26-FOI-00415 00000006279 "UNCLASSIFIED" 4/30/2026

NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)
UNIVERSAL SINGLE-LEVEL FLEET REPLACEMENT

GENERAL PROVISIONS

CONTRACT NO: _____

1. DEFINITIONS

Capitalized terms used in these General Provisions without definition shall have the meaning ascribed to them in this Article 1. Certain additional capitalized terms are defined elsewhere in this Contract. Unless the context otherwise requires, the singular shall include the plural, and the masculine gender shall include the feminine and neuter genders and vice versa.

"**Adverse Rights**" has that meaning ascribed to it in Article 19.

"**Agreed Testing Program**" means the testing program and Test Plan described in the Specification to be produced by the Contractor and approved by and agreed to by Amtrak.

"**Amtrak**" refers to the National Railroad Passenger Corporation, which has its headquarters at 1 Massachusetts Avenue, NW, Washington, DC 20001, and any permitted assignee of Amtrak's rights under the Contract.

"**Amtrak Collateral**" means all present and future Supplies and Equipment, including Cars, Special Tools, Spares, Amtrak Owned Spares, Mockups, and Contractor IP Rights, software, applications and programs, Technical Documents, machinery, inventory, tools, tooling, materials, components and any Work in process to be furnished by Contractor under the Contract or otherwise related to the design, engineering, manufacture, testing or equipping of the Equipment; all general intangibles and contract rights of Contractor in respect of subcontracts and supply contracts with Subcontractors to supply parts, equipment, materials, or services to perform the Contract or to manufacture, assemble, test, and deliver the Equipment and other Supplies; and all products, supporting obligations and proceeds, including insurance proceeds, of any of the foregoing.

"**Amtrak-Owned Spare**" means any spares purchased by Amtrak under the Contract.

"**Applicable Laws**" means all applicable federal, state and local laws, codes, ordinances, rules, regulations, judgments, decrees, directives, guidelines, policy requirements, orders or other governmental restrictions of any Government Authority, each as may be amended and in each case including successor provisions. For the avoidance of doubt, "Applicable Laws" includes any applicable Rules of Particular Applicability issued by the FRA and the Foreign Corrupt Practices Act.

"**Base Order**" refers to the first order of Equipment ordered by Amtrak under the Contract. The Base Order shall be identified in the Contract document signed by the Parties.

"**Business (Working) Day**" means a weekday (Monday to Friday) in the United States that is not an Amtrak holiday.

"**Car/Cars**" means the railroad passenger cars to be provided by the Contractor pursuant to this Contract. For the avoidance of doubt, the term Car or Cars includes any reference in the Contract Documents to Pilot Cars and/or Production Cars.

"**Car Builder**" means the Contractor.

"**Certificate of Conditional Acceptance**" refers to the certificate to be furnished by Amtrak to Contractor pursuant to Article 8, Section 8.3.

"**Certificate of Final Acceptance**" refers to the certificate to be furnished by Amtrak to Contractor pursuant to Article 8, Section 8.3.

"**Certificate of Final Fleet Acceptance**" refers to the certificate to be furnished by Amtrak to Contractor pursuant to Article 8, Section 8.4.

"**Change**" means any change or variation authorized by Amtrak pursuant to a Contract Modification issued by the Contracting Official or his representative.

"**Change Order**" means a unilateral written order by the Contracting Official directing the Contractor to make a change that Article 15, Changes, authorizes the Contracting Official to order without the Contractor's consent.

"**Claim**" means a formal demand or assertion by Contractor seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" may also include Contractor demands or assertions related to other disputes and matters in question between Amtrak and Contractor arising out of or relating to the Contract.

"**Component**" except for purposes of the domestic preference or Buy America(n) requirements, shall mean usually self-contained, a component is comprised of parts, devices and structure and performs a distinctive function necessary to the operation of a system or subsystem.

"**Conflict of Interest**" means that because of activities or relationships with other persons or entities, (1) a person or entity is unable to render impartial assistance or advice to Amtrak, (2) the person's or entity's objectivity in performing the Work under this Contract is or might be otherwise impaired, or (3) the person or entity has, or attempts to create, an unfair competitive advantage.

"**Contract**" means the Equipment Contract between Amtrak and Contractor, signed by the duly authorized representatives of Amtrak and Contractor. The Contract includes multiple documents, which are collectively referred to as the Contract Documents.

"Conformed Specification" means these Specifications as revised to include and reflect all approved change orders, variances and waivers implemented throughout the duration of the Contract.

"**Contract Documents**" are identified in the Contract. They consist of the Contract and all other documents specifically identified and incorporated therein, including, without limitation, the Supplementary General Provisions for Non-construction Contracts, these Equipment Contract General Provisions; the Pricing Schedule; Drawings (and Revisions thereto); Specifications (and

Addenda thereto); Contract Modifications; and any other documents identified as Contract Documents in the Contract. Unless specifically identified in the Contract, the Contract Documents do not include solicitation documents (e.g., requests for bids or proposals, instructions to bidders or offerors). The Contract Documents follow the order of precedence as set forth in Section "Order of Precedence".

"**Contract Amount**" means the total purchase price for the Work including all amounts in respect of the Base Order, Contract Modifications, escalations and Option Orders or quantities.

"**Contract Modification**" is a document Amtrak issues that is executed after the Contract is awarded, to clarify, revise, add to, or delete from, or to modify the Contract. To be a valid modification, a Contract Modification must be in writing. Contract Modifications will serve as written amendments to the Contract, or a change order signed by Amtrak, or by Amtrak and the Contractor.

"**Contract Time**" means the period of time allotted in the Contract for completion of the Work or a portion thereof, as applicable.

"**Contracting Official**" or "**CO**" means is the individual identified as such in the Contract (or their delegee or successor) and duly authorized in writing by Amtrak to execute, administer, and make changes to the Contract on behalf of Amtrak and to make related determinations and findings on behalf of Amtrak. This includes a duly appointed successor. The Contracting Official is not necessarily an officer of Amtrak, is empowered to act within the limits of the Contracting Official's authority, and assumes no personal liability under the Contract. Other individuals including but not limited to the Contracting Official's Technical Representative, Program Managers, and Project Managers do not possess the authority of the CO.

"**Contracting Official's Technical Representative**" or "**COTR**" means the Contracting Official's Technical Representative identified in the Contract and any duly appointed successor. The COTR may monitor the Contractor's performance and provide technical advice to the CO within the Statement of Work or performance of work regarding the progress of the Contract. The COTR may not change the terms and conditions of the Contract without written approval by the Contracting Official.

"**Contractor**" means the individual, entity, or authorized representative of same, identified as such in the Contract.

"**Contractor Party**" means Contractor or any of its Subcontractors, suppliers, or any of their respective employees, agents or authorized representatives.

"**Day**" or "**day**" as used in the Contract means a United States calendar day unless otherwise noted.

"**Delivery Documentation**" means, in respect of each unit of Equipment, details of any Changes applied to that Equipment, repairs made during production, modification status, all critical components by part number/serial number, Service Bulletin embodiment status, Failures

identified during testing and actions taken in respect of those Failures, differences from any previously accepted Equipment and originals, when necessary, of all certificates issued in relation to a unit of Equipment in all cases prior to acceptance or conditional acceptance of that Equipment.

"**Delivery and Acceptance Schedule**" as used herein means the mutually agreed upon schedule for the delivery and acceptance of the Equipment.

"**Documentation**" except as applicable to commercially available software, includes all user manuals, Systems manuals, training materials, guides, logic diagrams, programmer's notes, flow-charts, algorithms, development tools and development platforms and other materials necessary for Amtrak's understanding and use of the Software for the Allowable Uses in the form prepared by the Contractor, subcontractor, Supplier or Manufacturer in the regular course of its business, or, to the extent that the Specification requires a different form, then in the form required by the Specification.

"**Draw Event**" means, with respect to a Letter of Credit, one or more of the following: (i) the Contract has been terminated by Amtrak for default pursuant to Section 16.1; (ii) Contractor or Guarantor is subject to a bankruptcy or insolvency event; (iii) Contractor has not paid indemnity obligations owed to Amtrak arising out of third party claims for bodily injury or death, or damage to or loss (including loss of use) of any property, or any infringement, violation or misappropriation of third party intellectual property rights; (iv) Contractor has not maintained insurance as required by Article 59; (v) Contractor has failed to make payment of undisputed amounts to its Subcontractors and Amtrak has made demand on Contractor to do so, and Contractor has failed to do so within thirty (30) days thereafter; or (vi) the Letter of Credit or its Confirmation will expire within thirty (30) days or less and the conditions for cancellation or release of the Letter of Credit as stated in Section 6.12 have not been met.

"**Drawings**" means, as applicable, two (2) dimensional or three (3) dimensional models, modules or drawings.

"**Equipment**" means all Cars, and Spare Vehicles ordered under the Contract, including all options for additional Cars or Spare Vehicles exercised. It may also refer to any physical device that is part of the Cars and/or is the object of maintenance actions.

"**Excess Costs**" are the difference between the Contract price for the terminated Supplies and/or Work and the total costs incurred by Amtrak to procure replacement Equipment and/or Work.

"**Excused Performance**" shall mean a Force Majeure Event, accident, vandalism (including graffiti), operational anomalies or negligence by Amtrak, its officers, directors, employees, agents, servants, or any other damage or events not attributable to Contractor and/or Amtrak. Minor Debris Damage shall not be covered by this definition.

"**Facility**" or "**Facilities**" as used herein means the facilities for service, inspection, periodic maintenance and/or repair.

"**Failure**" means that the Equipment or a unit thereof, a component, or other supplies, instructions, Technical Support, software, or any service supplied by Contractor or Contractor Party under the Contract or the TSSSA did not comply with the requirements or specifications or violated any applicable law, did not perform as designed or its intended purpose or the use to which it was put, or if a service, was improperly delayed or omitted, in all such cases, whether in consequence of faulty design, faulty Materials, poor workmanship, improper handling, security, storage or installation, negligence, willful misconduct or strict liability, or other errors or omissions or for any other reason attributable to the Contractor.

"**Failure – Type I**" shall mean a Failure that results in either one of below:

(a) A Car being Unfit for Revenue Service within one (1) hour of the scheduled departure due to but not limited to a trainline failure resulting in loss of train line communications or power transmission resulting in Amtrak making modifications to a scheduled consist to operate the train in Revenue Service, or a Car causing an en-route delay of the Revenue Service train more than sixty (60) minutes at a scheduled departure or arrival at any scheduled station, or a failure requiring a Car to be removed from the train consist en-route.

(b) A loss of fifty percent (50%) or more of food service in any of the food service cars due to equipment failure that results in a loss of food storage, refrigeration, cooking, increased meal prep times and/or food delivery, etc.

(c) The loss of the water and/or waste system in a Car during Revenue Service and/or the loss of any restroom in a Car during Revenue Service.

(d) The loss of one (1) HVAC unit in a car during Revenue Service.

(e) The loss of 50% of any one passenger amenity in any car type (i.e. convenience outlets, etc.). A list of all amenities will be determined prior to Contract Award.

(f) The failure of the Passenger Emergency Intercom (PEI) or Public Address/Intercom (PAIC) system in any Car.

Contractor understands and agrees that if vehicle options are exercised, this failure type will be updated and revised to reflect the unique components associated with those cars

"Failure – Type II" shall mean a Failure that results in:

(a) A Car being Unfit for Revenue Service within four (4) hours of the scheduled departure due to but not limited to a trainline failure resulting in loss of train line communications or power transmission resulting in Amtrak needing to make modifications to a scheduled consist, or a Car causing an en-route delay of the Revenue Service train of less than sixty (60) minutes but more than fifteen (15) minutes of a scheduled departure or arrival at any scheduled station.

(b) The failure or impacted operation of any door that adversely affects boarding and/or

alighting, passenger comfort and/or any passenger or crew accommodations.

(c) The loss of any passenger amenity including but not limited to, lighting, seating, etc. that affects ten percent (10%) or more of the seating capacity in that given Car.

(d) The loss of wayfinding capabilities in a Car during Revenue Service, i.e., any passenger information screen.

(e) The loss of connectivity in a Car during Revenue Service due to a defect or failure of Contractor supplied Material.

"**Failure – Type III**" shall mean a Failure that results in an actual repair time that exceeds one-half (0.5) labor hour and does not meet the criteria of a Type I or a Type II Failure. Type III Failures constitute Unscheduled Maintenance and can typically be repaired without causing delay to the scheduled departure or arrival of a Car or requiring the movement of the Car to a repair track or facility. I.E. cabinet latch, drawer slide, display screen not fully illuminated, loose trim, etc. not causing a safety issue.

"**Failure – Type IV**" shall mean any Failure that leads to a train being annulled or unable to be placed in Revenue Service.

"**Federal Railroad Administration**" or "**FRA**" means an agency within the U.S. Department of Transportation.

"**Fleet**" means all means all, Cars and Spare Vehicles ordered under the Contract, including all options for additional Cars or Spare Vehicles exercised

"Field Modification Instructions (**FMI)**" means instructions for applying and installing engineering solutions to resolve fleet-wide defects and/or upgrade installations and/or systems to Equipment that have already been shipped from the factory.

"**Final Fleet Acceptance**" means the Fleet has met all conditions prerequisite for issuance of a Certificate of Final Fleet Acceptance.

"**Final Payment**" refers to the retainage or final installment of the Contract Amount payable in connection with the Work. Final Payment is made to the Contractor when it has satisfied all of the requirements called for by all provisions of the Contract, including all of the required documentation.

"**Financing Parties**" means Lender or any Person that advances funds or provides financing (other than as capital contributions) to Amtrak for all or a part of the costs and expenses associated with the Equipment, including (a) Lender, banks, financial institutions and capital market participants and (b) any trustee or agent acting on behalf of any Person referred to in the preceding clause (a).

"Fit for Purpose" means:

(a) In respect of each Equipment, that:

i). all relevant approvals in respect of that Equipment have been obtained and remain in force;

ii). such Equipment:

(b) meets the requirements of the Contract, and

(c) is in a condition which enables Amtrak to operate such Equipment in Revenue Service in accordance with the Contract; and such Equipment is and shall remain fit for the purposes specified in paragraph (a)(ii) above throughout its service life;

(d) In relation to each Amtrak-Owned Spare that such Amtrak-Owned Spare when incorporated into an Equipment, does not prevent such Equipment from being Fit for Purpose as defined in paragraph (a) above; and

(e) In relation to each Special Tool that such Special Tool is fit for use by a maintainer of rolling stock to carry out the maintenance and/or services.

"**General Provisions**" means these terms and conditions.

"**Government Authority"** means (a) any international, foreign, federal, state, county or municipal government, or political subdivision thereof, (b) any governmental or quasi-governmental agency, authority, board, bureau, commission, department, instrumentality or public body or (c) any court or administrative tribunal of competent jurisdiction.

"**Guarantor**" means the company that will execute, deliver and be liable on the Parent Guaranty, or the respective successor.

"**Indemnified Party Claim**" has that meaning ascribed to it in Article 32.1.

"**Indemnified Parties**" means Amtrak, its officers, directors, employees, agents, servants, successors, assigns subsidiaries, subcontractors, representatives, attorneys, and consultants, and any Financing Parties.

"**Intellectual Property**" shall mean any recognized protectable intellectual property, such as patents, utility models, copyrights, corporate names, trade names, trademarks, trade dress, service marks, applications for any of the foregoing, discoveries, inventions, software, firmware, trade secrets, mask works, industrial design rights, rights of priority, know how, design flows, methodologies and any and all other intangible protectable proprietary information that is legally recognized. Intellectual Property includes without limitation any and all drawings, designs, specifications, documentation, notes and other works, prepared, developed or acquired in performance of the design services component of the Work (collectively, the "Equipment Design Documents") or in the performance of the Design/Build Services (collectively, the "Design

Procurement Documents") or otherwise delivered to Amtrak in connection with the Work (the "Other Documents").

"**IP Rights**" means any and all of the following rights and interests worldwide: (a) any and all patent applications and patents and unpatented inventions or technology; (b) any and all proprietary knowledge, know-how, data and trade secrets; (c) any and all copyrights, whether registered or unregistered, and applications to register the same; (d) any and all rights in software, data, databases or related documentation; (e) any and all engineering data and information; and (f) any and all other proprietary rights or Intellectual Property rights.

"**Lender**" means any entity that lends Amtrak funding for the Contract.

"**Letter of Credit**" means a letter of credit to Amtrak in the form of Exhibit U-9, Irrevocable Standby Letter of Credit or otherwise acceptable to Amtrak issued with only such modifications to such form as are approved by Amtrak in its sole discretion. The Letter of Credit shall be issued by one or more Qualified Issuers and if requested by Amtrak, will be issued in SWIFT format through Amtrak's designated advising bank.

"**Major Component**" shall mean those components designated by Contractor and agreed to by Amtrak as being significant for purposes of Article 13, Section 13.7.

"**Mandatory Modification**" means a Modification which is required to be made under any Applicable Laws.

"**Mean Time Between Component Failures (MTBCF)**" means time between individual component failures.

MTBCF = Total Operating Distance (miles)

Total Number of Component Failures

"Mean Distance Between Service Failures (MDBSF)" means operating mileage between service failures caused by equipment or system failures.

MDBSF = Total Operating Distance (miles)

Total Number of Service Failures

"**Modification**" means any variation, modification or addition to the Equipment Contract.

"**Non-Allowable Service Interruption**" means Service Interruptions other than Allowable Service Interruptions.

"**Northeast Corridor**" or "**NEC**" means the intercity operations of Amtrak from Washington, D.C. to Boston, Massachusetts.

"**Notice to Proceed**" or "**NTP**" means a notice provided to Contractor that it may begin performance of the Contract or a Contract Modification.

"**Option Order**" refers to one or more of the options that may be exercised by Amtrak in its sole discretion for purchasing additional Equipment. under the terms of the Contract.

"**Parent Guaranty**" means a guaranty of payment and performance (and not of collection) issued by Guarantor guarantying the Work under this Contract, including Contractor's present and future performance, obligations and liabilities under this Contract.

"**Performance and Payment Bond**" has that meaning ascribed to it in Article 6.

"**Person**" means a person (including Contractor and Amtrak) and shall be construed as including references to an individual, firm, company, corporation, unincorporated association or body of persons or any government authority (including any of its agencies).

"**Pilot Car(s)**" means the first Car (of each type) to be fully assembled at the Contractor's final assembly facility.

"**Project Schedule**" means the mutually-agreed upon project schedule for production of the Equipment and the provision of other deliverables.

"**Project Management Plans**" or "**Plans**" means the Project Management Plan described in the Specification.

"**Qualified Issuer**" means either: 1) an issuing bank that issues the Letter of Credit that meets the following criteria: (i) it is a U.S. bank or a U.S. branch of a foreign bank, (ii) it has and maintains assets of at least $50 billion USD, and (iii) it or its holding company's long term debt is rated no lower than A by Standard & Poor's Rating Services or no lower than A3 by Moody's Investor Service, or 2) a surety(ies) acceptable to Amtrak, registered in the U.S. Department of Treasury's Circular TD 570, licensed to do business in all states in which the Work is performed, and carrying a financial rating from A.M. Best Company of A-VIII or better.

"**Reliability Demonstration Commencement Date**" means the date that the first unit of Equipment is placed into Revenue Service.

"**Reliability Demonstration for Final Fleet Acceptance**" has that meaning ascribed to it in Article 8, Section 8.4.

"**Reliability Target**" has that meaning ascribed to it in Article 8.

"**Relevant Approval**" means a consent, approval or authorization granted or required to be granted (as the context may require) by a Government Authority in relation to the Equipment in order to permit the operation of such Equipment with or without passengers.

"**Revenue Service**" means the time when a unit of Equipment is available to the general public and there is a reasonable expectation of carrying passengers that either directly pay fares, are subsidized by public policy, or provide payment through some contractual arrangement. Equipment operated in fare free service are considered in Revenue Service.

"**Safety**" means the condition in which persons and equipment are free from threat, danger, harm, or loss arising from improper design, manufacture, assembly or function, or a failure of the car or any of its components or systems.

"**Safety Critical**" means a system, or any portion thereof, means the correct performance of which is essential to safety of personnel or Equipment, or both; or the incorrect performance of which could cause a hazardous condition, or allow a hazardous condition which was intended to be prevented by the function or system to exist.

"**Safety Plan**" means the safety plan produced by Contractor based on the principles specified in the Management Plans and approved by and agreed to by Amtrak in accordance with the Contract.

"**Scheduled Final Fleet Acceptance Date**" means the date specified in Contractor's Amtrak-approved Project Schedule on which Final Fleet Acceptance is scheduled to occur.

"Scheduled Trip" means a scheduled train trip from start to finish.

"**Security**" has that meaning ascribed to it in Article 6.

"**Service Bulletin**" means any documentation produced by Contractor that sets out details of any design changes to the Cars and details how such changes impact the Equipment; what, if any, modifications are necessary; and any other relevant information.

"**Spares**" means spare parts, Supplies, Equipment, and components that fit, form and functionally equivalent to the original design and consumables or expendables.

"**Software**" means any and all computer application programs which are incorporated as part of any system, subsystem, assembly, subassembly or components thereof, or any interface system control between or among the systems, subsystems, assemblies, subassemblies, or components thereof, in the Cars , or which are used in connection with a system (which use involves microprocessors, controllers, drivers, or other electronic data processing elements) or which are used in connection with any related diagnostic or testing equipment, together with all related Documentation, including without limitation, the object code, source code and pseudo-code versions of such assemblies, subassemblies, programs, firmware containing such programs, know-how protocols, listings, instruction sets, indices and other intellectual property necessary for the Amtrak's use of the Software for the Allowable Uses in the form prepared by the Contractor, Subcontractor, Supplier or Manufacturer in the regular course of its business, or to the extent that the Specification requires a different form, then in the form required by the Specification.

"**Source Code**" means the programming statements and instructions a programmer writes, but which statements and instructions ("code") are not directly executable by the computer that will execute the instructions provided by the programmers until converted into executable or machine language.

"**Special Tools**" means all specialized tools, gauges, meters, diagnostic equipment (including laptop computer software), etc. that will be necessary to operate, maintain, overhaul, inspect, test, troubleshoot and repair all configurations of the Equipment throughout its design life. Special tools do not include those tools that are commercially available "off the shelf".

"**Specification**" means any specification referenced in this document, including any schedule, exhibit or attachment to it, or any Contract or Subcontract, including without limitation the Technical Specification with Options, as amended, the Conformed Specification, and the technical specifications referenced therein.

"**Subcontractor**" means any party that takes portions of the Contract from Contractor or another subcontractor to provide a service and/or Supplies, parts or material necessary for the performance of the Contract.

"**Subcontractor IP Rights**" shall mean all rights and interests held or otherwise controlled by a Subcontractor worldwide in and to any IP Rights.

"**Supplies**" means the supplies, equipment, materials, articles, or other items ordered by Amtrak and furnished by Contractor under the Contract including, but not limited to, Cars, Amtrak-Owned Spares, Special Tools, and Mock-Ups.

"**Technical Proposal**" means the technical proposal submitted by Contractor to Amtrak in response to the RFP, as amended.

"**Technical Specification**" refers to the Amtrak Mechanical Department Rolling Stock Equipment Specification for Long Distance Universal Single Level Fleet Replacement, Specification No. 1139, as amended.

"**Technical Support and Spares Supply Agreement**" or "**TSSSA**" means the agreement entered into between Amtrak and Contractor for the provision of technical support and spares.

"**Temporary Permit to Enter**" means a permit issued by Amtrak to permit Contractor to enter Amtrak's property and perform work or services.

"**Test Plan**" means the plan and schedule for conducting all the tests required on the vehicle.

"**Total Order**" refers to the Equipment ordered by Amtrak under the Base Order and Option Orders.

"**Three-Year Warranty Period**" for each of unit of Equipment means the three (3) year period after issuance of a Certificate of Final Acceptance or Certificate of Conditional Acceptance.

"**Train**" means any number of cars coupled to a locomotive or a source of self-propulsion, and moving as one.

"**Train Delay**" means an Equipment-related failure that causes a Train in service to be: more than 15 minutes late at its destination terminal; canceled either at its originating point or en-route; or reduced in size or revenue capacity due to requiring a failed Car to be removed from the train.

"**Unfit for Revenue Service**" means the presence of one or more Failures preventing use of the Equipment in Revenue Service.

"**Unscheduled Maintenance**" shall mean those unpredictable maintenance requirements or activities that were not previously planned or programmed, but require prompt attention and must be added to, integrated with or substituted for previously scheduled workloads. This includes, but is not limited to, maintenance that restores operability to the Equipment that is performed after a Failure, defect or problem emerges in Equipment.

"**U.S. Department of Transportation**" (USDOT) means the Secretary of the USDOT and other persons who may at the time be acting in the capacity of the Secretary, or authorized representative or any person otherwise authorized to perform the functions to be performed hereunder, including representatives of the Federal Transit Administration (FTA) and Federal Railroad Administration (FRA).

"**Vehicle**" means the same as Car or locomotive.

"**Vehicle History Book**" means a document specific to an individual rail vehicle containing records of technical and parts data pertinent to that individual vehicle.

"**Work**" as used herein, means the provision of the deliverables and Equipment, including, but not limited to, the Equipment, Amtrak-Owned Spares, and Special Tools, identified and required by the Contract and the designs, engineering, manufacturing, assembly, testing, operations, maintenance services or other activities/services performed pursuant to the Contract. Work includes the work performed and materials acquired for the Contract under a limited notice to proceed or similar request by Amtrak.

"**Work Product**" shall mean any deliverable described in the Statement of Work or Contract Documents, and all written or fixed media material, ideas, concepts, discoveries, inventions, improvements, enhancements, modifications, and designs (whether or not registerable or patentable), developed, conceived or reduced to practice by Contractor or its employees in connection with the performance of the Contract. Amtrak and Contractor hereby agree that the Equipment Design Documents, Design Procurement Documents, and Other Documents shall be Work Product under the Contract.

2. INTERPRETATION OF DOCUMENTS

2.1. The Contract constitutes the entire agreement of the parties. Except as provided under the Changes article hereof, neither oral statements nor other writings may be used to supplement, modify, or

otherwise affect the provisions of the Contract. Contractor acknowledges that it has not been induced to enter into the Contract by any representations or promises not specifically stated in the Contract. Unless otherwise specified herein, all previous or contemporaneous proposals, letters, promises, representations, documents, agreements, or understandings, whether written or oral, relating to the subject manner of the Contract are hereby declared to be null and void and are superseded by the terms and conditions of the Contract. The terms and conditions of the Contract supersede any and all terms and conditions submitted by Contractor prior to, concurrently with, or pursuant to the Contract. Any additional or different terms proposed by Contractor are expressly rejected unless specifically accepted in writing by the Contracting Official. No other terms and conditions, or changes or modifications to the Contract shall be binding upon Amtrak unless agreed to in writing in accordance with the Changes section herein.

2.2. Any inconsistencies in Contract provisions or Contract shall be resolved by giving precedence in the following order:

(a) Contract Modifications;

(b) The Universal Single-Level Fleet Replacement Equipment Contract;

(c) Supplementary General Provisions;

(d) General Provisions;

(e) Technical Specification; and

(f) Design documentation, including Drawings and/or construction or manufacturing Drawings produced as a result of the Technical Specification, or otherwise, in the following order of precedence:

i). Notes on Drawings,

ii). Large scale details,

iii). Figured dimensions, and

iv). Scaled dimensions.

2.3. If any uncertainty remains after reference to the hierarchy set forth in Section 2.2, the Contractor shall then confer with and be governed by the interpretation(s) of the Contracting Official or his authorized representative.

2.4. The captions in these General Provisions are for the convenience of the parties in identification of the several provisions and shall not constitute a part of the Contract nor be considered interpretative hereof.

2.5. Drawings and Specifications are complementary. Anything shown in the Drawings and not mentioned in the Specifications or mentioned in the Specifications and not shown in the

Drawings, shall have the same effect as if shown or mentioned in both. The Contractor is responsible for assuring that the Drawings and Specifications conform to the terms of the Contract. A typical or representative detail indicated on or reasonably inferable from the Contract or from normal custom and practice shall constitute the standard for workmanship and material throughout corresponding parts of the Work. Where necessary, and where reasonably inferable from the Contract, the Contractor shall adapt, or have adapted, such representative detail for application to corresponding parts of the Work. Repetitive features shown in outline on the Drawings shall be in reasonable accordance with corresponding features completely shown.

2.6. It shall be the Contractor's responsibility to study the Contract and to report, at once in writing to the COTR, any errors, inconsistencies or omissions therein. Should the Contractor believe that the correction of the alleged errors, inconsistencies or omissions shall be the cause of additional expenditures or impact the schedule for performance of the Work, or portion thereof, the Contractor shall so advise Amtrak as part of the written notification. Any Work performed by the Contractor prior to receiving a written response from Amtrak with respect to any alleged error, inconsistency or omission shall be at the Contractor's own risk and expense.

2.7. The Contractor is under an obligation to control and check all project materials. Errors or omissions in the Specification, Drawings or other supplementary specifications supplied by Amtrak shall in no way affect Contractor's warranties that the Equipment fulfills the provisions of this Contract in all respects.

2.8. Where standard specifications issued by a recognized industry association or regulatory body are referenced, the reference shall be interpreted as incorporating the standard specifications in total unless otherwise noted in the Contract.

2.9. The Contractor shall coordinate its designs and Drawings, and review them for accuracy, completeness, and compliance with Contract requirements and shall indicate its approval thereon as evidence of such coordination and review prior to submission to the COTR. Drawings submitted to the COTR without evidence of the Contractor's approval may be returned for resubmission. Acceptance by the COTR shall not relieve the Contractor from responsibility for any errors or omissions in such Drawings, nor from responsibility for complying with the requirements of this Contract, except with respect to variations expressly approved in accordance with the Contract.

2.10. If Drawings show variations from the requirements contained in the Contract, Contractor shall describe such variations citing the specific contract requirement(s) in writing, separate from the Drawings, at the time of submission. If the Contracting Official approves any such variation(s), he shall issue an appropriate Contract Modification or Change Order. If the variation is minor and does not involve a change in the time required for performance, or the cost of performing the Work, the Contracting Official shall note this fact on the Contract Modification and issue a corresponding no-cost or no-time extension Change Order.

2.11. The Equipment specified herein shall embody all of the latest tested and proven developments and improvements available to the Contractor during the course of design and manufacture of the Equipment and shall be of the best engineered design for the service intended. Unless stresses,

deflections, or properties of structural sections are specifically required herein, the Contractor shall use its best judgment and experience in determining the stresses imposed by the type of operation, and it shall provide for these stresses with an adequate margin of safety. In no case may design stresses exceed those generally considered reasonable and prudent in the industry.

3. APPROACH AND SUPERVISION OF WORK

3.1. The Contractor shall use a systematic management approach to provide completed Equipment meeting all specified performance levels compatible with all elements of the railway system over which the Equipment shall operate, for the service life of the Equipment (forty (40) years) as defined in the Contract. The Contractor shall apply this management approach throughout the design, development, production, and delivery phases of the Contract and to all aspects of the Work or material or components of the Equipment provided by the Contractor or its Subcontractors.

3.2. RESERVED

3.3. Copies of all drawings, manufacturing procedures, test procedures, test reports, test equipment calibration certificates, welder certifications, diagrams, schedules, changes, deviations, revisions and data shall be furnished to Amtrak at the same time these are made available to the Contractor's QA department and in advance of any work being performed. Data shall be sufficient to verify design, construction, assembly, installation, workmanship, clearance, tolerance and functioning of the Equipment.

3.4. The Contractor shall supervise and direct the Work, using its best skill and attention. It shall be solely responsible for all means, methods, techniques, sequences and procedures and for coordinating all portions of the Work prescribed by the Contract.

3.5. The Contractor shall submit, pursuant to Article 33, a list of Subcontractor(s) or supplier(s) selected to provide any Safety Critical systems, subsystems, components, or parts of the Equipment or to perform any aspect of the Work over an aggregate value of $1,000,000.

3.6. The Contractor shall require that each Subcontractor of materials, apparatus, components, assemblies or parts, except as otherwise provided herein, shall provide all labor, tools and materials necessary to make, assemble, completely test, and ready for installation by the Contractor, the component or apparatus to be furnished by said Subcontractor.

3.7. The Contractor shall require that the Subcontractors of all materials, apparatus, components, assemblies and parts, cooperate, to the fullest extent during design and manufacture of the Equipment, to ensure proper use and installation of their products. The Subcontractors shall give prompt notice to the Contractor and Amtrak if the use or installation of their Equipment by the Contractor is not satisfactory to them. No agreement with respect to the above shall be made without an immediate conference at which Amtrak, Contractor and the Subcontractor are each represented, and the resolution is approved by the Contracting Official. Copies of purchase orders and revisions to purchase orders for all major items of Equipment shall be promptly submitted to Amtrak upon request.

3.8. The Contractor shall take measurements and verify all conditions and shall carefully compare such measurements and conditions and other information known to the Contractor with the Contract before commencing activities. Errors, inconsistencies or omissions discovered shall be reported, in writing, to the Contracting Official at once. The Contractor shall satisfy itself as to the accuracy of all measurements and conditions. Any errors due to the Contractor's failure to so verify and to so take measurements shall be promptly rectified by the Contractor without any additional cost to Amtrak. No Change Order, whether for an adjustment in the Contract Amount or Contract Time, shall be allowed based on any such error described in this Article.

3.9. RESERVED.

4. APPROVED/REVIEWED

4.1. When the words "approved," "satisfactory," "proper" or "as directed" are in the Contract, approval by the Contracting Official or his authorized representative shall be required.

4.2. Contractor shall submit all documentation and Drawings for either Amtrak "review" or Amtrak "approval". All submittals are for Amtrak review, unless the Contract provides for Amtrak approval. Amtrak responses shall be in accordance with the Specification. Prior to requesting review by Amtrak, Contractor shall notify Amtrak in writing, providing Amtrak with sufficient advance notice, of the time when such review may be undertaken. If the review is to take place within the continental United States, thirty (30) days is sufficient advance notice. If the review is to take place outside of the United States, forty-five (45) days is sufficient advance notice. Contractor shall provide Amtrak with any and all related information and documentation, including information and documentation that may be requested by Amtrak, sufficiently in advance to enable Amtrak or its authorized representative to perform a meaningful review.

4.3. If Contractor submits two (2) or more requests for reviews and/or decisions, within the same or a similar timeframe or with the same or similar due dates, Contractor shall prioritize those items and advise Amtrak in writing which reviews or decisions should be addressed first. Amtrak shall advise Contractor of the time required for completion of its review and the parties shall mutually agree upon a date for the completion of Amtrak's review of those items or the rendering of Amtrak's decision.

4.4. Unless a greater time is set forth in the Contract, in the case of decisions with respect to the Equipment, Amtrak shall have at least thirty (30) business days or if Amtrak receives multiple requests from Contractor as described in Section 4.3 above, a mutually agreeable greater amount of time from the date on which Contractor completes its submission to Amtrak of all information and documents required in connection with making the requisite decision, to notify the Contractor of its decision. Notwithstanding the foregoing, in the case of decisions with respect to training documentation, manuals and parts catalogs, Amtrak shall have at least sixty (60) business days unless Contractor has specified a greater time period or some other time period is agreed to by the parties.

4.5. If a decision by the Contracting Official or COTR is required by a certain time in order to avoid a delay in the Work, the Contractor shall notify the Contracting Official in writing at the time the

request for decision is submitted. Such notice shall (1) set forth the requested due date for the decision; (2) provide the expected impact to the schedule if such decision is not received by the requested due date; and (3) transmit any information or documentation not previously provided to Amtrak that may be reasonably required for Amtrak to render a decision. Such notice shall be given sufficiently in advance to enable the Contracting Official or Amtrak to make an appropriately considered decision, and in no case later than the date on which Contractor first requests a decision from Amtrak. Failure to give such notice shall be deemed a waiver by the Contractor of its right to make a Claim based on an untimely decision by the Contracting Official.

4.6. For the avoidance of doubt, the times for decisions from Amtrak in this Article and the Specification only applies to decisions with respect to the Equipment. It does not apply to decisions with respect to any commercial or other aspects of the Contract.

5. CONTRACTING OFFICIAL'S REPRESENTATIVE (COR) AND CONTRACTING OFFICIAL'S TECHNICAL REPRESENTATIVE (COTR)

5.1. The Contracting Official may designate Amtrak personnel or agents to act as the Contracting Official's Representative (COR) or technical representative (COTR). Such designation shall be set forth in the Contract or by separate letter signed by the Contracting Official, and shall contain specific instructions as to the extent to which the representative may take action for the Contracting Official.

5.2. Unless otherwise provided in writing by the Contracting Official, the COTR's authority shall be to review and interpret Drawings and Contract technical submissions, review schedules, conduct design reviews, review invoices and progress payments, accept the Equipment and the related accessories and all other interface functions of a technical or commercial nature between the Contractor and Amtrak. All orders and directives issued by the COTR shall be in writing. Acceptance of Drawings by the COTR shall not relieve the Contractor of any contractual obligation. Acceptance of Drawings does not signify that the COTR is conducting an equal engineering effort in parallel with the Contractor to assure that the entire Equipment design as a whole shall meet all requirements of the Contract.

5.3. Contractor shall designate one of its employees as its Contractor Project Director, who shall be assigned by Contractor to supervise Contractor's Work hereunder and shall serve as Amtrak's point of contact for the resolution of problems. Amtrak shall designate an Amtrak Project Director to coordinate issues concerning Contractor's performance of the Work. The Amtrak Project Director shall serve as Contractor's point of contact for the resolution of problems related to the management of the relationship under the Contract. Contractor may not, without the consent of the Amtrak Project Director, replace its Project Manager unless the replacement is a result of the individual: (a) voluntarily resigning from employment with Contractor; (b) being dismissed by Contractor for misconduct or unsatisfactory performance; or (c) being unable to perform duties due to death or disability.

6. PERFORMANCE ASSURANCES REQUIRED FOR START OF WORK

6.1. Start of Work/Conditions on Issuance of NTP

6.1.1. Within ten (10) days after the Notice of Award (NOA) is issued and noticed to Contractor, Contractor must submit to Amtrak and thereafter cause to be maintained for the duration specified in this Article 6: (i) the Security in the amount described in herein, (ii) a Parent Guaranty, if applicable, in a form specified by Amtrak, together with an opinion of counsel if required by these general provisions, and (iii) a certificate of insurance evidencing the insurance coverage required hereunder, in each case with only such modifications to the scheduled form or requirements stated in this Contract as have been approved by Amtrak in writing. Within fifteen (15) days (or as soon as practicable thereafter) after Amtrak's receipt and acceptance of the Parent Guaranty accompanied by the opinion of counsel if required, and certificates from Contractor's insurers or insurance brokers showing insurance required hereunder is in place, Amtrak shall issue a NTP. The date of an NTP with respect to any phase of the Work shall be considered by Amtrak as the date that Work commences and shall provide the basis for the calculation of timely completion of the Work in connection with the Equipment and related Supplies, except that, in the event Contractor fails to timely submit the Parent Guaranty with accompanying opinion, and/or proof of required insurance, the fifteenth (15th) day after the execution of the Contract by Amtrak shall be used as the basis for calculating timely completion of the Work in connection with the Equipment and related Supplies.

6.2. Performance and Payment Security

6.2.1. Contractor shall furnish and cause to be maintained Security at fifty percent (50%) of the Contract Amount until the conditions of cancellation for the Security set forth below have been met.

(a) For purposes of this Contract, Security means:

i). A Performance Bond

ii). A Payment Bond in the form attached included in the Solicitation or a form otherwise acceptable to Amtrak that meets the requirements set forth herein (for the avoidance of doubt, each bond type will be issued in full at [TBD] ([TBD]) percent of the Contract Amount, respectively); or

iii). A Letter of Credit as that term is defined herein.

6.3. Performance and Payment Bonds as Security

6.3.1. The Performance and Payment Bonds must be issued by a Qualified Issuer. The Bonds must reference the Contract Number and shall be in a form agreeable to Amtrak and shall include: (1) a requirement that the surety agree that no change, extension of time, alteration, addition, omission, or other modification of the terms of the Contract or the work to be performed shall in any way affect its obligation on the bond, and (2) a requirement that the surety waives notice of any such change, extension of time, alteration, addition, omission or other modification. All bonds are subject to review by Amtrak and must have properly

executed power of attorney attached and seals affixed. Bonds must be properly countersigned where state law so requires.

6.4. Letter of Credit as Security

6.4.1. Letters of Credit shall have an initial expiration date of i) the date agreed to by Amtrak as the scheduled date of Acceptance of the second Production #3 or (ii) one (1) year from date of issuance but contain an automatic extension clause that requires at least ninety (90) days advance written notice to Amtrak by the issuer of a non-extension if the then current expiration date is not to be extended for another year.

6.4.2. Amtrak may give notice to Contractor that it must replace the Letter of Credit with Security issued by a Qualified Issuer if at any time (i) in the opinion of Amtrak, the issuer of the Letter of Credit ceases to be a Qualified Issuer, (ii) the issuer of the Letter of Credit sends notice that it will not be extending the Letter of Credit, (iii) the Letter of Credit will expire within sixty days (60) days or less, or (iv) the issuer wrongfully dishonors a draw made on its Letter of Credit by Amtrak. Contractor shall thereupon have thirty (30) days from the date of such notice to obtain a suitable replacement Security that meets the requirements of this Article 6 and is issued by a Qualified Issuer, in which event Amtrak shall authorize the cancellation of the original Letter of Credit. If Contractor fails to obtain a suitable replacement Security issued by a Qualified Issuer within such thirty (30) day period, Amtrak may draw upon the Letter of Credit for the full amount thereof, and hold the proceeds in a segregated account as cash collateral securing Contractor's obligations under this Contract. Such cash collateral shall be held until a suitable replacement Security issued by a Qualified Issuer in the amount required by this Contract is delivered to Amtrak or until the cash collateral is used to pay, perform or otherwise satisfy Matured Contractor Obligations. Upon receipt of a suitable replacement Letter of Credit in the proper amount, Amtrak shall release or cause the release of the cash collateral being held by it to or at the direction of Contractor. If at any time cash collateral is held by Amtrak as a result of a drawing on the Letter of Credit because the issuer ceases to be a Qualified Issuer or because the issuer sends a notice that the Letter of Credit will not be extended, the amount of such cash collateral shall be increased or reduced and the amount of the reduction released to Contractor in the same manner and in the same amounts as would be the case for an increase or reduction of the amount of a Letter of Credit were it still being held by Amtrak instead of cash collateral. If the issuer wrongfully dishonors a draw on its Letter of Credit and Contractor fails to procure and deliver to Amtrak a suitable replacement Security within the time specified above, then Contractor shall be in default of this Contract. Among other remedies, Amtrak may withhold milestone or other payments from Contractor until an amount of cash collateral equivalent to the amount required of Contractor for a Letter of Credit is withheld by Amtrak or until a suitable replacement Security is issued by a Qualified Issuer to Amtrak.

6.5. Amtrak may draw upon a Letter of Credit in accordance with the terms of the Letter of Credit for any Draw Event.

6.6. Within ten (10) days of Contract Award, Contractor shall submit Security for twenty percent (20%) of the Base Contract Amount. As a condition of Amtrak's approval and payment of the Contract milestones and any other payment made to Contractor, Security must be submitted or amended to increase the value before or with the milestone or other payment invoice, such that the total amount of Security will be equal to or exceed the sum of i) all payments previously made to Contractor and ii) the invoice submitted, before and as a condition of the subsequent milestone or other payment. The amount of Security required under this Article shall continue to increase in accordance with this provision until it meets or exceeds fifty percent (50%) of the Contract Amount.

6.7. Within ten (10) days of receipt of any Option Order, duly executed by Amtrak, Contractor shall submit Security for twenty percent (20%) of the Total Option Order Amount. As a condition of Amtrak's approval and payment of the Contract milestones and any other payment made to Contractor, Security must be submitted or amended to increase the value before or with the milestone or other payment invoice, such that the total amount of Security will be equal to or exceed he sum of i) all payments previously made to Contractor and ii) the invoice submitted, before and as a condition of the subsequent milestone or other payment. Note: if Amtrak exercises any options under the Contract, a milestone payment schedule for the Option Order shall be provided to Contractor. The amount of Security required under this Article shall continue to increase in accordance with this provision until it meets or exceeds fifty percent (50%) of the Total Option Order Amount.

6.8. The amount of the Security may be decreased by amendment to the Security as follows:

(a) No earlier than three (3) months after Amtrak has issued a Certificate of Conditional Acceptance for more than fifty percent (50%) of the Base Order of Equipment, and provided that all Equipment delivered to Amtrak as of that date has received a Certificate of Conditional Acceptance, Contractor may submit a written request for a reduction in the Security. Upon such request, Amtrak shall permit a reduction in the Security to an amount equal to twenty percent (20%) of the Base Order value, plus:

i). twice the amount that Amtrak is entitled to withhold for uncorrected defects, open field modification instructions (FMIs) or incomplete Work for any Equipment under the Contract for the Base Order that is subject to a Certificate of Conditional Acceptance, and

ii). any unpaid liquidated damages or other unpaid claims for damages or amounts due and owing by Contractor to Amtrak.

(b) No earlier than three (3) months after Amtrak has issued a Certificate of Conditional Acceptance for more than fifty percent (50%) of the Option Order of Equipment, and provided that all Equipment delivered to Amtrak as of that date has received a Certificate of Conditional Acceptance, Contractor may submit a written request for a reduction in the Security. Upon such request, Amtrak shall permit a reduction in the Security to an amount equal to twenty percent (20%) of the Option Order value, plus:

i). twice the amount that Amtrak is entitled to withhold for uncorrected defects, open FMIs or incomplete Work for Base Order any Equipment under the Contract for the Base Order that is subject to a Certificate of Conditional Acceptance, and

ii). any unpaid liquidated damages or other unpaid claims for damages or amounts due and owing by Contractor to Amtrak.

6.9. In no event shall the Security be reduced below twenty percent (20%) of the value of the Base Order and any Option Orders, except as provided in Section 6.10 below.

6.10. On the later of (a) thirty-six (36) months after issuance of a Certificate of Final Acceptance of the last unit of Equipment ordered and delivered or (b) the issuance of a Certificate of Final Fleet Acceptance, and provided that all warranty Work, uncorrected defects, and outstanding FMIs have been satisfactorily completed, Contractor shall be entitled to request Amtrak to authorize cancellation of the Security. Amtrak shall authorize a cancellation or, pursuant to the next sentence, a reduction of the Security upon review of such request if all the preceding conditions for cancellation of the Security have been met. If Amtrak refuses to authorize a cancellation of the Security to which the Contractor believes it is entitled because of pending claims or disputes, (i) Amtrak shall authorize reduction of the amount of the Security that Amtrak does not dispute can be reduced, and (ii) Contractor may reserve its rights or proceed to dispute resolution procedures to obtain the further reduction or cancellation of the Security to which it claims it is entitled.

6.11. Amtrak or a Financing Party may give written notice to Contractor that Amtrak's rights under the Security and/or this Article 6 will be exercised by a Financing Party, and Amtrak will notify Contractor promptly after it learns the identity of such Financing Party. In that event, the Financing Party shall be entitled to take all actions and succeed to all rights of Amtrak with respect to such Security and any related rights granted to Amtrak by this Article 6, once it is satisfied that such Financing Party has complied with the requirements described under Article 6.12.1 (iii) of the Contract.

6.12. Security Interest in Amtrak Collateral

6.12.1. To secure all of Contractor's present and future performance, obligations, liabilities and indebtedness to Amtrak under or in respect of this Contract, and in particular Contractor's obligation to deliver the Equipment, Contractor hereby grants to Amtrak and its Financing Parties a security interest in all its present and future rights, title and interest in and to the Amtrak Collateral, provided that the Financing Parties, if any, (i) satisfy the ethics, compliance and business conduct programs and policies that are applied by Contractor and its Guarantor to persons with which it does business, (ii) have sufficient financial resources, or shall be supported by a satisfactory guarantee, to carry out the obligations of Amtrak under the Contract in the event Amtrak assigns to the Financing Parties its rights and delegate its responsibilities, in whole or in part, under Article 39.1 of the Contract, (iii) has complied with all necessary "know your customer" or other similar checks under all applicable laws in relation to that security interest. "Know your customer" checks are the

identification checks that one or more Qualified Issuers request to meet its obligations under any applicable law or regulation to identify a person who is (or is to become) its customer, including being the beneficiary of a Letter of Credit or of a Performance and Payment Bond. In the event of default by Contractor under the Contract, nonperformance or nonpayment of any obligation of Contractor when due or termination of the Contract, Amtrak shall have all the rights and remedies of a secured creditor under Article 9 of the Uniform Commercial Code in each state where the Amtrak Collateral may be located or have as its situs. Such rights include the right to require segregation of, inspection and repossession or use or sale in place by Amtrak of the tangible Amtrak Collateral so that Amtrak can obtain it for use in continuing the Work with another contractor or sell it and realize on its value. Amtrak shall also have the right and remedy of enforcing its security interest in intangible Amtrak Collateral such as contract rights, by notifying and contracting directly with any and all Subcontractors to continue their work and furnishing supplies for the benefit of Amtrak.

6.12.2. Contractor represents that it has not, and covenants that it will not, grant to any other person or entity any interest including any security interest, in the Amtrak Collateral and will keep it free and clear of any other liens, claims or encumbrances. If there are any existing security interests, liens or claims filed against or otherwise granted by Contractor in or on any Amtrak Collateral, Contractor shall satisfy or otherwise obtain from the party holding such security interest, a disclaimer and release of their claim, lien or security interest in or on Amtrak Collateral as a condition of receiving any milestone or other payment from Amtrak. Contractor shall not lease, sell or otherwise dispose of Amtrak Collateral except in the ordinary course of its business. Notwithstanding the foregoing, if a Performance Bond is claimed upon, Contractor may assign to the surety those items of the Amtrak Collateral that are needed to allow the surety to perform its obligations under the surety agreement.

6.12.3. Contractor shall provide Amtrak monthly and upon request with a listing of the location and items of tangible Amtrak Collateral in its possession or control or in the hands of Subcontractors. Contractor must promptly notify Amtrak by written or electronic communication of any change in location of the Amtrak Collateral, specifying the new location. Contractor hereby grants to Amtrak the right to inspect the Amtrak Collateral at all reasonable times and upon reasonable notice. Contractor must: (a) maintain the Amtrak Collateral in good condition; (b) pay when due or discharge all judgments or charges of any kind payable in respect of or levied or assessed thereon; (c) keep current all rent, assessments, taxes, insurance premiums, maintenance fees, and mortgage payments due, if any, on premises where the Amtrak Collateral is located; and (d) maintain hazard insurance on the tangible Amtrak Collateral, with an insurance company and in an amounts required by Articles 58 and 59 of this Contract.

6.12.4. Contractor must notify Amtrak by written or electronic communication not less than thirty (30) days before taking any of the following actions and obtain Amtrak's written consent for each of them, which consent may be conditioned on insuring uninterrupted performance of this Contract by Contractor with sufficient working capital, assets, qualified workforce

and other capabilities: (a) changing or reorganizing the type of organization or form under which it does business; (b) moving, changing its place of business or adding a place of business; (c) changing its jurisdiction of organization; (d) selling or transferring any substantial part of its business or assets; or (e) changing its name.

6.12.5. Contractor consents, without further notice, to Amtrak's filing or recording of any documents necessary to perfect, continue, amend or terminate its security interest. Upon request of Amtrak, Contractor must sign or otherwise authenticate all documents that Amtrak deems necessary at any time to allow Amtrak to acquire, perfect, continue, amend, enforce or realize on its security interest in the Amtrak Collateral. Contractor will pay the filing and recording costs of any documents relating to Amtrak's security interest.

6.12.6. Amtrak or a Financing Party may give written notice to Contractor that Amtrak's rights as a secured party under this Article 6 will be exercised by a Financing Party. In that event the Financing Party exercising Amtrak's rights with respect to the security interests granted by this Article 6 shall be entitled to take all actions and succeed to all rights of Amtrak with respect to such security interests in the Amtrak Collateral and related rights granted to Amtrak by this Article 6 or otherwise available to it under Article 9 of the Uniform Commercial Code or other Applicable Law.

6.13. Parent Guaranty

6.13.1. If Contractor is a subsidiary of another entity, then Amtrak's obligations under the Contract shall be contingent upon Amtrak's receipt of a satisfactory Parent Guaranty executed by the ultimate parent entity of Contractor or a related entity acceptable to Amtrak guarantying payment and performance of Contractor's obligations and liabilities under this Contract. In the event the ultimate parent entity of Contractor is changed, the new ultimate parent entity of Contractor shall become the Guarantor, and the existing Parent Guaranty shall be substituted with a Parent Guaranty provided by the new ultimate parent entity of Contractor.

6.13.2. If Guarantor is incorporated or organized in a jurisdiction outside the United States of America, the Parent Guaranty delivered to Contractor shall be accompanied by an opinion addressed to Amtrak from counsel acceptable to Amtrak who are authorized to practice law in the Guarantor's jurisdiction, to the effect that the Parent Guaranty has been duly authorized, executed and delivered, is within the corporate power and authority of the Guarantor, requires no permits, filings, payments, consents or authorizations from any governmental authority or private party for its execution and delivery which have not been obtained by Contractor and/or Guarantor, complies with Applicable Laws, is legal, valid, binding, and a judgment or arbitration award properly obtained in the United States against Guarantor on the Parent Guaranty will be recognized and enforceable in the jurisdiction of the Guarantor without a de novo hearing on the merits of the judgment obtained.

6.13.3. Contractor shall provide to Amtrak a copy of the Contractor's most recent annual audited financial statements, if available (if not available, the annual financial statement is acceptable and shall be provided to Amtrak) and Guarantor's most recent annual audited

financial statements prior to Amtrak's issuance of a NTP and also within one hundred twenty (120) days after the end of each of Contractor's and Guarantor's fiscal years thereafter until three years after Amtrak's issuance of a Certificate of Final Fleet Acceptance. Any non-public financial statements submitted to Amtrak shall be treated as Amtrak treats its own confidential information if marked as such. The year-end financial statements of Contractor and Guarantor shall be prepared in accordance with US Generally Accepted Accounting Principles or other similar accounting principles. If Guarantor restructures or divests itself of assets causing a substantial reduction in its net worth, it shall provide Amtrak written notice thirty (30) days prior to the public announcement of any restructuring, unless Guarantor's notification to Amtrak would violate financial securities laws or regulations then in place, in which case such notification shall not be required. In that event, or in response to publicly disclosed or privately provided financial information regarding Guarantor, Amtrak may by written notice to Contractor require a meeting with senior officials of Contractor to discuss Guarantor's financial situation and what assurances Amtrak has of the Guarantor's ability to honor the Parent Guaranty and other obligations including the Contractor's ability to complete delivery of the Equipment and other Supplies under the terms of this Contract. If Amtrak is or remains insecure about Guarantor's financial condition or Contractor's ability to complete the Contract in accordance with its terms, Amtrak may by further written notice to Contractor, require Contractor to transfer title to Amtrak (but not risk of loss) to all present Equipment and Supplies in process notwithstanding their state of completion or that they remain in the possession of Contractor. Upon Amtrak's written notice given under the prior sentence, title to all Equipment and Supplies in process of Contractor relating to this Contract for which Amtrak has been invoiced and such invoices have been paid as required by this Contract, shall automatically be deemed to have transferred to Amtrak at the time of such notice.

6.13.4. The Parent Guaranty may be enforced by either Amtrak or a Financing Party, the latter's enforcement being subject to the prior consent of the Contractor that such Financing Party has complied with the requirements described under Article 6.12.1 (i) and (ii) of the Contract, provided that the enforcement of the Parent Guaranty by any such Financing Party shall only be permitted for Contractor defaults and damages and amounts owed by Contractor to Amtrak under this Contract, and not for defaults by Amtrak under any of its funding agreements or otherwise outside of the scope of this Contract. In the event that Amtrak transfers the Contract, the obligations of the Guarantor pursuant to the Parent Guaranty shall not exceed Contractor's unsatisfied obligations under the Contract.

6.13.5. Following receipt of payment by Contractor for the Equipment as required by this Contract for which Amtrak has been invoiced and that have been manufactured and allocated to this Contract but have not been delivered to Amtrak (including the Equipment and/or Supplies referenced in Section 10.2), Contractor shall, use its existing information technology systems to segregate such Equipment and Supplies from its other inventory and designate Amtrak as the sole beneficiary of such Equipment and Supplies.

7. CONTRACT DELIVERABLES AND REQUIREMENTS

In addition to the requirements and deliverables specified elsewhere in the Contract, including the Technical Specification, Contractor shall provide those items listed in the Sections below.

7.1. The Equipment

7.1.1. The Contractor shall design, manufacture, test, certify, commission, and sell the Equipment, and provide warranty support in accordance with the Contract, including the Technical Specification, the Agreed Testing Program, and all Applicable Laws.

7.1.2. If Contractor's performance of the Work or delivery of the Equipment is delayed for any reason, Amtrak may, in its sole discretion, adjust the due dates for any deliverables or CDRLs and may extend, compress, re-sequence, or otherwise modify the schedule as it deems appropriate in light of such delay. Contractor shall perform in accordance with all such revised schedules and shall not be entitled to any increase in the Contract Amount, equitable adjustment, or extension of the Contract time arising from Amtrak's exercise of these rights except to the extent expressly authorized in writing by Amtrak.

7.1.3. If Amtrak determines that Contractor is behind schedule, Amtrak may require Contractor to develop and submit at Contractor's sole cost and expense, a schedule-recovery plan. Such plan shall include: (a) corrective actions; (b) additional resource allocations; (c) revised sequencing; and (d) updated recovery timelines. Contractor shall implement the approved recovered plan promptly. Failure to timely submit or implement an adequate recovery plan shall constitute a material breach of the Contract.

7.2. Technical Proposal

7.2.1. If after submission of Contractor's Technical Proposal, as amended, Contractor identifies any improvements and/or modifications in relation to the design, testing and manufacturing process of the Equipment or other similar rolling stock, it will notify Amtrak and discuss in good faith whether and how such improvements could be incorporated into the design, manufacturing, testing and operation of the Equipment.

7.2.2. The Contractor shall build the mock-ups and develop the Equipment exhibits in accordance with the Technical Specification by no later than the date in the Contract or by some other date as may be specified by Amtrak.

7.3. Storage

7.3.1. Contractor shall be responsible for providing, at its own cost, for the storage of the Equipment, the Special Tools, Mock-Ups, at all times until the issuance of a Certificate of Final Acceptance or Conditional Acceptance, as the case may be, of such Equipment or, in the case of the Special Tools, until acceptance of such Special Tools in accordance with the Contract or, in the case of Amtrak-Owned Spares, until acceptance of such Amtrak-Owned Spares under the Contract. For the avoidance of doubt, Contractor shall not expect, rely upon, or assume the availability of any Amtrak property for the storage of Equipment at any time. After Acceptance of the Amtrak-Owned Spares, they shall be stored in

accordance with the TSSSA. Contractor shall also be responsible for the disposal of the Mock-Ups as directed by Amtrak.

7.4. Amtrak-Owned Spares

7.4.1. If Amtrak places an order for Amtrak-Owned Spares, Contractor shall supply the Amtrak-Owned Spares in accordance with Amtrak's written directions and in accordance with the Specification. Contractor shall ensure that all Amtrak-Owned Spares are Fit for Purpose and meet the requirements of the Contract.

7.5. Special Tools

7.5.1. The Contractor shall supply to Amtrak all Special Tools required to maintain the Equipment, and all associated Special Tools delivery documentation in accordance with the Specification, and all Applicable Laws, and shall ensure that all Special Tools and associated Special Tools delivery documentation are Fit for Purpose and meet the requirements of the Contract. Upon Amtrak's request and payment, Contractor shall supply to Amtrak any additional Special Tools ordered by Amtrak and delivery documentation that meet the requirements of this provision. The prices Contractor charges Amtrak for such Special Tools shall be the lowest prices Contractor has charged others for comparable items under similar terms and conditions.

7.6. Training

7.6.1. Contractor shall, at its own expense, organize and provide to Amtrak a program of training courses in accordance with the Specification, Training Requirements, including appropriate training of employees of Amtrak to administer such program, which will enable Amtrak to train its employees to operate the Equipment and to undertake its responsibilities under this Agreement and the TSSSA. Such courses shall be provided at a location specified by Amtrak and will include the provision of such training materials and equipment as are reasonably necessary to permit Amtrak's training instructors to undertake further training of Amtrak's employees. In the event that delivery of the Equipment is delayed, Contractor shall adjust the Training Scheduled as directed by Amtrak.

7.6.2. Contractor shall provide Amtrak for its review and approval proper written training materials in both hard copy and in an electronic format specified by Amtrak. Amtrak shall be entitled, free of charge, to duplicate as many copies of such training materials as it reasonably requires for the purposes of training its employees.

7.6.3. At Amtrak's request, Contractor shall provide such additional training as Amtrak may require (at Amtrak's cost), save that if such additional training is required as a result of any Modifications requested by Contractor (other than a Mandatory Modification) such training shall be provided at Contractor's expense.

8. DELIVERY, INSPECTION, AND ACCEPTANCE

8.1. Delivery

8.1.1. Prior to delivery of the production batches described in the Delivery and Acceptance Schedule at Exhibit V, Contractor shall deliver the Pilot Cars and such Pilot Cars shall meet the form, fit and functionality requirements of that Car type. The Pilot Car will be used to prove out manufacturability issues, confirm system integration and perform pre-qualification testing prior to construction and delivery of the remaining Cars. The Pilot Cars shall be delivered to the Transportation Technology Center, Inc. (TTCI) facility in Pueblo, CO or to another location designated by Amtrak for testing, including reliability testing and obtaining FRA and Amtrak approval for each Car type. Amtrak shall provide reasonable assistance to Contractor to ensure that the Association of American Railroads supports Contractor's request. After successful testing of the Pilot Cars and the approval described herein, unless otherwise agreed to by Amtrak in writing, Contractor shall return the Pilot Cars to its facility for rebuilding and modification to incorporate the latest configuration, including implementing the current modifications and renewing any Equipment requiring such (e.g. brake components) to reset the COTS date.

All remaining Equipment shall be delivered in accordance with the Delivery and Acceptance Schedule and Section 8.5 below.

8.1.2. Delivery of Equipment shall be FOB Destination, during normal working hours 8:00 AM to 4:00 PM (New York Time), to one or more of Amtrak's depots or some other location designated by Amtrak. Notwithstanding the foregoing, Amtrak, in its sole discretion, may agree to provide delivery services on Contractor's behalf, in this case, the movement of the Equipment shall be in accordance with Amtrak's then current Movement Agreement. Amtrak shall not be obligated to accept delivery or authorize the shipment of Equipment for which there are open FMIs.

8.1.3. Unless otherwise agreed to by Amtrak, Deliveries shall only be made on Business Days.

8.2. Inspection

8.2.1. All Equipment Delivered to Amtrak shall be inspected in accordance with the Specification and the agreed upon Inspection Plan.

8.3. Equipment Acceptance

8.3.1. Should arrival inspections and tests indicate that Equipment conforms to the requirements of the Contract, has been received in sound and serviceable condition at a location specified by Amtrak, has successfully performed under the tests specified in the Contract, and the COTR has determined the Equipment has met all of the requirements of the Contract and is Fit for Revenue Service, the COTR shall issue a Certificate of Conditional Acceptance or a Certificate of Final Acceptance; provided that, as a condition to the issuance of such Certificate, Contractor shall have delivered all documents or other materials necessary to achieve the passage of title to the applicable unit of Equipment free of all Adverse Rights in accordance with Article 19 hereof. Subject to Section 6.13.5, upon issuance of a Certificate of Conditional Acceptance or a Certificate of Final Acceptance for a unit of Equipment, title and risk of loss shall pass to Amtrak, or an entity designated by Amtrak.

8.3.2. During the testing of each unit of Equipment, after delivery to the appropriate facility where receiving and commissioning testing is to occur, and up to the point of final acceptance of the Equipment, Contractor shall make such adjustments and optimization of the mechanical, electrical, electronic and other technical equipment of the Equipment in general as Amtrak may find necessary or appropriate in order to obtain optimal functioning and reliability of the Equipment as contemplated by the Contract. Reasonable adjustments and optimization shall be made at no additional charge to Amtrak.

8.3.3. Amtrak may issue a Certificate of Conditional Acceptance, rather than a Certificate of Final Acceptance, to Contractor for a unit of Equipment when the applicable unit of Equipment meets all the conditions to acceptance identified and otherwise herein but is defective or deficient in some respects, but Amtrak determines the unit of Equipment is suitable for Revenue Service. The defects and/or deficiencies which caused the Contracting Official to issue a Certificate of Conditional Acceptance shall be listed on the Certificate of Conditional Acceptance and shall indicate that the unit of Equipment shall be accepted on the condition that all necessary repairs or corrective actions to remedy the defects and/or deficiencies shall be affected as soon as practicable, but in no event more than sixty (60) days, unless otherwise agreed to by Amtrak. In addition to the foregoing, should FMIs be identified after issuance of a Certificate of Conditional Acceptance, such FMIs must be completed within a reasonable timeframe. Should Amtrak conditionally accept a unit of Equipment, it may withhold from the relevant payment an amount as determined by the Contracting Official, which shall be no more than twice the estimated amount necessary to correct the defects and/or deficiencies, provided that no such withholding shall be required if Contractor provides Amtrak with a letter of credit in the applicable amount and satisfactory to Amtrak. Such letter of credit shall be assignable to the Financing Parties. Contractor shall not perform any such corrective Work on Amtrak's premises without Amtrak's express permission and direction.

8.3.3.1. If Amtrak grants Contractor permission to perform work on the railroad or Amtrak's premises, Contractor shall execute Amtrak's then current Temporary Permit to Enter prior to performing any work on the Railroad or Amtrak's premises. Amtrak shall set a date upon which the defects and/or deficiencies must be corrected. Unless otherwise agreed to by Amtrak, such date shall not allow for more than sixty (60) days to correct the defects and/or deficiencies. Should Contractor fail to remedy the defects and/or deficiencies within this timeframe, Amtrak may elect to remedy such defects and/or deficiencies in whatever manner it sees fit including hiring another contractor at Contractor's expense including any incidental costs related to the hiring of such third party.

8.3.4. After all defects and deficiencies, including open FMIs and any fleetwide modifications, have been remedied to Amtrak's satisfaction, the Contracting Official shall issue a Certificate of Final Acceptance.

8.4. Reliability Demonstration for Final Fleet Acceptance and Final Fleet Acceptance

8.4.1. As a condition precedent to Final Fleet Acceptance, in accordance with the Specification, a Reliability Demonstration must be successfully performed, analyzed and reported upon by the Contractor to validate the reliability of the cars, systems, subsystems and components in Revenue Service. To meet the Reliability Demonstration in any continuous three hundred and sixty-five (365) day period (the "Measurement Period"), the Fleet must meet the Reliability Requirements, including the MDBSF, MDBCF and availability targets and requirements, in the Specification at Chapter 4: Reliability, Availability and Maintainability. Additionally, all open FMIs and any outstanding Fleet wide modifications must be completed and accepted by Amtrak.

8.4.2. If Contractor is unable to achieve Final Fleet Acceptance within two (2) years after the issuance of a Certificate of Final Acceptance for the last unit of Equipment, Amtrak and Contractor shall meet to address the issue and Amtrak shall determine next steps.

8.5. Rate of Delivery and Acceptance

8.5.1. In any forty (40) day period, the Contractor shall not tender more than ten (10) Cars for acceptance or conditional acceptance, unless otherwise agreed to by Amtrak in writing. All Equipment shall be tendered for acceptance in accordance with the Amtrak-approved Delivery and Acceptance Schedule, which shall specify the type, quantity, and order of Cars to be delivered to Amtrak for acceptance . Unless otherwise agreed to and directed by Amtrak, no Option Orders shall be delivered to Amtrak until after delivery and acceptance of the Base Order.

8.6. Special Tools

8.6.1. The Contractor shall deliver and tender for acceptance the Special Tools to the locations identified in the Technical Specification (or any alternative location specified by Amtrak) upon the dates specified by Amtrak. Special Tools shall be delivered to Amtrak no sooner than within thirty (30) days of the first unit of Equipment is presented to Amtrak for conditional acceptance.

8.6.2. Amtrak shall not be obliged to accept any of the Special Tools for acceptance unless:

i). Amtrak has received the Special Tools Delivery Documentation;

ii). the Special Tools conform with the Contract; and

iii). the Special Tools comply with all Applicable Laws.

Where each condition specified herein has been fulfilled, acceptance of the Special Tools shall occur and, subject to receipt of payment for the Special Tools, title in the Special Tools shall transfer to Amtrak, or an entity designated by Amtrak.

8.6.3. The Contractor shall ensure that sufficient numbers of Amtrak's staff are trained to operate the Special Tools by the time the Special Tools are delivered pursuant to the Contract. If the TSSSA is terminated due to a TSSSA supplier event of default, the Contractor shall

arrange at its own cost for the training required to enable the replacement supplier's staff to operate the Special Tools.

8.7. Failures

8.7.1. Amtrak shall not be obligated to accept any unit of Equipment for final acceptance or conditional acceptance if a failure has become apparent in another unit of Equipment which has been, or is to be, delivered, until such time as Amtrak is satisfied that the same failure is not present in the unit of Equipment to be accepted, or has been remedied or Contractor has proposed a suitable plan to remedy such failure. Notwithstanding anything to the contrary contained herein, or contained under any other Article, the delivery, acceptance, or conditional acceptance of any unit of Equipment shall not constitute a waiver by Amtrak of its rights thereafter to identify and seek any remedies available under this Contract for any failure, nonconformity or defect in that or any other unit of Equipment.

9. TESTING

9.1. In accordance with the Specification, Contractor shall provide a test plan to Amtrak (the "Test Plan") which must be approved by Amtrak.

9.1.1. Unless otherwise provided in the Contract, all costs and expenses associated with testing and inspecting the Equipment shall be borne by Contractor.

9.1.2. Notwithstanding the preceding provision, Amtrak shall not charge the Contractor a fee for the use of Amtrak-owned facilities, tracks or utilities located at Amtrak's facilities, or for the use of Amtrak personnel, the first time a particular inspection or test is performed on a particular unit of Equipment. Amtrak shall have the right to charge Contractor for, and Contractor shall pay, all such expenses in connection with any re-inspection or retesting of a particular unit of Equipment required as a result of a unit of Equipment not having successfully passed the applicable test. Acceptance of the Fleet or any Equipment thereof by Amtrak shall not occur until after all tests, and retests if applicable, are successfully completed in accordance with the requirements stated in the Contract.

9.2. If the Contract, or any subcontracts, Applicable Laws of any public authority having jurisdiction over Amtrak operations, require the Equipment or other Supplies to be inspected, tested or approved, Contractor shall give Amtrak at least forty-five (45) days in order to assure timely notification to the FRA and sixty (60) days for international travel. This will allow time for arrangements for such testing so Amtrak may observe such inspection, testing or approval. Contractor shall perform and bear all costs of performing such inspections, tests and approvals unless otherwise provided in the Contract. If after Contractor begins delivery of the Equipment or Supplies, Amtrak determines that any such item, Amtrak determines that any such item requires additional inspection, testing, or approval (in addition to inspections and tests provided under the Contract), Contractor shall, upon written authorization from Amtrak, order such additional inspection, testing or approval and Contractor shall give notice as provided hereunder. These additional inspections or tests shall be conducted at the initial expense of Amtrak, and Amtrak shall grant a non-compensable extension of time equal to any delay caused by such tests.

Notwithstanding the preceding sentence, if such additional test or inspection reveals a defect or failure of the Equipment or Supplies to comply with the requirements of the Contract; or with any Applicable Laws, ordinances, rules, regulations or orders or if the original test or any retest or additional testing is improperly conducted by a Contractor Party, Contractor shall bear all costs of correction and retesting thereof, and no extension of the Contract Time shall be granted. Required certificates of inspection, testing or approval shall be secured by Contractor and promptly delivered to Amtrak. Neither the observations nor representations of Amtrak in its administration of the Contract, nor Amtrak's inspections, tests or approvals shall relieve Contractor from its obligations to perform the Work in accordance with the Contract.

9.3. Except as otherwise provided herein or agreed to by the Parties; tests shall be performed at plants of Contractor or its Subcontractors. Contractor shall have executed Amtrak's then-current Temporary Permit to Enter prior to performing any work on the Railroad or Amtrak's premises.

9.4. Contractor and Amtrak jointly shall select suitable track of proper length and alignment to permit implementation of the qualification track tests required. These tests shall be conducted by, and at the expense of, Contractor; provided that the first time a particular inspection or test is performed on a particular unit of Equipment, Amtrak shall not charge Contractor a fee for the use of Amtrak-owned facilities, tracks or utilities located on the Northeast Corridor, or for the use of Amtrak personnel, in connection with such inspection or test. Amtrak shall have the right to charge Contractor for, and Contractor shall pay, all such expenses in connection with any re-inspection or retesting of a particular unit of Equipment required as a result of the unit not having successfully passed the applicable test. All working and moving parts, and all operating devices and controls of each unit of Equipment and its apparatus, shall be tested and put in proper operating condition by Contractor and approved by Amtrak before a unit of Equipment shall be accepted by Amtrak. Contractor shall perform all of the adjustments specified herein.

9.5. Should a unit of Equipment be disassembled in any way for shipment, an operational test shall be conducted by Contractor upon reassembling at the delivery point on a track provided by Amtrak at the expense of Contractor. Any such test shall be witnessed by Amtrak.

9.6. After receipt of a unit of Equipment at the designated delivery point and before being put into passenger service, the unit of Equipment shall be inspected by Amtrak and any part, device or apparatus requiring adjustment, repair or replacement shall be called to the attention of Contractor, in writing, who shall promptly make adjustment, repair or replacement at its own expense. All costs and expenses incurred in performing these tests shall be borne solely by Contractor.

10. PAYMENT

10.1. Amtrak shall make milestone payments to Contractor pursuant to an approved payment schedule upon Contractor's successful completion of certain tasks (milestones) during the Contract. Contractor shall not be entitled to any milestone payment until its respective milestone is achieved and Contractor may only invoice Amtrak for the completion of a milestone if Contractor is in compliance with the Contract including the performance assurance requirements of Article 6. In the case of a conditional acceptance milestone, no milestone payment shall be due until the earliest

date such milestone was to have been achieved, as set forth in the Milestone Payment Schedule. Any milestone based on acceptance or conditional acceptance of a unit of Equipment shall be deemed achieved on the last day of the month in which a Certificate of Final Acceptance or Certificate of Conditional Acceptance, as applicable, for such unit of Equipment is issued.

10.2. Any invoice based upon the acceptance or conditional acceptance of Equipment shall indicate the Equipment number on the invoice, and have attached a copy of the signed Certificate of Final Acceptance or Certificate of Conditional Acceptance, as applicable. Payment for accepted or conditionally accepted Equipment shall be made in accordance with the Contract.

10.3. Except for any other express provisions to the contrary contained in the Contract, Amtrak shall pay all undisputed invoices within ninety (90) days of receipt of an invoice meeting the criteria set forth herein. Amtrak shall not pay penalties, interest charges, or collection fees on any late payments [Contractor may request earlier payment at a discount to be agreed by Amtrak at the time of invoice submission.] Notwithstanding the foregoing, in light of any potential Financing Parties requirements, reasonable adjustments to the payment procedures may be requested by Amtrak.

10.4. Final Payment shall not become due until a Certificate of Final Fleet Acceptance has been issued by Amtrak, there are no open FMIs and all associated contract deliverables have been delivered and/or submitted to Amtrak and the Contractor or its Subcontractor, if applicable, submits to Amtrak: (a) an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which Amtrak might in any way be liable have been paid or otherwise satisfied; (b) consent of surety, if any, to final payment; (c) if required by Amtrak, other data establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of liens arising out of the Contract, to the extent and in such form as may be designated by Amtrak; (d) all guarantees and warranties, license agreements, fabrication Drawings, and all other documentation or items required pursuant to the Contract; (e) proof of all governmental approvals related to operation of the Equipment that must be effectuated by Contractor; (f) a certificate evidencing that insurance required by the Contract to remain in force after final payment is currently in effect and shall not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to Amtrak and the Financing Parties; (g) a written statement that Contractor knows of no reason that the insurance shall not be renewable to cover the period required by the Contract; (h) a properly executed voucher and (i) any additional documents required to effectuate the transfer of title to Amtrak, or an entity designated by Amtrak, or ensure compliance with the Contract. If any of Contractor's Subcontractors refuse to furnish a release or waiver required by Amtrak, Contractor may furnish a bond satisfactory to Amtrak to indemnify it against any such lien. If any such lien remains unsatisfied after all payments are made, Contractor shall refund to Amtrak all moneys that the latter may be compelled to pay in discharging such lien, including all costs and reasonable attorney's fees. Final Payment is subject to adjustment to account for damages and disputed payments or Claims, including liquidated damages assessed pursuant to Article 12.

10.5. Contractor shall invoice Amtrak by submitting an original invoice, along with supporting documentation, to the individual at the address set forth in the Contract. In accordance with an

Amtrak-approved payment schedule, Amtrak shall pay Contractor ninety-five percent (95%) of all undisputed invoiced amounts. Amtrak shall pay all invoices in accordance with an Amtrak-approved payment schedule.

10.6. At least one hundred and twenty (120) days prior to completion of the second to the last scheduled milestone, the parties shall meet to discuss the transition period, which shall be the period from the transition meeting until Contract termination. During this transition, the Contractor shall provide Amtrak with all required documentation, evidence of work completion, updates to manuals, training curriculums and a schedule of future upgrades to the equipment and software. At this meeting, the contractor shall provide its plan for required warranty support and operational transition.

10.7. The acceptance of Final Payment shall constitute a waiver by Contractor of all Claims except for those that have been submitted to the dispute resolution procedures of Section 35.6.

11. PROJECT MANAGEMENT

11.1. Contractor shall manage the project in accordance with the Contract and comply with all terms therein.

12. LIQUIDATED DAMAGES

12.1. The parties have agreed that Amtrak shall be damaged if the conditions prerequisite to issuance of a Certificate of Final Acceptance or Certificate of Conditional Acceptance for the Base Order and any Options ordered under the Contract have not been met by Contractor with respect to any or all of the Equipment by the time (the "Delivery and Acceptance Schedule") specified in the Contract for such conditions to have been met, or any extension of such time granted pursuant to the terms of the Contract and (i) that such damages would include, but not be limited to, loss of revenues arising from the loss of both current and potential ridership and (ii) the extent of such damages would be uncertain in amount and difficult to ascertain. Accordingly, the parties have agreed that Contractor shall, in place of actual damages for such delay, pay to Amtrak as fixed, agreed, and liquidated damages an amount as follows:

Vehicle Type	**Liquidated Damages Amount**
Accessible Sleeper Car	$1,000
Cab Car	$1,000
Café' Car	$500
Diner Car	$1,000
Diner Lounge Car	$1,000
High-Capacity Coach Car	$500

Premium Accessible Coach Car	$500
Standard Coach Car	$500
Standard Sleeper Car	$1,000
Utility Car	$500

12.1.1. Contractor understands that Amtrak requires batch deliveries as set forth in Exhibit V to align with Amtrak's utilization, commissioning, maintenance, and fleet-integration plans. Amtrak does not intend to introduce Cars into Revenue Service on a one-off or incremental basis. Batch-level deliveries are necessary to allow Amtrak to place Cars into coordinated service configurations and to maintain efficient deployment and training schedules. Contractor shall therefore plan and execute its production and delivery activities in a manner that facilitates timely batch delivery and issuance of Certificates of Conditional Acceptance for all Cars in each batch.

12.1.2. The Parties acknowledge that, although the liquidated damages specified in this Article 12.1 are calculated on a per-Car basis, the Delivery and Acceptance Schedule set forth in Exhibit V requires that Cars be delivered in production batches of ten (10) Cars, or such batch size as may be expressly agreed to by Amtrak and reflected in Exhibit V. Contractor shall sequence and perform, production, testing, shipment and delivery activities so as to ensure that each batch is delivered in accordance with the dates established for that batch in the Delivery and Acceptance Schedule.

12.1.3. Cars that have been fully manufactured but are awaiting shipping, staging or tender to Amtrak while Contractor completes the remaining Cars in the applicable production batch shall not be exempt from liquidated damages. A Car shall continue to accrue liquidated damages until Amtrak issues a Certificate of Conditional Acceptance for that Car in accordance with Article 8.

12.1.4. For the avoidance of doubt, if any Car within a required batch does not meet the applicable Conditional Acceptance date for that Car, all Cars in that batch shall accrue liquidated damages until each Car in that batch has received a Certificate of Conditional Acceptance.

12.2. The liquidated damages described in Section 12.1 shall not exceed twenty percent (20%) of the Contract Amount.

12.3. Cars for each day of delay. The amount shall be calculated by multiplying the figure set forth in the chart above by the number of days delay for each Car.

12.4. In addition to the liquidated damages for delay described above, for a period of thirty-six (36) months for each unit of Equipment, Contractor shall pay Amtrak as fixed, agreed and liquidated damages, for each Car the following amounts:

(a) Failure – Type I the amount of $29,960.

(b) Failure – Type II the amount of $5,992.

(c) Failure – Type III the amount of $322.

(d) Failure – Type IV the amount of $60,000.

In addition to the foregoing, for each day that the original Failure has not been resolved due to Contractor's failure to provide the spare parts or Materials needed to remedy or repair the Failure, Contractor shall pay to Amtrak the Availability Performance Guarantees set forth in the TSSSA Scope of Work at Section G.11.

If a Failure can be classified as more than one type, Contractor shall pay the higher amount.

For each Car delivered under the Contract, the thirty-six (36) month period for each Car shall begin thirty (30) days after the date the Car is first placed into Revenue Service.

12.5. Amtrak shall use reasonable efforts to move any Equipment that requires warranty work to a maintenance facility within one (1) day. Any additional time required to move such Equipment to a maintenance facility shall not be deemed as "Out-of-Service" time. However, it is agreed that any time required to make such warranty repair or field modification work on any Equipment shall be deemed "Out-of-Service" time. Field modifications, which result from Amtrak change orders, shall not fall under this provision. During the period in which Equipment is in a maintenance facility for warranty work, Amtrak and/or the Federal Railroad Administration shall be allotted one (1) day of unavailability for any scheduled maintenance inspections and such time shall not be deemed "Out-of-Service" time.

12.6. Amtrak reserves the right to determine the suitability of any Equipment for return to Revenue Service based upon the past performance of such Equipment and the demonstration of the adequate and satisfactory repair of such Equipment.

12.7. Liquidated damages payable pursuant to this Article 12 may be retained by Amtrak from, and may be offset by Amtrak against, monies due or to become due to Contractor or, at its option, Amtrak may invoice Contractor for Liquidated damages payable pursuant to this Article 12 as they become due, in which case Contractor shall pay such invoices within thirty (30) days.

12.8. In the event that Contractor's performance is delayed to such an extent that, by the terms of Section 12.1, aggregate liquidated damages calculated in accordance with Section 12.1 would equal or exceed five percent (5%) of the Contract Amount, or the first two (2) units of Equipment ordered under the Contract do not meet the requirements for issuance of a Certificate of Conditional Acceptance within three-hundred sixty-five (365) days of the date scheduled for issuance of such certificates under the Contract, then Amtrak shall have the right to terminate this Contract for default, in whole or in part, under Article 16. If the Contract is terminated for default pursuant to this provision, Contractor shall be liable for fixed, agreed, and liquidated damages calculated as provided in Section 12.1, and such amount shall be in addition to amounts payable pursuant to Article 16 hereof; provided, however, that Amtrak shall not have the right to recover,

under Article 16, monetary damages for delay for which Amtrak was also compensated under this Article 12.

12.9. The parties have agreed that Amtrak shall be damaged in the event that the satisfaction of the condition's prerequisite to issuance of a Certificate of Conditional Acceptance with respect to any Equipment is delayed beyond the applicable Delivery and Acceptance Schedule. The parties further agree that (i) the damages that would result from such delay would include, but not be limited to, loss of revenues resulting from the loss of both current and potential ridership, increased project and personnel costs, and additional costs resulting from the use of replacement equipment, and (ii) the extent of such damages would be uncertain in amount and very difficult to ascertain. Accordingly, the parties have agreed to establish the liquidated damages set forth in this Article 12 and agree that these damages do not constitute a penalty but rather a reasonable prediction of portions of damages Amtrak would incur as a result of a delay in the delivery of the Equipment. Amtrak acknowledges that by entering into this liquidated damages provision except as otherwise provided for herein it shall forego portions of the consequential damages it might be entitled to recover arising from the events described in this paragraph. The remedy provided for by this Article 12 is cumulative with and in addition to all other rights Amtrak has hereunder and all other remedies to which Amtrak is entitled at law or in equity in respect of facts, circumstances, events or occurrences other than delays described in this Article 12, it being understood that Amtrak shall not have the right to recover monetary damages solely for such delay in excess of those contemplated by Article 16.

12.10. Amtrak may deduct from subsequent payments due Contractor under any contract with Contractor or from any sums retained, all or such part of these sums as may be required to pay the aforesaid damages, with Contractor being responsible for any deficiency.

13. WARRANTY

13.1. Contractor covenants and warrants to Amtrak that each unit of Equipment, Special Tool and Spare, including, but not limited to, the Amtrak-Owned Spares, and all parts (including spare parts), Mockups and equipment accessories and the Technical Documentation furnished under the Contract shall be new, the best of its kind or quality, free from Failures, defects in design, material and workmanship and Fit for Purpose, and shall be constructed and shall operate in conformance with the requirements and Specifications of the Contract. If required by Amtrak, Contractor shall furnish evidence satisfactory to Amtrak as to the kind and quality of materials and equipment. The terms "breach", "defect", "fault", or "defect in workmanship, materials or design" and like terms as used in this Article 13 shall mean, with respect to any Work, Supplies or other items furnished by Contractor or any Subcontractor, that they are not as warranted under this Article 13, which includes a warranty that items must comply with the requirements and specifications of the Contract.

13.2. Contractor also covenants and warrants that all electric, electronic and mechanical systems (including software) incorporated in the Equipment, Special Tool, Spare, including, but not limited to, the Amtrak-Owned Spares, and all parts (including spare parts), Mockups and equipment accessories and other Supplies and items furnished under the Contract shall be covered by the warranty of Section 13.1 and also shall be integrated so that they operate without any

electric, electronic, magnetic, mechanical, chemical or other interference between them. This applies whether the systems concerned are supplied by Contractor or its Subcontractors at any tier.

13.3. The warranties specified under this Article shall commence for a given Car upon the issuance of a Certificate of Final Acceptance or a Certificate of Conditional Acceptance, or at installation for Spare Parts. Subject to Section 13.4 hereof, the length of the warranty period for a component of a Car, including, but not limited to, the Amtrak-Owned Spares shall be as follows:

Component	**Warranty Period**
Car Body Structure	30 years
Truck Frames	15 years
All Supplies, Work, including elevators, lifts, retrofits, and other components, including, but not limited to the Amtrak-Owned Spares, Spares, parts and accessories (other than consumable or expendable items or materials within the purview of Section 13.4 hereof).	3 years

Ninety (90) days prior to the delivery of the first unit of Equipment, Contractor shall submit to Amtrak for its review and approval a Warranty Plan. This Plan shall describe how the Contractor will manage warranty activities including staffing, modifications/design changes, warranty spare parts, and any other activity necessary to maintain the required availability of the Fleet. As such:

(e) The Contractor shall establish and maintain procedures for servicing delivered products during the warranty period.

(f) Procedures shall define Contractor and subcontractor methods for verifying that warranty service requirements are met.

(g) Procedures shall delineate the Contractor's servicing and warranty responsibilities in accordance with this Contract.

(h) The Warranty Plan shall define the amount of warranty spare parts required for the entire warranty period, and where these spare parts will be stored for quick access.

(i) The Warranty Plan shall also describe how additional parts can be provided upon short notice in case of unexpected fleet-wide defects. Under no circumstances shall the Contractor use parts intended for ongoing vehicle production and assembly.

(j) In the Warranty Plan, the Contractor shall include a Field Modification Instruction (FMI) Control Plan.

13.4. Contractor is responsible for all costs of labor and material for defect identification and location, and for the removal, repair, or replacement of defective parts, and for alterations, repairs, tests, and adjustments in connection therewith, made to conform the Contract Specification and all other relevant provisions of the Contract. All work performed by Amtrak personnel on behalf of the Contractor in connection with this section and all other applicable sections of the Contract shall be billable in accordance with Amtrak's Billing Guidelines. Replaced and/or repaired items are warranted and guaranteed for the remainder of the warranty period or for one (1) year, whichever period is the greater.

In the event that Amtrak incurs costs, including consultant costs, which are directly attributable to the Contractor fulfilling its warranty obligations or the Contractor's breach of its warranty obligations, Contractor shall be responsible for Amtrak's total extra costs it incurs for the related labor, materials, Equipment and/or consultant services, including consultant efforts reviewing drawings, conducting inspections and monitoring FMI procedures. The remedies included herein are not exclusive and are in addition to those available to Amtrak under the Contract and at law.

13.5. During the respective periods of the warranty, all Car parts or material caused to be damaged as the result of a defect in design, material, or workmanship in other Car parts or material, shall be repaired or replaced at the expense of the Contractor. Failure reports must accompany all repaired parts.

(k) The Contractor shall, within three (3) days from discovery of a breach of warranty or notification by Amtrak of a warranty claim (whichever occurs first), deliver repaired and replacement parts; prior Amtrak authorization is required for return period exceeding three (3) days.

(l) The Contractor shall maintain support material necessary to eliminate any extended removal of cars from revenue service.

(m) Failure analysis reports must accompany all repaired parts.

13.6. In no case shall any correction of defects in design, material, or workmanship take the form of an increase in maintenance requirement beyond that specified in the Contract, described in the original edition of the maintenance instructions, approved in the Baseline design, or submitted by the Contractor at the time of proposal for the Contract.

13.7. Where five (5) percent of the quantity of a warranted item fails or where five (5) percent of Cars per a fleet type are affected during the warranty period as noted in the Specification(s), Amtrak may classify the total of such items as a failure, or fleet defect, including those items for which the warranty period expired before Amtrak recognized the failure. The Contractor is responsible for all costs of labor and material, for defect identification and location, and for removal, repair or replacement of defective parts, and for alterations, repairs, tests and adjustments in connection therewith made to obtain car performance identified in the technical specifications. All such

replaced or repaired items is warranted and guaranteed for the remainder of the warranty period or for one (1) year, whichever period is greater.

13.8. All corrective and warranty work and services shall be performed by Contractor, at Contractor's sole cost and expense, and may occur on Amtrak's property or at another location designated or approved by Amtrak. Amtrak employees may observe any such corrective or warranty work for training and knowledge-transfer purposes. Amtrak will not perform warranty repairs except where expressly authorized in writing by Amtrak, and any such authorized work performed by Amtrak shall be at Contractor's expense, including the costs identified in Exhibit S-Amtrak Billing Guidelines.

13.9. The Contractor shall provide an on-site Warranty Coordinator to handle and coordinate with Amtrak all warranty issues for a period of two (2) years from the date of Conditional Acceptance of each car. The Warranty Coordinator shall respond to all issues within one (1) business day of notification.

13.10. Any repair or retrofit work required to fulfill these guarantees shall be accomplished with minimum disruption to Amtrak's operation and its maintenance facility. Amtrak shall give prompt notice of the defect when and if it discovers it, and reasonable access to the defective part(s). Contractor warranty obligations may terminate if the defective part(s) has been materially changed or altered without the Contractor's knowledge.

13.11. If Equipment is removed from Revenue Service for one (1) week or more for warranty/repair/retrofit work, the duration of the time the Equipment is removed from service will extend the warranty period accordingly.

13.12. Due to the regular maintenance demands on Amtrak facilities and the operations personnel, it may be possible to undertake only minimal adjustment, repair, or replacement work on Equipment prior to Final Acceptance. The Contractor shall, in such an event, be responsible for securing facilities and personnel to complete all additional work required for the duration of the Contract.

13.13. Consumable or expendable items of material, as identified by part number and description by Contractor and agreed to by Amtrak, in writing, prior to final acceptance of the first unit of Equipment, such as brake pads, light bulbs, air filters, windshield wiper blades, etc., are warranted for the normal use of the item unless it is determined by Amtrak that the failure of the expendable or consumable item of material was caused by defective manufacture or design rather than normal wear and tear expected for such items.

13.14. During the Warranty Period whenever the failure rate exceeds that of the totals in Section 13.7, a failure analysis to determine the cause and frequency of defects covered by this warranty shall be performed by the Contractor and submitted to Amtrak for review. Type and process of said failure analysis and conclusions shall be reviewed and approved by Amtrak prior to determining suitable corrective action. Such analysis shall be performed and reported to Amtrak within thirty (30) days from the date Contractor becomes aware of each failure.

13.15. Upon occurrence of a breach of warranty, Contractor shall provide a written report on the scope of any repair or replacement warranty work necessary and plan an optimum manner of accomplishing such work (taking into account Out-of-Service time, skill levels, space restraints, cost and other relevant factors), which must be agreed to and approved by Amtrak. If Contractor fails promptly to remedy the breach, Amtrak may take such actions as it deems appropriate to remedy the breach and Contractor agrees to reimburse Amtrak for all costs and expenses, (including profit and overhead) incurred thereby.

13.16. If, at any time prior to the expiration of the Warranty Period for the Equipment, the cumulative defects or failures of any kind in identical components or systems within the Equipment serving substantially similar functions exceed the applicable percentage of such components or systems shown in the table below or in the case of Safety Critical of Major Components or Failures in such components reaches or exceeds five percent (5%), Contractor shall submit to Amtrak for review and approval within thirty (30) days a "Fleet Modification Program" with respect to all such components or systems in the Equipment. (Note: Within fifteen (15) days of shipment of the first unit of Equipment or some other time agreed to by Amtrak, Contractor shall provide to Amtrak for its approval, a list of Major Components.)

If the Total Number of Components or Systems in the Active Fleet is	**then the Applicable Failure Threshold Percentage Triggering Component Redesign is**
18 or less	20%
19 – 35	15%
36 – 500	10%
501 – 3,500	7.5%
3,501 or over	5%

The Modification Program shall ensure that all such components or systems on a fleet wise basis are no longer defective or at risk of defect or Failure, and are otherwise cured, at no additional cost to Amtrak. The Fleet Modification Program Plan shall include the Contractor's schedule for delivering the required materials, standard hours for installation and installation schedule. Contractor shall provide all required material, instructions and technical support along with reimbursement for Amtrak labor required to carry out the Fleet Modification Program. If Amtrak agrees to perform the labor, Amtrak shall be reimbursed in accordance with Exhibit S Amtrak Billing Guidelines (for the given Fleet Modification Program period. Such Fleet Modification Program Plan shall have as its goal to bring the fleet to optimal operating condition in as short a timeframe as possible with the least amount of financial and other impact to Amtrak.

If Amtrak notifies Contractor in writing that it does not approve of the Fleet Modification Program Plan, Contractor shall revise the proposed Fleet Modification Program Plan until approved by Amtrak, whose approval shall not be unreasonably withheld. Upon approval, the Fleet Modification Program shall be implemented promptly in accordance with a mutually agreed upon schedule.

If the material for a scheduled Fleet Modification Program is not available on the agreed-upon date per the Fleet Modification Program Plan, the Equipment shall then be considered in Car Held for Material (CHFM), status and Contractor shall pay to Amtrak the Performance Guarantee amounts for CHFM set forth in the TSSSA.

In the event that such defects or failures require the removal of major components or assemblies for the purpose of repairs or modifications, and such removals render any Equipment inoperable or unfit for safe and efficient operation in passenger service, Contractor shall furnish an adequate number of spare components or assemblies for the temporary use by Amtrak within twenty (24) hours of notification by Amtrak so as to avoid downtime of the affected Equipment while repairs or modifications are being done.

13.17. Contractor shall maintain a sufficient quantity of Spares and other spare components to enable it to provide for warranty parts replacement within the timeframes set forth in the TSSSA If Contractor fails to provide Spares within these timeframes, the Equipment shall be considered a CHFM, as that term is defined in the TSSSA and in accordance with the same, Contractor shall pay to Amtrak the amount set forth therein for each hour of delay. Any accepted Equipment which during the Warranty Period (including any extensions) that Amtrak has found to be unavailable for service beyond the twenty-four (24) hour period after notification due to the unavailability of Spares or spare components shall be treated as a delayed delivery and subject to the conditions of Liquidated Damages for delay.

13.18. After one (1) or more unit of Equipment has been accepted, if, during the Warranty Period, one (1) or more unit of Equipment is inoperable or unfit for safe and efficient operation in regular service during any thirty (30) day period due to defects in design, materials or workmanship whether or not of the same type or kind, as determined by the COTR, the COTR may require the Contractor, within thirty (30) calendar days after receipt of written notice from the COTR, to submit a Contractor's proposal for a "Remanufacturing Program" or "Campaign" to accomplish the necessary repairs, replacements or modifications at no additional cost to Amtrak with the least disruption to or interference with scheduled Revenue Service. Such Remanufacturing Program or Campaign shall consist of, but not be limited to, at least one of the following:

(n) Arrangement by Contractor to have the necessary repairs, replacements or modifications performed by Amtrak; or

(o) Arrangement by Contractor for the use of suitable facilities, on Amtrak property (if agreement can be reached on their availability) or in the vicinity thereof, to be manned by the Contractor's personnel to perform the necessary repairs, replacements or modifications; or

(p) Arrangement by Contractor to have the necessary repairs, replacements or modifications performed by qualified mutually agreed upon third parties located in the vicinity of Amtrak property, or if the parties cannot promptly mutually agree, by a qualified third party selected by Amtrak.

13.19. Except as otherwise provided in Sections 13.7 or 13.11 hereof, all materials, parts, and Equipment which are repaired or which replace items which were found to have had defects in design, material or workmanship shall be warranted for the remainder of the applicable Warranty Period or for one year from the completion of testing of the Equipment in which the repaired or replaced part is installed, or for one year from the date on which the applicable Equipment is returned to service, whichever provides the longest Warranty Period for the applicable item.

13.20. In the event during the Warranty Period that repairs and/or modifications on all or any Equipment, made necessary by defective design, material or workmanship or they are not otherwise as warranted, are not permanent or completed due to lack of material or inability to provide the proper repair, the Warranty Period for all parts and materials on such Equipment shall be extended by the amount of time the applicable Equipment is not in operation in regular service due to lack of Contractor parts, material or inability to provide the proper repair, as determined by Amtrak. In the event a fleet-wide retrofit is required during the Warranty Period due to defects in design, material or workmanship or parts, material or Equipment were not otherwise as warranted, then if the original Warranty Period for the relevant item is due to expire within three (3) years of the retrofit, the balance of such Warranty Period shall be extended two (2) years from the time then remaining on the warranty.

13.21. If separate or additional warranties covering material and/or Equipment included in a Equipment or the Fleet are furnished by any of its Subcontractors, Contractor shall provide these warranties to Amtrak in addition to the warranties set forth herein, provided that Amtrak shall not be obliged to look to anyone other than the Contractor for fulfillment of all warranty requirements under this Contract. The existence of any separate or additional warranties which run to the Contractor from any of its Subcontractors covering an item of material and/or Equipment included in an Equipment or the Fleet shall not relieve the Contractor of its obligation to repair or replace any of the material and/or Equipment due to defects in design, manufacture or workmanship or if they are not otherwise as warranted during the Warranty Period. Amtrak shall not be required to rely on another party for fulfillment of warranty provisions.

13.22. The Contractor shall, for a period commencing on delivery of the first unit of Equipment and terminating upon the expiration of the final Three-Year Warranty Period (or any extension thereof) maintain field engineers at the designated Amtrak sites as prescribed under the TSSSA (whether or not in effect) to correct faults and defects that may be encountered. These field service personnel shall be supervised and guided by a Field Service Supervisor who shall provide guidance of such warranty-related activities. The Contractor's representatives shall be qualified field engineers, knowledgeable in the repair and maintenance of Equipment and other Supplies covered under this Contract and when on-site shall be located at a portable field office at Amtrak. All utilities and all other supports necessary to maintain the portable office facility shall be provided by the Contractor.

13.23. During the Warranty Period, Contractor shall keep a log of all faults and defects found in each unit of Equipment, and of any adjustments and changes made in order to remedy such faults and defects. The Contractor shall submit to Amtrak a report of warranty work performed during preceding week. The Contractor shall track defects and submit a monthly report including all failures and defective items with running totals on a monthly and cumulative basis.

13.24. The warranties hereunder shall run to Amtrak, any Financing Party and each of their successors and assigns. The remedies provided for breach of warranties are cumulative and not exclusive.

13.25. Corrective Action During the Warranty Period:

Amtrak shall give the Contractor written notices of observed defects or failures. Unless otherwise directed in said notices, Contractor shall commence effort to correct the work at the time specified by Amtrak but in no event later than two (2) working days following notification by Amtrak of the defect or failure. Contractor shall diligently pursue such corrective work to completion. To prevent delays and disruption to Amtrak's operations, Amtrak shall have the right, when practical and feasible in its opinion, after receiving written comments from Contractor, to continue use of any such Supplies, including, but not limited to, the Equipment and subsystems, deemed defective or unsatisfactory, until such Supplies, including, but not limited to, the Equipment can be taken out of service pursuant to the corrective work hereby undertaken by Contractor.

13.26. In the event a defect or failure, in the opinion of Amtrak, constitutes an emergency which could jeopardize or impair the operations and schedules of Revenue Service, then in that event Amtrak shall provide the Contractor both verbal and written notice thereof and the Contractor shall commence corrective work within twenty-four (24) hours of any working day after receipt of Amtrak's incident report/warranty claim. Nothing herein shall be construed as preventing Amtrak's forces or its subcontractors from immediately commencing corrective work, provided such corrective work is performed in accordance with the Operator and Maintenance Manuals furnished by the Contractor as specified in the Contract. Contractor shall reimburse Amtrak for costs of such corrective work, including labor, fringe benefits, overtime and overhead at the prevailing rates when the work is performed. Amtrak shall advise Contractor of the current rates. Any corrective work by Amtrak's forces or its subcontractors shall not be construed to invalidate Contractor's warranties and other provisions contained in the section.

The Contractor shall submit a list of all parts and quantities being proposed that are appropriate and reasonably necessary to support warranty compliance efforts during this period. The list shall be submitted to the Amtrak COTR no later than delivery of the first unit of Equipment for approval. The list shall be submitted to the Amtrak Project Director no later than delivery of the first unit of Equipment approval. All of the items approved shall be stocked by Contractor and made available for use within thirty (30) days after approval of them. Contractor shall stock and make available additional items, spares and replacement parts which Amtrak determines are reasonably necessary or desirable for warranty service. Contractor shall acquire and stock such items, Spares and parts as soon as is practicable, and in accord with the terms governing the acquisition and stocking of Spares and parts under the TSSSA. At the end of the Three-Year Warranty Period for the final unit of Equipment, Contractor shall make available to Amtrak at no cost all remaining inventories of Spares and other parts acquired to provide warranty service.

The warranty provisions described in Article 13 above shall be applicable to each spare part replaced by Contactor for parts used pursuant to Section 13.16 above.

13.27. During the first three years of the Warranty Period, the Contractor shall maintain, a field office with qualified representatives to be available for the corrective work under the warranty. The Contractor's representatives shall be qualified field engineers, knowledgeable in the repair and maintenance of equipment covered under this contract and shall be located at a portable field office at Amtrak. All utilities and all other supports necessary to maintain the portable office facility shall be provided by the Contractor. The field engineers shall be available on twenty-four (24) hours advance notice until the expiration of the warranty period for all equipment covered under this contract and the completion of all warranty work on equipment covered under this contract. The field engineers shall follow up on all warranty claims and shall assist Amtrak in the resolution of any maintenance problems. Should any warranty claim be contested by Contractor, a joint inspection shall be made by Contractor and Amtrak, with a written report made by Contractor to Amtrak concerning the Contractor's proposal to resolve the claim. Amtrak shall review the proposal and if found acceptable, Contractor shall proceed in correcting the defective work. If Amtrak does not accept the proposal, the Contractor shall proceed in accordance with Amtrak's instructions and the matter shall be treated as a contract dispute in accordance with Article 35, Claims and Disputes.

13.28. Spares and repairs provided pursuant to corrective work hereunder shall be subject to prior approval of Amtrak and shall be tendered and performed in the same manner and extent as items originally delivered. Corrective work shall be performed at Amtrak facilities or locations referenced in the TSSSA. Any warranty work shall be accomplished with a minimum of disruption to Amtrak operations and its maintenance and service facilities. Amtrak shall provide the maintenance and service facilities free of charge and provide full access to Contractor whenever corrective work is being performed. Amtrak shall make every reasonable effort to make such facilities and Equipment available to Contractor, consistent with Amtrak's operational requirements. Contractor shall bear the cost of corrective work including necessary disassembly transportation, reassembly, repair of, and replacement of the defective goods, Supplies, including, but not limited to the Equipment and, subsystems, and work.

13.29. In the event the Contractor is unable or fails to immediately commence and diligently pursue and complete the corrective work, Amtrak is by this provision authorized by Contractor, at the option of Amtrak and upon written notice to the Contractor to contract with a third party or to use its own forces for the performance of the warranty work. The costs of such work (including labor and overhead) may be deducted from monies due, or to become due Contractor. If no monies are then owed the Contactor, Amtrak shall invoice Contractor for such costs, and the Contractor shall pay the invoice within thirty (30) calendar days of its receipt. Contractor hereby agrees to reimburse Amtrak for all costs and expenses in connection with such corrective work.

13.30. It is understood and agreed that time is of the essence in respect to all corrective work to be undertaken pursuant to the warranty herein contained.

13.31. Additional Warranties and Agreements Relating to Computer Hardware, software, etc. The warranties below in this Section 13.31 do not limit the warranties otherwise set forth in Section

13 as they may apply to any software or computer systems. Contractor represents, warrants and agrees:

(q) Virus Warranty: No viruses, Trojan horses, back-doors, malware, or similar items ("viruses") are coded or introduced into any Amtrak software or computer system used by Amtrak or any Equipment, Special Tools, or other Supplies or items furnished under the Contract. Contractor agrees that in the event that a virus is found to have been introduced, Contractor shall take all reasonable action at its own expense to eliminate the virus and reduce the effects of the virus on Amtrak's operations. Contractor further agrees to cooperate with Amtrak to mitigate and restore any loss of data or operational efficiency.

(r) Disabling Code Warranty: No time-bombs, drop-dead or disabling devices, back doors or similar items are coded or introduced into any Amtrak software or computer system used by Amtrak or any Equipment, Special Tools, or other Supplies or items furnished under the Contract, and that Contractor shall not install or invoke any code which could have the effect of disabling or otherwise shutting down any portion of Amtrak's software or computer systems or any Equipment, Special Tools, Train Scanner, Simulators or other Supplies or items furnished under the Contract.

(s) Function/Compatibility/Escrow Warranty: All Software, programming and computer hardware, systems and modules and related Technical Documents that Contractor or any Subcontractor furnishes to Amtrak are (i) Fit for Purpose, (ii) capable of performing the functions for which they are intended fully and correctly, (iii) if Software, written in a programming language that is commercially available in the United States and for which compilers, interpreters and other Software tools are commercially available in the United States, (iv) capable of being copied and used by Amtrak for Allowable Uses, and (v) where not delivered outright to Amtrak, being placed into escrow, including current versions, updates and fixes of them, as provided for by Article 31.

14. SPARE PARTS

14.1. Contractor shall submit, as part of its preliminary design proposal, a preliminary spare parts list. Additionally, at least ninety (90) days prior to delivery of the first unit of Equipment it shall submit a complete and comprehensive list of recommended spare parts ("Comprehensive Spare Parts List") for each Car type. In preparing this list, Contractor shall assume that the Equipment shall be maintained at up to four (4) separate Amtrak maintenance locations. The listing shall include the price of each item with indication of which items are biodegradable, and the estimated shelf life of each item.

14.2. The Comprehensive Spare Parts List shall also list the spare parts and items which Contractor plans to inventory, or those of its Subcontractors, and whether such parts are readily available to Amtrak for immediate procurement when needed. Contractor shall also prepare a list that identifies spare parts and/or replacement parts that cannot be procured within a thirty (30) day period from the date of the applicable order (the "Long Lead Spare Parts List"). Spare parts shall

be listed showing the original manufacturer's name, lead time and part number as well as Amtrak part number. Subassemblies shall be broken down into their individual components so that the components can be ordered separately. Where parts are supplied by a company with several departments, the number from the original manufacturing department shall be included in the parts lists. All electronic components shall be available from recognized electronic distributor sources in the United States.

14.3. Contractor shall also prepare a list of spare parts intended to be supplied with the Equipment as on-board consumables ("Consumable Spare Parts List"). Parts listed on the Consumable Spare Parts List shall be listed separately. Hardware, including fasteners, listed in the spare parts list shall be specified by grade, type of thread style, length, diameter, and finish. Amtrak reserves the right to review and approve, or reject, any spare part or numbers of spares from each of these lists. Parts subject to high wear or replacement shall be available from the Original Equipment Manufacturer ("OEM"). During the Service Life of the Equipment, there shall be no restriction to prevent direct procurement from the OEM of parts by Amtrak. Contractor warrants that, for the useful life of the Equipment, it shall supply to Amtrak upon Amtrak's request spare parts for the Equipment or equivalent replacement parts for spare parts no longer in stock, which parts must be capable of being incorporated in the Equipment without material changes to Spare parts must be new and conform to the specification and/or requirements applicable to the Equipment. Contractor shall take immediate action to submit a written order confirmation to Amtrak, stating the time of delivery and price, when Contractor has received Amtrak's orders for spare parts and/or replacement parts. Amtrak's orders for spare parts and/or replacement parts shall be executed and delivered as soon as possible and in no event later than thirty (30) days after the placing of the order, except in the case of spare parts and/or replacement parts that are identified in the Spare Parts List. For those items which Contractor has indicated a lead time on the Spare Parts List of more than thirty (30) days, Contractor shall maintain a nine (9) month supply of such spare parts.

14.4. Spare parts or replacement parts shall be supplied to Amtrak at a reasonable cost not to exceed the lowest price that Contractor charges other purchasers or, in the event the spare parts and materials are unique to the Equipment and this Contract, at their cost to Contractor plus a reasonable mark-up not to exceed three percent (3%), excluding any cost associated with or attributable to non-reoccurring engineering cost or any other cost associated with any asserted obsolescence of a Spare or replacement part; provided, however, that the prices contained in the final spare parts list shall be fixed for a period of one year from the date Amtrak receives the final list.

15. CHANGES

15.1. The Contracting Official may, at any time, without notice to the sureties, if any, by written order, direct any change within the general scope of this Contract.

15.2. A change for purposes of this Article 15 shall not include a directive or other order issued to conform the Equipment to the Specification or other Contract requirements.

15.3. If any such change causes an increase or decrease in the cost of, or the time required for completion of any part of the Equipment or an impact to the cost or time of the TSSSA, Contractor shall submit a proposal in accordance with this Article 15 and the Contracting Official shall make an equitable adjustment in the Contract Amount, the Contract Time, or both, and shall modify the Contract, as appropriate.

15.4. Contractor must immediately proceed with the Contract as changed, unless otherwise directed by the Contracting Official, and further must within forty-five (45) days from the date of receipt of the written order (i) assert in writing its right to an adjustment under this Article and (ii) notify Amtrak of any impact such change shall have. A failure by Contractor to timely assert its right to an adjustment or to timely notify Amtrak of such impact shall be deemed a waiver of Contractor's right to an adjustment with respect to the change or such other Work, and of its or its subsidiary's right to an adjustment under such separate contract.

15.5. If Contractor makes a proposed change request, Contractor, in connection with such request, shall furnish a price breakdown associated with both the Contract and the TSSSA, if impacted, itemized as required by the Contracting Official, impact to schedule, resources, any new risks or impact to existing known risks with applicable mitigation plans. Unless otherwise directed, the breakdown shall be in sufficient detail to permit an analysis of all material, labor, equipment, subcontract, and overhead costs, as well as profit. Any amount claimed for subcontracts shall be supported by a similar price breakdown. In addition, if the proposal includes a time extension, a justification therefore shall also be furnished. All such changes must be recorded in the Program Change Control Log along with applicable analysis documents and final disposition of changes and necessary approvals.

15.6. If Contractor's proposal for a change in the Contract Amount includes the cost of property made obsolete or redundant by the change, the Contracting Official shall have the right to prescribe the manner of the disposition of the property.

15.7. Failure to agree to any adjustment shall be a dispute as defined under Article 35, Claims and Disputes. However, nothing in such Article shall excuse the Contractor from proceeding with the Contract as changed.

15.8. When submitting any Claim exceeding $100,000, Contractor shall provide the following certification:

"I certify that the Claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the contractor believes Amtrak is liable; and that I am duly authorized to certify the Claim on behalf of the Contractor."

(t) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(u) The aggregate amount of both increased and decreased costs shall be used in determining when the dollar thresholds requiring certification are met.

(v) The certification may be executed by any person authorized to bind the Contractor with respect to the claim.

16. TERMINATION FOR DEFAULT

16.1. Amtrak may, by written notice to Contractor, terminate for default this Contract in whole or in part if Contractor fails to perform or comply with any of its material obligations under the Contract, including:

(a) failure to make progress, gain FRA authorization, or meet any milestone so as to endanger timely performance under the Contract;

(b) failure of the Equipment to materially conform with the requirements of this Contract;

(c) failure, without cause, to make undisputed prompt payment to Subcontractors or to make undisputed prompt payment for equipment, materials and/or labor;

(d) noncompliance with the Applicable Laws;

(e) failure to comply with Amtrak's rules and proper instructions;

(f) a bankruptcy event occurs with respect to the Contractor or the Contractor's Guarantor;

(g) Contractor's liability for liquidated damages satisfies the conditions in Section 12.8;

(h) Contractor is prevented from executing the Work or Amtrak is prevented from using the Work as a consequence of any infringement of letters patent, registered design, copyright, trade mark, trade name and the Contractor is unable, within ninety (90) days (or such longer period as the Parties may mutually agree) after notice thereof, to procure the removal at its own expense of the cause of the infringement;

(i) any representation or warranty made by the Contractor or the Contractor Guarantor shall prove to be false or misleading in any material respect as of the time made;

(j) any violation of anticorruption provisions of the Contract, including but not limited to Articles 54, 55, and 56, or any violation of applicable anticorruption laws, including but not limited to the Foreign Corrupt Practices Act; in each case, in connection with this Contract; or

(k) the Contractor Guarantor, if any, breaches any provision of the Contractor Parent Guaranty or Contractor fails to maintain the Letter of Credit, Parent Guaranty or Performance and Payment Bonds as required by Article 6.

For the avoidance of doubt, the parties agree that items (a) – (k) above are material and that items (a) – (k) do not represent an exhaustive list of material defaults.

Except as set out below, Amtrak will give the Contractor written notice of the default and the opportunity to cure the default within ten (10) days (or such greater timeframe that Amtrak may specify) of Contractor's receipt of the written notice of default from Amtrak. Amtrak shall not be required to allow such cure period if Contractor's default is a violation of Applicable Law or impacts safety. Additionally, Amtrak shall not be required to provide written notice of default if Contractor fails to deliver the Equipment within the time specified herein. In the event that Contractor's material default is not excused or cured to the satisfaction of Amtrak, Amtrak may terminate the Contract in whole or in part and reprocure the Supplies, including, but not limited to, the Equipment, from another source, in which event Contractor shall be liable for (1) repayment to Amtrak of any payments made by Amtrak and (2) any Excess Costs to Amtrak relating to the reprocurement. In the event that the Contract is terminated only in part, the remaining part shall remain in full force and effect.

16.2. If Amtrak terminates this Contract in accordance with this provision, Contractor shall not be entitled to receive any further payment for the terminated Work. Further, Amtrak may take possession of all of the materials, equipment and tools on the site(s) and may continue the Work by whatever method Amtrak may deem expedient, including the acquisition, under the terms and in the manner the Contracting Official considers appropriate, of Supplies or services similar to those terminated. Provided that the termination was for default, Contractor shall be liable to Amtrak for any excess costs for those Supplies or services.

16.3. Upon termination of this Contract for default, in whole or in part, Contractor shall, if directed by the Contracting Official, take action including but not limited to:

(a) Stop the terminated Work on the date and to the extent specified in the notice of termination, without creating a hazardous condition;

(b) Place no further subcontracts for materials, Equipment, services, facilities or other items, except as may be necessary for completion of such portion of the Work that is not terminated;

(c) Unless directed otherwise by Amtrak, terminate all subcontracts to the extent that they relate to the performance of terminated Work;

(d) Furnish Amtrak with a release of all claims against Amtrak, including all claims by Subcontractors, and including a release of all Claims related to Work completed in accordance with the Contract, to the extent Amtrak has made payment in respect thereof in accordance with Article 44.

(e) Take such other reasonable action as Contractor may deem necessary, or as Amtrak may direct, for the protection of property which is in the possession of Contractor and in which Amtrak has or may acquire an interest;

(f) Cooperate fully with Amtrak to enable Amtrak to effectively and efficiently continue and complete the Work;

(g) Assign to Amtrak, or an entity designated by Amtrak, in the manner, at the time, and to the extent directed by Amtrak, all of the right, title and interest of Contractor under the subcontracts;

(h) To the extent reasonably required by Amtrak, settle all outstanding liabilities and all claims arising out of the termination without cause of subcontracts, with the approval of Amtrak;

(i) Transfer title to Amtrak, or an entity designated by Amtrak, and deliver in the manner, at the time, and to the extent, if any, directed by Amtrak (1) the fabricated or un-fabricated parts, Work in progress, dies, jigs, fixtures, plans, Drawings, information, contract rights, completed Work, Supplies, and other material and other property produced as a part of, or acquired in connection with the performance of, the terminated Work, including without limitation all books, files and records relating to the Project, and (2) the completed or partially completed plans, Drawings, fabrication Drawings, information, and any other property which, if this Contract had been completed, would have been required to be furnished to Amtrak;

(j) To the extent requested by Amtrak, use its best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the Contracting Official, any property of the types referred to in Section 16.3(i) above, provided, however, that Contractor (1) shall not extend credit to any purchaser, and (2) may acquire any such property under the conditions prescribed and at a price or prices approved by the Contracting Official; and provided, further, that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by Amtrak to Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by the Contract or paid in such other manner as the Contracting Official may direct;

(k) Complete, in accordance with the Contract, performance of such part of the Work as shall not have been terminated by the notice of termination; and

(l) Execute any further documents reasonably required by the Contracting Official to confirm or effectuate the terms of this Article without compromising Contractor's right or remedies.

16.4. In the event Amtrak terminates this Contract for default pursuant hereto, Contractor shall bear all costs and expenses incurred in connection with this Article. In accordance with Section 63.2, this Article shall survive the termination of the Contract.

16.5. If, after termination, it is determined that Contractor was not in default, or that the default was excusable, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of Amtrak.

16.6. The rights and remedies of Amtrak in this Article are in addition to any other rights and remedies provided by law or in equity or otherwise provided under this Contract.

17. TERMINATION FOR CONVENIENCE

17.1. Termination for Convenience is the exercise of Amtrak's right to completely or partially terminate performance of work under the Contract when it is in Amtrak's interest to do so, without cause or justification. Amtrak's exercise of this right does not release Contractor from any obligations that it has to Amtrak under any other provision of the Contract Documents nor does it waive any existing claims that Amtrak may have pending at the time of the Termination for Convenience.

17.2. Upon thirty (30) days written notice to Contractor, Amtrak may, at its option and in its sole discretion, terminate the Contract in whole or in part at any time for Amtrak's convenience for whatsoever reason, or no reason, and without regard to fault or breach.

17.3. Upon termination of this Contract for convenience, in whole or in part, Contractor shall, if directed by the Contracting Official, take action including but not limited to:

(a) Stop the terminated Work on the date and to the extent specified in the notice of termination, without creating a hazardous condition;

(b) Place no further subcontracts for materials, Equipment, services, facilities or other items, except as may be necessary for completion of such portion of the Work that is not terminated;

(c) Unless directed otherwise by Amtrak, terminate all subcontracts to the extent that they relate to the performance of terminated Work;

(d) Furnish Amtrak with a release of all claims against Amtrak, including all claims by Subcontractors, and including a release of all Claims related to Work completed in accordance with the Contract, to the extent Amtrak has made payment in respect thereof in accordance with Article 44.

(e) Take such other reasonable action as Contractor may deem necessary, or as Amtrak may direct, for the protection of property which is in the possession of Contractor and in which Amtrak has or may acquire an interest;

(f) Cooperate fully with Amtrak to enable Amtrak to effectively and efficiently continue and complete the Work;

(g) Assign to Amtrak, or an entity designated by Amtrak, in the manner, at the time, and to the extent directed by Amtrak, all of the right, title and interest of Contractor under the subcontracts;

(h) To the extent reasonably required by Amtrak, settle all outstanding liabilities and all claims arising out of the termination without cause of subcontracts, with the approval of Amtrak;

(i) Transfer title to Amtrak or an entity designated by Amtrak, and deliver in the manner, at the time, and to the extent, if any, directed by Amtrak (1) the fabricated or un-

fabricated parts, Work in progress, dies, jigs, fixtures, plans, Drawings, information, contract rights, completed Work, Supplies, and other material and other property produced as a part of, or acquired in connection with the performance of, the terminated Work, including without limitation all books, files and records relating to the Project, and (2) the completed or partially completed plans, Drawings, fabrication Drawings, information, and any other property which, if this Contract had been completed, would have been required to be furnished to Amtrak;

(j) To the extent requested by Amtrak, use its best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the Contracting Official, any property of the types referred to in Section 16.3(i) above, provided, however, that Contractor (1) shall not extend credit to any purchaser, and (2) may acquire any such property under the conditions prescribed and at a price or prices approved by the Contracting Official; and provided, further, that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by Amtrak to Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by the Contract or paid in such other manner as the Contracting Official may direct;

(k) Complete, in accordance with the Contract, performance of such part of the Work as shall not have been terminated by the notice of termination; and

(l) Execute any further documents reasonably required by the Contracting Official to confirm or effectuate the terms of this Article without compromising Contractor's right or remedies.

17.4. Within thirty (30) days after Termination for Convenience, Contractor may submit to Amtrak in a form prescribed by Amtrak, a claim for termination costs. Termination costs may include: (1) Costs incurred in the performance of work performed prior to the termination, (2) a fair and reasonable profit on the incurred costs related to work performed prior to the termination, and (3) reasonable settlement expenses, including costs to ramp down the work. The Contractor and Amtrak may look to FAR 52.249-2 for guidance regarding termination costs, but are not bound by the requirements therein. In no event shall Amtrak's liability for termination costs exceed the unpaid balance of the Contract Amount or the compensation for the portion of the Work terminated, nor shall Amtrak be liable for consequential damages, including but not limited to lost or anticipatory profits, unabsorbed overhead or indirect costs. Contractor agrees to negotiate in good faith with Amtrak regarding any claim after termination. If appropriate, the Contracting Official shall issue a modification to the Contract reflecting any agreed upon adjustments to the Compensation resulting from the negotiation. Contractor's termination and related negotiation shall be subject to the Audit and Inspection Section herein. Contractor's subcontracts, sub-subcontracts, and purchase orders shall contain appropriate provisions for termination for convenience under this Section.

17.5. In the event of the failure of Contractor and Amtrak to agree upon the amount to be paid to Contractor by reason of the termination of Contract pursuant to this Section, the CO shall determine, on the basis of information available to him/her, the amount, if any, due Contractor by

reason of the termination and shall pay to Contractor the amount which the CO determines to be fair and reasonable subject to Contractor's right to assert a claim in compliance with the requirements of the Contract Documents.

18. CONTRACTOR KEY AND OTHER PERSONNEL

18.1. Contractor shall designate, prior to the commencement of the Work, "Key Personnel" who shall include: an individual to whom all Amtrak communications concerning this Contract may be addressed (the "Project Executive" or other title); and "Project Manager" (or other title), who shall report to the Project Executive, and shall be in charge of Contractor's Work related to the Equipment.

18.2. Amtrak considers the Key Personnel to be essential to the performance of the Contract. Accordingly, Contractor agrees that the Key Personnel shall perform as proposed. No substitutions by Contractor of Key Personnel shall be made without the prior written approval of the Contracting Official. Contractor shall notify the Contracting Official twenty (20) days in advance of any proposed substitution. The notification shall include: (i) an explanation of the circumstances necessitating the proposed substitution; (ii) a complete description of the qualifications of the proposed substitute, which shall be equal to or greater than the individual to be replaced; and (iii) any other information requested by the CO. Contractor shall have the right to transfer or replace any personnel other than Key Personnel and to substitute other qualified personnel, provided that such transfer or replacement shall not cause a delay in the performance of the Contract, a downgrading of the quality of the Supplies, or increased cost to Amtrak.

18.3. Amtrak shall have the right to require Contractor to replace any employee, including those not designated as Key Personnel, who Amtrak judges to be incompetent, careless, unsuitable or otherwise objectionable, or whose continued use is deemed contrary to the best interests of Amtrak. Before a written request is issued, it shall be discussed by the Contracting Official or his representative and the Project Executive. Upon receipt of a written request from Amtrak, Contractor shall be required to proceed with the replacement unless it can demonstrate that Amtrak's request is unreasonable. The replacement request shall include the desired replacement date and the reason for the request. Contractor shall affect the replacement in a manner that does not degrade quality of the Work.

18.4. In the event Contractor elects to remove any individual proposed as Contractor's Key Personnel from the Project without the Contracting Official's approval, Contractor shall pay to Amtrak the specified assessment for each individual removed during the time period indicated below.

First Year of Contract:	$1,000,000
Second Year of Contract:	$500,000
Third Year of Contractor:	$100,000
Remaining Period of Contract:	$50,000

18.5. The Contracting Official retains the right to approve any request by Contractor to remove Contractor's Key Personnel from the Project. Said approval shall not be unreasonably withheld. The assessments apply only if Contractor removes Contractor's Key Personnel without the Contracting Official's approval. The assessments do not apply if any of Contractor's Key Personnel leave the Project for reasons limited to retirement, resignation from Contractor's firm (but not including a situation where Contractor's Key Personnel takes another position with Contractor's firm, with any of its affiliated or subsidiary firms, its parent company or any firms affiliated with or subsidiaries of the parent company or any other entity which either owns or controls Contractor's firm, within one year of resignation), death, disability, personal hardship, or termination of the Key Personnel's employment by Contractor due to the Key Personnel's inability to meet performance requirements or for misconduct as defined in Contractor's Employee Handbook or Corporate policies and procedures.

18.6. Contractor shall comply with the applicable provisions of Amtrak Policy 7.39.2 (Contractor Background Check), a copy of which is incorporated herein by reference.

18.7. Amtrak and Contractor agree that, during the term of this Contract and for one year thereafter, neither party shall, either directly or indirectly, on the party's own behalf or on behalf of others, solicit or recruit any person to terminate such person's employment with the other party. This shall not restrict one party from hiring any employee of the other who responds to regular employment solicitation efforts, such as newspaper advertisements, employment agencies, open house or job fair events, or widely distributed announcements of job openings, or who makes a direct inquiry as to employment with Amtrak or Contractor.

19. CONTRACTOR'S REPRESENTATIONS

19.1. Contractor represents that at the time of transfer to Amtrak, or an entity designated by Amtrak, of title of each unit of Equipment, Contractor shall be vested with requisite authority to pass, and covenants that it shall pass such title, free of all liens and encumbrances, security interests, contractual rights (for example, such as those under debt instruments or leases), and all other rights of third parties of every kind and description including, without limitation, any creditors of Contractor (collectively, "Adverse Rights"). Contractor shall execute additional documents reasonably requested by Amtrak, or an entity designated Amtrak.

20. CERTAIN CONDITIONS ON AMTRAK'S OBLIGATIONS

20.1. At the date of acceptance of the last unit of Equipment to be delivered hereunder as part of the Total Order, as applicable, the chief legal officer of Contractor (or other counsel acceptable to Amtrak in the exercise of its reasonable judgment) shall issue to Amtrak an opinion:

(a) to the same effect as the representation contained in Article 19; and

(b) that the Bills of Sale and acknowledgment of receipt delivered to Amtrak pursuant to this Contract are valid and effective to, and accordingly do, confirm in Amtrak the absolute ownership of the Equipment free from all Adverse Rights.

21. SEVERABILITY

21.1. If any term or provision hereof is or becomes invalid or unenforceable, Contractor and Amtrak shall in good faith negotiate to replace the invalid or unenforceable term or provision with a term or provision which is valid and enforceable, and which comes as close as possible to expressing the intention of the invalid or unenforceable term or provision. The remaining valid portion of the Contract shall remain binding upon the parties.

22. CONFIDENTIALITY

22.1. Confidential Information: The term "Confidential Information" shall mean any and all information or proprietary materials (in every form and media) not generally known and which has been or is hereafter disclosed or made available by either Party (the "Disclosing Party") to the other Party (the "Receiving Party") in connection with the efforts contemplated hereunder, including: (i) all trade secrets; (ii) existing or contemplated products, services, designs, technology, processes, technical data, engineering, techniques, methodologies, and concepts and any information related thereto; (iii) information relating to business plans, sales or marketing methods or merchandising techniques, plans or information, and actual or potential customer information, lists or requirements; (iv) financial information or materials; (v) cost data; (vi) user lists and information; (vii) actual or potential vendor lists and information; (viii) procurement requirements; (ix) purchasing information; (x) manufacturing or development information; (xi) pricing policies; (xii) information about employees, independent contractors, interns, officers, directors, shareholders, investors, lenders, accountants, attorneys, and any other agents of either Party; (xiii) information about actual, under development, or what might reasonably be anticipated to be or become business and contractual relationships; (xiv) actual or potential lender, investor or partner lists and information; and (xv) other proprietary business information of either Party. "Confidential Information" as it relates to people or entities includes all contact information, including name, title, position, address, phone numbers, and email addresses. Further, "Confidential Information" includes any and all technical and non-technical information or material in which either Party has rights, opportunities, or obligations, whether or not owned or developed by such Party (or people or entities such Party may have disclosed to or received from pursuant to non-disclosure agreements).

22.2. Contractor agrees that all information furnished or disclosed by Contractor to Amtrak in connection with the performance of the Contract: (i) is furnished or disclosed as part of consideration of the Contract; (ii) shall not, unless otherwise agreed in writing by the CO, be

treated as confidential or proprietary information of Contractor; and (iii) subject to third party copyright restrictions, may be used, modified, copied, or disclosed by Amtrak for any purpose. Generally, routine deliverables provided by the Contractor to Amtrak will not be considered confidential. Contractor expressly waives any and all Claims against Amtrak and releases Amtrak from any and all Claims relating to the use, modification, copying or disclosure of such information by Amtrak, its assigns, or intended beneficiaries. No employee, agent, or representative of Amtrak, other than the CO, is authorized to accept any information which Contractor considers to be proprietary or confidential. Only the CO has authority to enter into an agreement, which shall be in writing, to provide for the confidential treatment of, or limit disclosure of, information furnished or disclosed by Contractor, its employees, agents or representatives.

22.3. Contractor shall: (i) hold Amtrak's Confidential Information in trust and confidence and not disclose or release any Confidential Information to any other person or entity; and (ii) not use the Confidential Information of Amtrak for any purpose whatsoever except as set forth in the Contract Documents or herein. Contractor shall disclose Amtrak's Confidential Information only to those of its employees, independent contractors, permitted subcontractors (including their employees and independent contractors) having a need to know such Confidential Information, provided that such persons and entities are bound by obligations of confidentiality and non-use no less restrictive that those contained herein. Upon completion or termination of the Contract, or as otherwise requested by Amtrak, Contractor shall immediately return all such items and information to Amtrak or make other disposition thereof as directed by Amtrak. Contractor shall not make any news releases, articles, brochures, advertisements, speeches or other information releases relating to the Contract without the prior written approval of the CO.

22.4. Contractor acknowledges that disclosure or use of Amtrak's Confidential Information without express written consent of the CO violates the Uniform Trade Secrets Act and federal Defend Trade Secrets Act. Contractor agrees not to improperly disclose third-party trade secrets or confidential information to Amtrak.

22.5. Contractor shall fully indemnify Amtrak against any and all actions, claims, liability, costs, charges, damages, and expenses suffered or incurred in connection with or arising out of any breach by Contractor of any of the provisions of this Section. Contractor acknowledges that a breach of its obligations hereunder cannot be compensated adequately by an award of damages or other pecuniary remedy, and that Amtrak shall also be entitled in the event of any such breach to the remedies of injunction, specific performance, or other equitable relief in respect of any such breach.

22.6. Contractor agrees that, in the event any Confidential Information of Amtrak is sought by subpoena, required by law or order of a court of competent jurisdiction or regulatory authority, or other process to the extent allowed by applicable law, Contractor shall notify Amtrak in writing as soon as practicable or within three (3) days of receipt of notice of such required disclosure in order to enable Amtrak to seek an appropriate protective order. Further, to the extent allowed by applicable law, Contractor shall reasonably cooperate and assist Amtrak in obtaining a protective order or other appropriate protection of its Confidential Information. If, nonetheless, the

Confidential Information is ordered to be disclosed, Contractor shall furnish only that portion of the Confidential Information that is required legally to be disclosed, and any portion of such Confidential Information required to be disclosed shall be used only for the purposes for which a court issues an order, or for other such purposes required by law.

22.7. Contractor agrees that, in the event any of Contractor's Confidential Information in Amtrak's possession is disclosed to a third party pursuant to a lawful subpoena, is required to be disclosed by law (e.g. FOIA) or order of a court of competent jurisdiction or regulatory authority, or other process to the extent allowed by applicable law, Contractor shall hold Amtrak harmless for such release.

22.8. This Confidentiality Article shall survive the termination or expiration of the Contract.

23. MONTHLY PROGRESS REPORTS

23.1. Timely and systematic reporting is vital to efficient and effective project management. Contractor shall submit to Amtrak written monthly progress reports which are the primary mechanism for providing detailed information about the progress of the project. These reports compile and combine all the information from the project functional areas and disciplines. Each report shall cover all significant activities occurring during the previous month and is due seven (7) calendar days after the end of each month.

23.2. The Monthly Progress Reports shall indicate month and calendar year and include as a minimum the following:

(a) Executive Summary & Narrative

(b) Project Schedule / FAI Schedule

(c) Schedule Status Update (notification of any risk of potential slippage)

(d) Engineering/Design Progress

(e) Project Look Ahead (activities for the next three months)

(f) Change Order Log

(g) Financial Summary

(h) Areas of Concerns/Problems

(i) CDRL Status Update

(j) Drawing Approval Status List

(k) Project Team and/or Organization or Responsibility Changes (as they occur)

24. RETURN OF DATA

24.1. Contractor, at any time upon the request of Amtrak, shall immediately return and surrender to Amtrak all copies of any materials, records, notices, memoranda, recordings, Drawings, specifications and mock ups and any other documents furnished by Amtrak to Contractor and Subcontractor.

25. ACCESS TO WORK

25.1. Amtrak, through its designated representative(s), the FRA, and the Financing Parties shall at all times have access to the Work at the project site(s), or wherever the Work may be in preparation or progress, and Contractor shall provide proper facilities for such access.

26. AMTRAK'S RIGHT TO STOP THE WORK

26.1. If Contractor fails to correct Work which is not in accordance with the requirements of the Contract or persistently fails to carry out Work in accordance with the Contract, the Contracting Official, by written order signed personally or by his authorized representative, may order Contractor to stop the Work or any portion thereof, until the cause for such order has been eliminated; however, the right of the Contracting Official to stop the Work shall not give rise to a duty on the part of Amtrak to exercise this right for the benefit of Contractor or any other person or entity. Contractor shall not be entitled to any extension of the Contract Time or increase in the Contract Amount in connection with any stopping of the Work or portion thereof pursuant to this Article.

27. AMTRAK'S RIGHT TO CARRY OUT THE WORK

27.1. If Contractor fails to carry out the Work in accordance with the Contract and fails, within a ten (10) day period after receipt of written notice from the Contracting Official to cure this default with diligence and promptness, the Contracting Official may give Contractor a second written notice to correct such deficiencies within a seven (7) day period. If Contractor within such seven (7) day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Contracting Official may, without prejudice to other remedies Amtrak may have, correct, or cause to be corrected, such deficiencies. In so doing, Amtrak or its designee shall utilize any of Contractor's materials, plant and equipment necessary to correct the deficient Work. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due Contractor the cost of correcting such deficiencies, including compensation for the Contracting Official's or Amtrak's additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due Contractor are not sufficient to cover such amounts, Contractor shall pay the difference to Amtrak. In accordance with Article 65 Amtrak's rights under this Article are in addition to any other rights it may have with respect to defective Work, including those rights of termination as specified elsewhere in the General Provisions.

28. NON-PERFORMANCE BY AMTRAK

28.1. Amtrak's failure to perform any of its responsibilities set forth in the Contract shall not be deemed to be grounds for termination, suspension or slowdown of the Work by Contractor; provided,

however, that Contractor's nonperformance of its obligations to perform the Work shall be excused if and to the extent: (a) Contractor is unable to perform and its inability to perform is caused solely by Amtrak's failure to perform its responsibilities, and (b) Contractor provides Amtrak with reasonable notice of nonperformance and uses all reasonable efforts to perform notwithstanding Amtrak's failure to perform.

29. SUSPENSION OF THE WORK

29.1. After the Work has been started, Contractor shall not suspend the Work without permission of the Contracting Official or his designated representative. When under suspension, the Work shall be put in proper and satisfactory condition, and properly protected as directed by the Contracting Official or his designated representative. In all cases of suspension, the Work shall not again be resumed until permitted by order of the Contracting Official or his designated representative.

29.2. In addition to any other rights afforded to Amtrak under this Contract to suspend the Work, Amtrak shall have the right at any stage of the Work, to suspend operations thereon, or upon any part thereof, either for a time named or indefinitely, by giving Contractor written notice. If such rights of suspension are exercised by Amtrak, the Contracting Official shall grant to Contractor an extension of the Contract Time for the relevant part of the Work equal to the length of the actual delay to the critical path necessarily caused by such suspension and may grant additional time necessary to overcome such delay, but there shall be no adjustment of the Contract Amount in connection with such suspension except as explicitly provided in this Article. In the event that operations on a part of the Work are suspended by Amtrak pursuant to this Article for more than thirty (30) days, in the case of suspension of the Work, the Contract Amount for such part of the Work may be adjusted for any increase in the cost of performance of the Work (excluding profit) necessarily caused by such suspension (it being understood that the economic adjustment formulae in the Contract shall compensate Contractor for increased costs attributable to inflation). However, no adjustment of the Contract Time or Contract Amount shall be made for any suspension: (a) to the extent that performance would have been suspended, delayed or interrupted by any other cause, including the fault or negligence of Contractor or (b) for which equitable adjustment is provided for or excluded under any other provision of the Contract. Amtrak's rights under this Article shall be in addition to any other right under the Contract to suspend the Work.

29.3. No Claim under this Section shall be allowed unless the Claim, is submitted to Amtrak in writing, setting forth any requested extension to the period of performance or increase in Compensation, and the basis therefore, as soon as practicable after the termination of such suspension, but no later than twenty-one (21) days after the termination of such suspension pursuant to the Claims Section.

30. TAXES

30.1. Pursuant to 49 U.S.C. 24301(k), Amtrak is exempt from payment of state or local sales and use taxes on personal property. Based on this statutory exemption, Contractor may be exempt from payment of state or local sales and use taxes on material and property purchased for performance of this Contract. It is Contractor's responsibility to determine applicability of any exemption from

taxation arising from his performance under this Contract and Contractor shall not be entitled to payment for any taxes for which any exemption was applicable.

31. INTELLECCTUAL PROPERTY RIGHTS

31.1. IP Rights

31.1.1. Contractor shall pay any and all royalties and license fees required to be paid to third parties in connection with (a) Contractor's (or its Subcontractors') efforts relating to the Work, and (b) Amtrak's use and exploitation of any portion thereof, including without limitation Amtrak's use of any deliverables, Work Product, or Supplies. In addition, Contractor shall defend and indemnify Amtrak from, and hold Amtrak harmless from and against, any and all costs, expenses, losses and liabilities (including without limitation costs, expenses and attorneys' fees) arising out of or in connection with any and all demands, suits, claims and other similar proceedings brought by third parties alleging infringement, misappropriation or violation of any IP Rights arising in connection with any Work, Work Product, deliverables or Supplies, or Amtrak's use and exploitation of any portion thereof, including without limitation Amtrak's use of any Work, Work Product, deliverables or Supplies; provided that Amtrak provides Contractor with reasonable notice of the same.

31.1.2. With respect to the Work, Contractor shall not use, or permit the use of, or furnish for use by Amtrak any appliance, article, device, method of construction, design or manufacturing, Work Product, Supplies, or any Intellectual Property or IP Rights, unless Contractor has obtained all necessary consents, permissions, or authorizations for such use or uses. Any and all such consents, permissions or authorizations shall include, without limitation, all rights necessary for Contractor to grant the licenses set forth below.

31.2. License and Use Rights

31.2.1. "**Allowable Uses**" shall be limited to (a) the use, maintenance or repair (including wreck repairs) of the Equipment, (b) work performed by or on behalf of Amtrak to complete the Work due to a Contractor default or failure (or, in the case of Subcontractor Intellectual Property, after termination for cause of the relevant Subcontractor), (c) marketing, branding, advertising and training initiatives, and/or (d) other Amtrak equipment acquisitions or other Amtrak business reasons (or, in the case of Subcontractor Intellectual Property, the applicable Subcontractor ceases to be in the business of selling the equipment to which the applicable Subcontractor Intellectual Property relates). The Contractor shall cause its Subcontractors to grant "Allowable Uses") to Amtrak as set forth in this section and these General Provisions.

31.2.2. Contractor Intellectual Property: Contractor hereby grants to Amtrak an irrevocable, perpetual, fully paid-up right and license (with the right to grant sublicenses, except as otherwise set forth herein) to use the Contractor's Intellectual Property: (a) for any and all Allowable Uses, (b) to make and use any and all Work, Supplies, Work Product, deliverables, products, methods and services, and (c) to use, copy, have copied, modify, have modified, incorporate in other products or services, prepare derivative works from,

have derivative works prepared from, and distribute any and all copyrightable works. The right and license set forth in this section shall survive the expiration or termination of this Contract and may be transferred by Amtrak to any third-party.

31.2.3. Subcontractor Intellectual Property: Contractor shall cause each and every Subcontractor to grant to Amtrak an irrevocable, perpetual, fully paid-up right and license (with the right to grant sublicenses) to use the Subcontractor's Intellectual Property (the "Subcontractor Intellectual Property"): (a) for any and all Allowable Uses, (b) to make and use any and all Work, Supplies, Work Product, deliverables, products, methods or services, and to (c) use, copy, have copied, modify, have modified, incorporate in other products or services, prepare derivative works from, have derivative works prepared from, and distribute any and all copyrightable works. The rights and licenses set forth in this section shall survive the expiration or termination of this Contract, and the expiration or termination of any agreements between Contractor and the Subcontractor, and may be transferred by Amtrak to any third party.

31.2.4. Without limiting any right or remedy of Amtrak, if Amtrak or any of its affiliates is enjoined from or likely to be enjoined from using all or any portion of the Work, Work Product, any deliverables or Supplies, or Amtrak's use and exploitation (as defined below) of any portion thereof, as to which Contractor is required to indemnify Amtrak against infringement, misappropriation or other violation, Contractor shall, at Amtrak's request and at Contractor's expense, either (a) procure promptly for Amtrak the right to continue using the foregoing, or (b) promptly replace all or any portion of the foregoing with a non-infringing product or part of equivalent functionality and performance which is satisfactory to Amtrak and the use of which does not violate the terms and conditions of such injunction, or (c) promptly modify all or any portion of the foregoing in a manner satisfactory to Amtrak so as to render use of the foregoing non-infringing and not in conflict with the injunction, and having equivalent functionality and performance.

31.3. Escrow

31.3.1. Escrow Materials and Escrow Agreement: To secure Amtrak's rights hereunder, Contractor shall place copies of its then current system design, Source Code and Object Code, listings and related Documentation including, without limitation, annotated notes (the "Escrow Materials") for the Contractor's Software and Subcontractor's noncommercially available Software with an independent escrow agent reasonably selected by Amtrak, subject to the terms and conditions of the independent escrow agent's standard agreement (the "Escrow Agreement") and in accordance with the provisions of this Article 31.

31.3.2. Release Conditions: As used in the Contract, "Release Condition" shall mean the occurrence of any of the following events with respect to Contractor during the term of Amtrak's rights hereunder:

(a) If Contractor materially breaches an express obligation with respect to the Contract, then Amtrak shall so notify Contractor in writing in accordance with the notice

provisions set forth in the Contract ("Breach Notice"), specifying in reasonable detail the basis for Amtrak's claim of breach. Amtrak shall serve a copy of the Breach Notice simultaneously upon the escrow agent under the Escrow Agreement. At the same time that Amtrak delivers the Breach Notice, it may also deliver notice to the escrow agent under the Escrow Agreement), with a copy to Contractor, requesting a release of the Escrow Materials (a "Release Notice"). The Release Notice will commence the thirty (30) Business Day period under the Escrow Agreement, if such thirty (30) Business Day period is required, for Contractor to issue contrary instructions. Contractor shall (i) cure such breach during the thirty (30) day period immediately following its receipt of the Breach Notice ("Cure Period"); or (ii) if such breach is of a nature such that it is not capable of being cured within such period, (A) provide Amtrak a plan for cure that will cure the breach within sixty (60) days from the date of the Breach Notice (the "Extended Cure Period") and (B) commence acting on such plan during the initial Cure Period. If Contractor fails to meet its obligations under (i) and (ii) above or does not send written notice to Amtrak of a good faith dispute of the breach specified in the Breach Notice, then Contractor hereby agrees that it will not issue contrary instructions to the escrow agent under the Escrow Agreement, and the escrow agent under the Escrow Agreement will be authorized to release the Escrow Materials upon the tolling of the thirty (30) Business Day Period during which Contractor was allowed to issue contrary instructions; provided however if the breach is of such a nature that it could not have been cured during the initial Cure Period and Contractor complied with its obligations under (ii) above, then Contractor may issue Contrary Instructions only to the extent it prohibits the escrow Agent under the Escrow Agreement from releasing the Escrow materials until the end of the Extended Cure Period.

(b) The entry of an order for relief in a proceeding in bankruptcy (other than Chapter 11 of Title 11 of the U.S. Code, as the same may be amended) in which Contractor is the named debtor; (ii) Contractor's making of an assignment for the benefit of Contractor's creditors; (iii) the appointment of a receiver for Contractor; (iv) the filing of (1) any bankruptcy proceeding against Contractor, other than Chapter 11 of Title 11 of the U.S. Code, (2) any proceeding for an assignment for the benefit of Contractor's creditors or (3) any proceeding for appointment of a receiver or custodian of the assets and property of Contractor, which proceeding shall be consented to or acquiesced to be by Contractor or has not been discharged or terminated within ninety (90) days; or (v) the rejection by Contractor or any trustee of Contractor of the License Agreement pursuant to 11 U.S.C. Clause 365. The terms of clause (a) of this Clause 4.1 shall apply if following the filing of a proceeding under Chapter 11 of Title 11 of the U.S. Code, Contractor or its trustee materially breaches an express obligation under the Contract.

(c) Contractor dissolves, liquidates or ceases to provide services or work similar to those provided for under the Contract for a substantial number of its customers for a period of at least thirty (30) days.

(d) The parties have entered into a good faith dispute and Contractor ceases providing services or work similar to those provided for under the Contract prior to the final conclusion of the dispute resolution process set forth in Article 35 "Claims and Disputes"; provided that no such release condition will be deemed to have occurred if (i) Contractor has obtained a court order allowing it to cease performance of the Contract or (ii) Amtrak has failed to pay undisputed invoices or make milestone payments for the Work for ninety (90) days following written receipt of notice of breach from Contractor.

31.3.3. Use of Escrow Materials: Contractor hereby grants Amtrak an irrevocable, perpetual, fully paid-up right license (with the right to grant sublicenses) to use or have used on its behalf the Escrow Materials upon their release to Amtrak only to perform and authorize the performance of the Allowable Uses, which includes without limitation the right to make and use any and all products, methods and services, and to use, copy, have copied, modify, have modified, incorporate in other products, prepare derivative works from, have derivative works prepared from, and distribute any and all copyrightable works, in each case in connection with and limited to Allowable Uses.

31.3.4. Establishment of Escrow: Within one (1) year of conditional acceptance of the first Consist of Cars, Contractor shall cause the Escrow Materials to be placed into escrow. The first ten (10) years of the escrow period, shall be maintained at the sole expense of Contractor under this Contract. After ten (10) years, Contractor shall continue to maintain the escrow, including the payment thereof, under the TSSSA. After the TSSSA terminates, Amtrak shall be responsible for payment of the escrow agent's fees. The deposit made with the escrow agent shall be kept current so as to accurately reflect the then current version of the Escrow Materials and promptly updated by Contractor following each material upgrade, modification or enhancement thereto. Contractor shall designate a mutually acceptable neutral third party that, at the expense and request of Amtrak made from time to time, may audit the materials deposited with the escrow agent for purposes of determining whether Contractor has fulfilled its deposit obligations. Contractor will promptly, at its expense, correct any deficiency disclosed by the audit.

31.3.5. Extension of Obligations: The obligations of Contractor under this Article 31 shall extend to any trustee in bankruptcy, receiver, administrator or liquidator appointed for Contractor, to Contractor as debtor-in-possession ("Trustee"), and to any other successor in interest to Contractor. Without limiting the generality of the foregoing, upon written request of Amtrak, Contractor shall not interfere with the rights of Amtrak as provided in the Contract or the Escrow Agreement to obtain the Escrow Materials from the Trustee or any other person or entity having possession thereof, and shall, if requested under the conditions specified in the Escrow Agreement for release of the Escrow Materials, cause a copy of such Escrow Materials to be made available to Amtrak.

31.4. Trademarks: Contractor shall not use Amtrak's name, trade name, logo, trademarks, or service marks in any context in connection with any advertising, publicity, product, equipment, promotion, or publication without the prior written consent of Amtrak. Contractor agrees to

comply with Amtrak instructions regarding trade dress, packaging, trade names, trademarks, service marks or other indicia of origin which shall appear on any items to be delivered under the Contract. Contractor further agrees that, after delivery of said items to Amtrak, Amtrak may modify the trade dress or packaging thereof, and/or replace, modify, or supplement any indicia of origin appearing thereon, to identify Amtrak as the source of said items.

31.5. Pre-existing Materials of Contractor and Subcontractors: Contractor hereby grants to Amtrak a non-exclusive, irrevocable, perpetual, worldwide, fully paid-up license to use, execute, reproduce, modify, display, transfer, distribute copies of and prepare derivative works based on materials and intellectual property embodied therein, including any and all modifications thereto, owned and developed independently by Contractor prior to the preparation of its proposal used to provide Equipment under the Contract. Contractor shall retain its ownership interest in such pre-existing materials. Contractor shall cause its Subcontractors to grant the licenses described herein.

31.6. Indemnity for Third Party Infringement Claims: The Contractor hereby represents and warrants that: (i) materials that it uses in its performance of the Work under the Contract; (ii) the Work, Work Product, including deliverables, Supplies, and Subcontractor Intellectual Property; and (iii) Amtrak's use of any Work, Work Product, including deliverables, Supplies, and Subcontractor Intellectual Property shall not infringe or misappropriate any U.S. or foreign patent, copyright, trade secret or other intellectual property right of a third party. If any claim is made against Amtrak claiming that its use of the Work, Work Product, including deliverables, Supplies, and Subcontractor Intellectual Property or other materials provided by Contractor hereunder infringes any third party intellectual property right, including but not limited to infringement of patent, copyright, royalty, trademark, service mark, proprietary right, misappropriation or wrongful use of trade secret, or confidential information ("Third-Party Infringement Claim"), Contractor shall, at its own expense, defend, indemnify, and hold harmless Amtrak and its Affiliates (including its directors, officers, employees, agents, subsidiaries, and assigns) ("the "Amtrak Indemnified Party") from and against any and all claims, damages, fees, losses, liabilities, penalties, and costs (including costs of defense and attorneys' fees) ("Losses"). In the event that a Third-Party Infringement Claim is asserted or sought against an Amtrak Indemnified Party, the Amtrak Indemnified Party shall notify the Contractor in writing in respect of such Third-Party Infringement Claim (a "Notice of Infringement Claim") as promptly as practicable; provided, however, that a failure or delay by the Amtrak Indemnified Party to provide a Notice of Infringement Claim as promptly as practicable shall not affect the rights or obligations of such Amtrak Indemnified Party unless the Contractor shall have been actually prejudiced as a result of such failure or delay. The Amtrak Indemnified Party shall enclose with the Notice of Infringement Claim a copy of all papers served with respect to such Third-Party Infringement Claim, if any, and any other documents evidencing such Third-Party Infringement Claim. Contractor shall have the obligation to assume the defense or prosecution of such Third-Party Infringement Claim and any litigation resulting therefrom with counsel of its choice (which counsel shall be reasonably satisfactory to the Amtrak Indemnified Party) and at its sole cost and expense (a "Third-Party Infringement Defense"), but only if the Contractor provides written notice of such assumption to the Amtrak Indemnified Party within sixty (60) days following delivery of the Notice of Infringement Claim and acknowledges in writing in such notice that any Losses that may be assessed against the Amtrak Indemnified Party in connection with such Third-Party Infringement

Claim constitute Losses for which the Amtrak Indemnified Party shall be indemnified pursuant to this Section. Notwithstanding the foregoing, the Contractor shall not have the right to assume the defense of such Third-Party Infringement Claim, if: (i) the Amtrak Indemnified Party shall have been advised by counsel that there are one or more legal or equitable defenses available to it which are different from or in addition to those available to the Contractor, and, in the reasonable opinion of the Amtrak Indemnified Party, counsel for the Contractor could not adequately represent the interests of the Amtrak Indemnified Party because such interests could be in conflict with those of the Contractor; or (ii) the Contractor shall not have assumed the defense of such Third-Party Infringement Claim in a timely fashion. If the Contractor assumes the Third-Party Defense in accordance with this Section: (i) Contractor shall diligently defend such Third-Party Infringement Claim; (ii) the Amtrak Indemnified Party shall have the right, but not the obligation, to participate in any such Third-Party Defense and to retain separate co-counsel at the sole cost and expense of Contractor; (iii) the Amtrak Indemnified Party will not file any papers or consent to the entry of any judgment or enter into any settlement with respect to the Third-Party Infringement Claim without the prior written consent of the Contractor; and (iv) the Contractor will not consent to the entry of any judgment or enter into any settlement with respect to the Third-Party Infringement Claim: (a) to the extent such judgment or settlement provides for equitable or injunctive relief without the prior written consent of the Amtrak Indemnified Party; (b) if such settlement does not include as a term thereof the giving by the third party asserting such claim to the Amtrak Indemnified Party a release from all liability with respect to such claim underlying such judgment or settlement; or (c) if such settlement or judgment contains any admission or statement suggesting any wrongdoing or liability on behalf of the Amtrak Indemnified Party. The Parties will use their commercially reasonable efforts to minimize Losses from Third-Party Infringement Claims and will act in good faith in responding to, defending against, settling or otherwise dealing with such claims. The Parties will also cooperate in any such defense and give each other reasonable access to all information relevant thereto. Notwithstanding the foregoing, Contractor shall have no indemnification obligation toward Amtrak under this provision if the respective Third-Party Infringement Claim is due to any modifications made by Amtrak or a third party acting on behalf of and with the authority of Amtrak or misuses by Amtrak.

31.7. Corrective Actions: If Amtrak's use of the Intellectual Property is enjoined, or if the Contractor's performance of its obligations under this Contract are materially impaired by reason of such Third-Party Infringement Claim, Contractor shall use commercially reasonable efforts, at its expense, to continue its performance hereunder, including without limitation, at its own elections: (i) to substitute an allegedly infringing item or process with a non-infringing item or process of at least the same functionality; (ii) to modify the allegedly infringing item or process so that it no longer infringes but remains at least functionally equivalent; or (iii) to obtain for Amtrak and its Affiliates the right to continue using such allegedly infringing item or process.

31.8. RESERVED

31.8.1. The terms and conditions set forth in this Section 31 shall survive the expiration or termination of the Contract, t and the rights and licenses set forth hereunder may be transferred by Amtrak to any third party.

32. INDEMNIFICATION

32.1. Contractor agrees to defend, indemnify and hold harmless the Indemnified Parties, from and against any claims, losses, liabilities (including without limitation environmental liabilities), penalties, fines, demands, causes of action, suits, costs and expenses incidental thereto, (including costs of defense and attorneys' fees) (collectively "Indemnified Party Claims"), arising in whole or in part from the fault, negligence or wrongful act of Contractor, which any of the Indemnified Parties may hereafter incur, be responsible for or pay as a result of breach of warranty, injury or death of any person, or damage to or loss (including loss of use) of any property, including property of the parties hereto, arising out of or in any degree directly or indirectly caused by or resulting from Supplies, material, deliverables, products or Equipment supplied by, or from activities of, or Work performed by Contractor, Contractor's officers, employees, agents, servants, Subcontractors, or any other person acting for or with the permission of Contractor under the Contract, or as a result of Contractor's failure to perform its obligations in compliance with the Contract.

32.2. In addition to the foregoing, Contractor agrees to defend, indemnify and hold harmless the Indemnified Parties, irrespective of any negligence or fault on the part of the Indemnified Parties, from and against any Claims which any of the Indemnified Parties may hereafter incur, be responsible for or pay as a result of injuries (including death) to any of Contractor's employees, agents or Subcontractors.

32.3. The indemnification obligations under this section shall not be limited by the existence of any insurance policy procured or maintained by Contractor or any Subcontractor or by any limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or any Subcontractor and shall survive the termination of the Contract.

33. AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

33.1. Within one hundred and eighty (180) days after execution of the Contract with respect to the Work Contractor shall furnish the Contracting Official, in writing, an accurate list showing all proposed Subcontractors' names, addresses, telephone numbers and nature of work. In addition, Contractor shall furnish the names of all persons or entities proposed as contractors of the products identified in the Contract (including those who are to furnish materials or Equipment fabricated to a special design) and, where applicable, the name of the installing Subcontractor. The Contracting Official shall within thirty (30) days reply to Contractor, in writing, stating whether or not the Contracting Official, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Contracting Official to reply within such period shall constitute notice of no reasonable objection. If Contractor changes a Subcontractor, within fifteen (15) days of the change, Contractor shall provide Amtrak with an updated list.

33.2. Contractor shall not contract with a proposed person or entity to which the Contracting Official has made reasonable and timely objection. Contractor shall not be required to contract with anyone to whom Contractor has made reasonable objection.

33.3. If the Contracting Official has a reasonable objection to a person or entity proposed by Contractor, Contractor shall propose another person or entity to which the Contracting Official or Contractor has no reasonable objection.

33.4. Contractor shall not change a Subcontractor, person or entity previously selected if the Contracting Official makes reasonable objection to such change.

33.5. Notwithstanding the foregoing, with the prior approval of Amtrak, Contractor may replace a Subcontractor or supplier if after such replacement Contractor will still be in compliance with the Buy America(n) requirements, as set forth in Article 47, Buy America(n) Requirements.

34. SUBCONTRACTORS

34.1. All references to Subcontractors herein include Subcontractors at any tier. Nothing contained in the Contract or any contract with a Subcontractor at any tier shall create any contractual relationship between Amtrak and any Subcontractor, or any third-party beneficiary rights in any Subcontractor; provided, however, that Amtrak shall be named as a third-party beneficiary of all contracts with a Subcontractor.

34.2. All work performed for Contractor by a Subcontractor shall be pursuant to an appropriate agreement between Contractor and the Subcontractor which shall contain provisions that:

(a) Preserve and protect the rights of Amtrak under the Contract with respect to the Work to be performed under the subcontract so that the subcontracting thereof shall not prejudice such rights;

(b) Require that such Work be performed in accordance with the requirements of the Contract;

(c) Require submission to Contractor of applications for payment under each subcontract to which Contractor is a party, in reasonable time to enable Contractor to apply for payment;

(d) Require that all claims for additional costs, extensions of time, damages for delays or otherwise with respect to subcontracted portions of the Work shall be submitted to Contractor (via any Subcontractor where appropriate) in sufficient time so that Contractor may comply in the manner provided in the Contract for like Claims by Contractor upon Amtrak;

(e) Contractor's insurance as specified in Article 58 of this Contract shall provide insurance coverage for each Subcontractor working on its behalf.

(f) Preclude Contractor and Subcontractor from naming, impleading or otherwise including Amtrak as a party in any arbitration or lawsuit between Contractor and any Subcontractor, and preclude the Subcontractor from naming, impleading or otherwise including Amtrak in any arbitration or lawsuit arising as a result of any Work performed by or for Contractor under the Contract;

(g) Provide that Contractor's rights under the subcontract shall be assignable to Amtrak at Amtrak's option;

(h) Require the Subcontractor to continue diligently to prosecute the Work, notwithstanding any disputes, including without limitation, disputes between Contractor and Amtrak, or Contractor and any Subcontractor;

(i) Provide that the subcontract is terminable on the same terms as the Contract, but that no termination shall be effective without Amtrak's consent, and the Work covered by the subcontract may be suspended on the same terms as the Work may be suspended pursuant to the Contract;

(j) Include Amtrak as a named indemnitee under any indemnification obligations imposed on the Subcontractor; and

(k) Obligate each Subcontractor specifically to consent to the provisions of this Article 34.

34.3. Whenever the Contract: (i) requires Contractor to include any provisions in an agreement with a Subcontractor, or (ii) requires Contractor to bind a Subcontractor to any obligation or otherwise create any obligation, responsibility, or liability on the part of any Subcontractor, or (iii) confers any rights or benefits on Amtrak with respect to a Subcontractor, the reference to "Subcontractors" shall be deemed to include Subcontractors of any tier, and Contractor shall require Subcontractors to include in all agreements with their suppliers: (a) provisions parallel to those required to be included in the agreement with the Subcontractor, (b) provisions necessary and sufficient to impose parallel obligations, responsibilities and liabilities on the Subcontractors, and (c) provisions necessary to confer such rights and benefits on Amtrak with respect to their suppliers.

34.4. Contractor shall promptly pay all Subcontractors, and shall require each Subcontractor to promptly pay its own Subcontractors. To verify payments to Subcontractors, Contractor shall provide any documentation reasonably requested by Amtrak.

34.5. The Contractor shall include all anticorruption provisions of the Contract in each subcontract and third-party agreement entered into under the Contract, including but not limited to representations and warranties of compliance with applicable anticorruption laws, including but not limited to the Foreign Corrupt Practices Act. Amtrak may require Contractor to terminate any Subcontractor in the event that the Subcontractor's continued performance of the Work would cause Amtrak to (i) violate any Applicable Law; or (ii) lose Amtrak's access to public funding for the Work, including from the Financing Parties.

35. CLAIMS AND DISPUTES

35.1. Submission of Claim and Decision of Contracting Official: If, prior to the date of Final Payment, the Contracting Official and the Contractor fail to agree on any request for adjustment, the Contractor may elect to submit a Claim to the Contracting Official for action. A decision by the Contracting Official, as provided in the "Resolution of Claims and Disputes" Section, shall be

required as a condition precedent to litigation of a Claim between Contractor and Amtrak as to all such matters arising prior to the date Final Payment is due, regardless of (a) whether such matters relate to execution and progress of the Services or (b) the extent to which the Services have been completed.

35.2. Time Limits on Claims: Claims by the Contractor must be made by written notice to Amtrak, identified as a "Claim" under this Section" within twenty-one (21) days after occurrence of the event giving rise to such Claim or within twenty-one (21) days after the Contractor first recognizes, or reasonably should have recognized, the condition giving rise to the Claim, whichever is later. Provided, however, that Contractor shall use its best efforts to furnish the CO, as expeditiously as possible, with notice of any Claim once such Claim is recognized, and shall cooperate with the CO in any effort to mitigate the alleged or potential damages, delay or other adverse consequences arising out of the condition which is the cause of such a Claim. A notice of Claim must clearly identify the alleged cause and the nature of the Claim and shall describe the basis for any request for an extension of the contract period of performance or increase in the contract sum and shall include data and information then available to the Contractor that will facilitate prompt verification and evaluation of the Claim.

35.3. Continuing Contract Performance: Pending final resolution of the Claim, including litigation, unless otherwise directed by Amtrak in writing, Contractor shall proceed diligently with performance of the Contract and Amtrak shall continue to make undisputed payments in accordance with the Contract Documents.

35.4. Waiver of Claims – Final Payment: The making of Final Payment shall constitute a waiver of Claims by the Contractor except for Claims made in writing prior to Final Payment pursuant to the requirements of the Contract Documents and identified by the Contractor in writing to the CO as unresolved at the time of Final Payment.

35.5. Any Claim of Contractor not made in compliance with the requirements of the "Time Limits on Claims" subsection above shall be deemed waived. No Claim by Contractor for a Contract change hereunder shall be allowed if asserted after Final Payment under the Contract.

35.6. Resolution of Claims and Disputes:

(a) Subject to Contractor's compliance with the "Changes in the Services" and "Claims" Sections, the Contracting Official will review Claims and take one or more of the following actions within thirty (30) days of receipt of a Claim: (a) request additional supporting data from Contractor; (b) notify the Contractor in writing when the Contracting Official expects to take action; (c) reject the Claim in whole or in part, stating reasons for rejection; (d) recommend approval of the Claim; or (e) or take other actions as deemed necessary by the Contracting Official.

(b) If a Claim has been resolved, the CO will prepare or obtain appropriate documentation for execution by Amtrak and the Contractor.

(c) Additionally, the decision of the CO shall be final and conclusive unless Contractor

pursues its rights or remedies under law, in accordance with the "Governing Law, Jurisdiction, and Venue" Section. Pending a final decision of a dispute by the court, Contractor shall diligently proceed with the performance of its work under the Contract in accordance with the decision of the CO, pursuant to the "Resolution of Claims and Disputes" Section, except to the extent that the CO's decision is that Contractor is not to proceed with the performance of all or part of the Contract.

36. LIMITATION OF LIABILITY

36.1. Amtrak and Contractor shall not be liable for punitive damages or special, indirect, consequential damages and each party releases the other from any such liability. With the exception of losses (including defense costs) covered by the proceeds of insurance carried by or insuring Contractor or any Subcontractor, Contractor's liability to Amtrak for damages resulting from or arising out of any causes of action (including but not limited to tort) relating to Contractor's performance of the Contract shall not exceed an aggregate amount equal to 100% of the Contract Amount. The foregoing limitation of liability and waiver of consequential damages will not apply to or limit any right of recovery respecting the following:

(a) Losses (including defense costs) arising out of the Work and covered by the proceeds of insurance carried by or insuring Contractor;

(b) Losses (including defense costs) of amounts which would have been reimbursed but for Contractor's failure to carry insurance required to be carried under the Contract;

(c) Losses (including defense costs) of arising out of Contractor's or a Contractor Party's fraud, criminal conduct, intentional misconduct, recklessness, bad faith or gross negligence;

(d) Contractor's indemnities under the Contract;

(e) Contractor's obligation to pay liquidated damages in accordance with the Contract;

(f) Fines assessed against Amtrak by a government authority to the extent that such fines are due to a Contractor Party's violation of Applicable Law; and

(g) Losses arising out of releases of hazardous materials by Contractor or Amtrak.

Notwithstanding the foregoing, the waiver of consequential damages herein shall not apply in the event that the liquidated damages payable to Amtrak pursuant to Section 12.1 reach or exceed twenty percent (20%) of the Contract Amount.

37. REASONABLE DELAYS

37.1. Contractor acknowledges that Work to be accomplished under the Contract may be required to be performed on Amtrak's property simultaneously with ongoing daily railroad operations. Such operations include, but are not limited to, the passage of trains, and the repair, construction, reconstruction, and maintenance of the railroad right-of-way and facilities. Contractor is advised

that these conditions may cause delays and suspension of the Master Project Schedule. Contractor acknowledges that to the extent such delays and suspensions are reasonably foreseeable in light of current railroad operations as of the date hereof and any such delays and suspensions have been taken into account by Contractor and are included in all performance schedules and the Contract Amount and shall give rise to no Claims by Contractor even if they have an impact on the critical path. However, if a delay in the critical path of the Master Project Schedule occurs as a result of railroad operations that were not reasonably foreseeable in light of existing railroad operations heretofore or of which Contractor did not know or have reason to know as of the date of the Contract, then Contractor shall be allowed an extension of the Contract Time equal to the actual delay to the critical path necessarily caused in the completion of the Work and to an adjustment of the Contract Amount for any increase in the cost of performance of the Work (excluding profit) necessarily caused by such delay (it being understood that the economic adjustment formulae in the Contract shall compensate Contractor for increased costs attributable to inflation). However, no adjustment of the Contract Time or Contract Amount shall be made for any delay: (a) to the extent that performance would have been suspended, delayed or interrupted by any other cause, including the fault or negligence of Contractor or (b) for which equitable adjustment is provided for or excluded under any other provision of the Contract.

37.2. If a delay or suspension in the completion of the Work is caused by a delay in a regulatory approval identified to Amtrak in writing by Contractor as being necessary prior to the issuance of the applicable NTP, then Contractor shall be allowed an extension of the Contract Time equal to the length of the actual delay to the critical path necessarily caused by the delay in receipt of the regulatory approval; provided, however, that no such extension shall be allowed if the delay in receipt of regulatory approvals is attributable to the act or omission of Contractor or its Subcontractors.

38. ASSIGNMENT OF CLAIMS

38.1. Claims for moneys due or to become due Contractor from Amtrak under this Contract may be assigned to a bank, trust company, or other financing institution, including any Federal lending agency upon the prior written consent of the Contracting Official, and may thereafter be further assigned and reassigned to any such institution upon the prior written consent of the Contracting Official. Any such assignment or reassignment shall cover all amounts payable under this Contract and not already paid, and shall not be made to more than one party except that any such assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in such financing.

39. SUCCESSORS AND ASSIGNS

39.1. Contractor. Contractor shall neither assign nor delegate its responsibilities under the Contract (or assign its right to be paid amounts due hereunder) without the prior written consent of the Contracting Official. Any assignment without Amtrak's consent shall be void. Amtrak shall have the right to assign all or part of the Contract without obtaining consent from Contractor or its sureties, if any. Subject to the foregoing, the Contract shall be binding upon and shall inure to the benefit of permitted assigns.

39.2. In connection with any assignment of the Contract for collateral purposes to Financing Parties pursuant to Section 39.1, Contractor shall provide to such Financing Parties a consent to assignment agreement in a form as may be reasonably required by such Financing Parties (it being agreed that such Financing Parties may reasonably require provision by competent counsel to Contractor of legal opinions addressing authorization, enforceability and other customary matters related to such consent or direct agreement), covering matters that are customary in project or equipment financings of the applicable type, which, among other things, shall authorize the Financing Parties, as secured parties, to exercise all rights of Amtrak under the Contract, and to subsequently assign such rights in connection therewith without the consent of Contractor and may also cover matters such as Financing Parties' security rights with respect to the Contract, direct notices to Financing Parties, step-in/step-out rights, access by Financing Parties' representative, deferral of Contractor's rights to terminate the Contract in certain circumstances and other matters applicable to such project or equipment financing. In this regard, Contractor shall cooperate with Amtrak in its efforts to obtain such financing, including by supplying information and documentation reasonably requested by the Financing Parties and taking such other actions as the Financing Parties may reasonably request.

40. TIME

40.1. The Contract Time is the period of time allotted in the Contract for completion of the Work or a portion thereof, as applicable.

40.2. The date of commencement of the Work or a portion thereof is the date established in a NTP for such Work or portion thereof.

40.3. The time of beginning, rate of progress, and time of completion are essential conditions of the Contract. If Contractor refuses or fails to prosecute the Work with such diligence as shall insure its completion within the time specified in the Contract, or any extension thereof as herein provided, or if Contractor abandons the Work or if Contractor fails to complete the Work within said time, Contractor shall be liable for liquidated damages as set forth in Article 12, Liquidated Damages. Amtrak may deduct from subsequent payments due Contractor under this or any contract with Contractor or from any sums retained there-under, all or such part of these sums as may be required to pay the aforesaid damages, with Contractor being responsible for any deficiency.

40.4. All phases of the Work shall be completed within the number of days as stated in the NTP. All NTPs shall be submitted to Contractor by facsimile and/or letter and Contractor shall signify the receipt of same by return facsimile or letter. The date of transmittal by Amtrak of a NTP shall constitute its effective date.

40.5. Should an impact of any nature whatsoever to the Master Project Schedule be identified by Contractor; Contractor shall immediately notify Amtrak in writing and provide recommendations for actions to be taken in order to mitigate the delay.

41. FORCE MAJEURE

41.1. For purposes of this Contract, a Force Majeure Event is any one of the following: act of God or the public enemy, act of a governmental authority acting in its sovereign capacity, fire, flood, epidemic, quarantine restriction, unusually severe weather, war, terrorism, riot, earthquake, strike or embargo. In the event that either party's failure to perform in accordance with any schedule or when otherwise required under the Contract arises solely out of a Force Majeure Event that is both out of the control of such party and without the fault or negligence of such party, the time for performance under the Contract will be extended proportionately up to a maximum of thirty (30) days (or longer, in the Contracting Official's sole discretion), consistent with the requirements of this Article 41. Notwithstanding the foregoing, Covid19 shall not be considered a Force Majeure under this provision.

41.2. Within ten (10) days of (i) becoming aware or (ii) the date by which it should reasonably have become aware, of a delay resulting from a cause specified in Section 41.1, whichever is earlier, Contractor shall advise the Contracting Official in writing of a claimed Force Majeure Event. The Contracting Official will then determine whether the event constitutes a Force Majeure as defined in Section 41.1 and will so advise the Contractor in writing. Once performance of the delayed work re-commences, or at the end of the thirty (30) day period (or such longer period as the Contracting Official in his or her sole discretion choose to allow), the Contracting Official will advise the Contractor of the time extension granted due to the Force Majeure Event. Contractor shall make every reasonable effort to minimize the duration of the Force Majeure Event.

41.3. Apart from extension of time, no Claim for additional payment shall be filed by Contractor and no payment or allowance of any kind shall be made to Contractor as compensation for damages occasioned by way of the causes specified in Section 41.1.

41.4. Contractor recognizes it is imperative that the Work proceed uninterrupted and shall endeavor to prevent and shall diligently take all reasonable steps to re-start performance fully in accordance with the Contract, cure any work stoppage or strike of Contractor's employees caused by any labor disputes, including jurisdictional disputes arising out of the assignment of any of the Work. Contractor shall cause parallel provisions to be inserted in all subcontracts at any tier. If Contractor's failure to perform extends for more than fifteen (15) days from the start of the Force Majeure Event, Amtrak may, at its discretion, terminate the Contract without liability or cost at any time after such fifteen (15) days or some greater timeframe that may be specified by Amtrak. In the event of such early termination, if requested by Amtrak, Contractor shall transfer title as directed by Amtrak and deliver to Amtrak in the manner directed by Amtrak, any completed or partially completed deliverables or other work products Contractor has produced or acquired specifically for performance of the Work under the Contract.

41.5. Contractor agrees that no time extension shall be granted for time lost due to normal seasonal weather conditions. In order to qualify for consideration for a time extension due to adverse weather conditions, Contractor must show that the weather conditions during a given quarterly period (summer, fall, winter, spring) were more severe than the most severe year of the previous five years for the project geographical area and, in addition, that these weather conditions critically impacted the final project completion date by delaying the performance of Work. If abnormal weather losses within the meaning of the preceding sentence can be shown to have

affected the Master Project Schedule, a non-compensable time extension shall be granted for that portion of the proven weather-related delays which exceeded the normal weather losses which should have been anticipated for the quarterly period in question, but no Claim for additional payment shall be filed by Contractor and no payment or allowance of any kind shall be made to Contractor as compensation for damages occasioned by way of any such abnormal weather.

41.6. Defaults or delays in performance of the Work by Contractor which are caused by acts or omissions of Subcontractors shall not relieve Contractor of its obligations, except to the extent that the relevant Subcontractor is itself subject to a Force Majeure Event covered hereunder and Contractor cannot reasonably circumvent the effect of the Subcontractors default or delay in performance through the use of alternate sources, work around plans or other means.

41.7. In the event that Amtrak's failure to perform in accordance with any schedule or when otherwise required under the Contract arises solely out and is the direct result of a Force Majeure Event that is both out of Amtrak' control and without the fault or negligence of Amtrak, Amtrak shall not be liable to the Contractor for such failure.

42. PRICING OF ADJUSTMENTS

42.1. When costs are a factor in any determination of a Contract price adjustment pursuant to Article 15, Changes, or any other provision of this Contract, such costs shall be in accordance with the contract cost principles and procedures of Part 31 of the Federal Acquisition Regulation (FAR), as amended by O.M.B. Circular A-87, in effect on the date of this Contract.

43. FEDERAL FUNDING, AUDIT, AND INSPECTION

43.1. Contractor hereby acknowledges and accepts that: (1) federal funds may be expended to it in connection with the tasks, assignments or duties which it performs pursuant to this Contract, and (2) the federal False Claims Act, 31 U.S.C. § 3729 et seq. may apply in connection with applications for payment, claims, requests for equitable adjustment or other requests for payment which Contractor submits to Amtrak under, or in connection with, this Contract.

43.2. Contractor acknowledges and agrees that Amtrak and Amtrak's Office of Inspector General (OIG) may inspect, copy and/or audit Contractor's data and records (in hard copy and/or electronic format) related in any way to the Contract, including without limitation, all data and records relating to: (1) support for any proposal, change order, or request for equitable adjustment submitted to Amtrak by Contractor; (2) Contract compliance and performance, including any work or deliverables in progress; (3) compliance with applicable provisions of Amtrak's federal grant, regulations and statutes; and (4) support for all direct and indirect costs or prices charged to Amtrak. Contractor agrees to maintain all such data and records throughout the term of the Contract and until three (3) years after final payment under the Contract, and agrees to cooperate with all audit activities.

43.3. In connection with audit and inspection activities, Amtrak and Amtrak OIG shall be afforded, upon request, (1) access to Contractor's facilities and to Contract work or deliverables in progress,

(2) the opportunity to interview Contractor's employees concerning any matter relating to the Contract, and (3) adequate and appropriate workspace.

43.4. Contractor agrees to reimburse Amtrak, within sixty (60) calendar days after receipt of a written request, the full amount of any undisputed audit findings or questioned costs, unless otherwise agreed by Amtrak in the course of post-audit negotiations with Contractor.

43.5. Contractor shall include the provisions of this clause in every subcontract or purchase order exceeding $100,000, as well as a provision requiring all subcontractors to include these provisions in any lower tier subcontracts or purchase orders exceeding $100,000. Contractor shall be responsible for subcontractor or lower tier subcontractor's compliance with this clause.

43.6. Nothing in this Contract shall be construed to limit the rights, obligations, authority, or responsibilities of Amtrak's Office of the Inspector General pursuant to the Inspector General Act of 1978, as amended, including the right to seek information by subpoena.

44. PAYMENT PROVISIONS – GENERAL

44.1. With respect to any amount to be paid to Amtrak by Contractor pursuant to the Contract, Amtrak may, at its option, set off that amount as a credit against the Contract Amount payable to Contractor for the Work.

44.2. Amtrak shall pay undisputed charges when such payments are due for the Work. Amtrak may withhold payment of particular charges that Amtrak disputes in good faith, and in that case, Amtrak shall advise Contractor, in writing, of the nature of the dispute and, at Contractor's request, the parties shall immediately commence resolution of the issue in accordance with Article 35, Claims and Disputes.

44.3. RESERVED

45. FAIR EMPLOYMENT PRACTICES/EQUAL EMPLOYMENT OPPORTUNITY

45.1. Contractor agrees to abide by Amtrak's policy and practice to ensure that all business organizations receive fair and equal consideration and treatment without regard to race, color, religion, sex, disability, veteran status or national origin of the owners or principals of the business organization. In addition, Contractor agrees that it shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, disability, veteran status or national origin and that it shall comply in all respects with the Americans with Disabilities Act, 42 U.S.C. 12101 et seq.

45.2. Contractor shall take affirmative action to ensure that applicants and employees are treated fairly without regard to their race, color, religion, sex, disability, veteran status or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this non-discrimination section.

45.3. Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice advising the labor union or workers' representative of Contractor's commitments under this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

45.4. The Contract may be canceled, terminated, or suspended in whole or in part based on Contactor's failure to comply with this section.

45.5. Contractor shall include the provisions of Sections 45.1 through 45.4 in subcontracts involving services to be performed or Supplies to be furnished under the Contract, unless exempted by rules, regulations, or orders of the U.S. Secretary of Labor.

46. ENVIRONMENTAL COMPLIANCE

46.1. Contractor shall comply with all Applicable Laws concerning the environment and/or waste disposal.

46.2. Contractor shall dispose of any wastes, including hazardous wastes, generated by Contractor, its Subcontractors or agents (either purposefully or accidentally) in connection with its performance of the Contract in accordance with applicable federal, state, and local laws, regulations, ordinances, and orders, at its sole expense, using its own EPA generator number. In no event shall Amtrak be identified as the generator of any such wastes. Amtrak reserves the right to require Contractor to provide to Amtrak a copy of the results of any tests conducted by or for Contractor on any such wastes and, at Amtrak's expense, to perform additional tests or examinations of any such wastes prior to disposal.

46.3. Contractor shall include and enforce this Environmental Compliance Article in all subcontracts or lower tier purchasing agreements.

47. BUY AMERICA(N) REQUIREMENTS

47.1. In accordance with Amtrak's Domestic Buying Preference requirements at 49 U.S.C. 24305(f), Amtrak shall only buy, and accordingly, Contractor shall only supply (a) unmanufactured articles materials, and supplies mined or produced in the United States; or (b) manufactured articles, material, and supplies manufactured in the United States substantially from articles, materials, and supplies mined, produced or manufactured in the United States. For purposes of this provision, substantially means that more than 55% of all components by cost must be domestic. This Section 47.1 shall apply only when the cost of those articles, material, or supplies bought or supplied to Amtrak by Contractor is at least $1,000,000.

47.2. When complying with Section 47.1, Contractor shall comply with the domestic preference requirements of the Build America, Buy America Act (BABA) § 70914, Pub. L. No. 117-58, div. G, tit. IX, subtit. A, 135 Stat. 429, 1298 (2021), as implemented by OMB, USDOT, and FRA.

47.3. In accordance with 2 C.F.R. §200.322, as appropriate and to the extent consistent with law, Contractor shall, to the greatest extent practicable, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but

not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subcontracts and purchase orders for work or products under this Contract.

(a) For the purposes of 2 C.F.R. §200.322:

1. "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.

2. "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

48. CUSTOM DUTIES

48.1. Contractor agrees that, if any items or Supplies are shipped F.O.B. (Free on Board) destination or D.D.P. (Delivered Duty Paid), Contractor shall be the importer of record for all articles that enter into the United States in connection with the Contract. Contractor shall be liable for all duties, fees, and taxes attaching on importation of such articles, including anti-dumping and countervailing duties, if any.

48.2. Contractor agrees that, if the items or Supplies are shipped F.O.B. origin, C.I.F. (Cost, Insurance & Freight) or F.C.A. (Free Carrier), Amtrak shall specify the customs broker and shall be the importer of record for all articles that enter into the United States in connection with the Contract.

48.3. Amtrak shall not pay on behalf of Contractor, or reimburse Contractor for any anti-dumping or countervailing duties for which Contractor may be liable.

49. EXPORT CONTROLS

49.1. Contractor represents and warrants that it shall comply with (1) all United States export laws and regulations issued by any U.S. government authority, including without limitation the U.S. Export Administration Regulations, the International Traffic in Arms Regulations and any regulations administered by the Department of the Treasury's Office of Foreign Assets Control, that govern the export or re-export of any deliverable, technology or technical data provided hereunder, including software, hardware, Equipment, documentation, specifications, Drawings, and schematics (collectively, the "Products") and any of the services, and (2) any applicable laws and regulations of countries other than the United States that govern the importation, use, export or re-export of Products and/or services. Contractor further represents and warrants that it shall (1) obtain appropriate export authorizations, consents or licenses that may apply to Contractor's export or import of any Products or services, and (2) comply with any conditions that are contained in any export or import licenses pertaining to the Products or services. Contractor shall comply with any reporting requirements that may apply to the export or re-export of the Products

and/or services and provide to Amtrak and the appropriate governmental authority any periodic reports containing such information as may be required under applicable law.

49.2. Each party will reasonably cooperate with the other in making the appropriate filings with any governmental authority and will, to the fullest extent permitted by law, provide any information, certificates or documents as are reasonably requested.

49.3. In performing services under this Contract, Contractor warrants and represents that it shall not cause any non-U.S. person who is a citizen of country that has been designated by the U.S. Government as a "terrorist supporting country" (see Country Group E at Supplement No. 1 to Export Administration Regulations Part 740) to perform under this Contract if such performance would violate the regulation.

49.4. With the exception of commodities, software or technologies that are controlled solely for "antiterrorism" reasons under the Export Administration Regulations ("EAR"), Contractor represents and warrants that the deliverables shall not contain any export-controlled technology or technical data under the export control laws or regulations unless approved by Amtrak's Contracting Official in writing. At least thirty (30) days prior to the earlier of the delivery, installation or provision of a deliverable containing any controlled technology or technical data, Contractor shall inform Amtrak's Contracting Official in writing of the EAR Export Control Classification Number(s) ("ECCN") or the International Traffic in Arms Regulations ("ITAR") U.S. Munitions List Classification ("MLC") numbers applicable to such deliverable. In addition, upon delivering or otherwise providing a deliverable with an ECCN or MLC number, Contractor shall place the following legend, or substantially similar one, as applicable on technical data and/or deliverable documentation:

"WARNING—INFORMATION SUBJECT TO EXPORT CONTROL LAWS: This document or software contains information subject to the Export Administration Regulations ("EAR") [or the International Traffic in Arms Regulations ("ITAR")]. This information may not be exported, released, or disclosed to foreign persons, whether within or outside the United States without first complying with the export license requirements of EAR [or ITAR]. Include this notice with any reproduced portion of this document. The EAR Export Control Classification Number(s) ("ECCN") [or the ITAR U.S. Munitions List Classification(s)] is/are: _____."

49.5. If the services under the Contract include the maintenance or servicing of a Product, Contractor shall be responsible for promptly informing Amtrak's Contracting Official of any changes in the ECCN or MCL status of such Product until expiration or termination of the maintenance or serving period for that Product.

49.6. If Contractor is provided, or provided access to, any technology or technical data by or through Amtrak that is restricted under the export control laws or regulations, Contractor shall fully comply with any and all restrictions imposed by Amtrak at no additional cost.

49.7. Contractor is fully responsible for compliance with the provisions herein on behalf of itself and its employees, agents and contractors and those of its Subcontractors, at any tier level, and their respective employees, agents and contractors.

50. TRANSACTIONS INVOLVING EMPLOYEES OF AMTRAK

50.1. Without giving prior written notice to the Contracting Official, Contractor shall not: (a) employ any employee of Amtrak when Contractor knows or has reason to believe that such person after employment by Contractor, shall also continue to remain in the employ of Amtrak; or (b) utilize as a consultant or otherwise, for compensation, the services of any employee of Amtrak in connection with the performance of the Work under this Contract; or (c) procure any portion of the Work under this Contract, or any materials or services required in connection with the performance of this Contract, from any firm (excluding corporations whose stock is listed on a recognized stock exchange) which Contractor knows or has reason to believe is owned or controlled by employees of Amtrak or in which employees of Amtrak have a substantial interest.

50.2. Contractor shall furnish the Contracting Official with such further information as the Contracting Official may request concerning any proposed transactions of Contractor set forth above.

51. AMERICANS WITH DISABILITY ACT

51.1. The Contractor shall comply with all the applicable requirements of the Americans with Disabilities Act of 1990 and regulations promulgated thereafter, including 49 CFR Parts 27, 37 & 38.

52. CONVENANTS AGAINST CONTINGENT FEES

52.1. Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this Contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by Contractor for the purpose of securing business. For breach or violation of this warranty, Amtrak shall have the right to terminate this Contract without liability or in its discretion to deduct from the Contract Amount, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

53. ETHICAL BUSINESS PRACTICES

53.1. Contractor, or any employee, agent, or representative of Contractor, shall not offer to any Amtrak employee, agent or representative any cash, gift, entertainment, commission, or kickback for the purpose of securing favorable treatment with regard to award or performance of the Contract or any other contract.

53.2. Contractor, or any employee, agent or representative of Contractor, agrees that it shall neither solicit nor accept any cash, gift, entertainment, commission, or kickback from a vendor, subcontractor or any other person or entity for the purpose of securing favorable treatment with regard to award or performance of any subcontract or contract issued in connection with the Contract.

53.3. Contractor agrees that it shall not: (i) employ the services of any Amtrak employee, their spouse or other member of an employee's immediate family as a consultant, subcontractor, or otherwise, in connection with the performance of the Contract; or (ii) purchase any material or services

required to perform the Contract from any entity owned or controlled (including a substantial financial interest) by any Amtrak employee or member of an employee's immediate family.

53.4. Contractor agrees that it shall direct any officer, employee, agent, or representative of Contractor ("Contractor Agents") to comply with the obligations stated in the foregoing subsections (A)-(C). Contractor further agrees that Contractor shall be responsible for ensuring compliance by Contractor Agents.

53.5. Contractor and its subsidiaries and, to the knowledge of the Contractor, its affiliates, have conducted their respective businesses in compliance with the Foreign Corrupt Practices Act of 1977, as amended, and the rules and regulations thereunder (the "FCPA") and have instituted and maintain policies and procedures designed to ensure, and which are reasonably expected to continue to ensure, continued compliance with the FCPA. Neither Contractor, nor any of its subsidiaries nor, to the knowledge of the Contractor, any director, officer, agent, employee, or other person associated with or acting on behalf of the Contractor has: (i) used any corporate funds for any unlawful contribution, gift, entertainment or other unlawful expenses relating to political activity; (ii) made any direct or indirect unlawful payment to any foreign or domestic government official or employee or to any political party or candidate for political office; (iii) violated or is in violation of any provision of the FCPA; (iv) made any bribe, rebate, payoff, influence payment, kickback, or other unlawful payment; or (v) made any payment of funds to the Contractor or its subsidiaries or received or retained funds in violation of any law, rule or regulation.

53.6. Violation of this Section shall be considered cause for termination of the Contract for Default.

53.7. Contractor shall use commercially reasonable efforts to include the provisions of this Article in each subcontract or third-party agreement entered into under this Contract.

54. CONFLICT OF INTEREST

54.1. Contractor hereby affirmatively represents that it shall not have a Conflict of Interest in performing the Services for Amtrak pursuant to this Contract. Contractor agrees not to (a) engage in activities, or (b) initiate or maintain relationships with persons or entities where such activities or relationships create a conflict of interest. Contractor shall use its best efforts to identify and prevent potential Subcontractor conflicts of interest. Contractor shall inform Amtrak of any activity or relationship that Contractor has reason to believe may create a conflict of interest. Without limiting the generality of the foregoing, Contractor shall not, and shall not knowingly permit any Subcontractor to, enter into any contract, subcontract, or other arrangement in excess of $50,000 (other than for personal employment) related to this Contract or the Work if any of its officers or directors or any members of the immediate family or one of the foregoing has any material interest in the contract, subcontractor arrangement, unless the other party (or parties) to such contract or subcontractor arrangement is the lowest qualified bidder on a publicly advertised, sealed-bid basis and written records of the entire transaction are kept by the Contractor and made available to Amtrak and FRA upon request.

54.2. Contractor represents that it is not a party to any existing agreement which would prevent Contractor from entering into and performing this Contract.

54.3. "Organizational Conflict of Interest" means that because of other activities or relationships with other persons or entities: (i) a person or entity is unable to render impartial assistance or advice to Amtrak, (ii) the person's or entity's objectivity in performing the Contract is or might be otherwise impaired, or (iii) the person or entity has, or attempts to create, an unfair competitive advantage. Contractor agrees not to engage in activities or initiate or maintain relationships with persons or entities where such activities or relationships create an Organizational Conflict of Interest. Contractor shall use its best efforts to identify and prevent potential subcontractor Organizational Conflicts of Interest. Contractor shall inform Amtrak of any activity or relationship that Contractor has reason to believe may create an Organizational Conflict of Interest. Contractor represents that it is not a party to any existing agreement which would prevent Contractor from entering into and performing this Contract.

55. GRATUITIES

55.1. Amtrak may, by written notice to the Contractor, terminate the right of the Contractor to proceed under this Contract if it is found, after notice and hearing, by Amtrak, that gratuities (in the form of anything of value, including but not limited to cash, entertainment, gifts) were offered or given by the Contractor, or any agent or representative of the Contractor, to any officer or employee of Amtrak with a view toward securing a contract or securing favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performing of such contract, provided, that the existence of the facts upon which Amtrak makes such findings shall be in issue and may be reviewed in any competent court.

55.2. In the event of a breach under Article 55.1, in addition to its right to terminate, Amtrak shall be entitled (i) to pursue the same remedies against the Contractor as it could pursue in the event of a breach of contract by the Contractor, and (ii) as a penalty in addition to any other damages to which it may be entitled by law, to exemplary damages in an amount (as determined by Amtrak) which shall not be less than three or more than ten times the cost incurred by the Contractor in providing any such gratuities to any such office or employee.

55.3. In accordance with Section 63.1 hereof, the rights and remedies of Amtrak provided in this Article shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.

56. OFFICIALS NOT TO BENEFIT

56.1. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this Contract, or to any benefit that may arise there-from; but this provision shall not be construed to extend to this Contract if made with a corporation for its general benefit.

56.2. The Contractor warrants that no director, officer, employee or agent of Amtrak is a director, officer, employee or agent of the Contractor, and that to the knowledge and belief of the Contractor, no director, officer, employee, or agent of Amtrak owns any stock or has a substantial interest in the Contractor.

57. NON-WAIVER

57.1. No waiver by Amtrak of any breach on the part of Contractor of any of Contractor's obligations herein contained shall constitute a waiver of any subsequent breach of the same or any other of such obligations, and no payment made hereunder shall be deemed to constitute an acceptance or approval of any defective or unsatisfactory material or workmanship, or a waiver of Amtrak's right to reject the same later. As provided in Section 63.1 hereof, the remedies of Amtrak under this Article are cumulative, and in addition to those provided by law.

58. INSURANCE

58.1. Contractor shall procure and maintain, at its own cost and expense, during the entire period of performance under the Contract, including the Three-Year Warranty Period for the final unit of Equipment (or any extension thereof), the types of insurance specified below. All insurance shall be placed with insurance carriers (i) reasonably acceptable to Amtrak (ii) authorized to do business in the jurisdiction(s) where Work is to be performed and (iii) have financial ratings of A- VIII or better in the Best's Rating Guide, latest edition in effect as of the date of the contract and subsequently in effect at the time of renewal of any insurance policies required hereunder. All insurance shall affirmatively include coverage for acts of terrorism.

Contractor shall furnish Amtrak with a certificate or certificates of insurance and endorsements, giving evidence of the required insurance prior to the issuance of a NTP or commencement of any portion of the Work pursuant to this Contract and upon renewal of any required insurance thereafter. Amtrak shall have the right to review and approve all insurance certificates and endorsements applicable to the Work. However, Amtrak's acceptance, acquiescence or failure to object to Contractor's submitted insurance certificates and endorsements shall in no way relieve Contractor from responsibility for obtaining insurance policies complying with the terms of this Contract. In no event shall Work be performed until the required certificates of insurance and endorsements have been furnished. If the insurance provided is not in compliance with the requirements listed below, Amtrak shall have the right to stop Work until proper evidence of all required insurance is provided. Contractor shall have no right to an adjustment of the Contract Time or the Contract Amount based on Amtrak's exercise of such right, and any delay in the completion of any portion of the Work caused by Amtrak's exercise of such right to stop Work shall be an unexcused delay.

If an indemnified claim arises involving an Indemnified Party and upon the request of Amtrak, Contractor will provide, or cause to be provided to Amtrak, copies of all insurance policies and endorsements implicated in the Indemnified Claim.

All Subcontractors shall be required to maintain the required Insurances hereunder. The Contractor or Contractor's insurance shall provide coverage for each Subcontractor working on its behalf for covered claims caused in whole or part by the Subcontractor.

Unless otherwise specifically provided to the contrary, all insurance coverages specified herein shall name Amtrak and the Financing Parties as additional insureds(collectively, "Additional Insured Parties") using ISO CG 20 10 04 13 and CG 20 37 04 13 or their equivalent, and shall provide that Additional Insured Parties are additional insureds with respect to the Work, shall be primary and noncontributory to any other insurance available to Additional Insured Parties and

their respective employees and agents, and shall include waivers of subrogation rights against Additional Insured Parties and their respective employees and agents. Except as otherwise expressly provided herein, Contractor's insurance obligations under this Article shall not be construed to limit Amtrak's rights whether in warranty, contract or any other applicable legal theory which may arise under provisions of the Contract or at law or in equity.

Contractor shall cause each insurance policy required hereunder to not be cancelled, non-renewed or materially altered without thirty (30) days advance written notice (ten (10) days advance written notice for non-payment of premium) to Amtrak, which must be stated on the certificate of insurance. Such policies must be endorsed to extend notice of cancellation rights to Amtrak, to the extent commercially available.

58.2. Workers' Compensation Insurance: A policy complying with the requirements of the statutes of the jurisdictions in which the Work shall be performed, covering all employees of Contractor. Employers' Liability coverage with limits of liability of not less than $1,000,000 for each accident or illness shall be included. Additional Insured Parties shall not be named as an additional insured under this policy, but the policy shall include a waiver of subrogation against the Additional Insured Parties and their respective employees and agents.

58.3. Commercial General Liability Insurance: A policy issued on an occurrence basis to and covering liability arising out of the Work to be performed by Contractor under the terms of the Contract. Products/Completed Operations Liability, Independent Contractors Liability, Contractual Liability (with railroad exclusions deleted), and Personal Injury/ Advertising Liability coverages are to be included. The policy shall contain a cross- liability endorsement allowing claims and suits between insureds, shall not have any exclusion for liability relating to railroad operations, and shall not require mediation or arbitration of any disputes. Coverage under this policy shall have combined single limits for bodily injury (including disease or death) and property damage (including loss of use) of not less than $325,000,000 per occurrence and $650,000,000 in the aggregate. Amtrak has the right to require an increase in the insurance limits in the event of an increase in the statutory limit in 49 U.S.C § 28103, and the aggregate limit shall be two times the per occurrence limit.

58.4. Automobile Liability Insurance: A policy issued to and covering the liability of Contractor arising out of the use of all owned, non-owned, hired, rented or leased vehicles which bear, or are required to bear, license plates according to the laws of the jurisdiction in which they are to be operated. Coverage under this policy shall have combined single limits of liability of $2,000,000 per occurrence and in the annual aggregate.

58.5. Railroad Protective Liability Insurance: With respect to Contractor's design and testing work activities within fifty (50) feet vertically or horizontally of railroad tracks, Contractor shall procure and maintain Railroad Protective Liability Insurance, written on the AAR-AASHTO (ISO/RIMA) occurrence based form (a claims made form is not acceptable), in the name of Amtrak (National Railroad Passenger Corporation) and other railroads and commuter agencies operating over tracks that are used in design and testing work. The policy shall have limits of liability of not less than $10,000,000 per occurrence and $20,000,000 in the aggregate. If

equivalent or broader wording is not contained in the policy form, the following endorsement must be included:

58.5.1. It is agreed that "Physical Damage to Property" means direct and accidental loss of or damage to all property owned by Amtrak and/or all property in the care, custody and control of Amtrak.

58.5.2. In addition, Endorsement CG 28 31 – Pollution Exclusion Amendment, must be included.

58.6. Professional Liability Insurance: A policy issued to and covering the liability of Contractor for engineering and design errors and omissions in the performance of this Contract. Contractor shall maintain such coverage during the term of this Contract and for at least 3 years following completion and acceptance of the Project. This insurance shall have limits of liability of not less than $25,000,000 per occurrence and in the annual aggregate. The deductible amount shall not exceed $500,000. The Additional Insured Parties shall not be named as an additional insured under this policy.

If professional liability insurance coverage is written on a claims-made basis: (1) the policy retroactive date shall coincide with or precede Contractor's start of contract services (including subsequent policies purchased as renewals or replacements); (2) the policy will allow for the reporting of circumstances or incidents that might give rise to future claims; (3) Contractor will use its best efforts to maintain similar insurance under the same terms and conditions for at least six years following completion of the services under the contract; and (4) if insurance is terminated for any reason, Contractor agrees to purchase an extended reporting provision of at least six years to report claims arising from the Contract.

58.7. Property Insurance: A policy or policies issued to the Contractor covering, Contractor's production facilities, Contractor equipment used in the manufacturing and testing the Equipment, and each Equipment, including all work in process and all component parts not yet installed and spare parts, during the design, manufacture, conveyance (including all inland and ocean transport and loading and unloading through a Stock Throughput Policy or Cargo Policy), storage and testing of each unit of Equipment until the issuance by Amtrak of a Certificate of Conditional Acceptance or Certificate of Final Acceptance (as used in this provision "Acceptance") as defined in Section 8.3 of this Contract. The coverage territory shall be worldwide and the insurance shall provide coverage on an all-risk basis, including the risks of earth movement, windstorm, storm surge and flood, and provide coverage for business interruption and extra expense for the Contractor and contingent business interruption and contingent extra expense, including all supplier and contractor relationships required to fulfill this Contract. Such coverages shall have limits on a per occurrence basis, adequate to cover the full replacement value of the production facilities, including test tracks and equipment with respect to property damage and limits of three hundred million dollars ($300,000,000) for business interruption and extra expense and contingent business interruption and contingent extra expense. The proceeds from such insurance shall be used exclusively to restore damaged Contractor property and to reimburse the Contractor for business interruption and extra expense for an event impacting the fulfillment of the Contractor's obligations in this Contract. In no instance shall the Additional Insured Parties be responsible for loss or damage to Contractor's or Subcontractor's property or equipment including

the Equipment prior to Acceptance. In addition, Contractor shall procure and maintain property insurance for the replacement value of Contractor tools and equipment brought onto Amtrak property. This insurance shall name the Additional Insured Parties as loss payees as their interest may appear.

58.8. Valuable Papers and Records Insurance: A policy covering loss or damage to valuable papers including blueprints, reports, surveys, designs or specifications in connection with this Contract, on an all -risk basis, in an amount no less than 100% of the replacement cost of such property. This insurance shall name the Additional Insured Parties as loss payees as their interest may appear and contain a waiver of subrogation against the Additional Insured Parties.

58.9. Technology Errors and Omissions Insurance: When Contractor's Services includes the delivery of information technology services and/or technology products to Amtrak, technology errors and omissions coverage for liability from errors, omissions or negligent acts in rendering or failing to render computer or information technology services and technology products, violation of software copyright, and the failure of products to perform the intended function or serve the intended purpose. The policy shall not contain a provision that would prevent, preclude or exclude liability triggered by or connected to a network failure, system failure or the disclosure of private information and shall have limits of not less than the amount set forth in the Contract per occurrence and in the aggregate, covering the information technology services performed in connection with Services and continuing in force by renewal or extended reporting provision for not less than the greater of three (3) years after final completion of the Services or the greater time under which a claim may be properly asserted under the applicable statute of limitations or repose. The policy shall have limits of insurance of not less than fifty million dollars ($50,000,000) per occurrence and in the annual aggregate.

58.10. Cyber Liability Insurance: When the Contractor's Services includes access to Amtrak's electronically stored proprietary information and personally identifiable information of Amtrak employees, customers or other third parties, cyber liability insurance for loss, disclosure and theft of data in any form, system failure, and network security failure, including but not limited to, social engineering, phishing, ransomware, denial of service attacks, and transmission of malicious code. Coverage shall include regulatory fines and penalties, the cost of notifying individuals of a security or data breach, the cost of credit monitoring services and any other causally-related crisis management expense for up to one (1) year, shall contain no provision that would prevent, preclude or exclude a claim triggered by or connected with an act of cyber terrorism, shall extend to actual or alleged acts, errors or omissions committed by the Contractor or its agents, subcontractors, independent contractors or employees, shall contain severability for the insured organization for any intentional act exclusions, shall include consequential or vicarious liabilities and direct losses for the wrongful acts or failures of the Contractor, and shall have the "Insured v. Insured" exclusion amended to allow an Indemnified Party to bring a claim against the Named Insured. The policy shall have limits of not less than the amount set forth in the Contract per occurrence and in the aggregate, covering the information technology services performed in connection with Services and continuing in force by renewal or extended reporting provision for not less than the greater of three (3) years after final completion of the work or the greater time under which a claim may be properly asserted under the applicable statute of limitations or repose.

The policy shall have limits of insurance of not less than fifty million dollars per occurrence and in the annual aggregate.

58.11. RESERVED

59. PROTECTION OF PERSONS AND PROPERTY

59.1. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work.

59.2. Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

(a) All employees involved in the Work and all other persons who may be affected thereby;

(b) All the Work and all materials and Equipment to be incorporated therein, whether in storage on or off the site or under the care or custody of Subcontractors; and

(c) Other property at the Work site(s) or adjacent thereto, including but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

59.3. Contractor shall comply with all applicable laws, ordinances, rules, regulations, and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. Contractor shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety rules and notifying owners and users of adjacent utilities.

59.4. Use or storage of explosives or other hazardous material shall not be permitted without the written approval of the Contracting Official. If use or storage of such materials is approved, Contractor shall exercise the utmost care in such use or storage and shall carry on such activities under the supervision of properly qualified personnel.

59.5. All damage or loss to any property referred to in this Article caused in whole or in part by Contractor, its Subcontractors, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable shall be remedied by Contractor.

59.6. Contractor shall designate a responsible member of his organization at the site(s) whose duty shall be the prevention of accidents. This person shall be Contractor's superintendent unless otherwise designated in writing by Contractor to the COTR.

59.7. Contractor shall not load or permit any part of the Work to be loaded so as to endanger personnel and/or property.

59.8. When working in and around Amtrak property, all personnel employed by Contractor or its Subcontractors shall abide by the applicable safety policies and procedures for the respective property.

59.9. Contractor shall notify Amtrak to arrange for permission to enter upon Amtrak and railroad property. Twenty-one (21) days prior notice must be given to Amtrak for property access when Amtrak protection personnel are required. Prior to entering Amtrak's property, Contractor and its Subcontractors may be required to execute Amtrak's then current Permit to Enter.

59.10. Contractor, his employees and Subcontractors shall attend all required safety seminars as directed by Amtrak.

59.11. Contractor must comply with all Amtrak safety rules and operating rules.

60. GOVERNING LAW

60.1. The Contract shall be governed by and construed in accordance with the laws of the District of Columbia, excluding that portion of District of Columbia law relating to the application of laws of another jurisdiction. Subject to the Claims and Disputes section hereof, each party agrees that all legal proceedings in connection with any dispute arising under or relating to the Contract shall be brought in the United States District Court for the District of Columbia. Contractor hereby accepts the jurisdiction of the United States District Court for the District of Columbia and agrees to accept service of process as if it were personally served within the District of Columbia.

61. COMPLIANCE WITH LAW

61.1. All Work shall comply with all Applicable Laws that bear on the performance of the Work (including without limitation all building codes, zoning and other Laws that bear, or would bear but for any exemption from such Laws enjoyed by Amtrak, on the Work), except as otherwise expressly specified in the Contract or directed by the Contracting Official. If Contractor observes that any of the Contract terms are at variance therewith in any respect, he shall promptly notify the COTR in writing, and any necessary changes shall be made by appropriate Contract Modification, provided that no Contract Modification shall extend the Contract Time or increase the Contract Amount if it is based on a law enacted at the time of Contract execution. Contractor shall be deemed to have had notice of all laws enacted at the time of Contract execution, regardless if the effective date is after Contract execution. Contractor shall be deemed to have included in the Contract Amount the cost of making all Work comply with all laws enacted at the time of Contract execution.

61.2. In the event any governmental requirements are removed, relaxed or changed in any way after the execution of the Contract so as to make Contractor's performance less expensive or less difficult, Amtrak shall have the option to either require Contractor to perform pursuant to the more rigorous requirements, or to receive a reduction in the cost of the items of material or equipment affected for all savings by reason of such change.

61.3. Contractor shall defend, indemnify and hold harmless Amtrak, its directors, officers, agents, servants and employees from any loss, cost, damage or expense incurred by them arising from, occasioned by or in any manner connected with Contractor's failure to perform the Work in compliance with any applicable laws, ordinances, rules, regulations or orders.

62. WRITTEN NOTICE

62.1. Any written notice required of the parties under the provisions of the Contract shall be deemed to have been duly served upon receipt if delivered in person to the individual or representative or officer of the relevant party for whom it was intended, or upon mailing if sent by registered or certified mail to the business address designated in the Contract.

63. RIGHTS AND REMEDIES

63.1. Each of Amtrak's rights and remedies hereunder shall be cumulative, in addition to, and not a limitation of, any duties, obligations, rights and/or remedies provided at law, in equity, or otherwise. Amtrak's failure to exercise any of its rights under the Contract shall not constitute a waiver of any past, present or future right or remedy. No action or failure to act by Amtrak or any of its representative(s), including the Contracting Official, shall constitute approval of, waiver of, or acquiescence to, a breach by Contractor unless specifically agreed in writing. Waiver by Amtrak of any breach by Contractor shall not constitute a waiver of any other breach of the same or any other provision of the Contract. Acceptance of any Supplies of services, or payment, therefore, shall not operate as a waiver of any breach.

63.2. All representations, warranties, guarantees, licenses, indemnifications, agreements to hold Amtrak harmless, and other obligations created by the Contract which by their terms are intended to be fulfilled in whole or in part after termination or completion of the Work or which can, under the particular circumstances at issue, reasonably be fulfilled only after termination or completion of the Work, shall survive termination of the Contract. Contractor shall cause a parallel survival clause to be inserted in all subcontracts.

64. AMTRAK/CONTRACTOR RELATIONSHIP

64.1. The Contracting parties are not employer and employee, and nothing herein shall be construed as creating such relationship between Amtrak and Contractor. Contractor may adopt such arrangements as it may desire, subject to the provisions of the Contract, with regard to the details of the Work and Contractor's personnel or workers, provided however, that the Work shall be done by Contractor in such manner as shall be consistent with the achievement of the result contracted for within the time herein agreed upon.

64.2. It is further understood and agreed that, in no event shall Amtrak be required to make deductions from compensation or report earnings of employees of Contractor under any Social Security Act, or any other state or Federal statute, purporting to levy a tax on payrolls or the compensation of employees; and Contractor hereby agrees to indemnify and save Amtrak harmless from any and all liability, cost, or expense under such law, growing out of performance under the Contract.

65. PRODUCT SAFETY NOTIFICATIONS

65.1. Contractor shall comply with the Occupational Safety and Health Administration's Hazard Communication Regulations 29 CFR 1910.1200 and 29 CFR 1926.59 by providing or making readily available at the worksite, material safety data sheets for all chemicals, compressed gases, products containing hazardous materials, and products that may release hazardous substances (welding rods, solder, insulation materials, transite panels, gaskets, stock metal, etc.) during routine application.

65.2. Contractor shall notify Amtrak immediately by telephone (followed by written confirmation within twenty-four hours) (email acceptable) whenever Contractor becomes aware that any component of the Supplies may contain a defect in design or construction which could in any way (a) become harmful to persons or property, or (b) create or present a risk to the health or safety of the public or to the environment, either by itself or when used by Amtrak within the scope of its intended purpose.

66. LABOR DISPUTES

66.1. Whenever an actual or potential labor dispute delays or threatens to delay the timely performance of the Contract, Contractor shall notify Amtrak immediately and furnish all relevant information. Contractor shall include the substance of this provision in all subcontracts hereunder.

67. CYBERSECURITY

67.1. Contractor shall follow the National Institute of Technology (NIST) Cybersecurity Framework (CSF) to maintain and enforce digital data protection, safety and physical security procedures with respect to the access, use, and possession of Amtrak's Confidential Information and Amtrak data, when providing supplies or services to Amtrak that are: (i) at least equal to industry standards and in compliance with all applicable laws; and (ii) which provide reasonably appropriate technical and organizational safeguards to protect Amtrak against the accidental or unlawful destruction, loss, alteration or unauthorized disclosure or access of such information, data or systems. Contractor shall take all reasonable measures to secure and defend its location and equipment against hackers and others who may seek, without authorization, to modify or access Contractor's systems, Amtrak's systems or the information or data found therein and shall immediately report to Amtrak any breaches of security or unauthorized access to Amtrak's Confidential Information or Amtrak data. Contractor shall use diligent efforts to remedy breaches in a timely manner and deliver to Amtrak a root cause assessment and future incident mitigation plan with regard to any breach of security.

67.2. If Contractor is providing supplies associated with the development and operation of Amtrak company websites on Contractor's IT infrastructure, Contractor agrees to engage a third-party vendor at least annually, at its own expense, and acceptable to Amtrak, to perform penetration testing and vulnerability scans with respect to Contractor's systems. Contractor shall use leading industry practices to perform penetration tests to probe for network and infrastructure weaknesses that could be exploited. Contractor shall provide Amtrak with a written report of any high and

medium level security issues, as defined by NIST Common Vulnerability Scoring System (CVSS), revealed during regular testing and how and when these vulnerabilities will be mitigated.

67.3. Contractor shall comply with the AMTRAK CYBERSECURITY AND PRIVACY TERMS AND CONDITIONS – STANDARD SHORT FORM attached hereto as Attachment 1.

68. CREDIT CARD INFORMATION

68.1. If in performance of this Contract, Contractor will store, process, transmit, or have access to payment account data belonging to Amtrak or entrusted to Amtrak by its business partners, customers, vendors, contractors or employees, Contractor shall (1) comply with the Payment Card Industry's Data Security Standard ("PCI-DSS"), as set forth at https://www.pcisecuritystandards.org/ and as may be updated from time to time by the PCI Security Standards Council, and (2) within thirty (30) days of each anniversary of this Contract, certify in writing (to Amtrak's Contracting Official) Contractor's compliance with PCI-DSS in all aspects of Contractor's performance of this Contract or, alternatively, the basis for Contractor's exemption from PCI-DSS compliance.

68.2. If any software, Supplies, goods, or Equipment (collectively "Goods") provided by Contractor pursuant to this Contract will store, process, transmit, or otherwise have access to credit card account numbers received from Amtrak or Amtrak's customers, such Goods shall comply with the Payment Card Industry's Payment Application - Data Security Standard ("PA-DSS"), as set forth at https://www.pcisecuritystandards.org/ and as may be updated from time to time by the PCI Security Standards Council.

68.3. Contractor acknowledges that it is responsible for compliance with PCI-DSS and PA-DSS, as applicable to Contractor's performance of this Contract.

69. SEPARATE CONTRACTS

69.1. If appropriate, Contractor shall afford other Amtrak Contractors reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work, and shall properly connect and coordinate its Work with theirs.

69.2. If any part of Contractor's Work is dependent in any way on the work of any other separate contractor, Contractor shall take all reasonable steps to become aware of any defects in the work of such other contractors that renders or would render such work unsuitable for proper execution of Contractor's Work. Contractor shall inspect the critical items of any such contractor's work before relying on or incorporating such work into Contractor's Work. If Contractor reasonably believes that another contractor's work is deficient or otherwise unsuitable for its intended purpose, Contractor shall notify Amtrak, in writing, immediately upon such discovery. Contractor shall waive his right to any claims regarding the unsuitability of such other contractor's work if Contractor fails to timely notify Amtrak of any defects in such other contractor's work that Contractor discovered or reasonably should have discovered.

69.3. Should Contractor or any Subcontractor cause damage to the work or property of any separate Amtrak contractor, Contractor shall, upon due notice, make all reasonable efforts to settle with such other contractor(s). If such separate contractor(s) sues Amtrak or initiates an arbitration proceeding on account of any damage alleged to have been so sustained, Amtrak shall notify Contractor, who shall defend such proceedings at its expense, and if any judgment or award against Amtrak arises there-from, Contractor shall pay or satisfy it and shall reimburse Amtrak for all attorneys' fees and court or arbitration costs which Amtrak incurred.

70. COMMENCEMENT OF STATUTORY LIMITATION PERIOD

70.1. Claims by Contractor shall not be brought after the earliest of (a) Final Payment; (b) one year after the date of the date of delivery of the last unit of Equipment; or (c) one year after the date of Contractor's last substantial Work.

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ATTACHMENT 1

AMTRAK CYBERSECURITY AND PRIVACY TERMS AND CONDITIONS – STANDARD SHORT FORM

1. GENERAL PURPOSE & APPLICABILITY

1.1. General Purpose: Contractors deliver supplies and/or services that may access, create, use, process, transfer, share and/or store Amtrak Data or connect to the Amtrak Infrastructure. These Cybersecurity and Privacy Terms and Conditions (collectively "Attachment") are cybersecurity standards that apply to all Contractors who provide supplies and/or services to Amtrak.

1.2. Compliance: Contractors must comply with all applicable laws, regulations, statutes, industry standards, and compliance framework requirements including, but not limited to: the Payment Card Industry Data Security Standards (PCI-DSS), Health Insurance Portability and Accountability Act (HIPAA), Health Information Technology for Economic and Clinical Health (HITECH) Act, Sarbanes-Oxley Act (SOX), Gramm-Leach-Bliley Act (GLBA), General Data Protection Regulation (GDPR), California Consumer Privacy Act (CCPA), California Privacy Rights Act (CPRA), Colorado Privacy Act (CPA), Connecticut Data Privacy Act (CDPA), Virginia Consumer Data Protection Act (VCDPA), Utah Consumer Privacy Act (UCPA), Illinois Biometric Information Privacy Act (BIPA), ISO/IEC 27001, ISO/IEC 27002, ISO/IEC 27701, ISO/IEC 27032, ISO/IEC 27017, ISO/IEC 27018, NIST SP 800-53, Rev. 5 and other applicable NIST SP 800 series publications, the National Institute of Technology (NIST) Cybersecurity Framework (CSF), and any U.S. State privacy laws to the extent applicable, including as enacted or amended during the term of the Agreement. Contractor shall also comply with any and all laws, regulations, and other compliance requirements and industry standards regarding data protection, data privacy, data security, data integrity, business continuity, incident response, and similar matters applicable to entities designated as "critical infrastructure" including as enacted or amended during the term of the Agreement.

2. CYBERSECURITY & PRIVACY GOVERNANCE

2.1. Cybersecurity Governance: The Contractor must follow industry best practices and maintain a cybersecurity program (the Program) that implements, maintains, improves, and enforces reasonable and appropriate policies, procedures, and controls for the governance, assessment, risk management, workforce management, access control, physical security, continuous monitoring, incident response, and digital data protection in relation to the access, use, and possession of Amtrak Data, including Amtrak Confidential Information and Amtrak Employee Information.

2.2. Cybersecurity Framework Alignment: The Program must provide appropriate organizational, technical, administrative, and physical safeguards that align with the NIST CSF through controls derived from applicable compliance frameworks such as NIST SP 800-53, Rev. 5 and ISO/IEC 27001. Program controls shall and meet or exceed any other applicable industry standards to protect Amtrak, Amtrak Employees, Amtrak Customers, Amtrak Data, and Amtrak Infrastructure against Security Incidents. The Contractor shall test and monitor the effectiveness

of its safeguards. The Contractor shall conduct a risk assessment and review and update the Program at least annually.

2.3. Cybersecurity Awareness Training: Contractor must require and verify that its employees, contractors, consultants, and other downstream third-party staff complete cybersecurity awareness training, privacy awareness training, and any applicable role-based training associated with the collection, processing, or handling of Amtrak Data, no less than once per year. Upon request, Contractor shall provide Amtrak with proof of certification and/or attendance for such annual training activities.

3. AUDITS AND ASSESSMENTS

3.1. Audit Rights and Testing: Notwithstanding anything contrary in the Agreement and with no limitation to audit rights of Amtrak OIG, specifically with regards to security-related audits, the audit terms set forth in this Attachment shall apply.

3.1.1. Contractor agrees that Amtrak or its third-party designee may, but is not obligated to, perform audits and security tests of Contractor's information technology (IT) or systems environment and procedural controls to determine Contractor's compliance with the system, network, data, data privacy, and cybersecurity requirements of this Attachment. Audits and security tests shall be limited to areas relevant to Contractor's contractual engagement with Amtrak. Amtrak audits of the Contractor system shall be initiated during normal business hours and with at least 20 days advance notice or in the event of any Security Incident, not less than five (5) business days after the resolution of such Security Incident. Audit shall be performed under standards established by a recognized standards organization.

3.1.2. Contractor shall provide all information reasonably requested by Amtrak in connection with any audits and shall provide reasonable access and assistance to Amtrak upon request. Contractor shall comply, within reasonable timeframes at its own cost and expense, with all reasonable compliance remediation recommendations that result from such inspections, tests, and audits. Amtrak reserves the right to review, upon request, any original security reports that Contractor has undertaken or commissioned to assess Contractor's own network security for the provided Services. If requested, copies of these reports will be made available for viewing by Amtrak via a method (e.g. remote, in person at Contractor's facility or an Amtrak location, etc.) specified by Amtrak. Contractor will notify Amtrak of any such security reports or similar assessments once they have been completed.

3.1.3. If requested by Amtrak, Contractor shall, on an annual basis: 1) permit security reviews by Amtrak on systems storing or processing Amtrak Data including without limitation the Program; and 2) permit testing of all security processes and procedures during the Term of the Agreement, including without limitation penetration tests. Tests may include coordinated security tests as mutually agreed upon as well as interviews of relevant personnel, review of documentation, and technical inspection of systems and networks

relating to the receipt, maintenance, use, retention, and authorized destruction of Amtrak Data.

3.2. Audit Certifications and Compliance Reports: Contractor shall provide the required compliance reports or audit certifications as applicable, on an annual basis, and at its own cost and expense, to enable Amtrak to fulfill its annual audit and compliance requirements. The delivery of the following reports referenced in this Section shall not fulfill, replace, or negate any of the rights or obligations detailed in Section 3.1 Audit Rights and Testing, Section 3.3 Right to Inspection, or Section 3.4 Regulatory Examinations of this Attachment:

3.2.1. Current year SOC 2 Type 2 report.

3.2.2. Current year ISO/IEC 27XXX audit report(s).

3.2.3. PCI DSS reports on compliance as applicable.

3.2.4. Cloud Security Alliance (CSA) Consensus Assessments Initiative Questionnaire (CAIQ) registry reports for Software as a Service (SaaS) products and/or applications as applicable.

3.2.5. Contractors utilizing the AWS hosting platform to provide services to Amtrak must comply with AWS Foundational Security Best Practices standard as well as CIS AWS Foundations v1.4.0 security standard, or most recent version, and/or any upgrades released by the CIS AWS Foundations Benchmark.

Contractors utilizing the Microsoft Azure hosting platform to provide services to Amtrak must comply with Microsoft Azure Foundational Security Best Practices standard as well as CIS Microsoft Azure Foundations Benchmark v1.4.0 Controls, or most recent version, and/or any upgrades released by the CIS Microsoft Azure Foundations Benchmark Security Standard.

3.3. Right to Inspection: Upon request, Contractor shall provide to Amtrak the opportunity to review copies of the Contractor's policies, procedures, controls catalog, and independent audit report summaries for the implementation of required technical, physical, and administrative safeguards or controls derived from applicable cybersecurity frameworks relating to, and without limitation, the Program (e.g. ISO/IEC 27001, ISO/IEC 27002, ISO/IEC 27701, ISO/IEC 27032, ISO/IEC 27017, ISO/IEC 27018, NIST CSF, NIST SP 800-53, Rev. 5, SOC 2 Type 2).

3.4. Regulatory Examinations: Contractor agrees that any regulator or other governmental entity with jurisdiction over Amtrak and its affiliates may examine Contractor's activities relating to the performance of its obligations under the Agreement and this Attachment to the extent that such authority is granted to such entities under the law. Contractor shall promptly cooperate with and provide all information reasonably requested by the regulator or other governmental entity in connection with any such examination and provide reasonable assistance and access to all equipment, records, networks, and systems reasonably requested by the regulator or other

governmental entity. Contractor agrees to comply with all reasonable recommendations that result from such regulatory examinations within reasonable timeframes.

3.4.1. Within sixty (60) days of the audit results from the regulator or governmental entity, Contractor will provide Amtrak with a mitigation plan to address any risks, threats, concerns, or areas of non-compliance identified in the audit.

4. INFORMATION GOVERNANCE

4.1. Data Management: Contractor may collect, access, use, and otherwise process Amtrak Data solely as necessary to provide Services to or on behalf of Amtrak and in compliance with all applicable privacy and data protection laws, the Agreement, and any notices or disclosures regarding Personal Information made available by or on behalf of Amtrak ("Privacy Requirements"). Unless prior written consent is provided by Amtrak, Contractor: (1) shall not access or use Amtrak Data for any purpose other than to provide the Services, and (2) shall not give any third-party access to the data, except subcontractors subject to data protection and confidentiality requirements no less strict than those imposed on Contractor under this Attachment, or where otherwise required by law or regulation.

4.2. Confidentiality: Contractor agrees to maintain Amtrak Confidential Information in all forms (including paper and electronic) in strictest confidence, using measures no less stringent than those that Contractor uses for its own most confidential or sensitive information. Contractor shall take all reasonable measures to secure and defend its location and equipment against external and internal threat actors and those who may seek, without authorization, to modify or access Contractor's systems, Amtrak's systems, Amtrak Data, or the Confidential Information found therein. Contractor shall require its employees, contractors, consultants, and other downstream third-party staff to enter into written obligations of confidentiality and protection with respect to Amtrak Data no less protective than those contained in the Agreement and this Attachment.

4.3. Obligations Regarding Personal Information: Other than as strictly necessary for the performance of the Services, Contractor will not collect, store, or use the Personal Information of Amtrak, Amtrak Customers, or Amtrak Employees through the performance of the Services. Contractor will identify, monitor, protect, and maintain the Personal Information of Amtrak, Amtrak Customers, and Amtrak Employees in accordance with all laws, regulations, and legal requirements applicable for the collection, access, use, processing, sharing, storage, and deletion of Personal Information, shall not "sell" such Personal Information (as such term is defined by applicable privacy laws), and shall not retain, use, or disclose such Personal Information for any purpose other than as expressly set forth in the Agreement and this Attachment. Contractor shall notify Amtrak in the event Contractor determines that it can no longer comply with applicable Privacy Requirements. Contractor shall provide Amtrak with assistance and cooperation in responding to requests from or on behalf of individuals to exercise legal rights regarding Personal Information and in connection with conducting any privacy impact assessments or similar assessments regarding Personal Information.

4.4. Data Aggregation and Anonymization: In the event that Contractor inadvertently collects any Personal Information through or as a result of Amtrak's, Amtrak Employees', or Amtrak Customers' usage of the Services, including without limitation Internet Protocol Addresses, Contractor must sanitize the data through Anonymization or Aggregation unless retention of Personal Information in an identifiable format is strictly necessary for the performance of the Services, for compliance with applicable law, or for compliance with the Agreement and this Attachment.

4.4.1. For the purposes of this Attachment, "Anonymization" refers to removal of Personal Information and any information reasonably likely to identify an individual person or household; provided such revised data does not include and is not subject to any key, code, or other mechanism that could be used to re-identify such information, and "Aggregation" refers to information that relates to a group or category of persons, households, or entities from which identifying information has been removed, that is not linked or reasonably linkable to any individual person, household, or entity, such as via a device; provided such revised data does not include and is not subject to any key, code, or other mechanism that could be used to re-identify such information.

4.4.2. Without limiting the generality of the requirements for Anonymized or Aggregated data, Contractor shall:

4.4.2.1. Implement technical safeguards that prohibit reversal of Anonymization or Aggregation of Personal Information collected through the Services;

4.4.2.2. Implement business processes that specifically prohibit such a reversal or recreation;

4.4.2.3. Make no attempt to achieve such reversal; and

4.4.2.4. Implement reasonable business processes to prevent inadvertent release of Anonymized or Aggregated Personal Information.

4.5. Machine Learning and Artificial Intelligence: Contractor shall not process or otherwise in any way use Amtrak Data for purposes of training, creating, or otherwise modifying any machine learning, large language model, artificial intelligence, or similar systems that learn and adapt without following explicit instructions through the use of algorithms and statistical models to analyze and draw inferences from patterns in data ("Machine Learning") without Amtrak's prior written authorization in each instance. If Contractor becomes aware of any use of Amtrak Data in violation of the foregoing restriction, Contractor shall promptly notify Amtrak and take steps in cooperation with Amtrak to remediate and/or mitigate such unauthorized use. In addition, Contractor shall not use Machine Learning for the purpose of generating or developing software, computer code, or other materials used in or provided to Amtrak as part of the products or services supplied hereunder without Amtrak's prior written authorization in each instance.

5. INFORMATION MANAGEMENT & PROTECTION

5.1. Asset Management: Contractor must maintain an asset inventory and classification to manage essential information about hardware, software, data flows, interfaces, and data disclosures (e.g., unique identifiers, version numbers, data recipients, physical locations). Contractor must implement asset management controls for any assets that may be used to access Amtrak Data, Amtrak Infrastructure or Amtrak Resources. Contractor shall follow the required security standards and safeguards referenced in this Attachment for the utilization of all hardware and software in the performance of services to Amtrak under the Agreement.

5.2. Access Control: Contractor must restrict access to Amtrak Data and all systems that access, process, or store Amtrak Data through the utilization of a provisioning process that meets or exceeds the standards provided in the NIST CSF, NIST SP 800-53, Rev. 5, and other applicable NIST SP 800-series publications. Access to Amtrak Data must be restricted to only authorized individuals with an express need-to-know for the performance of the Services. Contractor must ensure that only authorized individuals are permitted access to business applications, systems, networks, and computing devices containing or processing Amtrak Data using, without limitation, secured channels via Contractor authorized virtual private network (VPN), jump boxes, secure shell (SSH), multi factor authentication (MFA), or other secure mechanisms.

5.2.1. Contractor personnel access shall be consistent with, and in no case exceed the scope of, any such authorization granted by Amtrak. All Amtrak-authorized connectivity or attempted connectivity to Amtrak's systems or networks shall be in conformity with Amtrak's security policies as may be amended from time to time with notice to the Contractor.

5.2.2. Contractor will review and verify the continued need for Contractor personnel access and level of access to Amtrak Data, systems, networks, and property on a quarterly basis and will retain evidence of the reviews for two (2) years from the date of each review. Contractor shall provide a certification of such review to Amtrak upon request.

5.3. Passwords: Contractor must ensure that its password policies and procedures are compliant with NIST SP 800-63 Digital Identity Guidelines and NIST SP 800-53, Rev. 5 guidance on password creation and authentication. These password policies and procedures must follow NIST best practices in configuration and management, including length and structure. All passwords must remain confidential and must not be shared between the Contractor, its employees, contractors and downstream third-party users.

5.4. Multi-factor Authentication (MFA): Contractor must ensure that multi-factor authentication is implemented for accounts with access to Amtrak Data, Amtrak Infrastructure, and other systems, networks, applications, and computing devices based on the NIST best practices and guidelines found in NIST SP 800-63 and NIST SP 800-53, Rev.5. Contractor must work with Amtrak to implement single sign-on (SSO) solution for MFA accounts as needed for Amtrak employee access to the Services.

5.5. Physical Location of Data: Contractor must notify Amtrak, in writing, thirty (30) days prior to relocating any physical storage location of Amtrak Data to a location or country that is different from the one(s) documented in the Contractor's statement of work, contract, or any Data

Processing Addendum entered into between Amtrak and Contractor, so that any potential privacy or security implications can be addressed.

5.6. Virtualization & Cloud Solutions: If Contractor utilizes a cloud solution, then Contractor must adhere to the same security principles required by the terms in this Attachment, the Cloud Security Alliance Guidance, and applicable government regulations, laws, or directives as used throughout the Contractor's enterprise. The geographic location of the Contractor's infrastructure resources must be identified in writing to Amtrak prior to transferring out Amtrak Data to such resources. Contractor is required to receive prior approval from Amtrak, who has sole control over the data location in any cloud services, and shall cooperate with Amtrak to ensure compliance with local laws that restrict cross-border flow of data.

5.7. Physical Protection: Contractor must actively manage physical security controls and ensure that all buildings throughout the Contractor's enterprise that house critical IT functions (e.g., data centers, network facilities, and key user areas) and store, process or transmit Amtrak Data or any other service-related Amtrak information, or connect to Amtrak Infrastructure, are physically protected from unauthorized access. These physical security controls should follow security best practices and requirements (e.g., ISO/IEC 27002 and NIST SP 800-53, Rev. 5). Contractor must maintain and record facility access logs with access restricted to only those personnel with a business need-to-know. Contractor must review and update these access logs regularly but no less than quarterly.

5.8. Data Encryption: Contractor shall provide industry standard FIPS 140-2 encryption of Amtrak Data and Confidential Information in transit over public or leased circuits. Contractor shall also provide industry standard FIPS 140-2 encryption of Amtrak Data and Confidential Information at rest on local laptops, mobile devices, shared drives, information repositories, and backend data stores. In the event FIPS 140-2 standards regarding encryption are updated or replaced, Contractor shall use encryption that meets or exceeds such updated or replaced standards.

5.8.1. Contractor shall implement and maintain logical data segregation that meets or exceeds industry standards to ensure Amtrak Data is not viewable by unauthorized users.

5.9. Secure Destruction: Upon completion of the delivery of the products and services to be provided under the Agreement, or at any time upon Amtrak's request, Contractor shall return to Amtrak or destroy all Amtrak Data as provided herein. Contractor shall return to Amtrak all hardware and removable media provided by Amtrak containing Amtrak Data. Amtrak Data in such returned hardware and removable media shall not be removed or altered in any way. The hardware must be physically sealed and returned via a bonded courier or as otherwise directed by Amtrak. If any hardware or removable media containing Amtrak Data is owned by Contractor or a third-party, then the Contractor shall securely destroy such data or return it to Amtrak via hardware or removable media as requested by Amtrak. Contractor shall provide to Amtrak a notarized certification of destruction detailing the destruction method used and the data sets involved, the date of destruction, and the entity or individual who performed the destruction. Contractor's destruction or erasure of Amtrak Data pursuant to this Section shall be in compliance with industry standard practices (e.g., Department of Defense Media Sanitization and Data Wipe Standard, NIST SP 800-88).

6. CYBERSECURITY INCIDENT RESPONSE AND MANAGEMENT

6.1. Incident Management: Contractor must document all Security Incidents and maintain a documented cybersecurity event management process that covers incident response, escalation, and remediation of Security Incidents. All such documentation must be retained for a minimum of five (5) years following the conclusion of any Security Incident, unless otherwise required by applicable law.

6.2. Reporting Incidents: Contractor shall immediately but no later than 24 hours after discovery, provide a written notice to Amtrak of any Security Incident.

6.2.1. The written notice shall include the date and time of the Security Incident's occurrence (or the approximate date and time of the occurrence if the actual date and time of the occurrence is not precisely known) and a detailed summary of the facts and circumstances of the Security Incident, including a description of:

6.2.1.1. The date of the Security Incident's discovery and the circumstances surrounding such discovery;

6.2.1.2. Why the Security Incident occurred (e.g., a description of the reason for the system failure);

6.2.1.3. The amount and type(s) of Amtrak Data known or reasonably believed to have been Disclosed;

6.2.1.4. The systems and/or applications likely impacted;

6.2.1.5. The categories and approximate number of data subjects affected, and their country of residence and the categories and approximate number of records affected; and

6.2.1.6. The measures being taken or proposed to be taken by Contractor to address and remedy the Security Incident's occurrence to prevent the same or a similar event from occurring in the future.

6.2.2. Amtrak may impose additional notification requirements for Security Incidents that compromise Amtrak's Data based on applicable state breach notification laws or requirements under applicable domestic and/or international privacy laws.

6.2.3. Contractor shall provide written updates for the Security Incident to Amtrak addressing any new facts and circumstances learned after the initial written notice is provided and shall promptly, but no later than seventy-two (72) hours, provide such updates after learning of those new facts and circumstances. Contractor shall reasonably cooperate with Amtrak in Amtrak's efforts to determine the risk posed by the Security Incident, including providing additional information regarding the Security Incident upon request from Amtrak.

6.3. Response Plan Development and Implementation: Contractor shall develop and implement a "Response Plan," which shall include policies and procedures to address Security Incidents. The Response Plan shall include appropriate provisions for mitigating the harmful effects of Security Incidents and addressing and remedying the occurrence(s) to prevent the recurrence of similar Security Incidents in the future. Contractor shall provide Amtrak access to inspect Contractor's Response Plan upon request. The development and implementation of the Response Plan shall follow industry standard practices, such as those that at a minimum are consistent with the contingency planning requirements of NIST SP 800-61, Rev. 2, Computer Security Incident Handling Guide.

6.3.1. Immediately upon learning of a Security Incident related to the products and services provided to Amtrak, Contractor shall implement its Response Plan and, within twenty-four (24) hours of implementing its Response Plan, shall notify Amtrak in writing of that implementation as described above.

6.4. Notification to Affected Parties: Contractor will, at its sole cost and expense, assist and cooperate with Amtrak with respect to any investigation of a Security Incident, disclosures to affected parties, and other remedial measures as requested by Amtrak in connection with a Security Incident or required under any applicable laws related to a Security Incident.

6.4.1. In the event a Security Incident results in Amtrak Data being Disclosed such that notification is required to be made to any person or entity, including without limitation any customer, shareholder, or current or former employee of Amtrak under any applicable laws, including privacy, data breach notification, and consumer protection laws, or pursuant to a request or directive from a governmental authority, such notification will be provided by Amtrak, except as required by applicable law or approved by Amtrak in writing. Amtrak will have sole control over the timing, content, and method of providing such notification.

6.5. Business Continuity: Contractor shall implement and maintain a business continuity program that meets or exceeds industry standards and that provides a formal framework and methodology, including without limitation, a business impact analysis and risk assessment process to identify and prioritize critical business functions ("Business Continuity Program"). Contractor shall provide Amtrak with evidence of the Business Continuity Program upon request.

6.5.1. Contractor shall conduct a business continuity test every twelve (12) months, including a review of the Business Continuity Program, roles and responsibilities, business documentation requirements, recovery strategies, Mean Time to Recovery (MTTR), Recovery Time Objectives (RTOs), Recovery Point Objectives (RPOs), testing strategy and frequency to ensure that appropriate recovery time frames are maintained to meet Amtrak business requirements for the Services. Contractor shall provide the results of any business continuity tests to Amtrak upon request.

6.5.2. Contractor shall implement and maintain a disaster recovery program that meets or exceeds industry standards and that provides a formal framework and methodology,

including without limitation, a business impact analysis and risk assessment process to identify and prioritize critical business functions. Contractor shall provide Amtrak with evidence of the disaster recovery program upon request.

6.5.3. Contractor shall support Amtrak's business continuity and disaster recovery programs to restore critical business functions in the event of a cybersecurity incident and/or breach.

7. THIRD-PARTY MANAGEMENT

7.1. Outsourcing: Prior to making Amtrak Data available to any third-party contractor, subcontractor, vendor, processor, or supplier, Contractor shall notify Amtrak in writing and provide reasonable information regarding the scope of and reason for such proposed third-party's access to Amtrak Data. Contractor shall provide Amtrak with a reasonable time, not less than thirty (30) days, to object to the engagement of such third party and Contractor and Amtrak shall use reasonable good faith efforts to resolve any such objection by Amtrak, such as by identifying an alternative third party or adjustment to the services. Contractor must operate a formal process to address due care and due diligence considerations in the selection and management of downstream contractors, subcontractors, vendors, processors, and suppliers. Contractor must maintain all necessary agreements with such third parties that specify the security and data privacy requirements to be met before commencing work on behalf of Contractor that could have an impact on Amtrak Data, Amtrak Infrastructure, or any Amtrak business operations with the Contractor. Contractor shall ensure that these agreements align with the terms in this Attachment and must ensure that its contractors, subcontractors, vendors, processors, and suppliers are compliant with equivalent security and data privacy requirements to those contained in this Attachment and as required by applicable law.

7.2. Indemnification: Contractor agrees to indemnify Amtrak for any and all actions taken by its own contractors, subcontractors, vendors, processors, and suppliers. Contractor acknowledges that it will be fully liable for all acts and omissions of these third parties.

8. CYBERSECURITY ASSESSMENT

8.1. Contractor Onboarding Assessment: Amtrak shall have the option, at its sole discretion upon execution of the Agreement, to perform a full cybersecurity assessment on Contractor's Program and technical, physical, management, and security controls. Contractor agrees to comply with all reasonable cybersecurity requirements specified by Amtrak before commencing any work for Amtrak or accessing Amtrak Infrastructure or networks.

9. MISCELLANEOUS

9.1. Order of Precedence: In the event of a conflict between a provision or terms in this Attachment and any other Services Agreement or Contract the provision or interpretation that provides Amtrak, Amtrak Data, Amtrak Employees, Amtrak Customers, and Amtrak Infrastructure stronger protection will control.

9.2. Definitions: The following defined terms have the meanings set forth below and shall only apply to this Attachment. Any terms defined elsewhere in the Agreement will be given equal weight and importance as though set forth in this Attachment. In the event of a conflict, greater weight shall be given to the version which provides greater protection to Amtrak, Amtrak Data, Amtrak Employees, Amtrak Customers, and Amtrak Infrastructure.

9.2.1. "**Amtrak Data**" means (a) all data and information Amtrak provides to Contractor, made accessible by Amtrak to Contractor, or to which Contractor has access or that Contractor (or Contractor Services) accesses, retrieves, collects, or otherwise processes during the course of performance of the Services from or on behalf of Amtrak, Amtrak Employees, Amtrak Customers, or trackers on the Amtrak website; (b) all archives, derivatives, summaries, abstracts, compilations, combinations with other information, modifications or manipulations of the foregoing data or information, Aggregated information, Anonymized or de-identified information, data sets, subsets, and the like related to, or derived from such data or information; (c) all reports generated by the Services, or otherwise generated or provided by Contractor relating to or in connection with the Product or Services; and (d) all Amtrak Confidential Information.

9.2.2. "**Amtrak Infrastructure**" means any information technology system, virtual or physical, that Amtrak or its Affiliates own, control, lease, or rent, and that resides on or outside Amtrak's network. Amtrak Infrastructure includes infrastructure obtained from an IaaS provider and systems that are provided and located on the Amtrak network or hosted on a third-party network as part of a Service.

9.2.3. "**Confidential Information**" means any information that during the Term is disclosed by or on behalf of a Party or its Affiliate (the "Disclosing Party") to the other Party or its Affiliate (the "Receiving Party") and at the time of disclosure: (i) is designated in writing as confidential or proprietary; (ii) is designated orally as confidential or proprietary, and embodied by the Disclosing Party in written or other tangible form, including meeting minutes, memos, diagrams, flow charts, and software; or (iii) should reasonably be understood by the Receiving Party to be confidential to the Disclosing Party under the circumstances.

9.2.4. "**Disclosed**" means any circumstance when the security, integrity, or confidentiality of any Amtrak Data has been compromised, including but not limited to incidents where Amtrak Data has been damaged, lost, corrupted, destroyed, or accessed, acquired, modified, used, or disclosed by any unauthorized person, by any person in an unauthorized manner, or for any unauthorized purpose.

9.2.5. "**MTTR**" or Mean Time to Recovery means the average time it takes to recover from a product or system failure.

9.2.6. "**Personal Information**" means any information that identifies, relates to, describes, is reasonably capable of being associated with, or could reasonably be linked, directly or indirectly, with a particular individual or household and includes, without limitation, any information defined as "personal information," "personal data," "personally identifiable

information" or similar terms under applicable privacy or data protection laws. Personal Information of Amtrak Employees or Customers is considered to be Amtrak Data and Confidential Information, and includes without limitation: Social Security Numbers, personal tax ID numbers, military identification numbers, student identification numbers, passport numbers, driver's license numbers, other government identification numbers, financial account data, payment card information, biometric information, health or medical information, insurance information, educational information, usernames, email addresses, names, home addresses, phone numbers, passwords, unique online identifiers such as cookies and mobile identifiers, access codes, and security questions.

9.2.7. "**Security Incident**" means any circumstance when (i) Contractor knows or reasonably suspects that Amtrak Data hosted or stored by the Contractor has been Disclosed; (ii) Contractor knows or reasonably suspects that an act or omission has compromised or may reasonably have compromised the security of the products and Services provided to Amtrak by Contractor or the physical, technical, administrative, or organizational safeguards protecting Contractor's systems used to store or host Amtrak Data or any Amtrak Infrastructure; (iii) Contractor discovers or reasonably suspects any other incident that impacts or may impact Amtrak's business operations, Amtrak Data, or Amtrak Infrastructure; or (iv) Contractor receives any complaint, notice, or communication which relates directly or indirectly to any of the foregoing involving (A) Contractor's handling of Amtrak Data or Contractor's compliance with the data safeguards in this Attachment or applicable laws or (B) the security of the products and Services provided to Amtrak by Contractor.

9.2.8. "**Services**" mean all necessary or required services, tasks, functions, products and other responsibilities and activities as set forth in, or reasonably inferable from, the Agreement, or any Scope of Work, Order or any such other written document.

9.2.9. "**RPO**" Recovery Point Objective means the point in time to which data must be recovered after an outage.

9.2.10. "**RTO**" Recovery Time Objective means the overall length of time an information system's components can be in the recovery phase before negatively impacting Amtrak's mission or mission/business processes.

REQUEST FOR PROPOSAL ("RFP") – EXHIBIT A-2
UNIVERSAL SINGLE-LEVEL FLEET REPLACEMENT – TECHNICAL SUPPORT, SPARES AND SUPPLIES AGREEMENT (TSSSA)

NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)
1 Massachusetts Ave NW, Washington DC 20001

NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)
UNIVERSAL SINGLE LEVEL FLEET REPLACEMENT

GENERAL PROVISIONS

CONTRACT NO: _____

1. DEFINITIONS

Capitalized terms used in these General Provisions without definition shall have the meaning ascribed to them in this Article 1. Certain additional capitalized terms are defined elsewhere in this Contract. Unless the context otherwise requires, the singular shall include the plural, and the masculine gender shall include the feminine and neuter genders and vice versa.

"**Additional Insured Parties**" has that meaning ascribed to it in Article 47, Section 47.1.

"**Adverse Rights**" has that meaning ascribed to it in Article 11, Contractor's Representations.

"**Amtrak**" refers to the National Railroad Passenger Corporation, which has its headquarters at 1 Massachusetts Avenue, NW, Washington, DC 20001, and any permitted assignee of Amtrak's rights under the Contract.

"**Amtrak OIG**" has that meaning ascribed to it in Article 31, Section 31.1.

"**Amtrak Project Director**" has that meaning ascribed to it in Article 3, Section 3.3.

"**Annual Service Payment**" shall mean the amount paid or payable to Contractor under the TSSSA in a 1 (one) year period.

"**Applicable Laws**" means all applicable federal, state and local laws, codes, ordinances, rules, regulations, judgments, decrees, directives, guidelines, policy requirements, orders or other governmental restrictions of any Government Authority, each as may be amended and in each case including successor provisions. For the avoidance of doubt, "Applicable Laws" includes any applicable Rules of Particular Applicability issued by the FRA and the Foreign Corrupt Practices Act.

"**Breach Notice**" has that meaning ascribed to it in Article 21, Section 21.3.2

"**Business Day**" means a weekday in the United States that is not an Amtrak holiday.

"**Certificate of Final Fleet Acceptance**" refers to the certificate to be furnished by Amtrak to Contractor pursuant to the Equipment Contract.

"**Change**" means any change or variation authorized by Amtrak pursuant to a Contract Modification issued by the Contracting Official or his representative.

"**Change in Control**" means, with respect to Contractor, a transaction or series of transactions where the Persons who (i) directly or indirectly hold fifty percent (50%) or more of the equity ownership of Contractor prior to such transactions or series of transactions cease to directly or indirectly hold fifty percent (50%) or more of the equity ownership of Contractor as a result of such transaction or series of transactions or (ii) directly or indirectly have the power to control

the management and policies of Contractor prior to such transaction or series of transactions, Contractor as a result of such transaction or series of transactions.

"**Change Order**" means a unilateral written order by the Contracting Official directing the Contractor to make a change that Article 7, Changes, authorizes the Contracting Official to order without the Contractor's consent.

"**Claim**" has that meaning ascribed to it in Article 7, Changes, and as further defined in Article 26

"**Conflict of Interest**" means that because of activities or relationships with other persons or entities, (1) a person or entity is unable to render impartial assistance or advice to Amtrak, (2) the person's or entity's objectivity in performing the Work under this Contract is or might be otherwise impaired, or (3) the person or entity has, or attempts to create, an unfair competitive advantage.

"**Consumable Material**" shall mean consumable or expendable items of material, as identified by part number and description by the Contractor and agreed to by Amtrak.

"**Contract**" means the entire agreement between Amtrak and Contractor and supersedes all previous negotiations, representations, understandings and agreements, either written or oral, including the bidding documents, with respect to the subject matter hereof. The terms "Contract Documents" or the "Contract" refers collectively to the following:

a). The TSSSA Contract signed by Amtrak and Contractor;

b). The Contract attachments, and exhibits as identified in the TSSSA, including without limitation the General Provisions and all attachments, and exhibits thereto

c). Contract Modifications; and

d). Any plans, Drawings, specifications, or other documents which may be produced pursuant to this Contract or derived there from.

The terms "Contract," "Agreement" and "Contract Documents" are used interchangeably herein.

"**Contract Amount**" means the total purchase price for the Work including all amounts in respect of Contract Modifications, escalations and option orders or quantities.

"**Contract Modification**" a document executed after the Contract is awarded, to clarify, revise, add to, or delete from the Work. A Contract Modification is: (a) a written amendment to the Contract signed by both parties; or (b) a Change Order.

"**Contract Time**" means the period of time allotted in the Contract for completion of the Work or a portion thereof, as applicable.

"**Contracting Official**" or "**CO**" means the individual authorized in writing by Amtrak to enter into, administer and make changes to the Contract and to make related determinations and findings on behalf of Amtrak, pursuant to Article 3, Section 3.1. This includes a duly appointed successor or an authorized representative of the Contracting Official acting within the limits of his or her authority.

"**Contracting Official's Representative**" or "**COR**" means the individual delegated the authority to act on behalf of the Contracting Official.

"**Contracting Official's Technical Representative**" or "**COTR**" means the individual authorized in writing by Amtrak to carry out the initiating, planning, executing, monitoring/controlling and closing out the Work. The COTR manages the project team and is

accountable for accomplishing the stated project objectives relative to cost, schedule, scope and quality.

"**Contractor**" means the individual, entity, or authorized representative of same, identified as such in the Contract.

"**Contractor Party**" means Contractor or any of its Subcontractors, suppliers, or any of their respective employees, agents or authorized representatives.

"**Contractor Project Manager**" has that meaning ascribed to it in Article 3, Section 3.3.

"**Cure Period**" has that meaning ascribed to it in Article 21, Section 21.3.2.

"**Day**" or "**day**" as used in the Contract means a United States calendar day unless otherwise noted.

"**Design Procurement Documents**" has that meaning ascribed to it in Article 21, Section 21.3.

"**Dispute**" has that meaning ascribed to it in Article 26, Section 26.1.

"**Documentation**" except as applicable to commercially available software, includes all user manuals, systems manuals, training materials, guides, logic diagrams, programmer's notes, flow-charts, algorithms, development tools and development platforms and other materials necessary for Amtrak's understanding and use of the Software for the Allowable Uses in the form prepared by the Contractor, subcontractor, Supplier or Manufacturer in the regular course of its business,

or, to the extent that the Specification requires a different form, then in the form required by the Specification.

"**Dollar**" or "**$**" means a dollar of the United States (US).

"**Drawings**" means, as applicable, two (2) dimensional or three (3) dimensional models, modules or drawings.

"**Equipment**" means all Cars and Spare Vehicles ordered under the Contract, including all options for additional Cars or Spare Vehicles exercised.

"**Equipment Contract**" means the entire agreement between Amtrak and the Contractor for the manufacture and supply of Long-Distance Fleet Replacement Equipment.

"**Equipment Design Documents**" has that meaning ascribed to it in this Article 1.

"**Escrow Materials**" has that meaning ascribed to it in Article 21, Section 21.3.1

"**Excess Costs**" are the difference between the Contract price for the terminated Supplies and/or Work and the total costs incurred by Amtrak to procure replacement Supplies and/or Work.

"**Extended Cure Period**" has that meaning ascribed to it in Article 21, Section 21.3.2.a

"**Event**" has that meaning ascribed to it in Article 5, Section 5.1.3.

"**Federal Railroad Administration**" or "**FRA**" means an agency within the U.S. Department of Transportation.

"**Financing Parties**" means Lender or any Person that advances funds or provides financing (other than as capital contributions) to Amtrak for all or a part of the costs and expenses associated with the Equipment, including without limitation (a) Lenders, banks, financial institutions and capital market participants and (b) any trustee or agent acting on behalf of any Person referred to in the preceding clause (a).

"**Fit for Purpose**" means:

a). In respect of each unit of Equipment, that:

i). all relevant approvals in respect of that Equipment have been obtained and remain in force;

ii). such Equipment:

(a) meets the requirements of the Contract, and

(b) is in a condition which enables Amtrak to operate such Equipment in Revenue Service in accordance with the Contract; and such Equipment is and shall remain fit for the purposes specified in paragraph (a)(ii)(A) above throughout its service life;

b). In relation to each Amtrak-Owned Spare that such Amtrak-Owned Spare when incorporated into a unit of Equipment, does not prevent such Equipment from being Fit for Purpose as defined in paragraph (a)(ii)(A) above; and

c). In relation to each Special Tool that such Special Tool is fit for use by a maintainer of rolling stock to carry out the maintenance and/or Services.

"**Force Majeure Event**" has that meaning ascribed to it in Article 29.

"**Foreign Corrupt Practices Act**" means the United States Foreign Corrupt Practices Act of 1977.

"**General Provisions**" means these terms and conditions.

"**Government Authority**" means (a) any international, foreign, federal, state, county or municipal government, or political subdivision thereof, (b) any governmental or quasi-governmental agency, authority, board, bureau, commission, department, instrumentality or public body or (c) any court or administrative tribunal of competent jurisdiction.

"**Guarantor**" means ____, the company that will execute, deliver and be liable on the Parent Guaranty, or the respective successor, in accordance with Article 57.

"**Indemnified Parties**" means Amtrak and its affiliates, officers, directors, employees, agents, servants, shareholders, successors, assigns subsidiaries, subcontractors, representatives, attorneys, consultants and Financing Parties.

"**Indemnified Party Claims**" has that meaning ascribed to it in Article 22.1.

"**Intellectual Property**" shall mean any recognized protectable intellectual property, such as patents, utility models, copyrights, corporate names, trade names, trademarks, trade dress, service marks, applications for any of the foregoing, discoveries, inventions, software, firmware, trade secrets, mask works, industrial design rights, rights of priority, know how, design flows, methodologies and any and all other intangible protectable proprietary information that is legally recognized. Intellectual Property includes without limitation any and all drawings, designs, specifications, documentation, notes and other works, prepared, developed or acquired in performance of the design services component of the Work (collectively, the "Equipment Design Documents") or in the performance of the Design/Build Services (collectively, the "Design

Procurement Documents") or otherwise delivered to Amtrak in connection with the Work (the "Other Documents").

"**IP Rights**" means any and all of the following rights and interests worldwide: (a) any and all patent applications and patents and unpatented inventions or technology; (b) any and all proprietary knowledge, know-how, data and trade secrets; (c) any and all copyrights, whether registered or unregistered, and applications to register the same; (d) any and all rights in software, data, databases or related documentation; (e) any and all engineering data and information; and (f) any and all other proprietary rights or Intellectual Property rights.

"**Key Personnel**" has that meaning ascribed to it in Article 10, Section 10.1.

"**Lender**" means any entity that lends Amtrak funding for the Contract.

"**Material**" shall mean spare parts, supplies, equipment, components, material for Minor Debris Damage and Consumable Material for use on the Equipment that was supplied by Contractor, excluding special tools, test equipment or fixtures.

"**Measurement Period**" shall have the meaning in the TSSSA.

"**Minor Debris Damage**" shall mean damage to the Equipment as a result of striking debris along the railway. This damage is mild in that repairs can be made relatively quickly with simple tools. Items such as ladders, grab irons, angle cocks, track receivers, light assemblies, windows, hoses, cables, and other exterior components are susceptible to Minor Debris Damage.

"**Modification**" means any variation, modification or addition to the Equipment.

"**Notice to Proceed**" or "**NTP**" means a notice provided to Contractor that it may begin performance of the Contract or a Contract Modification.

"**Option Order**" refers to an option that may be exercised by Amtrak in its sole discretion for purchasing additional Equipment under the terms of the Contract.

"**Other Documents**" has that meaning ascribed to it in this Article.

"**Parent Guaranty**" means a guaranty of payment and performance (and not of collection) issued by Guarantor guarantying the Work under this Contract, including Contractor's present

and future performance, obligations and liabilities under this Contract, in form and substance acceptable to Amtrak in its sole discretion.

"**Performance Guarantees**" shall have the meaning set forth in the TSSSA Statement of Work.

"**Person**" means a person (including Contractor and Amtrak) and shall be construed as including references to an individual, firm, company, corporation, unincorporated association or body of persons or any government authority (including any of its agencies).

"**Project Executive**" has that meaning ascribed to it in Article 10, Section 10.1.

"**Project Manager**" has that meaning ascribed to it in Article 10, Section 10.1.

"**Proposed Supplier Change**" has that meaning ascribed to it in Article 24, Section 24.2.

"**Release Condition**" has that meaning ascribed to it in Article 21, Section 21.3.2

"**Release Notice**" has that meaning ascribed to it in in Article 21, Section 21.3.2.a

"**Revenue Service**" means the time when a unit of Equipment is available to the general public and there is a reasonable expectation of carrying passengers that either directly pay fares, are subsidized by public policy, or provide payment through some contractual arrangement. Equipment operated in fare free service are considered in Revenue Service.

"**RFP**" means that certain National Railroad Passenger Corporation (Amtrak) Request for Proposal for the Amtrak Universal Single Level Fleet Replacement Technical Support, Spares, and Supply Agreement ("TSSSA"), RFP Number DOC5509033158, dated as of 03/31/2026.

"**Services**" shall have mean the Work and other services described in the SOW.

"**Software**" means any and all computer application programs which are incorporated as part of any system, subsystem, assembly, subassembly or components thereof, or any interface system control between or among the systems, subsystems, assemblies, subassemblies, or components thereof, in the Equipment, or which are used in connection with a system (which use involves microprocessors, controllers, drivers, or other electronic data processing elements) or which are used in connection with any related diagnostic or testing equipment, together with all related Documentation, including without limitation, the object code, source code and pseudo-code versions of such assemblies, subassemblies, programs, firmware containing such programs, know-how protocols, listings, instruction sets, indices and other intellectual property necessary for the Amtrak's use of the Software for the Allowable Uses in the form prepared by the Contractor, Subcontractor, Supplier or Manufacturer in the regular course of its business, or to

the extent that the Specification requires a different form, then in the form required by the Specification.

"**Source Code**" means the programming statements and instructions a programmer writes, but which statements and instructions ("code") are not directly executable by the computer that will execute the instructions provided by the programmers until converted into executable or machine language.

"**Spares**" means spare parts, Supplies, Equipment, and components that are fit, form and functionally equal to or better to the original design and consumables or expendables made of new materials and free of defects.

"**Special Tools**" means all specialized tools, gauges, meters, diagnostic equipment (including laptop computer software), etc. that will be necessary to operate, maintain, overhaul, inspect, test, troubleshoot and repair all configurations of the Equipment throughout its design life. Special tools do not include those tools that are commercially available "off the shelf".

"**Specification**" means any specification referenced in this document, including any schedule, exhibit or attachment to it, or any Contract or Subcontract, including without limitation the latest version of Amtrak Mechanical Department Rolling Stock Equipment Specification for Universal Single Level Fleet Replacement, Specification No. 1139, Rev 2, dated as of 03/18/2026, as amended.

"**Statement of Work**" or "**SOW**" means the Amtrak Universal Single Level Fleet Replacement Technical Support, Spares and Supplies Agreement (TSSSA) Statement of Work, Rev 1, dated as of 03/26/2026, as amended.

"**Subcontractor**" means any party that takes portions of the Contract from Contractor or another subcontractor to provide a service and/or Supplies, parts or Material necessary for the performance of the Contract, and as further defined in Article 25, Section 25.3.

"**Subcontractor Intellectual Property**" has that meaning ascribed to it in Article 21, Section 21.3.

"**Subcontractor IP Rights**" shall mean all rights and interests held or otherwise controlled by a Subcontractor worldwide in and to any IP Rights.

"**Supplies**" means the Spares, including, but not limited to, the Amtrak-Owned Spares, Special Tools, supplies, Equipment, including the Equipment, Materials, articles, or other items furnished by or to be furnished by Contractor under the Contract.

"**Technical Proposal**" means the technical proposal submitted by Contractor to Amtrak in response to the RFP, as amended.

"**Termination Event**" has the meaning ascribed to it in Article 8, Section 8.1.

"**Termination Expenses**" has that meaning ascribed to it in Article 9.

"**Technical Specification**" refers to the Amtrak Mechanical Department Rolling Stock Equipment Specification for Universal Single-Level Fleet Replacement, Specification No. 1139, Revision No. 2, dated as of 03/18/2026, as amended.

"**Technical Support and Spares Supply Agreement**" or "**TSSSA**" means the agreement entered into between Amtrak and Contractor under the terms of the Scope of Work.

"**Temporary Permit to Enter**" means a permit issued by Amtrak to permit Contractor to enter Amtrak's property and perform Work or Services under the Contract.

"**Equipment Contract**" means the entire agreement between Amtrak and the Contractor for the manufacture and supply of Single-Level Fleet Replacement Equipment.

"**Trustee**" has that meaning ascribed to it in Article 21, Section 21.3.5.

"**Viruses**" has the meaning ascribed to it in Article 4, Section 4.1.a.

"**Work**" as used herein, means performing the Services by or on behalf of the Contractor and supplying Material by or on behalf of the Contractor required by and exclusively described in the Contract Documents including modification, amendments or extensions thereto by Contract Modifications or other written documentation.

2. INTERPRETATION OF DOCUMENTS

2.1. The Contract constitutes the entire agreement of the parties. Except as provided under the Changes section hereof, neither oral statements nor other writings may be used to supplement, modify, or otherwise affect the provisions of the Contract. Contractor acknowledges that it has not been induced to enter into the Contract by any representations or promises not specifically stated in the Contract. Unless otherwise specified herein, all previous or contemporaneous proposals, letters, promises, representations, documents, agreements, or understandings, whether written or oral, relating to the subject manner of the Contract are hereby declared to be null and void and are superseded by the terms and conditions of the Contract. The terms and conditions of the Contract supersede any and all terms and conditions submitted by Contractor prior to, concurrently with, or pursuant to the Contract. Any additional or different terms proposed by Contractor are expressly rejected unless specifically accepted in writing by the Contracting Official. No other terms and conditions, or changes or modifications to the Contract shall be binding upon Amtrak unless agreed to in writing in accordance with the Changes section herein. As used herein, all references to a given agreement, instrument or other document shall be a reference to that agreement, instrument or other document as modified, amended, supplemented and restated through the date as of which such reference is made. Any term defined or provision incorporated herein by reference to another document, instrument or

agreement shall continue to have the meaning or effect ascribed thereto whether or not such other document, instrument or agreement is in effect.

2.2. Any inconsistencies in Contract provisions or Contract shall be resolved by giving precedence in the following order:

a). Contract Modifications;

b). Supplies and Services Contract;

c). Supplementary General Provisions;

d). TSSSA General Provisions;

e). Technical Support Spares Supply Agreement (TSSSA) Statement of Work; and

f). Contractor's Technical Proposal submitted to Amtrak.

2.3. If any uncertainty remains after reference to the hierarchy set forth in Section 2.2, the Contractor shall then confer with and be governed by the interpretation(s) of the Contracting Official or his authorized representative.

2.4. The captions in these General Provisions are for the convenience of the parties in identification of the several provisions and shall not constitute a part of the Contract nor be considered interpretative hereof.

2.5. It shall be the Contractor's responsibility to study the Contract and to report, at once in writing to the COTR, any errors, inconsistencies or omissions therein. Should the Contractor believe that the correction of the alleged errors, inconsistencies or omissions shall be the cause of additional expenditures or impact the schedule for performance of the Work, or portion thereof, the Contractor shall so advise Amtrak as part of the written notification. Any Work performed by the Contractor prior to receiving a written response from Amtrak with respect to any alleged error, inconsistency or omission shall be at the Contractor's own risk and expense.

3. CONTRACTING OFFICIAL'S REPRESENTATIVE (COR) AND CONTRACTING OFFICIAL'S TECHNICAL REPRESENTATIVE (COTR)

3.1. The Contracting Official may designate Amtrak personnel or agents to act as the Contracting Official's Representative (COR) or technical representative (COTR). Such designation shall be set forth in the Contract or by separate letter signed by the Contracting Official, and shall contain specific instructions as to the extent to which the representative may take action for the Contracting Official.

3.2. Unless otherwise provided in writing by the Contracting Official, the COTR's authority shall be to review and interpret Drawings and Contract technical submissions, review schedules, review

invoices and progress payments, and all other interface functions of a technical or commercial nature between the Contractor and Amtrak. All orders and directives issued by the COTR shall be in writing.

3.3. Contractor shall designate one of its employees as its project manager, who shall be assigned by Contractor to supervise Contractor's Work hereunder and shall serve as Amtrak's point of contact for the resolution of problems ("Contractor Project Manager"). Amtrak shall designate one of its employees as its project director to coordinate issues concerning Contractor's performance of the Work ("Amtrak Project Director"). The Amtrak Project Director shall serve as Contractor's point of contact for the resolution of problems related to the management of the relationship under the Contract. Contractor may not, without the consent of the Amtrak Project Director, replace its Project Manager unless the replacement is a result of the individual: (a) voluntarily resigning from employment with Contractor; (b) being dismissed by Contractor for misconduct or unsatisfactory performance; or (c) being unable to perform duties due to death or disability.

4. WARRANTY, DELIVERY OF MATERIAL AND INSPECTION

4.1. Contractor covenants and warrants to Amtrak that the Material furnished under the Contract shall be the best of its kind or quality, and suitable for the Equipment. The warranties hereunder shall run to Amtrak, its successors and assigns. The warranties provided for under this Contract do not affect the warranties provided under the Equipment Contract.

Additional Warranties and Agreements Relating to Computer Hardware, software, etc. The warranties below do not limit warranties otherwise set forth herein as they may apply to any software or computer systems. Contractor represents, warrants and agrees:

a). Virus Warranty: No viruses, Trojan horses, back-doors, malware, or similar items ("viruses") are coded or introduced into any Amtrak software or computer system used by Amtrak or any Equipment, Special Tools, or other Supplies or items furnished under the Contract. Contractor agrees that in the event that a virus is found to have been introduced, Contractor shall take all reasonable action at its own expense to eliminate the virus and reduce the effects of the virus on Amtrak's operations. Contractor further agrees to cooperate with Amtrak to mitigate and restore any loss of data or operational efficiency.

b). Disabling Code Warranty: No time-bombs, drop-dead or disabling devices, back doors or similar items are coded or introduced into any Amtrak software or computer system used by Amtrak or any Equipment, Special Tools, or other Supplies or items furnished under the Contract, and that Contractor shall not install or invoke any code which could have the effect of disabling or otherwise shutting down any portion of Amtrak's software or computer systems or any Equipment, Special Tools, or other Supplies or items furnished under the Contract.

c). Function/Compatibility/Escrow Warranty: All Software, programming and computer

hardware, systems and modules and related Technical Documents that Contractor or any Subcontractor furnishes to Amtrak are (i) Fit for Purpose, (ii) capable of performing the functions for which they are intended fully and correctly, (iii) if Software, written in a programming language that is commercially available in the United States and for which compilers, interpreters and other Software tools are commercially available in the United States, (iv) capable of being copied and used by Amtrak for Allowable Uses, and (v) where not delivered outright to Amtrak, being placed into escrow, including current versions, updates and fixes of them, as provided for by Article 21.

4.2. Contractor shall ensure that Material is available in accordance with the Scope of Work.

4.3. Contractor shall plan and implement a quality assurance program which shall be maintained throughout the execution of the Contract to assure delivery of Material to Amtrak conforms to the contractual requirements of the Contract.

4.4. Amtrak shall have the right to inspect the Material within a reasonable time after arrival at the designated delivery location. Amtrak's making or failure to make an inspection of the Material does not relieve Contractor of its obligation to furnish the Material strictly in accordance with the terms of the Contract, and shall not operate as a waiver of any rights of Amtrak under the Contract. Such inspection or failure to make such inspection of the Materials shall not constitute Amtrak's approval or acceptance of the Materials.

5. PAYMENT AND TERM

5.1. Payment

5.1.1. Amtrak shall pay Contractor in accordance with the Scope of Work. Amtrak shall pay undisputed charges when such payments are due for the Work. Amtrak may withhold payment of particular charges that Amtrak disputes in good faith, and in that case, Amtrak shall advise Contractor, in writing within sixty (60) days of when Amtrak knew of such dispute, of the nature of the dispute and, at Contractor's request, the parties shall immediately commence resolution of the issue in accordance with Article 26 Claims and Disputes.

5.1.2. Contractor shall invoice Amtrak by submitting an original invoice that is properly payable, along with supporting documentation, to the individual at the address set forth in the Contract. To be considered properly payable, each invoice must show the Amtrak purchase order number, Contractor invoice number, Contractor payment information, provided that invoices for Chargeable Events shall also include the part number. The content and format of invoices may be modified from time to time through mutual written agreement of the parties. Contactor certifies that, by submitting an invoice to Amtrak, any Supplies or Services being billed (1) comply with all specifications and terms and conditions set forth in the Contract Documents, and (2) have been delivered to Amtrak in the quantities shown on the invoice or have been completed per the terms of the Contract

Documents. Except for any other express provisions to the contrary contained in the Contract Documents, Amtrak shall pay all undisputed invoices within ninety (90) days of receipt of an original invoice that is properly payable.

5.1.3. If after a merger with or acquisition of another entity, formation of a new company or a corporate restructuring (an "Event"), Contractor's cost of performance decreases by five percent (5%) or more, Contractor shall share at least fifty percent (50%) of such cost savings with Amtrak. Contractor shall review its cost of performance on an annual basis after any Event and shall, within one hundred eighty (180) days of any annual review or at any later time requested by Amtrak, meet with Amtrak to negotiate in good faith a reduction to the fees charged to Amtrak. The reduction shall be at least fifty percent (50%) of the cost savings accruing to Contractor. Prior to such negotiations, Contractor shall provide any data, records or other documentation reasonably requested by Amtrak to substantiate Contractor's cost of performance. Prior to such negotiations, Contractor shall propose to Amtrak a methodology to account for and verify any proposed cost savings deemed attributable to an Event. If the parties are unable to agree on the proposed methodology, this will constitute a Dispute which will be resolved pursuant to the Claims and Disputes provision herein.

5.2. Term

5.2.1. The Term of the Contract shall begin at the issuance of a Certificate of Conditional Acceptance for the first Unit of Equipment (the "Commencement Date") and unless Amtrak's exercises an option for an additional term shall end twenty (20) years thereafter. Amtrak, in its sole discretion, may terminate the Contract ninety-six (96) months after the Commencement Date. In order to exercise this option to terminate, Amtrak shall provide Contractor a minimum of one-hundred and eighty (180) days' written notice prior to the end of the ninety-sixtieth (96th) month of the Term. Additionally, Amtrak, in its sole discretion, may terminate the Contract one-hundred and fifty-six (156) months after the Commencement Date. In order to exercise this second option to terminate, Amtrak shall provide Contractor a minimum of one-hundred and eighty (180) days' written notice prior to the end of the one-hundred and fifty-sixth (156th) month of the Term. No termination costs will be paid to Contractor for either termination.

5.2.1.1. If Amtrak exercises its right to terminate the Contract in accordance with 5.2.1 above, within thirty (30) days of Amtrak's issuance of the notice described therein, Amtrak and Contractor shall meet to agree to a level of Spares that will be maintained by Contractor through the end of the 96th or 156th month term. Notwithstanding Section 5.3 below, Amtrak shall purchase the agreed upon Spares at the prices set forth in the Master Spares List. For the avoidance of doubt, all other Contractor obligations in Section 5.3 shall apply. Additionally, Amtrak shall pay Contractor a reasonable reimbursement fee for the following

transition services, to the extent requested by Amtrak: management of Spares transfer, transfer of technical support systems, transfer or technology, and relevant data on vehicles and parts. In no event shall such reimbursement fee reflect any consequential damages, lost or anticipatory profits, unabsorbed overhead, or any other indirect costs. Contractor agrees to negotiate in good faith with Amtrak regarding the reimbursement fee for transition services, and any reimbursement fee and related negotiation shall be subject to the Audit and Inspection of Records section of this Contract.

5.3. Upon termination of the Contract for any reason, Contractor shall comply with the requirements of the SOW regarding Transition at Termination of Contract.

6. PERFORMANCE GUARANTEES

6.1. If the delivery deadlines have not been met by Contractor, Contractor shall, in place of actual damages for failing to meet Performance Guarantees, pay to Amtrak a fixed and agreed amount as calculated in accordance with the Scope of Work. Except as otherwise set forth in the Contract Documents, the payment due under this Section 6.1 and the Scope of Work shall be the sole and exclusive remedy for failing to meet the Performance Guarantees.

7. CHANGES

7.1. The Contracting Official may, at any time, without notice to the sureties, if any, by written order, direct any change within the general scope of this Contract. No other Amtrak employee, agent or representative is authorized to do so, unless expressly authorized in writing by the Contracting Official.

7.2. RESERVED.

7.3. If any such change causes an increase or decrease in the cost of the Materials, or the time required for delivery of the Materials or Work, or impacts Contractor's ability to meet the Performance Guarantees, if appropriate, the Contracting Official shall make an equitable adjustment in the Contract Amount, to time, cost, and/or the Performance Guarantees and shall modify the Contract.

7.4. Contractor must immediately proceed with the Contract as changed, unless otherwise directed by the Contracting Official, and further must within thirty (30) days from the date of receipt of the written order (i) assert in writing its right to an adjustment under this Article and (ii) notify Amtrak of any impact such change shall have. A failure by Contractor to timely assert its right to an adjustment or to timely notify Amtrak of such impact shall be deemed a waiver of Contractor's right to an adjustment with respect to the change or such other Work, and of its or its subsidiary's right to an adjustment under such separate contract.

7.5. If Contractor makes a proposed change request, Contractor, in connection with such request, shall furnish a price breakdown, itemized as required by the Contracting Official, impact to schedule, resources, any new risks or impact to existing known risks with applicable mitigation plans. Unless otherwise directed, the breakdown shall be in sufficient detail to permit an analysis of all material, labor, equipment, subcontract, and overhead costs, as well as profit. Any amount claimed for subcontracts shall be supported by a similar price breakdown. In addition, if the proposal includes a time extension, a justification therefore shall also be furnished. All such changes must be recorded in the Program Change Control Log along with applicable analysis documents and final disposition of changes and necessary approvals.

If Contractor's proposal for a change in the Contract Amount includes the cost of property made obsolete or redundant by the change, the Contracting Official shall have the right to prescribe the manner of the disposition of the property.

7.6. Failure to agree to any adjustment shall be a dispute as defined under Article 26, Claims and Disputes. However, nothing in such Article shall excuse the Contractor from proceeding with the Contract as changed.

7.7. When submitting any Claim exceeding one hundred thousand Dollars ($100,000), Contractor shall provide the following certification:

"I certify that the Claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the contractor believes Amtrak is liable; and that I am duly authorized to certify the Claim on behalf of the Contractor."

a). The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a Claim.

b). The aggregate amount of both increased and decreased costs shall be used in determining when the Dollar thresholds requiring certification are met.

c). The certification may be executed by any person authorized to bind the contractor with respect to the Claim.

8. TERMINATION FOR DEFAULT

8.1. Amtrak may, by written notice to Contractor, terminate for default this Contract in whole or in part if Contractor fails to perform or comply with any of its material obligations under the Contract, including without limitation (each, a "Termination Event"):

a). failure to make progress or timely performance under the Contract;

b). failure, without cause, to make undisputed prompt payment to Subcontractors or to make undisputed prompt payment for equipment, materials and/or labor;

c). noncompliance with the Applicable Laws;

d). failure to comply with Amtrak's rules and proper instructions;

e). a bankruptcy event occurs with respect to the Contractor or the Contractor's Guarantor;

f). failure to meet Contractor's performance obligations by reaching the limits of guarantees specified in Section 9, Performance Guarantees and Performance Incentives of the SOW for two (2) consecutive Measurement Periods;

g). Contractor is prevented from executing the Work or Amtrak is prevented from using the Work as a consequence of any infringement of letters patent, registered design, copyright, trademark, trade name and the Contractor is unable, within ninety (90) days (or such longer period as the Parties may mutually agree) after notice thereof, to procure the removal at its own expense of the cause of the infringement;

h). any representation or warranty made by the Contractor or the Contractor Guarantor shall prove to be false or misleading in any material respect as of the time made;

i). any violation of anticorruption provisions of the Contract, or any violation of applicable anticorruption laws, including but not limited to the Foreign Corrupt Practices Act; in each case, in connection with this Contract;

j). the Contractor Guarantor, if any, breaches any provision of the Contractor Parent Guaranty if any, breaches any provision of or disavows the Contractor Parent Guaranty or Contractor fails to provide or maintain in full force and effect the Parent Guaranty as required by Article 57;

k). Contactor's assigns, transfers or pledges the Contract or any right or interest therein except as expressly permitted in Article 28;

l). Contactor fails to provide or maintain the insurance required under hereunder; or

m). The occurrence of any other event or circumstance expressly provided for hereunder as constituting a default by the Contractor.

n). Contractor fails to deliver or execute on a Modification Plan or recovery plan; or

o). The occurrence of any other event or circumstance expressly provided for hereunder as constituting a default by the Contractor.

For the avoidance of doubt, the parties agree that items (a) – (m) above are material and that items (a) – (m) do not represent an exhaustive list of material defaults.

Except as set out below, Amtrak will give the Contractor written notice of the default and the opportunity to cure the default within ten (10) days (or such greater timeframe that Amtrak may specify) of Contractor's receipt of the written notice of default from Amtrak. Amtrak shall not be required to allow such cure period if Contractor's default is a violation of Applicable Laws or impacts safety. Additionally, Amtrak shall not be required to provide written notice of default if the Termination Event is of the type described in Section 8.1(f). In the event that Contractor's material default is not excused or cured to the satisfaction of Amtrak, Amtrak may terminate the Contract in whole or in part and reprocure the Work, in which event Contractor shall be liable for (1) repayment to Amtrak of any payments made by Amtrak and (2) any Excess Costs to Amtrak relating to the reprocurement. In the event that the Contract is terminated only in part, the remaining part shall remain in full force and effect. If the Termination Event is of the type described in Section 8.1(f), without further notice or demand of any kind (all of which are hereby waived), Amtrak shall not be obligated to procure the Work hereunder and Amtrak may otherwise exercise any of the other remedies provided for herein with respect to all or a portion of this Contract as Amtrak in its sole discretion shall elect, to the extent permitted by applicable law then in effect.

8.2. If Amtrak terminates this Contract in accordance with this provision, Contractor shall not be entitled to receive any further payment for the terminated Work. Further, Amtrak may take possession of all of the materials, equipment and tools on the site(s) and may continue the Work by whatever method Amtrak may deem expedient, including the acquisition, under the terms and in the manner the Contracting Official considers appropriate, of Supplies or Services similar to those terminated. Provided that the termination was for default, Contractor shall be liable to Amtrak for any Excess Costs for those Supplies or Services.

8.3. Upon termination of this Contract for default, in whole or in part, Contractor shall, if directed by the Contracting Official, take action including but not limited to:

a). Stop the terminated Work on the date and to the extent specified in the notice of termination (unless such notice is waived as provided herein), without creating a hazardous condition;

b). Place no further subcontracts for materials, equipment, services, facilities or other items, except as may be necessary for completion of such portion of the Work that is not terminated;

c). Unless directed otherwise by Amtrak, terminate all subcontracts to the extent that they relate to the performance of terminated Work;

d). Furnish Amtrak with a release of all claims against Amtrak, including all claims by Subcontractors, and including a release of all Claims related to Work completed in

accordance with the Contract;

e). Take such other reasonable action as Contractor may deem necessary, or as Amtrak may direct, for the protection of property which is in the possession of Contractor and in which Amtrak has or may acquire an interest;

f). Cooperate fully with Amtrak to enable Amtrak to effectively and efficiently continue and complete the Work;

g). Assign or otherwise transfer to Amtrak, or an entity designated by Amtrak, in the manner, at the time, and to the extent directed by Amtrak, all of the right, title and interest of Contractor under the subcontracts;

h). To the extent reasonably required by Amtrak, settle all outstanding liabilities and all claims arising out of the termination without cause of subcontracts, with the approval of Amtrak;

i). Transfer title to Amtrak, or an entity designated by Amtrak, and deliver in the manner, at the time, and to the extent, if any, directed by Amtrak (1) the fabricated or un-fabricated parts, Work in progress, dies, jigs, fixtures, plans, Drawings, information, contract rights, completed Work, Supplies, and other Material and other property produced as a part of, or acquired in connection with the performance of, the terminated Work, including without limitation all books, files and records relating to the Project, and (2) the completed or partially completed plans, Drawings, fabrication Drawings, information, and any other property which, if this Contract had been completed, would have been required to be furnished to Amtrak;

j). To the extent requested by Amtrak, use its best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the Contracting Official, any property of the types referred to in 8.3(i) above, provided, however, that Contractor (1) shall not extend credit to any purchaser, and (2) may acquire any such property under the conditions prescribed and at a price or prices approved by the Contracting Official; and provided, further, that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by Amtrak to Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by the Contract or paid in such other manner as the Contracting Official may direct;

k). Complete, in accordance with the Contract, performance of such part of the Work as shall not have been terminated by the notice of termination; and

l). Execute any further documents reasonably required by the Contracting Official to confirm or effectuate the terms of this Article without compromising Contractor's right or remedies.

8.4. In the event Amtrak terminates this Contract for default pursuant hereto, Contractor shall bear all costs and expenses incurred in connection with this Article. In accordance with Section 53.2, this Article shall survive the termination or expiration of the Contract.

8.5. If, after termination, it is determined that Contractor was not in default, or that the default was excusable, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of Amtrak.

8.6. The rights and remedies of Amtrak in this Article are in addition to any other rights and remedies provided by law or in equity or otherwise provided under this Contract, and no termination of this Contract shall constitute a waiver, release or estoppel by Amtrak of any right, action or cause of action it may have against Contractor.

9. TERMINATION FOR CONVENIENCE

9.1. Termination for Convenience is the exercise of Amtrak's right to completely or partially terminate performance of work under the Contract when it is in Amtrak's interest to do so, without cause or justification. Amtrak's exercise of this right does not release Contractor from any obligations that it has to Amtrak under any other provision of the Contract Documents, nor does it waive any existing claims that Amtrak may have pending at the time of the Termination for Convenience.

9.2. Upon thirty (30) days written notice to Contractor, Amtrak may, at its option and in its sole discretion, terminate the Contract in whole or in part at any time for Amtrak's convenience for whatsoever reason, or no reason, and without regard to fault or breach.

9.3. Upon termination of this Contract for convenience, in whole or in part, Contractor shall, if directed by the Contracting Official, take action including but not limited to:

a). Stop the terminated Work on the date and to the extent specified in the notice of termination, without creating a hazardous condition;

b). Place no further subcontracts for materials, Vehicle, services, facilities or other items, except as may be necessary for completion of such portion of the Work that is not terminated;

c). Unless directed otherwise by Amtrak, terminate all subcontracts to the extent that they relate to the performance of terminated Work;

d). Furnish Amtrak with a release of all claims against Amtrak, including all claims by Subcontractors, and including a release of all Claims related to Work completed in accordance with the Contract, to the extent Amtrak has made payment in respect thereof in accordance with the Contract.

e). Take such other reasonable action as Contractor may deem necessary, or as Amtrak may

direct, for the protection of property which is in the possession of Contractor and in which Amtrak has or may acquire an interest;

f). Cooperate fully with Amtrak to enable Amtrak to effectively and efficiently continue and complete the Work;

g). Assign to Amtrak, or an entity designated by Amtrak, in the manner, at the time, and to the extent directed by Amtrak, all of the right, title and interest of Contractor under the subcontracts;

h). To the extent reasonably required by Amtrak, settle all outstanding liabilities and all claims arising out of the termination without cause of subcontracts, with the approval of Amtrak;

i). Transfer title to Amtrak or an entity designated by Amtrak, and deliver in the manner, at the time, and to the extent, if any, directed by Amtrak (1) the fabricated or un-fabricated parts, Work in progress, dies, jigs, fixtures, plans, Drawings, information, contract rights, completed Work, Supplies, and other material and other property produced as a part of, or acquired in connection with the performance of, the terminated Work, including without limitation all books, files and records relating to the Project, and (2) the completed or partially completed plans, Drawings, fabrication Drawings, information, and any other property which, if this Contract had been completed, would have been required to be furnished to Amtrak;

j). To the extent requested by Amtrak, use its best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the Contracting Official, any property of the types referred to in Section i). above, provided, however, that Contractor (1) shall not extend credit to any purchaser, and (2) may acquire any such property under the conditions prescribed and at a price or prices approved by the Contracting Official; and provided, further, that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by Amtrak to Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by the Contract or paid in such other manner as the Contracting Official may direct;

k). Complete, in accordance with the Contract, performance of such part of the Work as shall not have been terminated by the notice of termination; and

l). Execute any further documents reasonably required by the Contracting Official to confirm or effectuate the terms of this Article without compromising Contractor's right or remedies.

9.4. Within thirty (30) days after Termination for Convenience, Contractor may submit to Amtrak in a form prescribed by Amtrak, a claim for termination costs. Termination costs may include: (1) Costs incurred in the performance of work performed prior to the termination, (2) a fair and reasonable profit on the incurred costs related to work performed prior to the termination, and (3) reasonable settlement expenses. The Contractor and Amtrak may look to FAR 52.249-2 for

guidance regarding termination costs, but are not bound by the requirements therein. In no event shall Amtrak's liability for termination costs exceed the unpaid balance of the Compensation, nor shall Amtrak be liable for consequential damages, including but not limited to lost or anticipatory profits, unabsorbed overhead or indirect costs. Contractor agrees to negotiate in good faith with Amtrak regarding any claim after termination. If appropriate, the Contracting Official shall issue a modification to the Contract reflecting any agreed upon adjustments to the Compensation resulting from the negotiation. Contractor's termination and related negotiation shall be subject to the Audit and Inspection Section herein. Contractor's subcontracts, sub-subcontracts, and purchase orders shall contain appropriate provisions for termination for convenience under this Section.

9.5. In the event of the failure of Contractor and Amtrak to agree upon the amount to be paid to Contractor by reason of the termination of Contract pursuant to this Section, the CO shall determine, on the basis of information available to him/her, the amount, if any, due Contractor by reason of the termination and shall pay to Contractor the amount which the CO determines to be fair and reasonable subject to Contractor's right to assert a claim in compliance with the requirements of the Contract Documents.

10. CONTRACTOR KEY AND OTHER PERSONNEL

10.1. Contractor shall designate, prior to the commencement of the Work, "Key Personnel" who shall include: an individual to whom all Amtrak communications concerning this Contract may be addressed (the "Project Executive" or other title); and "Project Manager" (or other title), who shall report to the Project Executive, and shall be in charge of Contractor's Work.

10.2. Amtrak shall have the right to approve the assignment and replacement by Contractor of all Key Personnel. Before assigning an individual to any of the positions designated herein, whether as an initial assignment or a subsequent assignment, Contractor shall notify Amtrak of the proposed assignment, shall introduce the individual to appropriate Amtrak representatives, and shall provide Amtrak with a resume of any other information about the individual reasonably requested by Amtrak. If, after being notified thereof, Amtrak in good faith objects to the proposed assignment within fifteen (15) days, then Contractor agrees to discuss such objections with Amtrak and attempt to resolve such concerns on a mutually agreeable basis. If the parties have not been able to resolve Amtrak's concerns within five (5) days, Contractor shall not assign the individual to that position and shall propose to Amtrak the assignment of another individual of suitable ability, experience and qualifications.

10.3. Amtrak shall have the right to require Contractor to replace any employee, including those not designated as Key Personnel, who Amtrak judges to be incompetent, careless, unsuitable or otherwise objectionable, or whose continued use is deemed contrary to the best interests of Amtrak. Before a written request is issued, it shall be discussed by the Contracting Official or his representative and the Project Executive. Upon receipt of a written request from Amtrak, Contractor shall be required to proceed with the replacement unless it can demonstrate that Amtrak's request is unreasonable. The replacement request shall include the desired

replacement date and the reason for the request. Contractor shall affect the replacement in a manner that does not degrade quality of the Work.

10.4. In the event Contractor elects to remove any individual proposed as Contractor's Key Personnel from the Project without the Contracting Official's approval, Contractor shall pay to Amtrak the specified assessment for each individual removed during the time period indicated below.

First Year of Contract:	$1,000,000
Second Year of Contract:	$500,000
Third Year of Contractor:	$100,000
Remaining Period of Contract:	$50,000

10.5. The Contracting Official retains the right to approve any request by Contractor to remove Contractor's Key Personnel from the Project. Said approval shall not be unreasonably withheld. The assessments apply only if Contractor removes Contractor's Key Personnel without the Contracting Official's approval. The assessments do not apply if any of Contractor's Key Personnel leave the Project for reasons limited to retirement, resignation from Contractor's firm (but not including a situation where Contractor's Key Personnel takes another position with Contractor's firm, with any of its affiliated or subsidiary firms, its parent company or any firms affiliated with or subsidiaries of the parent company or any other entity which either owns or controls Contractor's firm, within one year of resignation), death, disability, personal hardship, or termination of the Key Personnel's employment by Contractor due to the Key Personnel's inability to meet performance requirements or for misconduct as defined in Contractor's Employee Handbook or Corporate policies and procedures.

10.6. Contractor shall comply with the applicable provisions of Amtrak Policy 7.39.2 (Contractor Background Check), a copy of which is incorporated herein by reference.

10.7. Amtrak and Contractor agree that, during the term of this Contract and for one year thereafter, neither party shall, either directly or indirectly, on the party's own behalf or on behalf of others, solicit or recruit any person to terminate such person's employment with the other party. This shall not restrict one party from hiring any employee of the other who responds to regular employment solicitation efforts, such as newspaper advertisements, employment agencies, open house or job fair events, or widely distributed announcements of job openings, or who makes a direct inquiry as to employment with Amtrak or Contractor.

11. CONTRACTOR'S REPRESENTATIONS

Contractor represents that at the time of transfer to Amtrak, or an entity designated by Amtrak, of title to the Supplies, Contractor shall be vested with requisite authority to pass, and covenants that it shall pass such title, free of all liens and encumbrances, security interests, contractual

rights (for example, such as those under debt instruments or leases), title retention and all other rights of third parties of every kind and description including, without limitation, any creditors of Contractor, whether or not filed, recorded or otherwise perfected or effective under applicable law (collectively, "Adverse Rights"). Contractor shall execute additional documents reasonably requested by Amtrak, or an entity designated Amtrak.

12. SEVERABILITY

If any term or provision hereof is or becomes invalid or unenforceable, Contractor and Amtrak shall in good faith negotiate to replace the invalid or unenforceable term or provision with a term or provision which is valid and enforceable, and which comes as close as possible to expressing the intention of the invalid or unenforceable term or provision. The remaining valid portion of the Contract shall remain binding upon the parties.

13. CONFIDENTIALITY

13.1. Confidential Information. The term "Confidential Information" shall mean any and all information or proprietary materials (in every form and media) not generally known and which has been or is hereafter disclosed or made available by either Party (the "Disclosing Party") to the other Party (the "Receiving Party") in connection with the efforts contemplated hereunder, including: (i) all trade secrets; (ii) existing or contemplated products, services, designs, technology, processes, technical data, engineering, techniques, methodologies, and concepts and any information related thereto; (iii) information relating to business plans, sales or marketing methods or merchandising techniques, plans or information, and actual or potential customer information, lists or requirements; (iv) financial information or materials; (v) cost data; (vi) user lists and information; (vii) actual or potential vendor lists and information; (viii) procurement requirements; (ix) purchasing information; (x) manufacturing or development information; (xi) pricing policies; (xii) information about employees, independent contractors, interns, officers, directors, shareholders, investors, lenders, accountants, attorneys, and any other agents of either Party; (xiii) information about actual, under development, or what might reasonably be anticipated to be or become business and contractual relationships; (xiv) actual or potential lender, investor or partner lists and information; and (xv) other proprietary business information of either Party. "Confidential Information" as it relates to people or entities includes all contact information, including name, title, position, address, phone numbers, and email addresses. Further, "Confidential Information" includes any and all technical and non-technical information or material in which either Party has rights, opportunities, or obligations, whether or not owned or developed by such Party (or people or entities such Party may have disclosed to or received from pursuant to non-disclosure agreements).

13.2. Contractor agrees that all information furnished or disclosed by Contractor to Amtrak in connection with the performance of the Contract: (i) is furnished or disclosed as part of consideration of the Contract; (ii) shall not, unless otherwise agreed in writing by the CO, be treated as confidential or proprietary information of Contractor; and (iii) subject to third party copyright restrictions, may be used, modified, copied, or disclosed by Amtrak for any purpose.

Generally, routine deliverables provided by the Contractor to Amtrak will not be considered confidential. Contractor expressly waives any and all Claims against Amtrak and releases Amtrak from any and all Claims relating to the use, modification, copying or disclosure of such information by Amtrak, its assigns, or intended beneficiaries. No employee, agent, or representative of Amtrak, other than the CO, is authorized to accept any information which Contractor considers to be proprietary or confidential. Only the CO has authority to enter into an agreement, which shall be in writing, to provide for the confidential treatment of, or limit disclosure of, information furnished or disclosed by Contractor, its employees, agents or representatives.

13.3. Contractor shall: (i) hold Amtrak's Confidential Information in trust and confidence and not disclose or release any Confidential Information to any other person or entity; and (ii) not use the Confidential Information of Amtrak for any purpose whatsoever except as set forth in the Contract Documents or herein. Contractor shall disclose Amtrak's Confidential Information only to those of its employees, independent contractors, permitted subcontractors (including their employees and independent contractors) having a need to know such Confidential Information, provided that such persons and entities are bound by obligations of confidentiality and non-use no less restrictive that those contained herein. Upon completion or termination of the Contract, or as otherwise requested by Amtrak, Contractor shall immediately return all such items and information to Amtrak or make other disposition thereof as directed by Amtrak. Contractor shall not make any news releases, articles, brochures, advertisements, speeches or other information releases relating to the Contract without the prior written approval of the CO.

13.4. Contractor acknowledges that disclosure or use of Amtrak's Confidential Information without express written consent of the CO violates the Uniform Trade Secrets Act and federal Defend Trade Secrets Act. Contractor agrees not to improperly disclose third-party trade secrets or confidential information to Amtrak.

13.5. Contractor shall fully indemnify Amtrak against any and all actions, claims, liability, costs, charges, damages, and expenses suffered or incurred in connection with or arising out of any breach by Contractor of any of the provisions of this Section. Contractor acknowledges that a breach of its obligations hereunder cannot be compensated adequately by an award of damages or other pecuniary remedy, and that Amtrak shall also be entitled in the event of any such breach to the remedies of injunction, specific performance, or other equitable relief in respect of any such breach.

13.6. Contractor agrees that, in the event any Confidential Information of Amtrak is sought by subpoena, required by law or order of a court of competent jurisdiction or regulatory authority, or other process to the extent allowed by applicable law, Contractor shall notify Amtrak in writing as soon as practicable or within three (3) days of receipt of notice of such required disclosure in order to enable Amtrak to seek an appropriate protective order. Further, to the extent allowed by applicable law, Contractor shall reasonably cooperate and assist Amtrak in obtaining a protective order or other appropriate protection of its Confidential Information. If,

nonetheless, the Confidential Information is ordered to be disclosed, Contractor shall furnish only that portion of the Confidential Information that is required legally to be disclosed, and any portion of such Confidential Information required to be disclosed shall be used only for the purposes for which a court issues an order, or for other such purposes required by law.

13.7. Contractor agrees that, in the event any of Contractor's Confidential Information in Amtrak's possession is disclosed to a third party pursuant to a lawful subpoena, is required to be disclosed by law (e.g. FOIA) or order of a court of competent jurisdiction or regulatory authority, or other process to the extent allowed by applicable law, Contractor shall hold Amtrak harmless for such release.

13.8. This Confidentiality Section shall survive the termination or expiration of the Contract.

14. RETURN OF DATA

Contractor, at any time upon the request of Amtrak, shall immediately return and surrender to Amtrak all copies of any materials, records, notices, memoranda, recordings, Drawings, specifications and any other documents furnished by Amtrak to Contractor and Subcontractor.

15. ACCESS TO WORK

Amtrak, through its designated representative(s), and the Financing Parties shall at all times have access to the Work at the project site(s), or wherever the Work may be in preparation or progress, and Contractor shall provide proper facilities for such access.

16. AMTRAK'S RIGHT TO STOP THE WORK

If Contractor fails to correct Work which is not in accordance with the requirements of the Contract or persistently fails to carry out Work in accordance with the Contract, the Contracting Official, by written order signed personally or by his authorized representative, may order Contractor to stop the Work or any portion thereof, until the cause for such order has been eliminated; however, the right of the Contracting Official to stop the Work shall not give rise to a duty on the part of Amtrak to exercise this right for the benefit of Contractor or any other person or entity. Contractor shall not be entitled to any extension of the Contract Time or increase in the Contract Amount in connection with any stopping of the Work or portion thereof pursuant to this Article.

17. AMTRAK'S RIGHT TO CARRY OUT THE WORK

If Contractor fails to carry out the Work in accordance with the Contract and fails, within a ten (10) day period after receipt of written notice from the Contracting Official to cure this default with diligence and promptness, the Contracting Official may give Contractor a second written notice to correct such deficiencies within a seven (7) day period. If Contractor within such seven (7) day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Contracting Official may, without prejudice to other remedies

Amtrak may have, correct, or cause to be corrected, such deficiencies. In so doing, Amtrak or its designee shall utilize any of Contractor's materials, plant and equipment necessary to correct the deficient Work. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due Contractor the cost of correcting such deficiencies, including compensation for the Contracting Official's or Amtrak's additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due Contractor are not sufficient to cover such amounts, Contractor shall pay the difference to Amtrak. In accordance with Article 53, Amtrak's rights under this Article are in addition to any other rights it may have with respect to defective Work, including those rights of termination as specified elsewhere in the General Provisions.

18. NON-PERFORMANCE BY AMTRAK

Amtrak's failure to perform any of its responsibilities set forth in the Contract shall not be deemed to be grounds for termination, suspension or slowdown of the Work by Contractor; provided, however, that Contractor's nonperformance of its obligations to perform the Work shall be excused if and to the extent: (a) Contractor is unable to perform and its inability to perform is caused solely by Amtrak's failure to perform its responsibilities, and (b) Contractor provides Amtrak with reasonable notice of nonperformance and uses all reasonable efforts to perform notwithstanding Amtrak's failure to perform.

19. SUSPENSION OF THE WORK

19.1. After the Work has been started, Contractor shall not suspend the Work without permission of the Contracting Official or his designated representative. When under suspension, the Work shall be put in proper and satisfactory condition, and properly protected as directed by the Contracting Official or his designated representative. In all cases of suspension, the Work shall not again be resumed until permitted by order of the Contracting Official or his designated representative.

19.2. In addition to any other rights afforded to Amtrak under this Contract to suspend the Work, Amtrak shall have the right at any stage of the Work, to suspend operations thereon, or upon any part thereof, either for a time named or indefinitely, by giving Contractor written notice. If such rights of suspension are exercised by Amtrak, the Contracting Official shall grant to Contractor an extension of the Contract Time for the relevant part of the Work equal to the length of the actual delay to the critical path necessarily caused by such suspension and may grant additional time necessary to overcome such delay, but there shall be no adjustment of the Contract Amount in connection with such suspension except as explicitly provided in this Article. In the event that operations on a part of the Work are suspended by Amtrak pursuant to this Article for more than thirty (30) days, in the case of suspension of the Work, the Contract Amount for such part of the Work may be adjusted for any increase in the cost of performance of the Work (excluding profit) necessarily caused by such suspension (it being understood that the economic adjustment formulae in the Contract shall compensate Contractor for increased costs attributable to inflation). However, no adjustment of the Contract Time or Contract

Amount shall be made for any suspension: (a) to the extent that performance would have been suspended, delayed or interrupted by any other cause, including the fault or negligence of Contractor or (b) for which equitable adjustment is provided for or excluded under any other provision of the Contract. Amtrak's rights under this Article shall be in addition to any other right under the Contract to suspend the Work.

19.3. No Claim under this Section shall be allowed unless the Claim, is submitted to Amtrak in writing, setting forth any requested extension to the period of performance or increase in Compensation, and the basis therefore, as soon as practicable after the termination of such suspension, but no later than twenty-one (21) days after the termination of such suspension pursuant to the Claims Section.

20. TAXES

Pursuant to 49 U.S.C. 24301(k), Amtrak is exempt from payment of state or local sales and use taxes on personal property. Based on this statutory exemption, Contractor may be exempt from payment of state or local sales and use taxes on material and property purchased for performance of this Contract. It is Contractor's responsibility to determine applicability of any exemption from taxation arising from his performance under this Contract and Contractor shall not be entitled to payment for any taxes for which any exemption was applicable.

21. INTELLECTUAL PROPERTY RIGHTS

21.1. IP Rights.

21.1.1. Contractor shall pay any and all royalties and license fees required to be paid to third parties in connection with (a) Contractor's (or its Subcontractors') efforts relating to the Work, and (b) Amtrak's use and exploitation of any portion thereof, including without limitation Amtrak's use of any deliverables, Work Product, or Supplies. In addition, Contractor shall defend and indemnify Amtrak from, and hold Amtrak harmless from and against, any and all costs, expenses, losses and liabilities (including without limitation costs, expenses and attorneys' fees) arising out of or in connection with any and all demands, suits, claims and other similar proceedings brought by third parties alleging infringement, misappropriation or violation of any IP Rights arising in connection with any Work, Work Product, deliverables or Supplies, or Amtrak's use and exploitation of any portion thereof, including without limitation Amtrak's use of any Work, Work Product, deliverables or Supplies; provided that Amtrak provides Contractor with reasonable notice of the same.

21.1.2. With respect to the Work, Contractor shall not use, or permit the use of, or furnish for use by Amtrak any appliance, article, device, method of construction, design or manufacturing, Work Product, Supplies, or any Intellectual Property or IP Rights, unless Contractor has obtained all necessary consents, permissions, or authorizations for such use or uses. Any and all such consents, permissions or authorizations shall include,

without limitation, all rights necessary for Contractor to grant the licenses set forth below.

21.2. License and Use Rights.

21.2.1. "Allowable Uses" shall be limited to (a) the use, maintenance or repair (including wreck repairs) of the Equipment, (b) work performed by or on behalf of Amtrak to complete the Work due to a Contractor default or failure (or, in the case of Subcontractor Intellectual Property, after termination for cause of the relevant Subcontractor), (c) marketing, branding, advertising and training initiatives, and/or (d) other Amtrak equipment acquisitions or other Amtrak business reasons (or, in the case of Subcontractor Intellectual Property, the applicable Subcontractor ceases to be in the business of selling the equipment to which the applicable Subcontractor Intellectual Property relates). The Contractor shall cause its Subcontractors to grant "Allowable Uses" to Amtrak as set forth in this section and these General Provisions.

21.2.2. Contractor Intellectual Property: Contractor hereby grants to Amtrak an irrevocable, perpetual, fully paid-up right and license (with the right to grant sublicenses, except as otherwise expressly set forth herein) to use the Contractor's Intellectual Property: (a) for any and all Allowable Uses, (b) to make and use any and all Work, Supplies, Work Product, deliverables, products, methods and services, and (c) to use, copy, have copied, modify, have modified, incorporate in other products or services, prepare derivative works from, have derivative works prepared from, and distribute any and all copyrightable works. The right and license set forth in this section shall survive the expiration or termination of this Contract and may be transferred by Amtrak to any third-party.

21.2.3. Subcontractor Intellectual Property: Contractor shall cause each and every Subcontractor to grant to Amtrak an irrevocable, perpetual, fully paid-up right and license (with the right to grant sublicenses) to use the Subcontractor's Intellectual Property (the "Subcontractor Intellectual Property"): (a) for any and all Allowable Uses, (b) to make and use any and all Work, Supplies, Work Product, deliverables, products, methods or services, and to (c) use, copy, have copied, modify, have modified, incorporate in other products or services, prepare derivative works from, have derivative works prepared from, and distribute any and all copyrightable works. The rights and licenses set forth in this section shall survive the expiration or termination of this Contract, and the expiration or termination of any agreements between Contractor and the Subcontractor, and may be transferred by Amtrak to any third party.

21.2.4. Without limiting any right or remedy of Amtrak, if Amtrak or any of its affiliates is enjoined from or likely to be enjoined from using all or any portion of the Work, Work Product, any deliverables or Supplies, or Amtrak's use and exploitation (as defined below) of any portion thereof, as to which Contractor is required to indemnify Amtrak against infringement, misappropriation or other violation, Contractor shall, at Amtrak's

request and at Contractor's expense, either (a) procure promptly for Amtrak the right to continue using the foregoing, or (b) promptly replace all or any portion of the foregoing with a non-infringing product or part of equivalent functionality and performance which is satisfactory to Amtrak and the use of which does not violate the terms and conditions of such injunction, or (c) promptly modify all or any portion of the foregoing in a manner satisfactory to Amtrak so as to render use of the foregoing non-infringing and not in conflict with the injunction, and having equivalent functionality and performance.

21.3. Escrow.

21.3.1. Escrow Materials and Escrow Agreement. To secure Amtrak's rights hereunder, Contractor shall place copies of its then current system design, Source Code and Object Code, listings and related Documentation including, without limitation, annotated notes (the "Escrow Materials") for the Contractor's Software and Subcontractor's noncommercially available Software with an independent escrow agent reasonably selected by Amtrak, subject to the terms and conditions of the independent escrow agent's standard agreement (the "Escrow Agreement") and in accordance with the provisions of this Article 21.

21.3.2. Release Conditions. As used in the Contract, "Release Condition" shall mean the occurrence of any of the following events with respect to Contractor during the term of Amtrak's rights hereunder:

a). if Contractor materially breaches an express obligation with respect to the Contract, then Amtrak shall so notify Contractor in writing in accordance with the notice provisions set forth in the Contract ("Breach Notice"), specifying in reasonable detail the basis for Amtrak's claim of breach. Amtrak shall serve a copy of the Breach Notice simultaneously upon the escrow agent under the Escrow Agreement. At the same time that Amtrak delivers the Breach Notice, it may also deliver notice to the escrow agent under the Escrow Agreement), with a copy to Contractor, requesting a release of the Escrow Materials (a "Release Notice"). The Release Notice will commence the thirty (30) Business Day period under the Escrow Agreement, if such thirty (30) Business Day period is required, for Contractor to issue contrary instructions. Contractor shall (i) cure such breach during the thirty (30) day period immediately following its receipt of the Breach Notice ("Cure Period"); or (ii) if such breach is of a nature such that it is not capable of being cured within such period, (A) provide Amtrak a plan for cure that will cure the breach within sixty (60) days from the date of the Breach Notice (the "Extended Cure Period") and (B) commence acting on such plan during the initial Cure Period. If Contractor fails to meet its obligations under (i) and (ii) above or does not send written notice to Amtrak of a good faith dispute of the breach specified in the Breach Notice, then Contractor hereby agrees that it will not issue contrary instructions to the escrow agent under the Escrow Agreement, and the escrow agent

under the Escrow Agreement will be authorized to release the Escrow Materials upon the tolling of the thirty (30) Business Day Period during which Contractor was allowed to issue contrary instructions; provided however if the breach is of such a nature that it could not have been cured during the initial Cure Period and Contractor complied with its obligations under (ii) above, then Contractor may issue Contrary Instructions only to the extent it prohibits the escrow Agent under the Escrow Agreement from releasing the Escrow materials until the end of the Extended Cure Period.

b). the entry of an order for relief in a proceeding in bankruptcy (other than Chapter 11 of Title 11 of the U.S. Code, as the same may be amended) in which Contractor is the named debtor; (ii) Contractor's making of an assignment for the benefit of Contractor's creditors; (iii) the appointment of a receiver for Contractor; (iv) the filing of (1) any bankruptcy proceeding against Contractor, other than Chapter 11 of Title 11 of the U.S. Code, (2) any proceeding for an assignment for the benefit of Contractor's creditors or (3) any proceeding for appointment of a receiver or custodian of the assets and property of Contractor, which proceeding shall be consented to or acquiesced to be by Contractor or has not been discharged or terminated within ninety (90) days; or (v) the rejection by Contractor or any trustee of Contractor of the License Agreement pursuant to 11 U.S.C. Clause 365. The terms of clause (a) of this Clause 4.1 shall apply if following the filing of a proceeding under Chapter 11 of Title 11 of the U.S. Code, Contractor or its trustee materially breaches an express obligation under the Contract.

c). Contractor dissolves, liquidates or ceases to provide services or work similar to those provided for under the Contract for a substantial number of its customers for a period of at least thirty (30) days.

d). the parties have entered into a good faith dispute and Contractor ceases providing services or work similar to those provided for under the Contract prior to the final conclusion of the dispute resolution process set forth in Article 36 "Claims and Disputes"; provided that no such release condition will be deemed to have occurred if (i) Contractor has obtained a court order allowing it to cease performance of the Contract or (ii) Amtrak has failed to pay undisputed invoices or make milestone payments for the Work for ninety (90) days following written receipt of notice of breach from Contractor.

21.3.3. Use of Escrow Materials. Contractor hereby grants Amtrak an irrevocable, perpetual, fully paid-up right license (with the right to grant sublicenses) to use or have used on its behalf the Escrow Materials upon their release to Amtrak only to perform and authorize the performance of the Allowable Uses, which includes without limitation the right to make and use any and all products, methods and services, and to use, copy, have copied, modify, have modified, incorporate in other products, prepare derivative works from,

have derivative works prepared from, and distribute any and all copyrightable works, in each case in connection with and limited to Allowable Uses.

21.3.4. Establishment of Escrow. Within one (1) year of conditional acceptance of the first Consist of Cars, Contractor shall cause the Escrow Materials to be placed into escrow. The first ten (10) years of the escrow period, shall be maintained at the sole expense of Contractor under this Contract. After ten (10) years, Contractor shall continue to maintain the escrow, including the payment thereof, under the TSSSA. After the TSSSA terminates, Amtrak shall be responsible for payment of the escrow agent's fees. The deposit made with the escrow agent shall be kept current so as to accurately reflect the then current version of the Escrow Materials and promptly updated by Contractor following each material upgrade, modification or enhancement thereto. Contractor shall designate a mutually acceptable neutral third party that, at the expense and request of Amtrak made from time to time, may audit the materials deposited with the escrow agent for purposes of determining whether Contractor has fulfilled its deposit obligations. Contractor will promptly, at its expense, correct any deficiency disclosed by the audit.

21.3.5. Extension of Obligations. The obligations of Contractor under this Article 31 shall extend to any trustee in bankruptcy, receiver, administrator or liquidator appointed for Contractor, to Contractor as debtor-in-possession ("Trustee"), and to any other successor in interest to Contractor. Without limiting the generality of the foregoing, upon written request of Amtrak, Contractor shall not interfere with the rights of Amtrak as provided in the Contract or the Escrow Agreement to obtain the Escrow Materials from the Trustee or any other person or entity having possession thereof, and shall, if requested under the conditions specified in the Escrow Agreement for release of the Escrow Materials, cause a copy of such Escrow Materials to be made available to Amtrak.

21.4. Trademarks. Contractor shall not use Amtrak's name, trade name, logo, trademarks, or service marks in any context in connection with any advertising, publicity, product, equipment, promotion, or publication without the prior written consent of Amtrak. Contractor agrees to comply with Amtrak instructions regarding trade dress, packaging, trade names, trademarks, service marks or other indicia of origin which shall appear on any items to be delivered under the Contract. Contractor further agrees that, after delivery of said items to Amtrak, Amtrak may modify the trade dress or packaging thereof, and/or replace, modify, or supplement any indicia of origin appearing thereon, to identify Amtrak as the source of said items.

21.5. Pre-existing Materials of Contractor and Subcontractors. Contractor hereby grants to Amtrak a non-exclusive, irrevocable, perpetual, worldwide, fully paid-up license to use, execute, reproduce, modify, display, transfer, distribute copies of and prepare derivative works based on materials and intellectual property embodied therein, including any and all modifications thereto, owned and developed independently by Contractor prior to the preparation of its proposal used to provide Equipment under the Contract. Contractor shall retain its ownership

interest in such pre-existing materials. Contractor shall cause its Subcontractors to grant the licenses described herein.

21.6. Indemnity for Third Party Infringement Claims. The Contractor hereby represents and warrants that: (i) materials that it uses in its performance of the Work under the Contract; (ii) the Work, Work Product, including deliverables, Supplies, and Subcontractor Intellectual Property; and (iii) Amtrak's use of any Work, Work Product, including deliverables, Supplies, and Subcontractor Intellectual Property shall not infringe or misappropriate any U.S. or foreign patent, copyright, trade secret or other intellectual property right of a third party. If any claim is made against Amtrak claiming that its use of the Work, Work Product, including deliverables, Supplies, and Subcontractor Intellectual Property or other materials provided by Contractor hereunder infringes any third party intellectual property right, including but not limited to infringement of patent, copyright, royalty, trademark, service mark, proprietary right, misappropriation or wrongful use of trade secret, or confidential information ("Third-Party Infringement Claim"), Contractor shall, at its own expense, defend, indemnify, and hold harmless Amtrak and its Affiliates (including its directors, officers, employees, agents, subsidiaries, and assigns) ("the "Amtrak Indemnified Party") from and against any and all claims, damages, fees, losses, liabilities, penalties, and costs (including costs of defense and attorneys' fees) ("Losses"). In the event that a Third-Party Infringement Claim is asserted or sought against an Amtrak Indemnified Party, the Amtrak Indemnified Party shall notify the Contractor in writing in respect of such Third-Party Infringement Claim (a "Notice of Infringement Claim") as promptly as practicable; provided, however, that a failure or delay by the Amtrak Indemnified Party to provide a Notice of Infringement Claim as promptly as practicable shall not affect the rights or obligations of such Amtrak Indemnified Party unless the Contractor shall have been actually prejudiced as a result of such failure or delay. The Amtrak Indemnified Party shall enclose with the Notice of Infringement Claim a copy of all papers served with respect to such Third-Party Infringement Claim, if any, and any other documents evidencing such Third-Party Infringement Claim. Contractor shall have the obligation to assume the defense or prosecution of such Third-Party Infringement Claim and any litigation resulting therefrom with counsel of its choice (which counsel shall be reasonably satisfactory to the Amtrak Indemnified Party) and at its sole cost and expense (a "Third-Party Infringement Defense"), but only if the Contractor provides written notice of such assumption to the Amtrak Indemnified Party within sixty (60) days following delivery of the Notice of Infringement Claim and acknowledges in writing in such notice that any Losses that may be assessed against the Amtrak Indemnified Party in connection with such Third-Party Infringement Claim constitute Losses for which the Amtrak Indemnified Party shall be indemnified pursuant to this Section. Notwithstanding the foregoing, the Contractor shall not have the right to assume the defense of such Third-Party Infringement Claim, if: (i) the Amtrak Indemnified Party shall have been advised by counsel that there are one or more legal or equitable defenses available to it which are different from or in addition to those available to the Contractor, and, in the reasonable opinion of the Amtrak Indemnified Party, counsel for the Contractor could not adequately represent the interests of the Amtrak Indemnified Party because such interests could be in conflict with those of the Contractor; or (ii) the Contractor shall not have assumed the

defense of such Third-Party Infringement Claim in a timely fashion. If the Contractor assumes the Third-Party Defense in accordance with this Section: (i) Contractor shall diligently defend such Third-Party Infringement Claim; (ii) the Amtrak Indemnified Party shall have the right, but not the obligation, to participate in any such Third-Party Defense and to retain separate co-counsel at the sole cost and expense of Contractor; (iii) the Amtrak Indemnified Party will not file any papers or consent to the entry of any judgment or enter into any settlement with respect to the Third-Party Infringement Claim without the prior written consent of the Contractor; and (iv) the Contractor will not consent to the entry of any judgment or enter into any settlement with respect to the Third-Party Infringement Claim: (a) to the extent such judgment or settlement provides for equitable or injunctive relief without the prior written consent of the Amtrak Indemnified Party; (b) if such settlement does not include as a term thereof the giving by the third party asserting such claim to the Amtrak Indemnified Party a release from all liability with respect to such claim underlying such judgment or settlement; or (c) if such settlement or judgment contains any admission or statement suggesting any wrongdoing or liability on behalf of the Amtrak Indemnified Party. The Parties will use their commercially reasonable efforts to minimize Losses from Third-Party Infringement Claims and will act in good faith in responding to, defending against, settling or otherwise dealing with such claims. The Parties will also cooperate in any such defense and give each other reasonable access to all information relevant thereto. Notwithstanding the foregoing, Contractor shall have no indemnification obligation toward Amtrak under this provision if the respective Third-Party Infringement Claim is due to any modifications made by Amtrak or a third party acting on behalf of and with the authority of Amtrak or misuses by Amtrak.

21.7. Corrective Actions. If Amtrak's use of the Intellectual Property is enjoined, or if the Contractor's performance of its obligations under this Contract are materially impaired by reason of such Third-Party Infringement Claim, Contractor shall use commercially reasonable efforts, at its expense, to continue its performance hereunder, including without limitation, at its own elections: (i) to substitute an allegedly infringing item or process with a non-infringing item or process of at least the same functionality; (ii) to modify the allegedly infringing item or process so that it no longer infringes but remains at least functionally equivalent; or (iii) to obtain for Amtrak and its Affiliates the right to continue using such allegedly infringing item or process.

21.8. RESERVED

21.9. The terms and conditions set forth in this Article 21 shall survive the expiration or termination of the Contract, and the rights and licenses set forth hereunder may be transferred by Amtrak to any third party.

22. INDEMNIFICATION

22.1. Contractor agrees to defend, indemnify and hold harmless the Indemnified Parties, from and against any claims, losses, liabilities (including without limitation environmental liabilities), penalties, fines, demands, causes of action, suits, costs and expenses incidental thereto,

(including costs of defense and attorneys' fees) (collectively "Indemnified Party Claims"), arising in whole or in part from the fault, negligence or wrongful act of Contractor, which any of the Indemnified Parties may hereafter incur, be responsible for or pay as a result of: (a) breach of warranty, (b) injury or death of any person, or damage to or loss (including loss of use) of any property, including property of the parties hereto, arising out of or in any degree directly or indirectly caused by or resulting from Supplies, Material, deliverables, products or Equipment supplied by, or from activities of, or Work performed by Contractor, Contractor's officers, employees, agents, servants, Subcontractors, or any other person acting for or with the permission of Contractor under the Contract, (c) occasioned by or in any manner connected with Contractor's failure to perform the Work in compliance with any applicable laws, ordinances, rules, regulations or orders, or (d) as a result of Contractor's failure to perform its obligations in compliance with the Contract.

22.2. In addition to the foregoing, Contractor agrees to defend, indemnify and hold harmless the Indemnified Parties, irrespective of any negligence or fault on the part of the Indemnified Parties, from and against any Claims which any of the Indemnified Parties may hereafter incur, be responsible for or pay as a result of injuries (including death) to any of Contractor's employees, agents or Subcontractors.

22.3. The indemnification obligations under this section shall not be limited by the existence of any insurance policy procured or maintained by Contractor or any Subcontractor or by any limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or any Subcontractor and shall survive the termination or expiration of the Contract.

23. LIMITATION OF LIABILITY

23.1. With the exception of losses (including defense costs) covered by the proceeds of insurance carried by or insuring Contractor or any Subcontractor, Contractor's liability to Amtrak for damages resulting from or arising out of any causes of action (including but not limited to tort) relating to Contractor's performance of the Contract shall not exceed an aggregate amount equal to 100% of the Contract Amount. The foregoing limitation of liability will not apply to or limit any right of recovery respecting the following:

a). losses (including defense costs) arising out of the Work and covered by the proceeds of insurance carried by or insuring Contractor;

b). losses (including defense costs) of amounts which would have been reimbursed but for Contractor's failure to carry insurance required to be carried under the Contract;

c). losses (including defense costs) of arising out of fraud, criminal conduct, intentional misconduct, recklessness, bad faith or gross negligence;

d). Contractor's indemnities under the Contract ;

e). Contractor's obligation to pay liquidated damages in accordance with the Contract;

f). fines assessed against Amtrak by a government authority to the extent that such fines are due to a Contractor Party's violation of Applicable Law; and

g). losses arising out of releases of hazardous materials by Contractor or Amtrak.

Notwithstanding any other provision in the Contract, except in respect of the express Performance Guarantees and liquidated damages in the Contract or as otherwise set forth herein, neither party shall be liable to the other party for consequential damages.

24. SOURCING OF SPARES

24.1. In performing the Work, Contractor shall only provide Material of the same or similar standards, functionality, features and quality as the original equipment manufactured component or part provided under the Contract, except where Contractor seeks and is granted Amtrak approval, which shall not be unreasonably withheld.

24.2. If Contractor wishes to change the supplier of any component or Material (a "Proposed Supplier Change"), Contractor shall notify Amtrak in writing of the Proposed Supplier Change including the new supplier's name and the Contractor's suppliers' part numbers, and any other information reasonably requested by Amtrak.

25. SUBCONTRACTORS

25.1. All references to Subcontractors herein include Subcontractors at any tier. Nothing contained in the Contract or any contract with a Subcontractor at any tier shall create any contractual relationship between Amtrak and any Subcontractor, or any third-party beneficiary rights in any Subcontractor; provided, however, that Amtrak shall be named as a third-party beneficiary of all contracts with a Subcontractor. Contractor agrees to obtain Amtrak's prior written approval before subcontracting the Contract or any substantial portion hereof; provided, however, this limitation shall not apply to the purchase of standard commercial supplies or raw material.

25.2. All work performed for Contractor by a Subcontractor shall be pursuant to an appropriate agreement between Contractor and the Subcontractor which shall contain provisions that:

a). Preserve and protect the rights of Amtrak under the Contract with respect to the Work to be performed under the subcontract so that the subcontracting thereof shall not prejudice such rights;

b). Require that such Work be performed in accordance with the requirements of the Contract;

c). Require submission to Contractor of applications for payment under each subcontract to which Contractor is a party, in reasonable time to enable Contractor to apply for payment;

d). Require that all claims for additional costs, extensions of time, damages for delays or otherwise with respect to subcontracted portions of the Work shall be submitted to Contractor (via any Subcontractor where appropriate) in sufficient time so that Contractor may comply in the manner provided in the Contract for like Claims by Contractor upon Amtrak;

e). Contractor's insurance as specified in Article 47 of this Contract shall provide insurance coverage for each Subcontractor working on its behalf.

f). Preclude Contractor and Subcontractor from naming, impleading or otherwise including Amtrak as a party in any arbitration or lawsuit between Contractor and any Subcontractor, and preclude the Subcontractor from naming, impleading or otherwise including Amtrak in any arbitration or lawsuit arising as a result of any Work performed by or for Contractor under the Contract;

g). Provide that Contractor's rights under the subcontract shall be assignable to Amtrak at Amtrak's option;

h). Require the Subcontractor to continue diligently to prosecute the Work, notwithstanding any disputes, including without limitation, disputes between Contractor and Amtrak, or Contractor and any Subcontractor;

i). Provide that the subcontract is terminable on the same terms as the Contract, but that no termination shall be effective without Amtrak's consent, and the Work covered by the subcontract may be suspended on the same terms as the Work may be suspended pursuant to the Contract;

j). Include Amtrak as a named indemnitee under any indemnification obligations imposed on the Subcontractor; and

k). Obligate each Subcontractor specifically to consent to the provisions of this Article 24

25.3. Whenever the Contract: (i) requires Contractor to include any provisions in an agreement with a Subcontractor, or (ii) requires Contractor to bind a Subcontractor to any obligation or otherwise create any obligation, responsibility, or liability on the part of any Subcontractor, or (iii) confers any rights or benefits on Amtrak with respect to a Subcontractor, the reference to "Subcontractors" shall be deemed to include Subcontractors of any tier, and Contractor shall require Subcontractors to include in all agreements with their suppliers: (a) provisions parallel to those required to be included in the agreement with the Subcontractor, (b) provisions necessary and sufficient to impose parallel obligations, responsibilities and liabilities on the Subcontractors, and (c) provisions necessary to confer such rights and benefits on Amtrak with respect to their suppliers.

25.4. Contractor shall promptly pay all Subcontractors, and shall require each Subcontractor to promptly pay its own Subcontractors. To verify payments to Subcontractors, Contractor shall provide any documentation reasonably requested by Amtrak.

25.5. The Contractor shall include all anticorruption provisions of the Contract in each subcontract and third-party agreement entered into under the Contract, including but not limited to representations and warranties of compliance with applicable anticorruption laws, including but not limited to the Foreign Corrupt Practices Act. Amtrak may require Contractor to terminate any Subcontractor in the event that the Subcontractor's continued performance of the Work would cause Amtrak to (i) violate any Applicable Law; or (ii) lose Amtrak's access to public funding for the Work, including from the Financing Parties.

26. CLAIMS AND DISPUTES

26.1. Submission of Claim and Decision of Contracting Official: If, prior to the date of Final Payment, the Contracting Official and the Contractor fail to agree on any request for adjustment, the Contractor may elect to submit a Claim to the Contracting Official for action. A decision by the Contracting Official, as provided in the "Resolution of Claims and Disputes" Section, shall be required as a condition precedent to litigation of a Claim between Contractor and Amtrak as to all such matters arising prior to the date Final Payment is due, regardless of (a) whether such matters relate to execution and progress of the Services or (b) the extent to which the Services have been completed.

26.2. Time Limits on Claims: Claims by the Contractor must be made by written notice to Amtrak, identified as a "Claim" under this Section" within thirty (30) days after occurrence of the event giving rise to such Claim or within thirty (30) days after the Contractor first recognizes, or reasonably should have recognized, the condition giving rise to the Claim, whichever is later. Provided, however, that Contractor shall use its best efforts to furnish the CO, as expeditiously as possible, with notice of any Claim once such Claim is recognized, and shall cooperate with the CO in any effort to mitigate the alleged or potential damages, delay or other adverse consequences arising out of the condition which is the cause of such a Claim. A notice of Claim must clearly identify the alleged cause and the nature of the Claim and shall describe the basis for any request for an extension of the contract period of performance or increase in the contract sum and shall include data and information then available to the Contractor that will facilitate prompt verification and evaluation of the Claim.

26.3. Continuing Contract Performance: Pending final resolution of the Claim, including litigation, unless otherwise directed by Amtrak in writing, Contractor shall proceed diligently with performance of the Contract and Amtrak shall continue to make undisputed payments in accordance with the Contract Documents.

26.4. Waiver of Claims - Final Payment: The making of Final Payment shall constitute a waiver of Claims by the Contractor except for Claims made in writing prior to Final Payment pursuant to

the requirements of the Contract Documents and identified by the Contractor in writing to the CO as unresolved at the time of Final Payment.

26.5. Any Claim of Contractor not made in compliance with the requirements of the "Time Limits on Claims" subsection above shall be deemed waived. No Claim by Contractor for a Contract change hereunder shall be allowed if asserted after Final Payment under the Contract.

26.6. Resolution of Claims and Disputes:

26.6.1. Subject to Contractor's compliance with the "Changes in the Services" and "Claims" Sections, the Contracting Official will review Claims and take one or more of the following actions within thirty (30) days of receipt of a Claim: (a) request additional supporting data from Contractor; (b) notify the Contractor in writing when the Contracting Official expects to take action; (c) reject the Claim in whole or in part, stating reasons for rejection; (d) recommend approval of the Claim; or (e) or take other actions as deemed necessary by the Contracting Official.

26.6.2. If a Claim has been resolved, the CO will prepare or obtain appropriate documentation for execution by Amtrak and the Contractor.

26.6.3. Additionally, the decision of the CO shall be final and conclusive unless Contractor pursues its rights or remedies under law, in accordance with the "Governing Law, Jurisdiction, and Venue" Section. Pending a final decision of a dispute by the court, Contractor shall diligently proceed with the performance of its work under the Contract in accordance with the decision of the CO, pursuant to the "Resolution of Claims and Disputes" Section, except to the extent that the CO's decision is that Contractor is not to proceed with the performance of all or part of the Contract.

27. ASSIGNMENT OF CLAIMS

Claims for moneys due or to become due Contractor from Amtrak under this Contract may be assigned to a bank, trust company, or other financing institution, including any Federal lending agency upon the prior written consent of the Contracting Official, and may thereafter be further assigned and reassigned to any such institution upon the prior written consent of the Contracting Official. Any such assignment or reassignment shall cover all amounts payable under this Contract and not already paid, and shall not be made to more than one party except that any such assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in such financing.

28. SUCCESSORS AND ASSIGNS

28.1. Contractor shall not assign, transfer or pledge (whether by operation of law or otherwise) the Contract nor delegate its responsibility under the Contract without the prior written consent of the Contracting Official which may be withheld in Amtrak's sole discretion, nor shall

Contractor assign any moneys due or to become due to him there-under, except as provided in Article 28. Amtrak may assign its rights and delegate its responsibilities, in whole or in part, under the Contract (including rights under required insurance policies and bonds) (i) to any entity succeeding to all or substantially all of Amtrak's interests in the assets [associated with the Northeast Corridor] or which otherwise is to be the operator of the Equipment, (ii) to any Amtrak lessor of the Equipment, or (iii) to the Financing Parties. For purposes of this Section 29.1, a "Change in Control" shall be deemed to be an assignment.

28.2. In connection with any assignment of the Contract for collateral purposes to Financing Parties pursuant to Section 28.1, Contractor shall provide to such Financing Parties at is sole cost and expense a consent to assignment agreement in a form as may be reasonably required by such Financing Parties (it being agreed that such Financing Parties may reasonably require provision by competent counsel to Contractor of legal opinions addressing authorization, enforceability and other customary matters related to such consent or direct agreement), covering matters that are customary in project or equipment financings of the applicable type, which, among other things, shall authorize the Financing Parties, as secured parties, to exercise all rights of Amtrak under the Contract, and to subsequently assign such rights in connection therewith without the consent of Contractor and may also cover matters such as Financing Parties' security rights with respect to the Contract, direct notices to Financing Parties, step-in/step-out rights, access by Financing Parties' representative, deferral of Contractor's rights to terminate the Contract in certain circumstances and other matters applicable to such project or equipment financing. In this regard, Contractor shall cooperate with Amtrak in its efforts to obtain such financing, including by supplying information and documentation reasonably requested by the Financing Parties and taking such other actions as the Financing Parties may reasonably request.

29. FORCE MAJEURE

29.1. For purposes of this Contract, a Force Majeure Event is any one of the following: act of God or the public enemy, act of a governmental authority acting in its sovereign capacity, fire, flood, epidemic, quarantine restriction, unusually severe weather, war, terrorism, riot, earthquake, strike or embargo. In the event that either party's failure to perform in accordance with any schedule or when otherwise required under the Contract arises solely out of a Force Majeure Event that is both out of the control of such party and without the fault or negligence of such party, the time for performance under the Contract will be extended proportionately up to a maximum of 30 days (or longer, in the Contracting Official's sole discretion), consistent with the requirements of this Article 29.

29.2. Within ten (10) days of (i) becoming aware or (ii) the date by which it should reasonably have become aware, of a delay resulting from a cause specified in Section 29.1, whichever is earlier, Contractor shall advise the Contracting Official in writing of a claimed Force Majeure Event. The Contracting Official will then determine whether the event constitutes a Force Majeure as defined in Section 29.1 and will so advise the Contractor in writing. Once performance of the delayed work re-commences, or at the end of the thirty (30) day period (or such longer period as

the Contracting Official in his or her sole discretion choose to allow), the Contracting Official will advise the Contractor of the time extension granted due to the Force Majeure Event. Contractor shall make every reasonable effort to minimize the duration of the Force Majeure Event.

29.3. Apart from extension of time, no Claim for additional payment shall be filed by Contractor and no payment or allowance of any kind shall be made to Contractor as compensation for damages occasioned by way of the causes specified in Section 29.1.

29.4. Contractor recognizes it is imperative that the Work proceed uninterrupted and shall endeavor to prevent and shall diligently take all reasonable steps to re-start performance fully in accordance with the Contract, cure any work stoppage or strike of Contractor's employees caused by any labor disputes, including jurisdictional disputes arising out of the assignment of any of the Work. Contractor shall cause parallel provisions to be inserted in all subcontracts at any tier. If Contractor's failure to perform extends for more than fifteen (15) days from the start of the Force Majeure Event, Amtrak may, at its discretion, terminate the Contract without liability or cost at any time after such fifteen (15) days or some greater timeframe that may be specified by Amtrak. In the event of such early termination, if requested by Amtrak, Contractor shall transfer title as directed by Amtrak and deliver to Amtrak in the manner directed by Amtrak, any completed or partially completed deliverables or other work products Contractor has produced or acquired specifically for performance of the Work under the Contract.

29.5. Contractor agrees that no time extension shall be granted for time lost due to normal seasonal weather conditions. In order to qualify for consideration for a time extension due to adverse weather conditions, Contractor must show that the weather conditions during a given quarterly period (summer, fall, winter, spring) were more severe than the most severe year of the previous five years for the project geographical area and, in addition, that these weather conditions critically impacted the final project completion date by delaying the performance of Work. If abnormal weather losses within the meaning of the preceding sentence can be shown to have affected the Project Schedule, a non-compensable time extension shall be granted for that portion of the proven weather-related delays which exceeded the normal weather losses which should have been anticipated for the quarterly period in question, but no Claim for additional payment shall be filed by Contractor and no payment or allowance of any kind shall be made to Contractor as compensation for damages occasioned by way of any such abnormal weather.

29.6. Defaults or delays in performance of the Work by Contractor which are caused by acts or omissions of Subcontractors or unavailability of parts or Spares shall not relieve Contractor of its obligations, except to the extent that the relevant Subcontractor is itself subject to a Force Majeure Event covered hereunder and Contractor cannot reasonably circumvent the effect of the Subcontractors default or delay in performance through the use of alternate sources, work around plans or other means.

29.7. Force Majeure Events shall also not include (a) a failure of the Equipment or Supplies, (b) sabotage by employees or any contractors, subcontractors or suppliers of the party claiming the

Force Majeure Event, (c) increases in commodity, manufacturing or delivery costs or (d) changes in foreign currency exchange rates.

30. PRICING OF ADJUSTMENTS

When costs are a factor in any determination of a Contract price adjustment pursuant to Article 7, Changes, or any other provision of this Contract, such costs shall be in accordance with the contract cost principles and procedures of Part 31 of the Federal Acquisition Regulation (FAR), as amended by O.M.B. Circular A-87, in effect on the date of this Contract.

31. FEDERAL FUNDING, AUDIT, AND INSPECTION

31.1. Contractor hereby acknowledges and accepts that: (1) federal funds may be expended to it in connection with the tasks, assignments or duties which it performs pursuant to this Contract, and (2) the federal False Claims Act, 31 U.S.C. § 3729 et seq. may apply in connection with applications for payment, claims, requests for equitable adjustment or other requests for payment which Contractor submits to Amtrak under, or in connection with, this Contract.

31.2. Contractor acknowledges and agrees that Amtrak and Amtrak's Office of Inspector General (OIG) may inspect, copy and/or audit Contractor's data and records (in hard copy and/or electronic format) related in any way to the Contract, including without limitation, all data and records relating to: (1) support for any proposal, change order, or request for equitable adjustment submitted to Amtrak by Contractor; (2) Contract compliance and performance, including any work or deliverables in progress; (3) compliance with applicable provisions of Amtrak's federal grant, regulations and statutes; and (4) support for all direct and indirect costs or prices charged to Amtrak. Contractor agrees to maintain all such data and records throughout the term of the Contract and until three (3) years after final payment under the Contract, and agrees to cooperate with all audit activities.

31.3. In connection with audit and inspection activities, Amtrak and Amtrak OIG shall be afforded, upon request, (1) access to Contractor's facilities and to Contract work or deliverables in progress, (2) the opportunity to interview Contractor's employees concerning any matter relating to the Contract, and (3) adequate and appropriate workspace.

31.4. Contractor agrees to reimburse Amtrak, within sixty (60) calendar days after receipt of a written request, the full amount of any undisputed audit findings or questioned costs, unless otherwise agreed by Amtrak in the course of post-audit negotiations with Contractor.

31.5. Contractor shall include the provisions of this clause in every subcontract or purchase order exceeding $100,000, as well as a provision requiring all subcontractors to include these provisions in any lower tier subcontracts or purchase orders exceeding $100,000. Contractor shall be responsible for subcontractor or lower tier subcontractor's compliance with this clause.

31.6. Nothing in this Contract shall be construed to limit the rights, obligations, authority, or responsibilities of Amtrak's Office of the Inspector General pursuant to the Inspector General Act of 1978, as amended, including the right to seek information by subpoena.

32. PAYMENT PROVISIONS – GENERAL

32.1. With respect to any amount to be paid to Amtrak by Contractor pursuant to the Contract, Amtrak may, at its option, set off that amount as a credit against the Contract Amount payable to Contractor for the Work.

32.2. Amtrak shall pay undisputed charges when such payments are due for the Work. Amtrak may withhold payment of particular charges that Amtrak disputes in good faith, and in that case, Amtrak shall advise Contractor, in writing, of the nature of the dispute and, at Contractor's request, the parties shall immediately commence resolution of the issue in accordance with Article 26, Claims and Disputes.

32.3. Contractor represents that the prices specified in the Contract and any prices for options do not or will not exceed the current and/or generally offered selling price for the same or substantially similar Material, supplies, or services to any other purchasers, taking into account quantity and geographical factors.

33. RESERVED.

34. FAIR EMPLOYMENT PRACTICES/EQUAL EMPLOYMENT OPPORTUNITY

34.1 Contractor agrees to abide by Amtrak's policy and practice to ensure that all business organizations receive fair and equal consideration and treatment without regard to race, color, religion, sex, disability, veteran status or national origin of the owners or principals of the business organization. In addition, Contractor agrees that it shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, disability, veteran status or national origin and that it shall comply in all respects with the Americans with Disabilities Act, 42 U.S.C. 12101 et seq.

34.2 Contractor shall take affirmative action to ensure that applicants and employees are treated fairly without regard to their race, color, religion, sex, disability, veteran status or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this non-discrimination section.

34.3 Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice advising the labor

union or workers' representative of Contractor's commitments under this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

34.4 The Contract may be canceled, terminated, or suspended in whole or in part based on Contactor's failure to comply with this section.

34.5 Contractor shall include the provisions of Articles 34.1 through 34.4 in subcontracts involving Services to be performed or Supplies to be furnished under the Contract, unless exempted by rules, regulations, or orders of the U.S. Secretary of Labor.

35. ENVIRONMENTAL COMPLIANCE

35.1 Contractor shall comply with all Applicable Laws concerning the environment and/or waste disposal.

35.2 Contractor shall dispose of any wastes, including hazardous wastes, generated by Contractor, its Subcontractors or agents (either purposefully or accidentally) in connection with its performance of the Contract in accordance with applicable federal, state, and local laws, regulations, ordinances, and orders, at its sole expense, using its own EPA generator number. In no event shall Amtrak be identified as the generator of any such wastes. Amtrak reserves the right to require Contractor to provide to Amtrak a copy of the results of any tests conducted by or for Contractor on any such wastes and, at Amtrak's expense, to perform additional tests or examinations of any such wastes prior to disposal.

35.3 Contractor shall include and enforce this Environmental Compliance Article in all subcontracts or lower tier purchasing agreements.

36. BUY AMERICA(N) REQUIREMENTS

36.1 In accordance with Amtrak's Domestic Buying Preference requirements at 49 U.S.C. 24305(f), Amtrak shall only buy, and accordingly, Contractor shall only supply (a) unmanufactured articles materials, and supplies mined or produced in the United States; or (b) manufactured articles, material, and supplies manufactured in the United States substantially from articles, materials, and supplies mined, produced or manufactured in the United States. For purposes of this provision, substantially means that more than 55% of all components by cost must be domestic. This Section 5.1 shall apply only when the cost of those articles, material, or supplies bought or supplied to Amtrak by Contractor is at least $1,000,000.

36.2 When complying with Section 5.1, Contractor shall comply with the domestic preference requirements of the Build America, Buy America Act (BABA) § 70914, Pub. L. No. 117-58, div. G, tit. IX, subtit. A, 135 Stat. 429, 1298 (2021), as implemented by OMB, USDOT, and FRA.

36.3 In accordance with 2 C.F.R. §200.322, as appropriate and to the extent consistent with law, Contractor shall, to the greatest extent practicable, provide a preference for the purchase,

acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subcontracts and purchase orders for work or products under this Contract.

a). For the purposes of this Section 36.3:

1. "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.

2. "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

37. CUSTOM DUTIES

37.1 Contractor agrees that, if any items or Supplies are shipped F.O.B. (Free on Board) destination or D.D.P. (Delivered Duty Paid), Contractor shall be the importer of record for all articles that enter into the United States in connection with the Contract. Contractor shall be liable for all duties, fees, and taxes attaching on importation of such articles, including anti-dumping and countervailing duties, if any.

37.2 Contractor agrees that, if the items or Supplies are shipped F.O.B. origin, C.I.F. (Cost, Insurance & Freight) or F.C.A. (Free Carrier), Amtrak shall specify the customs broker and shall be the importer of record for all articles that enter into the United States in connection with the Contract.

37.3 Amtrak shall not pay on behalf of Contractor, or reimburse Contractor for any anti-dumping or countervailing duties for which Contractor may be liable.

38. EXPORT CONTROLS

38.1 Contractor represents and warrants that it shall comply with (1) all United States export laws and regulations issued by any U.S. government authority, including without limitation the U.S. Export Administration Regulations, the International Traffic in Arms Regulations and any regulations administered by the Department of the Treasury's Office of Foreign Assets Control, that govern the export or re-export of any deliverable, technology or technical data provided hereunder, including software, hardware, equipment, documentation, specifications, Drawings, and schematics (collectively, the "Products") and any of the Services, and (2) any applicable laws and regulations of countries other than the United States that govern the importation, use, export or re-export of Products and/or Services. Contractor further represents and warrants that it shall (1) obtain appropriate export authorizations, consents or licenses that may apply to

Contractor's export or import of any Products or Services, and (2) comply with any conditions that are contained in any export or import licenses pertaining to the Products or Services. Contractor shall comply with any reporting requirements that may apply to the export or re-export of the Products and/or Services and provide to Amtrak and the appropriate governmental authority any periodic reports containing such information as may be required under applicable law.

38.2 Each party will reasonably cooperate with the other in making the appropriate filings with any governmental authority and will, to the fullest extent permitted by law, provide any information, certificates or documents as are reasonably requested.

38.3 In performing Services under this Contract, Contractor warrants and represents that it shall not employ or make use of any non-U.S. person who is a citizen of country that has been designated by the U.S. Government as a "terrorist supporting country" (see Country Group E at Supplement No. 1 to Export Administration Regulations Part 740).

38.4 With the exception of commodities, software or technologies that are controlled solely for "antiterrorism" reasons under the Export Administration Regulations ("EAR"), Contractor represents and warrants that the deliverables shall not contain any export-controlled technology or technical data under the export control laws or regulations unless approved by Amtrak's Contracting Official in writing. At least thirty (30) days prior to the earlier of the delivery, installation or provision of a deliverable containing any controlled technology or technical data, Contractor shall inform Amtrak's Contracting Official in writing of the EAR Export Control Classification Number(s) ("ECCN") or the International Traffic in Arms Regulations ("ITAR") U.S. Munitions List Classification ("MLC") numbers applicable to such deliverable. In addition, upon delivering or otherwise providing a deliverable with an ECCN or MLC number, Contractor shall place the following legend, or substantially similar one, as applicable on technical data and/or deliverable documentation:

"WARNING—INFORMATION SUBJECT TO EXPORT CONTROL LAWS. This document or software contains information subject to the Export Administration Regulations ("EAR") [or the International Traffic in Arms Regulations ("ITAR")]. This information may not be exported, released, or disclosed to foreign persons, whether within or outside the United States without first complying with the export license requirements of EAR [or ITAR]. Include this notice with any reproduced portion of this document. The EAR Export Control Classification Number(s) ("ECCN") [or the ITAR U.S. Munitions List Classification(s)] is/are: _____."

38.5 If the Services under the Contract include the maintenance or servicing of a Product, Contractor shall be responsible for promptly informing Amtrak's Contracting Official of any changes in the

ECCN or MCL status of such Product until expiration or termination of the maintenance or serving period for that Product.

38.6 If Contractor is provided, or provided access to, any technology or technical data by or through Amtrak that is restricted under the export control laws or regulations, Contractor shall fully comply with any and all restrictions imposed by Amtrak at no additional cost.

38.7 Contractor is fully responsible for compliance with the provisions herein on behalf of itself and its employees, agents and contractors and those of its Subcontractors, at any tier level, and their respective employees, agents and contractors.

39. TRANSACTIONS INVOLVING EMPLOYEES OF AMTRAK

39.1 Without giving prior written notice to the Contracting Official, Contractor shall not: (a) employ any employee of Amtrak when Contractor knows or has reason to believe that such person after employment by Contractor, shall also continue to remain in the employ of Amtrak; or (b) utilize as a consultant or otherwise, for compensation, the services of any employee of Amtrak in connection with the performance of the Work under this Contract; or (c) procure any portion of the Work under this Contract, or any materials or Services required in connection with the performance of this Contract, from any firm (excluding corporations whose stock is listed on a recognized stock exchange) which Contractor knows or has reason to believe is owned or controlled by employees of Amtrak or in which employees of Amtrak have a substantial interest.

39.2 Contractor shall furnish the Contracting Official with such further information as the Contracting Official may request concerning any proposed transactions of Contractor set forth above.

40. AMERICANS WITH DISABILITY ACT

The Contractor shall comply with all the applicable requirements of the Americans with Disabilities Act of 1990 and regulations promulgated thereafter, including 49 CFR Parts 27, 37 & 38.

41. CONVENANTS AGAINST CONTINGENT FEES

Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this Contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by Contractor for the purpose of securing business. For breach or violation of this warranty, Amtrak shall have the right to terminate this Contract without liability or in its discretion to deduct from the Contract Amount, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

42. ETHICAL BUSINESS PRACTICES

42.1 Contractor agrees that it shall not give, promise, or offer to any Amtrak employee, agent or

representative any cash, gift, entertainment, commission, or kickback, or anything of value.

42.2 Contractor agrees that it shall neither solicit nor accept any cash, gift, entertainment, commission, kickback or anything of value from a Subcontractor or any other person or entity.

42.3 Contractor agrees that it shall not (1) knowingly employ the services of any Amtrak employee or member of an employee's immediate family as a consultant, Subcontractor, or otherwise, in connection with the performance of Services under the Contract, or (2) purchase any material or Services required to perform the Contract from any entity owned or controlled (including a substantial financial interest) by any Amtrak employee or member of an employee's immediate family.

42.4 Contractor represents and warrants that (i) it has not committed any violations of any applicable anticorruption laws in connection with the Contract; (ii) it is not aware of any violations of any applicable anti-corruption laws in connection with the Contract; (iii) it will not commit any violations of any applicable anti-corruption laws in connection with the Contract; and (iv) it has in place a compliance program reasonably designed to detect and prevent violations of any anti-corruption laws in connection with the Contract; and (v) the Contractor, its parent, and its affiliates are not subject to any deferred prosecution agreements with any U.S. or foreign government authority. For the avoidance of doubt, applicable anticorruption laws include, but are not limited to, the Foreign Corrupt Practices Act.

42.5 Contractor shall certify that it has performed due diligence reasonably calculated to identify anticorruption risk on any subcontractor or any consultants, representatives, or agents retained in connection with this Contract.

42.6 Contractor shall use commercially reasonable efforts to include the provisions of this Article in each subcontract or third-party agreement entered into under this Contract.

43. CONFLICT OF INTEREST

43.1 Contractor hereby affirmatively represents that it shall not have a Conflict of Interest in performing the Services for Amtrak pursuant to this Contract. Contractor agrees not to (a) engage in activities, or (b) initiate or maintain relationships with persons or entities where such activities or relationships create a conflict of interest. Contractor shall use its best efforts to identify and prevent potential Subcontractor conflicts of interest. Contractor shall inform Amtrak of any activity or relationship that Contractor has reason to believe may create a conflict of interest. Without limiting the generality of the foregoing, Contractor shall not, and shall not knowingly permit any Subcontractor to, enter into any contract, subcontract, or other arrangement in excess of fifty thousand Dollars ($50,000) (other than for personal employment) related to this Contract or the Work if any of its officers or directors or any members of the immediate family or one of the foregoing has any material interest in the contract, subcontractor arrangement, unless the other party (or parties) to such contract or subcontractor arrangement is the lowest qualified bidder on a publicly advertised, sealed-bid basis and written records of the entire transaction are

kept by the Contractor and made available to Amtrak and FRA upon request.

43.2 Contractor represents that it is not a party to any existing agreement which would prevent Contractor from entering into and performing this Contract.

44. GRATUITIES

44.1 Amtrak may, by written notice to the Contractor, terminate the right of the Contractor to proceed under this Contract if it is found, after notice and hearing, by Amtrak, that gratuities (in the form of anything of value, including but not limited to cash, entertainment, gifts) were offered or given by the Contractor, or any agent or representative of the Contractor, to any officer or employee of Amtrak with a view toward securing a contract or securing favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performing of such contract, provided, that the existence of the facts upon which Amtrak makes such findings shall be in issue and may be reviewed in any competent court.

44.2 In the event of a breach under Article 44.1, in addition to its right to terminate, Amtrak shall be entitled (i) to pursue the same remedies against the Contractor as it could pursue in the event of a breach of contract by the Contractor, and (ii) as a penalty in addition to any other damages to which it may be entitled by law, to exemplary damages in an amount (as determined by Amtrak) which shall not be less than three or more than ten times the cost incurred by the Contractor in providing any such gratuities to any such office or employee.

44.3 In accordance with Section 53.1 hereof, the rights and remedies of Amtrak provided in this Article shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.

45. OFFICIALS NOT TO BENEFIT

45.1 No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this Contract, or to any benefit that may arise there-from; but this provision shall not be construed to extend to this Contract if made with a corporation for its general benefit.

45.2 The Contractor warrants that no director, officer, employee or agent of Amtrak is a director, officer, employee or agent of the Contractor, and that to the knowledge and belief of the Contractor, no director, officer, employee, or agent of Amtrak owns any stock or has a substantial interest in the Contractor.

46. NON-WAIVER

46.1 No waiver by Amtrak of any breach on the part of Contractor of any of Contractor's obligations herein contained shall constitute a waiver of any subsequent breach of the same or any other of such obligations, and no payment made hereunder shall be deemed to constitute an acceptance or approval of any defective or unsatisfactory material or workmanship, or a waiver of Amtrak's right to reject the same later. As provided in Section 53.1 hereof, the remedies of Amtrak under

this Article are cumulative, and in addition to those provided by law.

47. INSURANCE

47.1 Subject to the provisions of Article 47, and to the extent not required by the Equipment Contract during the term of the TSSSA, Contractor shall procure and maintain, at its own cost and expense, during the entire period of performance under the Contract, the types of insurance specified below. All insurance shall be placed with insurance carriers reasonably acceptable to Amtrak and authorized to do business in the jurisdiction(s) where Work is to be performed. All insurance shall affirmatively include coverage for acts of terrorism. Amtrak shall have the right to review and approve all insurance certificates applicable to the Work. However, Amtrak's acceptance, acquiescence or failure to object to Contractor's submitted insurance certificates shall in no way relieve Contractor from responsibility for obtaining insurance policies complying with the terms of this Contract. Contractor shall furnish Amtrak with a certificate or certificates of insurance giving evidence of the required insurance prior to the issuance of a NTP or commencement of any portion of the Work pursuant to this Contract and upon renewal of any required insurance thereafter. In no event shall Work be performed until the required certificates of insurance have been furnished. If the insurance provided is not in compliance with the requirements listed below, Amtrak shall have the right to stop Work until proper evidence of all required insurance is provided. Contractor shall have no right to an adjustment of the Contract Time or the Contract Amount based on Amtrak's exercise of such right, and any delay in the completion of any portion of the Work caused by Amtrak's exercise of such right to stop Work shall be an unexcused delay. All Subcontractors shall be required to maintain the required insurance for the Contractor or Contractor's insurance shall provide coverage for each Subcontractor working on its behalf for covered claims caused in whole or part by the Subcontractor. Contractor shall provide thirty (30) days prior written notice to Amtrak in the event coverage is changed or the policy is canceled or not renewed. Unless otherwise specifically provided to the contrary, all insurance coverages specified herein shall name Amtrak and the Financing Parties as additional insureds (collectively, "Additional Insured Parties") using ISO CG 20 10 04 13 and CG 20 37 04 13 or their equivalent, and shall provide that Additional Insured Parties are additional insureds with respect to covered "liability caused in whole or in part arising out of" the Work, shall be primary and noncontributory to any other insurance available to Additional Insured Parties and their respective employees and agents, and shall include waivers of subrogation rights against Additional Insured Parties and their respective employees and agents. Except as otherwise expressly provided herein, Contractor's insurance obligations under this Article shall not be construed to limit Amtrak's rights whether in warranty, contract or any other applicable legal theory which may arise under provisions of the Contract or at law or in equity. If an indemnified claim arises involving an Indemnified Party and upon the request of Amtrak, Contractor will provide, or cause to be provided to Amtrak, copies of all insurance policies and endorsements implicated in the Indemnified Claim.

47.2 Workers' Compensation Insurance. A policy complying with the requirements of the statutes of the jurisdictions in which the Work shall be performed, covering all employees of Contractor.

Employers' Liability coverage with limits of liability of not less than $1,000,000 for each accident or illness shall be included. Additional Insured Parties shall not be named as an additional insured under this policy but the policy shall include a waiver of subrogation against the Additional Insured Parties and their respective employees and agents.

47.3 Commercial General Liability Insurance. A policy issued on an occurrence basis to and covering liability arising out of the Work to be performed by Contractor under the terms of the Contract. Products/Completed Operations Liability, Independent Contractors Liability, Contractual Liability (with railroad exclusions deleted), and Personal Injury/ Advertising Liability coverages are to be included. The policy shall contain a cross liability endorsement allowing claims and suits between insureds, shall not have any exclusion for liability relating to railroad operations, and shall not require mediation or arbitration of any disputes. Coverage under this policy shall have combined single limits for bodily injury (including disease or death) and property damage (including loss of use) of not less than $325,000,000 per occurrence and $650,000,000 in the aggregate. Amtrak has the right to require an increase in the insurance limits in the event of an increase in the statutory limit in 49 U.S.C § 28103, and the aggregate limit shall be two times per the occurrence limit.

47.4 Automobile Liability Insurance. A policy issued to and covering the liability of Contractor arising out of the use of all owned, non-owned, hired, rented or leased vehicles which bear, or are required to bear, license plates according to the laws of the jurisdiction in which they are to be operated, and which are not covered under Contractor's Commercial General Liability Insurance. Coverage under this policy shall have combined single limits of liability of not less than $2,000,000 per occurrence and in the annual aggregate.

47.5 Railroad Protective Liability Insurance. Contractor shall procure and maintain Railroad Protective Liability Insurance, written on the AAR-AASHTO (ISO/RIMA) occurrence based form (a claims made form is not acceptable), in the name of Amtrak (National Railroad Passenger Corporation) and other railroads and commuter agencies operating over tracks that are used in design and testing work. The policy shall have limits of liability of not less than $10,000,000 per occurrence and $20,000,000 in the aggregate. If equivalent or broader wording is not contained in the policy form, the following endorsement must be included:

47.5.1 It is agreed that "Physical Damage to Property" means direct and accidental loss of or damage to all property owned by Amtrak and/or all property in the care, custody and control of Amtrak.

47.5.2 In addition, Endorsement CG 28 31 – Pollution Exclusion Amendment, must be included.

47.6 Professional Liability Insurance. A policy issued to and covering the liability of Contractor for engineering and design errors and omissions in the performance of this Contract. Contractor shall maintain such coverage during the term of this Contract and for at least three (3) years following completion and acceptance of the Project. This insurance shall have limits of liability of not less

than $25,000,000 per occurrence and in the annual aggregate. The deductible amount shall not exceed $500,000. The Additional Insured Parties shall not be named as an additional insured under this policy.

If professional liability insurance coverage is written on a claims-made basis: (1) the policy retroactive date shall coincide with or precede Contractor's start of contract services (including subsequent policies purchased as renewals or replacements); (2) the policy will allow for the reporting of circumstances or incidents that might give rise to future claims; (3) Contractor will use its best efforts to maintain similar insurance under the same terms and conditions for at least six years following completion of the Services under the Contract; and (4) if insurance is terminated for any reason, Contractor agrees to purchase an extended reporting provision of at least six years to report claims arising from the Contract.

47.7 Property Insurance. A policy issued to and covering Contractor equipment used in Contract performance under this Contract. The insurance shall provide coverage on an all-risk basis and shall have limits adequate to cover the full replacement value of the Supplies and Contractor's Equipment. This insurance shall name the Additional Insured Parties as loss payees, as their interest may appear, and contain a waiver of subrogation against Additional Insured Parties.

47.8 Valuable Papers and Records Insurance: A policy covering loss or damage to valuable papers including blueprints, reports, surveys, designs or specifications in connection with this Contract, on an all-risk basis, in an amount no less than 100% of the replacement cost of such property. This insurance shall name the Additional Insured Parties as loss payees as their interest may appear and contain a waiver of subrogation against the Additional Insured Parties.

47.9 Technology Errors and Omissions Insurance. When Contractor's Services includes the delivery of information technology services and/or technology products to Amtrak, technology errors and omissions coverage for liability from errors, omissions or negligent acts in rendering or failing to render computer or information technology services and technology products, violation of software copyright, and the failure of products to perform the intended function or serve the intended purpose. The policy shall not contain a provision that would prevent, preclude or exclude liability triggered by or connected to a network failure, system failure or the disclosure of private information and shall have limits of not less than the amount set forth in the Contract per occurrence and in the aggregate, covering the information technology services performed in connection with Services and continuing in force by renewal or extended reporting provision for not less than the greater of three (3) years after final completion of the Services or the greater time under which a claim may be properly asserted under the applicable statute of limitations or repose. The policy shall have limits of insurance of not less than fifty million dollars per occurrence and in the annual aggregate.

47.10 Cyber Liability Insurance. When the Contractor's Services includes access to Amtrak's electronically stored proprietary information and personally identifiable information of Amtrak employees, customers or other third parties, cyber liability insurance for loss, disclosure and theft of data in any form, system failure, and network security failure, including but not limited

to, social engineering, phishing, ransomware, denial of service attacks, and transmission of malicious code. Coverage shall include regulatory fines and penalties, the cost of notifying individuals of a security or data breach, the cost of credit monitoring services and any other causally-related crisis management expense for up to one (1) year, shall contain no provision that would prevent, preclude or exclude a claim triggered by or connected with an act of cyber terrorism, shall extend to actual or alleged acts, errors or omissions committed by the Contractor or its agents, subcontractors, independent contractors or employees, shall contain severability for the insured organization for any intentional act exclusions, shall include consequential or vicarious liabilities and direct losses for the wrongful acts or failures of the Contractor, and shall have the "Insured v. Insured" exclusion amended to allow an Indemnified Party to bring a claim against the Named Insured. The policy shall have limits of not less than the amount set forth in the Contract per occurrence and in the aggregate, covering the information technology services performed in connection with Services and continuing in force by renewal or extended reporting provision for not less than the greater of three (3) years after final completion of the work or the greater time under which a claim may be properly asserted under the applicable statute of limitations or repose. The policy shall have limits of insurance of not less than fifty million dollars per occurrence and in the annual aggregate.

48. RESERVED.

49. PROTECTION OF PERSONS AND PROPERTY

49.1 Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work.

49.2 Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

a). All employees involved in the Work and all other persons who may be affected thereby;

b). All the Work and all materials and equipment to be incorporated therein, whether in storage on or off the site or under the care or custody of Subcontractors; and

c). Other property at the Work site(s) or adjacent thereto, including but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

49.3 Contractor shall comply with all applicable laws, ordinances, rules, regulations, and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. Contractor shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety rules and notifying owners and users of adjacent utilities.

49.4 Use or storage of explosive or other hazardous material shall not be permitted without the written approval of the Contracting Official. If use or storage of such materials is approved, Contractor shall exercise the utmost care in such use or storage and shall carry on such activities under the supervision of properly qualified personnel.

49.5 All damage or loss to any property referred to in this Article caused in whole or in part by Contractor, its Subcontractors, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable shall be remedied by Contractor.

49.6 Contractor shall designate a responsible member of his organization at the site(s) whose duty shall be the prevention of accidents. This person shall be Contractor's superintendent unless otherwise designated in writing by Contractor to the COTR.

49.7 Contractor shall not load or permit any part of the Work to be loaded so as to endanger personnel and/or property.

49.8 When working in and around Amtrak property, all personnel employed by Contractor or its Subcontractors shall abide by the applicable safety policies and procedures for the respective property.

49.9 Contractor shall notify Amtrak to arrange for permission to enter upon Amtrak and railroad property. Twenty-one (21) days prior notice must be given to Amtrak for property access when Amtrak protection personnel are required. Prior to entering Amtrak's property, Contractor and its Subcontractors may be required to execute Amtrak's then current Permit to Enter.

49.10 Contractor, his employees and Subcontractors shall attend all required safety seminars as directed by Amtrak.

49.11 Contractor must comply with all Amtrak safety rules and operating rules.

50. GOVERNING LAW

The Contract shall be governed by and construed in accordance with the laws of the District of Columbia, excluding that portion of District of Columbia law relating to the application of laws of another jurisdiction. Subject to the Claims and Disputes section hereof, each party agrees that all legal proceedings in connection with any dispute arising under or relating to the Contract shall be brought in the United States District Court for the District of Columbia. Contractor hereby accepts the jurisdiction of the United States District Court for the District of Columbia and agrees to accept service of process as if it were personally served within the District of Columbia. In accordance with Section 53.2, this Article shall survive the termination or expiration of the Contract.

51. COMPLIANCE WITH LAW

51.1 All Work shall comply with all Applicable Laws that bear on the performance of the Work (including without limitation all building codes, zoning and other Laws that bear, or would bear but for any exemption from such Laws enjoyed by Amtrak, on the Work), except as otherwise expressly specified in the Contract or directed by the Contracting Official. If Contractor observes that any of the Contract terms are at variance therewith in any respect, he shall promptly notify the COTR in writing, and any necessary changes shall be made by appropriate Contract Modification, provided that no Contract Modification shall extend the Contract Time or increase the Contract Amount if it is based on a law enacted at the time of Contract execution. Contractor shall be deemed to have had notice of all laws enacted at the time of Contract execution, regardless if the effective date is after Contract execution. Contractor shall be deemed to have included in the Contract Amount the cost of making all Work comply with all laws enacted at the time of Contract execution.

51.2 In the event any governmental requirements are removed, relaxed or changed in any way after the execution of the Contract so as to make Contractor's performance less expensive or less difficult, Amtrak shall have the option to either require Contractor to perform pursuant to the more rigorous requirements, or to receive a reduction in the cost of the items of material or equipment affected for all savings by reason of such change.

52. WRITTEN NOTICE

Any written notice required of the parties under the provisions of the Contract shall be deemed to have been duly served upon receipt if delivered in person to the individual or representative or officer of the relevant party for whom it was intended, or upon mailing if sent by registered or certified mail to the business address designated in the Contract.

53. RIGHTS AND REMEDIES

53.1 Each of Amtrak's rights and remedies hereunder shall be cumulative, in addition to, and not a limitation of, any duties, obligations, rights and/or remedies provided at law, in equity, or otherwise. Amtrak's failure to exercise any of its rights under the Contract shall not constitute a waiver of any past, present or future right or remedy. No action or failure to act by Amtrak or any of its representative(s), including the Contracting Official, shall constitute approval of, waiver of, or acquiescence to, a breach by Contractor unless specifically agreed in writing. Waiver by Amtrak of any breach by Contractor shall not constitute a waiver of any other breach of the same or any other provision of the Contract. Acceptance of any Supplies of Services, or payment therefore, shall not operate as a waiver of any breach.

53.2 All representations, warranties, guarantees, licenses, indemnifications, agreements to hold Amtrak harmless, and other obligations created by the Contract which by their terms are intended to be fulfilled in whole or in part after termination or completion of the Work or which can, under the particular circumstances at issue, reasonably be fulfilled only after termination or completion of the Work, shall survive termination or expiration of the Contract. Contractor shall cause a parallel survival clause to be inserted in all subcontracts.

54. AMTRAK/CONTRACTOR RELATIONSHIP

54.1 The Contracting parties are not employer and employee, and nothing herein shall be construed as creating such relationship between Amtrak and Contractor. Contractor may adopt such arrangements as it may desire, subject to the provisions of the Contract, with regard to the details of the Work and Contractor's personnel or workers, provided however, that the Work shall be done by Contractor in such manner as shall be consistent with the achievement of the result contracted for within the time herein agreed upon.

54.2 It is further understood and agreed that, in no event shall Amtrak be required to make deductions from compensation or report earnings of employees of Contractor under any Social Security Act, or any other state or Federal statute, purporting to levy a tax on payrolls or the compensation of employees; and Contractor hereby agrees to indemnify and save Amtrak harmless from any and all liability, cost, or expense under such law, growing out of performance under the Contract.

55. PRODUCT SAFETY NOTIFICATIONS

55.1 Contractor shall comply with the Occupational Safety and Health Administration's Hazard Communication Regulations 29 CFR 1910.1200 and 29 CFR 1926.59 by providing or making readily available at the worksite, material safety data sheets for all chemicals, compressed gases, products containing hazardous materials, and products that may release hazardous substances (welding rods, solder, insulation materials, transite panels, gaskets, stock metal, etc.) during routine application.

55.2 Contractor shall notify Amtrak immediately by telephone (followed by written confirmation within twenty-four hours) (facsimile acceptable) whenever Contractor becomes aware that any component of the Supplies may contain a defect in design or construction which could in any way (a) become harmful to persons or property, or (b) create or present a risk to the health or safety of the public or to the environment, either by itself or when used by Amtrak within the scope of its intended purpose.

56. LABOR DISPUTES

Whenever an actual or potential labor dispute delays or threatens to delay the timely performance of the Contract, Contractor shall notify Amtrak immediately and furnish all relevant information. Contractor shall include the substance of this provision in all subcontracts hereunder.

57. PARENT GUARANTY

57.1 If Contractor is a subsidiary of another entity, then Amtrak's obligations under the Contract shall be contingent upon Amtrak's receipt of a satisfactory Parent Guaranty executed by the ultimate parent entity of Contractor or a related entity acceptable to Amtrak guarantying payment and performance of Contractor's obligations and liabilities under this Contract. In the event the

ultimate parent entity of Contractor is changed, the new ultimate parent entity or a related entity acceptable to Amtrak shall become the Guarantor, and the existing Parent Guaranty shall be substituted with a Parent Guaranty provided by the new ultimate parent entity of Contractor , a related entity or a replacement guaranty acceptable to Amtrak.

57.2 If Guarantor is incorporated or organized in a jurisdiction outside the United States of America, the Parent Guaranty delivered to Contractor shall be accompanied by an opinion addressed to Amtrak from counsel acceptable to Amtrak who are authorized to practice law in the Guarantor's jurisdiction, to the effect that the Parent Guaranty has been duly authorized, executed and delivered, is within the corporate power and authority of the Guarantor, requires no permits, filings, payments, consents or authorizations from any governmental authority or private party for its execution and delivery which have not been obtained by Contractor and/or Guarantor, complies with Applicable Laws, is legal, valid, binding, and a judgment or arbitration award properly obtained in the United States against Guarantor on the Parent Guaranty will be recognized and enforceable in the jurisdiction of the Guarantor without a de novo hearing on the merits of the judgment obtained.

57.3 Contractor shall provide to Amtrak a copy of the Guarantor's most recent annual audited financial statements prior to Amtrak's issuance of a NTP and also within one hundred twenty (120) days after the end of each of the Guarantor's fiscal years thereafter until three years after Amtrak's issuance of a Certificate of Final Fleet Acceptance. Any non-public financial statements submitted to Amtrak shall be treated as Amtrak treats its own confidential information if marked as such. The year-end financial statements of Guarantor shall be prepared in accordance with US Generally Accepted Accounting Principles or other similar accounting principles. If Guarantor restructures or divests itself of assets causing a substantial reduction in its net worth, it shall provide Amtrak written notice thirty (30) days prior to the public announcement of any restructuring, unless Guarantor's notification to Amtrak would violate financial securities laws or regulations then in place, in which case such notification shall not be required. In that event, or in response to publicly disclosed or privately provided financial information regarding Guarantor, Amtrak may by written notice to Contractor require a meeting with senior officials of Contractor to discuss Guarantor's financial situation and what assurances Amtrak has of the Guarantor's ability to honor the Parent Guaranty and other obligations including the Contractor's ability to complete the Work and delivery of the Supplies under the terms of this Contract. If Amtrak is or remains insecure about Guarantor's financial condition or Contractor's ability to complete the Contract in accordance with its terms, Amtrak may by further written notice to Contractor, require Contractor to transfer title to Amtrak (but not risk of loss) to all present Equipment and Supplies in process notwithstanding their state of completion or that they remain in the possession of Contractor. Upon Amtrak's written notice given under the prior sentence, title to all Equipment and Supplies in process of Contractor relating to this Contract for which Amtrak has been invoiced and such invoices have been paid as required by this Contract, shall automatically be deemed to have transferred to Amtrak at the time of such notice.

57.4 The Parent Guaranty may be enforced by either Amtrak or a Financing Party, provided that the enforcement of the Parent Guaranty by any such Financing Party shall only be permitted for Contractor defaults and damages and amounts owed by Contractor to Amtrak under this Contract, and not for defaults by Amtrak under any of its funding agreements or otherwise outside of the scope of this Contract. In the event that Amtrak transfers the Contract, the obligations of the Guarantor pursuant to the Parent Guaranty shall not exceed Contractor's unsatisfied obligations under the Contract.

57.5 If at any time the Credit Rating of Guarantor falls below "BBB" by Standard & Poor's or "BBB" by Moody's or Guarantor is placed on credit watch for a possible downgrade below such levels, Contractor shall provide to Amtrak a replacement Letter of Credit within five (5) days of such occurrence. "Credit Rating" means the long-term corporate credit rating or the senior unsecured and uncredit-enhanced debt rating of such Person.

58. SEGREGATION OF EQUIPMENT AND SUPPLIES

Following receipt of payment by Contractor for Equipment and Supplies as required by this Contract for which Amtrak has been invoiced and that have been manufactured and allocated to this Contract but have not been delivered to Amtrak, Contractor shall use its commercially reasonable efforts, using its existing information technology systems to segregate such Equipment and Supplies from its other inventory and designate Amtrak as the sole beneficiary of such Equipment and Supplies.

59. CREDIT CARD INFORMATION

59.1 If in performance of this Contract, Contractor will store, process, transmit, or have access to payment account data belonging to Amtrak or entrusted to Amtrak by its business partners, customers, vendors, contractors or employees, Contractor shall (1) comply with the Payment Card Industry's Data Security Standard ("PCI-DSS"), as set forth at https://www.pcisecuritystandards.org/ and as may be updated from time to time by the PCI Security Standards Council, and (2) within thirty (30) days of each anniversary of this Contract, certify in writing (to Amtrak's Contracting Official) Contractor's compliance with PCI-DSS in all aspects of Contractor's performance of this Contract or, alternatively, the basis for Contractor's exemption from PCI-DSS compliance.

59.2 If any software, Supplies, goods, or equipment (collectively "Goods") provided by Contractor pursuant to this Contract will store, process, transmit, or otherwise have access to credit card account numbers received from Amtrak or Amtrak's customers, such Goods shall comply with the Payment Card Industry's Payment Application - Data Security Standard ("PA-DSS"), as set forth at https://www.pcisecuritystandards.org/ and as may be updated from time to time by the PCI Security Standards Council.

59.3 Contractor acknowledges that it is responsible for compliance with PCI-DSS and PA-DSS, as applicable to Contractor's performance of this Contract.

60. SEPARATE CONTRACTS

60.1 If appropriate, Contractor shall afford other Amtrak Contractors reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work, and shall properly connect and coordinate its Work with theirs.

60.2 If any part of Contractor's Work is dependent in any way on the work of any other separate contractor, Contractor shall take all reasonable steps to become aware of any defects in the work of such other contractors that renders or would render such work unsuitable for proper execution of Contractor's Work. Contractor shall inspect the critical items of any such contractor's work before relying on or incorporating such work into Contractor's Work. If Contractor reasonably believes that another contractor's work is deficient or otherwise unsuitable for its intended purpose, Contractor shall notify Amtrak, in writing, immediately upon such discovery. Contractor shall waive his right to any claims regarding the unsuitability of such other contractor's work if Contractor fails to timely notify Amtrak of any defects in such other contractor's work that Contractor discovered or reasonably should have discovered.

60.3 Should Contractor or any Subcontractor cause damage to the work or property of any separate Amtrak contractor, Contractor shall, upon due notice, make all reasonable efforts to settle with such other contractor(s). If such separate contractor(s) sues Amtrak or initiates an arbitration proceeding on account of any damage alleged to have been so sustained, Amtrak shall notify Contractor, who shall defend such proceedings at its expense, and if any judgment or award against Amtrak arises there-from, Contractor shall pay or satisfy it and shall reimburse Amtrak for all attorneys' fees and court or arbitration costs which Amtrak incurred.

61. COMMENCEMENT OF STATUTORY LIMITATION PERIOD

Claims by Contractor shall not be brought after the earliest of (a) final payment under the Contract; (b) one year after the date of final completion of the project; or (c) one year after the date of Contractor's last substantial Work.

62. CYBERSECURITY

62.1 Contractor shall follow the National Institute of Technology (NIST) Cybersecurity Framework (CSF) to maintain and enforce digital data protection, safety and physical security procedures with respect to the access, use, and possession of Amtrak's Confidential Information and Amtrak data, when providing supplies or services to Amtrak that are (a) at least equal to industry standards and in compliance with all applicable laws; and (b) which provide reasonably appropriate technical and organizational safeguards to protect Amtrak against the accidental or unlawful destruction, loss, alteration or unauthorized disclosure or access of such information, data or systems. Contractor shall take all reasonable measures to secure and defend its location and equipment against hackers and others who may seek, without authorization, to modify or access Contractor's systems, Amtrak's systems or the information or data found therein and shall immediately report to Amtrak any breaches of security or unauthorized access to Amtrak's

Confidential Information or Amtrak data. Contractor shall use diligent efforts to remedy breaches in a timely manner and deliver to Amtrak a root cause assessment and future incident mitigation plan with regard to any breach of security.

62.2 If Contractor is providing services to develop and operate Amtrak company websites on Contractor's IT infrastructure, Contractor agrees to engage a third-party vendor at least annually, at its own expense, and acceptable to Amtrak, to perform penetration testing and vulnerability scans with respect to Contractor's systems. Contractor shall use leading industry practices to perform penetration tests to probe for network and infrastructure weaknesses that could be exploited. Contractor shall provide Amtrak with a written report of any high and medium level security issues, as defined by NIST Common Vulnerability Scoring System (CVSS), revealed during regular testing and how and when these vulnerabilities will be mitigated.

62.3 Contractor shall comply with the AMTRAK CYBERSECURITY AND PRIVACY TERMS AND CONDITIONS – STANDARD SHORT FORM attached hereto as Attachment 1.

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ATTACHMENT 1

AMTRAK CYBERSECURITY AND PRIVACY TERMS AND CONDITIONS – STANDARD SHORT FORM

1. GENERAL PURPOSE & APPLICABILITY

1.1. General Purpose: Contractors deliver supplies and/or services that may access, create, use, process, transfer, share and/or store Amtrak Data or connect to the Amtrak Infrastructure. These Cybersecurity and Privacy Terms and Conditions (collectively "Attachment") are cybersecurity standards that apply to all Contractors who provide supplies and/or services to Amtrak.

1.2. Compliance: Contractors must comply with all applicable laws, regulations, statutes, industry standards, and compliance framework requirements including, but not limited to: the Payment Card Industry Data Security Standards (PCI-DSS), Health Insurance Portability and Accountability Act (HIPAA), Health Information Technology for Economic and Clinical Health (HITECH) Act, Sarbanes-Oxley Act (SOX), Gramm-Leach-Bliley Act (GLBA), General Data Protection Regulation (GDPR), California Consumer Privacy Act (CCPA), California Privacy Rights Act (CPRA), Colorado Privacy Act (CPA), Connecticut Data Privacy Act (CDPA), Virginia Consumer Data Protection Act (VCDPA), Utah Consumer Privacy Act (UCPA), Illinois Biometric Information Privacy Act (BIPA), ISO/IEC 27001, ISO/IEC 27002, ISO/IEC 27701, ISO/IEC 27032, ISO/IEC 27017, ISO/IEC 27018, NIST SP 800-53, Rev. 5 and other applicable NIST SP 800 series publications, the National Institute of Technology (NIST) Cybersecurity Framework (CSF), and any U.S. State privacy laws to the extent applicable, including as enacted or amended during the term of the Agreement. Contractor shall also comply with any and all laws, regulations, and other compliance requirements and industry standards regarding data protection, data privacy, data security, data integrity, business continuity, incident response, and similar matters applicable to entities designated as "critical infrastructure" including as enacted or amended during the term of the Agreement.

2. CYBERSECURITY & PRIVACY GOVERNANCE

2.1. Cybersecurity Governance: The Contractor must follow industry best practices and maintain a cybersecurity program (the Program) that implements, maintains, improves, and enforces reasonable and appropriate policies, procedures, and controls for the governance, assessment, risk management, workforce management, access control, physical security, continuous monitoring, incident response, and digital data protection in relation to the access, use, and possession of Amtrak Data, including Amtrak Confidential Information and Amtrak Employee Information.

2.2. Cybersecurity Framework Alignment: The Program must provide appropriate organizational, technical, administrative, and physical safeguards that align with the NIST CSF through

controls derived from applicable compliance frameworks such as NIST SP 800-53, Rev. 5 and ISO/IEC 27001. Program controls shall and meet or exceed any other applicable industry standards to protect Amtrak, Amtrak Employees, Amtrak Customers, Amtrak Data, and Amtrak Infrastructure against Security Incidents. The Contractor shall test and monitor the effectiveness of its safeguards. The Contractor shall conduct a risk assessment and review and update the Program at least annually.

2.3. Cybersecurity Awareness Training: Contractor must require and verify that its employees, contractors, consultants, and other downstream third-party staff complete cybersecurity awareness training, privacy awareness training, and any applicable role-based training associated with the collection, processing, or handling of Amtrak Data, no less than once per year. Upon request, Contractor shall provide Amtrak with proof of certification and/or attendance for such annual training activities.

3. AUDITS AND ASSESSMENTS

3.1. Audit Rights and Testing: Notwithstanding anything contrary in the Agreement and with no limitation to audit rights of Amtrak OIG, specifically with regards to security-related audits, the audit terms set forth in this Attachment shall apply.

3.1.1. Contractor agrees that Amtrak or its third-party designee may, but is not obligated to, perform audits and security tests of Contractor's information technology (IT) or systems environment and procedural controls to determine Contractor's compliance with the system, network, data, data privacy, and cybersecurity requirements of this Attachment. Audits and security tests shall be limited to areas relevant to Contractor's contractual engagement with Amtrak. Amtrak audits of the Contractor system shall be initiated during normal business hours and with at least 20 days advance notice or in the event of any Security Incident, not less than five (5) business days after the resolution of such Security Incident. Audit shall be performed under standards established by a recognized standards organization.

3.1.2. Contractor shall provide all information reasonably requested by Amtrak in connection with any audits and shall provide reasonable access and assistance to Amtrak upon request. Contractor shall comply, within reasonable timeframes at its own cost and expense, with all reasonable compliance remediation recommendations that result from such inspections, tests, and audits. Amtrak reserves the right to review, upon request, any original security reports that Contractor has undertaken or commissioned to assess Contractor's own network security for the provided Services. If requested, copies of these reports will be sent via bonded courier to the Amtrak security contact. Contractor will notify Amtrak of any such security reports or similar assessments once they have been completed.

3.1.3. If requested by Amtrak, Contractor shall, on an annual basis: 1) permit security reviews by Amtrak on systems storing or processing Amtrak Data including without limitation the

Program; and 2) permit testing of all security processes and procedures during the Term of the Agreement, including without limitation penetration tests. Tests may include coordinated security tests as mutually agreed upon as well as interviews of relevant personnel, review of documentation, and technical inspection of systems and networks relating to the receipt, maintenance, use, retention, and authorized destruction of Amtrak Data.

3.2. Audit Certifications and Compliance Reports: Contractor shall provide the required compliance reports or audit certifications as applicable, on an annual basis, and at its own cost and expense, to enable Amtrak to fulfill its annual audit and compliance requirements. The delivery of the following reports referenced in this Section shall not fulfill, replace, or negate any of the rights or obligations detailed in Section 3.1 Audit Rights and Testing, Section 3.3 Right to Inspection, or Section 3.4 Regulatory Examinations of this Attachment:

3.2.1. Current year SOC 2 Type 2 report.

3.2.2. Current year ISO/IEC 27XXX audit report(s).

3.2.3. PCI DSS reports on compliance as applicable.

3.2.4. Cloud Security Alliance (CSA) Consensus Assessments Initiative Questionnaire (CAIQ) registry reports for Software as a Service (SaaS) products and/or applications as applicable.

3.2.5. Contractors utilizing the AWS hosting platform to provide services to Amtrak must comply with AWS Foundational Security Best Practices standard as well as CIS AWS Foundations v1.4.0 security standard, or most recent version, and/or any upgrades released by the CIS AWS Foundations Benchmark.

Contractors utilizing the Microsoft Azure hosting platform to provide services to Amtrak must comply with Microsoft Azure Foundational Security Best Practices standard as well as CIS Microsoft Azure Foundations Benchmark v1.4.0 Controls, or most recent version, and/or any upgrades released by the CIS Microsoft Azure Foundations Benchmark Security Standard.

3.3. Right to Inspection: Upon request, Contractor shall provide to Amtrak the opportunity to review copies of the Contractor's policies, procedures, controls catalog, and independent audit report summaries for the implementation of required technical, physical, and administrative safeguards or controls derived from applicable cybersecurity frameworks relating to, and without limitation, the Program (e.g. ISO/IEC 27001, ISO/IEC 27002, ISO/IEC 27701, ISO/IEC 27032, ISO/IEC 27017, ISO/IEC 27018, NIST CSF, NIST SP 800-53, Rev. 5, SOC 2 Type 2).

3.4. Regulatory Examinations: Contractor agrees that any regulator or other governmental entity with jurisdiction over Amtrak and its affiliates may examine Contractor's activities relating to

the performance of its obligations under the Agreement and this Attachment to the extent that such authority is granted to such entities under the law. Contractor shall promptly cooperate with and provide all information reasonably requested by the regulator or other governmental entity in connection with any such examination and provide reasonable assistance and access to all equipment, records, networks, and systems reasonably requested by the regulator or other governmental entity. Contractor agrees to comply with all reasonable recommendations that result from such regulatory examinations within reasonable timeframes.

3.4.1. Within sixty (60) days of the audit results from the regulator or governmental entity, Contractor will provide Amtrak with a mitigation plan to address any risks, threats, concerns, or areas of non-compliance identified in the audit.

4. INFORMATION GOVERNANCE

4.1. Data Management: Contractor may collect, access, use, and otherwise process Amtrak Data solely as necessary to provide Services to or on behalf of Amtrak and in compliance with all applicable privacy and data protection laws, the Agreement, and any notices or disclosures regarding Personal Information made available by or on behalf of Amtrak ("Privacy Requirements"). Unless prior written consent is provided by Amtrak, Contractor: (1) shall not access or use Amtrak Data for any purpose other than to provide the Services, and (2) shall not give any third-party access to the data, except subcontractors subject to data protection and confidentiality requirements no less strict than those imposed on Contractor under this Attachment, or where otherwise required by law or regulation.

4.2. Confidentiality: Contractor agrees to maintain Amtrak Confidential Information in all forms (including paper and electronic) in strictest confidence, using measures no less stringent than those that Contractor uses for its own most confidential or sensitive information. Contractor shall take all reasonable measures to secure and defend its location and equipment against external and internal threat actors and those who may seek, without authorization, to modify or access Contractor's systems, Amtrak's systems, Amtrak Data, or the Confidential Information found therein. Contractor shall require its employees, contractors, consultants, and other downstream third-party staff to enter into written obligations of confidentiality and protection with respect to Amtrak Data no less protective than those contained in the Agreement and this Attachment.

4.3. Obligations Regarding Personal Information: Other than as strictly necessary for the performance of the Services, Contractor will not collect, store, or use the Personal Information of Amtrak, Amtrak Customers, or Amtrak Employees through the performance of the Services. Contractor will identify, monitor, protect, and maintain the Personal Information of Amtrak, Amtrak Customers, and Amtrak Employees in accordance with all laws, regulations, and legal requirements applicable for the collection, access, use, processing, sharing, storage, and deletion of Personal Information, shall not "sell" such Personal Information (as such term is defined by applicable privacy laws), and shall not retain, use, or disclose such Personal Information for any purpose other than as expressly set forth in the Agreement and this Attachment. Contractor shall

notify Amtrak in the event Contractor determines that it can no longer comply with applicable Privacy Requirements. Contractor shall provide Amtrak with assistance and cooperation in responding to requests from or on behalf of individuals to exercise legal rights regarding Personal Information and in connection with conducting any privacy impact assessments or similar assessments regarding Personal Information.

4.4. Data Aggregation and Anonymization: In the event that Contractor inadvertently collects any Personal Information through or as a result of Amtrak's, Amtrak Employees', or Amtrak Customers' usage of the Services, including without limitation Internet Protocol Addresses, Contractor must sanitize the data through Anonymization or Aggregation unless retention of Personal Information in an identifiable format is strictly necessary for the performance of the Services, for compliance with applicable law, or for compliance with the Agreement and this Attachment.

4.4.1. For the purposes of this Attachment, "Anonymization" refers to removal of Personal Information and any information reasonably likely to identify an individual person or household; provided such revised data does not include and is not subject to any key, code, or other mechanism that could be used to re-identify such information, and "Aggregation" refers to information that relates to a group or category of persons, households, or entities from which identifying information has been removed, that is not linked or reasonably linkable to any individual person, household, or entity, such as via a device; provided such revised data does not include and is not subject to any key, code, or other mechanism that could be used to re-identify such information..

4.4.2. Without limiting the generality of the requirements for Anonymized or Aggregated data, Contractor shall:

4.4.2.1. Implement technical safeguards that prohibit reversal of Anonymization or Aggregation of Personal Information collected through the Services;

4.4.2.2. Implement business processes that specifically prohibit such a reversal or recreation;

4.4.2.3. Make no attempt to achieve such reversal; and

4.4.2.4. Implement reasonable business processes to prevent inadvertent release of Anonymized or Aggregated Personal Information.

4.5. Machine Learning and Artificial Intelligence: Contractor shall not process or otherwise in any way use Amtrak Data for purposes of training, creating, or otherwise modifying any machine learning, large language model, artificial intelligence, or similar systems that learn and adapt without following explicit instructions through the use of algorithms and statistical models to analyze and draw inferences from patterns in data ("Machine Learning") without Amtrak's prior written authorization in each instance. If Contractor becomes aware of any use of Amtrak Data

in violation of the foregoing restriction, Contractor shall promptly notify Amtrak and take steps in cooperation with Amtrak to remediate and/or mitigate such unauthorized use. In addition, Contractor shall not use Machine Learning for the purpose of generating or developing software, computer code, or other materials used in or provided to Amtrak as part of the products or services supplied hereunder without Amtrak's prior written authorization in each instance.

5. INFORMATION MANAGEMENT & PROTECTION

5.1. Asset Management: Contractor must maintain an asset inventory and classification to manage essential information about hardware, software, data flows, interfaces, and data disclosures (e.g., unique identifiers, version numbers, data recipients, physical locations). Contractor must implement asset management controls for any assets that may be used to access Amtrak Data, Amtrak Infrastructure or Amtrak Resources. Contractor shall follow the required security standards and safeguards referenced in this Attachment for the utilization of all hardware and software in the performance of services to Amtrak under the Agreement.

5.2. Access Control: Contractor must restrict access to Amtrak Data and all systems that access, process, or store Amtrak Data through the utilization of a provisioning process that meets or exceeds the standards provided in the NIST CSF, NIST SP 800-53, Rev. 5, and other applicable NIST SP 800-series publications. Access to Amtrak Data must be restricted to only authorized individuals with an express need-to-know for the performance of the Services. Contractor must ensure that only authorized individuals are permitted access to business applications, systems, networks, and computing devices containing or processing Amtrak Data using, without limitation, secured channels via Contractor authorized virtual private network (VPN), jump boxes, secure shell (SSH), multi factor authentication (MFA), or other secure mechanisms.

5.2.1. Contractor personnel access shall be consistent with, and in no case exceed the scope of, any such authorization granted by Amtrak. All Amtrak-authorized connectivity or attempted connectivity to Amtrak's systems or networks shall be in conformity with Amtrak's security policies as may be amended from time to time with notice to the Contractor.

5.2.2. Contractor will review and verify the continued need for Contractor personnel access and level of access to Amtrak Data, systems, networks, and property on a quarterly basis and will retain evidence of the reviews for two (2) years from the date of each review. Contractor shall provide a certification of such review to Amtrak upon request.

5.3. Passwords: Contractor must ensure that its password policies and procedures are compliant with NIST SP 800-63 Digital Identity Guidelines and NIST SP 800-53, Rev. 5 guidance on password creation and authentication. These password policies and procedures must follow NIST best practices in configuration and management, including length and structure. All passwords must remain confidential and must not be shared between the Contractor, its employees, contractors and downstream third-party users.

5.4. Multi-factor Authentication (MFA): Contractor must ensure that multi-factor authentication is implemented for accounts with access to Amtrak Data, Amtrak Infrastructure, and other systems, networks, applications, and computing devices based on the NIST best practices and guidelines found in NIST SP 800-63 and NIST SP 800-53, Rev.5. Contractor must work with Amtrak to implement single sign-on (SSO) solution for MFA accounts as needed for Amtrak employee access to the Services.

5.5. Physical Location of Data: Contractor must notify Amtrak, in writing, thirty (30) days prior to relocating any physical storage location of Amtrak Data to a location or country that is different from the one(s) documented in the Contractor's statement of work, contract, or any Data Processing Addendum entered into between Amtrak and Contractor, so that any potential privacy or security implications can be addressed.

5.6. Virtualization & Cloud Solutions: If Contractor utilizes a cloud solution, then Contractor must adhere to the same security principles required by the terms in this Attachment, the Cloud Security Alliance Guidance, and applicable government regulations, laws, or directives as used throughout the Contractor's enterprise. The geographic location of the Contractor's infrastructure resources must be identified in writing to Amtrak prior to transferring out Amtrak Data to such resources. Contractor is required to receive prior approval from Amtrak, who has sole control over the data location in any cloud services, and shall cooperate with Amtrak to ensure compliance with local laws that restrict cross-border flow of data.

5.7. Physical Protection: Contractor must actively manage physical security controls and ensure that all buildings throughout the Contractor's enterprise that house critical IT functions (e.g., data centers, network facilities, and key user areas) and store, process or transmit Amtrak Data or any other service-related Amtrak information, or connect to Amtrak Infrastructure, are physically protected from unauthorized access. These physical security controls should follow security best practices and requirements (e.g., ISO/IEC 27002 and NIST SP 800-53, Rev. 5). Contractor must maintain and record facility access logs with access restricted to only those personnel with a business need-to-know. Contractor must review and update these access logs regularly but no less than quarterly.

5.8. Data Encryption: Contractor shall provide industry standard FIPS 140-2 encryption of Amtrak Data and Confidential Information in transit over public or leased circuits. Contractor shall also provide industry standard FIPS 140-2 encryption of Amtrak Data and Confidential Information at rest on local laptops, mobile devices, shared drives, information repositories, and backend data stores. In the event FIPS 140-2 standards regarding encryption are updated or replaced, Contractor shall use encryption that meets or exceeds such updated or replaced standards.

5.8.1. Contractor shall implement and maintain logical data segregation that meets or exceeds industry standards to ensure Amtrak Data is not viewable by unauthorized users.

5.9. Secure Destruction: Upon completion of the delivery of the products and services to be provided under the Agreement, or at any time upon Amtrak's request, Contractor shall return to Amtrak

or destroy all Amtrak Data as provided herein. Contractor shall return to Amtrak all hardware and removable media provided by Amtrak containing Amtrak Data. Amtrak Data in such returned hardware and removable media shall not be removed or altered in any way. The hardware must be physically sealed and returned via a bonded courier or as otherwise directed by Amtrak. If any hardware or removable media containing Amtrak Data is owned by Contractor or a third-party, then the Contractor shall securely destroy such data or return it to Amtrak via hardware or removable media as requested by Amtrak. Contractor shall provide to Amtrak a notarized certification of destruction detailing the destruction method used and the data sets involved, the date of destruction, and the entity or individual who performed the destruction. Contractor's destruction or erasure of Amtrak Data pursuant to this Section shall be in compliance with industry standard practices (e.g., Department of Defense Media Sanitization and Data Wipe Standard, NIST SP 800-88).

6. CYBERSECURITY INCIDENT RESPONSE AND MANAGEMENT

6.1. Incident Management: Contractor must document all Security Incidents and maintain a documented cybersecurity event management process that covers incident response, escalation, and remediation of Security Incidents. All such documentation must be retained for a minimum of five (5) years following the conclusion of any Security Incident, unless otherwise required by applicable law.

6.2. Reporting Incidents: Contractor shall immediately but no later than 24 hours after discovery, provide a written notice to Amtrak of any Security Incident.

6.2.1. The written notice shall include the date and time of the Security Incident's occurrence (or the approximate date and time of the occurrence if the actual date and time of the occurrence is not precisely known) and a detailed summary of the facts and circumstances of the Security Incident, including a description of:

6.2.1.1. The date of the Security Incident's discovery and the circumstances surrounding such discovery;

6.2.1.2. Why the Security Incident occurred (e.g., a description of the reason for the system failure);

6.2.1.3. The amount and type(s) of Amtrak Data known or reasonably believed to have been Disclosed;

6.2.1.4. The systems and/or applications likely impacted;

6.2.1.5. The categories and approximate number of data subjects affected, and their country of residence and the categories and approximate number of records affected; and

6.2.1.6. The measures being taken or proposed to be taken by Contractor to address and remedy the Security Incident's occurrence to prevent the same or a similar event from occurring in the future.

6.2.2. Amtrak may impose additional notification requirements for Security Incidents that compromise Amtrak's Data based on applicable state breach notification laws or requirements under applicable domestic and/or international privacy laws.

6.2.3. Contractor shall provide written updates for the Security Incident to Amtrak addressing any new facts and circumstances learned after the initial written notice is provided and shall promptly, but no later than seventy-two (72) hours, provide such updates after learning of those new facts and circumstances. Contractor shall reasonably cooperate with Amtrak in Amtrak's efforts to determine the risk posed by the Security Incident, including providing additional information regarding the Security Incident upon request from Amtrak.

6.3. Response Plan Development and Implementation: Contractor shall develop and implement a "Response Plan," which shall include policies and procedures to address Security Incidents. The Response Plan shall include appropriate provisions for mitigating the harmful effects of Security Incidents and addressing and remedying the occurrence(s) to prevent the recurrence of similar Security Incidents in the future. Contractor shall provide Amtrak access to inspect Contractor's Response Plan upon request. The development and implementation of the Response Plan shall follow industry standard practices, such as those that at a minimum are consistent with the contingency planning requirements of NIST SP 800-61, Rev. 2, Computer Security Incident Handling Guide.

6.3.1. Immediately upon learning of a Security Incident related to the products and services provided to Amtrak, Contractor shall implement its Response Plan and, within twenty-four (24) hours of implementing its Response Plan, shall notify Amtrak in writing of that implementation as described above.

6.4. Notification to Affected Parties: Contractor will, at its sole cost and expense, assist and cooperate with Amtrak with respect to any investigation of a Security Incident, disclosures to affected parties, and other remedial measures as requested by Amtrak in connection with a Security Incident or required under any applicable laws related to a Security Incident.

6.4.1. In the event a Security Incident results in Amtrak Data being Disclosed such that notification is required to be made to any person or entity, including without limitation any customer, shareholder, or current or former employee of Amtrak under any applicable laws, including privacy, data breach notification, and consumer protection laws, or pursuant to a request or directive from a governmental authority, such notification will be provided by Amtrak, except as required by applicable law or approved by Amtrak in writing. Amtrak will have sole control over the timing, content, and method of providing such notification.

6.5. Business Continuity: Contractor shall implement and maintain a business continuity program that meets or exceeds industry standards and that provides a formal framework and methodology, including without limitation, a business impact analysis and risk assessment process to identify and prioritize critical business functions ("Business Continuity Program"). Contractor shall provide Amtrak with evidence of the Business Continuity Program upon request.

6.5.1. Contractor shall conduct a business continuity test every twelve (12) months, including a review of the Business Continuity Program, roles and responsibilities, business documentation requirements, recovery strategies, Mean Time to Recovery (MTTR), Recovery Time Objectives (RTOs), Recovery Point Objectives (RPOs), testing strategy and frequency to ensure that appropriate recovery time frames are maintained to meet Amtrak business requirements for the Services. Contractor shall provide the results of any business continuity tests to Amtrak upon request.

6.5.2. Contractor shall implement and maintain a disaster recovery program that meets or exceeds industry standards and that provides a formal framework and methodology, including without limitation, a business impact analysis and risk assessment process to identify and prioritize critical business functions. Contractor shall provide Amtrak with evidence of the disaster recovery program upon request.

6.5.3. Contractor shall support Amtrak's business continuity and disaster recovery programs to restore critical business functions in the event of a cybersecurity incident and/or breach.

7. THIRD-PARTY MANAGEMENT

7.1. Outsourcing: Prior to making Amtrak Data available to any third-party contractor, subcontractor, vendor, processor, or supplier, Contractor shall notify Amtrak in writing and provide reasonable information regarding the scope of and reason for such proposed third-party's access to Amtrak Data. Contractor shall provide Amtrak with a reasonable time, not less than thirty (30) days, to object to the engagement of such third party and Contractor and Amtrak shall use reasonable good faith efforts to resolve any such objection by Amtrak, such as by identifying an alternative third party or adjustment to the services. Contractor must operate a formal process to address due care and due diligence considerations in the selection and management of downstream contractors, subcontractors, vendors, processors, and suppliers. Contractor must maintain all necessary agreements with such third parties that specify the security and data privacy requirements to be met before commencing work on behalf of Contractor that could have an impact on Amtrak Data, Amtrak Infrastructure, or any Amtrak business operations with the Contractor. Contractor shall ensure that these agreements align with the terms in this Attachment and must ensure that its contractors, subcontractors, vendors, processors, and suppliers are compliant with equivalent security and data privacy requirements to those contained in this Attachment and as required by applicable law.

7.2. Indemnification: Contractor agrees to indemnify Amtrak for any and all actions taken by its own contractors, subcontractors, vendors, processors, and suppliers. Contractor acknowledges that it will be fully liable for all acts and omissions of these third parties.

8. CYBERSECURITY ASSESSMENT

8.1. Contractor Onboarding Assessment: Amtrak shall have the option, at its sole discretion upon execution of the Agreement, to perform a full cybersecurity assessment on Contractor's Program and technical, physical, management, and security controls. Contractor agrees to comply with all reasonable cybersecurity requirements specified by Amtrak before commencing any work for Amtrak or accessing Amtrak Infrastructure or networks.

9. MISCELLANEOUS

9.1. Order of Precedence: In the event of a conflict between a provision or terms in this Attachment and any other Services Agreement or Contract the provision or interpretation that provides Amtrak, Amtrak Data, Amtrak Employees, Amtrak Customers, and Amtrak Infrastructure stronger protection will control.

9.2. Definitions: The following defined terms in have the meanings set forth below and shall only apply to this Attachment. Any terms defined elsewhere in the Agreement will be given equal weight and importance as though set forth in this Attachment. In the event of a conflict, greater weight shall be given to the version which provides greater protection to Amtrak, Amtrak Data, Amtrak Employees, Amtrak Customers, and Amtrak Infrastructure.

9.2.1. "**Amtrak Data**" means (a) all data and information Amtrak provides to Contractor, made accessible by Amtrak to Contractor, or to which Contractor has access or that Contractor (or Contractor Services) accesses, retrieves, collects, or otherwise processes during the course of performance of the Services from or on behalf of Amtrak, Amtrak Employees, Amtrak Customers, or trackers on the Amtrak website; (b) all archives, derivatives, summaries, abstracts, compilations, combinations with other information, modifications or manipulations of the foregoing data or information, Aggregated information, Anonymized or de-identified information, data sets, subsets, and the like related to, or derived from such data or information; (c) all reports generated by the Services, or otherwise generated or provided by Contractor relating to or in connection with the Product or Services; and (d) all Amtrak Confidential Information.

9.2.2. "**Amtrak Infrastructure**" means any information technology system, virtual or physical, that Amtrak or its Affiliates own, control, lease, or rent, and that resides on or outside Amtrak's network. Amtrak Infrastructure includes infrastructure obtained from an IaaS provider and systems that are provided and located on the Amtrak network or hosted on a third-party network as part of a Service.

9.2.3. "**Confidential Information**" means any information that during the Term is disclosed by or on behalf of a Party or its Affiliate (the "Disclosing Party") to the other Party or its Affiliate (the "Receiving Party") and at the time of disclosure: (i) is designated in writing as confidential or proprietary; (ii) is designated orally as confidential or proprietary, and embodied by the Disclosing Party in written or other tangible form, including meeting minutes, memos, diagrams, flow charts, and software; or (iii) should reasonably be understood by the Receiving Party to be confidential to the Disclosing Party under the circumstances.

9.2.4. "**Disclosed**" means any circumstance when the security, integrity, or confidentiality of any Amtrak Data has been compromised, including but not limited to incidents where Amtrak Data has been damaged, lost, corrupted, destroyed, or accessed, acquired, modified, used, or disclosed by any unauthorized person, by any person in an unauthorized manner, or for any unauthorized purpose.

9.2.5. "**MTTR**" or Mean Time to Recovery means the average time it takes to recover from a product or system failure.

9.2.6. "**Personal Information**" means any information that identifies, relates to, describes, is reasonably capable of being associated with, or could reasonably be linked, directly or indirectly, with a particular individual or household and includes, without limitation, any information defined as "personal information," "personal data," "personally identifiable information" or similar terms under applicable privacy or data protection laws. Personal Information of Amtrak Employees or Customers is considered to be Amtrak Data and Confidential Information, and includes without limitation: Social Security Numbers, personal tax ID numbers, military identification numbers, student identification numbers, passport numbers, driver's license numbers, other government identification numbers, financial account data, payment card information, biometric information, health or medical information, insurance information, educational information, usernames, email addresses, names, home addresses, phone numbers, passwords, unique online identifiers such as cookies and mobile identifiers, access codes, and security questions.

9.2.7. "**Security Incident**" means any circumstance when (i) Contractor knows or reasonably suspects that Amtrak Data hosted or stored by the Contractor has been Disclosed; (ii) Contractor knows or reasonably suspects that an act or omission has compromised or may reasonably have compromised the security of the products and Services provided to Amtrak by Contractor or the physical, technical, administrative, or organizational safeguards protecting Contractor's systems used to store or host Amtrak Data or any Amtrak Infrastructure; (iii) Contractor discovers or reasonably suspects any other incident that impacts or may impact Amtrak's business operations, Amtrak Data, or Amtrak Infrastructure; or (iv) Contractor receives any complaint, notice, or communication which relates directly or indirectly to any of the foregoing involving (A) Contractor's handling of Amtrak Data or Contractor's compliance with the data

safeguards in this Attachment or applicable laws or (B) the security of the products and Services provided to Amtrak by Contractor.

9.2.8. "**Services**" mean all necessary or required services, tasks, functions, products and other responsibilities and activities as set forth in, or reasonably inferable from, the Agreement, or any Scope of Work, Order or any such other written document.

9.2.9. "**RPO**" Recovery Point Objective means the point in time to which data must be recovered after an outage.

9.2.10. "**RTO**" Recovery Time Objective means the overall length of time an information system's components can be in the recovery phase before negatively impacting Amtrak's mission or mission/business processes.

NATIONAL RAILROAD PASSENGER CORPORATION
(AMTRAK)

SUPPLEMENTARY GENERAL PROVISIONS
FOR NONCONSTRUCTION CONTRACTS (ANNUAL GRANTS/IIJA SUPPLEMENTAL GRANTS)

1.0 Equal Employment Opportunity. Contractor shall comply and shall cause its subcontractors and lower tier subcontractors to comply with the regulations at 41 CFR Part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor." The equal opportunity clause provided under 41 CFR 60-1.4(b) is hereby incorporated by reference. Contractor shall prohibit discrimination based on race, color, religion, national origin, sex (including gender identity), disability, or age.

2.0 Rights In Intangible Property.

2.1 **Definition.** Intangible property, as defined herein means property having no physical existence, such as trademarks, copyrights, patents and property applications.

2.2 **Title to Intangible Property.** Intangible property acquired or created in the performance of this Contract vests in Amtrak upon acquisition or creation, as applicable. The requirements of this Section 2.0 shall apply only to intellectual property acquired or created under a planning, experimental, developmental, or research grant or contract.

2.3 **Copyright.** Amtrak may copyright any work that is subject to copyright and was created or for which ownership was acquired under this Contract. For any work acquired or created under a planning, experimental, developmental, or research grant or contract, Contractor agrees that the Federal Railroad Administration has reserved a royalty-free, nonexclusive and irrevocable right to reproduce, publish, or otherwise use the work for Federal purposes and to authorize others to do so for Federal Government purposes.

2.4 **Patents.** The following provisions will apply to patents under this Contract:

2.4.1 If the Contract involves the performance of experimental, developmental, or research work, the rights of the Federal Government and Amtrak shall be in accordance with 37 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the Federal Railroad Administration (FRA).

2.4.2 If any invention, improvement, or discovery of Contractor or any of its subcontractors is conceived or first actually reduced to practice in the course of or under a planning, experimental, developmental, or research grant or contract, Contractor agrees to grant Amtrak and the Federal Railroad Administration, a royalty-free, nonexclusive, and irrevocable license to use and to authorize others to use the patented device or process for Federal Government purposes.

2.5 **Research Data.** For any research data (as defined in 2 CFR Part 200.315(e)) acquired under this Contract, the Federal Railroad Administration has a right to:

2.5.1 Obtain, reproduce, publish, or otherwise use the research data produced under this Agreement for Federal Government purposes; and

2.5.2 Authorize others to receive, reproduce, publish, or otherwise use such research data for Federal Government purposes.

3.0 Byrd Anti-Lobbying Amendment. Contractors that apply or bid for an award exceeding $100,000 shall file the required certification at 49 CFR Part 20, and attached hereto as Appendix A. Each tier contractor certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier contractor shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to Amtrak.

4.0 Debarment And Suspension. For contracts that exceed $350,000, Contractor shall certify to Amtrak that Contractor is not listed on the government-wide exclusions in the System for Award Management (SAM), in accordance with OMB guidelines at 2 CFR Part 180 that implement Executive Orders 12549 and 12689, "Debarment and Suspension". SAM exclusions contain the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than E.O. 12549. Contractor shall comply and cause its subcontractors to comply with U.S. DOT regulations, 2 CFR Part 180 and 2 CFR Part 1200, "Nonprocurement Suspension and Debarment," Contractor shall execute the "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion" set forth in Appendix B. Contractor agrees to obtain the same such certification on debarment and

suspension from its subcontractors and lower tier subcontractors.

5.0 Domestic Buying Preference/Buy American Act.

5.1 In accordance with Amtrak's Domestic Buying Preference requirements at 49 U.S.C. 24305(f), Amtrak shall only buy, and accordingly, Contractor shall only supply (a) unmanufactured articles materials, and supplies mined or produced in the United States; or (b) manufactured articles, material, and supplies manufactured in the United States substantially from articles, materials, and supplies mined, produced or manufactured in the United States. For purposes of this provision, substantially means that more than 55% of all components by cost must be domestic. This Section 5.1 shall apply only when the cost of those articles, material, or supplies bought or supplied to Amtrak by Contractor is at least $1,000,000.

5.2 When complying with Section 5.1, Contractor shall comply with the domestic preference requirements of the Build America, Buy America Act (BABA) § 70914, Pub. L. No. 117-58, div. G, tit. IX, subtit. A, 135 Stat. 429, 1298 (2021), as implemented by OMB, USDOT, and FRA.

5.3 In accordance with 2 C.F.R. §200.322, as appropriate and to the extent consistent with law, Contractor shall, to the greatest extent practicable, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subcontracts and purchase orders for work or products under this Contract.

(a) For the purposes of this Section 5.3:

(1) "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.

(2) "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

6.0 Cargo Preference--Use Of United States-Flag Vessels. As required by U.S. DOT, Maritime Administration regulations, "Cargo Preference -- U.S.-Flag Vessels," 46 CFR Part 381, if equipment, materials or commodities may be transported by ocean vessel in carrying out the activities funded under this Contract, Contractor agrees:

6.1 To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, materials, or commodities pursuant to this Contract, to the extent such vessels are available at fair and reasonable rates.

6.2 To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, "On-Board" commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (a) above to Amtrak (through the prime contractor in the case of subcontractor bills-of-lading) and to the Division of Cargo Preference and Domestic Trade, Maritime Administration, 1200 New Jersey Avenue, SE, Washington, DC 20590, marked with appropriate identification.

6.3 To insert the substance of the provisions of this Section in all subcontracts issued pursuant to this Contract.

7.0 Drug-Free Work Place. Contractor agrees to comply with U.S. DOT regulations, "Government-wide Requirements for Drug-Free Workplace (Grants)", 49 CFR Part 32, and FRA regulations, "Control of Alcohol and Drug Use", 49 CFR Part 219.

8.0 Compliance With 2 C.F.R. § 200.321. Contractor shall comply with the requirements of 2 CFR § 200.321 consistent with all Executive Orders (EO) including, EO 14173 titled "Ending Illegal Discrimination and Restoring Merit-Based Opportunity' and EO 14151, titled "Ending Radical and Wasteful Government DEI Programs and Preferencing." Contractor shall insert this provision in all subcontracts issued pursuant to this Contract.

9.0 Record Retention And Access.

9.1 Contractor shall retain all financial records, supporting documents, statistical records and all other Contractor records pertinent to this Contract for a period of three years after contract closeout as set forth in 2 CFR 200.333-200.337.

9.2 Authorized representatives of the Federal Railroad Administration, Inspectors General, and the Comptroller General of the United States shall have access to and the right to examine, audit and copy any of Contractor's directly pertinent books, documents, papers, or other records involving transactions related to this Contract as long as the records are retained.

9.3 In cases where litigation, a claim, or an audit is initiated prior to the expiration of the three-year period, records must be retained until completion of the action and resolution of the issues or the end of the three-year period, whichever is later.

9.4 In accordance with the May 2013 Executive Order on Making an Open and Machine Readable the New Default for Government Information, the Contractor shall, whenever practicable, collect, transmit, and store Contract-related information in open and machine readable formats rather than in closed formats or on paper.

10.0 Environmental Protection. *This section applies if the Contract exceeds $150,000*. Contractor will conduct work under this Contract, and will require that work that is conducted as a result of this Contract be in compliance with the following provisions, as modified from time to time, all of which are incorporated herein by reference: the Clean Air Act, 42 U.S.C. 7401 *et seq*., and the Federal Water Pollution Control Act, 33 U.S.C. 1251 *et seq*., and all regulations issued thereunder. Where applicable, Contractor shall comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271 *et seq*.).

11.0 Application To Lower-Tier Subcontractors. Contractor shall insert in each subcontract the provisions set forth in these Supplementary General Provisions and also a provision requiring the subcontractors to include these provisions in any lower tier subcontracts. Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the provisions set forth herein. Contractor shall also include in each subcontract that exceeds $350,000, and cause its subcontractors to include in each lower tier subcontract that exceeds $350,000 provisions that allow for administrative, contractual or legal remedies in instances which a contractor or subcontractor violates or breaches contract terms.

12.0 Contract Termination Provisions. All subcontracts in excess of $10,000 shall address termination for cause and termination for convenience, including the manner by which termination will be effected and the basis for settlement.

13.0 Allowable Costs. Contractor's expenditures will be reimbursed only if they conform with Federal guidelines or regulations and Federal cost principles as set forth in Federal Acquisition Regulation, 48 CFR Chapter I, Subpart 31.2, "Contracts with Commercial Organizations", which are incorporated herein by reference. If any costs are disallowed, as determined by an audit by Amtrak or the Federal Government, Contractor agrees to reimburse Amtrak for such disallowed costs within sixty (60) days of advice to Contractor of the determination of disallowance.

14.0 Americans With Disabilities Act. Contractor shall comply and cause its subcontractors and lower tier subcontractors to comply with the requirements of the Americans with Disabilities Act of 1990, as amended (42 U.S.C. § 12101 *et seq*.), the Rehabilitation Act of 1973, as amended (29 U.S.C. 794 *et seq*.) and the implementing Department of Transportation regulations at 49 CFR Parts 27, 37 and 38.

15.0 Capital Acquisition. The FY 2016 Appropriations Act requires Amtrak to include a statement in any contract for a capital acquisition that exceeds $10,000,000 in life cycle costs that funding for the acquisition is subject to the availability of funds appropriated by Congress in an Appropriations Act, even though Amtrak is not subject to the Anti-Deficiency Act, does not receive appropriations directly from Congress, and possesses other sources of revenue that may fund the capital acquisition.

16.0 Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment. Contractor shall provide no equipment, services, or systems under the Contract that causes Amtrak to be in violation of 2 CFR §200.216 (Prohibition on certain telecommunications and video surveillance services or equipment). As of the effective date of 2 CFR §200.216, companies that may be implicated by this provision are: Huawei Technologies Company, ZTE Corporation, Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities). Contractor shall include this provision in all subcontracts it issues.

17.0 Application of Federal Laws and Regulations. Contractor understands that Federal laws, regulations, policies, and related administrative practices may be modified from time to time. Contractor agrees that the most recent of such Federal requirements will govern this Contract at any particular time, except if there is sufficient evidence in this Contract of a contrary intent.

APPENDIX A TO SUPPLEMENTARY GENERAL PROVISIONS
FOR
NONCONSTRUCTION CONTRACTS

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form LLL "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

_____
Name of Bidder/Offeror/Contractor

_____
Signature of Authorized Representative

_____
Printed Name of Authorized Representative

_____
Title of Authorized Representative

_____
Date

APPENDIX B TO SUPPLEMENTARY GENERAL PROVISIONS
FOR
NONCONSTRUCTION CONTRACTS

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

1. The offeror/prospective contractor certifies, by submission of this offer or proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

2. Where the offeror/prospective contractor is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this offer or proposal.

_____
Name of Bidder/Offeror/Contractor

_____
Signature of Authorized Representative

_____
Printed Name of Authorized Representative

_____
Title of Authorized Representative

_____
Date

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EXHIBIT C
NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)

REPRESENTATIONS AND CERTIFICATIONS

As a part of its Bid/Offer, Bidder/Offeror provides the following information:

1. Bidder/Offeror Information

A. Legal Name of Bidder/Offeror: _____

B. Employer Identification Number of Bidder/Offeror: _____

C. Bidder/Offeror operates as a (check as applicable): Individual _____, Partnership _____, Joint Venture _____, Corporation _____, or Limited Liability Company _____. If Bidder/Offeror operates as a Joint Venture, a copy of the executed Joint Venture Agreement must accompany this form.

D. Bidder/Offeror is organized under the laws of: _____.

2. Parent Company Information

A. Bidder/Offeror is ____ is not ____ owned or controlled by a parent company. For purposes herein, a parent company is one which (i) owns more than 50% of the voting rights in the Bidder/Offeror, or (ii) is able to formulate, determine, or veto basic business policy decisions of Bidder/Offeror through the use of various means, including, minority voting rights, proxy voting, or contractual arrangements.

B. Parent Company Name (if applicable): _____

C. Employer Identification Number of Parent Company (if applicable): _____

3. Small Business

A. Bidder/Offeror is ____ is not ____ a small business concern as defined by the United States Small Business Administration.

4. Worker Safety Record

In the past three years, Bidder/Offeror has ____ has not ____ admitted or been found to have committed, any willful or repeat violations of Federal or State worker safety laws, rules or regulations. Provide the specifics with respect to any such violations on an attached sheet of paper.

Bidder/Offeror agrees that, if it provides false or incomplete information herein, Amtrak has the right to reject its Bid/Offer and/or to terminate any resulting contract without liability.

I hereby certify that the information provided herein is true and complete.

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_____
BIDDER/OFFEROR

By: _____ Date: _____

Title: _____ IFB/RFP NO. WS_____

Amtrak
Mechanical Department
Rolling Stock Equipment

SPECIFICATION

For

Universal Single Level Fleet Replacement

SPECIFICATION No. 1139

Issue Date: 3/18/26
Revision No. 2

Approved By:

George Hull 3/18/2026 VP/Chief Mechanical Officer

David P. Bryant 3/18/2026 AVP/DCMO Fleet Programs

Michael L. Kraft 3/18/2026 Director, Long Distance Fleet

Michael L. Kraft 3/18/2026 Originator & Creation Date

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Specification Change Sheet

Revision	Date	Section(s)	Description	Approver
0	7/11/2025	-	-	M.L. Kraft
1	2/25/2026	-	-	M.L. Kraft
2	3/18/2026	-	-	M.L. Kraft

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1	2/25/2026		***Transition to Universal Single Level***	M.L. Kraft
		1.1.d	Interoperability requirements amended	
		1.1.g	Accessible core added	
		1.2.c	AAR Standards added	
		1.3.g	Food service equipment added	
		1.3.h	Chapter 31 added	
		1.4.a	Accessibility requirements added	
		1.4.c	Accessible core requirements amended	
		1.4.c.iii.(1)	Diner/Lounge added to accessible core	
		1.4.e	High capacity coach car option added	
		1.6.a	Car types added	
		Figure 11	Car types and capacity numbers amended	
		1.7.b	Passageway requirements added	
		1.7.c.iii	USB port requirements amended	
			Standard coach car and high-capacity coach car accessible seating location added	
		1.7.g.i	Side loading door requirements added	
		1.7.g.viii.(2)	Builder's plate requirements added	
		1.7.g.ix	12 months amended to 24 months	
		1.8.a	48 hours changed to 72 hours	
		1.9.b.i.(1)	Auto train option cars added	
		1.9.j; 1.9.k	Gangways added	
		1.9.p;1.9.q;1.9.r	Gangways or diaphragms added	
		1.11.a	Onboard access provisions added	
		1.11.a.iv	California DOT exception added	
		1.12.c	Environmental factors added	
		2.4.b.viii	M-934 added	
		2.4.f.i	B1.1 deleted	
		2.5.b.i.(2)	Acceptance definition removed	
		2.5.b.ii.(9)	Business Days definition removed	
		2.5.b.xiii.(1)	Permissive definition removed	
		2.5.b.xiv.(8)	Restrictive definition removed	
		2.5.b.xv.(2)	Service Failure definition amended	
		2.5.b.xvii.(1)	Unsafe definition removed	
		3.3.f; 3.3.k	30 days amended to 60 days	
		3.4.d	Cars changed to equipment	
		3.10.g	Milestones changed to deliverables	
		3.13.c.i.(4)	Sub-systems amended	
		3.13.c.i.(5)	Legacy equipment amended	
		3.13.g.iv	Design review submittal package added	
		3.13.k.i	Agreement requirements added	
		3.13.l.i.(1)	Change prototype request added	
		3.14.h.vii	Repair procedures added	
		3.15.b.i	Compliance matrix requirements added	
		3.15.d.iii		
		3.16.b.ii.(6)	90% changed to 95%	
		3.16.b.vi.(3).(c)	Interior mock-up requirements added	
		3.16.c.ii.(6)	Option removed for on-board mobility lifts in mock-ups	

			Soft mock-up material requirements	
		3.16.c.iii.(4)	added	
		3.16.c.iv	Food service seat types added	
		3.16.c.viii	Rooms and mechanical features added	
			Bedroom seat comfort mock-up added	
		3.16.c.xi	Shower rooms added	
		3.16.e.i.(3)	Cafe changed to dining	
		3.16.e.i.(4)	Cafe tables and seats added	
		3.16.e.i.(5)	Lounge seats and tables added	
		3.16.e.i.(13)	Trap door and folding steps added	
		3.16.e.i.(14)	Onboard mobility lift added	
		3.16.e.ii	Dining car features added	
		3.16.e.iii	Cafe car added	
		3.17.g	Sleeper car corridors added	
		3.18.b.vii.(2).(d)	Standard coach and standard sleeper added	
		3.19.b.ii	Car types added	
		4.1.d.(9)	Freeze protection added	
		4.3.b.iii	MDBSF requirements amended	
		4.3.c	Exhibit G added	
		Figure 41	Lounge added to food service	
		4.3.e.i	10% changed to 5%	
		4.5.f.iii.(2)	Extension added	
		4.6	Design changes after pilot car delivery added	
		4.7.a.iii.(4)	Snow/ice protection added	
		4.7.c.vi.(1)	Lifecycle cost analysis requirements amended	
		4.7.d.ix.(13)	Powered accessible toilet and accessible sleeper room doors added	
		4.7.d.ix.(14)	Sleeping accommodations added	
		4.7.d.ix.(15)	Non-powered sleeper room doors added	
		4.7.d.ix.(16)	Gangway added	
		4.7.d.ix.(18)	Wi-Fi added	
		4.7.d.ix.(19)	Digital trainline added	
		4.7.d.ix.(20)	Option removed	
		5.4.a.v.(7)		
		5.4.a.v.(6), and	Hold points and inspections added	
		all applicable	Coaches amended to cars	
		sections	Beds added	
		5.8.d.ii.(27)	Major fiberglass interior components	
		5.8.d.ii.(28)	and hardware added	
		5.8.d.ii.(29)	Complete sleeping modules added	
		5.8.d.ii.(30)	On-board mobility lift added	
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Amtrak Universal Single Level Fleet Replacement

Technical Specification

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1. Scope

Revision 2

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1.1 Overview

a). The purpose of this Technical Specification is to define the performance and technical requirements for a fleet of new single level rail cars for use across Amtrak's network.

b). The Cars shall be delivered in accordance with Exhibit V.

i). Cars shall be arranged to optimize both revenue and non-revenue capacities in accordance with the target capacities presented in this Chapter.

(1) In the optimization process, the Contractor shall strive to propose a car arrangement that maximizes revenue potential for Amtrak while simultaneously offering flexibility to efficiently develop the design and manufacturing processes.

c). Cars shall be modular in design to the best extent possible in order to be optimized for Amtrak's evolving needs over the life of the equipment while being interoperable with Amtrak's legacy fleets.

d). The Cars shall be used in locomotive hauled service and shall be compatible with Amtrak's current fleet of locomotives.

i). Cars may be operated with multiple locomotives at one end of the consist or locomotives at either end.

ii). Cars are primarily targeted for service with Amtrak's legacy fleet of locomotives.

iii). Cars are to be interoperable with Amtrak's legacy equipment, especially the Viewliner I & II fleets as the Cars will initially be deployed on Eastern routes to replace the Amfleet II fleet.

iv). The Standard Coach, Standard Sleeper, and Utility cars shall be able to convert from gangways to type 1 diaphragms or vice-versa on both ends of the cars.

v). The Premium Coach and Accessible Sleeper shall be able to convert from gangways to type 1 diaphragms or vice-versa on the non-vestibule end. All cars shall be shipped with gangways and diaphragms from the factory, and the required configuration will be outlined in Exhibit V.

vi). The cars must achieve full interoperability with both Viewliner I and II car types, including mechanical and functional interface compatibility with their diaphragm systems. If cars are shipped with diaphragms they will later transition to gangways, supporting smooth operation with the newly procured cars as the Viewliner fleet is gradually retired. Amtrak will provide details prior to car shipment to what depot the gangway or diaphragm will be shipped pending what configuration the car leaves the factory.

(1) Cars must be interoperable with Amtrak's legacy Single Level fleet of cars and locomotives. Viewliner II Baggage cars will be used in all consists unless the option for a Utility Car is exercised.

e). The Cars shall allow Amtrak to operate throughout the United States of America and portions of Canada/Mexico. The Single Level Fleet shall operate in both low and high platform territories.

f). Technical characteristics and performance parameters for these Cars are described herein, as are the design review, inspection, testing and documentation requirements for producing and supporting these Cars.

g). Accessibility and Universal Design for people with disabilities is a priority to Amtrak, Amtrak requires that the Cars meet or exceed the requirements of the Americans with Disabilities Act (ADA) revision 2010 while incorporating elements of RVAAC to the best extent possible. Amtrak considers Universal Design as a norm and envisions an accessible core design where all passengers using wheeled mobility devices have access to all amenities offered on the consist.

h). All design review, inspection, qualification and testing required by this contract shall be performed specifically for this contract. Reports from previous contracts or procurements will not be accepted unless otherwise reviewed and approved by Amtrak.

i). Throughout this technical specification, requirements are applicable to all chapters where relevant. For instance, requirements specified in Chapter 11 are equally applicable to Chapter 31, and vice versa.

1.2 Regulations

a). The Cars must be fully compliant with all applicable United States Federal and Transport Canada regulations for safety, operations, design, accessibility, testing and materials standards.

b). The Cars shall be designed and constructed in accordance with Federal Railroad Administration and APTA design standards, to minimize passenger and train crew potential injuries in the event of collision.

c). In addition, applicable industry standards, including but not limited to APTA and AAR standards, shall apply as determined by Amtrak and referenced in this Specification.

d). A complete listing of all regulations, standards, recommended practices and specifications that are referenced in this document can be found in Chapter 2.

e). The list of referenced documentation in Chapter 2 is not to be interpreted as a comprehensive and exhaustive list of all regulations and standards to which the Contractor must adhere to in the design and manufacture of the Cars.

f). The Contractor shall be solely responsible for complying with all standards, recommended practices and regulations that apply to the design and production of these Cars.

1.3 Concept and Definition

a). As defined in this Specification, all cars shall be configured with standard H Type couplers, air brake hoses, and passenger car head end power on both ends.

b). To allow for operation with existing rolling stock equipment, cars shall be designed with Power/Communications/locomotive MU control electrical trainlines and air connections to allow the Cars to have interoperability with existing Amtrak rolling stock.

i). The inter-car connection architecture shall be designed/provisioned to allow upgrades to other inter-car connection types when Amtrak's existing fleet of rail cars are retired.

ii). Reliability is key to Amtrak, and the inter-car connections shall be robust and future-proof.

c). The Contractor shall comply with regulatory requirements and meet the performance requirements that are outlined in this Specification.

d). The Cars must be designed and constructed to be suitable for unrestricted service in all service areas governed by Amtrak's Clearance Diagram, Single Level D-05-1355 Rev E.

e). The Cars shall be designed, tested and qualified for bi-directional operation at a maximum speed of 125 mph and 5" cant deficiency.

f). The Cars must also comply with all applicable provisions of Title 49 CFR, as administered by the Federal Railroad Administration (FRA), in effect at the time of Notice to Proceed.

g). The Cars shall be designed with adequate storage for food service equipment, cleaning supplies, linens, tools, and other necessary on-board equipment as required for the intended service and/or as specifically required by this specification.

h). Details for the accommodations to be incorporated within the cars are presented in Chapters 11 and 31.

1.4 Accessibility Requirements

a). In addition to compliance with the requirements of the ADA and other accessibility requirements in this specification, the Contractor shall comply with the terms of the Application for Equivalent Facilitation (EF) submitted by Amtrak and approved by the USDOT (Exhibits R-1 and R-2). The approved EF was based on a trainset configuration and will need to be revised to reflect the equipment configuration under this procurement. The Contractor with the support of Amtrak shall prepare and submit a revised EF application and shall work with Amtrak, FRA and disability community to obtain an accessibility solution that is accepted by all parties involved.

b). An accessible path is required to navigate from the side loading door entry vestibule to any car in the accessible core to the designated accessible seating or sleeping location(s) in all car types. The accessible path will go from end to end of all cars in the accessible core.

c). Accessible Core

i). To clarify one of the key requirements of Equivalent Facilitation, all accessible coach spaces and all accessible bedrooms shall be located in an Accessible Core which shall comply with the following definition and requirements.

ii). Accessible Core Definition:

(1) Centrally located grouping of car types within the consist with a fully accessible path via 32” aisle.

(2) The purpose of the Accessible Core is to provide an equitable experience with access to all onboard amenities for all passengers.

(3) The accessible core is critical to achieving "equal or better" accessibility requirements through alternative design standards detailed in the Equivalent Facilitation approved by the FRA.

(4) Successful deployment of the Accessible Core should allow for non-accessible and repeatable coach and sleeper cars with high-capacity accommodations outside of the Core.

iii). Accessible Core Requirements:

(1) The Café, Premium Accessible Coach, Accessible Sleeper, Diner/Lounge and Diner Cars shall be designed to be end-to-end accessible as these car types make up the accessible core.

(2) Core must include all accessible coach positions and all accessible bedrooms in order to provide priority placement with the shortest possible path to experiential amenities (e.g. Diner/Lounge, Café, etc.).

(3) Core must include at least two (2) accessible restrooms to provide redundancy along the accessible path.

(4) Core must include/comply with all accessibility requirements defined in the Equivalent Facilitation Alternative Design Standards

(5) Each Premium Accessible Coach must include at least three (3) accessible spaces and at least three (3) transfer seats but in reality, all aisle seats shall serve as transfer seats.

(6) Each Accessible Sleeper must include at least two (2) accessible bedrooms with restrooms.

(7) Each Diner Car with one (1) RVAAC accessible position.

(8) Each Diner/Lounge with three (3) RVAAC accessible positions – one (1) in the Diner seating area and two (2) in the Lounge seating area.

(9) Each Café Car with two (2) RVAAC accessible positions.

(10) Each Standard Coach with two (2) RVAAC accessible positions.

d). Seating shall be modular to allow for the addition of a second accessible location at either end of the Premium Accessible Coach car. All accessible amenities shall

be included for both locations such as a reading light and a workstation table.

e). If Amtrak exercises option for High Capacity Coach Cars (Chapter 30) and additional café cars, Amtrak prefers to provide six (6) RVAAC accessible seating locations with proximity to the Café Car with two (2) being provided in each adjacent car to the Café and two (2) being provided in the Café car as designed for the Intercity Trainset (Airo) fleet. As this fleet will be manufactured as single cars, the provision for the requirement for 1.4c) shall be included in all cars and the modular concept for additional accessible seating locations shall be provided as an option. A conceptual diagram shall be provided in Exhibit F for reference.

f). As an option, the Contractor shall provide provisions for up to four (4) RVAAC accessible seating locations in each car type which shall be modular in design which includes any restraints, adjustable height tables, call systems, outlets, reading lights and any associated wall panels.

1.5 Restroom and Bathroom Constraints

a). In coach cars with at least one accessible location, an accessible restroom must be provided in addition to the standard restroom.

1.6 Car Types and Car Capacities

a). Amtrak intends to have a Standard Coach car, a Premium Accessible Coach car, a Standard Sleeper Car, an Accessible Sleeper car, a Diner car, a Diner/Lounge car, a Café car, a Utility car as an option, and a High-Capacity Coach as an option that will operate with existing Amtrak equipment. The carshell design shall have the ability for modularity for additional options and shall allow for future reconfiguration of any car type to meet Amtrak's operational requirements in the future.

b). The Contractor shall optimize revenue and non-revenue capacities, minimize the number of unique Car shells, and comply with accessibility requirements of the CFR.

c). The target capacities are outlined for each car type in the base order in Figure 1-1.

Figure 1-1: Target Revenue Capacities

Target Capacities by Car Type	Base							Options	
	Standard Coach	Accessible Premium Coach	Café	Diner	Diner /Lounge	Accessible Sleeper	Standard Sleeper	High Capacity Coach (Option)	Utility Car (Option)
Coach Seats (2+2, 37" pitch)								66	
Coach Seats (2+2, 42" pitch)	60								
Premium Coach Seats (2+1)		33							
RVAAC Accessible seating location	1	3						1	
Accessible Bedroom with RR & Shower 60" turning circle						2			
Club Bedroom with RR & Shower						4			
Roomettes							7		
SoloSuites							12		
Roomette (Crew)						1	1		6
Standard RR	1	1					2	1	
Accessible RR 60" turning circle	1	1						1	
Standard RR (Crew)						1			2
Communal Shower						1	1		1
Café Booth Seats			36						
Café Mobility Positions			2						
Diner Booth Seats				18	36				
Diner Mobility Positions				1	1				
Lounge Seats					30				
Lounge Mobility Positions					2				
Checked Baggage									1,600 cu ft
Conductor's Office			1						

*Standard Coach Cars and High-Capacity Coach Cars shall be designed to permit the replacement of seating with a second accessible seating location at the same end of the car.

1.7 Car Configurations

a). All pneumatic trainlines, Head End Power (HEP) trainline, communications/door control trainline and push-pull trainline functionality shall be provided when coupled to other legacy Amtrak cars and locomotives.

i). All cars shall be fully compatible for movement when locomotive pulled or pushed, or when coupled to conventional freight cars as in a freight train.

b). The Cars shall be designed and arranged to permit safe, unrestricted passenger movement (walkable and wheeled) between all adjacent cars while the consist is in motion, through fully enclosed, weather-protected inter-car passageways suitable for passenger use.

c). Designs shall be modular to the extent practical, to minimize the amount of additional design required to adapt cars to future service class/type needs.

i). Carshell structures and attachment points of interior fixtures shall be designed to permit any service type defined in this Specification to be converted to any other service type defined in this Specification without requiring modifications to the carbody.

ii). The vehicle design shall provide Amtrak with flexibility to configure the vehicle arrangement to suit the applicable service route, including the ability to replace modules to adapt furnishings such as luggage tower, bicycle storage, food service equipment, coach seating assemblies, business seating assemblies, accessible seating assemblies, and tables.

iii). All outlets with USB ports must adhere to the latest industry standards approved by Amtrak six (6) months prior to the shipment of the first car and must be easily replaceable/interchangeable. Custom designs are prohibited. These USB ports should be capable of charging phones, tablets, computers, other personal electronic devices, and defend against hacking. The outlet design should be maintenance-friendly to facilitate easy replacement as technology evolves.

d). The carbody and all its structural elements, including trucks and running gear, shall have a minimum design life of 40-years and 10 million miles of operation at full seated passenger load.

i). The design and selection of materials shall prevent corrosion damage, including the effects of extreme weather conditions, during the 40-year design life. All interfaces between dissimilar metals will be treated to prevent galvanic corrosion.

e). Safety, reliability and maintainability shall be primary performance goals for the Cars and shall be incorporated into the design and design review process.

i). Use of specialized tools, hardware, or equipment shall be minimized. The need for a specialized tool must be approved by Amtrak.

ii). Any specialized tools, hardware or equipment needed for maintenance shall be included as a special tool deliverable with the first cars.

iii). Ease of access for inspection, maintenance and repairs shall be a major design consideration. The cars should be designed to allow inspections to be performed without requiring the car to be positioned over a pit with the ability to inspect the cars with scanning technology via cameras and other means that may be possible in the future.

iv). To ensure a car can complete its entire journey without needing to be set out enroute, system redundancies and debris-strike-hardening shall be implemented in all aspects of the car's design. Diagnostic systems shall be incorporated to allow remote monitoring of critical systems like HVAC, waste/water, LVPS, battery charger, and brakes. These systems shall be designed with the intention that proactive analysis will determine failure points that would limit the risk of setting out the equipment.

(1) Train crew and maintenance personnel shall be able to review system status and diagnostics for any car in the consist from the conductor's office display to streamline troubleshooting and reduce repair time.

v). All entrance areas shall be weather resistant to the extent that no water or snow intrusion can accumulate in those areas and must be properly mitigated when the side loading doors are open. This includes any door pockets or areas that might be exposed with alighting passengers.

vi). All designs shall be capable of operating with wayside scanning for visual analysis to determine wear conditions and/or running gear component failures.

f). Components used on this equipment shall be identical and interchangeable across the entire production run.

i). Components shall not be drilled or sized to fit.

ii). Components shall not be paired or married to a parent assembly without the specific review and approval by Amtrak.

g). In addition to the overall concept described above, the design and construction of the Cars shall also address the following:

i). The Standard Coach, Premium Accessible Coach, Diner/Lounge, Sleeper cars, Café, and Utility cars (Option) shall have one side loading door, trap door, and folding steps on each side of the car on one end of the car. Diner car side loading doors shall be in the center of the car for employee use. Alternative proposals can be submitted by the contractor for Amtrak's review and approval.

ii). The High-Capacity Coach (Option) car shall have two side loading doors, trap doors and folding steps on each side of the car with one being located on either end of the car.

iii). Where components have been specified by manufacturer and part number in this Specification, the Contractor may propose alternate manufacturers' components, for review and approval by Amtrak.

(1) Proposed alternative components must be functionally interchangeable with components called out herein.

(2) For safety critical items, introduction of alternative components will only be considered if such components have an established performance record in intercity passenger service, and/or have undergone an appropriate qualification program that demonstrates an acceptable level of safety, serviceability and reliability for passenger cars. This documentation shall be submitted to Amtrak for review and approval.

(3) Acceptance of proposed alternative components shall be solely at the discretion of Amtrak.

iv). Design reviews shall be employed to assess all proposed designs for compliance with specification requirements including safety, maintainability, ergonomics, functionality, and passenger comfort.

(1) Specific requirements for the design review process are described in Chapter 3.

v). Design reviews shall be supported by virtual and physical mock-ups. The mock-ups will allow Amtrak and its representatives to review the configuration and layout of the proposed design, to experience the workability, comfort, access and functionality and to fine-tune the design for maximum benefit.

(1) Specific requirements for the provision of mock-ups are provided in Chapter 3.

vi). Passenger Experience

(1) The Contractor shall focus on design aspects including but not limited to aesthetics, customer experience, functional design, usability, interaction, ergonomics and comfort reviews which align with the vision and requirements provided in Exhibit F.

(2) In the course of the design process, the Contractor shall have the following design authority and constraints:

(a) The Contractor shall comply with the design of the accommodations to ensure that they meet the required functionality and capacity.

(b) Throughout the Design Review process, the Contractor shall provide details with regard to color material and finish (CMF) to ensure the final accepted product design successfully delivers against Amtrak’s brand palette, brand DNA and the unique experience and spaces on our cars.

(c) At the start of Preliminary Design Review, Amtrak will provide the Contractor with its conceptual vision for the exterior livery of the cars. The Contractor should expect to work collaboratively with Amtrak throughout the design review process to arrive at a final livery design during Final Design Review.

(d) The Contractor shall be responsible for working collaboratively with Amtrak throughout the Design Review Process to successfully implement Amtrak's overall vision.

vii). Materials and workmanship shall meet the requirements of Chapter 19, and all equipment shall be designed to operate in the environmental conditions specified in Amtrak Specification 963.

viii). As detailed in this chapter, the Contractor shall develop proposals, renderings, and a comprehensive package for color palettes, storyboards, layout arrangements, interior materials, and exterior graphics for approval or modification by Amtrak.

(1) The features, components, layouts, graphics and customization of the cars shall be selected by Amtrak during design reviews.

(2) A builder's plate shall be provided in a concealed location in the vestibule and on the center sill. Precise location of these plates shall be subject to Amtrak approval.

(a) The contractor's name or the name of their suppliers shall not be visible to the riding public on either the interior or exterior of the equipment. This includes, but is not limited to, manufacturer stamps on windows or identification tags on seats, which are strictly prohibited.

ix). Amtrak shall provide unit numbers, reporting marks, and naming no less than 24 months after notice to proceed.

1.8 Duty Cycle

a). Cars shall be designed for continuous operation for up to 72 hours in a single run and shall support long-distance operations of at least 1600 miles within a 24-hour period.

1.9 Dimensions, Clearances and Track Geometry

a). Carbody dimensions and weights

i). The cars shall be designed and built to conform to the following overall AW0 weight limitations:

(1) A static axle load of no more than 38,500 lbs.

(2) Track dynamic (P2) forces per axle shall be limited to 68,000 lbs., calculated using the formula and parameters defined in Chapter 7.

(3) The Cars shall be weighed at the Contractor's facility, and shall have weight distribution and balance as follows:

(a) End-to-end balance of cars within 5% (both at full supplies and no supplies).

(b) Lateral balance (side to side) of all cars within 5% (both at full supplies and no supplies).

b). Length

i). Cars may be configured in consists up to 1,530 ft in length.

(1) If option cars are exercised to be utilized on Auto Train, consist lengths could be substantially higher, close to 5,000 ft. Contractor shall provide analysis that all systems will operate as intended at this length.

ii). All car functions shall operate per the standards of this specification within this train length range, except as noted below, including but not limited to trainline, communications, power, and carbody strength.

iii). Trainline functions may operate at reduced levels (tolerance to be approved by Amtrak) at consist lengths greater than 1,530 ft (due to trainline voltage drop).

iv). The brake system shall be designed for normal operation at all consist lengths up to 1,530 ft in total length, excluding any locomotive(s).

c). Clearances

i). The Cars shall fully conform to Amtrak's Clearance Diagram, Single level D-05-1355 Rev E under all operating conditions.

ii). The Clearance Drawing is based upon the assumption that a car is nominally 85 ft long with truck center spacings of 59.5 ft.

iii). No carbody-mounted appliances shall extend beyond the clearance envelope.

d). Track Geometry

i). The Cars shall be designed, tested and certified for revenue operation at all speeds up to 125 mph and 5" cant deficiency.

ii). The Cars shall be designed, tested and certified for operation on all classes of track (per 49 CFR Part 213) from FRA Class 1 to Class 8, at the maximum allowable speed on each class of track.

e). The Cars shall be qualified and capable of dead-in-tow operation at speeds up to 125 mph and 5" cant deficiency.

f). Track quality shall be assumed to be minimally compliant for each class of track, per FRA regulations and AREMA standards.

g). Ride quality standards and testing methods are specified in Chapters 7 and 20.

h). The Cars shall operate on standard gauge (56.5 in.) track.

i). The braking performance of the Cars shall comply with Chapter 9 and Amtrak braking performance drawing S-603.

j). The Cars shall be capable of negotiating a 250 ft radius (23 degree) horizontal curve, coupled to other equipment, without damage to the track or any portion of the Cars, including trucks and suspension, couplers, draft gears, air and electrical connections, gangways, diaphragms or carbody.

k). The Cars shall be capable of negotiating a 2000 ft radius vertical curve (concave or convex), coupled to other equipment, without damage to the track or any portion of the Cars, including trucks and suspension, couplers, draft gears, air and electrical connections, gangways, diaphragms or carbody.

l). The Cars shall be dynamically stable at all speeds up to and including 5 mph above maximum design speed.

m). No wheel of the Cars shall experience more than 50% wheel unloading when the train is stopped on a 7 in. super-elevation.

n). The Cars shall be capable of operating at a minimum of 5” cant deficiency, without requiring tilt, according to 49 CFR Part 213.329.

o). The Cars shall be capable of safely passing other cars that are operating at maximum authorized track speed in either direction on adjacent tracks with 12 ft centers.

p). The Cars shall be capable of negotiating a number 8 crossover between two tracks with 12 ft centers and a number 7 crossover between two tracks with 13 ft centers, coupled to other equipment, without damage or separation of any inter-car connections including air hoses and electrical connectors, and without damage to gangways or diaphragms.

q). The Cars shall be capable of negotiating facing number 8 turnouts per Amtrak Drawing No. AM 73195-A arranged to form a "S" curve with a minimum of 12 ft between track centers, coupled to other equipment, without damage or separation of any inter-car connections including air hoses and electrical connectors, and without damage to gangways or diaphragms.

r). The Cars shall be capable of negotiating two 400-foot radius reverse curves with zero tangent in-between, coupled to other equipment, without damage or separation of any inter-car connections including air hoses and electrical connectors, and without damage to gangways or diaphragms.

1.10 Catenary Wire

a). The Cars shall be immune to the effects of any electrical interference from 12 kV and 25 kV catenary systems, including induced electrical currents into the carbody and potential ground return currents through the trucks and wheelset journal bearings.

1.11 Passenger Station Platforms

a). The Cars shall be designed to serve high- and low-level boarding station platforms. While an individual car configuration may be optimized for a specific platform height, each Car shall include onboard access provisions that enable passenger boarding and alighting at any of the platform heights identified below,

without reliance on track-side equipment or station-installed infrastructure.

i). Low-level station platforms may be either below Top of Rail, at Top of Rail, 8 inches above Top of Rail and 61 inches from centerline of track, or 15 inches above Top of Rail and 64 inches from centerline of track.

ii). High level station platforms are 48” above Top of Rail.

iii). Many platforms at or below TOR are controlled by freight railroads who will protect their clearances. Careful consideration must be provided for these platforms as well.

iv). Some stops do not have platforms, so passengers may board or alight in the street and/or grade crossings. This must be considered in the design.

v). Note: California DOT may proceed with 22” platforms at their stations in the future. This equipment shall not interfere with any 22” platform design.

1.12 Environment

a). The Cars design shall comply with the environmental requirements of Amtrak Specification 963.

b). The equipment shall be designed and built for use in the North American passenger rail environment.

c). Special considerations for the high humidity and salt content in the air from the coastal marine areas, excessively fine dust, sandstorms, cotton wood seed ingestion, diesel exhaust intake, excessive snow amounts from the Mountain West, fine powder snow, wet heavy snow, sleet, freezing rain, and freezing temperatures exceeding -40°F and high temperatures exceeding 125°F (51.7°C) shall be incorporated into the design.

d). To the maximum extent possible, exterior equipment, cables, hoses and pipes shall be protected against debris strikes. Each mitigation, however, will need to be balanced with impacts to maintainability and shall be submitted to Amtrak for review and approval during the design review process.

1.13 Standard Keys

a). A total of two types of standard keys shall be used on the various car types, a coach (Conductor’s) key and a maintenance key, along with provisions in galleys of the Food Service cars for use of crew-supplied padlocks.

1.14 Documentation Requirements

a). All documents shall, as a minimum, contain the following:

i). A title page with a clear and concise title block, which includes all pertinent references to the Contract and an accurate description of enclosed information.

ii). Display approval signatures of the original document on the title page to serve as an easy reminder of the approval signatures required for all future revisions.

iii). Display Amtrak's contract number on the title page.

iv). Display the originating company's name and address on the title page.

v). Display the overall revision level on the title page and display the varying revision level on each consecutive page.

vi). Display the unique document number on each page of the document.

vii). Record the specific changes of a revision on a dedicated page that includes space for new approval signatures for that revision without requiring the removal of previous approval signatures.

viii). Record the revision levels of individual pages on a dedicated page for verification of proper document composition.

ix). Contain a table of contents and an itemized listing of tables and figures.

* End of Chapter 1 *

Amtrak Universal Single Level Fleet Replacement

Technical Specification

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2. References and Glossary

Revision 2

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2.1 Overview

a). Regulations, standards and specifications that are referenced in this document are listed below as a guide to the Contractor but shall not be construed as complete.

b). The Contractor is responsible for ensuring that all applicable regulations, standards and specifications in effect at time of Award are followed when complying with the requirements of this specification.

c). Nothing in this specification shall relieve the Contractor from ensuring that all applicable regulations, standards and specifications are followed. The Contractor shall provide the Compliance Matrix required by Chapter 3 as proof of compliance for those items so governed before the first batch of cars are accepted.

2.2 Supplemental Regulations, Standards, Specifications and Drawings

a). Regulations, standards, specifications and drawings, which may pertain to this specification, are listed below as information. The following list is furnished as a guide to the Contractor but shall not be construed as complete or actually used. When any of the following are superseded by an approved revision, the revision shall apply.

b). Unless specified otherwise, the Contractor shall be responsible for acquiring and maintaining copies of all applicable references from the appropriate source.

i). Amtrak shall not be obligated to provide these referenced documents unless specifically stated.

ii). The Contractor will be responsible for determining if there are newer versions of the referenced specifications/regulations/standards and obtaining them.

2.3 Regulations

a). ADA (Americans with Disabilities Act)

i). 36 CFR 1192.99: Floors, Steps and Thresholds

ii). 36 CFR 1192.113: Doorways

iii). 36 CFR 1192 Appendix: Advisory Guidelines

iv). 49 CFR Subtitle A, Figure 4: Intercity Rail Car (with accessible restroom)

v). 49 CFR 38.101: Lighting

vi). 49 CFR 38.117: Floors, Steps and Thresholds

vii). 49 CFR 38.123: Restrooms

viii). 49 CFR 38.125: Mobility and Accessibility

ix). 49 CFR 38.159: Mobility Aid Accessibility

x). Americans with Disabilities Act of 1990 and regulations promulgated thereafter, including 49 CFR 27, 37 & 38.

xi). Rail Vehicles Access Advisory Committee (RVAAC) of the United States Access Board

(1) Final Report: https://www.access-board.gov/advisory-committee-reports/rail/rvaac-report/

b). Canadian Transportation Agency

i). General Order O-10: Railway Safety Appliance Standards

c). DOE (U.S. Department of Energy)

i). Energy Policy Act (EPAct) of 2005

d). EPA (Environmental Protection Agency)

i). Title 40:

(1) Part 40 CFR Protection of Environment

(2) Part 82: Protection of Stratospheric Ozone

(3) Part 201: Noise Emission Standards for Transportation Equipment; Interstate Rail Carriers

(4) Part 1033: Control of Emissions from Locomotives

e). FAA (U.S. Federal Aviation Administration)

i). AC 43.13-1A, Section 449: Stripping Insulation

f). FDA (U.S. Food and Drug Administration)

i). 21 CFR 1250: Interstate Conveyance Sanitation

(1) 1250.41: Submittal of Construction Plans

ii). 2017 U.S. Food & Drug Administration: Food Code

iii). Handbook of Sanitation of Railroad Passenger Cars, 1964

g). FRA (Federal Railroad Administration)

i). 14 CFR 25.853: Compartment Interiors

ii). 21 CFR Part 1250: Interstate Conveyance Sanitation

iii). Title 49, 49CFR Transportation, Section II, Parts 200-299

iv). 210: Railroad Noise Emission Compliance Regulations

v). 213: Track Safety Standards

(1) 213.329: Curves, Elevation and Speed Limitations

vi). 213.333: Automated Vehicle Inspection Systems

vii). 213.345: Vehicle Qualification Testing

viii). 213.57: Curves; Elevation and Speed Limitations

ix). 221: Rear End Marking Device-Passenger, Commuter and Freight Trains

x). 222: Use of Locomotive Horns at Public Highway-Rail Grade Crossings

xi). 222.21: When Must a Locomotive Horn be Used?

xii). 223: Safety Glazing Standards--Locomotives, Passenger Cars and Cabooses

xiii). 231: Railroad Safety Appliance Standards

xiv). 236: Rules, Standards, and Instructions Governing the Installation, Inspection, Maintenance, and Repair of Signal and Train Control Systems, Devices, and Appliances

xv). 236 Subpart I: Positive Train Control Systems

xvi). 238: Passenger Equipment Safety Standards

(1) 238.103: Fire Safety

(2) 238.105: Train Electronic Hardware and Software Safety

(3) 238.107: Inspection, Testing and Maintenance Plan

(4) 238.111: Pre-revenue Service Acceptance Testing Plan

(5) 238.112: Door Emergency Egress and Rescue Access Systems

(6) 238.113: Emergency Window Exits

(7) 238.114: Rescue Access Windows

(8) 238.115: Emergency Lighting

(9) 238.121: Emergency Communication

(10) 238.123: Emergency Roof Access

(11) 238.131: Exterior Side Door Safety Systems

(12) 238.205: Anti-Climbing Mechanism

(13) 238.207: Link Between Coupling Mechanism and Car Body

(14) 238.215: Rollover Strength

(15) 238.217: Side Structure

(16) 238.219: Truck-to-Carbody Attachment

(17) 238.227: Suspension System

(18) 238.231: Brake System

(19) 238.233: Interior Fittings and Surfaces

(20) 238.235: Doors (Emergency Egress)

(21) 238.303: Exterior Calendar Day Mechanical Inspection of Passenger Equipment

(22) 238.307: Periodic Mechanical Inspection of Passenger Cars and Unpowered Vehicles Used in Passenger Trains

(23) 238.435: Interior Fittings and Surfaces

(24) 238.441: Emergency Roof Access

(25) 238 Appendix B: Test Methods and Performance Criteria for the Flammability and Smoke Emission Characteristics of Materials Used in Passenger Cars and Locomotive Cabs

(26) 238 Subpart B: Safety Planning and General Requirements

(27) 238 Subpart C: Specific Requirements for Tier 1 Passenger Equipment

xvii). 239: *Passenger* Train Emergency Preparedness

(1) 239.101: Emergency Preparedness Plan

(2) 239.107: Emergency Exits

xviii). 243: Training, Qualification, and Oversight for Safety-Related Railroad Employees

xix). 571.208, Subpart 6: Federal Motor Vehicle Safety Standards: Occupant Crash Protection

h). FTA (Federal Transit Administration)

i). FTA-PA-27-5194-12.1: Quality Management System Guidelines

i). Transport Canada

i). TC O-0-10: Installation of Air Reservoirs

ii). TC O-0-16: Railway Passenger Handling Safety Rules

iii). TC O-0-26: Passenger Car Safety Rules

iv). TC O-0-76: Locomotive Safety Rules

v). TC O-07-01: Passenger Train Brakes

j). USPHS (U.S. Public Health Service)

i). U.S. Public Health Service Food Code 2017

2.4 Standards

a). AAMA (American Architectural Manufacturers Association

i). 501.1-05: Standard Test Method For Water Penetration Of Windows, Curtain Walls And Doors Using Dynamic Pressure

b). AAR (Association of American Railroads)

i). C-II: Design, Fabrication, and Construction of Freight Cars

ii). M-101: Axles Carbon Steel, Heat-Treated

iii). M-107/M-208: Wheels, Carbon Steel

iv). M-114: Helical Springs, Heat-Treated Steel

v). M-201: Steel Castings

vi). M-601: Hose, Wrapped, Air Brake, “End Hose”

vii). M-618: Hose, Air, Wire-Reinforced

viii). M-934: Freight Car Journal Roller Bearings

ix). M-1001: Design, Fabrication, and Construction of Freight Cars

x). RP-585: Wiring and Cable Specification

xi). S-100, Section B: Bushings, Stainless Steel Tube–Coupler Shanks and Yokes

xii). S-400: Brake Equipment-Installation Specifications

xiii). S-471: Brake Pipe Restriction Test

xiv). S-4200: ECP Cable-based Brake Systems – Performance Specifications

xv). S-4210: ECP Cable-based Brake System Cables, Connectors and Junction Boxes – Performance Specifications

c). AHRI (Air-Conditioning, Heating, and Refrigeration Institute)

i). 700: Specifications for Fluorocarbon Refrigerants

d). Aluminum Association

i). AA-ADM-105: Aluminum Design Manual: Specifications and Guidelines for Aluminum Structures

ii). Aluminum Company of America (ALCOA) Technical Report 524, Specification Covering Use of Aluminum in Passenger Carrying Railway Vehicles

iii). Aluminum Standards and Data

e). ANSI (American National Standards Institute)

i). B16.18: Cast Copper Alloy Solder Joint Pressure Fittings

ii). C82.2: For Lamp Ballasts-- Method of Measurement of Fluorescent Lamp Ballasts

iii). S1.4: Specification for Sound Level Meters

iv). S3.2-2009: Method for Measuring the Intelligibility of Speech over Communication Systems

v). Z26.1: Safety Code for Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways

f). ANSI (American National Standards Institute)/ASME (American Society of Mechanical Engineers)

i). B1.13M: Metric Screw Threads

ii). B16.22: Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

iii). B18.1.2: Large Rivets (1/2 Inch Nominal Diameter and Larger)

iv). B31.1: Power Piping

g). ANSI (American National Standards Institute)/IEEE (Institute of Electrical and Electronics Engineers)

i). 730: Software Quality Assurance Plans

ii). 1016: IEEE Standard for Information Technology-Systems Design-Software Design Descriptions

iii). C37.13: IEEE Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures

iv). C37.14: IEEE Standard for DC (3200V and below) Power Circuit Breakers Used in Enclosures

v). C37.16: Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors

h). APTA (American Public Transportation Association)

i). Passenger Rail Equipment Safety Standards (PRESS) for Rail Programs

ii). Manual for the Development of System Safety Program Plans for Commuter Railroads

iii). Manual of Standards and Recommended Practices for Rail Passenger Equipment

i). ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers)

i). 41.1-1986 (R2006): Standard Method for Temperature Measurement

ii). 37-2009: Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment

iii). 23-2016: Guideline for the Design and Application of Heating, Ventilation, and Air-Conditioning Equipment for Rail Passenger Vehicles

j). ASME (American Society of Mechanical Engineers)

i). Boiler and Pressure Vessel Code

ii). Code for Pressure Piping

iii). B1.13M: Metric Screw Threads: M Profile

k). ASTM (American Society for Testing and Materials)

i). A6: Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

ii). A53/A53M-07: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

iii). A380-06: Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

iv). A488/A488M-07: Standard Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel

v). A502-03: Standard Specification for Rivets, Steel Structural

vi). A572, A568, A588, A606, A715, A710: High Strength Low Alloy Structural Steel

vii). A588: Standard Specification for High-Strength Low-Alloy Structural Steel

viii). A606: Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance

ix). A666: Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

x). A710: Standard Specification for Precipitation-Strengthened Low-Carbon Nickel-Copper-Chromium-Molybdenum-Columbium Alloy Structural Steel Plates

xi). A715: Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, with Improved Formability

xii). A802: Standard Practice for Steel Castings, Surface Acceptance Standards, Visual Examination

xiii). B26/B26M-09: Standard Specification for Aluminum-Alloy Sand Castings

xiv). B32-08: Standard Specification for Solder Metal

xv). B75-02: Standard Specification for Seamless Copper Tube

xvi). B85/B85M-09: Standard Specification for Aluminum-Alloy Die Castings

xvii). B108/B108M: Standard Specification for Aluminum-Alloy Permanent Mold Castings

xviii). B117: Standard Practice for Operating Salt Spray (Fog) Apparatus

xix). B247-09: Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings

xx). B633-07: Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

xxi). C177-10: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

xxii). C542-05: Standard Specification for Lock-Strip Gaskets

xxiii). C1166-06: Standard Test Method for Flame Propagation of Dense and Cellular Elastomeric Gaskets and Accessories

xxiv). D395-03: Standard Test Methods for Rubber Property-Compression Set

xxv). D412-06ae2: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

xxvi). D523-08: Standard Test Method for Specular Gloss

xxvii). D573-04: Standard Test Method for Rubber—Deterioration in an Air Oven

xxviii). D618-08: Standard Practice for Conditioning Plastics for Testing

xxix). D638-08: Standard Test Method for Tensile Properties of Plastics

xxx). D624-00: Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

xxxi). D746-07: Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

xxxii). D790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

xxxiii). D952: Standard Test Method for Bond or Cohesive Strength of Sheet Plastics and Electrical Insulating Materials

xxxiv). D1149-07: Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment

xxxv). D2240-05: Standard Test Method for Rubber Property—Durometer Hardness

xxxvi). D2261: Standard Test Method for Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure

xxxvii). D3574-95: Seat Cushion Testing Requirements

xxxviii). D3774-96(2008)e1: Standard Test Methods for Width of Textile Fabric

xxxix). D3775-08: Standard Test Method for Warp (End) and Filling (Pick) Count of Woven Fabrics

xl). D3776/D3776M - 09a: Standard Test Methods for Mass Per Unit Area (Weight) of Fabric

xli). D3884: Standard Test Method for Abrasion Resistance of Textile Fabrics

xlii). D4956-07: Standard Specification for Retroreflective Sheeting for Traffic Control

xliii). E94-04: Standard Guide for Radiographic Examination

xliv). E119-10b: Standard Test Methods for Fire Tests of Building Construction and Materials

xlv). E162-09: Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source

xlvi). E165-02: Standard Test Method for Liquid Penetrant Examination

xlvii). E168-06: Standard Practices for General Techniques of Infrared Quantitative Analysis

xlviii). E446-98(2004)e1: Standard Reference Radiographs for Steel Castings Up to 2 in. [51 mm] in Thickness

xlix). E662-09: Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials

l). E709-01: Standard Guide for Magnetic Particle Examination

li). E709-08: Standard Guide for Magnetic Particle Testing

lii). E802-95: Standard Reference Radiographs for Gray Iron Castings Up to 4 1/2 in.
(114 mm) in Thickness

liii). F1344-10: Standard Specification for Rubber Floor Tile

l). AWS (American Welding Society)

i). AWS Welding Handbook

ii). B2.1/B2.1M: Specification for Welding Procedure and Performance Qualification

iii). B2.2/B2.2M: Specification for Brazing Procedure and Performance Qualification

iv). B2.3/B2.3M: Specification for Soldering Procedure and Performance Qualification

v). C1.1M/C1.1:2000 (R2006): Recommended Practices for Resistance Welding

vi). C7.2: Recommended Practices for Laser Beam Welding, Cutting and Drilling

vii). C7.4/7.4M: Process Specification and Operator for Laser Beam Welding

viii). D1.1/D1.1M: Structural Welding Code – Steel

ix). D1.2/D1.2M: Structural Welding Code, Aluminum

x). D1.3/D1.3M: Structural Welding Code – Sheet Steel

xi). D1.6/D1.6M: Structural Welding Code, Stainless Steel

xii). D1.9/D1.9M: Structural Welding Code— Titanium

xiii). D17.2/D17.2M: Specification for Resistance Welding in Aerospace Applications

xiv). D17.3/D17.3M: Specification for Friction Stir Welding of Aluminum Alloys for Aerospace Applications

m). Boeing

i). BSS-7239: Test Method for Toxic Gas Generation by Materials on Combustion

n). Bombardier

i). SMP 800-C: Toxic Gas Generation of “Flex 35 Rev. D” Rubber Compound

o). British Railways Board Group Standard

i). GM/TT0088, Issue 1: Geometric Interfaces Between Railway Wheelsets and Track

p). CENELEC (European Committee for Electrotechnical Standardization)

i). EN 50128: Railway Applications - Communications, Signaling and Processing Systems - Software for Railway Control and Protection Systems

q). CSA (Canadian Standards Association)

i). C22.2, No. 197-M1983: PVC Insulating Tape

r). EIA (Electronic Industries Alliance)

i). 649-A 2004: National Consensus Standard for Configuration Management

s). European Norms

i). DIN EN 13452-1: Railway Applications – Braking - Mass Transit Brake Systems – Part 1: Performance Requirements

ii). BS EN 50126: Railway Applications. The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)

iii). BS EN 50155: Railway applications. Rolling stock. Electronic equipment

t). GSA (General Services Administration) – Federal Standards

i). QQ-B-654A: Brazing Alloys, Silver

ii). QQ-P-416F: Plating, Cadmium (Electrodeposited) (S/S by SAE-AMS-QQ-P-416)

iii). TT-P-38E: Paint, Aluminum, Ready-mixed

iv). TT-P-664D: Primer Coating, Alkyd, Corrosion-inhibiting, Lead and Chromate Free, Con-compliant (S/S by SSPC-PAINT25)

v). WW-C-563A: Conduit, Metal, Rigid, Electrical, Thin Wall Steel Type (Electrical Metallic Tubing), Straight Lengths, Elbow, & Bends (S/S by UL797)

vi). WW-C-566C: Conduit, Metal, Flexible (S/S by A-A-55810)

vii). WW-T-799F: Tube, Copper, Seamless, Water (For use with Solder-flared- or Compression-type Fittings) (S/S by ASTM-B88)

u). IEC (International Electrotechnical Commission)

i). 60571: Electronic Equipment used on Rail Vehicles

ii). 61373: Railway Application, Rolling Stock Equipment, Shock and Vibration Tests

v). IEEE (Institute of Electrical and Electronics Engineers)

i). 16: Standard for Electrical and Electronic Control Apparatus on Rail Vehicles

ii). 1016: Standard for Information Technology-System Design-Software Design Descriptions

iii). 1568-2003: Recommended Practice for Electrical Sizing of Nickel-Cadmium Batteries for Rail Passenger Vehicles

iv). C37.13: Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures

v). C37.14: Standard for Low Voltage DC Power Circuit Breakers Used in Enclosures

vi). C37.16: Standard for Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage AC (635 V and below) and DC (3200 V and below) Power Circuit Breakers

vii). P1477: Passenger Information System for Rail Transit Vehicles

w). IESNA (Illuminating Engineering Society of North America)

i). LM-79-08: Electrical and Photometric Measurements of Solid-State Lighting Products

x). IFI (Industrial Fasteners Institute)

i). Inch Fastener Standards, 7th Edition

ii). Metric Fastener Standards, 3rd Edition

y). IPC (Association Connecting Electronics Industries)

i). 2221: Generic Standard on Printed Board Design

z). ISO (International Organization for Standardization)

i). 2631: Mechanical Vibration and Shock – Evaluation of Human Exposure to Whole Body Vibration

ii). 9001:2000: Quality Management Systems-Requirements

iii). 15609-4: Specification and Qualification of Welding Procedures for Metallic Materials – Welding Procedure Specification – Part 4: Laser Beam Welding

aa). MIL (Military Standards)

i). MIL-C-5015: Connectors, Electrical, Circular Threaded, AN Type, General Specification for FSC 5935

ii). MIL-C-7438G: Core Material, Aluminum, for Sandwich Construction

iii). MIL-DTL-3950G: Detail Specification: General Specification for Switches, Toggle, Environmentally Sealed

iv). MIL-DTL-55302F: Detail Specification, Connectors, Printed Circuit Subassembly and Accessories

v). MIL-HDBK-132A: Protective Finishes for Metal and Wood Surfaces

vi). MIL-HDBK-505: Department of Defense Handbook: Definitions of Item Levels, Item Exchangeability, Models, and Related Terms

vii). MIL-I-46058C: Insulating Compound, Electrical (for Coating Printed Circuit Assemblies)

viii). MIL-P-13949: Sheet, Printed Wiring Board

ix). MIL-P-23469/2B: Pin-Rivet, Grooved, Brazier Head; Straight Shank, Six Locking Grooves, Aluminum Alloy, Corrosion-Resistant and Carbon Steels

x). MIL-P-8053C: Plywood, Metal-Faced

xi). MIL-S-83502: Socket, Plug-in, Electronic Components, Round to Style (T05)

xii). MIL-DTL-83731B: Detail Specification: General Specification for Switches, Toggle, Unsealed and Sealed

xiii). MIL-S-83734: Sockets, Plug-in Electronic Components (Right Angle Leads, for 14 and 16 Pin Dual-in-Line Packages)

xiv). MIL-PRF-8805D: Performance Specification: General Specifications for Switches and Switch Assemblies, Sensitive, Snap Action (Basic, Limit, Push Button and Toggle Switches)

xv). MIL-STD-882E: Standard Practices for System Safety

xvi). MIL-STD-883H: Department of Defense Test Method Standard: Microcircuits

xvii). MIL-STD-1472: Human Engineering

xviii). MIL-T-16366F: Terminals. Electric Lug and Conductor Splices, Crimp-Style

xix). MIL-T-55164C: General Specification for Terminal Boards, Molded Barrier, Screw and Stud Types, and Associated Accessories

bb). NFPA (National Fire Protection Association)

i). 10: Standard for Portable Fire Extinguishers

ii). 70: National Electric Code

iii). 130: Standard for Fixed Guideway Transit and Passenger Rail Systems

cc). SAE (Society of Automotive Engineers)

i). AMS-T-81914/1: Tubing, Plastic, Flexible, Convoluted, Polytetrafluoroethylene, Standard Convolutions

ii). AS7928: General Specification for Terminals, Lug: Splices, Conductor: Crimp Style, Copper

iii). J995_199907: Mechanical and Material Requirements for Steel Nuts

iv). Civilian American and European Surface Anthropometry Resource Project (CAESAR I)

dd). Amtrak Specifications to be provided by Amtrak

i). AMT-3: Air Brake and Train Handling Rules and Instructions 223: 480VAC Head End Power Jumper & Receptacle Hardware for Passenger Cars & Standby Equipment

ii). 315: Public Address/Intercom System

iii). 323: High Performance Wire and Cable for Use on Passenger Vehicles

iv). 352: Flammability, Smoke Emissions and Toxicity for use on Railway Passenger Cars and Locomotive Cabs

v). 353: Vendor Maintenance Manuals

vi). 354: Builder Operating & Maintenance Manual Family

vii). 429: Specification for Describing Environmental and Operating Conditions

viii). 498: 480, 240, 208, 120 VAC and 72VDC Switchboard Panels

ix). 528: 480, 240, 208, and 120 VAC 72VDC Relay and Contactor Panel

x). 563: Specification for Material and Workmanship for Replacement Truck Springs

xi). 665: Seat Cushion Assemblies

xii). 685: Disposable Air Filter

xiii). 696: Valve and Exterior Equipment Identification Tags & Labels and Operating Instructions

xiv). 697: National On-Board Signage Manual

xv). 700: Schematic, Wiring and Piping Diagram Drawings

xvi). 742-1: Paints and Coatings

xvii). 759: Replacement of Copper Waste Piping with Non-Metallic Pipe

xviii). 771-1: Specification for General Requirements for Wheels

xix). 794-1: Specification for Low Location Exit Path Marking Systems for use on Amtrak Passenger Cars

xx). 907: Specification for Passenger Car Wheelsets

xxi). 963: Operational and Environmental Conditions for Rail Rolling Stock

xxii). 967: Manufacture and Acceptance of Passenger Seating for Intercity Rail Cars

xxiii). 973: Specification for Passenger Car Disc Brake Pad Qualification Test

xxiv). 1004: Specification for Thermally Actuated Automatic Drain Valve for Freeze Protection on Passenger Cars

xxv). 1118: Specification for Shunt Improvement Device

ee). Drawings to be provided by Amtrak

i). Amtrak

(1) A-63-7675-15: Trainline Standard: 27 Point MU System

(2) A-63-7676-1: Trainline Standard 27 PT Communication System

(3) B-144: Standard Amtrak Coach Key (J.L. Howard Part No. 2555)

(4) C-01-1498: 27-Pin Communication Jumper Cable

(5) C-63-7422: 27-Pin MU Jumper Cable

(6) C-63-7437: 27-Pin MU Receptacles

(7) C-96-7591: Standard Trash Container (Amtrak Part No. 24-045-18737)

(8) D-00-1359: Speed Sensor and Cable Assembly

(9) D-00-7075: Temperature Probe and Connectors

(10) D-05-1355: Amtrak Clearance Diagram

(11) D-12-7191: 480 VAC Jumpers and Housing

(12) D-63-7439: 27-Pin Communication Receptacle

(13) D-63-7440: 27-Pin Communication Dummy Receptacle

(14) D-65-7449: Power Transformers

(15) E-140-2959: Emergency Equipment Cabinet Arrangement

(16) S-603: Braking Distance Calculations

(17) 73195.001.04: No. 8 Welded SGM Turnout

ii). Metro-North Commuter Railroad Company

(1) MSC100001: Clearance Diagram

iii). Supplemental Documentation

(1) Amtrak Intercity Trainset Technical Specification Clarification and Detail – Digital Technology

2.5 Definitions

a). The definitions and abbreviations defined below are used throughout this technical specification.

b). Wherever in the Contract Documents terms are used, the definition, intent and meaning shall be interpreted as follows:

i). **A**

(1) **A-End** (of the car) — Defined as the end of the car opposite from the B-end of all cars except the Cab car.

(2) **Accessible** — To be compliant with the applicable standards and regulations for accessibility as defined by the Americans with Disabilities Act of 1990 (ADA) as amended.

(3) **Accessible Toilet Room (ATR)** —Toilet room in the passenger rail cars, designed to be compliant with all applicable standards for accessibility as defined by the Americans with Disabilities Act of 1990 (ADA) as amended.

(4) **Actuator** — A self-contained brake system component that generates the force to apply the brake shoe or brake pad to the wheel or disc. An actuator typically consists of a cylinder, piston and piston rod.

(5) **Adhesion, Coefficient of** — During rolling contact, the ratio between longitudinal tangential force at the wheel-rail interface and normal force.

(6) **Amtrak** — The National Railroad Passenger Corporation, which has its headquarters at 1 Massachusetts Avenue, NW, Washington, DC 20001, and any permitted assignee of Amtrak's rights under the Contract.

(7) **Analysis** — Written report of the systematic examination of the design, performance and condition of parts, components and systems against Contract and Technical Specification requirements.

(8) **Approval** — Review and acceptance, in writing, by Amtrak. Amtrak approval in no way relieves the Contractor of meeting all requirements of the specification.

(9) **Approved Equivalent** — The term "approved equivalent" shall mean an item, which is fully equivalent or superior in terms of form, fit, function, performance and properties, to the specified item.

(10) **Assembly** — A collection of subassemblies and components typically performing a variety of functions within the context of a larger system.

(11) **Authorize** — To give authority or power to proceed.

(12) **Availability** — The percentage of the car fleet usable for revenue service at the beginning of each day's schedule. Also, on per car basis, the percentage of time a car is usable for service:

$$\text{Availability} = \frac{\text{MTBF}}{\text{MTBF} + \text{MTTR}}$$

ii). **B**

(1) **Baseline Design** — The design of the car or any of its components, apparatus, systems, subsystems, or materials, which has received both drawing approval and first article approval by Amtrak.

(2) **Baseline Work** — All activities, which shall be performed on the cars in order to comply with the requirements of this Specification.

(3) **B-End** (of the car) — The end of the car where the hand brake is located on all car types.

(4) **Bill of Materials** — A list of the components, sub-assemblies, assemblies, and systems required to manufacture the final railcar. The bill of material includes quantities, weights, material, manufacturer's name, and manufacturer's part number.

(5) **Braking, Blended** — In braking, the simultaneous control of dynamic (rheostatic and/or regenerative) and friction braking, with the effort of each continuously proportioned to achieve the required total braking effort.

(6) **Braking, Dynamic** — An electric primary braking system on locomotives so equipped, whereby the traction motors act as generators and the current derived thereof is modulated. This includes both rheostatic and regenerative modes.

(7) **Buff** — Compressive forces acting longitudinally through the carbody's primary structure.

(8) **Burn-In** — Operating a component, system, or device in a test mode, often in an extreme or cycled temperature environment, for a specified period of time or distance, to confirm reliable operation.

iii). **C**

(1) **Calibration** — Comparing the performance of a measuring device of unknown accuracy against one of known accuracy.

(2) **Cant Deficiency** — The condition when a rail vehicle's actual speed through a curve is greater than the speed at which the components of wheel-to-rail force, normal to the plane of the track, would be equalized for the outside and the inside rails.

(3) **Car/Cars** — The railroad passenger cars to be provided by the Contractor pursuant to this Contract.

(4) **Carbuilder** — See Contractor.

(5) **Characteristics** — Any distinct property, or attribute, of the material, or services, that can be described, and measured, to determine conformance, or non-conformance, to Contract requirements.

(6) **Commissioning** — Activities involved in delivering, adjusting, and testing the cars to demonstrate compliance with Specification requirements and prepare the cars for revenue service.

(7) **Component** — Usually self-contained, a component is comprised of parts, devices and structure and performs a distinctive function necessary to the operation of a system or subsystem.

(8) **Concept Drawings** — An initial set of drawings showing the general car layout and arrangement.

(9) **Conformed Specification** — These Specifications as revised to include and reflect all approved change orders, variances and waivers implemented throughout the duration of the Contract.

(10) **Contract Deliverable Requirements List (CDRL)** — List of documents and other deliverable items that the Contractor is required to deliver to Amtrak. CDRL is also used to refer to a specific item on the list.

(11) **Contractor's Drawings** — Items such as general drawings, detail drawings, graphs, diagrams, sketches, calculations, and catalog cuts which are prepared by the Contractor to detail its work.

(12) **Crash Energy Management, CEM** — Carbody design such that the structures crush in a controlled manner and absorbs energy with the goal to significantly improve crashworthiness.

(13) **Customer** — Amtrak

iv). **D**

(1) **Days** — Days shall mean a United States calendar day unless otherwise specified.

(2) **Delivery, Delivered** — The arrival of the completed vehicle at Amtrak's designated facility, ready for commissioning and acceptance testing.

(3) **Defect** — Any instance of non-conformance with a specification for material, appearance, finish, function, performance or manufacture.

(4) **Detrucking** — The complete disconnection and removal as required of all structural, mechanical, pneumatic, and electrical connections between the truck assembly and carbody in order to facilitate the complete jacking of the car to remove the carbody weight from the truck assembly.

(5) **Device** — Any component, subsystem or system, whether electrical, mechanical, pneumatic or hydraulic.

v). **E**

(1) **Equal/Equivalent** — Whenever the words "equal", "approved equal", "equivalent" or "approved equivalent" are used in connection with a specified component, material, system characteristic or performance requirement, the Contractor shall prepare and submit for Amtrak approval an analysis that demonstrates that a design, component or system characteristic as proposed by the Contractor has equal or superior appearance, performance interchangeability, availability and compliance with specification requirements to that of the design, component or system as originally specified. This equivalency shall take the form of a specification variance and shall only be permitted with the specific written approval of Amtrak. The reason for the variance request must be included in the analysis as submitted.

vi). **F**

(1) **Fail-Safe** — A characteristic of a system which ensures that no malfunction will create a condition that is not known to be safe.

(2) **Failure** — A condition in which equipment, components or systems do not function as specified, designed or intended.

(3) **Failure Mode and Effects Analysis (FMEA)** — A procedure for analysis of potential failure modes within a system for the classification by severity or determination of the failure's effect upon the system.

(4) **Failure Rate** — The frequency of failure, expressed as failures per hour or failures per mile. Failure rate is the mathematical reciprocal of MTBF or MDBF.

(5) **Fault Tree Analysis** — A failure analysis in which an undesired state of a system is analyzed using Boolean logic to combine a series of lower-level events. This analysis method is mainly used in the field of safety engineering to quantitatively determine the probability of a safety hazard.

(6) **Field Modification Instructions (FMI)** — Instructions for applying and installing engineering solutions to resolve fleet-wide defects and/or upgrade installations and/or systems to vehicles that have already been shipped from the factory.

(7) **First Article** — The first one of any production components of the base item or vehicle that is manufactured using production parts, components, processes and procedures.

(8) **First Article Inspection (FAI)** — The examination and approval by Amtrak of an initial part, major assembly, subassembly, system, subsystem, apparatus, or material, manufactured or assembled by either the Contractor or Subcontractors. The first article approval establishes the baseline design, configuration and the minimum level of quality for the balance of the production run.

(9) **Fleet** — All equipment under the contract including all options for additional exercise.

(10) **Fleet Defect** — Identified when 5% of the quantity of a warranted item fails or where 5% of cars per a fleet type are affected, including those items for which the warranty period expired before Amtrak recognizes the failure.

(11) **Free Travel** — The vertical lineal distance between the top of rail and a car body reference point as measured under static conditions when comparing an empty car (AW0) and fully loaded car (AW3).

vii). **H**

(1) **Hazard** — A real or potential condition that can cause injury, death, damage to or loss of equipment, personnel, or property or damage to environment.

(2) **Head End Power (HEP)** — Electrical Power (480 VAC, 3-phase, 60 Hz power) produced by a locomotive or power car, or supplied from stationary substation, which is used as the primary electrical power source by the cars.

viii). **I**

(1) **Independent Failure** — A failure which is not the result of another failure, either directly or indirectly.

(2) **Indicated** — As shown on the Contract Drawings, as described in the Specifications, or as required by other Contract Documents.

(3) **Inspection** — The careful examination, measurement, and testing of the characteristics and performance of materials, components and systems to ensure conformance with Contract requirements.

(4) **Inspection Equipment** — Any tool, gauge, fixture, apparatus, or other device used for inspection purposes.

(5) **Inspector** — The person or firm designated and authorized to perform quality control inspections.

(6) **Interface** — The points where two or more physical subsystems or systems meet to transfer load, energy or information.

ix). **L**

(1) **Left-Hand Side** — The side of the car on the left, when standing inside the car at the B-end facing the A-end.

(2) **Line Replaceable Unit (LRU)** — A modular component designed to be replaced quickly at an operating location to restore the car to an operational ready condition.

(3) **Lowest Level Replaceable Unit (LLRU)** — The lowest unit (component) of a system or subsystem, which is removable and replaceable from an installed position by standard attachments (e.g., bolts and nuts, quick-disconnects, etc.).

x). **M**

(1) **Maintainability** — A measure of a car's ability to be properly maintained considering the ease and frequency of maintenance tasks, ability to efficiently use applied labor, and accessibility of equipment to be maintained by Amtrak's maintenance staff. Maintainability is sometimes quantified by the Mean Time To Repair (MTTR).

(2) **Material** — An all-inclusive term used to denote raw materials, parts, components, assemblies, and equipment used in the finished product.

(3) **Mean Time Between Failures (MTBF)** — The mean operating time between consecutive independent failures, measured in calendar days as a ratio of the cumulative time to the number of failures under stated conditions.

$$\text{MTBF} = \frac{\text{Total Operating Time (hours)}}{\text{Total Number of Failures}}$$

(4) **Mean Distance Between Failures (MDBF)** — The mean operating mileage between consecutive independent failures computed as a ratio of the cumulative mileage to the number of failures under stated conditions.

$$\text{MDBF} = \frac{\text{Total Operating Distance (miles)}}{\text{Total Number of Failures}}$$

(5) **Mean Time Between Component Failures (MTBCF)** — The mean time between individual component failures

$$\text{MTBCF} = \frac{\text{Total Operating Distance (miles)}}{\text{Total Number of Component Failures}}$$

(6) **Mean Distance Between Service Failures (MDBSF)** — The mean operating mileage between service failures caused by equipment or system failures.

$$\text{MDBSF} = \frac{\text{Total Operating Distance (miles)}}{\text{Total Number of Service Failures}}$$

(7) **Mean Distance Between Train Delays (MDBTD)** — The mean operating mileage between train delays caused by equipment or system failures.

(8) **Mean Time To Repair (MTTR)** — The average time required to repair a failed component or device and return it to production status, including time needed for the maintainer to access, remove, replace/repair, close, and test-out the failed component or device. MTTR shall not include logistics time. Expressed mathematically, it is the total corrective maintenance time for failures divided by the total number of corrective maintenance actions for failures during a given period of time.

$$\text{MTTR} = \frac{\text{Total Repair Time (hours)}}{\text{Total Number of Repairs}}$$

(9) **Mileage, Operating** — The total distance traveled by the cars during scheduled and unscheduled movements.

(10) **Modify** — To change the design, placement, or other aspect(s) of an item to provide for a different form, fit or function or to resolve deficiencies or improve performance.

xi). **N**

(1) **New** — An item, OEM or approved equal, which has not previously seen service in whole or in part.

(2) **No-Motion** — The vehicle speed at or below the lowest speed detectable by the vehicle control systems. Also known as “zero speed”.

(3) **Normal** — As in, example, "normal operating conditions" or "operating normally" -- A condition in which relevant vehicle equipment is not in a failure mode and the environment is as specified.

(4) **Notice** — A written announcement from Amtrak.

(5) **Notice to Proceed (NTP)** — A written notice from Amtrak to the Contractor to officially start work on the Contract.

xii). **O**

(1) **Open Items** — Items not resolved on the car and documented as incomplete. It is the Contractor responsibility to resolve and close these issues. Open items may be documented at any time during the Contract duration.

(2) **Original Equipment Manufacturer (OEM)** — The original manufacturer of a hardware subsystem, component or completed vehicle.

xiii). **P**

(1) **Pilot Car(s)** — the first car (of each type) to be fully assembled at the Contractor's final assembly facility.

(2) **Procurement (Work)** — The furnishing of all equipment, items, materials, parts, systems, data, design, services, incidentals, labor and management and performance of the contractual requirements defined in the Contract Documents, including changes thereto, in order to produce and deliver the specified cars, spare parts, hardware and software goods, and services.

(3) **Proof** (used as a suffix) — Apparatus as designated as splash-proof, dust-proof, etc., when so constructed, protected, or treated that its successful operation is not interfered with when subjected to the specified material or condition.

(4) **Push-Pull Operations** — A method of controlling the actions of the propulsion, braking and other systems of a train from a control cab, located in either the locomotive or the cab car, for bi-directional operation.

xiv). **R**

(1) **Railroad —** Amtrak, or the owner(s) of the operating railroad over which Amtrak's trains operate, and/or the property and/or improvements used in connection with such operating railroads, as defined by 49 CFR Part 238.

(2) **Rapid Prototype Car(s)** — the first car (of each type) to be prototyped for form and fit issues that can be identified prior to production at the Contractor's final assembly facility.

(3) **Redundancy** — The existence of more than one means for accomplishing a given function. The ability to accomplish a given function by two or more independent means.

(4) **Reliability** — The ability of a system to perform the required function under stated operating conditions for a stated period of time. This is defined as the failure rate of an item expressed as a percentage or in time of operating hours. The desired result is to have high reliability (100%) with a low failure rate (0%).

(5) **Remanufacture** — To rebuild and recertify to OEM standards for functionality and appearance. Parts that cannot be remanufactured shall be renewed.

(6) **Renew** — To replace with a new equivalent component (regardless of condition of part being renewed).

(7) **Repair** — Correct specific damage to return to original condition or functionality.

(8) **Revenue Service** — When a rail car is available to the general public and there is a reasonable expectation of carrying passengers that either directly pay fares, are subsidized by public policy, or provide payment through some contractual arrangement. Vehicles operated in fare free service are considered in Revenue Service.

(9) **Right-Hand Side** — The side of the car on the right, when standing inside the car at the B-end facing the A-end.

xv). **S**

(1) **Safe** — Secure from potential harm, injury, danger or risk; free from danger or risk.

(2) **Safety** — The condition in which persons and equipment are free from threat, danger, harm, or loss arising from improper design, manufacture, assembly or function, or a failure of the car or any of its components or systems.

(3) **Safety Critical** — A system, or any portion thereof, means the correct performance of which is essential to safety of personnel or Vehicle, or both; or the incorrect performance of which could cause a hazardous condition, or allow a hazardous condition which was intended to be prevented by the function or system to exist.

(4) **Service** — (as in service use, service braking.) The operation of the cars under normal conditions.

(5) **Service Failure** — Refer to Exhibit G for definition.

(6) **Services** — Work and incidental material specified in a Contract such as inspection, nondestructive examination, calibration, testing, welding, analysis, etc.

(7) **Shipment** — The physical movement of the cars from the Contractor's production facility to the Contractor’s designated acceptance facility or other designated destination.

(8) **Shop Drawings** — Drawings or sketches prepared by the Contractor for use in its manufacturing facility, assembly facility, or shop, to fabricate, assemble, and/or install parts of the vehicles, whether

manufactured by it from raw materials or purchased from others in a ready-to-use condition.

(9) **Slide, Wheel** — During braking, the condition when the rotational speed of the wheel is slower than that of the actual pure rolling contact between tread and rail.

(10) **Slip, Wheel** — During acceleration, the condition existing when the rotational speed of the wheel is faster than that of pure rolling contact between tread and rail.

(11) **Special Tools** — All specialized tools, gauges, meters, diagnostic Vehicle (including laptop computer software), etc. that will be necessary to operate, maintain, overhaul, inspect, test, troubleshoot and repair all configurations of the rolling stock throughout its design life. Special tools do not include those tools that are commercially available “off the shelf”.

(12) **Specified or As specified** — As stated in this document or other referenced documents.

(13) **Speed, Design** — The specified maximum possible operating speed of the car. The car and all components shall be suitable for safe operation at all speeds up to and including this speed.

(14) **Standards and Specifications** — When industry, government, association, or society standards or specifications are referred to, the applicable issue at the time of Notice to Proceed (NTP) signing shall be used.

(15) **Step, Signal** — A signal having a constant value prior to the step and a different constant value immediately thereafter.

(16) **Stop, Emergency** — The stopping of a vehicle or train by an emergency brake application.

(17) **Subassembly** — A collection of components used to perform a distinct function, usually in conjunction with other subassemblies and components, as part of a larger system. Subassemblies are usually replaceable as units, such as circuit boards, bearings and valves.

(18) **Subsystem** — A defined portion of a system.

(19) **Superelevation** — The vertical difference between the top surface of the outside and inside rails of a curve.

(20) **System** — A combination of hardware, people, and or software systems, in any combination which are integrated to perform a specific operational function.

xvi). **T**

(1) **Tamperproof** — Fasteners are designated as tamperproof when they are selected so that they cannot be easily loosened with common tools such as screwdrivers or pliers.

(2) **Tare** — A term in weights and measurements which refers to the weight of an empty container. The tare weight can be subtracted when a filled container is weighed to determine the weight of the contents alone.

(3) **Test, Installation and Removal** — Tests are maintainability related tests which are used to ensure equipment, as designed, can be easily removed and replaced.

(4) **Test, Proof of Design** — Proof-of-Design tests are engineering tests which are used to ensure equipment, as designed, meets the functional and performance requirements of the vehicle specifications.

(5) **Test Plan** — A document that defines the plan and schedule for conducting all the tests required on the vehicle.

(6) **Test Procedure** — A step-by-step procedure that identifies the equipment, exact sequence of events and criteria used to ensure that components and systems function properly.

(7) **Test, Production** — A series of tests applied to each component or vehicle to ensure all systems and components perform according to design and specification.

(8) **Tight (used as a suffix)** — Apparatus is designed as watertight, dust-tight, etc., when so constructed that the design will exclude the specified material from affecting the functioning condition or performance of the component or system.

(9) **Time, Warm-up** — The elapsed time from application of power to an operable device until it is capable of performing its intended function.

(10) **Train** — Any number of cars coupled to a locomotive or a source of self-propulsion, and moving as one.

(11) **Train Delay** — A train delay is defined as a car-related failure that causes a train in service to be: more than 15 minutes late at its destination terminal; canceled either at its originating point or en-route; or reduced in size or revenue capacity due to requiring a failed car to be removed from the train.

(12) **Tram** — A condition of ideal truck geometry in which the axles are perfectly parallel and the wheels longitudinally in perfect alignment. The centers of the journal bearings represent the corners of a perfect rectangle. Tram is checked by measuring the diagonal and longitudinal distances between reference points on the axle bearing housing.

xvii). **U**

(1) **U.S. Department of Transportation (USDOT)** — Means the Secretary of the USDOT and other persons who may at the time be acting in the capacity of the Secretary, or authorized representative or any person otherwise authorized to perform the functions to be performed hereunder, including representatives of the Federal Transit Administration (FTA) and Federal Railroad Administration (FRA).

xviii). **V**

(1) **Vehicle History Book** — A document specific to an individual rail vehicle containing records of technical and parts data pertinent to that individual vehicle.

(2) **Verification** — Examination and testing by the QA Representative to confirm decisions made by those performing the work concerning conformance of material to Contract requirements.

(3) **Vehicle** — Same as car or locomotive.

xix). **W**

(1) **Warp, Track** — The difference in crosslevel of any two points within the specific distance along the track. The warp parameter in the track geometry is used to specify the maximum in the crosslevel difference of the track in any segment (tangents, curves and spirals).

(2) **Weatherproof** — Able to withstand exposure to all weather and environmental conditions without damage or loss of function.

(3) **Weights, Assigned** — The loaded car categories assigned by Amtrak as the basis for structural repair design and for subsystem and vehicle testing as indicated. Four weight categories are assigned:

(a) AWO: Actual weight of empty car, ready for revenue service, but with neither crew nor passengers aboard. Includes full fresh water supply, empty waste system and full complement of provisions in the Food service car.

(b) AW1: Car at seated load and no standees.

(i) Seated Load is defined as all the passenger seats occupied plus one crew member per car.

(c) AW2: Car at normal full load.

(i) Normal Full Load is defined as seated load plus one standee per 3 ft2 of clear floor space.

(d) AW3: Car at crush load.

(i) Crush Load is defined as seated load plus one standee per 1.5 ft2 of clear floor space. Each passenger or standee is assumed to weigh an average of 180 pounds.

(4) **Weight, Dry** — The measured axle weight of an empty passenger rail car (measured dry). Fully assembled but with no water or provisions.

xx). **Z**

(1) **Zero Speed** — See “No motion”.

c). Clarifications

i). Whenever in the specifications or on the plans the words **"required," "determined," "directed," "specified," "authorized," "ordered," "given," "designated," "indicated," "considered necessary," "deemed necessary," "permitted," "reserved," "suspended," "established," "approval," "approved," "disapproved," "acceptable," "unacceptable," "suitable," "accepted," "satisfactory," "condemned,"** or words of like import are used, it shall be understood as if such words were followed by the words in writing, **"by Customer," "to Customer," "Amtrak"** unless otherwise specifically stated.

ii). Wherever the words "**provided,**" "**supplied,**" or "**installed**" are used in the specifications in reference to work to be performed by the Contractor, it shall be understood to mean "**furnished and delivered completed and ready for revenue service**."

2.6 Acronyms and Abbreviations

a). The following is a list of acronyms and abbreviations in this specification. The list is not intended to be all-inclusive.

i). **A**

(1)	**AALA**	American Association of Laboratory Accreditation
(2)	**AAR**	Association of American Railroads
(3)	**AC**	Alternating Current
(4)	**ADA**	Americans with Disabilities Act of 1990 as amended
(5)	**AED**	Automated External Defibrillator
(6)	**AEI**	Automatic Equipment Identification
(7)	**AESS**	Automatic Engine Stop Start
(8)	**amp**	ampere
(9)	**ANSI**	American National Standard Institute
(10)	**APTA**	American Public Transportation Association
(11)	**ASHRAE**	American Society of Heating, Refrigeration and Air

Conditioning Engineers

(12) **ASME** American Society of Mechanical Engineers

(13) **ASSE** American Society of Sanitary Engineers

(14) **ASTM** American Society for Testing and Materials

(15) **ATC** Automatic Train Control

(16) **ATOR** Above Top of Rail

(17) **ATR** Accessible Toilet Room

(18) **ATS** Automatic Train Stop

(19) **AW0** Empty vehicle operating weight, Ready-to-Run (Assigned Weight “0” load)

(20) **AW1** Car at seated load and no standees

(21) **AW2** Car at normal full load

(22) **AW3** Car at crush load

(23) **AWS** American Welding Society

ii). **B**

(1) **BC** Battery Charger

(2) **B.C.P.** Brake Cylinder Pressure

(3) **BP** Brake Pipe

(4) **Btu** British Thermal Unit

iii). **C**

(1) **C** Celsius

(2) **CAD** Computer-Aided Design

(3) **CCJPA** Capitol Corridor Joint Powers Authority

(4) **CCTV** Close Circuit TV

(5) **CCU** Communication Control Unit

(6) **CDU** Central Diagnostics Unit

(7) **CDRL** Contract Deliverable Requirements List

(8) **CDT** Central Diagnostics Terminal

(9) **CEM** Crash Energy Management

(10) **CFC** Chlorinated Fluorocarbons

(11) **cfm** Cubic Feet per Minute

(12) **CFR** Code of Federal Regulations

(13) **CO** Central Office

(14) **COMM** Communication

(15) **COTS** Clean, Oil, Test and Stencil

(16) **CPM** Critical Path Method

iv). **D**

(1) **DB** Dry Bulb

(2) **dB** Decibel

(3) **dB/sec** Decibels per second

(4) **dBA/sec** Decibels (Acoustic) per second

(5) **DC** Direct Current

(6) **dBA** Decibels (Acoustic)

(7) **DCS** Data Communication System

(8) **DC** Direct Current

(9) **DCS** Data Communication System

(10) **DR** Design Review

(11) **DTE** Diagnostic Test Equipment

(12) **DTN** Data Trainline Network

(13) **DVD** Digital Versatile Disc

(14) **DVD-RW** Digital Versatile Disc – Rewriteable

v). **E**

(1) **EAB** Electronic Air Brake

(2) **ECP** Electronically Controlled Pneumatic

(3) **ECR** Engineering Change Request

(4) **EEPROM** Electrically Erasable Programmable Read Only Memory

(5) **ECR** Engineering Change Request

(6) **e.g.** exempli gratia (for example)

(7) **EMC** Electromagnetic Compatibility

(8) **EMD** Electro Motive Diesel (a locomotive and component manufacturer)

(9) **EMI** Electromagnetic Interference

(10) **EMIS** Equipment Maintenance Information

(11) **EPA** U.S. Environmental Protection Agency Equipment Maintenance Information

(12) **EPROM** Erasable Programmable Read Only Memory

(13) **ER** equalizing reservoir

(14) **etc.** et cetera (and so forth)

(15) **ETMS** Electronic Train Management System

vi). **F**

(1) **F** Front (end of locomotive or cab car designator as defined by 49 CFR Part 229.11)

(2) **F** Fahrenheit

(3) **FAI** First Article Inspection

(4) **Fc** foot-candle

(5) **FCC** Federal Communication Commission

(6) **FDA** U.S. Food & Drug Administration

(7) **FDR** Final Design Review

(8) **FEA** Finite Element Analysis

(9) **FEM** Finite Element Model

(10) **FMEA** Failure Mode and Effects Analysis

(11) **FMECA** Failure Modes and Effects Criticality Analysis

(12) **FMI** Field Modification Instruction

(13) **Fpm** feet per minute

(14) **FRA** Federal Railroad Administration
(U.S. Department of Transportation)

(15) **FRP** Fiberglass Reinforced Plastic

(16) **Ft** Foot

(17) **ft2** square foot

(18) **ft3** cubic foot

(19) **FTA** Federal Transit Administration
(U.S. Department of Transportation)

vii). **G**

(1) **g** Acceleration due to gravity

(2) **gal** Gallon

(3) **GB** Gigabyte

(4) **GFCI** Ground Fault Circuit Interrupter

(5) **GHz** Gigahertz

(6) **gpm** gallons per minute

(7) **GPS** Global Positioning System

viii). **H**

(1) **HAZ** Heat-Affected Zones

(2) **HBPS** Holding Brake Pressure

(3) **HDL** Hydrodynamic Labyrinth

(4) **HDMI** High Definition Multimedia Interface

(5) **HEP** Head End Power

(6) **Hg** Mercury (pressure or vacuum – measured in inches)

(7) **HPPL** High Pressure Photoluminescent

(8) **hr** Hour

(9) **Hz** Hertz

(10) **HVAC** Heating, Ventilation, and Air Conditioning

ix). **I**

(1) **i.e.** id est (that is)

(2) **IC** Intercommunication

(3) **IDR** Intermediate Design Review

(4) **IEC** International Electrotechnical Commission

(5) **IEEE** Institute of Electrical and Electronic Engineers

(6) **IGBT** Insulated Gate Bipolar Transistor

(7) **in.** Inch

(8) **in^2** square inch

(9) **IPC** Illustrated Parts Manual

(10) **IPS** Iron Pipe Size

(11) **ISO** International Organization for Standardization

(12) **ISP** Internet Service Provider

(13) **IVDN** Inter-Vehicle Data Network

(14) **IWS** Instrumented Wheelset

x). **J**

(1) **JEDEC** Joint Electronics Device Engineering Council

xi). **K**

(1) **K** Kelvin

(2) **kg** Kilogram

(3) **kHz** Kilohertz

(4) **km** Kilometer

(5) **ksi** 1000 pounds per square inch (psi)

(6) **kW** kilowatt

xii). **L**

(1) **LAHT** Low Alloy High Tensile

(2) **lb** Pound

(3) **lbf** pounds of force

(4) **lbs/ft2** pounds per square foot

(5) **LCC** Life Cycle Cost Analysis

(6) **LCD** Liquid Crystal Display

(7) **LDTS** Local Diagnostic and Test System

(8) **LED** Light Emitting Diode

(9) **LLEPM** Low Location Exit Pathway Markings

(10) **LLRU** Lowest Level Replaceable Unit

(11) **lm** Lumen

(12) **Log** Inspection and Test Log

(13) **LRU** Line Replaceable Unit

(14) **LSA** Lead Service Attendant

(15) **lx** Lux

(16) **LVPS** Low Voltage Power Supply

xiii). **M**

(1) **m** Meter

(2) **mA** Milliampere

(3) **MAP** Maintenance Analysis Program

(4) **MB** Megabyte

(5) **Mbps** Megabits Per Second

(6) **MCAT** Minimally Compliant Analytical Track

(7) **MCSCM** Mechanical Committee of Standard Coupler Manufacturers

(8) **MDBCF** Mean Distance Between Component Failures

(9) **MDBF** Mean Distance Between Failures

(10) **MDBSF** Mean Distance Between Service Failures

(11) **MDBTD** Mean Distance Between Train Delays

(12) **mg/sq.in.** milligrams per square inch

(13) **MHz** Megahertz

(14) **MIG** Metal Inert Gas

(15) **MIL** Military Specification

(16) **min** Minute, minutes

(17) **mm** Millimeter

(18) **MP3** MPEG Audio Layer 3

(19) **MPa** Megapascal

(20) **mph** miles per hour

(21) **mphps** miles per hour per second

(22) **mphpsps** miles per hour per second per second

(23) **MR** Main Reservoir

(24) **MSDS** Material Safety Data Sheet

(25) **msec** Milliseconds

(26) **MTBF** Mean Time Between Failures

(27) **MTTR** Mean Time To Repair

(28) **MU** Multiple Unit

(29) **mV** Millivolt

xiv). **N**

(1) **N/A** Not Applicable

(2) **NAS** Network Attached Storage

(3) **NBS** National Bureau of Standards

(4) **NC** Normally Closed

(5) **NDE** Non-Destructive Examination

(6) **NEC** Northeast Corridor

(7) **NEMA** National Electrical Manufacturers Association

(8) **NFLNo** Field Lubrication

(9) **NFPA** National Fire Protection Association

(10) **NIC** Network Interface Card

(11) **Ni-CAD** nickel-cadmium

(12) **NO** Normally Open

(13) **NPT** National Pipe Thread

(14) **NRPC** National Railroad Passenger Corporation (Amtrak)

(15) **NPRD** Non-Electronic Parts Reliability Database

(16) **NSF** National Sanitation Foundation

(17) **NTP** Notice-to-Proceed

(18) **NTSB** National Transportation Safety Board

xv). **O**

(1) **OCU** Operator Control Unit

(2) **ODBC** Open Data Base Connectivity

(3) **ODK** Operator Display Keypad

(4) **OEM** Original Equipment Manufacturer

(5) **OFE** Oxygen Free Electronic

(6) **OSHA** Occupational Safety and Health Administration

(7) **OTIS** Onboard Train Information System

(8) **oz** ounce

xvi). **P**

(1) **p/n** part number

(2) **PA** Public Address

(3) **PA/IC** Public Address/Intercom

(4) **PC** Personal Computer

(5) **PCB** Printed Circuit Board

(6) **PCMCIA** Personal Computer Memory Card International Association

(7) **PCS** Pneumatic Control Switch

(8) **PDF** Portable Document Format

(9) **PDR** Preliminary Design Review

(10) **PHS** Public Health Service

(11) **PIDS** Passenger Information Display System

(12) **PIS** Passenger Information System

(13) **PISCU** Passenger Information System Control Unit

(14) **PKO** Power Knock/Out

(15) **PM** Preventative Maintenance

(16) **PMP** Project Management Plan

(17) **POS** Point-of-Sale

(18) **ppm** parts per million

(19) **pphm** parts per hundred million

(20) **PRIIA** Passenger Rail Investment and Improvement Act

(21) **PROM** Programmable Read-Only Memory

(22) **psi** pounds per square inch

(23) **psig** pounds per square inch (gauge)

(24) **PTC** Positive Train Control

(25) **PTE** Portable Test Equipment

(26) **PTT** Push to Talk

(27) **PTU** Portable Test Unit

(28) **PVC** Polyvinyl Chloride

(29) **PWM** Pulse Width Modulation

xvii). **Q**

(1)	**QA**	Quality Assurance
(2)	**QC**	Quality Control

xviii). **R**

(1)	**RAID**	Redundant Array of Independent Disks
(2)	**RVAAC**	Rail Vehicles Access Advisory Committee
(3)	**RAM**	Random Access Memory
(4)	**RAM**	Reliability Availability and Maintainability
(5)	**RDT**	Reliability Demonstration Test
(6)	**RFI**	Radio Frequency Interference
(7)	**RFP**	Request for Proposal
(8)	**RGB**	red green blue
(9)	**RH**	Relative Humidity
(10)	**rms**	root mean square

xix). **S**

(1)	**S&I**	Service and Inspection
(2)	**SAE**	Society of Automotive Engineers
(3)	**SCFM**	Standard Cubic Feet per Minute
(4)	**sec**	Second
(5)	**SIV**	Secondary Impact Velocity
(6)	**SNR**	Signal-to-Noise Ratio
(7)	**SQL**	Structured Query Language
(8)	**SSP**	System Safety Plan
(9)	**SSS**	Sign System Server

xx). **T**

(1)	**t**	Thickness
(2)	**T/L**	Trainline

	(3)	**T/R**	Transmitter/Receiver
	(4)	**TB**	Terabyte
	(5)	**TBD**	To Be Determined
	(6)	**TCD**	Train Communications Data
	(7)	**TFT**	Thin Film Transistor
	(8)	**TIG**	Tungsten Inert Gas
	(9)	**TLC**	Trainline Complete
	(10)	**TMS**	Train Monitoring System
	(11)	**TOR**	Top of Rail
	(12)	**TSA**	US Transportation Security
	(13)	**TSSSA**	Technical Support, Spares and Supply Agreement
	(14)	**TTCI**	Transportation Test Center
xxi).	**U**		
	(1)	**U.S.**	United States
	(2)	**UL**	Underwriter's Laboratories, Inc.
	(3)	**ULSD**	Ultra Low Sulfur Diesel
	(4)	**UMLER**	Universal Machine Language Equipment Register
	(5)	**USB**	Universal Serial Bus
	(6)	**USDOT**	United States Department of Transportation
	(7)	**USPHS**	U.S. Public Health Service of the U.S. Department of Health and Human Services
	(8)	**USS**	United States Steel Corporation
	(9)	**UV**	Ultraviolet
xxii).	**V**		
	(1)	**V**	Volt
	(2)	**VAC**	Volt Alternating Current
	(3)	**VDC**	Volts Direct Current

	(4)	**VDSL2**	Very High Speed Digital Subscriber Line 2
	(5)	**VTI**	Vehicle Track Interaction
xxiii).	**W**		
	(1)	**W**	Watt
	(2)	**W/ft2**	watts per square foot
	(3)	**WB**	Wet Bulb
	(4)	**WCRS**	Waste Collection and Retention
	(5)	**WiFi**	Wireless Fidelity (Wireless Local Area Network protocol, IEEE 802.11b, 802.11g and 802.11n)
	(6)	**WLAN**	Wireless Local Area Network
	(7)	**WMS**	Work Management System
	(8)	**WPS**	Welding Procedure Specifications
xxiv).	**Y**		
	(1)	**yr**	Year
xxv).	**Z**		
	(1)	**Z**	Impedance

* End of Chapter 2 *

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

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3. Project Management & Reviews

Revision 2

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3.1 Overview

a). This chapter includes Project Management requirements for schedule, drawings, document control, and other program support functions.

b). All correspondence, drawings, data, manuals or other written communications pertaining to this Contract shall be in the English language.

c). All dimensions shall be shown in standard imperial units of inches and decimals, with a metric equivalent shown in parentheses adjacent to the imperial dimension. If a component or subassembly uses metric units as the primary system of measurement, then imperial equivalents shall be provided in parentheses.

3.2 Project Management Plan (PMP)

a). The Contractor is required to develop a Project Management Plan (PMP) which shall define how the project is to be executed, monitored and controlled.

b). The PMP shall be submitted to Amtrak for review and approval no later than 30 days after NTP. **[CDRL 3-01]**

c). The PMP shall include as a minimum the following elements:

i). Project Description

ii). Organizational Chart including all staff supporting the program

(1) Key positions including Senior to Mid-level Management shall identify the individual and his/her contact information.

(2) First Level Management and resource staff positions shall be shown to clarify staffing levels, but do not need to include the individual's information. However, the planned date of filling each of these positions shall be identified.

iii). Roles, responsibilities and authority of all key and decision-making personnel

iv). Contact information for principal subcontractors

v). Document control processes

vi). Communication processes

vii). Risk Management processes

viii). Material Procurement Management Plan that includes draft list of major sub-suppliers

ix). Project Schedule Management Plan, the contractor will provide a narrative describing how the schedule will be managed throughout the period of

performance of the Contract. Specifically, the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule.

x). Reference to document names and numbers for processes such as:

(1) Configuration Management

(2) Change Management

(3) Field Service Support

(4) Warranty Support

d). For the duration of the Contract, the Contractor shall revise and resubmit the PMP to properly reflect the processes and procedures implemented in the performance of the contracted work.

i). The Contractor shall revise the PMP when it varies significantly from implemented practice but at a minimum every twelve months.

ii). Should Amtrak become aware of significant discrepancies between the PMP and the Contractor's practice, it would request a revision and resubmittal.

e). The Contractor's Project Manager shall be the prime contact person to Amtrak.

i). All Subcontractor formal correspondence shall be through the Contractor's Project Manager.

f). Any proposed changes to key personnel named in the Project Organizational Chart shall be formally submitted in advance of implementation for Amtrak review and approval.

3.3 System Integration Plan (SIP) and Interface Control Document (ICD)

a). The Contractor's Systems Integration Plan (SIP) shall be based on the Preliminary Systems Integration Plan submitted as part of the Contractor's proposal.

b). The SIP shall include the Contractor's processes and procedures for validating and verifying that system integration is embedded in the design and manufacturing processes of the cars.

c). The SIP shall identify a System Integration Lead who shall be responsible for all mechanical, electrical and digital integration between systems and sub-systems.

i). The System Integration Lead shall be maintained on the project throughout the design review process until acceptance of the pilot cars.

d). The SIP shall detail the system integration between all systems, cars, locomotives and with Amtrak's infrastructure.

e). The SIP shall explain how integration with suppliers' systems will be managed.

f). The SIP shall be submitted to Amtrak for review and approval no later than sixty (60) days prior to the Preliminary Design Review meeting. **[CDRL 3-02]**

g). The SIP shall detail the implementation of a single Interface Control Document (ICD) which will cover each type and class of car.

h). Any interfaces and/or protocols between two (2) or more systems or components shall be tracked through the ICD.

i). Any interface mitigation resolution shall be documented in the ICD.

j). The ICD shall include, as a minimum:

i). System

ii). Interface type

iii). Interface from

iv). Interface to

v). Description/Requirement

vi). Method of Validation

vii). Other information as required to ensure proper integration

k). The ICD shall be submitted to Amtrak for review and approval, no later than sixty (60) days prior to the first Preliminary Design Review meeting and then quarterly thereafter until a minimum of 10 cars have been accepted. **[CDRL 3-03]**

l). The ICD shall be maintained throughout the production process and shall be revised, as necessary, to reflect engineering changes and field modifications. Any subsequent updates to the ICD shall be submitted to Amtrak for review and approval.

m). Prior to the ICD submittal to Amtrak, the Contractor's System Integrator shall review and approve all design documents that describe interfaces between and among components, systems and cars.

3.4 Coordination with TSSSA Contract

a). The Management Teams for the cars and the TSSSA contracts shall both be overseen by a single Fleet Director.

b). The Fleet Director shall be maintained through the delivery of the final piece of equipment on the base cars contract.

c). The Fleet Director shall attend, at a minimum, all car monthly status meetings.

d). The Equipment and TSSSA Team shall present to Amtrak as a single entity with conflicting priorities between the groups never impacting the progress of the program as a whole.

e). The Fleet Director shall ensure that both teams are working cohesively optimizing system reliability and transitioning to TSSSA technical services.

i). The Fleet Director shall ensure TSSSA Technical staff are in attendance at Design Review meetings to ensure long-term maintenance concerns are considered.

ii). The Fleet Director shall ensure that the TSSSA technical services personnel have extensive experience gained through the production of the Car Contract.

3.5 Galley Design Specialist

a). Throughout Design Review and Car production, the Contractor shall maintain a galley design specialist to support the development, simulation and optimization of the food service areas on the cars.

b). The galley design specialist may be a direct employee of the Contractor or a consultant but shall be a recognized expert in the field of restaurant design and on-board food service in the transportation industry.

c). The galley design specialist shall participate in design reviews, mock-up evaluation, workshops and qualification testing of on-board food service areas.

d). The galley design specialist shall be considered a key member of the Contractor’s design team.

3.6 Accessibility Specialist

a). Throughout the Design Review and Car production, the Contractor shall maintain an accessibility specialist to support the development, evaluation, and optimization of all passenger-facing areas to ensure compliance with applicable accessibility requirements and best practices.

b). The accessibility specialist may be a direct employee of the Contractor or a consultant but shall be a recognized expert in transportation accessibility, including demonstrated experience with ADA and applicable accessibility standards for passenger rail vehicles.

i). Amtrak will participate in the selection, vetting, and final approval process of this individual.

c). The accessibility specialist shall participate in design reviews, mock-up evaluations, workshops, and qualifications testing to verify compliance with accessibility requirements and to ensure equitable passenger access and usability throughout the vehicle.

d). The accessibility specialist shall be considered a key member of the Contract’s

design team.

3.7 Interface with Subcontractors, Designers, and Suppliers

a). The Contractor shall inform all designers and subcontractors of all specified requirements and ensure that appropriate engineering management tools are utilized to coordinate and provide communication among the designers of interrelated systems.

b). Subcontractors shall be made aware of additional requirements listed throughout other chapters of this technical specification.

c). Subject to Amtrak review and approval, the Contractor may request major Subcontractors be granted access to the Project's collaborative website.

d). All applications of material or equipment by the Contractor shall be with the full concurrence of the Subcontractor that the application is suitable and within the recommended limits of operation of the material or equipment.

e). The Contractor shall have all relevant designers and Subcontractors available when required for:

i). Meetings

ii). Resolution of Production or Manufacturing problems

iii). Testing

iv). Resolution of design, integration, or quality deficiencies

v). Resolution of Systems Reliability problems, and

vi). All other similar situations.

f). During all phases of this project, Amtrak shall have access to all designers and Subcontractors through coordination with the Contractor's Project Manager.

g). The Contractor shall coordinate all the project administration, scheduling, design, validation, commissioning and warranty activities with Amtrak's project management team.

h). At Amtrak's sole discretion, suppliers' technical staff must attend all relevant design reviews throughout the process to ease the communication flow between Amtrak, the Contractor and Suppliers.

3.8 Documentation Control

a). Amtrak shall use its Document Management System (DMS) as the documentation control system for the TSSSA program.

b). While the Contractor may opt to use its own document control system internally, it

shall use the DMS when submitting documents and contract letters to Amtrak and shall adhere to the processes inherent to that system.

c). During the course of the TSSSA program, Amtrak will have the right to transition to a different documentation management program.

3.9 Initial Meetings

a). Within 15 calendar days after NTP, a series of Kick-off Meetings shall be conducted for the Contractor to accomplish the following:

i). Review Contractor's Project mobilization activities

ii). Introduce the Key personnel of the team

iii). Establish communication protocols

iv). Establish the document coding schemes

v). Establish formats for Project Schedule and Monthly Reports

vi). Establish the format for an Open Items Tracking Matrix

vii). Establish project control methodology

viii). Confirm plans for initial activities prior to start of formal progress reporting, including all CDRLs due in the next 90 calendar days.

ix). Confirm that the Contractor is familiar with Amtrak's Operations and Maintenance environment; and

x). Identify any Contractor early needs for information or decisions required from Amtrak.

b). Five (5) days before scheduled Kickoff Meeting, the Contractor shall submit the Kickoff Meeting Presentation. **[CDRL 3-04]**

c). Within 30 days after NTP, a detailed Specification Review (section by section) shall be conducted to address:

i). Any outstanding questions the Contractor may have regarding the Technical and Commercial Specifications requirements.

ii). In addition to the Contractor, all key subsystem suppliers shall participate.

iii). The Contractor and applicable subcontractors and suppliers shall be required to sign off indicating its understanding of each specification section.

3.10 Project Review Meetings (PRM)

a). PRMs will be held at least monthly and will provide a forum to assess specific issues or to review issues that may have an impact on the design.

b). These review meetings will analyze and address both technical and commercial issues for which agreement could not be reached during DRMs.

c). The meetings will be attended by Contractor and Amtrak, and possibly external stakeholders designated by Amtrak or Contractor, e.g. FRA.

d). These meetings have two objectives, first to allow the participants to maintain a close involvement in the project's development, and second to allow Contractor's project team to answer questions and resolve issues that arise during the project.

e). The PRM shall achieve these goals by:

i). Reviewing Contractor's project progress report and ensuring that appropriate responsibility for actions is agreed upon.

ii). Ensuring that the Cars comply with the quality, safety and technical matters of the Contract.

iii). Identifying contractual matters which could potentially affect Contractor's performance.

iv). Identifying any major concerns regardless of source and ensuring that appropriate actions are agreed to facilitate resolution of such concerns.

v). Review any emerging issues.

f). The agenda for these meetings will not be fixed but will be customized for critical issues at hand.

g). Amtrak shall circulate an agenda at least one week prior to each meeting. Appropriate data packages covering the information to be discussed shall be submitted by Amtrak and Contractor prior to the upcoming meeting.

h). Attendees:

i). Amtrak and Contractor's Project Director shall attend the meeting.

ii). Other members of Amtrak and Contractor's organizations may attend as required.

iii). Contractor shall ensure that persons knowledgeable in the topics to be discussed, including the appropriate subcontractors, are present as required at these meetings.

i). All participants will have an opportunity to include on the agenda any issues that they deem important and in need of resolution at the meeting.

j). Meeting notes and action lists will be produced by Amtrak for each review meeting to allow issues to be followed up at subsequent meetings.

i). Amtrak shall provide the draft minutes and action list to the Contractor for review.

ii). After revision, the minutes and action list shall be formally submitted to the Contractor and entered into the contract record.

3.11 Project Schedule (PS)

a). The Contractor shall be required to use Oracle Primavera P6 to produce the Project Schedule (PS) Baseline, and all schedule updates, revisions, look ahead schedules, recovery schedules, and Time Impact Analysis schedules.

b). Baseline Project Schedule (PS): The Baseline PS and an associated narrative shall be submitted to Amtrak no later than 30 days after NTP for Amtrak's review and approval. **[CDRL 3-05]**

c). The PS and associated narrative shall detail the Contractor's approach to meeting the required contractual project milestones.

d). The PS requirement is established to ensure adequate planning, scheduling, management, and execution of the Work by the Contractor and to enable Amtrak to evaluate Work progress.

e). The PS shall encompass the Contractor's total execution of its Contract with Amtrak and shall be updated and submitted monthly to reflect actual versus planned progress for each item listed.

f). Work items shall be discrete items of Work accomplished during the performance of the Contract and that, when complete, produce definable, recognizable entities or stages within the project.

g). The Baseline PS shall include detail activities for all scope and deliverables listed in the Contract, including but not limited to:

i). All Contractual deliverables and key milestones and events, including those identified in the Contract Specification

ii). Projected Payment Milestones dates

iii). Necessary points of required input from Amtrak or third parties

iv). Activities for procurement of each subcontractor, with a milestone for Contract signing for each subcontractor

v). Contractor and Subcontractor/Supplier submittals including review cycles

vi). Project Design Review meetings

vii). Drawing packages requiring approval, with separate activities for "preparation", "submission", and "Amtrak review".

viii). Any regulatory approval periods shall be visible activities with durations

ix). All major off-site inspections and approval tests

x). All major steps of car body and truck fabrication

xi). All major subsystem fabrication and deliveries

xii). All assembly milestones

xiii). All deliverables

xiv). All progress milestone payments

xv). All CDRLs including but not limited to; design drawings, procedures, functional descriptions, and other documents required to be prepared by the Contractor and reviewed and accepted by Amtrak.

xvi). Activities for each test required by Contract, for each car

xvii). Activities for conditional acceptance of each car

h). Where a given contractual deliverable or requirement must be completed for each car, separate activities must be included for each car.

i). Additional Baseline PS requirements:

i). The Baseline PS start date shall be the Contract NTP date, and the schedule shall not show any activities with dates prior to NTP.

ii). The Baseline PS shall include a 7-day calendar week, which is applied to all contractual milestones.

iii). The Baseline PS shall also include a 5-day work week calendar with holidays which is applied to all work activities.

iv). All activities in the schedule, with the exception of NTP, shall be assigned at least one appropriate predecessor activity.

v). All activities in the schedule, with the exception of the Final Completion milestone, shall be assigned at least one appropriate successor activity.

vi). The majority of logic relationships must be “finish-to-start”.

vii). While the use of lags is acceptable, overuse is not; only a small percentage of logic relationships may use a lag. Negative lags, or leads, are not acceptable.

viii). No date constraints may be used. Float constraints, such as “Finish on or Before” may be used if appropriate.

j). The Baseline PS shall include a detailed schedule narrative including:

i). The general approach to the project and schedule, design, fabrication, manufacturing, assembly and methods, inspection, testing, shipping, delivery, and approval.

ii). A description of the critical path, and all near-critical paths, which are paths in the logic network with 2 weeks or less of total float.

iii). A listing and descriptions of all project risks to the schedule.

iv). Any required mitigation to address project delays.

v). A section describing the status of all key / contractual milestones.

3.12 Project Progress Schedule Updates

a). The PS and an associated narrative shall be updated and submitted on a monthly basis by the Contractor to accurately reflect current project progress status.

b). Actual start dates and actual finish dates are to be entered, and remaining durations reduced as appropriate.

c). All initial baseline dates shall remain listed on the schedule status reports in order to measure performance.

d). All actual dates must be before the data (schedule revision) date.

e). Activity IDs can never be changed in a schedule update.

f). The data (schedule revision) date of each schedule update shall be the first day of the month, and the schedule update shall be submitted to Amtrak on or before the 10th of each month.

g). A schedule narrative shall be provided each month, and shall include:

i). The status of all contractual / key milestones

ii). A discussion of the overall current schedule status and causes of any schedule impacts, with suggested mitigations.

iii). A discussion of progress made during the update period.

iv). A listing of work planned in the coming update period.

v). A description of the current critical path, and near-critical paths, with reasons given for any change to the previous update’s critical path

vi). In the event that a schedule revision identifies slippage beyond a contractually required milestone, the narrative shall include a detailed description of the reason for the slippage and the mitigation proposed by the Contractor to bring the PS back into compliance.

vii). Non-compliance with key milestones such as pilot car delivery or car production may result in a request for a Recovery Schedule per Section 3.9.

viii). A section that lists all Amtrak schedule comments, with responses to those comments.

ix). An appendix which lists all changes made to the schedule, with a reason given for each change. The changes that must be listed and explained are:

(1) Added activities

(2) Deleted activities

(3) Changes to original durations

(4) Added logic ties

(5) Deleted logic ties

(6) Any changes to constraints

(7) Changes to activity descriptions

(8) Changes to calendar assignments.

h). Revised PS submittals do not relieve the Contractor of any schedule requirements as outlined by the Contract.

i). Changes to any schedule related Contract requirements can only be obtained by the formal change order process in the General Provisions.

3.13 Recovery Schedule

a). If any schedule update is forecasting for the project to be late, Amtrak may require the Contractor to submit a recovery schedule to Amtrak for review and approval.

i). The Recovery Schedule shall be submitted within 21 calendar days of the request.

ii). The recovery schedule shall be accompanied by a narrative that describes in detail how the Contractor is planning to recover time.

iii). All changes made to the schedule to recover time must be listed and explained.

3.14 Design Review Overview

a). Purpose

i). Design Review will be a robust mechanism through which the Contractor shall develop, submit and receive approval for the designs necessary for the manufacture and supply of the Cars.

ii). Design Review is intended to:

(1) Determine whether Contractor has identified and understands the technical requirements;

(2) Determine whether Contractor has identified an adequate approach to demonstrate that each design requirement has been or will be met;

(3) Determine whether Contractor has identified all interfaces and has a comprehensive System Integration approach;

(4) Observe the relationship between Contractor and major suppliers and to ascertain that Contractor provides adequate technical oversight;

(5) Determine the state of Contractor's Quality Assurance program; and

(6) Determine the readiness of the design and Contractor to proceed to the next stage of the design, manufacturing and testing.

iii). The Contractor must recognize that the Design Review Process shall not be used to seek approval or authorization for deviations from any Contract requirements for the design of the Cars.

(1) Such changes will be handled in accordance with the General Provisions to the Contract, including without limitation Article 15 ("Changes") and Schedule 3 Change Request Process.

b). General

i). The design review process shall begin no later than three months after NTP.

ii). The overall Design Review Process shall consist of three sequential stages (see Section 3.10 for additional detail):

(1) Preliminary Design Review (PDR)

(2) Intermediate Design Review (IDR)

(3) Final Design Review (FDR).

iii). Design review activities shall continue throughout the entire pre-production period, with each succeeding stage presenting greater amounts of detail and reflecting the progress of the designs.

iv). As a minimum, each design review package shall be completed and approved, including Contractor’s resubmission of design documents with revisions in accordance with detailed review comments, before progressing to the next review process.

v). The Contractor shall be solely responsible for the vehicle design, including all sub-systems and materials.

(1) The Contractor shall be responsible to ensure that all systems, components, parts, and other equipment furnished by different subcontractors shall function as intended when installed and integrated in each car.

(2) The Contractor shall provide equipment meeting all specified performance levels and be compatible with all elements of the railway system on which Amtrak will operate the equipment, for the useful life of the equipment.

(3) Safety, reliability, ease of maintenance and compatibility with any of Amtrak's existing locomotives is imperative.

(4) The Contractor shall submit the design of all components being purchased from third party suppliers for review and discussion at the design review sessions.

c). Design Review Area Features

i). The features / Systems / Sub-systems that will be subject to design reviews, include, but are not limited to, the following:

(1) Transverse disciplines:

(a) Gauge/clearance calculation

(b) Safety

(c) RAM (Reliability, Availability and Maintainability)

(d) EMC (Electro Magnetic Compatibility)

(e) ADA (Americans with Disabilities Act) and accessibility

(f) Acoustics

(g) Dynamic behavior

(h) Fire and smoke performance

(i) Serviceability/Maintainability

(j) Climatic adaptation

(k) Aerodynamics and cross wind calculations

(2) Mechanical disciplines:

(a) Virtual Mock-Up Review

(b) Weight calculations

(3) Interiors and Industrial Design:

(a) Interior car arrangement

(b) Aesthetic design

(c) Customer experience

(d) Usability

(e) Interaction and functional design

(f) Ergonomics and human factors

(g) Color material and finish (CMF)

(h) Branding and Brand Application

(i) Mock-Up Review

(j) Accessibility review

(4) Sub-systems:

(a) CBS (Car Body Shell) for each different carbody arrangement, including floor System and FEA (Finite Element Analysis) calculations

(b) Smoke detection system/fire extinguisher

(c) HVAC (including air flow calculation) passenger cars

(d) Lighting

(e) Luggage racks and storage

(f) Passenger Seats, all types

(g) Booth Seats, all types

(h) Sleeping Accommodation, all types including accessible and non-accessible.

(i) Toilets

(j) Showers

(k) Food preparation areas, including all food service cars.

(l) Glazing

(m) Signage

(n) Public address, passenger information, intercommunication, Wi-Fi and entertainment

(o) Digital technologies

(p) Diagnostics

(q) Cybersecurity

(r) Communications

(s) Doors (Passenger access and interior doors) and steps

(t) Diaphragm/Gangway & articulation

(u) Couplers and draft gear

(v) Battery and battery charger

(w) Brake System

(x) Wheel slide protection

(y) TCMS (Train Control and Monitoring System)

(z) Electrical cubicles & harnesses

(aa) Truck to Carbody Connection

(bb) Trucks

(cc) Maintainability Demonstrations

(dd) Mock-Up Review

(5) Interoperability with legacy equipment (i.e. Locomotive fleet, Viewliner I and II fleets, Midwest Venture fleets, etc.)

d). Design Review Process Governance

i). The Contractor and Amtrak will work closely together in a collaborative way to ensure that the final design of the cars meets the contractual requirements and resolve any technical problems or issues that may arise during the project.

ii). This collaboration will be via:

(1) A continuous involvement by Contractor with Amtrak and stakeholders to resolve and validate all of the design-related issues that arise during the project, through the review meetings.

(2) Specific meetings where detailed analyses are reviewed by the parties for complete areas.

(3) A review of deliverables (including, where appropriate, but not limited to, drawings, 3D data or models, assembly drawings, technical descriptions, calculation notes, studies, electric diagrams, pneumatic diagrams, test procedures and operation and maintenance documentation) to be submitted for review.

e). Design Review Plan

i). Within 30 days of NTP, the Contractor shall submit for Amtrak review and approval a Design Review Plan (DRP) detailing the performance of the engineering design objectives, detailed submittal schedule, functions, processes and procedures throughout the design process. **[CDRL 3-06]**

ii). Design Review will begin once the DRP has been accepted by Amtrak.

iii). At a minimum, Design Review will continue throughout the entire pre-production period until acceptance of the pilot cars to ensure:

(1) No objection by Amtrak to the proposed car design in order to enable Contractor to procure materials and equipment to support the start of production of the cars.

(2) Amtrak's acceptance of a comprehensive, final set of fully representative drawings, 3D Models and Sub-system technical/functional Specifications.

iv). The Design Review Plan shall include at a minimum:

(1) Definition of the organization and relationships within the engineering team, with identification of the subgroups as organized by function or system.

(2) Definition of the relationship of the engineering team to the overall organization of the Contractor.

(3) The relationship between the engineering team and collaborative teams such as the testing team and the production process team.

(4) Critical path/workflow plan for completion of all engineering functions.

(5) A well-defined list of deliverables for each design review stage that Contractor will submit to Amtrak to comply with the requirements of this Contract and in coordination with the PS.

(6) The schedule for the progress and completion of major design activities including, but not limited to:

(a) All stages of design reviews;

(b) Mock-up review;

(c) Finalization of engineering;

(d) Test plan development;

(e) Car shell stress and structural performance analyses;

(f) Proof of design testing; and

(g) Delivery of all required engineering documentation.

(7) Oversight of subcontractor and supplier engineering functions and integration of supplier engineering into the Contractor's design and design process.

(8) Manufacturing engineering plan, including assembly station work scope, parts flow and estimated labor hours/station staffing plan. A comprehensive manufacturing engineering plan shall be submitted to Amtrak for review.

(9) Car shell engineering plan, including design, finite elements analysis, quasi-static and dynamic testing, measurement of critical dimensions, acceptance and shipment, and inspection/repair procedures.

(10) Completed car weight control plan.

f). Design Review Packages

i). At least 30 days prior to the start of the design review process, the Contractor must submit to Amtrak for review and approval a detailed Drawing Tree. **[CDRL 3-07]**

(1) The drawing tree shall include all production, assembly and component drawings that are expected to be produced at all levels including unique drawing identification for each level.

(2) It is the intention that this drawing tree will be utilized to ensure all drawings have been submitted to Amtrak for review and approval throughout the design review process.

(3) The top 4 levels of drawings will be provided by the Contractor at Preliminary Design Review.

(4) Subsequent levels will be submitted for additional detail during Intermediate Design Review.

(5) Final Design Review will not be approved until a full package of all production drawings is submitted and approved by Amtrak.

ii). Design review documentation will be submitted on an ongoing basis prior to the formal design package being submitted.

iii). For each Design Review Meeting, the Contractor shall submit a design review package at least thirty (30) days prior to the performance of the corresponding DRM.

(1) Amtrak will review the design review package with the goal of providing advance comments to the Contractor prior to the DRM.

iv). No DRM will be held without the entirety of the design package in question having been provided to Amtrak.

v). In the event of a late or insufficient documentation submittal, Amtrak shall determine if a delay of the corresponding meeting is necessary.

vi). If, for any reason, any particular design review package and its approval falls on the critical path and/or may put the Contract Time Plan at risk, Contractor will promptly notify Amtrak with sufficient advance notice in order that appropriate review prioritizing actions will be mutually agreed and implemented to expedite the design review.

vii). In all submissions and at all sessions, the Contractor and supplier presentations shall be organized to show exactly how the design meets each specific requirement of the Technical Specification.

g). Design Review Meetings (DRM)

i). All design review meetings shall be held at an Amtrak facility unless otherwise mutually agreed to by Amtrak and the Contractor.

ii). Amtrak will record the minutes of each design review meeting, and within two weeks of the meeting shall provide a package that shall include the meeting minutes and a copy of all documents that the Contractor presented and/or discussed at the meeting.

(1) Meeting minutes shall also include a summary of action items generated at the meeting. Items shall be referred to as action items if action or a decision is pending at the time that the minutes are issued.

iii). An action items matrix shall be maintained by Amtrak that includes both Contractor and Amtrak open action items.

(1) The action items matrix shall include technical references, the open item description, action required, responsibility and status (open or closed).

(2) The open items on the action items matrix shall be reviewed at each design review meeting and regularly after Final Design Review (FDR) meetings until all items are closed.

iv). Each design review meeting shall include adequate time to properly walk through the entire System Functional Description along with a detailed review of the design review submittal package at a minimum while utilizing drawings, 3D models and virtual reality to further explain the designs being presented.

v). Subsequent design review meetings shall be scheduled if the first design review meeting is deemed unacceptable by Amtrak.

h). Formal Design Review Response/Comments

i). Amtrak will complete the design review and issue its formal review comments/submission as expeditiously as possible.

ii). Amtrak's formal design review response will take into account the issues progressed/closed out-during the DRM as well as any open action documentation received following the DRM.

iii). Amtrak's formal response to the design review package will include a status as per 3.13.i). which will govern the Contractor's authorization to progress.

iv). The required review by Amtrak of all Contractor submitted design documentation does not relieve the Contractor of any of its contractual design responsibility.

i). Design Review Submission Statuses

i). Upon review of design submittals, Amtrak shall respond to the Contractor with comments and a submittal status. Status categories are as follows:

Figure 3-1: Design Review Submittal Statuses

For Information	The submittal has been reviewed for information and does not require a formal status
Rejected	The submittal does not demonstrate the minimum level of content, completeness, or quality. The submittal must be completely revised and resubmitted. The Contractor shall not progress to the next phase of the design process or manufacturing.
Revise and Resubmit	Specific comments are provided for the Contractor to address in the revision and resubmittal of the submittal. The Contractor shall not progress to the next phase of the design process or manufacturing.
Conditionally Accepted	Specific comments are provided for the Contractor to address in the revision and resubmittal of the submittal. However, the design has reached a completeness to allow progress to the next phase of the design process and/or manufacturing. However, design progression or

	manufacture related to the remaining open comments are at the Contractor's risk.
Accepted	The design submittal is considered closed. The Contractor may progress to the next phase of the design process and/or manufacturing.

j). Weekly Engineering Meetings

i). The Contractor shall participate in weekly engineering meetings to discuss current, relevant technical issues, challenges with the ongoing systems' design and any other pertinent technical concerns.

ii). At times during the design review process, additional specific engineering meetings may be required.

k). Additional Design Review Communications

i). In addition to Project Review Meetings (PRM), Design Review Meetings (DRM) and Weekly Engineering Meetings, the Contractor's technical project team shall maintain continuous communication with Amtrak and its stakeholders; however, all agreements shall be handled via formal communication.

(1) This communication may be by telephone, e-mail, video conference, or face-to-face meetings.

(2) This communication will be used to highlight potential issues, including Contractor assumptions, conceptual design solutions, and comments on the emerging designs.

(3) These communications are intended to provide an efficient process for providing directions on a regular basis, allowing the participants to maintain a close involvement in the project.

(4) The Contractor is reminded, however, that design acceptance must be documented in formal Contract correspondence.

l). Changes to Approved Designs

i). If the Contractor wishes to propose a deviation from a previously approved design, a request for change shall be submitted to Amtrak for review and acceptance prior to introducing any change to the accepted configuration.

(1) The Request for Change shall be made per the requirements of the General Provisions and shall include revised drawings and data substantiating the suitability of the design. Amtrak reserves the right to request a prototype or mockup of the proposed change to verify the fix solves the problem when implemented, prior to providing approval.

ii). Any component changes to form, fit, or function subsequent to design reviews shall be updated in the documentation and resubmitted to Amtrak.

(1) The implementation of any change which deviates from the design, arrangement and/or configuration previously approved by Amtrak without prior submission and approval by Amtrak may require rework or replacement back to the approved design.

(2) The determination of the necessity for rework shall be solely at the discretion of Amtrak.

3.15 Amtrak Involvement

a). Amtrak shall be an integral part of all aspects of the design, inspection, testing and approval program for the cars.

b). Amtrak shall designate staff or representatives to participate in the design review and inspection process on behalf of Amtrak.

c). Amtrak shall have the right to invite or permit to participate in any design review, audit or test anyone Amtrak deems appropriate.

d). Individuals or entities designated by Amtrak including, but not limited to the Federal Railroad Administration (FRA), shall be afforded all desired access to the project, including design reviews, witnessing of tests and audits.

e). Only those individuals, designated in writing by the Contracting Officer's Technical Representative (COTR), shall have the authority to take actions on behalf of Amtrak that relate to the DRP, including, but not limited to, approvals, acceptances and providing design review comments.

f). The Contractor shall not recognize the actions of those individuals not so designated in writing.

g). Amtrak will give Contractor reasonable notice of stakeholder participation but reserves the right to include participants without notice.

h). Amtrak's participation, review and acceptance shall be necessary for:

i). Design review and evaluation

ii). Supplier selection

iii). QA program review and approval

iv). Supplier Quality Audits

v). First article inspection and acceptance

vi). Inspection of all phases of car production

vii). Repair Procedures

viii). Testing

ix). Car acceptance

x). Sample selection

xi). Post-delivery training

xii). Warranty administration

3.16 Design Review Stages

a). General

i). The requirements for the three Design Review phases are summarized in Sections:

(1) 3.16c). Preliminary Design Review (PDR)

(2) 3.16d). Intermediate Design Review (IDR)

(3) 3.16e). Final Design Review (FDR)

ii). Progression from PDR to IDR and IDR to FDR, may be done on a system-by-system basis, with the approval of Amtrak, otherwise the progression shall follow the requirements of Sections 3.16c), 3.16d), and 3.16e).

iii). Mockups, Virtual Reality, product accommodations and CMF reviews shall be incorporated into the three design reviews.

b). Compliance Matrix **[CDRL 3-08]**

i). Beginning with PDR, the Contractor shall maintain a matrix showing all technical requirements of the contract and the Contractor's proposed design and/or component to meet each requirement. This matrix shall be a continuation of the matrix submitted during the proposal that serves as a traveling document to ensure all technical requirements are met and provides specific detail as to how each requirement is met.

ii). The compliance matrix shall be maintained throughout the three Design Review stages.

iii). Contractor will report the progress against the compliance matrix as one of the first steps of each design review meeting.

iv). The compliance matrix portion of the design review for each Sub-system/design area will cover regulatory compliance, compliance with industry standards and compliance with the technical requirements of the contract.

v). The matrix shall include the detail of where in the design review documentation each compliance is validated.

vi). The compliance matrix shall outline all non-compliances with the technical specification at the time of Contract Award. Any non-compliance identified after Contract Award shall be handled via the Change Review Process.

vii). Non-compliances identified after Contract Award may not be accepted by Amtrak.

viii). Post-Contract Award non-compliances that are accepted by Amtrak and result in a savings to the Contractor shall be commercially credited to Amtrak.

c). Preliminary Design Review (PDR)

i). The PDR of a system design will be conducted to achieve an approved 30% completion of the system's design and will provide a comprehensive overview of its development. **[CDRL 3-09]**

ii). Review of the car concept in the PDR stage of the project will include as a minimum, presentation of layouts, car body structure, external livery, interior design proposals, brief technical description of features / Systems / Sub-systems, truck concept and materials (e.g. electric, pneumatic).

iii). The PDR presentations will include a review of the design concept, written descriptions of the functionality, schematics and/or block diagrams of the System wiring, arrangement drawings and technical specifications and drawings of each major System and component as applicable to this design phase and the deliverables listed in Section 3.14.

iv). The objective is to conduct an initial analysis of proposed design solutions based on parameters such as functionality, performance, maintainability, software logic, ease of cleaning, reliability, security, etc., so that potential changes are identified as early as possible.

v). Amtrak retains the right to redline, comment, and request changes to improve design and/or functionality.

vi). PDR submittals and activities shall comprise but are not limited to the following:

(1) Compliance Matrix **[CDRL 3-10]**

(2) Drawing Tree and Schedule **[CDRL 3-11]**

(a) A drawing schedule, based on the required Drawing Tree, for all distinct releases covering the design of all areas and subsystems of the cars in conformance with the Contractor's configuration management plan shall be prepared prior to the start of the PDR and submitted to Amtrak for approval.

(b) Each release shall be given a proper title for the top drawing and a drawing number.

(c) Arrangement drawings to be developed during the PDR shall also appear on this schedule with a title and number.

(d) The drawing schedule shall be immediately updated to reflect any revisions.

(e) At a minimum, the Contractor shall provide the initial release drawings of the top 4 levels of the drawing tree for review during PDR.

(3) System Functional Description **[CDRL 3-12]**

(a) A detailed system functional description including dimensions and layout drawings.

(4) Arrangement Drawings and Related Documents **[CDRL 3-13]**

(a) During PDR arrangement drawings and related documents of the cars and all major subsystem hardware items as described above shall be submitted to Amtrak for review and approval. Drawings shall show at a minimum:

(i) Overall dimensions, orientation, center of gravity, weight, points of normal support, and method of support during mounting and removal.

(ii) Location of all doors, access panels and covers in relation to any enclosed equipment.

(iii) Required space for opening of all doors and access panels.

(iv) Location and space requirements for ventilation intake and exhaust openings and cable entrances.

(v) Location and space requirement for all major equipment.

(vi) Conceptual interior and exterior renderings, including CMF and product accommodation.

(vii) CMF Palette

(5) Detailed Technical Specification **[CDRL 3-14]**

(a) No later than 30 days prior to the first PDR meeting, the Contractor shall submit detailed technical specifications for all major systems and components.

(6) Review Program

(a) The Contractor shall submit to Amtrak an interim detailed technical specification **[CDRL 3-15]** covering the methods, materials and arrangements proposed for construction of the pilot cars.

(i) The document shall be similar in style and format to this Technical Specification, which shall take precedence in the event of any differences.

1. If the pilot cars return to the Contractor's facility after testing for rebuilding and modifications to bring the cars up to the latest configuration, any equipment requiring renewal, such as brake components to reset the COTS date, must also be addressed. The Pilot car rebuild plan, and schedule shall be submitted to Amtrak for approval)

(ii) An appendix shall give a complete tabulation of all suppliers and the products each is supplying and shall also include an update to the pre-award Buy America submittal, indicating any revisions to the manufacturer of goods and country of origin. **[CDRL 3-16]**

(b) After approval by Amtrak, it shall be updated by the Contractor every 30 days to continuously represent the current configuration of the details of the car, including all specification changes and addendums.

(c) A monthly revision sheet shall contain a complete listing of the original and revised text, and details of the approval given by Amtrak.

(d) During the design review process, Amtrak may request a 3D model of specific components such as a restroom module or a coach seat.

(i) 3D files shall be provided in a neutral file format such as STEP or IGES.

(ii) 3D files shall be provided within 10 days of request.

(7) Weight Analysis **[CDRL 3-17]**

(a) After receipt of the approved minutes of the first design review meeting the Contractor shall submit to Amtrak a report on the estimated car weight. The document shall then be revised and resubmitted to Amtrak at intervals agreed to with the car builder until the complete weighing of the pilot car.

(b) This shall include the most recent weights for the car body without trucks, each truck, and the complete car.

(c) It shall also include a list of weights for every subsystem on the car, indicating its percentage of the total car weight, and if these subsystem weights are based on actual scale weights of complete equipment.

(d) The Contractor shall weigh all components as early as possible.

d). Intermediate Design Review (IDR)

i). The IDR will be held when the design of the cars is approximately 60% complete. **[CDRL 3-18]**

ii). The IDR will represent an advancement of the design of the cars from the PDR to development of draft production drawings, arrangements, component and material specifications, and schematics for all Systems (Sub-systems and components) on each car type as applicable to this design phase and as agreed by the parties in the design review program.

iii). This information will be used by Amtrak to evaluate the proposed design of the cars to a level of detail sufficient that Contractor will be able to proceed with the development of the car design to the 95% draft final stage.

iv). The intent of the IDR is to present and provide all Sub-systems and their credentials, review of in-depth System and functional descriptions, review of main layouts (e.g. roof, under frame, body sides, traction System, software logic, auxiliaries, interiors etc.), calculations and simulations, consumptions and functionality (e.g. electrical diagrams).

v). IDR submittals and activities shall comprise but are not limited to the following:

(1) The continuation and updating of all activities specified as ongoing in the PDR, i.e., weights analysis, updated technical specifications, functional analysis, drawing schedule, arrangement drawings and supplier identification.

(2) Submission of all documentation identified for IDR on the Design Review Summary Matrix below.

(3) Detailed Drawings and Related Documents

(a) The Contractor shall submit as a minimum the following detailed drawings and related documents to Amtrak for review and approval:

(i) All drawings identified in the approved Drawing Tree, properly dimensioned, detailed, to scale and in accordance with the approved drawing schedule. **[CDRL 3-19]**

(ii) Provide all updated drawings that reflect changes from the PDR meetings as well as provide at least two additional levels of the drawing tree for review and approval by Amtrak. **[CDRL 3-20]**

(iii) During IDR, it is expected that drawings shall present manufacturer and model information for all material called out on the BOM of each drawing. Identification of a generic or unspecified component will not be acceptable.

(iv) Draft single line control schematic **[CDRL 3-21]** and functional block diagrams for each subsystem **[CDRL 3-22]**, and electrical wiring diagrams and schematics **[CDRL 3-23]** for all electrical circuits.

(v) A complete set of draft drawings related to clearance. **[CDRL 3-24]**

1. These shall include static and dynamic envelopes relative to the wayside allowances, including clearances for all parts of the truck, and general arrangement drawings with all static dimensions including camber, low level platforms, high level platforms, curves, etc.

(vi) Single line piping and flow diagrams for all pneumatic circuits, displaying all valves and control components. **[CDRL 3-25]**

(vii) Manufacturer's data and specification sheets on all control items. **[CDRL 3-26]**

(viii) Updated Compliance Matrix **[CDRL 3-27]**

(ix) Update interior and exterior renderings **[CDRL 3-28]** **[CDRL 3-29]**

(x) CMF Palette **[CDRL 3-30]**

(xi) Interior Material Samples **[CDRL 3-31]**

(xii) Layout of Product Accommodations **[CDRL 3-32]**

(xiii) Draft maintenance requirements and necessary procedures for all equipment in each subsystem. **[CDRL 3-33]**

1. These shall be listed from daily inspection and periodic inspection to complete overhaul, with frequency and time needed to service being tabulated, and shall highlight all FRA-required

inspections.

vi). Amtrak comments from the PDR stage shall be reviewed, and the Contractor shall provide documentation that Amtrak's comments were incorporated into the car design.

(1) All drawings, specifications, schematics, and other project documentation shall be updated for the IDR.

(2) Once reviewed, the drawings and designs shall be updated to incorporate Amtrak comments.

e). Final Design Review (FDR)

i). The Final Design Review (FDR) of the system components shall be held at the 95% or greater percent level of design and IDR has been closed out. **[CDRL 3-34]**

ii). FDR in summary will provide for an in-depth review of System and function descriptions, schematics of the system wiring, drawings of each assembly, sub-assembly, component, and sub-component showing dimensions and structural elements, calculations and simulations, weight estimates, consumptions, full functionality, final layouts, specifications, drawings, diagrams, test procedures and software functionality details.

iii). FDR submittals and activities will represent a continuation and updating of all activities specified as ongoing in the PDR, IDR and mock-up review as applicable to this design review stage.

iv). Redlines and comments from the IDR and mockup review shall be reviewed.

v). Amtrak retains the right to provide additional comments during this process as production progresses and concerns are brought to Amtrak's attention.

vi). FDR submittals and activities shall comprise but are not limited to the following:

(1) The continuation and updating of all activities specified as ongoing in the PDR, IDR, and mockup review, i.e.:

(a) Critical Path Method

(b) Weights Analysis **[CDRL 3-35]**

(c) Detailed Technical Specification **[CDRL 3-36]**

(d) Functional Analysis **[CDRL 3-37]**

(e) Drawing Schedule **[CDRL 3-38]**

(f) Arrangement Drawings **[CDRL 3-39]**

(g) Supplier Identification **[CDRL 3-40]**

(2) Detailed Drawings and Related Documents — The Contractor shall submit as a minimum the following detailed drawings and related documents to Amtrak for review and approval:

(a) All drawings identified in the approved Drawing Tree, properly dimensioned, detailed, to scale and in accordance with the approved drawing schedule. **[CDRL 3-41]**

(b) Single line control schematic **[CDRL 3-42]** and functional block diagrams **[CDRL 3-43]** for each subsystem, and electrical wiring diagrams and schematics for all electrical circuits. **[CDRL 3-44]**

(i) All test points shall be displayed.

(ii) The functional block diagrams shall identify the "normal" functional paths as well as the functional paths made available through cutouts, bypasses, and redundant circuits.

(iii) The diagrams shall identify, as a minimum, the critical hardware that permits safe movement of the car, safe ingress/egress of passengers, and essential environmental needs of the passengers and Operator.

(iv) The functional block diagrams shall display the levels of hardware (as defined in Military Specification MIL-HDBK-505) that identify the Lowest Level Replacement Unit (LLRU).

(c) A complete set of drawings related to clearance **[CDRL 3-45]**. These shall include static and dynamic envelopes relative to the wayside allowances, including clearances for all parts of the truck, and general arrangement drawings with all static dimensions including camber, low level platforms, high level platforms, curves, etc.

(d) Single line piping and flow diagrams for all pneumatic circuits, displaying all valves and control components. **[CDRL 3-46]** All test points shall be displayed.

(e) Graphs and curves giving response and functional characteristics of the cars, subsystems, and major items. **[CDRL 3-47]**

(f) Manufacturer's data and specification sheets on all control items. **[CDRL 3-48]**

(g) Maintenance requirements and necessary procedures for all equipment in each subsystem. **[CDRL 3-49]**

(i) These shall be listed from daily inspection and periodic inspection to complete overhaul, with frequency and time needed to service being tabulated, and shall highlight all FRA-required inspections.

(3) Stress Analysis – A Finite Element stress analysis (FEA) of the car body shall be submitted to Amtrak for approval, see Chapter 6 for more detail. **[CDRL 3-50]**

(4) Final Interior and Exterior Renderings **[CDRL 3-51] [CDRL 3-52]**

(5) CMF Boards and Samples **[CDRL 3-53]**

f). Design Review Summary Matrix

i). The Contractor shall be required to submit all documentation required by the requirements of 49 CFR 238.110 as listed in the Notice of Proposed Rule Modification for submittal to the FRA as required. **[CDRL 3-54]**

Figure 3-2: Design Review Summary Matrix

Element	Sub-Element	PDR	IDR	FDR
System Design	Functional Description	X	X	X
	Supporting Calculations & Analyses		X	X
	Contractor Specification	X	X	X
	Car body FEA Analysis		X	X
	Outline Drawings	X	X	X
	Exploded Isometric Drawings		X	X
	Interior Layout and Product Design	X	X	X
	Exterior Design and Livery	X	X	X
	Detailed Drawings	X	X	X
	Control schematic & functional block diagrams		X	X
	Clearance Drawings	X	X	X
	Piping and flow diagrams		X	X
	Component Details		X	X
	Technical Specification Data Sheets	X	X	X
	Installation Drawings		X	X
	Maintenance Clearance Drawings		X	X
	Bill Of Materials		X	X
	Complete list of LRUs		X	X
	Interface Analysis	X	X	X
	Interface Drawings		X	X
	Subcomponent & Supplier Information	X	X	X
	Subcomponent Drawings	X	X	X
	Fire Safety & Toxicity Analysis		X	X
	Weight Report	X	X	X
	EMI Susceptibility		X	X
	EMI Mitigation Plan	X	X	X
	Signage and Decal Plan		X	X
	Renderings	X	X	X
	Virtual Mock-Ups	X	X	X
	Soft Mock-Ups	X	X	
	Hard Mock-Ups		X	X
	Virtual Mock-Ups	X	X	X
Support	Training Requirements	X	X	X
	Training Plan and Syllabus		X	X
	Maintainability Report	X	X	X
	Maintenance Requirements	X	X	X
	Maintenance Documentation Plan	X	X	X
	Maintenance Documentation Drafts		X	X
	Spare Parts Requirements		X	X
CDRL	All	X	X	X
Testing	Test Plan	X	X	X
	Test Procedures		X	X

3.17 Mockup Development and Review

a). Mockup and Rendering Review Plan

i). The Contractor shall develop and submit a Mockup and Rendering Review Plan no later than thirty (30) days after NTP. **[CDRL 3-55]**

ii). The Plan shall describe all mockups and renderings to be developed by the Contractor, the locations where the mockups will be built and reviewed, and the schedule for completion and review of the mockups and renderings.

iii). Contractor may propose as an option to provide full-scale completed cars to satisfy the mockup requirements, subject to review and approval. For more mockup and rendering requirements see Sections 3.13 and 3.14.

b). Mockups Overview

i). Purpose

(1) The Contractor shall produce full-scale mock-ups for the purpose of presenting the design concepts for the exterior and interior of each car type.

(2) The mock-ups shall be used to demonstrate compliance with the specification requirements for passenger amenities and arrangements, passenger and crew ergonomics, access to equipment and controls, verification of lines of sight, accessibility of equipment for maintenance and passenger accessibility in compliance with ADA, Accessibility Specification for Transportation Vehicle, and 2010 (or newer) ADAAG Standard, and specification requirements.

(3) The mock-ups shall also be used to help Amtrak finalize the Contractor's implementation of Amtrak's design vision and CMF as shown in Exhibit F.

(4) The mock-ups shall be used to identify potential problem areas and facilitate the development of alternative solutions.

ii). General

(1) The Contractor shall provide full-scale mock-ups of each of the different car types included in the procurement.

(2) There shall be two types of each mock-up:

(a) Soft mock-ups shall be refined throughout PDR and IDR.

(b) The hard mock-up shall be refined throughout IDR and FDR.

(3) Each car class/variant shall be represented by its own stand-alone mock-up rather than conflating elements from several car variants into one “mixed” mock-up.

(4) The mock-ups shall be of sufficient size to include all requirements included in this chapter, including, but not limited to those in Section 3.17e).

(a) Soft Mock-ups must also meet the requirements of Section 3.17c).

(b) Hard Mock-ups must also meet the requirements of Section 3.17d).

(5) Each mock-up interior shall be complete and fully operational with respect to details and shall show the location and arrangement of all components, devices and amenities including all lighting and PIDS.

(6) In the case of repetitive, identical features, such as roomettes or sleeper modules, the Contractor may build out one module interior and represent the others as closed off as viewed from the aisle.

(7) The Contractor may build additional mockups for Amtrak review at different points in the design review process, to assist in the development and finalization of the design.

iii). Location

(1) The Contractor is responsible for supplying the facility for the mockups for the duration of the mock-up period.

(2) The mock-ups will be required to be built and presented within the Washington DC Metro Area, or at a location approved by Amtrak.

(3) The mock-ups must be presented in a space that is accessible and has accessible facilities.

(4) The location proposed for the mock-ups shall be attainable by public transportation.

(5) The location selected for the mock-ups shall be submitted to Amtrak for review and approval.

(6) Amtrak shall visit the proposed mock-up site prior to its acceptance of the proposed location.

iv). Materials and Finishes

(1) The initial presentation of the mock-ups may use materials that provide an indication of the equipment and component layout.

(2) As the design progresses, the materials and equipment shall be replaced with the final design components, except as specifically allowed by Amtrak.

(3) Equipment, controls and indicators may be represented by placeholders sized, shaped and colored as they would be on actual consoles.

(4) Except as otherwise indicated, all equipment shall be functional; but not required to meet the performance requirements.

(a) When powered, all indicators, lights, doors, fans etc., shall operate.

(5) Electronic equipment shall be wired to permit function (e.g., indicators illuminating or fans running) when powered by an external power supply.

v). Electrical Power

(1) The mock-up shall be provided with power supplies for the conditioning and conversion of power.

(2) Only 120 or 240 Vac power shall be necessary to be supplied to the mock-up.

(3) The Contractor shall specify the required amperage and install circuit protection for the incoming power.

vi). Accessibility

(1) The mock-ups themselves should be fully accessible and provide safe access for people with disabilities, including individuals who use wheeled mobility devices and individuals who are deaf, hearing impaired, blind and low vision.

(2) Mock-ups should be built with any necessary ramps to access points.

(3) Mock-ups should include the ability to test accessibility with user groups of people who use mobility devices.

(a) They shall provide an accurate representation of accessible space, including the features required in this area like table, reading light, seat reservation display and any PIDS.

(b) A seat should be available to safely test a transfer maneuver.

(c) The on-board mobility lift shall be installed and be functional as part of the mock-ups.

(4) Soft mock-ups for accessible rooms and accessible restrooms should be built in such a way to test and validate various handhold locations and sizes, as well as all interaction points like switches and buttons.

(a) These features should be easily swappable and moveable in a single focus group setting.

(5) Accessible restrooms should be in a suitable condition for testing by people who use wheeled mobility devices who will need to test transferring to toilets.

(6) Accessible turning circles will have all functional devices and apparatuses in place along the circumference of the turning circle. This will allow “real-world” test with all potential barriers in place. Accessible pathways, turning circles and accessible space requirements should be represented and marked on the floors of the mock-ups, including, but not limited to:

(a) Any access from platform to an accessible space or accessible bedroom.

(b) Routes from accessible spaces to accessible restrooms.

(c) Access between cars.

(d) Accessible aisle through the Café, Diner/Lounge, Diner, and all other accessible cars.

vii). Review Process

(1) Mockups shall be complete a minimum of 15 days prior to the first stakeholder review at each applicable design review stage.

(a) There shall be at least 2 rounds of soft mockup reviews.

(b) There shall be at least 2 rounds of hard mockup reviews.

(2) Each mockup review phase will span several weeks with up to 300+ external stakeholders reviewing and providing feedback to the current state of the designs.

(3) Amtrak expects to make various visits to view the mock-ups throughout the design review process.

(a) Visits are expected to include stakeholders from both inside and outside the Amtrak organization.

viii). Approval

(1) Approval of the mock-ups shall occur when the design elements demonstrated in the mock-ups have been frozen.

(2) Amtrak will continue to visit and reference the mock-ups until the FAI of the first car or the FAI of each different car type is completed, whichever is later.

ix). Disposal of Completed Mock-ups

(1) The Contractor is responsible for disposing of the mockups when the mockup deliverable is approved and closed by Amtrak.

(2) Contractor must request and receive permission from Amtrak prior to disposing of completed Mock-ups, as Amtrak retains the right to keep portions of, or the whole mockups as they see fit.

c). Soft Mock-Ups **[CDRL 3-56] [CDRL 3-57]**

i). Purpose

(1) The purpose of the soft mock-ups is to evaluate special layouts and designs, and to identify potential problem areas and facilitate the development of alternative solutions.

ii). Materials and Finishes

(1) Soft mock-ups are not expected to be manufactured using final proposed materials.

(2) Soft Mock-ups can be built from MDF/Plywood, foam core, machined foam board, comfort foam.

(3) Seat and bed surfaces should have a covering of soft foam.

(4) Interior elements should be painted white and grey.

(5) Power ports, light switches, and all other user interfaces can be represented as labels but should be accurately placed for review by Amtrak.

(6) Soft Mock-ups for each accommodation room type shall be constructed of materials with sufficient strength so that ergonomics, human factors and accessibility of beds can be evaluated safely and thoroughly by Amtrak.

(a) Options for size, shape and position of steps and handholds should be allowed for during a review process.

iii). Seating Areas

(1) Soft mock-ups of seating areas shall include accurate representations of seats in both reclined and upright positions, tables, cup holders and seat trays to assess spacing and relative positions.

(2) Representation of typical coach and premium coach sections should be shown – with representation of, side wall, ceiling, luggage rack, window sizes and window mask treatments and seat reservation display. This should be at least 1 window module in length.

(3) Accurate aisle width should be represented with seating installed or configured so this can be tested.

(4) All food service seating areas shall include accurate representations of all seat types including tables and accessible seating locations.

iv). Rooms

(1) An individual module for each room type shall be provided, including representative exterior side wall, module walls, ceilings, and room doors to accurately represent the interior volumes.

(2) Seated and sleeping conditions can be supplied as separate mock-ups or plug and play adaptations (assuming this can easily and quickly be changed during a design review) for all key room types.

v). Mechanical Features

(1) Separate mechanical rigs will be required to demonstrate and prove out key mechanical features sets, which shall include at a minimum:

(a) Seat to bed conversions

(b) Bunk deployment

(c) Divider

vi). Storage Areas and Components

(1) A preliminary functional example of an overhead luggage rack shall be provided mounted at the design height and including the adjacent ceiling panel, built so that the loading and removal of baggage may be performed.

(2) A mock-up of the luggage tower should be shown in respect of its condition against a sidewall, bulkhead and aisle built so that the loading and removal of baggage may be performed.

(3) Stowage pockets, luggage shelves and luggage area should be dimensionally accurate and suitable construction to test storage of luggage, bottles etc.

vii). Lighting

(1) Lighting should be represented in the correct positions and controlled by the grouping as specified in the technical specification.

viii). Bedroom Seat Comfort Mock-Up

(1) A standalone seat comfort mock-up shall be provided for Amtrak review.

(2) The bedroom seat comfort mock-up shall prove out seat comfort and ergonomics for all bedroom seats.

(3) The bedroom seat comfort mock-up must accurately represent seat dimensions, cushion density and cushion profiles.

ix). Food Service

(1) All food service soft mockups (Kitchen, Café, and Servery) should be designed in modular format with key equipment as separate representative blocks.

(2) The equipment positions will need evaluation and will be subject to user testing.

x). Vestibule

(1) The vestibule Soft Mockup shall show the general arrangement of the entrance area for a car.

xi). Restrooms and Shower Rooms

(1) Standard restrooms, shower rooms and accessible restrooms can be supplied as isolated mockups; however, they must provide an accurate representation of interior volumes, handholds, and suitable strength to test toilet seats etc.

d). Hard-Mockups **[CDRL 3-58] [CDRL 3-59]**

i). Purpose

(1) Hard mock-ups shall be used to help Amtrak finalize material, color and finish.

(2) Comments from the mockup reviews shall be incorporated into the design and presented to Amtrak for review and acceptance.

ii). Materials and Finishes

(1) Hard mock-ups should be finished with final materials and finishes where possible.

(a) Some materials can be represented with indicative materials and finishes with the approval of Amtrak.

(2) The hard mock-ups shall include all finishes, colors, patterns, textures, fasteners and hardware represented in the Contractor's proposal design.

(a) All materials utilized should be the final material choice unless otherwise approved by Amtrak.

(3) All mockups shall be constructed of materials with sufficient strength so that they can be evaluated safely and thoroughly by Amtrak.

(a) This includes the ability to sit on seats, lean on countertops, open and close doors, simulate operation of controls, appliances and equipment; and view the mockup from a variety of angles.

(4) The final mock-ups shall include all finishes, colors, patterns, textures, fasteners and hardware represented in the Contractor's proposal design.

(5) All materials utilized should be the final material choice unless otherwise approved by Amtrak.

(6) Approved decals and signage must be included.

(7) Except as otherwise indicated, all equipment shall be functional; but not required to meet the performance requirements.

(a) When powered, all indicators, lights, doors, fans etc., shall operate.

(b) Electronic equipment shall be wired to permit function (e.g., indicators illuminating or fans running) when powered by an external power supply.

(c) Passenger Displays shall be functional.

(d) Lighting shall be identical to what is installed in each car type.

iii). Food service areas shall include all equipment and countertops.

iv). Equipment, electrical lockers and equipment lockers

(1) All on-board and undercar lockers shall be mocked up with all switches, breakers, relay panels, access panels, doors, controls, indicators and components simulated to evaluate access, visibility, maintainability and removal.

(2) All equipment shall be accurately represented to allow for the evaluation of maintainability.

e). Required Elements of Mockup Deliverables

i). Each mock-up shall include, at a minimum, the following elements as applicable for the respective car type:

(1) At least four rows of seats

(2) Workstation table between the facing seats

(3) Dining Tables and seats

(4) Café Tables and seats

(5) Lounge seats and tables

(6) Accessible Toilet Room

(a) A fully equipped Accessible Toilet Room (ATR) shall be included for the purpose of evaluating and confirming that the design arrangement of the ATR meets all ADA/ADAAG requirements for layout, circulation and access to controls and appliances.

(7) Overhead luggage racks, including reading lights

(a) A fully functional example of an overhead luggage rack shall be provided mounted at the design height and including the adjacent ceiling panel, built so that the loading and removal of baggage may be performed.

(8) Wall panels, window, window mask and shades

(9) Partitions and windscreens (if applicable)

(10) Convenience outlets with USB ports

(11) Heater grilles and diffusers

(12) Working passenger side doors

(13) Working trap door and folding steps

(14) Working onboard mobility lift

(15) End door, Diaphragms/Gangways and Car-to-Car Connection

(a) The end door and car-to-car connection shall be complete, operable, accurate in all mechanical details, and representative of all the actual components between two of the mock-ups.

(16) All Corridors, end doors, and partition doors

(17) Handrails (where applicable)

(18) Bike Rack/Luggage Shelf Area

(19) Interior doors

(20) Ceiling panels

(21) Floor panels

(22) All lighting

(a) Lighting shall be identical to what is installed in each car type.

(23) Approved decals, placards and signage

(24) Crew arrangements

(25) Working passenger displays

(26) Equipment, electrical and equipment lockers:

(a) All on-board lockers shall be mocked up with all switches, breakers, relay panels, access panels, doors, controls, indicators and components simulated to evaluate access, visibility, maintainability and removal.

(b) All equipment shall be installed to all for the evaluation of maintainability.

(27) Vestibule, side doors, trap door, folding steps, wall, and ceiling panel area for access to door equipment:

(a) Vestibule with working passenger side doors, trap door, folding steps, wall, and ceiling panel area for access to door equipment.

(b) The vestibule side doors, trap door, folding steps, ceiling, and wall area shall be included to simulate access to all side door equipment that requires inspection, adjustment or maintenance.

(c) All wall and ceiling panels shall correctly simulate the means of attachment, removal and operation, to ensure that the ceiling panels are safe and easy to use by maintenance personnel.

(d) High level and low-level station platform boarding areas shall be included.

(28) All safety and emergency equipment.

(29) Exterior

(a) The mock-up exterior shall be complete with respect to details and shall show the location and arrangement of all devices including, but not limited to, car ends, decals, paint finish, lights, indicators, crew steps, and handles.

(b) Exterior Livery should be applied to the exterior of the car.

(30) Each unique Sleeper Module

(31) Each accessible Sleeper Module

ii). The Dining Car shall also include, at a minimum:

(1) All Kitchen and Kitchen equipment

(2) 4 rows of Dining Tables and Seats

(3) Servery and Servery Equipment

(4) Crew storage areas, emergency storage

(5) Accessible spaces with accessible table

(6) Countertops

iii). The Lounge Car shall also include, at a minimum:

(1) 1 module of lounge seating

(2) Accessible lounge seating

iv). The Café Car shall also include, at a minimum:

(1) All food service equipment

(2) Café area

(3) At least two (2) modules of café seating

(4) Accessible café table area

3.18 Virtual Mock-Up

a). The Contractor shall utilize an electronic virtual mockup from the conceptual stages of the project through FDR.

b). The virtual mock-ups shall be delivered as fully 3 dimensional virtual environments running in real-time on stand-alone 6DOF (6 Degree of Freedom) headsets.

i). The headsets will fully track head movements allowing the user to explore the environments fully and naturally.

ii). The virtual mock-up platform should be designed to be collaborative, supporting up to the simultaneous participation of up to ten (10) users.

iii). The design data shall be optimized to run on the proposed platform.

c). 3D modeling and VR shall be used to expedite the presentation and acceptance of concepts.

d). The virtual mock-up shall be a real time tool to evaluate design decision and alternatives analysis through the design review process and shall be presented prior to and in parallel with the required physical mockups.

e). Virtual mock-ups shall also be used to evaluate equipment placement and potential maintainability issues not specifically associated with the Industrial Product Design.

f). The virtual mock-ups shall clearly and accurately show the car arrangement of each different car type including seating conditions (reclined and upright), doors, sidewalls, ceilings, lighting, partitions, accommodations, branding, equipment.

g). The virtual mock-ups shall include all sleeper car corridors for each different sleeper car type, presenting full car length corridors including all junctions with partitions, doors and thresholds with vestibules, etc. Coffee stations and crew cupboards and equipment cupboards should be shown.

h). Color, finish and signage shall be accurately represented to the greatest extent possible.

i). The virtual mockup shall also provide a means for evaluating maintainability as the car design progresses.

j). The virtual mockup shall be presented during IDR and FDR for all systems to ensure no interferences are present.

k). The virtual mockups shall be an integral element of each design review phase.

l). Acceptance of the virtual mockups shall be required as part of the completion of each design review phase prior to progressing to the next design phase:

i). PDR **[CDRL 3-60]**

ii). IDR **[CDRL 3-61]**

iii). FDR **[CDRL 3-62]**

m). The virtual mockups shall present the industrial product design and shall include the up-to-date CMF application and the representation of accurate lighting.

3.19 Renderings

a). General

i). The Contractor shall submit renderings and associated 3D data to facilitate the interior and exterior design efforts at each stage of the design process.

ii). The renderings should be delivered to a high production value and present the design to a photorealistic level, including accurate representation of color, materials, textures, and finishes, lighting and reflections.

iii). The renderings shall convey the design, appearance and functional intent of the proposed product.

iv). The renderings shall show the proposed position, size and appearance of equipment, components, furniture, and appliances in each space.

v). The first set of renderings shall be submitted 30 calendar days prior to the first Interior PDR. **[CDRL 3-63]**

vi). Revised renderings shall be revised and submitted as the design changes through IDR **[CDRL 3-64]** and FDR **[CDRL 3-65]** until the interior and exterior design is frozen.

vii). Renderings shall be provided electronically in both TIFF and JPEG formats with a minimum of 1920 x 1080 resolution.

viii). Format

(1) Renderings shall be provided electronically in both TIFF and JPEG formats with a minimum of 1920 x 1080 resolution.

(2) Additionally, each submittal package of renderings shall include full color print versions at a minimum of 11’ x 17’, printed on glossy paper.

(3) Amtrak accepted final renderings shall be provided in high resolution electronic format as well as 24 (twenty-four) sets of high-quality sets of high-quality D size (24 inches x 35 inches) poster board backed prints for display in public forums.

b). Interior Renderings

i). Interior renderings shall be provided to convey the options for interior layouts.

ii). Renderings shall be submitted for each product type, car class/variant.

iii). Renderings shall be fully detailed and shall present all amenities and features included on-board the cars.

iv). Renderings should accurately represent all the color materials and finishes.

(1) These should be supported by the Color Material and Finish (CMF) sample boards at each stage.

v). Renderings should accurately show the lighting conditions as well as different lighting states (daytime mode and evening mode).

vi). Renderings should depict the various configurations of equipment and accommodations, such as upright and reclined seating arrangements that cater to both seating and sleeping needs.

vii). Renderings included in the PDR package shall include:

(1) Renderings of each proposed seating design concept.

(a) Renderings shall include front, back, side and three-quarter images.

(b) Renderings shall present the full feature set of each proposed concept, as well as the equipment in all seating conditions (reclined upright, table out etc.).

(c) Rendering shall include annotated break out of key features and shall identify key and critical dimensions.

(2) Interior renderings showing all accessible spaces in each car type.

(a) All accessible coach spaces

(b) Schematic 3D data and screen shots/renders showing all elements and break out of parts and annotated to break out of key features and identify key and critical dimensions.

(c) All vestibules and Pathways

(d) Café, Accessible Sleeper, Diner, Diner/Lounge, Premium Accessible Coach, Standard Coach and Standard Sleeper.

(e) All restrooms

viii). Renderings included in the IDR package shall include:

(1) Revised full of renderings for all spaces presenting how the design is evolving and clearly identifying any changes or revisions since the PDR submittal.

(2) Renderings shall incorporate the application of the current Color Material and Finish as well as all states and lighting conditions.

ix). Renderings included in the FDR package shall include:

(1) Final and full suite of all spaces as final renderings for sign off on design. Minimum of 6 renders of each space.

(2) Final full and comprehensive Schematic renders – showing all features sets and key dimensions

(3) Creation of final design book combining renders, drawings, layouts and schedule of finish.

c). Exterior Renderings

i). Throughout the Design Review process, the Contractor shall submit to Amtrak for review and approval exterior renderings of each car type and variant.

(1) Renderings shall show the complete cars, fully equipped and in a ready for service condition, including end masks, doors, windows, and all exterior features.

(2) The Renderings shall include proposed livery color scheme, finish and use of decals (reflective and non-reflective).

(3) To facilitate the review of reflective decals, the Renderings shall include night-time view of front, side and three quarter profile view.

ii). A minimum, six (6) sets of renderings (each with all the necessary views) shall be submitted for Amtrak review and acceptance as the design evolves over the Design Review Process.

(1) Each successive set of renderings will show refined levels of detail and communicate how the contractor will deliver the exterior livery design ambitions set out by Amtrak design vision.

iii). Livery design shall be supported by 2D elevation artworks for all car types – supplied as .PDF. **[CDRL 3-66]**

iv). Final artworks should be supplied as color correct artworks with application guidelines. **[CDRL 3-67]**

3.20 Color Material and Finish (CMF)

a). A robust process will need to be developed by the Contractor to deliver the design vision with a CMF scheme that represents its brand and unique Amtrak brand DNA. For further clarification of expectations, refer to Exhibit F.

b). As part of the process, the Contractor shall provide:

i). Evolving sets of materials boards and samples are required at each stage of the design review process. **[CDRL 3-68] [CDRL 3-69] [CDRL 3-70]**

ii). Samples boards should be produced that include all interior materials and finishes for the Coach cars, Sleeper Cars, Diner, Diner/Lounge, and Café environments.

(1) Sample boards shall be delivered as a collection of all materials that represent all the materials in each area.

(2) Individual samples will not be reviewed or approved without the context of the other materials in the palette for that space.

(3) Samples will not be approved without an accompanying 3D render of the space showing an accurate representation of the color, material, and finish.

iii). Material suppliers and detailed material specifications and data sheets are required for review by Amtrak for each material. **[CDRL 3-71]**

iv). Large samples for flooring and seating should be delivered to coincide with Soft-mock up review.

v). Duplicate sample boards should be produced (3 sets per space).

vi). The Contractor shall support up to three rounds of sampling as materials are color matched, or materials refined.

(1) Material supplier briefs must be submitted to Amtrak for review and approval to ensure that they meet Amtrak's needs and expectations.

(2) Specific refinement will be expected for seating and flooring with rounds of color matching by suppliers expected up to five rounds.

vii). A Schedule of Finish documentation which shall identify the CMF for every part of the interior. **[CDRL 3-72]**

3.21 Requirements for Drawings, Documents and Data

a). Individual drawings shall be prepared for each part incorporated, designed and/or manufactured by or for the Contractor for the construction of the cars.

b). Any and all drawings, shop drawings, plans and specifications produced by the Contractor shall upon presentation to the Authority, become the property of Amtrak consistent with the General Provisions.

c). Assembly, sub-assembly and arrangement drawings shall include a complete Bill of Materials on the field of the drawing or as a subsequent sheet.

i). The Bill of Materials shall describe all items, including the subcontractor's parts and all equipment and details which form part of the assembly.

d). American Welding Society (AWS) standards, references and symbols shall be used at weldments in drawings.

e). All the drawings supplied by the Contractor in accordance with this Specification shall be so delineated that the wiring, piping, or mechanical interference between components shall be readily and clearly identifiable.

f). The Contractor's Safety Engineer shall review all design layouts, assembly, and subassembly drawings of safety related features prior to their submission to

Amtrak and/or their release for production to ensure the safety of operations personnel, maintenance personnel and the riding public.

g). Drawing Sizes and Requirements

i). All drawings shall be prepared in American National Standards Institute (ANSI) standard sizes.

ii). All Contractor drawings shall utilize a standard title block in the lower right corner and application block in the upper-right hand corner

(1) The arrangement for the title block and the application block shall be agreed upon prior to the start of PDR.

iii). The Contractor shall be responsible for the conformity and standardization of all sub-suppliers drawings to be submitted to Amtrak.

h). 3D CAD Data Requirements

i). Contractor shall provide 3D CAD data in the form of well-organized STEP files, with both assemblies and part-level geometry

ii). Files shall be version-controlled and date-stamped to allow for traceability and proper review.

iii). The data shall be reviewable in native 3D environments to support detailed evaluation and integration.

iv). Viewer-only platforms or proprietary viewer formats are prohibited.

i). Bills of Material

i). All drawings shall include Bills of Material with a numbering system for easy identification on the drawing.

ii). Bills of Material shall indicate piece part and assembly weights.

iii). Bills of Material shall include US equivalent units.

iv). Bills of Material shall be carried on the drawings, or on attached sheets of the same size.

v). Bills of Material descriptions shall positively identify the materials used.

vi). For items on the Bills of Material referring to common manufactured materials, the description shall contain the manufacturer name, and manufacturer’s part numbers for the material.

vii). The Bill of Material shall have a separate column for future insertion of Amtrak’s part numbers.

j). Dimensions

i). All dimensions shall be shown in both imperial and metric units.

(1) Metric dimensions, enclosed in parentheses, shall follow imperial dimensions.

ii). Imperial units shall be shown consistently on all drawings as follows:

(1) Inches and fractions, or inches and decimals throughout.

(2) One inch mark (") shall be shown to the right of each dimension.

(3) Decimals shall be shown with maximum of three significant figures to the right of the decimal point as required.

iii). Dimensions up to and including 72" shall be shown in inches.

iv). Dimensions above 72" shall be shown in feet and inches.

k). Metric units shall be shown consistently on all drawings as follows:

i). Metric units shall be shown as millimeters and decimals.

ii). Millimeter units shall be accompanied by one blank space and the letters "mm" to the right of the figures.

iii). Dimensions smaller than one meter shall be shown in millimeters.

iv). Dimensions one meter and larger shall be shown in meters and decimal meters (1.000 m)

v). Decimal units shall be shown with as many significant figures to the right of the decimal point as required.

l). Stationing

i). Numerical station dimensions and lines shall be used on all assembly drawings, and as frequently as possible on detail drawings and views, to locate the individual items in the overall car configuration. All assembly and sub-assembly drawings shall contain station information to accurately locate the item on the car.

ii). Stations shall be shown in three planes:

(1) Longitudinally, commencing with the pulling face of coupler (P.F.C.) at the front end of the car.

(2) Transversely, commencing with the longitudinal centerline of the car and increasing left and right.

(3) Vertically, commencing with the tops of the running rails.

(4) Station figures shall be enclosed in circles.

(5) Transverse dimensions shall have the letters "L" or "R" shown below the figures, to indicate "left" and "right".

(6) Vertical dimensions shall have the letters "ATOR" (above top of rail) shown below the figures.

m). Numbering

i). The Contractor shall confer with Amtrak to develop a numbering system compatible with both the Contractor and Amtrak's standard numbering systems.

ii). All revisions of drawings shall be identified with an alphabetic suffix.

n). Integrated Schematics Package

i). General

(1) The Integrated Schematic Package shall be submitted as a component of the Running Maintenance Manuals.

(2) The Integrated Schematic Package shall be comprised of two parts:

(a) Integrated Schematics

(b) Integrated Wiring Diagrams

(3) The Integrated Schematics shall include all electronic and electrical components on the car.

(a) All minor subsystem components housed in "black boxes" shall also be included in the Record Drawings Schematic Package.

(b) The Integrated Schematic shall provide the physical location of all electrical system components.

ii). Electrical Schematics

(1) The Contractor shall prepare and submit, for acceptance by the Authority, an integrated schematic diagram package relating all electrical systems and including all components and all wiring on the cars.

(2) The schematic diagram shall be one which can be readily followed by technicians with basic electrical knowledge.

(3) Both an alphabetic tabulation and pictorial locator of all electrical components and devices and the physical location of these components shall be included with the integrated schematics.

(a) This tabulation should also identify the circuits where components are used, and the location of each circuit in the schematic package.

(b) Each drawing within the schematics shall include a grid locating system which shall be referenced for continuation to other drawings.

(c) Wire List

(i) The schematics shall be accompanied by a complete Wire List. The list shall include for each wire, as a minimum:

1. Originating equipment

2. Destination equipment

3. Wire size and type

4. Conduits and Raceways through which the wire runs

5. Wire number

(ii) This Wire List shall be provided in an electronic database format (with database software and license provided).

1. The database shall be arranged in logical fields that will allow various sorts of the information (such as by equipment, wire number, conduit, etc.).

2. Both hardcopy and electronic media file shall be provided.

iii). Pneumatic Schematics

(1) In addition to electrical schematics, the integrated schematic package shall contain pneumatic schematics including, at a minimum:

(a) Compressed Air System

(b) Brake System

(c) Secondary Suspension

(d) Any other pneumatic components or systems.

iv). Wiring Diagrams

(1) Complete wiring diagrams shall also be provided for all car wiring.

(2) These diagrams shall be arranged logically and all text shall be clearly legible.

(3) Wiring Diagrams shall:

(a) Identify all conduits and raceways in which wires are run

(b) Identify all wires in each conduit/raceway

(c) Clearly denote all connections at terminal blocks and connectors.

(4) A separate drawing noting the physical locations of all terminal boards and junction boxes shall be provided as part of the wiring diagram package

v). Format

(1) Sample formats for the following shall be submitted to Amtrak for review and approval before submittal as a component of the maintenance manuals:

(a) Electrical Schematics **[CDRL 3-73]**

(b) Pneumatic Schematics **[CDRL 3-74]**

(c) Electrical Component/Device Table **[CDRL 3-75]**

(d) Wiring Diagram **[CDRL 3-76]**

(e) Wire Run List **[CDRL 3-77]**

(2) The schematics shall be provided in B size, 11 inch by 17 inch packages.

(3) All schematics shall be prepared so that all text and other items on the drawings are clearly legible on the 11 inch by 17 inch sheets.

o). All other document control and formatting requirements shall be discussed and agreed upon within 30 days after the project kick-off meeting.

3.22 Rapid Prototype Cars

a). In previous contracts, Amtrak has allowed Contractors to progress with the development of rapid prototype cars (RPC) in parallel with the Design Review process.

b). The advantage of this process was to help prove out manufacturability issues, confirm system integration and conduct pre-qualification testing prior to the construction of the deliverable pilot cars.

c). Should the Contractor desire to propose the incorporation of rapid prototype cars, it should develop and submit to Amtrak a proposal for review and acceptance detailing the following:

i). A detailed schedule showing the progression of the RPC in parallel with the Formal Design Review Process.

ii). Detail of the implementation of gateways in the Design Review Process which will limit and control the progression of the RPC process.

iii). A discussion of how the RPC process will be used to support and optimize the Design Review Process.

iv). Should the Contractor desire to utilize an RPC as a production car, a plan on how it would be remanufactured to comply with the following:

(1) Completion of all FMIs

(2) Replacement of any pre-FAI components with post FAI equipment

(3) Agreement with final design configuration

(4) All quality requirements of this specification, including formal re-inspection of the updated vehicle by Amtrak resident inspectors

(5) Final and complete vehicle testing

d). The following shall be considered constraints for the development of a Rapid Prototype Car process:

i). Process shall not be started until after the carshell design and testing has been completed. The carshell shall be manufactured to the final configuration and using the production process.

ii). The RPCs shall not be considered the pilot cars and shall not be the first cars to be delivered to Amtrak.

iii). The incorporation of an RPC process shall not negatively impact the contractual schedule.

iv). The incorporation of an RPC process shall not result in an increased contract cost to Amtrak.

v). The incorporation of an RPC process shall not negatively impact the material supply for the pilot or production cars.

vi). The complete vehicle FAI shall not be performed on the RPCs.

e). The decision to allow the incorporation of an RPC program shall be solely at Amtrak's discretion.

3.23 CDRLs

CDRL	Description	Due
CDRL 3-01	Project Management Plan (PMP)	NTP + 30 days

CDRL 3-02	System Integration Plan (SIP)	60 days prior to 1st PDR meeting
CDRL 3-03	Interface Control Document (ICD)	60 days prior to 1st PDR meeting
CDRL 3-04	Kickoff Meeting Presentation	At least 5 days before kickoff meeting and within 10 days of NTP
CDRL 3-05	Baseline Project Schedule (Baseline PS) and Narrative	NTP + 30 days
CDRL 3-06	Design Review Plan	NTP + 30 days
CDRL 3-07	Detailed Drawing Tree	30 days prior to 1st PDR meeting
CDRL 3-08	Compliance Matrix	Contract Award and 30 days prior to each design review
CDRL 3-09	Preliminary Design Review (PDR)	90 days after Contract Award
CDRL 3-10	PDR – Compliance Matrix	30 days prior to 1st PDR meeting
CDRL 3-11	PDR – Drawing Tree and Schedule	30 days prior to 1st PDR meeting
CDRL 3-12	PDR – System Functional Description	30 days prior to 1st PDR meeting
CDRL 3-13	PDR – Arrangement Drawings and Related Documents	30 days prior to 1st PDR meeting
CDRL 3-14	PDR – Detailed Technical Specification	30 days prior to 1st PDR meeting
CDRL 3-15	PDR – Detailed Technical Specification covering methods, materials and arrangements for pilot car construction.	30 days prior to 1st PDR meeting
CDRL 3-16	PDR – Table of suppliers and products	30 days prior to 1st PDR meeting
CDRL 3-17	PDR – Weight Analysis	30 days prior to 1st PDR meeting
CDRL 3-18	Intermediate Design Review (IDR)	60 days after the closure of PDR
CDRL 3-19	IDR – All Drawings in the Drawing Tree	30 days prior to IDR meeting
CDRL 3-20	IDR – Drawing Tree: 2 Additional Levels	30 days prior to IDR meeting
CDRL 3-21	IDR – Draft Single Line Control Schematic	30 days prior to IDR meeting
CDRL 3-22	IDR – Functional Block Diagrams	30 days prior to IDR meeting
CDRL 3-23	IDR – Electrical Wiring Diagrams & Schematics	30 days prior to IDR meeting
CDRL 3-24	IDR – Clearance Drawings	30 days prior to IDR meeting

CDRL 3-25	IDR – Piping Diagrams	30 days prior to IDR meeting
CDRL 3-26	IDR – Manufacturer's Data and Spec Sheets for all Control items	30 days prior to IDR meeting
CDRL 3-27	IDR – Updated Compliance Matrix	30 days prior to IDR meeting
CDRL 3-28	IDR – Updated Interior Renderings	30 days prior to IDR meeting
CDRL 3-29	IDR – Updated Exterior Renderings	30 days prior to IDR meeting
CDRL 3-30	IDR – CMF Palette	30 days prior to IDR meeting
CDRL 3-31	IDR – Interior Material Samples	30 days prior to IDR meeting
CDRL 3-32	IDR – Layout of Product Accommodations	30 days prior to IDR meeting
CDRL 3-33	IDR – Draft Maintenance Requirements and Procedures	30 days prior to IDR meeting
CDRL 3-34	Final Design Review (FDR)	90 days after the close of IDR
CDRL 3-35	FDR – Weight Analysis	30 days prior to FDR meeting
CDRL 3-36	FDR – Detailed Technical Specification	30 days prior to FDR meeting
CDRL 3-37	FDR – Functional Analysis	30 days prior to FDR meeting
CDRL 3-38	FDR – Drawing Schedule	30 days prior to FDR meeting
CDRL 3-39	FDR – Arrangement Drawings	30 days prior to FDR meeting
CDRL 3-40	FDR – Supplier Identification	30 days prior to FDR meeting
CDRL 3-41	FDR – All Drawings in the Drawing Tree	30 days prior to FDR meeting
CDRL 3-42	FDR – Single Line Control Schematic	30 days prior to FDR meeting
CDRL 3-43	FDR – Functional Block Diagrams	30 days prior to FDR meeting
CDRL 3-44	FDR – Electrical Wiring Diagrams & Schematics	30 days prior to FDR meeting
CDRL 3-45	FDR – Clearance Drawings	30 days prior to FDR meeting
CDRL 3-46	FDR – Piping Diagrams	30 days prior to FDR meeting
CDRL 3-47	FDR – Graphs and Curves of Response and Functional Characteristics	30 days prior to FDR meeting
CDRL 3-48	FDR – Manufacturer's Data and Spec Sheets for all Control items	30 days prior to FDR meeting

CDRL 3-49	FDR – Maintenance Requirements and Procedures	30 days prior to FDR meeting
CDRL 3-50	FDR – Finite Element Stress Analysis	30 days prior to FDR meeting
CDRL 3-51	FDR – Final Interior Renderings	30 days prior to FDR meeting
CDRL 3-52	FDR – Final Exterior Renderings	30 days prior to FDR meeting
CDRL 3-53	FDR – CMF Boards & Samples	30 days prior to FDR meeting
CDRL 3-54	All documentation required by 49 CFR 238.110 as listed in the NPRM.	30 days prior to IDR
CDRL 3-55	Mockup and Rendering Review Plan	NTP + 30 days
CDRL 3-56	1st Round of Soft Mockups	15 days prior to the first PDR stakeholder review
CDRL 3-57	Updated Soft Mock-ups	15 days prior to the first IDR stakeholder review
CDRL 3-58	1st Round Hard Mock-Ups	15 days prior to the first IDR stakeholder review
CDRL 3-59	Updated Hard Mock-ups	15 days prior to the first FDR stakeholder review
CDRL 3-60	VR – PDR Submittal	30 days prior to PDR
CDRL 3-61	VR – IDR Submittal	30 days prior to IDR
CDRL 3-62	VR – FDR Submittal	30 days prior to FDR
CDRL 3-63	1st Round Renderings	30 days prior to PDR
CDRL 3-64	Updated Renderings	30 days prior to IDR
CDRL 3-65	Renderings	30 days prior to FDR
CDRL 3-66	Livery Artworks	30 days prior to FDR
CDRL 3-67	All Approved Physical Material Samples	30 days prior to FDR
CDRL 3-68	Initial Color Material and Finish (CMF) Boards	30 days prior to PDR
CDRL 3-69	Sampling and Color Boards	30 days prior to IDR
CDRL 3-70	Color Material and Finish Boards	30 days prior to FDR
CDRL 3-71	Material Suppliers and detailed Material Specifications and Data Sheets	30 days prior to each Design Review
CDRL 3-72	Interior Schedule of Finish documentation	30 days prior to each Design Review
CDRL 3-73	Draft Formats – Electrical Schematics	30 days prior to IDR
CDRL 3-74	Draft Formats – Pneumatic Schematics	30 days prior to IDR
CDRL 3-75	Draft Formats – Electrical Component / Device Table	30 days prior to IDR
CDRL 3-76	Draft Formats – Wiring Diagram	30 days prior to IDR
CDRL 3-77	Draft Formats – Wire Run List	30 days prior to IDR

* End of Chapter 3 *

26-FOI-00415 00000006276 "UNCLASSIFIED" 4/30/2026

Amtrak Universal Single Level Fleet Replacement

Technical Specification

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4. Reliability, Availability and Maintainability

Revision 2

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4.1 Reliability Overview

a). This chapter defines the Reliability, Availability, and Maintainability (RAM) and Warranty requirements for the Amtrak Single Level Fleet Replacement program, including analysis and other submittal requirements.

i). The Contractor shall ensure that the level of reliability, availability, and maintainability provided by the cars supplied under this Contract meet or exceed the minimum requirements defined in this technical specification.

b). The single level fleet will spend much of their operating life hundreds of miles away from the nearest repair point with no onboard mechanical personnel and few if any tools and where alternative transportation for passengers in the event of a mechanical failure will be limited and time consuming to obtain if available at all.

c). Reliability and uptime of systems is of the utmost importance on these cars.

i). Designs must be robust, prioritizing reliability in all mechanical, electrical, and digital aspects.

ii). Where possible, system design should incorporate elements that will allow partial functionality when some components have failed, or lockouts to allow the car to continue to move safely until a repair point can be reached.

d). The Contractor shall incorporate a Design for Reliability (DfR) philosophy throughout the design process.

i). DfR is a process that ensures a product, or system, performs a specified function within a given environment over its expected lifetime.

ii). DfR requires the integration of product design and process planning into a cohesive, interactive activity known as concurrent engineering.

iii). The Contractor shall discuss the implementation of DfR in its Reliability Program Plan.

iv). By employing DfR, Contractor shall consider reliability throughout the design process to minimize the types and impact of component failures, minimize single point failures, and identify and mitigate failures of critical components that affect system operation.

v). DfR would be expected to include:

(1) Utilize mature designs for systems and components.

(2) Select suppliers with effective parts controls programs.

(3) Minimize design complexity and dormant failure possibilities.

(4) Consider parts obsolescence in the design process.

(5) Ensure component duty cycles do not exceed limits.

(6) Ensure heat sources are insulated from critical components.

(7) Ensure components are isolated to minimize shock and vibration.

(8) Use electro-magnetic interference (EMI) protection on all electronic equipment.

(9) Protection from freeze-related damage and mitigation of issues caused by the accumulation of ice and snow during extended cold-weather conditions.

(10) Use best reliability design practices.

(11) Redundancy between components wherever practical.

4.2 Reliability Program Plan

a). The Contractor shall develop and implement a Reliability Program Plan to ensure the vehicle, its systems, and its subsystems meet or exceed the reliability requirements specified in this Chapter.

b). The Contractor shall be responsible for providing all measures required to meet the specified requirements, including design, manufacture, installation, retrofit of the entire fleet, and all changes.

c). No later than 30 days after NTP, the Contractor shall submit a Reliability Program Plan **[CDRL 4-01]** prior to Preliminary Design Review (PDR), and it shall be updated throughout the design process.

d). The Plan shall be submitted for Amtrak's review and approval.

e). The Reliability Program Plan should discuss the following items:

i). Reliability program objectives and requirements.

ii). Reliability program schedule, including activities and delivery dates.

iii). Organization structure, including the name(s) and qualifications of the Reliability Engineer(s).

iv). Methodologies used for analyses to ensure Plan requirements are achieved, including criteria for Line Replaceable Unit (LRU) classification.

v). Process for identifying subcontractors based on history of reliability capabilities and controls for activities of subcontractors and equipment suppliers.

vi). Reliability allocations.

vii). Method for component qualification and parts selection.

viii). Reliability demonstration test plans, including pass-fail criteria.

ix). Failure Review Board (FRB).

x). Reliability database or process to control failure data for FRB.

xi). Corrective action procedures, including procedure for failure analysis, root cause identification and verifying implementation of corrective actions. This should also address Fleet Defects.

xii). Failure Reporting, Analysis and Corrective Action System (FRACAS), including documentation procedures for capturing failure data, to include factory testing.

xiii). Reliability Progress Reporting, which details implementation of the approved program.

(1) Reports shall be submitted to Amtrak on at least a monthly basis to provide updates on critical Reliability KPIs (MDBCF, MDBSF, Availability, Failures and Fleet Defects).

4.3 Reliability Requirements

a). Every complete car, as well as each constituent component, assembly, subsystem and system element shall be designed in such a manner as to perform its function reliably in revenue service for the stated life expectancy of the component.

b). Failure Rates

i). Each car under all system operating conditions shall operate with a failure rate not exceeding that defined in these Technical Specifications.

ii). The car design and implementation of the design shall provide Amtrak with equipment that meets the Mean Distance Between Service Failure (MDBSF) and Mean Distance Between Component Failure (MDBCF) requirements.

iii). Compliance with MDBSF requirements shall include all failure modes for systems, subsystems, and components to meet the following requirements:

(1) All Car Types MDBSF = 120,000 miles

(2) The reliability objectives shall be based on single car operation at an average speed of 65 mph (104.6 kph.) and a utilization of 215,000 miles/yr. (344,000 km/yr.).

c). A Service Failure shall be defined as in Exhibit G – TSSSA Statement of Work.

i). Component Reliability Requirements

(1) The following MDBCF requirements shall be met:

Figure 4-1: MDBCF Requirements

System	MDBCF	
Braking System	300,000	[482,700 km]
Side and End Doors	300,000	[482,700 km]
HVAC System	380,000	[611,420 km]
Couplers	750,000	[1,207,008 km]
Trucks and Suspension	750,000	[1,207,008 km]
Auxiliary Power Systems	360,000	[579,363 km]
Lighting	1,000,000	[1,609,344 km]
Wheels and Axles	300,000	[482,700 km]
Communications Systems	600,000	[965,606 km]
Water and Waste System	750,000	[1,207,008 km]
Food Service (Café, Diner, and Lounge)	750,000	[1,207,008 km]
Toilet room	750,000	[1,207,008 km]

d). Reliability Prediction Analysis

i). The Contractor shall submit a Reliability Prediction Analysis **[CDRL 4-03]** prior to PDR, and approved prior to Final Design Review (FDR), to demonstrate how the system and subsystem reliability requirements can be achieved with their design.

ii). The Reliability Prediction Analysis should utilize historical reliability data wherever possible and minimize the use of handbook practices such as MIL-HDBK-217F or the NPRD.

iii). The Reliability Prediction Analysis shall be updated throughout the design process, no less frequently than bi-monthly.

iv). The Reliability Prediction Analysis shall be performed to the LRU level.

e). Fleet Defects

i). A Fleet Defect is identified when 5% of the quantity of a warranted item fails or where 5% of cars per a fleet type are affected during the warranty period as noted in the Specification.

ii). Amtrak may classify the total of such items as a failure, or fleet defect, including those items for which the warranty period expired before Amtrak recognized the failure.

iii). The Contractor is responsible for failure analysis, corrective action and all costs of labor and material, for defect identification and location, and for removal, repair or replacement of defective parts, and for alterations, repairs, tests and adjustments in connection therewith made to obtain car performance identified in the technical specifications.

iv). Replaced or repaired items due to a fleet defect are warranted and guaranteed for the remainder of the warranty period or for one (1) year, whichever period is greater.

f). Availability Requirements

i). Car reliability and car maintenance requirements shall be such that fleet availability shall exceed 99.99%, where Availability is defined as:

(1) MTBF (Mean Time Between Failures) see Chapter 2.

(2) MTTR (Mean Time To Repair) see Chapter 2.

$$\text{Availability} = \frac{\text{MTBF}}{\text{MTBF} + \text{MTTR}}$$

ii). Availability shall be measured daily and the exact time at which it will be measured must be approved by Amtrak.

4.4 Failure Review Board

a). A Failure Review Board (FRB) shall be jointly established consisting of representatives from Amtrak and from the Contractor.

i). The core members of the FRB shall be the Contractor's Warranty Manager and Reliability Engineers and Amtrak's assigned Reliability Representative/Warranty Officer and COTR.

ii). The core members shall be supplemented by appropriate personnel from Amtrak, the Contractor, and subcontractors/suppliers, as required, to facilitate a thorough and accurate review of all the data.

iii). The Contractor shall ensure the participation of subcontractors/suppliers to provide subject matter expertise of any problems with components/subsystems and to expedite resolution.

b). The FRB shall meet regularly, beginning when the first cars undergo factory acceptance testing and continuing through the Reliability Demonstration Test to the end of the Warranty Period.

i). FRB meetings shall be scheduled weekly with the understanding that Amtrak may, at its sole discretion, require more or less frequent meetings depending on the reliability of the equipment.

c). Responsibilities

i). The FRB shall review the failure report forms and logs to verify failure classifications and assign responsibilities of failures.

ii). The FRB shall review all reliability test data and failure reports, review failure analyses, report progress toward meeting reliability requirements, identify

areas needing improvement, and propose actions to ensure the successful completion of the reliability demonstration.

iii). The FRB shall correct and update failure reporting, analysis and corrective action system (FRACAS) data.

d). In the event the FRB is unable to reach agreement on the categorization of failures (chargeable/non-chargeable) or on the corrective action to be taken for any item, Amtrak's Reliability Representative will forward the issue, with relevant records and documentation, to Amtrak's COTR.

i). The COTR will act as the arbitrator for all project issues.

ii). Where appropriate, Amtrak's COTR will meet with the Contractor's representative to determine the path forward.

iii). Upon agreement, the decision will be formally communicated to the Contractor and the FRB.

4.5 Reliability Demonstration Testing

a). General

i). As a condition precedent to Final Fleet Acceptance, a Reliability Demonstration must be successfully performed, analyzed and reported upon by the Contractor to validate the reliability of the cars, systems, subsystems and components during revenue service.

ii). The Contractor shall closely monitor the failure modes of all systems to ensure that the cars will meet requirements.

iii). If at any time during the Reliability Demonstration the failure rate of any system exceeds the allowable failure rate (i.e., the MDBCF requirements listed in

iv).

v). Figure 4-1), the Contractor shall seek modifications and changes to bring the system into compliance.

vi). Reliability calculations will be performed using a 12-month rolling average.

(1) All equipment failures during car burn-in shall be reported and recorded, but not counted in establishing MDBCF and MDBSF values.

(2) Determination of pass or fail will be assessed only at the end of the reliability demonstration.

b). Grace Period

i). During the first six (6) months of data collection, Amtrak will consider the reliability results as biased by system interface issues, workmanship issues,

and infant mortality failures and will not hold the Contractor responsible for its reliability goals.

ii). The Failure Review Board shall, however, be active during this grace period.

iii). During the grace period, the Contractor must submit a procedure to identify the collection, review and control of the failure data pertinent to the Reliability Demonstration.

c). Reliability Progress Reporting

i). The Contractor shall submit monthly Reliability Progress Reports **[CDRL 4-02]** following the first Failure Review Board (FRB) meeting.

ii). The format for the monthly reports shall be determined by the FRB members, but shall include, at a minimum, the following:

(1) RAM activities within the reporting period, including minutes and actions of the Failure Review Board meetings.

(2) Reliability Test Report.

(3) Reliability achievements and problems.

(4) Reliability requirements, generic formulas and performance summaries for all defined requirements:

(a) Mean Distance Between Service Failures – Car Level

(b) Mean Distance Between Service Failures – Subsystem Level

(c) Mean Distance Between Component Failures – Car Level

(d) Mean Distance Between Component Failures – Subsystem Level

(e) Availability

(f) Fleet Defect items

(5) Reliability critical items.

(6) Expected reliability activities within the next reporting period.

(7) A summary and schedule of corrective actions, including in-progress and planned.

d). Component Failures

i). For all parts or material returned to the Contractor for repair or replacement, the Contractor shall provide a failure analysis report form to Amtrak.

ii). The failure analysis form shall clearly identify the part by description and part number; identify the car and service mileage of that car, the date and nature of the failure.

iii). The Contractor shall, within 60 days, provide Amtrak with the results of a root cause analysis for the failure along with any proposed action in the Reliability Report.

e). Reliability Design Modifications or Changes

i). The Contractor shall make necessary modifications during the reliability demonstration program in order to achieve the MDBCF and MDBSF requirements.

ii). The Contractor shall submit all requests for such design changes within 60 days of the end of the reliability demonstration using the Engineering Change Request (ECR) system and shall gain Amtrak approval prior to the implementation of any change.

iii). All reliability-related modifications defined during the reliability demonstration program shall be implemented on all cars and spare parts within 180 days of the date of approval of the modifications by Amtrak.

f). Reliability Demonstration Duration and Conclusion

i). The Reliability Demonstration will commence with the Approval for Revenue Service of the first car and continue until two (2) years after the Final Acceptance of the last car.

ii). Satisfaction of the reliability demonstration shall only be met when the specified availability and reliability requirements for each complete system within the fleet (that is all cars installed and commissioned) is achieved based on a consecutive 12-month period of test time.

(1) In the event the reliability demonstration is declared failed, the Contractor shall continue testing and extend the test period until the reliability demonstration is successful, unless otherwise directed by Amtrak.

iii). If two (2) years after the Final Acceptance of the last car it cannot be determined that all specified reliability requirements have been met, the Contractor shall re-design and modify or replace all such systems, subsystems, components, parts or equipment as needed to achieve acceptable reliability, at the Contractor's expense, regardless of whether these items have exhibited the defect or failure and regardless of the warranty status.

(1) Cars so modified shall undertake a further reliability demonstration of at least six months duration to prove reliability.

(2) Demonstration periods may be extended, as necessary, to validate season-dependent reliability. Reliability issues related to air conditioning systems shall not be considered satisfactorily demonstrated until performance has been verified through a full summer operating season. Similarly, reliability issues related to freeze protection or other winter weather conditions shall not be considered satisfactorily demonstrated until performance has been verified through a winter operating season, regardless of when corrective actions are implemented.

(3) Modifications shall continue at the Contractor's expense until the specified MDBCF and MDBSF reliability levels are met.

(4) Should such modifications not be completed within this six-month period, Amtrak shall have the right, at its sole discretion, to perform any necessary engineering or studies, and to correct the defect or failure.

(a) All costs incurred by Amtrak for such engineering and corrective work shall be at the Contractor's expense.

(b) Any items replaced by Amtrak during such corrective work will be disposed of by Amtrak in the manner requested by the Contractor and at the Contractor's expense.

(c) If the Contractor fails to furnish disposition instructions, Amtrak will dispose of such items at the Contractor's expense, where applicable.

g). Reliability Demonstration Report

i). Within 30 days after the completion of the Reliability Demonstration Test, the Contractor shall submit the Reliability Demonstration Report **[CDRL 4-04]** verifying that the reliability requirements of this chapter have been met.

h). Reliability Demonstration Plan

i). Prior to the start of Final Design Review, the Contractor shall submit for Amtrak review and approval the Reliability Demonstration Plan (RDP). **[CDRL 4-05]**

ii). The RDP shall define the specific procedures, facilities, staffing, and protocols to be employed by the Contractor during the Reliability Demonstration to monitor, test, adjust, and report progress toward achieving the reliability requirements of this Specification. Specifically, the Contractor shall provide a procedure to be followed in the reliability demonstration that includes, at a minimum:

(1) Method for all equipment failures to be reported during reliability testing, including forms and reliability database.

(2) The reliability program shall utilize failure data collected through the failure tracking process.

(3) Monitoring of overall car reliability on car and component level.

(4) Tracking of all component failures and identification of Fleet Defect.

(5) Details of the burn-in period for each car.

(a) All equipment failures during the burn-in shall be reported and recorded but not counted in establishing MDBCF values.

(6) Procedure for corrective action when necessary to meet reliability requirements.

(a) This shall include proposed reliability demonstration restart procedures, proposed changes, and appropriate supporting data.

(b) The proposed plan shall clearly identify a specific method for verifying the effectiveness of change(s).

(c) Credit may not be taken for time from previous failed tests, and the specified performance and other required characteristics of the equipment shall not be changed to achieve reliability requirements.

(7) Method for recording all relevant data necessary to calculate MDBCF values for the car and major systems and to verify successful demonstration of the MDBCF requirements.

4.6 Design Changes after Pilot Car delivery

a). If during or after Pilot Car testing and commissioning design changes are deemed necessary for any reason, including Fleet Defects, the Contractor shall formally submit such change for Amtrak approval through an Engineering Change Notification (ECN).

b). The ECN shall include all supporting information and shall be subject to Amtrak review and approval, including reason for change, updated drawings, other documentation, modification plan, schedule, impacted production vehicles, detailed Field Modification Instructions (FMI) as appropriate, and any other data required to allow Amtrak to fully evaluate and approve the request.

i). Amtrak reserves the right to request a prototype or mockup of the proposed change to verify the solution solves the problem when implemented, prior to providing approval.

c). The ECN shall also present which vehicle types shall require an FMI and which shall incorporate the modification into the production process. The modification shall apply to all cars in the fleet, a cut-in car will not be allowed unless approved by Amtrak.

d). FMI configuration management should be managed using a sharable database to follow the various steps to get the FMI implemented.

e). To support what is usually an extended FMI period, the Contractor shall develop and submit during the FDR Phase of Design Review an FMI Plan for submittal to Amtrak for review and approval **[CDRL 4-11]**. This plan should include what accommodations the contractor will require such as roof access, pit access, drop table/car jacks, FMI duration, uncouple, and so on.

4.7 Maintainability

a). General

i). The Contractor shall consider maintainability and its effect on the total cost of ownership of these vehicles throughout the vehicle design process.

(1) The general goal shall be to maximize the ease of testability, reparability, and maintenance of equipment and components that affect system operation during the car useful life.

(2) The quantifiable goal of designing for maintainability shall be that the target for Mean Time To Repair (MTTR) for running repairs and troubleshooting target shall be 30 minutes.

ii). Initiatives which may improve the maintainability of the vehicles may include:

(1) The use of modular design.

(2) Inter-changeability of components performing similar functions.

(3) Accessibility of components and fasteners.

(4) Moveability of replaceable components.

(5) Reparability including appropriate Maintenance Manual data.

(6) Appropriate self-test features.

(7) Built-in quick disconnect test points for air and electrical systems.

(8) Design of simplified test equipment for use as troubleshooting aids.

(9) Minimize the use of specialized tools to replace components.

(10) Equipment covers and access panels incorporate rugged, quick-removal fasteners.

(11) Use of consistent fastener types, where applicable.

iii). The car shall be designed and built to minimize maintenance and repair time and overall costs over the car life. The following shall be considered good

practice in designing for maintainability and shall be utilized in the car design:

(1) All systems and components serviced as part of periodic preventive maintenance shall be readily accessible for service and inspection from under the car (from a pit), from ground level or from inside the car. Periodic maintenance shall not require the use of cranes or fall protection.

(2) Removal or physical movement of components unrelated to the specific maintenance and repair tasks involved shall be minimized or eliminated.

(3) Relative accessibility of components, measured in time to gain access, shall be inversely proportional to frequency of maintenance and repair of the components. (Items requiring more frequent maintenance shall be easier to access).

(4) Items which may need to be accessed while operating over the road, including cut-out cocks to keep the train moving or portions of systems operating even when some components have failed, must be readily accessible by the crew. Access from within the car is best. If necessary to place it undercar or in the equipment room, it must be within easy reach of the side of the car and protected from the buildup of ice and snow.

(5) Assemblies and components that are physically interchangeable shall be functionally interchangeable.

(6) Modular or plug-in assemblies and components that are not functionally interchangeable shall not be physically interchangeable.

(7) Systematic fault isolation procedures shall be developed for inclusion in the maintenance manuals.

(8) Local built-in test points and fault/status indicators shall be provided and clearly marked for all major systems including friction braking, Heating, Ventilation and Air Conditioning (HVAC), passenger doors, auxiliary power, battery charger, Public Address (PA), wi-fi, trainline, toilet system and food service equipment (chillers).

(9) All test points, fault indicators, modules, wire terminations, piping, tubes, wires, etc., shall be identified by name plates, color coding, number coding or other means to assist the maintenance personnel.

(10) Component placements in equipment cabinets, enclosures or confined places shall give the most accessible positions to those items requiring the most frequent maintenance or adjustment. For example, the toilet room and kitchen equipment.

(11) Door panels and openings shall be of sufficient quantity, size and placement to permit ready access from normal work areas.

(12) Standard, commercially available components and hardware shall be used wherever possible.

(13) Captive fasteners shall be used on covers and access panels where periodic maintenance and inspection are to be carried out. The use of special tools for removal shall be avoided.

(14) Cabinets and access panels will prioritize the use of quarter-turn hardware, pencil latches, and coach keys. Special keys are only allowed with express permission from Amtrak Access shall be provided, to the greatest extent possible, to structural components to allow inspection for cracks and corrosion.

(15) Major components shall be designed for ease of removal. Handles and lifting eyes shall be provided as applicable, on heavy equipment and components not readily accessible.

(16) Means shall be provided to verify the operability of redundant hardware components, and their switching devices, during maintenance, troubleshooting and testing.

(17) Requirements for special tools and fixtures shall be minimized.

(18) Any component that may need to be removed from inside the car needs to easily be able to fit through window openings, end doors, access door/hatch or lower body doors after the car is fully fitted-out and in service.

(19) Required list of tools for each task shall be provided.

b). Maintainability Plan

i). The Contractor shall prepare and submit for review at PDR, a Maintainability Program Plan **[CDRL 4-06]** utilizing design standards that minimize Mean Time To Repair (MTTR), cleaning and maintenance costs throughout the car's intended useful life.

ii). The plan shall include the systems and car MTTR goals for the proposed car.

iii). An overall quantitative maintainability requirement goal for the car's corrective maintenance shall be the weighted average of the MTTR (Mean Time To Repair) of the key system elements.

iv). Diagnostic and set-up time shall not be included in the MTTR.

v). Preventive maintenance is defined as the maintenance tasks performed to minimize the possibility of future equipment failure, reduce or minimize wear rates, replace consumable parts, and satisfy warranty requirements.

vi). The elapsed time required to perform preventive maintenance (exclusive of servicing) on the car shall be demonstrated.

vii). The objectives of the maintainability program, including corrective and preventive maintenance, shall provide for:

(1) Maximization of car availability

(2) Minimization of maintenance costs, including cleaning

(3) Minimization of car down time

(4) Minimization of special and high skill levels for maintenance

(5) Minimization of special tools and fixtures

viii). Components and sub-assemblies requiring occasional removal shall be plug-in units, adequately identified and secured and keyed to prevent misapplication.

ix). The need for adjustments shall be avoided wherever possible.

x). Adjustment points shall be readily accessible, adequately identified and self-locking to prevent inadvertent operation and drift.

c). Mean Time to Repair Requirements

i). The Mean Time To Repair (MTTR) a car fault and restore the car to operational readiness shall not average more than 1.5 hours.

ii). MTTR shall be defined as the average time required to fix a failed component or device and return it to production status, including time needed for the maintainer to diagnose, access, remove, replace/repair, close, and test-out the failed component or device.

iii). MTTR shall not include logistics time.

iv). The weighted average of the MTTR values for the following subsystem elements shall be no greater than:

Figure 4-2: MTTR Requirements

System	MTTR or Replace Major Module (hours)
Braking System	1
Side and End Doors	0.5
HVAC System	1
Couplers	2
Trucks and Suspension	1.5
Auxiliary Electrical System	1
Lighting	0.5

Wheels and Axles	1.5
Communications Systems	1
Water and Waste System	1
Food Service (Cafe, Diner and Lounge)	1
Toilet room	1

v). Maintainability Analysis

(1) As part of FDR, the Contractor must submit a Maintainability Analysis **[CDRL 4-07]** per type of cars for Amtrak approval.

(2) The maintainability analysis must:

(a) Demonstrate the MTTR requirement based on all LRU failure rate as well as their replacement times.

(b) Include all scheduled maintenance tasks and their time estimates.

vi). Lifecycle Cost Analysis (LCC)

(1) The Contractor must submit a Life Cycle Cost Analysis (LCC) **[CDRL 4-08]** at IDR and be updated through the design process.

(2) The LCC analysis must estimate all maintenance costs as well as overhaul costs to determine the cost of maintenance during the vehicles service life.

(3) An estimated life cycle shall be provided for all major components and LRU's.

(4) These documents must be approved prior to final approval of FDR.

d). Maintainability Demonstration

i). The Contractor shall perform a formal maintainability demonstration.

ii). The procedures used in the maintainability demonstration shall be the same as those included in the maintenance manuals delivered.

iii). The maintainability demonstration must be held at Contractor's facility or the facility of a sub-supplier.

iv). Maintainability Demonstration Plan **[CDRL 4-09]**

(1) The Contractor shall submit a Maintainability Demonstration Plan based on MIL-HDBK-470 for Amtrak approval prior to qualification testing of the first car.

(2) The Plan shall include a list of tasks to be performed during the demonstration for Amtrak approval.

(3) The Plan shall also include the template that will be used to record the results of the maintainability demonstration of each task, including fields to record the task name, time to access, remove, replace/repair, close, and test-out the component.

(4) The maintainability demonstration shall include:

(a) preventive maintenance

(b) corrective maintenance

(c) train recovery

(d) Accessibility

(e) Troubleshooting guide(s)

v). The preventive maintenance demonstration shall include the periodic inspections and any preventive maintenance tasks identified by the Contractor during the Maintenance Analysis.

vi). The corrective maintenance demonstration shall include change-out of LRUs and LLRUs and use of special tools where special emphasis, instruction, or proficiency is needed.

vii). The LRU and LLRU change-outs shall demonstrate compliance with the MTTR requirements of each system element.

viii). The adequacy of the car design for maintainability shall be evaluated to the satisfaction of Amtrak using product components and equipment, mockups and actual cars during the design, production and acceptance phases.

ix). The maintainability of following systems shall, as a minimum, be demonstrated. However, Amtrak reserves the right to request the demonstration of additional systems.

(1) Braking System

(2) Side and End Doors

(3) HVAC System

(4) Couplers

(5) Trucks and Suspension

(6) Auxiliary Electrical System

(7) Lighting

(8) Wheels and Axles

(9) Communications Systems

(10) Water and Waste System

(11) Food Service (Café and Diner)

(12) Toilet room

(13) Powered Accessible Toilet and Accessible Sleeper Room Doors

(14) Sleeping Accommodations

(15) Non-powered Sleeper Room Doors

(16) Gangway

(17) Diagnostic and digital systems (PIDS, onboard computers, etc.)

(18) Wi-Fi

(19) Digital Trainline

(20) On-Board Mobility Lift

x). This demonstration shall include a shop exercise to troubleshoot, to change out of components, to perform corrective maintenance, and to use the Contractor supplied special tools and equipment.

xi). The demonstration shall also consider train-car lifting and crane access when developing the maintainability demonstration plan and maintenance manuals.

e). Maintainability Demonstration Conclusion

i). If at the end of the demonstration it cannot be determined that all specified maintainability requirements have been met, the Contractor shall re-design and modify or replace elements as needed to achieve acceptable maintainability at the Contractor's expense.

ii). Cars so modified shall undertake a further maintainability demonstration to prove maintainability.

f). Maintainability Demonstration Report

i). Upon completion of the Maintainability Demonstration Test, the Contractor shall submit the Maintainability Demonstration Report **[CDRL 4-10]** verifying that the maintainability requirements of this chapter have been met.

4.8 CDRL List

CDRL	Description	Due
CDRL 4-01	Reliability Program Plan	NTP + 30 days

CDRL 4-02	Reliability Progress Reports	Within 90 days following the 1st FRB, then monthly
CDRL 4-03	Reliability Prediction Analysis	30 days prior to PDR
CDRL 4-04	Reliability Demonstration Report	Reliability Demonstration Test + 30 days
CDRL 4-05	Reliability Demonstration Plan	30 days prior to start of FDR
CDRL 4-06	Maintainability Program Plan	30 days prior to PDR
CDRL 4-07	Maintainability Analysis	30 days prior to FDR
CDRL 4-08	Life Cycle Cost Analysis	30 days prior to IDR
CDRL 4-09	Maintainability Demonstration Plan	180 days prior to qualification testing of 1st car
CDRL 4-10	Maintainability Demonstration Report	Within 30 days after completion of the Maintainability Demonstration Test
CDRL 4-11	FMI Plan	90 days prior to shipment

* End of Chapter 4 *

Amtrak Universal Single Level Fleet Replacement

Technical Specification

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5. Quality Assurance

Revision 2

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5.1 Overview

a). This chapter describes the Contractor quality, manufacturing and inspection requirements for the single level fleet.

b). The Contractor is expected to have an overall Quality Assurance Program that is implemented throughout their organization and a project specific Project Quality Plan, described below.

5.2 Regulations, Standards, Specifications and Drawings

a). Amtrak takes no responsibility for the identification of applicable chapters and paragraphs of regulations and standards with which the Contractor must comply.

b). Nothing in this specification shall relieve the Contractor from ensuring that all applicable regulations, standards, and specifications are followed.

c). The Contractor shall provide proof of compliance with all applicable regulations, standards, and specifications per Section 3.15 b).

d). The Contractor is responsible for ensuring that all applicable regulations, standards, and specifications are followed when complying with the requirements of this document.

e). A summary list of regulations, standards and specifications is listed in Chapter 2 as a guide to the Contractor but shall not be construed as complete.

5.3 Quality Assurance (QA)

a). The Contractor shall develop and implement a Quality Assurance (QA) program that conforms to the latest edition of FTA-PA-27-5194-12.1: *Quality Management System Guidelines*, to assure the delivery of a quality product.

b). The elements of the QA program shall encompass and control the Contractor's entire organization and all other manufacturers, subcontractors and suppliers that perform work relating to this Contract.

c). Should the Contractor's QA program be structured following other Quality System standards such as ISO or IRIS, for example, the Contractor shall include in the Project Quality Plan, described below, a cross-reference matrix of the Standard's requirements versus the FTA-PA-27-5194-12.1.

d). The QA Program shall ensure that all aspects of car design, component manufacture and testing, car assembly and testing, and car commissioning are in full conformance with the design, materials and workmanship requirements provided in these Technical Specifications, and are comprehensively documented.

5.4 Project Quality Plan

a). Overview

i). A Contract-specific Project Quality Plan (PQP) shall be prepared that details when and where in the manufacturing process each element of the Contractor's and major supplier's organizations will perform specific actions required by the associated QA manual using the quality procedures found therein.

ii). The PQP shall also specifically identify an adequate number of qualified staff to carry out the required QA tasks and their roles and responsibilities.

iii). The PQP shall be provided to Amtrak for review and approval sixty (60) days after NTP. **[CDRL 5-01]**

iv). The PQP shall present how the Contractor shall meet the quality assurance requirements of this Technical Specification.

v). Required elements of the PQP include:

(1) Overview of Contractor's QA program.

(2) Contractor's PQP cross-reference matrix of the Contractor's Quality Program elements versus the FTA Quality Management System Guidelines listed above.

(3) Corporate organization chart showing how the unit responsible for QA fits into the overall corporate structure, including how it relates to other functional units such as engineering, purchasing, production and warranty, and how QA communicates with those other functions to ensure quality objectives are met.

(4) Organization chart for the QA unit, including names, duties and responsibilities, and contact information for QA unit personnel.

(5) Specific QA policies, procedures and objectives that are implemented at all stages of the project to ensure that the highest quality is maintained through the life of the project.

(6) References to all project management, administrative, design, production, inspection, testing and warranty procedures relevant to the manufacturing and servicing of the cars.

(7) Role of Amtrak in the QA process, including Amtrak design reviews, inspections and hold points, and Amtrak's authority to require corrective action, additional hold points, and/or inspections to resolve quality problems.

(8) Process for implementing, monitoring, and revising/improving QA policies and procedures, including the means by which QA has the ability to take corrective action to resolve quality problems within

engineering, production or testing, and the authority that gives QA the ability to stop production if problems go uncorrected.

(9) Process for engineering changes, configuration management, production control and other manufacturing tools to ensure that vendors and production are working to current revisions of all drawings, specifications, policies and parts lists.

(10) Process for auditing production to determine if QA policies and procedures are being implemented and maintained, and how problems are corrected.

(11) Process by which vendors and suppliers are verified to be in compliance with the Contractor's QA program, and the process for ensuring that vendors adhere to the PQP, including source inspections, inbound material inspections, resolving vendor quality problems, certification of parts authenticity and anti-counterfeiting efforts, and long-term parts availability in conformance with contractual provisions.

(12) Inspection process for monitoring quality during production, including flow chart and process for resolving defects and closing out non-conformances.

(13) Schedule for inspection and recalibration for all tools and devices used for measurement, testing or inspection.

(14) Comprehensive inspection plan (see Section 5.9)

(15) Process and objectives for defect reduction over the term of production of the cars, including trend analysis, engineering changes if necessary and modifications to inspection and testing processes.

(16) Monitoring of post-delivery performance of delivered cars, including evaluation and analysis of fleetwide failures, engineering changes to production, and field modifications to the delivered equipment if necessary. Refer to the Technical Support, Spares and Supplies Agreement for applicable failure rates.

(17) Process for monitoring the System Safety Program including dedicated resource for managing System Safety.

(18) The PQP shall also contain or refer to a comprehensive collection of standard forms to be utilized for documentation of quality control activities.

(a) These forms shall be designed to assure compliance of materials, processes, personnel and products to the approved design drawings and applicable specifications.

vi). The approved PQP and supplemental manuals, procedures and instructions shall be subject to regular scheduled and/or unscheduled audits by Amtrak.

vii). A quality organization chart included in the PQP shall show the reporting relationships of all QA management staff.

(1) The quality organization chart shall identify that the quality assurance function is fully independent of the production team.

(2) The organization of the Contractor's QA program shall report directly to the General Manager of the Contractor's facility or the Contractor's Project Manager.

(a) In any case, it must be completely independent of the Contractor's manufacturing or purchasing divisions.

viii). QA Authority and Autonomy

(1) The PQP shall clearly describe that the Contractor's QA representatives have the responsibility and sufficient authority to ensure that a nonconforming or discrepant product or service will not be used or delivered to Amtrak.

(2) The QA personnel shall have complete freedom to identify and evaluate problems; to recommend solutions; to verify implementation of solutions; and to control further processing, delivery, or installation of a nonconforming or deficient item until proper and documented disposition has been obtained.

5.5 Book of Quality

a). During the construction of the first car of each car type, the Contractor shall develop a Book of Quality for each car type.

b). The Books of Quality shall be developed and submitted to Amtrak for review and approval prior to the inspection of the first production car of each car type.

c). The Books of Quality shall be organized starting with zones of visibility, with Zone 1 being most visible to passengers and so on down to completely hidden areas.

d). The Books of Quality shall clarify inspection and acceptance criteria for all inspection categories such as gaps, flushness, depth of scratches, diameter of dimples, repairs, etc.

5.6 Additional Quality Requirements

a). QA Organization Responsibility

i). The Contractor shall, for the purposes of this Contract, designate a Project Quality Manager who has sufficiently defined responsibility, authority, resources and organizational freedom of action to be in charge of, and implement on behalf of the Contractor, such QA as is required to ensure a proper control of the production process.

ii). The QA organization must report independently from production and have fully independent authority to reject unsatisfactory material and subassemblies regardless of any effect on the progress of the Work.

b). Personnel Qualifications

i). The Contractor's QA personnel performing inspections and tests shall be certified for such work.

ii). Certification of personnel shall be by the virtue of those skills which are obtained by experience or training and verified by testing.

iii). All manufacturing personnel performing special processes, such as welding, brazing, etc. shall be trained and AWS certified for such work. All certifications shall be maintained and kept up to date throughout the production build.

iv). Welding inspections shall be completed by AWS certified Welding Inspectors. All certifications shall be maintained and kept up to date throughout the production build.

v). Records of personnel certifications shall be maintained and monitored by the Contractor's QA department. These records shall be made available to Amtrak for review.

vi). The Contractor shall, upon request, make measuring and control recordings available to Amtrak for review and provide copies of documentation as requested.

vii). The Contractor shall ensure that inspection and tests are based on the latest approved revision or change to drawings, specifications, and all other applicable design documentation.

c). Revision Control Procedure

i). Prior to the start of PDR, the Contractor shall develop and submit to Amtrak for review and approval a revision management procedure which controls the adequacy, completeness, change and update of drawings and other design documentation. **[CDRL 5-02]**

ii). This procedure shall be in coordination with the change control system as provided in this Specification and Contractor’s configuration management system.

iii). The Contractor shall ensure that requirements for the affectivity point of changes are met and that obsolete drawings and change requirements are promptly removed from all points of issue and use.

(1) Means of recording the effective points shall be employed and made available to Amtrak.

d). Non-Conforming Material

i). Identification and Disposition

(1) The Contractor shall establish and maintain an effective and positive system for controlling nonconforming material and/or workmanship, including procedures for its identification, segregation, and disposition.

(2) Dispositions allowing the use or repair of nonconforming material or workmanship shall require Amtrak's approval.

ii). Segregation of Non-Conforming Materials

(1) All nonconforming material shall be positively identified to prevent unauthorized use, shipment or intermingling with conforming material.

(2) Holding areas and procedures developed by the Contractor and reviewed and accepted by Amtrak shall be established and maintained by the Contractor for the duration of the Contract.

iii). Corrective Action

(1) Corrective action and related information shall be documented and made available to Amtrak upon request.

(2) Corrective action shall extend to the performance of all sub-suppliers and include as a minimum:

(a) Analysis of data and examination of discrepant products to determine extent and causes with corrective action implemented in an expeditious manner prior to the next shipment, order or inspection.

(b) Introduction of required improvements and corrections, initial review of the adequacy of such measures, and monitoring of the effectiveness of corrective action taken.

(c) Analysis of trends in processes or performance of work to prevent nonconforming products.

e). Subcontractor Quality Assurance Requirements

i). The Contractor shall require that each subcontractor or supplier establish and maintain a QA program compliant with that of the contractor and acceptable to the Contractor and Amtrak for the services and items it supplies.

ii). The Contractor is responsible for all subcontractor and supplier quality and performance.

iii). The Contractor shall survey, audit and periodically review each subcontractor and their facilities to assure adequate capabilities to perform subcontracted efforts in compliance with the Contractor’s QA program. These surveys/audits shall be documented and available to Amtrak upon request.

iv). Each major subcontractor or supplier shall have a QA system that is approved by the Contractor and fully implements the PQP of the Contractor as it applies to the subcontractor or supplier's scope of work.

f). Quality Assurance Assessments (Audits)

i). Amtrak Quality Assurance Audits of Contractor, Subcontractors and Suppliers

(1) Amtrak shall, throughout this Contract, have the right to access and visit all facilities of the Contractor, subcontractors and suppliers associated with this contract to conduct initial and on-going assessments (audits).

(a) Amtrak will perform scheduled and unscheduled audits of the Contractor's/Subcontractor's/Supplier's quality assurance activities.

(b) These assessments shall determine if the QA programs are being properly adhered to in compliance with the approved PQP, and that they are producing quality products compliant with the requirements of this Contract.

(c) During these assessments, the Contractor shall provide Amtrak personnel reasonable assistance as they inspect production facilities, examine operations in progress and review documentation.

(2) At a minimum, the following audits of the Contractor will be performed:

(a) During production of the first carshell (will include an audit of both the Contractor and major subcontractors)

(b) During manufacturing, installation of equipment, and testing

(c) Before acceptance of the first car

(3) The Contractor will be notified of other audits to be performed by Amtrak as deemed appropriate.

(4) The Contractor will be provided with an audit report containing audit result information following an Amtrak performed audit.

(a) If any deficiencies are noted, Amtrak shall provide its findings detailing the identified deficiencies.

(b) The Contractor shall implement corrective action and notify Amtrak of the mitigation that was implemented.

ii). Contractor Quality Assurance Self Audits

(1) The Contractor shall perform periodic internal quality assurance audits and inspections throughout the life of the project/during the execution

of the Contract to ensure that all QA program obligations are being fulfilled, that all aspects of Amtrak-approved PQP have been effectively implemented, and that all deliverables meet the requirements of the Technical Provisions and all approved drawings and procedures. These internal self-audits shall be documented and available to Amtrak upon request.

(2) The Contractor shall provide Amtrak with an internal audit schedule **[CDRL 5-03]** at the onset of the project and whenever revisions to the schedule occur.

(3) Deficiencies discovered during the audit process shall be documented and corrected.

(a) Corrective actions shall include measures to preclude recurrence of the deficiency.

(b) Deficient areas shall be re-audited on an accelerated schedule.

(c) These deficiencies shall be documented and available to Amtrak upon request.

(4) Amtrak audits and monitoring will be performed independent of and in addition to the Contractor's quality assurance function, but will in no way replace, negate, override or lessen the Contractor's QA obligations.

iii). Contractor Quality Assurance Audits of Subcontractors/Suppliers

(1) The Contractor shall audit subcontractors to assure compliance with the approved PQP.

(2) As a minimum, the following audits of each subcontractor shall be performed:

(a) Prior to a subcontracted or purchased item being delivered

(b) Within thirty (30) days of the scheduled First Article Inspection (FAI), qualification test or the Contractor's acceptance of any supplied items or services

(3) Amtrak shall be notified in advance of any scheduled audit and may participate as a witness on any Contractor performed audit. These audits shall be documented and available to Amtrak upon request.

g). Quality Assurance Records

i). The Contractor shall maintain adequate records of compliance with its QA program plan for the life of the Contract and through any subsequent warranties.

ii). These records shall be made available to Amtrak on request, and a complete set of records shall be submitted to Amtrak at the end of the warranty period.

h). Audit Reports and Corrective Action

i). The Contractor shall fully plan and document all quality audit activities performed internally and at subcontractor premises.

ii). The Contractor shall develop an audit report within thirty (30) days of each audit detailing any non-compliances found during the audit, corrective action requests and establishing dates by which the corrective actions are required.

iii). The Contractor shall submit a Monthly Quality Report (MQR) that describes the status of key project elements described in the PQP as well as all other quality issues affecting the project.

iv). The Contractor shall submit its first draft MQR to Amtrak for review and acceptance within sixty (60) calendar days of NTP. **[CDRL 5-04]**

v). For the duration of the Contract, the Contractor shall submit a monthly MQR to Amtrak, as part of the Monthly Project Report (MPR).

i). Monthly Quality Report (MQR) Content

i). The MQR shall include, but not be limited to:

(1) Description of the current status of the design and/or production status of the project

(2) Status of PQP open issues

(3) Status of Project Quality Management

(4) Status of Contractor corrective actions

(5) Status of First Article Inspection (FAI) open issues

(6) Status of non-conforming material

(7) Status of field modifications

(8) Contractor’s project audit schedule and results

(9) Subcontractor and supplier audit schedule and results

(10) Project Quality KPIs

(11) Contractor’s internal activities

(12) Vendors and Sub-Contractors activities

(13) Software quality assurance audit results; and

(14) FRB major issues

j). Monthly Project Quality Meetings

i). The Contractor shall hold monthly Project Quality meetings with Amtrak to discuss quality issues and review the MQR. The quality meetings shall include any relevant subcontractors as required.

5.7 Initiatives that Promote Sustainability in the Manufacturing Process

a). The Contractor shall submit to Amtrak for review documentation regarding initiatives it has undertaken to promote sustainability and reduce the amount of material and energy waste produced by the manufacturing process. **[CDRL 5-05]**

b). This documentation shall extend to the strategies employed by the Contractor's suppliers and vendors.

c). These initiatives shall identify how manufacturing waste and energy consumption will be reduced, including tangible and quantifiable goals and the method for monitoring and improving the success of the program.

d). The waste reduction strategies may include (but are not limited to):

i). Creation and utilization of reusable packaging for the transport of materials and components between the facilities of the parts supplier and the Contractor

ii). Use of recyclable materials for packaging

iii). Use of recycled or renewable materials in the production process

iv). Reuse or recycling of excess material created during the manufacturing process

v). Use of energy-efficient or low-emission vehicles and equipment for transportation and production purposes

vi). Capture of reusable or recyclable materials such as office paper, cardboard, copier toner, beverage containers and other post-consumer recyclable material

vii). Use of facilities that meet the standards of the Leadership in Energy and Environmental Design (LEED) program

viii). Employee awareness campaigns that promote reduction of material and energy waste; and

ix). Strategies that promote the reduction of unnecessary use of materials and energy.

e). The Contractor's waste reduction program shall provide to Amtrak quarterly reports **[CDRL 5-06]** that document the status of the program and the level of success that the program is achieving.

5.8 First Article Inspection (FAI)

a). General

i). The Contractor shall perform a First Article Inspection (FAI) of all major components, subassemblies and fully assembled cars of each type.

ii). Amtrak or its representatives shall be present to witness all FAIs.

iii). The Contractor shall perform a satisfactory preliminary FAI on each article prior to notification of Amtrak of an FAI.

iv). The Contractor shall lead, document and report on all FAIs.

v). FAIs shall be conducted at the manufacturing facility of the material of interest, be it the Contractor, a subcontractor or a supplier.

b). FAI Plan and Process

i). Within ninety (90) days of NTP the Contractor shall develop an FAI Plan and submit to Amtrak for review and approval. **[CDRL 5-07]**

ii). The FAI plan shall include the following requirements at a minimum:

(1) A list of assemblies, subassemblies and components subject to FAI along with their projected schedule.

(2) A tracking system to identify each FAI subject and accurately reflect the present status of each inspection. The tracking system shall be maintained through the completion of all scheduled FAIs.

(3) The sample for each FAI shall be considered to be complete by the manufacturer and shall reflect the approved baseline drawings.

(4) The FAI sample shall have been produced using the production methodology and tooling.

(5) Successful completion of engineering tests for the subsystem is a prerequisite for conducting the FAI.

(6) The FAI shall be performed using the approved baseline drawings in conjunction with the Technical Specification reflecting specific requirements of the subject along with any special tools and/or equipment needed to verify the design requirements, configuration, and operation (if applicable) of the item being inspected.

(7) All technical data required for the maintenance manual and/or parts catalogs shall be submitted as initial drafts prior to the full acceptance of the FAI. **[CDRL 5-08]**

(a) The initial drafts shall contain enough information to adequately maintain the equipment during the pilot program and initial production car delivery.

(8) Amtrak shall be given notice of an upcoming FAI at least thirty (30) days before its schedule date for domestic FAIs and forty-five (45) days before its scheduled date for international FAIs.

iii). The FAI Plan shall be updated monthly and presented as an attachment to the program meeting minutes.

iv). None of the material and/or parts listed in this Chapter of the Technical Specification shall be installed on the equipment unless the FAI has been performed and approved by Amtrak.

c). Amtrak Participation

i). For equipment that requires an FAI, the equipment shall not have passed the FAI unless Amtrak or its representative participates in the inspection to its satisfaction.

ii). An inspection that requires Amtrak participation but is conducted without a qualified Amtrak representative shall not be considered as having passed.

iii). Amtrak reserves the right to waive their own participation of FAIs given that the Contractor has provided the requisite amount of notification of the scheduled FAI.

iv). Should Amtrak arrive for an FAI and find the Contractor and/or supplier unprepared, the FAI shall be considered failed.

v). Should the equipment fail inspection, the problem(s) shall be corrected and re-inspected to Amtrak's satisfaction before the FAI is considered passed and production released.

(1) FAI findings shall be closed in person upon resolution of the issue. Closure is to be conducted at the car builders' facility unless alternative arrangements are agreed upon.

d). Systems Requiring FAI Approval

i). The FAI Plan shall include a listing of all items proposed to be subject to an FAI. It is noted that this list may be expanded as the design review progresses and additional critical components are identified.

ii). At a minimum, the FAI program shall include the following components:

(1) Carshell

(2) Floor panels

(3) Door leaves

(4) Gangway and/or Diaphragms

(5) Door hardware, latches

(6) Manual doors (if provided)

(7) Power doors, operators and controls (if provided)

(8) Onboard mobility device lift (if provided)

(9) Windows, including emergency windows or emergency egress hatches

(10) Truck-frame

(11) Truck-fully assembled

(12) Wheel and axle assemblies

(13) Couplers and draft gear

(14) Air brake system

(15) Seats including booths

(16) Digital signage and displays

(17) Tables (workstation and food service area)

(18) HVAC system, controls and temperature controls

(19) All external and internal lighting systems

(20) Communication system, including Central Diagnostics Unit, and Digital Trainline systems

(21) Food service galley, and equipment including refrigeration system

(22) Restrooms (modules)

(23) Water supply system

(24) Waste collection and retention system

(25) Sidewall Panels

(26) Ceiling Panels

(27) Beds

(28) Major fiberglass interior components and hardware

(29) Complete sleeping modules

(30) On-Board Mobility Lift

(31) First completed production car for each car type

iii). The final approval of all colors and finishes shall also be subject to FAI and acceptance by Amtrak. See Chapter 11 of the technical specification for more information.

iv). Equipment shall be shipped from the point of manufacture only after the FAI has been approved.

v). FAI's will not be performed unless the design drawings, production processes, production tooling and any other relevant documentation required for the item to be inspected have been approved.

(1) The inspection area, as well as any components to be inspected, must be cleaned to a new condition before commencing the inspection.

e). Approved FAI Items / FAI Sample / Golden Unit

i). Approved FAI items shall establish the quality of workmanship for the remainder of the same items being produced.

(1) That quality shall be well documented.

(2) Samples of welds, fit-ups, finishes, and colors, photographs, FAI documentation, etc., shall be retained for the duration of the production phase in a secure area at the Contractor's facilities for reference by the Contractor's and Amtrak's representatives.

(3) Changes, modifications or adjustments to this baseline must be approved by Amtrak and will be cause for initiating another FAI by Amtrak.

ii). The FAI sample (Golden Unit) shall be retained by the equipment manufacturer and may be installed on the last applicable model of the production cars.

(1) Either Amtrak or the Contractor may deny usage of the FAI unit in production if just cause is provided such as configuration control.

(2) The FAI sample must be stored at the Contractor's facility and must be updated with any modifications throughout the duration of the Contract.

(a) This requirement does not apply to any completed car FAI.

f). FAI Preparation

i). Availability of the information in a timely manner is essential to ensure that the appropriate level of Amtrak's technical expertise is available for each FAI and that the individuals have sufficient prior information to inspect the equipment.

ii). The Contractor shall provide the following information to Amtrak at least thirty (30) business days before a scheduled FAI **[CDRL 5-09]**:

(1) A complete list of the equipment and its bill of materials to be inspected.

(2) Identify each completed assembly along with the configuration in which it is to be presented.

(3) A copy of the technical Specification for the equipment and the subcontractor's scope of supply.

(4) A complete drawing package with current drawing approvals.

(a) The drawing package should be in sufficient detail to inspect, at a minimum, the fit and finish of the assembly and subassemblies, wire and pipe routing, clearances between components, ergonomic considerations, and any other details that are required to ensure that the equipment is acceptable for the intended purpose.

(5) System schematics, electrical, fluid, pneumatic and piping, with current approvals.

(a) The schematics shall be sufficient to determine that the equipment will operate as intended.

(6) Routine test report(s).

(7) All instruction manuals, operating manuals, maintenance procedures and heavy repair shall be presented at the FAI for review.

(8) A report by a recognized independent testing laboratory certifying that all materials used in the equipment comply with the 49 CFR Part 238 Appendix B requirements and NFPA 130, as applicable.

(9) All material certifications.

(10) Calibration certificates for all routine test equipment and inspection tools.

(11) An Amtrak-approved FAI and acceptance test procedure and an Amtrak approved qualification test procedure to which the equipment will be inspected. A functional test shall be required as part of the FAI.

iii). Should any of the above documents be incomplete or otherwise unacceptable to Amtrak, this shall be grounds to delay the FAI until they are made right.

(1) The burden of any delay shall be with the Contractor.

iv). In addition, during the FAI the Contractor shall provide the following, as applicable:

(1) The Contractor shall make available all previously submitted and accepted pertinent calculations or analyses that show that the design is adequate for the purpose intended.

(2) The Contractor's complete stress analysis and summary, submitted under shall be available during the carshell FAI.

(3) All manufacturing variations of specified materials that vary in color, texture, pattern, etc., shall be presented, for approval by Amtrak, at FAI.

(a) Samples of acceptable variation extremes will be retained for reference in future inspections.

v). The FAI shall include a maintainability demonstration for repairs, the removal/reinstallation of consumables, and routine inspections.

vi). FAIs are considered closed when all FAI open items are closed.

vii). All the information listed above shall be included in a FAI Binder, that after the FAI is concluded, is submitted to Amtrak for review and acceptance. **[CDRL 5-10]**

g). FAI Findings

i). The Contractor shall provide, within ten (10) business days of each FAI, an FAI report which shall include a copy of all the documents presented and/or discussed at the meeting. **[CDRL 5-11]**

ii). The Contractor shall be required to mitigate any unsatisfactory findings at an FAI, up to and including revisiting the design of affected components or subcomponents regardless of FDR status.

(1) Instances of an unsatisfactory demonstration encompass, but are not restricted to:

(a) The operation of components is impeded or compromised due to conflicts within the system.

(b) Improper design or omission of components resulting in a failure of functionality or unsatisfactory operational efficiency.

(c) Tolerance issues which result in interferences between components.

(d) Identification of potential safety issues that pose a risk for injury during operation or maintenance activities.

iii). The Contractor shall include an action plan to correct all deficiencies discovered during the FAI.

iv). The FAI will remain open until all action items are completed to Amtrak's satisfaction.

v). Depending on the severity of the deficiency, follow-up FAI may be required.

h). FAI Photographs

i). Within thirty (30) days following each FAI the Contractor shall provide color photographs of each item on which an inspection was performed.

(1) The photographs shall be provided on 8.5 in. by 11 in. size paper and also in a digital format.

ii). A second set of these photos shall be compiled into an album for Amtrak's reference for future car inspections and will be supplied to Amtrak with the delivery of the first shipment of cars. **[CDRL 5-12]**

5.9 Inspection

a). General

i). As part of the Project Quality Plan, the Contractor shall include a comprehensive inspection plan covering the processes and procedures proposed to ensure the overall quality and compliance of the equipment under this Contract.

(1) The inspection area, as well as any components to be inspected, must be cleaned to a new condition before commencing the inspection.

ii). Amtrak shall, at all times, have the right to inspect any and all work being performed for this Contract.

iii). The Contractor shall grant Amtrak access to the facilities of the Contractor, subcontractors and suppliers to conduct initial and on-going inspections and assessments of the work to determine if it is being performed in accordance with both the requirements of the Contract as well as all approved design documents.

iv). During these assessments, the Contractor, subcontractors and suppliers shall make every reasonable effort to assist Amtrak personnel, including the supply of any necessary equipment to access areas of the assembly and all equipment necessary to perform inspections.

v). Inspection or lack of inspection, approval, or acceptance of any portion of the work by Amtrak shall not relieve or release the Contractor from its obligations to fully comply with all requirements of the Contract documents.

vi). For hold point inspections, the Contractor shall not progress to the next station or commence any testing without approval or a waiver from Amtrak. A comprehensive review of open inspection items, modifications, engineering issues, and material shortages must be conducted to assess their impact to the build before a decision can be made to proceed to the next activity.

vii). The Contractor shall correct any portion of the work not meeting the requirements of the Contract documents at the Contractor's expense to the satisfaction of Amtrak.

viii). Amtrak at any time before issuance of final acceptance for any car may order re-inspection of any portion of the work.

b). Inspections and Tests

i). Inspection of components to be used by the Contractor in performance of the work under this Contract shall be the responsibility of the Contractor

ii). It is preferable for inspections to be performed at the plant where the respective processes are taking place to give the Contractor and/or supplier every opportunity to correct, under factory conditions, any inadequacies found.

iii). Inspection of supplier components shall also be performed at the Contractor's plant to identify any damage in transit.

iv). Amtrak, its representatives and its designees, including the FRA, shall also have the right to:

(1) inspect selected items at any time, whether or not accompanied by the Contractor's representative.

(a) This shall in no way lessen or eliminate the Contractor's responsibility to make proper inspection.

(2) inspect at subcontractor manufacturing facilities any materials, processes, assembly and testing of equipment it deems necessary to validate compliance with the Contract, technical specifications and accepted design documents.

(3) Have access at all times to those parts of the Contractor's and/or subcontractor's plants in which any portion of the work is performed for the purposes of:

(a) inspecting materials and workmanship, and

(b) determining conformity to the Specification during the progress of construction and assembly of the equipment.

v). If any portion of the car shall become hidden by subsequent work contrary to the specific request of Amtrak, that portion of the car shall be made visible for Amtrak inspection by the Contractor at the Contractor's expense (Section 5.8f)).

vi). Amtrak shall be allowed to participate in all Contractor and/or subcontractor tests and inspections of all components of the equipment, at the Contractor's and subcontractor's plants, for the purpose of QA.

(1) Such right to participate shall include Amtrak's right to supplement its on-site inspector with additional experts as necessary according to the particular nature of the test or inspection involved.

vii). The presence of Amtrak in the plant of either the Contractor or subcontractor shall not, in any way, supplant or relieve the Contractor's responsibility for making proper inspections or meeting the requirements of the Specification.

viii). Amtrak shall have the right to reject all materials and workmanship that do not conform to the Specification.

(1) When 3 or more rejections occur for the same item or component, the Contractor shall prepare a written report for Amtrak detailing the problem(s) discovered during inspection and the efforts to be taken to remedy the problem(s).

(2) No further acceptance or production shall take place until the Contractor notifies Amtrak in writing that the problems have completely resolved.

ix). The Contractor shall document the results of both inbound material inspection, outbound inspection, and testing for each car.

(1) A "traveler" shall be attached to each car to track QA functions as the work progresses through the shop.

(2) A copy of the report must be attached to each car through conditional acceptance.

x). If Amtrak has reason to believe that defective work has been performed or permitted by Contractor, or that defective materials were used, Amtrak may examine any partially or fully completed work.

(1) If Amtrak makes such an examination, Contractor shall at its own expense furnish the appliances and labor required by Amtrak to make such investigation and inspection.

(2) Any defective or nonconforming work so disclosed shall be promptly corrected by Contractor at Contractor's expense.

xi). Except as otherwise provided herein, costs incurred by Amtrak in performing or participating in inspections under this Contract shall be borne by Amtrak.

(1) However, Contractor shall reimburse Amtrak for Amtrak's costs incurred as a result of any re-inspection resulting from a failed inspection or Contractor's failure to meet a scheduled inspection or where a scheduled inspection was postponed and rescheduled upon less than three (3) days' notice to Amtrak.

xii). Inspection and Test Log

(1) An Inspection and Test Log (Log) shall be maintained by the Contractor during equipment assembly.

(2) The Log shall be submitted to Amtrak for review before each car will be released for shipment to the delivery site. **[CDRL 5-13]**

(3) All Contractor and Amtrak in-process inspection sheets and test data records for that car shall be contained in this Log, which will be provided in the vehicle history book.

xiii). For those routine inspections and tests of components that are typically performed solely by Amtrak, the Contractor shall give at least 72 hours' notice of such inspections or tests to Amtrak.

(1) Amtrak shall be allowed to participate in such Contractor or subcontractor inspections or tests at the Contractor's or subcontractor's plants for the purposes of QA.

xiv). The Contractor must maintain office copies of all records, and they must be accessible to Amtrak, not more than five (5) days after such notice is given.

c). Contractor Provisions for Amtrak Inspectors

i). From NTP continuously through production, the Contractor shall provide office facilities for Amtrak representatives at no additional cost to Amtrak.

ii). Office facilities will be required at the car construction plants, including the final assembly site and the carshell fabrication site (if a separate facility), as well as similar facilities at any car or equipment qualification testing sites for the duration of the tests.

iii). These office facilities shall enable convenient inspection of materials, work and equipment under this contract.

iv). The office facilities shall be secure, heated, cooled, and adequately lighted private office for a minimum of five people, with access to toilets and a private conference area, and shall be furnished with desks, chairs and lockable locker facilities.

v). Desks and file cabinets shall be lockable, and all keys submitted to Amtrak.

vi). A minimum of five dedicated telephones with an outside line, high speed Internet connection, access to a photocopy machine capable of high-quality copies shall be provided within Amtrak's office.

vii). Reserved parking places shall also be provided for all Amtrak representatives assigned to the Contractor's facility.

viii). Amtrak requires that the Amtrak designated office facility be prepared for up to 15 Amtrak individuals working at the facility at one time.

ix). All resident inspectors, test engineers and the dedicated Amtrak program team require Contract or badges for access to the plant as well as our office facility.

x). Electronic copies of all drawings, manufacturing procedures, test procedures, test reports, test equipment calibration certificates, welder certifications, diagrams, schedules, changes, deviations, revisions and data shall be made available to Amtrak at the same time these are made available to the Contractor's QA department.

(1) Data shall be sufficient to verify design, construction, assembly, installation, workmanship, clearance, tolerance and functioning of the cars.

d). Scheduling of Inspections and Tests

i). Inspection and testing activities by Amtrak staff will normally be conducted during normal daytime shifts and will not be conducted on Saturdays, Sundays or any holidays observed by Amtrak.

(1) Amtrak staff may be made available in extenuating circumstances outside normal hours, provided a fully substantiated request is made at least forty-eight (48 hours) in advance in writing and is approved by Amtrak.

(2) This request will include compensation by the Contractor to Amtrak for this additional expense, as defined in the General Provisions.

ii). The Contractor shall provide Amtrak a one-week inspection/test look ahead **[CDRL 5-14]** to plan and make resources available.

iii). In preparation for an upcoming inspection or test, the Contractor shall provide Amtrak with the proposed activity schedule, location and associated processes, procedures and documentation. This information shall be provided to Amtrak per the following schedule:

(1) For inspections and testing activities in the Contractor's facilities, the Contractor shall present a written schedule of activities to Amtrak's inspectors at least 24 hours before the activities are to take place.

(2) In case an inspection or test proposed for performance outside that standard work schedule of Amtrak's resident inspector, the Contractor shall notify Amtrak at least 72 hours before the scheduled test or inspection.

(3) For inspections and testing activities at subcontractor's facilities in the US, after written notice is submitted to Amtrak ten (10) business days prior to the activities, Amtrak will advise within five (5) calendar days whether a representative will attend the inspection or test.

(4) For inspections and testing activities at subcontractor's facilities outside of the US, after written notice is submitted to Amtrak forty-five (45) business days prior to the activities, Amtrak will advise within five (5) calendar days whether a representative will attend the inspection or test.

e). Receiving Inspection

i). The Contractor shall provide for the inspection of all incoming systems, subsystems, components, parts, equipment and materials to ensure their conformance with procurement documents and condition.

ii). All material certifications and test reports used as the basis for acceptance shall be reviewed for compliance with specifications, retained by the Contractor and kept readily available for inspection by Amtrak personnel.

f). Manufacturing/Assembly Inspection Hold Points

i). The Contractor shall establish inspection hold points in the manufacturing process to provide for critical inspections by the Contractor's quality staff and Amtrak's representative of completed operations/installations or to inspect items that are about to be covered by succeeding assembly operations.

ii). As part of the PQP, the Contractor shall submit a list of hold point inspections per car type **[CDRL 5-15]** for review and approval, which shall include as a minimum the following:

(1) Each carshell section before painting

(2) Each carshell section after painting

(3) Each truck frame

(4) Each assembled truck, prior to installation under a car

(5) Each car underfloor area prior to receiving trucks

(6) Each carshell water tightness test prior to installation of insulation and interior finishings

(7) Each car final water tightness test

(8) Each car interior wiring and components before being covered by panels

(9) Each car underfloor area and connections prior to concealment

(10) Each finished car interior

(11) Each finished car exterior

(12) Each finished car underfloor

iii). The Hold Point Inspection Plan shall include a pre-inspection performed internally by the Contractor prior to the inspection witnessed by Amtrak.

iv). Prior to submitting an invitation to Amtrak inspectors/engineers, the Contractor shall complete its own internal inspection and work off all identified findings.

(1) Amtrak may request the results of the pre-inspection prior to performing the requested inspection.

v). The Contractor shall provide Amtrak at least 24 hours advance notice of each such inspection or 72-hours for off-site inspectors/engineers.

vi). If during manufacturing or testing, a component is replaced after it has gone through a hold point inspection, a subsequent hold point inspection shall be scheduled after the replacement.

vii). Amtrak reserves the right to add hold point inspections based on inspection findings or changes to the design or production process even after the initial plan had been accepted.

viii). The Contractor and Amtrak representatives shall use inspection forms to record any discrepancies noted during inspection. The contractor shall write the findings and provide a physical and electronic copy to Amtrak.

(1) Nonconforming products shall not be released from a hold point area until all discrepancies have been corrected.

(2) The inspection forms shall be posted at or near the point of inspection for each car and included in the vehicle history book when all discrepancies have been eliminated.

(3) The procedure for addressing the findings will be detailed in the PQP and must be approved by Amtrak.

g). Production Completion Inspection

i). After all work, including factory static and dynamic testing as per Chapter 20 of the technical specification is completed, the Contractor shall perform the Production Completion Inspection, including final function testing of each system, according to an Amtrak approved procedure.

ii). All manufacturing or testing non-conformance reports shall be closed out and no configuration upgrades or applicable FMIs will be pending before pre-shipment inspection begins.

iii). The vehicle history book as specified in Chapter 23 shall be complete and ready for review and approval signature by Amtrak.

iv). The Contractor shall provide a qualified supervisor to accompany Amtrak during inspection to assure that proper corrective action is taken and to record the findings.

v). The Contractor shall provide Amtrak with labor and appropriate tools to remove or open and reapply covers and doors.

vi). During inspection, all systems shall be operational without the use of special equipment or power supplies.

vii). Should the Contractor plan to store the car for any longer than 14 calendar days, the Production Completion Inspection shall validate that the car is properly prepared and protected for such storage.

viii). The Contractor shall provide Amtrak 72 hours advance notice of each such inspection.

ix). The Production Completion Inspection shall be documented using an Amtrak approved inspection form.

x). The Production Completion Inspection Form shall be signed off by both the Contractor and Amtrak.

xi). Any damage to the cars and/or any parts or components thereof which become damaged from any cause whatsoever, subsequent to the performance of the Production Completion Inspection and prior to the Pre-Shipment Inspection, shall be made good at the expense of Contractor with no extension of the Contract Time or increase in the Contract Amount.

xii). Subsequent to the performance of the Production Completion Inspection, no components or material may be removed from the inspected vehicle to facilitate the inspection or testing of another vehicle.

(1) Removal of any components or material shall nullify the Production Completion Inspection.

(2) Amtrak may seek the return of any milestone payments made against such a nullified Production Completion inspection until the respective car has been returned to its completed state and the inspection has been successfully reperformed.

xiii). Minor open items shall be documented on the form and be approved by Amtrak.

xiv). Closure of Production Completion Inspection open items shall be documented and included in the Vehicle History Book for the affected car.

h). Pre-Shipment Inspection

i). Should the planned shipment date be more than 14 calendar days after the completion of the Production Completion Inspection, a Pre-Shipment Inspection including function testing of each system, according to an Amtrak approved procedure shall be performed.

ii). The Pre-Shipment Inspection shall validate the completion of all production work, including factory static and dynamic testing as per Chapter 20 of the technical specification.

iii). All manufacturing or testing non-conformance reports shall be closed out and no configuration upgrades or applicable FMIs will be pending before pre-shipment inspection begins.

iv). The Pre-Shipment Inspection shall validate that the vehicle history book as specified in Chapter 23 is complete and has been approved and signed by Amtrak.

v). The Contractor shall provide a qualified supervisor to accompany Amtrak during inspection to assure that proper corrective action is taken and to record the findings.

vi). The Contractor shall provide Amtrak with labor and appropriate tools to remove or open and reapply covers and doors.

vii). During inspection, all systems shall be operational without the use of special equipment or power supplies.

viii). The Contractor shall provide Amtrak 72 hours advance notice of each such inspection.

ix). Pre-Shipment inspections shall be documented using an Amtrak approved inspection form.

(1) Prior to shipment, the Pre-Shipment Inspection Form shall be signed off by both the Contractor and Amtrak.

(2) Minor open items shall be documented on the form and be approved by Amtrak.

(3) Closure of these Pre-Shipment open items shall be documented and included in the Vehicle History Book for the affected car.

x). Any damage to the cars and/or any parts or components thereof which become damaged from any cause whatsoever, during the progress of production or shipping or otherwise before risk of loss has passed to Amtrak, shall be made good at the expense of Contractor or the Subcontractor in whose plant the damage occurs, and with no extension of the Contract Time or increase in the Contract Amount.

i). Shipping Inspection

i). Following pre-shipment inspection, the Contractor shall ensure the car is properly prepared, protected and loaded for shipment in accordance with approved procedures.

ii). For shipments by sea, this shall include all necessary preparations for shipment below decks.

iii). Amtrak representative(s) will then perform a cursory walk-through inspection to confirm that the car has been adequately prepared for shipment before issuing a Release for Shipment document to the Contractor.

(1) The Contractor shall provide Amtrak 72 hours advance notice of each such inspection.

iv). See Chapter 22 for additional shipping requirements.

v). Should a car need to be stored for longer than thirty (30) days, the Contractor shall submit a Long-Term Storage Plan to Amtrak for review and approval.

j). Modification Inspection

i). The Contractor shall provide written procedures for Amtrak review and approval, for the inspection of any modifications or retrofits arising from engineering changes implemented either at the Contractor's facility or on Amtrak property.

ii). Upon completion of the change, the Contractor shall verify satisfactory completion and modify any quality assurance documentation affected by the change, including the Vehicle history book.

iii). The Contractor shall provide Amtrak 72 hours advance notice of each such inspection.

5.10 CDRLs

CDRL	Description	Due
CDRL 5-01	Project Quality Plan (PQP)	NTP + 60 days
CDRL 5-02	Revision Management Procedure	30 days prior to PDR
CDRL 5-03	Internal Audit Schedule	NTP + 30 days
CDRL 5-04	Monthly Quality Report (MQR)	NTP + 60 days, then monthly
CDRL 5-05	Documentation of Initiatives to Promote Sustainability	NTP + 30 days
CDRL 5-06	Waste Reduction Program Quarterly Reports	NTP + 90 days
CDRL 5-07	FAI Plan	NTP + 90 days
CDRL 5-08	FAI – Technical data for maintenance manuals and parts catalogs	Prior to full acceptance of FAI
CDRL 5-09	FAI Documentation	30 business days before FAI
CDRL 5-10	FAI Binder	After conclusion of FAI
CDRL 5-11	FAI Report	Within 10 business days of FAI
CDRL 5-12	Complete set of FAI photographs	With 1st shipment of cars delivered
CDRL 5-13	Inspection and Test Log for each car	Before release for shipment
CDRL 5-14	Inspection and Test 1-Week Look Ahead	14 days prior to initiation of any manufacturing activities then, every weekly
CDRL 5-15	PQP – List of Hold Point Inspections for each car type	NTP + 60 days

* End of Chapter 5*

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

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6. Carbody

Revision 2

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6.1 Overview

a). This chapter defines the structural performance characteristics of the individual carbody shells. It also lists analysis and other submittal requirements.

b). The structure of the cars shall be independent from each other and capable of meeting all structural requirements on a stand-alone basis.

c). The car structures shall comply with the latest applicable APTA recommended practices and FRA passenger equipment requirements and shall minimize weight to the greatest extent possible.

d). All required standards shall utilize the most recent revisions available at the date of NTP.

e). If contradictions arise between this Technical Specification, APTA recommended practices, and/or FRA requirements, the more stringent shall be used unless otherwise approved by Amtrak.

f). All materials and workmanship shall comply with the requirements of Chapter 19.

6.2 General Requirements

a). The design of each carbody shall be compliant with the Tier I requirements of the FRA contained in the 49 CFR Part 238. Specifically, the carbody shall comply with 238.203 through 238.219 without utilizing alternative compliance.

b). Each carbody's design shall conform to the applicable sections of the most recent edition of the APTA-PR-CS-S-034 standard, "Design and Construction of Passenger Railroad Rolling Stock," as of the time of the Notice to Proceed (NTP).

c). In the selection of the type and thickness of steel and stainless-steel materials to be used, the Contractor shall be guided by the desire to obtain the maximum strength and reliability with the minimum weight and minimum number of different material grades which is obtainable at reasonable cost.

d). The Contractor shall base its structural design on the specific loads, deflections and properties of structural sections called for in this Specification.

e). For structures not specifically covered, the Contractor shall base its design on its experience, subject to successful stress analysis and structural testing.

f). The structure and equipment supplied shall resist these loads, including fatigue loads, with factors of safety consistent with those which have previously been shown to be successful for existing North American Intercity passenger equipment for service at maximum design speed.

6.3 General Design Details

a). General

i). The structure of the individual carbody shell shall be designed and manufactured to provide for the mounting and functioning of all the elements/features defined in this Specification, including:

(1) Passenger seating and related convenience features

(2) Doors, passageways, windows, and emergency exits

(3) Mechanical elements such as trucks, brakes and HVAC

(4) Electrical elements such as lighting, communications, and control trainlines

(5) Accessibility equipment as required by ADA requirements

(6) All ancillary equipment

(7) Diaphragms and/or Gangways

ii). The general arrangement of carbody shells, layout/mounting of the subcomponents, and equipment access setups shall be approved by Amtrak during the mockup and design review process described in Chapter 3.

b). Dimensions, Weights and Under Car Clearance

i). The individual cars shall meet the dimensional and clearance drawing requirements stated in Chapter 1.

ii). Each completed car shall comply with the minimum allowable clearance above top of rail for the carbody and all associated components under the worst combination of conditions, including fully worn wheels, solidly compressed or broken springs, AW3 passenger load, carbody deflection to zero camber and environmental conditions including wind, snow and ice.

c). Physical Requirements

i). The carbody structure shall be designed to prevent water, snow, debris or dust ingress when operating at any permissible speed up to maximum design speed under all weather conditions consistent with the worst case climatic data as specified in Amtrak Specification 963.

ii). The carbody shall be designed to be watertight for a service life of at least 40 years, without maintenance.

iii). Housings for externally mounted equipment shall be completely watertight when covers are in place, excluding battery boxes and the HVAC unit, which shall be designed to prevent water intrusion while allowing adequate ventilation and air flow.

iv). Pneumatic equipment that can tolerate environmental exposure may be mounted in an unsealed container per manufacturer’s recommendations.

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v). Drain holes shall be provided to prevent the accumulation of water.

vi). Exterior surfaces shall not contain pockets that may accumulate or retain water or debris such as leaves.

vii). Exterior structural pockets with flat bottom surfaces shall, at a minimum, include drain holes.

viii). The carbody shall be designed for ease of accident repair, including replacement of any CEM components, CEM structural zones skin panels, and any undercar components or covers.

ix). Frequently damaged parts such as corner posts, edges of side doors, side sill steps, and the ends of undercar shrouds, shall be designed to be simple to remove and replace with readily available or readily fabricated components. Lead time must be minimal for parts that will be frequently damaged and in need of replacement.

x). The Contractor shall review these and other aspects of the carbody design with Amtrak during the design review process.

xi). The Contractor shall include accident repair procedures as part of the deliverables, which will cover a range of scenarios identified by Amtrak, including sideswipes, dragged rolled-over equipment, strike damage to the lead end of the end car and sides of all cars, and automotive grade crossing collision damage to the underframe components of all cars.

xii). Some recommended design techniques consist of use of spot welds, and not seam welds, for attachment of the visible exterior side sheathing, and the routing of underfloor car piping and electrical cables as far inward from the end sheeting and as close to the center sill as possible.

d). Carbody Materials

i). Materials used in carbody construction shall be in accordance with APTA Standards PR-CS-S-034, PR-CS-S-004-98, PR-CS-S-015 and the requirements of Chapter 19.

ii). The carbody shall be constructed of American Iron and Steel Institute (AISI) type 301LN or approved equivalent.

iii). Components such as bolsters, end draft sills, end sills/anticlimbers, structural shelves, corner posts and collision post stubs may be fabricated from High-Strength Low-Alloy (HSLA) steel per American Society for Testing and Materials (ASTM) A588, or approved equal.

iv). Selected steel shall have inherent corrosion resistance equal to or greater then A588 when evaluated per ASTM G101, paragraph 6.3.1.1.

v). All welding and fastening shall conform to the requirements of Chapter 19.

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vi). Other alternate materials and fabrication techniques providing equivalent strength, fatigue resistance and performance goals may be proposed by the Contractor for Amtrak approval. Aluminum will not be accepted for use in carbody structures.

vii). The method used by the Contractor to prevent corrosion from the inside surfaces of closed structural sections (i.e. inside of tubular sections) shall be identified at the design review. **[CDRL 6-01]** At a minimum, each such element shall include a drain hole.

viii). There shall be no corrosion that reduces the load carrying ability below the design strength requirements for the design life of the vehicle.

ix). This can be met by material selection, coating or corrosion allowance and shall be submitted for review and approval at the design review.

x). Cross sectional views shall be provided on carshell drawings and must be submitted for approval at the design review.

xi). Drawings must be submitted not only of individual structural members, but all sub-assemblies and assemblies in order to have a clear record of the carshell assembly construction and process.

xii). Carshell drawings shall be submitted for Amtrak review and approval 30 days before starting the fabrication of any components for the carbody structure. **[CDRL 6-02]**

xiii). The drawings shall show the location of all principal framing members, their cross sectional area, material, metal thickness along with detailed type and method of joining and applicable references to Welding Procedure Specifications.

xiv). Bill of materials shall be provided to link the drawing number and location each part in its assembly level drawing.

xv). Thickness of all sheathing materials shall be provided.

xvi). This information shall be of sufficient detail to permit manufacture of any structural parts necessary to repair damage to a car.

e). Carbody Exterior Finish

i). Specifications and samples for all external surfaces meeting the grit requirement of TS19.5.6 shall be submitted for review and approval. Three samples of all exterior finishes shall be submitted to Amtrak for approval. **[CDRL 6-03]**

ii). These approved samples shall then be used throughout the program as references to maintain quality.

iii). All exterior surfaces shall be free of ripples and buckling.

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iv). Dents, gashes or other surface imperfections shall not be permitted. Maximum allowable variation from a straight line or the designed curved line shall be as follows:

(1) All exterior side and roof surfaces not hidden by covers or shrouds shall have a maximum 0.09375 in. variation (peak to valley) in 3 ft measured in any direction or 1/300 of the span between adjacent members or areas questioned as ripples.

(2) Areas within 8 in. of the side doors and vehicle ends may have a gradual slope towards the doors and ends with a maximum deviation of 0.1875 in. from the side sheet contour.

(3) Exterior surfaces hidden by covers and shrouds shall have a maximum 0.3125 in. variation (peak to valley) in 3 ft measured in any direction.

(4) All other sheet metal exposed to view, inside or outside the assembled vehicle, shall have a maximum variation from a straight line on flat surfaces measured in any direction of 0.1875 in. and 0.125 in. over a distance of 36 in. and 12 in.

f). Fabrication

i). The carbody shall be fabricated so that the shells are identical to the maximum extent practical.

ii). The level of tolerance in different dimensions of carshell build shall be identified in the design process.

iii). Undercar and interior components shall be designed to accommodate those tolerances while remaining interchangeable between cars.

iv). Unless otherwise approved by Amtrak, the carbody shall be assembled using fusion welding or resistance welding.

v). Connections consisting of primary structural members shall be designed so that the ultimate strength of the connection exceeds the ultimate strength of the weakest member joined.

vi). Mechanically fastened connections used in the construction of the carbody structure should be avoided, however, rare exceptions can be submitted for Amtrak approval with fatigue analysis and a factor of safety of 2.0 based upon the proof load for limited connections.

vii). Clamping force friction shall be ignored in the design and analysis of mechanically-fastened connections.

viii). Self-tapping screws are prohibited from being used in the construction of the car.

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ix). Fabrication practices shall ensure that the life of the vehicle is not shortened because of fatigue, corrosion, including galvanic corrosion, breakage or wear.

x). Maintenance practices shall be considered so that parts are not easily lost and cannot be installed in the incorrect orientation.

xi). Fasteners shall be captive wherever practical. Captive fasteners shall be replaceable without drilling or cutting.

xii). A sufficient number of jigs, fixtures and templates shall be used to assure interchangeability of components and uniformity of structure throughout the fleet.

xiii). Parts of the bodies, such as underframes, side frames, end frames and roofs shall be built on jigs.

xiv). All weld and bolt patterns shall be identical on all cars.

xv). Visible weld and bolt patterns shall be uniform and symmetrical and shall be submitted for review and approval by Amtrak.

xvi). All equipment hangers shall be interchangeable on all cars without the use of shims or elongated holes.

g). Equipment Access

i). Apparatus and truck equipment requiring frequent inspection or attention, including any element of a CEM system that requires periodic inspection to confirm serviceable condition, shall be readily accessible and replaceable.

ii). The frequency of required service shall govern the degree of accessibility. Apparatus requiring attention more frequently than every 120 days, or in emergencies, shall be accessible from the side of the car or from the inside of the car unless specifically approved by Amtrak.

iii). All undercar shrouds shall be spaced a minimum of 3 ft. from the adjacent truck to permit ease of truck access at outlying maintenance points not having a maintenance pit. Shrouds shall be designed to be identical for ease of replacement in the future. If different sizes are needed, Contractor shall be required to obtain specific approval from Amtrak.

iv). All other underfloor apparatus shall be arranged to provide ready access from the side of the car.

v). Large apparatus shall be capable of ready replacement by forklift truck from the side of the car, or by overhead crane through appropriately sized roof access panels and lifting eyes.

(1) All mounted equipment weighing 50 lbs or more must be designed for removal by a lifting device. Special processes for equipment removal

are not permitted. The removal and replacement process shall be included in the design review.

vi). All protective devices on the car shall be accessible to maintenance personnel from the side of the car.

vii). For purposes of this paragraph, protective devices shall include devices requiring replacement or resetting to move the car or cause auxiliaries to function, such as air brake cut outs, circuit breakers, fuses, latching protective relays, etc.

viii). Locations for all protective devices shall be identified on arrangement and installation design drawings and approved by Amtrak.

ix). Apparatus supports, and housings shall be mounted interchangeably.

6.4 Structural Design Details

a). Level

i). The difference in height Above Top of Rail (ATOR) of the four corners of each finished car shall not exceed (1/2750) of the carbody length, measured at the car ends.

ii). The measurement shall be made on the completely assembled and equipped car mounted on its completed trucks at AW0.

iii). The measurement may be made from any suitable structural member of the underframe and shall be documented in each vehicle history book.

b). Camber

i). Carbody camber shall be defined as its vertical curved shape as viewed in side elevation and shall have a smooth curvature from end-to-end of the carbody.

ii). Each completed car shall have a positive camber not to exceed (1/2000) of the carbody length under AW1 conditions.

iii). It must be designed so that under full AW3 load, and for the life of the car, a negative camber does not occur.

iv). The maximum difference between the cambers of each side sill, measured at the location of maximum deflection, shall not exceed 0.125 in.

v). The Contractor shall evaluate and submit camber values at AW0, AW1 and AW3 load for approval at the design review.

vi). Camber requirements shall be validated during the AW3 vertical load test.

c). End Doors

i). The end of each car shall be equipped with a weathertight lockable sliding pocket powered door with manually operated override unless otherwise approved by Amtrak.

ii). Door must be airtight to prevent the entrance of diesel fumes.

iii). The use of a fixed end cover is strictly prohibited.

d). Strength, Stiffness and Fatigue Requirements

i). The strength of the carbody, and all carbody components, shall meet the Tier I requirements of 49 CFR Parts 229 and 238.

ii). All safety critical structural connections that are in an impact load path shall be designed so that, in case of excessive impact, failure shall be by buckling or crushing of structural elements rather than by shearing of structural elements or by failure of connections between elements.

iii). The cars shall also be designed, at the minimum, for the worst loading case arising out of the possible simultaneous combinations of the following operational loads acting on the car:

(1) Car tare weight (AW0)

(2) Crush passenger load (AW3)

(3) Vertical, lateral and torsional dynamic load due to wheel/rail interaction

(4) Loads due to vehicle pitching caused by braking

(5) Snow or ice loads

(6) Aerodynamic loads

(7) Train passing wind loads: Compressive and lateral loads caused by another train passing in the opposite direction on an adjacent track with relative speeds of 285 mph

(8) Buff/draft loads

(9) Racking or torsional loads

iv). The carbody strength shall be sufficient to permit operation under the above defined loads for the design life of the car (40 years) without structural damage, including fatigue cracks.

v). For the operational cases defined above, the stresses in the carbody shall not exceed the lesser of 50% of the guaranteed minimum material yield or the buckling strength.

vi). The buckling strength of all structural members with a compressive stress equal to, or greater than 35% of its material's yield strength shall be calculated.

(1) Any variations in the material compression moduli with stress shall be addressed in the buckling strength calculations.

(2) These calculations shall also address the inelastic buckling strength of structural members subjected to any combination of compression and shear.

e). Natural Frequency

i). The FEA model shall be used to calculate natural frequency of the carbody under AW0 and AW3 load and supported at the bolsters.

ii). The natural frequency of the carbody under AW3 load, and rigidly supported at the bolsters, shall be no less than 2.5 times the natural frequency of the car's secondary suspension system.

f). Fatigue

i). The carbody shall be designed to permit operation under nominally expected operational loads in the three orthogonal directions and about the torsional axis, for the design life of the car (40 years) without fatigue cracks/issues.

ii). Fatigue critical joints and members shall be identified using an appropriate analytical method such as finite element analysis (or alternate method as approved by Amtrak). The key load cases from a fatigue consideration are:

(1) Vertical loads from car weight and passenger loads (from AW2 loading)

(2) Load input at the carbody/truck interface due to vehicle-track interaction

(3) Load input at the coupler interface due to traction and braking

iii). Compliance with the design life requirements shall be demonstrated through cumulative damage analyses on all potential fatigue critical locations.

iv). The methodology for the cumulative damage analysis shall be approved by Amtrak.

v). Load spectra for the cumulative damage analyses may be obtained from the following:

(1) Actual test data from existing equipment that is substantially similar, running on similar North American track and having similar braking/acceleration profiles.

(a) Details on any dissimilarities shall be provided and suitably accounted for.

(2) Dynamic analysis of vehicle performance under the appropriate modes, the results of which must be verified by test on the first vehicles.

(3) For the vertical direction, the number of cycles in the life of the vehicle calculated from the first free-free vertical bending mode natural frequency of the car. This will give a constant amplitude loading, the dynamic factor for which shall not be less than ±20%.

vi). Alternatively, an endurance limit analysis may be used for materials that have an established endurance limit, such as materials covered by AWS Standard D1.1.

(1) All stress range cycles shall be below the endurance limit or 10 million cycles, which ever is more stringent.

(2) The dynamic load factor shall be determined by the Contractor and shall not be less than ±20 %.

(3) An endurance limit extrapolated from test results shall not be acceptable.

(4) An endurance limit calculated using a survival percentage is not acceptable unless explicitly approved by Amtrak, but in no case shall the percent survival be below 97.5%.

vii). A detailed fatigue analysis clearly identifying the endurance limits, allowable fatigue stresses, fatigue stress ranges and load cycle information shall be submitted for review and approval. **[CDRL 6-04]**

viii). Fatigue design data such as allowable fatigue stress levels, endurance limits, S-N curve data, MGD characteristics, etc. shall be derived from current versions of nationally accepted standards such as the AAR Manual of Recommended Practices, AWS Standards, or the Aluminum Association Aluminum Design Manual, Specifications and Guidelines for Aluminum Structures, American Association of State Highway and Transportation Officials, or other publication that is acceptable to Amtrak.

ix). For joint designs not covered by the above (IE spot and laser weld joints), the Contractor shall conduct the fatigue tests necessary to develop the needed design data.

g). Underframe Structure

i). Coupler carrier

(1) The coupler carrier, and those portions of the carbody to which it is attached, shall be designed to withstand the loads caused by supporting one end of the car on the coupler carrier, with the truck

attached, such as might occur during emergency jacking or lifting with a crane in the event of a derailment.

(2) Under this coupler carrier load, the allowable design stress of the coupler carrier, or any part of the carbody structure to which it is attached, shall be 80% of whichever is lowest of the yield strength, the critical buckling stress or ultimate tensile strength.

(3) The coupler carrier and its pocket on all car types shall be capable of having an APTA Type H knuckle coupler applied.

(4) Alternate designs may be proposed to Amtrak for approval.

ii). Body Bolster or Equivalent Structure

(1) The design shall provide clearance for the truck in all positions and accessibility for truck maintenance and de-trucking.

(2) Positive stops and safety hangers shall be provided between the carbody and the truck to limit the vertical and transverse movement of suspended trucks when the carbody is lifted with trucks attached.

iii). Cross bearers, floor beams and floor pans

(1) No moisture, dirt, dust or debris shall be able to enter into the subfloor for the life of the vehicle.

(2) The floor pan, or equivalent structure, shall be designed to facilitate replacement or repair of damaged portions and yet provide the attachment and seal welds required to meet the structural, car pressurization and fire safety requirements.

(3) Adhesives shall not be utilized to seal the floor pan or equivalent structure.

(4) The cross bearers and floor pans, if used, shall be constructed of stainless materials.

(5) The floor pan shall contain the underfloor thermal and acoustic insulation.

(6) The pans shall be suitably reinforced for structural rigidity and to prevent resonant noise and vibration and “oil canning” under any operating condition.

iv). Subfloor and Floor System

(1) Floors shall be designed and manufactured so that no permanent deformation or soft spots shall occur during the required service life of the vehicle.

(2) Floors shall be watertight and resistant to spills, washing solutions and moisture. Standing water is prohibited from entering and collecting in any cavities inside of the carbody. Material choices shall be reviewed and approved by Amtrak to ensure that any retained moisture does not adversely affect the life of the carbody.

(3) The floor panel system shall be waterproof and resistant to degradation.

(4) Floor system panels shall be fully sealed composite panels, as large as practical to minimize joints in walkways and shall have no joints in the doorways.

(5) Plymetal and aluminum honeycomb floor panels are not permitted.

(6) If the floor system is designed to be primary structure, it shall be represented in all tests and analyses.

(7) The maintenance manual shall specify the strength and attachment requirements for replaceable elements of the floor system, subject to Amtrak review and approval.

(8) The number of unique floor panels shall be minimized throughout the vehicle and between vehicles.

(9) Under a dead load and a maximum passenger loading of AW3, the floor panels shall deflect by no more than 1/250 of the short span between crossmembers, up to a maximum of 0.0625 in., without permanent deformation.

(10) The sub-floor and its attachments to adjacent structural members shall be capable of resisting the shear resulting from the specified compression loading without permanent deformation.

(11) The flooring system shall meet 49 CFR 238.103 Fire Safety requirements, utilizing ASTM E119 testing as detailed in Appendix B of the CFR with a minimum fire-endurance rating of 30 minutes at AW3.

(12) The representative section of each unique floor assembly configuration shall be reviewed and approved by Amtrak but shall be no less than the entire width by 10 feet.

(13) All joints shall lie on supporting structure.

(14) The floor shall not squeak for the life of the vehicle.

(15) Tapping plates for above-floor equipment shall be suitably attached capable of supporting at least 150% of the equipment load. Plate thickness and dimensions shall be reviewed and approved by Amtrak during design review.

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(16) Carpeting or composite floor covering, where specified, shall be installed per manufacturer's recommendation and shall be approved by Amtrak.

h). Collision Posts

i). If CFR 238.211.d will be followed in leu of other collision post standards and regulations, a documented engineering analysis shall be submitted for review and approval by Amtrak within 30 days of NTP verifying the coupling system and supporting structure is capable of preventing disengagement and telescoping. **[CDRL 6-05]**

ii). Analysis and test plan information applicable to the collision post and coupler shall be included.

iii). Car ends utilizing collision posts to meet telescoping regulations shall meet the following requirements:

(1) A continuous cross section shall be fully welded to the bottom and top of the underframe and continue up to at least 18 in. and then taper to a point at 30 in. or continue to the roof.

(2) Longitudinal overload of collision post at 30 in. above the underframe resulting in failure along the post shall not cause deformation in the connections to the under/frame and its supporting structure. Overload capabilities shall be validated through analysis and testing.

i). Roof

i). General

(1) The design loads for equipment and apparatus attached or mounted to the roof, including HVAC units, gutters, air scoops, antennae, lights, equipment supports and supporting roof framing shall meet the carbody strength and fatigue requirements in this Specification.

(2) All parts of the roof structure, sheets, equipment covers, roof walkway, screens and other guards shall have sufficient strength to withstand, without exceeding 80% of the yield strength and critical buckling stress under the following conditions:

(a) Three concentrated loads of 250 lbs spaced 30 in. apart, each applied over a 3 in. by 3 in. area, such as might be applied by maintenance personnel working on the roof.

(b) The placement of the loads shall be such as to produce the worst-case condition for the roof structure without exceeding the yield strength, 80% of ultimate strength and critical buckling meet the rollover strength requirement defined in 49CFR Section 238.215.

(c) loads imposed by a mechanical car washer consisting of a pressure of 60 lbs./ft^2 over a 12 in. wide band extending transversely across the carbody.

ii). Emergency Roof Access

(1) Roof emergency access shall be in accordance with FRA 49 CFR Part 238.123. Perimeter of the cut-zone shall have a retro-reflective sign demarcating the opening, and clearly indicating the purpose, instructions and other emergency signage per APTA Standard PR-PS-S-006-23 and PR-PS-S-002-98.

(2) Cross sections of the fully assembled vehicle shall be provided at the emergency roof access locations to validate the entire cut-zone has uniform cutting thickness and the space below is free from all obstructions and secondary structure.

(3) Configuration of the emergency roof access zone with the roof window layout shall be included. **[CDRL 6-06] [CDRL 6-07] [CDRL 6-08] [CDRL 6-09]**

(4) An emergency egress plan shall also be supplied for each vehicle configuration and shall include a dedicated document with vehicle wide ingress procedure options for emergency responders. **[CDRL 6-10]**

iii). Gutters and deflecting plates

(1) Water deflecting gutters shall be installed on the roofline above all door openings on both sides of the car, to 12 in. inward from the end of the door opening or the end of the car as appropriate.

(2) They shall prevent water from dripping into or in front of the side door opening, any exterior indicator lights or key switches when the car is stopped.

(3) Deflecting plates shall be installed at the ends of the roof of each car to direct water between cars and away from any gangways or diaphragm.

(4) The design arrangement and installation of roof equipment shall not permit accumulation of water.

(5) If used, drains shall be fabricated from stainless steel or aluminum tubing and be designed to be inherently protected from clogging (large diameter size, large radii bends, no fittings, large slope, etc.) as a result of debris, leaves, dust, sand or dirt. Drainage provisions must be submitted for approval at the design review.

(6) Gutters and deflecting plates shall withstand regular passage through a car wash.

(7) Gutters shall be made from the same material as the carbody shell, roof and side sheets.

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(8) Alternative gutter designs that meet the Specification requirements shall require approval of Amtrak.

j). Jacking Pads and Lifting Eyes

i). Jacking pads, with anti-skid plates, shall be provided in approved locations on the side sills to lift the car, with trucks attached, for maintenance and for re-railing.

ii). The car shall be designed to permit jacking or lifting one end of the car for truck removal or re-railing with the other end of the car resting on its truck, without damage to the truck attachments, underframes or any of the underfloor equipment.

iii). The Contractor shall coordinate the jacking pad locations with Amtrak so as to permit the use of existing shop permanent jacking systems to the greatest extent possible. **[CDRL 6-11]** Jacking shall not require any special attachment or removal of components from the carbody.

iv). Lifting eyes shall also be provided in approved end-of-car locations to lift the car.

v). If any lifting fittings or adapters are required for connection to the car, 10 sets shall be provided to Amtrak at the time of delivery of the first car.

vi). It shall be possible to lift up a complete car, or either end of a car, utilizing portable jacking devices or a crane and to subsequently support the car with portable stands with truck(s) remaining on the rails and remove the lifting device.

vii). The truck(s) shall be removable without interference, while the car is supported on jacking pads. All such conditions shall be considered at AW0 without exceeding 80% of yield.

viii). The localized strength around each of the jacking pads and lifting eyes shall be designed for a vertical load of one half the weight of the car at AW0 (including trucks) with a horizontal load of 10% of the vertical load.

ix). The horizontal load shall be applied simultaneously with the vertical load in any direction to produce the worst stress condition.

x). The allowable design stress shall be yield or 80% of ultimate, whichever is lower or the critical buckling stress of any part of the lifting location or the structure to which it is attached.

xi). The empty carbody, with trucks attached (AW0), shall be capable of being lifted on any symmetric lifting eyes or jacking pads without exceeding 80% yield.

xii). The empty carbody, with trucks attached (AW0), shall be capable of being lifted on the outboard most diagonally opposite jack pads or lifting eyes without exceeding 80% of yield.

xiii). Analysis of the carbody structure under torsional loading of all diagonal jacking and diagonal lifting cases, and all symmetric lifting and jacking cases, shall be included in the stress analysis.

6.5 Truck to Carbody Interface

a). The carbody stress analysis must assess the carbody's compliance with the truck-to-carbody connection criteria detailed in Chapter 7.

b). This assessment shall use the reaction loads derived from the truck-to-carbody connection evaluation presented in Chapter 7.

6.6 Doorways, Trapdoors and Passageways

a). All car types shall be fully compliant, at the time of manufacture, with all the latest rules and regulations of the Americans with Disabilities Act, as follows:

i). For wheeled mobility devices entraining and detraining, vestibules shall be designed for the use of an on-board mobility lift that meets all requirements per Part 1192, Subpart F – ADA, Accessibility Guidelines for Intercity Rail Cars and Systems.

ii). A minimum 36-inch wide clear passage shall be provided through the B-End powered side entrance doors, center doors on the diner car, as well as the A-End for High Capacity Option Coach car, collision post doors, and diaphragm passage, and a path from the B-end vestibule to accessible location within the car interior. A 60-inch turning circle in the vestibule shall be provided.

iii). A minimum 36-inch wide clear passage shall be provided through the gangway and body-end door, and a 32” path to accessible locations.

iv). Trap Door and Folding Steps: Each side of the vestibule on each car shall be equipped with a modular electrically powered trap door and folding step assembly for safe boarding and discharging of passengers at both low- and high-level platform stations. The module shall be Form-Fit-Functionally interchangeable with other cars in this procurement, with the additional requirement of meeting the clearance requirements per D-05-1355 Rev E-Clearance Diagram. Exception, the diner car shall only have a powered door for loading/unloading food and beverage products.

(1) The trap door and folding steps shall be compliant with all aspects of ADA requirements.

(2) The trap door and folding steps must be designed in a robust manner to operate even with up to 1” of ice coating the outside, or with built in heaters that will prevent the build-up of ice in environmental conditions as described in Amtrak Specification 963.

b). Refer to Chapter 12 for additional details.

6.7 Diaphragm

a). A modular diaphragm, compliant with Amtrak drawing D-00-2031, shall be provided to enclose the walkway on the identified procured cars. The diaphragm shall be compliant with Amtrak specification # 332. It shall provide a safe, enclosed passage for passengers/ crew passing between cars. The diaphragm shall provide a tight seal, with the diaphragm from the adjacent car, under all conditions encountered during normal train operation. The car-to-car path shall meet ADA requirements. A minimum clear opening of a minimum of 32 inches through the diaphragm shall be provided when the car is at rest on level tangent track. Joint between diaphragm and carbody shall be waterproof, so that no water enters the carbody.

i). The faceplate shall be approximately 2 inches beyond the coupler pulling face to provide compressive pre-load when the cars are coupled. The foot plate shall be nominal 53±0.5 inches above Top of Rail.

ii). The design shall provide a weathertight seal when coupled with legacy equipment. Furthermore, access to legacy equipment to and from the new single level vehicles shall be accessible between cars without any tripping hazards, pinch points, etc. while traversing all track geometries on the long-distance service.

b). Diaphragm Curtain

i). Retractable curtains with restraining devices shall be provided on either side in the diaphragm passage. The curtains shall be directly interchangeable, without adapters, with existing curtains, and shall include "automatic retraction or break away" feature. The diaphragm hook to retain and secure the diaphragm curtain shall be located at identically the same height above top of rail as Viewliner I & II for inter-car compatibility. This dimension may be taken from a convenient carbody reference.

ii). A safety gate shall be provided to prevent passage through the collision post opening when is open at the end of the train. A mechanism to secure the gate in the extended and retracted position without rattling shall be provided. In either retracted or extended position, the gate shall not interfere with operation of the handbrake, nor infringe on the FRA required clearance.

c). Diaphragm to Gangway Conversion

i). Both ends of the standard coach, standard sleeper, and utility cars; the non-vestibule end of the premium coach and accessible sleeper shall be designed to accommodate both a traditional type 1 diaphragm or an enclosed gangway to the best extent possible. Amtrak’s vision is that this fleet will operate with legacy cars during the initial years of operation which shall require the use of the traditional diaphragm; however, utilizing the same mounting locations, an enclosed gangway will be installed when the legacy fleet is phased out with procured cars now making up the consist. If the option for the utility car is not exercised one baggage car will be used in all consists.

ii). Amtrak requires flexibility to change the car types listed to gangway or diaphragm configurations to meet operational requirements.

iii). The contractor is responsible for making sure that either configuration will meet all clearance and curve testing with procured and legacy equipment to ensure compatibility without interference.

6.8 Gangway

a). At car ends, a weathertight bellows shall be provided completely enclosing the doorway between cars, including the space below the doorway.

b). It shall provide a safe, stable, weather resistant passageway between two coupled cars which meets or exceeds all ADA requirements for wheelchair passage and target a 40” wide opening as much as practical.

c). The gangway shall be designed to quick-disconnect and shall be separated by one person within 2 minutes without the use of any tools to facilitate car removal and/or adding cars.

d). The design shall also permit trainset wheeled catering carts, as well as wheeled passenger baggage, to easily pass through the cars.

e). The maximum variation in walking surface height when passing between cars, from vestibule to vestibule, shall comply with ADA requirements.

i). Changes in level up to ¼ inch (6.4 mm) shall be permitted.

ii). Changes between ¼ inch (6.4 mm) and ½ inch (13 mm) shall be beveled with a slope not steeper than 1:2.

iii). Changes greater than ½ inch (13 mm) shall not be permitted under any operating condition.

f). Tripping hazards and pinch points shall be eliminated by design.

g). Passenger vertical handrails shall be provided on both sides of the passageway.

h). The passageway shall exclude water ingress within the clearway of gangway system, shall exclude drafts under all normal operating conditions, and shall have a minimum design life of 16 years.

i). Any wear surfaces shall have a design life of no less than 8 years.

j). The design shall have no metal-to-metal contact between moving parts, in order to prevent noise, minimize wear between all parts, and require no lubrication.

k). The walkway plates, buffer and side stems shall be designed to permit coupled cars to negotiate minimum radius curves and crossovers, without any binding of the mechanism.

l). The passageway arrangement and installation shall be identical at all car ends, to

easily allow changes in trainset consist configuration, and is subject to approval by Amtrak during design review.

m). The inter-car bellows shall be mounted so as to easily allow its disconnection from the end of the car(s) to allow access to lifting eyes in Section 6.4.j). for lifting derailed cars in an emergency.

n). The end of each car shall be equipped with a weathertight lockable sliding pocket powered door with a manually operated override. Doors must be airtight to prevent entrance of diesel fumes.

o). All exposed metal components shall be stainless steel including all mounting hardware.

p). The gangway shall be capable of self-supporting when disconnected from either end so that when coupling, a jack is not required to recouple.

q). To the largest extent practicable, car to car trainlines shall be protected within the gangway to protect against the elements and debris strikes.

r). The gangway must remain securely attached to the car at either end of the train, whether the consist is set out or the cars are stored in the yard. It should be designed to prevent snow accumulation, water pooling, and withstand turbulent air. Additionally, the gangway should be designed to stay clean and functional, minimizing the need for extra maintenance when cars are added. Complete removal of the gangway for revenue service is not acceptable.

s). The gangway shall be removable for heavy maintenance and replacement.

t). Mounting locations and hardware shall be standard across all car types.

6.9 On Board Mobility Lifts

a). Overview

i). Contractor shall provide an on-board mobility lift for use by passengers at all side loading doors. At a minimum, a provision shall be installed so that an On-Board Mobility Lift can be added in the future.

ii). This section describes the design and functionality of the lift necessary to support this operation.

(1) Lift utilized to facilitate boarding of accessible passengers between platform heights and cars.

iii). Refer to Chapter 11 and 16 for the passenger interface details of these features.

iv). Structural connections for lifts shall be evaluated in parallel with the carbody stress analysis and at a minimum include conclusions within the carbody stress analysis report.

v). On Board Mobility Lift must be designed free of any recessed pocket to prevent any pinch point injuries. Contractor is responsible for working with Amtrak's safety and operations departments to ensure lifts will operate as intended when in service.

b). As an option, the On-Board Mobility Lift shall be provided in the Utility Car. If the option to install lifts is not exercised on the Utility car, the car shall have the structural provisions installed to facilitate mounting, should Amtrak decide to pursue this option. These provisions shall be integrated into the car design without compromising structural integrity or functionality.

c). General Requirements

i). All Lifts and associated equipment shall be suitable for sustained operation under all ambient conditions through which these cars are expected to operate (see Chapter 3).

ii). Controls for each Lift shall be adjacent to the Lift they control. The Accessibility Lift controls must enable one (1) train crewmember to effectively oversee all aspects of lift operation and the occupant's movements to and from the lift, without impeding or restricting the occupant's mobility. The crewmember shall be capable of assisting the occupant either within the car or on the platform, without the need to access the occupant through an alternative exterior door.

iii). Lifts shall be included on each premium accessible coach, standard coach, accessible sleeper, diner/lounge, café cars, and as an option on the utility car and provisioned in all car types.

iv). Lifts on single-level cars shall be sized for moving passengers from the lowest height low-level platforms to the boarding door.

v). Lifts shall be interlocked with the vehicle braking system so that train movement is inhibited with the lift deployed.

vi). When not in operation the Lifts shall be stowed in such manner to not inhibit passenger movements.

vii). Lifts shall be capable of lifting 800 lbs (363 kg).

d). Structural Requirements

i). All lifts shall be secured to the car structure in a manner such that twist, roll or flexing of the shell shall not affect lift operation.

ii). Lift tracks or guide rails shall not be distorted by carbody or vehicle movement to prevent operation. Clearance between car structure and lift tracks can be developed as needed for design however any bridging between lift platform and car floor shall be automatic.

e). Lift Requirements

i). The lifting device must be engineered with sufficient robustness to prevent twisting, rolling, or flexing during operation. It is essential that the lift provides a secure and stable experience for passengers who rely on its use.

ii). Two Lifts shall be provided on the cars, mounted on opposite sides of the same vestibule space.

iii). Lift operation may be a combination of manual and automatic features. Manual actions to deploy or stow the lift shall be accomplishable by a 5th percentile female; however, shall be designed to be operated by one (1) crew member without any assistance

iv). Lift controls shall be in the vestibule space and shall require an Amtrak standard coach key to enable.

f). Power Requirements

i). Lift shall be powered by car 480VAC bus.

ii). Controls, indicators, and interlocks shall be powered by cars 72VDC bus.

iii). Lift shall meet the requirements of 49 CFR Part 38 Subpart E Paragraph 38.95.

g). Emergency operation

i). In the event of a loss of power, the Lift shall include manual operation provisions to allow passengers to be moved between the car floor and platform. Manual operation shall allow for continuous operation to move multiple passengers as needed.

ii). Manual deployment, lift and lower operations shall be limited to a maximum of 50 lbs. for any individual task.

iii). The lowest station platform height for the purposes of the lift's upper and lower reach shall be assumed be 16" below top of rail. The lift design shall also allow for operation when the car is on a curve with up to 7 in. of lean, due to super-elevation.

(1) When the lift is lowered to the platform, the lift shall sit flush with the platform surface and shall not exhibit any skew, tilt or misalignment.

iv). The lift shall be of modular, compact design to facilitate removal and replacement for servicing/repair.

v). Under power operation, the complete cycle of deploying the platform, lowering the lift to platform height, raising the lift to car floor height and stowing the lift platform shall require no more than 60 seconds.

vi). The lift shall comply with the most recent RVAAC recommendations and any applicable ADA standards.

6.10 Safety Appliances

a). Exterior

i). Railroad safety appliances shall be provided to each car in accordance with 49 CFR Parts 229, 231 and 238, and APTA Standard PR-M-S-016-06.

ii). An ergonomic evaluation shall be performed by the Contractor and approved by the Engineer regarding the size, placement, and positioning of all safety appliances, especially loop step arrangement and necessary handholds. **[CDRL 6-12]**

iii). The Contractor is requested to recommend improvements which facilitate train crew and maintenance personnel boarding and detraining.

iv). Handholds shall be 0.625 inch diameter one piece forged stainless steel and attached with stainless steel bolts or rivets.

v). The Contractor shall arrange for an FRA sample car inspection of the safety appliance applications and shall provide Amtrak with a copy of the FRA “no exceptions taken” letter prior to release of the first equipment of each type. **[CDRL 6-13]**

b). Interior Passenger Grab Handles

i). ADA compliant passenger grab handles shall be provided throughout the cars for safety, and in particular as follows:

(1) Grab handles must be capable of withstanding 400 lbf. without failure.

(2) At each side entrance doorway to allow crew to stand safely in the open doorway; and

(3) At each side entrance doorway to allow use during the entire boarding and alighting process; and

(4) On both sides of the passageway adjacent to the diaphragm or gangway; and

(5) Additional handholds shall be provided in the passenger compartment for standing passengers and in the Food service areas. The quantity and location of handholds will be reviewed during design review. See Chapters 9 and 14 for additional details.

6.11 Equipment, Equipment Boxes, Equipment Rooms and Access Doors

a). General

i). The high-speed nature of service intended for the cars will require a high degree of protection from foreign object damage, and from the effects of winter weather conditions.

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ii). All undercar equipment, other than the trucks, shall be housed in an undercar equipment enclosure fitted with lightweight hinged panels meeting the materials and workmanship requirements of Chapter 19.

iii). Each compartment of the equipment bay shall be completely enclosed by one (1) hinged access door, one (1) drop-down panel, and one (1) bottom panel on each side of the car longitudinal centerline or another proposed lightweight designed by the Contractor for review and approval by Amtrak. Mounting of equipment on any of the doors and panels is prohibited.

iv). The enclosure shall be aerodynamically designed for low drag, and to inhibit the collection of water, debris and snow. The sides of the vehicle below the side sills shall incorporate a continuous aerodynamic contour from front to back that shall include the equipment boxes. The outboard ends of the enclosure facing the trucks, and/or the ends of the car shall be reinforced, spaced at least 3 ft. from the trucks for maintenance access, and protected to the greatest extent possible from foreign objects run over by the car.

v). The enclosures shall quickly allow damaged components to be unbolted and replacement components installed during servicing and allow ease of repair of damaged enclosures at the Amtrak shops. No enclosures shall be directly welded to the carbody.

vi). The enclosure parts shall be standardized as much as possible and shall be assembled with welding and/or mechanical fasteners. Use of adhesives for enclosure assembly is prohibited.

vii). A small, separate set of hinged covers shall be provided on each side of the car for the water tank fill points, and the waste tank drain hose/control valve access points, so as to not require the full side access covers to be opened for their servicing.

viii). Panels shall be designed to be standardized lengths across the entire car, to the best extent possible, and across car types. Any deviation of this requirement will need review and approval by Amtrak.

ix). Panels shall be designed so that undercar components or systems requiring daily or routine maintenance are readily and easily accessible.

x). All equipment boxes, which are required to be watertight, shall be given a water test. Junction boxes are required to be watertight.

xi). The interior of all electrical equipment boxes and terminal boxes shall be primed and shall be given one coat of white insulating coating.

xii). A single coat of insulating varnish, enamel or white (or approved color) epoxy powder coating may also be used. Insulating coatings are not required on fiberglass surfaces.

xiii). Final dimensions, arrangement of all equipment compartment access points and attachments to the carbody shall be subject to approval by Amtrak. **[CDRL 6-14]**

b). Carbody Attachment

i). Brackets and other means of support for the equipment shall be designed and installed to facilitate access for maintenance and servicing and for removal and re-application.

ii). The interfaces of the brackets and major structural components shall be designed to allow Amtrak to alter, remove, or add undercar equipment without modification to the structural members of the carbody.

iii). Fasteners shall be conveniently accessible.

iv). The attachment of all apparatus over 150 pounds to the carbody shall be in accordance with APTA Standard PR-CS-S-034 Section 2.7.

v). Interior fittings shall be in accordance with 49 CFR 238.233 and APTA Standard PR-CS-S-006.

vi). In no case shall the strength of a fastener or the shearing of the fastener through the base material be the limit of the carrying capacity of a member with no bolts in tension.

vii). The analysis of the connection of each fastener shall include considerations for shear, pull out, and tension.

viii). Equipment supported on resilient mounts shall always be designed to have the resilient mount in compression and have safety straps or other devices that will support it in case of a failure of the resilient mounts.

ix). The design of the safety straps shall include the effect of the equipment dropping from its mounts.

x). Under no circumstances shall equipment be supported by bolts in holes that are tapped into the primary structure of the end underframe.

xi). The following shall apply to apparatus over 25 pounds:

(1) Vertically oriented bolts shall not be the primary vertical load-bearing mechanism.

(2) Bolted connections shall be designed with a factor of safety of 1.5 using bolts of not less than 0.375 of an inch diameter when analyzed for in-service loads.

(3) All bolted connections in equipment supports shall be supplied with minimum SAE J429 Grade 5 bolts or equivalent, plated for corrosion resistance in accordance with Chapter 18. Alternatively, metric fasteners of at least property class 8.8 or A4-80 may be used.

c). Floor and Roof Penetrations

i). The Contractor shall ensure that all floor and roof penetrations shall be sealed against fire, pressure differential and entry of vermin and provide for a watertight and dust tight carbody.

ii). Floor penetrations shall be sealed with an appropriate material to prevent flame propagation from underfloor flame sources; and shall be designed to last the life of the car.

iii). Considerations shall be made for compliance to ASTM E119 for representative floor penetrations.

iv). Full interior to exterior floor penetrations shall be made through sealed tubes to prevent moisture from entering pan to floor area.

d). Battery Box

i). See Chapter 15.

e). Electrical Connections

i). Enclosures which, because of internal layout and/or limited external access, require removal from the car for mid-life overhaul shall have electrical connections made by the use of connectors meeting the requirements outlined in this Specification.

ii). The connectors shall lie within the enclosure, and the cables shall enter the enclosure through watertight fittings.

iii). Fully enclosed cable ducts or conduits shall not connect directly to such enclosures but shall incorporate a flexible or rigid, detachable transition piece that will facilitate breaking the connection.

iv). Other enclosures shall have cables and wires entering the box through watertight fittings and shall terminate on devices, bus bars, terminal blocks, etc.

f). Under Car Covers

i). Outboard covers shall rise upward to a minimum of 110 degrees for quick examination of the interior without removing the covers.

ii). Inboard covers shall open to the maximum extent possible, but in no case less than 90 degrees.

iii). All hinged covers shall also be readily removable.

iv). Openings provided upon removal of covers shall be of sufficient size to permit removal and replacement of any component in the box and easy access to equipment in the box for inspection and maintenance.

v). All covers shall have a permanently attached "hold open" feature.

vi). The “hold open” feature shall in no way interfere with or impede the easy removal or replacement of the cover.

vii). These covers shall be provided between the trucks and trucks to end wall as required to complement the overall aerodynamic and aesthetic design and shall not violate any of the clearance requirements of the car.

(1) Trucks to end wall may use removable shields in place of covers this will be determined at design review. Clearance between the end of the covers/shields and trucks shall not inhibit truck maintenance, especially that of brake pads and calipers.

viii). They shall be designed to be lightweight and readily repairable at Amtrak facilities in the event of debris strikes.

ix). Skirt panels shall be operable by a single person, including securing the hold-open feature while holding it up and requiring no more than 25 lbs. of force to open, lift, secure open, or close.

x). Panels shall be designed to be standardized across the entire car, to the extent possible, and across car types.

xi). Panels shall be designed so that undercar components or systems requiring daily or routine maintenance are readily and easily accessible.

xii). All latches that must be manipulated to gain entrance to the enclosures shall be quick-release, spring loaded latches which operate with a toggling-type action.

xiii). Latches must be recessed or have a safety lock which will prevent accidental activation.

xiv). All latches shall be of the highest quality, designed for heavy-duty railroad service and applied in sufficient number to ensure adequate gasket compression needed for long term watertight quality sealing.

xv). A spring-loaded safety catch shall be provided at each enclosure cover.

xvi). The safety catch shall be designed to retain the cover at all operating speeds without the cover latches engaged.

xvii). The safety catch design shall preclude damage from cover misalignment, slamming covers and attempts to open covers with the catch engaged.

xviii). An approved cover nameplate shall identify the location of the safety catch.

xix). All covers more than 3 ft in width shall have two or more handholds arranged about the center of gravity of the cover, and recessed flush into the cover surface. The handholds shall not accumulate debris or moisture.

xx). The covers shall be arranged so that only one person is required to easily open, remove, reapply, close and lock any cover, regardless of size.

xxi). Adequate clearances for all handholds, latches, etc., shall be provided so that a person wearing gloves in a winter environment is not hindered.

xxii). All covers shall fit well and be adequately gasketed where necessary to prevent the entrance of water (including both a driving rain and a high-pressure car wash spray), dust and snow.

xxiii). All gaskets shall remain intact for a period of at least 10 years.

xxiv). Only one common type of gasket shall be used on all covers using a positive mechanical means of attachment.

xxv). Flat foam strips or glue-on attachments shall not be permitted. The design shall allow for ease of gasket replacement, without use of adhesives.

xxvi). All removable doors on underfloor enclosures shall be interchangeable between similar enclosures on different cars without need for adjustments to ensure proper seal operation.

xxvii). All hinged covers should have the hinge placed so that the cover cannot swing down and contact the rail or ground or fall open due to failure of the latch.

xxviii). On each side access door, a rudimentary and intuitive indicator shall be provided in a conspicuous location to help visually identify whether doors are locked or unlocked when viewing the side of the car.

6.12 Windows

a). General

i). Frame and glazing rubber of side passenger windows and side door windows shall be designed to securely retain the glazing material under all operating conditions on specified track configurations. The use of sealant for the installation of the glazing material is prohibited.

ii). Glazing assembly (frame, rubber and glazing material) shall not leak during carbody water tests and shall not rely on sealant.

iii). The glazing material shall show no physical damage or degradation of optical qualities when exposed to the environment encountered in rail passenger service.

iv). All glazing assemblies shall meet all applicable requirements of 49 CFR Parts 223 and 238 for FRA Tier I service. They shall meet any applicable APTA requirements.

v). The Contractor may propose as an alternate design the deletion of the restroom side window for Amtrak approval.

vi). Material selection for glazing rubber and all other materials in all locations must take into account the possible interaction between the materials as well as the environment.

vii). The design of all glazing shall be approved by Amtrak. **[CDRL 6-15]**

viii). Windows shall be designed to not compromise cellular attenuation in any capacity.

b). Glazing Materials

i). Glazing material shall be polycarbonate and shall conform to the requirements specified in Chapter 19.

ii). Only flat glazing shall be used.

iii). The passenger area and restroom side windows shall be double glazed units.

iv). All door, sign and interior partition windows shall be single glazed units.

v). Material shall be integrally tinted with no appreciable variation in color over the entire area of each glazing and between panel of like color designation and thickness.

vi). Color measurements shall be taken with a spectrometer.

vii). Markings are to be in accordance with current ANSI Standard Z26.1 and 49 CFR Part 223.

viii). Location of these markings must be visible for identification after installation.

c). Side Windows

i). General

(1) Side windows shall be double glaze and conform to the requirements specified in Chapter 19.

(2) The edges of the unit shall be sealed.

(3) Retention of glazing material shall allow installation and/or removal of the main rubber extrusion from the carbody frame.

(4) The window opening in the carbody shall be as large as practical and reinforced to keep the opening flat.

(5) A leak proof seal shall be provided.

(6) The use of sealants or adhesives is prohibited to achieve a watertight seal.

(7) The construction of window glazing shall not inhibit cellular audio or data signals from freely flowing into and out of the carbody.

d). Emergency Side Windows

i). A two part "Emergency" handle shall be provided at designated "Emergency" windows for removal of the window from inside of the car.

ii). The design of the glazing rubber shall also allow removal of the glazing from the outside of the car by emergency responders as described below.

iii). All windows on the car except those mounted in a side loading door must function as Emergency windows.

iv). Bonding the emergency pull handle to the window is not allowed.

e). Rescue Access Windows

i). All side windows shall be emergency windows designated as an emergency and rescue access – dual-function window.

ii). Rescue access windows shall provide a means of rescue access by emergency personnel such as, police, fire department, etc.

iii). Identification and removal instructions shall be provided in accordance with 49 CFR Part 223, 49 CFR Part 238.114, APTA Standard PR-PS-S-002-98, and ASTM Standard D 4956-07 for Type I material sheeting.

f). Door Windows

i). All door windows (such as the side door, end car collision post door and sliding interior door). The side door window dimensions shall permit a standing train crew member to clearly see out of the window.

ii). The end car collision post door shall be clear and meet the requirements for FRA Type I glazing.

iii). The side door windows shall be tinted and meet the requirements for FRA Type II glazing.

iv). The sliding interior door window shall be clear and meet the requirements for FRA Type II glazing.

g). Exterior Destination Sign Windows

i). Each exterior destination sign shall have a flat piece of FRA Type II non-tinted window glazing, of sufficient size to prevent masking the display.

ii). The glazing shall be resistant to any defrosting heat which may be applied.

h). Skylight Window (Option)

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i). Skylight windows shall be included in the offering from the Contractor for Amtrak to exercise as an option in the Diner/Lounge car.

ii). Passenger visibility shall be maximized through the use of flat glazing as large as practical considering maintenance practices for weight and support methods for maintenance personnel, this point shall be discussed in design review.

(1) This shall be achieved by incorporating an upper row of windows aligned above the roof rail.

(2) Skylight windows shall be mounted at an angle on the roof of the car.

(3) Alternatively, a window arrangement with a better viewing field can be proposed for Amtrak review and approval.

iii). Skylight windows shall line up with the coach sidewall windows.

iv). The depth that the window extends inward along the roof of the car shall be determined by the Contractor but shall be no less than 26” x 24” so that the skylight window can provide emergency roof access according to 49 CFR 238.123 as a rescue access window according to 49 CFR 238.114.

v). To the extent practical, the gap between the upper and lower window rows should be reduced to the bare minimum and positioned at the highest point.

vi). The viewing field along the length of the vehicle shall be optimized by reducing structural and interior obstructions for the windows, i.e., the thickness/depth of the posts and interior panels should be minimized so the glazing is flush with the structure and interior to the maximum extent practical.

vii). Skylight windows shall be easily replaceable by maintenance staff while providing leak free design. Design shall be focused on providing a controlled drainage path to prevent accumulation of liquids and to not collect in any area which would result in leaks to the interior or corrosion of components.

6.13 Insulation

a). Acoustical Insulation

i). To reduce movement, structurally-borne sound and noise generated by the vibration of the roof, floor and side sheets, panels, air conditioning ducts and other metal surfaces, in particular the doors, damping material shall be applied to the inner side of these surfaces where necessary.

ii). The thickness of the damping material shall be such that the acoustic requirements are fulfilled.

iii). The damping material shall have a vibration decay rate of not less than 35 decibels per second (dB/sec) as measured by the Geiger-Hamme Thick Plate Test Method.

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iv). The damping material shall have a hydrodynamically smooth finish and shall be receptive to painting.

v). It shall be resistant to dilute acids, alkalis, greases, gasoline, aliphatic oils and vermin.

vi). It shall be unaffected by sunlight or ozone and shall not become brittle with age.

vii). The material shall not contain any asbestos and shall meet the flammability and smoke emission requirements of Chapter 19.

viii). Its application shall be according to the supplier's recommendations and shall include an application of a recommended primer.

ix). The sound dampener shall be compatible with the material used at the affected locations in the car structure.

x). The inner surface of the carbody structural shell, except for the end underframe welds, shall be coated, and the inside surfaces of structural members sprayed to the extent necessary.

xi). Structural members under the floor of the carbody shall not be coated.

xii). The outside or inside surfaces of the main air duct, and all ventilation cross ducts shall be treated with acoustic insulation to reduce noise.

xiii). Duct splitters (if used), the underside of the main air duct, top/bottom of floor beams and inside door pockets shall not be coated.

b). Thermal Insulation

i). The heat transfer through the carbody, using only the carbody's own floor heaters, shall not exceed 14 Btu/Hr/°F per foot of car length (derived from 1200 Btu/Hr/°F for an 85 ft car) under the environmental conditions specified in Amtrak Specification 963 while the carbody is stationary. Other values may be proposed to Amtrak for consideration.

ii). Glass wool or fiberglass insulation shall be used.

iii). The use of urethane foam insulation is prohibited.

iv). All insulation used shall not mold, rot, have any odor, corrode any metals, nor shake down in long service under vibrating conditions.

v). The heat transfer capabilities shall not diminish over the life of the vehicle.

vi). The Contractor shall supply a thermal analysis of completed car for approval at the design review.

vii). A vapor barrier shall be provided between all interior linings and the carbody insulation.

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viii). There shall be no all-metal path between interior of the carbody and outside of the carbody skin.

ix). The insulation shall be mechanically fastened to the carbody.

6.14 Exterior Finish

a). General

i). The exterior finish of the vehicle shall maintain its appearance with regular maintenance.

ii). Soon after fabrication, all non-weathering carbon steel portions of the carbody shall be prepared for painting and immediately thereafter painted with the first coat of primer by trained technicians utilizing the paint supplier's written procedures.

iii). Stainless steel shall not be painted, but shall be sufficiently passivated after assembly, and no signs of rusting at welds or along any portion of the exterior shall be allowed.

iv). The surface preparation and graphics applications shall ensure that the car can operate at least eight years between major exterior finish repairs or replacement.

v). All exterior surface treatment plans and specifications shall be submitted to Amtrak for review and approval. **[CDRL 6-16]**

vi). All paint shall include, at a minimum, a primer coat, color coat and clear coat, applied in accordance with manufacturer specifications.

b). Painting – Exterior

i). Care in painting application shall ensure freedom from runs, sags, orange peel and other unsightly paint deficiencies, by trained technicians utilizing the paint supplier's written procedures.

ii). Exterior designs shall be approved by Amtrak during Design Reviews.

iii). Paint system is subject to approval by Amtrak for its corrosion protection and aesthetic durability.

iv). The paint system must allow for at least twelve years of durability.

v). Replacement of decals shall withstand a minimum of eight years and not damage the paint surface during removal.

vi). Paint system shall meet Amtrak Specification 742-1.

6.15 Graphics and Labels

a). Exterior Graphics

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i). All exterior graphics, lettering and signage, including vehicle numbers and reporting marks, shall be applied to the vehicle in accordance with Amtrak specifications as identified by Amtrak during design review.

ii). The Contractor may request minor modifications to the size, location and placement of decals, striping and paint application in order to accommodate carshell features, equipment, maintenance points or other obstructions that will affect the quality, appearance or longevity of the decals or graphics.

iii). All exterior decals shall be retro-reflective unless specified otherwise.

iv). All decals, graphics and signage shall be specified and designed to function in the operational, environmental and climatic conditions specified in Amtrak specification 963 with no fading, material degradation, delamination, discoloration, shrinkage or expansion, wrinkling or peeling.

v). It is the expectation of Amtrak that the exterior livery would be jointly developed by the Contractor and Amtrak.

vi). It would be expected to be a final design of vinyl material that allows for the wrapping of all exposed stainless-steel surfaces of the carbody including the roof, end sheets and any undercar elements including but not limited to shrouds.

vii). Each mock-up shall have a vinyl wrapped exterior livery for further input on the design direction.

viii). All exterior decals shall have edge seal applied unless otherwise agreed to.

b). Labels

i). Exterior equipment shall be labeled in accordance with Amtrak Specification 696. Emergency-related decals and signage shall conform to all applicable APTA standards and FRA requirements.

c). Interchangeable Exterior Signage

i). The Contractor shall provide an interchangeable, easily replaceable exterior sign on all car types to be utilized by Amtrak to modify class designation for future operation of the single level fleet.

(1) The sign shall be designed to be interchangeable across all cars in the fleet mounted to the carbody within close proximity to the side loading doors using standardized fasteners or approved locking mechanisms allowing for tool-less removal and replacement.

(2) The sign shall be constructed of non-flammable, scratch resistant and UV-stable materials suitable for the exterior environment complying with all CFR and ADA requirements.

(3) Contractor shall work with Amtrak to develop this signage during the design review process but it is Amtrak's intention that the Standard

Coach car can be reclassified as a Business Class car utilizing this interchangeable exterior signage.

6.16 Automatic Equipment Identification (AEI) Tags

a). Each car shall be equipped with an Automatic Equipment Identification (AEI) transponder tag on each side, located in conformance with Universal Machine Language Equipment Register (UMLER) dimensional and securement requirements and programmed with the reporting marks of the owner, road number of the vehicle and all other technical data required by UMLER.

b). The Contractor is responsible for ensuring the following:

i). Tags are properly installed and sealed in accordance with UMLER requirements.

ii). Tags are properly programmed with all data required by UMLER; and

iii). The UMLER/EMIS system is updated with the data for each vehicle as required for shipment.

6.17 Stress Analyses

a). Stress Analyses and Test Plan

i). A stress analysis and test plan for the carbody structure shall be submitted for approval no later than 120 days after NTP. **[CDRL 6-17]**

ii). Separate plans shall be prepared for each car type as required.

iii). The Plan shall address the requirements of this specification, any applicable CFR, and the latest APTA Standard PR-CS-S-034-99.

iv). The Stress Analysis and Test Plan shall be discussed during the first design review meeting.

v). Each Plan shall be a working document and updated as the design develops.

vi). When the plan for the analyses and testing is revised, it shall be updated and resubmitted no more frequently than monthly.

vii). Each revision shall include revision level indications.

viii). The stress analyses and tests plan shall be approved prior to submittal of the stress analysis report required by this Specification.

ix). The Plan shall be made a volume of the stress analysis report.

x). The Plan shall follow the general requirements of the report as identified herein.

xi). A master table of all different carbody types and their applicable car types for the entire project shall be provided in each plan.

xii). Carbody types utilizing an analysis or test from a different carbody type for validation shall clearly reference it in the plan.

xiii). Carbodies which utilize different drawing or part numbers because of small differences that utilize the same validation analysis or test shall include thorough design differences comparisons in the design review package.

xiv). The Stress Analyses and Test Plan shall detail the methods and approach that will be used to analyze and test the carbody and truck.

xv). It shall also include the following, with references to standards and publications as appropriate:

(1) A comprehensive table of material properties detailing the engineering properties of each grade and temper used in the carbody.

(a) This table shall include the FEA material property inputs and literature references or testing reports supporting these selections.

(2) Detailed and high-resolution illustrations of each material's respective locations.

(3) A numbered listing of each load condition for analysis and test, including load magnitudes and points of application, with CFR, APTA, and Specification references.

(4) Acceptance criteria for each load condition.

(5) Diagrams displaying loads applied and points of support for each load condition for analysis and for testing.

(6) A description of the software settings, model setup, and meshing quality assurance.

(7) Description and examples of methods for analyzing and evaluating the critical structural connections for static and fatigue (all major joint types shall be included; IE resistant and laser welding). Examples should include partial penetration welds if used (IE resistant and laser welding).

(8) Fatigue joint testing plan for joint designs not covered by AAR, AWS, Aluminum Association Aluminum Design Manual.

(9) Descriptions and examples of methods used in past projects to evaluate and justify stress singularities and stress concentrations in the FEA results.

(10) Table of all interior fittings to be analyzed and vehicle equipment over 150 lbs shall be provided with their respective mass and locations.

(11) Description of structural manufacturing work done outside the Contractors main manufacturing facility.

(12) If applicable, description of design process for dissimilar metal connections to isolate and prevent any galvanic reactions.

b). Finite Element Models

i). The Contractor shall submit electronic copies of the preliminary and final Finite Element (FE) models for review by Amtrak. **[CDRL 6-18] [CDRL 6-19] [CDRL 6-20]**

(1) The formats and which major loading results shall be agreed upon between the Contractor and Amtrak.

ii). As part of the carbody FAI, the carbuilder shall provide reports, models, illustrations, and drawings for the Authority to audit and verify the final FEA model represents the final condition of the carbody structure.

iii). If the FEA model does not represent the final condition of the carbody structure such as welds or holes to accommodate interfacing sub-systems, these differences shall be summarized and justified.

iv). Car types claiming to use the same carbody structure shall be similarly validated.

v). The FEA model shall include the major structural components of the HVAC if not resiliently mounted.

vi). Other major equipment which adds considerable stiffness to the carshell may be required at the Authority's discretion.

c). Carbody Stress Analyses

i). The stress analysis shall show the calculated and allowable stresses and margins of safety for all elements, for all specified load conditions, and shall include calculations of stresses in joints, joint elements, and other important elements.

(1) It shall include FEA results, connection, buckling, natural frequency and fatigue analyses.

ii). Preliminary stress analysis results shall be prepared and submitted for review and approval not later than 60 calendar days after approval of the analysis and test plan. **[CDRL 6-21]**

(1) Preliminary results of all load cases shall be included.

(2) The formats shall be agreed upon between the Contractor and Amtrak. **[CDRL 6-22]**

iii). The stress analysis report shall be prepared and submitted for review and shall be fully approved prior to commencing manufacture of any carbody structural parts. **[CDRL 6-23]**

(1) The Contractor shall submit the required stress analysis report in compliance with the format and content specified herein.

(2) If a cited reference in the report is not readily available to Amtrak, the Contractor shall provide the reference or copies of the pertinent pages.

(3) All references shall be in English.

(a) If an English language reference is not available, an English translation shall be provided, and both the original and the translation shall be included in the report.

(4) The report shall demonstrate that all structural members satisfy the requirements of the FRA, APTA and this Specification for compliance with each design load and condition and represent good design practice in the North American railroad industry.

(5) The report shall be organized and in sufficient detail so that Amtrak can readily follow the theory and its application to the car.

(6) The Contractor shall certify that the analysis and calculations have been reviewed and validated before the report is submitted to Amtrak.

(7) If tests are conducted to provide the necessary data, the entire test report shall be submitted.

(8) This report shall show the test procedure, raw data as well as reduced data, and summary, with detailed discussion of the results.

(9) The report shall include analyses of all critical connections and summarize the connections in a critical weld list.

iv). Critical connections which cannot be adequately analyzed shall be prototyped and tested to demonstrate compliance with the requirements of the design and the Specification.

v). The FEA shall be supplemented as necessary by manual or computer calculations of stresses at joints.

d). Validation of Stress Analyses

i). Validation of the finite element model shall be accomplished by comparing the carbody structural test results for each test required by Chapter 19 with the corresponding stress analysis results.

(1) This information shall be tabulated and submitted with the carbody structural test reports for each test. **[CDRL 6-24]**

ii). In the test procedure for each test to be used for validation, there shall be a pre-selected list of strain gauges to be used for the comparison, which shall not be less than half of the total number of strain gauges used during the test.

(1) This table shall include gauge number, type, element number, general location, stress analysis strain value in the active direction of the gauge, active direction of gauge on carbody, a column for the strain gauge value, and a column for notes.

(2) For rosette strain gauges, the information above must be supplied for each leg as well as the combined result.

iii). The test report shall include tables that compare stresses calculated from the test strain gauge readings with analytical stresses from the FEA and shall include the test stress value, the analytical stress value, the percent difference between the two values, and a space for annotation.

(1) The report shall include a graph plotted using commercially available spreadsheet software comparing the stresses calculated from test strain gauge readings with analytical stresses from FEA.

iv). For gauges applicable to the individual tests, the percent difference between the two values shall be within ±15% for 80% of the compared values of the test results and analytical results for each gauge type, with none beyond ±30%.

(1) This shall not include load cells.

v). It is assumed all gauges of interest will target areas of stress over 35% of the allowable stress.

vi). Additional strain gauges can be used for experimental or reference only purposes but shall not help satisfy the gauge count requirements and shall be clearly identified as such in all documentation.

(1) Such experimental gauges may be applied on or extremely close to weld joints with no penalty to the correlation requirements but are not exempt from the yielding requirements and thus must measure and record data the same as the required gauges.

vii). If the analyses results do not agree with the test results within the above-specified tolerance, the Contractor shall revise the stress analyses, update the FEM, and re-run all FEA.

(1) All manual analyses using data from the FEA shall be recalculated using the corrected values.

(2) This process shall be repeated until agreement of results is within the specified tolerance.

(3) The stress analysis report shall be revised and re-submitted.

(4) All results from re-analysis shall meet specification requirements.

(5) The design shall be corrected if such requirements are not met.

viii). Analytical values which disagree with the test value by more than 15%shall include an individualized and detailed explanation of the reasons for the variance in the carbody test report for individual review and approval by the Authority.

(1) This explanation may include supporting manual calculations.

ix). Approval of the carbody test report shall depend, in part, on the adequacy of the justification for excessive variance between analytical and test stress values.

6.18 CDRLs

CDRL	Description	Due
CDRL 6-01	Method of Corrosion Prevention for Interior Surfaces of Enclosed Structural Sections	30 days prior to PDR
CDRL 6-02	Carshell Drawings	30 prior to initiation of any component fabrication.
CDRL 6-03	Three Samples of all Exterior Finishes	30 days prior to FDR
CDRL 6-04	Detailed Fatigue Analysis	30 days prior to PDR and on-going through each DR
CDRL 6-05	Documented Engineering Analysis (Coupling system and supporting structure verification)	NTP + 30 days
CDRL 6-06	PDR – Cross sections of the emergency roof access locations	30 days prior to PDR
CDRL 6-07	IDR – Cross sections of the emergency roof access locations	30 days prior to IDR
CDRL 6-08	FDR – Cross sections of the emergency roof access locations	30 days prior to FDR
CDRL 6-09	FAI – Cross sections of the emergency roof access locations	30 days prior to FAI
CDRL 6-10	Emergency Egress Plan and Emergency Responder Ingress Procedure	30 days prior to PDR
CDRL 6-11	Jacking Pad Locations	30 days prior to PDR
CDRL 6-12	Safety Appliance Placement Ergonomic Evaluation	30 days prior to PDR
CDRL 6-13	FRA Sample Car Inspection for Safety Appliance Applications	30 days prior to FAI

CDRL 6-14	Equipment Compartment Access Points and Attachments to the Carbody - Final Dimensions and Arrangement	30 days prior to PDR and on-going through each DR
CDRL 6-15	Glazing Design	30 days prior to PDR
CDRL 6-16	Exterior Surface Treatment Plans	30 days prior to PDR
CDRL 6-17	Carbody Structure Stress Analysis and Test Plan	NTP + 120 Days
CDRL 6-18	PDR – Finite Element Model Electronic Copies	30 days prior to PDR
CDRL 6-19	FDR – Finite Element Model Electronic Copies	30 days prior to FDR
CDRL 6-20	FAI – Finite Element Model Electronic Copies	30 days prior to FAI
CDRL 6-21	PDR – Preliminary Stress Analysis Results	60 days after approval of Stress analysis and Test Plan [CDRL 6-15]
CDRL 6-22	Stress Analysis Result Report Format	30 days prior to PDR
CDRL 6-23	Stress Analysis Result Report	30 days prior to FDR
CDRL 6-24	FEA Model Verification – Tabulation of test results to analysis	Prior to carshell FAI

* End of Chapter 6 *

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

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7. Trucks

Revision 2

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7.1 Overview

a). This chapter covers the truck design for Amtrak's Universal Single Level Fleet.

b). The cars shall be equipped with trucks designed for safe and reliable operation at all speeds and cant deficiencies up to their maximum, on all FRA Classes of track up to and including Class 7.

c). Maximum operating speed of 125 mph and 5" cant deficiency.

d). Truck frames may be either cast or fabricated. The trucks shall incorporate braking via disc and tread brakes. At a minimum one (1) manual mechanical handbrake per car shall be provided. The handbrake shall not require power or air to apply or release the mechanism. The trucks must be designed to accommodate the maximum static axle load as specified in Chapter 1.

7.2 General Requirements

a). The truck assembly shall be designed for operations specified in Chapter 1, under the environmental and operating conditions identified in Amtrak Specification 963, including track configurations across the entire Amtrak network.

b). Truck designs must have a proven service history in intercity or commuter rail service with a minimum of 2 million miles and must be demonstrated as being compliant with all Specification requirements through finite element analysis, truck dynamic behavior through computer simulation (validated as defined by Amtrak) and instrumented testing at an approved test track facility.

c). All truck frames and bolsters (if used) shall be directly interchangeable between all locations of a given car type.

d). All materials and workmanship shall meet the requirements of Chapter 19.

e). The truck shall be equipped with the brake equipment specified in Chapter 9.

i). The disc brake arrangement shall be sufficient for the thermal load produced by the specified braking performance.

ii). Brake equipment shall provide braking rates as identified in Chapter 9.

f). The Contractor shall provide instructions in the appropriate Maintenance Manuals for allowable field repair welding procedures for the truck.

g). Provisions shall be made for use of a wheel truing machine for re-profiling wheels while mounted on a car without requiring any degree of truck disassembly.

i). Access to the ends of the axle for wheel truing shall be available without the removal of any additional parts, including roller bearing end caps (with the exception of plugs or axle tachometer generators).

h). Components, such as air valves and linkages, wheel slide sensors, speed sensors and wiring shall be located as best as possible to protect them from debris strikes or have shields added.

i). Wheel slide sensors shall be a fixed depth as to be visible for use of a Go-No Go gauge or alternative as approved by Amtrak.

7.3 Vehicle/Track System Qualification

a). Each car type must meet the requirements of 49 CFR Part 213.57, Part 213.329 (d), and the requirements of 49 CFR Part 213.345 for service operation up to the maximum speed and cant deficiency specified in Chapter 7.1.

b). The truck dynamic characteristics shall be suitable for the train application and must demonstrate appropriate response for all speeds, curves, spirals and turnouts, and for all typical track perturbations found within defined safety limits of FRA track geometry standards and as described in this Specification.

i). The truck design must meet this level of suitable performance without use of a tilt system.

c). Vehicle Dynamic Performance Qualification Plan

i). The Contractor shall submit a vehicle dynamic performance qualification plan for Amtrak review and acceptance. **[CDRL 7-01]**

(1) The purpose of this plan is to outline the documentation, process and steps which will be followed to ensure all vehicle dynamic performance requirements are met and ensure timely FRA approval of the planned operation.

(2) The plan shall outline the approach for each project phase through concept development, design, simulation, testing and model validation.

(3) At a minimum this plan must include:

(a) Overview of proposed qualification process, key milestones and planned documentation.

(b) Outline of planned simulation cases and pass/fail criteria.

(c) Preliminary listing of track geometry inputs and rail profiles.

(d) Listing of planned tests and test locations for all component and pilot car tests.

(e) Outline of FRA submittals required in each project phase for vehicle qualification per 49 CFR Part 213.345. Please reference 49 CFR 238.111 for guidance on documentation specific to the acceptance testing project phase.

(f) Outline of simulation model validation plan (i.e. plan for correlation of simulation predicted results with physical test results to ensure validity of the simulation model).

ii). After the vehicle dynamic performance qualification plan is approved by Amtrak, each of the subsequent documents listed below shall be submitted for review and approval.

iii). Periodic vehicle dynamic simulation review meetings between the Contractor and Amtrak will be required as the project progresses through each phase.

iv). It is Amtrak's intent to work collaboratively with the Contractor to ensure that the vehicle dynamic model properly represents the vehicle design and that track inputs represent the actual operational environment.

v). During these vehicle dynamic simulation meetings, Amtrak must be able to review the fully detailed simulation model, track inputs and results in the native simulation software environment.

d). Vehicle Dynamic Simulation Plan

i). The Contractor shall submit a detailed vehicle dynamic simulation plan for Amtrak review and approval. **[CDRL 7-02]**

(1) Details of all planned simulation cases and pass/fail criteria.

(2) Preliminary listing of key simulation model parameters (mass, suspension type, key dimensions, wheel profile).

(3) Description of vehicle model and planned simulation software.

(4) Definition of speed and track geometry inputs.

(5) Vehicle dynamic simulations must be performed using an industry recognized software (NUCARS, VAMPIRE, SIMPACK, etc.).

e). Vehicle Dynamic Simulation Report

i). A vehicle dynamic simulation report must be submitted during the vehicle design process for Amtrak review and approval **[CDRL 7-03]**. At a minimum this report must include:

(1) Tabulation of results for all simulation cases.

(2) Model parameters fully defining all dimensions, masses, wheelsets, suspension components and friction elements along with an indication of the source of the data (manufacturer specification, Contractor specification, measured data, calculation, etc.).

(3) Wheel profile(s), rail profile(s) and resulting wheel-rail contact plots.

(4) Detailed plots of simulation results as requested by Amtrak.

f). Vehicle Dynamic Model Validation Plan

i). A validated vehicle model is required by 49 CFR 213 Appendix D(2)(a). A vehicle dynamic model validation plan must be submitted to Amtrak for review and approval **[CDRL 7-04]**. At a minimum this plan must include:

(1) List of planned quasi-static vehicle characterization tests (static lean, wheel equalization, modal vibration test, truck rotational stiffness, etc.).

(2) List of vehicle dynamic on-track tests (curving, lateral track perturbation, vertical track perturbation).

(3) List of planned suspension component tests (springs, dampers, bumpers, traction rods, friction elements, etc.).

(4) Proposed methods for comparing simulation and test data, including variables to be compared (force, acceleration, modal frequencies, etc.) and acceptance criteria which demonstrated the model has been validated.

(5) Reference APTA-PR-M-S-031-22 Low-Speed Curving Performance, Chapter 2.7, Validations, for additional guidance.

(6) Dynamic simulation model shall be delivered for running internal dynamic simulations after completion of the qualification process with the model being fully editable.

g). Vehicle Dynamic Model Validation Report

i). A vehicle dynamic model validation report must be submitted to Amtrak for review and approval. **[CDRL 7-05]**

ii). The purpose of this report is to demonstrate that the simulation model has been validated by correlating the simulation predicted results with the physical testing results.

iii). This report must include correlation of suspension component and vehicle level test results with model inputs and results.

iv). If this validation effort requires updates to the model, a revision of the vehicle dynamic simulation report must also be submitted.

7.4 Vehicle Dynamic Performance Requirements

a). Wheel Load Equalization

i). The trucks shall conform to the latest revision of APTA PR-M-S-014-06, Wheel Load Equalization of Passenger Railroad Rolling Stock, for Class G equipment.

ii). Per FRA Safety Advisory 2013-02, the suspension system shall control static wheel-load distribution when the equipment is stationary on level track such that the lightest wheel load deviates by no more than 5% from the nominal wheel load for a given truck.

b). Static Lean

i). Maximum Cant Deficiency – Each car type shall meet the requirements of 49 CFR Part 213.329 (d) for wheel unloading and carbody roll angle.

ii). Maximum Cant Excess – No wheel shall experience more than 50% wheel unloading when the train is stopped on a 7-inch superelevation.

c). Wind Loading

i). A side-wind loading analysis shall be performed per APTA PR-M-RP-009-98 Rev 2, Section 3.9 using the environmental conditions specified by Amtrak Specification 963.

d). Low Speed Curving

i). Simulations shall be performed according to the requirements of APTA-PR-M-S-031-22 Low-Speed Curving Performance Standard.

e). Minimally Compliant Analytical Track (MCAT)

i). Each car type shall demonstrate acceptable performance for MCAT simulations as defined by 49 CFR 213 Appendix D.

ii). For the purposes of 49 CFR 213.345 qualification with the FRA, MCAT simulations shall be run with AW0 car loading and all truck components in the new condition.

iii). A select sub-set of additional MCAT simulations for Amtrak information, to be proposed by the Contractor and approved by Amtrak, shall be run with AW3 car loading and all truck components in the new condition.

f). Representative Service Route

i). Each car type shall demonstrate acceptable performance for simulations on track segments of each track Class which are representative of the planned operation as defined by 49 CFR 213.345(c)(2)(ii).

(1) Measured track geometry for these simulations will be provided by Amtrak.

ii). Simulations on representative track segments shall be run with:

(1) AW0 car loading and

(2) AW3 car loading with all truck components in the new condition.

iii). Additional simulations shall be run to ensure safety with truck components in the worn or failed condition: broken coil spring, inoperative damper, high friction at sliding interfaces, stiffening of elastomeric elements due to low temperature and aging, worn wheels, running in emergency-spring-engaged condition.

g). High Speed Stability

i). Each car type must not exhibit truck hunting or sustained vehicle body lateral oscillation up to a maximum service speed of 125 mph, up to a maximum speed of 130 mph (125+5 mph) during qualification testing and up to a maximum speed of 140 mph (125+15 mph) by vehicle dynamic simulation.

ii). Limits for sustained truck lateral and vehicle body lateral accelerations are defined by 49 CFR 213.333.

iii). Linear Modeling

(1) Stability simulations must be performed by linear Eigenvalue analysis with creep factor range of 0.67-1.00 and equivalent wheel conicity range of 0.025-0.400.

iv). Non-Linear Modeling

(1) Stability simulations must be performed in both new and worn conditions using the full non-linear model running through a lateral track perturbation at sufficient speed to cause hunting.

(2) A “top-down speed sweep” must then be used to determine the critical hunting speed.

(3) Simulations must use friction coefficient of 0.5 along with combinations of new/worn wheel profiles and new/worn truck components (dampers, friction elements, elastomer elements, etc.) as well as a friction coefficient of 0.05 for low adhesion scenarios, i.e. wet rails and pectin formation on TOR.

(4) Amtrak will provide representative worn NRCC6 wheel profiles for simulations.

h). Ride Quality

i). A comfortable ride (as defined in this chapter) shall be provided at all permissible speeds under normal operating conditions for each FRA track class, up to maximum vehicle service speed.

ii). Ride quality for all proposed truck designs shall be demonstrated analytically and through actual track testing per the requirements of Chapter 20.

iii). A comfortable ride is defined as weighted root mean square (rms) acceleration in the vertical, lateral and longitudinal directions of less than 0.032g (0.315 m/s^2) and a crest factor less than 9.

iv). The vibration total value (root sum of squares summation) for each measurement point must not exceed 0.051g (0.50 m/s^2).

v). Both values must be based on data in the frequency range of 0.5 to 80 Hz using a 3-minute sliding window.

vi). Weighted rms acceleration and crest factors shall be calculated according to ISO Standards 2631-1 and 2631-4.

vii). Simulations shall be performed in the AW1 load condition.

viii). Monitoring locations for ride quality shall be chosen at representative floor and seat locations of each car type.

i). Ride Quality Measurement System

i). All trucks on all cars shall be equipped with an rMetrix ride quality measurement system (RQMS), manufactured by dFuzion, Inc.

ii). The system shall include at least one truck-mounted triaxial accelerometer on each truck, one carbody-mounted triaxial accelerometer and one GPS receiver.

iii). All diagnostics shall be reported out to the CDU and be able to be viewed remotely.

iv). The RQMS system must meet the following minimum functional requirements:

v). Continuously record, analyze, and report V/TI data including acceleration, vehicle location, heading and speed.

vi). Storage of all V/TI data for a period one year.

vii). Calculate all V/TI exceptions based on the FRA safety requirements per 49 CFR Part 213.333.

viii). Capability to perform fleet wide reporting and analytics.

ix). Extraction of raw data for advanced analysis in third-party applications such as LabView, Matlab, or Microsoft Excel.

j). Natural Frequencies and Damping Rates

i). Eigenvalue analysis must be performed to determine the characteristic damped natural frequencies of the vehicle body and trucks (pitch, bounce, yaw, upper center roll and lower center roll).

ii). Truck hunting modes (free wheelset kinematic) and truck oscillation modes (parallel wheelset kinematic) must be determined over the full range of speed and expected equivalent wheel conicity range of 0.025-0.400.

iii). Characteristic frequencies and damping rates as a percentage of critical damping must be provided.

k). P2 Forces

i). A calculation must be made to show that the vertical track dynamic (P_2) forces do not exceed 68,000 lbs. for a 0.5 degree dip angle and all speeds

up to the operating speed limit. The calculation is to consider nominally stiff concrete tie track and to use the British Rail Equation (as defined in British Railways Board Group Standard GM/TT0088 Issue 1).

ii). The specific equation to be used is as follows:

$$P_2 = P_0 + 2\alpha v \sqrt{\frac{m_u}{m_u + m_t}} \left(1 - \frac{\pi c_t}{4\sqrt{k_t(m_u + m_t)}}\right) \sqrt{k_t m_u}$$

Where:

P_0 Static wheel load in pounds

α Dip angle in radians

v Vehicle speed in inches/second

m_u Unsprung mass per wheel in lbf/in/sec2

m_t Track mass per wheel in lbf/in/sec2

c_t Track damping per wheel in lbf/in/sec

k_t Track stiffness per wheel in lbf/in

Track parameter values are as follows:

α 0.0085 Total dip angle in radians based on ½ degree on both sides of the dip

m_t 1.1335 Track mass per wheel in lbf/in/sec2 for nominally stiff concrete tie track

c_t 671 Track damping per wheel in lbf/in/sec for nominal track conditions (from literature)

k_t 392,900 Track stiffness per wheel in lbf/in for nominally stiff concrete tie track (corresponds to track modulus of 5,100 lb/in/in, assuming a track deflection of 0.084 inches under a 33,000 pound wheel load)

iii). Calculation of P_2 forces using Contractor proposed alternative values in the British Rail Equation and resulting change in the value of P_2 forces may be considered by Amtrak upon approval of justification for such changes by Amtrak and that such calculations are also approved by the owner of the track or its designated representative.

7.5 Truck-to-Carbody Connection

a). The truck frames and all components shall be retained to the carbody in accordance with the requirements of 49 CFR Part 238.219 and APTA Standard PR-CS-S-034-99.

b). The ultimate strength of the truck and the truck-to-carbody connection shall be

sufficient to secure the entire truck to the carbody in a manner which will prevent truck separation during derailments, collisions, or other adverse events in which a horizontal load of 250,000 lbs. is applied to the truck frame.

i). This load may be transmitted from the truck frame through structural members, positive stops, or other rigid, mechanical safety devices and/or combinations thereof to the carbody bolster.

ii). Bolster anchors/traction links (if used) shall not be used to provide any part of this strength.

c). Vertical safety hangers shall be provided to secure the truck to the carbody.

d). Depending on truck design, a locking center pin may satisfy this requirement.

7.6 Truck Clearance

a). All truck-mounted equipment shall conform to the clearance requirements of Amtrak Clearance Drawing D-05-1355 Rev E.

b). A clearance of at least 2.50 inches shall be provided between truck parts (including wiring, hoses, cables, and chains) and the carbody under AW1 load and the most unfavorable dynamic combination of vertical and horizontal track curvature, wheel wear, lateral and vertical motion, roll, and broken coil springs.

7.7 Truck Structural Design

a). Structural Validation Plan

i). The Contractor shall submit a structural validation plan as outlined by APTA PR-M-RP-009-98 Rev 2, Section 3.1.5, for Amtrak review and approval. **[CDRL 7-06]**

ii). The purpose of the validation plan is to describe in detail the list of the steps planned to demonstrate structural safety and compliance with the requirements defined in the technical specification.

iii). The validation plan shall act as a guide for the design and testing process.

iv). After the structural validation plan is accepted by Amtrak, each of the subsequent truck structural analysis and test documents listed below shall be submitted for review and approval.

b). Truck Structural Analysis and Test

i). The Contractor shall submit each document outlined below, detailing each step of the structural validation plan, for Amtrak review and approval.

(1) Truck Stress Analysis Plan **[CDRL 7-07]**

(2) Truck Stress Analysis Report **[CDRL 7-08]**

(3) Truck Stress Test – Laboratory, Plan **[CDRL 7-09]** (see requirements in Chapter 20 – Truck Frame and Bolster Load Tests)

(4) Truck Stress Test – Laboratory, Report **[CDRL 7-10]**

(5) Truck FEA Structural Model Validation Plan **[CDRL 7-11]** (can be combined with CDRL 7-09)

(6) Truck FEA Structural Model Validation Report **[CDRL 7-12]** (can be combined with CDRL 7-10)

(7) Truck Stress Test – On-Track, Plan **[CDRL 7-13]**

(8) Truck Stress Test – On-Track, Report **[CDRL 7-14]**

(9) Fatigue Assessment Validation Report **[CDRL 7-15]**

(10) Manufacturing Validation Report **[CDRL 7-16]**

c). Allowable Stress

i). Fatigue

(1) Contractor and/or the truck designer shall determine the maximum allowable stresses for the truck frame, bolster and truck components in order to perform without degradation over the 40-year useful life.

(2) The allowable stresses shall be determined using industry standard practice and shall be submitted to Amtrak for review and approval as part of the truck stress analysis plan.

ii). Static

(1) Maximum allowable stress shall be 55% of the yield strength of the material.

iii). Overload

(1) Maximum allowable stress shall be the yield strength of the material. No permanent deformation allowed in structural elements.

d). Truck Design Loads

i). The loads specified herein are minimum values.

ii). The Contractor shall be responsible for selecting loads that will develop a high level of confidence in the adequacy of the truck design for the intended purpose and application.

iii). The highest vertical load of all car types, as seen at the truck, shall be used for the loadings.

iv). Loads marked by double asterisk (**) shall be included in the stress analysis but will not be applied during the laboratory truck stress test.

(1) Fatigue

(a) Vertical – 1.0g +/-0.2g x AW1 loaded carbody weight per truck.

(b) Lateral – +/-0.15g x AW1 loaded carbody weight per truck applied at the carbody center of gravity.

(c) Longitudinal – +/-0.15g x AW1 loaded carbody weight per truck applied at the carbody center of gravity.

(d) Braking – Full-service braking, split between tread and disc mounting locations according to Chapter 9.

(e) Twist – One wheel lifted/lowered length equal to 1% of wheelbase.

**Dampers – +/-100% of maximum dynamic condition.

**Truck-Mounted Equipment Mass Inertia Loads

v). Vertical, lateral, longitudinal and braking loads shall be applied simultaneously with phasing and directions which represent the operating environment.

vi). Damper and truck-mounted equipment loads are for localized analysis of brackets and mounts.

vii). Twist load shall be applied in combination with vertical load only.

(1) Static

(a) Vertical – 110% of AW3 loaded carbody weight per truck.

(b) Lateral – 25% of the vertical load, applied at the carbody center of gravity.

(c) Longitudinal – 15% of the vertical load, applied at the carbody center of gravity.

(d) Vertical, lateral, and longitudinal loads shall be applied simultaneously.

(2) Overload

(a) Vertical – 1.5g x AW3 loaded carbody weight per truck.

(b) Lateral – 0.3g x AW3 loaded carbody weight per truck applied at the carbody center of gravity.

(c) Longitudinal – 1.0g x truck weight.

(d) Braking – Maximum specified deceleration, split between tread and disc mounting locations according to Chapter 9.

(e) Twist – Complete wheel unloading at one wheel with Vertical – 1.0g x AW3 loaded carbody weight per truck.

**Dampers – 2 x damper force at reference speed.

**Truck-Mounted Equipment Mass Inertia Loads.

viii). Vertical, lateral, longitudinal and braking loads shall be applied simultaneously. **Damper and truck-mounted equipment loads are for localized analysis of brackets and mounts. Twist load shall be applied in combination with vertical load as listed.

e). Truck-Mounted Equipment Mass Inertia Loads

i). Truck Frame Mounted Equipment

Direction	Fatigue Acceleration	Overload Acceleration
Vertical	+/- 12 g	+/- 40 g
Lateral	+/- 10 g	+/- 20 g
Longitudinal	+/- 5 g	+/- 10 g

ii). Axle and Axlebox Mounted Equipment

Direction	Fatigue Acceleration	Overload Acceleration
Vertical	+/- 50 g	+/- 140 g
Lateral	+/- 10 g	+/- 20 g
Longitudinal	+/- 10 g	+/- 20 g

7.8 Truck Component Design

a). Detailed drawings of all truck components shall be provided to Amtrak. **[CDRL 7-17]**

b). Truck Frame and Bolster

i). Truck frames and truck bolsters (if used) shall be of cast or fabricated steel construction.

(1) They shall be heat stress-relieved after all primary welding is completed, unless otherwise approved by Amtrak.

(2) Critical areas of all welds and castings shall be magnetic-particle inspected per ASTM Standard E709 on all production units.

(3) Radiographic inspection per ASTM Standards E94, E446 and E186 and ultrasonic inspection per AWS D.1.1 shall be used to qualify fabrication and casting techniques and for periodic inspection of production lots, see Chapter 19.

ii). All truck frame and bolster (if used) openings or voids shall be sealed with plastic plugs or similar arrangements, to prevent the accumulation of wayside debris such as leaves therein.

iii). All wearing parts or surfaces shall be provided with renewable liners or bushings.

(1) Truck frame pedestals, if used, shall be lined with low-friction components to minimize wear.

(2) If possible, the truck design shall permit replacement of pedestal liners without requiring the removal of the wheelset.

iv). Retainers shall be provided to prevent an axle from leaving the truck, and to also prevent any primary suspension element from leaving its proper position, when the car is lifted with the trucks attached, or in the event of a derailment.

(1) It shall be possible to change a wheelset expediently (by removing the axle retainer and lifting the car above the wheelset, after intra-car couplings are disconnected), to facilitate changing wheels in locations without a drop table, including changing wheelsets in the field after a derailment.

v). The truck frame shall include attachment points for lifting by a shop crane.

c). Bolster Anchor

i). Longitudinal forces shall be transmitted between the truck and the carbody through bolster anchors or similar method.

ii). The bolster anchors, if used, shall be designed to accommodate longitudinal, swiveling and vertical forces encountered during operation on all classes and conditions of track identified in Amtrak Specification 963.

iii). See Chapter 6 for other requirements for the bolster anchor and related carbody mounting points.

d). Suspension

i). Coil springs and/or rubber element suspension components may be used for primary suspension.

ii). Elastomeric suspension components shall be designed for a minimum functional service life (95% survival) of ten years. To the greatest extent possible, elastomeric components which may require replacement between truck overhauls, shall be designed for replacement without truck removal

iii). Dampers shall have a minimum functional life (95% survival) of five years.

iv). The Contractor shall provide analyses to demonstrate the effect of asymmetric forces from braking on primary suspension deflection, wheelset angle of attack and body yaw accelerations. **[CDRL 7-18]**

v). The carbody secondary suspension shall be provided by coil springs or an alternative may be proposed for Amtrak's approval.

vi). The secondary suspension shall include internal resilient stops to limit vertical travel and act as an "backup spring" should the main spring element fail.

vii). All metal springs shall be mounted using resilient mounting pads to prevent metal-to-metal contact and provide sound and vibration deadening.

viii). All mounted equipment shall be designed for ease of inspection, tramming, access, replacement and maintenance, including allowances for witness point or reference marks to assist in automated visual inspection machines.

ix). Tram marks shall be located on the top and bottom of the truck frame, allowing tramming without flipping the frame.

x). Elastomeric primary springs shall be secured to the truck frame when axle assemblies are removed.

xi). Elastomeric primary springs shall be color-coded for spring rate and shall be installed in matching sets, with only one color-code per truck.

xii). All coil springs shall meet the latest revision of Amtrak Specification 563 and follow the recommended practices of APTA PR-M-RP-009-98, Section 3.5, Helical Coil Spring Design Guidance.

xiii). The Contractor shall submit coil spring design stress calculations for Amtrak review and approval. **[CDRL 7-19]**

xiv). Coil springs shall be grouped by height under AW0 load after manufacturing, then marked to clearly identify group for each spring (banding, color-coded, etc.).

xv). All springs must be in the same group for a given truck.

xvi). In case of a coil spring failure, the system should ensure that the train speed is not compromised, the ride quality remains smooth, and the gangway passageway for customers remains even and safe.

xvii). Elastomeric components shall be fatigue tested to validate service life.

e). Stops

i). Rubber stops limiting vertical and lateral motion shall be designed with a progressive compression rate and shall not exceed 90% of their design compression under any condition that can be developed in the truck.

ii). Lateral stops shall limit the motion of the carbody to stay within the clearance in either direction.

iii). Stops that limit truck over-rotation shall be designed to prevent metal-to-metal contact.

f). Adjustments

i). Provisions shall be made for adjusting the carbody height to compensate for wheel wear or other variations and shall have provisions for being captive.

ii). Adjustments to carbody height shall not impact ride quality.

iii). Suspension design shall permit adjustments to be made without disconnecting the truck from the carbody.

7.9 Wheel and Axle Assembly

a). General

i). Amtrak intends to use existing wheelset designs which are already in service on Amtrak cars.

ii). A conventional wheel and axle assembly shall consist of an axle, two wheels, two journal bearings, two brake discs, speed sensor gear at one bearing per axle, bearing temperature sensors which communicate with car diagnostics, and associated materials.

iii). Mounting graphs and inspection records shall be included in each vehicle history book for all components.

iv). If existing Amtrak wheelsets are deemed incompatible with the new car designs, alternate wheelsets may be proposed by the Contractor and approved by Amtrak.

v). Wheel and axle assemblies shall utilize materials made to the same specifications as above and insofar as deemed practical by the Contractor, components in common with the conventional wheel and axle assembly shall be used. All wheel and axle assemblies shall be sourced domestically.

vi). All wheelset components shall be manufactured and assembled by a supplier currently certified under the AAR Standard M-1003.

vii). It shall be possible to change a wheelset out by removing the axle retainer with hand tools and lifting the car above the wheelset.

b). Axles

i). The axle shall be designed according to APTA PR-M-RP-008-98, Rev.2, Passenger Rolling Stock Axle Design.

ii). The axle shall be solid, forged, Grade “F”, carbon steel meeting the chemical composition and mechanical property requirements of AAR Standard M-101, arranged for outboard journal bearings.

iii). Axle design and application shall be confirmed with theoretical stress calculations. **[CDRL 7-20]**

iv). Axles shall be designed to meet or exceed performance and applicable safety standards.

v). Material and heat treatment certification shall be provided with vehicle history final reports.

vi). Each axle shall be inspected by both the wet fluorescent magnetic particle and ultrasonic methods.

vii). A record of all certification and heat numbers shall be supplied to Amtrak.

viii). If possible, the axle shall have an oversize wheel seat to provide longer service life.

c). Wheels

i). The wheels shall be 36 in. diameter (nominal) Class B, wrought steel multiple-wear type, of a low stress (S-plate) design, conforming to AAR Standard M-107 and M-208, APTA Standard PR-M-S-012-99 Rev.2, and Amtrak Specification 771, latest issue.

ii). The wheels shall be inspected by both the wet fluorescent magnetic particle and ultrasonic methods.

iii). Wheel tread profile shall be in accordance with Amtrak wheel profile NRCC6 per drawing 62-00106, Revision D or later, unless otherwise approved by Amtrak.

iv). A record of all certification and heat numbers shall be supplied to Amtrak.

v). Analytical evaluation of the wheel design for combined mechanical and thermal overload conditions shall be performed according to AAR S-660, with thermal input load adjusted to represent the selected tread/disc braking configuration and Amtrak service.

(1) Analytical evaluation of the wheel design for fatigue loading shall be performed according to AAR S-669.

(2) The results of these analyses shall be submitted to Amtrak for review and approval. **[CDRL 7-21]**

d). Brake Discs

i). For brake disc requirements, see Chapter 9.

e). Axle Journal Bearings

i). The journal roller bearings on conventional axles must outboard located, fully enclosed, rotating end cap, grease lubricated, AAR roller bearings manufactured in compliance with AAR Manual of Standards and Recommended Practices, Section H. If an existing Amtrak wheels set design is not selected, the bearings of the new design must be AAR class “K”.

ii). Roller bearings shall be configured for No Field Lubrication (NFL), with Hydrodynamic Labyrinth (HDL) seals (or equivalent).

iii). The L10 design life of the journal bearing shall be at least 1 million miles under AW3 loading.

iv). The Contractor shall provide design analysis to verify the roller bearing estimated L10 life. **[CDRL 7-22]**

v). The journal bearing end cap shall incorporate a hole allowing access to the axle's centers to allow truing of wheel sets. If the wheel set design has end caps exposed to the weather, the end cap shall be equipped with a plastic plug designed to keep water from penetrating the center hole when in service.

vi). One journal bearing end cap on each axle must accommodate a speed sensor.

vii). The speed sensor design must continue to function under the worst conditions of manufacturing tolerances and wear thresholds for the journal bearing housing, bearing, sensor, etc.

viii). Journal roller bearings shall be new and meet the requirements of Amtrak Specification 900, *Purchase of New or Reconditioned Roller Bearings.*

ix). Bearing temperature monitoring shall be integrated into the car diagnostics system, allowing for real-time recording and trending. This functionality will enable proactive maintenance by identifying irregularities and predicting potential failures. Standalone system may be proposed as an alternative to be reviewed and evaluated by Amtrak.

f). Axle Bearing Housings

i). Removable axle bearing housings shall be provided.

ii). Pressing shall not be required to remove the housing from the bearing.

iii). Axle bearing housings shall be common for all locations, including a provision for mounting a speed sensor.

iv). Each axle bearing housing shall include a hot bearing sensor, such as Amtrak Drawing D-00-7075 Hot Bearing Detector Probe or approved equivalent.

v). Bearing housing must be designed to allow access to axle centers for truing wheels without removing the wheel set from the car.

g). Wheelsets

i). Each wheelset shall be assembled in compliance with the requirements of:

(1) Amtrak specification 907, APTA-PR-M-S-019-17, *Passenger Wheel Set Assembly*, latest issue, and

(2) AAR Manual of Standards and Recommended Practices, Section G, Parts I and II, *Wheel and Axle Manual*, using an AAR certified facility.

ii). A wheelset inspection record shall be completed for each wheelset, which shall include component press tonnage charts, all component serial numbers and inspection measurements.

iii). Torque seal shall be applied to the head of all fasteners after torquing.

7.10 Shock Absorbers (Dampers) and Shock Mounts

a). Lateral, yaw and vertical motion of the trucks and carbody shall be damped through the use of shock absorbers (hydraulic dampers).

b). Shock absorbers, if used, shall terminate in elastomeric bushed connections to eliminate metal to metal contact.

c). All shock absorbers shall be accessible for replacement without requiring the removal of the trucks from the carbody. Shock absorbers shall be protected from debris strikes from under the vehicle.

d). Shock absorber mounting brackets on the trucks and carbody shall be designed to last the life of the carbody without wearing, deforming, loosening or otherwise requiring repair, excluding bushing replacement.

e). Threaded mounting brackets are prohibited.

f). Durability of the shock absorbers, their mounting brackets and bushings shall be demonstrated analytically and through accelerated life cycle testing simulating actual shock absorber functional service life.

g). Test plan for the shock absorbers and shock mounts shall be submitted to Amtrak for approval as part of the Contractor's proof of design testing (see Chapter 20).

h). The shock absorbers shall be appropriately rated for a service life (95% survival rate) of no less than five years.

7.11 Shock and Vibration

a). All pneumatic, electrical and electronic equipment/components mounted to the truck shall be tested for shock and vibration in accordance with IEC 61373 (1999) – *Railway Application, Rolling Stock Equipment, Shock and Vibration Tests*.

7.12 Electrical Wiring

a). All electrical wiring shall be protected from damage during service.

b). Watertight connections shall be provided for connecting electrical devices. At a minimum these connections shall meet IP68.

c). Speed Sensor

i). A speed sensor cable shall be provided on each truck to transmit a signal from the speed sensor on each axle to the wheel slip control system (see Chapter 9).

ii). The speed sensor cables shall be attached to the truck frame using elastomer-coated steel clamps on dedicated mounting pads that provide secure attachment while not abrading or pinching the cable.

iii). Clamps shall be securely fastened to the truck frame.

iv). Appropriate slack shall be incorporated into the cable length to allow free movement of trucks and truck components while providing adequate securement for the cable. Cables shall be protected against debris strikes.

v). Cables shall be routed to prevent damage from pinching, stretching or catching on adjacent equipment. Cable routing shall be designed to minimize potential debris strikes.

vi). Speed sensor and cables shall be per Amtrak Drawing D-00-1359, *Speed Sensor and Cable Assembly*.

d). Grounding

i). An electrical ground path using highly flexible copper cables or straps and ground brushes/rings shall be provided from the carbody to the rail.

ii). Grounding paths shall be run from the truck frame to the truck bolster (if used) and from the truck bolster to the carbody.

iii). Grounding cables or straps shall not restrict the movement of truck components and shall remain slack under all operating and maintenance conditions. Grounding straps must be visible in normal operating conditions to allow for regular inspection.

iv). At least two grounding brush/ring assemblies per truck shall be installed providing a grounding path between the truck frame and axle to bypass current flowing through the journal bearings.

e). Shunting

i). The trucks and its wheelsets shall be designed such that the maximum rail-to-rail resistance through the train shall be no greater than 0.010 Ohms in any combination of vehicles.

ii). It is preferred that the standard truck and wheelset design be capable of achieving the required shunting performance.

iii). Any such supplemental equipment shall be designed in accordance with Amtrak Specification 1118.

7.13 Painting

a). The truck manufacturer shall apply at least one coat of a metal primer on all

exposed surfaces of the trucks immediately after final assembly cleaning, repairs, and inspection.

b). A final coat of an ASTM B-117 1,000-hour paint shall be applied using an Amtrak-approved color.

7.14 Handbrake Linkage

a). Truck mounted hand brake linkage shall be lever type unless otherwise approved by Amtrak.

b). Chains are preferred; however, cables may be used on the truck itself to interconnect the components.

c). All trucks shall be equipped with necessary attachment points for hand brake linkage and shall accommodate the full range or car height adjustment.

d). Refer to Chapter 9 Brakes for operator details.

7.15 Height Adjustment and Shimming

a). Approved provisions shall be made for adjusting the carbody height up to 2.50 inches to compensate for wheel wear or other variations.

b). The design and method of height adjustment shall allow for quick and easy adjustment without disassembly of the truck or removal of the truck from the car.

c). Height adjustment may be by shimming, component adjustment or component exchange, to be proposed by the Contractor and approved by Amtrak.

d). All coil springs and shims shall be positively captured at both top and bottom surfaces.

e). Visual indication of shimming limits (maximum shim height) shall be provided at each respective shim location.

7.16 Truck Classification Plate

a). Amtrak standard truck classification plate shall be mechanically applied to both sides of each truck. The truck classification plate shall contain the following information:

i). Amtrak name and symbol

ii). Bearing size

iii). Center-plate loading

iv). Wheel size and type

v). Truck serial number (to be permanently stamped into the plates)

vi). Manufacturer

vii). Manufacturer's part number

viii). Date of manufacture

7.17 Maintainability

a). The trucks, and associated components (shocks, etc.), attachment fasteners to the carbody shall be accessible with standard pneumatic or hydraulic tools. All fasteners should be readily available and not of a special design.

b). All major components shall be easily accessible and replaceable during repair or overhaul.

c). The overhaul manual shall include all details of disassembling, tramming, and reassembling the truck frame for routine overhauls.

d). The contractor shall provide a heat map of high-stress zones under various dynamic conditions. The intent is to ensure that any welded area in a high-stress zone is visible during daily inspections in normal operation.

e). Rebuild instructions with parts lists shall be provided for all assemblies and subcomponents.

f). Documentation requirements are described in Chapter 22.

7.18 CDRLs

CDRL	Description	Due
CDRL 7-01	Vehicle dynamic performance qualification plan	NTP + 120 days
CDRL 7-02	Vehicle dynamic simulation plan	PDR
CDRL 7-03	Vehicle dynamic simulation report	IDR
CDRL 7-04	Vehicle Dynamic Model Validation Plan	IDR
CDRL 7-05	Vehicle Dynamic Model Validation Report	Post Type Tests
CDRL 7-06	Structural validation plan	NTP + 120 days
CDRL 7-07	Truck Stress Analysis Plan	PDR
CDRL 7-08	Truck Stress Analysis Report	IDR
CDRL 7-09	Truck Stress Test – Laboratory, Plan	FDR
CDRL 7-10	Truck Stress Test – Laboratory, Report	Post Type Test
CDRL 7-11	Truck FEA Structural Model Validation Plan	IDR
CDRL 7-12	Truck FEA Structural Model Validation Report	Post Type Test
CDRL 7-13	Truck Stress Test – On-Track, Plan	FDR
CDRL 7-14	Truck Stress Test – On-Track, Report	Post Type Test
CDRL 7-15	Fatigue Assessment Validation Report	Post Type Test
CDRL 7-16	Manufacturing Validation Report	IDR
CDRL 7-17	Detailed drawings of all truck components	FDR
CDRL 7-18	Analyses demonstrating the effect of asymmetric forces from braking	IDR
CDRL 7-19	Coil spring design stress calculations	IDR

CDRL 7-20	Axle design and application theoretical stress calculations	IDR
CDRL 7-21	Wheel design analysis for combined mechanical and thermal overload conditions per AAR S-660	IDR
CDRL 7-22	Design analysis verifying roller bearing estimated L10 life	IDR

* End of Chapter 7 *

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8. Couplers and Draft Gear

Revision 2

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8.1 Overview

a). The universal single level cars shall be equipped with an APTA standard Type H Tightlock coupler and associated draft gear.

i). Energy absorbing couplers and draft gears shall be used for each car type as required by the Contractor's car design to achieve compliance with FRA carbody strength requirements in 49 CFR Part 238.

b). AAR approved tightlock couplers, coupler parts, radial connections, yokes and attachments for passenger equipment cars shall be provided.

8.2 General Requirements

a). The Type H Tightlock coupler and draft gear assembly shall be compliant with the requirements of APTA Recommended Practice PR-M-RP-003-98.

b). All couplers, draft gear, and associated components shall conform to the strength requirements specified in all applicable APTA and FRA standards and recommended practices.

c). Coupler carriers shall be capable of withstanding the vertical forces identified in 49 CFR 238.207.

d). All components shall be designed to operate properly under the operational and environmental conditions defined in Amtrak Specification 963.

e). It shall be possible to remove or install a coupler and draft gear assembly without requiring lifting of the carbody or removal of the truck.

f). The coupler pocket shall be designed to prevent any possibility of moisture being trapped.

g). The coupler pocket, coupler carrier, draft gear and associated components shall have a modular design for Amtrak’s future use. This includes the possibility of changing to drawbars with gangways. The contractor shall demonstrate how this will be possible.

h). As an option, Contractor shall design coupler assembly to be interchangeable with a semi-permanent coupler shank. Contractor shall outline any technical complications with this option.

8.3 Performance Requirements

a). Under normal operating conditions, all couplers, articulations and associated apparatus, including coupler carriers and centering devices, shall be capable of withstanding for any horizontal position of the coupler a vertical load of 100,000 lbs. applied in either direction to the coupler as near to the pulling face as practical, without deformation to the coupler carrier, supporting carbody structure and intermediate connections.

b). The car shall be capable of operating normally while coupled to any other car or

locomotive used in passenger service under the operational and environmental conditions defined in Amtrak Specification 963, including legacy equipment. The car shall be equipped with a centering device to ensure proper alignment during coupling.

c). Coupler swing shall be such that a car shall be able to negotiate a 250-foot radius (23 degree) curve while coupled to other cars and/or locomotives as specified without damage to trucks, draft gear, carbody, diaphragms, gangways, air hoses or car-to-car connections.

d). End stops or equivalent mechanism shall be installed to prevent damage to car due to a deflected coupler caused by mis-coupling.

i). 250-foot radius curve requirement shall be achievable with end stops or equivalent installed.

e). The coupler air connections shall be designed in conformance with APTA Recommended Practice PR-M-RP-001-97.

f). Coupler centering devices shall be provided for all H-type couplers to maintain the coupler head in a centered position.

g). Amtrak shall be able to lift one end of the car using the coupler without causing damage to the car.

i). See Chapter 9 for details regarding car-to-car air connections.

8.4 Coupler and Yoke

a). Material for couplers and yokes shall conform to AAR M-201 for grade E high tensile steel.

b). The bottom of the end coupler shank shall have a replaceable steel wear plate installed where it contacts the coupler carrier.

c). Intermediate couplings shall achieve similar performance.

8.5 Draft Gear

a). The car coupler draft gear characteristics shall be equal or better to twin-cushion WM-6-DP draft gear packs.

b). The draft gear pockets shall allow for the implementation of push-back couplers if required by the design.

c). Draft gears shall be designed to take into account the overall car ride quality and compliance with any CEM performance requirements, if utilized.

d). If regular inspection is required, inspection of draft gears and rubber elements shall be possible without removal of other major components.

8.6 Coupler Carrier

a). The coupler carrier shall be designed to support adequately and consistently the coupler through its full range of vertical and horizontal movement.

b). The coupler shall be supported at a nominal 34.5 in. height Above Top of Rail (ATOR), with an adjustment range of plus/minus 1 in., as measured at the center of the coupler when uncoupled.

c). The coupler carrier shall be designed to accommodate the complete push-back motion of the coupler without interference if an energy absorption function is used.

i). During coupler push-back, contact between the coupler head and the coupler carrier shall not result in unintentional activation of the coupler uncoupling mechanism and therefore cause car separation.

d). A means shall be provided to allow removal and replacement of wear plates, carrier springs and carrier stops.

i). The top surface of the coupler carrier shall be equipped with a replaceable nylon (or other low friction material) wear plate.

ii). The coupler shall not rest on a metal surface.

iii). Alternate service proven methods appropriate for rail vehicle service and as approved during design review process will be considered.

8.7 Coupler Uncoupling Mechanism

a). All coupler uncoupling levers and hardware shall meet the safety requirements of 49 CFR Part 238.

b). Each knuckle coupler shall be equipped with an AAR number 6 uncoupling operating mechanism, in conformance with section 5.10 of APTA Standard PR-M-S-016-06.

i). It shall be located on the left side when facing the end of the car.

c). Minimum clearance of 2 in. shall be maintained between uncoupling mechanism and all other components on the end of the car (including jumper cables, receptacles and carbody structural elements such as collision posts) when car is either coupled or uncoupled.

d). The uncoupling levers shall seat firmly when locked in place, shall not bind when being used, and shall not rattle or vibrate.

e). The uncoupling levers shall be designed with a locking mechanism to prevent unintentional unlocking of the coupler due to vibration or debris strikes.

f). Alternative uncoupling lever designs may be proposed.

g). The uncoupling mechanism shall be designed to accommodate any push-back motion of the coupler without unintentional activation of the coupler lock mechanism causing car separation.

h). The coupler should have a failsafe mechanism to prevent car separations if components become worn.

8.8 Mounting Arrangement

a). The proposed mounting arrangement of the coupler assemblies shall be submitted for Amtrak approval during design review. **[CDRL 8-01]**

8.9 Crash Energy Management

a). If a push-back coupler system is required by design, it shall be coordinated with the carbody Crash Energy Management (CEM) design, if utilized.

i). To ensure operational compatibility, any push-back energy absorbing coupler assemblies at the ends shall have a minimum initiation load of 600,000 lbs.

ii). The slope of the force during push-back shall be greater than or equal to zero for all CEM elements.

iii). The coupling system must be capable of transferring a 150,000 pounds draft load at any time during the push-back sequence to ensure that cars remain coupled during and after an impact.

b). Indicators shall be provided that shall be visible from outside the car to indicate full or partial activation of the energy absorption unit and the need for its replacement.

i). The activation of the energy absorption unit shall be readily apparent when performing periodic inspections.

8.10 CDRLs

CDRL	Description	Due
CDRL 8-01	Proposed mounting arrangement for couplers	During PDR

* End of Chapter 8 *

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9. Brakes

Revision 2

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9.1 Overview

a). This chapter describes the design and functionality of the electro-pneumatic and mechanical braking systems that shall be provided on the rolling stock equipment.

b). The braking systems shall include an electro-pneumatic system for service and emergency brake applications, a wheel slide control system and a handbrake.

c). All materials and workmanship shall comply with Chapter 19.

9.2 General Requirements

a). Electronic Brake System

i). All cars shall be equipped with a Passenger Electronic 26C Emulation Braking system meeting the requirements of APTA PR-M-S-020-17.

ii). The brake system on the cars shall also comply with the requirements of Electronically Controlled Pneumatic (ECP) brake system configured per APTA PR-M-S-021-17.

iii). This shall include the installation of trainlines, an electrical terminal box at each end of the car (for installation of the inter-car cabling), a terminal box at the brake manifold, conduit connecting them, as well as armored cable wiring.

iv). The ends of all cars shall include the ECP inter-car cable and junction connections. Design, arrangement and installation shall be subject to Amtrak approval during design review. **[CDRL 9-01]**

v). At a minimum the brake system shall:

(1) Be powered by the ECP trainline (when available), by a low voltage source from the car (when available) and/or a back-up battery when car battery is not available. Amtrak understands that interoperability with ECP braking will not be able to be utilized until legacy cars are assembled with ECP equipment.

(2) Have a discrete means to configure the brake controller for ECP or brake pipe operation.

(3) Incorporate fully pneumatic backup control of emergency brake application, if a malfunction of the electronic brake system occurs, if the car battery is depleted or if no electrical power is present on the car.

(4) Accommodate mounting of pneumatics and electronics within a single module or manifold inside of the car.

(a) If mounting inside the car is not possible, undercar mounting enclosure shall be sealed from dust, moisture and snow.

(b) The enclosure shall be shielded from debris damage and its location and arrangement provide easy access for maintenance.

(5) Incorporate component standardization in accordance with current APTA requirements.

(6) Use brake control valves meeting the approval of APTA PR-M-S-025-018.

vi). The air brake equipment shall be arranged to be compatible with Type 26C/26L air brake equipment and trainlines as per APTA PR-M-RP-001-97 currently in use in Amtrak intercity rail passenger service. This is in addition to having complete ECP brake trainline connections, for operation with an ECP-equipped locomotive.

(1) As described in Chapter 1, the intention is for the equipment to be delivered to be interoperable with Amtrak's legacy fleet initially which will require the use of a traditional braking system; however, the goal is for the entire new fleet to be equipped with ECP when completely assembled.

vii). Nominal air pressures in the air brake system shall be:

(1) Main Reservoir: 140 psig

(2) Brake Pipe: 110 psig

(3) Brake Cylinder: 100 psig maximum

viii). Each car shall be equipped with a brake pipe for emergency braking to provide break-in-two protection, and a main reservoir pipe.

ix). All components shall be equipped with an identification plate or tag which includes:

(1) Vendor

(2) Vendor part number

(3) Date of manufacture

(4) Serial number

9.3 Performance

a). The system shall be designed for normal and dead-in-tow operation at all speeds up to 125 mph in train consists of up to 1,530 ft in total length [excluding locomotive(s)] with propulsion provided by the rail passenger locomotives.

b). The air brake system shall be designed for normal and dead-in-tow operation in conformance with all applicable Amtrak air brake rules, specifically AMT-3.

c). Braking performance shall be in conformance with the braking performance curve

as identified for Average Performance Distance (no safety factor) for Amfleet equipment operating at 125 mph in Amtrak Drawing S-603.

d). A car built to this specification in a train of up to 1800 ft in total length and one Amtrak ALC-42 or equivalent locomotive shall have a minimum full service braking rate of 1.35 miles per hour per second (mphps) at 125 mph increasing to and maintaining an average of 2.00 mphps at speeds of 70 mph or less.

e). The cars shall be loaded to AW2 condition.

i). The instantaneous full-service deceleration rate shall not exceed 2.75 mphps nor be less than 1.25 mphps.

ii). The emergency brake rate shall not be less than 2.50 mphps at speeds below 70 mph.

f). The Contractor shall verify that the brakes are fully functional under all operating and environmental conditions found in Amtrak Specification 963.

g). Locomotive dynamic braking shall not be used to determine compliance with specified brake rates.

h). The maximum jerk rate (the change in the rate of deceleration) during initial service brake application shall be limited to 1.5 miles per hour per second per second (mphpsps) under all normal conditions.

i). There shall be no jerk limit for emergency brake applications.

j). The Contractor shall determine the brake system delay/dead time, build-up time, response time and equivalent deceleration rates for all speeds from maximum speed to full stop.

i). This information shall be provided to Amtrak during the brake system design review. **[CDRL 9-02]**

ii). The Contractor shall use *Mass Transit Brake System - Performance Requirements* per DIN EN Standard 13452-1 as the method to measure dead time response time and deceleration rate where applicable.

9.4 Design Review

a). Preliminary design review shall address the following subjects, describing Engineer actions and indications and also providing detailed technical design and performance analysis for the following subjects:

i). Concept:

(1) Concept and operation of friction brake system

(2) Thermal capacity of brake system

(3) Calculations showing that the system’s performance requirements will be met

(4) Graduated release setting of control valve

(5) Graduated release mode of automatic brake valve operation

(6) Wheel slide control

(7) Handbrake interface with brake system, as per APTA PR-M-S-006-98.

(8) Pneumatic supply to accommodate auxiliary systems

(9) Brake Cylinder Pressure Sensors and Settings

ii). Operating:

(1) Push-pull operation with locomotive in either leading or trailing position

(2) Push-pull operation with a non-powered control unit

(3) Stopping on a grade

(4) Starting on a grade

(5) Conductor- or passenger-initiated emergency brake application

(6) Train separation (break-in-two)

(7) Operation of short trains [consists of up to 300 ft in total length excluding the locomotive(s)]

(8) Operation of long trains [consists of up to 1800 ft in length excluding the locomotive(s)]

(9) Dead engine movement

iii). Design and performance analysis will be evaluated during design review, First Article Inspection (FAI) and proof of design testing. **[CDRL 9-03]**

9.5 Car Body Components

a). Piping and Fittings

i). The inside diameter of the trainline Main Reservoir (MR) pipe shall be 1.00 in. Iron Pipe Size (IPS), or equivalent.

ii). The Brake Pipe (BP) shall be 1.25 in. IPS, or equivalent.

iii). All pipes and fittings in both lines that are located on the exterior of the car shall be 304 stainless steel pipes in accordance with ASTM Standard A-53 or equivalent.

iv). Type K copper pipe may be used if located in the car interior.

v). Brake pipe trainline must pass Brake Pipe Restriction Test per AAR Standard S-471.

vi). Brake Equipment Installation and Design shall conform to AAR Standards S-400, and S-401.

vii). AAR type branch pipe tees, or approved equivalent, shall be provided and shall be orientated at a 45 degree slope upwards or higher to prevent moisture from being drawn into the branch pipes.

viii). The trainline MR branch pipe shall be routed to the main reservoir tanks before being routed to the brake manifold.

ix). Piping shall be routed to avoid traps and avoid draining moisture toward brake valves or brake manifold. Traps and low spots in the piping are prohibited.

x). The low point of the MR pipe shall be equipped with a heated automatic drain valve, to rid the pipe of moisture buildup; moisture drain shall be in response to either brake release cycle or timed cycle.

xi). The air supply system shall conform to APTA Standard SS-M-011-99 for compressed air quality for passenger locomotive and car equipment.

xii). All pneumatic piping shall conform to APTA Standard APTA PR-M-S-029-21.

xiii). A coalescing filtration system shall be utilized to remove moisture in any portion of the MR pipe before being supplied to the brake system.

xiv). Inter-car hoses shall be designed to allow for coupling between legacy and new equipment at a length that will not pull apart or drag on the right of way.

xv). Approved test gauge fittings shall be installed in the brake system piping to facilitate testing and troubleshooting the brake system.

(1) They shall include all fittings needed for conducting single car brake tests, including the brake cylinder lines to each truck downstream of all cutout cocks.

(2) Protective caps shall be provided as necessary.

b). Angle and Cut-out Cocks

i). Locking handle, ball type, cut-out cocks shall be provided in the MR Pipe and the BP at each end of every car, in a location for ease of access when coupling in restrictive tunnel locations.

(1) The BP angle cocks shall not be vented and must include a spring-loaded locking handle.

(2) The MR pipe cutout cock shall be vented toward the hose end, oriented below horizontal.

(3) The MR pipe cutout must include a spring-loaded locking handle.

ii). Each brake manifold shall be provided with a brake pipe cutout cock located for ease of access and simultaneous protection.

iii). A locking vented ball-type cut-out cock shall be provided in the brake cylinder line to each axle or truck as appropriate for venting brake cylinder pressure.

(1) The cutout cock shall be a 3-way type, vented down-stream.

(2) The vent port of the cut-out cock shall be tapped for 0.25 in. National Pipe Thread (NPT).

iv). A single Amtrak-approved brake cylinder cutout shall be provided inside the body of each car, requiring use of the standard coach key to access, to be able to vent the brake cylinder pressure on all axles or trucks in emergency or rescue situations.

v). All cut-out cock handles, except end of car BP end angle cocks, shall be arranged so that the handles are parallel to the air pipe in the closed position.

(1) Closed end of car BP cut-out angle cock handle shall be perpendicular to the air pipe.

vi). Labels

(1) All valves and cocks shall be labeled including the cut-in and cut-out positions.

(2) A flow bar cast or stamped into cock handles shall be acceptable for cut-in/cut-out position labeling.

(3) All air brake angle cocks and cutout cocks are to be clearly labeled using engraved and color-coded stainless steel or aluminum tags.

c). Hoses and Couplings

i). All connecting hoses, except BP and MR trainline hoses, shall be AAR Standard M-618 double wire braid reinforced hose.

(1) BP and MR car and trainline hoses shall be AAR Standard M-601 or M-618 hose.

ii). All hose material, when installed on the car, shall be less than one year old from date of manufacture unless approved by Amtrak.

iii). MR and BP end hoses shall be supported near the glad hand end from the coupler using rubber hose supports.

iv). End hose locations shall be in conformance with APTA Recommended Practice PR-M-RP-001-97 or alternate approaches can be proposed by the Contractor for Amtrak’s approval.

v). Two dummy couplings, one "F" type and one "E&L" non-vented type, shall be provided at each end of the car along with one ECP dummy coupling.

(1) The dummy coupling shall be secured to the car with chains in a manner which will prevent the trainline hoses and cables at the ends of the car from dragging when the couplings are connected to the hoses and cables.

vi). Inter-car jumpers and hoses shall be designed to allow for coupling between legacy and new equipment at a length that will not pull apart or drag on the right of way.

d). Emergency (Conductor) Brake Application Valves and Vent Valves

i). Manually operated conductor's valves shall be provided as follows:

(1) On both ends of the passenger compartment of each car just inside the body end door, right side of the door facing outward.

(2) At least two conductor's valves shall be provided per the equivalent length of the single-level passenger car.

(a) These valves shall be monitored by the car diagnostics system.

(3) Ensure no fouling condition in both application and resetting function of conductor valves.

(4) The valves shall be located in a conspicuous location for ease of operation.

(5) Valves shall not be blocked by any doors or access panels when they are opened.

(6) The operating handles shall be red and shall be clearly labeled, in accordance with Amtrak Specification 697, and shall not rattle when in service.

ii). These emergency brake valves, when used in conjunction with an appropriate brake application valve, shall cause an emergency brake application when activated.

iii). Vent valves shall be provided along the BP in accordance with air brake system design requirements based on brake pipe length and control manifold locations.

iv). Ready access shall be provided to all valves to facilitate inspection, replacement and maintenance.

v). The valves shall meet the requirements of APTA Standard PR-M-S-007-98.

e). Air Reservoirs

i). Reservoirs of sufficient capacity shall be provided to enable a minimum of three full-service brake applications and releases followed by an emergency brake without recharging.

ii). The Contractor shall define necessary service inspection and change-out intervals for filters.

iii). Check valve isolation requirements must be demonstrated for dedicated reservoirs.

iv). ASME-certified main and auxiliary (brake cylinder) supply reservoirs shall be drilled with telltale holes as described in 49 CFR Part 229 to eliminate the need for hammer and hydrostatic testing.

v). When installed, they shall include a manual purge valve with locking handle to drain accumulated moisture.

vi). The reservoir shall not have volume accessible to fluid below the plane of the purge valve inlet.

vii). All valves shall be easily accessible from the side of the car.

viii). Main reservoirs and air supply reservoirs used for water raising or other auxiliary functions shall be protected to prevent corrosion. If a coating is applied, the coating must last the life of the tank with no failures impacting any system.

ix). All reservoirs shall be welded and shall comply with the ASME *Boiler and Pressure Vessel Code* as applicable.

x). Air reservoirs shall be sloped if drain valves are located at end of the tank.

f). Control Manifold and Valves

i). The Electronic 26C Service portion shall provide the functionality equivalent to a Type 26C service portion and shall be manifold mounted.

ii). The air brake control manifold valve may be mounted underfloor.

iii). Branches will leave the brake pipe at a 45-degree slope upwards or higher and shall utilize an AAR "branch pipe tee", or approved equivalent.

iv). The air brake control manifold shall include test fittings for main reservoir, brake pipe, brake cylinder and #16 air pipes.

v). In addition, the relay valve exhaust shall have a threaded exhaust outlet to permit mounting a gauge.

vi). Full-face gaskets or O-ring gaskets shall be used for valve portion interface sealing.

vii). All stud mounted components shall be designed to allow installation or removal with standard socket wrenches by a single person.

viii). Electronic modules, pneumatic modules, cutouts, test points and electrical connections shall be front-plate mounted on the manifold.

ix). Front-plate mounting is not required if the manifold is oriented so that access is provided to both sides.

x). All power, input and output connections, external to the manifold, shall be provided with multiple pin connectors or a screw-type terminal block.

xi). Individual spade-type or threaded connectors are not permitted.

xii). Ring terminals shall be used if connected to a screw-type terminal block.

xiii). All valves on the manifold, as well as the manifold itself, shall be easily removable for servicing.

xiv). All valves shall be individually replaceable with the manifold installed on the car without removing any additional valves or components.

xv). All air brake system components which are subject to scheduled, regulated maintenance shall be serialized.

xvi). Valves shall be acoustically isolated from the passenger car interior areas to minimize exposure of passengers and crew to noise generated by the air brake components.

xvii). Exhausted air shall be piped to the underside (exterior) of the car.

xviii). All valves that have an exhaust port shall be equipped with a wasp excluder.

xix). Brake cylinder pressure shall be supplied and maintained by a relay valve with a 1:1 ratio, or approved equivalent.

xx). All devices shall be clearly and permanently labeled on the manifold body, including cut-in and cut-out positions of all valves and cocks.

xxi). Etching or silk screen printing during the machining process is acceptable for labeling manifold items.

xxii). Stamped aluminum tags may be used on valve handles.

xxiii). Full-service brake and emergency brake cylinder pressure shall be sufficient to achieve the required brake rates.

g). Auxiliary Air Equipment

i). MR air will be used for air-operated auxiliary devices.

ii). BP air shall not be used, except for air suspension (if applied).

iii). Auxiliary functions shall be isolated from air brake functions and shall be disabled when MR pressure falls below 80 psig.

iv). Adjustable-setting auxiliary valves with governors shall regulate air pressure for MR-supplied functions such as water raising and toilets.

v). Cutout cocks and pressure test ports shall be provided.

vi). All water raising, or waste system air valves shall be mounted above the water level of the storage tank to prevent backflow of water into the air system during normal operation or when the air system is depressurized.

(1) Appropriate check valves will also be used to ensure this functionality.

(2) The valves shall be readily accessible for maintenance and replacement.

9.6 Truck Components

a). General

i). All cars shall be equipped with disc and tread brake equipment.

ii). The contractor shall preferably use an existing Amtrak wheel set design including the existing disc design, count, diameter, and spacing.

iii). The actuators for both the disc brakes and the tread brakes shall operate at the same air pressure from the same air source.

iv). Brake effort contributions from disc and tread brakes shall be specified to avoid wheel thermal cracking and brake disc damage.

v). Under all circumstances the brake rates defined in this Chapter and in this Specification shall be achieved.

vi). The truck-mounted components as specified have been identified for the purposes of interchangeability with other single level passenger cars.

vii). The Contractor may propose alternate components for Amtrak approval if the components as specified cannot achieve the specified braking rates or if superior braking performance can be achieved through the use of other brake system components or based on the car design constraints.

viii). The truck brake equipment and general car arrangement shall facilitate ease of access for disc brake pad and tread brake shoe replacement at remote yard locations, without the need for a servicing pit.

b). Disc Brake Actuator

i). Caliper Assembly

(1) An air actuated caliper mounted on the truck frame shall be used in conjunction with each disc to develop braking effort.

(2) Suspension of caliper assembly shall be a 3-point position type or a compact caliper that permits caliper to follow lateral movement of the wheel assembly without restriction.

ii). Slack Adjusters

(1) Automatic slack adjusters shall have sufficient capacity to maintain nominal pad clearance and piston travel through the full range of new to worn discs and brake pads.

(2) The slack adjuster shall have sufficient capacity to maintain nominal shoe clearance and piston travel through the full range of new to worn discs and brake pads.

iii). Brake Pads

(1) The disc brake system shall use pads compliant with Amtrak Specification 973 and approved during Design Review.

(2) The disc brake units shall be capable of using 35mm thick brake pads if possible.

(3) Performance of brake disc friction material shall be suitable for the speeds, route brake duty cycle and overall train braking performance and shall not induce temperatures that may result in long- or short-term thermal damage to the disc friction ring as defined by brake disc manufacturer. This requirement shall be validated by a brake pad wear study to ensure that the expected mileage wear rate is met or exceeded.

(4) Pad holders and disc pads shall have an approved locking device.

iv). The disc actuator shall be capable of handling pressure up to 150 psig without damaging the actuator, disc, brake rigging or any other system or component on the vehicle.

c). Brake Discs

i). The number of brake discs per axle and the type of brake disc (axle or wheel mounted disc) shall be sufficient to meet the brake rates specified herein and not exceed the thermal rating of the disc or pads.

ii). Brake disc supplier shall provide an analysis of the thermal capacity of the discs based on the planned train operational pattern including frequency of braking for various braking initial speeds and station stopping patterns as provided by Amtrak. **[CDRL 9-04]**

iii). In the design of axle mounted discs, the fatigue life of the connection between the hub and friction ring must take into account cyclic loading from thermal and shock environments that are separately considered and are encountered in normal service.

(1) The shock environment due to wheel/rail interaction at normal revenue speeds is known to result in disc response in the form of a “bending out of plane” vibrational mode.

(2) The natural resonance frequency of the disc, for this bending mode, shall be demonstrated (by analysis or test) to be greater than 350 Hz. **[CDRL9-05]**

(3) The frequency analysis is to be performed under the assumption that the disc is fixed to the axle or wheel.

(4) The fatigue life at the most highly stressed location in the connection between the hub and spoke, due to combined strains from thermal and shock load, shall be equal to or greater than the projected service life of the friction ring or 1,000,000 miles, whichever is greater.

iv). All brake discs shall be manufactured by an Amtrak-approved facility with a history of successfully supplying railway brake discs.

v). Disc characteristics compliant with the requirements of this Chapter shall be demonstrated during design review.

vi). The brake disc supplier shall use the brake disc specifications currently used by Amtrak for a G-size axle unless it can be demonstrated that this design is unsuitable for the application.

vii). Design Criteria

(1) The brake discs (including friction ring and spokes) shall have adequate mechanical and thermal capacity for service on and off the Amtrak Northeast Corridor (NEC), under the environmental and operating conditions identified in Amtrak Specification 963.

(a) The discs shall be designed to withstand the mechanical loads arising from track-generated accelerations and thermal loading from friction braking from initial installation through the projected service life of the disc friction ring.

(b) This shall be verified by Finite Element Analysis (FEA) per Section 9.6c).vii) and a fatigue life estimate **[CDRL 9-06]** based on the results of the analysis performed by the brake disc supplier and shall be submitted to Amtrak for review and acceptance.

(2) An analysis shall be conducted to predict the fatigue performance of the proposed brake disc from the thermal loading measured from the dynamometer testing performed pursuant to the requirements of Chapter 20 and submitted to Amtrak for approval.

(3) For mechanical loading, each shock event shall translate into a minimum of two full bending stress reversals when evaluating the

fatigue life of the disc, to account for the damping of the excitation in the disc.

(4) A moment arm shall be taken into account for the distance from the axle box to the center of the disc for vertical shock loads, based on the worst case condition.

(5) The fatigue analysis of the disc shall take into account fatigue damage from in-service thermal and mechanical loading combined.

(6) The fatigue limit shall be selected based on at least a 50% probability of survival and shall account for manufacturing technique, surface finish, metallurgical properties, etc. as specified in recognized industry standards.

(a) The factor of safety shall be at least 1.50.

(b) The factor of safety shall be applied to the stresses obtained from the FEA which are incorporated in the fatigue estimate to reduce the predicted fatigue life.

viii). Brake Disc FEA report

(1) The brake disc supplier shall submit a brake disc FEA report, for approval by Amtrak. **[CDRL 9-07]**

(2) The maximum stress from the FEA at the specified loads, with a factor of safety of at least 1.50, shall be less than the allowable fatigue limit.

(3) The Contractor may elect to simplify the load cases into stepped increments, provided the methodology and the data utilized to establish equivalency is found acceptable to Amtrak.

(4) The FEA report must include an analysis for fatigue life and must include a Miner's rule calculation showing the damage factors due to loads imposed by vertical and lateral axle box acceleration and thermal loads resulting from friction between the disc and brake pads.

(a) The Miner's sum must not exceed 0.3 for the service life of the disc for the hub-friction ring connection.

(5) The FEA report shall include, but not be limited to, the following:

(a) Introduction

(b) Table of Contents

(c) Summary

(d) Physical properties of each material used for the disc.

(i) This table shall include, but not be limited to:

1. Yield strength
2. Ultimate strength
3. Elongation
4. Tension modulus
5. Compression modulus
6. Shear modulus

(ii) Minimum values shall be used and shall be selected from ASTM (or equal) material specifications, as approved by Amtrak.

(iii) The brake disc supplier may propose alternate material specifications for Amtrak approval.

(e) Views of key structural areas (spokes, hub-friction ring connections, etc.) showing member locations and geometry, and indicating the material and thickness of each.

(i) Other FEA views may be required where critical stress areas are identified.

(f) A tabulation or fatigue curve justifying the Contractor's selection of allowable fatigue stresses for the disc material for each transition or joint, and the fatigue-critical stress ranges.

(i) The FEA report shall include a description of how this process is carried out.

(g) The complete test report must be submitted including procedure, raw and reduced data, and summary of results, including:

(i) Structural sketches and/or layouts of the critically stressed locations showing locations and shapes depicted in scale, thickness, section properties and material. Methods of joining (if appropriate) shall be defined.

(ii) Diagrams displaying externally applied loads and boundary conditions.

(iii) Color plots of the stress under each load condition for critically stressed areas.

(iv) Natural Frequencies of the disc.

d). Tread Brake Units

i). Tread brake units shall be added to the car to supplement disc braking.

ii). A truck mounted air actuated tread brake unit, with integral single acting slack adjuster shall be applied at each wheel.

iii). The tread brake unit shall operate in conjunction with the adjacent disc brake caliper from the same air source.

iv). Composition brake shoes 2.5 inch thick, of a size and type in general use by Amtrak and conforming to Amtrak Specification 80-276 shall be provided.

v). Performance of brake shoe friction material shall be suitable for the speeds, route brake duty cycle and overall train braking performance and shall not induce temperatures at the wheel tread that may result in long- or short-term thermal damage, as defined in 49 CFR Part 238. This requirement shall be validated by a brake pad wear study to ensure that the expected mileage wear rate is met or exceeded.

vi). A brake key shall secure the brake shoe to the brake heads and shall not require the use of specific tools for installation or removal.

vii). The design of the tread brake shall accommodate the maximum allowable size wheel with sufficient clearance for operation and maintenance.

viii). The slack adjuster shall have sufficient capacity to maintain nominal shoe clearance and piston travel through the full range of new to worn wheels and brake shoes and shall provide sufficient clearance to install a 2.5 in. brake shoe against a new wheel.

9.7 Wheel Slide Control System

a). General

i). The wheel slide control system shall modulate the application of the pneumatic brakes to prevent sliding of the wheels through the use of a microprocessor design. The system for each wheel location shall include:

(1) System unit/controller with pre-wired connector plugs

(2) Modulation type dump valves as required

(3) Molded T-harness cable, or equivalent protected cable type as required

(4) Active speed sensors (one per axle or wheel location)

(5) The ability to perform wheelslide system diagnostics with a laptop Portable Test Unit (PTU) (test unit itself is not required) and by the car CDU.

(a) Additionally, the system shall be capable of logging historical data and events by way of the system diagnostics and the car diagnostics unit.

(6) Adapter cable to connect a PTU to the wheelslide control unit

(7) Wheel Slide Control may be incorporated into the ECP controller with the approval of Amtrak

ii). The system shall continuously measure the speed of each axle/wheel and take corrective action should a sliding wheel be detected.

iii). The wheel slide system shall operate under all braking conditions and shall not permit the jerk limit to be exceeded on reapplication of brakes following a slide correction.

iv). The system shall be designed to prevent permanent thermal damage to the wheel tread as evidenced by spalling, under all adhesion conditions.

b). Control Unit

i). The control unit shall not be mounted under the car unless approved by Amtrak.

ii). The wheelslide control equipment is subject to the following conditions:

(1) The wheel slide function shall be automatically self-calibrating to continuously adjust for the difference in wheel circumference from nominal new wheel to fully worn wheel rim thickness.

(2) The system software shall be designed to account for the rotational inertia properties of the wheel set assembly.

(3) Wheel slide corrections shall not occur at normal deceleration rates on dry, level tangent track.

(4) System logic and criteria for detection and correction of wheel slide and instantaneous deceleration rate shall be submitted for review and approval. **[CDRL 9-08]**

(5) The system software/control electronics shall possess features to prevent inappropriate wheel slide correction function from transient signals arising from one damaged or missing gear tooth.

(a) This requirement includes provisions for intelligent interpretation of transient changes in signal amplitude at all speeds due to axle gear run-out, vibration of sensor mounting bracket or sensor/gear clearance settings.

(b) Wheel slide protection shall be retained on all remaining axles should the control unit fail to receive one or more axle speed signals.

(c) It is recognized that the system performance for the axle with the defective sensor is compromised under these conditions.

(6) A safety timing function meeting the requirements of EN Standard 50126 SIL 3 shall be provided to cancel wheel slide corrections

exceeding a specified duration to be determined based on final system design.

(a) Protection shall be locked out on the affected axle/truck until car is at zero speed.

(7) The system shall utilize software that is at the current revision at the time of installation. All software revision levels shall be checked at commissioning to verify compliance.

iii). Auxiliary Functions

(1) The system shall supply at least two auxiliary zero speed signals, provided for door control, as described in Chapter 12, as follows:

(a) A zero-speed switching device shall close below 3 mph, and shall open above 3 mph.

(b) A 20-mph speed switching device shall close below 20 mph and shall open above 20 mph.

(2) Logic shall be fail-safe, such that zero-speed and 20 mph relay drop out in the event of any component failure or loss of power.

(3) Speed signal logic shall meet the requirements of EN 50126 SIL 2.

(a) The speed signal shall incorporate separate relays that break both the positive and negative components of the zero and 20 mph signals.

(b) Both the normally open and normally closed contacts shall be made external to the unit.

(c) Contact rating shall be 0.25A at 80VDC.

(d) Contacts shall be high reliability to reduce the probability of welding.

iv). Diagnostics

(1) The wheelslide control unit shall include integral diagnostic indications (at a minimum) of the following system states with the vehicle moving:

(a) Open, shorted or grounded speed sensor circuit

(b) Open, shorted or grounded dump valve circuit

(c) Electronics fault identified at component level

(d) Power loss/low supply voltage

(e) Software logic fatal error or program lockup

(f) Time out of safety timer

(g) Weak/missing speed sensor signal

(h) Logging capability for running total of slide corrections

(i) Locked axle

(2) When the car is stationary with adequate power and air, it shall be possible to conduct a self-test that shall verify the following functions in addition to those above:

(a) Ability of magnet valves to release and apply brake cylinder pressure

(b) Ability to test magnet valve time-out

(c) Ability to exercise zero-speed relays

(d) Power loss/low supply voltage

(3) The diagnostic information listed in Diagnostics and Faults shall interface with the car CDU, and shall be accessible remotely.

(4) Diagnostics and faults shall be capable of remaining in stored memory for no less than 3 months and shall continuously overwrite the oldest data with the newest with the capability of remote access.

(5) Refer to Chapter 24 for additional details.

v). Faults

(1) Faults detected shall be retained in the fault memory and displayed on the front of the controller using a numerical display that indicates proper system operation, or a fault code. The readout shall:

(a) Be able to identify defects down to printed circuit board, individual speed sensor or dump valve level.

(b) Include transient faults detected while the car is in motion.

(c) Provide sufficient information to enable maintenance personnel to determine if the unit is working properly, and if not, whether the system can be repaired while on the car or must be removed for repairs.

(2) A permanent label shall be fixed to or near the wheel slide control unit that identifies the codes for faults represented by the display.

(a) It shall also provide instructions for initiation of self-test program and the clearing of faults from memory.

(b) The chart shall be positioned so that it can be easily referenced in seated or standing position (as appropriate) while reading the display or manipulating button.

vi). Components

(1) All components shall be identified with:

(a) Vendor name

(b) Vendor part number

(c) Date of manufacture

(d) Revision level

(e) Serial number

vii). Test Equipment and Software

(1) The Contractor shall provide wheelslide system diagnostic software to be used on a PTU. **[CDRL 9-09]**

(a) Amtrak shall be licensed and permitted to install and use this software on an unlimited number of laptop computers for the maintenance of the cars or via remote access.

(b) Operating and installation instructions for this software shall be included in the vehicle maintenance manuals.

(2) The Contractor shall provide a common method for each car for connecting locally to a PTU to the wheelslide control unit and remotely to allow on-car troubleshooting. **[CDRL 9-10]**

c). Dump Valves

i). When a slide condition is detected by the wheel slide control unit, it shall be relieved on a per truck/per axle basis, by controlled reduction of brake cylinder pressure by an electro-pneumatic modulating type dump valve.

ii). Braking shall be reapplied after correction is made at a rate designed to take maximum advantage of prevailing adhesion without exceeding the jerk rate.

iii). Air consumption shall be minimized during slide correction.

iv). The dump valve porting and internal capacity shall be optimized for car dead and displacement brake cylinder volumes.

v). The manufacturer must provide a pre-wired mating plug connector for each dump valve.

vi). The wire pigtail must be molded construction and sealed at the plug.

d). Speed Sensors and Wiring

i). Axle/wheel speed shall be determined from an active speed sensor mounted on a journal bearing adapter and a toothed gear mounted on the axle.

(1) The sensor shall detect all speeds down to 0 mph at 0.01 mph increments.

ii). The speed sensors shall connect to the wheelslide control unit through a T-harness, or equivalent protected cable system.

iii). The T-harness or equivalent protected cable system shall connect to the carbody wiring through a MIL standard circular connector, mounted to an electrical box on the carbody.

iv). Terminal and junction boxes shall not be mounted on the trucks.

v). The speed sensor cables and T-harness, or equivalent protected cable system, shall be attached to the truck frame, or equivalent, using coated clamps that provide secure attachment while not abrading or pinching the cable.

(1) Each clamp shall secure no more than one cable.

vi). Clamps shall be attached to the truck frame, or equivalent, using fasteners and lock washers.

vii). There shall be sufficient slack in the speed sensor wiring to allow the bearing adapter to move to the bottom of the pedestal opening without stressing the cable (such as when the truck is lifted with axles installed).

viii). Cables and harnesses shall be accessible for replacement while the car is at a normal service and inspection facility.

ix). Mounting and wire routing of all truck components shall be arranged to minimize the exposure to wayside debris damage.

9.8 Brake Indication Devices

a). Indicators

i). Indicators, one on each side of the car at each truck or axle, shall be connected to the brake cylinder supply line between the brake cylinder cut-out cock and the brake cylinder.

ii). These indicators shall provide a positive visual status of the brake system to crew members.

iii). The indicators shall be readily visible from station platforms as well as track level, and from both ends of each side of the car.

b). Pressure Switches and Brake Status Lights

i). A pressure switch shall be provided for each truck or axle, monitoring the brake cylinder pressure downstream of the truck or axle cutout cock.

ii). A test fitting shall be provided in each brake cylinder line to the trucks/axles, downstream from cutout cock and dump valve.

iii). In addition, a test fitting shall be provided for each pressure switch to check calibration. These pressure switches operate the brake applied/released indicator lights.

iv). Trainline function is as follows:

(1) Brake released: continuity when air brake pressure on both trucks “zero” and handbrake is released.

(2) Brake applied: continuity when brake cylinder pressure on both trucks is applied at “Min” or more.

v). The exterior of each car adjacent to the air brake control manifold shall be equipped with two 3-lamp LED indicator assemblies, as specified in Chapter 13.

vi). Indicators shall display the following aspects, top to bottom:

(1)	Solid Green:	All service brakes released
(2)	Solid Yellow:	Service brakes applied
(3)	Flashing Yellow:	Handbrake applied (with air brakes applied or released)

vii). For handbrake applications, a weatherproof micro-switch or pressure switch shall be provided to indicate handbrake status to the car’s exterior brake status lights, and to the locomotive via the 27-point communication trainline and the digital trainline.

(1) The switch shall be weatherproof to prevent damage from environmental conditions.

viii). Alternatively, an integrated car diagnosis could be implemented. An electronic monitoring computer in certain areas of the car could allow a full diagnosis of all the car axles brake status from only one point.

ix). A pressure transducer or pressure switch monitors the brake cylinder pressure downstream of each truck or axle cutout cock. Output from those pressure measuring devices will be routed to car electronics, and from there to the monitoring centers in the car via communication car buses including historical data storage. In parallel, brake pressure indicators will be maintained on the exterior of the car. Communication trainlines will provide the same functionality.

9.9 Hand Brake

a). A sufficient number of wheels shall be equipped with handbrakes, such that compliance with APTA Standard PR-M-S-006-98 is achieved.

b). The handbrake shall be capable of holding AW3 loaded car, on a 5% grade, with an applied force of 125 lbs, 3 inches from the end of the handle under all normal truck wear (tread, wheel and brake shoe) conditions.

c). The system shall be able to be applied and released infinite times without air or power.

i). The handbrake shall be provided with a lever type handle at the B-end of each car in the diaphragm area.

d). Operating instruction labels shall be provided for the train crew regarding manual operation and rescue operation when normal air or electrical supplies are disrupted. These shall be provided at the control location and also at the ends of the cars.

9.10 CDRLs

CDRL	Description	Due
CDRL 9-01	Design of ECP brake system inter-car cable and junction connection	30 days prior to Brake System PDR meeting
CDRL 9-02	Brake system delay/dead time, build-up time, response time and equivalent deceleration rates for all speeds from maximum speed to full stop.	30 days prior to Brake System IDR meeting
CDRL 9-03	Brake System design and performance analysis	30 days prior to Brake System IDR meeting.
CDRL 9-04	Disc Brake Thermal Capacity Analysis from supplier	30 days prior to Brake System IDR meeting
CDRL 9-05	Brake Disc Natural Frequency Analysis	30 days prior to Brake System IDR meeting
CDRL 9-06	Brake Disc Fatigue Life Estimate	30 days prior to Brake System IDR meeting
CDRL 9-07	Brake Disc FEA Report	30 days prior to Brake System IDR meeting
CDRL 9-08	Wheel Slide System Detection Logic and Criteria	30 days prior to Brake System IDR meeting
CDRL 9-09	Wheelslide System Diagnostic Software (5 electronic copies for PTU)	With Pilot Car Delivery
CDRL 9-10	Wheelslide PTU Connection Cables (qty. 40 minimum)	With Pilot Car Delivery

* End of Chapter 9 *

Amtrak Universal Single Level Fleet Replacement

Technical Specification

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10. HVAC System

Revision 2

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10.1 Overview

a). General

i). Each car in any configuration shall be equipped with two independent HVAC units to provide heating, ventilation and air conditioning to the car, along with the overhead and convection heaters evenly distributed in the vehicle interior.

(1) The cars shall have roof mounted HVAC units that must be removable without opening covers and hatches.

(2) The covers and hatches shall be coordinated with the appearance and contour of the main structural roof.

(3) There shall be no handles, flanges or other drag or noise inducing features on the hatch covers which project above the basic contour of the unit.

ii). The HVAC units shall be identical, self-contained, independent, easily removable, interchangeable among like cars and have seamless integration with the car shell design and contained within a stainless steel or aluminum housing and shall be mounted in a watertight recess on the main carbody or structural roof with an IP rating of 66 or better. If dissimilar metals are used, there shall be sufficient dielectric isolation from the carbody.

iii). The HVAC units shall utilize scroll compressors using an US EPA approved refrigerant and choose a unit capable of handling refrigerant regulation updates by the EPA for cooling and shall supply a ceiling-mounted main air distribution duct capable of supplying all air diffusers along the length of the car.

iv). Each HVAC unit shall consist of one or more compressor/condenser sections and one or more evaporator sections with electric heating units.

v). In the event of a failure of one of the HVAC units, the ducting shall be capable of providing limited air supply throughout the entire car whether through automated dampers or split ductwork.

b). Design Requirements

i). The HVAC system shall provide a comfortable temperature-controlled environment of the interior areas of all areas of the cars.

ii). The cars shall be designed to operate in all environmental and climatic conditions identified in Amtrak Specification 963.

iii). The HVAC system components shall be service proven and supported by design and test information to demonstrate compliance with the Contract requirements.

iv). The HVAC units shall be controlled depending on car type. Likewise, the floor heat shall be independently controlled, with different approaches for open-body and compartmented car types.

v). Single-level car passenger loads shall be assumed to be AW1 for cooling load calculations.

vi). ASHRAE standards for passenger and solar heat load will be used.

vii). Heating and cooling requirements shall simulate loading and unloading as follows in all outside ambient temperatures identified in Amtrak Specification 963.

(1) This shall include the opening of vestibule doors, end doors, and all sets of side doors on alternating sides of the vehicle every 15 minutes, with the doors held open for 2 minutes each time.

viii). Ambient conditions as specified and heat losses due to car motion shall be included in HVAC system performance evaluation.

ix). Air losses due to door and carbody leakage shall be included in the HVAC system performance evaluation, including the temperature gradient end to end of the Car (one end hot and one end cold).

x). Supply air flow shall be balanced in all occupied areas of the car as well as food service area.

xi). Dampers on the fresh air intake vents shall control the amount of outside air taken in by the HVAC system.

xii). Freeze protection shall be provided and turned on when the ambient outside temperatures drop below 45°F, and shall shut off when the outside temperatures rise to 50°F.

xiii). The Contractor shall prepare, and submit for Amtrak's approval during design review, a detailed heating and cooling load analysis along with recommended heating, cooling and ventilation capacities of all car types. **[CDRL 10-01]**

xiv). The HVAC unit manufacturer shall conduct qualification testing to verify the heating and cooling capacity of the unit per ASHRAE Standard 37-2009 and to verify the design approved by Amtrak.

xv). Power

(1) Power to the HVAC system and controls shall be from the following supplies:

(a) HVAC system:

(i) 480VAC, 3-phase, 60 Hz supply

(b) Temperature controls:

(i) 120VAC, 1-phase, 60 Hz suppl. Alternatively, carbuilder may propose a DC powered controller as an alternative supply voltage.

(c) Freeze protection circuits:

(i) 120VAC, 1-phase, 60 Hz supply.

(2) Alternate supply voltages may be proposed to Amtrak for approval.

(3) The HVAC system shall be designed to perform at the nominal voltages and operate within the voltage and frequency tolerance ranges specified in Amtrak Specification 963.

(4) To minimize the effects of motor inrush currents on the head end power system, the controls on each car shall incorporate a soft start or a method to provide randomly staggered starting of the refrigerant compressor motors in the car.

(a) Control scheme shall be submitted for review and approval. **[CDRL 10-02]**

(5) HVAC system circuit breakers, temperature display, fault detection and protection, PTE/diagnostic port, and status indicator screen shall be located in the electrical locker and shall be accessible only to the operating and maintenance crews. Roof-top or under-car access shall not be required.

(6) Circuit breakers, controls and relays shall be inaccessible to the passengers.

xvi). Temperature controls shall be reliable and maintain car temperature at desired values.

xvii). The control system(s) shall not shut down by themselves and require manual reset. All connectors shall be rated to an IP rating of 68 or better.

xviii). The HVAC unit shall utilize a scroll compressor using an US EPA approved refrigerant for cooling, hermetically sealed, without threaded components, or other non-brazed fittings, except for service ports (high and low pressure and, if required, charging port).

xix). Pressure transducers shall be provided to allow the microprocessor to monitor both the discharge and suction line pressures.

(1) This information shall be available to technical personnel for troubleshooting purposes.

xx). The performance of the entire assembled HVAC system as installed in a completed car shall be verified at the climate room test.

10.2 Design Parameters

a). The following parameters are to be assumed in the design of the cooling system:

Figure 10-1: Cooling System Design Parameters

Ambient Temperature	110°F Dry Bulb/76°F Wet Bulb, with 120°F air entering the condenser
Solar Load	Based upon worst case conditions in Phoenix, AZ
Passenger Heat Load	440 BTU/hr/person at a heat ratio of 0.60
Number of Passengers	Full coach car seating per AW1
Carbody Heat Transmission	In accordance with the Contractor's carbody insulation design to meet the requirements of this Specification, but not greater than 1200 BTU/hr-F° for standard car length of 85 ft
Minimum Fresh Air	12 Cubic Feet per Minute (cfm)/seated passenger, with 9cfm/seated passenger permitted at outside temperatures above 100°F.
Other Heat Loads	Normal vehicle lighting, electrical equipment and appliance loads

b). The following parameters are to be assumed in design of the heating system:

Figure 10-2: Heating System Design Parameters

Ambient Temperature	-30°F Dry Bulb
Carbody Heat Transmission	In accordance with the Contractor's carbody insulation design to meet the requirements of this Specification, but not greater than 800 BTU/hr-°F for stainless steel, or 1600 BTU/hr-F° for aluminum.
Minimum Fresh Air	12 Cubic Feet per Minute (cfm)/seated passenger, with 9cfm/seated passenger permitted at outside temperatures below 0°F.
Solar Load	None
Passenger Load	None
Other Heat Loads	"Quiet car" lighting only (see Chapter 13)

c). The city of Minot, ND should be considered for worst case heating load requirements and the city of Phoenix, AZ should be used for cooling load

calculations.

10.3 Comfort Requirements

a). Interior

i). The following temperatures shall be maintained within the car, including toilet rooms when the associated ambient outside temperatures are present:

Figure 10-3: Required Interior Vehicle Temperatures

Outside Ambient	Interior Vehicle Temperature
Below -30ºF	As system will provide
-30ºF to +60ºF	70°F ± 2°F (±4°F for toilet room)
60ºF to 110ºF	72°F ± 2°F (±4°F for toilet room)
Above 110ºF	As system will provide, but no less than 25ºF below outside temperatures up to 130ºF.
Layover Heat Mode	50ºF ± 5°F

ii). During all modes of air conditioning, the interior relative humidity shall not exceed 55%.

iii). Except within the area of the side doors and vestibules, the HVAC system shall maintain a temperature variation of the following:

(1) Vertical variation:

(a) On any vertical line, 4 in. above floor to 43 in. above floor, not closer than 12 in. from walls, and not closer than 20 in. from doors.

(b) 3°F maximum difference between end points of the vertical line.

(2) Horizontal variation:

(a) On horizontal planes measured 4 in., 43 in. and 67 in. from floor, not closer than 12 in. from walls and not closer than 20 in. from doors.

(b) The temperature at any point within each plane should not exceed ± 3°F from the average temperature in that plane.

iv). The average car temperature shall recover within 2°F of the required interior vehicle temperature within three minutes maximum following a two-minute door opening of vestibule doors, end doors and all doors on one side of the car.

(1) It shall be demonstrated that this requirement can be met during two hours of continuous door cycling on alternate sides of the vehicles of two minutes open and 15 minutes closed at the design conditions in both heating and cooling modes.

v). When the car interior temperatures are within the ranges specified, the air temperature differential between the car interior and the air leaving the diffuser at the slot outlets shall not be greater than 25ºF.

vi). An exhaust duct system and fan shall be used to collect air from public restrooms and galleys exhausting it into the undercar equipment bay, both to provide pressurization and also ventilation with some heating/cooling value.

vii). The Supply Air Diffusers made of stainless steel or satin finish to be approved during design review shall be provided in the lower row of windowsills to distribute conditioned air. Alternate solutions may be submitted for review and approval.

b). Sleeper Cars

i). Each HVAC unit shall have its own temperature controls, monitoring the car temperatures of the respective zone independent of the other HVAC unit/controller.

ii). Separate car air temperature sensors shall be used to provide independent floor heat control in open-body areas as well as hallways.

iii). In the sleeper compartments, each passenger/crew room supply air diffuser shall be integrated into the room's thermostat to allow the room occupant to modulate the volume of conditioned air entering the room.

iv). Likewise, floor heat modulation for each room shall be integrated into the room's thermostat.

v). The temperature differential between the upper and lower berth of each configuration of sleeper car room shall be less than 4°F; (room air circulation fans may be used if required)

vi). An exhaust duct system and fan shall be used to collect air from each toilet/shower, public restroom and shower, exhausting it to the undercar. Sleeper compartments shall utilize static exhaust ventilation.

vii). The sleeper cars shall employ a duct running down the center of the roof, with inlets from each sleeping room, all toilet/showers as well as the public restrooms and showers.

(1) The exhaust fan will be located in the HVAC plenum, with the outlet venting it outside of the car.

viii). The Supply Air Diffusers made of stainless steel or satin finish shall be provided in the lower row of windowsills to distribute conditioned air to the following car areas:

(1) Accessible bedrooms, bedrooms, roomettes, attendant rooms, passenger seating areas, hallway, lounge, hallways, dining room, galley.

(2) Vents shall be designed to prevent debris from falling into the diffusers, screens may be used if necessary.

ix). Controls in passenger/crew rooms shall be integrated into the room to allow the room occupant to adjust air flow volume. Adjustments to the air flow shall not create any noise such as whistling and when fully closed, all air shall be blocked for passenger comfort.

x). In the sleepers, the two HVAC units both receive identical control instructions from the temperature controls but have independent internal controls.

(1) In this way, the A and B-end HVAC units may be controlled separately but supply of the conditioned air is provided to the entire car, at a reduced level if one unit fails.

(2) Details of the by-pass mode shall be developed during design review.

xi). The duct heat primarily is used to temper car fresh air, whereas floor heat is used to overcome carbody losses and adjust room temperature.

xii). In general, floor heat and duct heat will be independently controlled.

xiii). All car ventilation and humidity control shall be provided by the HVAC unit.

c). Noise and Vibration

i). The overall HVAC system shall be designed to minimize noise in the passenger and crew areas of the cars.

ii). The noise level from the HVAC system shall not exceed the values in Figure 10-4.

Figure 10-4: Maximum Noise Levels

Interior noise level: Coach seating areas, toilet rooms and galley	As specified in Chapter 11
Exterior noise level	75 Decibels (Acoustic) (dBA) max (15 ft from centerline of vehicle)

iii). Particular care shall be required at the return air grilles, and galley ceiling air diffusers.

iv). The main parts of the HVAC system should minimize the transmission of noise and vibration into the car interior.

v). Vibration eliminators shall be incorporated in the base of compressors or motors, if necessary, and in the refrigerant lines between resiliently mounted compressor(s) and rigidly mounted piping.

vi). The evaporator blower and condenser fan assemblies shall be balanced according to IEEE Standard 11-2000 “IEEE Standard for Rotating Electric Machinery for Rail and Road Vehicles” with no more than 0.001-inch peak-to-peak displacements in any direction.

10.4 Air Conditioning

a). General

i). The vehicles shall be cooled using electromechanical equipment that has been proven in rail service. Self-contained, hermetically sealed, roof-mounted HVAC units shall be provided on the cars.

ii). The HVAC units shall all be identical. The units shall be designed for an approved refrigerant at the time of delivery of the first vehicles, conforming to 40 CFR Part 82. All components within the unit, such as seals, shall be compatible with the refrigerant and its associated lubricants.

iii). Each occupied area of each car shall be supplied by two HVAC units arranged so that conditioned air will be evenly distributed to all areas in the event of a failure of one of the HVAC units.

iv). The air conditioning system shall be designed and adequately sized to maintain interior car temperature as specified at the normal ambient conditions.

v). For ambient temperatures at or above 110°F Dry Bulb/76°F Wet Bulb, with air entering the condenser above 120°F, the air conditioning system shall be capable of maintaining cooling at a reduced capacity, but in no case shall the average interior temperature be less than 25°F below the outside temperature.

vi). Application and integration of the system are to be in accordance with the recommendation of the air conditioning manufacturer who shall also specify air flow requirements.

b). Refrigerant

i). The units shall be designed for an approved refrigerant at the time of delivery of the first cars, conforming to 40 CFR Part 82.

ii). All production units must comply with any new regulations regarding refrigerant phase out enacted at the time of manufacture, and any new refrigerant or component changes associated with new regulations must be backward compatible with earlier production units.

iii). All components within the unit, such as seals, shall be compatible with the refrigerant and its associated lubricants.

c). Components

i). The refrigeration system shall include, at a minimum, the following components and features or alternative design as approved by Amtrak:

(1) Drain Pan

(a) A condensate drain pan shall be provided beneath the evaporator coil, headers, thermal expansion valves and coil U bends to collect moisture from the evaporator components subject to sweating.

(b) The condensate drain pan shall be made of stainless steel, with stainless steel or copper alloy fittings and shall discharge into the rooftop drain pan.

(c) The HVAC unit shall be mounted above rooftop drip pans and shall be sealed against moisture entering the carbody.

(d) The drain pans shall catch the evaporator condensate as well as any water entering the compressor/condenser section. The pan shall be designed to prevent clogging, freezing and not drain on top of any underframe equipment including trucks. The drain pan shall be visible for inspection without any disassembly.

(e) All collected moisture shall be directed to the roadbed through the car sidewall, without leaking into the car structure and shall not be discharged on undercar structure, wheels, brakes, trucks, or electrical equipment.

(f) Elastomeric silicone rubber flapper type check valves must be provided at the ends of the condensate drains.

(g) The exits of the drain pan lines to the undercar shall be arranged in an approved manner that shall be readily accessible for maintenance and shall be protected against clogging and rodent/wasp entry.

(h) Drain pan design and maintenance shall be presented for review and approval during design review.

(2) Compressors

(a) A service proven and efficient variable speed single scroll or two scroll type refrigerant compressors operating seamlessly between 30% and 100% capacity.

(b) If tandem scrolls are employed, means shall be provided to alternate use of compressors during single stage cooling so as to equally distribute use and wear.

(c) The Contractor may propose an alternative capacity regulation method for review by Amtrak.

(d) Pump-Down

(i) Refrigerant compressor shutdown control shall be by means of a pump down cycle that senses suction line pressure. The system shall automatically reset without faults of the input power to the compressors was interrupted.

(ii) Refrigerant system controls must include a bump start process that prevents liquid build up in a loss of power condition when pump down was not initiated or at start up if pump down routine has not occurred in the previous 90 minutes.

(iii) Pump-down or similar system must not be initiated if the system shut down is initiated by a protective safety device such as excessive pressure, temperature, or current protective devices.

(iv) A refrigerant control box, readily accessible within the return air opening, shall be provided containing transducers, service switches, etc.

(3) Condenser Fans

(a) Direct drive condenser fan and motor assemblies.

(b) Condenser fan motors must be rated IP56 per IEC 60529 or higher.

(4) Condenser Coil Assemblies

(a) Condenser coil assemblies with 0.008 in. thick copper or an approved coated aluminum fins on copper tubing at a spacing of 8 fins per in.

(b) Fins and tubes evaluated for minimum 600 hours in AASS per EN ISO 9227.

(5) A charging port and an evacuation port equipped with high quality Schrader valves and sealing metal caps.

(6) Filter Drier

(7) Discharge line check valves

(8) Sight glass/moisture indicators

(9) Direct drive supply air blower and motor assemblies

(10) Liquid line solenoid valves (2 per unit)

(11) Thermal expansion valves (2 per unit)

(12) Evaporator Coil Assemblies

(a) Evaporator coil assemblies with two interlaced cooling circuits for modulated and full cooling.

(b) The assembly shall have 0.008 in. thick copper or an approved coated aluminum fins on copper tubing at a spacing of 10 fins per inch.

(c) Fins and tubes evaluated for minimum 480 hours in AASS per EN ISO 9227.

(13) High- and low-pressure switches

(14) High- and low-pressure transducers

d). Leak, Evacuation, and Charging Procedure

i). Leak, Evacuation, and Charging procedure for Refrigeration System in accordance with ASHRAE GPC-23 or approved alternate shall be submitted to Amtrak for review and approval. **[CDRL 10-03]**

10.5 Heating

a). General

i). Each zone of the car shall be electrically heated using forced air overhead heaters in the HVAC unit and by convection heaters evenly distributed in the vehicle interior to provide maximum possible comfort for all passenger areas of the car.

ii). The heating system shall compensate for carbody losses and fresh air heating loads.

iii). The heating system components including floor level and compartment/module heating elements, fan motors, protective devices, heating resistor, and thermostats are considered an LLRU.

iv). The heating system shall be designed, controlled and be adequately sized to maintain interior temperatures as specified, throughout the car at normal outside ambient conditions.

v). Main heat shall be divided into stages to allow control of overhead heat output.

vi). The size of each heating stage shall be chosen and controlled so that cycling of the heating contactors is minimized.

vii). The maximum allowable heater grill and enclosure surface temperature accessible to passengers or train crew shall not exceed 125°F.

viii). Antifreeze protection, activated at an outside temperature of 45°F, shall be provided for the water tank and water drain valves, doors and thresholds, and elsewhere as required.

ix). The protective heater circuits shall be protected by an independent circuit breaker.

b). Layover Mode

i). Layover heat shall be provided by the HVAC system, the toilet room auxiliary heater and floor heat shall maintain an interior temperature of 50°F ± 5°F.

ii). During layover heating, the fresh air damper shall be closed, and the evaporator fan (if needed) shall only operate below 50°F ± 5°F.

iii). In layover mode, the dampers shall be fully closed and the temperature at the coldest place in the car cannot be less than 40°F.

c). Freeze Protection

i). Freeze protection system shall be provided to the side doors, thresholds, water tanks, water drain valves and all water and waste system components that may be exposed to freezing conditions.

ii). Freeze protection heaters shall have an LED indicator to indicate activation and facilitate troubleshooting, easily accessible by the maintainers. This applies to external mechanical components such as steps, waste valves, and similar systems exposed to freezing conditions.

iii). The system shall be controlled and monitored through the HVAC controller and shall allow unrestricted vehicle operation of systems down to -30ºF ambient temperature under all weather and car operating conditions, including at full operating speeds

d). Overhead Heaters

i). Overhead heaters shall be supplied within the evaporator compartment to provide tempering for fresh air intake and for reheat to maintain humidity control under partial cooling operation of the air-conditioning apparatus.

ii). The total heat capacity in shall be divided into stages of approximately 1/3 and 2/3 of total capacity, allowing for HIGH, MEDIUM, and LOW power operation.

iii). The heater elements shall be of low thermal inertia, open coil, resistance wire type with terminations, and insulated supports as approved by Amtrak.

iv). Alternative configurations shall be submitted to Amtrak for review and approval.

v). The heaters shall be powered from the nominal 480 VAC supply and shall be staged to provide variable power operation.

e). Overhead Heater Protection

i). The overhead heaters shall be protected against over-temperature.

ii). Over-temperature protection utilizing airflow detection, resettable and manual reset devices and other control means shall be evaluated during design review prior to approval by Amtrak.

iii). An automatically resettable overheat protection thermostat (OHPT1) shall be installed in a location to sense the temperature reliably and accurately in the area of the heater coils.

iv). The thermostat shall be wired directly in series with the coil of the overhead heat contactor and shall also provide feedback to the control logic.

v). The set point shall be selected such that the overhead heaters may cycle indefinitely on overhead thermostat control with no damage caused to any HVAC system components.

vi). The set point shall also prevent nuisance trips from any condition that may be expected to arise during normal operation, including operation over the allowed range of input voltage and air filter maximum recommended pressure drop.

vii). A backup overheat protection thermostat (OHPT2) shall be provided to positively remove power to the overhead heater elements in the event of a control failure or failure of the overheat thermostat.

viii). The backup protection may be a thermostatic sensor wired to a shunt-trip circuit in the overhead heat circuit breaker.

ix). The set point shall be selected such that no damage shall occur to any HVAC component by temperatures reached before or after the back-up protection device actuates.

x). The setting of the back-up device shall be coordinated such that it will not actuate under any conditions which may be achieved with normally operating controls and functional overheat thermostat.

f). Heated Floor Panels

i). All passenger loading entrance areas shall be equipped with service-proven heated floor panels or alternative solution to ensure no ice or water accumulation at the passenger entrance.

ii). The heated floor panels shall not be covered and any replacement of a heated floor panel shall not require the disassembly of other assemblies unless otherwise approved by Amtrak.

iii). The total floor heat capacity in each zone shall have uniform temperature distribution throughout the whole vehicle for passenger comfort.

iv). Each floor panel must be protected with two levels of over-temperature protection as specified under UL 1995, Section 30, Electric Heaters.

v). Fault detection and diagnostic features of heated floor panels shall be submitted for review and approval. **[CDRL 10-04]**

(1) These features shall be available to be accessed remotely.

vi). Alternate methods of heating and temperature regulation, ground fault detection and protection may be submitted for consideration by Amtrak.

g). Floor Heaters

i). Floor heating shall be provided throughout the passenger areas using convection type heaters.

ii). The Contractor shall take appropriate steps in the design of the floor heat system to minimize overall power demand while complying with all technical requirements of this specification.

iii). The floor heating system shall be controlled via a PulseWidth Modulation (PWM) circuit to regulate thermal output. This control strategy shall enable the use of a single high-capacity heating circuit while minimizing the risk of temperature overshoot and reducing excessive on/off cycling of the system.

iv). Alternative capacity regulation method may be provided for approval by Amtrak.

v). Floor heating shall be provided using electric strip heaters, powered from the 480 VAC HEP supply, mounted behind stainless steel heater guards along the side walls at the floor.

vi). The electric floor heater elements shall be of the strip-heater type consisting of a nickel-chromium resistance wire embedded in a baked, compressed, refractory material sealed within a rust proof, high heat transfer metal sheath.

vii). The heater elements shall be mounted on ceramic standoffs, or equivalent, to provide a high resistance to arcing or grounding under wet conditions.

viii). The floor heat shall have sufficient capacity to heat the car interior from 12º F to 70º F with the ventilating fans and overhead heat inoperative and without benefit of solar or passenger loads.

ix). The heaters shall be uniformly distributed.

h). Heater Fault Detection and Protection

i). Each heated floor and floor heater circuit shall have its own circuit breaker, fault detection and protection.

ii). The heater fault detection circuit shall be able to indicate if any of the heaters in the circuit is either open, shorted, or grounded.

iii). Each heater circuit shall have current input to and output from the floor heaters monitored by the differential relay which energizes for a predetermined difference between the two.

iv). When this relay energizes, both the positive and negative feeds to the affected floor heater circuit shall be interrupted.

v). The ground fault type circuit shall remain latched in the disconnected mode until manually reset by means of a momentary reset button located in the HVAC control box.

vi). The fault trip must not be affected by control power loss or fluctuation.

vii). A tripped ground fault circuit shall be annunciated by means of an LED indicator on the ground fault detection device in the HVAC control box.

viii). The sensor device shall be designed such that it is not necessary to disconnect heater power leads to remove and replace the ground fault detection unit.

ix). A separable sensing coil or other approved method shall be provided to accomplish this requirement.

x). Alternate methods of ground fault detection and protection may be submitted for consideration by Amtrak.

10.6 Ventilation

a). General

i). The ventilation system for each car shall include, at a minimum, the following components and features:

(1) Exterior fresh air intakes with water eliminators and filter with a minimum of MERV 13, if it is deemed that air flow is compromised by using a MERV 13 filter, an alternative filter may be proposed.

(2) Electrically motorized automatic fresh air dampers.

(3) Disposable pleated-type fresh and return air filters with a minimum of MERV 13.

(4) Air distribution ducts

(5) Air diffusers and grilles

(6) Exhaust ducts

(7) Exhaust fans

(8) Emergency fan shutoff switches

ii). The ventilation system shall provide a minimum positive carbody pressurization of 0.1 in. water gage (with full fresh air flow) above ambient exterior pressure with all exterior doors and windows closed and the toilet room and electric locker exhaust fans running.

b). Fresh Air Mixing

i). Intake of filtered fresh air shall be regulated according to demand and shall be adequate to maintain positive interior pressurization under all operating conditions and a minimum of 0.1” w.g. while at standstill.

ii). Fresh air shall enter the car through fresh air intakes and air filters and shall pass through ducts which include drains for condensation and water to be diverted to the outside of the car.

iii). In addition, the fresh air exterior intakes shall be fitted with louvers or grilles that prevent ingress of water and snow.

iv). Re-circulated air shall pass through grilles into a plenum chamber where it shall mix with the fresh air and pass to the HVAC unit blower.

v). Fresh and re-circulated air shall be filtered at the HVAC units by disposable pleated-type filters.

vi). The filters shall be located for ease of replacement from inside the vehicle via the return air grill and shall meet the requirements specified in Amtrak Specification 685 and be commercially available.

c). Return Air Temperature Sensors

i). The Return Air Temperature Sensors should be installed in such way that they only measure the temperature of the re-circulated air, and not when later mixed with the fresh air.

d). Evaporator Blower Fans

i). Ventilation of each car shall be provided by blower fans supplied as part of the HVAC units.

ii). The blower fans shall move the mixed air through the cooling and heating coils and force the conditioned air into the supply air ducts.

iii). The evaporator blower fans shall be sized to overcome the high external static pressure as determined by the Contractor.

iv). The blower shall be centrifugal type, directly driven from the motor shaft.

v). The motor shall be TEFC, class H insulation, resiliently mounted, and equipped with permanently lubricated sealed bearings.

vi). Use of variable speed motor controls for the blower and exhaust fans is permitted if it will lead to a more efficient and energy saving system.

e). Air Ducts

i). The air ducts shall be sized to minimize noise from air velocity.

ii). The air ducting shall be free of any obstructions such as electrical wiring or piping.

iii). Ducts should be able to be cleaned using rotating brushes with vacuum system.

iv). Mounting of the air ducts to the carbody structure shall minimize noise and heat transfer across the joints.

f). Insulation

i). Use of polyolefin insulation is prohibited including the use of any type of insulation inside the air ducts.

ii). Insulation shall be adequate to prevent condensation from occurring in or outside the duct under any operating conditions.

iii). Insulation shall comply with Amtrak Flame, Smoke and Toxicity Requirements, # 352.

g). Air Discharge

i). The air diffusers shall be designed to deliver equalized airflow throughout the car and meet the temperature variation requirements specified.

ii). The velocity of discharge air shall not exceed 100 feet per minute (fpm) measured 6 in. below the face of the diffusers.

iii). Air delivery performance shall be verified during HVAC system proof-of-design testing. Refer to Chapter 20.

iv). The diffusers shall be fixed on all vehicles, except for the car(s) designated for proof-of-design testing, where adjustable diffusers may be used and then permanently set following successful test.

v). The total air flow from the evaporator blower fans on the HVAC units shall be determined by the Contractor to meet the interior requirements at the specified ambient temperatures but shall not be less than 70 cfm per foot of occupied car length.

vi). The supply air shall be adequate to maintain positive interior pressurization under all operating conditions and a minimum of 0.1” w.g. while at standstill.

h). Baffle Plates

i). Baffle plates shall be used to set the volumes of fresh and re-circulated air.

ii). The baffle plates shall be fixed on all cars, except for the car(s) designated for testing, where adjustable baffle plates may be used and then permanently set following successful test.

iii). Adjustment and balancing procedures shall be included in the final deliverables with the first batch of cars and identified in the maintenance manuals.

i). Toilet Room Exhaust Fans

i). A forced exhaust fan vented to the exterior of the car shell shall be provided in each toilet room, exhausting away from any fresh air intake for a minimum 0.5 cfm/ft2 to maximum 1 cfm/ft2.

ii). Toilet room exhaust shall, at all operating speeds, maintain a negative pressure in the toilet room at all times when activated, as compared to the rest of the car interior.

iii). Another method of preventing toilet odors in the car may be proposed and approved by Amtrak.

j). Electric Locker Ventilation

i). A forced exhaust flow shall be provided in the electric locker to assist in cooling the electrical equipment in the electrical locker.

ii). The electric locker fans shall draw air from the car interior and exhaust it to the exterior.

k). Controls

i). The temperature controls shall provide for ventilation with no heating or cooling when temperature conditions fall in the ventilation range shown for comfort requirements in Section 10.3.

ii). Ventilation detection and interlocking devices shall be provided and installed such that there shall be no overhead heat and/or cooling when absence of ventilation is detected.

10.7 Fresh Air Dampers

a). The fresh air intakes shall be equipped with electrically power operated fresh air dampers that shall at a minimum provide two positions:

i). fully open

ii). fully closed

iii). adjustable stop for restricting.

b). The dampers shall be controlled by the vehicle temperature control panel; the dampers shall be used to provide full fresh air into the vehicle under normal operating conditions.

c). With temperatures outside the normal range, the dampers shall operate variably between open and closed to optimize fresh air quantity for the purpose of maintaining the required interior temperature while providing the maximum possible percentage of full fresh air.

d). During layover and warm up/cool down, the dampers shall be fully closed.

e). Alternate arrangements may be proposed to Amtrak for approval.

f). The damper frame, blades and hardware shall be constructed of corrosion resistant material so they will last the life of the car with no attention other than inspection and cleaning at 8-year intervals.

g). The drive motor shall be robust and readily available.

h). The dampers shall incorporate a spring close feature so that they self-close upon loss of power.

i). They shall also incorporate a position sensor to provide a feedback signal to the temperature control panel.

j). Design of the damper unit shall keep the number of adjustments required to a minimum.

k). Once settings are made, they shall be locked so they remain fixed for the life of the damper.

10.8 Controls

a). General

i). A microprocessor-based, integrated HVAC temperature control system shall be provided to monitor the inside and outside temperatures, and adjusts the system's cooling, and heating functions to maintain a comfortable inside temperature and humidity level throughout the range of environmental and climatic conditions of the car.

ii). Activation of the HVAC system on each car shall be under the control of the train crew.

iii). The system shall be designed to maintain the specified interior passenger area temperature and humidity and to also assure adequate interior ventilation.

iv). The output of the microprocessor shall be short circuit protected and shall drive solid state and electromechanical relays and contactors which shall, in turn, control electrical power to the heater elements, motors and various control devices.

v). The changeover between heating and cooling shall be automatic and, except for the reheat stage of overhead heat, shall preclude the simultaneous operation of heating and air conditioning.

vi). The microprocessor application software shall permit Engineering Level maintenance personnel using on board touch screen display to modify temperature and pressure set points as well as various other parameters, such as timers and fault management.

vii). Measures shall be taken to prevent control algorithms that might cause contactor hunting.

viii). Provisions shall be made to control, download, and monitor HVAC status information from a single point of access through intercar connections.

ix). All HVAC sensor inputs, faults, and monitoring shall be available to the car's vehicle diagnostic system and shall be available to be accessed remotely.

x). Heating and cooling shall be sufficiently capable of maintaining desired interior temperature near the lockout temperatures for the compressors or condenser fans with maximum solar loads.

b). Sensors

i). A sufficient number of temperature and humidity sensors shall be provided to regulate heating and cooling in response to temperature changes inside and outside the vehicle.

ii). Temperature sensors in the car body shall be located such that they reflect temperature without being influenced by external heat sources or solar radiation.

iii). All sensor information shall be recorded by the controller and available to the vehicle monitoring system.

iv). At a minimum, the following temperature sensors shall be required:

(1) Minimum of one interior temperature sensor located throughout the passenger seating area for layover heat.

(2) Return air sensor at each HVAC unit return air grille.

(3) Fresh air sensor at each HVAC unit fresh air inlet.

(4) Supply air sensor where each HVAC unit supplies the main duct.

(5) Freeze protection thermostat located in a position that accurately measures outside temperature. (May utilize a signal from the fresh air sensor).

(6) Evaporator coil sensors to detect ice build-up on the evaporator coils.

(7) Humidity sensor at each HVAC Unit (location TBD)

c). Use of Controls

i). The temperature control system for each car shall be under the command of a rotary mode selector switch located in the switch locker and operated by the train crew.

ii). This switch shall determine the operating mode of each of the two HVAC systems and the heating system.

iii). The mode selector shall switch from AUTO/NORMAL to LAYOVER without cycling the HVAC through OFF.

iv). In the event an air conditioning compressor is in operation when it is commanded to shut down, the pump down cycle shall be initiated before the compressor(s) are shut down.

v). Positions and functions are as follows:

Figure 10-5: Temperature Control Positions

Name	Function
AUTO/NORMAL	Car HVAC and heating set up and provides the normal occupied car environment. All systems including freeze protection operate automatically.
LAYOVER	Used for car storage in winter to minimize energy consumption, yet still maintain interior temperature of 50°F. Only floor heat and freeze protection shall be available.
OFF	Used to shut off all car heating and cooling when car is being serviced or in storage. Does **not** disable the freeze protection system.

d). Status Display

i). Each HVAC control panel shall include an indicator and monitor display which shall show the control logic state, unless other display options are reviewed and approved by Amtrak.

ii). Indications shall be by means of suitably labeled Light Emitting Diodes (LEDs) and by an LCD screen, which shall display all microprocessor requests for heating or cooling from the zones controlled from that panel.

iii). Fresh air temperature, supply air temperature, return air temperature, suction line pressure and discharge pressure shall be displayed for each HVAC unit.

iv). Overload indicators and resets shall be available for use by the train crew without exposing the crew to hazardous voltages.

v). The control system shall include the ability to download data using a laptop computer or a flash memory card that is loaded with the Contractor's HVAC diagnostic software.

vi). The requirement to remotely monitor the system status, faults, etc. for the HVAC system is required as part of the base scope of work. The HVAC diagnostic software shall provide the following functionality:

(1) A controller that provides HVAC system status at a glance through remote viewing and has strong diagnostic features.

(2) This includes remote viewing of all sensor status, alerts, errors and relevant data.

(3) Monitor the HVAC system and provide the following:

(a) Have the capability to test the HVAC system and temporarily override the control system.

(b) Log performance, all faults and download history.

(c) Have several levels of security to limit the access and controls of the system (crew, technician, programmer).

(d) Display HVAC system pressure and temperatures

(e) Display HVAC System current mode

(f) Display suction and discharge line temperatures

(g) Display ambient air, fresh air, supply and return air temperatures

(h) Display motor status and current of blower motor and condenser motor

(i) Display heater status and current

(j) Display humidity level

(k) Display fresh air damper position and status

(l) Forecast air filter replacement and condenser and evaporator coil cleaning through the use of differential pressure sensors

(m) Ability to record and indicate system faults

(n) Automatically calculate system superheat and subcooling

(4) HVAC High Pressure and Low Pressure fault Condition

(5) Have the capability to test the HVAC system and temporarily override the control system.

(6) Log performance, all faults and download history.

(7) Have several levels of security to limit the access and controls of the system (crew, technician, programmer).

(8) Provide capability to diagnose failures down to the failed component. Details to be discussed during design review.

vii). The control system shall include, at a minimum, the following components and features:

(1) Temperature sensors

(2) Motor starters

(3) Motor protective devices

(4) The control method shall rely on a combination of the return air and fresh air temperature measurements.

(5) Diagnostics and test capabilities

(6) Heater switching devices

(7) Pressure transducers

viii). The Contractor shall submit a temperature control schedule and a detailed description of operation for approval by Amtrak at the HVAC system design review. **[CDRL 10-05]**

(1) The temperature schedule shall be approved by Amtrak.

(2) In the temperature control schedule, control switch points shall be separated by at least one degree differential for rising and falling temperatures to prevent oscillation of operating modes.

(3) A Ventilation Mode should be present between the heating and cooling modes.

e). Emergency Ventilation Cut-Out Temperature Measurements

i). The following control device functions shall be reviewed and approved by Amtrak and their functions will be monitored by the controller and their activation displayed, including any lockout criteria that is met:

(1) High Pressure Switch

(2) Low Pressure Switch

(3) Freeze Protection Temperature Sensor

(4) HVAC Emergency / Load Shed Operation

(5) Overheat Protection Devices

f). Emergency Ventilation Cut-Out

i). A ventilation system isolation cut-out switches shall be provided on each car for use of the train crew.

ii). The emergency ventilation cut-out shall immediately shut down the HVAC system ventilation blowers and disable heating or cooling on all HVAC units to prevent the circulation of smoke or fumes throughout the car in the event of an emergency.

iii). Operation of the ventilation cut-out shall also fully close the fresh air dampers.

iv). The switch arrangement and labeling shall be identical as that used on existing Amtrak cars and shall be approved by Amtrak during design review.

g). HVAC Emergency / Load Shed Operation

i). In the event of a load shed operation or loss of HEP power supply, HVAC shall provide ventilation in high ambient temperature conditions for a minimum of 6 hours.

ii). Ventilation rate may be reduced if necessary but shall be subject to Amtrak review and approval and in no case shall be below 8 CFM per passenger for AW2 loading.

iii). Alternative solutions may be submitted to enable heating or cooling at extreme ambient temperatures after extended periods of time after 480V power loss. Contractor to include overall impact to vehicle design and battery capacity/size.

10.9 Accessibility and Maintainability

a). Each HVAC unit shall be designed to provide full accessibility where all the basic troubleshooting and running maintenance can be performed from inside the car without removing the equipment and without interference from other systems.

b). All filter replacement shall be performed from inside of the car.

c). Where necessary, the Contractor shall provide custom lifting eyes, slings, jigs or handles that allow safe removal and replacement of major components using Amtrak's existing maintenance facility and material handling equipment.

d). Tapered guide pins or a suitable method shall be provided to guide the HVAC unit into its position.

e). Quick connections shall be provided to the car air ducts and electrical connections.

i). The design should avoid using a special lifting fixture to remove HVAC units. If a fixture is required Amtrak approval is required.

f). The installation and removal process, including removing and installing all

mounting hardware, and electrical connections, shall not exceed one hour and shall be demonstrated for Amtrak approval before final approval of the final design review.

g). At a minimum, the following components shall be a part of the unit and shall be easily accessible for servicing and replacement either through a hinged grille, which provides access to the return air plenum from the inside of the vehicle, or inside the electric locker making access easy for the onboard crew:

i). Air filters

ii). Diagnostic test plug/connector for the PTE

iii). System fault and status LED's

iv). Return air sensors

v). Dampers

vi). Test switch, if provided

vii). All electric transducers and pressure controls

viii). Circuit breakers, relays, and contactors

ix). Refrigerant gauge ports

x). Liquid line sight glass

xi). Crankcase oil sight glass, if applicable.

h). It is anticipated that the air filters and return air sensors shall be accessible via the return air plenum and the other components through interior access doors in the intermediate level ceiling or alternate location.

i). All other components shall be easily accessible for servicing and replacement from within the equipment bay.

10.10 Thermal Response Analysis

a). The Contractor shall perform and submit a comprehensive thermal response analysis for each car type to support the development of Amtrak's Standard Operating Procedures (SOPs) for emergency power-loss scenarios. **[CDRL 10-06]**

b). The Contractor shall analyze no fewer than ten (10) distinct power-loss conditions that may reasonably occur during operations, including but not limited to variations in:

i). Ambient outdoor temperature (hot and cold extremes)

ii). Car occupancy levels

iii). HVAC operating state at time of power loss

iv). Train speed and ventilation state (static vs. moving)

v). Door and vestibule leakage conditions

vi). Emergency ventilation modes

vii). Battery-only or degraded-power modes

viii). Duration of power outage

ix). Seasonal environmental differences

x). Any additional conditions identified by the Contractor through hazard analysis

c). For each scenario, the Contractor shall quantify:

i). Rate of internal temperature change (increase or decrease) over time following loss of normal power.

ii). Time required for interior temperatures to reach thresholds relevant to passenger health and safety (e.g., heat stress, cold-stress, ADA considerations).

iii). Effects of residual thermal mass, insulation performance, and solar loading.

iv). Influence of passive ventilation, infiltration, and natural convection paths.

v). Impact on critical passenger systems, including emergency lighting, communication systems, and safety equipment.

d). The Contractor shall provide a final report identifying worst-case heating and cooling scenarios for each car type and recommended operational considerations for Amtrak personnel during emergency conditions based on observed thermal behavior.

10.11 CDRLs

CDRL	Description	Due
CDRL 10-01	Detailed heating and cooling load analysis	30 days prior to PDR, on-going updates for each DR
CDRL 10-02	In-rush mitigation control scheme	30 days before IDR
CDRL 10-03	Leak and Charging procedure for Refrigeration System	30 days before IDR
CDRL 10-04	Fault detection and diagnostic features of heated floor panels	30 days before IDR
CDRL 10-05	Temperature Control Schedule	30 days before IDR
CDRL 10-06	Thermal Response Analysis	30 days before IDR

* End of Chapter 10 *

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Amtrak Universal Singe Level Fleet Replacement

Technical Specification

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11. Interiors - Coach and Café Cars

Revision 2

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Part I: General Requirements

11.1 Overview

a). This Chapter defines the interior design and configuration for each car type.

b). All car types are single level with:

i). Entry/exit to the car from train side is from the single vestibule located at the B-end of the car. It is equipped with powered side doors, powered trap doors, powered folding steps, and on-board mobility lifts on defined cars.

ii). A powered collision post door is provided to seal the vestibule from weather when it is oriented at the end of the consist.

iii). Power operated body end doors at both the vestibule and blind ends of the car provide access to the car interior.

iv). Ceiling lighting in the vestibule illuminates not only the vestibule, but also the station platform outside the car, meeting ADA requirements.

v). Ceiling lighting is provided along the passageway, as well as low-location exit path marking.

c). Accessibility

i). The accessibility areas of the cars will conform to ADA requirements as listed in 49 CFR 38, Americans with Disabilities Act (ADA) Accessibility Specification for Transportation Vehicles and 2010 ADA Standard as applicable.

ii). In addition to compliance with the requirements of the ADA and other accessibility requirements in this specification, the Contractor shall comply with the terms of the Application for Equivalent Facilitation (EF) submitted by Amtrak and approved by the USDOT. (Exhibits R-1 and R-2). If the design concept is modified and a new Equivalent Facilitation (EF) is necessary, the Contractor is responsible for working with Amtrak, FRA and disability community to obtain an accessibility solution that is accepted by all parties involved.

d). Compliance with preliminary design concepts included in the specification and attachments does not relieve the Contractor of all the other requirements within the specification.

e). All car types shall be easily reconfigurable to another car type to meet Amtrak's evolving business needs over the life of the equipment. All components shall be modular in design to be easily replaced with a different configuration if needed.

11.2 General Requirements

a). This Chapter describes the basic requirements for the interior configuration of all coach and café cars.

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b). Each car type shall meet or exceed all requirements for ADA accessibility and general seating arrangements that provide comfort and amenities such as electrical outlets, task lighting, and individual work trays or tables.

c). The interior of the car shall be designed and constructed for maximum safety, comfort, convenience, and service to the passenger, and shall be fully ADA compliant along the accessible path.

d). The Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design.

e). All mechanisms described below should be durable, free from jamming, and racking.

f). All operable features intended for passengers use, unless otherwise specified or approved by Amtrak, shall comply with ADA requirements, including a maximum force of 5 lbf to operate. Operable controls shall be usable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Forward or side reach operable controls shall be mounted between 34 inches and 48 inches above the finished floor.

g). The design should meet abuse, load, and crash criteria as described in CFR.

h). Dimensions, position, configuration, comfort, and usability of all items and features will be subject to Amtrak approval during the mockup review.

i). Walls, ceiling panels, and window masks shall be easily cleanable and designed and constructed to form a safe and attractive environment.

j). Visible fasteners shall be minimized.

k). All systems requiring maintenance shall be easily accessible and removable for cleaning and repair.

l). Interior layouts shall be developed by the Contractor and submitted to Amtrak for review and approval during design review per the Design Review processes outlined in Chapter 3.

m). Whenever possible, common components shall be used in all car types.

n). Strength of all interior fittings and their attachment to the carbody shall meet APTA Standard SS-C&S-006-98 and 49 CFR Section 238.233.

o). All interior or occupied areas shall have Emergency Lighting and LLEPM that leads to the primary exits.

    i). These areas include non-seated areas restricted to crew members including the kitchen, café, and baggage areas. See Chapter 13 for additional information.

p). The interior clear height from the top of the floor to the ceiling shall be no less than 84” unless otherwise approved by Amtrak.

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q). The use of self tapping screws is forbidden in the construction of all equipment.

r). Protection shall be provided to prevent damage along the accessible path especially with respect to seats, armrests, walls, etc. Arm rests shall be designed to absorb wear and tear over the life of the assembly. Details to be reviewed and approved by Amtrak during Design Review.

11.3 Human Factors Study

a). As part of PDR, the Contractor shall submit for Amtrak review and acceptance a Human Factors Study Report. **[CDRL 11-01]**

b). The report shall also address specific human factors for restrooms, including but not limited:

i). to accessible paths,

ii). aisle and door clearances accessible reach zones,

iii). wheeled mobility device accessible features,

iv). wheeled mobility device and leg clearances,

v). handrail heights and sizes,

vi). transfer positions to seats and toilets.

c). The report shall also address all seating human factors for each seated position including but not limited to:

i). Recline

ii). Leg room

d). The Human Factors Study Report shall validate the use of all features of the cars by a 95% US male and a 5% US female.

e). Wheeled mobility device animations shall be included to validate accessible paths.

11.4 Accessibility and Universal Design

a). Each car shall be fully compliant at the time of manufacture, with all rules and regulations of 49 CFR 38, Americans with Disabilities Act (ADA) Accessibility Specification for Transportation Vehicles and 2010 ADA Standard as applicable.

i). No part of this specification alters or changes those requirements.

b). Review of the car’s accessible features (including all drawings, calculations, and supplier information required to define the proposed installation) shall be conducted with Amtrak as part of the mockup review.

c). Each car with accessible positions shall include accessible wheeled mobility device locations, which shall allow passengers using wheeled mobility devices to

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remain in their wheeled mobility devices while on board the car.

i). The number of dedicated accessible areas for wheeled mobility devices is determined by the car configuration, as described in Chapter 1.

ii). A storage area for an unoccupied, folded wheeled mobility device, 48 in. long by 20 in. wide and 40 in. high, in close proximity to the dedicated accessible area and to accessible seating, shall be provided on each car for each accessible space.

d). Each coach which includes revenue seating with an accessible area for a wheeled mobility device shall also include an accessible toilet room with direct access via a 32” path from the accessible area to the accessible toilet room.

i). The toilet room door shall operate automatically and may operate manually in emergency situations and shall be of the sliding type.

ii). Requirements for the toilet and associated equipment are detailed in this Chapter.

e). ADA-compliant car-to-car access is required along the accessible path.

i). The accessible coach car shall include end doors and bulkhead doors that have a clear, unobstructed opening of no less than 32 in. wide.

ii). Overlapping gap closer or bridge plates shall be provided between coupled cars to allow wheeled mobility devices to pass from car-to-car without trapping the wheels in gaps.

f). The accessible toilet room and standard toilet room should be in the vestibule area, separated from the coach seating area by the vestibule door.

11.5 Arrangement Flexibility and Modularity

a). The basic car interior shall be standardized to the greatest extent possible and shall be capable of reconfiguration, upgrade, or replacement without disrupting adjacent interior elements of the car. Contractor shall utilize a seat track or C-channel integrated into the carbody design for attachment of all assemblies.

b). All like components and all associated assemblies (e.g. floor panels, bulkheads, side wall & ceiling panels, etc.) and their spare parts shall be designed and manufactured to be identical/ interchangeable, both as individual parts and as sub-assemblies, throughout the entire car order production.

c). All parts shall mount without modification. Replacement parts shall also be interchangeable.

d). Easy accessibility shall be provided for all items that require periodic maintenance and/or may require replacement.

i). Access doors or panels shall be secured using approved captive fasteners or locks.

ii). It shall be possible to remove these parts without damage to the individual pieces or adjoining components.

11.6 Signage and Labels

a). The Contractor shall equip each car with adequate signage to provide passengers and crew information about the amenities and safety-related features of the cars.

b). The signage to be provided shall include, but is not limited to, the following:

i). Location of safety equipment

ii). Hazards such as high voltage or heat sources

iii). Operation of emergency exit equipment

iv). Operation of on-board equipment such as doors and door latches/locks

v). Amenities such as trash and recycling containers, potable drinking water, 120VAC outlet, etc.

vi). Toilet room amenities

vii). Seat numbers

viii). Capacities for storage locations such as luggage racks and overhead luggage bins

ix). Service-related signs for maintenance and inspection

x). Vehicle road number on both ends of the car

xi). Exterior signage for service points

c). The interior and exterior signage shall conform to the latest revision of Amtrak Specification #697, National On-Board Signage Manual.

i). The artwork, material, location, and specifications for each sign shall be submitted to Amtrak for approval at the design review.

d). Provisions shall be made for all seating locations to have a dedicated safety card holder at each location.

e). A metallic American flag sign shall be installed in each entrance area of each car. The sign shall be light weight and corrosion free.

f). Existing Amtrak signs, in accordance with Amtrak Specification #697, shall be used where possible.

i). Where new sign designs are required, the Contractor shall develop artwork per the Amtrak Onboard Signage Guidelines and submit to Amtrak for review and approval as part of IDR.

ii). The Contractor will provide a signage application drawing for Customer approval identifying all signs and labels used on each car type, including text, as well as the mounting location.

g). Emergency Signage and LLEPM shall be installed in accordance with APTA Standards APTA-PR-PS-S-006-23 Emergency Egress/Access Signage and LLEPM for Passenger Rail Equipment while in compliance with the CFR.

i). All HPPL signage shall be passive and shall not utilize electric components to reach required illumination levels.

ii). HPPL shall utilize LED backlighting to ensure charging under all lighting conditions except Emergency. Locations incapable of utilizing backlighting can use overhead lighting with the approval of Amtrak.

iii). The HPPL material shall be charged and shall maintain charge under all lighting conditions except Emergency.

iv). All HPPL shall have drawings for placement with specific part numbers.

h). Additional signage guidance will be supplied at NTP.

11.7 Interior Noise Levels (Passenger Areas)

a). Under all specific vehicle and operating conditions listed below, the interior noise levels on any car shall not exceed the sound levels below:

i). Vehicle Condition:

(1) Completely assembled car

(2) No passenger load

ii). Operating Conditions:

(1) Operating in any specified mode of acceleration, deceleration, or coasting at any speed up to 125 mph.

(2) On tangent, at-grade, ballast-and-tie track with clean, smooth continuous welded rail.

(3) All auxiliaries operating simultaneously at normal conditions.

iii). Measurement Location:

(1) Any and all points at least one foot from the ceiling, floor, end walls, or side walls.

iv). Maximum Sound Levels which include transient noise, i.e. locomotive horn:

(1) 70 Decibels (Acoustic) (dBA) in seating areas.

(2) 75 dBA in entrance areas (referred to 0.0002 microbar).

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b). Compliance with this requirement shall be demonstrated using a Type 2 sound level meter as defined by ANSI Standard S1.4: American National Standard Specification for Sound Level Meters, using the slow meter scale.

11.8 Vibration

a). All car equipment shall be designed to operate without damage or degradation of performance when subjected to vibration and shocks encountered during normal service.

b). All newly designed equipment and auxiliaries mounted anywhere on any car, car body, or trucks shall not cause vertical or horizontal vibrations anywhere on the car floor, walls, ceiling panels, and seat frames in excess of:

i). 0.10 in. peak-to-peak amplitude,

ii). 0.01 acceleration due to gravity (g) peak acceleration for the frequency range from 5 Hertz (Hz) to 14 Hz, and

iii). 0.045 in. per second peak vibration velocity for the frequency range above 14 Hz.

c). Carbody-mounted components shall be designed to withstand vibrations of not less than 0.2 g at frequencies up to 100 Hz and randomly oriented shock loads of 8 g longitudinal, 4 g vertical and 4 g lateral.

d). Shock and vibration tests shall be conducted in accordance with IEC 61373 (1999) – Railway Application, Rolling Stock Equipment, Shock and Vibration Tests.

11.9 Sanitary Design

a). Cleanability

i). The car interior and all materials shall be designed so that they do not soil, stain, or show dirt easily.

ii). Interior materials shall be easy to clean using few tools and little specialized equipment.

iii). Items such as HVAC grilles shall only require opening to access the ductwork during extensive periodic cleaning.

iv). The number of items that require removal for cleaning shall be kept to a minimum.

(1) Equipment seen by the passenger and crew shall be cleanable in daily service without removal.

(2) Those items that must be removable shall be easy to remove and replace, preferably without tools, with all like units being interchangeable.

(3) Removable items shall employ captive fasteners of a type that will not deteriorate or degrade in effectiveness with use over the life of the car.

(4) If screws are used, they shall be easy to line up with the mating hole on the fixed part.

b). Protection from Fluids

i). All floors and pipe connections, etc., shall be sealed internally to prevent liquids from leaking into the car sub-floor and insulation.

(1) This is to avoid sanitation and odor problems and minimize potential for sub-floor corrosion.

(2) Sealing design is subject to Amtrak approval.

c). FDA Requirements

i). Interior design and installation shall meet all applicable requirements of FDA for water, waste, and general sanitation issues.

ii). All areas inside a food service car must meet all FDA requirements of sanitary construction.

11.10 Maintenance and Material Performance Expectations

a). Attachment Methods

i). Strength of all interior fittings and their attachment to the carbody shall meet APTA Standard PR-CS-S-006-98 and 49 CFR Part 238.233.

ii). Secondary structure shall be provided to securely anchor car interior items that are subject to significant loads, such as handrails, light fixtures, etc.

iii). In instances where FRP components are used, they shall be stiffened and reinforced appropriately with stainless steel, balsa panels or other materials as approved.

(1) Stiffening and reinforcing will be subject to approval by Amtrak for each application.

iv). All components shall be secured to the car auxiliary structure with machine screws, which engage stainless-steel tapping plates.

v). Floating nut assemblies may be used if they are part of a tapping plate assembly.

vi). Nut-inserts (Riv-nuts, Nut-serts, etc.) are not an acceptable alternative to tapping plates. Likewise, spring type mountings are not acceptable.

vii). Where components attach to car interior materials, such as FRP, mounting shall be coordinated so the appropriate provisions are incorporated into the design of those materials.

(1) When the component is mounted on FRP, the tapping plate shall be embedded deeply into the FRP behind the primary FRP wall and completely glassed in using woven glass fabric and resin, so it never loosens for the life of the car.

(2) Mounting holes can be incorporated into the panels to which the components are mounted or drilled in place using a template.

(3) Match drilling using the component as a template is not acceptable.

(4) Components should be mounted from the exposed side of the mounting surface so that the component can be removed for repair or replacement from the front.

(5) Provisions are required to prevent squeaking between the component and mounting.

b). Access Panels

i). Easy access shall be provided for all items that require periodic maintenance, defect repair or replacement.

ii). Panels/ doors covering this equipment shall be hinged, where possible and fastened with approved captive fasteners in a manner that permits these activities.

iii). Safety catches shall be provided for access panels/doors to prevent sudden or accidental deployment.

iv). Window masks shall allow for easy window replacement.

c). Junction Boxes

i). Junction boxes shall be located within electric lockers or hidden behind access panels. See Chapter 15 for additional information.

d). Time to Repair/ Replace

i). All lowest replaceable units (LRUs) shall be replaceable in less than 30 minutes by a single maintenance worker unless otherwise approved by Amtrak. See Chapter 4 for additional information.

11.11 Safety

a). Fire Safety

i). The builder shall provide a Fire Safety Analysis for Amtrak review and approval, in accordance with APTA RP-PS-005-00. See Chapters 19 and 25.

ii). All interior materials shall meet the flammability and smoke emissions requirements of Amtrak Specification # 352 (which incorporates references to 49 CFR 238.103).

iii). Test reports from an independent lab showing compliance with Amtrak Specification # 352 shall be provided in advance of related FAI's.

b). Injury Prevention

i). The car interior shall be designed to provide a safe, comfortable, and convenient functional environment to the passengers, crew, and maintenance staff.

ii). Interior design shall integrate the car sidewall, transverse wall, window mask, ceiling, and other interior surfaces into a harmonious unit.

iii). Generously rounded edges and corners to guard against personnel injury by passengers, crew, and maintenance staff shall be provided.

iv). The use of visible fasteners shall be kept to a minimum, and where used, be inconspicuous.

c). Pinch Points

i). Gaps smaller than 1.5 inches, and larger than 0.5 inches shall be considered potential pinch points that shall be avoided to the maximum extent possible.

(1) Exceptions can be presented to Amtrak if the gap surface depth is less than 0.5 inches.

ii). The Contractor shall develop and submit a Pinch Point Gap Analysis **[CDRL 11-02]** document that identifies all potential pinch points and justifications.

(1) The analysis shall be submitted for Final Design Review FDR approval.

Part II: Interior Components

11.12 Doors and Latches

a). Relevant information for doors and latches as they pertain to interiors is generally described below.

i). Further information for doors and latches can be found in Chapter 12.

b). All interior doors shall be built of robust materials to withstand repeated use without deforming or losing adjustment.

c). Doors, unless otherwise indicated as sliding doors, shall have a continuous piano hinge and shall open outward into the interior of the car unless specified otherwise.

d). All latches and hinges shall be stainless steel piano hinges unless approved by Amtrak during the design review process.

e). Access panel doors shall have stainless-steel piano hinges.

f). Cabinet doors shall be supplied with lanyard or equivalent door limiting mechanism to ensure that no collisions occur between cabinet doors and other components of the train.

i). Doors with lanyards shall be limited to 130 degree opening as a default setting with minimal adjustment. Lanyards shall be removable without the use of special tools.

g). Doors shall close securely without requiring the use of a key and shall remain closed without rattling or becoming loose during operation.

h). As necessary for proper airflow in each car according to the HVAC design, doors shall have a grille located in the lower half of the door panel for air circulation.

i). Electrical locker and utility locker doors shall have a release lever on the inside of the latch.

j). Doors that have passenger safety equipment behind them shall use paddle latches with no locking mechanism. Please refer to Chapter 18 for more information regarding emergency equipment.

k). Doors that cover PA handsets shall be equipped with a single, positive-locking latch or lock. The locking mechanism shall automatically re-engage upon door closure, without requiring the operator to turn a key or manually actuate the latch.

11.13 Cleaning Supply Cabinet

a). General

i). Cleaning supplies shall be stored in a full height cabinet that is at least 2.5 ft wide and 2 ft deep.

ii). One cleaning supply cabinet shall be provided per car.

iii). This cabinet shall have adjustable shelving and retaining devices to hold equipment in place and/or on the shelf.

iv). Provisions shall be made for retention of one cordless vacuum with a dedicated outlet, one broom, one dustpan, one mop, and one mop bucket in all car types.

v). The cabinet shall have a light that turns on when the door is opened and light switch inside.

vi). The cabinet shall have a duplex service outlet.

b). Material and Construction:

i). Cleaning Supply Cabinet door panels shall have melamine or factory-applied laminate.

(1) Alternatively, panels may be constructed of honeycomb or plymetal wall materials.

ii). Adjustable shelves with retaining bars shall be provided in these cleaning supply cabinets.

iii). A minimum of 3 shelves per cabinet shall be the default for the cleaning supply closet design and the final number of shelves and installed spacing arrangement shall be determined at the mockup review.

c). Cleanability:

i). The inside of the cleaning supply cabinet shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

ii). Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

11.14 Windows

a). Window size should be maximized with an equal pitch where possible.

b). All seating positions and accessible spaces should have a view out of the window.

c). See requirements of Chapter 6 and Chapter 19.

11.15 Window Masks

a). The window masks shall be either Fiberglass Reinforced Plastic (FRP) or thermoformed plastic.

b). The window edge should incorporate openings for heating vents at the window and shall not interfere with minimum accessible clearance requirements.

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c). Sidewall heat vents may be separate powder coated aluminum (as appropriate for the mask to window interface), or integral to the window mask.

d). The window masks must not readily collect dust/dirt and shall be easy to clean without removal or special tools.

e). Window masks shall be wrapped in a protective film in accordance with Chapter 19. Paint is prohibited.

f). Panel construction shall allow for removal and recovering of the surface covering at overhaul without damage to the base material.

g). Window masks shall allow for easy window replacement.

11.16 Window Blinds

a). Window blinds shall be provided for all side windows and skylight windows if the option is exercised.

b). Blinds should cover the entirety of the window.

c). Blinds shall be replaceable within a 30 min timespan.

d). A single pull-down blind system shall be provided per window, common across all car types, capable of delivering both daytime solar/glare control and full blackout performance, as follows:

i). In daytime mode, the blind shall provide effective sun shading and glare control without creating an overly dark or opaque interior.

ii). In night-time mode, the blind shall achieve full blackout and privacy suitable for sleeper accommodations.

iii). The blind system may utilize engineered fabric solutions (e.g. graduated density, variable weave, perforation, or equivalent) to enable both modes of performance within a single blind system.

e). Side window blinds shall be provided with a handle on the lower edge that is easy to use and accessible. It shall move the blind with no racking or jamming and without exceeding 5 lbf. during operation.

f). Blinds shall be stored in a valance so that they can easily be accessed for maintenance.

i). Where luggage racks are provided, the blinds may instead be stored behind the luggage rack.

g). Operation

i). Coach side window blinds shall be operated manually by a passenger.

ii). If the skylight window option is exercised, then the skylight window blinds shall be automated so that the conductor can deploy or retract the blinds at

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the push of a button. Alternatives may be proposed for Amtrak's review and approval.

Part III: Storage Areas

11.17 Storage in Coach Areas

a). Each storage location below shall integrate into the coach area in an inconspicuous manner and shall flow seamlessly with the aesthetic of the rest of the coach car.

b). Each storage location shall be clearly labeled according to Amtrak Specification #697.

c). Each storage location shall be easily opened and accessed by any passenger and the use of paddle latches or push-button latches is desired.

d). Folded Wheeled Mobility Device storage spaces shall be dedicated for at least two devices per car along the accessible path for passengers wishing to transfer to another seat.

e). Storage space for an evacuation chair shall be included. Please refer to Chapter 29.

f). Emergency Equipment listed below shall have appropriate storage locations within the coach car. Please refer to Chapter 18 for more information regarding emergency equipment.

i). Trauma Kit and Stretcher

ii). AED

iii). First Aid Kits

11.18 Trash and Recycling Storage

a). General:

i). Trash and Recycling Receptacles shall be provided on each car type in conspicuous locations to encourage passenger/crew use.

ii). Recycling and trash receptacles shall be provided on both ends of each car type as close as practical to restroom areas.

iii). The recycling and trash receptacles shall be either side-by-side in a row or directly across the aisle from one another.

iv). The recycling and trash receptacles shall meet all FDA and NSF requirements for trash containers and their materials.

v). To the extent possible, these receptacles will be designed to maximize trash capacity or at a minimum accommodate the Amtrak standard trash container, per Amtrak Drawing C-96-7591.

vi). The receptacles shall be boldly labeled with an intuitive icon for type of trash, in accordance with Amtrak Specification # 697.

vii). The inside of each trash receptacle door shall be permanently labeled with the Amtrak AMMPS number of the container required for that space.

viii). Each set of receptacles shall include two separate openings and respective bins:

(1) one for trash

(2) one for recyclables (cans, bottles, and newspapers)

b). Material and Construction:

i). Trash and recycling locker door panels shall have melamine or factory-applied laminate.

(1) Alternatively, panels may be constructed of honeycomb or plymetal wall materials.

ii). The trash locker container access door shall be secured closed with a square lock.

iii). The trash locker door shall include a recessed grab handle to be used to pull the door open when unlatched.

iv). Visible hardware and fasteners shall be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

v). Recycling and trash receptacle lockers shall be of panel construction with substructure as appropriate to support components.

vi). The locker shall include appropriate brackets and/or guides, etc. to properly index the trash containers with the openings, and as required, to keep them upright.

(1) These devices shall be rounded, etc. to protect staff handling the containers or servicing the end door from injury.

vii). The locker enclosure with walls & door material will be fireproof or be lined with fire-resistant material.

viii). The locker shall use as few joints as possible in fabrication; they shall be permanently sealed against moisture and vermin.

ix). The locker shall be structurally sound and conform to requirements set out in 49 CFR 238.233.

c). Cleanability:

i). The inside of the trash locker shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

ii). Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

iii). Easy to clean trash guides shall be provided on the sides and back of the locker and on the inside of the locker door. The trash guides shall prevent trash and liquids from getting between the container and locker wall.

iv). Horizontally accessed recycling and trash receptacles shall include a hinged self-closing door flap of a touch-free design that is as large as practical.

(1) This flap shall be as wide as possible.

(2) It shall be possible to open the trash flap by pushing against the vertical surface and further provide for opening without touching the vertical surface.

(3) If possible, the flap should be attached to the locker top surface rather than a door-within-a-door concept.

(4) Spring tension of a stainless-steel spring should prevent the door from swinging/ banging as a result of train motion.

(5) These flaps shall avoid trapping any hands or fingers.

v). Vertically accessed recycling and trash receptacles shall have clear openings without flappers.

(1) Enclosure shall be constructed so as to not ignite, produce lingering char, or allow fire to spread to adjacent interior elements.

d). Required Trash and Recycling Volumes

i). Figure 11-1 defines required trash and recycling capacity volumes in each section of the car:

Figure 11-1: Trash and Recycling Quantities

Section	Location	Type	Volume
Coaches	Entrance Area	Trash and Recycling	7.5 cu ft
	General	Trash and Recycling	20 cu ft
	Accessible Toilet Room	Trash Only	2.25 cu ft
	Standard Toilet Room	Trash Only	2 cu ft
Café	General	Trash and Recycling	20 cu ft
	Café	Trash and Recycling	20 cu ft

11.19 Emergency Equipment

a). General

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i). Emergency Equipment boxes shall be mounted on each end of the car.

ii). These boxes shall contain, at a minimum:

(1) a fire extinguisher

(2) crowbar

(3) hammer

(4) snap lights

(5) first aid kit

iii). Emergency equipment boxes shall not be locked and be mounted in an area easily accessible to all passengers in the event of an emergency.

iv). The labels and gages for the fire extinguisher shall be visible and readable from either a seated or standing passenger in an aisle.

v). Further information on these emergency equipment boxes can be found in Chapter 18.

b). Material and Construction

i). Emergency equipment locker door panels shall have melamine or factory-applied laminate.

(1) Alternatively, panels may be constructed of honeycomb or plymetal wall materials.

c). Cleanability

i). The inside of the emergency equipment locker shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

ii). Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

11.20 Luggage Storage – General

a). General

i). Luggage racks shall conform to 49 CFR 238.737.

ii). The Contractor shall factor in:

(1) Safety

(2) Crashworthiness, abuse, load, and crash criteria

(3) Materials and Workmanship

(4) FDA cleaning clearances

(5) FDA cleaning radii

(6) Sanitary design

iii). All mechanisms should be durable, free from jamming, and racking.

iv). Dimensions, position, and usability will be subject to Amtrak approval during the mockup review.

b). Cleanability

i). The inside of the luggage storage locations shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

ii). Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

c). Required Luggage Storage Volumes and Baggage Analysis

i). Baggage storage volumes shall comply with the requirements of this Specification.

ii). Luggage Tower

(1) Each coach car shall have luggage towers located at one end of the car closest to the side loading door with sufficient capacity for all potential passengers' suitcases to the best extent possible.

(2) Luggage towers shall have a minimum width of 48" and shelf spacing shall maximize the storage of large and medium suitcases.

(3) Each passenger's suitcase shall be stored on the car they are travelling in.

(4) For calculation purposes, assume 50% of the suitcases are large and 50% are medium sized.

(5) Sizes

(a) Large suitcases measure 30" x 20" x 12"

(b) Medium suitcases measure 26" x 18" x 11"

iii). Overhead Luggage Rack Volume

(1) Each car shall have capacity for one carry on case per passenger to be stored widthwise in the overhead rack.

(2) Each passenger's carry-on shall be stored on the car they are travelling in.

(3) Carry-on cases measure 22” x 14” x 9”

iv). As part of PDR, the Contractor shall develop and provide an analysis of how the proposed car arrangements shall comply with the requirements of this specification. **[CDRL 11-03]**

d). Key Features

i). Expected features for Luggage Storage areas are summarized in Figure 11-2 and detailed below.

Figure 11-2: Luggage Storage Key Features

Feature	Short Description	Qty
Trim Panels	Wall panel with provisions for mounting signage, etc.	TBD during design review
Roll Stop	Retaining bar for luggage	1 per shelf level
Glass Side Panel	Safety Glass on side of stack to allow passengers to view bags	On side facing passengers
Kick Strips	Stainless steel strips	each exposed side
Solid Panel	HPL panel	TBD during design review
Upper Shelf	Shorter depth shelf	1
Protective Back Panel	Replaceable wear panel	1 per shelf
Shelves	Full depth shelf	TBD during design review
Bottom Shelf	Floor luggage storage for large bags	1

ii). Trim Panels

(1) Trim panels shall interface with side wall and ceiling with no gaps or dirt traps.

(2) Trim panels are made from HPL composite sandwiches.

iii). Roll Stop

(1) Retaining bars or similar detail shall be provided on large shelving edges that prevent luggage from falling or rolling out.

iv). Kick Strips

(1) Stainless steel kick strips at 9” high should be used on all exposed edges.

v). -Side Panels

(1) A solid panel with HPL skin and no safety glass should be used when stacks are placed up against bulkheads.

(2) In all locations where luggage stacks permit passenger views of stored baggage, safety glass side panels shall be provided.

vi). Upper Shelf

(1) Upper shelf can be shallower for smaller bags and aid in passenger reach of luggage.

vii). Protective Back Panel

(1) Replaceable trim panel that protects wall from scuffing shall be provided. Panel should be easy to replace.

viii). Shelves

(1) Shelving with hard wearing finish shall be provided. Shelf should be easily replaceable, easy to clean, with no dirt traps.

ix). Bottom Shelf

(1) The bottom shelf shall be deep enough for large suitcases. It shall have an easy clean surface, no dirt traps, and a soft back corner.

11.21 Overhead Luggage Storage

a). General

i). Overhead luggage storage racks shall be provided above all coach seating.

ii). Overhead luggage storage shall incorporate dividers to prevent excessive shifting/movement of luggage.

iii). The luggage racks shall consist of modular units bolted to the sidewall and roof structure and extend the entire length of the passenger seating compartment.

iv). The racks shall accommodate carry-on luggage of up to 14 in. x 9 in. x 22 in. in size and smaller personal items.

v). Length of the racks shall match the window pitch so that the bin dividers are centered on the pillar between windows.

vi). Design of the racks shall include as few obstructions as possible for manipulating luggage into and out of the rack.

vii). The luggage bearing surface shall be durable and not require replacement or refurbishment for the life of the car.

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viii). The lower edge of the rack at the aisle shall incorporate a smooth convex radius to mitigate passengers bumping their heads against the underside of the luggage bin.

ix). An easily reached continuous passenger handhold shall be provided facing the aisle way.

b). Strength and Attachment

i). The rack structure and attachment to carbody structure shall have sufficient strength to support a load of 250 lbs., applied over a 10 in. by 10 in. area, midway between adjacent supports with a deflection not to exceed 0.25 in. (including rack itself and its attachment to carbody) and without fracture or permanent deformation.

ii). The load-bearing surface shall be inclined upward from the horizontal toward the center of the car at an angle of approximately three degrees.

iii). The complete and fully loaded luggage rack and its attachment to the carbody shall be designed to resist loads, without failure, due to accelerations of 8g longitudinally 4g laterally and 4g vertically, acting on the mass of the luggage.

iv). The contractor shall demonstrate the strength and luggage retention capability of the luggage racks during the design review.

c). Reading Lights

i). Track-mounted reading light assemblies, as described in Chapter 13 may be mounted on the underside of the racks, for accessible seating locations.

ii). The design shall allow the light fixture units to be moved in small increments longitudinally to be centered above each accessible passenger seating area.

iii). The luggage rack shall be equipped with a wiring chase or equivalent that provides the flexibility in wiring to achieve this.

(1) Alternate arrangements may be proposed for Amtrak review.

11.22 Luggage Towers

a). General

i). Quantity and location of luggage towers shall be guided by the information presented in Chapter 1 as well as the compliance with the Baggage Analysis required in Section 11.20.

b). Materials and Construction

i). A luggage tower shall be of robust stainless-steel construction and include shelves.

ii). Bumper guards shall be mechanically attached to the wall panels within the luggage tower to prevent damage to walls or luggage.

iii). The towers shall have sufficient strength to support a load of 250 lbs. midway between adjacent supports with a deflection not to exceed 0.25 in. and without permanent deformation.

iv). The load-bearing surface shall not be less than 24 in. wide and shall be inclined upward from the horizontal toward the center of the car at an angle of approximately three degrees.

c). Aesthetics

i). The towers shall have decorative graphics and patterns.

ii). Exact graphics, decals, opacity, etc. shall be determined with Amtrak during the design review process.

d). Luggage Tower

i). Luggage towers should be built as a modular set of parts.

ii). Various lengths of luggage tower shall be allowed for within the same modular construction.

iii). Luggage towers should be integrated with the side wall and ceiling with no gaps or dirt traps between it and the adjoining body side panels.

iv). Bumper guards shall be mechanically attached to the wall panels within the luggage rack/tower to prevent damage to walls or luggage.

Part IV: Integrated Electronics and Technology

11.23 Digital Displays

a). General

i). Digital displays shall be provided.

ii). Displays shall be capable of both displaying uniform content across multiple screens and displaying unique information.

(1) This should be adjustable by Amtrak employees who have access to software passwords for such activities.

iii). See Chapters 14 and 26 for additional information and requirements for displays.

iv). Please refer to Exhibit F for further guidance on screen placement.

b). Materials and Construction

i). All display screens shall be rail rated and/or service proven.

ii). Displays shall be integrated into an access panel for ease of maintenance and replaceability.

iii). Behind each access panel should be provisions for electrical, diagnostics, and communications connections even if the display screen is only powered by the Contractor.

iv). Displays shall be flush mounted unless otherwise agreed with Amtrak during IDR and Mockup Review.

c). Required Screen Quantities

i). The required type and quantity of display screens in each section of the car is summarized.

d). Screen Placement

i). General

(1) Screens shall be located to ensure high visibility and legibility for passengers throughout the train.

(2) The intent is to provide consistent access to passenger information without prescribing exact screen sizes, orientations, or positions.

(3) Screen placement shall support dynamic wayfinding, real-time travel updates, and service information including advertising.

(4) Please refer to CMF and suggested layout attachments for further information on screen placement and examples.

ii). Visibility Guidelines by Area

(1) Entrance Areas

(a) Screens should be clearly visible upon entering and exiting the car.

(b) Screens should be positioned to be readable from multiple angles.

(2) All Coach Cars

(a) Screens should be positioned so that at least 75% of passengers have a clear line of sight from their seated position to at least one screen.

(b) Where full visibility is restricted by luggage racks or partitions, multiple screens should be used to maintain coverage.

(c) Content should remain legible from a seated position without obstruction from fittings or furniture.

(d) Available bulkheads and high-level positions shall be used to maximize screen visibility across the car.

(e) Screens shall be positioned to maintain adequate head clearance in walkways- avoiding any obstruction to passenger movement in low ceiling areas.

(f) Seat reservation screens (Option) shall have a resolution comparable to a mobile phone in order to provide a clear display void of any pixilation which would result in screens appearing dated and pixelated. Details of the screen resolution and aspect ratio shall be discussed during design reviews.

(3) Food Service Areas

(a) Screens used for digital menus, Food and Beverage Promotions, or service information must be readable from multiple positions including:

(i) While queuing (even when two or more people are in line)

(ii) Directly at the point of purchase

(iii) From seated dining positions

(4) Screen Format

(a) Aspect ratio, orientation, and mounting should be selected to support clear visibility in each context.

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(b) All screens shall feature anti-glare treatments and meet accessibility standards for legibility, contrast, and resolution.

(5) Screen Selection and Placement

(a) Amtrak reserves the right to modify screen placement or suggest screen selection changes during the design review process and mock up stages of the design.

11.24 Electrical Locker and Panels

a). The car electric/ switch locker shall be located within the car interior.

b). The car PA unit is located in the electric/switch locker, recessed into the wall.

c). The locker shall have separate doors for crew operated equipment, and maintenance operated equipment. See Chapter 15.

d). Locker walls shall be of melamine faced aluminum panel construction with substructure as appropriate to support components.

e). Longitudinal walls facing into the entrance area shall be decorated with melamine or other factory-manufactured laminate material.

f). The locker wall & door material shall be fireproof or be lined with fire-blocking material.

g). The substructure shall be robust to support the numerous heavy electrical panels, etc. located within the locker.

h). The door and frame shall be robust due to frequent use and rough treatment.

i). The door lock shall be a coach key style lock with interior release latch.

j). The electrical locker shall be positively pressurized by conditioned air as part of the HVAC system to prevent dust from entering and accumulating in the electrical locker.

k). Air shall only be allowed to vent from the electrical locker through gaps and voids where dust may enter.

l). There shall not be a vent or grille in the door to the electrical locker.

m). The locker shall include a metal pocket or rack to hold the car defect report book, which is approximately 8.5 in. wide by 11 in. tall by 1 in. thick.

n). The inside face of the electrical locker door shall have an identification sign listing the car number, car weight and freshwater capacity, and an 8.5 in. wide by 11 in. tall metal surface for an FDA inspection form and stickers.

o). The surface must be smooth to allow pasting up maintenance forms i.e. extermination.

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p). A train-level Central Diagnostic Unit control and display shall be included in the locker.

q). The electric locker door shall be labeled in compliance with Amtrak Specifications # 696 & # 697.

r). When the door is opened, the locker service lights shall be illuminated by service-proven, automatic switches.

s). The locker doors shall be hinged to open to not block aisleways/passageways when open.

t). The passage side of the electric locker with the door shall contain all crew and emergency controls in one location to facilitate emergency preparedness and response.

u). At a minimum the following components shall be located on the passage side of the electric locker:

i). B-end emergency fan switch

ii). B-end body end door cutout switch

iii). B-end conductors emergency brake valve (Note: exhaust of valve must not direct onto electrical equipment in the locker, so as to avoid blowing water onto it when valve is activated)

iv). Fire extinguisher enclosure (see Chapter 18)

v). Smoke Detector main display panel and controls, behind a transparent door, accessed with a coach key (see Chapter 25)

vi). Waste system status (see Chapter 17)

vii). System status indicator panel (See Chapter 10)

viii). All other crew operated emergency controls

v). The electrical equipment and switch locker shall be located as appropriate near the end the car.

w). A small switch locker shall be incorporated into the electrical locker, containing just the essential lighting and other control switches needed by the train crew for car setup for consist operation.

11.25 Outlets

a). General

i). Convenience outlets utilizing duplex receptacles as described in Chapter 15 shall be located throughout the interior.

ii). A “120 Volts” label, in accordance with Amtrak Spec. # 697, shall be installed at each outlet location, 0.5 inch from the outlet.

b). Passenger Convenience Outlets

i). Seat Outlets

(1) A duplex receptacle shall be provided for each seat, including those at tables, and all accessible locations in all car types. See the following sections for additional information:

(a) 11.32: Standard Coach Seats and Café

ii). Table Outlets

(1) A duplex receptacle shall be installed on each side of each table, located such that the table or seat does not interfere with access to the outlet.

iii). Mirror Outlets

(1) A duplex receptacle shall be installed adjacent to each mirror. See the following sections for additional information:

(a) 11.37: Standard Toilet Room (STR)

(b) 11.38: Accessible Toilet Room (ATR)

Part V: Interior Structures

11.26 Bulkhead Walls

a). General

i). Bulkhead walls at the end of each passenger seating area shall be constructed of melamine or HPL- faced aluminum panels for durability and to be pleasing to the passenger.

ii). Any fiberglass material shall be covered with a high gloss gel coat. All seams will be sealed, using appropriate sealing materials.

iii). Fasteners shall not protrude from the wall panels but countersunk to be flush with the wall panels.

iv). Bulkheads dividing the car shall be constructed for durability. All joints shall be sealed, using appropriate sealing materials.

v). Fasteners shall not extend from the wall panels but instead countersunk to be flush with the wall panels.

vi). The bulkhead shall meet the structural strength required in APTA PR-CS-S-006-98.

vii). Panels shall be machined smooth and free of sharp edges and burrs. Like panels shall be identical.

viii). Edges and corners shall have generous radii. Finished surfaces shall be decorative laminate, Schneller G20002T or high-pressure laminate.

ix). Amtrak shall reserve the right to choose material it deems appropriate for the application.

x). Provision for textile wainscot panels or sections shall be included.

xi). Panels shall include stainless-steel kick panels equal in height to the sidewall heater grills.

xii). Kick panels shall wrap the edges of the passage/ aisle side edge of the panel.

xiii). Bulkheads shall be designed so that decorative surfaces can be changed at overhaul without damaging the substrate.

xiv). Alternate panel construction will be considered where appropriate.

xv). To keep the number of fasteners low, service panels shall be kept as small as possible while still allowing access to the necessary items requiring access.

xvi). The gaskets shall be protected from crushing through the use of metal-to-metal stops incorporated around the mounting fastener holes.

xvii). There shall be one type of bulkhead wall on the car: bulkheads that include doors.

(1) Bulkheads with Doors

(a) Doors should be made from safety glass, have a minimal frame and an I/R sensor with a backup accessible touch button to open the door.

b). Interchangeable Bulkhead Signage

i). Contractor to provide a modular, easily replaceable/reconfigurable signage solution mounted on the bulkhead wall for the Standard Coach Car to be utilized as a Business Class Car enabling clear, consistent passenger information and flexible reconfiguration of car class designation.

(1) The signage shall be mounted on all bulkhead walls in the Standard Coach Car and shall be visible from the aisle clearly indicated the class of service while complying with Amtrak's branding and accessibility standards.

(2) The signage assembly shall be designed as a modular component that is interchangeable across all cars in the fleet using standardized captive fasteners or approved locking mechanisms, allowing for tool-less conversion from a Standard Coach Car to a Business Class Car designation.

(3) The sign panel shall be constructed of non-flammable, scratch-resistant and UV-stable materials suitable for high-traffic interior environments with permanently bonded or etched graphics to prevent peeling or fading over time.

(4) Signage shall comply with ADA requirements, including tactile lettering and Braille where applicable with placement and contrast meeting visibility standards for passengers with visual impairments.

(5) The sign shall be removable without damage to the bulkhead wall or adjacent components.

11.27 Ceilings

a). Ceiling panels shall be designed and constructed and installed to allow easy individual removal for maintenance and repair of any components included in the ceiling design, such as air ducts.

b). Ceiling panels shall be constructed of material that meets flame, smoke, toxicity, and structural standards, subject to Amtrak's approval.

c). The ceilings shall be made of a wear resistant and easy to clean material, preferably coated metal sheets or HPL panels.

d). Panels shall have a dense phenolic composite edge machined smooth and free of

sharp edges and burrs or may employ imbedded aluminum trim.

e). Alternatively, as appropriate, honeycomb aluminum panels may be used. Finished surfaces shall be decorative laminate, Schneller G20002T or Amtrak approved equivalent.

f). Corners and edges shall be rounded.

g). Panels should be self- trimming.

h). Where trim extrusions are necessary between panels, their size should be minimized.

i). The number of visible fasteners should be minimized.

j). Piano hinged ceiling panels shall be designed, constructed, and installed to allow easy individual opening and closing to provide access for maintenance and repair of any components located above the ceiling, such as:

i). body end door operators and tracks,

ii). HVAC air ducts,

iii). lighting fixtures,

iv). PA speakers,

v). water piping,

vi). wiring, etc.

k). These panels shall be hinged along one edge in such a way that they may be hung open or easily removed from the hinge.

l). Ceiling panel size shall allow a single person to open/ close the panels safely, unaided.

m). The panels shall be secured closed with a quarter turn Southco or equal quarter turn draw-tight vice-action latches with indicators for the locked position. When in the locked/closed position the latch arm shall not move freely. The latch will be determined during the design review process. Self-adjusting compression latches are prohibited.

n). The driver required for the latch will be determined during the design phase.

o). Each panel shall include a passive self-engaging safety catch to prevent accidental panel openings.

p). These safety devices shall be stainless steel and be configured so as not to rattle in service. The safety latch shall be self-engaging when opening and closing the panel.

q). Panels shall be sealed against air leaks around their entire perimeter, with the seal

on the stationary side of the joint.

r). Any components that penetrate the ceiling shall form an air-tight joint to the ceiling to avoid dirt streaking.

s). The seal on these items shall be on the component, rather than the ceiling panel.

t). The method of securing the ceiling panel to the car structure shall ensure that panels cannot drop at all due to any car motion from coupling/ uncoupling as well as under all operating conditions at all authorized speeds on any FRA class of track.

u). Hinged panels, which provide access of overhead equipment such as door operators, water heater, etc., shall be equipped with a limit switch so that when the panel is opened, the associated service lights shall be illuminated.

v). Where the car ceiling panels form the bottom of the HVAC duct, they shall be hinged along one side to allow them to be easily opened for periodic duct cleaning.

11.28 Flooring

a). Floor Covering

i). The car floor shall be equipped with a combination of carpeting and anti-slip flooring to provide an aesthetically pleasing and safe environment for the passenger.

ii). Safety and installation shall be foremost in the design.

iii). Carpeting is used not only for aesthetics, but also as a sound absorbent.

iv). All floor coverings shall be new.

v). The integration of the base floor material, carpeting, and restroom inserts shall be the subject of design review.

vi). Care shall be taken to ensure smooth transitions between flooring, carpeting, and transitions in doorways, restroom entrances, seat tracks, etc., to avoid tripping hazards.

vii). Generally, clamping thresholds should be used at these joints and longitudinal carpet-retaining tracks used to secure carpeting.

viii). Carpet-retaining track locations shall be coordinated with those of LLEPM tracks to ensure a smooth transition.

ix). Joints in the floor beneath the floor covering shall be smooth with no transmit bumps, ridges, and other irregularities through to the finished surface of the covering.

x). The builder shall provide an adhesive system suitable for railcar applications and be unaffected by the inherent flexing of vehicle interior color panels and temperature swings during train operation.

xi). The adhesive shall not degrade the flammability, smoke emissions, and toxicity characteristics of the carpet, composite flooring, or car substrate.

xii). The composite flooring, floor coverings, and their adhesive systems shall be able to withstand a wide variety of periodic and specialized stain removal cleaning typical for a passenger rail vehicle without any stretching, puckering, rippling, fraying, pulling up, or other adverse effect to the surface appearance or function.

xiii). Cleaning may occur daily and at least every 90 days using a carpet cleaning machine, hot water, and caustic or acid chemicals.

xiv). Daily specialized spot cleaning will take place using chemical cleaners, scrubbing with brushes, and application of gum remover.

xv). The base floor and floor coverings shall be installed in accordance with the best practices of the industry and OEM instructions.

xvi). Floor coverings, their trim, and the installation of these materials shall result in a smooth and flat floor covering for the life of the floor covering. Coverings shall be removable at end-of-life with no damage to the underlying floor panels.

xvii). Floor covering seams should be kept to a minimum and the plan for seam location shall be approved by Amtrak during the design review process.

xviii). The carpet vendor shall provide detailed recommended cleaning instructions for the builder to include in the maintenance manual sets.

xix). To the extent possible, floor coverings for each site shall have the same dimensions among all cars, or among like cars at a minimum, so materials can be cut to size outside of the car and be installed with minimal on-car trimming.

xx). Repairing floor coverings is not allowed; instead, the covering must be replaced with new material up to the nearest seam. Any exceptions to this requirement will require approval from Amtrak on a case-by-case basis.

xxi). High-wear carpet locations especially center aisle carpers shall be designed to be fully replaced in under 30 minutes.

xxii). Walk-off carpets shall be installed and secured in all entrance areas to each car to prevent damage to the interior flooring of each car. Walk-off carpets shall be designed for high-traffic environments and must function under all conditions including temperature fluctuations, vibration, continuous passenger loading, and free of any condition that could create a trip hazard.

(1) The walk-off carpet system shall be easily replaceable and shall trap water and soil at the entryway to improve cleanliness and safety while providing a stable, firm and slip-resistant walking surface consistent with all accessibility requirements for floor surfaces.

(2) Walk-off carpets shall be replaceable in 15 minutes or less.

xxiii). Please refer to Figure 11-3 below for general outline of where each flooring type will be utilized:

Figure 11-3: Floor Covering Table

Location		**Flooring Type**
Standard Coach Seating Areas	Aisle	High Traffic Carpet 1
	Under Seats	High Traffic Carpet 1
	Entrance area	Anti-Slip Rubber Flooring 1
Premium Accessible Coach Seating Areas	Aisle	High Traffic Carpet 1
	Under Seats	High Traffic Carpet 1
	Entrance area	Anti-Slip Rubber Flooring 1
Café Areas	Aisle	Anti-Slip Rubber Flooring 1
	Under Seats (Booth)	Anti-Slip Rubber Flooring 1
	Entrance Area	Anti-Slip Rubber Flooring 1
	Café Queuing Area	Anti-Slip Rubber Flooring 2
	Café Crew Area	Anti-Slip Rubber Flooring 2
Restrooms	ATR and STR	Anti-Slip Rubber Flooring 2
High Capacity Coach Areas (Option)	Aisle	High Traffic Carpet 1
	Under Seats	High Traffic Carpet 1
	Entrance Area	Anti-Slip Rubber Flooring 1

b). Carpeting and Securement

i). Carpet

(1) Heavy-duty commercial carpet shall be provided as indicated including seating areas.

(2) Carpet shall be designed for modular replacement.

(3) All areas of common design shall use template cut carpets. Linear carpets such as those used for aisles, shall likewise be of identical sizes within car types.

(4) All carpet shall be designed per Amtrak specification and shall be designed to provide maximum passenger comfort and safety as dictated by ergonomic requirements.

(5) The carpet shall be compliant with all applicable APTA and ADA guidelines.

ii). Carpet Securement

(1) Generally, the aisle and hall carpet shall be mechanically secured to the floor using longitudinal carpet-retaining tracks along both sides of the center aisle and along the outside edges of the car.

(2) A cove shall be provided where the carpet meets the longitudinal wall for ease of cleaning.

(3) Clamping thresholds shall be used at transitions to rubber or composite flooring and metal moldings, as required, such as at bulkheads.

(4) The carpet-retaining tracks along the aisle may be incorporated in the tracks for LLEPM.

(5) The spacing between the carpet-retaining tracks, moldings, etc. shall be identical on all cars so that carpeting does not need to be trimmed to fit a specific car.

(6) If carpet must be glued into place at certain locations, these require Amtrak approval.

c). Anti-Slip, Skid Resistant Flooring

i). Skid-resistant, waterproof composite floor covering, that has been tested and proven to meet ADA requirements, shall be used where indicated including passageways, restrooms, food service areas and other utility areas where carpet is not installed.

ii). The floor design must comply with 36 CFR Part 1192 Appendix I and RVAAC VI Floor Surfaces recommendations.

iii). The floor covering shall have an integral cove of 4 in. radius, where specified, for easy cleaning, and shall extend from 2 in. to 6 in. up the wall, depending upon application.

iv). Transition strips shall be provided between composite flooring and carpeted areas.

v). Transitions between flooring types shall produce level changes in flooring surfaces less than 0.25 in.

vi). The trim strip between the wall lining and the floor covering shall be sealed to prevent harborage, accumulation of debris, or incursion of water and cleaning fluids.

vii). Floors in entrance areas and end passageways shall have a 3 in. wide high-contrast visibility strip directly adjacent to door openings to delineate the door opening for visually impaired passengers.

viii). The high-contrast strip at the side entry doors shall be made of high-performance photo-luminescent material so that it is integrated into the LLEPM system for exit pathway marking.

ix). The LLEPM material and application shall comply with APTA Standard APTA-PR-PS-S-006-23 Emergency Egress/Access Signage and LLEPM for Passenger Rail Equipment and shall be embedded in the floor system.

x). All flooring shall be installed using an adhesive system that is approved by the flooring manufacturer and Amtrak. Self-adhesive style flooring is prohibited (i.e. Nora nTx).

11.29 Entrance Area (Vestibule)

a). General

i). Entrances for the cars shall have entrance doors on both sides of the car.

ii). Entrance areas shall include a 60” turning circle.

iii). All entrance areas shall be designed and constructed to form a safe and attractive environment.

iv). Visible fasteners shall be minimized.

v). Modularity shall be optimized during the design process.

vi). All mounted items in the area shall be secured to the module structure through the use of fully embedded tapping plates when pullout strength or expected weight is greater than 20 lbs.

(1) These are expected to last the life of the car without coming loose.

vii). Consistent features shall be maintained across entrance areas to the extent possible.

viii). Please refer to Exhibit F for further guidance.

b). Integrated Systems

i). HVAC

(1) Supply Air Diffusers

(a) Conditioned air is delivered to the entry area via 2 supply air diffusers with adjustable air flow control.

(2) Exhaust Grille

(a) Exhaust air is removed from the entry area via the exhaust air grille which is located at the upper portion of the module.

(3) Air Circulation Fans

(a) Air circulation fans with controls shall be provided.

(b) The purpose is to stir air and decrease the potential for temperature differential between the vestibule and passenger area.

(c) The air circulation fans shall have manual adjustment of the airflow direction.

ii). Communications

(1) Speaker

(a) PA speaker shall be located on the central ceiling panel.

(b) The PA speaker shall have an associated mute button.

(c) The speaker used in this location shall be identical to PA speakers used in other locations in the car for ease of maintenance and replacement.

(2) Passenger Emergency Intercom

(a) Two (2) PEIs shall be located in every car as called out later in this section.

(b) The intention of this button is to notify the conductor and flag the entire train that there is an onboard emergency.

(3) All communications equipment shall meet the requirements in Chapter 14.

iii). Electrical System

(1) All electrical equipment in the entrance area shall meet the requirements in Chapter 15.

(2) Junction Box

(a) The junction box shall be located where practical and shall be presented during the design phase. It shall be easily accessible by the maintenance group.

iv). Lighting System

(1) Lighting general information is shared in detail for each area. Detailed lighting information can be found in Chapter 13.

(2) Note that all lighting part numbers, manufacturers, and temperatures shall be proposed by the Contractor and approved at Amtrak after the lighting simulation during the design review process.

v). Emergency Equipment

(1) Chapter 25 details emergency equipment requirements.

(2) Smoke Detector

(a) Smoke Detectors shall be mounted on the central ceiling panel.

(b) The smoke detector used in this location shall be identical to the smoke detectors used in other locations in the car for ease of maintenance and replacement.

c). Security

i). Many items within the entrance area will need to be secured.

ii). The following items are identified with specific locking preferences:

(1) Crew access panels

(2) Boarding equipment such as ramps, transfer bridges, etc.

iii). Any other locking or security items will be discussed with Amtrak during design reviews.

d). CMF and see CMF exhibit for details

i). Wall Panels

(1) Sidewall Panels along the carshell wall shall be made from molded thermoplastic or melamine resin composite with an easy to clean surface finish.

(2) Partition Walls shall be created from a composite structure such as aluminum honeycomb, melamine resin, or HPL skinned honeycomb panels.

(3) The finish of the wall and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

ii). Ceilings

(1) Ceiling shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(2) The finish of the passenger facing side of the ceiling panel and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(3) The finish of the material on the non-passenger facing side shall be coated such that there is no risk of corrosion from moisture from steam or humidity within the car.

iii). Flooring

(1) Flooring within the entrance area shall be made from high traffic anti-skid flooring. Please refer to Section 11.28 for details on this flooring type.

e). Key Features

i). A comprehensive list of expected features in entrance areas is provided in Figure 11-4 and detailed below.

ii). In addition to these requirements, the Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design. All mechanisms described below should be durable, free from jamming, and racking. The design should meet abuse load and crash criteria. Dimensions, position, and usability will be subject to Amtrak approval during the mockup review.

Figure 11-4: Key Features - Entrance Areas

Feature	Short Description	Qty
Handholds	49 CFR 38.115 compliant handrails	4
Door Threshold	Anti-slip, color contrast, texturized flooring at door	2
Trash Bin	Trash bin with push flaps and access door	2
Panel Work	HPL panels and Tedlar style sidewall liners split horizontally into two types (See Exhibit F)	All
Passenger Information Screens	Digital display monitor (PIS/OTIS) at each door	2
Control Panel Doors	Access panels with seamless features to panel work	All access panels
Kick Strips	9” stainless steel strips	All exposed panel work
Folding Stairs/Trap Door	Steps connecting low level platforms	1
Storage for Step Stool	Storage location for step stool	1
Wheeled Mobility Device Lift	Wheeled mobility device lift for boarding	1
Crew Door Control Panel	Exposed crew controls and buttons for doors and lifts	1
Electrical Control Panel	Maintenance storage location behind access panel	1

PEI	Emergency Alert system with intercom	1

iii). Handholds

(1) Compliant handholds should be supplied on both sides of each door for low- and high-level loading heights, and at key access point along aisles.

(2) Grab bar positioning will be subject to mockup testing and Amtrak approval.

(3) Grab bar shall meet the requirements in 49 CFR 38.115. Handhold grab bars shall be made from stainless steel.

iv). Door Threshold

(1) Door threshold should have a slip-free surface and a contrasting floor color to the main entrance area flooring to mark the threshold.

v). Trash Bin

(1) Trash bins shall be provided with stainless steel push flaps.

(2) Please refer to Section 11.18 for more information on trash and recycling requirements.

vi). Panel Work

(1) Entrance areas should be designed to have well fitted clean panels with a high tolerance build to manage split lines and cabinet edging.

(2) There should be no protruding equipment, snag point, or dirt traps.

(3) Lower side wall panels shall define a material split, with the lower panel in a wood finish.

(4) All equipment storage cabinets should be accessible using a crew key with discreet locks.

vii). Hand Sanitizer Dispenser

(1) An infrared hand sanitizer dispenser shall be installed in each car in the vestibule.

(2) The dispenser shall provide a touchless and hygienic solution for dispensing hand sanitizer in public places.

(3) Infrared Sensor

(a) The dispensers shall utilize advanced infrared sensor technology for touchless operation.

(b) The IR sensor shall have an adjustable sensor range to optimize detection distance.

(4) The dispenser shall accommodate a minimum of 1000 ml of hand sanitizer.

(5) The sanitizer reservoir shall be easily refillable without the use of tools.

(6) The dispensers shall be powered via hardwired connection.

(7) The dispensing volume shall be adjustable between 1.5 ml and 3.5 ml per application.

(8) The dispensers shall be constructed using durable and easy-to-clean materials suitable for high-traffic areas and compliant with all requirements of this specification.

(9) The dispenser shall have an LED indicator for low sanitizer levels.

(10) The dispensers shall be wall-mounted and shall allow for easy removal and replacement.

(11) Dispensers shall come filled with an unscented, hand sanitizer with a minimum alcohol content of 60%.

viii). Passenger Information Screen (PIS/OTIS)

(1) Display screens should be supplied on both sides of the interior vestibule door.

ix). Control Panel Door

(1) All equipment storage cabinets should be accessible using a crew key with discreet locks.

(2) These doors should use the same front panel as the other entrance area wall paneling.

x). Kick Strip

(1) Stainless steel kick strips at 9” high should be used in all entrance areas.

xi). Trap Door and Folding Stairs

(1) Stairs shall comply with ADA standards for riser, tread, nosing and handrails.

(2) The rake of the stairs shall be maximized within these guidelines.

(3) An additional lower handrail should also be included to assist children climbing the stairs, handrails should be free from snags.

(4) See chapter 6 and 12 for details.

xii). Step Stool and Storage

(1) A step stool shall be provided which aids passenger boarding when not at a level platform. The step stool shall work at floor height at all platforms.

(2) A storage location shall be labeled and located behind an access panel with a paddle latch for a step stool.

xiii). Wheeled Mobility Device Lift

(1) A wheeled mobility device lift shall be mounted by doors on both sides of the car, where any passenger with disabilities may board.

(2) The wheeled mobility device lift mounting shall not impede on passenger ingress or egress through the doorway.

(3) Please refer to Chapter 6 and 12 for more information.

(4) Crew door controls shall be exposed for ease of access and located on a panel near the entry and exit doors of the train. Please refer to Chapter 12 for more information.

(5) Electrical control panels shall be located behind access panel doors that are operated using a square lock, or as otherwise approved by Amtrak.

xiv). PEI

(1) Intercom and alert button shall be integrated into the sidewall for emergency notification and communication. Please refer to Chapter 14 for more information.

f). Lighting

(1) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups. Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

ii). Lighting Types and Locations

(1) Locations and sizes will be subject to review, user testing, and Amtrak approval.

(2) LED Panel Spotlights (White Lights)

(a) Small circular LED light panels shall act as spotlights above the doors, along aisles, and in the vestibule.

(b) The frame for the spotlights shall be color matched to the ceiling.

(c) Light should enhance contrast for visibility and safety.

(3) Step Lights

(a) Step lights should illuminate interior threshold during boarding.

Part VI: Coach Areas

11.30 Interior Structures – Coach Specific

a). Key Features

i). A comprehensive list of expected features of the Coach Interior structures is provided in Figure 11-5 and described in detail below.

Figure 11-5: Key Features - Coach Interior Structures

Feature	Short Description	Qty
Windows	Windows in the side wall of the car	TBD
Blinds	Blinds that cover windows	1 per window
Window Pillars	Structural member between windows	between each window
Window Masks	Cover for window installation	1 per window
HVAC Gondola	HVAC air path through the center of the car	all ceilings
Side Ceiling Panels	Lateral side ceiling panels along the curve from sidewall to ceiling panel	all ceilings
Kick Strips	9” high stainless steel strips	All wall panels
Lower Sidewall Panels	HPL sidewall liners with wood finish	All
Coat Hooks	Coat hooks that hold up to 50 lbs	2 per seat row
Luggage Shelf	Overhead luggage rack	Maximize
Reservation Screen	Passenger information screen for each seat assignment (option)	1 per seat row on each side of car

ii). General

(1) The Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design.

(2) All mechanisms described below should be durable, free from jamming, and racking.

(3) The design should meet abuse, load, and crash criteria outlined in CFR.

(4) Dimensions, position, and usability will be subject to Amtrak approval during the mockup review.

iii). Windows

(1) Windows shall be provided that meet the requirements of Section 11.14.

iv). Window Blinds

(1) Side window blinds shall be provided that meet the requirements of Section 11.16.

v). Window Pillars

(1) Window pillar width should be minimized.

vi). Window Mask

(1) Window mask should minimize or mask glass corners to create an architectural aesthetic.

vii). HVAC Gondola

(1) Gondola shall be designed to maximize headroom.

(2) Lighting washes both centrally into gondola and across side ceilings shall be provided.

(3) The gondola should terminate and transition to a separate lower ceiling section if any equipment or junction in the interior architecture prevents the gondola from completing a full uninterrupted run. Contractor shall present the solution at design review for review and approval.

(a) For example – where the ceiling moves around an ATR or STR.

(4) At these junctions, the gondola should terminate in a straight line with architecture that creates a visual ring at the termination point.

(5) The transition between ceiling profiles should be treated with clean and well considered intersections.

(6) These lower ceilings should have their own lighting light wells and HVAC vents.

viii). Side Ceiling Panels

(1) These side ceiling panels shall be curved to create a smooth transition from the ceiling to the back of the overhead luggage racks.

ix). Kick Strips

(1) Stainless steel kick strips at 9” high should be used in all coach areas.

x). Lower Sidewall Panels

(1) Lower side wall panels shall be provided such that the trim panel has minimized thickness to take advantage of full width of the car body.

(2) These should be designed to have well-fitted clean panels with a high tolerance build to manage split lines and cabinet edging.

(3) These panels shall define a material split, with the lower panel in a wood finish.

(4) There should be no protruding equipment, snag point, or dirt traps.

xi). Coat Hooks

(1) Coat hooks should be provided for each seated location, integrated with the luggage shelf and valance.

(2) Hooks should be easy to move if seat positions or set pitch are changed in the future.

(3) A solution where integrated coat hooks are provided at the back of the seat will also be considered and is subject to Amtrak approval during the design review process.

xii). Luggage Racks

(1) Overhead Luggage Racks shall meet the requirements of:

(a) Section 11.20: Luggage Storage – General

(b) Section 11.21: Overhead Luggage Storage

(2) The overhead luggage racks should be built in modules that align with window placements.

(3) Split lines and module length should be consistent and to visually match the window module splits.

(4) The overhead luggage racks shall be modular to create different length segments using extruded aluminum.

(5) The following elements shall be included:

(a) Back Barrier – Back of rack should prevent bags from damaging side ceiling panels.

(b) Roll stop Nosing – Nosing of luggage rack should be suitable to secure bags with a 3” restraint bar to the best extent possible.

(c) Glass Panel – Glass panel construction from safety glass to allow passengers to see bag and let light through – frosted finish or laminated with decorative film or etching pattern. The glass panel shall have protective film applied in the event of a failure that will stop shattered glass from falling on passengers.

(d) Module Dividers – Divider brackets to prevent bag slip – discreet design with no sharps, snags, or dirt traps.

(e) Blind Storage – Window blind storage should be easily accessible and discreetly hidden behind rack.

b). Lighting Requirements

i). General

(1) To the best extent possible, all lighting shall be provided via indirect lighting unless otherwise approved by Amtrak.

(2) Lighting general information is shared in the points below.

(3) Standard Coach

(a) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups.

(i) Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

ii). Lighting Types and Locations

(1) Gondola Ceiling Lighting

(a) Gondola Ceiling Lighting shall wash light from the gondola across both the central ceiling panels and the side ceiling panels.

(2) LED Panel Spotlights (White Lights)

(a) In the case where spotlights are proposed, small circular LED light panels shall act as spotlights along aisles.

(b) The frame for the spotlights shall be color matched to the ceiling.

(3) Standard Coach ONLY

(a) Compartment lighting at a fixed temperature with indirect wash lighting under each seat or seat pair shall be provided as an option.

11.31 Seats – General Ergonomics

a). Through the use of the CAESAR Database for Anthropometric Data, seat frame, cushion, and arm rests shall be designed and optimized to accommodate all passenger sizes from the 5th percentile female through the 95th percentile male in a full range of normal seating positions to the extent possible and as approved by Amtrak.

b). A human factor specialist shall be involved in all stages of the design, testing, and

review process.

i). A coach seat should provide initial comfort when first seated and then comfort over the length of passenger travel (minimum of 2 hours and maximum of 72 hours).

(1) Café Seating shall have a minimum of 2 hours and a maximum of 12 hours of comfort.

ii). It should comfortably accommodate a variety of seating postures and provide comfort when seated posture changes.

iii). Back and seat cushions shall both be custom contoured through pressure mapping analysis to minimize contact pressures through the widest possible range.

iv). Lumbar support shall accommodate all passenger profiles to the extent possible.

v). Sufficient knee space to allow for multiple seated positions for a 95th percentile male with no contact against the next seat backrest.

vi). Test rigs shall be utilized to evaluate both the initial design properties and longevity of materials, including but not limited to deflection, stiffness, thickness, material wear, and appearance.

vii). Deflection, stiffness, and thickness properties shall not decrease by more than 20% over the entire life of the cushion.

viii). Wear and appearance deterioration shall be minimized to accommodate an 8-year design life. Further detail is provided in Chapter 18.

11.32 Standard Coach Seats

a). Standard Coach Seats General

i). A modular system shall be used for seating arrangements, so Amtrak can change seat spacing, add, or delete seats in the future. This shall be accomplished without having to make any changes to the car other than moving the seats. The Contractor will submit their proposal for approval during the design review process.

ii). The standard coach seat is designed to work as pairs with four seats across the width of the train.

iii). The seat should be optimized for both day and nighttime operations.

iv). Features are included that aid in better night’s sleep or support passengers on longer journeys by maximizing comfort and available passenger space.

v). The minimum width of the seat between armrests should be 22” when arranged with a minimum aisle dimension of 22”.

vi). All seats must have a movable armrest.

vii). Braille and raised characters shall be posted at the seat's headrest edge.

viii). A single seat type may be required in smaller numbers to accommodate transfer seats, maximize capacity and fulfil requirements around accessible paths in the accessible coach car.

ix). Contractor is responsible for meeting all technical requirements for all seat types, including any potential single-seat designs.

x). All seat types are expected to be included in the mockups.

xi). Please refer to Chapter 1 for information regarding quantity of this accommodation type desired.

b). Standard Coach Seats Attachment

i). Passenger revenue seats must meet the performance requirements as defined in APTA Standard PR-CS-S-016-99, Standard for Passenger Seats in Passenger Rail Cars.

ii). This APTA Standard shall also be used as a design guideline.

iii). Seats shall be designed to provide maximum passenger comfort and safety.

iv). The seats shall be mounted on a standard adjustable seat-mounting track allowing for pedestal or pedestal wall mounting.

v). Mounting slots shall be included on the underside of the seat frame allowing for lateral adjustability so that the aisleway centerline and dimensions are consistent throughout the car with no misalignment or staggering.

vi). The seat attachment angle to the car floor shall optimize passenger knee room.

vii). HPPL signage shall be located either on the seat pedestal or seat frame.

viii). See Chapter 13 for additional details. HPPL shall not be placed on the floor to the best extent possible.

ix). Approved tamper-resistant means of connections to a subfloor cable duct for electrical supply and future audio/visual data lines shall be provided.

(1) These connections shall provide for ease of future changes in seat spacing.

x). Revenue seats shall be mounted in seat tracks on the floor and/or wall in all car types.

xi). Seat tracks shall be installed with Amtrak approval for all processes and drawings.

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xii). Between seats, the wall and floor seat tracks shall be covered with a trim suitable for the application and as flush to the floor or wall panel as practical.

(1) Alternative floor and wall seat track installation locations shall be allowed as approved by the Customer.

xiii). Seats shall be mounted to the seat tracks in accordance with the strength and crashworthiness requirements of 49 CFR Section 238.233 (a) and APTA standard PR-CS-S-016-99.

c). Standard Coach Seats Key Features

i). A comprehensive list of expected features in this type of coach seat is provided in Figure 11-6 and detailed below.

ii). In addition to these requirements, the Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design.

iii). All mechanisms described below should be durable, free from jamming, and racking.

iv). The design should meet abuse load and crash criteria.

v). Dimensions, position, and usability will be subject to Amtrak approval during the mockup review.

vi). Standard seat configuration will be all seats facing forward. The seat design shall be modular, so Amtrak can reconfigure the layout in the future.

Figure 11-6: Key Features - Standard Coach Seats

Feature	Short Description	Qty
Headrest Pillow	Adjustable portion of seat headrest	1
Privacy Wing	Protrusion on headrest to provide privacy	2
Hand Grab	49 CFR 38.115 compliant handrails	1
Reading Light	White light with adjustable lens and toggle switch	1
Seat Recline Mechanism	Sliding mechanism that attaches seat back to seat pan for recline	1
Calf Rest Pad	Cushioned pad for leg support	1
Seat Controls	Manual buttons that adjust seat configuration features	1
Folding Armrests	Arm rests that rotate upwards when stored	2
Flexible Net Pocket	Pocket at the base of the back of a seat for storage	1
On Seat Power	Outlets and USB integrated into the seat	2
Central Foot Pedestal	Support structure for a seat or pair of seats	1
Storage Strap	Small elastic band for retaining items	1

Fold Out Table	Table stored in the back of a seat	1
Cup Holders	Metal cup holder ring that folds flush with seatback	1
Device Holder	Small ledge for propping up a cell phone	1
Fold Out Footrest	Footrest that is stored in the back of a seat	1
Under Seat Lighting	Lighting shall be provided to illuminate the space under each seat	1

vii). Seat Dimensions

(1) The following seat dimensions should be used as the basis for designing the seat.

(2) Note that seat dimensions are subject to Amtrak approval during the design review and mockup review processes.

(a) Seat width between armrests – at least 20”

(b) Seat depth – at least 18”

(c) Highest point on seat pan (at knee bend) 19” from the ground

(d) Natural seat recline angle when in upright position – 105 degrees as measured from passenger facing side of seatback to passenger facing side of seat cushion.

(e) Seat pan recline – 5-7 degrees as measured from parallel to the floor.

(f) Seat pitch shall be a minimum of 42 inches.

viii). Headrest Pillow

(1) Headrest pillow should be adjustable in height to comfortably accommodate the range from 5th percentile female to 95th percentile male seated heights.

(2) It should have adjustable wings that fold outwards to adjust the width of the headrest while also providing lateral support for the head when the passenger is resting or sleeping in an upright seated position.

ix). Privacy Wing

(1) Privacy wing on the seats should provide good separation between passengers at head level and be wide enough and high enough as not to impact shoulder width for taller passengers.

x). Hand Grab

(1) Every aisle seat should have a compliant accessible grab for better access along the aisle.

(2) Grab bar positioning will be subject to mockup testing and Amtrak approval.

(3) Grab bar shall meet the requirements in 49 CFR 38.115.

xi). Reading Light

(1) Seats should include a reading light that is positioned so as not to disturb neighbor during nighttime hours.

(2) Passengers should be able to adjust the lighting angle to cast light over the shoulder and into the lap or at a position suitable to read a book at night.

(3) Light intensity should have three settings.

xii). Seat Recline Mechanism

(1) Seat recline mechanism should allow the seat pan to slide forwards so as not to burden the full recline onto the passenger behind in addition to reclining the seat back.

(2) It should be easy to use by people of all abilities and shall not require more than 3 lbf to adjust or operate.

(3) The mechanism should be durable and rattle free. It should be free from finger traps.

xiii). Calf Rest Pad

(1) Calf-rests tilt up for optimal leg support and comfort. Angle and width to be optimized as part of a detailed human factors study.

(2) The calf rest should be integral to the seat pan to avoid seat pinch.

xiv). Seat Controls

(1) Seat controls for recline and leg rest should be located within easy reach of a customer – for example, on the inner side of the outside armrests.

(2) It should be possible to control the seat back recline and the calf rest independently.

(3) The seat controls should be intuitive, easy to use by people of all abilities, and shall require 3 lbf or less to operate.

xv). Folding Armrests

(1) 2” wide armrest shall include a soft wrap around the top for comfort and a hard-wearing bottom wrap and side cap for durability.

(2) Armrests should be included on both sides of the seat and in between a seat pair.

(3) Armrest should fold flush or sub flush to the front surface of the seat back.

xvi). Flexible Net Pocket

(1) A storage pocket should be provided on the back of the seat.

(2) A semi-rigid frame with a net suitable for passengers to stow personal items or for Amtrak literature.

(3) The net should be durable and allow a clear view of the items placed inside to aid quick and easy cleaning routines.

(4) The design should allow for this element to be quickly and easily replaced on the train.

xvii). On-Seat Power

(1) Two USB ports should be provided on the back of each of the seats.

(2) Two duplex plug sockets should be located on the seat pedestal. Sockets should be shielded from spills from the table or cup holder.

xviii). Central Foot Pedestal

(1) A central seat pedestal should be positioned to maximize foot clearance.

(2) Interface with the floor should allow easy cleaning.

xix). Storage Strap

(1) Behind the fold down table a ledge and elastic restraint band suitable to allow customers to simply store smart phones and other personal items behind table.

(2) The band should be durable and easily replaceable.

xx). Fold Out Table

(1) A fold out table should be provided on each seat back. The fold out tray table in all positions shall be operable with one hand using 5lbf or less.

(2) The table shall have an independent pivot point so that its resting position will not be impacted by the recline of the seat in front.

(3) The latch design should prevent accidental activation, and the table should be free from rattle when either stored or fully deployed.

(4) The table should be able to extend forwards telescopically.

(5) The usable surface should allow people to use a 15” laptop – even when the seat in front of the passenger is fully reclined.

(6) The mechanism should be durable and rattle free.

(7) It should not extend accidentally.

(8) When the table is deployed it shall be able to support a 50 lbf point load on the end of the table without damage.

xxi). Cup Holders

(1) A metal cup holder should be positioned on the back of the seat.

(2) Cup holders should be placed in positions outside of knee and leg clearance and free from the movement of the seat.

(3) The cupholder should be an open clasp design capable of storing and securing cups of various diameters.

(4) It should be designed to prevent passing passengers getting snagged.

xxii). Device Holder

(1) A fold out ledge with clip should allow the secure mounting of passengers’ personal devices.

(2) The clip should be sprung and adjustable so different sizes can be securely kept in place including a typical tablet and/or a smartphone.

(3) The angle should be set so it is usable in both recline and upright positions.

(4) The latch should be designed in such a way to prevent accidental activation.

xxiii). Fold out Footrest

(1) A fold-out adjustable footrest should be provided.

(2) There should be three set positions, and the footrest should have a degree of angle adjustment.

(3) The size and positions should be defined by a detailed human factors study.

xxiv). Under Seat Lighting

(1) Lighting shall be provided to illuminate the space under each seat.

d). Standard Coach Seats Functional Elements

i). Seat Recline of 20 degrees

(1) Recline features

(a) When seats are fully reclined there shall be at least 7” of knee clearance for a 95th percentile male between the back of the seat in front of the passenger and his knees.

(b) The recline features shall be operated manually:

(i) The seatback shall recline

(ii) The seat pan shall slide forward

(iii) The calf rest shall extend forward to raise the legs

(iv) The footrest shall be able to be folded out

ii). Seat Rotation (OPTION)

(1) As an option, Amtrak shall be able to elect to have a manual rotation feature for each of the seats in standard coach.

(2) If option is exercised, the seats shall all be installed facing the same direction on both sides of the aisle.

(3) Seats should have the capability to rotate at the end of the line so that all seats are facing the opposite direction.

(4) This rotation would be manually performed by Amtrak staff.

(5) Each seat bench should be able to be rotated in less than 30 seconds and shall lock in place.

(6) A visual indicator of the seat being properly secured shall be provided.

(7) Any seat not fully locked into place shall send an alert to the conductor for inspection.

(8) The controller shall report alerts and faults to the car diagnostic system. See Chapter 24 for additional information.

e). Standard Coach Seats – Emergency Window Access

i). Seats shall not obstruct emergency windows and, to the extent possible, shall be arranged to optimize passenger access to window views.

f). Standard Coach Seats CMF

i). Please refer to Exhibit F for further information.

ii). All colors, cushions, fabrics, and appearance shall be as directed by Amtrak. All revenue passenger seats shall share the same common design appearance.

iii). Individual components shall be interchangeable wherever possible.

iv). They shall have a profile that is free of sharp corners and edges.

v). All seat coverings shall use synthetic leather.

vi). Arm rests, if upholstered, shall use the same covering as the seats.

vii). Final construction of the cushions including sewing and fire blocking shall be subject to the approval of Amtrak.

11.33 Café Seating

a). Booth Seating

i). Arrangement and Dimensions

(1) A repeatable booth module of back-to-back seating shall be provided in the Café.

(2) Booths should be 2x2 across the aisle.

(3) Seats shall be mounted to the seat tracks in accordance with the strength and crashworthiness requirements of 49 CFR Section 238.233 (a) and APTA standard PR-CS-S-016-99 as applicable.

(4) Seat width shall be maximized with a minimum acceptable dimension of 40” wide for a seat suitable for two passengers.

(5) To achieve a 32” accessible path between Café seats the side wall detail/clearance will need to be minimized and tolerances will need to be tightly controlled.

(6) Seat pan height shall be between 18” and 19” with a seat pan depth of no less than 18”.

(7) Seat back height from finished floor should be a minimum of 38” with a higher divider no lower than 44”.

(8) All seat dimensions, cushion density/ shore hardness will be subject to mock-up review, testing and approval by Amtrak.

(9) Booths shall be located on either side of a table in the Cafe.

(10) The table shall be centered in the window alignment.

(11) The privacy dividers in each booth shall align with the window pillars in a repeating 81” pitch.

ii). Under-Seat Storage

(1) Each booth seat shall be designed such that under the seat cushion there is a storage compartment for crew and cafe emergency storage items.

(2) The access to these seats should not impact the seat comfort or aesthetic.

(3) The actions required to access to the storage location should take the average person under 30 seconds.

iii). Seat Cushions

(1) Booth seat cushions should be contoured to aid seat comfort.

(2) Seat cushions shall provide ergonomic support in the following locations: back support, seat back and seat pan pillowing.

(3) Cushioning, seat trim, and detailing will be evaluated during the design review process.

iv). Pedestals

(1) Booth seats shall be mounted on a pedestal that is seamless with the floor, with no dirt traps, or protruding edges.

(2) Pedestals shall be undercut from the seat base to provide a floating seat aesthetic.

v). Materials

(1) The seat structure should be finished with high-quality, hard-wearing laminates and veneers.

(2) Laminate edges shall be protected with delicate trim details.

vi). Amtrak Approval

(1) Booth seating details shall be presented for Amtrak approval during the PDR.

(2) Final seat configuration and comfort shall be subject to Amtrak approval based on documentation and mockup information presented by the Contractor.

b). Table Module

i). A repeatable ‘workstation’ table module shall be used in the Cafe.

ii). A high-quality table surface should be used and shall have a protective edge trim detail.

iii). Split lines should be managed to a high tolerance and sealed to create a flush finish and prevent any potential dirt build up in edges.

iv). A minimum usable table length of 32” shall be provided.

v). Access in and out of the seat should be evaluated carefully. A tapered leading edge may be required to aid access to the seat.

vi). Top of table surface should be between 27” and 28” while also allowing 3” clearances in height for the legs for a 95th percentile male.

vii). Table leg location shall be positioned as to not provide a knee clash for passengers.

viii). All table dimensions will be subject to mock-up review, testing and approval by Amtrak.

ix). A fixed workstation table shall be provided compliant with APTA Standard PR-CS-S-018-13.

x). Although APTA Standard PR-CS-S-018-13 excludes cafe tables, it shall apply for the purposes of this Contract.

xi). Energy absorption features shall be built into the workstation table and/or its attachments such that human injury criteria for the 50th percentile HIII male ATDs are not exceeded during dynamic sled testing, per the requirements specified in APTA Standard PR-CS-S-018-13, Section 5.2.1, modified for testing with a workstation table installed.

xii). The table must meet the performance requirements specified in Section 5.2.1.3 of APTA Standard PR-CS-S-018-13.

xiii). The table must not become detached from its mountings and the ATDs must remain compartmentalized between the table and the launch seat.

xiv). Workstation tables shall be attached to the carbody via the wall seat track and to the floor seat track.

c). Accessible Table

i). Provisions for integrating a new accessible table or changing the booth table at the accessible space location shall differ from the standard booth table but shall meet the same strength requirements.

ii). In order to utilize the space to its full extent, fold down seats may be incorporated.

iii). In this instance, the accessible space shall also include a fold out seat from the side wall in this location so that if a person using a wheeled mobility device is not occupying the space, another passenger can opt to utilize the area instead.

d). Folded Wheeled Mobility Device Storage

i). A storage space for two folded wheeled mobility devices shall be located next to the transfer seat a for passengers wishing to transfer to another seat.

e). Accessible Space

i). Provisions for two accessible spaces with RVAAC compliant dimensions shall be provided.

ii). The accessible space shall also include a fold out seat from the side wall in this location so that if a person using a wheeled mobility device is not occupying the space, another passenger can opt to utilize the area instead.

f). Café Coach Style Seating (Option)

i). A modular system shall be used for seating arrangements, so Amtrak can change seat spacing, add, or delete seats in the future. This shall be accomplished without having to make any changes to the car other than moving the seats. The Contractor will submit their proposal for approval during the design review process.

ii). Generally, the passenger fixed seats shall be arranged to face the center of the seating area, with a worktable provided at the center facing pair of seats. The minimum distance between the two facing seats bottom cushion faces shall be 20 inches in the non-reclined position.

iii). All passenger revenue seating locations with Standard Coach seating shall use a fixed (non-rotating) reclining passenger seat. The predominant revenue seating arrangement shall be a central aisle with a 2 plus 1 seating configuration with a minimum seat pitch 42 inches.

iv). A comprehensive list of features for the Standard Coach seat is described in this chapter

v). A single seat type may be required in smaller numbers to accommodate transfer seats, maximize capacity and fulfil requirements around accessible paths.

vi). Contractor is responsible for meeting all technical requirements for all seat types, including any potential single-seat designs.

vii). All seat types are expected to be included in the mockups.

viii). Please refer to Chapter 1 for information regarding quantity of this accommodation type desired.

ix). Additional specifics regarding seats, seat pitch, seat fabrics and other details shall be discussed during Design Review. The seat attachment angle to the car floor shall optimize passenger knee room

11.34 Premium Coach Seats

a). General

i). Premium Coach seats shall only be installed in the Premium Accessible Coach.

ii). The Premium Coach seat is designed as an enhanced coach product. The seat shall be arranged 2x1 across a 32” accessible aisle.

iii). The seat should be optimized for both day and nighttime operations.

iv). Features are included that aid a better night’s sleep or support passengers on longer journeys by maximizing comfort and available passenger space.

v). The minimum width of the seat between armrests should be 22” when arranged with a 32” aisle.

vi). The minimum seat pitch shall be 48”.

b). Attachment

i). Passenger revenue seats must meet the performance requirements as defined in APTA Standard PR-CS-S-016-99, Standard for Passenger Seats in Passenger Rail Cars.

ii). This APTA Standard shall also be used as a design guideline.

iii). Seats shall be designed to provide maximum passenger comfort and safety.

iv). The seats shall be mounted in standard adjustable seat-mounting track allowing for pedestal or pedestal wall mounting.

v). Mounting slots shall be included on the underside of the seat frame allowing for lateral adjustability so that the aisleway centerline and dimensions are consistent throughout the car with no misalignment or staggering.

vi). The seat attachment angle to the car floor shall optimize passenger knee room.

vii). HPPL signage shall be located either on the seat pedestal or seat frame.

viii). HPPL charging shall be accomplished by local backlighting and not dependent on other interior light fixtures. See Chapter 13. HPPL shall not be placed on the floor.

ix). Approved tamper-resistant means of connections to a subfloor cable duct for electrical supply and future audio/visual data lines shall be provided.

(1) These connections shall provide for ease of future changes in seat spacing.

x). A provision for restraining two child retention seats per car as detailed by Amtrak during design review shall be provided.

xi). Revenue seats shall be mounted in seat tracks on the floor and/or wall in all car types.

xii). Seat tracks shall be installed with Amtrak approval for all processes and drawings.

xiii). Between seats, the wall and floor seat tracks shall be covered with a trim suitable for the application and as flush to the floor or wall panel as practical.

(1) Alternative floor and wall seat track installation locations shall be allowed as approved by Amtrak.

xiv). Seats shall be mounted to the seat tracks in accordance with the strength and crashworthiness requirements of 49 CFR Section 238.233 (a) and APTA standard PR-CS-S-016-99.

c). Key Features

i). A comprehensive list of expected features of the premium coach seats is provided in **Error! Reference source not found.** and detailed below.

ii). Detailed functional requirements for each feature are listed below.

iii). In addition to these requirements, the Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design.

iv). All mechanisms described below should be durable, free from jamming, and racking. The design should meet abuse load and crash criteria.

v). Dimensions, position, and usability will be subject to Amtrak approval during the mockup review.

vi). Seat Dimensions

(1) The following seat dimensions should be used as the basis for designing the seat (see **Error! Reference source not found.**).

(a) Seat Width: at least 22”

(b) Seat Depth: at least 20”

(c) Seat Pitch: at least 48”

(d) Highest Point on Seat Pan (at knee bend): 19” from the ground

(e) Natural Seat Recline Angle when In Upright Position: 105 degrees as measured from passenger facing side of seatback to passenger facing side of seat cushion

(f) Seat Pan Recline: 5-7 degrees in full upright position as measured from parallel to the floor.

(g) Seat dimensions are subject to Amtrak approval during the design review and mock-up review processes.

Figure 11-7: Key Features – Premium Coach Seat

Feature	Short Description	Qty
Headrest Pillow	Adjustable portion of seat headrest	1
Privacy Wing	Protrusion on headrest to provide privacy	2
Hand Grab	49 CFR 38.115 compliant handrails	1
Reading Light	White light with adjustable lens and toggle switch	1
Seat Recline Mechanism	Sliding mechanism that attaches seat back to seat pan for recline	1
Calf Rest Pad	Cushioned pad for leg support	1
Seat Controls	Manual buttons that adjust seat configuration features	1
Sliding Armrests	Arm rests that slide beneath the seat pan when stored	2
Flexible Net Pocket	Pocket at the base of the back of a seat for storage	1
On Seat Power	Outlets and USB integrated into the seat	2
Central Foot Pedestal	Support structure for a seat or pair of seats	1
Fold Out Table	Bifold table attached to seat armrest	1
Cup Holders	Metal cup holder ring that folds flush with seatback	1
Device Holder	Small ledge for propping up a cell phone	1
Fold Out Footrest	Footrest attached to calf rest pad that can be telescopically extended	1

vii). Headrest Pillow

(1) Headrest pillow should be adjustable in height to comfortably accommodate the range from 5th percentile female to 95th percentile male seated heights.

(2) It should have adjustable wings that fold outwards to adjust the width of the headrest while also providing lateral support for the head when the passenger is resting or sleeping in an upright seated position.

viii). Privacy Wing

(1) Privacy wing on the seats should provide good separation between passengers at head level and be wide enough and high enough as not to impact shoulder width for taller passengers.

ix). Hand Grab

(1) Every aisle seat should have a compliant accessible grab for better access along the aisle.

(2) Grab bar positioning will be subject to mockup testing and Amtrak approval. Grab bar shall meet the requirements in 49 CFR 38.115.

(3) With rotating seats (Option) hand grabs will need to be located on both sides of the seat.

x). Reading Light

(1) Seats should include a reading light that is positioned so as not to disturb neighbor during nighttime hours.

(2) Passengers should be able to adjust the lighting angle to cast light over the shoulder and into the lap or at a position suitable to read a book at night.

(3) Light intensity should have three settings.

xi). Seat Recline Mechanism

(1) Seat recline mechanism should allow the seat pan to slide forwards so as not to burden the full recline onto the passenger behind in addition to reclining the seat back.

(2) It should be easy to use by people of all abilities.

(3) The mechanism should be durable and rattle free.

(4) It should be free from finger traps.

xii). Calf Rest Pad

(1) Calf-rests tilt up for optimal leg support and comfort.

(2) Angle and width to be optimized as part of a detailed human factors study.

(3) The calf rest should be able to be operated independently from the seat pan.

xiii). Seat Controls

(1) Seat controls for recline and leg rest should be located within easy reach of a customer - for example on the inner side of the outside armrests.

(2) It should be possible to control the seat back recline and the calf rest independently.

(3) The seat controls should be intuitive to use by people of abilities and shall require 3 lbf or less to operate.

xiv). Armrests

(1) 2” wide armrest shall include a soft wrap around the top for comfort and a hard-wearing bottom wrap and side cap for durability.

(2) Armrests should be included on both sides of the seat and in between a seat pair.

(3) The aisle armrest on transfer seats must slide or fold out of the way to provide an unobstructed approach to the seat pan so a person using a wheeled mobility device can complete a successful side transfer.

(4) It is acceptable that a design that uses a folding armrest is adopted for dedicated transfer seats.

xv). Flexible Net Pocket

(1) A storage pocket should be provided on the back of the seat.

(2) A semi-rigid frame with a net suitable for passengers to store personal items or for Amtrak literature.

(3) The net should be durable and allow a clear view of the items placed inside to aid quick and easy cleaning routines.

(4) The design should allow for this element to be quickly and easily replaced on the car.

xvi). On-Seat Power

(1) Two USB ports should be provided on the back of each of the seats.

(2) Two duplex plug sockets should be located on the seat pedestal. Sockets should be shielded from spills from the table or cup holder.

xvii). Central Foot Pedestal

(1) A central seat pedestal should be positioned to maximize foot clearance.

(2) Interface with the floor should allow easy cleaning.

xviii). Fold Out Table

(1) An airline style bi-fold table should deploy from central console.

(2) The usable surface should allow people to use at least a 15” laptop.

(3) The table should also be able to track forward and back when deployed.

(4) The mechanism should be durable and rattle free.

(5) The size and resting position will be subject to mockup review, testing, and Amtrak approval.

(6) When the table is deployed it shall be able to support a 50lbf point load on the end of the table without damage.

xix). Cup Holders

(1) A fold out metal cup holder on each seat should be deployed from central console.

(2) It should be positioned within easy reach of the passenger.

(3) Cup holders should store in a position free from the movement of the seat and outside of knee and leg room.

(4) The cupholder should be capable of storing and securing cups of various diameters.

(5) It should be designed to prevent passing passengers getting snagged.

xx). Device Holder

(1) A fold out ledge with clip should allow the secure mounting of passengers' personal devices.

(2) The clip should be sprung and adjustable so different sizes can be securely kept in place including a typical tablet and/or a smart phone.

(3) The angle should be set so it is usable in both recline and upright positions.

(4) The latch should be designed in such a way to prevent accidental activation.

xxi). Fold out Footrest

(1) A fold out adjustable footrest should be provided.

(2) There should be three set positions and the footrest should have a degree of angle adjustment.

(3) The footrest should be durable to prevent damage is passengers misuse (e.g. step on accidentally while climbing in to aisle from window).

(4) The size and positions should be defined by a detailed human factors study.

d). Functional Elements

i). Seat Recline to Lazy Z

(1) Recline features- when seats are fully reclined there shall be at least 8" of knee clearance and 2" of foot clearance for a 95th percentile male between the back of the seat in front of the passenger and his knees.

(2) The recline features shall be operated manually:

(a) The seatback shall recline

(b) The seat pan shall recline to raise the knees upwards

(c) The calf rest shall extend forward to raise the legs

(d) The footrest shall be able to be folded out and adjust in length to support the feet

ii). Seat Direction

(1) The seats shall be installed all facing the same direction the right and left sides of the aisle.

(2) As an Option, rotation features shall be included for the premium seats.

(a) Seats should have the capability to rotate at the end of the line so that all seats are facing the opposite direction.

(b) This rotation would be manually performed by Amtrak staff.

(c) Each seat bench should be able to be rotated in less than 30 sec and shall lock in place.

(d) A visual indicator of the seat being properly secured shall be provided.

(e) Any seat not fully locked into place shall send an alert to the conductor for inspection.

(f) The controller shall report alerts and faults to the car diagnostic system. See Chapter 24 for additional information.

e). Emergency Window Access

i). Seats shall not obstruct emergency windows and, to the extent possible, shall be arranged to optimize passenger access to window views.

f). CMF

i). Please refer to the attached CMF document (Exhibit F) for the exact color, material, and finishes desired in this sleeper cabin area. Please also refer to chapter 19.

ii). All colors, cushions, fabrics, and appearance shall be as directed by Amtrak.

iii). All revenue passenger seats shall share the same common design appearance.

iv). Individual components shall be interchangeable wherever possible.

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v). They shall have a profile that is free of sharp corners and edges.

vi). All seat coverings shall use synthetic leather.

vii). Arm rests, if upholstered, shall use the same covering as the seats.

viii). Final construction of the cushions including sewing and fire blocking shall be subject to the approval of Amtrak.

11.35 Accessible Seating Spaces for Wheeled Mobility Users

a). Passengers who wish to transfer from wheeled mobility device

i). Designated transfer seat positions shall be reserved for passengers who wish to transfer from their wheeled mobility devices into a standard coach seat.

ii). Each transfer seat shall be of identical design and appearance to the other passenger seats.

b). Passengers who wish to remain in wheeled mobility device

i). Standard Coach shall have one RVAAC compliant accessible space. The car seating shall be modular with the ability to add one more accessible space.

ii). Premium Accessible Coach shall have three RVAAC compliant accessible spaces. The car seating shall be modular with the ability to add one more accessible space.

iii). Designated spaces shall be reserved for passengers who wish to remain in their wheeled mobility device.

iv). Each designated space shall include the features described for a seated standard coach passenger. This includes the following features:

(1) Reading Light

(a) Seating spaces should include a reading light that is positioned so as not to disturb neighbor during nighttime hours.

(b) Passengers should be able to adjust the lighting angle to cast light over the shoulder and into the lap or at a position suitable to read a book at night.

(c) Light intensity should have three settings.

(2) Flexible Net Pocket

(a) A storage pocket should be provided adjacent to the seating space.

(b) A semi-rigid frame with a net suitable for passengers to store personal items or for Amtrak literature.

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(c) The net should be durable and allow a clear view of the items placed inside to aid quick and easy cleaning routines.

(d) The design should allow for this element to be quickly and easily replaced on the train.

(3) Seat Power

(a) Two USB ports should be provided adjacent to each of the seats.

(b) Two duplex plug sockets should be accessible by a seated passenger. Sockets should be shielded from spills from the table or cup holder.

(4) Cup Holders

(a) A fold out metal cup holder at each seating space should be deployed and positioned within easy reach of the passenger.

(b) Cup holders should store in a position free from the movement of the seat and outside of knee and leg room.

(c) The cupholder should be capable of storing and securing cups of various diameters.

(d) It should be designed to prevent passing passengers getting snagged.

(5) Device Holder

(a) A fold out ledge with clip should allow the secure mounting of passengers' personal devices.

(b) The clip should be sprung and adjustable so different sizes can be securely kept in place including a typical tablet and/or a smart phone.

(c) The angle should be set so it is usable in both recline and upright positions.

(d) The latch should be designed in such a way to prevent accidental activation.

(6) Adjustable Workstation Table

(a) ADA compliant and adjustable height workstation table between 27" and 34" shall be provided for all wheeled mobility spaces.

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Part VII: Restrooms

11.36 Restrooms – General

a). General

i). Restrooms shall comply with water and waste system equipment requirements detailed in Chapter 15.

ii). The highest levels of winterization protection in the design of the toilet room shall be provided.

iii). Accessibility requirements for labeling in the restroom from Chapter 26 shall be followed. Please also reference signage from Section 11.6.

iv). All parts of the toilet room and associated water and waste piping shall have complete maintenance access provided to all components.

v). All toilet room fixtures, dispensers and appliances shall be constructed in accordance with the requirements of the US Public Health Service and 21 CFR Part 1250 requirements and ATR shall meet the ADA requirements of 49 CFR Part 38.123.

vi). Complete details of the toilet room, including maintainability analysis and winterization details, shall be presented for Amtrak approval during design review, and they shall be included in the interior mock-ups.

vii). The accessible toilet room and standard toilet room should be in the vestibule area, separated from the coach seating area by the vestibule door.

b). Floor Pan

i). The floor pan of the toilet room modules shall be FRP with 1.5 in. minimum radii corners to eliminate the accumulation of debris and aid in cleaning.

(1) A stainless-steel overflow pan shall be provided under the toilet and water connections.

(2) A waterproof rubber flooring covering which reduces noise and resists accumulation of odors shall be provided.

(3) The purpose is to prevent fluids from wicking beneath the toilet room flooring, both for hygiene and to prevent degradation of the subflooring materials.

(4) This pan shall be watertight and have raised edges of at least 4 in. in height. The pan’s exposed edges shall be folded for safety and to provide stiffness.

(5) The floor pan shall be installed over the subfloor of the car, and the perimeter of the pan shall be fully sealed to prevent moisture from seeping under the pan.

(6) Attachment points to secure the floor pan to the subfloor shall be in the sides, rather than the bottom surface, and be watertight. The floor pan joint at the door opening shall be waterproof to the subfloor.

(7) Floor penetrations shall be avoided, when possible, but where required, sealed to make the joint waterproof and with an appropriate material to prevent flame propagation from underfloor flame sources.

c). Floor Covering

i). A seam-free, skid-resistant rubber floor covering, solid surface material, or approved coating shall be used in the toilet room floor area.

ii). Color and pattern selection shall be approved by Amtrak.

(1) The floor covering shall be coved a minimum 4 in. up the sidewalls to form the inside scuff/kick plate.

(2) The edges shall be sealed to form a watertight seal.

d). Drainage

i). A provision shall be provided for a floor drain in the toilet room pan that shall be reviewed with Amtrak during Design Review.

(1) The floor shall be properly sloped toward the drain, preferably located near the toilet and an intumescent device shall be utilized to seal the drain in case of a fire, or alternate approved design.

e). Attachment Strength of Fittings

(1) The fittings in toilet rooms shall meet the attachment strength requirements defined in 49 CFR Part 238.233.

f). CMF

i). Please refer to Exhibit F for further information.

ii). Wall Panels

(1) Sidewall Panels along the carshell wall shall be made from molded thermoplastic or thermoset material with an easy to clean surface finish.

(2) Partition Walls shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(3) The finish of the wall and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

iii). Ceiling

(1) Ceiling shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(2) The finish of the passenger facing side of the ceiling panel and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(3) The finish of the material on the non-passenger facing side shall be coated such that there is no risk of corrosion from moisture from steam or humidity within the car.

iv). Flooring

(1) Flooring within the restroom area shall be made from rubber flooring with a friction, no-slip texture.

(2) Flooring will be durable to withstand spills, leaks, and all methods of cleaning. Flooring shall also not become frequently damaged or worn.

(3) Flooring shall have enough give to prevent fatigue from standing.

11.37 Standard Toilet Room (STR)

a). General

i). The STR shall have the ability to be used in two orientations.

ii). A modular design that allows different door positions should provide flexibility for the layout of the interior architecture.

iii). The orientation should always prioritize seats and passenger accommodation numbers where possible, while providing options for better aisle access in other instances.

iv). To the extent possible equipment, parts, and features in the STR shall be identical to equipment, parts, and features in the ATR.

v). The intent of this clause is to minimize spares and maintenance techniques.

b). Key Features

i). A comprehensive list of expected features in the Standard Toilet room is provided in Figure 11-8 and described in detail below.

ii). Detailed functional requirements for each feature is listed below. In addition to these requirements, the Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design.

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Figure 11-8: Key Features – Standard Toilet Room

Feature	Short Description	Qty
Restroom Door	Sliding door for entrance into STR	1
Toilet	Assembly including toilet bowl, shroud, and overflow pan	1
Toilet Seat	Assembly including lid and seat for toilet	1
Toilet Flush	Push button flush and automatic flush mechanisms	1
Toilet Paper Dispenser	Protective location for dispensing toilet paper	1
Toilet Seat Cover Dispenser	Protective location for dispensing seat covers	1
Sanitary Waste	Storage location for used feminine hygiene products	1
Sharps Bin	Storage location for used needles and other medical waste	1
Sink	Solid surface sink counter and basin	1
Hand Dryer	Automatic hand dryer and paper towel dispenser	1
Vanity Mirror	Mirror for passenger to look while washing hands	1
Trash	Storage for restroom related trash	1
Grab Handles	49 CFR 38.115 compliant handrails	1
Baby Changing Table	Fold out table for infant diaper care	1
Crew Storage	Locker with square key for dedicated crew storage	1
Coat Hooks	Coat hooks that hold up to 25lbs	2
PEI- Intercom only	Speaker for emergency conversations	1
Emergency Call Button	Buttons in accessible locations that activate PEI	2
Exhaust	Adjustable exhaust grille	1

iii). Restroom Door

(1) The door should be sealed to prevent leaking water escaping into the internal space of the car.

(2) The door should lock from the inside, with an indicator on the outside showing the door lock status.

(3) The clear width door opening shall be a minimum of 24”.

(4) The door shall be of lightweight construction, consistent with durability and be secured with stainless-steel hinges.

(5) The door shall be free from resonance and rattles when in the closed position when the train is in motion at any permissible speed.

(6) The door frame and attachment of the keeper shall be sufficiently rigid so that it does not flex when the door closes, even if it is slammed; the intention is that this interface does not deteriorate over the life of the car.

(7) Likewise, interior door construction shall incorporate interior stiffening in the area where the lock/ latch is attached to the door, so that the fasteners securing it to the leaf have a solid surface on which to clamp.

(8) The door latch, with a handle on both sides of the door, shall engage automatically when the door moves towards a closed position, but the lock requires definite action to engage.

(9) The door shall remain in the fully closed position at any permissible train speed.

(10) The lock shall be operable, in an emergency, from the outside with a standard Amtrak coach key.

(11) An instruction, in accordance with Amtrak Specification # 697, located on the interior side of the door, shall provide lock operating instructions.

iv). Toilet

(1) An elongated toilet, complete with toilet bowel assembly, shroud, and overflow pan shall be provided in the restroom.

(2) Toilet Bowl Assembly

(a) A toilet stand with shroud assembly shall be located in the toilet room. Each restroom shall be equipped with a toilet bowl assembly, encased in the toilet shroud.

(3) Toilet Shroud

(a) The shape of the toilet shroud housing shall locate the toilet seat ergonomically for ease of use and comfort.

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(b) Sufficient foot room shall be provided.

(c) When seated, the user's legs shall not contact the shroud.

(d) The toilet shroud shall be constructed of FRP with gel coat color to match the restroom shell or of stainless steel, with brushed finish or approved alternate.

(4) Toilet Overflow Pan

(a) The toilet bowl assembly shall be mounted on a stainless-steel overflow pan, which shall contain flooding should the toilet outlet become blocked or system leak.

(b) The overflow pan shall be watertight with raised edges of ~2 inches height, have the attachment points exterior to the pan, have all exposed edges folded for safety and to provide stiffness, and be equipped with an overflow tube.

v). Toilet Seat

(1) A standard toilet seat and toilet lid shall be provided.

(2) Toilet seat and seat lid should have soft close mechanisms.

(3) A white toilet seat with lid, meeting Amtrak Specification # 352, shall be provided.

(4) The toilet seat and cover shall be constructed of reinforced fiberglass or approved alternate.

(5) The lid and seat shall be stable in the up position regardless of train motion, including braking, to prevent it from slamming down suddenly against the shroud.

vi). Toilet Flush Mechanism

(1) A two-button push flush shall be located on the back wall of the restroom above the toilet.

(2) This shall provide standard and eco-flush features for the passenger.

(3) The flush mechanism shall also incorporate an automatic flushing feature when the passenger is done using the toilet.

vii). Toilet Paper Dispenser

(1) A toilet paper dispenser shall be provided adjacent to the toilet.

(2) This dispenser shall protect the toilet paper from getting wet.

viii). Toilet Seat Cover Dispenser

(1) A dispenser for paper toilet seat covers should be located by the toilet.

ix). Sanitary Waste Disposal

(1) A sanitary waste bin shall be provided to the right of the toilet complete with modesty flap. The minimum volume for this bin shall be 7 gallons.

x). Sharps Bin

(1) Provision for a sharps bin should be provided within the room.

(2) The size, position, and method of removal of sharps should be agreed and instructed by Amtrak.

xi). Sink

(1) General

(a) A solid surface sink with hot and cold water faucet shall be provided for passengers.

(b) The sink countertop shall be made from solid surface material and shall include a marine edge, 6” backsplash, and ¾” radius for cleanability.

(c) Note that all sink countertops shall be sloped toward the basin and drain.

(2) Sink Basin

(a) The sink basin shall have minimum internal dimensions of 18" width x 10" length x 5" depth.

(b) The sink shall have a 1/2 to 1 gallon capacity and be equipped with an overflow.

(c) The sink shall be drained through a nominal 1-1/4” diameter drain.

(3) Faucet

(a) The faucet shall be mounted behind the sink.

(b) The faucet shall use IR sensor to control water dispensing.

(c) Water flow from the faucet shall be aligned directly over the drain to not splash the user and/or countertop.

(d) Faucet shall be hardwired for power with a battery backup.

(4) Soap Dispenser

(a) An automatic liquid soap dispenser which will accept a Celeste Industries liquid soap refill shall be installed and shall be located adjacent to the mirror.

(b) Power for the soap dispenser shall be hardwired with a battery backup.

(5) 120V Outlet

(a) A duplex 120VAC GFCI receptacle shall be located on a panel adjacent the sink, preferably located to keep it dry from splashes from the sink.

xii). Hand Dryer

(1) A high velocity motion-activated hand dryer and a paper towel holder shall be mounted on the wall near the sink in an easily accessible location.

xiii). Vanity Mirror

(1) A large 41.5” x 23” mirror shall be positioned in front of the sink. The mirror can be split into two sections as necessary.

xiv). Trash

(1) A trash bin shall be provided under the sink with push flap cover.

(2) The minimum volume of trash for this receptacle shall be 2 cu ft.

(3) The trash flap for this receptacle shall be a minimum of 10” x 10”.

xv). Grab Handles

(1) Stainless-steel grab bars shall be provided on one side of the restroom to allow passengers to steady themselves against train motion.

(2) Bars shall be directly secured to car secondary structure or module structure.

(3) These bars shall be anti-slip grab bars in accordance with Subpart F of 49 CFR Part 38.123 (a) (3) shall be provided for passengers to utilize while using the facility.

xvi). Baby Changing Table

(1) A baby-changing table should be provided.

(2) The changing table should be easy to deploy and stow with an intuitive handle. The table shall include a strap to ensure passengers with limited reach can operate the table.

(3) The mechanism should be durable, free from jamming and racking.

(4) The design should meet abuse loads.

(5) It should have a soft opening mechanism.

xvii). Crew Storage

(1) A crew storage cabinet shall be provided at high elevations in the restroom for storage of restroom and cleaning supplies.

xviii). Coat Hooks

(1) Two coat hooks shall be provided on the partition wall. Coat hooks shall be capable of supporting up to 25lbs each.

xix). Emergency Call Button

(1) Two waterproof Emergency Call Buttons shall interface with the Passenger Emergency Intercom (PEI) in the toilet room.

(2) The Emergency Call Buttons are providing better access for passengers if they are not able to reach the PEI unit.

(a) The Emergency Call buttons shall have illuminated and audible indications when actuated.

(b) One Emergency Call button shall be located within easy reach while seated on the toilet and not easily confused with the flush button or other controls.

(c) A second button located within 12 inches from the floor or otherwise reachable for someone who has fallen.

(d) Placement of the buttons is subject to approval during design review.

(3) The PEI in the toilet room shall interface with the Emergency Call Buttons.

(a) The PEI and Emergency Call button arrangement, including the interfaces used between them, must maintain the same safety level and a standalone PEI.

(b) The PEI and Emergency Call Buttons must remain functional under any toilet module degraded mode condition.

(c) See Chapter 14 for additional details.

xx). Exhaust

(1) An exhaust grille shall be provided in the ceiling.

(2) Negative pressure in the restroom shall be provided by the HVAC system.

c). Additional Equipment Requirements

i). HVAC

(1) Supply Air Diffusers

(a) Conditioned air is delivered to the room via 2 supply air diffusers.

(2) Exhaust Grille

(a) Exhaust air is removed from the room via the exhaust air grille.

ii). Outlet

(1) Outlet to be provided within crew storage cabinet for maintenance and cleaning access.

iii). Lighting

(1) General

(a) Lighting general information is shared in the points below.

(b) Detailed lighting information can be found in Chapter 13.

(c) All lighting part numbers, manufacturers, and temperatures shall be proposed by the Contractor and approved at Amtrak after the lighting simulation during the design review process.

(d) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups.

(i) Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

(2) Lighting Types and Locations

(a) Main Ceiling Light (White Light)

(i) A large rectangular LED panel in the ceiling provides the main source of light for the room.

(b) Compartment Light

(i) Floor Lights

1. Lights shall be provided as indirect lighting that spills out across the floor under the sink counter.

(ii) Sink Lights

1. A wash light should be used to light the sink area indirectly.

2. This light shall only be activated when the door to the restroom is locked.

(iii) Mirror Light

1. A LED light shall illuminate the mirror around the boarder.

2. This light shall only be activated when the door to the restroom is locked.

iv). Communications

(1) Speaker

(a) PA speaker shall be located on the central ceiling panel.

(b) The speaker used in this location shall be identical to PA speakers used in other locations in the car for ease of maintenance and replacement.

(2) All communications equipment shall meet the requirements in Chapter 14.

v). Emergency Equipment

(1) Smoke Detector

(a) Smoke Detectors shall be mounted on the central ceiling panel.

(b) The smoke detector used in this location shall be identical to the smoke detectors used in other locations in the car for ease of maintenance and replacement.

vi). Security

(1) Many items within the restroom area will need to be secured.

(2) The following items are identified with specific locking preferences:

(a) Restroom Door Locking Mechanism

(3) Any other locking or security items will be discussed with Amtrak during design reviews.

11.38 Accessible Toilet Room (ATR)

a). General

i). All features shall be reached by a person sitting in a wheeled mobility device unless otherwise listed in this section.

ii). Dimensions shall be taken from the Americans with Disabilities Act.

iii). Additionally, the ATR shall conform with 49 CFR 38.123.

iv). To the extent possible equipment, parts, and features in the ATR shall be identical to equipment, parts, and features in the STR.

v). The intent of this clause is to minimize spares and maintenance techniques.

b). Key Features

i). A comprehensive list of expected features in Accessible Toilet Rooms is provided in Figure 11-9 and described in detail below.

ii). In addition to these requirements, the Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design.

Figure 11-9: Key Features – Accessible Toilet Room

Feature	Short Description	Qty
Restroom Door	Curved and automatic door for ATR	1
Toilet	Assembly including toilet bowl, shroud, and overflow pan	1
Toilet Seat	Assembly including lid and seat for toilet	1
Toilet Flush	Push button flush and automatic flush mechanisms	1
Toilet Paper Dispenser	Protective location for dispensing toilet paper	1
Toilet Seat Cover Dispenser	Protective location for dispensing seat covers	1
Sanitary Waste	Storage location for used feminine hygiene products	1
Sharps Bin	Storage location for used needles and other medical waste	1
Sink	Solid surface sink counter and basin	1
Hand Dryer	Automatic hand dryer and paper towel dispenser	1
Vanity Mirror	Mirror for passenger to look while washing hands	1
Trash	Storage for restroom related trash	1
Grab Handles	49 CFR 38.115 compliant handrails	1
Baby Changing Table	Fold out table for infant diaper care	1
Crew Storage	Locker with square key for dedicated crew storage	1
Coat Hooks	Coat hooks that hold up to 25lbs	2
PEI – Intercom only	Speaker for emergency conversations	1
Emergency Call Button	Buttons in accessible locations that activate PEI	2
Exhaust	Adjustable exhaust grille	1

iii). Restroom Door

(1) The door should be a curved automatic sliding door.

(2) The door should be sealed to prevent water escaping into the internal space of the car.

(3) The door should lock from the inside, with an indicator on the outside showing the door lock status.

(4) The restroom door shall also be able to operate in a manual mode in the event of power loss or malfunction so that the restroom is not put out of service due to door operation failure.

(5) The clear width door opening shall be a minimum of 44”.

(6) The door shall be of lightweight construction.

(7) The door shall be free from resonance and rattles when in the closed position when the train is in motion at any permissible speed.

(8) The door frame and attachment of the keeper shall be sufficiently rigid so that it does not flex when the door closes.

(9) The intention is that this interface does not deteriorate over the life of the car.

(10) Likewise, interior door construction shall incorporate interior stiffening in the area where the lock/ latch is attached to the door, so that the fasteners securing it to the leaf have a solid surface on which to clamp.

(11) The door latch, with a handle on both sides of the door, shall engage automatically when the door moves towards a closed position, but the lock requires definite action to engage.

(12) The door shall remain in the fully closed position at any permissible train speed.

(13) The lock shall be operable, in an emergency, from the outside with a standard Amtrak coach key.

(14) An instruction, in accordance with Amtrak Specification # 697, located on the interior side of the door, shall provide lock operating instructions.

iv). Toilet

(1) General

(a) An elongated toilet, complete with toilet bowel assembly, shroud, and overflow pan shall be provided in the restroom.

(2) Toilet Bowl Assembly

(a) A toilet stand with shroud assembly shall be located in the toilet room. Each restroom shall be equipped with a toilet bowl assembly, encased in the toilet shroud.

(3) Toilet Shroud

(a) The shape of the toilet shroud housing shall locate the toilet seat ergonomically for ease of use and comfort.

(b) Sufficient foot room shall be provided.

(c) When seated, the user's legs shall not contact the shroud.

(d) The form of the toilet should be floating or undercut at the bottom to maximize wheeled mobility device clearance.

(e) The toilet shroud shall be constructed of FRP with gel coat color to match the restroom shell or of stainless steel, with brushed finish or approved alternate.

(4) Toilet Overflow Pan

(a) The construction of the toilet in this room prevents a separate toilet overflow pan.

(b) Therefore, the entire ATR will be treated as an overflow pan in terms of preventative measures for water damage.

(c) The floor pan features described above are critical in this module.

v). Toilet Seat

(1) A standard toilet seat and toilet lid shall be provided. Toilet seat and seat lid should have soft close mechanisms.

(2) A white toilet seat with lid, meeting Amtrak Specification # 352, shall be provided.

(3) The toilet seat and cover shall be constructed of reinforced fiberglass or approved alternate.

(4) The lid and seat shall be stable in the up position regardless of train motion, including braking, to prevent it from slamming down suddenly against the shroud.

vi). Toilet Flush Mechanism

(1) A two-button push flush shall be located on the back wall of the restroom above the toilet.

(2) This shall provide standard and eco flush features for the passenger.

(3) The toilet flush buttons shall be mounted no more than 44” from the floor.

(4) The flush mechanism shall also incorporate an automatic flushing feature when the passenger is done using the toilet.

vii). Toilet Paper Dispenser

(1) A toilet paper dispenser shall be provided adjacent to the toilet. This dispenser shall protect the toilet paper from getting wet.

viii). Toilet Seat Cover Dispenser

(1) A dispenser for paper toilet seat covers should be located by the toilet.

ix). Sanitary Waste Disposal

(1) A sanitary waste bin shall be provided to the right of the toilet complete with modesty flap.

(2) The minimum volume for this bin shall be 0.25 cu ft.

x). Sharps Bin

(1) Provision for a sharps bin should be provided within the restroom.

(2) The size, position, and method of removal of sharps should be agreed and instructed by Amtrak.

xi). Sink

(1) General

(a) A solid surface sink with hot and cold water faucet shall be provided for passengers.

(b) The sink countertop shall be made from solid surface material and shall include a marine edge, 6” backsplash, and ¾” radius for cleanability.

(c) The sink countertop shall be approximately 32” from the floor and no more than 34” from the floor.

(d) Note that all sink countertops shall be sloped toward the basin and drain.

(2) Sink Basin

(a) The sink basin shall have minimum internal dimensions of 11" width x 16" length x 5" depth.

(b) The sink shall have a 1/2 to 1 gallon capacity and be equipped with an overflow.

(c) The sink shall be drained through a nominal 1-1/4” diameter drain.

(3) Faucet

(a) The faucet shall be mounted behind the sink. The faucet shall use IR sensor to control water dispensing. Water flow shall be aligned directly over the drain and shall be directed into the sink and not splash the user.

(4) Soap Dispenser

(a) An automatic liquid soap dispenser which will accept a Celeste Industries liquid soap refill shall be installed and shall be located adjacent to the mirror.

(b) Power for the soap dispenser shall be hardwired with a battery backup.

(5) 120V Outlet

(a) A duplex 120VAC GFCI receptacle shall be located on a panel adjacent the sink, preferably located to keep it dry from splashes from the sink.

xii). Hand Dryer

(1) A high velocity motion-activated hand dryer and a paper towel holder shall be mounted on the wall of near the sink in an easily accessible location.

xiii). Vanity Mirror

(1) A large mirror shall be positioned in front of the sink at an angle that allows both standing and sitting passengers to use adequately.

xiv). Trash

(1) A trash bin shall be provided under the sink with push flap cover.

(2) The minimum volume of trash for this receptacle shall be 2.25 cu ft.

(3) The trash flap for this receptacle shall be a minimum of 10” x 10”.

xv). Grab Handles

(1) Stainless-steel grab bars shall be provided on one side of the restroom to allow passengers to steady themselves against train motion.

(2) Bars shall be directly secured to car secondary structure or module structure.

(3) These bars shall be anti-slip grab bars in accordance with Subpart F of 49 CFR Part 38.123 (a) (3) shall be provided for passengers to utilize while using the facility.

xvi). Baby Changing Table

(1) A baby-changing table should be provided.

(2) The changing table should be easy to deploy and stow with an intuitive handle. The table shall include a strap to ensure passengers with limited reach can operate the table.

(3) The mechanism should be durable, free from jamming and racking.

(4) The design should meet abuse loads.

(5) It should have a soft opening mechanism.

xvii). Crew Storage

(1) A crew storage cabinet shall be provided at high elevations in the restroom for storage of restroom and cleaning supplies.

xviii). Coat Hooks

(1) Two coat hooks shall be provided on the partition wall.

(2) Coat hooks shall be capable of supporting up to 25lbs each.

(3) These hooks are identical to the towel hooks provided in the sleeper cabin.

(4) Hooks shall be positioned in accessible reach locations.

xix). Emergency Call Button

(1) Two waterproof Emergency Call Buttons shall interface with the Passenger Emergency Intercom (PEI) in the toilet room.

(2) The Emergency Call Buttons are providing better access for passengers if they are not able to reach the PEI unit.

(a) The Emergency Call buttons shall have illuminated and audible indications when actuated.

(b) One Emergency Call button shall be located within easy reach while seated on the toilet and not easily confused with the flush button or other controls

(c) A second button located within 12 inches from the floor or otherwise reachable for someone who has fallen.

(d) Placement of the buttons is subject to approval during design review.

(3) The PEI in the toilet room shall interface with the Emergency Call Buttons.

(a) The PEI and Emergency Call button arrangement, including the interfaces used between them, must maintain the same safety level and a standalone PEI.

(b) The PEI and Emergency Call Buttons must remain functional under any toilet module degraded mode condition.

(c) See Chapter 14 for additional details.

xx). Exhaust

(1) An exhaust grille shall be provided in the ceiling. Negative pressure in the restroom shall be provided by the HVAC system.

c). Accessibility Features

i). 44” Curved Toilet Door

(1) Access to the room will be subject to review and mockup user testing. Restroom door should be an automatic sliding door.

ii). Handrail Locations

(1) Horizontal Handrails

(a) ADA compliant horizontal handrails positioned to assist transfer through the restroom shall be provided.

(b) The handrail should be positioned to provide maximum access and support for passengers.

(i) Adjacent to sink

(ii) On the wall behind toilet

(iii) Along the stationary curved wall.

(2) Vertical Handrails

(a) ADA compliant vertical handrails positioned to assist transfer through the restroom shall be provided.

(b) The handrail should be positioned to provide maximum access and support for passengers.

(i) Adjacent to the toilet

(ii) On the wall near the door and baby changing table.

iii). Control Buttons

(1) Room Door

(a) The controls for the room door must be ADA compliant in position, size, and configuration.

(i) Door Open/Close

(ii) Door Lock

(b) The buttons should be easy and intuitive to use.

(c) An accessible manual lock should be included with an indicator to show lock condition.

(d) The control buttons shall be located 12” minimum from the inside corner.

(e) The buttons should have visual and haptic feedback. Dimensions, position, and usability will be subject to Amtrak approval during mockup review.

(i) Note this review will include the disability community input.

iv). 60” Turning Circle

(1) Center of room

(a) A clear 60” turning circle should be provided inside the room.

v). Accessible Space for wheeled mobility devices

(1) A clear accessible space of 59’’ x 32’’ shall be provided for use of the sink and associated features.

(2) A clear accessible space of 59’’ x 32’’ shall be provided for use of the baby changing table, side transfer to toilet, and seat covers.

d). Additional Equipment Requirements

i). HVAC

(1) Supply air diffusers

(a) Conditioned air is delivered to the room via 2 supply air diffusers.

(2) Exhaust grille

(a) Exhaust air is removed from the room via the exhaust air grille.

ii). Outlet

(1) Outlet to be provided within crew storage cabinet for maintenance and cleaning access.

iii). Lighting

(1) General

(a) Lighting general information is shared in the points below. Detailed lighting information can be found in Chapter 13.

(b) Note that all lighting part numbers, manufacturers, and temperatures shall be proposed by the Contractor and approved at Amtrak after the lighting simulation during the design review process.

(c) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups.

(i) Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

(2) Lighting Types and Locations

(a) Main Ceiling Light (White Light)

(i) A large circular LED panel in the ceiling provides the main source of light for the room.

(b) Compartment Light

(i) Floor Lights

1. Lights shall be provided as indirect lighting that spills out across the floor under the sink counter.

(ii) Sink Light

1. A wash light should be used to light the sink area indirectly.

2. This light shall only be activated when the door to the restroom is locked.

(iii) Mirror Light

1. A rounded LED light shall illuminate the mirror around the boarder.

2. This light shall only be activated when the door to the restroom is locked.

e). Communications

i). Speaker

(1) PA speaker shall be located on the central ceiling panel.

(2) The speaker used in this location shall be identical to PA speakers used in other locations in the car for ease of maintenance and replacement.

(3) All communications equipment shall meet the requirements in Chapter 14.

f). Emergency Equipment

i). Smoke Detector

(1) Smoke Detectors shall be mounted on the central ceiling panel.

(2) The smoke detector used in this location shall be identical to the smoke detectors used in other locations in the cars for ease of maintenance and replacement.

g). Security

i). Many items within the restroom area will need to be secured.

ii). The following items are identified with specific locking preferences:

(1) Restroom Door Locking Mechanism

iii). Any other locking or security items will be discussed with Amtrak during design reviews.

11.39 Premium Accessible Coach Car

a). General

i). The Premium Accessible Coach car shall include all of the elements listed in this Chapter; however, the arrangement of these elements can be modified by the Contractor to best meet the design requirements for the car as a whole.

ii). The Contractor shall provide the optimal general arrangement to Amtrak for review and approval for the Premium Accessible Coach car.

b). Key Features

i). A comprehensive list of expected features of the Coach Interior structures is provided in Figure 11-5 and described in detail below.

ii). General

(1) The Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design.

(2) All mechanisms described below should be durable, free from jamming, and racking.

(3) The design should meet abuse, load, and crash criteria outlined in CFR.

(4) Dimensions, position, and usability will be subject to Amtrak approval during the mockup review.

(5) There should be a 32” wide accessible path from end to end.

(6) In Premium Coach a linen closet shall be provided to accommodate a pillow and blanket for each premium coach passenger.

(a) See chapter 31 for linen closet requirements.

iii). Windows

(1) Windows shall be provided that meet the requirements of Section 11.14.

iv). Window Blinds

(1) Side window blinds shall be provided that meet the requirements of Section 11.16.

v). Window Pillars

(1) Window pillar width should be minimized.

vi). Window Mask

(1) Window mask should minimize or mask glass corners to create an architectural aesthetic.

vii). HVAC Gondola

(1) Gondola shall be designed to maximize headroom.

(2) Lighting washes both centrally into gondola and across side ceilings shall be provided.

(3) The gondola should terminate and transition to a separate lower ceiling section if any equipment or junction in the interior architecture prevents the gondola from completing a full uninterrupted run.

(a) For example - where the ceiling moves around a restroom.

(4) At these junctions the gondola should terminate in a straight line with architecture that creates a visual ring at the termination point.

(5) The transition between ceiling profiles should be treated with clean and well considered intersections.

(6) These lower ceilings should have their own lighting light wells and HVAC vents.

viii). Side Ceiling Panels

(1) Side ceilings should be washed with light form central gondola.

(2) These side ceiling panels shall be curved to create a smooth transition from the ceiling to the back of the overhead luggage racks.

ix). Kick Strips

(1) Stainless steel kick strips at 9” high should be used in all coach areas.

x). Lower Sidewall Panels

(1) Lower side wall panels shall be provided such that the trim panel has minimized thickness to take advantage of full width of the car body.

(2) These should be designed to have well-fitted clean panels with a high tolerance build to manage split lines and cabinet edging.

(3) There should be no protruding equipment, snag point, or dirt traps.

(4) These panels shall have different material/color to create a horizontal tide line with the window mask. See CMF document (Exhibit H)

xi). Coat Hooks

(1) Coat hooks should be provided for each seated location, integrated with the luggage shelf and valance.

(2) Hooks should be easy to move if seat positions or set pitch are changed in the future.

(3) A solution where integrated coat hooks are provided in the back of the seat will also be considered and is subject to Amtrak approval during the design review process.

xii). Luggage Shelf

(1) Overhead Luggage Shelf shall meet the requirements of:

(a) Section 11.2019: Luggage Storage – General

(b) Section 11.2120: Overhead Luggage Storage

(2) The overhead luggage shelf should be built in modules that align with window placements.

(3) Split lines and module length should be consistent and to visually match the window module splits.

(4) The overhead luggage shelf shall be modular to create different length segments using extruded aluminum.

(5) The following elements shall be included:

(a) Back Barrier – Back of rack should prevent bags from damaging side ceiling panels.

(b) Rollstop Nosing – Nosing of luggage shelf should be suitable to secure bags.

(c) Glass Panel – Glass panel construction from safety glass to allow passengers to see bag and let light through - frosted finish or laminated with decorative film or etching pattern.

(d) Module Dividers – Divider brackets to prevent bag slip - discreet design with no sharps, snags, or dirt traps.

(e) Blind Storage – Window blind storage should be easily accessible and discreetly hidden behind rack.

xiii). Reservation Screen

(1) As an option, passenger information displays should be integrated with the rack design.

(2) The position of the seat reservation module should be designed so they can easily be moved in case seat pitch or density is modified in the future. The display function shall indicate either single or double seat assignments, as applicable based on the seat location within the car. A single seat arrangement shall not have two displays.

c). Lighting Requirements

i). General

(1) Lighting general information is shared in the points below

(2) Premium Accessible Coach

(a) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups.

(i) Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

ii). Lighting Types and Locations

(1) Wash Lights

(a) Ceiling Panel Wash light

(i) Indirect strip lights wash light onto the ceiling from the central gondola fixture inward.

(b) Gondola Ceiling Lighting

(i) Gondola Ceiling Lighting shall wash light from the gondola across the side ceiling panels

(c) Under Luggage Rack

(i) Indirect wash lighting hidden behind the rack shall wash down the side walls.

(2) LED Panel Spotlights (White Lights)

(a) Small circular LED light panels shall act as spotlights along aisles.

(b) The frame for the spotlights shall be color matched to the ceiling.

(3) Compartment Lighting

(a) Under seat lighting. Indirect wash lighting under each seat or seat pair washes pools of light under and around seats.

(b) Spread of light to be approved by Amtrak.

11.40 Café Car

a). General

i). The Café shall include all of the elements listed in this Chapter; however, the arrangement of these elements can be modified by the Contractor to best meet the design requirements for the car as a whole.

ii). The Contractor shall provide the optimal general arrangement to Amtrak for review and approval for the Café car.

b). Key Features

i). A comprehensive list of expected features in the Café is provided in Figure 11-10 and described in detail below.

(1) Detailed functional requirements for each feature are listed below.

(2) In addition to these requirements, the Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design.

(3) All mechanisms described below should be durable, free from jamming, and racking.

(4) The design should meet abuse, load, and crash criteria.

(5) Dimensions, position, and usability will be subject to Amtrak approval during the mockup review.

(6) At least one (1) drain shall be provided inside the Café area to eliminate standing water from daily operations and cleaning.

ii). Please refer to Chapter 16 for information regarding the food service modules and appliances to be placed within the Café.

iii). The following features shall be incorporated into the Café:

(1) Digital Menus shall be included. Please refer to Section 11.22 Digital Displays for further information on placement.

(2) Qty 3 shall be provided in addition to PIS screens.

(3) One menu display shall be located near the point of sale.

(4) One menu display shall be located along the aisle side of the Café.

(5) One menu display shall be located perpendicular to the aisle on the wall where the service counter ends.

(6) Recessed Handrail

(7) A recessed handrail shall be incorporated into the wall for the outside of the coach café. This handrail shall meet the requirements in 49 CFR 38.115.

Figure 11-10: Key Features – Café

Feature	Short Description	Qty
Accessibility		
Accessible Path	32” continuous aisle through entire car for ADA regulated aisle	1
RVAAC Accessible Space	Location for a passenger using a wheeled mobility device to dine and remain using device - including 60" diameter turning circle	2
Folded Wheeled mobility device Storage	Open storage location for wheeled mobility devices	2
60” Turning Circle	60” diameter turning circle for accessibility at side of the Café	2
Interior Structures		
Café	Food service Area described in Chapter 16	1

Condiments Station	Convenience station for passengers in the Café	1
Windows	Aligned to booth tables and includes emergency egress features	TBD
Skylights (Option)	Aligned to booth tables and windows	1 per window
Blinds	A single blind system that provides sunshade and blackout performance	1 per window (+ skylight option)
Doors	Vestibule with a passenger door each side	1
Conductors Office	Enclosed seating area with a workstation for one and/or two persons	1
Seating and Tables		
Booth Seating	Repeatable and modular bench seating for 2 passengers each - minimum 40" width	22 booth seats
Table Module	Repeatable dining table for 4 passengers	10
Accessible Table	Modified version of table module with flip up portion	2
Privacy Divider	Safety glass divider between booths with hand grab features	1 between each booth
Lighting (Car Specific)		
Wall Lamps	Light fixtures mounted to each available window pillars in dining area	1 on each window pillar

iv). Fixed worktables shall be provided for each non-accessible seat. For detailed specifications, refer to section 11.32.

v). A repeatable booth module of back-to-back seating shall be provided in the Café. Booths should be 2x2 across the aisle. For detailed specifications refer to 11.32.

vi). Folded Wheeled Mobility Device Storage

(1) A storage space for two folded wheeled mobility device shall be located near the transfer seat in the Café car for passengers wishing to transfer to another seat.

vii). Accessible Path

(1) The Café car should be fully accessible end to end.

(2) There should be a 32” wide accessible path from end to end in the Café.

(3) Where a 90° turn is required across the car, the aisle should be 44” wide.

viii). 60” Turning Circle

(1) There should be a 60” accessible turning space at the vestibule end of the Café, at the accessible seating spaces, and at the counter POS location.

ix). Window

(1) Windows shall be provided that meet the requirements of Section 11.14.

x). Skylight Windows (Option)

(1) As an option, skylight windows shall be included for the cafe, diner and diner/lounge cars where booth tables and lounge seating are present.

(2) Please refer to Section 31.13 for window requirements.

xi). Skylight Blinds (Option)

(1) Skylight blinds shall be provided that meet the requirements of Section 31.15.

xii). Skylight Valance (Option)

(1) Skylight design should incorporate a valance without a luggage shelf, that contains only blinds, and coat hooks.

xiii). Blinds

(1) Side window blinds shall be provided that meet the requirements of this Technical Specification. Alternative solutions may be provided to Amtrak for review and approval.

xiv). Side Rails

(1) Side rails under each window shall include a tideline.

xv). Lower Sidewall Panels

(1) Lower side wall panels shall be provided such that the trim panel has minimized thickness to take advantage of full width of the car body.

(2) These should be designed to have well-fitted clean panels with a high tolerance build to manage split lines and cabinet edging.

(3) These panels shall define a material split, with the lower panel in a wood finish.

(4) There should be no protruding equipment, snag point, or dirt traps.

xvi). Kick Strips

(1) Stainless steel kick strips at 9” high should be used in all coach areas.

xvii). Hand Grab

(1) Where possible, a compliant accessible grab for passenger navigation shall be available.

(2) Grab bar positioning will be subject to mockup testing and Amtrak approval. Grab bar shall meet the requirements in 49 CFR 38.115.

xviii). Window Pillar

(1) Window pillar width should be minimized.

xix). HVAC Gondola

(1) Lighting washes both centrally into gondola and across side ceilings shall be provided.

(2) The gondola should terminate and transition to a separate lower ceiling section if any equipment or junction in the interior architecture prevents the gondola from completing a full uninterrupted run.

(3) At these junctions the gondola should terminate in a straight line with architecture that creates a visual ring at the termination point.

(4) The transition between ceiling profiles should be treated with clean and well considered intersections.

(5) These lower ceilings should have their own lighting light wells and HVAC vents.

xx). Outlets

(1) Duplex outlets with two USB sockets shall be provided for each seat or seat pair in the café.

(2) The outlets shall be located in easy reach of people while seated.

xxi). Trash Bin

(1) Trash bins shall be provided with stainless steel push flaps.

(2) Please refer to section 11.18 for more information on trash and recycling requirements.

(3) Condiment Station

(a) A condiment station shall be provided for use by both passengers and crew.

(b) The unit shall be compact and architecturally integrated with the diner interior and booth seating.

(c) The capacity and arrangement of the station shall be appropriate to the number of diners served.

(d) The station shall provide separate, food-safe compartments for cutlery, napkins, stirrers, single-use condiments, salt and pepper pots, and table dressings.

(e) Lower sections of the unit shall be provided for waste, recycling, and supplementary crew storage, as appropriate.

xxii). Conductor Office

(1) Conductor office location shall be located in the café Car.

(2) A conductor's office modular seating area with a workstation for one and/or two person(s) enclosed with full height wall and pocket door with window shall be provided for train crew to use as office space.

(3) The seat(s) shall be identical to the coach seat supplied for passengers unless otherwise approved by Amtrak.

(4) A pair of duplex electrical outlets and USB ports shall be provided for the crew to use for charging of radios, cell phones and other equipment. A dedicated AED charging station shall be provided.

(5) A PA, crew IC and OTIS control station shall be provided in accordance with the requirements of Chapter 14.

(6) An overhead luggage bin may be included, fitted with a standard coach key lock.

(7) The conductor office module shall be reviewed and approved by Amtrak during Design Review.

c). CMF

i). Please refer to Chapter 19 and Exhibit F for further information.

ii). Wall Panels

(1) Sidewall Panels along the carshell wall shall be made from molded thermoplastic with an easy to clean surface finish.

(2) Partition Walls shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(3) The finish of the wall and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

iii). Ceiling

(1) Ceiling shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(2) The finish of the passenger facing side of the ceiling panel and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(3) The finish of the material on the non-passenger facing side shall be coated such that there is no risk of corrosion from moisture from steam or humidity within the car.

iv). Flooring

(1) Flooring within the Café area shall be anti-slip flooring as listed in Section 11.28.

(2) Flooring shall be durable to withstand spills, leaks, and all methods of cleaning. Flooring shall also not become frequently damaged or worn.

(3) Flooring shall have enough give to prevent fatigue from standing.

v). Lighting

(1) General

(a) Detailed lighting information can be found in Section 13, Lighting System.

(b) Note that all lighting part numbers, manufacturers, and temperatures shall be proposed by the Contractor and approved at Amtrak after the lighting simulation during the design review process.

(c) Ceiling lighting shall match the ceiling lighting in the coach cars.

(d) A digital controller shall be provided allowing for crew to adjust the brightness of the lighting in the car.

(2) Featured Lighting

(a) Strip lighting

(b) LED Spotlights

(i) Spotlights cast down light on top of the service counter.

1. Note this is additional from the lighting required by Chapter 16 Food Service.

(c) Wash Light

(i) A wash light for the counter shall be included in the café.

(d) Wall Lamps

(i) On each window pillar, a wall lamp shall be provided that casts indirect light on the pillar.

(ii) The lamp is intended to be a premium design feature that contributes to the overall lighting of the space.

(iii) Lamp design, spread of light, lamp materials, and detail design will be subject to Amtrak's approval.

11.41 Drinking Water Stations

a). A drinking water station shall be included in the café car.

b). The drinking water station shall have the following features:

i). Recessed water dispenser with drain in accordance with the requirements listed in Chapter 17.

ii). An access side panel secured with quarter-turn fasteners for access to the water valves for maintenance

iii). ADA compliant design

iv). Shall operate with IR sensor

c). The dispenser shall be arranged to permit passengers to easily refill a 1-quart water container.

d). The design shall be in compliance with 21 CFR Part 1250 and US Public Health Service (USPHS) requirements, arranged for ease of sanitation, and approved by Amtrak.

e). Alternative designs can be provided for review and approval by Amtrak.

f). An option for a drinking water station shall be provided in each car for Amtrak to exercise during the design reviews.

Part XIII: CDRLs

11.42 CDRLs

CDRL	Description	Due
CDRL 11-01	Human Factors Study Report	30 days prior to PDR
CDRL 11-02	Pinch Point Gap Analysis	30 days prior to FDR
CDRL 11-03	Luggage and Baggage Analysis	30 days prior to PDR

* End of Chapter 11 *

Amtrak Universal Single Level Fleet Replacement

Technical Specification

12. Door Systems

Revision 2

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12.1 Overview

a). The Amtrak Single Level Fleet shall be equipped with electrically controlled power operated side entrance doors, carbody end doors, vestibule doors, trap doors, folding steps, accessible restroom doors, and accessible sleeping room doors.

i). The Contractor shall provide technical solutions for gap fillers and on-board mobility lifts. The requirements for the lifts are outlined in Chapter 6 while the requirements for the gap filler are outlined in this Chapter.

b). All doors shall use mar-resistant polycarbonate windows meeting FRA type I or II requirements. Window tint percentage will be reviewed/approved during the design review process.

c). The side entrance doors shall be located on the B-end of the car and designed to accommodate a portable ramp, and passenger boarding from high level (48”) and low level (8” and 15” and 0” and -8” ATOR) station platforms.

i). The diner car shall be equipped with centrally located powered doors, specifically designed without trap doors and folding steps, to streamline the loading and stocking of food and beverage products. The precise placement of these doors will be determined during the design review process. These powered doors shall be operable via local controls positioned both inside and outside the car, requiring a crew key for activation. Additionally, they shall be integrated into the door summary circuit and remain independent from trainline control by any other car in the consist, ensuring both operational security and convenience.

ii). If the option is exercised, the utility car side entrance doors will be located at the B-end of the car with powered traps doors and powered folding steps. Exception, the powered doors shall be operable via local controls positioned both inside and outside the car, requiring a crew key for activation. Additionally, they shall be integrated into the door summary circuit and remain independent from trainline control by any other car in the consist, ensuring both operational security and convenience.

d). The Contractor’s design for the entire door system must comply with the latest requirements of 49 CFR Part 37, 49 CFR Part 38, 49 CFR Part 238, EN50155, APTA PR-CS-S-012-02, and APTA Standard PR-M-S-18-10.

e). The door system shall operate over the entire range of operational, climatic, and track conditions identified in the Amtrak Specification 963, including the buildup of ice on unheated exterior surfaces during below-freezing temperatures with snow accumulation. Door control relays and associated panels shall meet Amtrak Specification 528.

i). Low level station platforms may be either below Top of Rail, at Top of Rail, 8 inches above Top of Rail and 61 inches from centerline of track, or 15 inches above Top of Rail and 64 inches from centerline of track.

(1) Mitigations for minimizing the gap between the door threshold and station platform shall be performed to the maximum extent possible.

ii). Many of the at or below TOR platforms are controlled by freight railroads who will protect their clearances. Careful consideration must be provided for these platforms as well.

f). As this equipment will operate throughout the entirety of the Amtrak network, Amtrak envisions this equipment utilizing powered side entrance doors for ease of boarding and alighting, especially at the busiest stations; however, Amtrak also acknowledges that many of the station stops off the Northeast Corridor are greater distances. As an option, Contractor shall propose an alternative solution that utilizes manual side entrance doors for Amtrak to review and evaluate.

i). Each side door window of the manually operated side door shall be designed to permit crew to easily lean out, when standing, and be able to view a station platform or the wayside in either direction. An alternative design hinged side window may be proposed for review and approval.

12.2 General Requirements

a). Design Objectives

i). Door systems have a demonstrated history of complexity and inconsistent performance that can affect the operation of passenger service and hinder maintenance and repairs. In order to maximize safety, system functionality and equipment availability, while minimizing the potential for degraded service or system performance, the side and end door systems shall be specified, designed and manufactured with an emphasis on addressing the following areas of concern:

(1) Unsafe conditions for passengers or crew members;

(2) Train delays from malfunctioning side door equipment;

(3) Poor system reliability in adverse operational and environmental conditions;

(4) Accumulation of dust and dirt that affects system performance and causes failures;

(5) System complexity that increases the time and effort required for troubleshooting and repairs; and

(6) Requirement for frequent adjustment and component replacement.

ii). The door systems shall be designed with great attention to details so that they are safe, very reliable, requires little maintenance, is easy to service, has support parts available and will have a long service life.

(1) All control devices, cutouts, bypass switches, and similar components shall be equipped with labels or decals that clearly describe their function and proper operation, enabling safe and confident, and error free use.

b). Design Requirements

i). The door system shall be designed and constructed so that no single point malfunction of door system components shall create an unsafe condition.

ii). Door system failures shall be detectable through the following means:

(1) Failure to complete the door closed summary circuit and therefore prevent the locomotive from developing traction power (when a door panel is not fully closed and latched, or mechanically locked in the closed position and isolated electronically.

(2) Use of indicator lights on the inside and outside of the car that signal when a door is not confirmed closed and latched; and

(3) An indicator that signals when a door has been locked manually and isolated electrically on the inside and outside of the car for each door.

iii). All controls, locks and latches, as well as door emergency access covers identified in this Chapter shall use the standard Amtrak coach key (coach key), per Amtrak Drawing B-144 (J.L. Howard Part No. 2555).

iv). Environmental Considerations

(1) When closed, the doors shall provide a weatherproof seal under all car operating conditions.

(2) Neither drafts, nor air noises shall be detectable from the closed door over the full range of operating speeds of the vehicle, on all specified classes of track.

(3) The doors shall operate as specified over the entire range of all operational, climatic and track climatic conditions identified in Amtrak Specification 963.

(4) None of the electrical components, such as limit switches, shall be directly exposed to the weather, even with the door open.

(5) Climatic and environmental conditions, such as dust, rain, snow or heat, shall not be a cause of door system failures.

v). The door equipment mounting and internal fasteners shall be such that once adjustments are made and locked, they will not need to be re-adjusted until equipment overhaul or replacement.

vi). Fasteners

(1) Fasteners shall be metric.

(2) Jam nuts, lock washers, nylock nuts or equivalent fasteners shall be used to secure door equipment.

(3) Fastening aids, such as Loctite or equivalent products, shall not be permitted, unless specifically approved by Amtrak.

vii). Maintainability

(1) All door mechanisms, including but not limited to tracks, operators, wiring to door panels, stops, limit switches and controls shall be accessible by opening hinged access panels on the inside of the car.

(2) No special tools will be required to open such panels, nor will any equipment have to be disconnected or removed to gain access.

(3) Access shall be provided from inside the car to all points necessary for inspection, service, installation or removal.

(4) All door system equipment shall be installed in such a manner so as to be:

(a) readily accessible to maintenance personnel with minimal effort

(b) readily available from the exposed side of the door operator

(c) able to be adjusted and maintained by a single person.

viii). Interchangeability

(1) All door equipment of like function and the same hand shall be interchangeable without requiring modification.

(2) All component mounting holes for all door hardware shall be jig-drilled by the manufacturer.

(3) Mounting holes on the car shall also be jig- drilled.

(4) Door operators, door tracks and thresholds shall have their mounting positions controlled through suitable jigs/fixtures so as to ensure the correct physical relationship between carbody, door track, door pocket and operator.

(5) All door operators, tracks, hangers, linkages, brackets, obstruction sensing and electrical fittings shall be manufactured or supplied by one subcontractor.

ix). Door panels shall be fully insulated against thermal and sound transmission and grounded per APTA Standard SS-E-005-98.

x). A Portable Test Unit connection and software will be provided to aid in troubleshooting and provide system diagnostics.

xi). Door controllers shall report alerts and fault information to the car diagnostic system.

12.3 Powered Side Entrance Doors

a). General

i). Trainline-controlled, power operated stainless steel side entrance plug or pocket doors shall be provided for each car type.

ii). Side entrance doors with a gap filler, stepwell and trap door shall be installed at the B-end of the car. Exception, the diner car shall have only doors located in the center of the car.

iii). A door control panel shall be installed adjacent to each exterior side door and shall have both local door and trainline controls. Exception, the diner and utility car (option car) shall only have local door controls.

iv). Side entrance doors shall provide an opening width of at least 36”.

v). Side entrance doors shall provide an opening height of at least 78” when boarding from a level platform.

vi). An exterior weatherproof coach key switch, complete with seal over key opening and detent latch, shall be provided adjacent to the side doors on each side of all cars to allow crew to open or close the adjacent door leaves, trap door, and folding steps to enter or exit the car.

vii). Each car shall be equipped with two (2) side entrance doors.

viii). A minimum number of door panel types shall be used for each car type.

ix). Hand-operated latches and handles shall provide clearance for operation by a gloved hand.

x). All doors shall be solidly mounted, of lightweight construction, vibration free, open or close positively, and not rattle or make noise in service.

xi). It is preferred that the design of the exterior doors of each car type shall be a flat panel, where possible. The panel shall meet the materials and workmanship requirements and shall have fully interchangeable components.

b). Side Door Controls and Operation

i). The side door controls for each car type shall include the following features:

(1) Trainline control at 74 Volts Direct Current (VDC) via 27-point communication trainline cable, in compliance with Amtrak Drawing A-63-7676-1. Exception, the diner and utility car shall have local control only.

(2) The side doors shall be operated from a local door control panel or via trainline OPEN or CLOSE commands from another location or train.

(3) Side doors shall not prohibit egress in an emergency situation or in the event of HEP power loss or air loss.

(4) A local maintenance on/off switch shall be provided per doorway to de-energize the local door circuits and motor during maintenance and/or troubleshooting.

(5) Interchangeability

(a) The DCU shall automatically detect the car type and location in which it is installed.

(b) The door system software shall be unified throughout all DCUs, so no additional manual configuration is needed when it is installed/replaced.

(6) Relay-based logic and discrete trainlines shall be provided for the issuing of control commands to the doors.

(7) Discrete trainlines shall also be used to monitor the door closed and locked status, and provide the required indications to the train crew.

(8) Safety Considerations

(a) The door control system shall incorporate logic that shall meet the requirements of EN 50126 SIL 3 so that no unsafe condition will be created:

(i) through normal operation of the door system, or

(ii) due to a failure of door system equipment or components.

(b) Door control system shall be able to tolerate two separate grounds anywhere in the train in the door circuits and not have an unintended door opening.

(c) Control system design shall be fault tolerant to prevent unintended door openings.

(9) Each door leaf shall be provided with a position sensor to detect that the door is fully closed and that it is mechanically latched.

(10) Zero Speed Protection

(a) The zero-speed protection from wheel slide control unit on each car shall include all of the following:

(i) Door control panel system deactivation if not at zero-speed.

(ii) Removal of power from door operator’s door OPEN function if not at zero speed.

(iii) Door CLOSE command automatically issued in both directions on left and right door close trainlines when car motion is detected.

(b) Zero-speed signal supplied by the wheel slide control unit shall be required in order to issue an OPEN command to the side doors.

(i) Conversely, the absence of a zero speed signal shall prohibit the issuance of an OPEN command to the side doors.

(11) Traction Interlock

(a) Traction interlock shall be provided, with door closed indication, that prevents the locomotive from developing tractive effort if any side door is not fully closed and latched, or mechanically locked and electrically isolated.

(i) There is no interlock between the door closed summary circuit and the brake system.

(12) Obstruction detection with over current and a sensitive edge on each door leaf meeting the requirements of APTA Standard SS-M-18-10.

(13) Emergency Releases

(a) Manual emergency release for each door leaf from inside the car, with frangible cover.

(b) Exterior emergency release for each door leaf, fully enclosed behind a weatherproof cover.

(14) Mechanical lock which can be engaged manually with a coach key from inside the car which allows the on-board crew to secure the door leaf closed and isolate the door operator electrically.

(15) All door control system signal and indicator lights shall use approved long life, high intensity Light Emitting Diode (LED) or LED arrays lamps having a rated life of at least 100,000 hours.

(16) Audible signal, on or near the door header at each side door opening at the same rate as the blue ADA indicator light.

(a) Tone and volume of audible signal to be submitted to Amtrak for approval during design review. **[CDRL 12-01]**

c). Side Door Operator and Linkage

i). General

(1) The side doors shall employ electric, electro-pneumatic or linear-induction operators, one per door leaf.

(2) Doors shall be operated from the nominal 74VDC car battery system but shall operate normally over the full voltage range from normal Head End Power (HEP).

(a) The motor and controls shall reliably be compliant to EN50155 and shall operate without damage and without affecting the reliability and serviceable life of the operator.

(b) The Contractor shall provide an engineering analysis to verify door operators will operate over this voltage range without damage to components. **[CDRL 12-02]**

ii). Locking Mechanism

(1) The operator shall include an over-center or equivalent locking mechanism so that a door which is closed will remain closed and latched upon loss of electrical or pneumatic power, regardless of car vibration.

(2) The door operators shall include a local mechanical cutout which allows the on-board crew to deactivate and isolate a door operator by locking the door.

iii). Opening and Closing Forces

(1) The drive mechanism shall be designed to minimize torque applied to door panels during operation.

(2) The operator and linkage for each panel shall be arranged so the maximum force required to manually move a door panel shall not exceed 30 pounds of force (lbf) at mid-point of travel.

(3) The doors shall open or close successfully with no greater than 60 lbf applied perpendicular to the interior door surface at a height of 56 in. above the floor, throughout the entire opening cycle, and through the closing cycle until 5 in. before the fully closed position.

iv). Dampening and Door Motion

(1) The door motion shall be smooth and free of shock and impact.

(2) The door operator shall decelerate the door leaves at each extremity, to preclude slamming or rebound, and bring them to rest gently at the extremity of door leaf travel.

(3) Damping shall be provided at the ends of travel of the door panel in both the opening and closing directions.

(4) The door operator motion shall be smooth and free of shock and impact and shall be capable of holding the door, without oscillation, in either an open or closed position with the car on all configurations of track as specified in Amtrak Specification 963.

(5) Door leaf travel shall be easily adjustable, with provisions, to set open and close positions.

v). Limit Switches and Proximity Sensors

(1) All limit switches and proximity sensors used in the operator shall be hermetically sealed and shall be easily replaceable.

(2) All limit switches and proximity sensors shall be precision units that are positively and precisely located so they may be replaced without the need for mechanism adjustment.

vi). Opening and Closing Times

(1) Door opening and closing times shall be independently adjustable and shall be initially set at:

(a) Opening: 3 (± 0.5) seconds

(b) Closing: 3 (± 0.5) seconds

(2) If sliding plug doors are used, the operating timing shall be defined as follows:

(a) Opening: 4.0 seconds – Adjustable 4.0 to 8.0 (± 0.5) seconds

(b) Closing: 4.0 seconds – Adjustable 4.0 to 8.0 (± 0.5) seconds

(3) The opening and closing values shall be independently adjustable by the Portable Test Unit.

vii). Protection from Damage

(1) Operator design shall be such that a mechanical or electrical failure shall not result in subsequent damage to other equipment.

(2) The door motor shall be suitably protected from the surrounding environment and be of a sealed design.

viii). Interchangeability

(1) All door operator motors shall be interchangeable from one door position to another, or between all doors of the same hand (right-hand and left-hand).

d). Side Door Panel Construction

i). The side entrance door panel shall be constructed of stainless-steel frame and skin with a honeycomb core.

ii). Doors shall be of an adequate thickness for the intended service, which means they shall be resistant to damage from impacts with roadside debris such as rocks, as well as resist being bent from misuse, attempted operation with the door stuck, or a mechanical malfunction.

iii). In addition, when supported at both ends, the door leaf shall sustain a concentrated load of 250 lbs applied at the center of the front face, over an

area of 4 in^2, at 90° to the plane of the panel, without deflecting more than 0.25 in., nor shall the panel take a permanent set.

iv). All door panel joints and edges shall be sealed against moisture.

v). Stainless steel reinforcements shall be provided at attachment points.

vi). Structure used to secure the door leaf to the door hanger shall last the life of the car, without fatigue cracks or similar failure, even if the door operator malfunctions and slams the door leaf repeatedly.

vii). Epoxy used in door panel construction shall be waterproof.

viii). All internal door leaf wiring and sensitive edge shall be run through internally routed conduit.

ix). The exterior surface of the door panel shall match that of the exterior of the car body.

x). The sensitive edge and door mounted weather seals shall be part of the door panel assembly.

xi). Door panels shall be insulated against thermal and sound transmission.

xii). Door panels shall be welded in accordance with all applicable AWS requirements.

e). Door Panel Windows

i). Each door panel shall have window openings formed to accept FRA Part 223 compliant glazing.

ii). The door window frame shall be an integral part of the door structure and shall be capable of retaining the window in the door opening when subjected to the impact applicable to the window location described in 49 CFR Part 223.

iii). The window and its glazing shall not extend beyond the outer surface of the door.

iv). All door windows shall be retained in the door frame by use of a rubber extrusion and zip strip combination which will allow installation/removal of the glazing from inside of the door.

f). Side Door Obstruction Detection

i). Each door leaf shall be equipped with an obstruction detection system. The system should include over-current detection and a sensitive edge.

ii). Should the door close against an obstruction, the obstruction detection system shall immediately initiate the door opening cycle.

iii). The force required to activate the system shall not exceed 20 lbf.

iv). The sensitivity of the obstruction detection system shall conform to APTA Standard SS-M-18-10.

v). The design of the obstruction detection system shall not allow the door to oscillate if no obstruction is present.

vi). The doors shall not close and latch to permit a closed-door indication if an obstruction is detected.

vii). Deflection of the sensitive edge shall have no effect on the door control system after the door has closed and locked.

viii). Soft elastomer edges shall be designed to permit the withdrawal of an obstruction that could be undetected between a closed side door and its mating edge

ix). The design of the obstruction detection system shall be subject to Amtrak approval during design review.

x). The Contractor shall provide a detailed assessment of the obstruction detection system as proposed, including theory of system operation, proven service history, reliability and maintainability, compliance with applicable regulations and standards, and safety analysis.

g). Overhead Door Track

i). Door leaves shall be suspended from an overhead door track.

ii). The track and door hanger assembly shall have minimum service life of 25 years.

iii). The door track/hanger shall not require lubrication over its life.

iv). The load bearing surface of the door track shall be convex, so as to be self-cleaning from buildup of dust.

v). The door track shall employ rollers with sealed, permanently lubricated bearings or other roller design that does not require lubrication.

vi). The overhead door track and rollers shall not be affected by environmental conditions, including the accumulation of dust.

vii). The door hanger and door track shall be able to resist, without damage or permanent deformation, a force of 200 lbf applied perpendicularly at the center of the door panel, both in inward and outward directions.

viii). The rollers shall be secured to the hanger assembly with a mechanism, both to adjust for level as well as control vertical free-play between the hanger assembly and door track.

ix). Door leaf adjustment shall allow the space between the nosing seal to be made constant from the top to the bottom of the leaf.

x). The amount of track-to-roller free-play shall prevent the trailing edge roller from lifting on the track if the door leaf strikes an obstruction down low while closing.

xi). Adjustment of free-play clearances shall be easily done using standard tools.

xii). The track itself and mounting to carbody (not the door-to-hanger connection) shall be adjustable to accommodate both carbody and door leaf tolerances, including both height and plumb.

xiii). Sliding plug doors with linear bearings may be used, provided that the linear bearings are of a service proven design and do not require lubrication more frequently than annually.

h). Bottom Door Guides and Thresholds

i). A door guide with corresponding threshold shall be provided at the bottom of the door.

ii). Adjustable wear strips, if provided, shall be easily replaceable without removing or readjusting the door panel.

iii). The bottom guide arrangement shall be designed not to collect dirt and debris and to ensure a low friction operation with no binding or rattling.

iv). The thresholds shall be compliant with ADA requirements.

v). The door guide/threshold shall form part of the door weather seal and shall incorporate drain holes to carry off water to the underside of the car.

vi). The threshold and drain and their sealing to the carbody shall ensure that water or other fluids do not seep underneath and cause deterioration of flooring, its substructure or insulation.

vii). Easy access shall be provided to the door guide/threshold for cleaning and maintenance.

viii). The guide shall be adjustable to accommodate both carbody and door leaf tolerances.

ix). Any part of the door guide system subject to wear shall be easily replaceable without removing the door panels.

i). Freeze Protection

i). Freeze protection system shall be provided at each side entrance door and shall be with sufficient capacity to prevent ice formation in the door pockets, bottom door guide, thresholds, gap fillers, vestibule steps, trap door, and boarding/alighting paths. The system shall prevent slippery conditions for passengers.

ii). All heaters shall be 120 VAC and shall be activated by the car freeze protection circuit at ambient temperatures of 40 degrees F or below.

iii). The design of the system shall be included in the door system design review and shall be subject to Amtrak design review and approval.

j). Weather Seal

i). Amtrak will operate the cars at 125 mph throughout the continental United States.

ii). The very high operating speeds of the cars combined with frequent winter exposure to snow, freezing rain and ice, as well as heavy rain conditions, makes it of extreme importance that exceptionally high levels of weather sealing be applied to the door systems.

(1) The leading edge of the door panel shall interlock with the adjacent door panel (if present) to form a weatherproof seal.

(2) The door opening, including the interior and exterior sides and top, shall be equipped with a flexible weather seal.

(3) The rear edge of the leaf shall be equipped with a batten that positively engages the door seal when the door is fully closed, including the radius at the top of the door opening.

(4) This combination shall create a dust and weatherproof seal (see Chapter 20 for test requirements).

iii). The seal shall be attached to the door frame with sufficient clearance so as to prevent chafing against the leaf as it moves, yet ensure every door leaf seals on every car, despite the combination of all manufacturing tolerances.

iv). The top of the opening shall also be equipped with a weather seal.

v). The interface between the bottom of the door and the threshold shall form a weather seal.

vi). Seal design shall also limit the entrance of dust and snow into the door pocket when the door is open.

vii). Adjustments to keep the seal system weather tight shall not be required more often than annually.

k). Emergency Releases

i). Manual interior and exterior emergency releases shall be provided to allow each side door panel to be opened manually in emergency situations.

ii). The emergency release handle shall be red and be simple for individuals to understand and operate.

iii). Activating the emergency release handle shall: remove power from the door motor, release the door mechanical lock (if locked) and disengage the door over-center locking mechanism and separate the door panels by at least one inch so that the door leaf may be manually opened.

iv). Using the emergency release, the force to disengage the door operator and to move the door leaf shall not exceed 30 lbf external per APTA Standard SS-C&S-012-02.

v). The exterior emergency release handle shall be located on the car side, near the door it releases, behind a weatherproof cover.

vi). At least one release shall be provided for each door opening that permits the opening of both door leaves.

vii). The cover shall allow access in an emergency and be able to be sealed and locked for securing car when not occupied.

viii). Operating instructions shall be provided on or near the cover.

ix). An interior emergency release handle shall be located adjacent to each door leaf, behind an easily replaceable, transparent frangible weatherproof cover.

x). To allow crew access to the release emergency release without breaking the frangible material, such as when the car has no power, the cover frame shall be hinged and equipped with a coach key release.

xi). Opening the frame will also allow the frangible material to be easily replaced.

xii). The inside handle, once actuated, shall remain in the actuated position.

xiii). Operating instructions for the emergency door release mechanism shall be installed near the emergency release, per the location and illumination requirements of 49 CFR Part 238.

xiv). It shall be possible for emergency personnel to manually open the side doors from outside the car with the car resting on its side, by using only tools normally carried by such personnel.

xv). This shall be demonstrated with an exterior door and frame assembly in the horizontal position, using actual production components.

xvi). It shall be assumed that no damage exists to the door, door frame or operating mechanism.

xvii). If a cable system is employed between the external release handle and door operator, it shall be run within a conduit to allow it to be replaced easily, without major car disassembly.

xviii). Appropriate labels shall be provided with operating instructions at convenient locations, consistent with APTA Standard SS-PS-002-98.

l). Door Control Panel

i). A stainless steel watertight door control panel shall be provided for the train crew to control all the side doors on its respective side of the train.

ii). The control panel shall be activated with a coach key, with the key removable only in the OFF position.

iii). Indicator lights on the panel shall employ socket-mounted LED technology.

iv). A button shall be provided at the door control panel for the Conductor's signal buzzer.

v). In addition to trainline operation, the side doors shall be equipped with a trainline/local coach key switch panel which allows the crew to select whether an adjacent door will open in response to trainline OPEN commands, or only on a local basis.

vi). Positions shall be labeled TRAINLINE/LOCAL (9 o'clock position) and LOCAL ONLY (6 o'clock position).

(1) The coach key shall be removable from either position.

vii). With the switch in the LOCAL ONLY position, the connection from the door open trainline is interrupted, so that the affected doors only open upon an OPEN command from the door control panel-local or the crew access switch adjacent to those doors and shall not open in response to a trainline OPEN command from another door control panel.

viii). When in the TRAINLINE/LOCAL position, the side doors at this location shall open either upon a trainline OPEN command from another door control panel, or from the adjacent door control panel-local or exterior crew access switch.

ix). In either position, the doors will close upon a CLOSE command from the door control panel-local, or from a trainline CLOSE command.

m). Crew Key Switches

i). The crew switch shall be three-position, spring return to center, with key capture in open and closed positions on the exterior of the car.

(1) A standard Amtrak crew (conductor's) key shall be used to operate the switch.

ii). The crew switches shall not be connected in parallel and shall have separate inputs to the DCU so lower and upper crew switches can be configured independently.

iii). Rotating the key to the left shall open the doors, and to the right shall close the doors.

iv). The crew key switch shall be arranged so that when the key is removed, the door shall remain in the last position commanded.

v). Local commands shall take precedence over trainline commands.

vi). If a door is opened with the local crew key switch, it shall be possible to close it by trainline control.

vii). Switches within the assembly shall be weatherproof.

viii). Switches shall require the use of the standard Amtrak coach key.

n). Door Cutout and Mechanical Lock

i). A positive mechanical lock function shall be provided for each passenger side door leaf, or pair of side door leaves if door operation uses synchronized door panels, to deactivate power from that door operator and to secure the leaf in the fully closed position.

ii). This lock shall be operated from inside the car only, by a coach key. The door closed and lock loop shall only be bypassed when the door leaf is fully closed, and the mechanical lock fully engaged.

iii). The emergency release function shall still be available for a locked-out door, but if the release is used, the door panel locked sensing function shall be reactivated.

iv). If the emergency release has been activated while the mechanical lock was in the locked-out position, the design of the keeper shall allow the lock bolt to re-engage automatically when the door leaf is again closed (so as to not ram the edge of the keeper with the bolt).

v). Engagement of the lock bolt shall be sufficient to provide positive panel locking under all conditions.

vi). It shall not be possible to withdraw the key unless the lock bolt is fully engaged or fully unlocked.

o). Door Status Indicators and Alarms

i). Audible and visual warnings that comply with the requirements of 49 CFR Parts 37 and 38 shall be provided at each doorway and shall be activated prior to door closing.

ii). Activation of the warnings shall precede the initiation of door closing by approximately 3 seconds.

iii). The warnings shall alert passengers inside and outside the car on the side of the car at which the doors are open.

iv). Exterior Door Open Indicators

(1) A red exterior LED type door open indication shall be provided on each side of the car at each entrance doorway (see Chapter 11).

(2) Both lights adjacent to an individual vestibule (one on each side of the car) shall be extinguished when all doors at that entrance vestibule (both sides of car) are closed and locked.

(3) The indicators shall be bright and visible at a distance of 1870 ft, on tangent track, bright enough to be visible in bright direct sunlight and shall be visible to crewmembers in vestibules and in the operating cabs of locomotives when looking down the side of the train from either direction.

v). Exterior Accessibility Indicators

(1) A blue Accessibility LED indicator shall be provided outside each passenger side entrance door that contains an onboard mobility device.

(2) The Accessibility indicators shall be triggered via the door controls to provide a flashing indication at 1 Hz while the doors at that location are open and shall flash at 2 Hz from the time that a CLOSE command is issued to those door until the doors are closed and locked.

vi). Interior ADA Door Closing Indicators and Alarms

(1) To warn hearing impaired passengers that the doors are about to close, red LED interior door closing warning lights shall be provided in the door header at each side entrance door.

(a) These lights shall be triggered via the door controls to provide a flashing indication, upon initiation of the door “close” command, and continue to flash until the door begins to close.

(b) The flashing rate of the indicator shall be approximately 2.0 Hz.

(2) To warn passengers that the doors are about to close, an interior door closing warning audio alarm shall be provided in the door header at each side entrance door.

(a) The door closing warning audio alarms shall be triggered by the door controls.

(b) The door closing warning alarm shall start to sound upon the initiation of the door CLOSE command and continue to sound until the door begins to close.

(c) The audio alarm shall be pulsing audio shall develop a sound level of 88 +/-2 decibels (dB) at 5 ft 6 in. above the center of the door threshold, with a frequency of 3000 Hz.

(3) An interior door closing interlock with Public Address (PA) system to initiate “doors closing” message shall be provided. See Chapter 14.

(4) When the door closed trainline is activated, a 3 second warning of the above visual and audio devices will be given at each entrance area before the doors begin to close.

vii). Interior Door Status Indicators

(1) Each door leaf shall be equipped with a yellow LED indicator light mounted in the ceiling panel over each door leaf. This indicator shall display the status of the door leaf:

(a) On continuously: Door leaf is open or is not confirmed closed and latched.

(b) Flashing (1 Hz): Door leaf is locked manually with the mortise lock and isolated from the door control circuit and the door closed summary circuit.

(c) Off: Door panel is confirmed closed and latched, but not locked with the mortise lock.

p). Design Safety Validation

i). The Contractor shall conduct a hazard analysis and a Failure Mode and Effects Criticality Analysis (FMECA) for hardware and a Fault Tree Analysis (FTA) for the entire side door system as necessary to demonstrate that the safety requirements of the system are met under all operating conditions.

ii). This analysis shall be performed for an individual car of each type and for a train consisting of cars from the same build lot. This shall include:

(1) logic,

(2) interlocks,

(3) mechanical mechanisms,

(4) indicators,

(5) bypasses,

(6) cutouts and

(7) controls.

iii). The analysis shall be submitted to Amtrak for review and acceptance as part of the Design Review process. **[CDRL 12-03]**

q). Door Pocket

i). If pocket doors are provided, the door pocket will accommodate the door leaf while the door is open.

ii). The bottom of the door pocket shall be lined with corrosion resistant material to prevent deterioration of car structure and flooring.

iii). The bottom of the door pocket shall also incorporate a pan designed to drain water out of the pocket area through a tube to the underside of the car.

iv). The drain shall be easily accessible for cleaning and shall be equipped with a backflow preventer to keep dust and moisture from blowing into the pocket.

v). It shall be designed to ensure that water does not seep underneath and cause deterioration of flooring, its substructure or insulation.

r). Door Markings

i). Door positions shall be numbered in accordance with Error! Reference s ource not found..

ii). In addition, each door shall be labeled for emergency egress in accordance with APTA Standard SS-PS-002-98, Rev 2.

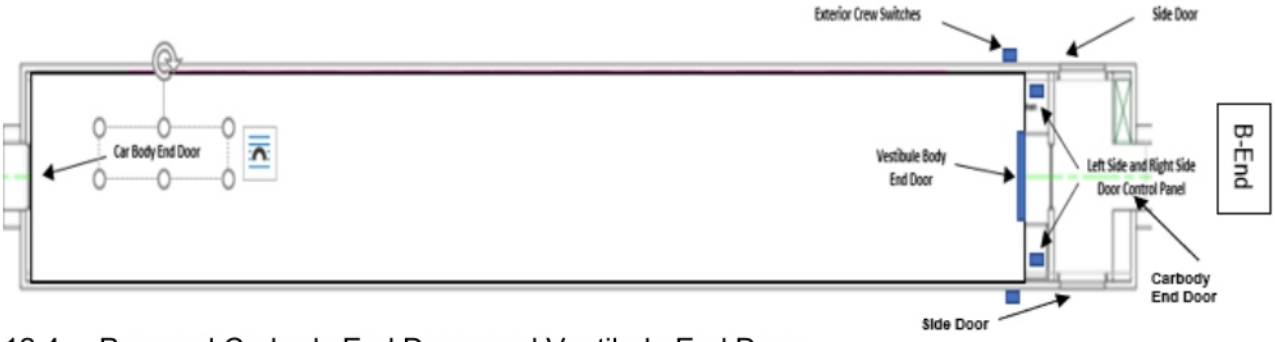
iii). Signage shall be installed on each door leaf that describes the procedure for opening the doors in the event of an emergency.

iv). This signage shall conform to the requirements of APTA Standard SS-PS-002-98 and 49 CFR Part 238.

v). Signage shall also be provided above each door leaf or pair of door leaves, adjacent to the yellow door status LED indicator, that states that the door leaf is inoperative or out of service when the yellow light is flashing.

vi). The proposed artwork, material, color, size, location and adhesive for these signs shall be submitted for Amtrak approval during the design review process. **[CDRL 12-04]**

Figure 12-1: Door Positions



12.4 Powered Carbody End Doors and Vestibule End Door

a). General

i). Carbody End Door

(1) A weathertight lockable sliding pocket powered doors with a manually operated override shall be provided at the ends of each car.

(2) The end door shall have a minimum footprint within the passenger area, pressure sealed, and mechanically lockable.

(3) A minimum 36 in. "clear passage" shall be provided through the doorway when the end door is fully opened.

(4) If applicable, carbody end doors shall have a removable window and kick panel in compliance with 49 CFR 238.112.

(5) The door shall be constructed from stainless steel with a stainless steel honeycomb core and shall be equipped with an FRA Type 1 window.

(6) The door shall be weatherproof and compliant with the requirements of 49 CFR 238.209.

(7) The door shall be of an adequate thickness for the intended service, which means it shall be resistant to minor wayside impact damage, as well as resist being bent from misuse.

(8) In addition, when supported at both ends, the door shall sustain a concentrated load of 200 lbs applied at the center of the front face over an area of 4 sq.in., at 90° to the plane of the panel without deflecting more than 0.25 in. nor shall the panel take a permanent set.

(9) The door shall be recessed from the front surface of the vehicle, so as to shield it from possible impacts.

(10) A safety end gate shall be provided to prevent passage through the collision post opening when the door is open on the end of the train or single car. A mechanism to secure the gate in the extended and retracted position without rattling shall be provided. In either the retracted or extended position, the gate shall not interfere with the clear path or devices like the handbrake.

ii). Vestibule Door

(1) An electrically powered sliding door shall be located at the vestibule to isolate the car interior.

(2) A minimum 36 in. "clear passage" shall be provided through the doorway when the door is fully opened.

(3) If applicable, the vestibule doors shall have a removable window and kick panel in compliance with 49CFR238.112.

(4) Each door leaf shall incorporate a service-proven obstruction sensing system.

(5) No door closing warning shall be given.

b). Door Controls

i). Carbody End Door

(1) Body end door controls shall include the following features:

(a) A kick plate, and push buttons shall be installed on both sides of the body end door for passenger activation, and

(b) A three (3) position toggle switch shall be provided with three distinct modes of end door operation, NORMAL, DOOR OPEN, and MANUAL.

(i) The switch shall be mounted to a stainless-steel faceplate with engraved lettering and a red switch guard which shall fully close only when the switch is in NORMAL position.

(2) In NORMAL mode:

(a) The end door shall automatically open fully within 2.5 (± 0.5) seconds after the proximity sensor or push button is activated. However, this opening time shall be adjustable and will be validated through the design review process.

(b) The end door shall remain open for 8 to 15 seconds, then automatically close. However, the closing time shall be adjustable and will be validated through the design review process.

(c) All parameter settings and door timings shall be easily adjustable by PTU.

(3) In DOOR OPEN mode:

(a) The end door will automatically open and remain open.

(4) In MANUAL mode:

(a) Electrical power shall be removed from the end door operator.

(b) The force to open or close the doors manually shall not exceed 20 lbs.

(c) The door shall be held in either the open or closed position with the vehicle subjected to track super elevation up to 7 in. (178 mm).

ii). Vestibule Door

(1) Each interior passenger area door shall be passenger operated on each side by both a ceiling mounted infrared proximity sensor, side door frame mounted push button, and a kick plate electrical switch.

(a) The proximity sensor shall have an adjustable detection range, suitable for the railroad environment and shall not open the door for typical nearby passenger movements (such as accessing nearby luggage racks, etc.) when doorway passage is not intended.

(b) It shall easily permit future adjustments in sensitivity and detection zone by Amtrak.

(c) Details must be submitted for approval by Amtrak.

(d) Approved LED back lighted push plate switches shall be used.

(e) The switches shall be back lighted when the door operator is in Normal mode.

(2) A backup local manual control shall be provided.

(3) Each door operator shall have a local electronic control unit which controls the door operation, that is self-checking and provides fault identification information.

(4) The control unit, as part of its self-diagnosing capability, shall provide performance degradation diagnostics to identify components approaching possible failure. These features shall be accessible via the PTU.

(a) The above features shall be communicated to the CDU and shall be accessible remotely.

(5) Each door operator shall include a maintenance switch which will remove power from the motor to prevent operation while maintenance work is in process.

(a) All functions will be available, including diagnostics.

(6) The door equipment mounting and internal fasteners shall be such that once adjustments are made, and locked, they need not be disturbed until equipment overhaul or replacement.

(7) Access shall be provided from inside the vestibule to all points necessary for service, installation or removal of powered doors and operating apparatus.

c). Door Lock

i). Car Body End Door

(1) The car body end door shall be equipped with a robust and service proven door lock that shall be lockable from inside the car, using a crew key.

(2) The door shall not be lockable from the exterior side of the car.

(3) A separately operated safety override shall be provided to unlock the door from inside or outside the car in the event of an emergency.

(4) When the door is in the locked condition and the lock override is used, the door will return to the locked position when closed.

(5) The arrangement provided for locking the end door shall be approved by Amtrak.

d). Door Operator

i). Power Requirements

(1) The door operator and controls shall operate from nominal 74VDC car battery system.

(2) The door operator and controls shall operate normally over the entire voltage range of charging down to load shed without damage and without affecting the reliability and serviceable life of the operator.

ii). Opening and Closing Forces

(1) The drive mechanism shall be designed to minimize torque applied to the door panel during operation.

(2) The operator and linkage for the doors shall be arranged so the maximum force required to manually move a door panel with power removed shall not exceed 20 lbs.

(3) The door shall open or close successfully with no more than a 60 lbf applied perpendicular to the interior door surface at a height of 56 in., throughout the entire opening and closing cycle.

iii). Dampening and Door Motion

(1) The door operator shall preclude slamming or rebound and shall bring it to rest gently at the extremity of door leaf travel.

(2) The door motion shall be smooth and free of shock and impact.

(3) Damping shall be provided at the ends of travel of the door panel in both the opening and closing directions.

(4) In the opening direction damping shall preclude the door leaf from contacting the mechanical door stop.

(5) Door leaf travel shall be easily adjustable through a single adjustment point to set open and close positions.

iv). Door Holding and Locking Capability

(1) The operator shall be capable of holding the door, without oscillation, in either an open or closed position with the car in service.

(2) Also, the operator shall include an over-center mechanism so that a door will remain in the open or closed position upon loss of power.

v). Protection from Damage

(1) Operator design shall be such that a mechanical or electrical failure shall not result in subsequent damage to other equipment.

(a) For example, if the operator linkage to the leaf comes loose, it shall not be possible for the operator to damage itself from over-travel of the mechanism.

(2) The door operator and drive motor shall be protected from damage created by in-service conditions.

(3) Stall protection will be provided to prevent operator or control damage or degradation should a leaf be immobilized.

(a) When the problem is corrected, the operator will return to full functionality without a manual reset.

(b) Thermal cutouts shall not be used for motor protection.

vi). Limit Switches and Proximity Sensors

(1) All limit switches and proximity sensors used in the operator shall be hermetically sealed and easily replaceable.

(2) All limit switches and proximity sensors shall be precision units that are positively and precisely located so they may be replaced without the need for mechanism adjustment.

vii). Opening and Closing Times

(1) Door opening and closing times shall be independently adjustable and shall be initially set with DC bus voltage with HEP on, at:

(a) Opening: 2.5 (± 0.5) seconds

(b) Closing: 3.0 (± 0.5) seconds

viii). Door motor control and timing function shall be incorporated on the operator unit.

ix). Reliability

(1) The door operator shall require adjustments no more frequently than every 460 days.

(2) The door motor and operator assembly shall be suitable for operation without component replacement between heavy overhaul periods of at least eight years.

(3) The door motor shall be a sealed design and suitably protected from the surrounding environment.

x). Interchangeability

(1) All door operator motors shall be interchangeable from one door position to another.

e). Door Panel Construction

i). Doors shall be constructed of stainless steel and have a honeycomb core.

ii). In addition, when supported at both ends, the door leaf shall sustain a concentrated load of 250 lbs applied at the center of the front face, applied over 4 sq.in. at 90° to the plane of the panel, without deflecting more than 0.25 in. nor shall the panel take a permanent set.

iii). Door panels shall be equipped for emergency escape per 49 CFR Part 238.112.

iv). All door panel joints and edges shall be sealed against moisture.

v). Stainless steel reinforcements shall be provided at attachment points.

vi). Structure used to secure the door leaf to the door hanger shall ensure it lasts the life of the car, without fatigue cracks or similar failure, even if the door operator malfunctions and slams the door leaf repeatedly.

vii). A hand-hold recess shall be provided on both sides of the door panel to allow manual opening of the door from the inside and outside, with the operator deactivated.

viii). Cutouts shall be provided on the inside and outside panels for the two push and kick plates and associated wiring.

ix). All internal door leaf wiring and sensitive edge tubing shall be run through internally routed conduit.

x). Each door panel shall have window openings formed to accept FRA Part 223 Type II compliant glazing.

xi). The door window frame shall be an integral part of the door structure and shall be capable of retaining the window in the door opening when subjected to the impact applicable to the window location described in 49 CFR Part 223.

xii). The glazing and its mounting system shall not extend beyond the outer surface of the door.

xiii). Door panels shall be fully insulated against thermal and sound transmission and grounded per APTA Standard SS-E-005-98.

xiv). Door panels shall not rattle or vibrate.

f). Obstruction Detection

i). Each door leaf shall be equipped with a service-proven obstruction detection system. The system should include over-current detection and a sensitive edge.

ii). Should the door close against an obstruction, the obstruction detection system shall immediately initiate the door opening cycle.

iii). The force required to activate the system shall not exceed 20 lbf.

iv). The sensitivity of the obstruction detection system shall conform to APTA Standard SS-M-18-10.

v). The design of the obstruction detection system shall not allow the door to oscillate if no obstruction is present.

vi). The design of the obstruction detection system shall be subject to Amtrak acceptance during design review.

vii). The Contractor shall provide a detailed assessment of the obstruction detection system as proposed, including theory of system operation, proven service history, reliability and maintainability, compliance with applicable regulations and standards, and safety analysis.

g). Overhead Door Track

i). Door leaves shall be suspended from an overhead door track.

ii). The track and door hanger assembly shall have minimum service life of 25 years.

iii). The track shall be convex with the curve on top, so as to be self-cleaning from buildup of dust.

iv). The door track shall employ concave rollers, with sealed, permanently lubricated bearings.

v). The overhead door track and rollers shall not be affected by environmental conditions, including the accumulation of dust.

vi). The door hanger and track shall be able to resist without damage or permanent deformation a force of 200-lbf applied perpendicular at the center of the door panel both in either the inward or outward directions.

vii). The rollers shall be secured to the hanger assembly with a mechanism, both to adjust for level as well as control vertical free-play between the hanger assembly and door track.

viii). Door leaf adjustment shall allow the space between the nosing seal to be made constant from the top to the bottom of the leaf.

ix). The amount of track-to-roller free-play shall prevent the trailing edge roller from lifting on the track if the door leaf strikes an obstruction down low while closing.

x). Adjustment of free-play clearances shall be easily done using standard tools.

xi). The track itself and mounting to carbody (not the door-to-hanger connection) shall be adjustable to accommodate both carbody and door leaf tolerances, including both height and plumb.

xii). The door track and hanger shall not require lubrication over its life.

h). Bottom Door Guides and Thresholds

i). A door guide with corresponding threshold shall be provided at the bottom of the door.

ii). Wear strips, if provided, shall be easily replaceable without removing or readjusting the door panel.

iii). The bottom guide arrangement shall ensure operation with no binding or rattling.

iv). The door guide/threshold shall form part of the door weather seal and shall incorporate drain holes to carry off water to the underside the car.

v). The threshold and drain and their sealing to the carbody shall ensure water or other fluids do not enter the equipment room, nor do they seep underneath and cause deterioration of flooring, its substructure or insulation.

vi). Easy access shall be provided to the door guide/threshold for cleaning and maintenance.

vii). The guide shall be adjustable to accommodate both carbody and door leaf tolerances.

viii). The bottom guide shall not require adjustments more often than every 360 days.

i). Weather Seal

i). The leading edge of the door panel shall interlock with the door frame to form a weatherproof seal.

ii). The interior and exterior of the door opening, including any curves at the top, shall be equipped with a flexible weather seal.

iii). The rear edge of the leaf shall be equipped with a batten that positively engages the door seal when the door is fully closed, including any radius at the top of the door opening.

iv). This combination shall affect a dust- and weatherproof seal.

v). The seal shall be attached to the door frame with sufficient clearance so as to prevent chafing against the leaf as it moves, yet ensure every door

leaf seals on every car, despite the combination of all manufacturing tolerances.

vi). The interface between the bottom of the door and the threshold shall form a weatherproof seal.

vii). When door is manually locked a seal shall prevent air infiltration.

viii). Seal design shall also limit the entrance of dust and snow into the door pocket when the door is open.

ix). The entire door seal arrangement shall be demonstrated during the design review process to provide an effective door seal under all operating conditions and is subject to Amtrak acceptance.

j). Door Pocket (If provided)

i). The door pocket will accommodate the door leaf while the door is open.

ii). Since the bottom of the carbody end door pocket is a wet area, it shall be lined with corrosion resistant material to prevent deterioration of car structure and flooring.

iii). This pan shall be designed to drain water out of the pocket area through a tube to the underside of the car.

iv). It shall be designed to ensure that water does not seep underneath and cause deterioration of flooring, its substructure or insulation, nor does not it freeze in the drain.

v). The drain shall be easily accessible for cleaning and shall be equipped with a backflow preventer to keep dust and moisture from blowing into the pocket.

12.5 Powered Gap Filler, Trap Door and Folding Step

a). General

i). Trainline-controlled, power operated stainless steel trap door, folding steps, and a gap filler shall be provided for each car type with a vestibule.

ii). Each side of the vestibule shall be equipped with a modular electrically powered trap door, gap filler, and folding step assembly for safe boarding and discharging of passengers at both low and high level platform stations.

(1) The design shall meet the requirements of the clearance diagram per D-05-1355.

(2) The trap door and folding steps shall be compliant with all aspects of ADA requirements.

iii). An exterior/interior weatherproof coach key switch, complete with seal over key opening and detent latch, shall be provided adjacent to the side doors on

each side of all cars to allow crew to open or close the adjacent door leaves, the trap door and folding steps to enter or exit the car.

iv). Hand-operated latches and handles shall provide clearance for operation by a gloved hand.

v). The module shall be complete with mounting holes so that it can be applied to the car vestibule floor from the top as a complete assembly or removed intact for major repairs. The design shall be interchangeable with other cars within this procurement.

vi). Amtrak will work with the Builder to identify J.L. Howard Hardware suitable for this application.

vii). See Chapter 20 for testing requirements.

b). Design/Construction

i). Gap Filler

(1) The powered side door high level platform gap filler shall undergo proof-of-design testing to evaluate and verify that the filler meets all specification requirements for:

(a) Compliance with all applicable ADA requirements.

(b) Functional and operational performance under all design loads, track conditions as specified, and safety factors without deformation or deflection.

(c) Rate of travel for extension and retraction.

(d) Proper operation of all safety provisions and functional interlocks and isolation devices within the unit and with the door system, brakes and indicators.

(e) Maintainability and reliability requirements.

(f) Manual retraction with power or mechanical failures.

ii). Folding Stairs

(1) The folding stairs shall consist of four (4) steps, with the lowest step located 17 inches above top of rail.

(2) Tread depth shall be 11 inches, and riser shall be 7 inches maximum.

(3) Open risers shall not be permitted.

iii). Trap Door and Threshold

(1) The trap door when closed shall form an integral floor with no relative gradient between the vestibule floor and the trap door.

(2) A rubber bumper shall be provided to cushion the stop when the trap door is raised to the open position.

(3) The trap door shall have devices to retain the trap door horizontal in the closed position and vertically in the raised position without rattling using corrosion-resistant railroad proven hardware.

(4) Neither the latch nor the trap door shall encroach into ADA accessible clear opening.

(5) Threshold of the trap door shall be ADA compliant.

iv). Trap Door and Folding Step Operation

(1) Trainline control at 74 Volts Direct Current (VDC) via 27-point communication trainline cable, in compliance with Amtrak Drawing A-63-7676-1.

(2) The trap door and folding steps shall be operated from the local door control panel or via trainline OPEN or CLOSE commands from another location or car.

(3) The trap door and folding steps shall not prohibit egress in an emergency situation or in the event of HEP power loss.

(4) A local maintenance on/off switch shall be provided per traps door and folding step to de-energize the local circuits and motor during maintenance and/or troubleshooting.

(5) Relay-based logic and discrete trainlines shall be provided for the issuing of control commands to the trap door and folding step.

(6) Discrete trainlines shall also be used to monitor the trap door closed and locked status, and provide the required indications to the train crew.

(7) Manual operation with power or mechanical failures.

v). Safety Considerations

(1) The trap door control system shall incorporate logic that shall meet the requirements of EN 50126 SIL 3 so that no unsafe condition will be created:

(2) through normal operation of the trap door system, or

(3) due to a failure of the trap door system equipment or components.

(4) Trap door control system shall be able to tolerate two separate grounds anywhere in the train in the trap door circuits and not have an unintended opening.

(5) Control system design shall be fault tolerant to prevent unintended trap door or step openings.

(6) Each trap door and folding step shall be provided with a position sensor to detect that the door is fully closed and that it is mechanically latched.

(7) Zero Speed Protection

(a) The zero-speed protection from wheel slide control unit on each car shall include all of the following:

(i) Trap door and folding step control panel system deactivation if not at zero-speed.

(ii) Removal of power from the trap door and folding step operator's OPEN function if not at zero speed.

(iii) Trap door and folding step CLOSE command automatically issued in both directions on left and right door close trainlines when car motion is detected.

(b) Zero-speed signal supplied by the wheel slide control unit shall be required in order to issue an OPEN command to the trap door and folding step.

(i) Conversely, the absence of a zero-speed signal shall prohibit the issuance of an OPEN command to the trap door and folding step.

(8) Traction Interlock

(a) Traction interlock shall be provided, with the trap door, gap filler and folding stairs closed indication, that prevents the locomotive from developing tractive effort if any side trap door and folding step is not fully closed and latched, or mechanically locked and electrically isolated.

(i) There is no interlock between the trap door closed summary circuit and the brake system.

(9) Obstruction detection with over current on each trap door and folding step meeting the requirements of APTA Standard SS-M-18-10.

(10) Emergency Releases

(a) Manual emergency release for each trap door and folding step from inside the car, with frangible cover.

(b) Manual exterior emergency release for each trap door and folding step, fully enclosed behind a weatherproof cover.

(11) Mechanical lock which can be engaged manually with a coach key from inside the car which allows the on-board crew to secure the trap door and folding step closed and isolate the trap door operator electrically.

(12) All trap door and folding step control system signal and indicator lights shall use approved long life, high intensity Light Emitting Diode (LED) or LED arrays lamps having a rated life of at least 100,000 hours.

(13) Audible signal, near the trap door at each side door opening.

(a) Tone or audible message and volume of audible signal to be submitted to the Amtrak for approval during design review. **[CDRL 12-01]**

vi). Handles

(1) The underside of the trap door shall be provided with an inverted N-shape grab handle to aid passenger egress/ingress when the trap is open.

(2) In addition, a handle shall be provided to aid in lifting the door and in pulling the door from its vertical position in manual mode.

vii). Safety

(1) The trap door and folding step assembly shall be designed to minimize pinch points.

(2) Trap doors, either open or closed, shall be free of sharp edges and corners, burrs, nicks and gouges.

c). Environmental Considerations

i). The outer edge must be designed to ensure the side entrance door seal is watertight.

ii). The trap door when closed shall form a water-tight seal with the adjacent side entrance door.

iii). Threshold of the trap door shall have provision for protective heat system to prevent ice-build up.

iv). Trap door devices shall be ice breaking type.

v). The folding steps shall be designed to prevent buildup of ice and snow from forming that would prevent the folding steps from operating or make them unsafe to use. Drain holes shall also be provided at the back of each tread.

d). Manual Operation

i). The trap door and step operating mechanism shall be designed so that the trap door can be opened or closed with a maximum force of 25 pounds at any point in travel in the event there is an electrical failure to the assembly.

ii). It shall be an assembled module mechanically linked such that moving the trap door controls the movement of the folding steps.

iii). When the step is being lowered, the mechanism shall be damped so it cannot fall freely.

e). Materials

i). The modular trap door and folding step assembly shall be constructed of stainless steel and shall not corrode during the life of the car despite the frequent use of salt for thawing, operating in seashore air, salt spray from operating near highways and grade crossings, etc.

ii). The threshold and surfaces subject to foot traffic shall be of a non-skid material as defined by the ADA.

iii). The top surface of the trap door shall be an approved non-skid synthetic floor covering surrounded with stainless steel protected edges.

(1) The synthetic floor shall be the same as the fixed floor in the vestibule.

iv). Treads shall be constructed of approved anti-slip material.

v). Non-skid surfaces shall retain their non-skid rating in wet and dry conditions and shall retain their coefficient of friction for minimum of five years.

vi). Wearable non-skid components shall not be permanently affixed to the car.

f). Markings

i). Periphery of the trap door and folding steps shall be highlighted by two (2) inch federal yellow stripes that are integral to the trap door and have high corrosion-resistance and wear-life.

ii). Reflective tape shall be applied to all step risers.

iii). Contrasting step edging shall be applied in a manner which makes the tread detectable whether ascending or descending stairs.

12.6 Onboard Mobility Device Lift

a). The standard coach, premium accessible coach, accessible sleeper, diner/lounge and café/lounge shall have an onboard mobility device lift on each side of the car.

b). The lowest station platform height for the purposes of the lift's lower reach shall be assumed to be 8" below the top of rail, to allow for emergency egress.

c). The lift design shall also allow for operation when the car is on a curve with up to 7 in. of lean, due to super-elevation.

d). When the lift is lowered to the platform, the lift shall sit flush with the platform surface and shall not exhibit any skew, tilt, or misalignment.

e). The lift shall be fully compliant with 49 CFR Section 38.

f). The lift proposal shall be service proven, modular, and of compact design to facilitate easy removal and replacement for servicing/repair.

g). The lift operation and its associated equipment shall be automatic and suitable for use by one crew member under all ambient conditions through which these cars are expected to operate.

h). The Contractor may propose alternative control configurations for one crew member operation for review and approval by Amtrak

i). Controls for each Lift shall be adjacent to the Lift they control. The Accessibility Lift controls must enable one (1) train crewmember to effectively oversee all aspects of lift operation and the occupant's movements to and from the lift, without impeding or restricting the occupant's mobility. The crewmember shall be capable of assisting the occupant either within the car or on the platform, without the need to access the occupant through an alternative exterior door.

j). In the event of lift failure or a power failure, it shall be possible to manually operate the lift to or from any position in the raising/lowering cycle, regardless of whether the lift is loaded or unloaded, and to stow and deploy the lift platform.

k). Operation of the lift in manual mode shall not damage the lift or its components.

l). A standard Amtrak coach key shall be required to operate the switch for each lift.

m). The controls for the operation of the on-board lifts shall be interlocked to prevent train motion.

n). Under power operation, the complete cycle of deploying the platform, lowering the lift to platform height, raising the lift to car floor height and stowing the lift platform shall require no more than between 30 and 60 seconds.

o). The lift shall comply with the most recent RVAAC recommendations and any applicable ADA standards.

p). The wheelchair lift shall report alerts and faults to the car diagnostic system.

q). The Contractor may propose other innovative solutions for onboarding passengers with mobility devices as an option.

12.7 Passenger Room Entrance Doors (Sleeping Accommodations)

a). General

i). A robust and service proven lockable sliding pocket entrance door shall be provided for each passenger room entrance door.

ii). The door shall be designed for low weight, sufficiently rigid, and strong construction to withstand when mounted and closed, a horizontal load of 330 lbs. (149.82 kg) applied at any point without permanent deformation.

iii). The door shall not rattle or squeak in any position and shall be sealed when closed to provide a highly soundproof barrier.

iv). The interior door face shall be consistent in appearance with the room modules.

v). The door itself and the partition door frame shall be of sufficient strength to not deflect, bend nor deteriorate from door slamming typical of normal car operation in the railroad environment.

vi). A louver shall be provided at the bottom of the door as a path for HVAC return air to exit the room.

b). Windows

i). Polycarbonate windows in the partition shall be included to provide natural light and enhance the room spaciousness.

ii). Windows shall each be ¼" thick with the following nominal dimensions:

(1) 17" x 44" in the door

(2) 15½" x 30½" in the partition wall.

iii). The door window shall be removable from either side through the use of a pry-out rubber zip strip as an emergency escape route should the door be jammed closed requiring 25 lbf or less to remove the window.

iv). The window shall be equipped with a privacy screen or alternates to be proposed for privacy and to block out hallway lights for sleeping.

c). Door Operating Components

i). The door shall be suspended from an adjustable, self-cleaning, heavy duty overhead low friction track.

ii). The force to open or close the door shall not exceed 10 lbf, once the détent is overcome. No less than 15 lbf shall be required to overcome the detent.

iii). The track rollers shall be sacrificial to the track for wear.

iv). The door will be stabilized at the threshold by an adjustable, self-cleaning guide at its leading edge only.

v). An approved détent shall be provided to keep the door in the open position during Car motion under all train operating conditions at all authorized speeds on any FRA class of track.

vi). A damper shall be provided to dampen a slamming door.

d). Door Pocket

i). The door and pocket walls shall be free from resonance, rattles and/ or banging in open, closed or closed & locked positions when the Car is in motion under all train operating conditions at all authorized speeds on any FRA class of track.

ii). An approved flat spring or similar anti-rattle device shall be provided to keep the door from rattling.

iii). The gap between the door and the edges of the door pocket shall be sized to avoid pinch points.

iv). The door shall not rub the door pocket in any way that marks the door with horizontal lines or scratches, etc.

v). Door pocket design shall discourage inadvertent use as a trash receptacle; it shall be possible to access the rear bottom of the pocket for cleaning or to retrieve objects trapped there. It shall be intended that the door perimeter gaskets prevent a line of sight to the compartment from other passengers.

e). Door Latch/Lock System

i). A robust and service proven latch/lock shall be provided for sleeping accommodations.

(1) The door lock shall allow the passenger to lock/unlock the door from the interior and exterior of the accommodation and shall be designed to prevent accidental lockouts. The contractor shall propose several concepts for Amtrak's review and approval.

(2) It shall incorporate the Amtrak standard coach key for override.

ii). The attachment of the latch and its keeper to the door frame shall be sufficiently rigid so that it does not flex when the door closes, even if it is slammed; the intention is that this interface does not deteriorate over the life of the car.

iii). Likewise, the interior of the door construction shall incorporate interior stiffening in the area where the latch is attached to the door, so that the fasteners securing it to the frame have a solid surface on which to clamp, rather than a somewhat resilient one.

iv). The latch, when engaged, shall keep the door in the fully closed position under all Car operating conditions at all authorized speeds on any FRA class of track at any permissible train speed.

v). The latch and lock system shall meet all CFR and ADA regulations as well as RVAAC and the United States Access Board especially with respect to reach range, hand position/grab angle, and operating forces. The latch and lock system shall be usable with one hand and must not require tight grasp/grip or awkward wrist motion.

vi). In an emergency, it shall be possible to disengage the latch from the hallway side with a screwdriver.

vii). An instruction, in accordance with Amtrak specification # 697, located on the interior side of the door, shall provide latch operating instructions.

f). Reliability

i). The passenger room entrance door shall undergo endurance testing to verify the door installation is not subject to premature wear.

(1) This shall include:

(a) Simulated door installation: door, track, module structure supporting track, door frame with adjoining partition, door latch assembly, detent, etc.

(b) 24,000 Open-close cycles with every tenth slammed

(c) Every 100 cycles, latch/ unlatch the door

(d) Measurement of change from initial setting at every 1500 cycles

(e) Measurement of force required to open/ close door every 1500 cycles

(f) Mutually agreed upon pass/ fail criteria shall be determined for allowable wear in advance of starting the test.

ii). Both track and détent shall be able to operate over 5 year maintenance cycles without adjustments or maintenance required.

iii). The design life of the door track and complete door installation shall be at least 30 years.

iv). The latch system shall be able to operate over 5 year maintenance cycles without adjustments or maintenance required.

g). Maintainability

i). The following shall be possible with only the need to open the hallway ceiling panel outside the room; no disassembly of the room partition is allowed:

(1) Disengage the door from the door mechanism

(2) Remove room door through door opening

(3) Remove door track

(4) Remove door détent (all pieces)

(5) Remove door damper (all pieces)

(6) Adjust the track, damper and détent

12.8 Automatic Sliding Restroom Door

a). A powered sliding pocket door with lock. The lock shall be operable from the outside with a standard Amtrak Conductor coach key

b). A minimum 32 in. "clear passage" shall be provided through the doorway when the door is fully opened.

c). All controls, switches and amenities readily accessible and operable by passengers with disabilities.

d). The door leaf shall incorporate a service-proven obstruction sensing system.

e). An LED indicator light REST ROOM OCCUPIED on the outside of the restroom, and a LED indicator light DOOR IS LOCKED WHEN LIT on the inside of the restroom, activated when the door is locked (see Chapter 11).

f). A decal shall provide door lock operation instructions.

g). In the event that the door operator is in fault, the door shall be operational in manual mode to open, close, and lock.

h). The door operator shall include a maintenance switch which will remove power from the motor to prevent operation while maintenance work is in process.

i). All functions will be available, including diagnostics.

i). The door equipment mounting and internal fasteners shall be such that once adjustments are made, and locked, they need not be disturbed until equipment overhaul or replacement.

j). Access shall be provided to all points necessary for service, installation or removal of the powered door and operating apparatus.

k). The door operator and controls shall operate from nominal 74VDC car battery system.

l). The door operator and controls shall operate normally over the entire voltage range of charging down to load shed without damage and without affecting the reliability and serviceable life of the operator.

m). The drive mechanism shall be designed to minimize torque applied to the door panel during operation.

n). The operator and linkage for the doors shall be arranged so the maximum force required to manually move a door panel with power removed shall not exceed 20 lbs.

o). The door operator shall preclude slamming or rebound and shall bring it to rest gently at the extremity of door leaf travel.

p). The door motion shall be smooth and free of shock and impact.

q). Damping shall be provided at the ends of travel of the door panel in both the opening and closing directions.

r). In the opening direction damping shall preclude the door leaf from contacting the mechanical door stop.

s). Door leaf travel shall be easily adjustable through a single adjustment point to set open and close positions.

t). Opening and Closing Times

i). Door opening and closing times shall be independently adjustable and shall be initially set with DC bus voltage with HEP on, at:

(1) Opening: 2.5 (± 0.5) seconds

(2) Closing: 3.0 (± 0.5) seconds

ii). Door motor control and timing function shall be incorporated on the operator unit.

u). Reliability

i). The door operator shall require adjustments no more frequently than every 460 days.

ii). The door motor and operator assembly shall be suitable for operation without component replacement between heavy overhaul periods of at least eight years.

iii). The door motor shall be a sealed design and suitably protected from the surrounding environment.

v). Overhead Door Track

i). Door leaves shall be suspended from an overhead door track.

ii). The track and door hanger assembly shall have minimum service life of 25 years.

iii). The track shall be convex with the curve on top, so as to be self-cleaning from buildup of dust.

iv). The door track shall employ concave rollers, with sealed, permanently lubricated bearings.

v). The overhead door track and rollers shall not be affected by environmental conditions, including the accumulation of dust._

vi). The door hanger and track shall be able to resist without damage or permanent deformation a force of 200-lbf applied perpendicular at the center of the door panel both in either the inward or outward directions.

vii). The rollers shall be secured to the hanger assembly with a mechanism, both to adjust for level as well as control vertical free-play between the hanger assembly and door track.

viii). Door leaf adjustment shall allow the space between the nosing seal to be made constant from the top to the bottom of the leaf.

ix). The amount of track-to-roller free-play shall prevent the trailing edge roller from lifting on the track if the door leaf strikes an obstruction down low while closing.

x). Adjustment of free-play clearances shall be easily done using standard tools.

xi). The track itself and mounting to carbody (not the door-to-hanger connection) shall be adjustable to accommodate both carbody and door leaf tolerances, including both height and plumb.

xii). The door track and hanger shall not require lubrication over its life.

w). Bottom Door Guides and Thresholds

i). A door guide with corresponding threshold shall be provided at the bottom of the door.

ii). Wear strips, if provided, shall be easily replaceable without removing or readjusting the door panel.

iii). The bottom guide arrangement shall ensure operation with no binding or rattling.

12.9 Accessible Rooms

a). The requirements of the passenger room doors and automatic sliding restroom door sections in this chapter apply to the accessible room doors.

b). Accessible bedrooms shall have the same lock that is provided for the other sleeping accommodations.

c). The lock incorporates the standard Amtrak Conductor coach key for override.

d). In the event that the door operator is in fault, the door shall be operational in manual mode to open, close, and lock.

12.10 CDRLs

CDRL	Description	Due
CDRL 12-01	Tone and Volume of Audible Signal	30 days prior to PDR

CDRL 12-02	Engineering analysis of side door operator's ability to operate over full HEP voltage range without damage.	30 days prior to IDR
CDRL 12-03	Side Door System Failure Mode and Effects Criticality Analysis (FMECA) and Fault Tree Analysis (FTA)	30 days prior to IDR
CDRL 12-04	Proposed door signage samples, location and adhesive	30 days prior to IDR

* End of Chapter 12 *

Amtrak Universal Single Level Fleet Replacement

Technical Specification

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13. Lighting System

Revision 2

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13.1 Overview

a). This Chapter describes the interior and exterior lighting system that shall be provided on all car types.

b). The lighting system as designed shall enhance the appeal of interior furnishings and create a comfortable and pleasant atmosphere while providing for maximum passenger and crewmember safety.

c). Normal and emergency lighting shall conform to the requirements of all applicable APTA standards and FRA regulations.

d). Automatic load shedding of certain lights shall take place when the Head End Power (HEP) supply is interrupted, and the battery voltage drops to certain levels.

e). All lighting equipment shall meet the requirements of Chapters 15 and 20, the voltage swing requirements of Amtrak Specification 429, and the environmental requirements of Amtrak Specification 963.

f). Lighting system components shall not cause radio frequency interference (RFI) to any car or operations systems.

g). The lighting system shall provide six modes of interior lighting: normal, quiet car, night, standby, emergency and cleaning.

h). Interior and exterior lighting, as well as indicator lights, shall be provided by Light Emitting Diodes (LEDs) and will be supplied by the low voltage DC system

i). Other state-of-the-art lighting technology may be proposed to Amtrak for review and acceptance.

j). Elements of this lighting system will be available for use as standby lighting.

k). Fluorescent, Incandescent and Halogen lights shall not be used except as specified.

l). For lighting requirements in the food service areas, see Chapter 16.

m). The Contractor shall prepare and submit an interior and exterior lighting plan **[CDRL 13-01]** for Amtrak review and acceptance during the design review. The plan shall describe the type of lighting to be used in all applications, including:

i). fixture type,

ii). voltage and color temperature,

iii). illumination levels at specified locations for all lighting modes, and

iv). compliance with emergency lighting and signage regulations and standards.

13.2 General Requirements

a). Fixtures installed in the interior within 3 ft. of a doorway that can be exposed to

weather when the door is open, shall be watertight to IP55 or better.

b). Fixtures installed on the vehicle exterior shall be watertight to IP56 or better.

c). Car interior lighting shall provide adequate and convenient illumination under all ambient lighting conditions from complete darkness to bright sunlight.

d). Lighting in all locations shall be arranged to minimize shadows, avoid glare and excessive brightness ratios.

e). Lighting shall be appropriate for the application, easily maintainable and compliant with all regulations and standards, including this specification.

f). Luminaires of differing voltages shall not share the same base design, and luminaires shall not be interchangeable between fixtures with differing voltages.

g). Commonality and standardization of components between fixtures should be used wherever possible.

h). Unless otherwise specified, the interior lighting shall be based on the latest guidelines of all of the following:

i). the Illuminating Engineering Society (IES) of North America

ii). Code of Federal Regulations

iii). the requirements of the American Public Transportation Association (APTA) standards:

(1) PR-E-RP-002-98: Wiring of Passenger Equipment

(2) PR-E-RP-012-99: Normal Lighting System Design for Passenger Cars

(3) PR-E-S-013-99: Emergency Lighting System Design for Passenger Cars

(4) PR-PS-S-006-23: Emergency Egress/Access Signage and Low-Location Exit Path Markings (LLEPM).

i). All lighting components shall have prior experience in North American transit, commuter rail or intercity passenger rail application.

j). All lighting sources shall be suitable for rough duty service found in the railroad environment throughout North America.

k). At its sole discretion, Amtrak may accept other components based upon provided shock and vibration test results, and EMC interference analysis.

l). The Contractor shall provide drawings of the lighting arrangement of each vehicle type, and the location and quantity of each lighting fixture, switch, control, and luminary type.

m). All luminaires used in all fixtures shall be readily available through a U.S.

distributor and available from multiple sources.

n). All luminaires must be replaceable without replacing the entire fixture or requiring specialty tools, except where approved by Amtrak.

o). All controllers shall report alerts and fault information to the car diagnostic system if applicable.

p). The design and all components of the lighting system shall be submitted for review and acceptance by Amtrak during Design Review.

q). All materials and workmanship shall comply with Chapter 19.

r). The lighting fixture housing or socket shall not be used as a ground return for any other electrical circuits.

s). Lighting fixture and consumable types shall be consolidated as much as practical.

13.3 Lighting Plan

a). Design Review

i). The Contractor shall provide drawings of the lighting arrangement of each car type for Amtrak review and acceptance during Design Review. Outline drawings shall be submitted at PDR and updated for FDR submittal. **[CDRL 13-02]**

ii). Fixtures providing standby and/or emergency lighting shall be identified at Preliminary Design Review. **[CDRL 13-03]**

iii). The location of each lighting fixture, circuit breaker size and location, switch, control, luminary type, color, luminance value (in footcandles) and quantity shall be clearly identified at Intermediate Design Review and updated for FDR submittal. **[CDRL 13-04]**

iv). Required charging light levels for photo luminescent (HPPL) emergency exit signage and Low Location Exit Pathway Markings (LLEPM) components will be identified during Design Review and validated during qualification testing. **[CDRL 13-05]**

v). Physical examples of each lighting fixture shall be provided for Amtrak review and approval at the Final Design Review. **[CDRL 13-06]**

vi). Lighting fixtures shall not be a source of Electromagnetic Interference (EMI) and shall be included in the Electromagnetic Compatibility (EMC) plan required by APTA Standard PR-E-S-010-98. See Chapter 20.

vii). The Contractor shall provide certification to Amtrak that the car's lighting system meets all standards and regulations **[CDRL 13-07]**

b). Additional Feature Lighting Fixtures

i). In addition to light fixtures required to meet standards and regulations, the following light fixture types shall be integrated into the interior and food service areas. See Chapters 11, 16 and 31 for additional information.

Figure 13-1: Feature Light Fixtures

Area	Type	Location
Luggage Storage	Indirect	Under Shelf
Hallway	Wash light	top of wall panels across ceiling
Hallway	Panel Spot Light	ceiling
Entrance	Wash light	top of wall panels across ceiling
Entrance	Panel Spot Light	ceiling
Entrance	Step lights	Threshold and steps
Coach/ Premium Coach	Wash light	across side ceiling panel
Coach/ Premium Coach	Wash light	across central ceiling panel
Coach/ Premium Coach	Reading Light	Overhead track/On seat
Coach/ Premium Coach	Panel Spot Light	ceiling
Coach/ Premium Coach	Compartment Light	under seat
STR	Panel Spot Light	ceiling master light
STR	Wash light	across floor for the length of the vanity unit
STR	Wash light	across sink and vanity counter
STR	Compartment Light	mirror light
ATR	Panel Spot Light	Main ceiling light
ATR	Wash light	across floor light along length of vanity unit
ATR	Wash light	across sink and vanity counter
ATR	Compartment Light	mirror light
Roomette	Wash light	across both end walls
Roomette	Panel Spot Light	ceiling master light
Roomette	Compartment Light	bunk step light
Roomette	Compartment Light	under seat
Roomette	Reading light	at both ends of upper bunk (when deployed)
Roomette	Reading light	each end of lower bunk/at each lower seat
SoloSuite	wash lights	down end wall behind rack
SoloSuite	wash lights	ceiling master light
SoloSuite	compartment lights	Inside ottoman footbox
SoloSuite	compartment lights	Under ottoman luggage area
SoloSuite	reading lights	lower seating/bed position
Club Bedroom	Wash light	across both end walls
Club Bedroom	Panel Spot Light	ceiling master light
Club Bedroom	Compartment Light	bunk step light
Club Bedroom	Compartment Light	under seat
Club Bedroom	Reading light	at both ends of upper bunk (when deployed)

Club Bedroom	Reading light	each end of lower bunk/at each lower seat
Club Bedroom	Restroom wash light	down back wall behind towel rack
Club Bedroom	Restroom Panel Spot Light	ceiling master light
Club Bedroom	Wash light	across sink and vanity counter
Club Bedroom	Compartment Light	mirror light
Accessible Bedroom	wash light	across both end walls
Accessible Bedroom	Panel Spot Light	ceiling master light
Accessible Bedroom	Compartment Light	under seat
Accessible Bedroom	reading light	at both ends of upper bunk (when deployed)
Accessible Bedroom	reading light	each end of lower bunk/at each lower seat
Accessible Bedroom	Restroom Panel Spot Light	ceiling master light
Accessible Bedroom	Wash light	across floor for the length of the vanity unit
Accessible Bedroom	Wash light	across sink and vanity counter
Accessible Bedroom	Compartment light	mirror light
Communal Showers	Wash light	across changing area wall
Communal Showers	Panel Spot Light	ceiling master light
Communal Showers	Panel Spot Light	ceiling - inside shower area
Communal Showers	Wash light	across floor for the length of the vanity unit
Communal Showers	Wash light	across sink and vanity counter
Communal Showers	compartment light	mirror light
Diner Lounge	Wash light	across side ceiling panel
Diner Lounge	Wash light	across central ceiling panel
Diner Lounge	Panel Spot Light	ceiling
Diner Lounge	Compartment Light	under table and seating
Diner Lounge	Feature Light	wall lamp at each window pillar
Diner Lounge	Feature Light	table booth lamp at each fixed dining table
Diner Lounge	Bar area lighting	feature pendant/down light
Diner/ Galley	Wash light	across central ceiling panel
Diner/ Galley	Wash light	across central ceiling panel
Diner/ Galley	Panel Spot Light	ceiling
Diner/ Galley	Feature Light	wall lamp at each window pillar
Diner/ Galley	Feature Light	table booth lamp at each fixed dining table
Diner/ Galley	Hallway wash light	top of wall panels across ceiling
Café Car	Wash light	across central ceiling panel
Café Car	Wash light	across central ceiling panel
Café Car	Panel Spot Light	ceiling
Café Car	Cafe area lighting	feature pendant/down light
Café Car	Cafe area wash light	down length of counter
Café Car	Café Interior Spotlights	downlights on counter and worktops
Café Car	Café compartment light	Display lighting

Café Car	Compartment Light	under table and seating
Café Car	Feature Light	wall lamp at each window pillar

13.4 Interior Lighting Levels

a). Lighting Standards

i). All light level measurements shall be made in accordance with the minimum standards defined by the following APTA standards unless otherwise approved by Amtrak:

(1) PR-E-RP-012-99: Normal Lighting System Design for Passenger Cars (for Coach Cars)

(2) PR-E-S-013-99: Emergency Lighting System Design for Passenger Cars

(3) PR-PS-S-006-23: Emergency Egress/Access Signage and Low-Location Exit Path Markings (LLEPM)

ii). Where lighting levels in Figure 13-2 differ from APTA PR-E-RP-012-99, the requirements indicated in Figure 13-2 shall be used.

b). Lighting Color Temperatures

i). The lighting color for all white interior luminaires throughout the car shall be in the range of 3000°K to 3600°K, +/- 500°K between any lights, and accepted by Amtrak. LED luminaires shall have a color rendering index (CRI) of at least 80, with the same color consistency and color stability.

ii). The Contractor is to provide a suggested light color plan for Amtrak's review and approval during the preliminary design review. **[CDRL 13-08]**

c). Minimum Lighting Illumination

i). The minimum spatial average of illumination shall be at the points listed in Figure 13-2, and shall meet the minimum value(s), measured in foot-candles, with all lights on and at the rated voltage when the equipment is new.

13.5 Interior Lighting Modes

a). Mode Control

i). See Section 13.11 for Control Description.

b). Normal Lighting Mode

i). Normal lighting mode shall be available when the car is operating from a Head End Power source.

ii). All lighting fixtures and elements intended for use while the car is in revenue service shall be available during normal lighting mode.

iii). Minimum illumination levels for normal lighting mode are shown in Figure 13-2.

c). Quiet Car Mode

i). Normal lighting mode in the car shall be arranged to allow the level of lighting to be reduced for passenger comfort during early morning and late evening operation, while maintaining sufficient lighting for passenger and crew safety, and compliance with standards and regulations.

ii). This reduced light level, referred to as “Quiet Car” mode, may use any combination of lighting elements so long as minimum light levels are maintained at “Standby” illumination levels throughout the car, and all light fixtures operating during quiet car mode remain powered at all times.

iii). A dedicated, clearly labeled switch in the electric locker shall permit operating personnel to easily select either normal lighting or quiet car mode lighting.

iv). Minimum illumination levels for quiet car mode are shown in Figure 13-2 under the “Quiet Car” column.

v). The Contractor shall carefully design the lighting fixtures and their controls to permit the Quiet Car lighting mode to have a minimum of glare and annoyance to sleeping passengers, especially those seated adjacent to the aisle.

vi). Light reflections and glare from bright metal body end doors shall be minimized.

d). Night Lighting Mode

i). Night lighting shall only provide minimal illumination to aisleways to allow safe passenger movement and not disturb seated passengers from resting.

ii). Night lighting mode shall not negatively impact the light intensity levels of all food and beverage service locations. All FDA light intensity level requirements for food preparation counters, sinks, and workspaces shall be maintained by shelf lighting alone. See Chapters 11 and 16 for additional information.

iii). The selection of lights being powered in this mode will be determined during design review when the lighting arrangement concepts are drafted.

iv). Contractor may propose that Quiet Car Mode and Night Lighting Mode are equivalent for Amtrak to review and approve.

e). Standby Lighting Mode

i). Standby lighting is that which is available when the cars have lost 480VAC Head End Power (HEP), but the car battery has not yet discharged to load shed.

ii). This lighting mode is intended to keep sufficient lighting operational for a period of at least 90 minutes so that short term loss of HEP will not affect the passengers' ability to safely move throughout the cars.

iii). Minimum illumination levels for Standby mode are shown in Figure 13-2.

f). Emergency Lighting Mode

i). Emergency Lighting mode is that which is available after load shed has occurred. See Chapter 15 for load shed details.

(1) This lighting provides passenger orientation and sufficient light levels for passengers to move about safely within the car and if necessary, to find the nearest safe exit point.

(2) It is especially important in trap steps, aisles, vestibules and enclosed spaces, such as toilet rooms.

ii). Emergency Lighting mode shall operate by hardware only. Software control of emergency light mode or intensity levels is prohibited.

iii). Emergency Light Intensity shall be met using the L70 end of life cycle light output levels.

iv). Once the low voltage system reaches a pre-determined low-voltage threshold, all standby lighting is extinguished and emergency lighting shall illuminate.

v). This lighting system may use dedicated fixtures, may provide a reduced level of illumination from the normal lighting system, or may use some but not all of the normal lighting fixtures.

vi). The emergency lighting system shall be powered by independent power sources for a minimum of 90 minutes as defined in APTA Standard PR-E-S-013-99.

vii). End-of-life self-diagnostic and test functions shall be included with the emergency lighting system.

viii). Emergency lighting shall comply with 49 CFR Part 238.115 and APTA Standard PR-E-S-013-99.

ix). Energy storage components, batteries or capacitors must have all contacts and terminals covered to prevent shorting during storage or installation, and easily changed out using a connector.

x). Energy storage components shall be common between all fixtures whenever possible.

xi). The Contractor shall submit an Emergency Lighting Plan to Amtrak for review and acceptance during Design Review. **[CDRL 13-09]**

(1) The Emergency Lighting Plan shall describe and illustrate the emergency lighting system, including location, type and design of all

lighting fixtures and the level of illumination that shall be provided at all points as identified in APTA Standard PR-E-S-013-99.

xii). The Contractor shall demonstrate compliance with emergency lighting requirements and shall provide to Amtrak written certification of compliance. **[CDRL 13-10]**

g). Cleaning Mode

(1) Cleaning Mode is a temporary mode that increases the interior light intensity to 30 foot candles to facilitate cleaning. See Section 13.11.b). for additional details.

13.6 Interior Lighting Requirements

a). Passenger Area

i). General

(1) The following describes the individual lighting fixture applications and specifications for all passenger areas of the car.

(2) Light fixtures in toilet room ceiling, vestibule ceiling and hallway ceiling shall be identical units if possible.

ii). Main Ceiling

(1) Longitudinal rows of lights shall provide the primary lighting for the revenue seating areas of all car types, and the passenger area of the food service car.

(2) Indirect lighting shall be the source of illumination to meet minimum illumination levels.

(3) Other arrangements can be proposed but are subject to Amtrak review and acceptance.

(4) These LED fixtures provide the main light source to the car and provide lighting to the aisle as well as general lighting to the seating areas.

(5) The fixtures shall be trough-construction units, mounted end-to-end. They shall be equipped with terminal blocks or connectors, as accepted by Amtrak, wired in parallel fixture-to-fixture, including all bus wiring for the entire fixture string for normal, quiet car, night and standby modes.

iii). Hallway Ceiling

(1) Hallway ceiling lights shall be used to supplement main ceiling lighting to achieve necessary illumination levels. Lighting shall be the same indirect style as the main ceiling. Direct lighting shall not be used unless specifically requested by Amtrak.

b). Reading Lights

i). General

(1) Reading lights shall be white LEDs powered by 74 VDC, 24 VDC or other approved DC voltage.

(2) They shall be mounted such that illumination requirements are achieved. Each reading light shall have an on/off switch.

(3) Reading lights shall have a maximum light intensity of 20 foot-candles when measured at a seated passenger's lap. Light intensity shall be passenger adjustable by either a dimmer switch or an integrated on/off/dimmer switch.

(4) Reading light orientation shall be passenger adjustable within a limited range, and beam dispersion to prevent disturbing adjacent passengers.

ii). Reading Lights for Main Passenger Seating

(1) Individual reading lights built into each revenue seat shall be provided. Overhead reading lights may still be necessary in certain seating locations, especially accessible seating locations.

iii). Reading Lights for Roomette, Bedrooms and Solo Suite

(1) A reading light shall be provided for each seating location.

(2) Location and arrangement of reading lights shall be proposed to Amtrak for review and acceptance during PDR.

(3) Physical dimming switches that are rated for railway application shall be provided in each sleeping accommodation for individual passenger control.

c). Bedroom Lighting

i). General

(1) Each sleeper room shall be equipped with indirect overhead lighting, fixed color temperature accent lighting, and a night light.

(2) Each light source shall be controllable by local physical switch.

(3) The HPPL will be powered on regardless of any light switch position.

d). Vestibules and other Non-Seating Areas

i). Flush-mounted overhead light fixtures

(1) Overhead lighting fixtures in vestibules and non-seating areas shall be proposed to be aesthetically appealing rather than an industrial type fixture.

(2) Flush-mounted overhead light fixtures with LED light elements shall be provided in the following locations for the purposes of commonality and interchangeability:

(a) End passageway

(i) The end passageway light(s) shall be a weatherproof, sealed light unit mounted overhead adjacent to the diaphragms or gangways on all car types.

(ii) The unit shall cast adequate light throughout the passageway area including handholds, door panel, walkway surface, signage and handbrake.

(b) Ceiling at side entry doors

(i) Flush-mounted lighted ceiling panel fixtures shall provide overhead light to the areas adjacent to the side entry doors and adjacent station platform.

(ii) The lighted panel assembly shall provide indirect lighting towards the center of the panel.

(iii) The same fixture shall be used at all side entrance locations, including service vestibules in the food service and lounge cars.

e). Toilet Rooms

i). Toilet ceiling and mirror

(1) Light fixtures shall be mounted on the ceiling of each toilet room to provide general lighting to the toilet room.

(2) Care shall be taken to provide good color rendition for cosmetic makeup application and other personal grooming purposes.

(3) Lighted mirror designs shall be presented in the toilet rooms during design review.

(a) A concept for a rounded LED light that illuminates the mirror around the boarder shall be presented at Preliminary Design Review and updated for approval at Final Design Review.

(b) A concept for a backlit mirror shall be presented at Preliminary Design Review and updated for approval at Final Design Review.

(c) The mirror light shall only be activated when the door to the restroom is locked. It shall be off when the door is unlocked to raise awareness to the passenger.

(4) The lighting fixtures shall be provided as part of the toilet module.

(5) Toilet room occupied/out of service sign

(6) There shall be a toilet occupied/out of service light fixture associated with each shared toilet room.

(7) The toilet occupied/out of service light fixture shall be mounted on the toilet room exterior wall, adjacent to the toilet room door for all toilet rooms.

(8) This light shall consist of a two-light LED fixture with a sign containing text and/or a pictorial symbol which provides indication as to when the toilet room door is locked (occupied) and a second light that provides indication that the toilet room is “out of service” (when the toilet system is not functioning) as per Chapter 17.

(9) Lights shall be on when the toilet is occupied or out of service and shall be extinguished when the toilet is available for use. These LEDs shall be yellow.

(10) Artwork for the labels shall be submitted to Amtrak for review and acceptance during the design review. **[CDRL 13-11]**

(11) An indicator shall be provided inside the toilet room, adjacent to the door, that illuminates when the door is locked (parallel with the toilet occupied indicator outside the toilet room).

(12) This indicator shall be labeled “Door locked” when light is on.

(13) Concept for indicator can be incorporated into the door open button; however, Amtrak will review and provide approval during design reviews.

(14) The Contractor shall reduce the light level in the toilet room, which changes to full brilliance when the toilet room door is properly locked.

f). Service and Utility Rooms

i). Electric/Utility locker(s)

(1) All electric/utility lockers shall be illuminated by a minimum of one overhead light, controlled by an automatic door open magnetic switch that turns on the light when the door is opened.

(2) For the purposes of this chapter, storage lockers, and storage cabinets shall be considered utility lockers.

(3) The light fixture(s) shall be protected by a clear shatterproof glass or polycarbonate lens, or other suitable protection, and shall not be vulnerable to damage during normal maintenance activities.

(4) Lights shall be operable during all lighting modes.

(5) The lights shall be so located as to provide general illumination within the locker, provide sufficient illumination to read any signage within the room, and be readily accessible for replacement.

ii). Utility/Equipment Rooms and Closets

(1) For utility rooms adequate lighting shall be provided for all potential maintenance activities in the space.

(2) Lights shall only turn on when the magnetic proximity switch detects the door or access panel is open. The lights shall turn on if there is a proximity switch failure.

(3) General lighting shall measure 20 foot-candles at the floor.

(4) Sufficient lighting shall be provided to illuminate all signage to 20 foot-candles.

(5) Any other areas that are called out for running repair maintenance tasks shall have sufficient lighting in the general area of 20 foot-candles at the floor.

g). Food Service Areas (Café and Diner)

i). Lighting requirements for the food service areas and seating areas are described in Chapters 11, 16 and 31, except as noted.

ii). All food service areas are considered occupied areas and must have emergency lighting and emergency signage.

iii). Under-shelf spot or strip lights are preferred in the food service areas to localize the high light intensity and not impact the adjacent passenger interior areas.

iv). The Café and Diner must not depend on main interior car lighting as there are minimal lights on during quiet and night modes of operation.

v). Food preparation and serving areas shall meet the requirements of FDA Food Code 2022, Section 6-303 Lighting.

(1) All food preparation surfaces shall measure 50 foot-candles along the entire counter.

(2) Utility sinks shall measure 50 foot-candles at the center of the sink at the height of the faucet.

(3) Hand wash sinks shall measure 20 foot-candles at the center of the sink.

(4) All food and beverage displays shall measure 20 foot-candles at each shelf.

vi). General kitchen area shall measure 20 foot-candles measured at the floor.

13.7 Interior Backlighting

a). At a minimum, backlighting will be expected on all mirrors, displays and logos unless otherwise directed by Amtrak.

b). Backlighting shall be reviewed during the interior design review process with renderings to provide lighting effect on mirrors, displays, advertising, company logos or other features that could be showcased.

13.8 Exterior Lighting Requirements

a). Standards

i). All exterior lighting components shall meet the environmental conditions specified in Amtrak Specification 963.

ii). All exterior lights shall be rated IP56 or greater.

b). Marker Lights

i). All cars shall have two red marker lights at both ends.

ii). The marker lights shall be LED with thermostat-controlled heating elements to protect against frosting, or be recessed behind heated cover, and shall meet FRA requirements in 49 CFR Part 221.

iii). If LEDs with heating elements are used, the condition of the heating system must be readily determined by simple visual inspection so that there is no risk of the marker visibility being diminished or obliterated.

iv). Failure of the heating system will be considered a failure of the marker itself.

v). The marker lights shall be operable during all lighting modes operating off main car battery.

vi). The marker lights will be controlled by a crew-operated switch in the car electric locker.

c). Platform Lights

i). Each side door opening shall have a station platform light(s) that will illuminate the platform area adjacent to that door opening when those doors are opened.

ii). These lights shall be mounted flush into the carshell or the threshold area and not protrude beyond the side of the carbody.

iii). The lights shall be aimed downward so as to not shine directly into the eyes of passengers or crew standing on the platform or in the vestibule of the car and shall be mounted in an impact-resistant and waterproof housing.

iv). The platform lights shall illuminate when any door panel in the adjacent door opening is opened, either by command from the door control system, by use of the emergency door release or by a local manual switch of a manual door.

v). The platform lights shall remain off when the door panels are closed.

vi). Low level station platforms shall be illuminated to the requirements of Figure 13-2, which exceeds 49 CFR Part 38 and APTA recommended practice.

vii). The platform lights shall also be a part of the emergency lighting system and shall conform to APTA Standard PR-E-S-013-99.

d). Step Lights

i). The trap steps on each side door shall be illuminated to the requirements of Figure 13-2, which exceeds 49 CFR Part 38 and APTA recommended practice.

e). Exterior Indicator Lights

i). Each exterior indicator light shall be visible from both ends of the train of up to ten (10) car train length.

(1) Assemblies shall be designed to avoid false positive light indications from direct sunlight.

(2) Lens assembly shall be designed to avoid snow and ice buildup, either by shape of the assembly or by use of heated lenses.

ii). Each car shall be equipped with exterior door open indicator lights, one per side door.

(1) These indicators shall be red LEDs and shall be located on the exterior of the car above and adjacent to the door, so that the status of each side door is visible to the Engineer when viewed down the side of the train.

(2) The indicators shall display a red indication when any door in the adjacent vestibule is open (i.e., not closed and latched) and shall be dark when all doors in that vestibule area are closed and latched.

(3) A small ceiling mounted indicator light, located in the side door vestibule adjacent to each door, shall also illuminate when the adjacent door is not fully closed and latched, as an aid to the train crew.

iii). Each car shall be equipped with two exterior brake indicator light units, one on each side of the car, as per Chapter 9.

(1) Mechanical brake indicators may be used as an alternate to the indicator lights, if there is a brake status display elsewhere for the crew.

(2) Brake indicator light units shall use green, yellow, and flashing yellow LEDs.

(3) All indicator light assemblies shall be visible from both the front and the rear of the train, be able to withstand car washer brushes, and be located clear of any roof drains or gutters.

(4) The indicator lens material shall be polycarbonate.

13.9 Systems Indicator Panel

a). The systems in the cars should connect to a single user interface screen that allows monitoring of each by selection, preferably through the CDU or OTIS terminals. Control of systems will be set at different levels of authority.

13.10 Lighting Component Requirements

a). Light Emitting Diode (LED) Lighting

i). LED fixtures shall conform to the requirements of the *Energy Policy Act of 2005* or more recent requirements. The correlated white color temperature throughout the car shall be in the range of 3000°K to 4100°K, +/- 500°K between any lights, and accepted by Amtrak. Fixed color temperature accent lights shall be reviewed and accepted during design review.

ii). Where practical, the LED lighting should be supplied from the DC system and be available in both Normal and Standby lighting modes.

iii). All fixtures shall be dust and moisture resistant and shall be arranged to facilitate replacement of the LED luminary from the passenger compartment.

(1) Luminaires shall be removable without special hardware after removing only the hinged lens if they are not replaced as a whole.

iv). An LED driver designed to ensure proper operation of the LEDs shall be mounted on the LED assembly.

v). LED assemblies shall be connected via interlocking, self-polarizing and modular connectors accessible when the light fixture is opened. Connectors and jumper wires shall be white in color to minimize visible dark spots behind lenses.

vi). Power supplies shall comply with the requirements of Chapters 4, 15 and 20.

vii). LEDs used in passenger area overhead lighting shall be mounted on replaceable boards installed in the light fixture.

(1) Boards shall be connected to the fixture by screws and shall be plug-connected electrically for easy replacement.

(2) The LEDs shall be sized and spaced so that the failure of up to three LEDs on an individual board shall not create an appearance of a dark area on the fixture. This dark area may be driven by the number of LEDs in series within the array, depending on the design.

viii). LED lighting shall be sized to provide the level of lighting as outlined in Figure 13-2.

ix). Changeable LED luminaires are preferred, and LED lighting may be dedicated to its fixture where the design is necessary.

x). Using common LED/Driver boards is preferred whenever possible. The number of different boards shall be minimized.

xi). White LED luminaires shall have lumen maintenance of 70 percent (L70) for a minimum of 120,000 hours as measured per the Illuminating Engineering Society of North America (IESNA) standard LM-79-08, Electrical and Photometric Measurements of Solid-State Lighting Products.

xii). All minimum lighting levels per APTA shall be maintained at the end of the 120,000-hour period.

xiii). The Contractor shall propose designs that include automated scenarios to address the known reduced light output as components age.

xiv). As Amtrak passengers occupy cars for extended periods, simply increasing the initial light output with no age compensation to address end of life degradation is not acceptable.

xv). LED luminaires shall be provided with sufficient heat sinks capable of keeping LED junctions and associated electronics below 125°F, regardless of summer ambient temperature and continuous operation.

b). Independent Power Source

i). General

(1) There shall be two independent power sources on each car to provide maximum emergency lighting availability on each car.

(2) Each power source shall be at least 20 feet apart from each other to avoid a single point failure in case of a catastrophic accident that could disable all emergency lighting on the car.

(3) Lighting fixtures shall alternate power sources over the entire length of the car to maximize availability of emergency lighting according to 49 CFR 238.115(b)(1) equivalent level of safety.

(a) It is acceptable to exceed the APTA specified distance between independent power source and the light fixtures that it powers as long as the 49 CFR 238.115(b)(1) equivalent level of safety is achieved with the overall arrangement.

(4) Independent Power Sources shall have their own dedicated equipment enclosure for improved maintainability.

(5) Independent Power Source risks must be included in the hazard analysis at Intermediate Design Phase.

(6) There shall be power source charge level indications to quickly show emergency lighting readiness to operations inspectors and maintainers preparing cars for passenger service.

(7) Power source charge level shall be reported on both the lighting power source enclosure with status LEDs, and the car network to the diagnostic system.

(8) Self-test functions of the independent power sources shall consider time required to function test the controller, validate power source capacity, and display to the maintainer estimated time for self-test completion.

(9) It shall be possible to self-test power sources either one at a time, or both simultaneously to minimize test duration for maintenance personnel.

ii). Battery-Based Power Source

(1) Batteries shall comply with all requirements in APTA PR-E-S-013-99.

(2) Battery and Battery Management Charging System can be combined into the same enclosure, but they cannot be combined with other lighting controls that have longer periodic maintenance intervals.

(3) There shall be deep discharge protection for the battery.

(4) Battery Management System failures and battery venting risks must be considered when designing the initial equipment enclosures at Intermediate Design Phase.

iii). Capacitor-Based Power Source

(1) The required emergency lighting that has an alternate back-up to the vehicle batteries may be supplied by capacitor-based lighting.

(2) The capacitors must be rated for a minimum of 500,000 charge cycles.

(3) Capacitor terminals shall be covered to protect shorting and shall be connected to fixtures through connectors.

(4) The capacitor-based power source for emergency lighting shall have a label located on the side of the unit exposed for service that includes the following information:

(a) OEM name and address

(b) OEM part number — revision/modification level and date

(c) Date of manufacture

(d) Unit serial number

(e) Voltage and capacity rating

13.11 Housings, Lenses and Diffusers

a). General

i). The overhead light assembly shall be designed for luminary replacement from below. The hinged light lens shall swing down allowing easy luminary replacement.

ii). No material shall suffer any loss of performance when exposed to environmental conditions specified in Amtrak Specification 963 or exhibit degradation of properties (including color) under long-term exposure to ultraviolet light.

iii). Lighting fixtures shall have lenses designed to aid in light distribution, prevent glare, permit easy luminary cleaning and facilitate luminary replacement.

iv). Fixtures equipped with lenses shall have a one-piece polycarbonate lens, either clear or translucent white, uniform in color and smooth on the exposed side, which will provide the specified intensity of illumination on the reading plane, while diffusing the light to illuminate adjacent wall and ceiling surfaces, increasing the overall brightness level in the interior of the car.

(1) The lens shall be mounted on a hinged bezel and shall be secured with captive fasteners.

v). The lenses shall project light with an even brightness without patterns and shall have a smooth surface on all sides and edges that are open to the passenger seating area to avoid injury.

vi). Tamper-proof fasteners shall retain door to the housing.

vii). A neoprene foam gasket around the lens assembly shall make the joining of door and reflector dust-resistant and rattle free.

viii). The diffuser lens shall be removable for replacement.

ix). The lenses shall be easily replaceable without having to disassemble the light fixture and shall be made of an approved Ultraviolet (UV)-stabilized polycarbonate and meet the Flammability, Smoke Emission and Toxicity requirements specified in Chapter 19.

b). Apparent Light versus Illumination:

i). The primary function of lighting fixtures is to provide controlled illumination for the safety, convenience and comfort of the passengers and train crew.

ii). Lighting fixtures produce illuminating and apparent light.

(1) Illuminating light projects or otherwise illuminates objects and areas. The illumination levels for those areas are defined within the

specification according to the activities of those areas or other specific needs.

(2) Apparent light is the illumination that the passenger or crew person sees of the fixture itself.

(3) Lighting fixtures used for normal lighting (non-emergency) in continuously occupied passenger and crew spaces shall be designed so that the apparent light is unobtrusive to passengers. This is especially critical when cars are in Quiet Car Mode.

(4) Fixtures shall be lensed and baffled to prevent the apparent light from being annoying or distracting to passengers and crew.

iii). Lighting shall be designed to eliminate reflected glare beyond the intended illumination zone.

iv). All fixtures in continuously occupied passenger and crew spaces must be shown during design review to not have normal direct view of the light source (LED array) or diffusor.

13.12 Controls

a). Lighting Control Human Interface General

i). All lighting controls shall operate on an individual car basis, under the control of the train crew.

ii). Amtrak accepted method of easily providing various levels of interior car illumination by the train crew shall be provided.

iii). The controls in this section apply to the main common area car lighting and does not override lighting controls in the bedroom and roomette controls described in Section 13.6.

iv). The car lighting controls shall be located in the switch locker located within the electric locker.

v). Lighting modes as described in Section 13.5 shall be selectable using the car network HMI to control the lights on a per-consist level. Transitions between lighting modes shall have an Amtrak adjustable PTU parameter for time duration.

vi). There shall be an individual override switch on each car to force a lighting mode.

vii). The car network may also be used with consideration for priority levels with physical switches and failure conditions defaulting to conservative operating modes.

b). Lighting Control Override Switch

i). Each car shall have a manual lighting control override switch with positions for Quiet, Night, Auto, and Cleaning as described in Section 13.5.

ii). The switch positions shall be monitored by the diagnostic system and fault information messages when a train-level command and car override switch position are not the same.

iii). Cleaning mode position shall be momentary, and all other positions shall be maintained.

iv). Cleaning mode shall have a software parameter time setting adjustable by Amtrak.

v). An additional reading light test switch or feature shall be provided such that all reading lights in a car can be turned on and off at once from the central controls.

vi). Controls and switches designated for crew operation shall be located on electrical panels separate from devices designated for maintenance operation such as circuit breakers. See Chapter 15 Electrical Panels for additional requirements.

vii). All lighting shall be circuit breaker protected. Lights identified for on/off control shall have an on/off switch in addition to the circuit breaker. Controls shall be housed in the electric locker, except as listed below, where local controls shall be provided:

(1) Each reading light shall have an on/off switch located adjacent to the reading light.

(2) Each reading light at an accessible seating location shall have an on/off switch located in accordance with the requirements of ADA.

(3) Electric and Utility lockers shall have automatic light magnetic proximity switches located inside the locker adjacent to the entry door.

(4) Selected lighting circuits in the food service area shall have on/off switches. See Chapter 16 for details.

13.13 LLEPM and HPPL Emergency Signage

a). General

i). A low-level exit path floor marking system shall be installed in the car in compliance with APTA Standard PR-PS-S-006-23 Emergency Egress/Access Signage and Low-Location Exit Path Markings (LLEPM).

ii). The system shall operate in conjunction with the emergency lighting system. Details shall be submitted to Amtrak for approval during design review. **[CDRL 13-12]**

13.14 Minimum Illumination Levels

a). Light levels shall be reviewed and finalized during design review.

Figure 13-2: Minimum Illumination Levels

			Illumination Levels in Foot-Candles			
Area	**APTA REF**	**Measured At**	**APTA LEVELS**	**Normal Lighting**	**Quiet Car Lighting**	**Standby Lighting**
General Overhead	6.3	45 plain	20	10	5	5
Reading Lights	6.3	45 plain	20	20	20	20
Aisleway Lighting	5.5	Floor	5	5	5	5
Vestibules, Steps	5.1	Floor Threshold	5	10	10	5
Low-Station Platform	5.1	Perpendicular to Threshold 3 feet away at each step height	2	5	5	5
End Passageway / Diaphragm/Gangway	5.1 / 5.4	Floor	5	10	10	5
All Toilet and Shower Rooms	5.6	Mirror	30	30	30	10
All Toilet Rooms	5.6	Area	15	15	15	10
Shower Rooms		Floor		30	30	30
Roomette, SoloSuite, and all Bedrooms (dimmable lights at full intensity)		Floor		10	10	5
Roomette, SoloSuite, and all Bedrooms (dimmable lights at full intensity)		Reading Lights, Desks and Tables		20	20	20
Food Service Area	10.3	Table Area	15	15	15	5
Passenger Service Counter Area	10.3	Counter	20	20	20	10
Kitchen General		30 inches above floor		20	20	5
All Food and Beverage Displays		Each shelf		20	20	5
All Food Preparation Areas (FDA Food Code 2022 section 6-303)		Counter		50	50	5
Electric Locker	5.7	All signage		20	20	5
Utility Closet	5.8	Floor, Shelves		5	5	5
Bike/Luggage Rack Area	11.3	Floor	5	10	5	5
Luggage Rack Tower	11.3	At aisle on Floor	5	10	5	5

13.15 CDRLs

CDRL	Description	Due
CDRL 13-01	Interior and Exterior Lighting Plan	30 days prior to Lighting PDR
CDRL 13-02	Drawing of lighting arrangement for each car type	30 days prior to Lighting IDR
CDRL 13-03	Identification of standby and/or emergency lighting fixtures	30 days prior to Lighting PDR
CDRL 13-04	Details of lighting fixtures, luminaries, circuit breakers, controls and switches.	30 days prior to Lighting IDR
CDRL 13-05	Required charging light levels for HPPL and HPPL Emergency markings	30 days prior to Lighting IDR
CDRL 13-06	Physical examples of each lighting fixture	At FDR
CDRL 13-07	Certification to Amtrak that the car's lighting system meets all standards and regulations	30 days prior to Conditional Acceptance
CDRL 13-08	Suggested Light Color Plan	30 days prior to Lighting PDR
CDRL 13-09	Emergency Lighting Plan	30 days prior to Lighting IDR
CDRL 13-10	Demonstration and Written Certification of Compliance for Emergency Lighting	30 days prior to Complete car FAI
CDRL 13-11	Toilet Room artwork for labels	30 days prior to Lighting PDR
CDRL 13-12	LLEPM and HPPL Emergency signage details, including integration	30 days prior to Lighting IDR

* End of Section 13 *

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

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14. Communication System

Revision 2

26-FOI-00415 00000006276 "UNCLASSIFIED" 4/30/2026

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14.1 Overview

a). System Manufacturer

i). This chapter describes the system requirements for the on-board communication system to be provided on each car of the supplied fleet.

ii). Amtrak is in-process of defining Televic based products or progeny as their enterprise-wide supplier of choice for all on-board communication systems.

iii). The contractor shall deliver a Televic or as an option, a comparable system that complies with the requirements of this specification. The contractor shall provide both solutions for Amtrak to evaluate.

b). System Composition

i). The communication system consists of:

(1) Public Address / Intercom (PA/IC) system, including

(a) Public Address Speakers

(b) Public Address Amplifiers

(c) Attendant call system

(d) Passenger Emergency Intercoms

(e) PA/IC Control Stations

(2) Onboard Train Information System (OTIS)

(3) A reservation display system (including seat, compartments, and other passenger reservable areas) – Option

(4) An electronic door lock system

(5) A video surveillance system – Option

(6) Ethernet Train Backbone (ETB)

(7) Ethernet Car Network (ECN)

c). System Functionality

i). These systems have discrete functions that are extensively integrated to provide a comprehensive communication system within each car and between the car and other cars in the assembled consist. Each car shall operate independently in situations where interoperability with the legacy fleet is required. New cars shall be interoperable with the existing legacy equipment, providing the full existing functionality of the legacy equipment when connected in consist on either, as well as both ends of contiguous sets of new cars. In addition to maintenance of existing functions of the legacy equipment

via 27-pin trainline connections, the new cars shall be capable of receiving and transmitting all analog audio functions implemented on the legacy fleet, as well as receiving, transmitting, and displaying attendant calls between the new fleet and legacy fleet. The Contractor shall prepare and implement an interoperability plan and demonstrate required interoperability with each identified fleet of legacy equipment.

ii). Where practical, this design shall be based on modern state-of-the-art technologies. It shall be built with an extensible architecture that shall both interface with systems that may already be in use in any existing rolling stock and in Amtrak's existing wayside environment, as well as support on-board systems, rolling stock, and wayside systems that may be added in the future.

iii). The communications system shall comply with the requirements of APTA Standard PR-PS-S-001-98 and all applicable federal and state regulations.

(1) In the event APTA standard couplers, air brake hoses, or passenger car Head End Power/Communications/locomotive MU control electrical trainlines are used inter-car, the connections must meet all applicable AAR, APTA, and Amtrak standards.

iv). The car's ECN shall be capable of multiple functions such as for destination sign and announcement control, diagnostics, video surveillance data transmission and download, and real-time health monitoring of on-board systems and components.

v). The consist ECN shall facilitate data transfer between the on-board systems of the car and train and wayside communication systems through cellular and Wi-Fi multi-modem, multi-carrier routers implemented as the Data Communication System (DCS).

(1) The Contractor shall utilize the ETB and ECN to facilitate the aforementioned data transfer.

(a) The Contractor shall identify cost savings by proposing alternate architectures.

vi). Consist Length

(1) Consists are typically configured up to 1,530 ft in length excluding locomotives.

(2) All car functions shall operate per the standards of this specification within this length range.

(3) Trainline functions may operate at reduced levels at lengths greater than 1,530 ft based on an Amtrak approved technical justification that includes revised limits.

14.2 General Requirements

a). General

i). The OTIS/PIS shall provide the passengers with both visual, audible, and digital information as configured and programmed by Amtrak such as the train destination, present station, next station, pre-set messages, train consist arrangement, car and consist information, emergency messages and visual graphics, including advertising.

ii). The information shall be provided through the interior and exterior signs, through interior and exterior speakers, through the inductive audio loop system, through Bluetooth LE Auracast broadcasts (option), and through other digital networked connections as required by Amtrak.

iii). The OTIS/PIS shall be a fully automated system, with the capability for overrides and adjustments by train crew and Amtrak wayside operations.

iv). Once the system is activated, through the selection of a pre-programmed route by train crew or an Amtrak wayside operation, it will automatically establish train location through the Global Positioning System (GPS) and sequentially display and announce the upcoming stations at programmed locations.

v). The system shall receive speed signals from the Ethernet Car Network to facilitate continued operation during times when GPS is not available and shall be capable of receiving train crew input to resynchronize train location.

vi). The network and software architecture, design, and configuration of the equipment identified in this section shall be maintainable and extensible by Amtrak, facilitating the addition or replacement of additional vehicle switches and end devices throughout the life of the vehicle through exposed APIs implemented at each device supplied as a part of these requirements which facilitate the interaction with Contractor supplied communication components.

b). EMI/EMC Design Requirements

i). The design and installation of the communications system shall ensure that it functions as intended, without interference to or from any other electronic equipment on the cars.

ii). It shall comply with the requirements of the Federal Communications Commission (FCC) for Class A radiation standards, the requirements of APTA Standard PR-E-S-010-98 and Chapter 19 for materials and workmanship.

c). Fault Tolerance and Recovery

i). The car and train level components of the system shall be fault tolerant, so that failure of one item shall not impair normal operation of the remainder of the system, and that any single point of failure does not result in good cause to remove the train from continued revenue service.

ii). To accomplish this, it is expected that multiple communications controllers will be required per train, and that multiple PA Amplifiers will be required per car, and that diagnostic information will be available through multiple controllers.

iii). The Contractor shall identify the fault tolerance capabilities, recovery time, and user interaction required to maintain system operation. **[CDRL 14-01]**

iv). Momentary Head End Power (HEP) power outages shall not cause the system to require any reset, and upon the loss of power for any reason while executing a journey, the system shall return to its previous route and location without re-programming or reconfiguration by train staff.

d). Public Address/Intercom (PA/IC) System Component Locations

i). PA / IC control stations shall be secured from unauthorized use in a physically locked area/cabinet and located at least in the following areas, to be confirmed based on proposed car design and layout:

(1) At least one located in each car

(2) One located at each crew area, including:

(a) Conductor's office (if equipped), paired with a control terminal

(3) Located at each serving counter area

(4) One located at each boarding area, paired with a passenger accessible control terminal

ii). Speakers shall be provided throughout all cars.

iii). Speaker zones shall be located in the following areas of each car:

(1) Interior public passenger areas

(2) Individual zones in each private passenger compartments such as bedrooms and roomettes

(a) Volume control shall be provided in each private passenger compartment, which can be overridden by the selection of the Interior – Override zone

(3) Exterior "left" zone

(4) Exterior "right" zone

iv). IP Based PA amplifier

(1) A minimum of two shall be provided in each car to provide redundancy of audible broadcasts.

v). Inductive Loop Amplifier

(1) Inductive loop amplifiers shall be provided on each car to provide passengers with assistive listening devices in passenger areas access to public PA announcements for that car.

vi). Interface to OTIS system

(1) The PA / IC system shall be controlled through OTIS Control Units throughout the train.

vii). Interface to analog trainlines

(1) Each car's Public Address / Intercom shall support interface to analog trainlines.

viii). Interface to Ethernet Train Backbone

(1) Each car shall interface with a redundant Ethernet Train Backbone (ETB) dedicated to support the functions of the Communication system and its components. The Communication system ETB shall be independent and isolated from any ETB used for train control, monitoring and diagnostics, and other onboard systems.

e). OTIS System Components

i). The Contractor shall provide the following equipment:

(1) Exterior destination signs; (all cars)

(2) Interior graphical displays; (all cars)

(3) Interior graphical displays with integrated control terminal; (all cars)

(4) OTIS Control Unit (OCU); (all cars)

(5) Data Communication System (DCS); (all cars)

(6) GPS; (all cars)

(7) Interface to Ethernet Train Backbone

ii). Some consolidation of functions may occur between PA and OTIS but the combined system must meet the requirements herein.

f). Cellular Telephones

i). The Contractor shall ensure that mobile cellular telephones can operate reliably inside all cars within each car, under all on-board equipment operating conditions and at all locations along the Amtrak operating system, provided that the necessary external facilities have been installed by others.

ii). The Contractor shall include appropriate considerations taken as a part of the carbody design and/or window design to limit the impacts on cellular reception inside the vehicles from car construction, and from electrical and electronic equipment integrated into the vehicle.

iii). At PDR, the Contractor shall submit for Amtrak approval a plan for minimizing the attenuation based on car construction, such as using etched window

coatings in vehicle glazing, RF transparent car-body components, or other approved approach.

iv). The Contractor shall submit a plan identifying the approach to reducing the attenuation of the carbody, on-board equipment, and glazing impact on cellular telephone reception to Amtrak for review and approval prior to PDR. **[CDRL 14-02]**

14.3 Public Address/Intercom (PA/IC) System

a). Public Address (PA) System General Requirements

i). Each car shall be equipped with a fully digital, IP Ethernet based PA system.

(1) Contractor shall provide alternate proposals to the use of IP Ethernet based system. Contractor shall determine cost effectiveness of options and present them to Amtrak for review.

ii). The system shall permit the train crew to provide a manual PA announcement to the passengers and allow it to be directed to loudspeakers on only the local car interior, to the interior of all cars and/or to the exterior speakers of all cars.

iii). The PA system shall also provide a means for a train crewmember to communicate by voice in an emergency situation to persons in the immediate vicinity of the car.

iv). The PA system shall provide Amtrak's Consolidated National Operations Center (CNOC) with the capability to control the Public Address System, including making audio, visual, video and graphical announcements for emergencies, service disruptions, and otherwise as commanded by authorized Amtrak personnel. Connectivity options shall be secured with appropriate authentication and encryption.

v). PA Amplifier Requirements

(1) Each PA amplifier shall have power supplied directly from the car low voltage battery circuit and protected by a dedicated circuit breaker.

(2) The PA amplifier shall interface with the OCU and with the control terminal over the DTL and drive the car speakers whenever audio messages are generated.

(3) The PA amplifier shall have a power output capacity sufficient to drive all the speakers on the car at the nominal speaker output power plus 25% spare capacity. The same PA amplifier unit model shall be installed on all car types.

(4) The PA system (from the input to the microphone to the output of the interior speakers) shall have a 90% intelligibility rating when tested according to ANSI Standard S3.2-1989 (R1999) and shall have the following performance characteristics for all modes of operation, including manual and automated digitized announcements:

(a) Frequency Response: ± 5dB from 250 Hz to 8 kHz

(b) Total Harmonic Distortion: Less than 1%

(c) Hum or Buzz: Signal-to-noise ratio greater than 40dB

(5) The PA amplifier shall incorporate a volume control adjustable only with the use of the Portable Test Unit (PTU) and through administrative access provided via the wayside systems. The sound level from the car's speakers shall be uniform within ± 5dB at all passenger locations.

(6) The PA amplifier shall be a programmable amplifier.

(7) The PA system shall have a Day/Night mode. The Day mode will be in normal operation. The Night mode will decrease the output by 8db. This mode should be able to be triggered by PA Control Panels, OCU, and car control terminals. The setting shall be overridable by individual passengers in sleeper rooms through the Passenger Compartment Control Unit.

(8) The PA amplifier unit shall incorporate at a minimum, the following indicators on the front panel (alternate designs may be presented for Amtrak approval):

(a) On-Off LED – indicates when device is ON and power is present

(b) Fault indicator LED – indicates when a fault has occurred with PA Amplifier operation

vi). PA and intercom systems shall be provided with sufficient battery capacity to provide for a minimum of 90 minutes of operation following loss of HEP. See Chapter 15.

(1) Intermittent communication shall be considered equivalent to continuous communication during the last 15 minutes of the 90-minute minimum period for the purposes of Direct Current (DC) load budget calculations.

b). PA/IC Control Station Functional Requirements

i). Each PA/IC Control Station shall be IP/Ethernet based.

ii). Each PA/IC Control Station shall be powered via PoE via the Ethernet Car Network.

iii). Each PA/IC Control Station shall allow the selection of audio zones, to be proposed at PDR and approved by Amtrak. Zones shall include, at a minimum:

(1) Exterior Left side

(2) Exterior Right side

(3) Interior

(4) Interior – local car

(5) Interior – Override

(a) Interior audio override is a way to override passenger compartments who have configured to mute interior announcements. So, despite what volume control says in those cabins, it allows conductors to communicate in those rooms by overriding audio settings

(6) All speakers

(7) Other specific channels as configured by Amtrak onboard staff (such as Rail and Trails, or other secondary audio programming channels).

iv). Each PA/IC Control Station shall be equipped with a handset.

v). PA/IC Control Station Handset Requirements

(1) Handsets shall be equipped with a push-to-talk switch.

(2) The handset cord shall be equipped with an adequate strain relief fitting where it is attached to the handset.

(3) A handset holder shall be provided with each handset for storage when not in use.

(4) Each Handset should be attached to the PA Control Station the standard Amtrak microphone and handset connector plugs (p/n 10623456) to facilitate quick replacement when damaged.

c). Interior and exterior speakers

i). Each vehicle shall be equipped with a sufficient number of speakers located throughout the interior of the car to provide a uniform audio level throughout each passenger compartment.

ii). The interior speakers shall be installed for replacement from the front, and sufficient length shall be provided in the wiring for this purpose.

iii). Each vehicle shall also be equipped with weatherproof exterior speakers installed on the exterior of the car sides, one speaker near each set of doors to enable the broadcasting of messages to passengers on the platform from the PA system from within the car.

iv). The speakers shall be phased so that when the primary is connected to the distribution network, all speaker cones shall move in the same direction at the same time.

v). The exterior speakers shall be fully weatherproof, mounted behind a strong, replaceable stainless-steel grille resistant to thrown objects and be immune to the chemicals and detergents normally used during vehicle washing.

vi). There shall be no feedback between car speakers and the control station handset when the public address system is in use.

vii). Speakers housed in private passenger compartments shall include a means for a passenger to control the volume on non-overridden audio announcements.

viii). Through the content management tool, individual announcements shall be marked as normal messages or override messages – such that routine station announcements could be muted, but special messages indicating critical information will play at a normal volume despite individual volume control.

ix). Through the PA/IC Control station, train staff shall be able to select the type of manual announcement.

d). Inductive Loop

i). Each car shall be equipped with an audio inductive loop antenna and transmitter system, to allow receipt of announcements by passengers wearing hearing aids.

ii). The system shall be integrated with the OTIS and PA systems to broadcast interior public messages that are broadcasted in the area of the inductive loop.

iii). The system shall be ruggedized for the railroad environment and shall be a high output current design (no less than 10 Amps RMS), feature a high frequency gain potentiometer, feature metal loss correction, operate on vehicle nominal DC voltage, and include status LEDs for status information.

iv). The solution shall meet all appropriate certifications for both Rail and Hearing Loop technology including, but not limited to EN-50155, EN-50121-3-2, EN-45545-HL2, IEC-60118-4, and IEC-62489.

v). The solution design and implementation plan should align to BS-7594 or EN-303-348 and testing should be completed to verify that:

(1) Background magnetic noise is minimized.

(2) Magnetic Field is strong enough to provide full car coverage while minimizing interference with RF on the train (Wi-Fi, Mobile Voice and Data, etc.).

(3) Frequency Response is appropriate to T-Switch capable equipment.

vi). The inductive loop shall cover all areas of the passenger compartments.

e). Bluetooth LE Broadcast (Option)

i). Each car shall be equipped with the capability to broadcast audio and pertinent passenger train information via Bluetooth-based transmitters.

ii). All interior messages shall be broadcast via Bluetooth Auracast technology on a primary channel.

iii). The OTIS system shall be programmable with alternative audio tracks – synchronized to be played back based on train position - that shall be broadcast on additional Auracast channels.

iv). These additional program channels may be used to provide additional translations for audio announcements, or scenic commentary.

v). Additional live PA audio channels shall be made available via Auracast when configured by onboard train staff to facilitate secondary live channels for specific programming, such as to enable receiving Amtrak's Rails & Trails programming throughout the train.

vi). Bluetooth LE data channels shall enable broadcasting of a selection of triggers of passenger announcements to facilitate applications running on passenger devices to receive train information via the Passenger network, and relay information displayed on the interior displays.

vii). The Bluetooth LE broadcasts in each car shall enable beacon technology to facilitate micro-location within a train consist and train car. Amtrak shall have the capability to adjust beacon messaging. The contractor shall demonstrate that enough beacons have been implemented in each car to provide positioning within 8 feet when using triangulation techniques on consumer handsets.

f). Two-way crew intercommunications (intercom)

i). The crew intercom (IC) system shall be designed to allow the crew to communicate with other personnel on the train.

ii). For IC communications between crew members within the train consist, the IC mode must be selected on the PA/IC Control Station.

iii). To signal other crew members that an IC call has been requested, the PA/IC Control Station should give visual and audio feedback until another handset has been connected to IC by lifting it off the receiver and selecting IC mode.

iv). Audio and visual messaging indication through the interior passenger compartment speakers and interior messaging signs shall be capable of displaying and alerting train crew to a waiting intercom request through configurable means available to Amtrak.

v). At PA/IC Control Stations with adjacent Control Terminals, it shall be possible for train crew to communicate with specific IC stations, with IC stations on specific cars, or with specific connected crew app users.

vi). The intercom communication on a train shall support one to one and party line communications between PA/IC Control Stations and crew app users.

g). Passenger Emergency Intercom (PEI)

i). Cars shall be equipped with a passenger emergency intercom system that conforms to 49 CFR Section 238.121 and provides a means for passengers and crew members to communicate by voice with each other in an emergency situation.

ii). At least two PEI stations that are accessible to passengers without using a tool shall be located on each vehicle with one located on each end of the car. An additional PEI shall be located in each accessible room,

iii). The location of each PEI station intended for passenger use shall be conspicuously marked with luminescent material and legible and understandable operating instructions shall be posted at or near each such intercom. Instructions shall include indication that the calls may be recorded.

iv). PEIs shall trigger event recording on the NVR in order to mark the section of video recordings (if equipped) relevant to the PEI call.

v). Amtrak, through a configurable setting, shall be provided the ability to enable or disable the NVR recording of the two-way audio calls synchronized with the video of the closest camera (if equipped) to the PEI.

vi). PEIs shall be configurable by Amtrak, such that calls may be routed and answered by one or more call center locations that are not on the train, given there is sufficient bandwidth available from the Data Communication System. The PEI configuration shall include whether the calls simultaneously ring to the onboard staff or to the wayside, to the onboard staff only, to the wayside only, or to the wayside only if the onboard staff do not answer within a predefined time limit.

vii). PEI calls shall be configurable to be annunciated by PA tone, through crew-app notification, and on the display screens, control terminal displays, crew control panels, and remotely. The annunciation shall be configurable to include car number, road number, relative position in train based on display location, and location in the vehicle.

viii). A duress button shall be placed in publicly accessible restroom, which shall provide a similar indication as a PEI as described above.

ix). PEIs shall be full duplex.

h). Attendant Call System – Sleepers

i). Incorporated into all sleeping accommodations, a simple LED indicator light outside of the compartment shall be provided for the following functions that correspond with simplified controls inside each sleeping accommodation:

(1) Do Not Disturb

(2) Make up Room

(3) Attendant Call

ii). The system shall be capable of handling multiple attendant call requests, indicating the number, order, and location of all pending calls.

iii). Status of attendant calls shall be made available on the Control Terminals, through the crew app, and to Amtrak systems on the wayside.

iv). Attendant calls shall be selectable and answerable by PA/IC Control Units, through the crew app, and/or by Amtrak systems on the wayside.

v). Additionally, each attendant room incorporates an attendant call, smoke-fire detection/annunciator, and PEI panel used to identify the site of a passenger requesting service or emergency.

vi). Each Control Terminal, and through APIs provided by the OTIS, each Crew App Instance, shall include the capability to configure the attendant call system to:

(1) select one or more compartments, lifts, and cars to receive calls for that station

(2) silence all attendant calls for that station

(3) Compartments or lifts that are not manually assigned to one station shall ring all stations.

(4) Unanswered attendant calls shall ring through to other stations after a Amtrak configurable period of time.

i). Attendant Call System - Other

i). Status of the attendant call (including pending call, answered call, and call on hold) shall be indicated through visual and audible means at the location requesting the call. The audible means, including sound and repetition, shall be configurable by Amtrak.

ii). When an attendant call is answered, the call button shall indicate the call has been answered, and a dedicated microphone “on” indicator shall be illuminated in the calling compartment. Microphone circuitry shall ensure the “on” indicator is illuminated any time the microphone is listening and include a means for passengers to mute the microphone.

iii). Attendant call LED indicators on the exterior of the compartments with pending attendant call requests shall be illuminated.

iv). The system shall be capable of handling multiple attendant call requests, indicating the number, order, and location of all pending calls.

v). Status of attendant calls shall be made available on the Control Terminals, through the crew app, and to Amtrak systems on the wayside.

vi). Attendant calls shall be selectable and answerable by PA/IC Control Units, through the crew app, or by Amtrak systems on the wayside.

vii). Public restrooms and showers shall have a one-way attendant call request without audio capability for the purpose of indicating when a restroom or shower requires staff attention.

viii). Each Control Terminal, and through APIs provided by the OTIS, each Crew App Instance, shall include the capability to configure the attendant call system to:

(1) select one or more compartments, and cars to receive calls for that station.

(2) silence all attendant calls for that station.

(3) Compartments that are not manually assigned to one station shall ring all stations.

(4) Unanswered attendant calls shall ring through to other stations after an Amtrak configurable period of time.

j). PA Wiring

i). PA/IC Control Stations and PEIs shall be connected to the Otis Control Unit (OCU) via the Ethernet Car Network (ECN).

ii). The preferred method of powering PA/IC Controllers and PEIs is via PoE, alternative arrangement shall be submitted for approval by Amtrak.

iii). The OCU should be able to communicate between cars using an analog trainline.

(1) If ETB is exercised, the OCU should be able to communicate between cars using the Ethernet Train Backbone. The OCU shall also include an analog fallback that interfaces with the analog trainline.

14.4 OTIS/PIS Capability

a). General Requirements of a Passenger Information System

i). Amtrak's goal is to provide near-real-time travel information to customers about their journey from Amtrak's operational and onboard train systems.

ii). Contractor shall deliver a solution that:

(1) Provides critical train and journey information to customers in compliance with applicable ADA regulations and accessibility standards, including but not limited to the ADAAG for Transportation Vehicles and any successor guidelines, standards, or applicable DOT regulations in effect at the time of the design. If no applicable guidelines, standards, or regulations exist for OTIS/PIS at the time of the design, the RVAAC report published by Rail Vehicles Access

Advisory Committee of the Access Board shall be used as a minimum standard of compliance.

(2) Reduces conductor workload by automating the delivery of routine passenger messages.

iii). The OTIS shall be capable of full graphic, template, and video display including advertising through the interior signs.

(1) The OTIS shall provide the passengers with both visual and audible information such as:

(a) the train destination

(b) the car number

(c) the consist arrangement, including current car and coupled cars in a graphical format showing train layout and amenities.

(d) present station

(e) next station

(f) dynamic route map

(g) pre-set messages

(h) emergency messages

(i) visual graphics

(j) advertising

(k) Time and date

(l) Current speed

iv). The information shall be presented through the interior and exterior signs and the PA system as configured by Amtrak.

v). A flexible, template-based system shall be provided for the creation, programming, and management of content for the OTIS displays. The requirements for such a system are specified in Chapter 26.

vi). The OTIS shall be a fully automated system, with manual override feature. Once the system is activated, it will automatically establish train location through the Global Positioning System (GPS) and sequentially display and announce the upcoming stations at programmed locations.

vii). It is the Contractor's responsibility to supply equipment capable of operation in the rail environment consistent with Amtrak Specification 963 and EN 50155:2021.

(1) All individual components used in the fabrication of the equipment shall meet or exceed the requirements of the above standards.

viii). The Contractor shall submit documentation and calculations for all individual components, and for the system as a whole for review and approval by Amtrak at the Preliminary Design Review (PDR) to demonstrate the conformance to the requirements in this technical specification and referenced standards. **[CDRL 14-03]**

ix). The equipment shall meet the requirements of IEEE Standard 1477 and all FRA, AAR and ADA applicable rules, regulations and guidelines.

x). The PA function of the carborne OTIS system shall utilize only digital communication signals between OTIS equipped cars but be able to generate and receive analog audio signals from other cars as specified.

xi). OTIS Equipment Power Requirements

(1) All carborne OTIS equipment shall be powered from the car's DC power supply.

(2) All equipment shall function normally and provide the specified performance for all supply voltage variations as required by EN50155 and based on the DC power supply design.

(3) Partial shutdown after load shed/drop of the equipment is acceptable, followed by automatic restarting as the voltage returns to the specified levels.

(4) No permanent damage shall be caused to the equipment following these conditions. See Chapter 13 for load shed/drop schedule.

(5) All carborne OTIS equipment shall be protected from damage from a polarity reversal of the voltage supply, and power supply shutdown and immediate reapplications.

(6) All carborne OTIS equipment shall have integral power conversion and conditioning. External power supplies are not acceptable.

(7) All carborne OTIS equipment shall be protected by external dedicated circuit breakers located on the car low voltage control panel.

(8) The circuit breakers shall be sized to protect the smallest size wire directly connected to the protected circuit.

(9) Fuses shall not be accepted either outside or inside the equipment.

(10) Internal circuit protection shall not be used, but if unavoidable must be a re-settable type of circuit protection approved by Amtrak.

(11) All low voltage power supply inputs shall be isolated from ground.

(12) All supply inputs shall be adequately filtered to minimize current and voltage ripple.

(13) All equipment enclosures and shock-mounted equipment shall be grounded in accordance with APTA Standard PR-E-S-005-98.

(14) Smart Power Management Capability: There shall be a capability of automatically power cycling the OTIS system without manual intervention to ensure that the system is not powered on 24/7/365. This capability is necessary to keep the system components such as control units and interior/exterior displays, operating within the optimum performance levels. This automated power-cycling must not occur when the train is in service and must be completed within a short duration. The full criteria, timing, and related requirements shall be agreed upon during the design phase.

xii). OTIS Equipment Connectors

(1) All equipment shall be connected to the Ethernet Car Network via M12 connectors.

(2) All connectors shall be located in the front of the equipment or other easily accessible locations for quick connection and disconnection.

(3) All connectors of the same type and size, with the exception of Ethernet M12 connectors, shall be keyed to avoid insertion into the incorrect location.

(4) Connectors shall be identified in accordance with the schematic designation. All connector types shall be submitted to Amtrak for approval prior to preliminary design review.

xiii). OTIS Equipment Maintainability

(1) Removal and installation of any component shall not require the removal of any other equipment.

(2) Replacement of any Communication system component of the same type shall not require manual re-configuration. This shall be implemented through car-side coding connectors, dynamic assignment of IP addressing from car network switches, or other method approved by Amtrak.

(3) The enclosure mounting attachments shall be accessible for easy installation and replacement of the unit.

(4) Whenever enclosures are supported by their mounting attachments, threaded studs and self-locking nuts shall be used to facilitate their installation.

(5) All onboard equipment shall be housed in dust tight enclosures no less than IP54.

(6) Heat generating equipment shall have suitable heat sinks located on external surfaces of the enclosures and be cooled by natural airflow.

(a) Cooling fans are not acceptable.

xiv). OTIS WaysideCustomer Experience Simulation Lab

(1) A fully featured customer experience simulation lab shall be provided to simulate all aspects of the OTIS customer experience on the wayside. See Chapter 26 for specific requirements for the physical test lab specification.

xv). OTIS Journey Logging

(1) A comprehensive set of logs shall be captured on each car and be collected and organized per consist for each journey initiated by Amtrak crew or systems.

(2) The log shall include the set of system inputs and triggers received by the on-board systems necessary to recreate system performance in the OTIS Off-Board Customer Experience Simulation lab for the purpose of troubleshooting a journey configuration, further content development, and other uses.

(3) The log shall include a summary of system operations and outputs, including actions taken per display screen, audio announcements made per car and per audio zone, and general status of communication equipment.

(4) The system shall be capable of maintaining journey logs for a minimum of 30 days.

(5) Log offload shall be enabled through the DCS based on as-demand and/or on a scheduled basis as configured by Amtrak.

b). System Operation

i). The OTIS system shall automatically identify all cars by their car number and their location in the consist as soon as the train is formed, and power is applied.

ii). The OTIS system shall determine the train location with the use of the GPS receiver, with fallback to tachometer received via the Ethernet Car Network.

iii). The system shall self-report faults and errors in real-time over the air, and issues reporting and logging shall be automatic and feed into Amtrak systems. Additional diagnostic requirements can be found in Chapter 24.

iv). System operation shall be a simple, clearly intuitive operation for the train crew.

(1) This shall include the commands necessary to initially establish the system operation at start of trip, making revisions during the trip (such

as adding station stops, skipping station stops, special messages, food service advisory messages and so forth) and the conclusion of a trip.

(2) Such actions should be easily performed in a simple way without the need to refer to instruction lists.

(3) Any manual mode PA announcement by the train crew shall override any automatic announcement which may be taking place.

v). The system shall be configured to easily allow the train crew to designate one or more cars as a “Quiet Car”. This information shall be displayed on the car interior and exterior sign displays, and permit adjustment of audio announcements to a lowered level, as well as other features to be selected by Amtrak.

vi). It shall be easily possible for the train crew to designate a car on a local car basis to be a deadhead car (out of service) and provide suitable interior and exterior sign messages.

vii). Trip Operation

(1) To establish the initial operation of the system at the start of a trip, the system shall use the train number and provide a means to confirm origin and destination.

(2) The associated content database entry for that train number will automatically establish the destination sign displays and the automated station announcements.

(3) The system shall permit programming flexibility to not make some or all destination sign displays (which may differ from the exterior and interior sign displays) or not make some or all automatic announcements.

(4) Such conditions may be encountered on late evening/overnight trains or on an individual “Quiet Car”. At end of trip, a means shall be provided to automatically clear all displays after a programmable display of the last arrival / standing message.

viii). The system shall take into consideration the length of trip for Long Distance operations and shall reliably operate across two days without manual or automatic reboots or train crew interaction.

14.5 OTIS Requirements

a). Display Signs

i). General Requirements

(1) Sign Performance Requirements

(a) Signs shall be clearly readable in all ambient light conditions including total darkness and direct sunlight.

(b) The minimum viewing angle shall be 160° and readable at a distance of at least 115 ft for exterior and 45 ft for interior signs.

(c) The display shall have a high contrast ratio and have an automatic LED luminosity control for different levels of ambient light conditions.

(2) LED dimming shall also be activated automatically by the OCU, to reduce low voltage supply consumption and extend backlight life, in case of car battery charging failure or during train layover.

(3) All signs shall resume normal operation following supply power interruptions. No abnormal sign behavior shall follow any supply power interruption and reapplication.

(4) The signs shall be housed in a dust-proof enclosure with a polycarbonate non-glare display faceplate with anti-graffiti resistant film applied, at each end of each car.

(5) Signs shall have a self-diagnostic testing capability and provide fault condition information to the OCU, including sign location and type of fault.

(6) OTIS shall monitor the uptime, availability, and performance of each individual sign, and provide reports and logs through onboard PTU and wayside interfaces.

(7) The sign unit, upon the insertion of the car wiring connectors, shall automatically recognize its own location in the car, through special coding in the car-side connector pins.

ii). Interior Display Requirements

(1) Interior display screens shall be located to ensure high visibility and legibility for passengers throughout the train. The intent is to provide consistent access to passenger information without prescribing exact screen sizes, orientations, or positions. Screen placement should support dynamic wayfinding, real-time travel updates, and service information, including advertising (e.g. Travel Media Network).

(2) Screen Format: Aspect ratio, orientation, and mounting should be selected to support clear visibility in each context. All screens shall feature anti-glare treatments and meet accessibility standards for legibility, contrast, and resolution.

(3) Interior signs shall be sufficiently sized to maximize display area in the identified locations and be 4K displays. They shall be capable of:

(a) Audiovisual automatic announcements that include information such as present station, next station, route map, and arrival times.

(b) Text displays that may include time and date, train number, destination, and on-time and delay information.

(c) Special messages received from the onboard personnel and/or triggered from the wayside.

(d) Animated graphic displays, including entertainment, advertising, and content driven by wayside feeds configured by Amtrak.

(e) Reservation information for specific areas of the train.

(f) Menu options in food service areas.

(g) Other requirements as defined in this section and in TS section 26.

(4) The displays shall utilize the maximum available space and maximize the sign display area, with minimal bezels or unused screen area.

(5) Displays shall include ambient light sensors and be configured for auto-dimming.

(6) The signs shall meet all applicable The Americans with Disabilities Act (ADA) regulations and requirements, and the ADA Accessibility Guidelines (ADAAG) for Transportation Vehicles, including Subpart F.

(7) The signs shall be mounted in a tamper-proof anti-theft enclosure with tamper-proof fasteners.

iii). Interior Display Types

(1) Vestibule Screens

(a) Screens shall be clearly visible upon entering or exiting the car, positioned to be readable from multiple angles.

(2) Ceiling-mounted wide aspect displays

(a) Two ceiling-mounted wide aspect ratio (16:9) signs shall be installed in aisle ways where possible.

(3) Coach car displays

(a) Screens shall be positioned such that at least 75% of passengers have a clear line of sight from their seated position. Where full visibility is restricted by luggage racks or partitions, multiple screens should be used to maintain coverage. Content should remain legible from a seated position, without obstruction from fittings or furniture. Use available bulkheads to maximize screen visibility across the car. Position screens to maintain adequate head clearance in walkways, avoiding any obstruction to passenger movement in low-ceiling areas.

(4) Sleeper Cars

(a) Screens should be positioned at the end of hallways or in transitional spaces to assist with wayfinding.

(b) Screens shall be clearly visible from typical passenger circulation paths

(5) Food Service Areas:

(a) Screens used for digital menus, Food & Beverage promotions or service information must be readable from multiple positions including while queueing (even when two or more people are in line), directly at the point of purchase and/or from seated dining positions.

(6) Alternative displays in passenger compartment

(a) Where ceiling mounted wide aspect ratio displays are not practical, the contractor shall propose alternative display types such that each seated passenger has the ability to view a high resolution graphical display screen from their seated position in all coach areas.

(7) Café, Diner & Lounge Areas

(a) Interior graphical display screens shall be located at each café, lounge, and diner area to display digital menu options, Food & Beverage promotions or service information and other information as configured by Amtrak. Screens must be readable from multiple positions, including:

(b) While queuing (even when two or more people are in line)

(c) Directly at the point of purchase

(d) From seated positions in the Café, Lounge, and Diner cars

iv). Exterior Sign Requirements (Base)

(1) An interchangeable display sign shall be provided on each side of the vehicle to indicate car number, car type, and service type.

(2) Signs must be removable without damage to the sign or car should the car type or service type be modified post delivery.

(3) Sign and mounting assemblies shall provide a service life for the sign to protect against weather, vibration, ultra violet rays, etc.

(4) Special attention shall be given to ensure that the exterior sign does not appear interchangeable or temporary.

(5) As Amtrak envisions that the Standard Coach will be utilized as a Business Class car on some routes especially on the Northeast Corridor, designs for this interchangeable display sign shall be presented at each stage of the design review process for Amtrak review and approval.

(a) A business class signifier shall be developed to accommodate this expected change in service type as well as the base car types.

v). Exterior Display Sign Requirements (Option)

(1) As an option, an alternative exterior display sign shall be proposed. Exterior display sign shall be provided on each side of each vehicle to provide clear indication to passengers boarding relevant information about the train, car type, and amenities of the car. Alternatives may be presented for Amtrak review and approval.

(2) Exterior display signs shall have a 16:9 aspect ratio and be oriented in a landscape fashion.

(3) Exterior sign messages shall be configurable, and be capable of displaying train number, car number, car type, service type, destination, and other messages as programed by Amtrak with fixed, paged, and scrolling text.

(4) The exterior signs shall be full-color LED matrix (red/green/blue), high resolution and high brightness (1,300 nits minimum), with full multi-colored text and graphical capabilities.

(5) Final selection of exterior sign capabilities, including pixel dot pitch, shall be reviewed and approved during Design Review.

(6) All LED modules shall be controlled to extend LED life for a service life of no less than 12 years.

(7) The signs shall be installed and supported to prevent any rattling, dust infiltration or movement of the sign itself.

(8) The sign support shall allow for sign tilting to allow cleaning of the glass behind the sign.

(9) Exterior sign glazing must meet FRA type 2 projectile resistance, unless installed on the outside of the carshell.

(10) The exterior signs shall be designed to prevent fog and condensation and shall be resistant to any dust ingress or short periods of immersion in water.

b). OTIS Control Unit

i). The OTIS Control Unit (OCU) shall control all interior and exterior signs on that car for visual messages and provide digital input to the PA amplifier for audio announcements.

ii). The OCU shall monitor the signs and PA status for fault diagnostics and shall communicate with all other OCUs in a car over the trainline to verify their car systems status.

iii). The OCU shall be a microprocessor-controlled device, have an open architecture and allow expansion for communication and interface with additional other systems including the car's central diagnostic unit.

iv). In addition to the ports required for this expandability, at least one spare port shall be provided on each switch.

v). The OCU microprocessor usage shall not be greater than 60% of the available processor capacity.

vi). See Chapter 28.1 for requirements related to authentication, authorization and encryption. All equipment must conform to Amtrak standards for authentication and authorization. Logs will be generated and retained in keeping with Amtrak standards. Appropriate encryption shall be implemented to maintain message integrity, prevent communication and/or session hijacking.

vii). The Contractor shall provide all the software needed to operate the OCU. Message capability shall include, but not be limited to the following:

(1) Standard station stops

(2) Advertising messages, including audit logs of advertising playback

(3) Public service messages

(4) Unique messages, including car specific messaging and car number messaging (for ticketing).

(5) Emergency messages

viii). The OCU-stored data shall be divided in several files, following their specific function, and stored in non-volatile memory.

(1) Modifications to the OCU-stored data shall be achieved by changes only to the parts affected, to minimize the transmission time.

ix). Back-up batteries shall not be used.

x). Where removal of the chip is required for reprogramming, memory chips shall be made to easily upgrade and replace.

xi). The OCU microprocessor control shall re-initialize automatically and safely at power up, and/or following loss of supply power.

xii). All OCU inputs and outputs shall be galvanically isolated from the external circuits. Shorting or opening of any of the inputs or outputs shall not result in any damage to the internal circuitry of the OCU.

xiii). The OCU shall have a specific port for connection to a PTU.

xiv). All fault, diagnostic, status, and log information on the OCU shall be made available to the car's central diagnostic unit for remote access.

xv). All OCUs shall be directly interchangeable and capable of performing the same functions without the need for re-programming or re-configuration.

xvi). All data communication between the train's OCUs shall be through the ETB.

xvii). The OCU shall also contain a bi-directional analog interface module that utilizes the 27-pin COMM trainline as a fallback or when interfacing with legacy equipment.

xviii). The OCU should output per APTA PR-E-RP-017-99 maintaining compatibility with legacy equipment.

xix). The OCU should also be able to receive signals from legacy cars and locomotives via the 27-pin COMM and convert them for transmission along the trainline to the remaining OCUs in the cars.

xx). The OCU shall have a self-diagnostic capability and store faults occurring in the OCU and in the other controlled systems, such as the signs and the PA amplifier.

xxi). The OCU shall have on a clearly visible location, separate from the display, a multicolor LED indicator providing indication of the car OTIS/PIS status.

Table 14-1 OTIS/PIS status Indicator

LED indicator	OTIS / PIS status
Green	Normal
Yellow	Fault
Red	Failure

(1) The yellow indication shows that the system is working at a diminished performance, and that investigation, reset or repair is required, but the train may remain in service.

c). OCU Diagnostic Capabilities

i). Faults shall be recorded with reference data including:

(1) car number

(2) time

(3) date

(4) location

(5) consist arrangement

(6) train number

(7) Other reference data defined by Amtrak at design review.

ii). The fault memory shall store at least 100,000 faults in a first-in, first-out sequence.

iii). The self-diagnostic system in the OTIS shall be capable of identifying the faulty component down to the replaceable unit and indicate the electronic module which requires replacement.

iv). All subsystem signals, including all system hardware inputs and outputs (whether they are used or not), and software variables that impact the functionality of the system shall be transmitted to the CDU for viewing and recording in data monitoring systems.

v). This information shall be stored in non-volatile memory locally and be transmitted for recording within the fault log in the CDU.

vi). The diagnostic capabilities, including the list of signals, list of faults, and demonstration.

d). Reservation Display System

i). A comprehensive reservation display system shall be provided that is controlled by the OTIS.

ii). The system shall be capable of displaying Amtrak configured reservation information at each passenger position on the train, including:

(1) Coach and Premium Coach Seats

(2) Mobility Positions

iii). The system shall be capable of displaying both availability of seats as well as reservation information on clear to read, high-resolution, TFT LCD based displays.

(1) Reservation displays shall be configurable on a per-location, per-car, and per-train basis based on pre-loaded templates that are configurable by Amtrak.

(2) Displays shall be full-color graphical displays.

(3) The displays shall be capable of displaying a line of text, minimum 30 characters long, for each passenger position in the train. Displays shall support smooth scrolling for messages that exceed the maximum text line size.

(4) Display size, capabilities, and resolution shall be based upon the location in which they are used, including the distance from the position of a passenger standing in the car aisle adjacent to the display. Displays shall be a minimum of 480x224 pixels of resolution, with a display area of 275x75x25mm. Amtrak will entertain smaller than required displays as proposed by carbuiders which will be subject to Amtrak approval.

(5) Display dimming shall be coordinated with interior passenger information signs and interior lighting status.

iv). Discrete RGB LED indicators shall be provided to indicate availability/occupancy status for each reserved location. The indicator shall be capable of being configurable by Amtrak to display a variety of colors based on the exposed Seat reservation API, and shall be initially configured to show:

(1) Reservation status, including but not limited to:

(a) Seat is reserved currently (red)

(b) Seat is available with no reservations for the remainder of the trip (green)

(c) Seat is reserved at a later point in the trip (yellow)

(2) Ticket lift status (orange, until a lift has been performed by an Amtrak conductor, or the customer has checked-in, in which case it will show reservation status).

v). The system shall be capable of receiving near-real-time updates on a seat-by-seat basis at all points of a trip via secure API from ground.

vi). The reservation display system screen installation shall be reconfigurable to match seat pitch and location and shall be approved during Design Review.

vii). Reservation displays shall be supplied at all seats and areas which may be reserved by passengers, such as handicap accessible locations and bike storage areas.

viii). In addition to the use of discrete reservation displays, Amtrak is open to supplier proposals which use alternative technologies, such as transversely mounted ultra-stretched TFT LCD displays at the ceiling to wall transitions, to functionally replace several reservation displays with one device.

ix). System shall support requirements for a car or class of service with an open seating model where seat assignment or seat selection is not offered by Amtrak. In such cars, Amtrak may desire flexibility to display a different fault text from the default text displayed in cars/classes of service with fully assigned seating e.g. “Open Seating.”

x). System shall support requirements for wheelchair spaces, transfer seats and similar accessible spaces or seats that are reserved for passengers with

accessibility needs or reduced/impaired mobility within a car with an open seating model where seat assignment or seat selection is not offered by Amtrak. In such cars, Amtrak may desire flexibility to display a different default text for the seats/spaces that are reserved than the default text displayed for standard seats that are open seating.

e). Video Surveillance System (Option)

i). Amtrak currently utilizes Genetec for surveillance video management throughout its enterprise, hereafter referred to as Amtrak's enterprise VMS. The Contractor shall be responsible for supporting the integration of the onboard video surveillance system with the existing wayside systems in use at Amtrak.

ii). Storage, functionality, and management of VSS video, metadata and any other associated data shall be completely segregated from any other recorded video onboard such as the head-end safety video from cab cars and locomotives. Any deviations from this requirement must be approved by Amtrak.

iii). Onboard VSS integration with the Wayside enterprise VMS shall include, but is not limited to, the following requirements. Additional requirements may emerge during the project analysis phase and will need to be elaborated and agreed upon.

(1) VSS shall allow wayside users to view, download, and manage the onboard video and associated metadata from the enterprise VMS platform.

(2) Video shall be remotely accessible using the Data Communication System (DCS).

(3) VSS shall support automated connection to a Wi-Fi network, and latest commercially available generations of cellular network technologies (when Wi-Fi is not available) and automated off-boarding of video to a ground-side repository. System should be designed to be readily upgradeable to subsequent generations of cellular technologies as they become available.

(4) The enterprise VMS shall have access to live videos from a dedicated camera stream configured for remote viewing.

(5) VSS shall queue up transmission of tagged video and associated metadata to the wayside enterprise VMS when certain, pre-defined events occur onboard.

iv). The VSS shall monitor and record data acquired from multiple onboard camera sources that shall be arranged to maximize the coverage of the vehicle and its operations.

v). VSS shall provide identification and recognition capabilities based on recommended pixel densities within applicable zones in accordance with

applicable standards in effect at the time of design and implementation including IEC/EN 62676-4: 2025 (OODPCVS) or successor standards.

vi). Each onboard camera shall include the following capabilities:

(1) have day and night capabilities with performance down to at least 0.1 lux.

(2) provide high quality color video.

(3) Cameras shall comply with EN50155, EN45545, and NFPA130.

(4) Camera housing shall meet IP66, IP67, and IK10 ratings.

(5) Cameras shall have electronic image stabilization built-in.

(6) Cameras shall include invisible IR LED built-in.

(7) The Cameras shall have adjustable resolution of at least 1080p.

(8) The Camera connector shall comply with 14.8e).

(9) Frame rates adjustable up to thirty (30) frames per second.

(10) The cameras shall natively support encoding in H.264 and H.265 video compression.

(11) A proven history of reliable operation on rail vehicles.

vii). VSS Power Requirements

(1) The system shall operate continuously off the low voltage power supply system and be backed up by car battery as a vital load.

(2) Prior to the loss of low-voltage power (e.g., due to load shed or train shutdown), the Genetec NVR shall be configured to safely shut down.

(a) This may be implemented using a dedicated uninterruptable power supply for the NVR, or

(b) through software means such that sufficient time is provided to the NVR to safely shutdown the system prior to load shed or vehicle shutdown from being triggered by a vehicle.

viii). Camera Locations

(1) A minimum of four (4) interior cameras shall be placed throughout each car to facilitate recognition of passengers and/or luggage onboard the rail vehicle.

(2) One camera shall be mounted in each vestibule with 360-degree coverage of the vestibule, lifts, and side doorways.

(3) No less than two cameras shall be mounted in each passenger seating area of each car.

(a) Cameras mounted in the passenger seating area shall be facing in opposing directions with overlapping viewing zones to maximize coverage.

(4) Cameras shall be mounted to provide coverage of hallways and loading areas.

(5) Each food service location, including café, and servery shall be covered by a minimum of two (2) cameras.

(6) Camera installation and arrangement shall support identification based on the IEC/EN 62676-4:2025 International Standard or a successor standard.

(7) The Contractor shall be responsible for submitting a coverage plan identifying the location, viewing angle, and details of the camera arrangement and capabilities to Amtrak for approval.

ix). Each camera shall deliver compressed video in real time to the NVR which can integrate to Genetec.

x). The surveillance system shall commence recording data when the car is powered on, and continue recording until the car is powered off, unless otherwise directed by the Engineer.

xi). NVR Requirements (Option)

(1) The NVR shall be configured with sufficient solid-state storage to capture a minimum of 90 days of full car video storage high-quality onboard transportation scenes at 1920x1080p resolution at a minimum of 15 fps continuous recording in each car before overwriting.

(2) The NVR shall be capable of incorporating telemetry data and other metadata received from onboard systems including CDU, the subsystems that report to the CDU, as well as the OTIS.

(3) Metadata recorded by the NVR, to be made available when viewing, searching, and downloading video shall include, but is not limited to:

(a) Synchronized date and time as other network components

(b) Global Position System (GPS) Location

(c) Consist speed

(d) Route information, including current trip, train number, most recent station location, next station location, location along the alignment

(e) Local car number for each camera stream

(f) Consist layout

(g) Signals required for the triggers identified in the following section

(4) Functionality shall exist to tag and persist segments of video beyond the 90-day limit based on specific train events or triggers.

(5) Tagged segments shall be capable of recording no less than 5 minutes prior to and 10 minutes following the trigger or event and be configured to apply to cameras relevant to the triggered event. Tagged segments and associated metadata shall be transmitted to the wayside enterprise VMS.

(6) Triggers events shall include, but are not limited to:

(a) Passenger Emergency Intercom request

(b) Door Emergency Egress / Ingress

(c) Door obstruction detection

(d) Emergency brake event (above zero speed)

(e) Penalty brake event (above zero speed)

(f) Fire suppression system activation

(g) Ride quality monitoring alert

(7) Using on-board intelligence, the system shall be capable of selectively recording only the video content that is determined to be relevant, and not ambient video. The intent of this requirement is to avoid the offloading of large amounts of ambient video to the enterprise VMS that has no value to Amtrak and adding to the wayside storage and management needs in the enterprise VMS. One way of meeting this requirement is through the use of a motion-detection feature, however, Amtrak is open to alternative designs.

(8) The system shall automatically overwrite non-tagged video after 90 days has elapsed.

(9) In the instance of the failure of a single NVR, a mechanism shall be implemented to facilitate the failover of cameras video archiving to an alternative NVR, such that failure of any single component of the Video Surveillance System does not impair all video recording on a car.

(10) The NVR shall be capable of supporting requirements for Onboard VSS integration with then Wayside enterprise VMS as specified earlier in this section.

xii). Chain of Custody Requirements

(1) If equipped, the surveillance system shall utilize methods and system controls to ensure chain of custody of all collected video and associated data from camera to ground.

(2) All acquired data shall be written, stored, and encrypted.

(3) All data shall reside on the rail vehicle on one or more solid state drives (SSD) that are designed and applied for the purpose of mobile data acquisition and storage.

(4) All storage shall be locked via a secure key to prevent access yet shall be easily removeable and replaceable to facilitate use as evidence.

(5) Data from the video surveillance system shall be available for real-time access for authorized personnel.

(6) An audit trail of personnel accessing the data shall be maintained on both the on-train VMS and within the wayside software (including video download, live view, and configuration).

xiii). Recording failures or system failures shall result in an alert available through the Control Terminal, CDU, and to Amtrak's enterprise VMS Platform (Genetec Security Center Platform).

xiv). All components supplied as a part of this contract, including Video Surveillance System cameras and NVRs, shall be compliant with the requirements of the National Defense Authorization Act.

xv). No equipment or services found on the Covered List as maintained by the FCC's Public Safety and Homeland Security Bureau as outlined in Section 1.50002 of the FCC's rules, and as directed by the Secure Networks Act, shall be supplied as a part of this contract.

xvi). The Contractor shall submit a comprehensive architecture and design package for review and approval. **[CDRL 14-04]**

(1) This submission shall include proposed camera layout, proposed calculation of retention, NVR software features and capabilities, redundancy capabilities, and details of integration between the on-board VSS and Amtrak's wayside enterprise VMS (Genetec installation).

f). Control Terminal

i). Each car shall be equipped with control terminals adjacent to each of the PA/IC control stations.

ii). Control Terminals shall be implemented as a high-resolution touchscreen display, and be multi-purpose devices that meet the requirements of the passenger graphical displays.

iii). The Control Terminal shall be a high-resolution touchscreen display

(1) Screen size shall be a minimum of 15” in crew rest areas and conductor’s office and

(2) At passenger boarding areas, the screen size, orientation, and look shall match the vestibule displays and be a minimum of 30” with 16:9 aspect ratio. When not in use by Amtrak crew, the display shall revert to a graphical information display.

iv). In cars with a conductor’s office, the control terminal shall be located in that office.

v). The control terminal shall be the main HMI between the operator and the car functions including providing access to the diagnostic information contained on the CDU, as well as control of the OCU and communication system functionality of the train. Alternative solutions that provide separate HMIs may be presented to Amtrak for review and approval.

vi). The Control Terminal shall implement the following functions:

(1) Allow train crew to input train number to configure the OTIS systems

(2) Initiate system and route start-up

(3) Trigger pre-programmed message selection and initiation

(4) Record and triggering of custom public address announcements that include a text component through an onscreen keyboard and editable speech-to-text and text-to-speech mechanisms.

(5) Control and adjustment of the reservation display system

(a) Modification of seat assignments / booking status

(6) live and recorded video surveillance review

(7) train formation display

(8) local display for fault annunciation

(9) Initiate system tests and verification

vii). The control terminal shall:

(1) Be of rugged heavy-duty construction.

(2) Include a projected capacitive touchscreen.

(3) Provide a high-resolution visual display, 1920x1080 minimum.

(4) The front panel shall have no exposed fasteners.

(5) The display shall be readable in both direct sunlight and total darkness.

(6) The display shall include auto-dimming features.

(7) The display shall be LCD with LED backlight and adjustable contrast and backlight intensity.

(8) Have a front-bezel rated to IP65.

viii). Control terminals shall implement a screen locking functionality utilizing personal identification and pin code. Access to enter ID and pin information shall be obscured, and pin and ID entry position shall move with each use. ID and pin validity shall be maintainable by routine updates by Amtrak through integrations with wayside systems.

ix). When the display is electronically locked, the display shall act as an additional OTIS graphical display and be capable of being configured by Amtrak to display electronic messages, route information as per the requirements of 14.4a).

(1) Displays located in the crew rest areas shall be configured to turn off the display upon activation of the electronic lock.

x). The control terminal shall be menu-driven for all the functions and the key legends shall correspond to the functions being performed.

xi). Data storage, if included in the control terminal, shall be via non-volatile solid-state memory.

xii). OTIS System Test Capability

(1) Through each control terminal, and through the PTU, a system self-test shall be possible to facilitate quick one-person confirmation of system functionality of all OTIS components throughout a coupled consist.

(2) The self-test shall include options for train crew to perform:

(a) Automated verification that each PEI works, including microphone and speaker transmission.

(b) Automated verification that individual PA Amplifiers and the speakers zones the power are functional.

(c) Automated verification that each hearing loop has continuity, and that current is flowing when audio is sent to the hearing loop amplifier.

(d) Automated verification that all displays, including graphical displays, accessibility displays, exterior displays, and seat reservation displays are connected and addressable.

(e) Automated verification that all electronic locks are online and responsive.

(f) Automated verification that all control units are addressable and functioning, including Control Terminals and Passenger Compartment Control Units.

(g) Automated verification that the NVR is communicating, and that all storage and cameras are operating.

(h) Guided verification of other system elements, such as display screens via a test pattern, physical buttons through a circle-check, and cameras via on-screen display.

(3) At the conclusion of the self-test, a report shall be recorded and displayed on screen that indicates the systems tested and the results of the test.

(4) Results shall be available to Amtrak Enterprise Systems via the Data Communication System.

(5) The contractor shall submit documentation defining the capabilities of the self-test functions for approval. **[CDRL 14-05]**

g). Data Communication System (DCS)

i). The Data Communication System (DCS) shall incorporate all the data transmission radios necessary to support the train to wayside communication as a part of the onboard systems, including communication required as a part of any system requiring offboard communication, including the OTIS / PIS / communications systems, the video surveillance system, the diagnostic systems, and bogie/carbody monitoring systems.

ii). To minimize the use of disparate communication systems requiring additional roof space, systems requiring dedicated wireless access outside the use of an integrated Data Communication System shall be submitted to Amtrak for review and approval.

iii). The DCS shall allow for data transmission between the onboard systems and wayside software provided by the Contractor, as well as support Amtrak's requirements as it relates to existing and future Amtrak system servers.

iv). The DCS shall automatically utilize and aggregate all available communication links throughout the train so that the highest data transfer capability is available for any train location.

v). DCS Antennas

(1) Antennas used for the DCS shall meet the requirements of Amtrak Specification 963.

(2) Each antenna shall support minimum 4x4 cellular MIMO supporting frequencies from 600Mhz to 4200MHz (US cellular operator bands) and GPS/GNSS, and 2x2 Wi-Fi 6e frequencies from 2400 to 2495 MHz and 5170 to 7125MHz.

(3) Two antennas shall be provided on each car for use by that cars DCS router.

(4) DCS shall offer satellite-based connectivity in support of Amtrak routes with poor or low cellular carrier coverage.

vi). DCS Router

(1) A DCS router shall be installed on each car to provide access to cellular and Wi-Fi infrastructure.

(2) Each DCS router shall provide two DCS modems to support redundant connections to major carrier networks.

(3) The DCS modems shall be compatible with the latest commercially available generation of cellular technologies with automatic fallback to a lower speed, earlier generation of cellular technology that is still supported by commercial carrier in US and Canada at the time of project design.

(4) The device shall be approved for use on all major carrier networks including Verizon, AT&T, and T-Mobile.

(5) Shall be connected to the Ethernet Car Network whose connection speed is to be determined.

vii). In conjunction with wayside software, the Data Communication System shall facilitate aggregation of all available DCS Router channels throughout the consist to maximize the available bandwidth to onboard applications, and to provide resiliency and redundancy in the event of any carrier, modem, router, or antenna failure, or in instances of limited signal coverage.

viii). The Data Communication System, in conjunction with on-board subsystems and wayside software supplied by the Contractor, shall provide:

(1) Transfer of consist monitoring and diagnostic data from the train to the wayside.

(2) Transfer of train status information from the train to the wayside.

(3) Remote troubleshooting of car systems.

(4) Transfer of content database updates from the wayside to the train, including:

(a) Content

(b) Schedule

(c) Informational Messages

(d) Editorial content

(e) Dynamic content (e.g., based on feeds)

(5) Transfer of software updates from the wayside to the train (for controlled installation on the train).

(6) Transfer of wayside initiated manual announcements (audio, text, graphical, and video) messages from the wayside to the train.

(7) Transfer the trigger of train wide pre-defined public and special message to the communication system.

(8) Transfer of recorded or real time video from the video surveillance system as configured by Amtrak's enterprise VMS Platform.

(9) Transfer of logs from the graphical displays, audio playback, and other OTIS performance indications.

ix). The DCS system components, including the 4G/5G and Wi-Fi modem and antenna shall be designed in such a way to facilitate future upgrades which will occur throughout the life of the vehicle.

x). The Contractor shall provide a document to Amtrak identifying the standard interface which would allow the integration of a replacement or additional DCS communications channels. **[CDRL 14-06]**

h). Global Positioning System (GPS)

i). The OTIS shall utilize a Global Positioning System (GPS) for the determination of the train location and the triggering of automatic station announcements and station display.

ii). The GPS receiver shall be a stand-alone unit or integrated into the DCS, powered by a dedicated power supply on each car and shall be capable of accuracy within 16ft.

iii). The OCU shall use the GPS for all location events. It shall not use wayside transponders or wheel rotation to determine the traveled distance when GPS is available.

iv). Door open signals shall be capable of triggering specified announcements as configured by Amtrak.

v). Whenever loss of GPS signal is experienced, the OCU shall maintain position via dead reckoning, and automatically re-establish train location once the GPS signal is again available.

vi). When the OCU loses GPS, all sign functions shall continue to be displayed. All OCUs shall be equipped with GPS.

vii). The antennas used for the DCS shall meet the requirements of Amtrak Specification 963.

14.6 Provision for Wireless Internet

a). General

i). The Contractor shall procure and install the infrastructure required to support a wireless network with a 10Gbps (per channel) Ethernet car bus.

ii). The scope of the requirements for this solution includes exterior and interior wireless and Wi-Fi antennas, exterior cellular antenna cabling, interior antenna cabling, data cabling, power cabling, a dedicated redundant Train Line, and defined locations for equipment installation.

iii). This Wireless Internet infrastructure is based on modular design for rapid component installation and simplified maintenance and serviceability. The design of the Provision for Wireless Internet shall be submitted for Amtrak review and approval throughout the design review. **[CDRL 14-07]**

b). Wireless Internet Components

i). MAR and AP Hardware Provisions

(1) All cars will supply a wireless Internet feed to the consist, distributed from the Mobile Access Router (MAR) over a DTL dedicated for passenger wireless internet to the rest of the consist.

(2) Additionally, all cars will provide Wi-Fi access to passengers and crew inside the car using multiple Access Points.

(3) All cars will include MAR hardware, AP hardware, and associated components.

(4) All cars shall include provisions and support for the following components:

(a) Two (2) MAR mounting locations (device names are MAR 1 and MAR 2)

(b) Two (2) Access Point (AP) mounting locations (AP names are AP1 and AP2)

(c) Three (3) Switch mounting locations (Switch names are SWITCH1, SWITCH2, and ANTENNA SWITCH) That antenna switch locations shall be near the MAR locations.

(d) Seven (7) 4x4 multiple-input multiple-output (MIMO) exterior antennas; two (2) antennas of the seven also support GPS and Wi-Fi capabilities. (Antenna names are ANT1, ANT2, ANT3...ANT7. Port names are P1, P2, P3, P4, WIFI 1, WIFI 2, and GPS). Each antenna location will also provide an ethernet connecting via M12x-coded connectors using the cable specification in (c) which lead to the switch locations.

(e) Three (3) Active 4x4 multiple-input multiple-output (MIMO) exterior antennas; these connect via M12x-coded connectors

using the cable specification in (c). (Antenna names are AANT1, AANT2, AANT3.)

(f) Four (4) 6x6 MIMO interior ceiling antennas for passenger connections. (Antenna names are PLAN1, PLAN2, PLAN3, and PLAN 4. Port names are P1, P2, P3,...P6.)

(g) Four (4) DTL bulk-head locations (two (2) on each end) (DTL connector name is DTLA1 or DTLA2 and DTLB1 or DTLB2 for A-end and B-end, left and right respectively. Port names are P1 and P4 for each DTL location. Each DTL umbilical shall house two (2) 10Gbps ethernet cables within their housing specifically for the Wireless Internet solution.

(h) Ethernet, RF, and power cabling to support the equipment.

ii). Train to Ground / Satellite Provisions

(1) In addition to the hardware found in all cars, cars shall include additional hardware to facilitate connection with a future Train-to-Ground (T2G) or Satellite connection.

(a) These cars shall include the following in addition to the requirements for MAR and AP Hardware:

(i) One (1) Train-to-Ground (T2G) Radio mounting location (T2G Radio name is T2G)

(ii) One (1) Satellite radio mounting location (Satellite radio name is SAT) with 10Gbps M12 X-Coded ethernet connectivity; 2 cables connecting to the switch location.

(iii) Power connections which support Starlink Tile:

1. Starlink Tile Antenna Input Voltage: 49VDC Input Current: 7.2A maximum Power Consumption: 360W Maximum See SpaceX drawing 06658000-102 for Antenna RF keep out zone requirements.

2. Starlink Power Supply Unit The Starlink Power Supply accepts standard aircraft AC power of 115VAC, 50-60 Hz and 400Hz. For aircraft without an AC power supply, the system can be powered using a 500W DC-AC inverter. Input Voltage: 115VAC Input Frequency: 50-60Hz or 400Hz Power Consumption: 400W Maximum (includes antenna power). It is Amtrak's preference to avoid the use of an inverter, and power this solution directly with 115VAC.

c). Ethernet Cabling Requirements

i). Cable and Connector Design Requirements

(1) CAT-7 rail-approved Ethernet copper cabling supporting 10Gbps throughput shall be utilized for all Ethernet cabling required to support the Provisions for Wireless Internet.

(2) All CAT-7 cabling shall be terminated with 8-pin M12 X-coded Male connectors, except where indicated (i.e. rooftop hand holes).

(3) The Contractor shall submit the cable and connector selection as well as the location of all cable terminations for approval by Amtrak.

(4) Cabling shall conform to the requirements of section 18.24.

(5) Cabling and equipment installation shall conform to EN50155:2017 rail standards.

(6) The DTL shall connect the consist, and this cabling shall support a fault-tolerant ring network.

ii). Cable Test Requirements

(1) After installation on each car, each Ethernet channel shall be certified to ISO/IEC 11801-1 – Class F for each copper cable.

(2) Test results shall confirm channel suitability for IEEE 802.3an-2006 10GBASE-T for each copper channel.

(3) The Contractor shall submit the test procedure to Amtrak for review and approval.

(4) The certification results for each cable shall be submitted to Amtrak as part of the vehicle history book.

iii). Cable Labeling Requirements

(1) All Ethernet cabling shall be labeled clearly on both ends of the wire, observable with less than 90° of cable rotation. The Wireless Internet naming convention for Ethernet and Fiber leads is:

(a) Prefix = Contractor cable number (as the Contractor convention requires)

(b) Underscore = use the '_' character between the prefix and origin

(c) Origin = <SWITCH1 or SWITCH2> (port name not required)

(d) Destination = <-device name> with <-port name;' when applicable> (see 12.6.1 for component and related port names)

(2) For example, the label on the Ethernet cable which terminates at one end to Switch #1 and the other to MAR#1 reads as:

Xxxxx-xxxx_SWITCH1-MAR1

(3) An Ethernet cable coming from Switch #2 does not require a port name on the label at the origin or destination; this example label terminates at AP#1 and is marked:

Xxxxx-xxxx_SWITCH2-AP1

(4) An Ethernet or fiber cable coming from Switch #2 does not require a port name on the label at the origin; this example label terminates at left-side DTL on the A-end at the Ethernet cable on port 4 it is marked:

Xxxxx-xxxx_SWITCH2-DTLA1-P4

d). Exterior Antennas and Cabling

i). RF Exterior Antenna Design Requirements

(1) The Contractor shall establish ten **(10)** flat (0° relative to the roofline angle) antenna mounting locations atop each car, with line-of-sight to both sides of the vehicle, and no elevation changes on the roofline which affect line-of-sight.

(2) The antenna elevation, not the roofline must be the catenary/structure envelope limit, not the roofline of the vehicles.

(3) Where Wi-Fi mobile Access Routers or train-to-ground, wayside, or satellite transceivers are to be installed, Amtrak requires a modular antenna mounting design using an interface plate in-between the train and the antenna allowing Amtrak to deploy or change antennas for the solution in all areas where antennas are used.

(4) Each interface plate shall support 10 kg (22 Lbs.), except for satellite antenna locations where the mounting plate shall support up to 25 kg (55 Lbs.). With antennas spaced no less than 600mm (24") apart, the antenna locations shall support an antenna of:

(a) Cellular and T2G/Wayside Antennas

(i) The design must facilitate the mounting of Eight (8) antennas, with the reference antenna being the Huber+Sunher SENCITY® Rail MIMO+ 4x4 Antenna (passive); 90mm x 508.7mm x 411.7mm (Height x Width x Depth). It is likely that other antennas shall be used, so the mounting location shall be designed with the use of intermediate mounting plates in mind.

(ii) These antennas will be selected by Amtrak at a later date with our Wi-Fi contractor of choice. All mounting positions shall be capped and watertight for Amtrak and their contractors to use them at their discretion and reseal them

with Sika Flex 227 or similar sealant at the date of antenna installation.

(iii) The option for inclusion of factory antenna installation by the Contractor for Amtrak's future antenna selection is required.

(b) Satellite Antennas – 900mm L x 900mm W x 300mm H (36" L x 36" W x 12" H). Satellite locations shall be provisioned.

(5) Amtrak shall inform the Contractor of the make and model of the exterior antenna and provide a template with the bolt pattern and cable port dimensions. Contractor shall procure and install all antennas.

(6) The Contractor shall provide the diagrams of the antenna locations and the bolt hardware specification for Amtrak review and approval. **[CDRL 14-08]**

ii). RF Rooftop Exterior Cable Design Requirements:

(1) Five (5) RF cables (four for cellular and one for GPS) and one (1) POE++ capable CAT-7 (or higher) Ethernet cable shall be plumbed between the MAR location and the hand hole at each antenna location on the roof.

(2) Two (2) of these eight antenna locations shall be plumbed with an additional pair (2) of RF cables to facilitate future Wi-Fi based train to ground communications.

(3) All RF cables shall be terminated with N-Male connectors at the rooftop hand hole, and N-Female at the MAR mounting location.

(4) M12 X-coded Female Ethernet connectors shall be in place at the roof hand hold and M12 X-coded Male connectors at the MAR or ANTENNA SWITCH locations.

(5) All of the eight (8) rooftop POE++ capable Cat-7 Ethernet cables shall have a long enough service loop at the MAR end to facilitate, connection to the MAR or local switch location.

(6) Intermediate RF connectors shall not be used. RF cables shall be at least one-half inch (½"; commonly referred to as "400" antenna cabling) in diameter.

(7) The cables shall support frequencies between 600MHz and 7125GHz.

(8) The location of all cable terminations shall be provided to Amtrak for approval.

iii). RF Rooftop Exterior Cable Testing Requirements

(1) Contractor shall test Cellular RF cables across cellular channels from 617MHz to 3.98GHz (the 4x4 MIMO array cables). Wi-Fi rooftop

RF cables shall be tested from 2400 – 2483MHz and 5150 – 7125MHz. GPS cables shall be tested from 1164 MHz to 1610 MHz.

(2) All VSWR results shall be 1.4 or less. All cable runs shall be tested when the cables are installed. GPS cables with antennas in place will not be swept, but a load shall be used to test the installed GPS antenna cables. All VSWR results will be provided to Amtrak for approval.

(3) Contractor shall measure the insertion loss of all RF cables. The insertion loss for each cable shall not exceed 2dB.

(4) Contractor shall test for return loss and distance-to-fault (DTF) for all RF cables after they are attached to exterior cellular and Wi-Fi antennas. The return loss value shall not exceed 13.7dB (VSWR 1.52).

(5) Contractor shall measure return loss values for the two (2) RF cables connected to GPS antennas with 50 ohm load only (no antenna). The insertion loss for each cable shall not exceed 2dB.

(6) Contractor shall confirm GPS/GNSS functionality from the MAR-end of the GPS cables by running a GPS program that validates GPS satellite signal strength, angles, acquisition, and counts.

(7) Contractor shall submit all test results to Amtrak for an approval. The test results for each cable shall be submitted to Amtrak as part of the vehicle history book.

iv). RF Rooftop Exterior Antenna and Cable Labeling Requirements

(1) All exterior antenna cabling shall be labeled clearly on both ends of the wire, observable with less than 90° of cable rotation.

(2) The Wireless Internet naming convention for the exterior antenna cables is:

(a) Prefix = Contractor cable number (as the Contractor convention requires

(b) Underscore = use the '_' character between the prefix and origin

(c) Origin = MAR1 (port name not required)

(d) Destination = <-antenna name> with <-port name; when applicable> (see 12.6.1 for antenna and related port names) GPS antennas shall be clearly called out with the inclusion of “GPS” at the trailing end of destination.

(3) For example, the label on the antenna cable which terminates at one end to MAR #1 and the other to exterior antenna 1 at the 4th cellular port shall read:

Xxxxx-xxxx_MAR1-ANT1-P4

(4) An antenna cable connecting MAR #1 and terminates at exterior antenna 6 Wi-Fi port 2 and is marked:

Xxxxx-xxxx_MAR1-ANT6-WIFI2

(5) Based on the previous example for MAR #1, a cable connected to the GPS port of antenna 10 is marked:

Xxxxx-xxxx_MAR1-ANT8-GPS

e). Interior Ceiling Antennas and Cabling – Passenger LAN (PLAN)

i). Interior Antenna Design Requirements

(1) Contractor shall mount a minimum of four (4) Huber & Suhner 1399.35.0020 Sencity® Rail Omni-SR 6x6 MIMO Antennas (PLAN antenna) on the ceiling within each car.

(2) The Wi-Fi system (APs with PLAN antennas) shall provide RSSI coverage of –65dBm for 95% of the passenger and crew occupying areas in each car, including the restrooms.

(3) With AP conducted power at 30dBm, RSSI shall measure less than -72dBm at 30 feet into the next car.

(4) Contractor shall conduct an RF propagation study to demonstrate the expected Wi-Fi coverage within the train car and the RF leakage to the adjacent cars with AP conducted power at 30dBm (any IEEE 802.11ac Wave 2 or ax AP with four or more antenna leads may be used for the study). The location of all cable terminations shall be provided to Amtrak for approval. **[CDRL 14-09]**

ii). Interior Ceiling Cabling Design Requirements

(1) RF cables connecting the APs and PLAN antennas shall be at least one-quarter inch (1/4-inch; commonly referred to as “240” antenna cabling) in diameter and shall not exceed three meters (3m) in length.

(2) Contractor shall terminate RF cables with QMA-Male connectors on the antenna-facing side and connect the cables with PLAN antennas.

(3) AP #1 connects to PLAN antenna 1 and 2, and AP #2 connects to PLAN antenna 3 and 4.

(4) Amtrak shall inform Contractor on connector type required on AP-end of the cable termination at a later date.

iii). Interior Ceiling Antennas and Cabling Testing Requirements

(1) All PLAN antennas and cables shall be tested across Wi-Fi frequency bands between 2400 – 2483MHz and 5150 – 7125MHz.

(2) Contractor shall measure the insertion loss of PLAN RF cables, and loss value shall not exceed 2dB.

(3) Contractor shall measure return loss and DTF with PLAN cables attached to antennas. The return loss value shall not exceed 13dB (VSWR 1.6).

(4) Contractor shall provide test all results to Amtrak for approval. The test results for each cable shall be submitted to Amtrak as part of the vehicle history book.

iv). Interior Ceiling Antennas and Cabling Labeling Requirements

(1) All PLAN antenna cabling shall be labeled clearly on both ends of the wire, observable with less than 90° of cable rotation. The Wireless Internet naming convention for PLAN cables is:

(a) Prefix = Contractor cable number (as the Contractor convention requires

(b) Underscore = use the '_' character between the prefix and origin

(c) Origin = AP1 or AP2 (port name not required)

(d) Destination = <-PLAN antenna name> with <-port name> (see 12.6.1 for antenna and related port names)

(2) For example, the label on the PLAN antenna cable connecting AP #1 and PLAN antenna 1 at port 4 shall read:

Xxxxx-xxxx_AP1-PLAN1-P4

(3) A PLAN cable connecting AP #2 to PLAN antenna 4 port 2 and is marked:

Xxxxx-xxxx_AP2-ANT4-P2

v). Interior Antenna Cutsheet

(1) The cutsheet for the Huber & Suhner 1399.35.0020 antenna is linked here:

https://www.mouser.com/datasheet/2/829/HUBER_2bSUHNER_1399_35_0020_SeriesDataSheet-2581677.pdf

f). Power and Wiring

i). Wireless Internet Power Requirements

(1) Sufficient power shall be provided to all components via WAGO or NEMA blocks (screw-type blocks supporting ring or fork connectors or friction connectors supporting tinned wiring between 12AWG and 18AWG are acceptable) for each equipment location.

(2) Contractor shall provide a Wireless Internet circuit of no less than 650w per car, connected to a single 10-amp circuit breaker. The location of all cable termination shall be provided to Amtrak for approval.

(3) Contractor shall provide sense power cabling to MAR locations to support post-run delay timer implementations (not required if located in load-shed circuit).

(4) In the event of 480V Head End Power (HEP) loss, power to all MAR locations shall remain by use of car side battery power.

(5) Ground post locations and 300mm (12") straps shall be provided and identified with easily visible green indicators to attach at each equipment mounting location.

(6) Amtrak shall provide leads connecting equipment to the WAGO or NEMA block at each equipment location.

ii). Power Wire Labeling Requirements

(1) Wiring labels for power leads shall state their origin and destination on both ends of the wire and both sides of the label.

(2) All power wiring shall be labeled clearly on both ends of the wire, observable with less than 90° of cable rotation. In the case of paired or multi-conductor power wires, one label per conductor is required. The Wireless Internet naming convention for power cables is:

(a) Prefix = Contractor cable number (as the Contractor convention requires

(b) Underscore = use the '_' character between the prefix and origin

(c) Origin = BRKR or SENSE or <device name> (port name not required; see 12.6.1 for component names)

(d) Source Voltage = voltage (if present; voltages exist from origin breaker or sense, but no voltage from MAR1, just pos or neg) Destination = <device name> (port name not required; see 12.6.1 for component names)

(3) For example, the label on the 72V power cable and the negative lead from the Wireless Internet circuit breaker to MAR1 WAGO block is respectively marked:

Xxxxx-xxxx_BRKR-72V-MAR1

Xxxxx-xxxx_BRKR-NEG-MAR1

(4) A positive and a negative power cable coming from MAR1 to the AP2 WAGO block would read respectively as:

Xxxxx-xxxx_MAR1-POS-AP2

Xxxxx-xxxx_MAR1-NEG-AP2

g). Equipment Locations

i). General Requirements

(1) Contractor shall provide a volume of space for each piece of Wireless Internet equipment as identified in 12.6.1.

(2) Each equipment location shall have one Ethernet link routed to the equipment location from each switch location; a total of two (2) Ethernet cables, labeled as described in c).iii).

(3) The location of all equipment shall be provided to Amtrak for approval.

ii). T2G Router/Mobile Access Router (MAR) locations

(1) Contractor shall provide a volume of space for two (2) T2G/MAR routers (including cable bend radius) in each car:

(a) T2G Router/MAR = 400 mm W x 320 mm L x 255 mm H (16" W x 12 5/8" L x 10" H)

(2) The two MAR positions shall be located within 300mm (12") of each other. Exterior antenna cabling (see 12.6.3.1) shall be routed to within 450mm (18") of the MAR locations.

(3) The location shall be accessible with a stepladder and locked behind a common keyed trapdoor, hinged panel, or in a cabinet.

(4) Components shall be serviceable/removable from that location without removing train components/panels.

(5) Load bearing specification per mounting position shall support 20 kg (44 Lbs.) and use no less than four (4) bolts.

(6) Contractor shall provide the volume dimensions and train fixture bolt hole patterns.

(7) A mounting plate/tray/bracket supplied by Amtrak shall be used to mount equipment into the cars; safe lifting or removal of this equipment should be a one-person task and there shall be enough access space for two persons to work there simultaneously.

iii). T2G Radio and Satellite Locations

(1) Contractor shall provide a volume of space for a T2G radio (T2G) and a satellite radio (SAT) in each end car as defined in 14.6b).ii).

(a) T2G Radio - 300mm W x 200 mm L x 100mm H (12" W x 8" L x 4" H)

(b) SAT Radio - 355mm W x 430 mm L x 152mm H (14" W x 17" L x 6" H)

(2) This space is for future use.

(3) Contractor shall install only power and Ethernet cabling to this location.

(4) T2G radios and satellite modems shall be placed in the ceiling within 2 meters of roof space not currently populated by antennas, facilitating future antenna installation.

(5) The location shall be accessible with a stepladder and locked behind a common keyed trapdoor or in a cabinet.

(6) Components shall be serviceable/removable from that location without removing train components/panels.

(7) Load bearing specification per mounting position shall support 10kg (22 lbs.) and use no less than 4 bolts.

(8) Contractor shall provide the volume dimensions and train fixture bolt hole patterns.

(9) A mounting plate/tray/bracket supplied by Amtrak shall be used to mount equipment into the cars; safe lifting or removal of this equipment should be a one-person task and there shall be enough access space for two persons to work there simultaneously.

iv). AP Locations

(1) Contractor shall provide a volume of space in the ceiling for two (2) AP radios in each car:

(a) AP - 273 mm W x 300 mm L x 100 mm H (10 ¾" W x 12" L x 4" H)

(2) The location shall be accessible with a stepladder and locked behind a common keyed trapdoor or in a cabinet.

(3) Components shall be serviceable/removable from that location without removing train components/panels.

(4) Load bearing specification per mounting position shall support 10kg (22 lbs.) and use no less than 4 bolts.

(5) Contractor shall provide the volume dimensions and train fixture bolt hole patterns.

(6) A mounting plate/tray/bracket supplied by Amtrak shall be used to mount equipment into the cars; safe mounting or removal of this equipment should be a one-person task.

v). Switch Locations

(1) Contractor shall provide a volume of space for switches that support two (2) switches (including cable bend radius) in each MAR Car:

(a) Switch - 300mm W x 430mm L x 255mm H (12" W x 17" L x 10" H)

(2) The location shall be accessible with a stepladder and locked behind a common keyed trapdoor or in a cabinet.

(3) Components shall be serviceable/removable from that location without removing train components/panels.

(4) Load bearing specification per mounting position shall support 10kg (22 lbs.) and use no less than 4 bolts.

(5) Contractor shall provide the volume dimensions and train fixture bolt hole patterns.

(6) A mounting plate/tray/bracket supplied by Amtrak shall be used to mount equipment into the cars; safe lifting or removal of this equipment should be a one-person task and there shall be enough access space for two persons to work there simultaneously.

Table 14-2 Equipment/Spacing Dimension References

#	Equipment	Qty	Location	Required Dimension	Remark
1	MAR	2	Interior	15" W x 12 5/8" L x 10" H	Volume Space
2	AP	2	Interior	10 ¾" W x 12" L x 4" H	Volume Space
3	Switch	2	Interior	12" W x 17" L x 10" H	Volume Space
4	T2G Radio	1	Interior	12" W x 8" L x 4" H	Volume Space (for future use)
5	SAT Radio	1	Interior	14" W x 17" L x 6" H	Volume Space (for future use)
6	T2G/SAT Antennas	1	Roof	36" L x 36" W x 12" H	Volume Space (for future use)
7	Exterior Passive Antennas	7	Roof	18 3/8" L x 14 ½" W x 8" H	Equipment
8	Exterior Active Antennas	7	Roof	18 3/8" L x 14 ½" W x 8" H	Equipment
9	Ceiling Antennas	4	Ceiling	TBD	Equipment

h). Regulatory and Quality Validation

i). The Contractor shall provide manufacturer cut sheets/datasheets for all cabling and equipment in consideration for this infrastructure design which includes the following specifications:

(1) Dimensions,

(2) Weight,

(3) Environmental (operating temperature/storage temperature/IP rating),

(4) Material Type,

(5) detailed RF parameters (operating frequency, insertion loss, and return loss) and

(6) Compliance/Regulatory.

ii). If the manufacturer does not provide the data requested in their spec sheets, the Contractor shall seek the missing data from the manufacturer.

i). Modular Mounting Design

i). Amtrak requires a modular mounting solution for all Wireless Internet equipment to facilitate rapid installation and removal.

ii). The Contractor shall provide the load capacity, mounting dimensions, hardware specification, and train fixture bolt hole patterns for all MAR, T2G radio, SAT modem, AP, antenna (exterior and interior), and Switch spaces.

iii). Amtrak shall affix components to plates/trays/brackets based on these measurements and apply these fixtures at the time of installation.

j). Test Requirements

i). Contractor shall provide all test procedures/reports of the Contractor and Subcontractor tests for an approval.

ii). All test results shall be provided with each vehicle history book prior to the conditional acceptance.

iii). Additionally, both routine and qualification tests by the Contractor during or after the production shall be witnessed by Amtrak.

iv). Sub-contractor Testing:

(1) Specifications of the RF cable(s) in use including applicable mechanical, electrical and regulatory information.

(2) “Birth certificates” of the RF cables with run length, return and insertion loss measurements between 617MHz and 7125MHz shall be conducted if cables are pre-assembled outside of the contractor facility.

(a) If cables are assembled by the contractor, cable measurements shall be provided from post-installation testing described in 1.5.3.1. and “Birth Certificates” are not required, as all cable(s) not passing specifications, and rejected by Amtrak will be remanufactured on-site by the contractor.

v). Contractor/Production Testing (as a Routine Test):

(1) Continuity, Megger and Hi-pot shall be performed on all power wires.

(2) All Ethernet cables shall be certified to ISO/IEC 11801-1 - Class F (CAT7) with an appropriate cable certifier (Ex. Fluke DSX series).

(3) All Fiber cables shall be certified to ISO/IEC 11801-1 – OM3.

(4) RF Cable Analyzer (time and frequency domain reflectometer (Ex. Anritsu Sitemaster Series, Keysite Fieldfox Series, or Bird Sitehawk SK series)) shall be utilized to perform on all RF Cables as stated in below conditions. (See Table 14-3 for criteria)

(a) Condition 1: Without connecting to Antennas, measure and verify the 'return loss' and 'insertion loss':

(i) MAR to Roof-mount Cellular Antennas

(ii) MAR to PLAN/Wi-Fi Antennas

(iii) MAR and GPS Antennas

(b) Condition 2: After connecting the connectors to Roof-mounted Cellular and PLAN/Wi-Fi Antennas, measure and verify the 'return loss' and 'distance-to-fault (DTF)'. DTF parameters (speed of propagation, insertion loss, etc.) shall be programmed into cable analyzer to ensure accurate DTF measurements.

(i) MAR to Roof-mount Cellular Antennas

(ii) MAR to PLAN/Wi-Fi Antennas

(c) Condition 3: After connecting the connectors to Roof-mounted GPS Antennas, measure and verify the GPS satellite signal strength, angles, acquisition and counts as well as GPS/GNSS functionality. These shall be measured/confirmed by connecting the portable GPS receiver to MAR-end of the GPS cable and running the GPS program. Note that detailed pass/fail criteria and designated GPS program for Condition 3 will be provided during the design review.

Table 14-3 RF Cable Criteria

Frequency (MHz)	Measurement Granularity (no. of points)	Type of Antenna Connection
617 to 894	>3000	Cellular
1710 to 2700	>3000	Cellular
3300-3980	>3000	Cellular
2400-2483	>3000	PLAN/WiFi
5150-7125	>3000	PLAN/WiFi

1164-1610	>3000	GPS

14.7 Information Technology and Architecture

a). Overview

i). Amtrak views real-time data from the cars a critical component of understanding and monitoring and proactively addressing safety issues, and meeting customer expectations.

ii). The ability to understand the health of cars in real-time is a critical component to ensure Amtrak can address safety, mechanical, operational, and customer service needs as the cars are in service.

iii). All information technology hardware, software, and data shall fully comply with the Amtrak Digital Technology requirements identified in TS Section 26.

b). Digital Architecture

i). The Contractor shall provide detailed architectural and design documentation for all digital assets and systems either on train or ground, including Information, Application, Networking, and Security.

ii). For software, platforms or systems operated on Amtrak's behalf, provide a high-level description of the environment, certifications, and incident response model as well example of Service Level Agreements and Operating Level Agreements for those managed systems.

c). Data: Sharing and Analysis

i). The Contractor shall indicate what data is created from systems, either on the vehicle or on the wayside in order to support the vehicles.

ii). All data generated as a part of the operation or support of the Amtrak equipment shall be made available and accessible for Amtrak use/reuse.

iii). Data dictionaries, interpreters, and tools suitable for automated batch processing to open formats shall be provided to Amtrak such that the full fidelity of all data is accessible by Amtrak personnel and digital systems.

iv). The Contractor shall also indicate any ownership or legal restrictions on data generated on Amtrak trains.

v). The Contractor shall describe any digital models used to support predictive or conditional maintenance and whether those models are available for Amtrak use.

d). Security Architecture

i). In addition to security requirements defined in Section 28, the Contractor shall provide detailed documentation for policies, processes, systems and tools

utilized to secure all digital assets, systems, and networks either on the equipment or on ground.

ii). This documentation shall include audits and certifications completed by third parties to show compliance with Industry Standards.

iii). The Contractor shall indicate the type of COTS and OEM software being provided, including embedded systems, aboard the car, and the processes and mechanisms used to ensure all software is kept up-to-date and safe from a cybersecurity perspective.

iv). Security locks shall be used to protect communication equipment from unauthorized access. Square keys shall not be considered as an appropriate measure of security to prevent unauthorized access.

v). Network devices shall not be installed in lavatory compartments, sleeper compartments, or other areas that are not subject to video surveillance.

vi). Access to the network shall require authentication, and the network shall be designed with security network zoning principles per IEC 62443 and TS 50701

e). Train Control Systems, IOT and Data

i). The Contractor shall indicate the types of onboard sensors and devices used to generate data to support either real-time or analytical data.

ii). The Contractor shall indicate if they have integrated external data such as Track Wayside Detectors into their management and analytics solutions.

iii). The Contractor shall indicate whether a GPS signal can be sent in real time to Amtrak to support accurate car movement for Amtrak customer channels and operational needs.

f). Onboard Train Information System (OTIS)

i). The Contractor shall provide detailed application and design documentation for all Onboard Train Information Systems deployed to communicate with passengers and employees including deployment, integration, information, and security requirements for all ground systems.

ii). This documentation shall include how content is created, managed, distributed and controlled.

iii). The Contractor shall indicate types of signage onboard the train, indicate Amtrak's ability to affect the digital signage, and whether digital signage has been provided to support Food Service sales.

g). ADA Compliance for All Passenger Information/Interaction Systems

i). All Onboard Information Systems shall comply with the latest ADA standards at time of delivery and detailed documentation shall be provided to verify compliance as well as ongoing support and maintenance.

h). Data Integration

i). Integration and data sharing are a critical component of success in ensuring Amtrak can deliver services safely and successfully to its customers.

ii). The Contractor shall identify how they have integrated data from railcar to customer.

iii). The Contractor shall provide application descriptions and high-level design/integration documents for ground systems that will integrate with Amtrak.

iv). These documents must include deployment, integration, information, and security requirements for all car and ground systems.

v). The Contractor shall indicate if they have integrated with platforms such as SAP, Maximo, Kronos and Adobe Experience Manager.

i). Software Updates, Training, and Licensing

i). The Contractor shall indicate how any software that is part of car and support equipment will be updated, including processes used to ensure software flaws, bugs, and obsolescence are mitigated.

ii). For all software, the Contractor shall indicate if training is necessary, and any training required.

iii). The Contractor shall indicate the type of license used for all software provided (perpetual/subscription).

iv). The Contractor shall indicate how Amtrak will retain the right to use and provide updates to software in the event the Contractor or software is purchased by a different entity.

j). Safety Data Collection and Sharing

i). The Contractor shall provide detailed application and design documentation for all systems utilized in the collection and distribution of Safety related information, including Operational Telemetry, Video and other communications required to monitor and manage Safety Systems and processes.

ii). The Contractor shall indicate whether this information is available in real-time and how data will be made available to Amtrak.

k). IT Systems to Support Maintenance

i). The Contractor shall describe the Ground Systems recommended or required to support the operation, maintenance and repair of the cars.

l). Interface with Passenger and Crew Applications

i). The Contractor shall provide on-board APIs that facilitate secure access to communication system functions that enable the development of handheld device applications that interface with or receive information from the onboard communication system. These APIs shall be:

(1) Easy to learn and understand – Developers should grasp how to use them quickly for basic cases.

(2) Easy to use – Follows conventions

(3) Hard to misuse – Design prevents common mistakes

(4) Consistent and predictable – Uniform naming and consistent response formats

(5) Well-documented – up-to-date documents including quick starts and examples.

(6) Complete and concise – Does exactly what it needs to

(7) Evolvable and versionable – Can grow without breaking existing clients. Backward compatible.

(8) Secure by default – Uses HTTPS and strong authentication, authorization, rate limits, input validation, and protection against common vulnerabilities.

(9) Reliable, performant, and scalable – Handles load, provides meaningful status codes, supports caching and pagination.

(10) Discoverable and self-descriptive – Uses standard HTTP methods correctly.

ii). The intended use for on-board APIs include:

(1) Crew applications, which, through the Contractor supplied API, shall be capable of the command and control of the communication system functions including:

(a) Setting and adjusting routes

(b) Making manual PA announcements (including graphics visual, text, and audio)

(c) Selecting pre-loaded special messages to play

(d) Answering PEI calls

(e) Making and receiving intercom calls, including general calls, calls to specific intercom clients, and call to specific cars

(f) Answering Attendant Call requests, resetting attendant calls, and configuring the attendant call functionality

(g) Configuring the reservation display system

(h) Viewing system, car, and train status and diagnostic information

(i) and other system functions identified by Amtrak during the design review process.

(2) Passenger applications, which, through the Contractor supplied secured API, shall support:

(a) The capability to display and playback onboard announcements and current train.

(b) The capability to display route information.

(c) The capability to display the consist configuration, individual car amenities, and current location in a car and train.

(d) and other communication system features identified by Amtrak during the design review process.

(3) The method of communication and control shall be secure, with configuration and security considerations identified during the design review.

14.8 Ethernet Train Backbone (ETB) and Ethernet Car Network (ECN)

a). General

i). The ETB is used to control and transmit communication information throughout a passenger train consists of between 2 and 22 vehicles and locomotives.

ii). The ETB shall carry information along multiple paths between adjacent vehicles.

iii). The ETB is designed to have no less than 1 Gbps of bandwidth when using the wired network for purpose of managing the traffic across the network.

iv). All cabling and connectors used for the ETB shall support speeds of 10 Gbps.

v). The IP addressing scheme of all onboard IP networks shall be based on EN 61735. The IP addressing scheme, and a list of all IP devices shall be submitted for review and approval by Amtrak. **[CDRL 14-10]**

vi). The Contractor shall provide a description of the ETB and ECN control and architecture for Amtrak review and approval. The description shall include details of the data network protocols, fault tolerance, degraded operating modes, redundancy arbitration, and a description of network initialization and configuration. **[CDRL 14-11]**

b). Equipment

i). The network architecture, network protocols, and all interfaces between all network components located on or off the car shall be non-proprietary. The use of proprietary protocols is prohibited.

ii). Network Interface Control Documents shall be submitted for Amtrak review and approval for all onboard and wayside interfaces between any two software executables. **[CDRL 14-12]**

iii). The ETB equipment is required to provide a high availability of the overall train network, so the system shall ensure that failure of a single active component or power failure within one vehicle shall not interrupt the ETB functionality for the remainder of the train.

iv). The ETB shall remain operational on battery power while in Standby operation.

v). All hardware should be adapted from PRIIA 305-919.

vi). All IP Switches shall be managed, and shall support:

(1) Ethernet Frame Switching as per IEEE 802.1D

(2) Quality of Service as per IEEE 802.1Q

(3) Virtual Local Area Network as per IEEE 802.1Q

(4) Link Layer Discovery Protocol as per IEEE 802.1AB

(5) Switches shall provide sufficient buffering and queuing capability to avoid network bottlenecks.

c). Ethernet Train Backbone (ETB) Switches

i). At least two managed railway grade Layer 3 Ethernet Train Backbone switches shall be installed at each end of the vehicle for the ETB OTIS, PA Communications, car diagnostic systems, and other operations-critical systems use.

ii). The switches shall incorporate bypass contacts to be capable of allowing the Ethernet signals from adjacent vehicles and switches to pass through them when they fail or lose power.

iii). The Contractor shall provide ETB switches that manage link redundancy and maintain network communications in the event of a link failure.

iv). The switches shall conform to the requirements of EN61375-2-5:2014.

v). Ethernet switches shall be mounted inside at each end of the vehicle near the locations where the jumper receptacle cables enter the vehicle, or at a location approved by Amtrak.

vi). One additional pair of switches, supplied by Amtrak as a part of the passenger wireless internet system, will be utilized for the passenger Wi-Fi and Entertainment system.

vii). Ethernet Train Backbone switches shall communicate successfully with other ETB nodes without limitation as to the sequence or orientation within the train, and without a requirement for manual configuration.

d). Ethernet Car Network Switches

i). Ethernet Car Network switches shall be connected to each other through a Gigabit speed fault tolerant ring topology to form the Ethernet Car Network (ECN).

ii). The ECN shall be connected to the ETB switches through redundant Gigabit speed links.

iii). When ECN nodes are replaced, the network system shall automatically identify the replacement equipment, and its communication links. Replacement of any subsystem controller or network switch shall not require any manual configuration of the controller or switch.

e). Cabling and Connectors

i). Eight Cat 6A Ethernet cables are installed within a direct conduit along the length of the vehicle to connect the switches at each end of the vehicle together.

ii). Details shall be provided during design review.

iii). The Ethernet terminations on both Ethernet switches and on the ends of the cable receptacles shall be fitted with four-way M12 connectors utilizing D-Coding for fast Ethernet and eight-way X-Coded for Gigabit or 10 Gigabit Ethernet.

f). System Interconnection

i). The car ETB shall at a minimum include eight category 6A cable end-to-end.

ii). Wi-Fi and Passenger entertainment systems defined in TS 12.6 shall utilize switches and cabling as defined in that section.

iii). The passenger Wi-Fi and Entertainment system shall be connected end-to-end utilizing at a minimum four dedicated Ethernet cables of the Ethernet Train Backbone.

iv). All remaining car systems including OCUs, PA Control Panels, OTIS displays, system controllers and other devices shall utilize this network.

v). Devices involved in the PA system shall have cables routed directly to the network switches.

g). ETB External Hardware

i). The components of the exterior vehicle-to-vehicle network are the fixed receptacles, receptacle housings, bulkhead connectors and jumper cables.

ii). Each car shall have one ETB header located on each corner.

h). Bulkhead Connectors

i). Each Fixed Receptacle will be pre-wired with two category 6A cables.

ii). Each of the category 6A cables shall be terminated with an eight-way X-Coded bulkhead M12 connector.

iii). Cables shall be routed in such a way that they are protected from EMI.

iv). The Fixed Receptacle shall be secured to the vehicle to ensure that the Ethernet Jumper attaches at an angle of approximately 15 degrees from vertical.

v). The center line of the fixed receptacle mounting junction box shall be 60 in. from TOR and 31.25 in. outward from the vehicle longitudinal center line.

vi). Alterations to this placement must be approved by Amtrak.

vii). For car-to-car interfaces Position 1 of each bulkhead shall be connected to the nearest Wi-Fi and Entertainment switch.

viii). Position 3 of each bulkhead shall be connected to the nearest car system switch.

ix). Positions 2 and 4 of the bulkheads shall remain empty for future expansion.

i). Jumper Cables

i). For car-to-car interfaces each jumper shall be composed of four Category 6A or Category 7 cables and shall be long enough to support a car-to-car connection while the car is tuning at the greatest angle of turn the vehicle is rated for.

ii). Each cable will provide bandwidth that is at least 10 Gbps.

iii). Each end of the jumper cable is designed to allow free movement, with a horizontal 270-degree arc of the mating face, in relation to the cable jumper to prevent excessive force on the jumper either when being mated to the vehicle or during normal vehicle movement.

iv). The jumper pulling failure force should be no greater than 100kg-ft which shall be less than the strength of the attachment of the receptacle housing to the carbody.

j). Integration and Fault Tolerance Testing

i). The contractor shall perform a Network Interface Card (NIC) test for each end station and each switch to verify compliance with IEEE standards.

ii). The Contractor shall perform a complete network integration test of all train subsystems, including transmission through jumper cables, to pre-qualify the proposed architecture of networks before vehicle implementation.

(1) This test shall consist of a simulated train with all train switches, actual cable and cable length, pins, and connectors that will be used on the vehicles.

(2) All intelligent system controls connected to the on-board networks shall be the actual units for one car of each type.

(3) The tests shall verify that all protocols, datasets, and messages used on all networks correspond to the Network Interface Control Document and the specific signal, message, and dataset documentation provided for each network.

(4) At the time of the integration tests, the Contractor shall demonstrate the fault tolerance of all networks by simulating all possible faults.

iii). Amtrak shall have the option of witnessing the tests.

iv). The test procedure **[CDRL 14-13]** and results **[CDRL 14-14]** shall be submitted to Amtrak for review and approval.

k). Protocol Analyzer

i). The Contractor shall provide a laptop-based Protocol Analyzer for Amtrak use to perform real-time monitoring of network activity on all networks provided under this contract. The Protocol Analyzer shall have the capability of:

(1) Displaying data in engineering units.

(2) Setting of capture filters to limit the recording of telegrams and network packets to only the ones that are targeted.

(3) Providing a visualization of the protocol stack in adjustable levels of detail.

(4) Developing and displaying statistical reports on traffic, errors, protocol types, etc.

(5) The Contractor shall submit for Amtrak review and approval the capabilities of the Protocol Analyzer for each Network. **[CDRL 14-15]**

14.9 Electromagnetic Interference

a). General EMI / EMC Requirements

i). All carborne supplied equipment and its wiring shall be electromagnetically compatible and have no negative impact on, nor suffer from a negative impact from the use of:

(a) All other components on the cars

(b) All components of the communication system

(c) Operational electronics used by crewmembers, including radios, wireless ticketing devices and others

(d) Consumer electronics used by passengers, including cell phones, computers, radios and others

(e) Wayside equipment including signaling systems

ii). The Contractor shall develop an Electromagnetic Compatibility (EMC) control plan, which shall describe the methodology used to measure control and mitigate all the Electromagnetic Interference (EMI) emissions by the supplied equipment.

iii). The Electromagnetic Compatibility Control Plan shall be submitted to Amtrak as part of the PDR for the communication system. **[CDRL 14-16]**

14.10 CDRLs

CDRL	Description	Due
CDRL 14-01	The Contractor shall identify the fault tolerance capabilities, recovery time, and user interaction required to maintain system operation.	30 days prior to PDR
CDRL 14-02	Plan identifying the approach to reducing the attenuation of the carbody, on-board equipment, and glazing impact on cellular telephone reception	30 days prior to PDR
CDRL 14-03	Documentation and calculations for all individual components, and for the system as a whole, demonstrating the conformance to the requirements in this technical specification and referenced standards.	30 days prior to PDR
CDRL 14-04	Comprehensive architecture and design package	30 days prior to PDR
CDRL 14-05	Documentation defining the capabilities of the OTIS self-test functions	30 days prior to PDR
CDRL 14-06	Document identifying the standard interface which would allow the integration of a replacement or additional DCS communications channels	30 days prior to PDR
CDRL 14-07	Design of the Provision for Wireless Internet	30 days prior to PDR
CDRL 14-08	Diagrams of the antenna locations and the bolt hardware specification	30 days prior to IDR
CDRL 14-09	RF propagation study	30 days prior to IDR
CDRL 14-10	The IP addressing scheme, and a list of all IP devices shall be submitted for review and approval by Amtrak.	30 days prior to PDR
CDRL 14-11	Description of the ETB and ECN control and architecture	30 days prior to PDR
CDRL 14-12	Network Interface Control Documents	30 days prior to IDR

CDRL 14-13	Integration and Fault Tolerance Testing Procedure	30 days prior to IDR
CDRL 14-14	Integration and Fault Tolerance Testing Results	30 days prior to FDR
CDRL 14-15	Capabilities of the Protocol Analyzer for each Network	30 days prior to PDR
CDRL 14-16	Electromagnetic Compatibility (EMC) Control plan	30 days prior to PDR

* End of Chapter 14*

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

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15. Electrical System

Revision 2

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15.1 Overview

a). This Chapter describes the major electrical power distribution and control systems required for the car and locomotive-to-car power and signal trainline circuits.

b). The locomotive-to-car systems include 480V Head End Power (HEP), trainline, 27-point door control/communications and 27-point locomotive control trainlines (MU).

c). Alternative inter-car trainline connection arrangements can be proposed for review and approval.

d). The car systems may include:

i). 480 Volt Alternating Current (VAC) HEP trainline and power distribution,

ii). 208VAC power distribution,

iii). 120VAC power distribution,

iv). 74 VDC Low Voltage Power Supply (LVPS) power distribution,

v). battery,

vi). 27-pin trainlines for car-to-car multiple unit (MU) and communications (COMM), and

vii). electrical locker circuit breaker panels.

e). It is intended that all cars be configured with these standard trainlines or an agreed upon alternative design to permit flexibility in length and interchangeability of cars especially with legacy fleet.

f). Cars may be configured in train consists up to 1,530 ft in length. All car functions shall operate per the standards of this specification within this train length range.

g). Trainline functions may operate at reduced levels (tolerance to be approved by Amtrak) at consist lengths greater than 1,530 ft (due to trainline voltage drop).

h). The maximum power consumption for a 10-car consist shall not exceed 1000 kW under worst case conditions or cause the ALC-42 HEP to trigger self-protection. For calculation purposes, a train consist shall include one diner, one café, one premium accessible coach, one accessible sleeper, one diner/lounge, and any five car combination of sleepers or passenger seating car types. An additional 100 kW of overload is available for an undefined short period of time on cold equipment, but any use of this margin requires Contractor to demonstrate at Contractor's cost.

15.2 General Requirements

a). Hotel power to the cars shall be provided through trainline cables from an external 480VAC, 3-phase, 60 Hertz (Hz) source not located on the vehicles.

b). The system shall be designed for normal operation using power supplied by a locomotive HEP source, or from a wayside 480VAC power source that can have a

tolerance up to -15% to +10%. See 15.5 for additional phase imbalance requirements.

c). Each car shall be equipped with 27-point locomotive control (MU), 27-point communication (COMM), and digital (DTL) trainline receptacles connected at each end of the car. Receptacles shall be arranged so that existing legacy jumper cables can be used to couple a new car to a legacy car and meet all dynamic clearances defined in Chapter 1.

d). All trainline wires shall run the entire length of each car and be connected from end-end.

e). Cars shall be connected using standard jumpers.

f). The primary communication trainline within the car shall be one or more IP Ethernet based network(s) for car level diagnostics.

g). All electrical systems and components utilized on the cars shall be electromagnetically compatible with other electrical systems and components, including but not limited to:

i). crew radio,

ii). digital train line,

iii). ECP cabling (see Chapter 9 for additional information),

iv). on-board train information system,

v). on-board lighting,

vi). passenger wireless devices and

vii). laptop computers.

h). The electrical power distribution and all subsystem equipment shall be in accordance with all applicable FRA regulations, APTA standards (including but not limited to PR-E-RP-002-98, PR-E-RP-004-98, PR-E-S-005-98, PR-E-RP-007-98, PR-E-RP-009-98), IEC/EN railway standards (including but not limited to EN 50155, EN 50121-3-2, IEC 62597, EN 45502, and associated referenced standards), IEEE standards including IEEE Standard 16-2020 or latest version, and other recommended practices and industry standards.

i). In the event APTA standard couplers, air brake hoses, or passenger car Head End Power/Communications/locomotive MU control electrical trainlines are used inter-car, the connections must meet all applicable AAR, APTA, and Amtrak standards.

i). All materials and workmanship shall comply with Chapter 19.

j). Terminal blocks, connectors, and other car wiring devices shall be accessible for inspection, troubleshooting and re-terminating. There shall be no equipment blocking access that must be disassembled or removed.

k). Terminal blocks and connectors shall not be located on the floor.

l). As a supplement to APTA PR-E-RP-002-98 pertaining to wiring of passenger equipment:

i). Unterminated wire connections to terminal blocks are prohibited.

ii). All terminal blocks where the manufacturer states that terminals can be used with or without ferrules, all wires shall use crimp-type ferrules unless otherwise approved by Amtrak.

iii). Flexible conduit located exterior to the carbody shall be liquid-tight flexible metal conduit. Non-metallic conduit exterior to the carbody is prohibited.

iv). Non-metallic conduit shall not be used unless approved by Amtrak before Final Design Review.

m). Ribbon cable connections are prohibited.

n). Underframe junction box, conduit, cabling, and other equipment shall be adequately protected from debris strikes, snow and ice while traveling forward or reverse.

o). Any non-metallic enclosures or components located in the underframe shall be minimized. If used, they shall have additional stainless steel debris shields that will not accumulate debris, snow or ice while traveling forward or reverse.

p). All power supplies, controllers, motors, and other electronic devices shall report fault information to the car diagnostic system. Microprocessor-based devices shall communicate via the Ethernet Car Network to the car diagnostic system. Simple, non-microprocessor-based devices shall provide health and fault status via discrete outputs to the car diagnostic system, or Amtrak approved alternative.

15.3 Trainline Systems for Communication and Multiple Unit Wiring

a). General

i). Locomotive-to-car communication for MU and COMM shall be provided by 27-point plugs and receptacles.

1) Trainline communication shall be possible with legacy fleet for interoperability.

ii). The trainline system shall be compatible in function with APTA Recommended Practice PR-E-RP-017-99.

iii). The 27-point COMM, 27-point MU, DTL, and 480VAC HEP trainline control circuits shall each be run in separate conduits or wire trays.

b). Communication Trainline

i). The COMM trainline provides car-to-locomotive and car-to-car connections for systems such as door control, door closed summary circuit, public address, passenger information and brake status lights.

ii). Trainline pin assignments are shown in APTA PR-E-RP-017-99. See Table 15-1.

iii). The primary communication trainline within the car shall be the digital trainline. When coupled with legacy equipment, the train consist shall automatically provide relevant functionality using the legacy COMM communication connections.

c). End of Train Functions

i). To provide end of train circuit information, depending upon the train consist configuration, at the end cars of the train, a jumper cable may be connected between the right side COMM receptacle and an adjacent white dummy COMM receptacle, to provide end-of-train detection for on-board systems.

ii). Looping relays shall be provided for each car to establish "end of train" for the four communication trainline circuits (#19, #20, #23 and #26).

(1) The looping relay shall be energized when the 27-pin COMM jumper is connected between the COMM receptacle and the adjacent dummy receptacle.

(2) Alternate methods may be proposed to Amtrak for approval.

iii). The DTL system shall be capable of establishing end-of-train functionality to be used in place of the COMM dummy functionality for train summary circuits in the future.

(1) The DTL system shall be capable of handling all existing COMM functions that are not safety relevant.

d). Multiple Unit (MU) Trainline

i). In push-pull operation, locomotive control functions shall be transmitted through the cars from the locomotive by means of a standard AAR MU trainline.

ii). A single MU jumper cable (commonly 71 in. long) shall be used between the locomotive and the adjacent end car using the trainline pin assignments shown in Table 15-2.

iii). All MU trainline receptacles and functions shall conform to APTA PR-E-RP-017-99.

iv). Each MU trainline wire shall be pass-through, uninterrupted from end to end. There shall be no switching or disconnect device that can open the MU trainlines.

e). Trainline System Application to Vehicles

i). Two digital trainline receptacles shall be installed on each end of each car in accordance with PRIIA Specification 305-919.

ii). In addition, two sets of COMM and MU receptacles shall be installed on each end of all cars, one on each side of coupler pocket per APTA Recommended Practice RP-E-017-99.

iii). One MU and one COMM 27-point jumper cable shall be connected between the car and the locomotive.

iv). One or more dummy COMM receptacles may be required at the end of each car to ensure compliance with Section 15.3.

v). Alternative locations for these receptacles may be proposed to Amtrak for approval.

vi). The plate to which receptacles and jumper flanges are mounted shall be designed to resist a 500-pound force, without deforming, produced by pulling the locked jumper (with the receptacle cover locked down utilizing a rubber-O ring type retainer) out of the receptacle.

vii). There shall be no interference that restricts the receptacle cover from being fully opened to allow insertion or withdrawal of jumpers.

viii). Under all operating conditions, a minimum of 2 in. clearance for the trainline cables shall be provided between trainline jumpers and the carbody and all appliances including air hoses, couplers, uncoupling levers and other equipment.

ix). Each car shall be delivered with one loose jumper cable of each type for each connection that would need to be made.

f). Trainline Junction Boxes

i). Separate stainless steel weatherproof junction or switch boxes shall be provided at each end of each car for the communication (both DTL and COMM) and MU trainline systems.

ii). Trainline junction boxes shall be located behind the F-end truck or other Amtrak approved protected location.

iii). The inside of any exterior-mounted box shall be powder coated with an insulating paint or varnish.

iv). All wires shall be terminated using Amtrak approved termination method mounted onto terminal blocks in the junction boxes.

v). Trainline junction boxes shall be located where they are shielded from roadbed debris and car system liquid drains.

vi). All trainline junction boxes shall be weatherproof to NEMA4 requirements or IP56 if located on the exterior.

g). Additional Trainline Signals

i). Amtrak requires three additional trainline functions that are not currently allocated in the 27-pin COMM trainlines. These three functions shall be realized by other means on a per car basis and then communicated to the locomotive.

(1) Hot Journal bearing from any vehicle,

(2) Locked Axle from any vehicle,

(3) Fire/Smoke indication from any vehicle

(4) Any other signal that cannot be transmitted by car network

15.4 Digital Networks

a). General

i). Ethernet/IP (Internet Protocol) shall be the medium of communications between systems (HVAC, LVPS/BC, doors, communications system components, event recorder, cameras, brake system, etc.) inside a car and between cars that make up a train consist.

ii). A Car Ethernet Network, based on IEC 61375-3-4, shall provide communication for the devices / sub-systems within the car. It should provide programmable real-time data monitoring information.

iii). Ethernet Train Backbone, based on IEC 61375-2-5, shall be provided for communication between vehicles in the consist.

b). Car Ethernet Network

i). The primary communication method between on-board microprocessor-controlled subsystems is to be via a Car Ethernet Network. All systems and subsystems on-board the vehicle are to be connected by way of a Car Ethernet Network.

ii). The Contractor shall provide a list of all IP devices on the Car Ethernet Network and Ethernet Backbone. The IP addressing scheme, to be approved by the Project Manager, shall be based on ENI EC 61375.

iii). The network design of the Car Ethernet Network and Ethernet Backbone shall be non-proprietary. The network design should include protocols, such as those defined by TCN Open TRDP, that facilitate the addition and subtraction of components without requiring modifications to on-board software configuration items.

iv). The Contractor shall provide a description of the Car Ethernet Network control and architecture to the Project Manager for review and approval. This description shall include detail on the data network protocols, fault tolerance, degraded operating modes, redundancy arbitration, error detection, and a description of network initialization and configuration.

v). All networks (including the ETB) shall be based on the seven (7) layer open systems interconnection (OSI) model. Full documentation of each layer for each network shall be provided in a network interface control document to be submitted prior to the preliminary design review. The document shall be updated with all changes through testing and the end of the warranty period. **[CDRL 15-01]**

vi). Subsystem monitoring and control within the car shall be primarily by means of the Car Ethernet Network with minimal use of discrete control wires for non-safety-related functions. Systems controlled (non-safety-related functions) and/or monitored by the Car Ethernet Network shall, at a minimum, include the following:

(1) Door System

(2) HVAC System

(3) Brake System

(4) LVPS/BC System

(5) Lighting System

(6) PA Amplifiers

(7) Signs

(8) PEIU

(9) Communication System Components

(10) TWC Gateway

(11) Video Surveillance Systems (Option)

(12) Water and Waste System

(13) Monitoring and Diagnostics System

(14) Maintenance Display Units

vii). The Contractor shall perform a network interface card (NIC) test of each networked device to verify compliance with IEEE standards.

viii). When nodes on the network are replaced using parts supplied by the Contractor or equipment supplier, the network system shall automatically identify the replacement equipment and its communication links. Replacement of networked subsystem controllers shall not require any configuration of the controller or vehicle switches.

ix). For the purposes of network maintainability and diagnostics, full per interface statistics of each network connected device shall be available via PTE, on-board diagnostic screen and wayside diagnostic system. The interface

statistics shall include, at a minimum, packets transmitted, received, transmitted errors (broken down by type), received errors (broken down by type), packet types (unicast, multicast, broadcast, etc.), as well as interface connection duration, speed, and resets. The counters shall be capable of being reset on a per-interface basis via PTE, on-board diagnostic screen and wayside diagnostic system.

x). The PTE Ethernet port shall be located in an electrical locker in each car. Location to be determined during design reviews. A device shall provide the display of the network statistics showing an overview of the activities of the devices connected to the network and indicate issues such as interfaces which have a high number of errors and resets.

xi). The Contractor shall test to ensure each Car Ethernet Network channel link satisfies the complete Cabling Transmission Performance and Test Requirements of TIA/EIA 568-B.2, utilizing a device that meets the accuracy requirements of a Level III tester. Tests shall be performed each time a cable is replaced or re-terminated through test and warranty. Test results shall be recorded by the Contractor and provided to the Project Manager in a spreadsheet format for each car.

xii). The network diagnostic capabilities shall be submitted to the Project Manager for review and approval.

xiii). All software configuration items installed on any network connected device shall be maintained by an onboard controller to facilitate component replacements. A report of expected and current onboard software versions shall be accessible through the PTE, onboard diagnostic system, and wayside diagnostic systems. A software update command using a copy available on the update controller shall be available to maintainers when the report indicates that an expected version of a software configuration item is in conflict with the installed version on the network device.

c). Ethernet Car Backbone (ETB) General

(1) Communication between cars shall be implemented via a Gigabit Ethernet Train Backbone based on IEC 61375-2-5 that provides high speed trainline communication between cars, and between the cars and the wayside.

(2) The Contractor shall provide a description of the Ethernet Train Backbone control and architecture to the Project Manager for review and approval. This description shall include detail on the data network protocols, fault tolerance, degraded operating modes, redundancy arbitration, error detection, and a description of network initialization and configuration.

(3) An Ethernet Train Backbone Node (ETBN) shall be provided on all cars to provide routing between the ETB and the Car Ethernet Network. Each ETBN shall be implemented to provide link redundancy.

(4) The ETB configuration, receptacles, and jumpers shall be implemented. Two Category 6A or Category 7 cables (one in use, one for future provision) shall be run from the ETB receptacles to the location of the Ethernet Train Backbone Node.

(5) The ETB shall provide and support communication of data required to perform the following functions:

(a) Recognition of the train consist, including vehicle order, orientation, and number within the consist

(b) Automatic reconfiguration of the network when cars are coupled or uncoupled

(c) Car monitoring and diagnostics

(d) Train-to-wayside (TWC) data transfer

(e) Transfer of data needed from/by other ETB capable cars or locomotives in the consist

(f) Remote PTE/PTU access to Car Ethernet Network attached devices

(6) The ETB shall support all of the diagnostic and monitoring functions of the monitoring and diagnostic system.

(7) The cars shall be capable of operating in a consist with between 2 and 22 vehicles.

(8) The Contractor shall test to ensure each Ethernet Car Backbone channel link satisfies the complete Cabling Transmission Performance and Test Requirements of TIA/EI 568-C.1 for Category 6A (CAT6A) cables and the 1000BASE-T link transmission performance requirements specified in IEEE Std 802.3. Tests shall be performed as per TIA/EIA 568-B.2, utilizing a device that meets the accuracy requirements of a Level IIIe tester. Tests shall be performed each time a cable is replaced or re-terminated through test and warranty. Test results shall be recorded by the Contractor and provided to the Project Manager in a spreadsheet format for each car.

d). Interoperability

i). The ETB, and systems utilizing the ETB and Car Ethernet Network for communication, shall be designed for interoperability with future fleets without requiring configuration or software changes (that are not affected by the defined ETB interface).

ii). The vehicle specific definition of faults, alarms, screen and screen layouts, display panels, vehicle status, and vehicle network capabilities shall be transmitted by each vehicle via the ETB. The transmission of these data items shall enable future fleets to be integrated without modification to the vehicle's

software. It is anticipated that this will be accomplished utilizing a stack of technologies including service discovery protocols such as zeroconf, application protocols such as HTTP, markup languages such as XML or HTML, and scripting languages such as JavaScript.

iii). The technologies utilized shall be non-proprietary and fully defined by the Contractor to enable future fleets to add displays to the monitoring and diagnostic display, as well as allow access to the monitoring, diagnostic, and status information of the vehicle to the displays integrated on future fleets. This shall allow future fleets, including locomotives coach cars, and cab cars, display information on the maintenance display and driver display of the vehicles purchased under this contract without requiring modifications to software installed on this fleet of coach cars.

iv). Details of the interoperability shall be submitted with the Network Interface Control Document.

v). Optionally, to facilitate development and integration of current and future fleets into the ETB network, the Contractor shall supply a PC based network simulator software package which provides the capability to simulate ETB and Car Ethernet Network communication.

15.5 480 VAC Head End Power (HEP) Trainline System

a). General

i). HEP will be provided from the source to the car through receptacles and jumpers at standard locations on each end of the car and on both sides of the coupler, in accordance with APTA Recommended Practice PR-E-RP-016-99.

(1) Total should be 4 connectors (two male, two female) on each end of the car able to conduct 1600 Amps combined or 400 Amps each.

ii). Contractor shall propose alternative end-of-car cabling arrangements that would help mitigate low hanging debris strikes while still properly maintaining clearance around all track conditions on the Amtrak network. This alternative solution may include permanent or semi-permanent connections on one end of a car and/or fixed connections higher on the end sheet of one car but Amtrak has a keen interest in understanding how to prevent debris strike damage with low hanging cables with the future of this fleet.

iii). In addition to the three main power conductors, the HEP cabling shall also include three control wires to provide locomotive trainline complete information (indicating all cabling from car to car is in place), and a car-to-car carbody ground bond.

(1) HEP circuit assignments shall be in accordance with Amtrak Specification 963.

iv). Load Balancing

(1) The loads between phases shall be balanced so that the load on one phase will not exceed more than 5% of the load on either of the other two phases.

(2) The delta phase current between any phases shall always remain under 90A total for the train consist to prevent locomotive HEP shutdown faults. For calculation purposes, a train consist shall include one diner, one diner/lounge, one café, and any eight-car combination of sleepers or passenger seating car types coupled to a single locomotive.

(3) Load balancing shall take into account each car type and operational loadings including maximum heating, partial heating, maximum cooling, partial cooling, re-heat and ventilation only modes.

v). All HEP cabling shall be arranged and routed to minimize EMI emissions using techniques including trefoil arrangements, shielding, and other strategies.

b). Receptacles and Jumpers

i). Jumper Cables

(1) Both ends of the car shall be equipped with two jumper cables utilizing the latest fabrication techniques and two receptacles with housings, per APTA Recommended Practice PR-E-RP-016-99 and APTA Recommended Practice PR-E-RP-018-99.

(2) Components shall be in accordance with Amtrak Specification 223 and Amtrak drawing D-12-7191, and include 480VAC jumpers, 480VAC receptacles, and 480VAC receptacle housing.

(3) The HEP jumpers shall be of adequate length to reach from the end sheet to the car junction box.

(4) No portion of the HEP cables shall hang down to within 5 in. of the top of rail (vertically) when connected to an adjacent car on straight, level track.

(5) No portion of the cable shall pass below top of rail when navigating a 250 ft. radius turn.

ii). HEP Receptacles

(1) The receptacles shall be mounted with a downward slope of approximately 15° to provide drainage.

(2) Receptacles and fixed jumper flanges shall be mounted to the carbody with stainless steel bolts.

(3) All HEP receptacles shall be labeled with appropriate danger 480V warnings, in accordance with Amtrak Specification 696.

(4) Receptacle Mounting Plate

(a) The plate to which the receptacles and fixed jumper flanges are mounted shall be reinforced to resist, without bending, a 500 lb. force produced from pulling the locked jumper out of the receptacle, such as by an unintended uncoupling.

(b) They shall consist of a short length of stainless-steel tubing with a stainless-steel crossbar at the bottom, of a diameter to accept the 480V plug body, yet prevent it from sliding through.

(c) The holster shall be sloped steeply downward to allow any moisture which has accumulated in the plug to drain.

iii). HEP Trainline Junction Box

(1) The trainline junction box shall be located at the transition bulkhead or if there is no transition bulkhead, beyond the adjacent truck.

(2) This shall be accomplished without requiring connectors, splices or intermediate terminals.

c). Wiring and Connections

i). The 3-phase HEP trainline power cables per APTA Recommended Practices PR-E-RP-002-98 and PR-E-RP-009-98, with 1600-amp capacity, shall be routed along the length of the car.

ii). The wire used in the trainline power cables shall be 4/0 as specified in APTA Recommended Practice PR-E-RP-016-99.

iii). The voltage drop due to the impedance of the power trainline at the extreme end of the train consist shall be minimized under the train's heaviest load.

iv). The HEP cables may run between junction boxes of each car in a protected wire race.

v). All cables shall be enclosed in rigid galvanized steel conduit or trays, where possible, and shall be supported by heavy-duty stainless-steel conduit straps equipped with vibration resistant material at intervals not to exceed 48 in.

vi). All cables not able to be installed in rigid galvanized steel conduit shall be protected from debris strikes and will be supported by suitable cleats at appropriate intervals not exceeding 24 in. Cleat material shall not damage or breakdown cable insulation over time.

vii). Spare COMM and MU trainline wires shall be identified in the junction boxes.

d). Power Junction Boxes

i). An HEP trainline junction box shall be located at each end of the cars, where the jumpers and leads from the receptacles on the end sheet shall be terminated and connected to the trainline cables.

e). Emergency Backup Operation (OPTION)

i). In the event of a locomotive 480VAC HEP failure, there shall be an emergency backup power system for the following systems:

(1) HVAC System, operating at reduced capacity. See Section 10.08.g) for additional information.

(2) Water and Waste System, operating at reduced capacity. See Chapter 17 for additional information.

(3) LVPS System, operating in load shed mode. See Table 15-1 for additional information.

ii). Emergency backup mode shall provide the above functions for a minimum of 6 hours.

iii). The emergency backup power system must include all necessary controls, switch gear, interfaces and sensors to:

(a) Coordinate an automatic changeover from locomotive sourced HEP to emergency power.

(b) Provide full protection for the emergency backup power system from overload, supply overvoltage, and all transient events.

(c) Provide full protection for all connected loads from any failures or maloperation of the emergency power supply.

iv). The emergency backup power supply converter shall be designed and tested per IEC 61287, and all other requirements for power converters as detailed elsewhere in these technical specifications.

v). The emergency backup power supply system shall include a diagnostic interface to the car diagnostic system. See Chapter 24 for additional information.

vi). The emergency backup power system shall output a hardwire signal that will provide the signal for the emergency load systems to enter Emergency Operation Mode. The hardwire signal shall be monitored by the car diagnostic system.

vii). Details for the proposed emergency backup power supply system shall be submitted for review and approval **[CDRL 15-04]**

15.6 480VAC Power Distribution

a). General

i). The 480VAC power is distributed within the cars utilizing switch and circuit breaker panels located in the electrical and/or equipment lockers accessible from the car interior.

ii). 480VAC power shall be controlled and fed to all loads through this distribution system.

b). Each 480VAC circuit breaker auxiliary contact shall be monitored by the diagnostic system.

c). Main HEP Circuit Breaker:

i). One main circuit breaker shall be provided in the electrical locker to allow isolation of each car from the 480VAC trainline systems.

ii). The main 480VAC circuit breaker auxiliary contact shall be monitored by the diagnostic system by a dedicated I/O.

d). Power Transformers

i). All transformers shall be of a dry type, convection cooled, and in accordance with Amtrak Drawing D-65-7449, revision D, unless otherwise approved.

ii). All transformers shall have delta primary windings.

iii). All inputs and outputs shall be circuit breaker protected with suitable circuit breaker discrimination to avoid unnecessary loss of equipment functionality under load fault conditions.

iv). At a minimum, the following types of transformers shall be provided at a minimum on all car types:

(1) 480/120VAC transformers to provide 120VAC service with GFCI functionality.

(2) 3-phase 480/208-120VAC, delta-wye, to provide 120-208VAC, 3-phase service with a grounded neutral.

v). If the contractor can demonstrate that the 120VAC service, with acceptably stable voltage, with GFCI functionality may be provided from a tertiary winding from the 3-phase transformer, then the contractor may propose this arrangement at preliminary design review.

vi). Additional provisions shall be made for food service cars.

vii). All transformers shall be located inside the electrical lockers or under car in equipment boxes if necessary.

(1) If under the car, transformers shall be sealed to NEMA 4 unless it is located in an IP56 water sealed container.

viii). The Contractor shall demonstrate, by calculation, that there is sufficient ventilation to prevent transformer failure and/or damage resulting from excessive heat buildup during all operating conditions.

ix). Transformers shall be derated at least 10% for current, or other appropriate approved factor, based upon duty cycle.

x). Transformers shall be thermally rated such that their life expectancy shall exceed that of the vehicles when operated at full load and at specified maximum ambient temperatures.

xi). Maximum ambient temperatures shall include in the analysis increases in temperature above vehicle external ambient temperature in the transformer mounting locations, transformer efficiency losses, and heat generated from other equipment adjacent to the transformers.

xii). Calculations shall be provided to demonstrate that the transformers provided have sufficient capacity to supply their intended loads with 15% capacity reserved for future use and will have an expected lifetime exceeding that of the vehicle. **[CDRL 15-02]**

15.7 120VAC Power Distribution

a). General

i). The 120VAC power shall be distributed within the car utilizing 480/120VAC step down transformers, and switch and circuit breaker panels located in the electrical equipment lockers accessible from the car interior.

(1) Power shall be controlled and fed to all 120VAC loads through this system.

ii). A main circuit breaker shall control the power distribution to all 120VAC circuit breakers.

iii). The main 120VAC circuit breaker auxiliary contact shall be monitored by the diagnostic system by a dedicated I/O.

iv). Weather-proof, GFCI protected service outlets shall be provided undercar near subcomponent assemblies spaced no less than 25’ from any major system and isolated on a separate circuit independent of interior outlets.

v). Each 120VAC circuit breaker auxiliary contact shall be monitored by the diagnostic system.

vi). Passenger convenience outlets on single level cars shall be divided into a minimum of eight (8) separate circuits to mitigate nuisance tripping impacts.

b). Passenger Convenience Outlets

i). Passenger Seat Outlets

(1) A flush-style 120VAC duplex convenience outlet shall be installed in each revenue seat location using the GFCI circuits, as detailed in Chapter 11, and shall include an equal number of appropriate USB PD (Power Delivery) ports as approved by Amtrak.

(2) Provisions shall be included so that outlets do not limit the ability to reconfigure seats within the cars.

(3) The outlets are intended to provide power for passenger electronic equipment, such as laptop computers.

ii). Table Outlets

(1) Two duplex outlets supplied by a power strip, shall be installed at each table, located such that the table or seat does not interfere with access to the outlet.

(2) Each outlet shall also include an equal number of USB ports.

iii). An Amtrak-standard 120V decal per Amtrak Specification 697 shall be installed at each outlet location.

iv). The passenger convenience outlets shall be protected by a number of separate power circuits, each of which shall be equipped with a 20-amp GFCI breaker with test and reset buttons.

(1) The convenience outlets on each car shall be evenly divided into the power circuits.

(2) The number of power circuits will be determined by the Contractor, but they should use 1 amp per foot of carbody as a guide.

v). Each passenger convenience outlet shall include a power indicator light to indicate power at the outlet.

c). Interior Service Outlets

i). Duplex GFCI service outlets shall be located in each toilet room, electrical locker and utility lockers in all car types, in locations and quantities suitable for their intended use in those areas.

ii). The food service area of the food service car shall be equipped with GFCI protected service outlets as specified in Chapter 16.

iii). Service outlets shall be protected locally by GFCI outlet rated for 120VAC, single phase, 60 Hz, 20 amps at each service outlet location.

d). Special Service Outlets

i). In each accessible area there shall be a dedicated GFCI outlet or charging cable capable of charging mobility aid devices such as electric wheelchairs.

(1) The circuit shall be fed by a dedicated circuit breaker and all associated wiring shall be able to support up to 0A current draw.

(2) If the outlet itself cannot support 30A, the circuit breaker shall be rated to the weakest component in the arrangement.

e). Sleeper Room Service Outlets

i). Each sleeper room shall have 120VAC duplex convenience outlets with GFCI protection and shall include an equal number of appropriate USB ports as approved by Amtrak. See Chapter 11 for more information.

ii). A fault event in any sleeper room shall not impact any other sleeper room on the car.

15.8 Battery Charger

a). General

i). Each car shall have two solid-state DC battery chargers with temperature compensation.

(1) The second battery charger will act as an emergency hot standby in case the first battery charger has a failure and can no longer operate. If the first battery charger fails, the changeover to the second battery charger shall be automatic and not require any manual intervention.

(2) Battery chargers shall rotate to avoid extended periods of inactivity.

(3) There shall be a backup manual override that can be crew operated in case the automatic battery charger changeover fails.

(4) Each individual battery charger shall meet the reliability requirements in Chapter 4.

(5) The battery charger shall be either mounted under the car in an equipment box, near the battery box, oriented so that the indicator lights can be seen from outside the car without opening panels, or the battery charger shall be installed in the electrical locker.

(6) The battery charger shall be rated appropriately for the DC load it will be supplying.

(7) Alternative proposals, subject to Amtrak review, may be allowed if the performance criteria are satisfactorily accounted for.

(8) The battery charger function description shall be submitted at PDR and updated during design review. **[CDRL 15-03]**

ii). The battery charger shall provide DC power to support all DC loads, including battery charging, while the car is operating with HEP on.

iii). Upon the loss of HEP or the failure of the battery charger, the system shall automatically transfer the DC loads to the battery system without interruption of power and shall be demonstrated during design review.

iv). The DC battery system shall be responsible for feeding car loads and systems which must be available for operation independent of the availability of the 480VAC HEP, such as public address, digital trainline, marker lights, side and end door systems, standby lighting, and others, as specified in Table 15-3.

v). The battery and charger system shall be comprised of:

(1) Battery charger with temperature sensor

(2) Battery (multiple cells)

(3) Load drop device or devices

(4) Load drop controller (may be located elsewhere)

(5) The same battery type and battery charger shall be used on all car types.

b). Operation

i). The battery charger shall be connected in parallel to simultaneously charge the battery while supplying power to the individual car bus and shall be capable of supplying uninterrupted DC power during load transfer between LVPS and battery.

ii). The charging system shall incorporate modes for Current Limit, Normal Charge, and Trickle Charge.

iii). The Contractor shall propose an Amtrak approved method to incorporate battery charging and the output voltage will be regulated at a battery temperature-compensated value.

iv). The charger shall be sized with sufficient capacity to simultaneously recharge the battery from a fully discharged state and to support the maximum possible DC bus loads plus a 25% reserve beyond the worst-case continuous load condition.

v). Recharge time of a fully discharged battery shall not exceed five hours to reach at least 80% of capacity at 77°F, with all normal car DC loads on.

vi). The Contractor shall provide, at design review, a load budget assessment that includes calculations to demonstrate that the charger provided has sufficient capacity to meet these needs. **[CDRL 15-05]**

c). Basic Charger Characteristics

i). Basic charger characteristics shall include the following:

Input Voltage	480VAC nominal (tolerance range +10%/-15%), 3-phase, 3-wire
Input Frequency	60 Hz nominal (tolerance range 56-64 Hz)
Input Protection	3-pole circuit breaker (external reset)
Output Voltage, Temperature Compensated	73.6VDC at 68°F ambient; 80VDC maximum
Temperature Compensation	In accordance with the battery manufacturer's recommendation

Ripple	Maximum of 2 volts peak-to-peak any load within rating
Audible Noise	62 dBA maximum for components mounted inside the car
Ability to automatically recharge the battery from any state of discharge, including 0 volts on battery terminals.	
Charging voltage ambient temperature compensated as sensed at the battery.	
Following a HEP power outage, the charger shall restart with a reduced current load for a period of time after restoration of HEP in order to minimize the short-term startup HEP load.	
Diagnostic information for the battery charger and battery current and voltage levels shall be recorded and available remotely.	
See Chapter 4 Reliability, Availability, Maintainability for additional requirements.	

d). Circuit Breakers

i). The charger system shall be equipped with two circuit breakers, one for the charger output and one for the battery disconnect near the battery charger.

ii). If needed a second battery disconnect switch shall be located adjacent to the battery box.

e). Indicators

i). The charger shall include individual status indication LEDs that are displayed from the front face. These shall include:

Supply 480VAC On	Green
Current Limit (in current limit mode)	Amber
Load Dump Relay Energized	Amber
Supply 480VAC off/out of tolerance	Red
Rectifier Failure	Red
Temperature Sensor Failure	Red

ii). A lamp test pushbutton shall be provided, which when pressed will cause all lamps to light. All indicators and meters should be able to operate without 480VAC present.

iii). The charger shall include four meters on the front face:

DC Amps (total charger output)	0-100 amps
Battery Amps (current into/out of battery)	100-0-100 amps (zero center)
DC volts (charger output voltage)	0-100 volts
Battery Temperature	0-250 degrees F

iv). All metered information, diagnostics, and fault information shall be recorded and available remotely through the car diagnostic system.

f). Self-Protection

i). At a minimum, the charger shall be self-protected against the following fault conditions:

(1) Open circuit battery or wiring

(2) Short circuit battery or wiring

(3) Battery ground fault

(4) Temperature sensor fault

(5) Low input voltage

(6) Low output voltage

(7) Input phase loss

(8) Reversed battery connections

(9) System overload

(10) Voltage or current over limit

g). Temperature Sensor

i). The temperature sensor shall be sealed and mounted onto one of the inter-cell plates of the battery assembly and shall be sufficiently marked so as to be readily identifiable and accessible during maintenance or battery cell change out.

h). Operation of Battery Charger System

i). Operation of the battery charger shall be as follows. See Table 15-3 for additional details:

(1) **Normal Mode:** 480VAC HEP “ON”; DC system “ON”

(a) All AC and DC loads available

(b) All DC loads fed by battery charger

(2) **Standby Mode:** 480VAC HEP “OFF”; DC system “ON”

(a) Battery voltage above manufacturer recommended standby level based on battery type.

(b) All DC loads fed by battery

(c) Immediately after loss of HEP, the car shall go into standby mode, where most of the car lighting, all doors, ECP braking, and the communications system remain in operation.

(d) Refrigeration equipment shall remain on.

(3) **Load Shed Mode:** 480VAC HEP “OFF”; DC system “ON”

(a) Battery voltage potential range for load shed the manufacturer has recommended based on battery type.

(b) Only essential DC loads remain on, de-energizing non-essential systems.

(4) **Emergency Mode:** 480VAC HEP “OFF”; DC system “OFF”

(a) Battery voltage below the manufacturer recommended minimum level based on battery type.

(b) All DC loads are without power because the load drop device has disconnected the battery system, or the battery system is disabled due to equipment failure.

(c) In emergency mode only independently, powered systems remain on. Upon restoration of HEP, all DC loads shall be available immediately after a brief window to confirm HEP is stable, including those that were disconnected as part of standby, emergency or load drop. DC load transfer by the battery charger shall be independent of the state of the battery when HEP is available. The battery charger should be able to operate normally regardless of the condition of the battery set.

i). Load Shed/Drop Device

i). The low-voltage power system shall be equipped with a switching device(s), which shall shed load from the battery in accordance with Table 15-3 and the battery manufacturers recommendations.

15.9 Battery System

a). General

i). The battery shall provide power for necessary systems when the HEP system is not available.

ii). The battery system shall be compliant with APTA Recommended Practice PR-E-RP-007-098.

b). Batteries

i). The Contractor shall submit a battery design that:

(1) Meets the load requirements found in Table 15-3 with at least 25% extra capacity;

(2) Provides the longest life-cycle cost effective system; and

(3) Provides the latest technology that is available in passenger rail battery design.

ii). All car types shall utilize the same type of battery cell.

iii). The batteries shall be recharged by the battery charger as specified above.

iv). Batteries shall be nickel-cadmium (Ni-CAD) or nickel-metal hydride, or other Amtrak approved type.

(1) Lead-acid and Lithium-Ion batteries are prohibited.

v). The batteries shall be housed in cases of a fire-retardant design.

vi). The batteries shall be a low-maintenance type and shall not require the frequent adjustment of the electrolyte level.

vii). The battery system may utilize a centralized water fill apparatus that meets the ambient environmental requirements of the specification.

viii). The battery shall be designed to minimize hazards to operating personnel during service, operation, line maintenance and shop maintenance.

c). Battery Performance

i). Nominal battery voltage of 64VDC shall be provided to the DC power distribution system in each car when HEP is not present and the batteries are fully charged.

(1) Alternate methods of compliance for battery system voltage may be proposed but must still meet the requirements and relative performance characteristics and modes specified for the battery and battery charger systems.

ii). The batteries shall have a design service life of no less than twelve years and shall be capable of withstanding a minimum of 2000 deep cycles without failure.

(1) A deep cycle shall be defined as discharging the battery to 0.8V/cell to 1.0V/cell and recharging it to 80% of its rated capacity at 77°F in no more than five hours.

(2) The actual discharge voltage will be established in accordance with the battery manufacturer’s recommendations.

iii). The battery system shall be sized to carry the full DC load after loss of HEP, as defined in Table 15-3 (standby mode) for no less than two hours.

(1) The battery system shall provide a 25% power safety margin above the calculated load.

iv). A DC load budget shall be developed by the Contractor and submitted to Amtrak for approval during the design review process, demonstrating that the

battery system as proposed meets all requirements and provides adequate capacity for the required loads for the required duration.

d). Battery Markings

i). Each battery cell or battery unit shall be permanently marked with the following information:

(1) Manufacturer's name

(2) Battery type

(3) Catalog or part number

(4) Nominal rated capacity at five- and eight-hour discharge rates

(5) Serial number

(6) Date manufactured

(7) Amtrak name

(8) Amtrak part number

(9) Warning and safety precautions (i.e. use no acid, etc.)

(10) Blank space where installation date can be written

ii). Markings shall be resistant to the chemical and mechanical environment encountered in service for the design life of the cell.

iii). Polarity of the positive cell terminal shall be identified by a red post insulator or bushing and/or a plainly marked p, pos or + symbol.

iv). Polarity or the negative post shall be identified with a black post insulator or bushing and/or a plainly marked n, neg or - symbol.

e). Battery Enclosure

i). Design and Construction

(1) Battery Enclosures shall meet the requirements of 49 CFR 238.225 and EN 50272-2.

(2) The batteries shall be housed in an approved rattle-proof stainless steel battery box located in an approved location under the car floor unless isolated from the passenger seating areas by a non-combustible barrier.

(3) The battery box shall be of adequate size to accommodate a crated battery from at least two suppliers.

(4) Battery enclosure covers shall be hinged and designed to prevent the direct entry of water.

(5) No combustible material shall be used for the trays or cell blocking.

(6) The battery box floor shall have a drain inboard of the running rail.

(7) Means shall be provided to prevent lateral and longitudinal movements of the battery using approved fire-resistant material.

(8) The cells shall be installed such that the plates are parallel to the sides of the car.

(9) Wire terminations shall be both labeled and color coded red (for positive) and black (for negative).

(10) Battery enclosure shall be protected by the use of a fire suppression system that is adequate to contain/extinguish any type of battery fire.

ii). Accessibility for Maintenance

(1) The battery shall be mounted for ease of replacement and maintenance.

(a) All cells shall be fully and easily accessible for servicing.

(2) When open, the hinged covers should provide unimpeded access to the batteries for the replacement or routine maintenance and shall include a suitable prop rod or latching mechanism to hold the access door open.

(3) If the battery trays must be moved to provide access for servicing, they shall be mounted on a robust locking slide-out tray.

(a) The tray shall lock in the fully extended and fully retracted positions, with a safety latch.

(b) Sufficient slack shall be provided in the battery cables to permit tray movement, and anti-chafing materials such as cable carriers shall be applied to prevent damage to the cables.

(c) Use of cable disconnect plugs for tray movement is prohibited.

(4) The rearmost cells shall have vertical line of sight visibility to the filler caps well clear of the side of the carbody when the tray is extended.

(5) The battery box shall be completely self-draining to allow flushing of the battery with water.

iii). Ventilation

(1) Battery venting shall be designed so that there can be no accumulation of trapped gases.

(2) There shall be no devices that can cause sparking in the battery ventilation airflow.

(3) Ventilation holes shall be provided with a fine mesh that allows for proper ventilation but prevents intrusion of leaves or small debris.

(4) Fiberglass or other approved fire resistant easily replaceable filtering media shall be applied to ventilation openings to prevent dust ingress due to car motion.

f). Battery Disconnect

i). There shall be a battery disconnect available to first responders in case of an accident. The location shall be readily accessible in any accident scenario include a rollover derailment such as in the interior in the vestibule area.

ii). The battery disconnect concept and arrangement shall be submitted at Preliminary Design Review. **[CDRL 15-06]**

15.10 DC Power Distribution System

a). General

i). Power for all DC loads shall be distributed throughout the car through switch and circuit breaker panels located in the electrical equipment lockers accessible from the car interior.

ii). A master battery emergency OFF switch/pushbutton shall be included in the switch locker, which shall permit the train crew to totally disconnect the car battery from all car loads.

iii). Each DC branch return circuit shall be floated from the carbody.

iv). The low voltage power distribution arrangement concept shall be submitted at Preliminary Design Review. **[CDRL 15-07]**

b). 74VDC Power System

i). Systems and components that are operated on 74VDC shall be powered from the battery charger through a power distribution system that includes control switches, circuit breakers and load shed and load drop relays located in the electrical locker.

ii). Circuit breakers shall be sized and labeled according to their circuit and function.

iii). A main circuit breaker shall control power distribution to all 74VDC circuit breakers.

iv). The main 74VDC circuit breaker auxiliary contact shall be monitored by the diagnostic system by a dedicated I/O.

v). Each 74VDC circuit breaker auxiliary contact shall be monitored by the diagnostic system.

c). 24/12VDC Power System

i). If multiple systems utilize 24VDC or 12VDC power sources, then there shall be a consolidated 24/12VDC power distribution system located in the electric locker instead of using multiple DC/DC converters.

ii). A main circuit breaker will be supplied for the DC-to-DC converter and each sub system utilizing the 24/12VDC system shall have its own dedicated circuit breaker.

iii). Each converter shall report health to the diagnostic system.

iv). Each 24/12VDC circuit breaker auxiliary contact shall be monitored by the diagnostic system.

d). DC-to-DC Converters and Inverters

i). DC-to-DC Converters and Inverters used to supply other voltages, including commercially available units, shall be certified to EN 50121 and 50155.

ii). Converter and Inverter reliability shall meet the auxiliary power MDBCF requirements in Chapter 4.

15.11 Electrical Panels

a). General

i). An electrical locker shall be provided in all car types, locked with the standard coach key.

(1) All control switches, circuit breakers and indicators shall be located in this locker unless specified otherwise. These controls, breakers, and indicators shall not be located undercar in the event a reset is required during service by the onboard crew or maintenance personnel. Any controls, breakers, and indicators located undercar will need to be approved by Amtrak during the design review process.

ii). Controls and switches designated for crew operation shall be located on electrical panels separate from devices designated for maintenance operation such as circuit breakers.

(1) If crew and maintainer controls are located in the same locker, the panels shall have separate doors to prevent crew operators from accidentally using maintenance devices.

iii). All circuit breaker and switch panels shall meet all recommendations of APTA Recommended Practice PR-E-RP-002-98.

iv). The circuit breaker panels shall be dead front type, with removable front covers, of a design such that all components are front serviceable.

v). Circuit breakers shall be arranged so that the handles move vertically, with the ON position up.

vi). The panels shall be conveniently located, in the electrical locker, for ease of access by service personnel.

vii). Reduced wiring and ease of maintenance shall be of prime consideration.

viii). If it is impractical to house all circuit breakers in the electrical locker, additional circuit breaker panels may be proposed for Amtrak approval.

ix). A wiring gutter shall be provided along the top, sides and bottom, for the routing of high voltage leads to their designated circuit breakers.

x). Appropriate installation methods and materials (wire gutters, conduits, tie bars, etc.) shall be provided for routing high voltage leads to their designated circuit breakers internal to the electrical locker.

xi). The circuit breaker panel shall be configured for easy removal so that maintenance and repair action are not impeded.

xii). Electrical locker arrangement, including separation details of crew operated devices and maintenance operated devices, shall be submitted at IDR. **[CDRL 15-08]**

b). Switch and Circuit Breaker Panel Arrangement

i). Each circuit breaker panel shall carry apparatus arranged to be easily accessible to connections and designed to prevent an operator from coming in contact with live voltage when operating switches or circuit breakers.

ii). All switches and circuit breakers shall be provided with a nameplate clearly identifying the electrical circuit it controls with at least three spare slots for future circuit breaker installations.

iii). The ampere rating for each circuit breaker shall be indicated on the circuit breaker front plate, arm or toggle lever.

iv). All circuit breakers and switches shall indicate ON with toggle up and OFF with toggle down.

v). Circuit breakers for the different voltage power distribution systems shall each be grouped with their respective voltage and be labeled according to the appropriate voltage.

vi). A main circuit breaker shall be provided for each voltage level.

vii). Circuit breakers, whether in groups or individually, shall provide a means for locking out and tagging out with off-the-shelf Lockout Tagout (LOTO) devices.

viii). The Contractor shall illustrate the Lock Out Tag Out procedure during the design review process.

15.12 Spare Conduit

a). Spare conduits shall be installed for future use in concealed areas where there are no access panels. Spare conduits shall follow requirements in APTA PR-E-RP-002-98, Installation of Wire and Cable.

b). Areas include but are not limited to underneath the floor panels, sidewalls, vestibules, ceiling panels, etc. for running future wiring laterally across the aisle, or longitudinally down the car.

c). Spare conduits shall be uninterrupted from end to end. If pull boxes are needed, they shall be located in areas that have sufficient maintenance access.

d). Spare conduit size shall be a minimum 0.5 in.

e). Spare conduit shall have a pre-installed spare wire through the length of the conduit to facilitate easy wire pulling in the future. The spare wire shall be an appropriately size that can withstand the mechanical strength of pulling a bundle of wire without breaking.

f). There shall be separate spare conduits for 208V class, 120V class, 74V class, and communications and network class wiring.

g). From the 120V circuit breaker panel, there shall be conduits that can run wire to each corner of the car.

h). From the 74V circuit breaker panel, there shall be conduits that can run wire to each corner of the car.

i). For communications and network conduits, there shall be sufficient conduits between equipment lockers and vacant areas where future equipment could be installed.

15.13 Car Location Identifiers for All Subsystems

a). To consolidate LRU configurations, each LRU that can be installed in multiple locations within the car shall utilize a car location identifier key integrated into the car wiring.

b). Each LRU shall be able to read the location and determine on its own the appropriate functionality.

c). LRUs shall not be manually configured with different software, dip switch settings, or other manual means.

d). The system integrator shall be responsible to oversee that each subsystem is following this approach.

15.14 Integrated Schematics

a). The Contractor shall prepare and submit, for acceptance by Amtrak, an integrated schematic diagram package showing all electrical systems and including all components, wiring, and loads on the car. **[CDRL 15-09]**

b). Conduit, wiring, and locator diagrams should also be included. See Chapter 23.

Table 15-1: Communication Trainline Pin Assignments

(For car-to-locomotive connections only)

Pin	Amtrak Standard	APTA Standard
1	Shield	Shield (Common)
2	Battery Negative	Battery Negative
3	PA/Tape Music #1 (black) (**)	PA/Tape Music #1 (black)
4	PA/Tape Music #1 (white) (**)	PA/Tape Music #1 (white)
5	Intercom (black) (**)	Intercom (black)
6	Intercom (white) (**)	Intercom (white)
7	PA Control (black) (**)	PA Control (black)
8	PA Control (white) (**)	PA Control (white)
9	Passenger Info (black) (**)	Music-3 (radio)(black)
10	Passenger Info (white) (**)	Music-3 (radio)(white)
11	Brake Application (pass-thru for future use)	Brake Application
12	Brake Release (pass-thru for future use)	Brake Release
13	Brake Negative (pass-thru for future use)	Brake Negative
14	Open Doors R.H. (*)	Open Doors R.H.
15	Open Doors L.H. (*)	Open Doors L.H.
16	Close Doors R.H. (*)	Close Doors R.H.
17	Close Doors L.H. (*)	Close Doors L.H.
18	Door Closed Light (*)	Door Closed Light
19	Brake Released Light	Brake Released Light
20	Brake Applied Light	Brake Applied Light
21	Hot Journal Light	Hot Journal Light
22	Conductor's Signal	Conductor's Signal
23	Door Closed Light (*)	Door Close Light
24	Tape Music #2 (black) (pass-thru)	Tape Music #2 (black)
25	Tape Music #2 (white) (pass-thru)	Tape Music #2 (white)
26	Conductor's Door Light Feed	Conductor's Door Light Feed
27	Attendant Call System	Attendant Call
Crossed Trainlines (*)	14 & 15, 16 & 17, 18 & 23	14 & 15, 16 & 17, 18 & 23
Twisted Shielded pairs (**)	3 & 4, 5 & 6, 7 & 8, 9 & 10, 24 & 25	3 & 4, 5 & 6, 7 & 8, 9 & 10, 24 & 25
Source	Amtrak dwg A-63-7676-1 (under revision)	APTA Std PR-E-RP-017-99

Table 15-2: Multiple Unit (MU) Trainline Pin Assignments

All MU trainlines shall be pass-thru with no interruptions as described in 15.3.2

Pin	Amtrak Standard	APTA Standard
1	Reserved Pass-thru	Spare (reserved for cruise control)
2	Alarm Bell	Alarm Bell
3	D Throttle	D Throttle
4	Control Negative	Control Negative
5	Emergency Sand	Emergency Sand
6	Generator Field	Generator Field
7	C Throttle	C Throttle
8	Forward (*)	Forward (*)
9	Reverse (*)	Reverse (*)
10	Wheel Slip	Wheel Slip
11	Reserved Pass-thru	Spare
12	B Throttle	B Throttle
13	Control Positive	Control Positive
14	Reserved Pass-thru	Spare
15	A Throttle	A Throttle
16	Engine Run	Engine Run
17	Dynamic Brake Setup	Dynamic Brake Setup
18	Remote Loadmeter (**)	Remote Loadmeter (**)
19	Remote Loadmeter (**)	Remote Loadmeter (**)
20	Dynamic Brake Warning	Dynamic Brake Warning
21	Dynamic Brake Start	Dynamic Brake Start
22	Reserved Pass-thru	Spare
23	Manual Sanding	Manual Sanding
24	Dynamic Brake Excitation	Dynamic Brake Excitation
25	Reserved Pass-thru	MU Headlight
26	Remote Fault Reset	Remote Fault Reset
27	Brake Emergency	Brake Emergency
Crossed Trainlines (*)	8 & 9	8 & 9
Twisted Shielded pairs (**)	18 & 19	18 & 19
Source	Amtrak dwg A-63-7676-1 (under revision)	APTA Std PR-E-RP-017-99

Table 15-3: Power Phase Matrix

NOTE: Battery voltage levels listed are included as an example based on specific battery type / chemistry.

Condition	Normal	Standby	Load Shed	Emergency
Description of Condition	– HEP Power. Normal operation. – All systems on and functioning.	– After loss of HEP. – Systems powered by main car batteries. – ALL DC loads on.	– After standby. Essential systems powered by main car batteries.	– No car battery power. – Lights are independently powered per FRA requirement.
Timeline	normal	2 hours		90 minutes
Threshold	normal	after HEP loss	after standby	after load shed
DC Lights:				
All Passenger Interior Lights. Vestibules, Toilet Rooms, Electric Locker, Cafe	Yes	Yes	Yes	No
Reading	Yes	Yes	No	No
All Exterior Lights: Platform, Status, Marker Lights	Yes	Yes	Yes	No
Independent Power Source Emergency Lights	No	No	No	Yes
Doors:				
Side Door Controls and Operators	Yes	Yes 40 sec every 30 min	Yes 40 sec every 30 min	No
End Door Controls and Operators	Yes	Yes 30 sec every 5 min	Yes 30 sec every 5 min	No
Door Closed Summary Circuit	Yes	Yes	Yes	No
Communications and Networks:				
PA	Yes	Yes 20 sec every 20 min	Yes 20 sec every 20 min	No
Networks	Yes	Yes	Yes	No

Condition	Normal	Standby	Load Shed	Emergency
Description of Condition	– HEP Power. Normal operation. – All systems on and functioning.	– After loss of HEP. – Systems powered by main car batteries. – ALL DC loads on.	– After standby. Essential systems powered by main car batteries.	– No car battery power. – Lights are independently powered per FRA requirement.
Timeline	normal	2 hours		90 minutes
Threshold	normal	after HEP loss	after standby	after load shed
Communications	Yes	Yes	Yes	No
Passenger Wi-Fi	Yes	Yes	No	No
HVAC System:				
HVAC heating and cooling	Yes	No	No	No
HVAC ventilation	Yes	Yes	No**	No
Toilet System:	Yes	Yes*	No	No
Other Systems:				
Wheelslide	Yes	Yes	Yes	No
Convenience Outlets	Yes	No	No	No
Food Service Cars:				
Refrigeration	Yes	Yes	No	No
Water System	Yes	Yes	No	No
Other Appliances	Yes	No	No	No
Point of Sale System	Yes	Yes	No	No

*Toilet System shall remain functional as long as main car battery, air supply, and water temperature are not preventing safe operation. See Chapter 10 HVAC and Chapter 17 Water and Waste for additional details.

**To be determined if possible, during Design Review

15.15 CDRLs

CDRL	Description	Due
CDRL 15-01	Network interface control document	30 days prior to Electrical PDR
CDRL 15-02	Transformer capacity and lifespan analysis	30 days prior to Electrical PDR
CDRL 15-03	Battery Charger Function description	30 days prior to Electrical IDR
CDRL 15-04	Emergency Backup System Details	30 days prior to Electrical PDR
CDRL 15-05	Battery Charger Load budget assessment	30 days prior to Electrical IDR
CDRL 15-06	Battery disconnect concept and arrangement	30 days prior to Electrical PDR
CDRL 15-07	Low voltage power distribution arrangement concept	30 days prior to Electrical PDR
CDRL 15-08	Electrical locker arrangement, including separation details of crew operated devices and maintenance operated devices.	30 days prior to Electrical PDR
CDRL 15-09	Integrated schematic diagram package	30 days prior to Electrical PDR

* End of Section 15 *

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

16. Food Service

Revision 2

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16.1 Overview

a). This chapter defines the technical requirements, interior design, and configuration for the Café and Diner food service areas provided for the Universal Single Level Fleet.

i). Compliance with preliminary design concepts included in the specification and attachments does not relieve the Contractor of all the other requirements within the specification.

16.2 General Requirements

a). This chapter describes the required components and appliances for the food service areas, desired layouts, and functional criteria.

b). All food service area equipment and fittings shall meet the attachment requirements of 49 CFR Part 238.233 and APTA Standard PR-CS-S-006-98.

c). Compliance with the CFR requirements shall consider the worst-case scenario of the food service equipment when fully loaded with all supplies and an entire stock of fully loaded appliances.

d). A flexible, easily reconfigurable structural mounting system shall be provided for the food service equipment interface to the carbody.

e). Any location designated for alcohol storage shall be provided with a padlock hasp for lockability.

i). The capability to store alcohol in lockable refrigerated and lockable non-refrigerated storage areas is required. These areas will be finalized during the design review process.

f). General Mechanical Requirements

i). Food service components shall be designed to minimize noise.

ii). Replacement of any major appliance shall not require any disassembly of the food service area structure.

iii). Stainless steel fasteners with vibration-damping inserts shall be used to attach the food service area structure to the carbody.

iv). Metal surfaces of the food service area shall be suitably grounded to the carbody to prevent electrical shock.

v). All areas under sinks shall be constructed from stainless steel cabinetry with swinging doors.

g). General Appliance Requirements

i). All food service appliances shall be heavy-duty grade commercial food industry apparatus, suitable for the rail vehicle operating environment.

ii). Their structure shall be sufficiently robust for meeting the FRA mounting strength requirements without requiring framing reinforcement, unless otherwise approved by Amtrak.

iii). All appliances shall be mounted within the food service area in a manner that complies with regulations regarding attachment strength and resistance to acceleration forces.

iv). Wherever possible, appliances of the same manufacturer, model, and part shall be used for ease of spare management and maintenance.

v). Appliances with doors shall have mechanical latches and not solely rely upon magnetic latches to keep doors closed.

vi). Appliance change-out time (the time to remove a defective unit, install a replacement unit and verify function of the replacement unit) shall not exceed 30 min. for the food service appliances specified in this chapter.

vii). Appliances with refrigeration or freezing systems shall be self-contained units and not employ "split systems" with separate components located elsewhere such as under the floor.

(1) The retention mechanisms shall not interfere with the appliance's operation or routine cleaning or servicing and shall allow the removal and replacement of the appliances within the specified times.

(2) Equipment removal and installation shall require less than 50lbf.

viii). All appliances shall be installed to provide adequate ventilation for cooling/heat dissipation and to prevent heat buildup on adjacent surfaces, per the manufacturer's recommendations.

h). General Water System Requirements

i). Water system connections to individual appliances shall be made by FDA compliant quick-break connectors, with a labeled quarter-turn water supply ball valve.

ii). Any liquid drains shall be directed through the floor to drain under the car and clear of any undercar components, using easily accessible connectors.

iii). Potable water from the car supply tank using suitable water backflow checks shall be provided to the food service area for distribution to any appliance requiring the use of water.

iv). The potable water supply shall have a particulate filter and an antibacterial filter to purify the water to Public Health Service (USPHS) standards.

v). These filters shall be located between the freshwater tanks and the food service area equipment and shall be located for easy cleaning and replacement.

vi). These filters shall be identical to those specified for the potable water system on the other cars, to the extent possible.

vii). Individual ball type shut-off valves shall be provided for all appliances requiring the use of water. All water system components shall be of lead-free design.

viii). Manual ball type drain valves shall be provided to allow draining all of the food service area piping and appliances, either for water system servicing or manual draining of the car in advance of storage, or in anticipation of freezing conditions.

ix). These valves shall drain the water system to the ground under the car clear of any undercar components. Instructions shall be posted in an approved food service area location providing water draining instructions for the LSA, including the draining of water contained within appliances.

i). General Sanitation Requirements

i). The food service car shall be designed and constructed in full compliance with:

(1) US Food and Drug Administration (FDA) Food Code, 2017,

(2) FDA Handbook on Sanitation of Railroad Passenger Cars, 1964,

(3) Amtrak Food Service Sanitation & Public Health Standards, 1997

(4) 21 CFR Part 1250.

(5) All applicable Code of Federal Regulations concerning general sanitation, water, and interstate conveyance sanitation for:

(a) FDA

(b) US Environmental Protection Agency (EPA)

(6) The Contractor is required to arrange and comply with all Federal agency review, inspection and certification requirements for the food service area, such as described in 21 CFR Part 1250.41.

ii). Certificate Holder

(1) The food service area shall have a 5 in. high by 7 in. wide certificate holder on the inner face of a galley locker door to display under glass the FDA Form 2371, Certificate of Sanitary Construction when issued.

iii). The design and installation of countertops, wall panels, floor-to-wall joints, storage locations, recycling and trash and recycling receptacles and lockers and component mounting shall not permit food particles, debris, liquids or moisture to reside behind, over or under any of their surfaces.

(1) Countertops shall have a raised edge on all exposed faces and a cove on all edges adjacent walls and bulkheads and be properly sealed and caulked.

(2) All outside corners formed by two planes shall have a minimum radius of 0.25 in.

(3) Corners formed by three planes shall have a minimum spherical radius of 0.375 in.

iv). All approvals, including approvals from the FDA, are the responsibility of the Contractor.

(1) The Contractor shall be responsible for correcting any observations found during FDA inspections.

(2) All cars shall be certified for conformance with FDA regulations.

(3) All approvals shall be supplied with each car history book. **[CDRL 16-01]**

v). All countertops and serving counters must be non-porous, corrosive-resistant, and easily cleanable surfaces.

(1) The countertops for passenger use shall meet all ADA requirements.

(a) The area adjacent to the ADA service counter shall have a wheelchair turnaround circle for passengers using wheel mobility devices to turn around and travel back to their seating location.

(2) The countertops in food service preparation areas must comply with all FDA sanitation and lighting requirements.

vi). All storage locations below the countertop shall have:

(1) The inside of the storage location shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

(2) Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

(3) Easy to clean guides for all items stored within shall be provided on the sides and back of the locker and on the inside of the locker door. The guides shall prevent trash and liquids from getting between the container and locker wall.

j). General Safety Requirements

i). All food service equipment shall be designed to accommodate passengers and train crews from the 5th percentile female to the 95th percentile male ranges.

ii). Safety of passengers, crew and maintenance personnel shall be a prime consideration in design of all food service equipment.

iii). Emphasis shall be placed by the Contractor for inclusion of passenger and LSA handholds throughout the food service area, to assist if the car unexpectedly lurches or sways.

(1) They shall be provided for passenger use when entering the car from connecting cars, passing through the car, standing in the food service area, using the condiment stations, or other areas where a passenger or crew may be standing.

(2) In general, there should be a convenient handhold for passenger use throughout the car.

(3) The perimeter of the LSA food service area counters shall be equipped with a continuous safety handrail, or similar safety assist arrangement.

(4) Handrails shall be finished to be consistent with their surroundings and shall not infringe into clear passageway widths as defined by the ADA.

iv). Projections from the food service area face or edge of countertop which could injure crew members, including knobs, switches, outlets, and latches shall be recessed.

(1) There shall be no finger pinch points in the food service area, or elsewhere in the food service car.

v). In addition to the basic emergency equipment to be provided on all car types, the food service areas shall also have the listed emergency equipment in the food service area.

(1) The emergency equipment storage locations shall be labeled in accordance with all applicable Amtrak signage requirements.

k). General Electrical Requirements

i). The food service electrical distribution system shall provide suitable Head End Power (HEP) and low voltage power supply electrical power distribution, including 208VAC or 120VAC 60 Hz power, to the food service area (see Chapter 15).

(1) Each food service appliance shall have an identified dedicated simplex outlet and individual supply circuit breaker and switch.

ii). Located in the car main electrical locker shall be all main terminal boards, main circuit breakers and other items required for distribution of food service electrical power to a local food service area electrical panel.

(1) Each circuit breaker shall interrupt all lines of the circuit.

(2) Circuit breakers and electrical outlets intended to provide a dedicated power circuit to a specific food service appliance shall be permanently and clearly labeled for that appliance.

(3) The appliance operation shall be supported during Head End Power (HEP) outages using approved designs.

iii). The Contractor shall provide both a complete electrical schematic and a wiring diagram for all food service equipment.

iv). Each appliance shall be powered from its own circuit breaker located in the food service equipment electrical locker, and the appliance shall be grounded to the carbody through its wiring harness.

(1) Individual labeled electrical outlets shall be provided for each appliance.

(2) In addition, a toggle switch shall be provided in an approved food service area location for each appliance to allow the unit to be switched off manually.

(3) A Light Emitting Diode (LED) pilot shall be provided for each switch, wired so that it will illuminate when power is on at the load side of the respective closed appliance switch.

(4) Alternate power connection arrangements may be proposed during design review.

v). The food service area shall have a local dedicated circuit breaker panel for LSA use which shall include circuit breakers and switches for the food service equipment and food service lighting.

(1) It shall be covered with a polycarbonate door (to allow the positions of the switches and circuit breaker to be seen) with a paddle latch to keep the door closed.

(2) The dedicated circuit breaker panel shall meet the requirements in Chapter 13.

l). General HVAC Requirements

i). The car HVAC system will provide ventilation, heating and cooling to the food service area as part of the overall car HVAC system, as described in Chapter 10.

ii). The Contractor shall ensure that the HVAC system is designed to remove the heat produced by the appliances and any other heat sources.

(1) HVAC cooling/heating distribution shall be designed to accommodate all Food Service arrangements and be adjustable depending on arrangement load demands.

(2) Details to be reviewed during Design Review.

iii). The Contractor will supply a heat load analysis to Amtrak for review.

(1) All food service equipment shall be installed with sufficient free space between the equipment and walls to permit circulation of cooling/ventilation air in accordance with the manufacturer's recommendations.

m). General Lighting Requirements

i). All food service appliance area lighting shall be in accordance with APTA Recommended Practice PR-E-RP-012-99 and the latest revision of the USPHS FDA Food Code.

(1) All normal light levels along the entire length of the food service area shall be a minimum of 30 foot-candles, and all standby lighting shall provide a minimum of 10 foot-candles.

ii). Types and styles of lighting fixtures shall be presented by the Contractor during initial bid and shall be submitted for approval by Amtrak during the design review. All lighting shall be controlled by switches in the food service circuit breaker area.

iii). Lights shall be located so they will not produce glare, nor shine into the face either of passengers or the LSA.

(1) The fixtures selected shall be suitable for the railroad environment and shall be robust, easy to clean and maintainable for the life of the food service area.

n). General Cart Requirements

i). The carts described below are intended to function interchangeably across the fleet and with the Airo platform carts for standardization.

ii). The carts shall be capable of being used as refrigerated carts and dry storage carts.

iii). The intention is for the same carts to be used as room service delivery carts.

(1) The cart shall be sturdy and robust enough for frequent movement throughout the cars of the consist.

(2) The cart must have the capability to deliver food and beverages to all cars at constant temperatures to comply with all federal regulations.

16.3 Material Preferences

a). The food service and seating areas shall be designed to provide an aesthetically pleasing and efficient area for passengers and train crew.

i). The Contractor shall be responsible for providing a comprehensive and unified appearance throughout all areas of the car as well as being

complimentary and consistent with any other car type(s) built to this Specification.

ii). Choice of finish materials shall be submitted for Amtrak review and approval.

iii). Please refer to Exhibit F for more information.

16.4 Diner Kitchen Requirements

a). Vision

i). The kitchen area shall be ergonomically designed to minimize the number of steps the chef and kitchen crew need to take to prepare, plate, and deliver food to passengers.

ii). The kitchen area shall be designed with the idea that there is a preparation and a washing area where applicable appliances and features are kept apart as much as possible.

iii). Preserving landing spaces and work areas is very important to Amtrak.

iv). The Kitchen should be a pleasant space to work. The arrangement of the kitchen and kitchen equipment should be safe, practical, and ergonomic with a layout that delivers operational efficiencies.

v). The design of the back of house should be future ready – The design of this area should be considered as modular so that equipment can be upgraded or changed as service models and technologies evolve over time.

b). Layout

i). The layout shall provide the desired approximate locations and relative footprints for each element of the kitchen from an ergonomic and preparation flow perspective.

(1) The Contractor shall submit layouts at each stage of the design review process for Amtrak's review and acceptance. **[CDRL 16-02]**

c). Appliances

i). Figure 16-1 lists the desired appliances along with an example part number and the quantity required within the kitchen food service area.

(1) Example part numbers are given to establish a starting place for appliance performance and will be finalized during the design reviews. Example part numbers are given to plan for adequate space requirements as well as pricing proposal.

(2) The car builder will propose a compliant manufacturer and part number for each appliance that meets requirements for functionality, shock and vibration, service history, power requirements, and ability to meet crashworthiness requirements for mounting.

(3) Appliances that exceed the capabilities of the example appliances are acceptable to be proposed for Amtrak review and approval.

Figure 16-1: Appliance List – Kitchen

Appliance	Description	Example Part No.	Quantity Desired
Utility Sink	This is a 3-compartment sink used for washing food preparation and storage items.	-	1
Refrigerated Cart Docking Station (2 cart)	2 cart docking station with cart chiller, cart sensor, temperature monitoring,	-	1
Refrigerated Cart	Insulated food cart with capability to maintain food temperature of 40 degrees F for one hour after loss of power	Bucher BA700036	2
Dishwasher	Dishwasher with 13 racks per hour capacity under heavy setting, holds standard size dish racks, 17” door opening, 0.62 gallons of water per rack, NSF rated high temperature,	Hobart LXeR advansys	2
Handwashing Sink	Sink basin with IR faucet for handwashing purposes, includes soap dispenser and paper towel holder mounting	-	1
Microwave	Steamer oven with 3500W, pull down door, heavy volume, 4 stage cooking, touch control	Amana AMSO35	1-
Trash and recycling Storage	Stainless steel module for storing removable trash and recycling bin. Trash and recycling bin is accessible through a drawer.	-	1
Steam Table/ Induction Table	Hot food well, drop in, (4) 12” x 20” pan capacity with 4” deep well, individual adjustable thermostatic controllers	Alto-Shaam 400-HWI/D4	1
Flat Top Grille	Countertop griddle with 48” cooking surface, ¾” thick polished steel plate, thermostatic controls, grease trough	Royal Range RTGE-48	1
Rapid Cook Oven	0.83 cu ft capacity, rapid cook, impingement, and convection options, operate each section at different temperatures touch control, ventless	TurboChef PLEXOR M2	1
Convection Oven	Combitherm CombiOven that fits (5) 12’x20’ full size hotel pans, stackable kit	Alto-Shaam 6-10E PRO	2
Freezer	Insulated freezer cabinet with ability to keep food goods at or below 0 degrees F	-	4
Warming Drawers	Insulated warming drawer with ability to keep food goods between 60 and 200 degrees F.	-	2
Storage Cabinets	Stainless steel cabinets or open shelving for dry storage to maximize space usage within food service area.	-	As space allows
Refrigerated Cabinets	Insulated refrigerator cabinet with ability to keep food goods between 32 and 40 degrees F	-	4
Countertop Workspace	Clear available workspace for food preparation with 6” backsplash and 0.25” radii.	-	As space allows
ATLAS Carrier Storage	Stainless steel cubbies for ATLAS Carrier storage to maximize space usage within food service area.	-	At least 3
ATLAS Carrier	Atlas sized dry goods container for storage and transport of goods between commissary and food service area	Bucher BA740012	At least 21
Scrap Sink	A scrap sink for rinsing food scraps off dirty dishes shall be provided. This sink shall include a scrap block and trash bin located directly below.	-	1

ii). Detailed functional requirements for each appliance are listed on the following pages.

iii). In addition to these requirements, the Contractor shall factor in FDA cleaning clearances, radii, and sanitary design. An FDA inspection and subsequent approval will be required for all car types. The Contractor will be responsible to rectify any discrepancy discovered by the FDA inspector at any time until a certificate of sanitary construction is issued.

iv). Appliance accessory storage/placement if applicable will be reviewed during the design reviews (i.e., turbo chef paddle, dishwasher racks).

(1) Utility Sink

(a) A three-compartment sink shall be provided where each sink basin is large enough to submerge the largest washable item.

(b) The compartments and sink counterspace shall be made from welded stainless steel.

(c) Marine edges shall be included on the front edge of the utility sink area.

(d) A backsplash of at least 6” shall be included on the other edges of the utility sink area.

(e) The radius between the backsplash and the utility sink shall be at least ¾”.

(f) The three-compartment sink shall include overflow provisions in each sink basin.

(g) The overflow piping shall join in a central location before draining through the floor penetration.

(h) The drain in the bottom of each sink basin shall be 2” in diameter and shall be capable of being plugged with a ball valve attached to an L shaped rotational lever mechanism.

(i) The L shaped rotational mechanism shall extend to the front of the module so that it is easy to reach this lever.

(j) All requirements described in the water and waste chapter of this specification shall apply to the utility sink.

(k) The faucet for the utility sink shall be centered above the middle sink and shall pivot to the right and left sinks for filling each basin.

(l) The faucet shall have a mechanical handle for turning on and off the water flow through the faucet.

(m) Under the Kitchen Utility Sink Only, a retractable hose shall be included.

(i) The hose shall be mounted on a reel that can retract. The hose shall be long enough to reach both ends of the kitchen.

(ii) The water supply shall be independently controlled with hot and cold water.

(iii) Convenient access to this hose and associated plumbing fixtures is required.

(2) Refrigerated Docking Station

(a) Refrigerated carts shall be stored within a docking station built into the food service area as a module.

(b) Each cart docking compartment shall include carrier stops, guide rails, and retention latches.

(c) Drainage from cart condensation shall be directed away from the front of the docking station to avoid flooding, spills, and water leakage onto the floor of the food service area.

(i) The module shall have a base pan with a cross break and 0.25” radii on all edges.

(d) Locations for the cart docking shall be designed for the carrier door to remain closed when in the stored position.

(i) Carts will remain closed in ‘stored’ configuration due to spacing and optimizing space in the galley.

(ii) In order to access goods in a cart, the retention latch must be rotated, and the door of the cart must be opened.

(e) The retention latches shall be used to retain the cart in its position.

(i) The latches shall rotate 180° so that they can be rotated clockwise or counterclockwise to release the carts.

(f) The guide strips inside the docking station shall be made from a polymer material that prevents damage to the carts while also securing them in place to prevent rattling.

(i) The guide strips shall be replaceable in case of significant damage.

(g) Cart Identification Sensor

(i) These sensors indicate to the chiller cart if there is at least one cart docked to the refrigerated docking station.

1. If there is a cart docked, the chiller will function as

normal.

2. If there are no carts detected, the chiller will not be on.

(ii) This will prevent potential damage to the internal components of the chiller.

(h) Cart Chiller

(i) The cart chiller shall be mounted on wheels that allow the cart chiller to easily traverse the threshold of the refrigerated docking station.

(ii) The chiller cart is intended to dock semi-permanently inside the refrigerated docking station.

1. This chiller would only be removed for maintenance or replacement.

(iii) The cart chiller shall be roughly (12” x 37” x 21”) and shall be interchangeable with the chiller carts used in the Amtrak Intercity Trainset (Airo) Procurement.

(iv) The cart chiller shall function to keep food at or below 40˚F.

1. The cart chiller will be suitably insulated to prevent all condensation from appearing on the outside of the module.

2. The temperature within the exhaust and return ducts of the module shall be monitored and reported to wayside.

(v) There will be alarm annunciation to the train crew that the refrigerated display is malfunctioning if the temperature in the display case reaches 41˚F for a continuous one-hour period or if the temperature ever reaches 50˚F.

(vi) The cart chiller shall be suitably sized to maintain pre-chilled stock to 40 ˚F or lower within 90 min of startup as determined by refrigeration system capabilities.

(vii) The cart chiller will be qualified using the EN ISO 23953-2:2015 test.

(viii) Refrigerant used in the refrigeration equipment shall be presented and approved by Amtrak during PDR.

(ix) The cart chiller shall have the following features:

1. Push handle at the front

2. Mounted on 4 wheels

3. Quick locking mechanism to secure in docking station

4. Connection to the cooling area on the back side

5. Power connection for 120V AC/48V DC with Harting plug

6. Protection against evaporator freeze-up during low load operation

7. Digital Controller with touch panel that includes alarm annunciation, status displays, and password protection for setting adjustment

(x) The refrigeration system shall be controlled by the suction line pressure signal and the supply air and exhaust air temperature sensors.

1. Depending on the changes in pressure, the speed of the compressor shall be adjusted accordingly between the minimum and maximum speed.

2. The unit shall be turned on and off based on the temperature sensor readings.

(i) Ducting

(i) The ducting on the back of this module directs the warm and cool air to and from the food carts so that the carts are always within the expected temperature range.

(ii) The ducting also is directed to the car's HVAC exhaust system to take heat away from the refrigeration equipment.

(iii) The ducting shall be insulated so that the condensation is limited as much as possible.

(iv) Insulation should be mechanically fastened to the duct with no exposed insulation fibers. The use of insulation tape is not allowed.

(j) Electrical Connection

(i) The electrical connection between the chiller cart and the docking station shall provide a quick connect, not damage any electrical connectors, and be properly insulated from moisture.

(3) Refrigerated Cart

(a) Carts are intended to move food items from the commissary to the train, dock in their compartment and be taken back to commissary for restocking after a trip is complete.

(b) The cart shall be roughly (16” x 21” x 37”) and shall be interchangeable with the carts used in the Airo fleet. Example part number listed as Bucher BA700036.

(c) The refrigerated cart shall be delivered with 12 trays loaded on shelves inside.

(d) The cart shall be able to move seamlessly in and out of the docking station.

(e) The Contractor is responsible for ensuring that the tolerances between the docking station and the refrigerated cart both:

  (i) Do not cause rattling of the cart while the train is in motion.

  (ii) Are not so tight that the cart is damaged during docking and undocking.

(f) Carts shall continue to keep items at FDA acceptable temperatures from the time food is placed inside until the food is removed for consumption.

  (i) Food cart interior will be accessed semi-regularly and will be docked to a refrigeration docking station when used as a refrigerated cart on the café car.

(g) The cart is expected to function with limited wear and tear damage for the lifespan of the train.

(h) Stainless steel push-to-close or slam latches shall be used on the cart doors.

  (i) Sealant on the door gasketing is subject to FST testing-silicone is recommended.

(i) The cart will come with a padlock hasp for locking the contents of the cart when the cart is unattended.

(j) A card holder shall be provided at the top of the cart door.

  (i) This material will be aluminum and clear anodized.

(k) A 75 mm diameter wheel will be used on all carts.

  (i) The top of the cart handle shall be 30 mm above the top surface of the cart to allow for items to be placed on top of the cart during transport.

(l) The cart shall be capable of a maximum loading of 115 kg, or similar as determined by the supplier.

(i) The cart shall be 25 kg empty, or similar as determined by the supplier.

(m) The bottom of the module will be a single pan that includes the lower portion of the sidewalls to contain any condensation.

(i) The main sidewalls of the module will be fastened to the lower pan so that water does not exit the module.

(ii) The cart module will be adequately sealed to prevent leakage of cart contents into the galley during normal train operation.

(n) The inner and outer surfaces of the cart will be non-porous, corrosive resistant, and easily clean-able.

(i) Any seams will need to be sealed with silicon or mounted with gaps of < 1/32" to meet FDA requirements.

(ii) No sharp edges, chips, or surface defects will be present.

(iii) The interior of the cart shall have 0.25” radius or greater on all corners for cleaning.

(o) The cart in conjunction with a compliant working chiller shall function to keep food at or below 40˚F.

(p) The cart will be suitably insulated to prevent all condensation from appearing on the outside of the module.

(q) The cart shall be suitably insulated to allow a compliant working chiller to bring room temperature stock down to 40 ˚F or lower within 90 min from startup or pull down pre-chilled stock to 40 ˚F or lower within 90 min of startup as determined by refrigeration system capabilities. (i.e., no gaps or cold air leaks)

(r) The cart shall be capable of holding up to 12 trays inside.

(i) The tray dimensions will be determined by the inside dimensions of the cart.

(ii) These dimensions will be relayed in drawings to the customer.

(iii) It is understood that trays for these carts will likely be custom size.

(iv) Trays shall be provided by the Contractor within the cart upon delivery.

(s) The refrigerated cart module will be aesthetically pleasing. The supplier shall provide sublimation treatment to all cart panels.

(t) The supplier shall provide either anodizing with clear or single color on the structural extrusions for the cart.

(u) Any required labeling from the manufacturer shall be placed in a location that is not visible while the cart is in the stored position.

(v) The Contractor shall provide a manufacturer drawing showing all critical dimensions for the cart for Amtrak approval.

(4) Dishwasher

(a) A purchased, off-the-shelf dishwasher shall be provided which meets or exceeds the features from the example part number. Example part number listed as Hobart LXeR advansys.

(i) Dishwasher with 13 racks per hour capacity under heavy setting,

(ii) holds standard size dish racks,

(iii) 17” door opening,

(iv) 0.62 gallons of water per rack,

(v) NSF rated high temperature

(b) Dedicated dish rack storage for up to 8 racks shall be provided.

(5) Handwashing Sink

(a) A sink shall be provided where the sink basin is at least (12” x 10” x 6”).

(b) The basin and sink counterspace shall be made from welded stainless steel.

(c) Marine edges shall be included on the front edge of the handwashing sink area.

(d) A backsplash of at least 6” shall be included on the other edges of the utility sink area.

(e) The radius between the backsplash and the handwashing sink shall be at least ¾”.

(f) The drain in the bottom of the sink basin shall be 1.25” in and shall be capable of being plugged with a ball valve attached to an L shaped rotational lever mechanism.

(g) The L shaped rotational mechanism shall extend to the front of the module so that it is easy to reach this lever.

(h) All requirements described in the water and waste chapter of this specification shall apply to the utility sink.

(i) The faucet for the handwashing sink shall use an IR sensor to allow water to run through the faucet. The faucet shall be sized and shaped to allow the water to flow to the center of the handwashing sink basin.

(j) Power for the faucet shall be hard wired. Battery replacement arrangements are prohibited.

(k) Faucet spout shall be located centered over the drain of the sink basin.

(l) The soap dispenser used by Amtrak is manufactured by Celeste Industries Corporation.

(i) The Contractor should supply the mounting base for the soap dispenser.

(ii) The base is made of Delrin and is tapered.

(m) The paper towel holder shall be SanTRAL Plus PTU 31 E ST or similar.

(i) This shall have anti-fingerprint coating, have a filling volume of 500-600 sheets of folded paper towels, be lockable, and be wall mounted.

(6) Microwave

(a) A purchased off the shelf item shall be provided that meets or exceeds the features from the example part number. Example part number listed as Amana AMSO35.

(i) Steamer oven with 3500W,

(ii) pull down door,

(iii) heavy volume,

(iv) 4 stage cooking,

(v) touch control

(b) A spare microwave shall be provided in storage in the event of failure.

(7) Trash and Recycling Storage

(a) Trash and recycling will be stored in a stainless-steel module with drawers for the trash and recycling bins to slide in and out of the module.

(b) The drawer shall be mounted on sturdy, durable, cleanable drawer slides that allow for continuous cycles of opening and closing and operate smoothly.

(c) The drawer shall operate with push to open, slam to close latches.

(d) The stainless-steel or aluminum trash and recycling bins shall be completely sealed so that no liquid can escape the trash and recycling bin.

(i) These bins are intended to be removable for emptying the trash and recycling and for cleanability.

(e) In this food service area, the cumulative minimum internal volume for the trash and recycling required is 44 cu ft.

(i) 18.8 cu ft (31 in horizontal x 35 in tall x 30 in deep).

(ii) Plus 25.2 cu ft (39 in horizontal x 35 in tall x 32 in deep).

(f) The trash and recycling drawers shall be designed with cleanability features including 0.25” radii at the bottom of the drawer and there shall be no fastener protrusions into the base of the drawer.

(8) Steam / Induction Table

(a) A purchased off the shelf item shall be provided that meets or exceeds the features from the example part number. Example part number listed as Alto-Shaam 400-HWI/D4.

(i) Hot food well,

(ii) drop in,

(iii) (4) 12” x 20” pan capacity with 4” deep well,

(iv) individual adjustable thermostatic controllers

(9) Flat Top Grille

(a) A purchased off the shelf item shall be provided that meets or exceeds the features from the example part number. Example part number listed as Royal Range RTGE-48.

(i) Countertop griddle with 48” cooking surface, ¾” thick polished steel plate,

(ii) thermostatic controls,

(iii) grease trough

(iv) Shall be accompanied by exhaust hood with a fire damper.

1. This shall be an overhead cabinet exhaust hood with 120 VAC control and remote 208VAC 3-Phase exhaust fan. The suggested part number is Gaylord: CG3-BDL-XXX; however, Amtrak does not want any water sprays.

2. Exhaust from the hood should not result in grease collecting on the car's exterior.

(10) Rapid Cook Oven

(a) A purchased off the shelf item shall be provided that meets or exceeds the features from the example part number. Example part number listed as TurboChef PLEXOR M2.

(i) 0.83 cu ft capacity

(ii) rapid cook, impingement, and convection options,

(iii) operate each section at different temperatures

(iv) touch control,

(v) ventless

(11) Convection Oven

(a) A purchased off the shelf item shall be provided that meets or exceeds the features from the example part number. Example part number listed as Alto-Shaam 6-10E PRO.

(i) Combitherm CombiOven

(ii) fits (5) 12'x20' full size hotel pans,

(iii) stackable kit

(12) Freezer

(a) The freezer shall function to keep food at or below 0˚F.

(b) The freezer shall be suitably insulated to prevent all condensation from appearing on the outside of the module.

(c) The temperature within the module shall be monitored and reported to wayside.

(d) There shall be alarm annunciation to the train crew that the freezer is malfunctioning if the temperature in the freezer reaches 1˚F for a continuous one-hour period or if the temperature ever reaches 5˚F.

(e) Drainage for the freezer condensation shall take into account ice melt in the freezer and condensation generated by the evaporator.

(f) The freezer shall be easily cleanable with a base pan that has a backsplash and 0.25” radii.

(g) In this food service area, the cumulative minimum internal volume for each freezer required is 27 cu ft. (46 in horizontal x 40 in tall x 26 in deep). Four total freezers are included in this area for a total of 108 cu ft of internal freezer volume at a minimum in this area.

(h) At least 5 adjustable shelves shall be included in the freezer.

(i) Refrigerant used in the refrigeration equipment shall be presented and approved by Amtrak during PDR.

(13) Warming Drawer

(a) A warming drawer shall be placed directly below the steam/induction table. The module shall be constructed from stainless steel.

(b) In this food service area, the cumulative minimum internal volume for the warming drawer required is 7.3 cu ft. (44 in horizontal x 12 in tall x 24 in deep).

(c) The drawer shall be mounted on sturdy, durable, cleanable drawer slides that allow for continuous cycles of opening and closing and operate smoothly.

(d) The drawer shall operate with push to open, slam to close latches.

(e) The warmer shall be suitably insulated to maintain temperature ranges from 60 degrees F to 200 degrees F and the temperature shall be controlled or set with up and down arrow buttons.

(f) There shall be a digital temperature display that indicates the set temperature and a signal to identify when the drawer is outside of the setpoint by more than 5 degrees.

(g) The drawer shall be sized to be capable of holding bread rolls, hotel pans, and potatoes.

(14) Storage Cabinets

(a) Storage Cabinets shall be constructed from stainless-steel.

(b) These modules shall be designed to retain goods while the train is in motion.

(c) Storage cabinets can come in the form of a cabinet with hinged doors or open shelving with retaining bars.

(d) This will depend on the item stored in each location and shall be determined with Amtrak during the design reviews.

(e) Storage cabinets that function as cabinets shall have:

(i) hinged doors with stainless-steel hinges,

(ii) push to open, slam to close latches,

(iii) door swing limiting mechanism to prevent the doors from colliding and denting

(iv) option for adjustable shelving to accommodate varying products

(f) Storage cabinets that function as shelves shall have:

(i) Option for adjustable shelving to accommodate varying products

(ii) Stainless steel retention bars to prevent items from sliding off the shelf while the train is in motion.

(g) In this food service area, the cumulative minimum internal volume for the storage required is 180 cu ft

(i) 89.9 cu ft. (148 in horizontal x 35 in tall x 30 in deep).

(ii) Plus 63.1 cu ft (104 in horizontal x 35 in tall x 30 in deep).

(iii) Plus 26 cu ft (114 in horizontal x 20 in tall x 20 in deep)

(15) Refrigerated Cabinet

(a) The temperature within the module shall be monitored and reported to wayside.

(i) There will be alarm annunciation to the train crew that the refrigerated display is malfunctioning if the temperature in the display case reaches 41˚F for a continuous one-hour period or if the temperature ever reaches 50 ˚F.

(b) The refrigerated display shall be suitably sized to bring room temperature stock down to 40 ˚F or lower within 90 min from startup.

(i) The refrigerated display shall be suitably insulated to maintain temperature within limits during a power loss of 60 min.

(c) The refrigerated display shall function to keep food at or below 40˚F.

(i) The display case will be suitably insulated to prevent all condensation from appearing on the outside of the module.

(d) Drainage for the refrigerated cabinet condensation shall take into account liquid spills and condensation generated by the evaporator.

(e) Shelves in the refrigerated cabinet shall be mounted on drawer slides that allow ease of access and cleaning for each storage area within the refrigerated cabinet.

(i) Shelves shall have sufficient strength to hold 30 lbs. of goods.

(ii) Shelves shall have sufficient perforations to allow for airflow within the refrigerated cabinet to maintain required temperatures.

(iii) Shelves shall have a short raised, hemmed edge on all sides to prevent items from sliding off the shelf while the train is in motion.

(iv) Shelf drawers shall only slide out when activated so that if the train lurches suddenly, the drawers do not slide out on their own.

(v) The shelf shall be mounted on sturdy, durable, cleanable drawer slides that allow for continuous cycles of opening and closing and operate smoothly

(f) Refrigeration cabinet doors shall be constructed from stainless steel with sufficient insulation to help maintain temperatures within the cabinet and to prevent condensation on the outside of the doors.

(g) In this food service area, the cumulative minimum internal volume for the refrigerated cabinets required is 99 cu ft. (184 in horizontal x 31 in tall x 30 in deep).

(h) Refrigeration equipment shall be easily accessible behind a plate with a grille for air flow and locked with square locks for maintenance or replacement of equipment. Refrigeration equipment shall be mounted on a removable skid for changeout that will constitute as the LRU for the refrigerated cabinet.

(i) Refrigerant used in the refrigeration equipment shall be presented and approved by Amtrak during PDR.

(16) Countertop Workspace

(a) A stainless-steel workspace is required for food preparation.

(b) The workspace shall have 6” backsplash and 0.25” radius minimum for cleanability.

(c) The countertop shall be of a usable height between 36” and 38” tall.

(d) The countertop shall be attached to the adjacent modules with no holes for fasteners on the top of the workspace.

(e) In this food service area, the minimum surface area for workspace required is 78.9 sq ft (175 in horizontal and 65 in deep).

(17) ATLAS Carrier Storage

(a) ATLAS carriers shall be stored within carrier compartments built into the food service area module.

(b) Each carrier compartment shall include carrier stops, guide rails, and retention latches.

(c) Carrier storage modules shall be made from stainless-steel.

(d) Locations for the carriers are designed for the carrier door to remain closed when in the stored position.

(i) Carriers will remain closed in ‘stored’ configuration due to spacing and optimizing space in the galley.

(ii) In order to access goods in a carrier, the retention latch must be rotated, and the door of the food storage container must be opened.

(e) The carrier storage compartments will include carrier stops to ensure the carrier is located toward the front of module.

(f) The retention latches shall be used to retain the carrier in its position. The latches shall rotate 180° so that they can be rotated clockwise or counterclockwise to release the carriers.

(g) The guide strips inside the storage cabinets shall be made from a polymer material that prevents damage to the carriers while also securing them in place to prevent rattling.

(i) The guide strips shall be replaceable in case of significant damage.

(18) ATLAS Carrier

(a) This carrier is designed to fit into modules throughout the galley as dry storage containers.

(b) This carrier is made from standard Atlas carrier dimensions and is subject to a 25lb single person lift regulation.

(c) This includes the weight of the carrier and the contents of the carrier.

(d) The carrier shall be able to move seamlessly in and out of the carrier storage compartments and the Contractor is responsible for ensuring that the tolerances between the storage location and the carrier both do not cause rattling of the carrier while the train is in motion and is not so tight that the carrier is damaged during docking and undocking.

(e) The carrier is expected to function with limited wear and tear damage for the lifespan of the train.

(f) Stainless steel push-to-close or slam latches shall be used on the carrier doors. Sealant on the door gasketing is subject to FST testing.

(g) A card holder shall be provided at the top of the cart door. This material will be aluminum and clear anodized.

(h) The carrier shall be capable of a maximum loading of 9 kg, or similar as determined by the supplier. The carrier shall be 2.5 kg empty, or similar as determined by the supplier.

(i) The carrier module will be adequately sealed to prevent leakage of carrier contents into the galley during normal train operation.

(j) The inner and outer surfaces of the carrier will be non-porous, corrosive resistant, and easily cleanable.

(i) Any seams will need to be sealed with silicon or mounted with gaps of < 1/32" to meet FDA requirements.

(ii) No sharp edges, chips, or surface defects will be present. The interior of the carrier shall have 0.25” radius or greater on all corners for cleaning.

(k) In alignment with the Atlas Standard, this carrier shall be capable of holding 4 half size Atlas trays.

(l) The carrier module will be aesthetically pleasing.

(i) The supplier shall provide the carrier with sublimation treatment to only the door of the carrier.

(m) The supplier shall provide either anodizing with clear or single color on the structural extrusions for the carrier.

(n) Any required labeling from the manufacturer shall be placed in a location that is not visible while the carrier is in the stored position.

(o) The Contractor shall provide a manufacturer drawing showing all critical dimensions for the cart for Amtrak approval.

(19) Scrap Sink

(a) A scrap sink for rinsing food scraps off dirty dishes shall be provided. The sink shall be located next to the dishwashers to facilitate the loading of dishes after rinsing.

(b) The basin and sink counterspace shall be made from welded stainless steel.

(c) Marine edges shall be included on the front edge of the scrap sink area.

(d) A backsplash of at least 6” shall be included on the other edges of the scrap sink area.

(e) The radius between the backsplash and the scrap sink shall be at least ¾”.

(f) The sink shall be a 4 inch deep stainless steel pan formed into the countertop.

(g) A faucet-fed spray nozzle, equipped with back-flow prevention, shall be located on the backsplash and shall be secured to prevent the nozzle from entering the sink both when in use and when stored.

(h) The sink shall be comprised of two parts, a scraping area and a rinsing area.

(i) The scraping area shall include:

(i) This sink shall include a scrap block directly over a trash chute in an elevated hole to prevent water from entering the trash bin located directly below.

(j) The rinsing area shall include:

(i) Normal drainage piping is also required for this sink in the sink basin portion.

d). Functional Criteria

i). The following items shall be reviewed with the criteria listed below for each.

ii). Sanitary Design Review Criteria

(1) Appropriate cleaning radii of at least 0.25” on worksurfaces and 0.75” on sink areas.

(2) Backsplashes of at least 6” on worksurfaces and sink areas.

(3) Appropriate cleaning clearances around appliances such that a 95th percentile male can fit their hand and a rag easily between objects for cleaning.

(4) All edges and seams are sealed with food grade silicone sealant and gaps greater than 1/32” are sealed in food storage, food preparation, and all other food related areas such as trash compartments shall be sealed in this manner.

(5) Floor drains are provided for locations prone to spills and leaks, especially near water piping to eliminate water pooling on the floor.

(6) Openings are protected from allowing pests and vermin to congregate

(7) Proper sealing methods are used to prevent moisture from corroding or otherwise damaging the food service area

(8) All drain pans and catches are accessible for cleaning

(9) No tools are required to remove objects subject to daily cleaning rituals

iii). Refrigeration and Freezer Equipment Review Criteria

(1) Temperature Monitoring System Functionality

(a) Temperature monitoring shall be accomplished through a set of redundant sensors.

(i) The refrigeration controller shall relay temperatures for each of the refrigerated modules locally and in one location on a panel in the kitchen.

(b) Additionally, temperatures shall be reported to wayside through the use of a PT100 sensor.

(i) The PT100 sensor and the controllers for the equipment shall be calibrated to ensure they are reporting the same temperature.

(ii) Temperatures shall be logged and accessible for at least a 6 month period of time after the date of data collection.

(c) Temperatures for the refrigerated food carts shall be monitored in the ducting between the refrigerated docking station and the refrigerated cart.

(i) Industry standard is to monitor the temperature and combine 80% of the temperature for the return air and 20% for the air supply.

(d) This calculation shall be used to determine the likely warmest temperature of the air in the food cart and shall inform the setpoint and need for temperature adjustment. Temperatures for refrigerated cabinets shall be monitored directly in the refrigeration cabinet at the warmest temperature location and shall inform the setpoint and need for temperature adjustment.

(e) Presently, Amtrak monitors the temperature of a refrigerated food cart by placing a yogurt in the center of the cart and manually records the temperature of the yogurt on an interval. If the yogurt is out of temperature the food in the cart is considered out of temperature and therefore spoiled. The Contractor shall provide a system that consistently functions without allowing the yogurt to test out of temperature and cause loss of revenue from spoiled goods.

(2) Type Tests

(a) Type Tests for refrigeration and freezer systems shall be evaluated using ISO 23953-2 to determine the temperature probe location and validate performance of the system and produce a test report for Amtrak's evaluation and approval as specified in ISO 23953-2 **[CDRL 16-03]**.

(b) The following elements of design validation are of particular interest to Amtrak and shall be performed as type tests if information is not included in the ISO 23953-2 test report:

(i) Operational Temperature

1. The system shall maintain food safe temperatures between 33°F to 40°F (1°C to 4°C) consistently for 24 hours.

2. The freezer module will need to maintain temperature ranges below 0°F (-18°C) consistently for 24 hours.

3. The supplier will propose a test to show the units maintain operational temperature under standard conditions:

a. 74.6°F (23.7°C) and 55% rH.

b. An allowable tolerance to this would be +/- 2 degrees F and +/- 5%.

4. The refrigeration systems shall be suitably insulated to maintain the specified temperature limits during a

power loss of 60 minutes to avoid condemning of perishable food products.

5. The refrigeration system shall have real-time and remote temperature monitoring and alarm annunciation capabilities that shall alert onboard crew.

6. The Contractor shall propose a test to show the units maintain operational temperature under standard conditions:

    a. 74.6°F (23.7°C) and 55% rH.

    b. An allowable tolerance to this would be +/- 2 degrees F and +/- 5%.

(ii) Probe Placement

1. The temperature probe will need to be placed in the warmest location of the refrigerated compartment so that all food items stay within the acceptable temperature range.

(iii) Air Flow

1. The air flow through the module will need to be evaluated to ensure that there are no warm air pockets within the refrigerated compartment.

(iv) Operational Load Testing

1. The operational load of the refrigeration module needs to be evaluated to ensure that the refrigeration unit functions within the acceptable temperature range with simulated service loading conditions.

2. Amtrak will provide loading conditions prior to test procedure approval.

3. Three total tests will satisfy the operational load requirement: full load, half load, empty load.

4. The operational temperature of the refrigeration system should maintain food safe temperatures.

5. The refrigeration module will need to maintain temperature ranges between 33°F to 40°F (1°C to 4°C) consistently for 24 hours.

6. The freezer module will need to maintain temperature ranges below 0°F (-18°C) consistently for 24 hours.

7. The Contractor shall propose a test to show the units

maintain operational temperature under standard conditions:

a. 74.6°F (23.7°C) and 55% rH.

b. An allowable tolerance to this would be +/- 2 degrees F and +/- 5%.

(v) Condensation Evaluation

1. The refrigeration module, freezer, and chilled cart modules shall function with zero condensation on the outside surface of a module when exposed to the following environmental conditions:

a. 74.6°F (23.7°C) and 55% rH.

b. An allowable tolerance to this would be +/- 2 degrees F and +/- 5%.

c. Zero condensation is defined as no fogging, beading, or dripping liquid on any outside surface of the module.

2. The Contractor shall perform a test to observe modules while they are functioning at the specified temperatures for 24 hours.

(vi) Pull Down

1. The refrigeration and freezer modules are expected to pull down to temperature within 90 min with an inlet temperature of 70°F and repeated with inlet temperature of 110°F.

2. The module will be completely empty for this test.

3. The refrigeration unit shall reach a temperature range of 33-40°F within the specified time.

4. The freezer unit shall reach a temperature of below 0°F within the specified time.

iv). Warming Equipment Review Criteria

(1) Type Tests for warming equipment shall be evaluated using DIN 18868-2 to determine the temperature probe location and validate performance of the system and produce a test report for Amtrak's evaluation and approval as specified in DIN 18868-2. **[CDRL 16-04]**

e). Additional Equipment Requirements

i). Crew Comfort

(1) Two crew tip up seats shall be provided

(2) Handholds shall be provided at locations determined during the design review process

ii). HVAC

(1) Food service areas generate a large amount of ambient heat, smells, and humidity in the air; as a result, the HVAC system calculations must take into account the appliances and usage case of each food service area. Detailed HVAC requirement information can be found in Chapter 10, HVAC System.

(2) Kitchen Area Ventilation

(a) Ventilation to area in the kitchen shall include appliance generation of large amount of ambient heat, smells, and humidity in the air.

(b) HVAC shall be separately controlled for the kitchen for mitigation of the issues listed above and for staff comfort.

(3) Appliance-Specific Ventilation

(a) Ventilation to specific appliances is required.

(b) This ventilation can come in the form of recycled air through the HVAC system or directly exhausting the outlet air for an appliance.

(c) The Contractor shall submit a proposal for which appliances listed below will be directly exhausted and provide all relevant calculations as justification.

(d) The submittal will be subject to Amtrak's review and approval during the design review process. **[CDRL 16-05]**

(i) Ovens

1. Convection Ovens
2. Rapid Cook Ovens
3. Microwave Ovens

(ii) Refrigeration

1. Refrigerated Docking Station
2. Refrigerated Storage

(iii) Freezer

(iv) Other Appliances

1. Steam/Induction Table
2. Flat top Grille
3. Dishwasher

iii). Electrical Equipment

(1) Electrical equipment information is shared in the points below; and detailed electrical requirements can be found in Chapter 15, Electrical System.

(2) Convenience Outlets

(a) Convenience outlets shall be located during design reviews after discussion and approval from Amtrak.

(b) At least 8 duplex convenience outlets shall be located within the kitchen food service area.

(c) Only the convenience outlet near the attendant seat shall have USB ports.

(d) General purpose convenience outlets in these areas shall not have USB ports.

(3) Appliance Outlets

(a) Appliance outlets shall be located directly behind a desired appliance.

(b) The outlets shall be properly sized and selected to safely power each appliance and the electrical system shall provide a dedicated breaker for each type of outlet.

(c) Appliance outlets shall not have USB ports.

(4) POS Ticket Screen Outlet

(a) A provision for a POS Ticket Screen Outlet shall be linked to the POS at the Server Station in the Diner with both communications cabling and share the same electrical circuit and dedicated breaker as the POS.

(b) The POS outlet shall have USB ports.

(c) The POS outlet must be available on car battery power and follow the battery load table 15-3: Power Phase Matrix.

iv). Lighting

(1) General lighting information is shared in the points below; and detailed lighting information can be found in Chapter 13, Lighting System.

(2) Overhead Lighting

(a) Overhead lighting shall be from flush mounted panel lights in the ceiling panels and/or from spotlights.

(b) Overhead lighting can be turned off if the car lighting mode is set to night mode.

(c) These overhead light fixtures cannot be required to meet FDA light intensity level requirements for food preparation counters, sinks, and workspaces.

(3) Shelf Lighting

(a) Shelf lighting will be from surface mounted strip lights. These strip lights will be different brightness levels based on the area they are illuminating.

(b) Shelf lighting alone shall be the main source of illumination to meet FDA light intensity level requirements for food preparation counters, sinks, and workspaces.

(c) To illuminate a shelf, the shelf or underside of the top of the module above the shelf shall have a strip light mounted.

(d) To illuminate a workspace, the underside of the shelf above the workspace shall have a strip light mounted.

v). Communications Equipment

(1) Communications equipment for the kitchen area are described below; and detailed information regarding communications equipment can be found in Chapter 14, Communications.

(2) PA Speakers

(a) PA speakers shall be located on the ceiling panels at both ends of the kitchen.

(b) The speakers used in this location shall be identical to PA speakers used in other cars for ease of maintenance and replacement.

(3) PA Intercom

(a) PA Intercom shall be mounted near the side loading door of the kitchen area.

(b) This intercom shall be identical to the PA intercom used in other cars for ease of maintenance and replacement.

(4) Security Cameras (Option)

(a) As an option, security cameras shall be mounted to ceiling panels and shall give surveillance view of all areas of the kitchen for security, theft protection, and identification of possible hazards.

(b) At least 4 cameras shall be used to achieve this goal.

(5) POS Ticket Display Screen

(a) This screen shall be wired to communicate with the POS and display ticket items for plating and delivery to customers in the diner.

(b) The screen shall be 32” and more information can be found in Chapter 11: Interiors, Chapter 14, and Chapter 26 in regard to this display.

(c) The screen shall be resistant to damage from steam and humidity within the kitchen area.

(d) Alternatives may be proposed to Amtrak that may be more cost effective and provide a similar solution for the Amtrak personnel working in the galley.

(6) Smoke Detectors

(a) Smoke Detectors shall be mounted on the ceiling panels at both ends of the kitchen.

(b) The smoke detectors used in this location shall be identical to the smoke detectors used in other cars for ease of maintenance and replacement.

vi). Emergency Equipment

(1) The following emergency equipment pieces shall be included and stored in a conspicuous, accessible, and labeled location. Please refer to Chapter 18 Emergency Equipment for more information.

(a) Snap lights

(b) First aid kit

(c) Fire extinguisher

(d) AED

(e) Fire Suppression System shall be provided as an option and is discussed in detail in Chapter 25.

vii). Security

(1) Many items within the food service area will need to be secured. The following items are identified with specific locking preferences. Any other locking or security items will be discussed with Amtrak during design reviews.

(a) Cart Locking

(i) The cart storage compartments shall include mechanisms that will lock the carts in the compartment as well as prevent the cart door from opening.

(ii) The locking mechanism shall use an Amtrak supplied padlock to secure the carriers.

(b) Cabinet Locking

(i) Cabinets shall include padlock hasps as determined with Amtrak during design reviews.

(ii) The locking mechanism shall use an Amtrak supplied padlock to secure the selected cabinets.

(c) Carrier Locking

(i) The carrier storage compartments shall include mechanisms that will lock the carriers in the compartment as well as prevent the carrier door from opening.

(ii) The locking mechanism shall use an Amtrak supplied padlock to secure the carriers.

(d) Refrigeration Cabinet Locking

(i) Refrigeration cabinets shall include padlock hasps as determined with Amtrak during design reviews.

(ii) The locking mechanism shall use an Amtrak supplied padlock to secure the selected cabinets.

(e) Freezer Locking

(i) The freezer shall include padlock hasps as determined with Amtrak during design reviews.

(ii) The locking mechanism shall use an Amtrak supplied padlock to secure the selected cabinets.

viii). Color Material and Finish (CMF)

(1) Please refer to Exhibit F for exact color, material and finishes desired in this food service area.

(2) Please also refer to Materials and Workmanship in Chapter 19 and be expected to work with Amtrak through the industrial design review process to ensure Amtrak's brand vision is accurately captured in all customer-facing elements of the food service cars.

(3) General expectations are listed below.

(a) Stainless Steel Modules

(i) Stainless Steel Modules shall be created from sheet metal that is sized to prevent denting, oil canning, or otherwise non-sturdy structures.

(ii) The modules shall be constructed from 304 stainless-steel with a #4 finish (320 grit) or as approved during design reviews with Amtrak.

(b) Carshell Walls

(i) Carshell walls shall be lined to create interior walls for the kitchen. Sidewall liners shall be made from molded thermoplastic with an easy to clean surface finish.

(c) Partition Walls

(i) Partition Walls shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(ii) The finish of the wall and material of the outside skin shall be inspired by the CMF document and meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(d) Ceiling Panels

(i) Ceiling Panels shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(ii) The finish of the passenger facing side of the ceiling panel and material of the outside skin shall be inspired by the CMF document and meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(iii) The finish of the material on the non-passenger facing side shall be coated such that there is no risk of corrosion from moisture from steam or humidity within the car.

(e) Kitchen Area Countertops

(i) Countertops within the kitchen area shall all be made from stainless-steel and shall follow the requirements from point (1) above.

(f) Kitchen Area Flooring

(i) Flooring within the kitchen area shall be made from rubber flooring with a friction, no-slip texture.

(ii) Flooring will be durable to withstand spills, leaks, and all methods of cleaning.

(iii) Flooring shall also not become frequently damaged or worn by cart movement or by kitchen staff standing in specific locations.

(iv) Flooring shall have enough flexibility to prevent fatigue from standing.

(v) Anti-fatigue mats and anti-slip mats shall be provided for onboard crew in all applicable areas.

(vi) Floor design shall have incorporate drains to prevent standing water during static and dynamic movements.

16.5 Café

a). Vision

i). The café provides an opportunity for all coach passengers to purchase food and refreshments on board, however it also provides a chance to relax and enjoy the beautiful landscape of the United States of America. In this way, it is a focal destination as well as a functional space.

ii). The café should have a large, open and continuous counter at an accessible height. This highly visible area should have a passenger friendly aesthetic.

iii). A space should be reserved on the outside wall of the café for branding.

iv). The counter should be kept clear of equipment to allow for future food service opportunities such as a ‘grab and go’ location.

v). The design should be future ready – The design should be considered as modular so that equipment can be upgraded or changed as service models evolve over time.

vi). Please refer to Exhibit F for more information.

b). Appliances

i). Figure 16-2 lists the desired appliances along with an example part number and the quantity required within the café food service area.

ii). Note that example part numbers are given to establish a starting place for appliance performance and will be finalized during the design reviews.

iii). The car builder will propose the exact manufacturer and part number for each appliance based on functionality, shock and vibration, service history, power requirements, and ability to meet crashworthiness requirements for mounting.

iv). Detailed functional requirements for each appliance is listed below.

v). In addition to these requirements, the Contractor shall factor in FDA cleaning clearances, radii, and sanitary design. An FDA inspection and subsequent approval will be required for all car types. The Contractor will be responsible to rectify any discrepancy discovered by the FDA inspector at any time until a certificate of sanitary construction is issued.

(1) Refrigerated Docking Station

(a) Refrigerated carts shall be stored within a docking station built into the food service area as a module.

(b) Each cart docking compartment shall include carrier stops, guide rails, and retention latches.

(c) Drainage from cart condensation shall be directed away from the front of the docking station to avoid flooding, spills, and water leakage onto the floor of the food service area.

(i) The module shall have a base pan with a cross break and 0.25” radii on all edges.

Figure 16-2: Appliance List – Café

Appliance	Description	Example Part Number	Quantity Desired
Refrigerated Cart Docking Station (3 cart)	3 cart docking station with cart chiller, cart sensor, temperature monitoring,	-	1
Refrigerated Cart	Insulated food cart with capability to maintain food temperature of 40 degrees F for one hour after loss of power	Bucher BA700036	3
Handwashing Sink	Sink basin with IR faucet for handwashing purposes, includes soap dispenser and paper towel holder mounting.	-	1
Microwave	Countertop stackable microwave, 0.6 cu ft capacity, 2100 watts, heavy volume, 4 stage cooking, touchscreen	Amana HDC212	2
Trash and Recycling Storage	Stainless steel module for storing removable trash and recycling bin. Trash and recycling bin is accessible through a drawer.	-	1
POS	Point of Sale machine for commercial transactions. POS provided by Amtrak, provisions provided by Contractor	-	1

Appliance	Description	Example Part Number	Quantity Desired
Rapid Cook Oven	0.54 cu ft capacity, ventless, cool touch exterior, touch control	TurboChef ECO ST	1
Freezer	Insulated freezer cabinet with ability to keep food goods at or below 0 degrees F.	-	1
Storage Cabinets	Stainless steel cabinets or open shelving for dry storage to maximize space usage within food service area.	-	As space allows
Countertop Workspace	Clear available workspace for food preparation with 6” backsplash and 0.25” radii.	-	As space allows
Coffee Maker	Twin coffee brewer with 1.5 gallon satellite servers,	Wilbur Curtis GEMTS16A-1000	1
Ice Maker	590 lb., 26” wide water cooled, cublet-nugget style ice machine and waster dispenser with bin, countertop mounting, 40lb bin ice storage	Hoshizaki DCM-500BWH	1
ATLAS Carrier Storage	Stainless steel cubbies for ATLAS Carrier storage to maximize space usage within food service area.	-	As Space Allows
ATLAS Carriers	Atlas sized dry goods container for storage and transport of goods between commissary and food service area	Bucher BA740012	As Space Allows

(d) Locations for the cart docking shall be designed for the carrier door to remain closed when in the stored position.

(i) Carts will remain closed in ‘stored’ configuration due to spacing and optimizing space in the galley.

(ii) In order to access goods in a cart, the retention latch must be rotated, and the door of the cart must be opened.

(e) The retention latches shall be used to retain the cart in its position.

(i) The latches shall rotate 180° so that they can be rotated clockwise or counterclockwise to release the carts.

(f) The guide strips inside the docking station shall be made from a polymer material that prevents damage to the carts while also securing them in place to prevent rattling.

(i) The guide strips shall be replaceable in case of significant damage.

(g) Cart Identification Sensor

(i) These sensors indicate to the chiller cart if there is at least one cart docked to the refrigerated docking station.

1. If there is a cart docked, the chiller will function as normal.

2. If there are no carts detected, the chiller will not be on.

(ii) This will prevent potential damage to the internal components of the chiller.

(h) Cart Chiller

(i) The cart chiller shall be mounted on wheels that allow the cart chiller to easily traverse the threshold of the refrigerated docking station.

(ii) The chiller cart is intended to dock semi-permanently inside the refrigerated docking station.

1. This chiller would only be removed for maintenance or replacement.

(iii) The cart chiller shall be roughly (12” x 37” x 21”) and shall be interchangeable with the chiller carts used in the Amtrak Intercity Procurement.

(iv) The cart chiller shall function to keep food at or below 40˚F.

1. The cart chiller will be suitably insulated to prevent all condensation from appearing on the outside of the module.

2. The temperature within the exhaust and return ducts of the module shall be monitored and reported to wayside.

(v) There will be alarm annunciation to the train crew that the refrigerated display is malfunctioning if the temperature in the display case reaches 41˚F for a continuous one-hour period or if the temperature ever reaches 50˚F.

(vi) The cart chiller shall be suitably sized to maintain pre-chilled stock to 40 ˚F or lower within 90 min of startup as determined by refrigeration system capabilities.

(vii) The cart chiller will be qualified using the EN ISO 23953-2:2015 test.

(viii) Refrigerant used in the refrigeration equipment shall be presented and approved by Amtrak during PDR.

(ix) The cart chiller shall have the following features:

1. Push handle at the front
2. Mounted on 4 wheels
3. Quick locking mechanism to secure in docking station
4. Connection to the cooling area on the back side
5. Power connection for 120V AC/48V DC with Harting plug
6. Protection against evaporator freeze-up during low load operation
7. Digital Controller with touch panel that includes alarm annunciation, status displays, and password protection for setting adjustment

(x) The refrigeration system shall be controlled by the suction line pressure signal and the supply air and exhaust air temperature sensors.

1. Depending on the changes in pressure, the speed of the compressor shall be adjusted accordingly between the minimum and maximum speed.
2. The unit shall be turned on and off based on the temperature sensor readings.

(i) Ducting

(i) The ducting on the back of this module directs the warm and cool air to and from the food carts so that the carts are always within the expected temperature range.

(ii) The ducting also is directed to the car's HVAC exhaust system to take heat away from the refrigeration equipment.

(iii) The ducting shall be insulated so that the condensation is limited as much as possible.

(iv) Insulation should be mechanically fastened to the duct with no exposed insulation fibers. The use of insulation tape is not allowed.

(j) Electrical Connection

(i) The electrical connection between the chiller cart and the docking station shall provide a quick connect, not damage

any electrical connectors, and be properly insulated from moisture.

(ii) 3 carts shall be docked in the café docking stations.

(2) Refrigerated Cart

(a) Carts are intended to move food items from the commissary to the train, dock in their compartment and be taken back to commissary for restocking after a trip is complete.

(b) The cart shall be roughly (16” x 21” x 37”) and shall be interchangeable with the carts used in the Airo fleet. Example part number listed as Bucher BA700036.

(c) The refrigerated cart shall be delivered with 12 trays loaded on shelves inside.

(d) The cart shall be able to move seamlessly in and out of the docking station.

(e) The Contractor is responsible for ensuring that the tolerances between the docking station and the refrigerated cart both:

(i) Do not cause rattling of the cart while the train is in motion.

(ii) Are not so tight that the cart is damaged during docking and undocking.

(f) Carts shall continue to keep items at FDA acceptable temperatures from the time food is placed inside until the food is removed for consumption.

(i) Food cart interior will be accessed semi-regularly and will be docked to a refrigeration docking station when used as a refrigerated cart on the café car.

(g) The cart is expected to function with limited wear and tear damage for the lifespan of the train.

(h) Stainless steel push-to-close or slam latches shall be used on the cart doors.

(i) Sealant on the door gasketing is subject to FST testing-silicone is recommended.

(i) The cart will come with a padlock hasp for locking the contents of the cart when the cart is unattended.

(j) A card holder shall be provided at the top of the cart door.

(i) This material will be aluminum and clear anodized.

(k) A 75 mm diameter wheel will be used on all carts.

(i) The top of the cart handle shall be 30 mm above the top surface of the cart to allow for items to be placed on top of the cart during transport.

(l) The cart shall be capable of a maximum loading of 115 kg, or similar as determined by the supplier.

(i) The cart shall be 25 kg empty, or similar as determined by the supplier.

(m) The bottom of the module will be a single pan that includes the lower portion of the sidewalls to contain any condensation.

(i) The main sidewalls of the module will be fastened to the lower pan so that water does not exit the module.

(ii) The cart module will be adequately sealed to prevent leakage of cart contents into the galley during normal train operation.

(n) The inner and outer surfaces of the cart will be non-porous, corrosive resistant, and easily clean-able.

(i) Any seams will need to be sealed with silicon or mounted with gaps of < 1/32" to meet FDA requirements.

(ii) No sharp edges, chips, or surface defects will be present.

(iii) The interior of the cart shall have 0.25” radius or greater on all corners for cleaning.

(o) The cart in conjunction with a compliant working chiller shall function to keep food at or below 40˚F.

(p) The cart will be suitably insulated to prevent all condensation from appearing on the outside of the module.

(q) The cart shall be suitably insulated to allow a compliant working chiller to bring room temperature stock down to 40 ˚F or lower within 90 min from startup or pull down pre-chilled stock to 40 ˚F or lower within 90 min of startup as determined by refrigeration system capabilities (i.e., no gaps or cold air leaks).

(r) The cart shall be capable of holding up to 12 trays inside.

(i) The tray dimensions will be determined by the inside dimensions of the cart.

(ii) These dimensions will be relayed in drawings to the customer.

(iii) It is understood that trays for these carts will likely be custom size.

(iv) Trays shall be provided by the Contractor within the cart upon delivery.

(s) The refrigerated cart module will be aesthetically pleasing. The supplier shall provide sublimation treatment to all cart panels.

(t) The supplier shall provide either anodizing with clear or single color on the structural extrusions for the cart.

(u) Any required labeling from the manufacturer shall be placed in a location that is not visible while the cart is in the stored position.

(v) The Contractor shall provide a manufacturer drawing showing all critical dimensions for the cart for Amtrak approval.

(3) Handwashing Sink

(a) A sink shall be provided where the sink basin is at least (12” x 10” x 6”).

(b) The basin and sink counterspace shall be made from welded stainless steel.

(c) Marine edges shall be included on the front edge of the handwashing sink area.

(d) A backsplash of at least 6” shall be included on the other edges of the sink area.

(e) The radius between the backsplash and the handwashing sink shall be at least ¾”.

(f) The drain in the bottom of the sink basin shall be 1.25” in and shall be capable of being plugged with a ball valve attached to an L shaped rotational lever mechanism.

(g) The L shaped rotational mechanism shall extend to the front of the module so that it is easy to reach this lever.

(h) All requirements described in the water and waste chapter of this specification shall apply to the sink.

(i) The faucet for the handwashing sink shall use an IR sensor to allow water to run through the faucet. The faucet shall be sized and shaped to allow the water to flow to the center of the handwashing sink basin.

(j) Power for the faucet shall be hard wired. Battery replacement arrangements are prohibited.

(k) Faucet spout shall be located centered over the drain of the sink basin.

(l) The soap dispenser used by Amtrak is manufactured by Celeste Industries Corporation.

(i) The Contractor should supply the mounting base for the soap dispenser.

(ii) The base is made of Delrin and is tapered.

(m) The paper towel holder shall be SanTRAL Plus PTU 31 E ST or similar.

(i) This shall have anti-fingerprint coating, have a filling volume of 500-600 sheets of folded paper towels, be lockable, and be wall mounted.

(4) Microwave

(a) a purchased off the shelf item that meets or exceeds the features from the example part number. Example part number listed as Amana HDC212.

(i) Countertop stackable microwave,

(ii) 0.6 cu ft capacity, 2100 watts,

(iii) heavy volume,

(iv) 4 stage cooking,

(v) Touchscreen.

(5) Trash and Recycling Storage

(a) Trash and recycling will be stored in a stainless-steel module with drawers for the trash and recycling bins to slide in and out of the module.

(b) The drawer shall be mounted on sturdy, durable, cleanable drawer slides that allow for continuous cycles of opening and closing and operate smoothly.

(c) The drawer shall operate with push to open, slam to close latches.

(d) The stainless-steel or aluminum trash and recycling bins shall be completely sealed so that no liquid can escape the trash and recycling bin.

(i) These bins are intended to be removable for emptying the trash and recycling and for cleanability.

(e) In this food service area, the cumulative minimum internal volume for the storage required is 20.2 cu ft. (50 in horizontal x 35 in tall x 20 in deep).

(f) This includes the features for the trash and recycling bin.

(6) Point-of-Sale (POS)

(a) A Point-of-Sale unit will be provided by Amtrak in the food service area.

(b) The POS unit will be manufactured and installed in accordance with Amtrak POS standards in effect at the time of design and manufacture of the cars.

(c) The POS operation shall be supported during Head End Power (HEP) outages according to the Table 15-3 Power Phase Matrix battery table.

(d) The system shall also support real time inventory management of on-board food service items.

(e) Shortages shall be annunciated to onboard crew as well as transmitted wayside for mitigation by Amtrak Food and Beverage Services.

(f) Details of the wayside messaging shall be clarified during mobilization.

(7) Point of Sale System

(a) As an option, the Contractor shall submit an option to provide a point-of-sale system as part of this contract.

(b) A Point of Sale (POS) system is a specialized computerized system that facilitates the processing and completion of retail transactions. It serves as the central hub where passengers make a payment for goods on-board the train.

(c) Hardware:

(i) Terminal/Checkout Counter: This is the physical location where the POS system is set up. It includes a computer terminal with a display, a barcode scanner, receipt printer, and a customer-facing display.

(ii) Barcode Scanner: Used to scan the barcodes on products, providing quick and accurate identification.

(iii) Card Reader: Allows customers to make electronic payments using credit or debit cards.

(iv) Cash Drawer: Safely stores cash received during transactions.

(v) Receipt Printer: Prints transaction receipts for customers.

(vi) Customer Display: A screen facing the customer that displays the items being rung up and the total cost.

(d) Software:

(i) Point of Sale Application: The core software that manages and processes transactions. It includes a user interface for the crew to input items, calculate totals, and finalize sales.

(ii) Inventory Management: Tracks the quantity of products available for sale and updates inventory levels after each transaction.

(iii) Sales Reporting: Generates reports on sales, inventory, and other key metrics.

(iv) Employee Management: Manages user accounts and permissions.

(v) Payment Processing Integration: Links with payment gateways to process electronic transactions securely.

(vi) Security Features: Includes measures like user authentication, transaction encryption, and audit trails to ensure data security and integrity.

(vii) Network segregation is critical to Amtrak and must be addressed and handled through Design Review with Amtrak.

(8) Rapid Cook Oven

(a) A purchased off the shelf item that meets or exceeds the features from the example part number. Example part number listed as TurboChef ECO ST.

(i) 0.54 cu ft capacity

(ii) ventless

(iii) cool touch exterior

(iv) touch control

(9) Freezer

(a) The freezer shall function to keep food at or below 0˚F.

(b) The freezer shall be suitably insulated to prevent all condensation from appearing on the outside of the module.

(c) The temperature within the module shall be monitored and reported to wayside.

(d) There shall be alarm annunciation to the train crew that the freezer is malfunctioning if the temperature in the freezer reaches 1˚F for a continuous one-hour period or if the temperature ever reaches 5˚F.

(e) Drainage for the freezer condensation shall take into account ice melt in the freezer and condensation generated by the evaporator.

(f) The freezer shall be easily cleanable with a base pan that has a backsplash and 0.25” radii.

(g) In this food service area, the cumulative minimum internal volume for the freezer required is 9 cu ft. (24 in horizontal x 36 in tall x 18 in deep).

(h) Two adjustable shelves that can only be removed with tools at a maintenance facility shall be included.

(10) Storage Cabinet

(a) Storage Cabinets shall be constructed from stainless-steel.

(b) These modules shall be designed to retain goods while the train is in motion.

(c) Storage cabinets can come in the form of a cabinet with hinged doors or open shelving with retaining bars.

(d) This will depend on the item stored in each location and shall be determined with Amtrak during the design reviews.

(e) Storage cabinets that function as cabinets shall have:

(i) hinged doors with stainless-steel hinges,

(ii) push to open, slam to close latches,

(iii) door swing limiting mechanism to prevent the doors from colliding and denting

(iv) adjustable shelving to accommodate varying products shall be provided

(f) Storage cabinets that function as shelves shall have:

(i) Adjustable shelving to accommodate varying products

(ii) Stainless steel retention bars to prevent items from sliding off the shelf while the train is in motion.

(g) In this food service area, the cumulative minimum internal volume for the storage required is 6.25 cu ft. (27 in horizontal x 20 in tall x 20 in deep).

(11) Countertop Workspace

(a) A stainless-steel workspace is required for food preparation.

(b) The workspace shall have 6” backsplash and 0.25” radius minimum for cleanability.

(c) The countertop shall be of a usable height between 36” and 38” tall.

(d) The countertop shall be attached to the adjacent modules with no holes for fasteners on the top of the workspace.

(e) In this food service area, the minimum surface area for workspace required is 23.75 sq ft. (90 in horizontal x 38 in deep). An alternative workspace may be proposed if space is a constraint.

(12) Coffee Maker

(a) A purchased off the shelf item shall be provided that meets or exceeds the features from the example part number. Example part number listed as Wilbur Curtis GEMTS16A-1000.

(i) Twin coffee brewer

(ii) 1.5 gallon satellite servers

(iii) A spare coffee maker shall be provided in storage in the event of failure.

(iv) All coffee maker drains shall have the capacity to drain both warmers without overflowing or splashing liquid onto the counter.

(13) Ice Maker

(a) A purchased off the shelf item shall be provided that meets or exceeds the features from the example part number. Example part number listed as Hoshizaki DCM-500BWH.

(i) 590 lb. production capacity in 24 hour period

(ii) 26” wide

(iii) water cooled, cublet-nugget style ice machine

(iv) waster dispenser

(v) countertop mounting,

(vi) 40lb bin ice storage

(14) LSA Seat

(a) A seat similar to a coach seat shall be provided with an associated table for the LSA to rest during breaks as to not occupy one of the passenger seats in the seating area.

(b) The table shall be designed to support 50 lbf at the edge of the table.

(c) This seat shall be capable of supporting 300lbs downward force in all loading conditions.

(15) ATLAS Carrier Storage

(a) ATLAS carriers shall be stored within carrier compartments built into the food service area module.

(b) Each carrier compartment shall include carrier stops, guide rails, and retention latches.

(c) Carrier storage modules shall be made from stainless-steel.

(d) Locations for the carriers are designed for the carrier door to remain closed when in the stored position.

(i) Carriers will remain closed in ‘stored’ configuration due to spacing and optimizing space in the galley.

(ii) In order to access goods in a carrier, the retention latch must be rotated, and the door of the food storage container must be opened.

(e) The carrier storage compartments will include carrier stops to ensure the carrier is located toward the front of module.

(f) The retention latches shall be used to retain the carrier in its position. The latches shall rotate 180° so that they can be rotated clockwise or counterclockwise to release the carriers.

(g) The guide strips inside the storage cabinets shall be made from a polymer material that prevents damage to the carriers while also securing them in place to prevent rattling.

(i) The guide strips shall be replaceable in case of significant damage.

(16) ATLAS Carrier

(a) This carrier is designed to fit into modules throughout the galley as dry storage containers.

(b) This carrier is made from standard Atlas carrier dimensions and is subject to a 25lb single person lift regulation.

(c) This includes the weight of the carrier and the contents of the carrier.

(d) The carrier shall be able to move seamlessly in and out of the carrier storage compartments and the Contractor is responsible for ensuring that the tolerances between the storage location and the carrier both do not cause rattling of the carrier while the train is in motion and is not so tight that the carrier is damaged during docking and undocking.

(e) The carrier is expected to function with limited wear and tear damage for the lifespan of the car.

(f) Stainless steel push-to-close or slam latches shall be used on the carrier doors. Sealant on the door gasketing is subject to FST testing.

(g) A card holder shall be provided at the top of the cart door. This material will be aluminum and clear anodized.

(h) The carrier shall be capable of a maximum loading of 9 kg, or similar as determined by the supplier. The carrier shall be 2.5 kg empty, or similar as determined by the supplier.

(i) The carrier module will be adequately sealed to prevent leakage of carrier contents into the food service area during normal train operation.

(j) The inner and outer surfaces of the carrier will be non-porous, corrosive resistant, and easily cleanable.

    (i) Any seams will need to be sealed with silicon or mounted with gaps of < 1/32” to meet FDA requirements.

    (ii) No sharp edges, chips, or surface defects will be present. The interior of the carrier shall have 0.25” radius or greater on all corners for cleaning.

(k) In alignment with the Atlas Standard, this carrier shall be capable of holding 4 half size Atlas trays.

(l) The carrier module will be aesthetically pleasing.

    (i) The supplier shall provide the carrier with sublimation treatment to only the door of the carrier.

(m) The supplier shall provide either anodizing with clear or single color on the structural extrusions for the carrier.

(n) Any required labeling from the manufacturer shall be placed in a location that is not visible while the carrier is in the stored position.

(o) The Contractor shall provide a manufacturer drawing showing all critical dimensions for the cart for Amtrak approval.

c). Functional Criteria

i). The following items shall be reviewed with the criteria listed below for each.

ii). Sanitary Design Review Criteria

(1) Appropriate cleaning radii of at least 0.25” on worksurfaces and 0.75” on sink areas.

(2) Backsplashes of at least 6” on worksurfaces and sink areas.

(3) Appropriate cleaning clearances around appliances such that a 95th percentile male can fit their hand and a rag easily between objects for cleaning.

(4) All edges and seams are sealed with food grade silicone sealant and gaps greater than 1/32” are sealed in food storage, food preparation, and all other food related areas such as trash compartments shall be sealed in this manner.

(5) Floor drains are provided for locations prone to spills and leaks, especially near water piping to eliminate water pooling on the floor.

(6) Openings are protected from allowing pests and vermin to congregate

(7) Proper sealing methods are used to prevent moisture from corroding or otherwise damaging the food service area

(8) All drain pans and catches are accessible for cleaning

(9) No tools are required to move objects subject to daily cleaning rituals

iii). Refrigeration and Freezer Equipment Review Criteria

(1) Temperature monitoring of the refrigeration and freezer equipment shall be provided.

(2) Temperature monitoring system functionality

(a) Temperature monitoring shall be accomplished through a set of redundant sensors.

(i) The refrigeration controller shall relay temperatures for each of the refrigerated modules locally and in one location on a panel in the kitchen.

(b) Additionally, temperatures shall be reported to wayside through the use of a PT100 sensor.

(i) The PT100 sensor and the controllers for the equipment shall be calibrated to ensure they are reporting the same temperature.

(ii) Temperatures shall be logged and accessible for at least a 6 month period of time after the date of data collection.

(c) Temperatures for the refrigerated food carts shall be monitored in the ducting between the refrigerated docking station and the refrigerated cart.

(i) Industry standard is to monitor the temperature and combine 80% of the temperature for the return air and 20% for the air supply.

(ii) This calculation shall be used to determine the likely warmest temperature of the air in the food cart and shall inform the setpoint and need for temperature adjustment.

(d) Temperatures for refrigerated cabinets shall be monitored directly in the refrigeration cabinet at the warmest temperature location and shall inform the setpoint and need for temperature adjustment.

(e) Presently, Amtrak monitors the temperature of a refrigerated food cart by placing a yogurt in the center of the cart and manually records the temperature of the yogurt on an interval. If the yogurt is out of temperature the food in the cart is considered out of temperature and therefore spoiled. The Contractor shall provide a system that consistently functions without allowing the yogurt to test out of temperature and cause loss of revenue from spoiled goods.

(3) Type Tests

(a) Type Tests for refrigeration and freezer systems shall be evaluated using ISO 23953-2 to determine the temperature probe location and validate performance of the system and produce a test report for Amtrak's evaluation and approval as specified in ISO 23953-2. **[CDRL 16-03]**

(b) The following elements of design validation are of particular interest to Amtrak and shall be performed as type tests if information is not included in the ISO 23953-2 test report:

(i) Operational Temperature

1. The system shall maintain food safe temperatures between 33°F to 40°F (1°C to 4°C) consistently for 8 hours.

2. The freezer module will need to maintain temperature ranges below 0°F (-18°C) consistently for 8 hours.

3. The supplier will propose a test to show the units maintain operational temperature under standard conditions:

   a. 74.6°F (23.7°C) and 55% rH.

   b. An allowable tolerance to this would be +/- 2 degrees F and +/- 5%.

4. The refrigeration systems shall be suitably insulated to maintain the specified temperature limits during a power loss of 60 minutes to avoid condemning of perishable food products.

5. The refrigeration system shall have real-time and remote temperature monitoring and alarm annunciation capabilities that shall alert onboard crew.

6. The Contractor shall propose a test to show the units maintain operational temperature under standard conditions:

   a. 74.6°F (23.7°C) and 55% rH.

   b. An allowable tolerance to this would be +/- 2 degrees F and +/- 5%.

(ii) Probe Placement

1. The temperature probe will need to be placed in the warmest location of the refrigerated compartment so that all food items stay within the acceptable temperature range.

(iii) Air Flow

1. The air flow through the module will need to be evaluated to ensure that there are no warm air pockets within the refrigerated compartment.

(iv) Operational Load Testing

1. The operational load of the refrigeration module needs to be evaluated to ensure that the refrigeration unit functions within the acceptable temperature range with simulated service loading conditions.

2. Amtrak will provide loading conditions prior to test procedure approval.

3. Three total tests will satisfy the operational load requirement: full load, half load, empty load.

4. The operational temperature of the refrigeration system should maintain food safe temperatures.

5. The refrigeration module will need to maintain temperature ranges between 33°F to 40°F (1°C to 4°C) consistently for 8 hours.

6. The freezer module will need to maintain temperature ranges below 0°F (-18°C) consistently for 8 hours.

7. The Contractor shall propose a test to show the units maintain operational temperature under standard conditions:

   a. 74.6°F (23.7°C) and 55% rH.

   b. An allowable tolerance to this would be +/- 2 degrees F and +/- 5%.

(v) Condensation Evaluation

1. The refrigeration module, freezer, and chilled cart modules shall function with zero condensation on the outside surface of a module when exposed to the following environmental conditions:

   a. 74.6°F (23.7°C) and 55% rH.

   b. An allowable tolerance to this would be +/- 2 degrees F and +/- 5%.

   c. Zero condensation is defined as no fogging, beading, or dripping liquid on any outside surface of the module.

2. The Contractor shall perform a test to observe modules while they are functioning at the specified temperatures for 8 hours.

(vi) Pull Down

1. The refrigeration and freezer modules are expected to pull down to temperature within 60 min with an inlet temperature of 70°F and repeated with inlet temperature of 110°F.
2. The module will be completely empty for this test.
3. The refrigeration unit shall reach a temperature range of 33-40°F within the specified time.
4. The freezer unit shall reach a temperature of below 0°F within the specified time.

d). Additional Equipment Requirements

i). HVAC

(1) Food service areas generate a large amount of ambient heat, smells, and humidity in the air; as a result, the HVAC system calculations must take into account the appliances and usage case of the food service area. Detailed HVAC requirement information can be found in Chapter 10, HVAC System.

(2) Appliance-Specific Ventilation

(a) Ventilation to specific appliances is required.

(b) This ventilation can come in the form of recycled air through the HVAC system or directly exhausting the outlet air for an appliance.

(c) The Contractor shall submit a proposal for which appliances listed below will be directly exhausted and provide all relevant calculations as justification.

(d) The submittal will be subject to Amtrak's review and approval during the design review process. **[CDRL 16-05]**

(i) Ovens

1. Rapid Cook Ovens
2. Microwave Ovens

(ii) Refrigeration

1. Refrigerated Docking Station
2. Refrigerated Storage
3. Refrigerated Alcohol Display

(iii) Freezer

(iv) Other Appliances

1. Coffee Maker

2. Ice Maker

ii). Electrical Equipment

(1) Electrical equipment information is shared in the points below. Detailed electrical requirements can be found in Chapter 15, Electrical System.

(2) Convenience Outlets

(a) Convenience Outlets shall be located during design reviews after discussion and approval from Amtrak.

(b) At least 8 duplex convenience outlets shall be located within the café food service area.

(c) Only the convenience outlet near the attendant seat shall have USB ports.

(d) General purpose convenience outlets in this area shall not have USB ports.

(3) Appliance Outlets

(a) Appliance Outlets shall be located directly behind a desired appliance.

(b) The outlets shall be properly sized and selected to safely power each appliance, and the electrical system shall provide a dedicated breaker for each type of outlet.

(c) Appliance outlets shall not have USB ports.

(4) POS Outlet

(a) POS shall have an electrical circuit and dedicated breaker.

(b) The POS outlet shall have USB ports.

(c) The POS outlet must be available on car battery power and follow the battery load Table 15-3: Power Phase Matrix.

iii). Lighting

(1) Lighting general information is shared in the points below.

(2) Detailed lighting information can be found in Chapter 13, Lighting System.

(3) Overhead Lighting

(a) Overhead lighting shall be from flush mounted panel lights in the ceiling panels and/or from spotlights.

(b) Overhead lighting can be turned off if the car lighting mode is set to night mode.

(c) These overhead light fixtures cannot be required to meet FDA light intensity level requirements for food preparation counters, sinks, and workspaces.

(4) Shelf Lighting

(a) Shelf lighting will be from surface mounted strip lights. These strip lights will be different brightness levels based on the area they are illuminating.

(b) Shelf lighting alone shall be the main source of illumination to meet FDA light intensity level requirements for food preparation counters, sinks, and workspaces.

(c) To illuminate a shelf, the shelf or underside of the top of the module above the shelf shall have a strip light mounted.

(d) To illuminate a workspace, the underside of the shelf above the workspace shall have a strip light mounted.

iv). Communications Equipment

(1) Communications equipment for the café is described below.

(2) Detailed information regarding communications equipment can be found in Chapter 14, Communications.

(3) PA Speakers

(a) PA speakers shall be located on the ceiling panels at both ends of the café car.

(b) The speakers used in this location shall be identical to PA speakers used in other locations for ease of maintenance and replacement.

(4) PA Intercom

(a) PA Intercom shall be mounted near the entrance door of the café.

(b) This intercom shall be identical to the PA intercom used in other locations for ease of maintenance and replacement.

(5) Security Cameras

(a) As an option, security cameras shall be mounted to ceiling panels and shall give surveillance view of all areas of the café car for security, theft protection, and identification of possible hazards.

(b) At least 3 cameras shall be used to achieve this goal.

(6) Smoke Detectors

(a) Smoke Detectors shall be mounted on the ceiling panels at both ends of the café.

(b) The smoke detectors used in this location shall be identical to the smoke detectors used in other locations for ease of maintenance and replacement.

v). Emergency Equipment

(1) The following emergency equipment pieces shall be included and stored in a conspicuous, accessible, and labeled location. Please refer to Chapter 18 Emergency Equipment for more information.

(a) Snap lights

(b) First aid kit

(c) Fire extinguisher

(d) AED

vi). Security

(1) Many items within the food service area will need to be secured. The following items are identified with specific locking preferences. Any other locking or security items will be discussed with Amtrak during design reviews.

(a) Cart Locking

(i) The cart storage compartments shall include mechanisms that will lock the carts in the compartment as well as prevent the cart door from opening.

(ii) The locking mechanism shall use an Amtrak supplied padlock to secure the carriers.

(b) Cabinet Locking

(i) Cabinets shall include padlock hasps as determined with Amtrak during design reviews.

(ii) The locking mechanism shall use an Amtrak supplied padlock to secure the selected cabinets.

(c) Carrier Locking

(i) The carrier storage compartments shall include mechanisms that will lock the carriers in the compartment as well as prevent the carrier door from opening.

(ii) The locking mechanism shall use an Amtrak supplied padlock to secure the carriers.

(d) Freezer Locking

(i) The freezer shall include padlock hasps as determined with Amtrak during design reviews.

(ii) The locking mechanism shall use an Amtrak supplied padlock to secure the selected cabinets.

vii). Countertop Heights

(1) Countertop shall be 36” maximum.

viii). Dispensers

(1) The following dispensers shall be provided in the café:

(a) Cold beverage cup dispenser

(b) Paper towel dispenser

(c) Napkin dispenser

(d) beverage stirrer dispenser

(e) utensil dispenser

(f) condiment holders

ix). Color Material and Finish (CMF)

(1) Please refer to Exhibit F for more information.

(2) Please also refer to Materials and Workmanship in Chapter 19.

(3) General expectations are listed below.

(a) CMF will be finalized with Amtrak after the mockup review.

(b) Stainless Steel Modules

(i) Stainless Steel Modules shall be created from sheet metal that is sized to prevent denting, oil canning, or otherwise non-sturdy structures.

(ii) The modules shall be constructed from 304 stainless-steel with a #4 finish (320 grit) or as approved during design reviews with Amtrak.

(c) Carshell Walls

(i) Carshell walls shall be lined to create interior walls for the café. Sidewall liners shall be made from molded thermoplastic with an easy to clean surface finish.

(d) Partition Walls

(i) Partition Walls shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(ii) The finish of the wall and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(e) Ceiling Panels

(i) Ceiling Panels shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(ii) The finish of the passenger facing side of the ceiling panel and material of the outside skin shall be inspired by the CMF document and meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(iii) The finish of the material on the non-passenger facing side shall be coated such that there is no risk of corrosion from moisture from steam or humidity within the car.

(f) Café Area Countertops

(i) Countertops within the cafe area shall all be made from solid surface material at the service counter and from stainless-steel at the LSA workstation area.

(g) Café Area Flooring

(i) Flooring within the café area shall be made from rubber flooring with a friction, no-slip texture.

16.6 Reference Information

a). Planned Dishware

i). Please refer to the attachment regarding dishware China storage needs

ii). The following dimensions shall be used for estimating storage provisions:

(1) 10.25” diameter dinner plates and entrée bowls

(2) 7.5” diameter bread and butter plates

(3) 16 oz bowl with 7.25” diameter

(4) 10 oz bowl with 6.25” diameter

b). Passenger Flow

i). The Contractor shall diagram expected passenger flow through/past food service areas for Amtrak agreement and approval.

(1) This shall be presented by the Contractor at the IDR phase. **[CDRL 16-06]**

c). Hotel Pan Sizing Information

i). Hotel pans shall be used and placed in many appliances including the warming drawers, steam/induction table, convection ovens, and refrigerated cabinets. Reference information on the sizing of the hotel pan is included below.

(1) Size of hotel pan: 21” L x 12 ¾” W

(a) (this includes the outer flange that holds the pan in the well)

(2) Size of half hotel pan: 10 3/8” L x 12 ¾” W

(a) (this includes the outer flange)

d). Bussing Tub

i). Bussing tub dimensions are assumed as follows:

(1) 20” x 15” x 7” deep

(2) Fully loaded tub can be assumed to be less than or equal to 25 lbs.

e). Serving Tray

i). Serving tray dimensions are assumed as follows:

(1) 10” x 14” x 9/32” deep

(2) Fully loaded tray can be assumed to be less than 25 lbs.

16.7 CDRLs

CDRL	Description	Due
CDRL 16-01	FDA Approvals	Prior to revenue service
CDRL 16-02	Food Service Layouts	During PDR, IDR, and FDR
CDRL 16-03	Type Tests for Refrigeration and Freezer systems	During FDR
CDRL 16-04	Type Tests for all Warming Equipment	During FDR
CDRL 16-05	Ventilation Plan	During IDR
CDRL 16-06	Passenger Flow	During IDR

* End of Chapter 16*

Amtrak Universal Single Level Fleet Replacement

Technical Specification

17. Water and Waste System

Revision 2

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17.1 Overview

a). General

i). Each car shall have a water supply system and toilet rooms consistent with the arrangements and requirements in Chapters 1,11 and 31.

(1) For rooms and cars having an Accessible Toilet Room (ATR), the layout shall meet the requirements of 49 CFR Parts 27, 37, and 38 or latest regulation, and U.S. Department of Transportation Section 504 covering the barrier free transportation of the elderly and handicapped.

(2) The Food Service cars shall have systems of larger water capacity for food preparation needs, as detailed in Chapter 16.

ii). All water, waste and sanitation systems on all cars shall comply with:

(1) All applicable Federal regulations, including:

(a) the most recent edition of the US Food and Drug Administration (FDA) Food Code,

(b) the requirements of the US Public Health Service (USPHS), and

(c) the applicable Code of Federal Regulations for the FDA and the Environmental Protection Agency (EPA) concerning general sanitation, water, toilets and interstate conveyance sanitation, including 21 CFR Part 1250.

(2) The latest edition of the Amtrak Food Service Sanitation regulations and the Amtrak Public Health Standards.

iii). The Contractor shall work with Amtrak to arrange for an FDA inspection of the design and completed installation of the water and waste system of the cars to ensure that it meets all requirements, in accordance with 21 CFR Part 1250.41.

(1) Documentation of compliance shall be submitted to Amtrak. **[CDRL 17-01]**

iv). All materials and workmanship shall comply with Chapter 19 requirements.

v). The water and waste system shall be able to operate without damage or failure under all specified environmental temperatures and elevations per Amtrak Specification 963.

(1) All components selected by the Contractor shall be designed to withstand the railroad environment from a durability and debris damage perspective especially with respect to freeze protection.

(2) All freeze protection components shall have a complete and automatic draining function for all fresh water from the system whenever water

temperature approaches freezing with a minimum of specialized hardware being required.

(3) Means for alerting train crew in advance of automatic draining shall be provided to avoid nuisance activation of this feature.

(4) Any undercar water and waste piping and systems shall be housed within undercar protective enclosures and shall not be exposed.

vi). It is required that the water supply piping systems be designed to provide gravity drainage with a minimum of automatic freeze protection valves, manual drain valves and vacuum breakers being required for complete drainage in freezing conditions when power is not available.

vii). Gasket selection for the water system shall be suitable for the application. Any water that flows to a drinkable source shall be suitable for potable water. Cork gaskets are explicitly prohibited.

viii). Ease of servicing and maintenance, rapid repair, reliability, resistance to winter freezing conditions, and safety shall be major design considerations.

(1) Where servicing of consumable items is required, such as filters, accessibility shall be gained from the interior of the car.

(2) Maintainable components of the in-room faucets, shower components, food service components, and piping shall be easily accessible

(a) Easily accessible means an access panel that provides a comfortable working environment to remove and replace parts.

(3) The design of the water system on all car types shall incorporate means to easily sanitize and flush the entire water system, as periodically required by the FDA.

(4) All potable water lines shall be isolated from flush water lines through appropriate valves or by alternate means.

ix). Each water consuming device on the car, such as each sink, drinking water dispenser, shower, toilet, coffee maker, etc., shall have an individual stainless steel quarter-turn supply line shutoff valve located adjacent to the device that can be accessed by the train crew without the use of tools, to deal with in-service failures during train operation.

(1) This device shall not be accessible to passengers.

(2) Servicing and shutoff valves shall be stainless steel quarter-turn ball valves unless otherwise specified.

(3) Each shutoff valve, drain valve, reset switch or other control device for the water and waste systems shall have an exterior locker identification label and shall have identification and operating instructions on the valve or device itself.

x). Complete details of the water and waste systems on all car types, including Food service appliances and restrooms, shall be presented to Amtrak for approval during design review.

(1) This shall include maintainability analysis and access provisions, and winterization details.

b). Capacity

i). In all but the food service cars, the water supply system shall have sufficient capacity to serve a fully seated passenger load for the car configurations described in Chapter 1 for a 72-hour period without replenishment for all water consumption needs, including hand washing, and toilet flushing operations.

(1) The car providing the greatest water capacity demand shall be used in determining water capacity. This size tank shall be applied to all passenger car types other than the Food service cars.

(a) In the food service cars, the water supply system shall have a capacity sufficient to supply all food service functions along with normal restroom and drinking water requirements for a full passenger carload for at least 72 hours.

ii). The waste retention system capacity shall be based upon providing 0.05 gallons of volume for each car passenger seat per hour, plus an additional 8 ounces of water per flush, for 72 train operating hours, with sufficient tank capacity to permit a toilet servicing cycle of five days. Expected capacity for waste retention system is 250 gallons.

iii). The car requiring the greatest waste retention shall be used in determining waste capacity, with this same size tank applied to all passenger car types which contain toilet facilities.

17.2 Water System

a). General

i). Each car shall be provided with a water system which will supply hot and ambient temperature potable running water for various crew and passenger needs. The water shall be provided for drinking, hand washing, cafe requirements and toilet system operation.

ii). Particular emphasis shall be placed on meeting the winterization and maintainability requirements.

iii). Refer to Chapter 16 for additional galley requirements.

iv). The water system shall include:

(1) water tanks,

(2) fill system,

(3) drain system with freeze protection valves,

(4) protective heaters,

(5) water pressurization equipment (if used),

(6) filter,

(7) water distribution piping with service valves,

(8) water heater and thermal insulation

v). The water system shall be pressurized or gravity fed.

(1) If pressurized, it shall use filtered air derived from the main reservoir system using a governor system, with adjustable water system pressure, or pressurized system by means of an electric pump.

vi). The potable water supply shall have a particulate filter and an antibacterial filter to purify the water to Public Health Service (PHS) standards.

(1) These filters shall be located between the freshwater tanks and the dispensing equipment and shall be located for easy cleaning and replacement.

(2) All filters shall be easily replaced.

vii). Means for complete freeze protection, system drainage, maintainability and periodic sanitation shall be included.

viii). The entire water system shall conform to FDA and USPHS regulations and shall use lead-free components.

ix). Plans for construction of the water system shall be submitted to the FDA for review for conformity with FDA requirements. **[CDRL 17-02]**

x). The design and materials shall be approved by Amtrak.

xi). The water system shall be designed to allow complete drainage of all equipment by gravity.

xii). Potable water piping shall be designed to allow periodic sanitization by an Amtrak approved process.

xiii). As an option, the Contractor shall supply an on-board Ozone system to support filtration, disinfection and odor control of the water and waste system. The system shall operate reliably under all environmental conditions defined in Amtrak Specification #963, including freeze protection and debris shielding while being integrated into the water distribution system, ensuring no backflow. The system shall be demonstrated through water sample analysis before and after treatment using NSF/ANSI-certified methods.

(1) If the option is not exercised, the water and waste system shall be designed to accommodate an external filtration system allowing for a closed system flush.

b). Storage Tanks

i). Storage tanks shall be stainless steel or other approved materials having equal durability and include internal baffle plates.

ii). The tanks shall be located in a protected equipment enclosure and fully covered with water resistant fiberglass insulation and supplied with protective heating for winter operating conditions.

iii). All storage tanks shall be constructed in accordance with the latest revision of Section VIII of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code for Unfired Pressure Vessels designed to withstand a static water pressure of 110 psig.

iv). Each storage tank shall have a manual drain valve, a manual shutoff valve, an ASME pressure relief valve and a freeze protection automatic drain valve or approved alternate design.

v). A permanent sign shall be installed on the inside face of the electric locker door identifying the total car freshwater tank capacity.

vi). A manual drain valve shall be provided to permit the water tanks to be flushed and drained.

vii). All water tanks shall be located and designed to allow full accessibility for servicing, removal and replacement. All tanks shall incorporate lifting/supporting points for handling by maintenance personnel.

viii). Water storage tanks shall be implemented with safe and reliable water treatment system to minimize the requirement for regular cleaning of water tanks. Amtrak is open to alternatives regarding water treatment solutions to reduce the amount of cleaning requirements for water storage tanks.

ix). Storage tanks shall be designed so as not to allow accumulation or sediment or other debris, a flat bottom shall not be permitted.

c). Water System Fill Stations

i). General

(1) The water fill point itself shall be a barbed male nozzle, which shall be enclosed in a blue painted metal housing with a self-closing cover.

(2) The water fill point shall be compatible with existing Amtrak wayside filling equipment and shall use a minimum 0.75 in. diameter fill piping.

(3) All water fill stations shall be easily cleanable and so located and protected as to minimize the hazard of contamination of the water supply.

(4) Complete identification signage and refill instructions shall be provided.

ii). Fill Station Locations

(1) A water fill point for the car's water system shall be provided on each side of the car at approved locations, at a sufficient distance to prevent contamination from the waste tank drain stations.

(2) The fill points shall be located and self-protected to minimize contamination hazards arising from wastewater system discharge, dust, dirt and debris.

iii). Fill Station Enclosures

(1) Each fill station shall be mounted in a recessed corrosion resistant enclosure and covered with a spring loaded, top-hinged, weather-tight, corrosion resistant, gasketed cover.

(2) The cover shall be labeled and equipped with over-center springs to securely keep the cover either open or closed.

(3) The bottom surface shall be designed to allow complete drainage of fluid from the enclosure interior

(4) The design of the water fill point shall be adequately dimensioned for ease of use by maintenance personnel wearing heavy winter gloves. The water fill point itself shall be a male nozzle, which shall be enclosed in a blue painted metal housing with a self-closing cover.

iv). Water System Pressurization Valve

(1) If required for pressurization, adjacent to the fill point shall be a three-way water system pressurization valve in compliance with the requirements of Amtrak AAMPS catalog number 22 946 70710.

(a) This valve must have the enlarged vent port design to permit rapid venting of the water tank within seconds.

(2) The valve shall have two positions, FILL and WATER.

(a) In the FILL position, the valve shall cut off tank pressurization air, if used, rapidly vent the water tank and permit filling the tank. This will allow the tank to be filled via a check valve located immediately behind the fill nozzle.

(i) The system shall permit complete filling from one side of the car, without requiring access to the other side of the car.

(ii) A means shall be provided to indicate when the water tanks are completely filled.

(iii) Any excess water shall be directed to the bottom of the car and easily visible from the side of the car.

(b) When the valve is placed in the WATER position, the vent will be closed, and air pressure applied to the water in the tank, if used.

(c) The air valve and check valve shall be enclosed behind sheet metal, easily serviceable from the front, with only the valve operating handle exposed.

d). Hot Water

i). Each car shall be capable of producing hot water.

(1) One hot water tank shall be provided for each car with the capacity of the tanks dictated by the car with the most demand on the longest long-distance route. The water heater shall operate from 480 VAC, 3-phase and shall be rated at 9kW. Hot water temperature shall be maintained at approximately 180° F in the tank.

(2) An active mixing valve shall deliver hot water at 118° F to the hot water distribution system. A temperature and pressure gauge shall be provided at the tank and a temperature gauge downstream of the mixing valve.

(3) The water heater shall include, but not be limited to the following features: electric immersion heater, a factory installed thermostatic control, and low water protection. Tank shall be well insulated thermally. The tank shall be located to permit removal of the heater elements without disturbing the tank. Elements shall be replaceable in one hour or less.

(4) Control voltage to the electric water heater system shall be 120 VAC from car power supply.

(5) Status, faults, errors, and diagnostics (overload contactor switch, heating elements, water level, etc.) for the hot water heater shall be accessible by PTU.

(a) All freeze protection shall be monitored by the car's diagnostic system

(b) The above shall be communicated to the CDU. Details to be discussed during design reviews.

ii). Hot Water Delivery

(1) The water heating system shall be capable of providing continuous water heated to 100°-105°F at every faucet.

(2) The water heating system shall be capable of providing continuous water heated to 110°-119°F in the food service area for a minimum of 15 minutes.

(3) Wherever hot water is dispensed, the system shall be designed to deliver heated water immediately.

(4) The water heating system design, potentially using a mixing valve, shall be capable of delivering water at the required temperatures while minimizing the volume of water used.

iii). Hot Water Storage Tanks

(1) All hot water storage tanks shall be stainless steel or other corrosion resistant approved material and suitably insulated.

(2) They shall be constructed in accordance with the latest revision of Section VIII of the ASME Boiler and Pressure Vessel Code for Unfired Pressure Vessels at a setting pressure of 75 psig.

(3) Gravity drainage provisions shall be incorporated into the design.

(4) The storage tanks shall have an easily accessible manual drain valve, a manual shutoff valve and a freeze protection automatic drain valve.

(5) Storage tanks shall be designed so as not to allow accumulation of sediment or other debris, a flat bottom shall not be permitted.

iv). Water Heater Protection

(1) Each water heater shall be equipped with an accessible thermostat, an ASME temperature and pressure sensitive relief valve piped to drain under the car and be equipped with low water protection.

(2) No damage shall result to the water heater and related devices and wiring if the water supply is cut off causing it to run dry, or if electrical power is disconnected in freezing conditions.

(3) Information labels shall be installed on all doors where reset switches are located.

v). Maintainability

(1) The water heater elements shall be easily replaceable with the tank installed in the car.

e). Drinking Water Dispenser

i). Each dispenser shall be constructed of stainless steel, have a touchless or otherwise self-closing dispenser spigot, include a drain system for any spillage, and be dimensioned to permit 1-quart containers to be refilled. It shall dispense filtered water from the supply system.

ii). Water Cooler

(1) Locations of water coolers and dispensers is detailed in Chapter 11.

(2) The water cooler shall be capable of producing at least 5 gal of 50°F chilled drinking water per hour and be capable of chilling water from 80°F to 50°F within ten minutes.

(3) The cooler shall use an environmentally acceptable refrigerant and meet USPHS regulations.

(4) It shall be unitized for quick removal and replacement, with suitable piping and electrical connectors.

(5) The water-cooling system shall allow for easy access for cleaning, sanitization and servicing.

(6) It shall be supplied from the potable water tank after the filtering system.

iii). Water dispensers and coolers shall have an easily accessible manual drain valve, a manual shutoff valve and a freeze protection automatic drain valve.

iv). Supply piping shall be arranged to facilitate gravity drainage.

v). Alternate designs can be submitted for review and approval by Amtrak.

f). Water Piping

i). All water system piping and fittings, unless otherwise approved by Amtrak, shall be seamless stainless-steel tubing, piping or other approved materials having equal durability.

ii). Layout and installation shall be accomplished with a minimal number of connections.

iii). Anti-water hammer air chambers shall be provided as required.

iv). Waterproof plastic identification labels shall be applied to all piping where connections are made to valves or devices.

v). All water supply piping and components shall be of lead-free construction and shall comply with the requirements of Chapter 19.

g). Water Backflow Checks

i). The water system shall be configured to prevent water backflow into the water raising system under all conditions, in compliance with USPHS regulations.

ii). If points of connection between potable and non-potable water exist, backflow and back siphon protection devices meeting American Society of Sanitary Engineers (ASSE) standards shall be installed to protect against mixing of potable and non-potable water.

iii). These devices shall be located to also protect against potential backflow or back siphon conditions may occur.

iv). They shall be arranged to allow easy replacement if necessary.

h). Water Raising

i). If a water raising system is required, it shall use compressed air supplied by the cars main air reservoir pipe through an approved governor and regulator valve to pressurize the water system, per Chapter 9, or pressurized system by means of an electric pump.

ii). Particulate and desiccant type air filters with an automatic drain and an oil removal filter shall be provided to remove all contaminates and moisture from the air supply to the system.

(1) The arrangement shall easily allow replacement of the filters.

iii). All air regulation valves shall be mounted above the top of the water level in the storage tanks.

iv). An ASME pressure relief valve shall be provided.

v). The potable water supply to the sinks and drinking water dispenser shall be provided through a check valve and adjustable pressure reduction valve.

vi). The potable water supply used for toilet rinse water shall be separately taken from the water supply tanks through a check valve and adjustable pressure reduction valve.

vii). All pressure adjustment settings shall be easily accessible for inspection with pressure test ports being provided, and backflow protection shall be provided.

i). Restroom Sink Supply

i). Hot and cold water shall be piped to each sink faucet.

ii). Water supply for all faucets shall be 0.5GPM.

iii). In all cases where there is a toilet, a sink is expected to be provided next to or within close proximity.

iv). The faucet shall be touchless.

v). Power for the faucet shall be hard wired. Battery replacement arrangements are prohibited.

vi). All exposed parts shall be stainless steel.

vii). All fixtures, dispensers and appliances shall be constructed in accordance with the requirements of USPHS.

viii). The faucet design shall be approved by Amtrak.

ix). See Chapter 11 for additional details.

j). Shower Supply

i). Hot and cold water shall be piped to each shower

ii). Water supply flow shall be 1.5GPM in all showers

iii). All fixtures, dispensers and appliances shall be constructed in accordance with the requirements of USPHS.

iv). The shower design shall be approved by Amtrak.

v). See Chapter 31 for additional details.

k). Galley Supply

i). The food service cars shall draw filtered, potable water from the car supply, and distribute it to the hand sink, utility sinks, coffee brewers, ice makers and other water consuming appliances in accordance with the requirements of Chapter 17.

ii). All water system exposed parts shall be stainless steel.

iii). All fixtures, dispensers and appliances shall be constructed in accordance with the requirements of USPHS.

iv). The galley hand wash sink shall provide 110°F-119°F water per FDA requirements.

17.3 Freeze Protection

a). During Operation

i). The freeze protection system shall consist of automatic water drain valves, insulation, protective heaters, manual drain valves, self-draining pipes and similar devices configured to provide the required protection.

ii). The system shall have sufficient capacity to permit train operation without damage or failure under all operating and environmental conditions specified by Amtrak Specification 963.

iii). There shall be sufficient excess capacity of insulation to allow for time-related deterioration over the design life of the equipment.

iv). The freeze protection system shall be designed to permit pipes and fittings to be disassembled for maintenance and repair without removing the entire protective system.

v). The freeze protection system shall be fully automatic in operation and not require any train crew or maintenance personnel action to activate or reset.

vi). All freeze protection valves shall meet the requirements of Amtrak Specification 1004, latest revision or approved equal.

b). Out of Operation

i). The water system shall be freeze protected to enable it to be disconnected from Head End Power (HEP) indefinitely in subfreezing temperatures, with no damage resulting to any component of the water system under any condition.

ii). Complete manual means shall also be provided to permit the system to be fully drained when desired.

iii). The entire water system, including its piping and all appliances, shall be free-draining and shall avoid arrangements where water may become trapped.

iv). Automatic vacuum breaker valves shall be installed at all elevated points and other locations as necessary to permit complete venting of the system when draining.

v). The system shall be designed and geometrically arranged so as to require the absolute minimum of drain valves.

vi). All pipe insulation shall be water resistant.

vii). A permanent sign shall be installed on the inside face of the electric locker door providing instructions for the manual draining of the car's water system.

c). Drain Valves

i). The freeze protection system shall make use of an Amtrak approved automatic, self-contained drain valve which will automatically open when sensing an adjacent ambient air temperature of approximately 38°F (temperature falling) and close at 40°F (temperature rising) when there is no electrical power on the car.

ii). All drain valves shall be equipped with a quick warm-up heater to close the drain valves when HEP is available, to allow a car in freezing temperatures to be immediately watered when placed on electrical power.

iii). All drain valves shall have a manual override feature located near the fill valve to allow the car to be filled at any time regardless of temperature or HEP availability.

d). Electrical Protective Heat Tape

i). The water storage tanks and all water supply components exposed to ambient temperatures shall be protected against freezing by electrically powered self-regulating heat tape and thermal insulation.

ii). To prevent unnecessary electrical consumption, all heat tapes shall be supplied electrical power only when the exterior ambient temperature is below 45°F.

iii). All electrical protective heat tape shall be of an automatic self-limiting 120VAC design which can be cut to length from bulk rolls for replacement.

iv). All connections shall be made using the manufacturer's watertight splicing kit, and each individual length shall be terminated with a power monitoring system.

v). Such heat tape shall be of a design that can withstand the application of live steam at 225°F without damage, as this is often the only method available in an Amtrak maintenance facility for thawing a frozen car.

e). Electrical Heat Tape Monitoring System

i). An approved system shall be provided in the electrical locker inside the car to indicate the operating status of all heat tape systems.

ii). To verify the proper operation of all antifreeze protective heat tapes for the water and waste system, the Contractor shall arrange a monitoring system and associated indicators to verify that electrical power is present at the far end of every heat tape segment when power is being supplied to the system.

iii). A logical, organized system layout shall be provided, with each indicator labeled for ease of maintenance personnel quickly identifying an individual defective heat tape.

iv). A POWER ON test pushbutton shall be located on the panel to allow electrical power to be supplied to all of the heat tapes on the car when ambient temperature is above the setting at which the system would be energized.

v). Monitoring of the current or ground fault circuit breaker status, as well as the presence of voltage at the end of each heat tape, shall be provided.

vi). Alternate methods for detecting and reporting the failure of any heat tape segment may be employed subject to Amtrak approval.

f). Maintainability

i). Maintainability aspects of the system shall be demonstrated on the interior mock-ups.

g). All details of the freeze protection system shall be submitted to Amtrak for approval during design review. **[CDRL 17-03]**

17.4 Waste Retention System

a). General

i). All waste collection fixtures and components shall be constructed in accordance with the requirements of 21 CFR Part 1250 and USPHS.

ii). The system shall have previous successful application in rail passenger service.

iii). All toilet system piping, the waste tank and all associated fittings, drain piping and serving valves, unless otherwise permitted by Amtrak, shall be manufactured from acid-resistant stainless steel suitable for sewage service.

iv). All waste retention system servicing valves shall be quarter-turn stainless steel ball valves with full diameter port openings.

v). The WCRS shall be a positive/negative pressure type system with sufficient useable capacity to collect and retain all toilet waste generated on the car during a 72-hour period in a single tank, for discharge at a wayside dumping facility. Minimum waste capacity shall be per Section 17.1b).

vi). Electrical and plumbing connections shall be designed so that components can readily be installed, removed and exchanged.

vii). Modular construction shall be utilized in the design of all components and subassemblies.

viii). No special tools shall be required for maintenance or replacement of system components.

ix). As there are frequent foreign object blockages of the toilet system encountered in toilets, sufficient easily accessible leak-tight access caps and cleanout ports shall be provided in all waste system piping to permit rapid and easy removal of clogs by maintenance staff during servicing stops.

x). The waste tank, all waste piping, and waste system components shall be designed to prevent accumulation of mineral deposits and scale and provide a procedure for their removal.

xi). The waste system shall be designed to operate over all operating and environmental conditions specified by Amtrak Specification 963 and avoid damage from freezing.

xii). Plans for the toilet system shall be submitted to the FDA for review for conformity with FDA requirements. **[CDRL 17-04]**

(1) Complete details on the system design shall be presented to Amtrak for approval during design review.

b). System Requirements

i). The system shall be designed for fail-safe operation and protection of passengers, crew, service personnel and equipment.

ii). Ease of servicing and maintenance, reliability and safety shall be major design considerations.

iii). Compressed air shall be supplied by the main reservoir trainline pipe.

(1) This system shall be kept separate from any compressed air supply system which may be required for the water supply system.

(2) Air lines and valves shall be sized for air pressures up to 150 psig.

(3) Any use of pressurized air for the WCRS or a water raising system shall not impact the functionality of the air brake system under any scenario.

iv). Designs shall incorporate features to limit the amount of air consumed during flush cycles or leaks or failures within the system.

v). The toilet system shall automatically recover from loss of power (including interruptions of HEP and/or compressed air) without nuisance alarms.

c). Toilet Operation

i). A toilet flush cycle shall be initiated by the passenger by operating a touchless, ADA-compliant flush actuator, which shall be mounted on the wall, unobstructed by a raised toilet lid, and easily apparent to the passenger.

ii). Signal indicator lights may be provided for passenger information on system status and any delay in mechanical flushing action shall be supplemented with visual feedback of a flush request.

iii). Rinse water shall be sprayed into the toilet bowl during the flush cycle to adequately clean the bowl without allowing water to exit the bowl.

iv). The toilet waste shall be drawn by vacuum and / pressure from the toilet to the waste tank, for later discharge at a collection facility.

v). Filtering shall be provided to protect the pressure generating device from blockage due to waste debris, waste fluid or water.

vi). It is desired that the water consumption during the flush cycle be minimized.

vii). The toilet shall not flush if the waste tank is full, or if system logic determines that a complete flush cycle is not possible and shall protect against excessive air consumption created by unnecessary multiple flush requests or multiple flushes on cars with multiple toilet rooms.

viii). The flush control unit shall be approved by Amtrak during design review. **[CDRL 17-05]**

d). Toilet

i). All toilets shall be ADA-compliant, where applicable.

ii). The toilet shall be designed as a service-proven, self-contained unit with an elongated bowl, interchangeable between all car types.

iii). The shroud shall be coordinated with the toilet module design.

iv). The toilet shall be securely mounted to the restroom, using stainless steel or approved corrosion resistant mounting fasteners.

v). The toilet bowl shall be easy to maintain and clean.

vi). It shall be designed to prevent waste matter and mineral deposits from adhering and shall not rust or corrode.

vii). Bowl surfaces shall curve in a continuous fashion and shall be free of recesses and inaccessible areas.

viii). The sides of the bowl shall be steep and sloped toward the discharge to allow waste to accumulate for evacuation.

ix). To prevent downstream blockage of waste system piping, the bowl outlet shall be a smaller diameter than the piping to serve as the most restrictive point in the piping system.

x). Overflow protection shall be provided to prevent the bowl from flooding should the outlet be plugged.

xi). Rinse water shall be injected into the bowl with sufficient force and distribution to push all waste matter toward the bowl outlet and completely clean the bowl unless otherwise approved by Amtrak.

xii). The bowl shall be easily and completely cleaned with ordinary cleansing agents and tools.

xiii). The flush-drain valve shall be a self-contained unit which provides a zero-leakage seal at the bowl outlet after operation.

xiv). The toilet system shall be designed to retain a hermetic seal over the opening of the waste pipe when closed to prevent odors from entering the restroom.

xv). The valve design shall be self-cleaning and prevent waste material from being trapped in it.

xvi). The design shall survive closing on solid objects without damage.

xvii). Cutout valves shall be easily accessible, without tools, for operation en route from inside the car.

xviii). The toilet assembly and its components shall be mounted so as to be accessible and removable for service and maintenance.

xix). Special attention shall be given for ease of clearing foreign object clogs from the piping system, and additional piping cleanout ports with suitable maintenance access should be provided in the toilet to waste tank piping to facilitate rapid cleanout.

xx). A special design shall be installed in the toilet bowl that prevents larger objects from being flushed into the waste system. The specially designed large object preventer shall be thoroughly cleaned during each flushing cycle to prevent waste build up.

xxi). A special decal shall be installed clearly outlining that no trash can go in the toilet. Details on the decal to be discussed during design review.

e). Waste Tank Assembly

i). The waste tank assembly shall be designed as a self-contained unit. Waste tanks shall be located and designed to allow full accessibility for servicing, removal and replacement. Waste tanks shall incorporate lifting/supporting points for handling by maintenance personnel.

ii). The waste tank assembly shall be constructed to withstand debris damage.

iii). The waste tank shall be constructed of acid-resistant stainless steel.

iv). The tank design shall prevent sloshing during normal train operations but shall not impede normal tank drainage nor flushing operations and shall not retain excessive sludge deposits during operation.

v). The tank design shall allow all internal portions of the tank to be cleaned by maintenance personnel.

vi). Suitable interlocks shall be applied to prevent system operation when draining the waste tank. Waste tank drainage shall be readily possible from either side of the car, through a 4 in. diameter Amtrak standard Andrews 400A style quick-disconnect adapter. The 4" waste drain handle shall be ergonomic requiring less than 50 LBF to operate.

vii). The hose connection and any necessary valve handle to operate shall be easily accessible without the need to open any covers but shielded from debris damage.

viii). A hose connection to the adapter shall interface with the wayside servicing facility.

ix). Only one person shall be required to drain and service the waste tank from a single point outside of the car without needing to crawl under the equipment.

x). The drain connection arrangement shall minimize the amount of possible waste spillage when the drain hose is disconnected.

xi). All waste tank assembly exposed surfaces which are liable to waste spillage during servicing shall be sealed as water resistant and as nonporous as practical and shall be easily sanitized by Amtrak maintenance forces without damage.

xii). Storage tanks shall be designed so as not to allow accumulation or sediment or other debris, a flat bottom shall not be permitted.

xiii). The waste tank shall be heated to prevent freezing as well as all waste lines to the tank.

(1) During climate chamber testing, Contractor shall ensure that waste tank does not freeze in extreme ambient conditions.

f). Vent

i). The exhaust from any waste tank system device shall be routed to the top of the car or underside of the car, and designed to prevent passengers, both

inside and outside the car, from being exposed to objectionable odors from waste gases, or from odors being ingested by the car fresh air intakes.

ii). The Contractor shall also model behavior when the car is in motion as well as when adjacent cars are in motion. Air flow modeling shall be presented at Design Reviews for Amtrak review and approval.

iii). The Contractor shall design the ventilation system with a charcoal muffler filter arrangement that is easily changed every 3-6 months to further prevent odors from exiting the restroom.

g). Waste System Piping

i). All waste system piping shall be seamless acid-resistant stainless steel or approved alternative materials suitable for sewage service.

ii). All piping shall be installed with generous radius sweep bends and elbows to avoid blockages.

iii). Cleanout access ports shall be provided throughout the waste piping.

iv). The system shall be designed to facilitate the clearing of any line blockage.

v). All piping and tubing shall have a smooth interior finish.

vi). Any pneumatic system piping used shall comply with Chapter 19.

vii). All drain piping not connected to the WCRS shall be seamless stainless steel.

(1) This shall include the piping from all restroom sink drains, Cafe car sink drains, and coffee brewer drains and all other drains not handling human wastes.

(2) Such drains shall be piped using a suitable penetration through the car floor to discharge under the car, well clear of the track rails and adjacent undercar apparatus.

viii). All waste system drain piping shall be installed with positive gravity drainage slope, and have generous radius sweep bends and elbows to avoid blockages.

(1) The piping shall be designed to facilitate the clearing of any line blockage between the toilet and waste tank.

(2) Ice shall not be allowed to build up at the drain point.

(3) Kazoos or approved alternate shall be placed on all through floor gray water drains to prevent insect intrusion into the car.

17.5 Status Indicators

a). The status of the water and waste system, including the volume of water in the water tank, and the volume of waste collected in the waste tank, shall be

monitored continuously, and displayed on an indicator panel or screen inside the car. Water and waste tank fill levels shall be provided in no less than four even increments.

b). A separate system shall provide car level diagnostic status of the antifreeze protection heat tapes on the car when HEP is present and shall be accessible remotely.

c). The design of all status indicators shall be approved by Amtrak. **[CDRL 17-06]**

d). Water and waste tank fill levels shall also be displayed on the car exterior in close proximity to the water fill stations.

e). An OUT OF SERVICE indicator shall be located on the outside of each restroom, which shall indicate if the control system has determined the toilet to be out of service due to a full waste tank or other malfunction, or if the train crew has locked the restroom.

17.6 Waste System Controls

a). An Amtrak approved control system shall be supplied to provide proper control and maintenance diagnostics for the WCRS.

b). Design and materials shall comply with all applicable requirements of this specification.

c). The system shall be designed for the railroad passenger car environment and shall not be affected nor need to recycle itself due to interruptions of the HEP, trainline air pressure, en-route waste tank system servicing or other normal aspects of intercity train operation per this Specification.

d). All controls, switches and sensors shall be unaffected by the environment, and be maintenance free for a six-year period.

i). All diagnostic information for the waste system shall be available to the car diagnostic system and shall be available remotely.

ii). Each portion of the waste lines shall be monitored via the diagnostic system to identify clogs and the exact location of any clog in the system.

e). The Contractor during design review shall present for Amtrak approval a matrix of all normal, abnormal and fault conditions, and the water and waste system response to each condition. **[CDRL 17-07]**

f). All logic parameters shall be designed for ease of future adjustments and reprogramming by Amtrak, with complete software provided to Amtrak to make such adjustments.

g). All limit switches shall be environmentally sealed, nonadjustable, keyed to ensure proper installation and permanent setting, provided with one wiring configuration, color coded and labeled.

h). color coded and labeled.

17.7 Emergency Operation

a). As an option, the toilet system shall be designed for emergency service during extended loss of HEP and main reservoir trainline.

b). The toilet system must provide equivalent usage rate as specified in Section 17.1 for a minimum of 6 hrs.

c). At the start of the 6 hour emergency condition the train will be fully considered fully operational with all fluids on board, car batteries charged to 100% and main reservoir trainline pressure at 140 psi.

d). Lighting requirements for the toilet room space are to be controlled by the lighting supplier and emergency light requirements of Chapter 13.

e). Usage of load shedding such as disabling sub-systems, disconnecting water heaters, reduced flow or flushing speed etc., maybe proposed.

f). Local storage of power via integrated batteries is acceptable subject to Amtrak approval.

g). Batteries must meet all requirements of Chapter 15 and be replaceable.

h). Local storage of pneumatic pressure is preferred but an auxiliary compressor maybe proposed if its usage provides a better energy management and is subject to Amtrak approval.

i). Operation of emergency mode maybe key selectable such that a conductor must enable emergency mode operation, to be determined by Amtrak during the design review process.

j). Emergency toilet operation shall be provided for all ADA accessible spaces and a select number of additional units up to 100% of on-board toilets to be determined during design review process.

17.8 CDRLs

CDRL	Description	Due
CDRL 17-01	Documentation of FDA Compliance	Prior to system Qualification Testing
CDRL 17-02	FDA Approval of Water System Construction	30 days before IDR
CDRL 17-03	Details of Freeze Protection System	30 days before IDR
CDRL 17-04	FDA Approval of Toilet and Waste Retention System	30 days before IDR
CDRL 17-05	Flush Control Unit Details	30 days before IDR
CDRL 17-06	Status Indicator Designs	30 days before IDR
CDRL 17-07	Matrix of all Conditions (normal, abnormal and fault) and the Water and Waste System response.	30 days before IDR

* End of Chapter 17 *

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

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18. Emergency Equipment

Revision 2

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18.1 Overview

a). Each car shall be equipped with emergency equipment per the requirements of 49 CFR Part 239.101.a.(6) as well as outlined in this chapter.

b). Emergency equipment provided shall include fire extinguishers, pry bars, sledgehammers, first aid kits, chemiluminescent snap lights and seat-back passenger safety information cards.

c). One storage container for an Automated External Defibrillator (AED) shall be provided in each of the Café and the Diner cars. Final locations will be determined during the design review process.

18.2 General Requirements

a). Emergency equipment as provided shall meet all applicable regulations, standards and specifications.

b). Equipment provided shall be located and installed in a manner that facilitates identification and access of the emergency equipment when needed by passengers and crew members without the use of keys or tools, unless otherwise specified.

c). Emergency equipment shall be located as to be available to passengers in the range from the 5th percentile female to the 95th percentile male, and in accordance with applicable ADA regulations.

d). All emergency equipment shall be new and shall be qualified for use for a minimum of one year after delivery of the car.

e). Each car shall be shipped with a full complement of emergency equipment unless otherwise specified by Amtrak.

18.3 Emergency Equipment Lockers

a). General

i). An emergency equipment locker shall be provided on each car in a location approved by Amtrak.

ii). The location of the locker shall be in compliance with all applicable ADA requirements.

iii). The emergency equipment locker shall be recessed into the wall and shall have a clear polycarbonate hinged front panel, equipped with sealing provisions.

iv). The polycarbonate panel shall be mounted in an equipment locker door equipped with a non-lockable paddle latch, so crewmembers can access the emergency equipment without breaking the seal.

v). There shall be a light fixture located inside the equipment locker that will always be illuminated regardless of door position.

vi). Alternate emergency equipment locker designs can be submitted for approval by Amtrak.

vii). The locker shall be marked with emergency equipment signage that is compliant with Federal emergency signage standards and compatible with Amtrak standard signage per Amtrak Specification 697 for the safety equipment contained therein.

viii). All emergency signage shall be HPPL decals unless otherwise approved by Amtrak.

ix). At a minimum, the emergency equipment locker shall be designed to include emergency tools, a fire extinguisher, a first aid kit and snap lights.

x). The equipment shall be securely attached to the interior of the locker and shall not be loose nor rattle within the locker but shall be easily removed in the event of an emergency.

b). Emergency Tools

i). Each emergency equipment locker shall include the following emergency tools:

(1) A 6 lbs. sledgehammer with an 18 in. handle

(2) An 18 in. pry bar

ii). The tools shall be installed in a manner that will prevent vibration and rattling and be readily available for emergency use.

iii). The Contractor shall incorporate the same tools currently in use by Amtrak. Vendors and part numbers shall be provided during Design Review.

c). Fire Extinguisher

i). The fire extinguisher shall be securely mounted in a manner that will prevent vibration and rattling and allow its prompt removal in case of fire.

(1) The installation shall conform to the requirements of NFPA Specification No. 10.

(2) The fire extinguisher shall be clearly marked with instructions in accordance with NFPA Specification No. 10.

(3) The extinguisher shall be installed so that the pressure gauge can be easily seen for inspection without opening the locker cover.

ii). A dry-chemical, 10-pound fire extinguisher, UL rated 2A-40 type B/C shall be included in the emergency equipment locker of each car.

iii). A dry-chemical, 2.5 lbs. fire extinguisher, UL rated 1A-10 type B/C shall also be included in the food service cars. See Chapter 16.

iv). Fire extinguishers shall have all required certifications prior to shipment of the car and be within their current annual inspection date.

v). The Contractor shall incorporate the fire extinguishers currently in use by Amtrak. Vendors and part numbers shall be provided during Design Review.

d). First Aid Kit

i). A first aid kit, compliant with the requirements of 49 CFR Part 239.101a.(6).(ii), Pac-Kit model 6311AMT or approved equal, shall be included in the emergency equipment locker.

ii). First aid kits, identical to those specified above, shall be located in the emergency equipment locker, and in the cafe area of the Cafe cars (see Chapter 16).

iii). The Contractor shall incorporate the first aid kit currently in use by Amtrak. Vendors and part numbers shall be provided during Design Review.

e). Snap Lights

i). Each emergency equipment locker shall include one package (quantity of 10) of 6 in. yellow 12-hour chemiluminescent snap-lights, Cyalume model 9-01360 or approved equal.

ii). Snap lights shall also be provided in the Food service car.

iii). The Contractor shall incorporate the snap lights currently in use by Amtrak. Vendors and part numbers shall be provided during Design Review.

iv). Appropriate storage should be provided assuming snap lights are delivered in a loose plastic bag.

f). Trauma Kits/Stretchers

i). The Contractor shall provide one (1) trauma kit and one (1) stretcher in each Café car and each Diner car, in accordance with Transport Canada “Railway Passengers Car Inspection and Safety Rules” Section 21.5.

ii). A dedicated storage location for these items shall be provided.

iii). Location of the trauma kits/stretchers will be reviewed and approved during Design Review.

iv). The Contractor shall incorporate trauma kits and stretchers currently in use by Amtrak. Vendors and part numbers shall be provided during Design Review.

18.4 Automated External Defibrillator (AED)

a). One storage container for an Amtrak-provided Automated External Defibrillator (AED) shall be provided in each of the Café and the Diner cars that is accessible to everyone, in accordance with Amtrak AED installation specification.

i). The container shall be a minimum of 9 in. wide by 20.5 in. deep and shall provide no less than 19 in. of vertical storage clearance.

ii). If the AED is to be lifted vertically out of the holder, a minimum clearance of 24 in. must be provided above the top of the holder.

iii). The containers shall securely retain the AED under all car accelerations. Appropriate signage shall identify the locations of the AED units.

b). Details of location and installation of the defibrillator shall be submitted for Amtrak review and approval. **[CDRL 18-01]**

18.5 Seat-Back Safety Information Card

a). The Contractor shall develop the artwork for a passenger seat-back safety information card illustrating the type, location and use of all safety features, emergency equipment, emergency signage and emergency exit pathways for each car type.

b). Only a single safety information card shall be provided, which shall adequately describe all car types in a possible consist.

c). This safety card shall be designed in the format of Amtrak's "Passenger Safety Instructions" and shall include a clear Braille overlay.

i). Artwork is to be provided for Amtrak review and approval.

d). Electronic artwork, suitable for printing, shall be provided to Amtrak prior to the delivery of the first batch of cars. **[CDRL 18-02]**

e). The Contractor shall be responsible for the printing and delivery of the first 10,000 copies of the seat-back safety card prior to the delivery of the first batch of cars.

f). Seat-back safety cards shall be shipped to a location to be determined by Amtrak.

g). Seat back safety cards are required for all potentially occupied seating locations in each car.

h). Additionally, a dedicated seat back safety card holder shall be included at each seating location. This must be different than the main passenger storage area.

i). In the event of interference with assemblies such as workstation tables, alternate holder locations and designs shall be the responsibility of the Contractor.

j). The holder design for all locations should be identical unless approved by Amtrak.

18.6 CDRLs

CDRL	Description	Due
CDRL 18-01	AED Location and Installation Details	During PDR
CDRL 18-02	Seat-Back Safety Card Electronic Artwork	30 days prior to PDR

* End of Chapter 18 *

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

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19. Materials and Workmanship

Revision 2

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19.1 Overview

a). This Chapter defines the requirements for materials and workmanship that shall apply to the design and manufacture of systems and subsystems for assembly into Amtrak's passenger vehicles.

b). This Chapter shall apply to all phases of the project.

c). It shall be the responsibility of the Contractor to inform its suppliers of the requirements of this Chapter as well as enforce them.

19.2 Sustainability

a). The Contractor shall consider environmental responsibility throughout the performance of this contract.

b). By emphasizing sustainable measures and materials, the goal is to minimize the overall environmental impact, surpassing standard alternatives and contributing to a more resilient and eco-friendly future.

c). When selecting materials, the Contractor shall evaluate and prioritize materials with lower environmental footprints, considering factors such as resource extraction, production processes, and end-of-life recyclability. The Contractor shall prioritize the use of renewable and recycled materials over non-renewable alternatives wherever feasible.

d). The Contractor shall consider throughout the design review process initiatives to optimize energy usage throughout the project's lifecycle, from construction and operation to decommissioning.

19.3 General Requirements

a). Applicability

i). This Chapter defines the requirements for all material and workmanship which shall apply to the design and manufacture of the vehicles, and all systems, subsystems and components contained therein, that are to be built to this specification.

ii). All materials and methods of assembly shall be in conformance with the applicable requirements of this Chapter, and all applicable standards, specifications, and references.

(1) Those references, standards and specifications listed constitute a partial listing; the Contractor shall be responsible for identifying and complying with all applicable regulations, industry standards and material specifications whether listed herein or not.

(2) The revision of these references that are current at time of issuance of Notice To Proceed (NTP) shall apply unless a specific revision of a given specification or standard is referenced.

b). Marking and Storage

i). All materials intended for use on these vehicles shall be marked or stored so as to be readily identifiable and shall be adequately protected during handling and storage.

ii). All stored material subject to corrosion shall be protected by waterproof covers, coatings or packaging. Equipment covers, cable entrances and openings shall be closed to prevent ingress of water or dirt.

iii). All dated material shall have the expiration date clearly marked. Expired material or material expiring within one year of car acceptance shall not be used.

iv). Material or components which require maintenance during storage shall be properly maintained per the component(s) manufacturer's instructions. The Contractor shall document such maintenance, and provide these records as requested by Amtrak.

v). Rejected material shall be clearly marked and stored in an area specifically designated for that purpose.

vi). Carshells stored outside shall have open cavities covered to prevent water and dirt ingress. Covers should be inspected weekly to check for damage.

c). Prohibited Materials

i). The following materials shall not be used in the construction of the vehicle:

(1) Polyvinyl Chloride (PVC)

(2) Asbestos

(3) Cadmium (except for batteries) and cadmium plating

(4) Lead (excluding solder used on safety-critical electronics or in brake shoes)

(5) Butyl Products

(6) Urethane foam

(7) Carcinogenic materials as listed by current publication of the American Conference of Governmental Industrial Hygienists (ACGIH):

(a) Where there are materials that contain trace amounts of carcinogenic substances, they shall be clearly identified in the Safety Data Sheet.

(b) Exposure to classifications A1, A2, and A3 carcinogens shall be carefully controlled to levels as low as possible below the TLV (Threshold Limit Value) set by the ACGIH.

(8) Materials in the List of Highly Hazardous Chemicals, Toxics and Reactives, 29 CFR 1910.19, Appendix A.

(9) Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs)

(10) Materials that, in their normal installed state, emit products that are known to be toxic or irritants.

(11) Magnets, unless approved by Amtrak. Magnets for transformers and proximity switches that do not exceed IEC 60601-2-23 are acceptable.

d). Material Reporting Requirements

i). Whenever a commercial material is not covered by a specification or standard, the Contractor shall identify the material by the commercial trademark, name and address of the Supplier. The Contractor shall submit a description and the technical data specifications of the material composition along with independent laboratory test results of material being tested per 49 CFR Part 238 requirements for approval at the intermediate design review. **[CDRL 19-01]**

ii). The Contractor shall keep on file Safety Data Sheets (SDSs) for all chemical materials (paints, solvents, adhesives, lubricants, etc.) used in the manufacture, maintenance, operation or repair of the vehicles, and shall provide a copy of each SDS in the appropriate maintenance manual. SDSs shall comply with 29 CFR Section 1910.1200 (g).

iii). The Contractor shall maintain records that trace all materials to their manufacturers and production specifications and methodologies.

(1) The Contractor shall propose a digital material passport for all materials to track data involved in its life cycle and can facilitate data mining in supply management during the production process.

19.4 Joining and Fastening

a). General

i). Certain combinations of materials require particular care in joining to avoid the possibility of corrosion. Isolating and moisture-proofing materials, appropriate to the materials being joined, shall be used at all times where these combinations exist.

ii). The Contractor shall submit joining and fastening data, specifications and standards for all types and methods of fastening and joining used to Amtrak for review and approval at the design review. **[CDRL 19-02]**

iii). All hinges shall be stainless and piano hinge style.

(1) The use of any other hinge must be submitted to Amtrak for review and approval on a case-by-case basis.

iv). The Contractor shall submit to Amtrak a dissimilar metals report, identifying all locations where dissimilar metals, or metals and wood are joined, and describing the methods used for mitigating galvanic or chemical corrosion at those locations. Merely treating a surface with primer, anodization, or coating may not be acceptable if it is likely to be compromised during maintenance and handling over the life cycle of the equipment. These methods shall be subject to review and approval by Amtrak. **[CDRL 19-03]**

b). Joint Fitting

i). Joints shall be properly fitted, whether exposed or concealed. When not otherwise specified in drawings or specifications, materials between 0 and 0.5 inches of thickness shall have gaps between joints held to a dimension not greater than 10% of the thinner material being joined, or 0.002 in., whichever is greater. Materials with thickness greater than 0.5 inches shall be held to a maximum gap of 0.06 inches. Gaps shall be uniform in width. The edges of panels shall have a smooth, finished appearance.

ii). Where excessive gaps (greater than those permitted by approved drawings or standards) are found to exist at the faying surfaces of structural bolted or riveted connections, metal shims of the same material as that of the deficient part may be used, but only with the written permission of Amtrak. Shims, if used, shall be mechanically fastened to one of the base parts being joined. The use of epoxy or other plastic filler at such locations is prohibited.

iii). Cut-to-fit, match drilling, filing, and other hand-fitting practices are prohibited.

iv). Location and process for implementing seams must be submitted for approval.

v). All seaming plans must be submitted for Amtrak acceptance.

c). Metal-to-Metal Connections

i). Where metals contact each other, the contact surfaces shall be free of dirt, grease, rust and scale. Unless specified otherwise, the contact surfaces shall be coated with a metal-base primer that conforms to GSA Federal Standard TT-P-664D or alternate coating technology meeting or exceeding the applicable performance requirements noted in TT-P-664D. Metal primer may be omitted for like-stainless steel to like-stainless steel joints.

d). Wood-to-Metal Connections

i). Where wood and ferrous metal surfaces are placed together, except as bonded surfaces in plymetal, the exposed wood shall be coated with two coats of aluminum paint conforming to GSA Federal Standard TT-P-3E, that prevents moisture intrusion, and the metal shall be coated appropriately with an Amtrak approved primer that conforms to GSA Federal Standard TT-P-664D.

ii). Additionally, all bolts or rods passing through wood shall be coated with aluminum paint conforming to GSA Federal Standard TT-P-38E.

e). Wood-to-Wood Connections

i). Where wood and wood are placed together, both abutting surfaces shall be coated with two coats of aluminum paint conforming to GSA Federal Standard TT-P-38E that prevents moisture intrusion.

19.5 Fasteners

a). General

i). The Contractor and all suppliers are responsible for selecting fastener types, sizes, styles, lengths, materials, grades and finishes that will meet the requirements of this Specification. The Contractor shall minimize the number of different sizes and styles of fasteners used. Whenever a maintenance process requires the removal or application of a fastener, consideration shall be given to the ease of access to such fasteners.

ii). Fasteners used throughout the vehicle shall be metric fasteners. All fasteners used on the vehicle shall be specified under one of three categories: electrical and electronic; structural and safety-related; or decorative.

iii). Safety-related fasteners include, but are not limited to, those applied to trucks, bolsters, brake equipment attachment, couplers and attachment of interior components or other fasteners as identified by Amtrak. A fastener is safety related if a single fastener failure will create an unsafe condition.

iv). The following are prohibited:

(1) Self-tapping and self-drilling screws, Velcro/dual lock and double-sided tape shall not be used without approval by Amtrak.

(2) Protruding screws, mounting bolts, or similar items on the vehicle interior or exterior, except for those appointments that cannot be built into the structure in any other manner.

(3) Tapped holes in structure, brackets, and other vehicle assemblies. Tapping plates shall be used when installing fasteners into vehicle structure or subassemblies.

(4) Fasteners installed into blind holes, unless specifically approved by Amtrak.

(5) Use of elastic stop nuts for electrical connections.

(6) Self-adjusting compression latches.

b). Threaded Fasteners

i). If approved by Amtrak, all inch-standard threaded fasteners shall dimensionally conform to ANSI Standard B1.1 or Industrial Fasteners Institute Fastener Standards. All approved inch-standard threaded fasteners shall conform to SAE J429 and J995, or ASTM F593 and ASTM F594 for both material and strength.

ii). Prevailing-torque type locknuts shall be nylon insert type, ESNA or approved equivalent, conforming to IFI Fastener Standards or NASM21044. Distorted thread locknuts shall only be used where the locknut may be exposed to temperatures above 200°F.

iii). When making connections to heat producing apparatus, thermal expansion of the components shall be taken into consideration for selection of fastener materials. If the joined components are high expansion alloys such as copper or austenitic stainless steel, austenitic stainless-steel fasteners shall be used. If the joined components are low expansion materials such as carbon steel or ferritic stainless steel, zinc plated carbon steel fasteners of minimum Grade 5 shall be used.

iv). All screws or bolts used to secure access panels to the interior, undercar, or roof equipment shall be made captive to the panel in which they are used.

v). When bolts are used to secure apparatus where the bolt head is not accessible, a reusable mechanical locking device shall be used to prevent the bolt head from turning when the nut is being turned. Threaded inserts shall not be permitted without prior written Amtrak approval.

vi). At least 1.5 screw threads shall be visible beyond all nuts. When used without elastic stop nuts, bolts shall not project more than 1.5 threads plus 0.25 in. for bolts 0.25 in. diameter or less and shall not project more than 8 threads for larger diameter bolts. With elastic lock nuts, bolt threads shall not project more than 0.25 in., regardless of bolt size.

c). Metric Fasteners

i). Metric fasteners shall be utilized on all components and assemblies in all cars. All components, control groups, or individual units that are supplied by a supplier or sub-supplier to the Contractor, shall be supplied with metric fasteners conforming dimensionally to ANSI B1.13M (ISO-metric) Standards. Metric fastener material and strength shall conform to ISO 898-1 and 898-2 or ISO 3506-1 and 3506-2. All internal fasteners and threaded components of the approved assembly shall have ISO-metric threads. Internally, there shall be no mixing of metric and inch threaded fasteners. Replacement, repair or maintenance parts supplied under this Specification shall contain all necessary replacement fasteners of the correct size and grade.

ii). Metric fasteners shall be marked as required in *Metric Fastener Standards*, Industrial Fasteners Institute, latest edition.

d). Structural Fasteners

i). All structural fasteners shall have documentation identifying manufacturer and purchase specifications available for examination by Amtrak at the Contractor's Quality Assurance (QA) department. This documentation shall include the fastener material or grade and finish including plating material and specifications, when applicable. Whether the purchaser is a subcontractor, supplier or the Contractor, the Contractor shall obtain and hold this documentation for a period of not less than the expiration of the warranty period of the last vehicle accepted.

ii). All safety-related fasteners shall either: a) be manufactured, tested, and distributed in accordance with ASME Standard B18.18.3M, including the requirements of ASME accreditation or b) have a representative sample of each production lot of fasteners tested for conformance to purchase specifications by an independent laboratory accredited by the American Association of Laboratory Accreditation (A2LA), or approved equivalent. A production lot is defined as one size of fastener, from one manufacturer, and produced during one continuous production run. Fasteners not meeting this definition of production lot shall be treated as separate lots. Testing shall be performed using sample quantities as proposed by the Contractor and approved by Amtrak. Tests conducted shall confirm that fastener material meets specified chemistry, strength and manufacturing method requirements. The purchaser shall obtain certified test results from the testing laboratory and the Contractor shall obtain and hold the documents for a period of not less than the expiration of the warranty period of the last vehicle accepted.

iii). All structural or safety-related fasteners that have been subjected to processes introducing the risk of hydrogen-embrittlement must have certification of hydrogen-embrittlement testing. The certification must be based on a representative sample of actual production fasteners that have been tested for hydrogen embrittlement following SAE USCAR 7 procedures. The plating process must be certified to ASTM F519 procedures. An ASTM F606/F606M wedge test sample may be used in place of the ASTM F519 standard samples. Test loads must be a minimum of either proof load or 80% of ultimate tensile strength and held for a minimum of 168 hours. If any failures occur the entire lot shall be rejected.

iv). All structural bolts, nuts and washers for undercar equipment shall be a minimum Grade 8 and the bolt diameter shall be no less than 0.375 in., regardless of design load. Stronger fasteners shall be used if the application requires. The mounting and attachment bolts for undercar mounted equipment and equipment support structures or brackets shall be sized to the design strengths required plus an appropriate safety factor. Undercar mounted equipment shall be supported by brackets or other structures whenever possible. Bolts or screws used for structural connections shall have full size bodies in areas subject to bearing and/or shear loads.

v). Drawings containing all dimensions, standards, plating and any other requirements for the fastener shall be provided for all structural or safety-related fasteners. For fasteners of similar design with the same properties a schedule drawing showing each part number, and its specific requirements

maybe provided. Drawings for structural or safety-related fasteners shall be provided prior to delivery of the first cars to Amtrak.

e). Decorative and Appearance Fasteners

i). All interior fasteners exposed to view shall be limited whenever possible and be either bright or finished to match the surfaces being joined and installed such that the fastener head is flush with the mating surface. The fastener head shall be tamper-proof. Bright finished fasteners used for stanchions shall be austenitic stainless steel. Bright finished interior fasteners may be either austenitic or plated martensitic stainless steel. Type A sheet metal screws shall not be used. Amtrak reserves the right to approve all exposed fasteners in the customers view.

ii). All exterior fasteners visible to passengers shall be austenitic stainless steel for steel, High Strength, Low Alloy (HSLA) steel and stainless-steel car bodies. Exterior aluminum shall be joined by austenitic stainless steel or aluminum alloy fasteners, as appropriate to the design and appearance requirements. Fasteners used on the side sill to attach heavy equipment brackets shall be considered structural fasteners.

iii). All fasteners used to secure access covers or panels to equipment boxes or interior panels shall be made captive to the panel in which they are used. Where access for service is expected more often than every five years, access panels shall be equipped with stainless steel draw-down latches. Quarter- turn fasteners shall have a minimum shank diameter of 0.25 in. and be of adequate strength.

iv). All decorative and appearance fasteners shall have documentation that identifies the manufacturer, base material, plating or finish if applied and the fastener type. The Contractor or supplier shall maintain this documentation on file for Amtrak to review for a period of not less than the expiration of the warranty period of the last vehicle accepted.

f). Torquing

i). All safety-related fasteners, including truck and brake equipment bolts and all fasteners exposed to fatigue loads, shall be torqued to industry standard torque values for the size and grade of fastener and "torque striped" after torquing by paint or other approved means. All other fasteners shall be torqued to a value appropriate to the application, so that they do not loosen in service.

g). Washers and Lock Washers

i). Appropriate grade flat washers, conforming to ASME B18.21.1 or ASME B18.22M, shall be used under the heads of all bolts and under all nuts where enlarged holes, slotted holes or soft mating metals are being fastened.

Where high strength fasteners are applied, flat washers shall be hardened and comply with ASTM F436/F436M.

ii). Helical lock washers shall not be used. If applicable, prevailing torque nuts or standard nuts with the use of appropriate Loctite or equal thread locking compound shall be used for these applications.

iii). Other types of washers, including Belleville, NORD-Lock, or Nomel washers, may only be used for special applications with Amtrak's approval.

h). Rivets and Lock Pins

i). Rivets and lock pins exposed to passengers or crew shall be austenitic stainless steel or aluminum, as appropriate to the materials being joined. Structural steel rivets shall conform to ASTM A502-03 or ANSI B18.1.2 Standards. Rivets may be hand driven when hot and shall completely fill the rivet holes. Rivets driven cold shall be mechanically driven. Exposed heads shall be concentric with the shank and free from rings, fins, pits and burrs.

ii). Swage-locking (Huck bolt type) fasteners shall conform to Military Specification MIL-P-23469/1B. All rough surfaces of the collar end of these fasteners shall be machined or ground smooth where accessible to passengers, crew or maintenance personnel.

i). Plating of Fasteners

i). All carbon, alloy and martensitic steel fasteners shall be plated with zinc with clear or yellow chromate finish, unless specifically waived by Amtrak.

ii). Zinc plating shall conform to ASTM B633-07, Type VI, Hexavalent Chromium Free.

iii). Requests for alternative coatings must be submitted to Amtrak for review and approval.

iv). The Contractor shall submit qualification results for each process used at each subcontractor applying the proposed coating, as noted below.

v). Any request for alternative coating shall, as a minimum, include:

(1) coating manufacturer's product data including required thickness,

(2) ASTM B117 test results from an accredited third-party laboratory,

(3) documentation of torque/tension characteristics, and

(4) supporting documentation from the coating manufacturer regarding the propensity for the coating process to cause hydrogen embrittlement of the fastener during coating.

vi). Regardless of the coating's propensity for hydrogen embrittlement, each lot of high strength fasteners, including OEM zinc or yellow chromate plated bolts (Grade 5 or Metric Grade 8.8 or higher) shall be tested for hydrogen

embrittlement. Each lot of lower strength fasteners shall be tested for hydrogen embrittlement if the coating has the possibility of causing hydrogen embrittlement. If the proposed coating results in a change in the K-value for the plated fastener to outside the range of 0.13-0.15, as defined by Industrial Fasteners Institute Standard IFI-543, the Contractor shall use the alternate coating on all fasteners within the particular LRU. The LRU shall contain an indelible label identifying the coating type used within the LRU and the required torque values for each size fastener used therein. Fasteners internal to a subcomponent within an LRU may use the standard coating system if they are not subject to removal during Amtrak's maintenance activities. Alternative coatings shall not be used unless specifically approved by the Project Manager.

j). Bolt Holes

i). All bolt holes shall be accurately located and aligned, and when necessary, during assembly, holes may be reamed round to a specified size in position, as approved by Amtrak. Bolt hole clearances shall not exceed the Industrial Fasteners Institute's requirements. Slotted hole size for length, width, and edge distance should follow industry standards.

19.6 Stainless Steel

a). General

i). Contractor shall provide structural stainless steel that complies with the following requirements:

(1) Austenitic stainless steel shall meet the Certification Provisions of ASTM A666.

(a) Structural applications: Contractor shall test for susceptibility to intergranular corrosion in accordance with ASTM A262:

(i) Practice A: Shall be used to accept material only.

(ii) Practice E: Required for final determination of acceptance or rejection of material that is not acceptable by Practice A.

(2) Any connected or abutting visible metal parts will be of a matching metal (aluminum or stainless steel) in single grade and should match in color and finish, unless specifically called for to be contrasting in the specification.

(3) Sustainability

(a) As stainless steel is one of the most predominately materials over the car body the upmost efforts must be main to ensure sustainable sourcing.

(b) The stainless-steel supplier shall optimize the use of green energy and maximize the percentage of recycled material while maintaining all material composition and strength requirements.

(4) Duplex stainless steel may be used only with specific Amtrak approval:

(a) General requirements:

(i) As per ASTM A480/A480M

(ii) When CVN impact tested, based on lots, shall have minimum absorbed energy of 27 J (20 ft-lb) at -29 C (-20 F)

(b) Structural applications:

(i) Test for susceptibility to intergranular corrosion in accordance with ASTM A923:

1. Practice A: Use to accept material only.

2. Practice C: Required for final determination of acceptance or rejection of material that is not acceptable by Practice A.

(ii) Where duplex stainless steels are welded to other structural steels, paint the less-noble steel with weld-through primer.

(5) Structural components assembled by fusion or resistance welding:

(a) Specification and composition of austenitic stainless steel shall conform to:

(i) AISI type 201L, 301L, 301LN or SUS301L (with Nitrogen), 316L

(ii) ASTM A666 requirements, except that the carbon content shall not exceed 0.03% and type 301LN and SUS301L (with Nitrogen) shall not exceed 0.25% nitrogen.

(b) Austenitic Stainless steel used in structural applications covered by the Specifications shall also conform to APTA PR-CS-S-004-98.

(6) Other stainless steels conforming to ASTM A666 are acceptable for non-welded applications.

(7) Use:

(a) Contractor shall comply with uses as permitted throughout the Specifications.

(b) Austenitic and duplex stainless steels may be unpainted.

(c) Unpainted austenitic or duplex stainless steels exposed to passengers shall be a single grade in which both the color and surface finish of abutting pieces shall match, except where the design specifically calls for contrasting appearance.

b). Testing

i). Tensile strength shall be determined with a testing machine having a maximum head speed of one-half inch per minute. The bend test shall be made with the axis of the bend parallel to the direction of rolling; after bending, no cracks shall be visible to the naked eye. Gauge (thickness) tolerances of materials shall be in accordance with standard industrial tolerances.

c). Flatness Tolerance

i). Coil stock shall meet standard mill flatness tolerances, unless otherwise specified. Sheet stock shall be of stretcher-leveled quality. The camber of the sheet stock shall not exceed 0.25 in. in 8 ft.

d). Finishing Methods

i). Unless otherwise specified, all smooth surfaces exposed to passengers shall be given a medium-grit finish on the exposed side. Grain shall be in a direction to suit the decorative treatment in the interior of the car and shall be specified on the component drawings. Alternate finishes shall be submitted to Amtrak for approval.

ii). 120-180 grit finish on interior and exterior surfaces (#4 Brushed Finish), 30 Ra µin MAX.

e). Surface Treatment

i). All stainless-steel portions which contribute to the car aesthetics such as car shell or interior fittings shall be treated with a nitric or citric acid passivation bath.

(1) Passivation medium, concentration level and duration of treatment, as well as the rationale for selection, shall be proposed by the Contractor for review and approval by Amtrak. **[CDRL 19-04]**

(2) Waivers from passivation may be granted on a case-by-case basis excepting carshell components which cannot be exempted from passivation.

ii). Stainless steel shall be cleaned in accordance with American Society for Testing and Materials (ASTM) A380. Post passivation testing shall be

performed in accordance with ASTM A967. Test results, as well as visual approval of the aesthetics of the FAI pieces, shall be subject to Amtrak review and acceptance. The approved FAI piece shall form the basis of pass-fail acceptance criteria of all future vehicles.

19.7 High-Strength Low-Alloy (HSLA) Steel

a). General

i). HSLA steels shall be more than twice as corrosion resistant to atmospheric exposure as plain carbon steels, as measured by the ASTM G101 corrosion index. It is preferred that HSLA steels used for welded structure meet specified weld- and heat-affected zone toughness requirements without post-weld heat treatment or heat-generated stress relief. As a minimum, HSLA steels shall conform to ASTM A572, ASTM A588, ASTM A606 - Type 4, ASTM A1008 or A1011- Grade A or 70 or ASTM A710, Grade A, Class III.

ii). Exposed sheet steel shall have a smooth surface free from pitting. Mill test reports for each heat of steel used in the construction of these vehicles shall be retained on file by the Contractor, shall be available for inspection by Amtrak upon request and shall be submitted with the vehicle history book.

iii). Heat treated parts made of HSLA steel shall be certified. A record of this certification, including hardness test results, shall also be retained on file and available for inspection by Amtrak upon request.

19.8 Steel Castings

a). General

i). The Contractor shall be responsible for selecting casting grade, composition, strength, heat treatment, finishing, and design best suited for the intended application. As a minimum, steel castings for structural use, including cast-weld designs for truck frames and bolsters, shall comply with AAR M-201 Grade B plus 2% Nickel, with the following mechanical properties:

(1) Minimum tensile strength: 75 ksi (517 MPa)

(2) Minimum yield strength: 48 ksi (331 MPa)

(3) Elongation: Minimum 25% in 2 inches

(4) Reduction of area: Minimum 50%

ii). Design and testing of truck bolsters and side frames shall comply with AAR M-202 and AAR M-203, respectively. Cast steel to ASTM A27/A27M, grade 65-35, may be used for truck structure, bolster and center bearing arrangements as an alternative to the AAR M-201 material specified above.

iii). Coupler, drawbars, and anchors shall comply with AAR M-201, Grade "C", quenched and tempered.

iv). Pattern markings and serial numbers shall be applied in a manner that does not impair the casting strength. If castings are found to be non-conforming to requirements determined by the design qualification castings, the material shall be repaired, retested, and re-inspected or destroyed at the Contractor's expense.

v). Qualification Test: The quality of steel castings shall be checked in accordance with the requirements of AAR M-201. The contractor shall perform a Qualification Test on one casting, selected by Amtrak, from the first lot of production castings to verify the casting design. The Contractor shall have radiographic testing performed per ASTM E94 or E1030 using reference radiographs from ASTM E446- or E186, as may be applicable. The radiographic sensitivity shall be at least 2% (2- 2T) for sections >3/4 in. thick and (2-4T) for sections ≤3/4". Acceptance levels for the radiographic testing shall be submitted to Amtrak for review and approval. The surface quality of the steel castings shall be evaluated in accordance with ASTM A 802/802M. Radiographs resulting from the Qualification Test shall be made available to Amtrak for review.

vi). Welding: All weld repairs shall be qualified in accordance with the requirements of AWS D15.1 or ASTM A488/A488M. When castings are found to be unacceptable, they shall be repaired in the original factory of manufacture prior to shipment or by another repair process approved by Amtrak. Castings requiring repair or modification by welding after completion of heat treatment may be stress relieved locally by using electrically controlled heating to not greater than 1,150°F, followed by slow cooling. Manual torch stress relief shall not be permitted. For cast-weld designs, the entire length of all welds on any welded assembly of several separate castings selected for design qualification shall be radiographically inspected to ASTM E94/E94M using reference radiographs from ASTM E390.

vii). The Contractor shall prove the quality of castings by either destructive or 100% radiographic inspection. Following the establishment of a satisfactory procedure, quality control shall be maintained by testing one or more of each lot at a frequency to be determined by Amtrak, the Contractor and the subcontractor. This frequency shall be influenced by the critical requirements of the part.

viii). Steel castings used in locations not specifically referred to shall be selected by the Contractor or its subcontractor for composition and characteristics best suited to the application but shall be subject to review by Amtrak.

b). Heat Treating

i). Where physical strength is gained by heat treating, a physical test shall be conducted on each treating charge of each heat of castings. Where more than one heat is represented in a treating charge, a physical test shall be conducted on each heat represented in each treating charge.

ii). All steel castings used in the truck structure shall be made of electric furnace or controlled open hearth steel and shall be heat treated.

19.9 Aluminum

a). General

i). Aluminum alloy mill products shall be identified by designations prescribed by The Aluminum Association and shall conform to specifications contained in the Association's publication *Aluminum Standards and Data*. Aluminum alloy castings shall only be used for trim and for door thresholds. Such castings shall conform to ASTM B26, B85 or B108 for, respectively, sand, die or permanent mold castings. Aluminum alloy forgings shall conform to ASTM B247-02a. Copies of all test reports for sheet, extrusions, and forgings used shall be retained on file by the Contractor, shall be available for inspection by Amtrak upon request and shall be submitted with the vehicle history book.

ii). Unpainted aluminum used for interior surfaces exposed to contact by passengers and the crew shall have anodic coating, with a minimum coating thickness of 0.0004 in. and a minimum coating weight of 21 milligrams per square inch (mg/sq. in.) to protect the material.

(1) Color and coating type shall implement the Customer Experience Vision and CMF requirements of the contract and shall be subject to Amtrak approval.

(2) Scratched or damaged anodized aluminum components may not be repaired and delivered to Amtrak as part of the assembly.

iii). All aluminum surfaces of the car body, including not only surfaces in contact with dissimilar metals but also surfaces in contact with aluminum and surfaces not in contact with any materials at all, but excluding exterior uncolored surfaces, shall be cleaned and given one coat of zinc chromate primer or approved-equivalent.

iv). Aluminum used for heat sinks shall be nickel plated to minimize contact corrosion and surface pitting.

v). All interior Aluminum components, trims, and finishes shall utilize 100% recycled Aluminum wherever possible. Where virgin grades are required, production must incorporate the use of renewable energy.

b). Fabrication and Fastening

i). The forming of aluminum parts, their joining by bolting, riveting, and welding, and the protection of contact surfaces shall conform to the requirements of the Aluminum Company of America's (ALCOA) Technical Report Number 524 Specification Covering Use of Aluminum in Passenger Carrying Railway Vehicles, except as specified otherwise.

ii). The specific measures to be taken to prevent risk of contact and resultant possible electrolytic corrosion shall depend upon determination of the most suitable method which shall be adapted to the design involved, and the

following instructions are provided for general guidance. These instructions shall not supersede recommendations of the aluminum manufacturer.

iii). Aluminum alloy surfaces shall not be secured to, nor make direct metal-to-metal contact with, the surfaces of copper, brass, bronze, silver, nickel and nickel-plated parts or alloys thereof, lead, tin and ferrous materials. The surfaces of aluminum alloy parts secured to steel parts shall be protected with a one-part polysulfide sealant, zinc chromate paste, silicone sealant or Amtrak approved equal used as the joint compound. Alternatively, an insulating material shall be non-hygroscopic and, if fibrous, shall be impregnated with bitumen or other water-repellent substance.

iv). Wood shall not be placed in contact with aluminum alloy except with written permission from Amtrak.

v). Some form of surface covering, or insulation shall be provided for all bolts, rivets, securing clips and devices to prevent contact with the aluminum alloy, if the bolt or other device does not also consist of a compatible aluminum alloy. Stainless steel and carbon steel fasteners, including washers and nuts, plated in accordance with provisions of this Specification, shall be coated with a protective non-chromate paste before installation. Where possible, only the head and unthreaded portion of the shank of the bolt shall be in contact with the aluminum part when secured in place. Suitable bushings may be used in place of the protective non-chromate paste. Rivets driven hot shall be covered by a protective oxide coating due to the heating; but the method of riveting shall, if possible, always be with the formed rivet head in contact with the aluminum alloy.

c). Gauge

i). Aluminum sheet gauge size shall be in accordance with the American or Browne and Sharp Standard Gauge.

19.10 Elastomers

a). General

i). All elastomeric parts shall be of neoprene, or approved equal, unless otherwise specified. The elastomer shall be compounded and cured to perform satisfactorily in the temperature range specified. The elastomers shall have high resistance to ultraviolet and other solar radiation, weather, all Amtrak car washing fluids, and the longest possible life consistent with other specified characteristics. All elastomeric parts shall be resistant to ozone, oxidation, heat, oil, grease and acid.

ii). All resilient mounts shall be of natural rubber. Synthetic rubber compounds may be substituted for natural rubber only when approved for a specific application.

iii). All elastomeric parts are to be marked with the date of manufacture and shall not have aged more than 12 months when assembled into the vehicle.

b). Tests

i). All tests shall be conducted according to the latest revisions of the specified ASTM test procedures, unless otherwise specified. All resilient, natural rubber mounts and elastomeric truck suspension components shall be tested in accordance with the performance requirements for the following and must be provided by the manufacturer: ASTM D2240-05, ASTM D412-06ae2, ASTM D1149-07, ASTM D573, ASTM D395-03.

ii). (Method B), ASTM D624-00 (die C) and ASTM D746-07. All joints shall be vulcanized. The durometer hardness shall be suitable for the construction and conditions specified.

iii). Unless otherwise agreed by the Contractor:

(1) ASTM D412-06ae2 tensile strength shall be 1500 psi (min.)

(2) ASTM D412-06ae2 elongation for sheet material shall be 300% (min.)

(3) ASTM D412-06ae2 elongation for extruded material shall be 275% (min.)

(4) ASTM D573 loss in tensile strength shall be 15% (max.) when subjected to 168 hours at 158°F.

(5) ASTM D1149-07 shall have no cracks when subjected at 100 parts per hundred million (pphm) at 104°F for 100 hours and a specimen elongation of 20%.

iv). The test specimens shall be cut out from the extruded material, and at least one tensile strength and elongation test and one accelerated aging test shall be made on the material used for each order. If the compound or cure, or both, are changed during the production of material for one order, at least one test of each type shall be made for each different batch.

v). The ozone resistance of the elastomer shall be tested in accordance with ASTM Standard D1149 using an ozone concentration of 100 ppm, an exposure time of 100 hours at 100°F, and a specimen elongation of 20%. The elastomer shall not exhibit any cracks during the test period.

c). Life Expectancy

i). For all parts made by vulcanizing an elastomer to metal, any premature failure (less than five years) between metal and the elastomer or in the elastomer, occurring when the parts are used in normal service and according to the provisions of this Specification, shall be considered as having been caused by defect of materials or workmanship.

d). Metal Parts

i). Metal parts to which elastomeric material is vulcanized shall be made of SAE 1020 or 1045 hot-rolled steel, except for air brake equipment.

e). Bonding

i). The joining of elastomeric pieces shall be conducted by the hot vulcanization process. Bonding of elastomers shall not be allowed unless the Contractor submits the application, bonding procedure, and bonding agent technical data for approval prior to the purchase of any materials.

f). Truck Parts

i). Truck bumpers and snubbers shall be compounded to be resistant to abrasion, oil, grease and acid.

g). Air Brake Parts

i). Brake control system elastomer compounds shall be selected by the air brake supplier guidelines.

h). Glazing Strips

i). Glazing strips shall be of neoprene conforming to ASTM C542-05, or of rubber fulfilling fire safety requirements of this specification.

ii). The compounding of the rubber shall be such as to preclude discoloration or staining of neighboring areas, particularly from water drainage.

iii). Window glazing sections shall be service proven and constructed of high-quality elastomeric compounds containing neoprene subject to approval by Amtrak.

iv). Glazing strips and other elastomeric extrusions shall be continuous and made from neoprene or other compounds suitable for the purpose and shall be free of major defects of material or workmanship.

19.11 Glazing Materials

a). General

i). All window glass shall be provided with tints, screens, or other solar/thermal limiting measures as required by the Heating, Ventilation and Air Conditioning (HVAC) design. The tints shall not preclude passengers from being seen from outside the car or limit their vision when looking out the body side windows. The window glass shall meet Amtrak Specification 336 or be otherwise approved by Amtrak.

b). Safety Glass

i). All safety glass must meet the requirements of ANSI Z26.1, Table 1, Safety Glazing Material for Use Anywhere in Motor Vehicle. Where specified, safety glass must also meet the requirements for the following:

(1) FRA Type I as specified in 49 CFR 223 and 49 CFR 238

(2) FRA Type II as specified in 49 CFR 223 and 49 CFR 238

ii). Where FRA Type I or Type II glass is required, the glazing, its mounting to the vehicle, and the vehicle structure must meet the requirements for ballistic impact and large object impact as required by 49 CFR 238. All glazing performance requirements must be met both with and without the application of the glazing protective film. All safety glass must be of the laminated type.

iii). Flatness

(1) When an individual window of glass is laid on a truly flat surface, such as a surface plate, the glass shall not indicate a bow of more than 0.030 inch per linear foot.

iv). Dimensional Tolerance

(1) The overall dimensions of any window supplied shall not exceed ± 0.060 in. dimensional deviation. The thickness of individual pieces must be held within 5% of the specified thickness.

v). Overlap Tolerance

(1) The overlap of one laminate of the window with respect to the other at an edge shall not exceed 0.03125 in. Corners and burrs shall be ground smooth and all edges shall be treated in accordance with SAE J673, Edge No. 4.

vi). Color

(1) When new, there shall be no more than ± 4% variation in the color of individual windows of laminated sheet glass when examined over a white background.

vii). Haze

(1) All the laminates of the safety glass shall be so nearly free from haze that the laminated glass shall have approximately the same clarity as non-laminated plate glass of the same nominal thickness.

viii). Internal Contamination, Dirt, Specks and Scratches

(1) Occasional specks of foreign material and scratches are permissible, provided such specks do not exceed

(2) 0.020 in. in greatest dimension and scratches do not exceed a total of 3 in. in length and neither are within the central three-quarters area of the window. Amtrak reserves the right to determine which windows are to be rejected.

(3) The visual inspection criteria for laminated glazing shall be submitted for Amtrak approval as part of the glazing design review. **[CDRL 19-05]**

ix). Bond Separation

(1) The bond between two sheets of glass and the membrane shall be of such quality that when the glass is broken by twisting or by direct impact, there will be no separation between the glass sheets. Windows that contain un-bonded areas shall not be used.

c). Light Transmission

i). Average visible light transmission through clear safety glass must be a minimum of 85%.

d). Plastic Glazing

i). Plastic glazing must meet the requirements under ANSI Z26.1, Table 1, Item 4, Safety Glazing Material for use in Motor Vehicle only in Specific Locations. Where specified, safety glass must also meet the requirements for the following:

(1) FRA Type I as specified in 49 CFR 223 and 49 CFR 238

(2) FRA Type II as specified in 49 CFR 223 and 49 CFR 238

ii). Where FRA Type I or Type II glazing is required, the glazing, its mounting to the vehicle, and the vehicle structure must meet the requirements for ballistic impact and large object impact as required by 49 CFR 238. Material must be selected from Sabic “Margard,” Atohaas “Tuffak CM 2,” or approved equal, meeting 49 CFR 223. The installation must meet 49 CFR 238.113, Emergency Window Exits, and 49 CFR 238.221, Glazing.

e). Material Physical Properties

i). Plastic materials used in the glazing of side windows and door windows must meet the following requirements.

f). Strength

i). Samples must be prepared and tested according to 49 CFR 223 and 49 CFR 238 and ANSI Z26.1, Section 5.10, Impact, Test 10 (Dart Drop, Table 2 Heights). Samples must not shatter or break when subjected to the falling dart impact requirements of Test No. 10. The dart tip must be no more than 0.5 in. radius. Denting or marring of the surface of the tested piece in this test is permissible.

g). Light Transmission

i). Visible light transmission through clear plastic glazing must not be less than 85% in 0.125 in. thickness, 82% in 0.25 in. thickness, 80% in 0.375 in. thickness, and 78% in 0.5 in. thickness.

h). Color

i). Materials must have UV stabilizer additives to inhibit fading and loss of properties due to extended exposure to direct sunlight. When new, there must be no more than 4% variation in the color between lights of plastic material of a specified color and thickness, when examined over a white background, and measured by the appropriate light transmission or colorimeter inspection and test instruments.

i). Abrasion Resistance

i). Plastic glazing materials must be silicone-coated on both sides to increase resistance to abrasion. The coated plastic must meet ANSI Z26.1, Section 5.17, Abrasion Resistance, Test 17 (Plastics). The change in percent haze after 100 cycles must be less than 6%. The glazing material supplier must perform the following test prior to qualification: The plastic glazing material after 300 hours of weatherometer testing must pass abrasion resistance ANSI Z26.1, Section 5.17. This test must be performed for initial product certification and the results must be provided with drawing submittal.

j). Chemical Resistance

i). Samples must be prepared and tested per ANSI Z26.1, Section 5.19, Chemical Resistance, Test 19 (Non-stressed). The exposed fabricated edges of the test samples may be coated with the same material as the face surfaces by the manufacturer. In addition to the chemicals specified in this test, the test must include, but not be limited to, such cleaning solutions as dilute oxalic acid solution (3% by weight), half-strength Neleco Products Subway Soil Solvent – (one gallon Part 1 to 2 pounds Part 2, in 10 gallons water), and Electrosol. The exposure time of the test must be increased to 1-hour intimate contact with the test chemicals on the faces of the test sample. The contaminants must be either wiped or sprayed onto the coated faces of the test sample. Any tackiness, crazing, or apparent loss of transparency is cause for rejection. After immersion, a change in percent haze greater than 55, as measured by ANSI Z26.1, Section 5.17, Abrasion Resistance, Test 17, is cause for rejection.

k). Dimensional Tolerance

i). The overall dimensions of individual units as supplied must be within 0.030 in. of the nominal dimension specified. The thickness of the plastic materials must be within a tolerance of + 5% of the nominal thickness.

l). Flatness

i). When an individual piece is placed on a truly flat surface, such as a surface plate, the material must not indicate a bow of more than 0.030 inch per linear foot, in any direction.

m). Edge Work

i). All edges must be straight and perpendicular to the surface and must be sawed or routed and free of burrs in order to prevent cutting of the rubber glazing strips. Sharp corners must be removed around the entire periphery.

n). Optical Quality

i). Optical quality of the plastic glazing materials must be in accordance with ANSI Z26.1, Section 5.15.2.2, Visibility Distortion. No light and dark patches, existent over the entire area, may appear in the shadow of the unmasked area of the specimen before the specimen has been moved a distance of at least 14 in. from the screen.

o). Weathering

i). The plastic glazing material must pass the long arc Xenon lamp Weathering ANSI Z26.1, Section 5.16, Weathering, Test 16. No detectable cracks in the coating must develop when the specimen is strained 2%. Stress may be applied by imposing 6,000 psi loading, using a tensile testing machine.

p). Material Quality

i). Foreign Material and Inclusion Defects

(1) Foreign material and inclusion defects must not exceed the following limits:

(a) Less than 0.009 in.: Allowed to the extent that they do not constitute a severe defect such as clustering.

(b) 0.009 in. to 0.020 in.: Allowed up to 10 per square foot average over the area of the piece.

(c) 0.021in. to 0.050 in.: Allowed up to three per square foot average over the area of the piece.

(d) 0.051 in. to 0.065 in: Allowed one per square foot average over the area of the piece.

(e) 0.0651 in. to 0.15 in.: Allowed one per edge, only in the outer 25% of the piece.

(f) Above 0.15 in.: Not allowed.

(2) There must be no black speck clusters of three or more above 0.02 in. in a 1 in. diameter circle.

(3) Defects occurring in those areas of the lights that are covered by the glazing strips is not cause for rejection.

ii). Fibers and Scratches

(1) Fibers and scratches must not exceed the following limits:

(a) Less than 0.060in. in length: Allowed to the extent that they do not constitute a severe defect such as clustering.

(b) 0.061 in. to 0.125 in. in length: Allowed up to a maximum of two per square foot average over the area of the piece.

(c) 0.126 in. to 0.250 in. in length: Allowed up to a maximum of one per square foot average over the area of the piece.

(2) Greater than 0.250 in. in length: Not allowed.

(3) Fine scratches that are detectable only when viewed in bright back lighting are acceptable.

iii). Bubbles

(1) There must be no clusters of bubbles, no chain bubbles, and no bubbles larger than 0.030 in. in diameter. If present, bubbles 0.020 in. to 0.030 in. in diameter must have a minimum separation of 3 in. In any 2 in. diameter area of glazing material, there must be a maximum of four bubbles with diameter between 0.010 in. and 0.020 in.

iv). Apparent Runs

(1) Apparent runs must not exceed the following limits:

(a) Less than 0.125 in.: Allowed to the extent that they do not constitute a severe defect such as clustering.

(b) 0.125 in. to 0.250 in.: Allowed up to a maximum of four per square foot average over areas of piece but not to the extent that they constitute a severe defect.

(c) 0.251 in. to 0.500 in.: Allowed up to a maximum of one per square foot, if it does not constitute a severe defect.

(d) 0.501 in. to 1.00 in.: Allowed up to a maximum of one per edge, only in the outer 25% of piece area.

(e) Above 1.00 in.: Not allowed.

v). Orange Peel

(1) “Orange peel” in the surface is cause for rejection of the material.

vi). Marking

(1) All glazing shall be marked with proper identification in accordance with FRA 49 CFR Part 223 requirements. Each window shall be marked for identification by the supplier in legible letters 0.125 in. to 0.25 in. high in the lower right-hand corner as viewed from the inside of the vehicle. This identification shall be no closer than 0.375 in. to the edge. The identification shall give the product name, the manufacturer, the serial number and FRA Type designation. Markings shall be legible

and permanent for this application and shall be applied in such a manner so as not to reduce the integrity of the coating.

vii). Shipping

(1) The material shall be carefully prepared for shipping and shall be properly protected to prevent damage. If a pressure sensitive masking is used, it shall be easily strippable from the material and not leave a gummy or sticky residue.

q). Window Shades

i). Fire Resistance and Durability

(1) All shades, blinds and nets should meet the requirements for 14 CFR 25, Appendix F, Part 1, (Vertical test) Flame time ≤ 10 sec and Burn length ≤ 6 inches. As well as ASTM E 662-01 Ds (4.0) ≤200.

(2) The materials must display high dimensional nubility under extreme climactic conditions and fluctuations as well as high UV resistance and high degree of tear resistance and resilience.

ii). Certificates Required:

(1) GREENGUARD Gold

(2) STANDARD 100 Class IV by OEKO-TEX®

(3) Environmental Product Declaration (EPD)

(4) Health Product Declaration (HPD)

r). Sunshades

i). Quality and Composition

(1) Sunshades should block out glare and solar heat, while having a excellent rate of visibility in order to enjoy the view with the shade down, aiming for a visible light transmittance (vT) of 10%. Composition should be made up of 100% knitted polyamide or rPET with a metalized backing.

(a) Sunshades shall be installed on the Café, Diner, and Diner/Lounge.

s). Blackout Blinds

i). Blackout Blinds should be constructed of a weave with 1-2% openness and aim to have a vTlevel of 0%, by using a laminated back layer to block out visible light.

(1) Blackout blinds shall be installed on the Sleeper Cars and Coach Cars.

19.12 Luggage nets

a). Luggage nets should be made up of knitted polyamide with open round geometry and intergraded edging.

b). The material should have a level of dimensional stretch to allow for easy access storage by customers.

c). Material must meet all flammability, smoke and toxicity requirements of this specification.

19.13 Rubber Floor Covering

a). General

i). The rubber flooring shall be made of a synthetic rubber compound mixed with multi-colored speckles of the same material dispersed throughout the material thickness, with a semi-matte finish.

ii). Rubber floor covering shall meet ADA visibility and coefficient of friction requirements, with a static coefficient of friction of at least 0.6 on level surfaces and 0.8 on ramps, even when wet with both rubber and leather soled shoes.

iii). Rubber floor covering shall be non-staining, non-discoloring, and 100% non-oil extended.

iv). Only high-quality hard clay shall be used as filler.

v). No whitening (limestone) shall be used in the compound. At room temperature, the rubber flooring shall bend around a 0.75 in. (19 mm) diameter mandrel without breaking, cracking, crazing or showing any change in color.

vi). The rubber flooring material shall be fully homogeneous throughout and shall meet the requirements of ASTM F1344-04. Rubber flooring shall conform to the criteria below.

vii). The flooring shall meet TRRL Pendulum Dry 91 Wet 29.

b). Sustainability

i). The raw material should be sourced from suppliers who adhere to ethical and sustainable practices.

ii). The rubber flooring must contain a minimum of 15% recycled content.

c). Thin Skinned Blister

i). A thin-skinned blister is a blister, which when finger-pushed, will collapse upon itself. Thin skin blisters of the indicated sizes will be permitted as follows and shall be repaired as indicated:

(1) Maximum Size – 0.030 in. (0.8 mm) height, 0.80 in.^{2} (5.2 cm^2) area with longest dimension of 2 in. (51 mm).

(2) Maximum Population – 3 blisters in a 12 in. (30.5 cm) by 12 in. (30.5 cm) area, and there shall be only one other blister within 3 ft (0.91 m) of this area.

(3) Repair Method – using a hypodermic needle, apply just enough Super Bond 420 or Bostik 1685 to bring to a flush surface.

d). Thick Skinned Blister

i). A thick-skinned blister is a blister, which when finger-pushed, will collapse and then return to its original condition. Thick skin blisters of the indicated sizes will be permitted as follows and shall be repaired as indicated:

(1) Maximum Size – 0.030 in. (0.8 mm) height, 0.80 in.^{2} (5.2 cm^2) area with longest dimension of 2 in. (51 mm).

(2) Maximum Population – 3 blisters in a 12 in. (30.5 cm) by 12 in. (30.5 cm) area, and there shall be only one other blister within 3 ft (0.91 m) of this area.

(3) Repair Method – no repair authorized.

e). Lumps

i). A lump is a blister without a void, consisting of solid material. Lumps of the indicated sizes will be permitted as follows and shall be repaired as indicated:

(1) Maximum Size – 0.030 in. (0.8 mm) height, 0.80 in.^{2} (5.2 cm^2) area with longest dimension of 2 in. (51 mm).

(2) Maximum Population – 3 lumps in a 12 in. (30.5 cm) by 12 in. (30.5 cm) area, and there shall be only one other lump within 3 ft (0.91 m) of this area.

(3) Repair Method – no repair required.

f). Holes

i). A hole is a defect, which is 100% through the material. Holes of any size or population will not be permitted nor shall holes be repaired.

g). Thin Area

i). A thin area is a defect where the sheet is below thickness locally. Thin areas of the indicated sizes will be permitted as follows and shall be repaired as indicated:

(1) Maximum Size – 0.030 in. (0.8 mm) deep at the lowest point, 3 in.^{2} (19.4 cm^2) area with the longest dimension of 5 in. (127 mm).

(2) Maximum Population – one thin area in a 40 in. (1 m) by 40 in. (1 m) area, and there shall not be another thin area within 3 ft (0.91 m) of this area.

(3) Repair Method – rub with #00 steel wool to blend this area into the normal thickness material and then buff to a normal surface finish.

h). Color and Marbling Distribution

i). Tolerances for color and marbling variation shall be submitted to Amtrak for approval during preliminary design review. If the base coloring is not within 5% between production runs, or the marbling is not consistent over the entire surface, the roll shall be rejected.

ii). Additives should provide UV resistance to prevent fading or discoloration from sunlight exposure through windows. Pigments must withstand cleaning chemicals without bleeding or loss of color.

19.14 Paneling

a). Plymetal

i). The term "plymetal" as used in this Specification covers metal-faced plywood and shall conform to the following requirements when tested per ASTM D2718 and ASTM D3930:

Test Conditions	Minimum Metal to Wood Average Shear Value (or 80% Wood Failure)
Dry shear	250 lbf/in.^{2} (1.7 MPa*)
Boil shear, 3-hour boil, tested wet at room temperature	150 lbf/in.^{2} (1 MPa) – Flat, non-textured sheet 60 lbf/in.^{2} (0.4 MPa) – Textured sheet
Soak shear, 48-hour soak wet at room temperature	150 lbf/in.^{2} (1 MPa) – Flat, non-textured sheet 60 lbf/in.^{2} (0.4 MPa) – Textured sheet
Creep or cold flow, under static load for 48 hours, at room temperature	250 lbf/in.^{2} (1.7 MPa)
* **MPa** = Megapascal	

ii). Plymetal that is faced with melamine shall have the melamine bonded to the metal sheet in accordance with this Specification, and the melamine-faced metal sheet shall then be laminated to the plywood core in accordance with this Chapter. Melamine shall be pressure bonded to marine grade plywood using industry approved adhesives. No contact bonding of melamine to plywood is permitted. The term "cored panels" means honeycomb panels bonded to melamine or to metal faced hardboard (similar to Metalcomb, as

marketed by Cored Panels, Inc., Farmingdale, New York). Such panels must comply with United States Department of Agriculture Forest Products Laboratory Report No. 1937, Shear-Fatigue Properties of Various Sandwich Construction.

iii). All exposed edges of the panels shall be covered in a fireproof manner.

iv). Plymetal prohibited for use in flooring.

b). Plywood

i). All plywood shall be manufactured to conform to the requirements of NIST PS 1, and then stored under cover. All plywood panels shall be formed from one piece and shall be sealed with two coats of epoxy paint on all edges and cutouts as soon as possible after fabrication. All exposed edges of the panels; joints between panels, fastener heads and openings of panels used in areas accessible to moisture shall be waterproofed and sealed in accordance with MIL-P-8053, paragraph 3.4, prior to installation in the car.

c). Honeycomb Panels

i). The term "honeycomb panels" as used in this Specification refers to an assembly of honeycomb material bonded to melamine-faced metal panels or to metal panels. Aluminum honeycomb core material shall be commercial-grade meeting the requirements of MIL-C-7438G per AMSA-81596 and shall meet the requirements of AMS-C-7438. Bonding shall be sufficient to develop the full strength of the honeycomb material. Stainless steel honeycomb panels shall be constructed in accordance with the requirements of MSFC-SPEC-445. The adhesive bond strength of the honeycomb core to the stainless-steel face shall not be less than 15 lb/in. (2.68 kg/cm) climbing drum strength when tested in accordance with SAE-AMS-STD-401. The adhesive bond strength of the integral stainless frame to stainless steel face shall not be less than 30 lb/in (13.6 kg/2.5 cm) climbing drum strength when tested in accordance with SAE- AMS-STD-401. Stainless steel honeycomb panels shall be tested in accordance with SAE-AMS-STD-401 to demonstrate the following requirements. Test results shall be subject to Amtrak review and approval.

(1) Core shear yield at 200°F (93°C) 250 lbf/in.^{2} [1.72 Megapascal (MPa)]

(2) Flatwise tension at 200°F (93°C) 250 lbf/in.^{2} (1.72 MPa)

(3) Beam flexure at 200°F (93°C) 75,000 lbf/in.^{2} (517.13 MPa)

(4) Core shear fatigue at R.T. 150 lbf/in.^{2} @ 106 cycles (1.03 MPa)

(5) Flatwise tension at R.T. 250 lbf/in.^{2} @ 106 cycles (1.72 MPa)

(6) Beam flexure at R.T. 50,000 lbf/in.^{2} @ 106 cycles (344.75 MPa)

ii). Honeycomb panels meet the relevant flammability and smoke emission requirements. Results shall be subject to Amtrak review and approval. No other honeycomb materials will be permitted.

d). Melamine-Faced Aluminum

i). Melamine-faced aluminum panels shall be constructed by laminating melamine to aluminum sheets as follows: The melamine impregnated papers shall be directly molded to the aluminum sheets at temperatures of no less than 270°F (132°C) and pressure no less than 1000 psi (6.9 MPa). The surface characteristics, after manufacture, shall be no less than that required of type GP (General Purpose) in the NEMA Standards Publication No. LD-3. The melamine and the required binder sheets shall be 0.020.

ii). ± 0.005 in. (0.51 ± 0.13 mm) thick. The aluminum sheets shall not be less than 0.025 in. (0.64 mm) in thickness when used as a facing on plywood. The aluminum sheets shall not be less than 0.081 in. (2.1 mm) in thickness when not laminated to a substrate such as plywood. Aluminum sheets shall be properly cleaned by etching, sanding or other approved process to ensure full, permanent, acceptable adhesion.

iii). The use of any adhesives to bond the melamine sheets to the aluminum backing will not be acceptable. The bond between the melamine and aluminum sheets shall, as a minimum, meet the following requirements:

ASTM D952 Internal Bond	2,600 lbf/in.^{2} (17.9 MPa)
ASTM D790 Flexural Strength - (S)	with grain: 26,500 lbf/ in.^{2} (183 MPa) crossgrain: 25,300 lbf/ in.^{2} (174 MPa)
ASTM D790 Modulus of Elasticity - (E)	with grain: 2.8 x 106 lbf/ in.^{2} (19.3 GPa) crossgrain: 3.1 x 106 lbf/ in.^{2} (21.4 GPa)
ASTM D638-08 Tensile strength	with grain: 22,300 lbf/ in.^{2} (154 MPa) crossgrain: 20,300 lbf/ in.^{2} (140 MPa)

e). Melamine Panels

i). Unbacked melamine panels may be used in the vehicle interior. The panels shall be a minimum of 0.125

ii). ± 0.005 in. (3.2 ± 0.1 mm) thick. The surface characteristics shall be no less than that required of type GP (General Purpose) in the NEMA Standards Publication No. LD-3. Sidewall panels shall be of unbalanced melamine. However, ceiling panels located under air ducts must be balanced melamine to prevent warpage from duct condensation.

f). Phenolic Composite Floor Panels

i). Phenolic composite floor panels shall be designed to withstand the following physical requirements with no visible or audible indications of delamination of the panel skin from the core and permanent deformation of the top surface shall be less than 0.010 in. (0.25 mm) unless otherwise specified. There shall be no puncture or damage to fibers of the top surface. There shall be no separation of any internal core from the top or bottom skin. There shall be no fracture of the balsa core.

(1) Indentation Resistance – The floor panel shall withstand a concentrated load of 300 lbs. (136 kg) applied to a test dowel that has an overall 0.375-sq in.^{2} (242 sq. mm^2) surface area, with a 0.0625- in. (1.6 mm) radius on bottom edge of test dowel.

(2) Static Load Test – Average Loading – A representative sample section of the flooring (without rubber floor covering attached) shall be supported on beams spaced at the maximum spacing used on the car using production bonding and fastening techniques. A uniformly distributed load in accordance with the crush loading requirements of Chapter 2 shall be applied to both sides of the joint (butt and/or shiplap). There shall be less than 0.088-in. (2.2 mm) deflection.

(3) Static Load Test – Maximum Loading – Using the identical floor panel-mounting configuration as described above, a uniformly distributed load of 200 lb/ft^2 (976 kg/m^2) shall be applied to both sides of the joint (butt or shiplap).

(4) Small Area Static Load Test – Using the identical floor panel mounting configuration as described above, a 300 lb (136 kg) load shall be applied to a 1.0 in. (25.4 mm) by 3.0 in (76 mm) contact area directly over the midspan, 6 in. (152 mm) from the outer car body sidewall edge. The footprint shall be machined flat within 0.010 in. (0.24 mm) and the edges shall have a radius of not more than

(5) 0.125 in. (3.17 mm) – There shall be less than 0.200 in. (5.08 mm) deflection as a result of the load applied.

(6) Small Object Impact Test – Using the identical floor panel mounting configuration as described above, a 16 lbs. (7.26 kg) standard bowling ball shall be raised directly over the mid-span, 24 in. (610 mm) from the edge of the panel and dropped from height of 60 in. (1500 mm). Permanent deformation of the top surface shall be less than 0.0625 in. (1.587 mm).

(7) Large Object Impact Test – Using the identical floor panel mounting configuration as described above, a 150 lb (68 kg) load shall be dropped upon a 3.0 in. (76 mm) by 8.0 in. (200 mm) contact “footprint” pad located directly over the midspan, 24 in. (610 mm) from the edge of the panel and dropped from a height of 12 in. (305 mm). The “footprint” pad shall have a rubber pad on the downside surface with a Shore D 70 minimum, at a 1.00 in. (25.4 mm) thickness machined flat within 0.060 in. (1.524 mm) with edges having a radius of not more than 0.030 in. (0.762 mm). Permanent deformation of the top surface

shall be less than 0.030 in. (0.762 mm). Some damage to the top phenolic composite skin will be allowed.

(8) Rolling Load Test – Using the identical floor panel mounting configuration as described above, a four-wheel cart with a load of 200 lbs. (91 kg) per wheel shall be rolled on the panels laterally, longitudinally and in a circular path 24 in. (610 mm) radius. The wheels shall be 3 in. (75 mm) in diameter, 1 in. (25.4 mm) wide with a 0.125 in. (3 mm) radius on each edge with a Shore A durometer of 80.

(9) Flammability and Smoke Emission Tests – Floor panels meet the relevant flammability and smoke emission requirements.

g). Acoustic Wood Paneling

i). Acoustic wood paneling provides a premium experience in the luxury suite, mitigating the high volume of auditory disturbance experienced within the train. The acoustic dampening properties combined with the real wood veneerers elevate this space to a luxury choice, reflecting the on-cost of ticket purchase and manufacture.

ii). Acoustic wood paneling structure should be made up of:

(1) Real wood decorative surface with an FR treatment (matching the wood used across the train)

(2) Laminated onto 16 mm MDF substrate (natural color)

(3) Balancing + black 100% PET felt paneling.

iii). Design details of spacing will be determined during design reviews.

iv). The material shall meet all flammability, smoke and toxicity requirements of this specification.

v). All wood must be FSC certified, backing materials will be comprised of recycled materials.

vi). Acoustic Performance

(1) The panels shall demonstrate sound absorption coefficients (αw) of at least 0.95, determined through accredited lab testing in accordance with ISO standards.

(2) Absorption values for common frequency ranges shall meet or exceed specified targets.

vii). Panel thickness shall be approximately 16-18mm. Weight shall be kept to a minimum while maintaining acoustic performance and durability.

viii). The panels shall stand up to common impacts and surface wear. Their decorative finish shall resist scratching, abrasion, and scuffing. Panels shall be repairable if damaged.

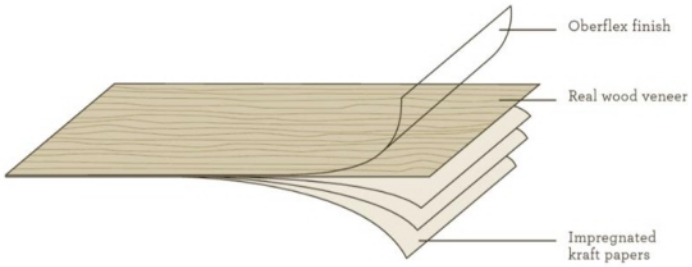
h). Real Wood Laminate

i). The laminate shall have a decorative real wood veneer surface with a satin finish, protected with a Tedlar Cap layer.

ii). The material shall meet all flammability, smoke and toxicity requirements of this specification.

iii). The laminate shall utilize FSC certified wood from responsibly managed forests. Adhesives and resins shall have low VOC content, per 40CFR59 Subpart C. It shall be recyclable at end of life.

iv). The application of the Tedlar cap will provide good abrasion, chemical and UV resistance to the material.



19.15 Woven Fabrics

a). The texture of fabrics on trains should be soft and comfortable to the touch, while also being durable and easy to clean. Woven fabrics for Amtrak cars must be breathable, moisture-wicking, temperature regulating, and comfortable to the touch. A composition of 60% Wool and 40% cotton is recommended to provide breathable, moisture wicking and natural antibacterial properties.

b). Sustainability

i). All raw materials should be sourced from suppliers who adhere to ethical and sustainable practices.

ii). Natural materials should be sourced organically, while synthetic materials should be made from recycled or renewable sources.

iii). Where possible OEM and suppliers should prioritize non dyed coloring to minimize processing and impact on the environment.

c). Fabrics must be fire-resistant, passing NFPA-130 seat upholstery, BSS 7239 FAR 25.853 (a) Appendix F, part 1. FR should not be affected by when exposed to liquids or conventional cleaning methods (wet shampooing or dry cleaning).

d). Woven fabrics must pass the abrasion ASTM D3884 test, passing <50% wear with 150 cycles of wear with a CS-10 wheel under a 1000 gram load. Tear resistance is defined by ASTM D2261 by applying a force of 15 lbf to a tear in the material in both the warp and fill directions. The test passes if the material does not tear

completely in either direction.

e). Burst/puncture resistance is defined by FTMS 191A Method 5122 and tested by applying a force of 200 lbf to the material. The test passes if the material does not burst or puncture under the applied force.

f). Anti stain treatment should be applied to ensure longevity and cleanability.

g). Dyes and finishing treatments must ensure UV resistance and color fastness.

19.16 Non-Woven Fabrics

a). Microfibre Cloth

i). The faux suede fabric shall have a soft, plush, supple texture and handle. It shall be made from a non-woven structure of fine microfibers to ensure it is lightweight, draping, stain resistant, and exceptionally durable. The composition should be made up of the following layers, totaling a minimum weight of 27 ounces per linear yard:

(1) FACE: 100% recycled polyester microfiber 0,15d

(2) INNER SCRIM: 100% recycled polyester 150d

(3) BACKING: 10% recycled polyester microfiber 0,15d and 90% polyester FR 0,50d

ii). Sustainability – As above, the composition of the cloth should come from predominantly recycled polyester with >60% over the finished article.

iii). The fabric shall meet all flammability, smoke and toxicity requirements of this specification.

iv). The fabric shall have a thickness of 1.2mm +/- 20% and demonstrate breathability.

v). The fabric shall withstand 200,000 double rubs per Wyzenbeek method and have a minimum breaking strength of 115 lbs. warp and 118 lbs. fill per ASTM D5034. It shall be resistant to sagging, crocking, pilling, and shrinking. The fabric shall be spot cleanable and machine washable for easy maintenance. It shall achieve grade 4.5 minimum for colorfastness to light and crocking per AATCC 16.3 and 8.

b). Acoustic Felt

i). Acoustic felt should be made up of 90% wool and 10% Nylon or 100 percent Trevera.

ii). Acoustic felt shall meet the same performance characteristics as microfiber.

iii). The fabric shall meet all flammability, smoke and toxicity requirements of this specification.

19.17 Seat Cushion and Upholstery

a). Cushion Material

i). The bottom seat cushion shall be molded polyurethane foam with an approved fire barrier material or silicone. It shall meet Amtrak Specification 665 or be otherwise approved by Amtrak. Indentation Force Deflection (IFD) measured at 25% compression of 50 ± 5 lbs., 3.5 +/-0.4 lbs./cubic ft. density with a support factor of 2.1 min or be otherwise approved by Amtrak.

ii). The back cushion shall be molded polyurethane foam meeting Amtrak Specification 665 or be otherwise approved by Amtrak.

iii). IFD measured at 25% compression of 33 ± 3 lbs., 3.1 ± 0.3 lbs./cubic ft. density with a support factor of 2.1 min. or be otherwise approved by Amtrak.

iv). The Engineer's and Assistant's seat in the Engineer's cab shall be silicone or a molded polyurethane foam with an approved fire barrier material.

v). Approved fire barrier fabrics are Tex Tech Industries TTI 8174 and DuPont Nomex 17253. Alternative fire barrier materials will be considered. Approval is contingent upon submittal of the following tests to Amtrak's Industrial Design group for review and written approval.

Test Identification	Test Description	Test Pass/Fail Criteria
ASTM D3884 (CS-10 wheel, 1000 gm wt.)	Abrasion Resistance	150 cycles @ 50% wear through
ASTM D2261	Tear Resistance	15 lbf (in both the warp and fill directions)
FTMS 191A Method 5122	Burst/Puncture Resistance	200 lbf

b). Lamination

i). All visible surfaces must be made from a tri-laminate panels. The laminate is a heat set polymer web adhesive (Min 0.9 OZ/SQ YD) that allows the fabric to bend and breathe easily. The durability of the laminate is a key performance requirement for Amtrak and each vendor submitting a bid must be able to demonstrate that they have at least two years of experience in manufacturing laminated textile panels, they have a quality control system to ensure repeatable performance, and their lamination panels have been tested under jounce and squirm conditions to 100,000 cycles with no visible delamination, puckering, crack marks, bubbles, or blisters. Tests must be conducted to Daimler Chrysler Test Specification PF-10254 Change A, S6.4 Jounce and Squirm or approved equivalent. Additionally, the laminate must meet the 12 second vertical burn flammability requirements of 14 CFR Part 25.853(a) Appendix F, Part I(1)(a)(ii) as defined in FRA 238.103 appendix B.

ii). Alternate materials may be suggested and must be submitted to Amtrak Industrial Design for initial approval.

c). Synthetic Leather

i). The grain of synthetic leather shall complement traditional top grain leather.

(1) It shall be a soft organic texture which shall approximate a top grain finish but without an animal hide appearance.

ii). The synthetic leather shall have a weight of approximately 410 Grams Per Square Meter and a thickness of approximately 1.15 Millimeters.

iii). Synthetic leathers should be comfortable and sustainable over the product lifetime, both in their material composition and longevity.

(1) All synthetic leathers should be primarily bio-based and where possible sourced from agricultural waste as opposed to potential food sources.

iv). Backcloths to be 100% bio-based, constructed of rayon along with a bio-based PU layer, achieving an overall bio-based content of >60%.

v). Requirements

Test Identification	Test Identification	Test Pass/Fail Criteria
ASTM D-3884	Abrasion	1000 cycles, 500g H-18 wheels. No wear through
AATCC 8	Colorfastness	Dry/Wet grade 5
ASTM D-4705	Stitch tear strength	23.85 lbf. Warp/Weft average
ASTM D-4157		300,000 Double Rubs
ASTM D-2261	Tear strength	

vi). Synthetic leather shall have the cushioning foam laminated to the back to achieve a soft feel.

vii). Material must meet the flammability, smoke and toxicity requirements of this specification.

viii). Color Accuracy

(1) The color differences between any measured production component and the accepted color sample for that component shall be less than ± 1 dE.

d). Top Grain Leather

i). All upholstery leather applications shall have a top-grain finish, ensuring a consistent color and texture devoid of any defects or imperfections. The thickness of the hide will be between 1.0 and 1.2 mm. Leather strap applications must use belting leather at a thickness of 2.8-3.2 mm.

ii). Leather should be sourced from suppliers who adhere to ethical and sustainable practices (i.e. minimize impact on water scarcity, run on renewable energy, reuse of waste material, etc.). The tanning process used to treat the leather should also be environmentally friendly.

iii). The leather must comply with smoke, toxicity, and flammability requirements of this specification.

iv). The leather should offer a superior and comfortable seating experience for passengers, with excellent breathability to ensure comfort during long journeys. It should withstand 60,000 cycles on the BS EN ISO 5402-1 (Flexometer Method) without cracking of the finish.

v). The color differences between any measured production component and the accepted color sample for that component shall be less than ± 1 dE.

vi). Durability and Maintenance

(1) The leather must exhibit resistance to regular wear and tear, as well as fading when exposed to sunlight. It should pass a 72-hour UV light exposure test with a score of 4 or better on the AATCC greyscale for color change.

(2) The leather should also have anti-stain treatments and anti-soiling properties to ensure easy cleaning and maintenance.

(3) The leather's color fastness will be tested according to ASTM D5053 (50 cycles wet & dry), and it must achieve a score of 4 or better on the AATCC greyscale for color change. The following standards must be met:

(a) Flex ASTM D 2097: 70,000 Flexes

(b) Elongation: ASTM D 2211: 30-50% at 50lb

(c) Slit Tear ASTM 2212: 15lb

(d) Tear strength: ASTM D 4705: 40 lb

(e) Abrasion ASTM D 7255: 4000+ cycles (CS-10 wheels), 300+ cycles (H-18 wheels)

19.18 Carpet

a). All carpets shall meet all flammability, smoke and toxicity requirements of this specification.

b). The carpets should be easily maintained with regular vacuums and cleaning products. The final construction of all carpets should work towards durability without significant wear for 8 years + Anti stain.

c). Wherever possible suppliers should use non-dyed yarns to minimize processing and use of dye, by utilizing naturally occurring colors such as natural whites, light

and dark greys. All polyamide (PA) to be Econyl® 100% recycled material.

d). Location and process for implementing seams must be implemented for approval.

e). All seaming plans must be submitted for Amtrak acceptance.

f). High Traffic Areas

i). Carpets for use in corridors, aisles and any other high traffic areas should be highly durable and easy to traverse with a suitcase, food cart or wheelchair.

ii). Quality and Composition

(1) Four colors: Yarn dyed carpet with a square woven, level loop pile construction, 100% PA Econyl®, with a low pile hight (approximately 0.106 inches). Total weight

(2) 49.95 oz. Per yd². Backing material to be 100% synthetic yarns, from recycled feedstock where possible.

iii). The carpet should be installed directly on to the floor surface, without an additional underlay.

g). Low Traffic Areas

i). These areas, such as sleeper cabins should have a luxurious feel and maintain a ‘new’ appearance over repeated use.

ii). Four color: Yarn dyed carpet with a square woven, level loop pile construction, high quality 90% wool, 10% PA Econyl®, with a medium pile height (approximately 0.177 inches). Backing material to be 100% synthetic yarns, from recycled feedstock where possible. To be used with an additional pad or underlay for comfort with a weight of 17.0 oz. Per yd².

iii). Total carpet weight minimum 66.5 oz. Per yd²

h). The carpet will have a stain resistant chemical applied.

i). The carpet will have a secondary, moisture resistant backing applied that will not delaminate. The thickness shall be nominally 0.09375 in. with a density of 18 lb/ft3, and a weight of 30 oz./yd2. The compression resistance shall be 5 lb/in.

j). The carpet shall be easily removable without extensive labor while eliminating the likelihood of damaging the floor paneling.

k). Carpet adhesive shall be submitted to Amtrak for approval.

l). Alternate carpet types may be submitted for review but must meet or exceed the performance requirements of this Chapter.

19.19 Counters

a). All counter surfaces shall be made from Amtrak approved materials. All countertop

material shall be made from FDA and NSF approved non-porous material.

b). All stainless-steel countertops shall be made from type 304 stainless steel with a thickness of at least 14 gauge. Stainless steel countertops shall have a brushed satin finish. All seams shall be finished to match the counters brushed satin finish. Counters shall be built in a manner that do not flex, deform, rattle or “oil can”.

19.20 Welding and Brazing

a). Responsibility

i). The Contractor shall be responsible for the quality of all welding and brazing. All welders employed in the making of welds on structures or products built under this Specification shall have been tested and qualified to determine their ability to operate the welding equipment to be used in making the types of welds required hereunder and to produce satisfactory welds therewith.

ii). All welding practices shall be according to requirements of AWS D1.1, *Structural Welding Code – Steel*; AWS D1.2, *Structural Welding Code – Aluminum*; AWS D1.3, *Structural Welding Code – Sheet Steel*, AWS D1.6, *Structural Welding Code – Stainless Steel*, AWS D15.1 Railroad Welding Specification for Cars and Locomotives, and the AWS Handbook. AWS Standard D1.1 shall apply to steel of ⅛-in. and greater thickness, and AWS Standard D1.3 shall apply to steel less than 0.125 in. thickness. Requirements for cyclically loaded structures shall be applied. Cast steel welding shall be according to AWS D15.1 or ASTM A 488/488M, *Steel Castings, Welding, Qualification of Procedures and Personnel*. Resistance welding shall be in accordance with AWS D17.2/17.2M, *Specification for Resistance Welding in Aerospace Applications*. Laser welding, if used, shall comply with AWS C7.2, *Recommended Practices for Laser Beam Welding, Cutting, and Drilling*.

iii). All welding practices not specifically covered in this Chapter shall be in accordance with the applicable requirements and recommendations of the American Welding Society (AWS). Should the Contractor propose an alternate standard, it shall be subject to Amtrak’s approval.

iv). All arc Welding Procedure Specifications (WPS) shall be fully qualified by the Contractor, accompanied by Procedure Qualification Records (PQR) containing welding test results, and subject to approval by Amtrak and a Certified Welding Inspector, welding engineer, or other individual qualified to review said documentation. The use of WPS qualified per AWS B2.1 shall not be permitted in their original form. WPS and PQR originally qualified per AWS B2.1 may be rewritten to conform to the requirements of the applicable structural welding code and used within the limitations of that code. Resistance welding schedule certifications and machine qualifications shall be submitted for review and approval by Amtrak along with the arc welding WPSs and PQRs.

v). Welders shall make only those welds for which they have been qualified according to the requirements of the applicable AWS code, ASTM A

488/488M, or other approved qualifying procedures. Records of welder qualification tests shall be made available for review.

b). Test Welds

i). Amtrak shall have the right to require an operator to make test welds to determine their ability to produce satisfactory welds of any given type. Amtrak shall also have the right to require the making of test welds to settle any question that shall arise as to the suitability of any welding method or procedure used during production. The recommendations of the AWS shall be followed in the making of tests and the settlement of other questions that may arise hereunder regarding welding practice.

ii). Fatigue allowable stresses shall not exceed the lesser of fatigue limits in AWS D1.1, or 50% of the joint strength level calculated from ASME maximum allowable stress values. Higher values shall only be used if qualified by Contractor tests.

c). Cleaning

i). Prior to welding, parts to be joined shall be properly cleaned of coatings and films such as rust, oxide, mill scale, oil, grease, corrosion products, and other foreign materials. Cleaning materials and processes shall be in accordance with applicable parts of Section 2, MIL-HDBK-132, *Protective Finishes*. Finished welds shall present a clean appearance.

d). Welding Rod

i). All welding rod, wire, electrodes or filler metal; shall be chosen by the Contractor or subcontractor with respect to manufacturer, type and size necessary to achieve the highest quality work. The Contractor shall have full responsibility for the character of the work produced. It shall be purchased in packages which shall be marked with the Manufacturer's name and the specification, diameter, and net weight of the material.

ii). The material shall be stored in accordance with recommendations of the AWS *Structural Welding Code* so as to protect it from damage, and so that it shall be easily identified. Material shall be issued and handled in such a way as to prevent it from being mixed with that of another specification.

iii). The ferrite number for austenitic stainless-steel welds shall be between WRC4 and WRC10, or as proposed by the Contractor and approved by Amtrak.

iv). In case a question arises regarding the suitability of welding rod, wire, electrodes or filler metal, the provisions of AWS Standard D1.1/D1.1M shall govern.

e). Control

i). Current, voltage, distance, flame, and other variables shall be so controlled as to give a smooth weld, free of gas pockets, oxide inclusions, variations in width and thickness, wandering and spattering.

f). Penetration

i). Penetration of weld metal into the bottoms of angles and vees and fusion, shall be complete. Weld metal shall run into the base metal at the finished surface of the weld in a smooth curve approximately tangent to the surfaces of the base metal to avoid sudden change of section and resultant concentration of stress. Undercutting shall not exceed 10% of the thickness of the thinnest element, or 0.030 in., whichever is less.

g). Warpage

i). The method of depositing weld metal shall be chosen so as to minimize warpage and locked-up stresses. Tack welding, skip welding, offset welding and other comparable procedures shall be used for this purpose.

h). Intermittent Weld Spacing

i). Intermittent fusion-weld spacing pitch shall not exceed 5 in. for 2-in. (minimum) weld lengths, such that a minimum weld length of 40% of the overall joint length is achieved. Exceptions may be granted, for example to avoid warpage in thin sheet, where the design exhibits sufficient strength with welds applied on larger spacing, subject to Amtrak review and approval.

i). Fusion Welding

i). Manual fusion welding by the gas process may only be used on sheets more than 3/32 in. (2.38 mm) in thickness. Any other application of this process must be approved by Amtrak.

j). Resistance Welding

i). Resistance welding shall be in accordance with AWS Standard D17.2/D17.2M Class B for structural applications and Class C for non-structural applications. Production witness testing requirements shall be followed unless specifically waived or modified by Amtrak in writing.

ii). Stainless steel parts shall be joined, insofar as possible, by resistance welding. Procedures shall employ accurate control of current, time, electrode size and shape, and tip force, to produce uniform welds of specified strength which shall not be subject to surface corrosion. Resistance welds in materials other than austenitic stainless steel shall be arranged to avoid tension or "peeling" forces on the welds under any anticipated loading condition.

iii). Spacing of resistance and spot welds shall be appropriate to the design. Spacing shall not exceed 2 in. plus twice the weld nugget diameter for any structural application, including car body side sheets. For any corrugation application, if the pitch of the corrugation nodes does not allow the above weld spacing, there shall be two spot welds between each node.

iv). Surface indentation shall not exceed 20% of material thickness (t) or 0.01 in., whichever is greater. However, for exterior resistance-welded areas exposed

to passenger view, indentation shall not exceed 10% of material thickness or 0.005 in., whichever is greater. For exposed welds, the Contractor shall vary welding parameters and conditions within their acceptable ranges to minimize indentations. Surface burn and discoloration shall be removed by chemical cleaning, or an approved equal method, and sanding or polishing to match the surrounding surface.

k). Special Welding

i). Procedures for structural welding of stainless steel to HSLA, or other combinations of metals or conditions not covered by AWS specifications or codes, shall be submitted for approval. Welding PQRs for these dissimilar welds shall include a Vickers microhardness traverse spanning both base metals, the weld metal and both Heat Affected Zones (HAZ) and shall demonstrate that the hardness does not exceed 400 HV.

ii). Austenitic stainless-steel electrodes or wire specifically intended for welding of dissimilar metals, such as 309L or 312L, shall be used to join carbon or HSLA steels to stainless steels.

iii). For the application of welding processes not addressed in other parts of this specification, the Contractor shall submit equipment qualifications, procedure qualification records, and welding procedure specifications either conforming to identified industry standards or consistent with the approach of AWS Standard D17.2/17.2M, *Specification for Resistance Welding in Aerospace Applications*.

iv). Standards that may apply to selected processes include:

(1) AWS Standard D17.3/D17.3M, Specification for Friction Stir Welding of Aluminum Alloys for Aerospace Applications.

(2) ANSI/AWS Standard C7.2, Recommended Practices for Laser Beam Welding, Cutting, and Drilling.

(3) ANSI/AWS Standard C7.4/C7.4M, Process Specification and Operator for Laser Beam Welding.

(4) ISO/DIS Standard 15609-4, Specification and Qualification of Welding Procedures for Metallic Materials - Welding Procedure Specification - Part 4: Laser Beam Welding.

v). Galvanized steel shall not be welded to stainless steel. Brazing shall not be used to join stainless steel to either stainless steel or to any other metals.

l). Toughness of Welded Assemblies

i). The Contractor shall prove all welded steel structures are above the ductile-brittle transition temperature for the specified environmental exposure. Specifically, the weld Heat-Affected Zone (HAZ) and base metal shall resist service impact loads at the lowest specified operating temperature without brittle failure. If the Contractor's approved design does not require greater

toughness, the minimum impact value for Charpy V-Notch (CVN) specimens shall be 20 ft-lbf of absorbed energy at the lowest specified operating temperature. CVN test results shall be submitted along with Procedure Qualification Records (PQRs) for all structural steel welding procedure specification (WPS) qualifications.

m). Torch Brazing

i). All brazing, characterized by heating above 840°F, shall follow the recommendations contained in the AWS *Welding Handbook*, Volume 2. Procedures and personnel who do brazing work shall be qualified in accordance with AWS Standard B2.2, *Standard for Brazing Procedure and Performance Qualification*.

n). Torch Soldering

i). All structural (not electrical) soldering, characterized by heating below 840ºF, shall follow the recommendations contained in the AWS *Welding Handbook*, Volume 2. Procedures and personnel who do torch soldering shall be qualified in accordance with AWS Standard B2.3/B2.3M, *Specification for Soldering Procedure and Performance Qualification*.

19.21 Exterior Marking Films and Graphics

a). General

i). Graphics shall be transportation grade materials, printed on opaque background with clear, vandal resistant overlayment. All graphics materials are to be approved by Amtrak. Application techniques shall be in accordance with manufacturer's recommendations.

b). Physical Properties

i). Shall be able to withstand long-term exposure to all environmental and operating conditions specified in Amtrak Specification 963.

ii). Lettering film shall be sufficiently opaque so that, when applied, films shall completely hide any contrasting background and shall be readily legible.

iii). There shall be an initial 60-degree gloss value of 40 when tested in accordance with ASTM Standard D523-08.

iv). Films shall retain adhesive properties after one week of continuous exposure to a temperature of 66°C (150°F).

v). Films shall be able to conform to moderate contours of the vehicle's interior and exterior surfaces at locations where decals are to be applied.

vi). Overall thickness of processed film shall be between 0.10 mm and 0.20 mm (0.004 and 0.008 in.).

vii). Films shall withstand immersion in either distilled water or SAE No. 20 motor oil for 24 hours at temperatures from 21°C to 32°C (70°F to 90°F) without any appreciable degradation in adhesion, color or general appearance.

viii). Marking films shall withstand effects of detergents and brushes used in vehicle washing procedures for removal of graffiti.

ix). Films shall use a removable grade adhesive that upon removal does not require use of solvents or secondary operations.

x). Square or rectangular graphics shall have rounded corners of suitable radius.

19.22 Paints and Coatings

a). Materials and General Requirements

i). Painting of the car shall serve to protect the vehicle from corrosion.

ii). Paint is prohibited on the interior of the car at customer facing areas, unless otherwise approved by Amtrak on a case-by-case basis.

iii). Paint coatings should also assist in the overall maintenance of the vehicle by providing easy to clean surfaces. The vehicle must be fully and properly coated to achieve its service life with regular maintenance intervals. Interior surfaces shall in general not be painted, with specific approval being required during Design Review.

iv). The surface preparation, primer, paint, and graphics applications shall ensure that the car can operate at least eight years between major exterior finish repairs or replacement.

v). Preparation of the painted surface and application of painting materials for brushing or spraying shall be in accordance with the paint supplier's recommendations. Each coat shall be uniformly applied over all surfaces to be covered, and shall be free from runs, sags, or other application defects.

b). Paint Process Documentation

i). The Contractor shall prepare a paint coating and application document containing procedures for surface cleaning and preparation, priming, surfacing, repairing, and painting for the car body and all equipment that is painted or powder coated.

(1) A detailed paint schedule showing the equipment painted, paint type and manufacturers, recommended thickness, and other pertinent information shall also be included.

(2) The document shall meet Amtrak Specifications 353 and 354.

(3) This document shall be submitted during IDR and FDR and shall be included in the maintenance manuals. **[CDRL 19-06]**

c). Painting Restrictions

i). Any equipment or parts of equipment which would be damaged or suffer impaired operation from painting shall not be painted and shall be corrosion resistant.

ii). The following items shall not be painted:

(1) Wire and cable

(2) Copper tubing, piping, and fittings

(3) Conduit and fittings

(4) Heat transfer surfaces

(5) Grounding pads and straps

(6) Wheels

(7) Axles

(8) Brake rotors

(9) Brake shoes and pads

(10) Air hoses

(11) Pedestal liners

(12) Elastomeric parts

(13) Grease fittings

(14) Linkages

(15) Threaded parts used for adjustments

(16) Electrical equipment

(17) Couplers, drawbars, draft gears, and yokes

(18) Wearing surfaces

(19) Corrosion Protection

(20) Stainless steel carbody

d). Color Accuracy

i). The color differences between any measured production component and the accepted color sample for that component shall be less than ± 1 dE.

e). Corrosion Protection

i). Concealed surfaces capable of rusting or oxidation shall be properly cleaned, then primed with a rust inhibiting paint, and painted with an approved finish coat of paint.

ii). All exposed surfaces shall be suitably finished to prevent corrosion during storage and operation, in accordance with the following requirements:

(1) Areas exposed to dirt shall be designed to minimize retention of dirt and moisture, and sections that may retain moisture or dirt shall be provided with adequate drainage and ventilation and shall be accessible for cleaning. Under-pans or covers, suitable sealed, may be used where applicable to protect underframe sections.

(2) Joints and crevices shall be sealed with a polysulphide or equivalent sealant which is resistant to the operating environment, shall not absorb moisture and shall remain resilient and maintain its sealing properties for the life of the vehicle.

(3) Metal surfaces shall be treated with surface preparation and primer materials specific for the metal with due consideration for the severity of exposure to which the surface is subjected.

(4) Any corrosion protection removed for welding shall be replaced after welding is completed.

(5) Where arc welding is performed on joints between stainless steel and other materials.

19.23 Powder Coating

a). Powder coating shall have a smooth flow and uniform appearance with a particle size of <100 µm, and film thickness of 60 µm - 80 µm. For durability finished thickness will be between 1.5 and 2.5 mm.

b). Where like-anodize is specified. The powder coating shall have a silk gloss (satin) finish resembling anodized aluminum. Gloss level 65-85 R'/60°.

c). The powder coating shall be formulated to minimize environmental impact. VOC content shall be less than 5 g/L. Waste powder shall be recyclable and reusable.

19.24 Durability and Maintenance

a). The coating shall exhibit anti-graffiti properties and excellent weather resistance, achieving over 50% gloss retention after 3 years Florida exposure per ISO 2810.

b). It shall pass 1000 hours xenon arc exposure with over 90% gloss retention per ISO 16474-2.

c). The coating shall show no infiltration or blistering after 1000 hours condensation water exposure and acetic acid salt spray testing per ISO 6270-2 and ISO 9227.

d). It shall demonstrate good hardness and flexibility, passing cross-hatch adhesion, impact, cupping, and bending tests per ISO 2409, 2794, 1520, and 1519. The

coating shall allow mortar residue to be removed after 24 hours per ASTM D3260.

19.25 Insulation

a). Acoustical Insulation

i). To reduce movement, structurally borne sound, and noise generated by the vibration of the roof, floor and side sheets, panels, air conditioning ducts and other metal surfaces, in particular the doors, damping material shall be applied to the inner side of these surfaces (exterior of the HVAC ducts).

ii). Korfund Vibrodamper Compound, Aquaplas DL-10-HV or Amtrak approved equal shall be applied to the interior of the complete structural car shell including the roof, sides, floor, ends, webs of all posts, carlines, floor beams and other structural elements; however, if acoustic requirements can be fulfilled by car shell design (e.g., local stiffness) then a partial application of the compound would be sufficient.

iii). The material shall not contain any asbestos and shall meet the flammability and smoke emission requirements of Chapter 19.19. Application of this damping compound and the surfaces to which it shall be applied shall be in accordance with recommendations of the manufacturer of the compound. The thickness of the damping material shall be such that acoustic requirements are fulfilled.

b). Thermal Insulation

i). The roof, sides, under floor, and ends of the vehicles, including the inside faces of posts and structural members shall be fully insulated. The density, thickness and type insulation shall be determined by U value requirements established by the HVAC calculations and shall be in accordance with the requirements of these Technical Provisions.

ii). General

(1) Insulation materials shall be rigid, nonrigid or spray-on type. Materials shall be non-absorptive of fluids and gases, self-extinguishing, and vermin-proof, and shall have the required properties to meet the noise, vibration and heat loss limits as specified herein.

(2) All materials shall be graded and labeled as standard with the recognized industry associations or societies. Labels shall be permanently affixed to, or imprinted on, the packages or containers of the materials.

iii). Installation

(1) All insulation materials shall be installed in accordance with the Manufacturer's recommendations. Rigid and non-rigid preformed insulation shall be secured with mechanical fasteners or fire-resistant adhesive, or both. Spray-on insulation shall be applied over surfaces free from dirt, grease and other contaminants that might affect the

adherence of the material. Parts subject to corrosion shall be given required protection prior to applying the insulation. The Contractor shall take care to avoid thermal shorts in the insulation as installed. Exposed insulation fibers are not allowed. The design should minimize the use of insulation tape.

iv). Materials

(1) The following materials are acceptable for use on the vehicle:

(a) Rigid insulation

(b) Glass fiber preformed board

(c) Non-rigid Insulation

(d) Spun glass fiber in flexible rolls or mineral wool batts

v). Insulation Performance

(1) Insulation materials shall be certified to conform to the following requirements:

Property	**ASTM Test Method**	**Requirement**
Flame Resistance		
Glass Fiber Board	E162 E662	Flame spread 25 max Ds(4.0) – 100 max
Non-rigid Insulation	E162 E662	Flame spread 25 max Ds(4.0) – 100 max.
Spray-on Insulation	E162 E662	Flame spread 25 max Ds(4.0) – 100 max.
Vapor Barrier		
Rating	C353 Water Method	2.5 perm at 90°F [32°C] and 50% relative humidity
Note: A vapor transmission rate of one grain of water vapor per square foot per hour at a pressure difference of one inch of mercury is defined as one perm.		

(2) The thermal conductivity of insulation materials shall be certified when tested in accordance with ASTM C177-04 or ASTM C518 at 75°F [24°C] mean temperature.

(3) Insulation separated by a vapor barrier shall be used under the floor. The underfloor insulation shall be protected by stainless steel sheathing which shall seal the underside of the vehicle against water, dust and debris.

(4) Floor insulation material shall be compatible with the material used at locations in the vehicle structure and shall not mold, rot, or sustain vermin.

19.26 Flammability and Smoke Emissions

a). General

i). The vehicle and its components shall comply with the requirements of 49 CFR Part 238.103 Appendix B, NFPA 130 Chapter 8, and APTA Recommended Practice PR-PS-RP-005-00. Compliance of the materials with these requirements shall be fully documented with test reports and certificates. For test reports submitted from previously performed tests, the Contractor shall demonstrate that materials included in the test report are identical to the actual materials used on the construction of the vehicles. For high-risk materials, test data from these reports shall be dated no more than five years old from the Contract award data and shall be submitted to Amtrak for approval. For low-risk materials, test date from these reports that are dated between five and 10 years old shall be accompanied by a letter from the manufacturer stating that the materials included in the test report are identical to the actual materials used in the construction of the vehicles. Materials deemed as low risk shall be approved by Amtrak.

ii). There are instances where the Specification calls for use of specific materials, such as Lexan, when it is known that they do not meet all requirements of this Chapter. It is predetermined that use of materials defined by this Specification is acceptable.

iii). A Smoke, Flammability and Toxicity Matrix showing the total weight of each combustible material, where used, supplier's name, flammability and smoke emission test identity, test facility, test requirements, test results, nature and quantity of the products of combustion, and heating value in Btu/lb and Btu/hr shall be submitted by the Contractor during detailed design review. This table shall include all items including items which are/ have been waived from testing or are considered small items with associated waiver numbers listed for approved waivers. **[CDRL 19-07]**

iv). Maximum limits for smoke emission shall be determined using the smoke propagation mode which generates the most smoke.

v). Should the Contractor believe that the quantity of a particular material is such that it would not contribute significantly to a fire, the Contractor may request a waiver from testing for this material. The waiver shall be submitted in writing and shall include the total weight of the material to be used, the location and the distribution of the material in the vehicle, and any previous test reports available. Waivers shall be accompanied by proper justification and will be reviewed on a case-by-case basis. The Contractor shall be responsible for complete conformance with these standards for itself and its subcontractors and suppliers. Amtrak may, at its discretion, require that the current batch of material being provided for this Contract be retested for conformance with these standards.

b). Electrical Fire Safety

i). Electrical equipment shall conform to NFPA Standard 130, Section 8-6, except where more restrictive requirements are imposed by this Specification.

c). Combustible Content

i). The design of the vehicle shall minimize the total combustible material content of the vehicle.

d). Toxicity

i). Those materials and products generally recognized to have highly toxic products of combustion shall not be used.

ii). All materials used in the vehicle construction, except for materials used in small parts (such as knobs, rollers, fasteners, clips, grommets, and small electrical parts) that would not contribute significantly to fire propagation or to smoke or toxic gas generation, shall be tested for toxicity using Boeing Specification Support Standard BSS-7239. Materials shall meet the following maximum toxic gas release limits (ppm) as determined per BSS-7239.

Carbon Monoxide (CO)	3500 ppm
Hydrogen Fluoride (HF)	200 ppm
Nitrogen Dioxide (NO_2)	100 ppm
Hydrogen Chloride (HCL)	500 ppm
Hydrogen Cyanide (HCN)	150 ppm
Sulfur Dioxide (SO_2)	100 ppm

iii). The tests shall be run in the flaming mode after 240 seconds using the NBS Smoke Density Chamber for sample combustion. The gas sampling may be conducted during the smoke density test. The test report shall indicate the maximum concentration (ppm) for each of the above gases at the specified sampling time. The Toxicity test data shall be included in the Smoke, Flammability and Toxicity Matrix.

19.27 Piping

a). General

i). All piping shall be deburred and blown out after cutting or forming. After installation, the piping runs shall be cleaned using an approved method and procedure.

ii). Piping shall be installed free of low spots to provide complete drainage away from control devices and to prevent damage by freezing. All piping shall be adequately clamped (clamps not welded to pipe) to prevent vibration, using an approved elastomeric tape between the clamp and the pipe. Copper tubing shall be sheathed at clamps or sheathed clamps shall be used. Piping through bulkheads or structure shall be positioned to avoid chafing by the

use of clamping and/or grommets. Air and water lines shall be assembled to allow sufficient slope to permit gravity drainage.

iii). All piping shall be installed using a minimum number of fittings. Unions shall be used only where necessary to permit replacement of apparatus. Hoses shall be provided with swivel type fittings to allow replacement without disturbing surrounding piping or apparatus. Steel braided hoses should be considered for connection of all faucets and small water heaters for ease of maintenance. Piping in storage or left open due to the installation shall be capped to prevent contamination.

b). Air Brake Piping and Fittings

i). Air brake tubing and piping shall be of good commercial quality, free of burrs and scale.

ii). Carbody air line which is 0.5 in. nominal and smaller, and in protected locations, shall be of seamless copper tubing, in accordance with Federal Specification WW-T-799F, Type "K", with wrought copper or cast brass sweat type fittings in accordance with ANSI Standards B16.22 and B16.18, or stainless steel. Fittings for stainless steel pipe shall be approved by Amtrak.

iii). All air piping on trucks and carbody air lines larger than 0.5 in. nominal or where subjected to flying debris shall be black pipe conforming to ASTM Standard A53/A53M (schedule 80) with black malleable iron welded fittings, all painted the same as the underframe. Stainless steel pipe and welded stainless steel fittings may also be used where approved by Amtrak. Bends in piping shall utilize large bend radii whenever possible to prevent restriction to the free flow of air. Threaded fittings may be used only where approved on a case-by-case basis. Malleable iron street ells or close nipples shall not be used, except at brake valve exhaust ports.

iv). Hoses shall be allowed where relative motions are expected such as coupler to carbody, truck to carbody, between truck components, vibrating equipment to its mounting base, and other applications as approved by Amtrak.

v). Brake system piping shall be installed in accordance with the recommendations of AAR Standard S-400. Brake piping shall have no low spots (traps) or any 45º or 90º elbows that form "doglegs" in piping runs. The highest point in the Brake Pipe shall be the branch pipe connection to the brake control unit.

vi). Any piping or tubing which could be disconnected during servicing (event recorder air manifold, etc.) shall be permanently labeled to enable the piping to be reconnected correctly when reassembled.

vii). Flexible air lines utilized in toilet systems shall meet or exceed SAE J844.

c). Air Conditioning and Refrigeration System Piping and Fittings

i). Air Conditioning refrigerant lines shall be of annealed seamless copper tubing meeting the requirements of either ASTM B 280 or ASTM B 88 Type K copper tubing and the requirements of ANSI Standard B16.22 shall be used for wrought copper sweat type fittings. This shall also apply to lines within supplier furnished apparatus except that finned tubing in evaporators and condensers need not be type K. Instead of elbows, tubing may be bent by means of a tubing bending tool. All tubing shall be deburred after cutting.

ii). Piping shall be routed to keep the amount of bends to a minimum. All inaccessible runs of tubing shall be without joints. All suction lines and those subject to sweating shall be insulated. If necessary to limit transmitted noise and vibration to the carbody or to protect the refrigerant compressor from external vibrations, vibration isolators shall be used in the piping connections to the refrigerant compressor.

iii). After fabrication, the system shall be cleared of all dirt and foreign matter using an approved procedure. The completed refrigeration system shall be evacuated and charged with refrigerant using an Amtrak-approved procedure.

iv). The discharge of condensate drains lines shall be directly to the roadbed avoiding car structure, electrical cables, and other undercar equipment.

d). Soldering of Piping and Fittings

i). Copper air brake and refrigerant tubing lines shall be continuously purged with an inert gas during joining and shall be joined using silver solder conforming to Federal Specification QQ-B-654A, BCuP-5, or BAg-5.

ii). Condensate drain tubing and car body air brake tubing shall be joined using silver solder. Soldered joints shall be wiped, and the flux cleaned from the tubing and fittings after soldering.

e). Water Piping and Fittings

i). Water piping shall be stainless steel or seamless copper tubing in accordance with ASTM Standard B75- 02 and sized for the service intended. Piping shall be clamped with necessary sound insulation to prevent rattle and be sloped to allow drainage. The use of color coded PEX water lines with crimped fittings may be acceptable but needs further approval by Amtrak.

ii). Fittings shall be sweat type wrought copper or cast brass in accordance with ANSI Standards B16.22 and B16.18 or “Swage-lok” compression type or stainless steel.

iii). All piping, fittings and other wetted surfaces shall be of "lead free" composition.

iv). If copper piping is used, it shall be joined using silver solder conforming to AWS Bag-2 for cast brass fittings and to AWS BCup-3 brazing filler metal for wrought copper fittings, using a continuous purging with an inert gas during

joining. The use of solder with lead content is strictly forbidden. The exterior of brazed joints shall be wiped clean after brazing. Flux shall be cleaned from the piping interior of brazed joints.

v). After installation, the complete water system shall be sanitized using the sanitizing procedure currently used by Amtrak per SMP 47601.

vi). The piping shall be routed and sloped to allow for proper drainage. Low points in piping shall be equipped with Ogontz or equivalent automatic drain valves (specified in respective Chapters), each equipped with a heater, which shall discharge all the water in the vehicle to the tracks whenever the air temperature at the valve falls below 38ºF. This shall be demonstrated during the climate room testing described in Chapter 20.

vii). To ensure complete drainage, venting valves shall be provided to operate in conjunction with the drain valves. At each automatic drain valve, a manual drain valve shall be piped in parallel. Sufficient manual drain valves shall be provided to allow complete draining of the car. Valves shall be labeled in accordance with Amtrak Specification 696. Manual drain valves shall be accessible without use of tools and location is subject to Amtrak approval.

viii). Drains from the water system shall be routed to discharge directly onto the ground, avoiding car structure, electrical cables and all other undercar equipment.

ix). To ensure effective drainage and prevent the accumulation of standing liquid, all drains must either have a recessed cover or, if no cover is required, the drain hole must be positioned as the low point with no interferences “i.e.” weld buildup. Additionally, to prevent liquid pooling all drainage systems must be sloped to the drain, allowing liquid to flow freely.

x). Electrically powered freeze protection, such as heat trace tape secured with conductive aluminum tape, shall be provided for the water fill housings, underfloor and/or equipment area water piping, water system drainpipes, and water tanks. A blanket heater may be used to protect the water tank. All electrically powered freeze protection components shall be readily accessible for routine maintenance and repair. Provisions shall be provided, whether through current detection and/or LED indicators to alert on board personnel as to the function of the freeze protection components.

f). Sewage Piping and Fittings

i). All toilet system piping, the waste tank and all associated fittings, drain piping and serving valves, unless otherwise permitted by Amtrak, shall be manufactured from acid-resistant stainless steel suitable for sewage service.

19.28 Fiberglass-Reinforced Plastic

a). General

i). Fiberglass-Reinforced Plastic (FRP) shall be a glass-fiber-reinforced, laminated material, composed of a gel coated surface, fiberglass

reinforcement and a polyester or other approved thermoset resin. FRP shall withstand, without any physical deformation or structural damage, the environmental conditions in Amtrak Specification 963, be resistant to acids, alkalis and cleaning solutions used by Amtrak.

ii). FRP shall be manufactured by the matched die molding or open molding process. Production techniques shall ensure that the glass fiber reinforcement is distributed throughout the final product in such a manner as to avoid resin-rich or resin-starved sections. A structural analysis shall be provided to confirm that the construction method chosen is adequate for its intended purpose.

iii). FRP parts shall have a greater thickness at attachment points and edges. Exposed sharp edges will not be allowed on any parts. Fasteners used to secure sections of FRP assemblies if used shall not be removed or cutoff to facilitate fit-up during installation to the car.

b). Resin

i). The resin shall be of high-quality, commercial grade, thermosetting, polyester, phenolic or vinylester material selected to meet the requirements of the Contractor and manufacturer molding process requirements.

c). Reinforcement

i). The fiberglass reinforcement shall be mat, fabric woven roving, continuous roving, chopped spun roving, or swirl mat as required to meet the physical properties of this Specification and the molding process requirements. The glass content shall be a minimum of 20% by weight. FRP should be straight without bowing and flexing. Additional supports may be required.

d). Gel Coat

i). The gel coat shall be a high gloss finish resistant to scuffing, fire, weather and cleaning agents. The gel coat shall have a minimum thickness of 0.015 in. If the surface of the FRP panel is to be painted, a primer gel coat shall be used and the part shall be painted in accordance with manufacturer’s specifications. If the FRP panel does not receive paint, then the gel coat shall be pigmented to match the color selected by Amtrak. The reinforced composite component shall be gel-coated on all exposed surfaces. The surfaces shall withstand, without any physical deformation or structural damage, the environmental conditions and resistance to acids, alkalis and cleaning solutions recommended by the Contractor.

e). Additives

i). Additives, fillers, monomers, catalysts, activators, pigments, fire retardants and smoke inhibitors shall be added to the resin mixes to obtain finished products with the required physical characteristics of this Specification.

ii). Mineral filler shall not exceed 28% of finished weight for any preformed matched die molding process.

f). Color Accuracy

i). The color differences between any measured production component and the accepted color sample for that component shall be less than ± 1 dE.

g). Strength Requirements

i). Independent laboratory test certificates shall be provided stating that the reinforced plastic material complies with the requirements of the following standards. Test specimens shall be conditioned in accordance with ASTM D618-08.

Mechanical Property	ASTM Test	Open Moldings	Matched Die Molding
Tensile Strength	D638-08	10,000 lbf/in.^{2}	12,000 lbf/in.^{2}
Compressive Strength	D 695	18,000 lbf/in.^{2}	22,000 lbf/in.^{2}
Flexural Strength	D790	15,000 lbf/in.^{2}	22,000 lbf/in.^{2}
Impact Strength	D 256	6 ft lb per in. of notch	8 ft lb per in. of notch
Hardness	--	45 Barcol	45 Barcol

19.29 Thermoplastic Sheet

a). General

i). Thermoplastic sheet used in the construction of the vehicle shall withstand, without any physical deformation or structural damage, the environmental conditions described in Amtrak Specification 963, and shall be resistant to Amtrak cleaning solutions. Thermoplastic sheet shall be used as extruded or vacuum-formed.

ii). All non-visible thermoplastics should be made up of 100% recycled content, and visible parts a minimum of 50% recycled content.

iii). Only UV stabilized pigments shall be used to create the specified color of the thermoplastic sheet. The color and surface finish of parts manufactured from this material shall be approved prior to the production run of any parts.

iv). Unless otherwise stated in the specification, all visible plastic moldings should have a textured surface of VDI39 with a uniform surface appearance.

b). Quality

i). The finished parts shall be free of waves and quilting on both sides. Degraded polymer in the sheet shall not be allowed, and if present, shall be cause for rejection of the piece. Voids, lumps and contamination shall also be cause for rejection of parts if the defects are larger than 0.010 in., and the population of these defects is greater than one defect in four square feet.

c). Strength Requirements

i). Independent laboratory test certificates shall be provided stating that the thermoplastic sheet complies with the requirements of the following standards. Extruded sheet in the surface finish specified shall be used for testing.

Mechanical Properties	ASTM Method	Value
Specific Gravity	D 792	1.20 to 1.45
Tensile Strength	D638-08	7,000 lbf/in.^{2} minimum
Tensile Modulus	ASTM D638	450,000 psi
Flexural Strength	D790	10,000 lbf/in.^{2} minimum
Flexural Modulus	D790	4.5 x 10^5 lbf/in.^{2}
Hardness Rockwell	D 785	90 to 120 ("R" Scale)
Heat Deflection (annealed)	D 648 @ 264 lbf/in.^{2}	190ºF minimum
Impact Strength (Fabricated Parts)	D 3029 Gardener Dart Drop 0.5" dia. ball at 73°F	320 in. lb minimum

d). Color Accuracy

i). The color differences between any measured production component and the accepted color sample for that component shall be less than ± 1 dE.

19.30 High Pressure Laminates

a). Flat Textured HPL

i). The laminate shall have a decorative melamine surface available in a variety of colors, patterns, and finishes. The backside shall be sanded smooth. The laminate shall have a uniform appearance free of defects and 0.375 in thickness.

ii). The laminate shall utilize sustainable materials with low VOC content, per 40CFR59, Subpart C. It shall be recyclable at end of life.

iii). HPL must meet ASTM E 162-98 for flammability index of less than 35 and BS 476 Part 7 Class 1 for flame spread. It shall meet ASTM E-662-01 with smoke emission of less than 100 in the first 1.5 minutes and less than 200 in the first 4 minutes.

iv). Thickness shall be approximately 0.030 to 0.050 inches to meet strength and fire performance requirements.

v). The laminate shall resist staining, impacts, boiling water, and other common exposures. It shall have wear resistance of 400 cycles minimum per NEMA LD3. Laminate shall be repairable or replaceable if damaged.

b). Pressed HPL

i). Pressed laminate will emulate a slatted wood effect, with a pressed texture design on a wood-grain HPL.

ii). This material should match as closely as possible the color and grain of the real wood laminate specified.

iii). Texture detail to be defined in the design review process.

iv). Pressed HPL will meet all performance criteria listed in Section 19.28a).

19.31 Decorative Laminate Film

a). The decorative laminate film shall be a lightweight, glass fiber reinforced Tedlar-capped material suitable for application to thermoplastic substrates. The film shall be dimensionally stable yet flexible enough for application to flat and moderately curved surfaces.

b). The material shall meet all flammability, smoke, and toxicity requirements of this specification.

c). Multiple layers will be required to meet the Customer Experience Vision requirements as approved in Final Design Review.

d). Film materials must meet low toxicity standards set out in ABD 0031 for the following substances (ppm):

i). HF ≤ 70 *)

ii). HCl ≤ 120 *)

iii). HCN ≤ 10 *)

iv). NOx ≤ 10 *)

v). CO ≤ 300 *)

vi). H2S+SO2 ≤ 10 *)

e). Durability and Maintenance

i). The film shall demonstrate exceptional resistance to staining, solvents, chemicals, and abrasion for ease of cleaning with common cleaners.

ii). In high traffic areas, film must be glass fiber reinforced.

iii). The film shall pass testing for adhesion, abrasion resistance, mar resistance, dimensional stability, graffiti resistance and detergent resistance. It shall demonstrate a tensile peel strength of at least 4.5 lbs/in after 168 hours when applied according to manufacturer specifications. Standard details:

(1) Adhesion of Surface Layer DMS 2291: Pass

(2) Abrasion Resistance DMS 2290: Pass

(3) Tensile Strength ASTM D 882 (psi / N/mm²)

(a) long. d. ≥10.670 / ≥ 75

(b) tran. d. ≥ 9.960 / ≥ 70

19.32 Solid Polymer Surface

a). Solid surfaces will be a non-porous, fully sealed, homogeneous material maintaining the same composition throughout the part.

b). Composition shall be of acrylic polymer, natural minerals (aluminum trihydrate) and pigment, with a satin finish.

c). A thickness of no less than 1/2 inch must be approved by Amtrak on a case-by-case basis.

d). Material shall naturally resist damage from heat, mold, mildew and stains.

e). Material shall be assembled with non-porous, waterproof seams.

i). Location and process for implementing seams must be implemented for approval.

ii). All seaming plans must be submitted for Amtrak acceptance.

f). The material shall meet all flammability, smoke and toxicity requirements of this specification.

g). A minimum of 14% Pre-Consumer Recycled Acrylic should make up the composition of the material.

h). The material must meet GREENGUARD GOLD Certification for low chemical emissions and be ROHS compliant.

i). Solid surface should be repairable in situ for scratches, and the supplier should provide a 10-year commercial warranty for the material.

19.33 Air Filters

a). HVAC and Equipment Ventilation Filters

i). HVAC system air filters shall conform to Amtrak Specification 685 or as approved by Amtrak and shall be selected in accordance with the manufacturer's recommendations for the specific equipment involved. All filters shall have an integral frame. Filters shall be the throw-away type available in standard commercial sizes except reusable filters that may be approved for specific applications where throw-away filters are not available. Filters shall be designed to meet the performance requirements of each installation and shall be approved.

b). High Pressure Air Filters

i). An air filter assembly with a replaceable filter element shall be provided in the air line that connects each subsystem to the main reservoir air supply

system. The main reservoir air filter filtering capability, flow rate capability and overall size shall be appropriate for the application so that the filter replacement interval is greater than one year. Quality of compressed air supplied by the locomotive shall conform to APTA Standard PR-M-S-011-99. It shall be possible to gain access to the filter element for replacement without requiring any pipe fittings to be disconnected or loosened. Glass fiber mat types of filter media shall not be used for high pressure or high-volume applications. Filters shall be provided for each of the following systems and any others operated from the air supply system:

(1) Each air brake control assembly

(2) Waste system

(3) Horn

(4) Low pressure air filters

ii). Replaceable media type filters shall use resin-bound, spun-glass fiber materials. It shall be non-absorptive of fluids and gases.

19.34 Wire and Cable

a). General

i). All wire and cable used shall exhibit the physical and electrical properties for 110ºC rated wire and cable specified in Amtrak Specification 323. High temperature wire, used for heater circuits, shall be as defined as Amtrak Specification 323.

ii). A minimum number of wire types and sizes shall be used in the vehicle. Selection of wire size and insulation shall be based on the current carrying capacity, voltage drop, mechanical strength and temperature and flexibility requirements and in accordance with APTA Recommended Practice PR-E-RP-009-98 and applicable AAR, ICEA, ASTM or MIL Specifications. The Contractor shall submit to Amtrak for review and approval, a procedure for installation of wiring and cable, including the criteria and procedures for the repair of damaged wire or cable. This procedure shall be included in the heavy maintenance manual.

iii). In no case shall wire smaller than the following sizes be used:

(1) Wire on electronic units, cards, and card racks – No. 22

(2) Wire in control compartment – No. 16, No. 18 with Amtrak approval

(3) Wires pulled through conduits and/or wireless – No. 12, No. 14 with Amtrak approval

(4) All other wire – No. 12, No. 16 with Amtrak approval

b). Wiring – General

i). All vehicle wiring shall be in conformance with APTA Recommended Practice PR-E-RP-002-98 and PR-E- RP-009-98, Chapter 3 of the National Fire Protection Association's Publication NFPA No. 70, and the AAR Manual of Standards and Recommended Practices, Section F, Specification S-538, *Wiring Practice and Rolling Stock Standard*, except where otherwise specified, and except that all wire shall be as required in this Specification. Design wire amperage capacity shall comply with the latest revision of the National Electric Code. When more than three current-carrying conductors are applied in a raceway or cable, the amperage capacity shall be derated. Circuit protection shall be in conformance with Chapter 2 of NFPA publication No. 70, Article 240.

ii). Shields used for audio and other wiring requiring EMI/RFI protection shall be grounded at one point only within the vehicle, and not at both ends of the shield.

c). Data Communications Wiring

i). All data communications (Ethernet) wiring shall be able to support EIA/TIA 568 Cat 6a communications for data on rolling stock. It shall be suitable for use in undercar and inter-car applications when installed in flexible (polyimide) or rigid conduit; it shall be suitable for the application and shall maintain long-term electrical integrity for all aspects of the EIA/TIA requirements including impedance, crosstalk, attenuation, and shielding effectiveness. The cable will also meet environmental and safety requirements associated with rolling-stock cables. The cable shall be designed with rolling-stock requirements in mind and will support high-speed data transfer for no less than 20 years in the rail environment. All accelerated life tests performed in the qualification are specified with the intention of this service life. The cable shall be designed so that installation with normal care into new car shells or undercar will not damage its electrical integrity. The cable shall be designed so that installation in raceways with other cables is proper (cable will not be impacted by crushing or cable-to-cable abrasion). The cable shall be able to be terminated with vendor specified connectors that are suitable for use in industrial communication equipment (M12 or similar).

ii). The cable shall have the following characteristics:

(1) Construction

(a) Conductors: Stranded tin-plated copper 4 x (2 x #24AWG) (or .5mm2)

(b) Insulation: Radiation cross-linked data grade polyolefin 125V

(c) Component configuration: Wires are twisted or helically cabled to ensure electrical performance to Cat 6a standards – 100Z characteristic impedance on finished cable

(d) Shielding: Foil and TC braid designed to meet 200mZ/m transfer impedance

(e) Binders/tapes: As required to enhance integrity

(f) Jacket: Radiation cross-linked polyolefin (low smoke, complying with toxicity requirements) 0.8 mm minimum at thinnest point.

(2) Electrical Requirements

(a) Impedance: 100Z+/-5Z

(b) Shielding effectiveness (30 MHz- 100 MHz): 40dB

(c) Voltage rating: 300V

(d) Shall comply with TIA Standard, TIA-568-C.2 for Balanced Twisted-Pair Telecommunications Cabling and Components Standards

(3) Environmental Requirements

(a) Cable jacket will withstand the following tests per AAR RP 585

(b) Tensile and Elongation Section 5.1 and 5.2

(c) Oil Resistance 5.3 and 5.4

(d) Thermal Shock 5.8.4

(e) Penetration 5.9.4

(f) Abrasion 5.9.8.2

(g) Corrosion resistance ASTM D2671-00(2007)e1

(h) Temperature -40°C - 90°C

(4) Mechanical Requirements

(a) Bending radius: 6x OD (fixed)

(b) Car-to-car cables should have a test modeling the installed condition, with periodic measurement of electrical characteristics – 3,000K cycles – with no application-altering failure in electrical performance.

(5) Smoke and Flame

(a) NFPA 130 (UL1685) or equal, i.e., UL 1581 (tray) or IEEE 383 1974

(b) Amtrak Specification 352, Smoke Flame and Toxicity

d). Wire Handling

i). All wiring shall be performed by qualified, experienced wiring personnel using appropriate tools for stripping insulation, cutting, tinning, soldering, harness making, attaching terminals and other wire fabrication tasks. All wiring tools and equipment shall be used as recommended by the tool and equipment manufacturer.

ii). Wire shall be protected from damage during all phases of equipment manufacture. Wire shall not be walked on, dragged across sharp or abrasive objects, kinked, or twisted, or otherwise mishandled. The ends of wire shall not be permitted to lay on wet floors or other damp areas where moisture may be absorbed into the conductors.

iii). When removing insulation, wire strands shall not be nicked or broken in excess of the requirements of FAA Specification No. AC 43.13-1A, Section 449, *Stripping Insulation*. Additionally, the following criteria apply:

Wire Size	**Maximum Number of Nicked Strands***
Wires smaller than No. 10	None
No. 10 through 1/0	7.4 percent
Above 1/0 through 1600/24	4.4 percent
Above 1600/24	graduated scale
*Definitions: A cutoff strand shall count as two nicked strands. A nick is defined as 25% or more of the strand area damaged or cut more than 1/3 of its diameter.	

e). Wire Harness

i). The layout of wiring, for both vehicles and equipment, shall be designed in advance of its installation and in cooperation with the suppliers of the related equipment. Wiring shall be prefabricated into standard harnesses, wrapped, and tied with nylon wire ties or a high strength, waxed lacing cord designed not to invade the wire insulation. Harnesses shall be installed with identical arrangement and location in each vehicle having similar equipment. Separate harnesses shall be provided for major circuit groups or types, or as required for specified circuit separation. All circuits and branches shall be separable by means of terminal boards or approved connectors to isolate portions from others for troubleshooting. All circuits subject to periodic high potential tests shall be so arranged that they can be conveniently isolated for the tests.

ii). Alternative methods for fabricating and installing wiring, which are standard carbuilder practice, may be submitted for consideration by Amtrak at the appropriate design review.

iii). Harnessed wires shall not be installed in conduit or wire ways. Wires from different conduits or other openings shall not be harnessed together with wires running within the box or entering the box through another entrance point. Each harness or group of wires between equipment enclosures shall

contain a minimum of 10% spares, but no fewer than two spares for each wire size at the time of car delivery. All conduits and wire ways shall be arranged to allow ease of replacement of individual wires between equipment enclosures after delivery.

f). Circuit Separation

i). Circuits shall be physically separated to reduce the possibility of unsafe conditions, electrical interference, or equipment damage.

ii). The following major circuit groups shall not be harnessed or bundled together, shall not run in the same conduit, and shall be physically separated and secured in enclosures, wire ducts, junction boxes, or other wire routing devices:

(1) 480VAC HEP trainline

(2) 27-point communications trainline

(3) 27-point MU trainline

(4) I-ETMS/PTC/Cab Signal circuits

(5) AC power circuits

(6) DC control circuits

(7) Communication circuits

(8) Unprotected wiring (e.g., battery or HEP trainline to circuit breaker)

(9) Data communications (Ethernet) wiring even though it might be in the same car to car 27-point communications trainline jumper

iii). Conductors which shall operate at potentials differing by 50 volts or more shall not be cabled together and shall not be placed in the same conduit, raceway, duct, junction box, or enclosure, except that 120VAC and 480VAC may be run in same conduits providing all the wire insulation is rated at 600VAC minimum. Where it is impossible to avoid having wires at different voltages in the same equipment enclosure, the wires shall be physically separated, bundled, and secured separately such that contact between wiring is not possible. All wiring within an enclosure shall be insulated for the highest voltage in the enclosure unless Amtrak approved otherwise.

iv). Wiring connected to transient-generating apparatus shall not be run adjacent to wiring carrying signals to, from, or between semiconductor circuits, logic circuits, vital no-motion circuits, data transmission or communication circuits. In cases in which adequate physical separation is impossible, shielded wire shall be used for all conductors involved.

g). Wire and Cable Runs

i). Wire and cable runs shall be properly placed to be protected from the environment, debris and be arranged to allow for proper heat dissipation per manufacturer's requirements.

ii). All wire and cable shall be free of kinks, insulation damage, insulation abrasions and nicked strands. Wire installation shall not be subject to accumulations of water, oil, or other foreign matter. Flexible Nylon or Sealtite conduit shall not be used on the exterior or underside of the carbody without Amtrak approval.

iii). Cables shall be laid in place with sufficient slack at the bends so that cables will clear the inside bend surface of the strain relief device.

iv). Conduit shall be attached to the carbody employing clamps; welding shall not be used under any circumstances.

v). Concealed wires, such as within conduits, raceways, and wire ducts shall be such that wires may be replaced or added to without the removal of other than an access panel at each end of the wire. It shall not be necessary to disconnect or disassemble conduit to accomplish this task.

vi). Wiring run in loom shall not be carried over a potential chafing hazard.

vii). Wires entering any removable box shall be harnessed and secured to facilitate removal of the box.

viii). All wires and cables shall be fully protected against any contact with any surface other than that designed specifically to support or protect them. This applies to all current carrying wires, cables, or buses on the vehicle.

h). Undercar

i). The 480VAC HEP trainline conductors shall be cleated in place; No. 6 AWG and larger may be cleated in place or installed in rigid conduit.

ii). All undercar wiring smaller than No. 6 AWG shall be run in Rigid Galvanized Steel (RGS) conduits in an approved manner. Conduits shall be of waterproof construction. Permanently retained watertight strain relief bushings, with insulated throat liners of an approved design, shall be used at locations where wires, cords or harnesses enter or exit conduit, junction boxes and equipment enclosures. In addition, strain relief bushings on equipment enclosures shall include a permanently retained O-ring type seal.

iii). In addition to cleating of the 480 VAC trainline and NO 6 AWG and larger cables, they should be enclosed in a stainless-steel wire way as to not be exposed to the elements or debris strikes.

iv). Wires or cables shall not pass through or over the battery compartment and shall not pass overheat generating equipment, even if the wires or cables are in conduit.

v). Rigid galvanized steel conduit shall be run to all rigid-mounted enclosures. One Rigid conduit union shall be used in each run of conduit between rigid-mounted enclosures. The use of running threads is prohibited.

vi). RGS conduit shall be run as near as possible to resiliently mounted equipment, with flexible conduit, not to exceed 18” in length, completing the run. The use of flexible conduit shall be limited as much as possible.

vii). Open undercar wiring shall be protected over the trucks by running the wiring through RGS conduit, with suitable protective bushings applied at the ends.

viii). Conduit routing and the connection to boxes shall minimize exposure to water entering the conduit: for example, conduit should not enter from the top of the enclosure if possible. Drip loops shall be employed as appropriate.

i). Exterior of Roof

i). All wiring to roof-mounted equipment shall be run in rigid galvanized steel conduits within the carshell.

ii). Wires or cables exposed or in conduit shall not pass over or near heat generating equipment.

iii). Conduit routing and the connection to boxes shall minimize exposure to water entering the conduit: for example, conduit should not enter from the top of the enclosure if possible. Drip loops shall be employed as appropriate. Boxes shall be raised above surfaces where water, snow/ ice could accumulate (including from plugged drains), to reduce the possibility of water incursion.

j). Interior

i). Any wiring passing through the floor shall be run in rigid conduit. Wiring, even if enclosed in loom, must not be run through partitions without suitable bushings being provided at such points of passage. Conduit openings from below must extend at least 1 in. above the floor level to ensure water cannot enter the conduit from above, such as from a wet floor.

ii). All 480V wiring above the car floor and within the sides, ends or roof of the car shall be carried in EMT or rigid steel conduits. Short runs, not to exceed 18 in. of flexible conduit may be employed to make final connections to equipment. If used, flexible conduit must meet all Smoke, Flame and Toxicity requirements. All wiring in the walls shall be in EMT or rigid conduit. Wiring in the roof shall be carried in thin-wall aluminum or steel conduit, in metal duct or “Panduit” material meeting the requirements of Amtrak Specification 352. All flexible nonmetallic conduits shall be installed in protected areas only, unless specifically approved by Amtrak. In wire ducts, wire shall be secured at each entrance and exit point, to prevent chafing movement.

k). Cable Cleating and Support

i). Open-run cable shall be supported by using split-block cleats of molded neoprene or silicone rubber, spaced no more than 4 feet apart. Slack shall be allowed in the cable to accommodate both thermal expansion and contraction of cable.

ii). Each cleat shall have a channel-shaped stiffener of at least 10-gage material on the side away from the mounting bracket which shall act to spread the bolt clamping force over the entire length of the cleat. Bolts shall have lock nuts.

iii). Cleats shall be designed to grip each cable individually and firmly, but without causing any damage to cable insulation, including cold flow of the insulation. Cleats shall include spacers in the mounting holes to prevent crushing the cleat by overtightening the mounting bolts. Each cable in the cleat shall have its own cutout sized to the correct wire diameter. The cleat material shall be fire retardant insulating material with a durometer of 50 to 60.

iv). Cleated cables shall be routed and supported such that they cannot, under any combination of forces and car movement, touch each other or any other part of the car, except the cleat cushioning material.

l). Wire Securement and Termination

i). All wiring shall be secured and protected against movement, chafing, and any contact with conductive, sharp, or abrasive objects including the inside surfaces of wire runs.

ii). No wiring shall be secured directly to the vehicle structure, equipment enclosures, or any metallic surface. Wiring securing devices shall be either completely non-metallic or metallic with a resilient, insulating member between the wiring and the metallic portion of the device.

iii). All wiring shall be located and secured such that normal equipment motions, maintenance access, heat sources and the environment do not damage or reduce the life of the wiring.

iv). Junction boxes, with terminal boards, shall be used, as required, for wire terminations. Harness connections to the boxes, as well as internal wiring to terminal boards, shall be as specified. Exterior junction boxes shall be watertight.

v). Wire and cable dress shall allow for sufficient slack at equipment terminals to provide for movements induced by shock and vibration, equipment shifting, alignment, cover removal and component replacement. Sufficient lengths shall be provided at points of termination for additional re-terminations without applying tension to the wire and without splicing the wire, as follows:

No. 10 AWG and smaller	Three re-terminations
No. 8 AWG and large	Two re-terminations

vi). A drip loop shall be provided on all exposed wires and cables to prevent fluid runoff into connected equipment.

vii). Wire tying devices shall be of such material and construction that they will adequately retain the wires for the life of the wiring and shall be resistant to ozone and ultraviolet light. Wire and cable ties shall be trimmed using the proper tool and located to eliminate any hazard to personnel from sharp edges. Wire tying devices shall be snug but shall not be so tight as to cause indentation and cold flow damage to the insulation. Wire tying devices shall be mechanically fastened to a permanent structure. Adhesive-installed mounting bases shall not be used for ties or for cable support.

viii). Wire tying devices shall not be used:

(1) For any external undercar application

(2) To support wire under its own weight

(3) To support/secure any type of conduit

ix). All wire bundles and cables within an enclosure shall be supported by the use of tape rails, shall be spaced away from the equipment box structure, metal edges, bolt heads and other interference points and shall have electrical clearance from the covers, regardless of the insulation properties of covers. Wire bundles shall be located above or alongside the apparatus rather than at the bottom of the box wherever possible. In all cases, wire shall be a minimum of 1 inch above the bottom of the box. Wire entry into control or junction boxes shall not be permitted through the bottom of the box.

x). Truck wiring shall be designed to ensure sufficient slack, for pivoting, spring action and jacking and shall be provided with clamp supports and abrasion protection. T-splices will not be permitted.

xi). All jumpers, jumper heads and jumper receptacles shall be sealed in an approved manner to prevent the entry of water at any operational speed.

xii). Any wiring needed to calibrate and test vehicle functions shall be a part of the permanent vehicle wiring to enable Amtrak to conveniently maintain the equipment. This wiring shall terminate in approved connectors in the respective control groups and cabinets.

xiii). Amtrak requires wiring and cabling to be accessible for repairs; the Contractor shall submit a complete wiring plan for evaluation at the appropriate design reviews.

m). Marking

i). All terminal boards and terminal posts shall be plainly marked with non-conductive hot stamping type markings so that they shall be easily identified. Devices shall be labeled via silk-screening onto panels, mechanically attached plastic labels (adhesives are not acceptable alternate), or other permanent means approved by Amtrak in design review.

ii). Wires shall be marked with sleeve-type labels with permanent typed-on lettering, such as TE/Raychem TMS or approved equal, or with non-

conductive hot stamping type markings. Both ends of each wire are to be identified. Wires smaller than 6 AWG should be labeled the length of the wire at intervals of 6” and the wire identification should be color coordinated as to voltage type. Wires 16 AWG or smaller may be color coordinated and tagged on each end with the sleeve type labels mentioned here.

n). Cable and Wire Identification

i). The Contractor shall provide a listing of all wire codes and device and connector identification used on its equipment as part of the integrated schematics manual.

ii). The identification system shall be designed to utilize the minimum number of alphanumeric characters to identify devices and interconnecting wiring. Device, terminal and wire identification is intended to provide unique, consistent, clear, concise and recognizable identification of wiring and devices as an aid to maintenance of electrical systems. The wire-designation system shall be one which relates the designation in some way to indicate where it shall go and where it shall come from. Each individual piece of wire shall be given its own distinct identification so that it shall be positively identified at its opposite end without the necessity for "ringing through." As much as possible, naming shall be consistent among all Amtrak equipment. This naming system will be employed on the following:

(1) Electrical Arrangement Drawings

(2) Electrical Schematics

(3) Wiring Diagrams

(4) Labels on hardware

(5) Car Electrical Panels, etc.

(6) Device names: circuit breakers, indicators lights, switches, relays, contactors, pressure switches, etc.

(7) Car Wiring

(8) The above categories on drawings provided by different vendors (for example, air brake schematic and electrical schematics)

iii). By using the nomenclature and appropriate schematic, an electrician shall be able to easily identify any point in a circuit, such as an auxiliary contact, and locate that point on the hardware.

iv). The identical name shall be used for a given component in all references - arrangement and schematic drawings, wiring diagrams, panel and switch plate legends, and maintenance manuals.

v). It shall be the Contractor's responsibility to ensure that:

(1) All equipment suppliers conform to this Specification.

(2) A consistent numbering system is used throughout the vehicles; and

(3) Component device and wire names are not duplicated.

vi). At a minimum, the following major electrical system components shall be identified:

(1) Electrical panels

(2) Contactors and motor starters

(3) Relays and timers

(4) Switches and circuit breakers

(5) Electronic components

(6) Terminal blocks

(7) Connectors

(8) Each wire

(9) All labels shall be permanent and expected to be legible for the life of the vehicle.

(10) Labels shall be easy to read and observable without having to disturb wiring, especially for:

(a) Relay names

(b) Contactor/Motor starter names

(c) Terminal block and terminal identity.

(11) In cases where two or more identical panels are used, the respective panel names "A" and "B" (as appropriate) shall be affixed to the car body or mounting plate, not the panel.

(12) Numbering system shall be consistent between Contractor and component supplier, such as floor heat wire names. It shall be possible for an electrician to connect all external car wiring to a panel without requiring a drawing.

o). Pulling Compound

i). Pulling compound shall be non-conductive, non-hygroscopic, non-odorous, and shall not attract vermin.

p). Solder

i). Wire connections or terminations by soldering shall not be permitted unless explicitly approved by Amtrak prior to application.

q). Tape

i). Use of electrical tape shall be minimized. Electrical tape shall not be used without the prior approval by Amtrak. If used, electrical tape shall be as specified in Section F, S-540 of the AAR Electrical Manual of Standards and Recommended Practices, or equivalent; UL Listed; and a minimum of 0.007 inch thick. Electrical tape shall meet or exceed the voltage rating of wire where the tape is applied.

19.35 Wire and Cable Connections

a). General

i). All wire and cable shall be free of kinks, insulation damage, insulation abrasions and nicked strands. Wire installation shall not be subject to accumulations of water, oil, or other foreign matter.

ii). Cables shall be laid in place with sufficient slack at the bends so that cables will clear the inside bend surface of the strain relief device.

iii). Conduit shall be attached to the carbody employing clamps; welding shall not be used under any circumstances.

iv). Concealed wires, such as within conduits and wire ducts shall be such that wires may be replaced or added to without the removal of other than an access panel at each end of the wire. It shall not be necessary to disconnect or disassemble conduit to accomplish this task.

v). Wiring run in loom shall not be carried over a potential chafing hazard.

vi). Wires entering any removable box shall be harnessed and secured to facilitate removal of the box.

vii). All wires and cables shall be fully protected against any contact with any surface other than that designed specifically to support or protect them. This applies to all current carrying wires, cables or buses on the vehicle.

viii). All equipment enclosures and junction boxes shall be fitted with terminal boards or connectors.

ix). The Contractor shall submit the proposed design and product line for all connections and terminations for approval as part of PDR. **[CDRL 19-08]**

(1) Number 6 and smaller type terminal boards and quick-disconnect terminals, other than those stated herein, will only be permitted with approval.

b). Terminal Boards and Terminal Points

i). All electrical terminal points and terminal boards of wire size AWG 10 or larger shall have brass studs and connections, each of which shall be locked using a single brass nut with brass flat washer and a plated spring-type lock washer. Studs, nuts, and washers may also be made of corrosion-resistant

plated steel, where approved. Each board or connector shall have the necessary number of terminations plus a minimum of 10% spares, but not fewer than one spare unless approved. Binding head screw type terminal boards will be permitted only where approved. All terminal boards shall be in accordance with Federal Specification A-A-59125.

ii). All wires of size range AWG 12 to 14 shall use modular spring lock terminal blocks. The terminal block modules will be mounted on din rails. The supplier shall provide standard 35mm wide DIN-rail in 7.5mm, 15mm and 58mm heights. The DIN-rail shall meet RoHS (Restriction of Hazardous Substances Directive) standards and shall be available perforated or unperforated. Materials will include chromated-steel, copper, and aluminum. The modules shall be color coded for the ability to tell the signal type at a glance. The metal body shall contain a high strength spring steel spring element that will provide a gas-tight connection with the conductor.

iii). Spring connection shall be stainless steel. The terminal blocks shall come with carbody ground modules that are connected directly to carbody ground. The terminal blocks shall come with insertable shorting plugs. The terminal blocks will have snap in positive lock labels. Terminal Blocks shall have a method of labeling for easy identification which is universal across all connection technologies. The modules will have a place to label the terminal number as well as the terminal block name. Each wire shall have a ferrule on its end and be able to be inserted by engaging the spring with a standard 3mm slot size screwdriver. Stranded wire of any size shall have a ferrule on its end.

iv). Terminal Block accessories and bridging systems shall be compatible and interchangeable with all connection technologies (screw, spring and IDC technology) including flexible bridging system, modular testing, standardized labeling system and pluggability features.

v). Threaded studs shall have a minimum of 2-1/2 threads exposed beyond the final nuts. Adequate space shall be provided to permit connecting wire terminals with standard tools. All terminals shall be properly torqued to assure sound connections. Spacers shall not be used.

vi). Jumpers between terminal board points shall be brass or plated steel. Wire jumpers between adjacent terminals of terminal boards will not be permitted.

vii). Terminal blocks will employ closed bottom blocks.

viii). An approved permanent marking strip on each terminal board shall be provided and attached adjacent to the wire junction point to identify the wires attached thereto.

ix). A maximum of two terminals shall be connected to any one binding screw. A maximum of four terminals shall be connected to any one threaded stud, provided that there is no interference between terminal barrels. On terminal boards, the wiring shall be arranged so that no more than two terminals are connected to a stud, from each side of the terminal boards.

c). Wire Terminations

i). Terminals and connections used throughout the vehicle shall be the mechanical, solderless, crimp type made by TE Connectivity/AMP or other approved manufacturer with a comprehensive line of terminals, connector pins and application tools available.

(1) Terminals shall be tested to Military Specification MIL-T-16366F for temperature rise, voltage drop, vibration, current overload, and corrosion.

ii). All wire terminations shall be accessible to remove or replace. Wire terminations shall not be covered by other wires.

iii). All heater wiring terminations shall be Nickel plated and the terminal insulation shall be rated for high-temperature applications.

iv). Terminals and connections shall be attached to the wiring with proper crimping tools and dies as recommended by the manufacturer. Application tooling shall incorporate die or piston stops to prevent over crimping. To prevent under crimping, all application tooling shall incorporate a “full cycle” feature that once started, requires the tool to be brought to the stops before the crimped connection can be removed. The Contractor and its suppliers shall employ a certification process to ensure that all tooling remains within calibration to properly crimp the lugs.

v). Spade (i.e., Fast-On) terminal usage is to be limited and shall only be used with Amtrak approval. Hook-type terminals shall not be used. Corrosive protection shall be provided for all base materials.

vi). Conductors subject to motion relative to the terminal shall be protected by suitable means to prevent breakage of the conductor at or near the terminal. Sufficient slack shall be provided in all wires and cables to prevent breaking or pulling out of bushings and terminals. A maximum of one wire shall be crimped in any one terminal.

d). Power Cable Terminations

i). Power cables shall be terminated with an approved compression terminal. Sufficient cable slack shall be provided to preclude breaking or pull-out from bushings or terminals and to allow two terminal changes. Cable conductors shall be clean prior to installation of terminals. Compression terminals shall be applied using tools and procedures recommended by the terminal manufacturer for that purpose. Swaging tools shall be of a type that ensures complete swaging in every case.

e). Cable Connectors

i). All cable connectors shall conform to SAE AS50151 except for the screw coupling arrangement replaced with the ¼ turn quick disconnect bayonet lock. They shall employ removable crimp contacts of the correct size for the wire being terminated. Except as noted below, the connector contact area

shall be plated with a minimum of 0.000030 in. of gold over a minimum of 0.000050 in. of low stress nickel. For high current applications, the connector contact area shall be plated with a minimum of 0.00010 in. of silver. Adjacent connectors shall either use different inserts or different insert orientations to prevent erroneous connections. The car-side piece of all cable connectors shall be rigidly mounted.

ii). Connectors shall be keyed so as to not be accidentally interchanged between adjacent connectors. Spare contact allocation shall be 10% to 15%, but no less than 4, per connector. Reduced numbers of spare wires in a given connector may be submitted to Amtrak for review and will be approved on a case-by-case basis if 10% of the contact count is less than 4.

iii). Power and control wiring shall be separated in different connectors if they exceed 120VAC. Disconnected plugs will be supported so as to not drop to the ground, floor or other position in which they might be readily damaged. Connectors are to be mounted to provide convenient hand access so as to be easily mated and unmated.

iv). All cable connectors used in exterior locations shall be of the environmental watertight variety and a molded type wherever possible (such as speed sensors). Cable connectors shall be equipped with sealing gaskets on the front mating surface and on the back where the cable enters. Bolts within the connector shall be long enough to ensure that there is sufficient room to terminate the cable wires within the connector body. The cable jacket shall be held by a clamp within the connector body. Unused connector pin positions shall be sealed with either connector contacts or plastic sealing plugs designed for that purpose.

v). Plastic bodied connectors shall not be used on the exterior of the vehicle.

vi). In waterproof interior locations, the use of non-weatherproof connectors will be allowed as approved. All other connector requirements specified in this Chapter which do not directly apply to weatherproofing shall be met.

vii). Alternative connectors such as Harting HAN™ Modular series may be used as approved by Amtrak.

viii). Ethernet connectors shall be M12 style connectors (per IEC 61076-2-101) as manufactured by Harting or approved equal. Ethernet connectors for intercar jumpers shall be housed in an environmentally sealed connector shell suitable for M12 connectors as manufactured by Harting, or approved service-proven equal.

f). Quick-Disconnect Terminals

i). Only Amtrak-approved quick-disconnect terminals may be used. They shall be modular, and they shall provide positive terminal engagement and be shock and vibration proof. All terminals shall be provided with insulation equal to that of the wire. No "push-to-fit" (FAST-ON) type terminals will be permitted unless specifically approved by Amtrak for that unique application.

g). Grounding/ Bonding Connections

i). Grounding and bonding shall be done in accordance with APTA Standard PR-E-S-005-98, unless otherwise approved by Amtrak. All grounding and bonding jumpers and straps shall be sized to handle fault current for which the voltage drop shall not exceed 25V. The bonding method employed shall not produce a dc resistance in excess of 0.0025 ohms, or more than 0.025 ohms at 150 kilohertz for any applied ac voltage. Grounding and bonding jumpers, and brazed shunt straps shall be flexible.

ii). The car body shall be grounded to each truck frame by means of a separate cable which shall be sized to safely ground the car under normal conditions.

iii). The 120VAC, 60 Hz, single-phase service shall be separately and firmly grounded to the car body structure and have a green indicating color band applied to the terminations.

iv). All apparatus operating at 480VAC and not directly grounded to the car body through its mounting shall have grounding straps. This particularly applies to resiliently mounted equipment.

h). Wire Splicing

i). Splicing of conductors shall be avoided and shall be permitted only with Amtrak approval, on a case-by-case basis.

ii). Splicing of conductors in conduit will not be permitted. In the event a splice is approved, it shall be in a junction box and the spliced joint shall be mechanically as strong and have the same conductivity as any other part of the conductor. The splice shall be an insulated permanent crimp splice in accordance with SAE AS7928, Type II, Class I, and shall be installed with the crimping tool and die of the splice manufacturer. All splices shall be insulated with a self-sealing, weathertight, seamless shrink tubing. The outside diameter of the spliced portion of the cable after the insulation is applied shall not exceed the outside diameter of the un-spliced portion by more than 40%. Splices shall be identified in the integrated schematic.

19.36 Conduit

a). Types

i). Thin-wall EMT type conduit shall conform to UL 797. Flexible metal conduit shall conform to Federal Specification A-A-55810. Flexible polymer conduit shall conform to SAE AS81914.

b). Size and Fill

i). Conduit shall be sized such that the sum of the cross-sectional areas of the conductors and their insulation does not exceed 40% of the cross-sectional area of the conduit for three or more conductors. For two conductors, a limit of 31% shall be used, while for a single conductor, a limit of 53% will be permitted. Where conduit having a length not exceeding 24 in. without bends

of more than 15º is used between enclosures, a maximum fill of 40% will be permitted.

c). Installation

i). General

(1) A run of conduit between junction boxes and/or pulling outlets shall not contain more than the equivalent of four quarter bends, 360° total, including the outlet fittings. Bend radii at the inner surface of the bend shall be no less than eight times the nominal inside diameter of the conduit.

(2) All conduit bends and offsets used shall be made by the use of special forms or tools and shall have the largest radius possible so that wires can be pulled without the use of tackle or power.

(3) Conduit shall be securely clamped with all runs electrically grounded to make a continuous ground. Suitable approved insulation to prevent electrolysis shall be provided where steel and aluminum are in contact.

(4) All conduits shall be arranged to prevent moisture traps and shall drain toward control boxes, except that all open-ended conduits shall be installed in such a manner as to ensure gravity drainage out the end. The conduit arrangement and installation shall be subject to approval. Open ended conduits are prohibited.

d). Conduit Fittings and Junction Boxes

i). General

(1) The conduit fittings and junction boxes for vehicle wiring shall be as manufactured by the Contractor or by a supplier of a comprehensive line of parts.

(a) The Contractor shall submit the proposed product line for approval. **[CDRL 19-09]**

(2) All conduit fittings and junction boxes shall be provided with gasketed covers.

ii). Boxes

(1) All exterior junction boxes shall be fabricated of material appropriate for exterior usage, such as stainless steel, or as approved by Amtrak. All exterior junction boxes shall be weatherproof and shall be connected in such a way that drainage from equipment groups will not pass through the conduit into the junction boxes. Interiors of all junction boxes shall be primed and then protected with a white, insulating epoxy powder coating. If electrical faults within the box can be detected, the interior of the junction boxes may be left unpainted. Equipment areas containing non-insulated electrical devices at more

than 120 volts to ground shall be plainly marked with warning signs worded DANGER – XXX VOLTS. Covers for electrical junction boxes shall be accessible at all times without having to remove other equipment.

iii). Conduit Interface

(1) The open ends of conduit shall be provided with strain relief type fittings with extended rubber bushings, bell-mouth fittings, or insulated throat box connections as approved or an alternate solution may be presented and used subject to approval. All conduit entries into removable equipment boxes shall be secured by means of a bolt-on watertight access panel or an alternative solution may be presented and used subject to approval.

iv). Covers

(1) All junction box covers shall be retained by captive screws. All fasteners used in junction boxes shall be stainless steel. All covers shall be designed to accept or mate with a bulb-type clamp-on seal.

v). Wireways

(1) Wireways shall only be permitted in approved ceiling locations. They will not be permitted in the car body sidewall or under flooring areas. Only conduit will be permitted to run within the car body.

(2) All wireways shall be “Panduit”, meeting Amtrak Specification 352, or rigid steel with a coating to minimize the risk of oxidation and rust formation. The trays shall be adequately supported throughout their entire length in an approved manner. There shall be absolutely no sharp edges. The trays shall be completely de-burred before installation on the vehicles. Grommet clamps shall be provided at all locations where cables or wires enter or leave the wireways. Under no circumstances shall leads be draped over the edge of the wireways, with or without wireway edge protection.

(3) Wireways shall be located to provide access to the harnesses contained within for maintenance action.

(4) Bends in wireways shall be avoided; however, if they are required, approved protection shall be provided to avoid insulation chafing at the bends.

(5) Wireways shall not contain more than 30 current-carrying conductors at any cross-section. The sum of the cross-sectional areas of all conductors contained at any cross-section of a wireway shall not exceed 40% of the interior cross-sectional area of the wireway.

(6) All wire and cable shall be securely fastened within wireways to eliminate movement and resultant chafing.

19.37 Electrical and Electronic Designs

a). General

i). Except as otherwise indicated, electrical equipment and components shall conform to IEEE-16 (2020). Electronic equipment shall conform to EN 50155. Solid state power converters shall conform to IEC 61287-1. All mandatory type and routine tests shall be performed.

b). Reliability Standards

i). A standardized MIL-HDBK-217F reliability part stress prediction shall be performed on all electrical and electronic control systems. This reliability prediction shall be based on the "ground Mobile" environment. Use of alternative reliability database information and prediction methodologies or statistically meaningful filed failure data from comparable operating environments may be permitted with Amtrak approval.

c). Ability to Repair

i). All electrical devices including such items as PC boards, relays, contactors, and filters shall be capable of being repaired by Amtrak in its electronics laboratory. It is recognized that some equipment, due to its complexity, cannot be economically repaired by Amtrak. In preliminary design reviews, the Contractor shall identify all situations where this could be the case, for ruling by Amtrak, whose decision shall be final.

ii). Units shall not be sealed, potted, or constructed to prohibit repair by Amtrak. Units that must be potted or sealed by design other than Lowest Level Replaceable Units (LLRUs) shall have a minimum 10-year warranty.

d). Hardware

i). All hardware associated with electronic and electrical systems, including the case, heat sinks, mounting brackets, etc., shall be protected against moisture, oxidation, and common airborne contaminants.

e). Wiring

i). Wire selection, routing and securement shall be accomplished with the goal of having the wire and cable last the life of the car body. All movement and chafing of wire and cable shall be eliminated. The use of additional wear material(s) to extend life without elimination of the movement, wearing or chafing will not be permitted.

f). Optical Fibers

i). Any application of optical fibers shall be approved by Amtrak. Samples of all fiberoptic cables and termination connectors shall be submitted for approval.

ii). Fiber optic cables shall be installed in accordance with the cable manufacturer's instructions, shall be adequately protected from damage of any kind, and shall be readily accessible for maintenance and inspection. Fiber optic terminations shall be of quick disconnect type, designed to prevent degradation due to the car environment, including vibration and variation in temperature, and shall be capable of inspection and repair without removal from the car.

19.38 Electrical Devices and Hardware

a). General

i). All electrical devices shall be service-proven. Electrical connections shall use either captive screws or captive nuts, with crimp terminals.

b). Suppressors

i). Suppressors shall be incorporated across inductive devices to minimize switching transients. All suppression devices shall be selected on the basis of their ability to absorb the amount of energy available in the connected circuit, for the number of cycles of operation expected in service, without requiring replacement prior to scheduled overhaul. All magnet valves and relay/contactor coils shall have free-wheeling diode or metal-oxide varistor voltage spike suppression, or other suppression means, except where this results in deterioration of performance. Coil suppression devices shall be located physically on or as close as possible to the coil it protects (preferably directly at the coil terminal). Wherever possible, the suppression of transients shall be at the source.

c). Contactors and Relays

i). Contactors shall be defined as those devices, which control one kilowatt or more of electricity through their main contact tips. Unless specified, all contactors shall meet or exceed the requirements of Amtrak Specification 528, section 4.3- 4.5 or Amtrak approved alternative solution.

ii). Relays shall be defined as those devices which switch less than one kilowatt of electricity through their contacts. Unless specified, all relays shall meet or exceed the requirements of Amtrak Specification 528, section 4.3- 4.5 or Amtrak approved alternative solution.

iii). Preference shall be given to solid state relays and contactors where possible.

iv). All contactor and relay coils shall be suppressed with a solid-state device to prevent transients being generated onto the low-voltage network.

v). All devices shall be satisfactorily tested for proper functioning in orientations up to 30° from the mounting plane as fitted in the vehicle. They shall be installed to be fully accessible for inspection, servicing, repair and ease of replacement. There shall be no more than two wires connected to any one terminal. Installation shall be such that, when required, arc spray is directed, by a non-asbestos arc chute, away from ground and adjacent electrical devices.

vi). All devices shall be constructed and utilized in a fail-safe manner; that is, all failures shall be in a direction such that neither the passengers, the crew, nor the equipment is placed at risk.

vii). All magnetic devices shall be a heavy-duty type suitable for railroad service. They shall be constructed such that the main tips or contacts "make" and "break" with a wiping or rolling motion that minimizes build- up of deposits and/or pitting. Contact and/or tip replacement shall not exceed 5% of the total number during any annual inspection period.

viii). Device contacts or tips shall not be placed in parallel to increase the total current load in excess of the rating for an individual contact or tip.

ix). All devices shall be readily identifiable by means of a permanent, durable marking strip giving the device circuit designation. No identifications shall be obscured, or partially obscured, by wire routing. The identification strip shall be mounted adjacent to the mounting of said device.

x). Bifurcated contacts shall be used in low voltage applications whenever necessary due to dry contacts or low current switching requirements.

xi). All time delay relays shall be of the R-C delay or solid-state type. No mechanical or pneumatic time delay devices will be permitted.

xii). Where plug-in relays are approved, the relay shall be positively retained by means of a retaining clip or bar. This device shall be captive, of rugged construction and shall be easily positioned for relay installation and removal without the need for special tools. When the relay is removed, the retainer shall itself be retained so that it cannot come in contact with devices, which may have exposed energized electrical circuits, and it shall not interfere with the operation of any other device when in this position.

d). Switches

i). Switches are defined as those manually operated devices that control less than one kilowatt of electrical power through their contacts. Unless otherwise specified, switches shall meet the requirements of MIL-DTL- 3950. Toggle and push button switches shall be per MIL-DTL-3950, MIL-PRF-8805, MIL-DTL-83731 or equal, as approved by Amtrak. All exterior switches and switches located in “wet” areas shall be IP66 rated or higher. All switches provided shall be of high quality and shall be fully suitable for the rigors of Amtrak’s service environment, including cycle life. The design and selection of all switches shall be subject to review and approval.

ii). Switches shall be provided with a "keying" feature such that after installation, the body of the switch will be constrained from mechanical rotation.

iii). Under no circumstances shall poles of switches be placed in parallel to carry currents in excess of the contact pole rating given by the manufacturer.

iv). There shall be a maximum of two wires connected to each terminal of the device.

v). Switches shall be individually replaceable without disconnecting or removing anything other than the mounting fasteners and electrical connections of the switch to be replaced.

vi). All control switches, which are subject to water splash, which is defined to mean any switches mounted near windows or doors, or mounted on the Engineer's control console, shall be environmentally sealed.

e). Circuit Breakers

i). All circuit breakers provided shall be extremely rugged and fully suitable for the service intended. They shall meet the requirements of Amtrak Specification 498, section 4.4. Design and selection of all circuit breakers not available within Amtrak's material control system shall be subject to review and approval.

ii). The continuous current rating of thermal-magnetic trip circuit breakers shall be selected in accordance with ANSI C37.16 for the load and type of service specified. All thermal-magnetic trip circuit breakers shall conform to the requirements of ANSI C37.13 and ANSI C37.14.

iii). All circuit breakers of the same rating shall be of the same manufacture and model throughout the vehicle. Circuit breaker current rating shall be clearly and permanently marked and shall be completely visible after installation.

iv). The ON, OFF and TRIPPED positions of all circuit breakers shall be permanently marked on the handle or the case of the circuit breaker. The circuit breaker, when tripped, shall assume a distinct position between the ON and OFF positions to permit determination of the fact that it has been tripped by either its overcurrent or shunt trip elements.

v). Circuit breakers shall be individually replaceable without disconnecting or removing anything other than the mounting fasteners and electrical connections of the breaker to be replaced.

vi). Every input power circuit shall be protected by an individual circuit breaker. Separate circuit breakers shall be provided for major assemblies or functions. No circuit breaker shall protect more than one circuit, nor shall any one circuit be protected by more than one circuit breaker. Circuit breaker terminals shall not be used as junction points.

vii). All circuit breakers shall be selectively coordinated as to ensure that the protective device nearest the fault trips before upstream devices.

viii). All circuit breakers shall be sized by current rating and tripping time to protect both the associated equipment and the minimum size wire used for power distribution within the protected circuit without causing nuisance tripping.

ix). Each circuit breaker pole shall be equipped with adequate means of arc extinction to prevent flashover.

x). Circuit breakers shall not be intended for use as on/off switches. All circuits requiring on/off switches shall be so equipped.

f). Fuses

i). Circuit protection functions that can be performed by fuses shall normally be performed by appropriately rated circuit breakers. Fuses shall be used only where specifically called for in the Specification or where the use of circuit breakers is not technically feasible, and only with specific written approval. Fuses may be considered in applications as follows:

(1) To protect solid-state equipment from catastrophic damage.

(2) Where current or voltage levels prohibit circuit breakers.

ii). Fuses shall be permanently identified adjacent to the fuse, including functional name, fuse type and rating. The rating of each fuse shall be permanently and clearly marked directly on each fuse.

iii). Fuses shall be readily accessible. All fuses mounted in exterior equipment boxes shall be accessible without going under the vehicle.

iv). Fuse holders shall contain fuse retention devices at both ends.

v). Unless explicitly noted otherwise in this Specification, all fuse compartments shall have a spare fuse of identical size and rating for each "in-circuit" fuse and shall be mounted next to the respective "in-circuit" fuse with the fuse holder clearly marked SPARE FUSE. The spare fuse holder shall not be enclosed and shall not consist of any loose parts.

vi). The use of current limit-type fuses is prohibited.

g). Bus Bars

i). Bus bars are to be fabricated from OFE (Oxygen Free Electronic) or ETP (Electrolytic Tough Pitch) copper (CDA 101). The bus bar conductivity shall be 100% IACS. All bus bar joints and bolted connection points shall be silver or tin plated.

ii). Current densities, other than at joints, shall not exceed 1000 amperes per square inch, and in any case shall not exceed a value which would cause a bus bar temperature rise greater than 30°C. Current densities in joints shall not exceed 150 amperes per square inch.

iii). Bus bars shall be properly brazed together at joints unless bolted connections are found to be necessary for maintenance purposes and are approved. The overlap at bus bar joints shall be no less than 10 times the thickness of the bus material. Bus bar connection bolts shall be torqued to obtain a uniform bus bar connection pressure of 200psi. Bolting hardware shall be plated steel with Belleville washers to maintain connection pressure.

iv). Except for connection areas, bus bars shall be safety insulated, using a high-dielectric, powder coating or other approved means. Tape will not be acceptable. Bus bars that are behind insulating panels will be exempt from this requirement.

h). Capacitors and Resistors

i). Dry tantalum capacitors shall be used in place of aluminum electrolytes, except for high values which are not commercially practical or available, in which case long life grade aluminum electrolytic or dry polypropylene film capacitors shall be used.

ii). Dry tantalum capacitors shall be in hermetically sealed metal cases, except for surface mounted types when hermetically sealed metal cases are not available.

iii). Commutating capacitors shall be a paper or plastic film type, shall incorporate a non-toxic impregnant, and shall be chosen to give a service life of at least 20 years. Filter capacitors shall have high ripple current rating for long life.

iv). Capacitors shall be derated 20% for voltage based on the nominal supply voltage and maximum case temperature. If filter capacitors are exposed to low ripple voltages, lesser values of derating may be accepted if it can be shown that reduced operating temperatures can be achieved due to lower dissipation; however, the sum of the dc and ac ripple voltages shall always be less than the capacitor's voltage rating at a maximum case temperature of 85°C.

v). All resistors shall be operated at less than 50% of their rated maximum power dissipation. Other power resistor applications may be submitted for approval of lower derating, on a case-by-case basis.

vi). Use of trim potentiometers or adjustable resistors shall not be permitted without Amtrak approval. Generally, the need for adjustments shall be avoided by use of the appropriate circuitry, and stable precision components.

vii). Transformers and Inductors

viii). Transformers and inductors shall be rated at 20% over the maximum specified current level.

i). Switch, Circuit Breaker and Fuse Panels

i). All switch, circuit breaker and fuse panels shall conform to Amtrak Specification 498, with dead front, mounted in the specified equipment enclosures and switch/ electric lockers.

ii). Each switch and circuit breaker panel shall carry the necessary apparatus, arranged to be easily accessible to connections and designed to prevent operating or maintenance personnel from coming in contact with live parts when operating the switches or circuit breakers. All live portions of the protected circuitry shall be completely concealed so that no danger of electrocution or shock exists from the touching of the panel, or any appurtenances or devices mounted thereto.

iii). All switches, breakers, fuses, and indicating lights shall be provided with a nameplate of raised or recessed lettering on the dead front, clearly identifying the circuit which each device controls and its circuit designation. The dead front panel shall conform to NFPA No. 70, Article 408. A wiring gutter shall be provided along the top, sides, and bottom, for the routing of high voltage leads to their designated circuit breakers.

iv). The panel shall be secured by approved, captive fasteners and shall be configured for easy removal so that maintenance and repair action is not impeded.

v). Power distribution to circuit breakers and switches shall be from a bus bar or bus circuit.

vi). Distributing power by successive or "daisy-chained" connections between device terminals will not be permitted.

vii). Battery Backup Circuits

(1) Any device provided that requires a backup battery must be designed with a five-year battery life unless specifically approved by Amtrak.

(2) A “low battery replacement” indicator or an equivalent fault message in the equipment diagnostics shall be provided to enable timely battery replacement prior to a loss of backup functionality.

19.39 Semiconductor Standards

a). General

i). Semiconductors shall be selected to withstand all continuous and transient voltage and power demands present in the circuit application without damage or reduction in life.

ii). All circuit designs shall provide for the presence of high current switching equipment on the vehicle and the resultant induced voltages and currents in electrical equipment.

b). Rating

i). Discrete semi-conductors shall have the following minimum voltage breakdown rating, dependent on the use:

(1) Transistors and thyristors operated from the nominal battery supply, or those connected to trainlines, shall have minimum breakdown ratings of four times the maximum circuit rating. Suppression devices shall be provided as necessary to protect the devices and limit the circuit voltage.

(2) Diodes operated from the nominal battery supply, used as suppression devices, or those connected to trainlines shall have a minimum Peak Inverse-Voltage rating (PIV) of 1000V. Diodes with less than 1,000 V PIV rating may be used if adequate circuit transient protection is also provided.

(3) All discrete semiconductors operated from inverters or other isolating devices shall have minimum breakdown ratings of two times the maximum circuit voltage (except where specifically detailed otherwise). Suppression shall be provided, as necessary, to protect the devices and limit the circuit voltage to the values specified by the semiconductor manufacturer.

ii). Semiconductors shall be placed in a clean and ventilated environment which shall favor easy replacement.

iii). All semiconductor junction temperatures shall be limited to 150ºC (or to the maximum rated temperature for the device, whichever is less) or less at maximum ambient temperature and at maximum rated output power.

iv). All semiconductors shall be operated at less than 50% of the maximum continuous current rating or maximum continuous power rating, whichever is more restrictive.

v). Integrated circuits operated from the battery supply through inverters or other isolating devices shall be operated within the voltage and current ratings specified by the manufacturer, derated to less than 50% of the maximum stress level at the maximum operating temperature of the device as specified by the manufacturer.

vi). Where the supplies to integrated circuits are regulated and surge protected, the voltage rating shall be 15% below the manufacturer's recommended maximum. In addition, the maximum power shall be limited to 50% of the manufacturer's specified maximum at the maximum operating temperature.

vii). All gallium arsenide and similar optical semi-conductors shall be rated for operation over the temperature range of -40°C to +85ºC.

viii). All semiconductors shall be rated “industrial or automotive grade” for reliable operation over the temperature range of -40ºC to +85ºC, except for discrete power semiconductors (>=1 Watt) which shall be rated for temperature range of -55ºC to +125ºC. Exceptions shall not be taken without proper identification and written authorization from Amtrak prior to first article tests.

ix). All suppliers of semiconductors shall be selected according to a recognized standard such as ISO-9002 Section 4.6 or better. Exceptions shall not be taken to the above provisions without proper identification and written authorization from Amtrak prior to the first article inspection.

c). Availability and JEDEC Registration

i). To the highest extent practicable, thyristors, transistors and diodes shall be JEDEC registered and numbered.

ii). All semiconductors shall be available from at least two manufacturers and available from U.S. distributors. Single source devices, such as high voltage power devices, microprocessors, ASICs, and related support chips may be used only if approved. Such devices shall be essential to the proposed equipment, shall meet the service-proven requirements and shall be supplied by veteran manufacturers likely to support the device.

iii). Environmental Stress Screening All printed circuit boards or assembled card racks shall undergo Environmental Stress Screening (ESS) in accordance with Section 5.10 of IEEE Std 16-2020. ESS alternatives based upon EN 61163-1 guidance will be considered as approved by Amtrak. All ESS records must be maintained for review by Amtrak inspectors.

19.40 Printed Circuit Board Standards

a). General

i). Printed circuit boards shall be designed to IEEE Std 16-2020, Section 4.10 except as noted otherwise below.

ii). Printed circuit boards incorporating vital functions shall be designed to IPC-2220 Design Standards Series, Printed Boards, Class 3.

iii). Printed circuit boards incorporating components whose power dissipation is in excess of 2 watts, or boards mounted adjacent to such components shall utilize circuit board material per NEMA Standard LI 1, Type FR-5.

iv). Printed circuit boards shall have a minimum thickness of 0.0625 in base material. All conductor material shall be copper and shall be firmly attached to the board and shall be resistant to blistering and peeling when heated with a soldering iron.

v). All printed circuit boards shall be designed for ease of testing per ANSI/IPC-D-275, “Testability Design Check List.”

vi). Traces shall be made as wide as practical, with the minimum width being based on a 10ºC temperature rise.

vii). Components with pins shall be mounted only on one side. Connections shall be made to the other side or internal layers via plated through holes. Surface mounted components may be mounted on both sides if part of an approved existing design.

viii). All circuit boards shall be inherently stiff or shall be reinforced to prevent damage due to vibration or handling. Unless otherwise approved circuit boards larger than 100 $in.^2$ shall be centrally stiffened.

ix). All equipment shall be designed using stable, high tolerance components to eliminate the need for adjustments. Compensation for manufacturing tolerances may be made through parallel precision resistors. All replacement printed circuit boards shall be directly interchangeable without any additional adjustments.

x). All printed circuit boards shall be of the "plug-in" type, with positive support against vibration, except where otherwise approved otherwise.

xi). No more than one PC board shall be stacked on each PC card.

xii). Printed circuit board connectors shall be heavy duty, high reliability, and proven in prior successful rail service. All printed circuit boards shall plug into keyed sockets. Contact fingers and edge connectors shall have 0.000050 in. thick gold plating.

b). Marking

i). All circuit boards shall be labeled with a part number, serial number, and descriptive nomenclature.

ii). All components shall be labeled on the board with component drawing references and such other information as may be required to repair and troubleshoot the board. The component and wiring sides of the board shall each be marked to indicate capacitor and diode polarity, and at least two leads or one lead and a graphic symbol indicating orientation of all transistors and thyristors.

iii). Integrated circuits and other multi-terminal devices shall have an index mark on the component side of the board, visible with the component inserted, to indicate proper keying and insertion; the first pin on all integrated circuits packages shall be identified on the wiring side of the board.

iv). For boards whose component density is greater than 2.25 components per square inch, the Contractor may submit an alternate marking plan for possible approval. Such a plan should include board marking, augmented by layout drawings.

c). Component Mounting

i). Components shall be fastened to the board in such a manner as to withstand repeated exposure to shock and vibration. Large components shall be supported in addition to the solder connections. Power resistors shall be mounted on standoffs so that the resistor bodies do not contact the board, spaced far enough away from the board so that resistor-produced heat will not discolor or damage the board or adjacent wires or components.

d). IC and Device Sockets

i). IC and device sockets are prohibited except for components that must be removed for reprogramming or initial calibration procedures or devices that are available only for mounting in sockets. All socket applications shall be subject to approval by Amtrak. All other components shall be soldered in place.

ii). Where approved, IC and device sockets shall comply with MIL-DTL-83502E and MIL-DTL-83734H, as is applicable for the device, and shall be made of the following materials:

(1) The bodies shall be molded from diallyl phthalate, PTFE Teflon, or approved equal.

(2) The contacts shall be fabricated from beryllium copper and shall be plated with a minimum of 0.000030-inch (0.000762-mm) of gold over a minimum of 0.000050-inch (0.00127-mm) of low-stress nickel in the area of contact with IC pins.

e). Conformal Coating

i). Both sides of the assembled printed circuit boards shall be coated with a clear insulating and protective coating compliant with IEEE Std 16-2020.

ii). All IC sockets, connectors and test points shall be masked when the coating is applied.

f). Keying

i). All printed-circuit boards shall be "keyed" to prevent insertion into the wrong socket. Further, circuit boards in safety related control systems, such as friction brakes, cab signal, PTC, and systems which can cause damage or unsafe train operation if the vehicle is operated with a card removed, shall be connected through a safety circuit or checked through an auto test to disable the vehicle if a circuit board is removed.

g). Circuit Board Connectors

i). Printed circuit board connectors shall be heavy duty, high reliability, two-part type with a history of successful service in rail applications and shall be approved by Amtrak prior to commencing design.

ii). Connectors which comply with MIL-DTL-55302G or DIN 41612 (EN 60603) Level 1 or 2, and which have plated contacts as described below, are considered to comply with the requirements of this Chapter.

iii). The connector contact area shall be plated with a minimum of 0.000050 in. of gold over a minimum of 0.000050 in. of low stress nickel.

iv). Card edge connectors are prohibited.

v). All connectors within one panel assembly shall be keyed to prevent damage or malfunction due to incorrect insertion.

h). Testing

i). Sufficient clearance shall be provided between components to allow testing, removal and replacement without difficulty due to lack of space.

ii). Test points shall be provided in appropriate locations on modules and printed circuit boards. A negative return test point shall also be provided. The test points shall either accept and hold a standard 0.080 in. diameter tip plug or shall be a turret lug similar to Cambion No. 160-1026-01-05, or approved equal, with sufficient clearance to permit it to accept a standard oscilloscope probe clip and shall be identified by appropriate markings.

iii). When test points are not suitable, as for complex circuits or micro-processor-based control system, self- diagnostic routines and/or special test equipment may be used to identify the failed Lowest Replaceable Unit.

i). Plated-Through Holes

i). In addition to the general guidelines of the Institute of Printed Circuits (IPC), the following requirements shall be met:

(1) Plating Holes – Copper plate shall be a minimum of 0.001 in. minimum average thickness, and 0.003 in. maximum average thickness. Solder plates shall be 0.0003 in. minimum average thickness and 0.0015 in. maximum average thickness.

(2) Plated Hole Defects – No more than three voids per hole will be acceptable. Total area of the voids shall not exceed 10% of the total wall area. The largest void dimension shall not exceed 25% of the core diameter or the board thickness, whichever is smaller. There shall be no pits, voids, or cracks at the junction of the whole wall and terminal area to a depth of 1-1/2 times the total copper thickness on the surface.

j). Enclosures

i). All circuit boards that are rack mounted shall plug into racks containing the mating half of the circuit board connector. The circuit board rack shall mount in an enclosure conforming to requirements in this document. The rack, circuit board and circuit board hardware shall be designed as an integrated system.

ii). The rack and enclosure shall provide environmental and EMI shielding necessary to meet the requirements of this Specification.

iii). Printed circuit boards shall be positively retained by means of keeper bars or other approved method. The enclosure or rack cover shall not be used to retain the circuit boards.

iv). Each circuit board shall be fitted with an ejector or hand grip to assist in board removal. The rack and the edge of each board, or the card ejector, shall be labeled with corresponding numbers to identify board location within the enclosure.

k). Extenders

i). Printed circuit board extenders (six sets of each type) shall be provided by the Contractor for test purposes. At least two extenders of each type shall be available for use and evaluation throughout the design conformance and acceptance test programs. The interfaces between extender and enclosure and PC board shall be positive and secure and shall prevent malfunction and loss of securement during testing. Mechanical locking means shall be considered for large PC boards.

19.41 Auxiliary AC Motors

a). Motors shall limit starting current to within industry recommended practices and be equipped with NEMA C-frame type sealed bearings that shall not require re-lubrication for the life of the bearing. Bearings shall be sized to provide a minimum life of 6 years. Any motor mounted with the shaft vertical shall have bearings suitable for this type of application. Any motor which is exposed to weather shall be a type specifically designed for the environment. Any motor with a vertical shaft and subject to the weather shall include a moisture seal on the shaft to prevent water from entering the bearings.

19.42 Recyclable Materials

a). Expendable items that are recyclable shall be identified with the appropriate symbols, as defined by the Society of the Plastics Industry, permanently imbedded in the material.

19.43 CDRLs

CDRL	CDRL Description	Due
CDRL 19-01	Material description and test lab results	During IDR
CDRL 19-02	Joining and fastening data	During IDR
CDRL 19-03	Dissimilar metals report	During IDR
CDRL 19-04	Passivation process details	During IDR
CDRL 19-05	Visual inspection criteria for laminated glazing	During IDR
CDRL 19-06	Paint Process Documentation	During IDR through FDR
CDRL 19-07	Smoke Flammability and Toxicity Matrix	During IDR through FDR
CDRL 19-08	Design and product line for electrical connections	During PDR
CDRL 19-09	Design and product line for conduit fittings and junction boxes	During PDR

* End of Chapter 19 *

Amtrak Universal Single Level Fleet Replacement

Technical Specification

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20. Test Requirements

Revision 2

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20.1 Overview

a). This Chapter addresses the requirements for the testing of the design and production of the cars and its components. It is based upon the traditional descriptions of testing an individual passenger car.

b). The cars may have varying components and features depending upon Amtrak.

i). Based upon this, the Contractor shall review each part of this Chapter and prepare a matrix of its adaptation for the specific applicability for testing to the cars being constructed.

ii). This car testing matrix shall be presented to Amtrak for approval. **[CDRL 20-01]**

iii). The overall testing program shall be mutually agreed upon by the Contractor and Amtrak.

c). In the following text, the words consist and car may need to be used interchangeably to meet the intention of the specific test.

d). References to first car or pilot train shall refer to the first delivered equipment of a particular type.

e). As part of the production of the cars and its components under this Contract, the Contractor shall be responsible for a comprehensive series of tests to be performed to verify both the suitability of design and workmanship of each car.

f). The Contractor is also responsible to fulfill all requirements called for by the Federal Railroad Administration (FRA) for testing new passenger equipment, and for operation at 125 mph per the applicable requirements of 49 CFR Parts 238 and 213.345 for Tier I equipment, for submission by Amtrak to the FRA.

g). The tests and any required adjustments to be performed are grouped into four classifications:

i). Material Certification,

ii). Proof of Design,

iii). Production, and

iv). Acceptance.

h). Whenever test requirements overlap, the more comprehensive shall govern.

i). The Contractor shall perform all tests under Amtrak observation, and the FRA may also observe such tests.

j). All contractual tests shall be conducted in accordance with Amtrak approved test procedures.

k). Testing activity scheduled and/or conducted before test procedure approval will be

at the Contractor's risk.

l). Material Certification Tests consist of all tests required to certify that the materials used in the manufacture of the rail cars meet the performance and behavior requirements of the manufacturer's specifications, all applicable industry standards, and Federal requirements.

m). A full listing of the material certification tests shall be included in the Master Test Plan, and the certifications and test results shall be submitted to Amtrak for review and approval.

n). All material samples used for certification testing shall be scrapped upon the conclusion of testing and shall not be used in the manufacture of the cars.

o). Proof of Design Tests are those tests conducted on the systems and components to validate the design of the cars, to confirm that the systems and components function as intended and in accordance with specifications and Federal requirements, and to ensure that no unintended or undesirable consequences are encountered during production or operation of the cars.

p). Proof-of-design tests shall be conducted on all major systems and components prior to release of the first cars of each type, and as necessary during production in the event of a design change or component substitution.

q). Production Tests consists of all components, systems and car tests to be performed on each production car to ensure that each car meets all functional, operational and workmanship requirements and standards, and that any production errors or nonconforming materials or components are revealed and corrected prior to the vehicle being released from the Contractor's facility.

i). These tests comprise component-level testing at the supplier's facility, and system-level testing at the Contractor's facility during and at the completion of production to demonstrate conformance with Technical Specification and baseline configuration requirements prior to delivery.

r). Acceptance Tests consist of production car tests to be performed on each car by the Contractor after delivery of each car to the Contractor's field site or Amtrak's facilities to demonstrate conformance with the Technical Specifications, to ensure that no system functionality was lost during shipment and transit of the vehicle, and as a condition for Acceptance.

s). Tests related to contract options are included in this Chapter. If a contract option is not exercised, then the relevant tests will not be applicable.

20.2 General Requirements

a). The Contractor is required to perform all tests as specified herein.

b). The Contractor and its subcontractors may, at their option, perform additional testing as they deem necessary as part of the quality assurance program.

c). Unless indicated otherwise, all costs associated with any of the tests performed

are to be borne by the Contractor.

d). In the event of a failure to meet the Technical Specification requirements in any test, necessary corrections shall be made by the Contractor at its expense, and the failed test shall be rerun in its entirety at the Contractor's expense.

e). If further corrections or modifications affecting the item under test are instituted, the Contractor shall perform a complete retest at its expense to demonstrate compliance with the Technical Specification requirements.

f). Notwithstanding the preceding provision, Amtrak shall not charge the Contractor a fee for the use of Amtrak-owned facilities, tracks or utilities located on the Northeast Corridor, or for the use of Amtrak personnel, the first time a particular inspection or test is performed on a particular car.

g). Amtrak shall have the right to charge Contractor for, and Contractor shall pay, all such expenses in connection with any re-inspection or retesting of a particular car required as a result of a car not having successfully passed the applicable test.

h). Acceptance of the Fleet or any car thereof by Amtrak shall not occur until after all tests, and retests if applicable, are successfully completed in accordance with the requirements stated in the Contract.

i). The Contractor shall give at least ten days' notice to Amtrak prior to the start of any test referred to herein.

j). In the case of pre-revenue service tests per 49 CFR Part 238.111 (b) (2), 45 calendar days' notice shall be given to Amtrak in order to assure timely notification of the FRA. Additionally, CFR Part 238.110 is intended to complement 238.111, as proposed to be revised in the NPRM, and shall be included in the testing requirements.

k). If the Contract, or any subcontracts, Applicable Laws of any public authority having jurisdiction over Amtrak operations, require the Locomotives or other Equipment or Supplies to be inspected, tested or approved, Contractor shall give the COTR thirty (30) days (sixty (60) days for international travel) notice of its readiness and of the date arranged for any such testing so Amtrak may observe such inspection, testing or approval.

l). The Contractor shall perform and bear all costs of performing such inspections, tests and approvals unless otherwise provided in the Contract.

m). If after Contractor begins delivery of the cars or other Equipment or Supplies, Amtrak determines that any such item requires additional inspection, testing, or approval (in addition to inspections and tests provided under the Contract), Contractor shall, upon written authorization from Amtrak, order such additional inspection, testing or approval and Contractor shall give notice as provided hereunder.

n). These additional inspections or tests shall be conducted at the initial expense of Amtrak, and Amtrak shall grant a non-compensable extension of time equal to any delay caused by such tests.

o). Notwithstanding the preceding sentence, if such additional test or inspection reveals a defect or failure of the cars or Supplies to comply with the requirements of the Contract; or with any Applicable Laws, ordinances, rules, regulations or orders or if the original test or any retest or additional testing is improperly conducted by a Contractor Party, Contractor shall bear all costs of correction and retesting thereof, and no extension of the Contract Time shall be granted.

p). Required certificates of inspection, testing or approval shall be secured by Contractor and promptly delivered to Amtrak.

q). Neither the observations nor representations of Amtrak in its administration of the Contract, nor Amtrak's inspections, tests or approvals shall relieve Contractor from its obligations to perform the Work in accordance with the Contract.

r). Except as otherwise provided herein or agreed to by the Parties; tests shall be performed at plants of Contractor or its Subcontractors.

s). Contractor shall have a valid Amtrak Temporary Permit to Enter prior to performing any work on the Railroad or Amtrak's premises.

t). For onsite track testing, Amtrak shall identify suitable track meeting the length, alignment and other characteristics identified by the Contractor to permit performance of the required qualification track tests.

u). Except as provided herein, Amtrak may, at its sole discretion, allow the Contractor to furnish test reports which indicate that equipment furnished under this Contract is identical to equipment which has been previously tested for the same application and accept this as showing conformance with the requirements of this Technical Specification. Amtrak has the discretion to reject any test reports from similar or identical equipment that the Contractor may propose in lieu of actual testing, for any reason at all, including but not limited to differences in the equipment, differences in the operating environment, insufficient time or mileage in service, or anything else whatsoever.

20.3 Test Plans, Procedures and Reports

a). The Contractor shall prepare and provide to Amtrak as specified the following test documentation. See Chapter 22 for additional details regarding submittal of documents to Amtrak.

i). Master Test Plan

(1) No later than 180 days after NTP, the Contractor shall submit to Amtrak for review and acceptance a Master Test Plan **[CDRL 20-02]** covering all tests listed in or otherwise required by this Technical Specification.

(2) The Master Test Plan shall be updated monthly and presented as an attachment to the program meeting minutes.

(3) The Master Test Plan shall include a testing matrix identifying, all tests as required to be performed by the Contractor and suppliers, including but not limited to:

(a) Material certification tests;

(b) Proof-of-design tests, including all required carshell, truck and suspension and ride quality tests;

(c) Production tests; and

(d) Acceptance tests.

(4) It shall include a detailed schedule showing the sequence in which the test will be performed, and the time and place of each test to be performed.

(5) The plan shall be updated periodically, showing the status of each test procedure, test and associated report summarized in a spreadsheet format.

ii). Test Procedures

(1) The Contractor shall prepare a detailed test procedure for all tests required by this Specification and for all other tests to be conducted by the Contractor or its suppliers in connection with its own quality assurance program. **[CDRL 20-03]**

(2) Tests procedures shall be submitted for approval in advance of the anticipated test dates as follows:

Figure 20-1: Test Procedure Submittal Due Dates

Test Type	**Procedure Due Date**
Supplier Qualification, Proof of Design and Production	No less than 60 days prior to start of testing
Contractor Qualification, Proof of Design Tests	No less than 60 days prior to start of testing
Contractor Production Tests	No less than 45 days prior to start of testing

(3) All required testing shall be conducted in accordance with Amtrak-approved master test plan and approved test procedures.

(4) The test procedures shall include the following information:

Title/Approval Page: Includes the name of the test, test number, revision level, date, author,

	signature of engineer responsible for system, signature of personnel who reviewed and approved the test, etc.
Revision History:	Provides the history of changes made to the document, including description, not merely date.
Table of Contents:	
1.0 Purpose	Identifies what the test is to accomplish.
2.0 Application	Identifies which car types/equipment is tested with this procedure.
3.0 References	Identifies any documents used as guidance for the test, such as APTA, FRA, ASTM, etc.
4.0 Definitions	Provides definitions of terms used in the test.
5.0 Prerequisites	Provides requirements of car condition before the test can be conducted, such as which tests must be successfully conducted before this test.
6.0 Equipment	Identifies test equipment and any other special requirements; lists instrument model numbers, calibration dates and serial numbers.
7.0 Initial Conditions	Identifies positions and/or state of all devices, controls and equipment.
8.0 Procedure	This is the actual test sequence. The test procedure shall identify pass/fail (or in some cases, intentional overload) criteria for each step in the procedure. Test data may be recorded within this section, or in a separate data section. The test procedure shall identify the conditions required for the performance of the test, including a sheet where test conditions can be recorded, such as voltage, current, resistance, time, etc. Each test performed shall be signed and dated by the technician performing the test.

9.0 Data Sheets	This is a form in which data is recorded, if it is not recorded within the body of the test. If data is recorded by instruments, such as strip chart format, etc., those results shall be attached here.

(5) Each car and system shall be tested in exact accordance with Amtrak-approved revision of the test procedure.

(6) All test and inspection instruments shall be properly calibrated.

(7) Should a system or component fail a test, the component or system shall be repaired or replaced, and the test repeated from the beginning.

(a) The test shall not be restarted at the point at which the failure occurred.

(b) Amtrak may, at its sole discretion, determine portions of the failed test which need not be repeated. Unless Amtrak gives written approval to re-test only the portion impacted by the failure of a component.

(8) Each test shall be a separately controlled document and identified by its own number, title and revision.

(9) All revisions shall be submitted to Amtrak for approval.

(10) A history of test revisions and changes shall be maintained and recorded within the test document.

(11) All tests must be written in an instructional form describing the full activity of each test step and written in duplex-numerical form (similar numbering system as seen in this specification).

(12) All special tools and/or equipment to be used must be specified within the test document.

(13) A data collection form shall be used with each procedure and shall be fully identified.

(14) Each individual test shall be accompanied by a separate sheet where the test results are documented.

(15) Each step of the test requiring a specified result or measurement shall be included and identified by the duplex-numeric step number referenced in the test document.

(16) Areas shall be provided for recording actual values produced during the test where needed.

(17) In addition, acceptance criteria and associated tolerances shall also be shown in parenthesis near the space available for recording the actual value.

(18) The test number, revision and page number shall be shown on the header of each page or all test procedures.

(19) Areas shall also be allocated for the date, car number, component serial numbers (as applicable), test equipment serial numbers, verification of test equipment calibration, test status (accepted/rejected) and signature areas for the test technician, Contractor Quality Assurance (QA) representative and Amtrak representative.

iii). Testing Notification

(1) In the case of pre-revenue service tests per 49 CFR Part 238.111(b)(2), the Contractor shall provide no less than 45 calendar days' notice to Amtrak in order to assure timely notification of the FRA.

(2) For other tests, each detailed test procedure shall be submitted to Amtrak for review far enough in advance of the planned test date to allow Amtrak at least 60 days for Qualification and Proof of Design tests and 45 days for production tests to initially review and comment on, or approve the procedure, and still have sufficient time to allow the Contractor to modify a rejected procedure and resubmit to Amtrak, to have approval a minimum of ten (10) working days prior to any testing covered by the procedure.

(3) Amtrak shall witness all tests.

(a) Under no circumstances will Amtrak accept the results of a test performed without approved procedures.

(b) Amtrak requires the Contractor to do internal pre-testing to validate performance prior to the Amtrak-witnessed testing and may require it for tests requiring Amtrak personnel to travel to a Contractor site. In the event the witnessed tests fails, the unwitnessed test results may not be used as a substitute.

iv). Test Documentation

(1) The Contractor shall be responsible to provide Amtrak with written test reports for all tests performed on the cars and their components, including supplier test reports.

(2) Upon the completion of each test, the Contractor shall submit a written report of each test, including copies of all test data, to Amtrak for approval. **[CDRL 20-04]**

(3) In every case, the report shall include a description of the test, all raw data collected in the test, and a summary of the results in a form that can be directly compared to the Technical Specification without further calculations.

(4) The test report shall include a record of the testing dates, tracing numbers for any calibrated instruments used during testing and an overall conclusion of the test findings.

(5) A test shall not be considered as completed until Amtrak (and the FRA, as required) has approved its final written test report.

(6) Should the test procedure or reports be inadequate and not meet the requirements of the Technical Specification of the FRA, Amtrak reserves the right to require revisions including those requiring more testing tasks or data to satisfy itself that the test program or report is adequate and does meet FRA and Specification requirements.

(7) The approval of Amtrak does not in any way relieve the Contractor of responsibility for the adequacy of the test program within the scope of this technical specification.

(8) Upon the completion of all required engineering tests associated with the pilot program, all copies of all test procedures, reports and approvals shall be copied and presented to Amtrak in a single volume and a single pdf document with links to each test that is easily searchable. **[CDRL 20-05]**

(9) All material certification and proof-of-design test procedures and reports shall be supplied by the Contractor in a separate binder and submitted to Amtrak for review and approval prior to acceptance of the first car of each type and a single pdf document with links to each test that is easily searchable. **[CDRL 20-06]**

(10) The master test plan shall be included in this binder and a single pdf document with links to each test that is easily searchable.

(11) Reports on all certification and proof of design tests plus the acceptance tests for the first car of each type shall be submitted and approved by Amtrak prior to acceptance of the first car of each type and a single pdf document with links to each test that is easily searchable.

(12) For production tests, which are performed on all cars or all components, a separate volume shall be submitted to Amtrak containing all approved tests applicable to individual cars and a single pdf document with links to each test that is easily searchable.

(13) In the event a test is revised, the Contractor shall supply a copy of the test reflecting approved changes and the upgraded revision

status to replace the existing test within this volume and a single pdf document with links to each test that is easily searchable.

(14) The test reports required by this specification that are performed on all cars or all components shall be included in the vehicle history books. At the front of the test diction of the vehicle history book there shall be a test log and a single pdf document with links to each test that is easily searchable.

(15) This test log shall be maintained by the Contractor during the equipment assembly.

(16) The test log shall have a place for a technician signature and date and will be signed when each test procedure has been completed.

(17) The test log shall be submitted to Amtrak for review before each car shall be released for shipment to the delivery site.

(18) All Contractor and Amtrak in process inspection sheets and test data records for that car shall be contained in this test log.

20.4 Material Certification Tests

a). All materials used in the production of the vehicles shall be tested to verify conformance with all applicable standards, regulations and specifications, and to ensure that the material performs as specified. At a minimum, the following materials shall undergo material certification testing:

i). All exterior glazing shall be certified to conform to 49 CFR Part 223 requirements.

ii). All interior materials shall be certified to meet smoke, flame and toxicity requirements.

iii). All subfloor panels shall be certified to meet strength and impact resistance requirements.

iv). All materials used in production of the carshell shall be certified to meet material strength, composition and performance characteristics.

v). All components used in the manufacture of truck, suspension and coupler assemblies shall be certified to meet all applicable strength, composition and performance requirements.

vi). All insulation materials shall be certified to meet applicable insulation performance standards.

vii). All materials used in food preparation areas of the Food service car, potable water systems and trash storage shall be certified to meet all applicable Public Health Service sanitation requirements.

viii). All interior and exterior emergency signage materials shall be certified to meet FRA emergency exit signage requirements.

ix). All emergency power sources shall be certified to meet FRA emergency exit pathway.

x). All emergency equipment shall be certified to conform to all applicable FRA regulations and other requirements as necessary.

xi). All exterior graphics components, including paint, decals and hardware, shall be certified to meet all applicable performance requirements including environmental and air quality requirements, durability in accordance with environmental and climatic conditions, and application in a railroad environment.

xii). All electrical devices producing magnetic fields shall not pose a hazard to any person with a pacemaker or other cardiac device within any area of the carbody interior, including passenger and maintenance areas. The magnetic field generated by the electrical devices shall be such that the magnetic field at any location where a passenger, driver or maintainer can be shall not exceed 1 mT (ref.."EN 45502-2-1, paragraph 27.6 " equivalent to ISO 14117, paragraph 4.6) when measured using the method defined by EN 50500 or IEC 62597. All car level EMC tests shall include applicable magnetic field interference testing for medical devices.

20.5 Proof of Design Tests

a). General

i). The Contractor shall develop a series of tests to evaluate the design of the carshell and each car system, subsystem and major component to verify that:

(1) the performance requirements of the carshell structure, systems and components have been met

(2) the system and all component parts function as intended and within all specified parameters

(3) no unintended or unanticipated functions, problems or non-conformances are discovered during production or operation of the cars.

ii). These tests shall validate the design of all systems and components as supplied by the Contractor and subcontractors and prove that these designs are fully compliant with all applicable specifications, regulations and performance requirements.

iii). Proof-of-design tests shall be conducted on systems and components at the facilities of the Contractor or suppliers, or at other facilities as designated by the Contractor.

iv). The carshell and its primary structure shall undergo extensive proof-of-design testing to validate the structural strength, dimensional accuracy and performance of the carshell.

v). Proof-of-design tests shall also be conducted on completed cars at the Contractor's facility, to ensure that the individual systems and components have been integrated to function as intended within the completed car, without unanticipated or undesirable effect or degradation of performance of other systems or components.

b). Carbody

i). Weight and Balance

(1) Each completed car shall be weighed on a certified scale at AW0 condition ready to run [i.e. water, food service equipment, supplies, etc.] to determine compliance with the maximum weight and weight distribution requirement of the specification.

ii). Clearance

(1) Each completed car type shall be measured at AW0 and AW2 load to verify compliance with the clearance diagram. This shall include all exterior fittings, hardware, safety appliances, (including FRA top-of-rail clearance requirements) etc. Width measurements shall be taken from the centerline of calibrated track, not the carbody.

iii). Car Curving

(1) The first train containing each car type shall be tested to verify compliance (including having sufficient clearance between truck and carbody/equipment) to successfully negotiate the specified minimum curving radius in both directions of curving.

(2) This must take into account suspension motion (including worst case broken or collapsed springs), wheel wear, and the actions of maximum buff and draft with all connections made between cars.

(3) Each possible combination of vehicle configurations including locomotives, car types, procured cars with gangways, diaphragms, and legacy cars shall be tested to confirm interoperability.

(a) Couplers, trainlines and brake hoses compatibility shall be performed to confirm proper integration of the system at worst case curves, switcher, vertical curves, etc. including proper receptacles/plugs junctions and length compatibility.

iv). Structural

(1) General

(a) Unless otherwise indicated, all references to APTA, FRA and other standards indicate applicability of the current versions of the standards, as of the date of the NTP.

(b) The test plans shall be coordinated with the final design of the carbody shell compliant with 49 CFR Part 238 requirements and

shall test structural element strength and/or crash energy management performance, as based upon the design.

(c) Specific details of the structural test plan shall be submitted to Amtrak for approval.

(d) The first representative carbody of each car type shall be tested by the Contractor to confirm that the FEA is sufficiently accurate to ensure that the carbody structure complies with this Specification.

(e) If there are no major structural differences between the carbody types and the test results are comparable with the FEA, the Contractor may choose to present data showing the similarities and differences between different carshell types to propose that the testing of certain carshell types can validate the performance of multiple types. In those cases, the worst case carshell must be the one subject to testing. Selection of carshells for testing is subject to approval by Amtrak and to review and objections from the FRA

(f) The tests shall be performed at an Amtrak approved facility.

(g) To be acceptable, the test facility must have documentation showing calibration of all instrumentation, have qualified personnel with experience in conducting similar tests, and have the necessary equipment, instrumentation and control equipment to conduct the test.

(h) The tests shall not begin until the carbody stress and any energy absorption analyses have been submitted and approved by Amtrak.

(i) The test carshell shall be completely inspected and any non-conformances corrected. All inspection, test, rework, repair and corrective action reports shall be available for review. Particular attention shall be given to recording flatness and straightness.

(j) The test carshell shall be structurally complete, including all structural parts and fiberglass ends (if part of the design), but excluding such items as exterior and interior trim, windows, doors, seats, lights, interior lining, or other parts that would obscure any structural member from view, or that would interfere with the performance of the test.

(k) The test shell shall have no paint, primer, sound damping coating, or insulation.

(l) The weight of underfloor and above floor compartment-mounted equipment and heavy roof-mounted equipment shall be simulated by equivalent weights at their respective locations.

(m) All structural tests shall be conducted on the same carshell or carshells.

(n) The carshell shall be weighed and the weight recorded prior to installation of any test equipment.

(o) For the tests, the car shall be supported on the trucks or equivalent supports to allow longitudinal movement.

(p) All gauges and instruments shall be in current calibration and remain so for the duration of the test.

(q) The methods of calibration and time periods for recalibration shall be in accordance with the test laboratory's national standard or ISO standards.

(r) The laboratory shall have on file a current certification of calibration traceable to the laboratory's national standard or ISO standards.

(s) The Contractor may conduct preliminary tests per the approved test procedures, but all critical dimensions and flatness shall be verified after the Contractor tests and before the official test begins. All data from preliminary tests shall be recorded per the approved test procedures and available to Amtrak upon request.

(t) The test of record is to be witnessed by Amtrak.

(u) A copy of all recorded data shall be given to Amtrak at the conclusion of each test.

(v) A data acquisition system shall be provided to permanently record all gauge outputs at each load step. The data acquisition system and complete sensor set up shall be qualified by a handheld, high precision fixed shunt resistor across sensors chosen by the Amtrak test representative.

(w) At the end of each load step, a printout of all strain gauge readings in proper engineering units (micro-strains) and a plot of load vs. gauge reading for critical gauge locations shall be given to Amtrak or its representative for review. Loads shall be reported in pounds for each individual application and totaled.

(x) The Contractor shall obtain approval of Amtrak or its representative after every load step before proceeding with the next step.

(y) All vertical and compression loads shall be complete removed, residual stresses measured, and sensors (including vertical load sensors) zeroed at the end of each individual test.

(z) The Contractor shall not break down the test fixtures until Amtrak or its representative has reviewed and accepted all data for the applicable test.

(aa) The Contractor shall prepare a color photographic record of the test.

(bb) This record shall include photographs of the car in the test fixture configuration for each test, installation of sensor configuration for each test, repairs or modifications, deviations from the drawings, and any areas found to be non-compliant.

(cc) The entire procedure shall be video recorded by the Contractor. The camera shall rove to view and record key areas.

(dd) All video taken during this test shall become the property of Amtrak. Video camera locations must be approved by Amtrak.

(ee) Amtrak reserves the right to test a second car of each type during the construction period.

(ff) Should such a test be ordered, it shall be at the expense of Amtrak unless such tests prove the design is non-compliant in any structural area, in which case, the Contractor shall be responsible for the test expense and for all of Amtrak's costs, and the cost of modifications necessary for the car and all other cars to be made compliant with the Specification.

(gg) The Contractor (at its expense) shall also perform a complete set of structural tests to qualify the modified car.

(2) Test procedures

(a) A procedure shall be prepared for each test.

(b) The procedure shall include a description of the test, its purpose, how and with what equipment the specimen is to be loaded and the load increments, the type and location of strain gauges, the location of deflection gauges, a complete description of all fixtures, instruments and gauges and a detailed description of the data acquisition system.

(c) Annotated copies of catalog cuts may be used to provide parts of the description.

(d) An explanation of the accuracy of the instrumentation shall be provided.

(e) Photographs (where available), drawings and sketches shall be included to clarify the text.

(f) The test procedure shall provide a step-by-step instruction describing how the load is to be applied, the load at each step,

when data is to be recorded, a space for the signature of the test supervisor and a space for recording the authorization to proceed obtained from Amtrak or its representative.

(g) Test procedures shall be submitted not less than 60 days in advance of the proposed test date; approvals of the test procedure and stress analysis are prerequisites for the start of testing.

(h) The test procedure shall include a copy of the current calibration certification for each instrument and gauge to be used for the test.

(i) Typical logging sheets, printouts, plotting forms and examples of any other data sheets for the test or in the final report shall also be submitted as part of the test procedure.

(j) Tables shall be included to give the maximum allowable reading for each gauge and loading condition.

(k) Other tables shall be included to provide the requirements for all other test criteria.

(l) Each test procedure shall contain a table of predicted strain (or stress) its magnitude of the allowable, and deflection at selected gauge locations.

(m) This table shall list the strain or deflection gauge number, the location of the gauge, the predicted strain (or stress) or deflection from the stress analysis, spaces to enter the actual gauge readings, and a space to enter the calculated percent difference, defined as:

$$\% \text{ difference} = \frac{\text{Actual} - \text{Predicted}}{\text{Actual}} \times 100$$

(3) Strain gauges

(a) For structural strength testing, a minimum of 200 strain gauges (as typical for an 85 ft long car) shall be applied to the car structure for each of the compression, vertical load and diagonal jacking tests.

(b) 75% of the strain gauges shall be 3 gauge combinations, such as rosette gauges.

(c) Some gauges may be used for more than one test if their location on the structure is appropriate for other tests as accepted by Amtrak, but readings from at least 200 strain gauges in locations of interest shall be obtained for each test.

(d) The location of the strain gauges shall be based on the Contractor's experience, the stress analysis and Amtrak's recommendations.

(e) There shall be no less than three locations where there are a sufficient number of gauges to encircle the carbody, providing cross sections through the vehicle for evaluation.

(f) One location shall be outboard of the bolster, one shall be at the quarter-point between the truck centers, and one shall be at the center of the car.

(g) Gauges shall be placed, for example, on all four sides of the side sill and body sills, on the side framing, along the cant rail, on the cross members, and at the center line of the car.

(h) For structural post tests (if used), there shall be a minimum of 100 strain gauges applied to the post and car structure in the vicinity of the post.

(i) Some of the gauges may be for more than one test if their location on the structure is appropriate for other tests, but readings from at least 100 strain gauges in locations where the stress may be critical shall be obtained for each test.

(j) Drawings and sketches showing the location of each strain gauge shall be prepared by the Contractor and submitted for approval as part of the test procedure.

(i) These drawings shall dimension the location and orientation of each gauge, showing their distances from edges, connections and bends.

(ii) Their locations on the upper or lower, inner or outer surface shall be noted on these drawings.

(k) The gauges shall be calibrated and applied in accordance with the manufacturer's instructions for the material being measured and be compensated for temperature.

(4) Deflection gauges

(a) For structural strength testing, vertical deflection of the carbody shall be measured along both side sills at each load step during all tests.

(b) At least 11 gauges per side shall be used.

(c) Gauges shall be located at the end sills, at the bolsters, and at the mid-point between the bolsters.

(d) The remaining gauges shall be evenly spaced between the five locations.

(e) Measurements shall be taken to the nearest 0.01 in., and the deflections shall be considered as the average of the readings recorded on both sides of the car.

(f) To measure the longitudinal deflection of the car during compression testing, additional deflection gauges shall be applied at the end sill, near the ram, and at the opposite end sill, near the reaction.

(g) For the diagonal jacking and lifting tests, an additional deflection gauge shall be applied at the jack or crane that is lowered or raised to measure the vertical movement at the lifting locations.

(h) During the vertical load test, the change in carbody width due to bending shall be measured and recorded at the belt rail in the center of the car.

(i) Two additional deflection gauges shall be applied in one of the side door openings closest to the center of the car to measure the change in the diagonal dimensions of the opening during the tests.

(j) To measure the bending of the collision and corner posts during the post tests, deflection gauges shall be applied at a minimum of seven locations on each post being tested: top, bottom, middle, load application point, between the load application point and the bottom, between the load application point and the center, and between the center and the top.

    (i) These gauges shall be mounted to measure the deflection of the post in the direction of the applied force.

(k) Deflection gauges shall be mounted on rigid stands separate from the carbody and its fixtures.

(l) The contact surface on the car shall have a smooth, polished, low-friction surface plate mounted perpendicular to the axis of the deflection gauge.

(m) If, during a test, the deflection gauge moves off of this surface plate or contacts the test carshell or the fixtures, the test shall be terminated.

(n) The gauges shall be readjusted, and the test repeated from the beginning.

(o) The deflection gauges shall have electrical outputs compatible with the data logging apparatus used with the strain gauges.

(p) All deflections shall be recorded simultaneously with the strain gauge recordings.

(q) In addition to the above electronic recordings, dial indicators (mechanical) of sufficient stroke shall be employed.

(i) Two shall measure the vertical deflection at the center of both side sills during all tests.

(r) During the compression tests, dial indicators shall be employed to measure the longitudinal deflection at the end sill next to the ram and next to the reaction at the opposite end of the car.

(i) An indicator shall be located next to the lowering jack during the diagonal jacking test.

(ii) A dial indicator shall be mounted at the center of the post during each post tested.

(iii) These dial indicators shall be read and manually recorded at each load step.

(s) All deflection gauges shall have sufficient stroke capacity to measure the maximum deflection expected in the test without the need for resetting any gauge during the test.

(5) Load cells

(a) In order to verify the accuracy of the applied loads and reactions, load cells shall be provided at the appropriate locations for each test. Each load cell shall be calibrated to 1.0% accuracy and certified within one year before commencement of the tests over the full range of 1.5 times the maximum load to which the load cell will be subjected during these tests. The Contractor shall provide records of calibration results prior to commencing these tests. The load cells shall have electrical outputs compatible with the data logging apparatus used with the strain gauges. All loads shall be recorded simultaneously with the strain gauge recordings.

(b) Load cells shall be placed at the end of the ram and at the reaction point for the compression test. A load cell shall be placed at each secondary spring location for the vertical test and at each ram if the load is applied hydraulically. A load cell shall be placed at each jack location for the diagonal jacking test. A load cell shall be placed at the end of the ram for each post test. Load cell readings shall be taken and recorded at each step of load application and removal process.

(6) Load Application

(a) Unless otherwise agreed to by Amtrak, all loads for all tests shall be applied using hydraulic actuators to ensure quick testing schedules of the multiple carshell variants.

(7) Vertical load test

(a) Test description

(i) For structural strength testing, the carbody supported on trucks or simulation thereof, shall be subjected to a vertical load test. The instrumented carshell shall be loaded to simulate ready-to-run weight. A test load, equivalent to the AW3 passenger load, shall be applied to the car in 4 equal steps, resulting in a total of five vertical load increments. The test load shall be distributed in proportion to the distribution of weight in the furnished car. The specimen shall be unloaded in the increments in which it was loaded. Strain gauge, deflection and load cell readings shall be taken at each load increment.

(ii) During the vertical load structural testing, both sets of doors on the vehicle shall be installed and their performance validated during max load. Alternatively, six additional deflection gauges can be used to validate the FEA's predicted worst case door opening deflections and the door may be test separately using these worst case deflections.

(b) Test criteria

(i) The car shall be considered compliant with vertical load testing if all of the following conditions are met:

1. Stresses are in accordance with the requirements of APTA Standard PR-CS-S-034-99.

2. Vertical deflection readings plotted against load do not vary by more than ± 5% from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at that point which represents the measured deflection for maximum vertical load.

3. Strain readings plotted against load do not vary by more than ± 5% from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at the point which represents the measured deflection at maximum load.

4. Maximum stresses calculated from stain readings in any structural element do not exceed the allowable stresses approved prior to starting the test program as part of the stress analysis.

5. Recorded residual vertical deflection between bolsters following removal of the maximum vertical

test loading does not exceed 0.01 in.

6. Recorded residual car transverse width and/or opening diagonal dimensions following removal of the maximum vertical test load do not exceed 0.01 in.

7. Indicated residual strains at strain gauges on principal structural elements following removal of the maximum vertical loading do not exceed the maximum error resulting from the accuracy of the instrumentation.

8. Carbody deflection, as measured during the vertical load tests under a load equal to the passenger load of AW3, is not more than the design camber in the side sill at any point between the carbody bolsters.

9. Door operation is normal, including normally expected cycle times.

10. There are no permanent deformations, fractures, cracks or separations in the car structure. Broken welds resulting from the test are to be inspected jointly by the Contractor and Amtrak to determine if the failure is the result of weld quality or stress.

11. Vertical deflection readings validate the required camber values

(8) End Sill Compression Load Test

(a) Test Description

(i) For structural strength testing, a compression test load as defined in APTA Standard PR-CS-S-034-99 is to be applied to the end sill assembly in the underframe of the test specimen by means of a ram. This load shall be applied horizontally at the horizontal centerline of the carbody.

(ii) During the compression test, the carshell shall be supported on trucks or simulations thereof to allow free longitudinal movement. The carshell shall be loaded with sufficient dead weight to bring the total body weight of the test specimen to that of an AW0 loaded car. This loading shall be distributed in proportion to the distribution of weight in the finished car.

(iii) The compression test load shall be applied by means of a controlled hydraulic ram, and the force measured by a means independent of those producing the force. The

force shall be measured at the ram and at the reaction at the opposite end of the car. The ram shall be supported at the car end but shall remain free to move longitudinally with respect to the car end. The ram's connection to the structure shall allow vertical rotation for any deflection of the structure throughout the test.

(b) Test criteria

(i) The car shall be compliant with end sill compression testing if all of the following conditions are met:

1. Stresses are in accordance with the requirements of APTA Standard PR-CS-S-034-99.

2. The vertical deflection of each side of the test structure is within ± 10% of the value determined by the analysis.

3. The force measured at the reaction load cell is within 1.0% of the force applied at the ram.

4. Maximum stresses calculated from strain readings in any structural element do not exceed the allowable stresses approved prior to starting the test program as part of the stress analysis.

5. Indicated residual strains at strain gauges on principal structural elements following removal of the maximum vertical loading do not exceed the maximum error resulting from the accuracy of the instrumentation.

6. There are no permanent deformations, fractures, cracks or separations in the car structure. Broken welds are to be jointly inspected by the Contractor and Amtrak to determine if the failure is the result of weld quality or stress.

(9) Compression load test at the draft stop

(a) Test description

(i) For structural strength testing, a compression test load of 800,000 lbs. shall be applied to the rear draft stop in the draft gear housing. This load shall be applied at the car transverse centerline and vertically at centerline of shaft. No allowance shall be made for the camber of the carbody.

(ii) A fixture, which simulates the regular draft gear and carrier, shall be installed. During the compression test, the carshell shall be supported on trucks, or a simulation

thereof to allow free longitudinal movement. The carshell shall be loaded with sufficient dead weight to bring the total body weight of the test specimen to that of an AW0 loaded car. This loading shall be distributed in proportion to the distribution of weight in the finished car. The ram's connection to the structure shall allow vertical rotation for any deflection of the structure throughout the test.

(iii) The compression test load shall be applied by means of a controlled hydraulic ram, and the force measured by a means independent of those producing the force. The force shall be measured at the ram and at the reaction at the opposite end of the car. The load shall be applied in increments of 25%, 50%, 75%, 87.5% and 100% of full load. After each load increment is applied, the load shall be reduced to not more than 2% of full load. Strain gauge, deflection and load readings shall be taken at each load increment and at each relaxation of load. The ram may be supported at the car end but shall remain free to rotate at its contact with the car end.

(b) Test criteria

(i) The car shall be compliant with compression testing if all of the following conditions are met:

1. Stresses are in accordance with the requirements of APTA Standard PR-CS-S-034-99.

2. The vertical deflection of each side of the test structure is within ± 10% of the value determined by the analysis.

3. The force measured at the reaction load cell is within 1.0% of the force applied at the ram.

4. Vertical deflection readings plotted against load do not vary by more than ± 5% from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at the point which represents the measured deflection at maximum load.

5. Strain readings plotted against load do not vary by more than ± 5% from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at the point, which represents the measured deflection, at maximum load.

6. Maximum stresses calculated from strain readings in any structural element do not exceed the allowable stresses approved prior to starting the test program

as part of the stress analysis.

7. Recorded residual vertical deflection between bolsters following removal of the maximum vertical test load does not exceed 0.01 in.

8. The residual horizontal deflection between ends following removal of the maximum load does not exceed 0.04 in.

9. Indicated residual strains at strain gauges on principal structural elements following removal of the maximum vertical loading do not exceed the maximum error resulting from the accuracy of the instrumentation.

10. There are no permanent deformations, fractures, cracks, or separations in the car structure. Broken welds are to be jointly inspected by the Contractor and Amtrak to determine if the failure is the result of weld quality or stress.

(10) Diagonal Jacking Test

(a) Test description

(i) For structural strength testing, the carshell shall be loaded to its AW0 weight, with trucks, or equivalent weight, hanging from the body bolsters. The carshell shall be supported symmetrically at the jack pads at the four corners of the car. One of the jacks shall be lowered in five equal increments until it is free of the jacking pad. The selection of the jack to be lowered should be based on its relation to the center of gravity of the carshell so that the diagonally opposite jack remains in contact with the jacking pad and carries some car weight. All gauges shall be recorded at each increment of jack position. The procedure shall be reversed until the load on the jack is returned to its original level.

(ii) The amount of torsional deflection or twist shall be measured.

(b) Test criteria

(i) The car shall be compliant with diagonal jacking testing if all of the following conditions are met:

1. Maximum stresses calculated from strain readings in any structural element do not exceed 80% of the yield strength.

2. Strain readings plotted against load do not vary by more than ± 5% from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at the point that represents the measured deflection at maximum load.

3. Indicated residual strains at strain gauges following return to original level do not exceed the maximum error resulting from the accuracy of the instrumentation.

4. There are no permanent deformations, fractures, cracks or separations in the car structure.

5. Broken welds are to be jointly inspected by the Contractor and Amtrak to determine if the failure is the result of weld quality or stress.

(11) Diagonal lifting test

(a) Test description

(i) For structural strength testing, the carshell shall be loaded to its AW0 weight, with trucks, or equivalent weight, hanging from the body bolsters. The carshell shall be supported symmetrically at the four most outboard jacking pads of the car. One of the corners shall be lowered in five equal increments until it is free of the support. The selection of the corner to be lowered should be based on its relation to the center of gravity of the carshell so that the diagonally opposite corner remains in contact with the support and carries some car weight. All gauges shall be recorded at each increment of crane position. The procedure shall be reversed until the load is returned to its original level.

(ii) The amount of torsional deflection or twist shall be measured.

(b) Test criteria

(i) The car shall be compliant with diagonal lift testing if all of the following conditions are met:

1. Maximum stresses calculated from strain readings in any structural element do not exceed 80% of the yield strength.

2. Strain readings plotted against load do not vary by more than ± 5% from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at the point that represents the measured

deflection at maximum load.

3. Indicated residual strains at strain gauges following return to original level do not exceed the maximum error resulting from the accuracy of the instrumentation.

4. There are no permanent deformations, fractures, cracks or separations in the car structure.

5. Broken welds are to be jointly inspected by the Contractor and Amtrak to determine if the failure is the result of weld quality or stress.

(12) Collision post (if included) elastic test

(a) Test description

(i) For structural strength testing, the ability of the carbody structure to resist collision post longitudinal loads shall be tested.

(ii) During the collision post test, the carshell shall be supported on trucks or simulations thereof to allow free longitudinal movement. The post-applied load shall be reacted at the coupler. The carshell shall be loaded with sufficient dead weight to bring the total carbody weight of the test specimen to that of an AW0 loaded carbody. This loading shall be distributed in proportion to the distribution of weight in the finished car.

(iii) The specimen shall be instrumented as required for the car and collision post per the corresponding test plan. Strain gauges and deflection gauges shall be installed at the same places at some locations so that the structural equivalence of the model to the carbody can be determined.

(iv) A longitudinal test load as specified in APTA Standard PR-CS-S-034-99 shall be applied to, and centered on, the collision post. This load shall be distributed over an area not to exceed the width of the collision post by 6 in. in height. If the required load allows an ultimate strength limit, a reduced load can be proposed but shall maximize the lad to the greatest extent practicable and shall be approved by Amtrak.

(v) The test load shall be applied by means of a controlled hydraulic ram, and the force measured by a means independent of that producing the force. A fixture and means of cushioning, such as lead sheets, shall be provided to assure uniform bearing and to prevent crippling

around the area of force application. This fixture and cushion shall not be attached to the post. The test load shall be applied horizontally parallel to the car longitudinal centerline. The load shall be applied in increments of 25%, 50%, 75%, 87.5% and 100% of full load. The load shall be reduced to not more than 2 percent of full load after each step. Strain gauge and deflection readings shall be taken at each load increment and at each relaxation of load. The ram shall be supported at the car end but shall remain free to move longitudinally with respect to the car end.

(b) Test criteria

(i) The car shall be compliant with collision post testing if all of the following conditions are met:

1. Deflection readings plotted against load do not vary by more than ± 5% from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at the point that represents the measured deflection at maximum load.

2. Strain readings plotted against load do not vary by more than ± 5% from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at the point which represents the measured deflection at maximum load.

3. Maximum stresses calculated from strain readings in any structural element do not exceed the allowable stresses approved prior to starting the test program as part of the stress analysis.

4. Indicated residual strains at strain gauges on principal structural elements following removal of the maximum loading do not exceed the maximum error resulting from the accuracy of the instrumentation.

5. There is no permanent deformation, fractures, cracks or separations in the car structure.

6. Broken welds are to be jointly inspected by the Contractor and Amtrak to determine if the failure is the result of weld quality or stress.

(13) Corner post (if included) longitudinal load test

(a) Test description

(i) For structural strength testing, the ability of the carbody structure to resist primary side corner post longitudinal compressive loads to all cars shall be tested.

(ii) During the corner post longitudinal test, the carshell shall be supported on trucks or simulations thereof to allow free longitudinal movement. The post applied load shall be reacted at the coupler. The carshell shall be loaded with sufficient dead weight to bring the total carbody weight of the test specimen to that of an AW0 loaded carbody. This loading shall be distributed in proportion to the distribution of weight in the finished car.

(iii) The specimen shall be instrumented as required for the car and corner post in the corresponding test plan. The strain gauges and deflection gauges shall be installed at the same places at some locations so that the structural equivalence of the model to the carbody can be determined.

(iv) Longitudinal test loads shall be applied to, and centered on, the corner post as specified in APTA Standard PR-CS-S-034-99. The magnitudes of the loads shall be limited to values that approach the yield strength of the past as predicted by the approved FEA but shall maximize the load to the greatest extent practicable and shall be approved by Amtrak. These loads shall be distributed over an area not to exceed the width of the collision post and not to exceed 6 in. in height.

(v) The test load shall be applied by means of a controlled hydraulic ram, and the force measured by a means independent of that producing the force. A fixture and means of cushioning, such as lead sheets, shall be provided to assure uniform bearing and prevent crippling around the area of force application. This fixture and cushion shall not be attached to the post. The test load shall be applied horizontally parallel to the car longitudinal centerline. The load shall be applied in increments of 25%, 50%, 75%, 87.5% and 100% of full load. The load shall be reduced to not more than 2% of full load after each step. Strain gauge and deflection readings shall be taken at each load increment and at each relaxation of load. The ram shall be supported at the car end but shall remain free to move longitudinally with respect to the car end.

(b) Test criteria

(i) The car shall be compliant with corner post longitudinal testing if all of the following conditions are met:

1. Deflection readings plotted against load do not vary by more than ± 5% from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at the point which represents the measured deflection at maximum load.

2. Strain readings plotted against load do not vary by more than ± 5% from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at the point which represents the measured deflection at maximum load.

3. Maximum stresses calculated from strain readings in any structural element do not exceed the allowable stresses approved prior to starting the test program as part of the stress analysis.

4. Indicated residual strains at strain gauges on principal structural elements following removal of the maximum loading do not exceed the maximum error resulting from the accuracy of the instrumentation.

5. There is no permanent deformation, fractures, cracks or separations in the car structure. Broken welds shall be jointly inspected by the Contractor and Amtrak to determine if the failure is the result of weld quality or stress.

(14) Corner post transverse load test

(a) Test description

(i) For structural strength testing, the ability of the carbody structure to resist corner post transverse loads shall be tested.

(ii) During the corner post test, the carshell shall be supported on trucks or simulations thereof. Transverse restraint shall be at the lateral stops between the carbody bolsters and truck frame. The carshell shall be loaded with sufficient dead weight to bring the total body weight of the test specimen to that of an AW0 loaded carbody. This loading shall be distributed in proportion to the distribution of weight in the finished car.

(iii) The specimen shall be instrumented as required for the car and corner post in the corresponding test plan. The strain gauges and deflection gauges shall be installed at the same places at some locations so that the structural equivalence of the model to the carbody can be determined.

(iv) Longitudinal test loads as specified in APTA Standard PR-CS-S-034-99 shall be applied to and centered on the corner post. This load shall be distributed over an area not to exceed the width of the corner post and not to exceed 6 in. in height.

(v) The test load shall be applied by means of a controlled hydraulic ram, and the force measured by a means independent of that producing the force. A fixture and means of cushioning, such as lead sheets, shall be provided to assure uniform bearing and prevent crippling around the area of force application. This fixture and cushion shall not be attached to the post. The test load shall be applied horizontally perpendicular to the car longitudinal centerline. The load shall be applied in increments of 25%, 50%, 75%, 87.5% and 100% of full load. The load shall be reduced to not more than 2% of full load after each step. Strain gauge and deflection readings shall be taken at each load increment and at each relaxation of load. The ram shall be supported at the car end but shall remain free to move transversely with respect to the car end.

(b) Test criteria

(i) The car shall be compliant with corner post transverse testing if all of the following conditions are met:

1. Deflection readings plotted against load do not vary by more than ± 5% percent from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at the point which represents the measured deflection at maximum load.

2. Strain readings plotted against load do not vary by more than ± 5% from a straight line (linear) deflection curve, with one end point at the origin (no load) and the other at the point which represents the measured deflection at maximum load.

3. Maximum stresses calculated from strain readings in any structural element do not exceed the allowable stresses approved prior to starting the test program as part of the stress analysis.

4. Indicated residual strains at strain gauges on principal structural elements following removal of the maximum loading do not exceed the maximum error resulting from the accuracy of the instrumentation.

5. There are no locations of permanent deformation, fractures, cracks or separations in the car structure. Broken welds are to be jointly inspected by the Contractor and Amtrak to determine if the failure is the result of weld quality or stress.

(15) Collision post (if included) elastic-plastic test

(a) Test description

(i) Collision posts at the vehicle ends coupled with locomotives shall be tested per the following requirements.

(ii) For structural strength testing, the ability of the connections between the collision posts and the carbody structure to withstand a longitudinal load equal to the ultimate load carrying capacity of the post shall be tested.

(iii) This test shall also verify the structural energy absorption requirement outlined in APTA Standard PR-CS-S-034-99, if used in the design.

(iv) The test specimen shall be a full-scale structural model of the end of a car. The structural model shall include all structural elements required to support the collision posts including the end underframe and roof between the forward end of the end frame and the bolster. All connections shall be identical to those of production cars. The bolster end of the model shall be attached to a rigid fixture so that the stresses in the post and its supporting structure shall be the same as those in a car subjected to the same load.

(v) The specimen shall be instrumented in the same manner in which it was instrumented in the collision post elastic test, except that instruments of greater capacity may be needed for this test. The strain gauges and deflection gauges shall be installed in the same locations so that the structural equivalence of the specimen to the carbody can be determined. Longitudinal test loads shall be applied to and centered on the collision post. This load shall be distributed over an area not to exceed the width of the collision post and not to exceed by 6 in. in height.

(vi) The compression test load shall be applied by means of a controlled hydraulic ram, and the force measured by a means independent of that producing the force. A fixture and means of cushioning, such as lead sheets, shall be provided to assure uniform bearing and prevent crippling around the area of force application. This fixture and cushion shall not be attached to the post. The test load shall be applied horizontally parallel to the car longitudinal centerline.

(vii) The initial load shall be applied in increments of the same magnitude as those used during the collision post elastic load test. The load shall be reduced to not more than 2% of full load after each step. Strain gauge and deflection

readings shall be taken at each load increment and at each relaxation of load.

(viii) The strain gauge readings and deflections measured during this test shall be within 5% of the gauge readings for the same load and location measured during the collision post elastic test. If difference between the two test results, the fixture and/or the model shall be corrected until agreement within 5% between the two tests is obtained.

(ix) After agreement between the two tests is demonstrated, the collision post shall continue to be loaded in stroke increments of 20% of the full depth of the collision post until the load carrying capacity of the collision post is obtained. At each 20% load increment, all load cell(s), strain gauges and deflection gauges shall be recorded. The load need not be relaxed after each step.

(x) The ultimate load carrying capacity of the post shall be defined as the condition where the post cannot support an increased load, or the center of the post has deflected more than its full depth. This deflection shall be measured at the middle of the post from a string connected between the top and bottom of the post.

(b) Test criteria

(i) The collision post shall be compliant with collision post elastic-plastic testing if all of the following conditions are met:

1. All strain gauges and deflection gauges have the same readings within ± 5% for the same loads at the same locations as the collision post elastic load test for 0% to 100% as tested in the elastic test.

2. The connections between the collision post and all other structural members are not completely broken.

3. If required by the design, the collision post and supporting structure have absorbed energy as per APTA Standard PR-CS-S-034-99.

v). Floor Panel Fire Resistance

(1) Amtrak approved sample of materials representing structural flooring and floor panels shall be tested to verify the ability to withstand the requirements of ASTM E119, when exposed for 30 minutes at up to 1400°F on the material underside.

vi). Safety Appliances

(1) Must demonstrate compliance with FRA and APTA requirements.

vii). Emergency Window Egress and Access

(1) Tests shall be conducted to measure the force required to remove each type of emergency window from the carbody. This shall be done both from inside and outside the car. The test shall include a check that car interior furnishings do not interfere with window removal. The force shall not exceed 25 lbf.

viii). Paint Adhesion

(1) A paint adhesion verification test shall be performed using a standard crosscut adhesion test. This test consists of scribing a grid of four horizontal and four vertical 1-inch long lines through the coating with a sharp steel blade. Pressure sensitive tape, Scotch brand No. 335-2, is then pressed firmly over the scribed area and is then pulled away at 90 degree angle to the sample sheet. The coating shall pass the test if no coating is removed from the substrate material. Several test specimens shall be created by preparing the base metal in the same fashion as the carbody, selecting them to represent different conditions on the car. Specimens shall be painted at the same time as the carbody, with the same painting orientation as on the car (side, overhead, etc.).

(2) An alternate paint adhesion test procedure based upon a recognized industry standard such as ISO 2409 or ASTM D3359.may be submitted for review and approval.

ix). Gap Filler

(1) The powered side door high level station platform gap filler shall undergo proof-of-design testing to evaluate and verify that the filler meets all specification requirements for:

(a) Compliance with all applicable ADA requirements;

(b) Functional and operational performance under all design loads, track conditions as specified, and safety factors without deformation or deflection;

(c) Rate of travel for extension and retraction;

(d) Proper operation of all safety provisions and functional interlocks and isolation devices within the unit and with the door system, brakes and indicators;

(e) Maintainability and reliability requirements; and

(f) Manual retraction with power failure

(2) These tests shall include an endurance test in which the filler shall be subjected to no less than 500,000 repeated cycles of deployment and storage.

c). Trucks

i). Wheel Load Equalization

(1) The truck shall be tested in accordance with APTA Standard PR-M-S-014-06, for Class G passenger equipment

(2) To verify the equalization provided by the truck design, one truck on the first car at AW0 load shall have one wheel jacked up (lifted) 2.5 in. and then increasing to 3 in. while taking load readings every 0.5 inches in both the increasing and decreasing direction and suitable instrumentation provided to measure the load carried on the other wheels. The process shall be repeated with one wheel being dropped (lowered). The load changes shall be in accordance with the requirements of APTA Standard PR-M-S-014-06. In the event that suitable equalization is not attained as indicated by the tests, the truck design shall be corrected, the truck retested at the expense of the Contractor, and all trucks installed under the cars shall be modified to be in accordance with the corrected design.

ii). Truck Frame and Bolster Static Load Test

(1) The truck frame and bolster shall be tested to verify that the maximum allowable stresses established by the Contractor and approved by Amtrak under an AW3 load are not exceeded. This is a static load test, repeated twice with a complete release between applications and shall be performed with the suspension elements replaced by solid blocking (with resilient pads if necessary). The truck shall be tested either as individual load bearing components or as an assembly, as the Contractor elects. If the load bearing components of the truck rather than the complete assembly are tested, provision must be made to apply all input loads described herein and for the member under test to react to these input loads in a manner which is identical to the reactions that would occur when included as part of the assembly. Forces shall enter the parts or truck at the normal application points and shall be so combined in each case as to produce the maximum unit stresses at the critical points for which the stress estimates were furnished. The tests shall be witnessed by Amtrak.

(2) No less than 75 strain gauges shall be applied to the truck near the locations of maximum stress points as agreed to by the Contractor and Amtrak, Amtrak having the power of decision in disagreement. The locations of maximum stress points are to be determined by analysis. The critical stress readings of the two applications shall be averaged for comparison with the estimated stresses.

(3) The loads shall be as listed in Chapter 7. The vertical, lateral, longitudinal, and braking loads shall be applied simultaneously. At no point shall the average stress exceed the allowable stress. If it does, Amtrak shall have the right to require that the design be corrected to bring the test stresses with the allowable stresses; the truck shall be retested at the expense of the Contractor, and all trucks installed in the cars shall be modified to be in accordance with the corrected design. Testing will not be required on service qualified components which can be shown to have had satisfactory service experience of comparable severity and duration, as determined by Amtrak.

iii). Truck Frame and Bolster Overload Test

(1) To demonstrate that the truck design has adequate strength to sustain a maximum load in the presence of a combination of minor manufacturing defects, a truck frame and bolster shall be overloaded statically. The suspension elements shall be replaced by solid blocking (with resilient pads if required). The loads shall be as listed in Chapter 7.

(2) No less than 75 strain gauges shall be applied to the truck near the locations of maximum stress points as agreed to by the Contractor and Amtrak, Amtrak having the power of decision in case of disagreement. The location of maximum stress is to be determined by analysis.

(3) Unit stresses at critical locations shall be measured before and after the test at representative points on the truck as agreed to between the Contractor and Amtrak, Amtrak having the power of decision in the event of disagreement. Certain before-test and after-test critical characteristic dimensional checks may be agreed upon to supplement strain gauge readings. Amtrak shall be present for the tests. There shall be no permanent deformation as determined from strain gauge readings. If such deformation appears, the design shall be corrected to bring the stress under the test condition within the elastic limit of the material involved, the truck shall be retested at the expense of the Contractor, and all trucks installed in the cars shall be modified to be in accordance with the corrected design. Testing will not be required on service qualified components which can be shown to have had satisfactory service experience of comparable severity and duration, as determined by Amtrak.

iv). Truck Frame and Bolster Fatigue Load Test

(1) To demonstrate that the truck has adequate fatigue strength under dynamic loading, the truck frame and bolster shall be fatigue tested according to the provisions of APTA Recommended Practice PR-M-RP-009-98. Rev.2. For cast and fabricated truck frame and bolster designs the base fatigue test (Phase 1) shall be 6 Million cycles. The number of quasi-static lateral load reversals (curves),

braking/traction direction reversals and applied twist loads shall correspond to the expected operation and service environment.

(2) The truck frame and bolster shall be tested as a unit, with the suspension elements replaced by solid blocking (with resilient pads if necessary). The loads shall be as listed in Chapter 7. The phasing of loads shall result in maximum combined stresses at the critical locations. The test shall demonstrate that the maximum combined stresses at the critical locations do not exceed those required. Critical locations shall be agreed upon by the Contractor and Amtrak, Amtrak having the power of decision in the event of disagreement.

(3) The frequency of the load cycling shall be as proposed by the Contractor for approval by Amtrak. Prior to the test, the Contractor shall provide documentation and/or drawings for all defects that existed in the truck elements as produced, and the repairs made to the parts containing these defects.

(4) During the fatigue tests, the truck shall be inspected regularly to detect possible crack initiation and progression. If evidence of progressive cracking or failure is found, the cause shall be assessed by Amtrak and the Contractor after which an appropriate correction shall be established and the test repeated.

(5) At the conclusion of the fatigue test, a magnetic particle or dye penetrate inspection shall be made for cracks in the presence of Amtrak. If any crack is found, or pre-existing cracks have propagated, the design shall be corrected, the truck retested at the expense of the Contractor and all trucks installed under the cars shall be modified to be in accordance with the corrected design. Testing will not be required on service qualified components which can be shown to have had satisfactory service experience of comparable severity and duration, as determined by Amtrak.

(6) After completion of the base fatigue test, an extended fatigue test shall be performed. The purpose of the extended fatigue test is to quantify the additional fatigue margin in the truck design.

(7) The extended fatigue test shall be 2 million cycles with loads increased by 20% (Phase 2), then 2 million cycles with loads increased by 40% (Phase 3) or until failure occurs.

(8) At the conclusion of the extended fatigue test, a magnetic particle or dye penetrate inspection shall be made for new cracks and propagation of pre-existing cracks. Note that new cracks, propagation of pre-existing cracks and structural failures do not by default constitute a failure for the extended fatigue test but rather data gathered during the extended fatigue test shall be used as part of the Fatigue Assessment Validation Report.

v). Truck Primary Suspension Tests

(1) A load deflection test shall be performed to demonstrate that the spring rates of the primary suspension system in all axes are within the design limits. This test shall demonstrate that the primary suspension system behaves as predicted and will not result in excessive deflection or a decrease in truck clearance above top of rail to less than the minimums prescribed.

(2) For elastomeric primary suspension elements, the following tests are also required following the guidance in EN 13913: low temperature (stiffness), fatigue resistance, static creep, stiffness under sinusoidal motion and damping.

(3) Hydraulic shock absorber (damper) accelerated life cycle endurance tests shall be performed following the guidance in EN 13802, selection of additional operational environment, physical characteristic and functional requirement tests to be proposed by the Contractor and approved by Amtrak.

(4) If defects are found, the design shall be corrected and shall be retested at the expense of the Contractor, and all trucks modified to be in accordance with the corrected design.

vi). Truck Secondary Suspension Tests

(1) Characterization and type testing of air springs shall be based on EN 13597, with tests and test parameters based on Amtrak's specific application as proposed by the Contractor, subject to Amtrak review and approval.

(2) A load deflection test shall be performed to demonstrate that the spring rates of the secondary suspension system in all axes are within the design limits. This test shall demonstrate that the secondary suspension system behaves as predicted and will not result in excessive deflection.

(3) Hydraulic shock absorber (damper) accelerated life cycle endurance tests shall be performed following the guidance in EN 13802, selection of additional operational environment, physical characteristic and functional requirement tests to be proposed by the Contractor and approved by Amtrak.

(4) If defects are found, the design shall be corrected and shall be retested at the expense of the Contractor, and all trucks modified to be in accordance with the corrected design.

vii). Shunting

(1) A shunting test shall be performed to verify the rail-to-rail resistance over the vehicle complies with the requirements in Section 5.8 using a suitable track signal voltage. Any auxiliary equipment shall be tested for proper operation per the manufacturer's specifications. Any auxiliary equipment activation

and deactivation sequences shall be tested through 1000 cycles or the manufacturer's recommendation, whichever is greater, without defect.

d). Couplers

i). The complete coupler assembly; including draft gear, radial connector, yoke, coupler carrier and uncoupling mechanism, shall be tested to validate conformance to the requirements, including all FRA regulations and applicable APTA standards and recommended practices, (including CEM performance requirements if used), range of motion, vertical loading, draft and buff loads and operations. This shall apply to all coupler types and/or drawbars used on the cars.

e). Brakes

i). General

(1) The design and specifications of the friction brake system shall be verified through a series of tests that simulate the environment in which the brake system will function. These tests shall analyze the brake system's performance, reliability and safety under the extreme conditions found in revenue service, including full-service and emergency brake rate measurements, analysis of component fatigue, heat creation and dissipation calculations, handbrake performance and materials analysis. These tests shall include computer simulations and dynamic testing of brake system components as performed by the brake system supplier, as well as track tests performed by the Contractor using completed cars.

ii). Brake pad/shoe force tests

(1) Tests shall be conducted on the first car to verify the actual force produced at the brake pad by the disc brake assembly, and at the brake shoe by the tread brake unit at both a parking brake if a parking brake is supplied and a non-parking brake location agree with calculated values. Tests shall be conducted with brake cylinder pneumatic pressures in 5 pounds/square inch increments, from 0 pounds per square inch to the maximum used, and from application of the parking brake.

(2) Load cell brake disk caliper and tread brake shoe force measurements shall be taken on each car type to determine brake efficiency. Measurements shall be taken at minimum, full service and emergency brake pipe conditions, operating from 110 psig brake pipe setting and 140 psig main reservoir value. Force shall be measured also with the parking brake applied.

iii). Brake component fatigue tests

(1) A test set-up shall be arranged such that a disc brake assembly, tread brake unit and brake pad and shoe are exposed as nearly as

possible to the same conditions as they will encounter in service. The brake pad and shoe shall be loaded by applying air pressure equivalent to a maximum service brake (friction only) application to the disc brake assembly and the tread brake unit, and the forces developed by brake reaction torque shall be applied through the mounting arrangement. The entire brake assembly shall be subjected to 1,000,000 cycles of applications and releases at the working loads predicted for an AW2 loaded car. The direction of the reaction torque shall be reversed every ten brake applications. This test will not be required for hardware that has had satisfactory service experience of comparable severity and duration, as determined by Amtrak.

iv). Friction brake system endurance tests

(1) The first complete car set of the friction brake pneumatic control system produced, before mounting on a car, shall be subjected to an endurance test of 1,000,000 cycles of normal applications and releases to demonstrate that the control apparatus has the endurance required for rail service. The system will not be considered acceptable until the test has been performed without a component failure of any kind during 1,000,000 consecutive operating cycles. Testing will not be required on service qualified components which can be shown to have had satisfactory service experience of comparable severity and duration, as determined by Amtrak.

v). Brake capacity tests

(1) The first production disc brake assembly, tread brake unit and brake pad and shoe for the car shall be tested using a full scale dynamometer to verify that the friction brake system design can perform the specified friction brake-only operation. A dynamometer test shall be performed to simulate the proposed revenue speed profile, driven by Amtrak defined train schedule service for speeds up to 110 mph. Any elevation grades exceeding 0.2% shall also be taken into account. The complete dynamometer procedure, dynamometer facility and test protocol shall be provided by the Contractor and approved by Amtrak. This procedure is an amendment to the qualification of brake shoe and disc brake materials as specified in Amtrak Specification 973 and Amtrak Specification 80-276. All other attributes of friction brake material performance shall be in accordance with Amtrak Specification 973 and 80-276. The production brake pads and materials shall be used, and temperature limits specified by the brake and wheel supplier shall not be exceeded. For tread brake and brake shoe dynamic testing, a test wheel shall be provided by Amtrak. The test shall be coordinated according to the planned operating pattern.

vi). Handbrake tests

(1) Handbrake performance shall be verified for compliance to the specification as well as APTA PR-M-S-006-98 using new brake shoes/pads.

(2) On the first car, a test of the adequacy of the design of the handbrake shall be made (using first new and then fully worn brake shoes) by measuring with a scale the force needed to move the car with the handbrake applied on level tangent track.

(3) The “handbrake-applied” indicator light shall also be tested.

f). Door System

i). General

(1) The side and end door systems shall be subjected to extensive testing to confirm that the systems and components meet all requirements for:

(a) System integrity

(b) Safety

(c) Functionality and operation

(d) Weather sealing

(e) Opening and closing times and speeds

(f) Trainline controls, indicators and interlocks

(g) Compliance with regulations, recommendations and standards

(h) Reliability

(i) Maintainability

(j) Sustained and compliant performance under all specified operational and environmental conditions

(2) All door system components shall be tested through rigorous multiple-cycle operation that simulates the actual installation, hardware and climatic conditions as specified.

ii). Passenger Rooms and Restrooms Door Endurance Tests

(1) The passenger rooms and restrooms entrance door shall undergo endurance testing to verify the door installation is not subject to premature wear. This shall include:

(2) Simulated door installation: door, track, module structure supporting track, door frame with adjoining partition, door latch assembly, detent, etc.

(3) 24,000 Open-close cycles with every tenth slammed

(4) Every 100 cycles, latch/ unlatch the door

(5) Measurement of change from initial setting at every 1500 cycles

(6) Measurement of force required to open/ close door every 1500 cycles

(7) Mutually agreed upon pass/ fail criteria shall be determined for allowable wear in advance of starting the test.

iii). Side door, Trap door, and Folding step system reliability test

(1) A set of side door panels and operators, fully equipped with all required equipment as designed including trap doors, folding steps, and gap filler devices , shall be installed in a test fixture at the facilities of the door system supplier, and subjected to a repeated open and close cycle test of no less than 500,000 full cycles, so demonstrate the durability of the operators, hangers, switches, motors and all other components of the door system. The test fixture shall simulate the actual door opening, threshold and any pocket in which the doors will be mounted. Power and control to the doors shall be via the actual wire leads that will connect the door operator to the carbody wiring in a production installation. The door operators shall be monitored for proper function and continued operation. Any failure of the door operators to function or perform according to the specifications, test procedure or performance criteria shall be considered a failure. All failures shall be investigated and analyzed as to cause, and the Contractor or door system supplier shall propose corrective action. Once approved by Amtrak, the door operators shall be modified to conform to the corrective action, and the test shall be started over again. The door system test shall be conducted until both operators function continuously without failure for 500,000 cycles.

(2) Once the first car has been completely assembled, and the entire side door system has been installed and the functionality has been verified, the side doors, trap doors, and folding steps shall be operated for 15,000 continuous trouble-free cycles each, split evenly between high level and low level opening/closing of the door, trapdoor, and including gap filler cycling. The system shall be monitored to confirm that each door operates through a complete cycle of fully opening and fully closing and latching for all 15,000 cycles. No adjustments or maintenance will be allowed during the test. Any door or door control failure occurring prior to completion of the test will require that the test be stopped, corrective action be taken to document and resolve the failure and start the test at the beginning for all car doors.

iv). Side door, Trap door, Folding steps, Gap filler safety test

(1) Once installed in a completed car, the side door system, including all side doors, trap doors, folding steps, and gap fillers shall be functionally tested to verify that the door system design conforms to all applicable safety requirements, including:

(a) Trainline and local control, door summary circuit and zero-speed operation

(b) Obstruction detection and recycle operation

(c) Interlocks, isolation and manual locking

(d) Interior, exterior and trainline door status indicators

(e) Manual release (interior and exterior), including the force to activate the manual release, the force to open a door that has been released and the process for resetting the doors to normal operation

(f) Structural integrity of the door panel and glazing

(g) Signage and emergency operation

(2) Under no circumstances shall a door be allowed to create an unsafe condition.

v). End door reliability test

(1) An end door and operator, fully equipped with all required equipment as designed, shall be installed in a test fixture at the facilities of the door system supplier, and subjected to a repeated open and close cycle test of no less than 500,000 full cycles, so demonstrate the durability of the operator, hanger, switches, motor and all other components of the door system. The test fixture shall simulate the actual door opening, threshold and pocket that the door will be mounted in. Power and control to the door shall be via the actual wire leads that will connect the door operator to the carbody wiring in a production installation. The door operator shall be monitored for proper function and continued operation. Any failure of the door operator to function or perform according to the specifications, test procedure or performance criteria shall be considered a failure. All failures shall be investigated and analyzed as to cause, and the Contractor or door system supplier shall propose corrective action. Once approved by Amtrak, the door operator shall be modified to conform to the corrective action, and the test shall be started over again. The end door test shall be conducted until the operator functions continuously without failure for 500,000 cycles.

(2) Once the first car has been completely assembled, and the entire end door system has been installed and the functionality has been verified, the end doors shall be operated for 15,000 continuous

trouble-free cycles each. The system shall be monitored to confirm that each door operates through a complete cycle of fully opening and fully closing for all 15,000 cycles. No adjustments or maintenance will be allowed during the test. Any door or door control failure occurring prior to completion of the test will require that the test be stopped, corrective action be taken to document and resolve the failure and start the test at the beginning for all car doors.

(3) The end door shall also be tested for proper opening, closing and hold-open times, the force required to manually open the door in manual mode, and for proper operation of the obstruction detection system, the normal/manual/open selector switch, and the push button.

(4) A set of end door push buttons shall be subjected to a 100,000-cycle test that simulates the use of the buttons to command an end door to open. The buttons shall perform as intended through the 100,000-cycle test without showing signs of wear, abrasion or degradation of the switch, wiring, connectors or seals.

vi). Side Door On-Board Mobility Lift

(1) The powered mobility lift shall undergo proof-of-design testing to evaluate and verify that the lift meets all specification requirements for:

(2) Compliance with all applicable ADA requirements;

(3) Functional and operational performance under all design loads, track conditions as specified, and safety factors without deformation or deflection;

(4) Rate of travel upward and downward for the lift platform under loaded and unloaded conditions; rate for one full cycle shall not exceed 105 seconds in powered operation and 305 seconds in manual operation;

(5) Full range of vertical movement for the lift to adequately reach the range of station platforms as specified;

(6) Proper operation of all safety provisions and functional interlocks and isolation devices within the unit and with the door system, brakes, car diagnostic system and indicators;

(7) Function of lift after loss of power while in mid-travel, then with restoration of power;

(8) Proper and secure storage of the lift within the car;

(9) Maintainability and reliability requirements; and

(10) Manual operation of lift at rated load.

(11) These tests shall include an endurance test in which the lift shall be subjected to no less than 2,500 repeated cycles of deployment and storage.

g). Interior

i). Luggage Racks/Towers

(1) A complete overhead luggage rack, mounted on simulated carbody structure, shall be tested to verify it meets the 250 lb. load requirement. A complete overhead luggage rack, fully loaded with actual weighted luggage and mounted on simulated carbody structure, shall be tested to verify it meets the 8/4/4g crashworthiness requirements. Similarly, a luggage tower module shall be mounted on simulated carbody structure and tested to verify that it meets the design load requirements as well as the 8/4/4g crashworthiness requirements. Additionally, luggage tower modules shall be tested to verify proper operation of all auxiliary functions in secondary storage configurations (i.e. bike storage, ski storage, etc). All variations of luggage towers including towers utilized in the baggage area shall be tested.

ii). Seats

(1) One sample seat of each seat type identical to a production version shall be tested in a simulated carbody structure by the manufacturer for all criteria specified in APTA Standard PR-CS-S-016-99 and submitted to Amtrak with a detailed test report. This test result must be approved by Amtrak before additional seats can be ordered and assembled into the pilot cars for pre-delivery testing.

iii). Seat Cushion Tests

(1) Seat cushions of each seat type selected twice at random by Amtrak during cushion production shall be tested to verify compliance with Chapter requirements.

(2) Seat cushions including those in booth seats (both foam and upholstery) shall be tested to verify compliance with requirements.

iv). Side and End Wall Liner Tests

(1) A 20lb load distributed over a 0.5 in x 0.5 in surface area applied anywhere on the surface of interior panels shall not cause the panel to deflect more than 1/8 inch. A 50lb load distributed over a 6 in x 6 in surface area applied anywhere on the surface of interior panels shall not cause the panel to damage or crack. Upon removal of the loads, the panel shall return to the original position without signs of damage or permanent deflection.

v). Doors and Hardware

(1) All interior doors and hatches, including food service units, shall be functionally checked to verify:

(2) doors hang vertically; verify correct relationship between carbody plane and door plane

(3) proper open travel

(4) proper fully closed position

(5) smooth movement

(6) smooth latching/ unlatching

(7) smooth locking & unlocking from external side of door

(8) correct latch and/ or lock engagement/ release

(9) non-interference, freedom from sticking or excessive looseness (rattles)

(10) proper switch activation for all door opening/closing lights, i.e., restroom, locker, closet, etc.

(11) proper engagement of the ceiling hatch safety catches

(12) proper function of door lock

(13) proper function of emergency egress capabilities

h). HVAC

i). Heating and Air-Conditioning Tests

(1) One complete Heating, Ventilation and Air Conditioning (HVAC) unit and its complete controls shall be given a qualification and capacity test by the air conditioning manufacturer to verify the performance of the unit. This test shall be successfully completed before commencement of the vehicle climate room test. The test shall be conducted in accordance with ANSI/ASHRAE Standard 37. The testing laboratory shall be approved by Amtrak.

(2) The actual HVAC control system, with actual temperature sensors, shall control all system operations during the test, unless indicated otherwise for specific tests.

(3) Tests shall be conducted at nominal voltage and frequency, except where otherwise specified. Appropriate test log sheets and calculation forms shall be generated and included with the test procedure for approval. They shall become a part of the test report.

(4) The accuracy and tolerances of all instrumentation and tests shall comply with the requirements of the ASHRAE Standard 37 Table 4 and all of the required data shall be continuously recorded. Temperature measurements and measurement techniques shall comply with ASHRAE Standard 41.1. An event recorder shall be provided to monitor operation of relays and contactors.

(5) Note: If more than one type of HVAC unit and/ or controls is provided, then each type shall be fully tested for the following:

(a) Temperature Control Performance

(i) Verify:

1. function after cold-soak of controls
2. integration with HVAC unit
3. demonstration in all possible modes of operation, for all car types identified in the temperature control specification; not merely cars ordered at this time.
4. ramp up and ramp down of all temperature inputs
5. demonstration of all logic functions, input and output, including:

a. control and power circuits

b. operation of all safety circuits

c. all modes of operation, including fault conditions

d. indicators/ display(s), including each condition possible

e. fault displays, including each condition possible

f. Portable Test Unit (PTU), including all modes of operation

(b) HVAC Unit and Controls Performance

(i) Verify:

1. operation of capacity controls
2. operation of pressure controls
3. performance of expansion valves and measurement of superheat

4. performance of duct heater safety circuits and thermostat(s)

(ii) Refrigerant charge test

1. The refrigerant charge, by weight, shall be confirmed at the system design conditions. The Contractor shall include the testing criteria in the test procedure which shall be approved by Amtrak. The criteria shall include the following, at a minimum:

a. Level of superheat at the evaporator outlet;

b. Level of superheat at the compressor suction valve;

c. Compressor suction and discharge pressures;

d. Level of liquid refrigerant sub-cooling at condenser outlet;

e. No air bubbles in liquid line sight glass;

f. Compressor(s) working at full load/capacity.

(c) HVAC Unit Performance

(i) Verify:

1. Design Cooling Capacity Test – Measured airflow with dry evaporator coil and with wet evaporator coil, Determination of cooling capacity at rated conditions, including power requirements

2. Modulation Capability Test

3. Maximum Operating Conditions (MOC) Functional Test

4. Extreme Operating Conditions Functional Test - capacity at 130° F ambient

5. Humidity Control Test

a. humidity control at mild load, high humidity conditions

6. Insulation Efficiency and Liquid Carryover Test

7. Low Temperature Operation – Minimum Cool / Low Ambient Test

8. Heating Capacity Test

9. Abnormal Heating Test with Restricted Airflow

10. Abnormal Heating Test with No Airflow

11. Test of High Limit Temperature Thermostat/Switches

12. Blower Motor / Heater Circuit / Cooling Circuit Interlock Test

    a. Blower Motor, heater interlock with airflow switch test

    b. Blower Motor, cooling circuit interlock with airflow switch test

13. Water Tightness Test

14. Exterior Noise Test

(d) Temperature Control Integration/Operation with HVAC Unit

(i) The temperature control components and software shall be connected with an HVAC unit and either fully functional PTU or necessary temperature and pressure sensing controls to effectively perform full functional testing of all software controls. Controller shall simulate actual operational controls and provide controls and verify correct feedback of HVAC unit response. All points of the approved temperature control schedule referenced in Chapter 10 shall be verified for both the temperature rising and the temperature falling cycles. Demonstration of all HVAC operating modes including the pump-down operation, bump start routine, and staggered compressor starting, when appropriate, shall be included.

(ii) Functional testing shall also include verification of all software control functions, status reporting, and fault recording including lockout conditions and reset.

(iii) Under steady state operation at design conditions, the control voltage shall be varied between the limits allowed by Amtrak Specification 963. The system shall operate steadily without malfunction.

1. All subjects identified above in “temperature control integration/operation” shall be verified on the integrated system of the temperature controls and HVAC unit.

ii). HVAC System Vehicle Level Pre-Test Requirements

(1) Prior to any cooling and heating system test, an air balance test, control scan test and a vehicle heat transfer test shall be

conducted. The purpose of these tests is to demonstrate conformance with interior ventilation, air flow and pressurization requirements, to demonstrate that the HVAC control, and thermostats perform as specified, and to demonstrate that the overall car body heat transmission does not exceed the specified limits.

(2) The pre-tests shall be satisfactorily completed before continuing to further climate room testing.

iii). Air balance test

(1) Prior to any cooling and heating tests, an air balance test and a vehicle pressurization test shall be conducted. Any adjustments to air baffle plates, grilles and diffusers shall be documented during this test.

(2) Each car type shall be tested and the results recorded to verify specification requirements are met for air distribution and balance, including:

(a) Fresh air flow rate

(b) Return air flow rate

(c) Exhaust air flow rate

(d) Car pressurization: car interior, restrooms (negative), electric locker

(e) Pressure differential of restrooms relative to adjacent car interior

(f) Uniformity of supply air flow

(g) Interior car noise levels after balancing with blowers on

(3) Correct air distribution shall be verified with the fresh air and diversion dampers in each of the nominal positions (e.g. For fresh air dampers, closed, partial, full open positions, etc.). Once the required values are established, the system adjustments and settings shall be recorded and diffuser/baffle settings permanently fixed to be used as base settings for the remaining cars of that type.

iv). Temperature control tests

(1) The temperature control components shall be exposed to the specified thermal environments. All points of the approved temperature control schedule referenced in Chapter 10 shall be verified for both the temperature rising and the temperature falling cycles. The temperatures shall be varied as slowly as practical to reflect natural temperature lags as experienced in the actual installation. Demonstration of the pump-down operation, bump

start routine, staggered compressor starting, when appropriate, shall be included.

(2) Under steady state operation at design conditions, the control voltage shall be varied between the limits allowed by Amtrak Specification 963. The system shall operate steadily without malfunction.

v). Heating and air-conditioning system tests

(1) General

(a) The first of each type of car shall be tested in an approved climate room test facility capable of maintaining any test temperatures from -40°F to 130°F and any relative humidity throughout that range between 25% and 95%. Temperature in the facility shall be uniform throughout. There shall be no more than 5°F variation from 24 in. above top of rail to 24 in. above the vehicle roof and from end to end of the vehicle. Fans may be used to circulate air. Passenger load shall be simulated by means of evenly distributed heaters and humidifiers inside the vehicle; solar loads shall be simulated by means of evenly distributed heaters inside or outside the vehicles. Humidity introduced into the vehicle shall be calculated and measured to accurately simulate the passengers' latent heat load. The climate room shall have the equipment available to locally raise the condenser temperature to demonstrate the air conditioning system's pressure modulation capability.

(2) Data requirements

(a) The Contractor shall record sufficient data at intervals of no more than 30 seconds for each air conditioning and heating test to show that the equipment operates satisfactorily and meets design requirements.

(b) The recorded data shall include the following:

(i) Temperatures (°FDB):

1. Return air at both HVAC units;

2. Mixed air at both HVAC units;

3. Fresh air at all air intakes (for both HVAC units);

4. Distributed air throughout the car;

5. Condenser air inlet at both units;

6. Liquid at the filter-drier outlet on both units;

7. Suction at evaporator on both units;

8. Suction at compressor(s) on both units;

9. All temperature sensors and thermostats;

10. Exterior temperature at 24 in. above the rail at both ends of the car;

11. Exterior temperature at 24 in. above the roof at both ends of the vehicle;

12. Interior temperature at 14 seats at 6 in. and 48 in. above the floor;

13. Interior temperature at 4 aisle positions at 6 in. above the floor and 12 in. below the ceiling;

14. Toilet room 6 in. and 48 in. above the floor and 12 in. below the ceiling;

15. Heater guard temperature at all heater locations;

16. Overheat heater compartment at all overheat protection devices;

17. Wet bulb temperatures at a minimum of two ambient locations next to the fresh air intakes.

(ii) Pressures:

1. Compressor(s) discharge on both units;

2. Compressor(s) suction on both units;

3. Liquid leaving condenser/sub-cooler outlet on both units;

4. Suction at evaporator at each evaporator circuit on both units;

5. Evaporator air pressure drop on both units;

6. Condenser air pressure drop on both units;

7. Vehicle pressurization (inches of water gauge).

(iii) Electrical Data:

1. Input Voltage;

2. Blower motor current, power, and speed on both units;

3. Compressor(s) motor current, and power on both

units;

4. Condenser fan motor current, power, speed on both units.

5. Fresh air damper motor current, power, and position on both units,

6. Supply air diversion damper motor current, power, and position an all dampers.

(iv) Relative Humidity Data:

1. Relative Humidity (RH) sensors at 3 aisle positions at 12 in. below the ceiling.

(c) For the heating tests all heater circuits and devices shall be continuously monitored to determine all device input voltages, currents and power draw. For all tests, the status of all temperature control modes shall be "event recorded" in parallel with the temperature, pressure and electrical data in a manner which will allow total system functional status to be followed throughout the testing. Coordinating time marks shall be used on all data recording devices.

(d) The data acquisition system shall have the capability to add channels, if required.

vi). Control scan test

(1) All control switching points for rising and falling temperatures shall be tested, by varying and adjusting the ambient conditions in the climate chamber and the interior loads in the car. All temperatures that affect the control system shall be tested individually. While stabilized within each control mode the interior comfort requirements of Chapter 10, shall be met. Stabilization shall be when the temperature swing at each of the interior car thermocouples, including all spaces such as the toilet room, stay within ± 3ºF per hour. In the event of any control failure, appropriate adjustments shall be made, and the entire scan test shall be repeated until all system controls performs as intended. If any air flow adjustments are made during the scan test, the airflow balance test shall be repeated. Cooling pump-down cycle, bump start routine, staggered compressor startup and cooling lockout shall also be demonstrated during this test. Heating and cooling shall be sufficiently capable of maintaining desired interior temperature near the lockout temperatures for the compressors or condenser fans with maximum solar loads.

vii). Vehicle heat transfer test

(1) The overall carbody heat transmission, value shall be determined during this test. The fresh air intakes and exhaust openings shall be sealed, the vehicle doors shall remain closed and the car ventilation system shall be shut down during this test. The climate room ambient temperature shall be maintained at a constant ambient temperature below 20°F during this test. Portable heaters and fans shall be evenly distributed throughout the car and shall be used to heat the car until the car interior temperature stabilizes. Once the car interior temperature is stabilized, the overall carbody heat transmission, value can be calculated by dividing the total heat applied in the car by the floor heaters (in BTU per hour) by the stabilized temperature difference between the ambient and interior temperature (in °F). The calculated value must be less than or equal to the specified value.

(2) In the event the Heat Transfer test is failed, appropriate changes to the car body insulation system shall be made, and the test shall be repeated.

viii). Cooling system tests

(1) General

(a) The air conditioning tests shall demonstrate the performance in cooling the car and maintaining specified car interior temperatures at various designated ambient conditions. Unless otherwise stated, the applied ambient temperatures shall remain constant, within ± 3ºF, during all tests.

(2) Pull down and steady state operation at design conditions test

(a) Prior to this test, the car shall be "soaked" at 110°F Dry Bulb/76°F Wet Bulb in the climate chamber for at least 6 hours with all doors closed and maximum solar load applied until the interior temperature has stabilized as described above.

(b) After the completing the "soak" period, all electrical circuits, including car lights, shall be energized and the air conditioning system shall be turned ON with all car doors and windows closed. Fresh air dampers shall operate per control logic.

(c) The time required for the system to reduce the interior air temperature to normal ASHRAE conditions shall be recorded, as well as the time for stabilization. Stabilization shall be when the temperature swing at each of the interior car thermocouples, including all spaces such as the toilet room, stay within ± 3ºF per hour. Once stabilized conditions have been reached the test operation shall be continued for 30 minutes with temperatures, pressures, electrical and humidity data recorded at one minute intervals in order to evaluate temperature variations and interior humidity requirement as the controls and equipment cycle. The interior comfort requirements of Chapter 10 shall be met.

(d) The maximum design passenger load shall be introduced into the car, and the temperature of the ambient air entering the condenser units shall be raised locally to 130°F Dry Bulb, while maintaining 110°F Dry Bulb/76°F Wet Bulb in the climate chamber. Again, once stabilized conditions have been reached inside the car, the test operation shall be continued for 30 minutes with temperatures, pressures, electrical and humidity data recorded at 30 second intervals in order to evaluate temperature variations and interior humidity requirement as the controls and equipment cycle. The interior comfort requirements of Chapter 10 shall be met.

(3) Door cycling test (cooling)

(a) At the same conditions following the pull down and steady state operation at design conditions test, the doors shall be cycled on one side of the car at a rate of 2 minutes open and 15 minutes closed for two hours. The average car temperature shall recover within 2°F of the required interior car temperature within 3 minutes maximum after each door closing.

(4) High ambient temperature test

(a) At the same conditions following the pull down and steady state operation at design conditions test or upon completion of the door cycling test, the climate chamber's ambient temperature shall slowly be raised to 130°F Dry Bulb. After 130°F is reached, the system shall operate continuously for one hour. During the entire test, the system shall not shut down from high pressure, circuit breaker trip, compressor motor overload or failure of any device. Cooling shall be provided at a reduced capacity as described in Chapter 10 during this test. Temperatures, pressures, electrical and humidity data shall be recorded at one-minute intervals during the entire test.

(b) After the one-hour operation, the 480VAC power to the car shall be removed for 2 seconds and then reapplied. The system shall recover from the power interruption and restart with no system or component malfunction.

(5) High pressure cut-out test

(a) Upon completion of the high ambient test, the climate room temperature (or condenser air inlet temperature) shall be further increased until the high-pressure devices on both units are actuated, whereby shutting down the cooling. After actuation, both units must restart as directed by the control system. Temperatures, pressures, electrical and humidity data shall be recorded at one-minute intervals during the entire test.

(6) Condensate carry over test

(a) With the climate chamber temperature at 80°F Dry Bulb/75°F Wet Bulb, operate the air conditioning system continuously for a period of 4 hours in the cooling mode. The interior passenger load and solar load must be adjusted during this test to maintain system operation in cooling mode. Any adjustments to internal loads must hold the interior sensible heat ratio constant at 50%.

(b) At the end of the test, the heater coil, evaporator blower's compartment, supply air discharge plenum, air ducts and diffusers shall be examined for the presence of water.

(c) The test shall be considered successful if, during the test, no condensed water drops, runs, or is blown from the evaporator unit casing and/or its drain pan, and carried in the air stream to the heater coil, evaporator blowers, supply-air discharge plenum, air ducts or diffusers. Overhead heater elements must remain dry.

(7) Low ambient temperature test

(a) Upon completion of the condensate carry over test, the climate chamber shall be adjusted to the lowest ambient air temperature at 40% relative humidity that provides the minimum cooling mode with no reheat according to the Contractor's control schedule. The interior passenger load and solar load must be adjusted during this test to maintain system operation in this cooling mode. Any adjustments to internal loads must hold the interior sensible heat ratio constant at 50%. This HVAC system shall operate for 4 hours under these conditions without damage to the equipment, and the evaporator air flow shall not drop more than 15% from the manufacturer's design point. Temperatures, pressures, electrical and humidity data recorded at one-minute intervals in order to evaluate temperature variations and interior humidity requirement as the controls and equipment cycle. The interior must conform to the comfort requirements of Chapter 10. While the unit is still running, examine the evaporator coils for evidence of icing, and verify the oil level at each compressor sight glass.

(8) Low ambient temperature test with high internal load

(a) Upon completion of the low ambient temperature test, the interior loads shall be increased to the maximum design passenger load and full solar load and the ambient air temperature shall be lowered to 3 degrees F above cooling system lockout. Operate the system continuously for a period of 4 hours. During the entire test, the system shall operate continuously without damage to the equipment, with temperatures, pressures, electrical and humidity data recorded at one minute intervals in order to evaluate temperature variations and interior humidity requirement as the controls and equipment cycle. The interior must conform to the comfort requirements of Chapter 10.

ix). Heating system tests

(1) General

(a) The heating tests shall demonstrate the heating system's ability to heat the car interior and maintain specified interior car temperatures at various designated ambient conditions. Unless otherwise stated, the applied ambient temperatures shall remain constant, within ± 3ºF, during all tests. All heating tests shall demonstrate compliance to acceptable touch-safe temperatures on any heaters (125 degrees F).

(2) Layover verification test

(a) This test begins with the car in a stabilized automatic heating condition with an ambient temperature of 60°F. The car is then placed in its layover mode and the ambient temperature reduced to -40°F at a rate of change not to exceed 20°F/hour. This ambient temperature is maintained for a maximum of eight hours. The average interior temperature must remain within the allowed layover temperature range during the eight hour period.

(b) The layover state is continued an additional four hours with reduced applied voltage to its lowest allowable value. Again, the average interior temperature must remain within the allowed layover temperature range during the entire four-hour period.

(c) No areas of the vehicle may drop below 40°F throughout the test and random measurements may be taken during the test to verify compliance, with particular attention to water piping or sensitive equipment.

(3) Steady state heating at design conditions test

(a) Following the layover verification test, the nominal voltage supply is reapplied, and the car is placed in its normal mode, with all car doors closed. Fresh air dampers shall operate per control logic.

(b) The time required for the system to raise the interior air temperature to normal ASHRAE conditions shall be recorded, as well as the time for stabilization. Stabilization shall be when the temperature swing at each of the interior car thermocouples, including all spaces such as the toilet room, stay within ± 3ºF per hour. Once stabilized conditions have been reached, the test operation shall be continued for 30 minutes with temperatures, pressures, electrical and humidity data recorded at one minute intervals in order to evaluate temperature variations and interior humidity requirement as the controls and equipment cycle. The interior comfort requirements of Chapter 10 shall be met, and no heater guard temperature shall exceed the specified maximum, 125°F during the entire test.

(4) Steady state heating (minimum voltage)

(a) Upon completion of the steady state heating at design conditions test, the applied voltage shall be reduced to its ll wasowest allowable value. Again, the system shall stabilize the interior air temperature to normal ASHRAE conditions. Once stabilized conditions have been reached, the test operation shall be continued for 30 minutes with temperatures, pressures, electrical and humidity data recorded at one minute intervals in order to evaluate temperature variations and interior humidity requirement as the controls and equipment cycle. The interior comfort requirements of Chapter 10 shall be met, and no heater guard temperature shall exceed the specified maximum of 125°F during the entire test.

(5) Door cycling test (heating)

(a) At the same conditions following the steady state heating (minimum voltage) test, the doors shall be cycled on one side of the car at a rate of 2 minutes open and 15 minutes closed for two hours. The average car temperature shall recover within 2°F of the required interior car temperature within three minutes maximum after each door closing.

(6) Steady state heating tests

(a) Upon completion of the door cycling test, the doors shall be closed, the nominal voltage shall be re-applied and the maximum design passenger load passengers shall be introduced into the car. Again, once stabilized conditions have been reached, the test operation shall be continued for 30 minutes with temperatures, pressures, electrical and humidity data recorded at one minute intervals in order to evaluate temperature variations and interior humidity requirement as the controls and equipment cycle. The interior comfort requirements of Chapter 10 shall be met and no heater guard temperature shall exceed the specified maximum of 125°F during the entire test.

(b) This test shall be repeated at the applied voltage reduced to its lowest allowable value and at the applied voltage increased to its highest allowable value.

(i) An additional test shall be performed at the maximum voltage to determine the evaluate the temperatures of heaters and heater guards.

(c) Upon completion of the steady state heating test (with design passenger load), the nominal voltage shall be re-applied, and the design solar load shall be introduced into the car. The climate chamber ambient temperature shall be raised and maintained at 42°F. Allow the system to stabilize the interior air temperature to normal ASHRAE conditions. Once stabilized conditions have

been reached, the test operation shall be continued for 30 minutes with temperatures, pressures, electrical and humidity data recorded at one minute intervals in order to evaluate temperature variations and interior humidity requirement as the controls and equipment cycle. The interior comfort requirements of Chapter 10 shall be met, and no heater guard temperature shall exceed the specified maximum of 125°F during the entire test.

(7) Overhead heater safety tests

(a) The overhead heater protection devices shall be tested with restricted and with no airflow. All protection devices and backup protection devices protecting the heaters and housing from overheating shall be tested individually. The tests shall be conducted at nominal voltage supply with an ambient temperature maintained at 40°F, and then repeated at the applied voltage reduced to its lowest allowable value and at the applied voltage increased to its highest allowable value. The overhead heater shall be activated independently of the normal regulating controls. Temperature measurements at the devices and heater power measurements shall be taken throughout each test. After the functioning of the device, temperature measurement records shall be continued until steady temperature fall is observed.

(b) Each test shall be considered satisfactorily completed if the protection device under test has functioned as intended, backup overheat protection devices do not actuate, there is no damage to any equipment or component, and there are no smoke or significant odors detected. When the last level of backup protection device is tested, the test shall be considered satisfactorily completed if the protection device under test functioned as intended, there is no damage to any equipment or component, and there are no smoke or significant odors detected.

(8) Freeze protection tests

(a) The operation of the freeze protection system (including any door threshold, door pocket, water tank, waste system, waste tank, waste lines and water drain valve heaters) shall be demonstrated in the climate chamber. This test begins with the car in a stabilized automatic heating condition with an ambient temperature of 60°F. The car is then placed in its layover mode and the ambient temperature reduced to -40°F at a rate of change not to exceed 20°F/hour, no internal loads and the antifreeze protection circuit energized.

(b) With the HVAC system operating in automatic mode, cycle the doors on one side of the car open and closed at the same rate

as for the door cycling tests. When the doors are closed, spray water at 33°F onto the lower half of at least one pair of doors and the door threshold.

(c) Continue this operation for one hour. The door thresholds must remain free of ice, any door pocket drains must drain freely, and doors must open and close smoothly for the entire test period.

(d) Repeat the test using an application of simulated snow. Snow may be made prior to test and applied by hand to the threshold when doors are open, closed or both. The snow may be hard packed to simulate tracking in on footwear or may be spread out to simulate natural snowfall.

(e) Verify that the freeze protection for the water tanks and water drain valves is working correctly and record the temperature that the systems turned on. Following the Freeze Protection Test, the nominal voltage supply is reapplied, and the car is placed in its normal mode. Verify that the freeze protection systems for the water tanks and water drain valves continue to function as specified.

(f) A final manual test shall be conducted of the Ogontz water valve freeze protection. Following testing above and with the chamber at -40°F and water tanks full, remove all power from the vehicle and verify that the Ogontz valves operate at their intended temperature range and provide dumping of all water on the vehicle. Verify that the water piping, valves, and components are not damaged by visual inspection, and following test by bringing the car and chamber back up to room temperature and resupplying the water system to check for leaks and functionality.

x). HVAC Diagnostic Remote Access Test

(1) The HVAC diagnostics remote access functionality shall be validated.

i). Lighting

i). The function and intensity of all lighting systems and their respective controls shall be tested in the first car to verify compliance with the requirements. All systems shall be designed to function in accordance with APTA PR-E-S-010-98.

ii). Lighting fixture performance

(1) Light level of each fixture shall be measured and compared to the design requirements.

iii). Independent power sources (for emergency lights)

(1) Performance shall be verified in all modes of operation. Charge and discharge time shall be measured.

iv). Marker light certification

(1) The marker lights and fixture shall be tested to verify compliance with FRA 49 CFR Part 221.

v). Lighting intensity-interior

(1) Test shall verify light levels are in accordance with Chapter 13 including APTA PR-E-RP-012-99, APTA SS-PS-004-99, APTA PR-PS-S-002-98, all lighting modes as specified in Chapter 13 and table 13-1, and for all configurations and locations of HPPL signage and LLEPM.

(2) Test shall verify adaptive white light control per Chapter 13.13.c.

vi). Emergency lighting intensity and duration

(1) The test shall verify light levels and duration of each car type are in accordance with APTA Standard PR-E-S-013-99, 49 CFR Part 238.115 and any additional requirements of the specification. Tests shall be conducted in both Normal and Emergency modes and compete operation of independent power sources, including recharge times.

j). Communication/OTIS

i). General

(1) The communication system shall be tested on the first car of each type to verify that it functions in accordance with the requirements of Chapter 12. The diagnostic function of each individual system shall be tested as a separate test or in combination with other functional testing. The PTU shall be used to successfully access all available car subsystems. The capability to modify all password-protected software parameters shall be verified. The interface and functionality of the Central Diagnostics Unit (CDU) and the wireless Local Area Network shall be tested. Testing shall be conducted to ensure that car faults can be downloaded over the network and that the system database can be updated, the CDU and wireless LAN systems shall be fully functionally tested.

ii). PA/IC/OTIS system performance

(1) The performance of the public address and passenger intercom system shall be tested to verify that all aspects of the system perform as intended:

(a) System selector switch function and indication

(b) PA announcements to the car interior only

(c) PA announcements to the car interior and to other cars in the train

(d) PA announcements received from other cars in the train (coupled to legacy equipment)

(e) PA interface with the OCU and the passenger information system

(f) Intercom function between IC stations within the car and between the car and other cars in the train (coupled to legacy equipment)

(g) Communication along analog COMM/MU lines and communication on the DTL

(h) Emergency two-way intercommunications (intercom)

(i) Speaker volume, including interior and exterior speakers, and in both Normal and Night modes

(j) Signal to noise ratio

(k) Fault log tests and communication with the CDU

iii). OTIS system performance

(1) The performance of the automatic announcements, sign, and train map portions of the system shall be verified for specification compliance on each car type. All modes of trainline operation shall be demonstrated, as well as interaction with the PA/IC system.

(2) Proper readability of the interior signs at 45 feet and exterior signs at 115 feet in direct sunlight and complete darkness shall be demonstrated.

(3) The function used to advance the sign reading to the next message shall be demonstrated, using the actual input message to the system. Changes to data files within the OCU shall be demonstrated including editing of files and replacing in-kind.

(4) Simulated power drops and restarts shall be tested to ensure the system returns to proper operation without abnormal behavior.

(5) OTIS shall be tested per the manufacturer's recommendations to ensure it can be properly set-up, adjusted, reprogrammed, and edited to verify normal operation, minor changes to route or display options, or uploading of entirely new route and visual packages.

iv). EMI/EMC

(1) The test plan shall meet the requirements of APTA Standard PR-E-S-010-98, plus any additional requirements of the specification. All modes of operation shall be tested.

v). Wayside equipment tests

(1) Each wayside and Control Center component of the communications system installed under this Contract, including the radio system, CDU, GPS, automatic vehicle location system, the wireless local area network system, and all other communications and interface with the wayside shall be tested to verify that they function in accordance with the requirements. GPS accuracy shall be tested. The ability to modify software data files and change parameters for the wayside communications system equipment shall be successfully demonstrated. The interface and functionality of the car CDU and the wireless local area network shall be fully tested. Testing shall be conducted to ensure that car faults can be downloaded remotely and that the system database can be updated.

(2) Each component of the communications system, including the GPS, automatic vehicle location system and wireless local area network, shall be tested to verify that they function in accordance with the requirements. Wayside simulations shall be performed as approved by Amtrak to fully verify all functions. All equipment which is installed under the Contract on Amtrak wayside or Amtrak control center shall also be tested to verify compliance. The ability to modify software data files and change parameters for the communications system equipment shall be successfully demonstrated.

vi). Wireless LAN

(1) The wireless LAN system shall be shown to demonstrate communication between the cars and wayside equipment, to properly connect to representative user devices, and to properly function through intermittent connectivity or power.

k). Electrical

i). General

(1) All electrical circuit breakers, protection systems, switches, and relays shall be cycled under full load to demonstrate proper functionality. Electrical protection systems, where included, shall be tested to the degree possible to adhere to the manufacturers specifications.

ii). Electrical load/phase balance/power factor

(1) One completed car of each type shall be tested to determine the actual electrical loads, their phase balance and power factor. This

shall be done under at least three different conditions: maximum heating load, maximum cooling electrical load and ventilation. These values shall be used to verify specification compliance.

iii). Trainline tests

(1) Trainline tests shall be conducted at both ends of the first cars of each type. All receptacles for the HEP, inter-car, MU and COMM trainline circuits shall be tested for proper functionality using a trainline test unit. Proper functioning of the PA/IC/OTIS shall be conducted to verify communication into and out of the cars functions properly.

(2) The first cars shall be coupled to a locomotive or other car on the Contractor's test track, and all trainline functions, including coupling and uncoupling and diagnostic messages, shall be tested to verify correct operation.

(3) End of Train functionality for trainlines and 480VAC HEP shall be tested per Sections 15.3.c and 15.5.e.

iv). Network tests

(1) The Contractor shall submit the results of a Network Interface Card (NIC) test of each end device implementing Ethernet communication in order to verify compliance to IEEE standards. The Contractor shall submit the results to Amtrak for review.

(2) The Contractor shall perform a complete network integration test of all train networks, including all subsystems and all on-board networks in order to pre-qualify the proposed network architecture prior to implementation on the cars. This test shall consist of a simulated car with all train switches. The subsystem controllers and end devices shall be the actual units in one car, with at least one of every type of controller represented in the test. Other cars and devices may use simulated traffic generators. The tests shall verify that the protocols, datasets, and messages used on all networks correspond to the Network Interface Control Document, and that the specific signal, message, and dataset documentation are provided for each network. At the time of the integration tests, the Contractor shall also demonstrate the fault tolerance of all networks by simulating all possible faults. Amtrak shall have the option of witnessing the tests. The test procedures and results shall be submitted to Amtrak for review and approval.

(3) Network testing performed by the Contractor shall demonstrate that all networks have capacity 50% above the expected worst-case in-service load.

v). Battery and battery charger tests

(1) Tests of battery capacity and the battery charger shall be made to show compliance with their requirements. The ability to charge the batteries and support other low voltage loads shall be verified. The capacity of the battery to support essential loads for the required time upon loss of HEP output shall also be verified. Proper functioning of the load shed and load drop systems at the specified voltages shall be conducted. The ability to check the battery fluid levels and refilling shall be demonstrated.

(2) Utilizing a heat gun or approved simulated heat source, proper functioning of the over temperature protection of the batteries shall be demonstrated.

vi). Battery capacity

(1) Battery on each car type shall be tested to demonstrate specification compliance.

vii). Battery/battery charger performance

(1) The performance of the battery charger connected to the battery and a simulated carload, shall be tested to verify correct operation. This shall include battery charger self-test, verifying correct voltage control and current control modes of the charger, operation of the temperature sensor, load shed and drive to any external indicators. This shall include: 24-hour charge with DC loads active; discharge to load shed; recharge for 24 hours. Strip chart instrumentation shall monitor battery voltage and carload and battery current over the entire interval. The system shall be tested to verify fault coordination between battery charger, battery and main DC circuit breakers and the ability to support large step loads on car, such as door operators cycling. Proper load shed and load drop at the specified voltages shall be demonstrated. The test shall also verify proper operation of the equipment during:

(a) Loss of input phase (component supplier Proof of Design test)

(b) Reversed phase rotation (component supplier Proof of Design test)

(c) Reversed battery connections (component supplier Proof of Design test)

(d) Fault coordination between battery charger system, battery and main DC circuit breakers (car level Proof of Design test)

viii). Battery tilt and shock

(1) Verify each battery type complies with the 45 degree tilt and 8/4/4g acceleration requirements of 49 CFR Part 238.115.

(2) reserve time of at least eight (8) hours per Section 15.5.f.

l). Food Service

i). The following food service equipment tests shall be performed as required to verify the design:

ii). Structural performance

(1) Verify crashworthiness structural requirements for retaining carts, chillers, and appliances are met. Tables and booth seating shall meet APTA PR-CS-S-016-99.

iii). Refrigeration system performance

(1) A complete car set of Food service refrigeration equipment for each food service car type shall be assembled and connected to operate. Particular concern is that the system might slowly lose capacity over time, with buildup of ice on the evaporators, etc. Room in which the test is conducted shall have a relative humidity of at least 60% at the 70° condition. The following shall be verified:

(a) Pull down capacity at rated conditions with nominal condenser inlet air temperature of 70°F and 110°F

(b) Hot-soak pull down: cases soaked > 95°F rated high ambient

(c) Operation at light load

(d) Operation of condenser environmental controls

(e) Ability to maintain cases to required values, including minimal temperature gradient within case

(f) Ability of thermometer on units to accurately track air temperature

(g) Operation of protective devices, such as pressure switches.

(2) Instrumentation and measurement shall include:

(a) Inlet and outlet air temperature of each galley cart

(b) Inlet and outlet air temperature of evaporator of each freezer and/ or refrigerator box.

(c) For large units, such as stand-up freezer, several locations within the unit are required.

(d) Evaporator surface temperature inlet and & outlet of each coil

(e) Expansion valve bulb temperature of each valve

(f) Chiller conditioned air inlet and outlet air temperature each unit

(g) Condenser air inlet and outlet temperature each unit, also including chillers

(h) Suction and discharge pressures each unit, also including chillers

(i) Compressor current each unit, also including chillers

(j) Activation of chiller thermostat

(k) Activation of chiller defrost cycle

(l) Activation of each box thermostat and solenoid valve

(m) Activation of each freezer defrost function

(n) Activation of environment controls

(3) All food service equipment shall be installed and shall be operated in a test simulating revenue service to verify the proper operation of the appliances, cases, power distribution system (including proper operation of the battery), HVAC, lighting, and the water and waste systems.

iv). Food Service Appliances

(1) Correct operation of all modes of all appliances and any interfaces shall be demonstrated. The effects of interruption of HEP and its restoration shall be demonstrated to verify compliance. Any wireless functions shall also be included. Tests shall also verify EMI/EMC requirements are met.

v). Point of Sale System

(1) Correct operation of all modes of the complete point of sale system and any interfaces shall be demonstrated. The effects of interruption of HEP and its restoration shall be demonstrated to verify compliance. Any wireless functions shall also be included. Tests shall also verify EMI/EMC requirements are met.

m). Water and Waste

i). A set of equipment that simulates the fresh water distribution and waste retention systems on a car shall be assembled and connected to operate. The system shall be piped to simulate actual car piping.

ii). The proper operation of the following shall be verified:

(1) Performance of all system components and controls

(2) System pressures, temperatures and flow rates

(3) Safety controls

(4) Backflow prevention devices

(5) Tank level indications

(6) Vacuum/pressure levels attained and maintained

(7) Valve sealing

(8) Protection mechanisms

(9) Flush valve life cycle

(10) Water fill and capacity

(11) Freedom from backflow

(12) Showers

n). Diagnostics and Test Equipment

i). The Contractor shall demonstrate fully functionality of the diagnostic and test equipment. The Central Diagnostic Unit shall display, record, and upload any failure within the car.

ii). The Contractor shall develop acceptance and qualification tests for all systems identified as diagnostics and test equipment, including but not limited to the central diagnostics unit, the portable test units, the car temperature monitoring, and any bench testers. The tests shall verify all features and components are in compliance with the requirements of this Technical Specification.

(1) Verification that all faults that are configured for all sub-systems to be displayed on the CDU are displayed properly.

(2) Verification that all faults that are configured to be reported to the CDU are so reported.

(3) Verification that fault logs of all systems in the car are accessible from the maintenance screen of the CDU in any of the cars.

(4) Verification that the software version numbers on all non-communications subsystems in the car can be accessed from the CDU of any car.

(5) Verification that all software changes made as a result of the CDU Factory Qualification Test have been implemented on all systems connected to the CDU.

(6) Any faults from each and every system shall be simulated and demonstrated to display properly.

(7) Simulate fault data upload and alarming.

(8) Access to system level fault information and current status parameters through the CDU terminal, the PTUs, and the online portal.

(9) Proper operation of the data recording functionality.

(10) Verification that all PTUs and bench test equipment properly connect, function, and diagnose system-level equipment.

o). Emergency Equipment

i). The performance of the Fire and Smoke Detection System and any Fire Suppression systems shall be verified for specification compliance on each relevant car type. Each type of sensor, alarm, indicator, control and annunciator, as well as all inputs and outputs, shall be demonstrated. All functions and modes of operation shall be demonstrated. The effects of interruption of HEP and its restoration shall be demonstrated to verify spec. compliance. Operation of the complete system from its battery shall be demonstrated from full charge down to fully discharged condition and then recharge. Time the system is supported on battery and the duration of the recharge shall be recorded with a data recorder.

20.6 Installation, Removal, and Maintainability of Equipment

a). This test shall measure the time it takes as well as demonstrate that it is possible to successfully install and remove without interference large components as well maintain frequently serviced pieces of car equipment. These items shall be demonstrated on a fully assembled car, unless otherwise agreed in writing by Amtrak. Items include:

i). Car Exterior: Removal/Installation

(1) Side Loading Doors, gap fillers and operators – each unique location

(2) End Doors – each unique type and location

(3) Gangways and Diaphragms

(4) Undercar and sidewall access door change-out (each type)

(5) Tread brake unit and disc brake unit: worst-case location(s)

(6) Brake valves, including wheel slide dump valves

(7) On-board mobility device lifts

(8) Digital Displays

(9) All other equipment located on the exterior of the Car unless otherwise agreed to by Amtrak.

ii). Removal/ Installation

(1) HVAC unit: - each unique site

(2) Refrigeration condenser tray (if used)

(3) Waste System including complete waste tank assembly

(4) Water heater (each type)

(5) All other equipment installed on the car unless otherwise agreed to by Amtrak

iii). Coach and Premium Accessible Coach Car – Interior: Removal/Installation

(1) Seats (all configurations of each type, i.e., single seats, double seats, left-hand, right-hand, coach, premium coach, etc.)

(2) Interior Doors – each unique type and location

(3) Restroom with associated assemblies – each type and each unique location

(4) Lighting

(5) Digital Displays (all locations)

(6) Water Fill station

(7) All other equipment located in the interior of the coach and premium coach cars unless otherwise agreed to by Amtrak.

iv). Food Service Cars – Interior: Removal/Installation

(1) All Food Service appliances

(2) Booth Seats

(3) Lounge Seats

(4) All other equipment located in the interior of the Food Service cars unless otherwise agreed to by Amtrak.

v). Food Service Preparation Areas – Removal/Installation

(1) Dishwashers (all locations)

(2) Freezers (all types and locations)

(3) Refrigerators (all types and locations)

(4) Chillers (all types and locations)

(5) Each appliance: TurboChef, coffee makers, steam tables, microwaves, griddles, steam table, warming drawers, etc.

(6) Gaylord exhaust fan & motor (for cleaning)

(7) Point of Sale system

(8) All other equipment located in a food service preparation area unless otherwise agreed to by Amtrak.

vi). Sleeper Cars – Interior: Removal/Installation

(1) Sleeper and restroom modules (each type)

(2) Room entrance doors including any en-suite doors – all accommodation types and all unique locations.

(3) Sleeper seats and convertible beds – each unique accommodation type

(4) Upper Berths – each unique accommodation type

(5) Lighting

(6) Digital Displays (all locations)

(7) All other equipment located in the interior of the sleeper and utility cars unless otherwise agreed to by Amtrak.

vii). Car Exterior – Servicing:

(1) Change brake shoes and brake pads, all locations, without the use of a pit

(2) All other equipment that requires servicing in the exterior of the car unless otherwise approved by Amtrak.

viii). Equipment – Servicing:

(1) Clean HVAC unit evaporator drains, each drain on each unit

(2) Clean HVAC unit condenser coil, each unit

(3) Clean refrigeration unit condenser, if supplied

(4) All other equipment that requires servicing in the exterior of the car unless otherwise approved by Amtrak.

ix). Interior - Servicing

(1) HVAC air filters

(2) Air duct cleaning

(3) Removal of diffusers and grilles

(4) Seat cushion removal/ installation – each type

(5) Booth & Lounge seat cushion removal/ installation – each type

(6) Curtain/Shade removal/ installation- each type

(7) Toilet shroud – each type

(8) Toilet bowl assembly - each type

(9) Waste lines – to clear blockage in line – all unique locations

(10) Drains – to clear blockage in line- each type – all unique locations

(11) Trash receptacle container - each type

(12) Sleeper Modules – each type

(13) Restrooms – each type

(14) Shower valves -- each type

(15) All other equipment that requires servicing in the exterior of the car unless otherwise approved by Amtrak.

b). Tests shall also demonstrate that all 49 CFR 238 calendar day inspections and Class I brake inspections shall be capable of being performed without the use of a pit or elevated track.

20.7 Pilot Car Testing

a). Roll Angle (Lean) Tests

i). The first pilot car, in both the AW0 and AW3 load conditions, shall be placed upon a superelevated track up to a maximum of 7 inches in one-inch increments. The test shall be performed in both lean directions to determine compliance with:

ii). Clearance requirements by verifying the Contractor's clearance diagram despite any body roll and lateral shifting of the car body.

iii). Static lean (maximum cant deficiency and maximum cant excess) limits for wheel unloading and carbody roll angle.

iv). Tests shall measure body roll and wheel unloading to verify compliance with 49 CFR Part 213.57 and 213.329. The Contractor shall provide a test report providing all data required by 49CFR Part 213.329 and shall fully support Amtrak's submission to the FRA with additional information as requested by the FRA. This test must be simulated on all cars and performed on each representative car type.

b). Pilot Cars

i). General

(1) Pilot car testing refers to the test of the first car of each type at the Contractor's final assembly facility prior to shipment. To implement pre-delivery testing of the pilot cars, the Contractor shall provide at its assembly facility a test site on which the specified tests can be conducted. In addition, this site shall be equipped with locomotive HEP power simulation with which it shall be possible to test performance.

(2) All tests listed in this Chapter are in addition to the testing required for Production units, road brake tests, and post-delivery testing of pilot cars with other equipment, called out in other sections of this Chapter.

(3) All pilot cars shall be weighed and verified for proper weight distribution by wheel and maximum total weight.

ii). Pilot car testing

(1) After the pilot cars have undergone and passed all applicable proof-of-design and production testing requirements, the cars shall be combined for car-to-car operational, compatibility and coupler tests.

(2) All pilot car testing shall be performed at a dedicated facility that has the capability of testing the cars operations of up to 125mph for uninterrupted 8-10 hours per day.

(3) All trainline functions shall be tested and verified, including:

(a) Door control, door system status and door summary circuits

(b) End of train identification

(c) Locomotive control

(d) PA, IC, and OTIS communications

(e) If equipped, DTL and Wi-Fi data transfer, including wireless and cellular connectivity at all seating or standing locations within the car without interference

(f) HEP, power distribution, and power balancing

(g) Air brake application and release in ECP mode

(4) The pilot cars shall be tested to confirm compliance with track geometry requirements, including curve and crossover negotiation. All car-to-car connections shall be verified as performing in compliance with the track geometry requirements, including:

(a) Carbody clearance

(b) Truck swing

(c) Coupler swing

(d) MU, COMM, DTL, ECP, and HEP cables

(e) Brake pipe and main reservoir air hoses

(f) Gangways, Diaphragms and buffer plates

(5) The clearances between the carbody and the trucks, between the carbody and the couplers, and between cars shall be checked on all pilot cars by methods which place the relevant components in the correct angular relationship corresponding to the worst case conditions to be incurred by operation in the static car envelope. In addition to demonstrating adequate mechanical clearance of the major elements involved, this test shall demonstrate that no interferences or potentially damaging contacts or stress conditions occur between or to any parts of the cars, including stops, wires, cables, or enclosures. Trainline cables shall not droop when under slack conditions such that they can potentially contact the ground, the top of rail, or other obstructions below the car's operating envelope.

(6) The cars, with springs loaded statically to AW0 and AW3 conditions, shall be demonstrated by either testing (measured against a template, plumb line or other approved method) or analysis to confirm that the car conforms to the Contractor's designs and that all the specified clearances and static car envelope requirements have been met, both to wayside and rail. This test shall be performed successfully with each end of each car coupled to another car. Test results must verify compliance with the Contractor's clearance calculations and diagrams for the cars under all operating conditions. Test cars shall be selected so that all variations of car end configuration can be covered.

iii). Pilot car compatibility testing

(1) After the pilot cars have undergone and passed the above, existing Viewliner I or II cars will be coupled to one end of the equipment or in the consist and an Amtrak ALC-42 locomotive will be coupled to the other end of the equipment.

(2) All trainline functions shall be tested and verified, including:

(a) Door control, door system status and door summary circuits

(b) End of train identification

(c) Locomotive control

(d) PA, IC, and OTIS communications

(e) If equipped, DTL and Wi-Fi data transfer

(f) HEP, power distribution, and power balancing

(g) Air brake application and release in Emulation

(3) The compatibility test train shall be tested to confirm compliance with track geometry requirements, including curve and crossover negotiation. All car-to-car connections shall be verified as performing in compliance with the track geometry requirements, including:

(a) Carbody clearance

(b) Truck swing

(c) Coupler swing

(d) MU, COMM, DTL, ECP, and HEP cables

(e) Brake pipe and main reservoir air hoses

(f) Gangways, Diaphragms, buffer plates and curtains

(4) The clearances between the carbody and the trucks, between the carbody and the couplers, and between cars shall be checked on the pilot cars and existing cars and locomotives by methods which place the relevant components in the correct angular relationship corresponding to the worst case conditions to be incurred by operation in the static car envelope. It shall be possible to couple and connect cars and wiring throughout the range of worst case angular relationships based on track curvature. In addition to demonstrating adequate mechanical clearance of the major elements involved, this test shall demonstrate that no interferences or potentially damaging contacts or stress conditions occur between or to any parts of the car, including stops, wires, cables or enclosures. Trainline cables shall not droop when under slack conditions such that they can potentially contact the ground, the top of rail or other obstructions below the car's operating envelope.

(5) If equipped, for any ECP system used, testing shall be performed in both Normal and Emulation modes per APTA PR-M-S-020-17 and PR-M-S-021-17.

iv). Vehicle/Track System Qualification

(1) General

(a) The Pilot cars shall be tested in accordance with the applicable requirements of 49 CFR Part 213.345 for vehicle testing at speeds up to 125 mph on the track and 5" cant deficiency of a qualified test facility to be selected by the Contractor. After the completion of vehicle testing at the selected test facility, the official qualification testing shall be performed on Amtrak's

Northeast Corridor (NEC). Testing shall begin at a speed of no less than 80 mph and test speeds will be incrementally increased as described below. Test results shall be made available on the Pilot Cars immediately after the completion of each test trip and will be reviewed by Amtrak before the decision is made to proceed to the next higher speed increment. The maximum test speed shall be per 49 CFR 213.345 using the Pilot Cars with a minimum of one instrumented car of each car type to be tested. Vehicles with minor variations in their physical properties that do not result in significant changes to their dynamic characteristics are considered to be of the same type for testing purposes.

(b) As track class, signal, propulsion and other required infrastructure becomes available on the route intended for service to support speeds of 125 mph, the equipment shall be tested in accordance with 49 CFR Part 213.345. Should the infrastructure to achieve speeds of 125 mph (test speed to be 5 mph greater) become available at the time of delivery of the vehicle order, the Contractor will be responsible for the conduct of these tests. On all train routes identified by Amtrak where car operation is planned for a speed of 125 mph, the Contractor will be responsible to conduct Pilot Car tests using a car over the identified route segments to enable car operation at the maximum allowable timetable track speed.

(2) Test instrumentation

(a) Test instrumentation shall be provided by the Contractor to record all data necessary to demonstrate compliance with the acceleration limits identified in 49 CFR Part 213.345. Each of the instrumented Pilot cars shall be provided with one truck equipped with two Instrumented Wheelset (IWS) axles. The truck with the worst performance per the simulation shall be equipped with the IWS-equipped truck. Tests shall be conducted in both directions of movement. Friction brakes on the IWS-equipped truck shall be cutout for the duration of testing. The location of the IWS truck is dependent on the worst performing position identified by the MCAT analysis. The consist configuration under test shall be equal to the worst performance in the car simulation.

(b) Each truck on each instrumented car shall be equipped with two lateral accelerometers, mounted on the truck frame at diagonally opposite locations along the vertical line passing through the center of the journal bearing. All instrumented cars shall also be equipped with three carbody lateral and vertical accelerometers. They shall be located on the interior floor, on the car longitudinal centerline, above each carbody bolster and at the middle of the car.

(c) A GPS location system shall be used during testing to accurately report the location of the IWS trucks. This shall be done by a separate GPS system for testing, in which case the GPS antenna shall be located on the roof of the IWS-equipped car. An accurate speed signal shall be provided in the data. This signal may be provided by the locomotive or by separate test instrumentation. The speed signal data and the cab speedometer display shall agree to within 1 percent across the entire speed range.

(3) Data collection and reporting

(a) The Contractor shall provide carborne test equipment capable of recording all data required, analyzing these data for compliance with FRA criteria and reporting results to test train personnel in graphical form. Real time operational safety must be provided. Results will be reviewed on the test train for acceptability by Amtrak before the decision is made to move to the next higher test speed. Reports for a given test trip may be generated as a series of data packages, each covering a distance of approximately 2 to 5 miles.

(b) The reporting software shall be capable of generating the following for each data package:

(c) A time and date stamp.

(d) A graphical depiction of train location and speed by railroad milepost.

(e) A graphical depiction of the various wheel/rail force signals and the truck acceleration and carbody acceleration signals. It shall be possible to directly correlate these signals with the location, speed and time/date data. The location of the worst case data in each data set shall be indicated.

(f) A summary report of the worst case values recorded for the IWS wheel/rail force criteria, and the truck acceleration and carbody acceleration data. Any values which are in excess of those allowed by FRA shall be flagged as exceptions.

(g) Exception reports shall be provided for all events flagged as exceptions. These reports shall include the values recorded plus a close-up time history view of the data signal associated with each exception.

(h) Data packages shall be available within 5 minutes or less after collection of test data. Simultaneous data collection and report generation shall be required. All necessary calibration data, sign conventions, sampling rates, headers, etc. required to process the data shall be included in the report. Data shall be provided to Amtrak in both paper and electronic media which shall include all

software required to format, process and graphically view the test data.

(4) Failure to Satisfy Requirements

(a) Should the car fail to satisfy the vehicle/track interaction requirements, a program for correcting the deficiencies shall be submitted to Amtrak for approval. The Contractor shall submit to Amtrak, within 60 calendar days, a program containing mathematical analysis of the problem and a course of action for its correction. If Amtrak approves the analysis and corrective measures, those corrective measures shall be made effective on the pilot cars within 90 calendar days at the expense of the Contractor, the car shall be retested, and if the measures are successful, they shall be applied to all the cars. If not, the analysis and correction steps shall be repeated, resubmitted and retested until success is attained.

(5) Test reports

(a) The Contractor shall prepare the required final test reports for submission to the FRA by Amtrak. This shall include the track geometry data for the test zones, which accurately reflects the state of the track condition at the time of test. Amtrak reserves the right to require additional vehicle modeling, instrumentation and/or testing if test results show failure to comply with the FRA requirements for operation at any speed below 125 mph, or if additional dynamic behavior which may present a safety issue is observed.

v). Noise and vibration tests

(1) The interior and exterior noise levels and vibration levels of the pilot cars shall be measured to prove compliance with all specification requirements. Interior noise measurements shall be made with all car systems operational while operating on level tangent track in an open area, from standstill to 125 miles/hour and back to zero speed using full service braking. The sound level meter shall conform, as a minimum, to the requirements of ANSI Standard S1.4, Type 2, and set to an A-weighted slow response or with an audio dosimeter of equivalent accuracy and precision.

(2) In conducting interior sound level measurements with a sound level meter, the microphone shall be oriented vertically and positioned to simulate the location of a seated passenger or train Engineer's ear. Measurements with an audio dosimeter shall be conducted in accordance with manufacturer's procedures as to microphone placement and orientation.

(3) Vibration tests shall be made with all car subsystems operating, with the car stationary.

vi). Friction brake performance tests

(1) The friction brake system on one of the pilot cars shall be tested to demonstrate that it meets the requirements. The brake disc, brake pad, brake shoe and wheel temperature shall not exceed the supplier's working range, defined as that within which the material is capable of meeting the specified performance and tolerances. Successful completion of all of the preceding tests and acceptance of the test results by Amtrak will be required for final approval of the friction brake system.

vii). Ride quality tests

(1) To verify conformance to the ride quality requirements, one of the first pilot cars shall be subjected to ride quality road tests. At a minimum, the ride quality tests shall consist of testing of one or more cars on minimally compliant track that conforms with all FRA track standards for the classes of track over which the cares are designed to operate. The car or cars shall also be tested on a major segment of track over which the cars are intended to operate in revenue service, making all local stops while operating at normal scheduled speed, under AW0 and AW1 load conditions. The Contractor shall prepare a ride quality testing plan for submittal to Amtrak for review and approval, specifying the start and end points, speeds, test methodology, measurement parameters and criteria, and method of instrumentation for the ride quality tests. Results from previous ride quality tests that closely simulate Amtrak’s revenue service environment may, at the sole discretion of Amtrak, be accepted in lieu of additional ride quality testing. The results of these tests shall be compared to the results from the modeling performed as specified in Chapter 7.

(2) Instrumentation capable of measuring and charting (for permanent record) the magnitude and frequency of the vertical and lateral shocks expected, up to 5g and 0.5 to 80 Hertz, shall be provided and operated by the Contractor, who shall reduce the raw data for presentation to Amtrak. Sensing units shall be located on the car floor above the intersection of the car longitudinal center line and each truck transverse center line. Weights used in simulating the AW1 load, as well as their loading and unloading, shall be provided by the Contractor.

(3) In the event that the dynamic behavior of the cars is non-compliant in any respect with the requirements, the Contractor shall submit to Amtrak, within 60 calendar days, a program containing mathematical analysis of the problem and a course of action for its correction. If Amtrak approves the analysis and corrective measures, those corrective measures shall be made effective on the pilot cars within 90 calendar days at the expense of the Contractor, the car shall be retested, and if the measures are successful, they shall be applied to all the cars. If not, the analysis

and correction steps shall be repeated, resubmitted and retested until success is attained.

viii). Wheel Spin/Slide Control System Performance

(1) In order to provide a test of the operation of the wheel slide protection system under actual operating conditions, facilities shall be provided for a test of this system during the friction brake performance brake tests. Instrumentation shall be maintained on this train at all times ready to record the following quantities simultaneously:

(a) Individual axle speeds (all cars in the consist)

(b) B.C.P. (after each wheel slide dump valve and car command level)

(c) Time intervals

(d) Tractive effort / braking effort command level

(e) longitudinal acceleration of train

(2) Recording shall be by means of multiple-channel recording digital chart recorders. Personnel assigned to observe the test shall be prepared to run this instrumentation at any time that adverse adhesion conditions may occur. This test shall be continued until recordings have been obtained showing three stops and starts during which slides and slips were successfully corrected. In the event that sufficiently adverse rail conditions to obtain such recordings do not occur during the test, the Contractor shall induce slips and slides with artificial rail wetting equipment (soap or other material to induce slippery conditions that represent leaves on the rails with a 6% - 8% adhesion level) to demonstrate the performance of this system. The slip/slide test can be run in conjunction with the track test.

(3) The test consist size shall be determined based on consist configurations selected by Amtrak and shall include the following sections:

(a) Braking Performance (Friction only and blended for propulsion equipped cars)

(i) baseline (dry): full service braking at 15, 30, 60, 75 110, and 125 mph

(ii) reduced adhesion: full service braking at 15, 30, 60, 75 110, and 125 mph using the lubricant

(iii) very low adhesion: same speeds, with dry rail for 650 feet, 65 feet heavily lubricated rail, followed by dry rail

(b) Propulsion Performance

(i) Baseline (dry): Full Acceleration from zero to 30, 60 mph

(ii) Reduced Adhesion: Full Acceleration from zero to 30, 60 mph

(iii) Very Low Adhesion: from zero - 65 feet heavily lubricated rail, followed by dry rail for 650 feet followed by heavy lubricated rail for 65 feet followed by dry rail. Acceleration till the train reaches steady state acceleration

(4) For all adhesion levels above 5% the system shall regulate brake cylinder pressure, dynamic braking and tractive effort to achieve a minimum slide control efficiency of 80% under continuous full service braking and continuous tractive effort. "Worst-case" conditions shall be simulated by use of a compressed air powered spray device, with a solution of dish-washing soap and water or water-soluble cutting oil and water, as agreed between the Contractor and the Railroad, sprayed in front of the wheels on the leading axle to lower wheel-to-rail adhesion. Slide protection shall be verified by full service brake applications from initial speeds of 15, 30, 40, 60, and 70 mph. Test shall be performed both with and without dynamic braking. A similar set of tests shall be performed under full acceleration.

ix). Water Tightness Tests

(1) Each pilot car shall be tested for watertightness in both the completed shell and assembled car stages prior to pre-shipment.

(2) The entire carbody and all weather sealing around the doors, gangways, windows, any exterior screens, and all other penetrations through the carshell shall be tested during water tightness test similar to AMAA 501.1. A fan or turbine shall be set up that will provide 125 mph air speed longitudinally along the car body. 8” per hour of simulated rain water shall be applied to the area and the fan shall run for no less than 15 min showing no signs of leakage. This shall be repeated again but this time the fan shall be set up so that it will provide 50 mph of air speed at a perpendicular direction with respect to the car body with simulated 8” of rain per hour. This test is to be completed for all side doors, trap doors, folding steps, and windows and shall closely mimic the test conditions spelled out in AMAA 501.1.

(a) During the shell watertightness test, all areas of the sides, ends and roof of each car shall be given a complete test for watertightness. The tests shall be made before installation of sound deadening material, thermal insulation and interior finish.

(3) Each completed car shall be sprayed with water, simulating the conditions at the rated speed of the car, to verify there are no

leaks. Of special interest are the door, window openings, and any roof penetrations, such as those for antennae.

(a) All weather sealing around the doors, gangways, windows, any exterior screens, and all penetrations through the carshell shall be tested during water tightness test similar to AMAA 501.1. A fan or turbine shall be set up that will provide 125 mph air speed longitudinally along the car body. 8” per hour of simulated rain water shall be applied to the area and the fan shall run for no less than 15 min showing no signs of leakage. This shall be repeated again but this time the fan shall be set up so that it will provide 50 mph of air speed at a perpendicular direction with respect to the car body with simulated 8” of rain per hour. This test is to be completed for all side doors, trap doors, folding steps, and windows and shall closely mimic the test conditions spelled out in AMAA 501.1. Door weather sealing shall meet the latest version of EN 14752.

20.8 Production Tests

a). General

i). As a minimum, the tests listed in this Chapter shall be performed on each car (including all pilot cars) prior to the issuance of a release for shipment document by Amtrak. The Contractor's production conformance test shall include all tests and adjustments which can be made prior to delivery in order to keep car acceptance testing and adjustments at Amtrak to a minimum.

ii). Prior to performing each production test for witness by Amtrak, the Contractor shall successfully perform the test internally. Amtrak may request the results of the internal test prior to attending the witness test.

iii). After completion of each car, the Contractor shall demonstrate that each car subsystem is operational.

iv). The following static tests where power is required on the car shall be conducted by applying a supply voltage to the trainline cables to the car and functionally testing all car systems.

v). The test procedure shall include and use a check-off list that shall become a record that all systems have been actuated and have functioned as required. This is particularly required for all protective and safety related devices. All equipment final adjustments shall be made prior to car shipment. After completion of each car, the Contractor shall demonstrate that all discrepancies logged against the car during its construction and test period, by either the Contractor’s own inspection forces or Amtrak inspectors, have been suitably resolved to Amtrak’s satisfaction.

vi). After the installation, connection and cleaning of all piping as specified, the piping shall be pressure tested in accordance with the latest edition of the Code for Pressure Piping, ANSI B31.1. All leaks which appear during

pressure testing shall be repaired, after which the system shall be retested until leak-free.

vii). All air, water, waste system and HVAC pipe work, hoses and fittings shall be properly cleaned, purged checked for leaks with all systems in operation and any faults rectified.

viii). All equipment on each car (including all pilot cars) shall be given tests for proper operation and conformance, at the manufacturer's facility prior to shipment to the Contractor. All equipment shall also be given a functional test (pre-delivery) on the completed car to test for proper operation, by the Contractor prior to issuance of a release for shipment document by Amtrak. The test to be performed by each manufacturer and the Contractor on each car component or subsystem shall be in accordance with the applicable industry standards listed in this Technical Specification and the approved test plan. The following tests in this Chapter list some but not all of these tests to be performed; all Technical Specification requirements must be achieved in any case. The test reports of all tests shall become the property of Amtrak and be included in each vehicle history book as specified. This is in addition to, and is not to replace, the Contractor's and suppliers' QA plans.

ix). The Contractor shall conduct an acceptance test for each car of the cars provided. The test shall verify that each device in the assembly is adjusted correctly and operates properly, both mechanically and electrically. All wiring shall be verified and, as appropriate, tested for insulation resistance and dielectric strength. All cars shall be weighed to verify overall weight and distribution. Leak tests and pressure tests shall be conducted. All modes of operation shall be verified, with every switch and control, staging and input and output exercised, and motor currents measured. At a minimum, acceptance tests shall be conducted on the following systems:

(1) Powered body end, Side doors, Trap doors, and Folding Steps operators and controls

(2) Temperature controls

(3) HVAC system,controls, and remote diagnostics

(4) Air circulation fans & controls

(5) Lighting components

(6) Independent Power Sources (for emergency lights)

(7) Public Address/Intercom System (PA/IC)

(8) Onboard Train Information System (OTIS)

(9) Passenger Emergency Intercom (PEI)

(10) Reservation Display System (if equipped)

(11) Video Surveillance System (if equipped)

(12) Door Lock System

(13) Car and Train Networks

(14) Electronic Display Signs

(15) Electrical panels and electronic equipment

(16) Battery and Battery Charger

(17) Brake Equipment

(18) Wheelslide control system

(19) Food Service Appliances

(20) Water Heaters

(21) Waste System

(22) Fire and Smoke Detection System

(23) On-Board Mobility Lifts

(24) Sleeping Module Amenities

b). Carbody

i). Watertightness tests

(1) General

(a) Each car shall be tested for watertightness in both the completed shell and assembled car stages prior to pre-shipment.

(b) The entire carbody and all weather sealing around the doors, windows, any exterior screens, and all other penetrations through the carshell shall be tested during water tightness test similar to AMAA 501.1. A fan or turbine shall be set up that will provide 50 mph air speed at a perpendicular direction along the car body. 8” per hour of simulated rain water shall be applied to the area and the fan shall run for no less than 15 min showing no signs of leakage. This test is to be completed for all side doors, trap doors, folding steps, and windows and shall closely mimic the test conditions spelled out in AMAA 501.1.

(c) During the shell watertightness test, all areas of the sides, ends and roof of each car shall be given a complete test for watertightness. The tests shall be made before installation of sound deadening material, thermal insulation and interior finish.

(d) The entire carbody shall be watertightness tested in two stages during production:

(i) Stage 1: Bare carshell with windows and doors installed

(ii) Stage 2: Complete assembled car: all doors with gaskets including but not limited to side loading doors, junction boxes, access panels and maintenance doors shall be verified to be free from water ingress as part of stage 2.

(2) Water spray – bare car shell (watertightness test)

(a) Each car shell shall be sprayed with water, simulating the conditions at the rated speed of the car, to verify there are no leaks in the joints. All surfaces shall be sprayed. This shall be done before the application of any sound deadening material or thermal insulation. Openings, such as doors, windows, etc., shall be closed off by suitable means, such as blanking plates, during testing. All spray applications shall run ten minutes before and continuously during the inspection. Test arrangement is subject to Amtrak approval.

(3) Water spray – completed car

(a) Each completed car shall be sprayed with water, simulating the conditions at the rated speed of the car, to verify there are no leaks. Of special interest are the door, gangway, and window openings and any roof penetrations, such as those for antennae.

(b) All weather sealing around the doors, gangways, windows, any exterior screens, and all penetrations through the carshell shall be tested during water tightness test similar to AMAA 501.1. A fan or turbine shall be set up that will provide 50 mph air speed at a perpendicular direction with respect to the carbody along the car body. 8” per hour of simulated rain water shall be applied to the area and the fan shall run for no less than 15 min showing no signs of leakage. This test is to be completed for all side doors, trap doors, folding steps, and windows and shall closely mimic the test conditions spelled out in AMAA 501.1. Door weather sealing shall meet the latest version of EN 14752.

ii). Onboard mobility lift test

(1) Verify all functions, interlocks, safety features and timing

(2) Demonstrate lifting range

(3) Demonstrate manual operation of lift and timing

iii). AEI tag test

(1) A tag reader shall be used to verify that each AEI tag on each car operates correctly and contains the correct data.

c). Truck Tests

i). All trucks

(1) Trucks (including the frame, bolster and any primary structural members) shall have their fabrication techniques qualified by means of a complete radiographic inspection of the entire structure. If determined by the Contractor and agreed to by Amtrak that radiographic methods are not practical for some areas, then the inspection in these areas shall be performed using both ultrasonic and magnetic particle inspection or destructive sectioning methods approved by Amtrak. Castings shall be radiographed in accordance with requirements. Radiographs shall be made in accordance with ASTM Standards E94, E446 or E186 as may be applicable. The radiographic inspection quality level shall be selected by the truck manufacturer to be consistent with the truck design but shall not be of lesser quality than that required by Section 6.12.2 of AWS Standard D1.1. If the first truck fails the radiographic/ultrasonic inspection, then the second shall be inspected, and this process shall continue until a truck passes the inspection. The production variables for the succeeding trucks shall duplicate those for the truck which passes the above inspection.

(2) After qualification of the fabrication and casting techniques as per the above method, 4% of each production lot, randomly chosen by Amtrak, shall be inspected using radiographic, ultrasonic, and magnetic particle inspection methods as proposed by the Contractor and approved by Amtrak.

ii). Truck weight

(1) Each completed truck assembly shall be weighed, and the weight of the truck assembly recorded on a truck weight certificate, prior to installation of the trucks under the carbody. The completed truck shall include all truck-mounted equipment, including handbrake linkage if so equipped, but shall not include secondary suspension components or truck-to-carbody air hoses. The serial number of the truck frame shall be included on the truck weight certificate.

iii). Carbody leveling and floor height

(1) Each completed car shall be leveled and measured to verify correct truck setup adjustments, that the car is level, has the correct floor and gangway buffer plate heights and gangway curtain heights. Measurements shall be taken with the car on calibrated track.

iv). Truck attachment, leveling and coupler height tests

(1) All mechanical, electrical, pneumatic and hydraulic connections between the trucks and the carbody shall be checked. The AW0 car floor height/car level and the end car coupler height shall also be verified.

(2) The height of each corner of the carbody shall be measured from the top of rail on a level section of track to check for proper carbody level with all suspension components at proper design height. Side-to-side differences in height shall not exceed 0.25 in. End-to-end differences in height shall not exceed 0.5 in.

d). Couplers

i). Coupler height and operation of each car shall be verified, including clearance and operation of the uncoupling apparatus. All couplers and drawbars shall be gauged according to applicable FRA, APTA, and manufacturer standards.

e). Brakes

i). Single car brake and pneumatic system operation

(1) The brake system and auxiliary air system of each car shall be tested for leaks. The AAR S-471 Brake Pipe Restriction Test shall be conducted on the Brake Pipe. A functional test that exercises each function of all brake system valves, trainline, and components shall be conducted in accordance with the OEM recommendations. Brake applied indicators and the brake applied/released indicators shall be tested. Tests shall include auxiliary air system functions, such as the governor and regulator for water rising (if equipped). In addition, all requirements of APTA Standard PR-M-S-005-98 shall be met.

(2) For any ECP system used, testing shall be performed in both Normal and Emulation modes per APTA PR-M-S-020-17 and PR-M-S-021-17.

(3) The Contractor shall perform on its test track a complete functional test of the friction brake system prior to shipment of each car. This shall include, as a minimum, a single-car air test, in compliance with FRA requirements, as well as, a test of brake cylinder pressure settings, control and indicator checks, leakage tests, cut-out functionality tests, and handbrake test.

ii). Hand brake operation

(1) The hand brake of each car shall be tested to verify that, when applied, the brake shoe is in contact with the wheel and that the hand brake indicator properly displays the hand brake status.

iii). Wheelslide control system operation

(1) The wheelslide control system shall be tested on each car to verify correct speed sensor air gaps, correct end-for-end wiring of sensors and dump valves, and self-test functions of the controller, with the car on air to exercise the brakes. Speed signal interfaces for the door system shall also be tested. Dynamic testing shall also

be performed to ensure the wheelslide control system is operating as intended. The contractor is responsible for providing the dynamic test procedures for review and approval by Amtrak prior to dynamic testing.

f). Door System Tests

i). General

(1) All doors and their operating systems shall be checked and adjusted on all cars to assure smooth functioning, proper fit, attainment of the specified speed of operation and proper functioning of controls, signals and interlocks. This shall also include all body end, side doors, trap doors, and folding steps. All power operated doors shall be operated a minimum of 1000 consecutive, separate successful cycles in each of the applicable control methods. Initiation of the cycling through the trainline external from the car and initiation from a local control stand or push button shall be tested separately. Proper adjustments for opening and closing shall be checked on every door before and after the above test. Improper adjustment at the end of a test shall require the test to be repeated. Any door or door control failure occurring prior to completion of the test will nullify the test, requiring that it be repeated from the beginning following correction and documentation of the failure. Tests shall include, but not be limited to verification of:

(a) All doors:

(i) door hangs vertically; verify correct relationship between carbody plane and door plane

(ii) seal is attached properly

(iii) proper open travel

(iv) proper fully closed position

(v) seal is aligned properly with door and seals the door all the way around the periphery, with no gaps

(vi) the door moves freely on the door track or hinges

(vii) the door hinges do not have excessive sloppiness at any hinge

(viii) door does not drag on floor or other surface

(ix) proper engagement of hold-open device

(x) door latch engages smoothly at each site and with correct depth of engagement

(xi) lock operates smoothly and without undue effort

(b) Additionally for all passenger and crew doors:

(i) proper location of threshold on the trap/ floor

(ii) proper attachment of threshold to the trap/ floor

(iii) proper engagement of bottom of door with the threshold (vertically and laterally)

(iv) that the mechanical lock is adjusted properly so it can lock the door leaf closed

(v) that the secondary door latch or dog operates properly

(vi) dogs shall remain distinctly open when in that position (not close on their own, even resulting from train motion.

(vii) that the drain for the door threshold is clear

(viii) doors equipped with a door closer close reliably by themselves and engage the latch each time the door closes.

ii). Door safety systems

(1) All doors shall be individually tested to confirm correct operation, including all indicators, audible signals and interlocks, from the cab of a locomotive, from the individual local door pushbuttons, and when obstructions are placed in the door. Tests shall also be performed to confirm correct operation of all interior and exterior manual door opening/passenger emergency facilities, interlock bypass switches and crew door switches.

g). Interior

i). Interior doors and hardware

(1) All interior doors and hatches shall be functionally checked on each car to verify: smooth movement, latching, locking, unlocking from external side of door, correct latch engagement/release, proper operation of detente, non-interference, freedom from sticking or excessive looseness (rattles) and proper switch activation. Force to overcome the detente used on sliding toilet room doors shall be measured.

(2) Proper self-engagement of the ceiling hatch safety catches shall be checked.

(a) Safety catches shall be self-engaging when opening and closing panels.

ii). Seats

(1) Operation of each movable function of each seat and table on each car shall be tested to verify:

(2) Recline, footrest, tray table, workstations, and any deployable ADA tables shall be level when in the fully extended position and shall deploy and retract smoothly without binding.

h). HVAC

i). Air Distribution

(1) Each car shall be measured, and the results recorded to verify correct air distribution, including:

(a) fresh air flow rate

(b) return air flow rate

(c) exhaust air flow rate

(d) car pressurization

(e) uniformity of supply air flow

ii). Temperature Control

(1) Proper thermostatic operation of the air conditioning and heating equipment shall be verified on each car for compliance with the specified values. This shall include, but not be limited to:

(a) integration with HVAC unit- every input/ output verified

(b) demonstration in all possible modes of operation (day/ night, layover, as well as partial and full cool, partial & full heat, etc.)

(c) ramp up and ramp down of all temperature inputs: fresh air, return air and car air

(d) demonstration of all logic functions, input and output, including:

(e) control and power circuits

(f) operation of all safety circuits

(g) fault conditions – representative examples

(h) indicators/ display(s) – representative examples

(i) fault displays - representative examples

(j) Portable Test Unit (PTU), including all modes of operation

(2) The test shall include operation of the controls using car temperature sensors/ thermostats as follows:

(a) use override to warm car to 80° F minimum (est. value). Then, under thermostatic control, verify car cools to setpoint.

(b) use cool override to chill car to 60° F maximum (est. value). Then, under thermostatic control, verify the car heats to setpoint.

(c) verify car temperature gradient meets specified requirements

(d) Verify proper operation of sleeper room controls for validation of temperature ranges

iii). Heater circuit tests

(1) Each heater circuit shall be high potential tested in accordance with IEEE Standard number 16.

iv). Heating tests

(1) General

(a) The heating system, including doorway and protective heaters, shall be functionally tested in all cars. The operation of the thermostatic control system and layover heating shall be demonstrated by test. Controls shall be checked and adjusted for even distribution and proper volume of heat.

(2) Duct heater operation

(a) Duct heat of each car shall be verified for function, uniform temperature distribution and correct current draw.

(3) Duct heater shunt trip operation

(a) Proper operation of each safety interlock of the duct heat control system shall be verified on each car. In addition, operation of the shunt trip feature of the circuit breaker shall be exercised by applying heat directly to the high limit thermostat of each heater assembly.

(4) Floor heat operation

(a) Floor heat of each car shall be verified for function, uniform temperature distribution and correct current draw.

v). Air conditioning unit tests

(1) Each refrigerant compressor shall be given an air pressure test. Each evaporator and condenser coil shall be proof pressure tested and each complete unit shall be vacuum tested, leak checked with an electronic sniffer, and pressure tested to the requirements. All

pressure vessels shall have ASME certificates. Compliance to the random starting timing requirements in Chapter 10 shall be verified. Unit shall be tested for proper sealing against weather. Unit shall pass subcontractor qualification test for shock and vibration.

(2) All cars shall have proper air balancing performed, and smoke testing shall be used to verify ducting is free from leaks. Amtrak may re-evaluate this requirement once repeatability is demonstrated.

vi). Air conditioning system tests

(1) General

(a) The air conditioning system shall be functionally tested in all cars. The thermostatic control system operation shall be demonstrated by test. All controls and dampers shall be checked and adjusted for even distribution and proper circulation of air. Refrigerant charge and compressor oil levels shall be verified. The initial fine mesh liquid line strainer shall be replaced with the proper mesh at the conclusion of testing.

(2) Air conditioning system operation

(a) The air conditioning equipment on each car shall undergo an evacuation and leak test. For package units, this may be done at the supplier plant; however, a "sniff" type leak test shall be done on the car to verify no leaks have occurred as a result of shipping damage. The equipment on each car shall be checked to verify proper control response and function for all operational modes (partial cool, full cool, partial heat, full heat, etc.). In addition, motor currents shall be recorded for:

(i) Blower fan

(ii) Condenser fan(s)

(iii) Compressor

(iv) Exhaust fan(s)

vii). Freeze Protection

(1) Proper operation of all freeze protection equipment shall be verified on each car, verifying that each heater heats and that the current draw is proper. Heaters employing a local thermostat shall have cycling by the thermostat verified.

viii). HVAC Diagnostics Remote Access

(1) The HVAC diagnostics remote access functionality shall be validated.

i). Lighting

i). Lighting operation

(1) Proper function of all interior and exterior lighting fixtures and all their controls shall be verified on each car. This shall include operation in each lighting mode: normal, quiet car, standby, load shed and emergency modes as well as night. Adjustment of all limit switches controlling lighting shall be included. Test shall include verification operation of Independent Power Source functions.

ii). Marker lights

(1) Proper operation of marker lights shall be verified.

j). Communication/OTIS

i). General

(1) The performance, installation, and integration of all components which combine to meet the requirements of Chapter 14 shall be tested to verify proper installation and operation.

ii). PA/IC system performance

(1) The performance of the public address and passenger intercom system shall be tested to verify that all aspects of the system perform as intended:

(a) Control terminal function and indication

(b) PA announcements to each identified zone, including verification of the functionality and control of each speaker (interior and exterior)

(c) PA announcements received from other cars in the train including legacy equipment.

(d) Intercom function between IC stations within the car and between the car and other cars in the train

(e) Communication along analog COMM/MU lines (where equipped) and communication on the Ethernet Train Backbone

(f) Passenger Emergency Intercom functionality

(g) Speaker volume, including interior and exterior speakers, and in both Normal and quiet modes

(h) Attendant Call control and indication

(i) Inductive Audio Loop

(j) Bluetooth LE Broadcast

iii). OTIS system performance

(1) The performance of the automatic announcements, sign, and train map portions of the system shall be verified for specification compliance on each car type. All modes of operation shall be demonstrated, as well as interaction with the PA/IC system, Attendant Call, and diagnostic systems.

(2) Performance and indication of each interior and exterior Display Sign, including that each display sign can appropriately indicate messages specific to each individual sign location.

(3) Simulated power drops and restarts shall be tested to ensure the system returns to proper operation without abnormal behavior.

(4) System shall be loaded with the Amtrak route and display profiles and demonstrated to properly function per the manufacturer's recommended test plan.

iv). Passenger Compartment Control Unit

(1) Each Passenger Compartment Control Unit shall be tested to verify proper operation.

v). Reservation Display System (if equipped)

(1) Proper control and indication of each reservation display system screen, and proper communication between the reservation display system controllers and the diagnostic system.

vi). Door Lock System

(1) Operation and control of all door locks, including keyed overrides, performance on battery backup, and each method of wireless communication.

vii). Data Communication System and Global Positioning System

(1) The Data Communication System functionality including on-board cellular and Wi-Fi connections, shall be shown to demonstrate communication between the car and representative wayside equipment, to properly connect to representative user devices, and to properly function through intermittent connectivity or power.

(2) The Global Positioning System (GPS) capabilities of the communications system shall be verified.

viii). Video Surveillance System (if equipped)

(1) The proper aiming and operation of each video surveillance camera shall be verified. The aiming of each surveillance camera

shall be compared against the approved coverage design, and a screenshot shall be included in the vehicle history book.

(2) The NVR shall be tested for proper operation, including proper recording of all cameras and interface with onboard signals and networks for the purpose of metadata recording.

k). Electrical

i). Electrical apparatus tests

(1) Each component that is separately assembled, housed and wired into a package unit prior to installation shall be tested at its point of manufacture and a certified test report, signed by the responsible Quality Assurance representative of the manufacturer, shall be furnished to the Contractor with a copy to Amtrak. Tests shall be in accordance with IEEE Standard number 16 for control apparatus as appropriate.

ii). Battery tests

(1) Battery and battery charger operation

(a) The overall DC power system of each car shall be tested to verify correct operation. This shall include battery charger self test, verifying correct charge voltage and current of the charger, operation of the temperature sensor, load shed and all external indicators. The test shall include operation in which the battery supports the car loads for a minimum time, (i.e. 30 minutes)

(2) Battery capacity

(a) Verify battery meets 5 hour name-plate rating.

(3) Battery/battery charger performance

(a) The performance of the battery charger connected to the battery and a simulated car load, shall be tested to verify correct operation. The test shall also verify proper operation of the equipment during:

(i) Sustained low input voltage (component supplier Production test)

(ii) Overload or shorted battery charger output (component supplier Production test)

(iii) Battery ground fault (vehicle level Production test)

(iv) Temperature sensor fault (vehicle level Production test)

(v) System overload (component supplier Production test)

(vi) Ability to support large step loads on car, such as door operators cycling (vehicle level Production test)

(b) Each battery shall be given a capacity test at the point of manufacture in accordance with APTA Standard PR-E-RP-007-98 (component supplier Production test).

iii). Car wiring tests

(1) Continuity

(a) On each car, all wiring shall undergo a continuity test in which wire labeling, continuity of conductor and proper connection point are verified.

(2) Power distribution

(a) Power distribution of each car shall be tested including phase rotation, correct voltage of each transformer-derived voltage, polarity of DC at the load and correct feed by the respective bus.

(3) Electrical insulation testing

(a) Electrical insulation tests shall be conducted on all applicable electrical components to verify the state of the insulation to the case, between wiring of different voltage classes, and between the input and output circuit of high voltage line switches and circuit breakers. Semiconductor devices may be protected against the test voltage by means of shorting jumpers if they are not inherently protected by the circuit in which they are used.

(4) Network testing

(a) Every Ethernet cable installed on each car shall be certified to ISO/IEC 11801-1 – Class F after installation, demonstrating channel suitability for IEEE 802.3an-2006 10GBASE-T. The results shall be recorded and submitted as a part of the vehicle history book.

iv). Insulation testing

(1) All wiring on each car shall undergo a Megger and high potential test, in accordance with APTA Standard PR-E-S-001-98.

(2) Insulation resistance tests shall be conducted before high potential tests are conducted.

(3) On items with double insulation, such as grid resistors mounted on an insulated frame, each set of insulation shall be individually tested (i.e., resistors to frame and frame to carbody).

v). Trainline tests

(1) General

(a) The Contractor shall verify the accuracy of the trainline connections by use of a test panel which is connected to the trainline connectors at each end of the car. The test panel shall use the illumination of lights or other appropriate means to confirm that only the proper trainline wires are energized when the various car controls (public address system, doors, etc.) are operated, and that there are no shorted, crossed, incorrect or open circuits. This test shall exercise the controls on all door control panels, PA controls, etc. All spare trainline circuits shall also be tested.

(2) 480V HEP trainline

(a) The 480V trainline wiring shall be tested at each end of the car to verify continuity of each power and control conductor and grounding of control contacts.

(3) 27-Point communication trainline

(a) Through the use of a test fixture, the 27-point communication trainline shall be tested at each end of the car to verify continuity of each conductor, freedom from unintended cross-connections and shorts. Proper operation of any device which interrupts a circuit, such as pressure switches or relays, shall be demonstrated. Operation of end-of-train relays shall be verified. Transmit/receive functions of equipment that is controlled by the trainline, such as side doors, shall be demonstrated by the respective system test.

(4) 27-Point MU trainline

(a) Through the use of a test fixture, the 27-point MU trainline shall be tested at each end of the car to verify continuity of each conductor and check for unintended cross-connections and shorts. Transmit/receive functions of equipment which is controlled by the trainline shall be demonstrated by the cab system test.

(5) Digital Trainline / Ethernet Train Backbone (if equipped)

(a) Through the use of a test fixture, the digital trainline and all switches shall be tested at each end of the car to verify continuity of each cabling run and check for unintended cross-connections and shorts. Transmit/receive functions of equipment which is controlled by the trainline shall be demonstrated.

vi). Convenience outlets

(1) All 120VAC receptacles shall be tested for proper polarity, grounding and the trip action of any associated GFCI devices on

each car. All USB ports shall be tested for proper operation. Operation of DC receptacles shall likewise be verified.

vii). Auxiliary circuits and equipment tests

(1) All auxiliary circuits and equipment shall be tested for proper operation and adjusted or corrected as required.

l). Food Service

i). Doors and hardware

(1) All food service doors, hatches and quarter-turn latches shall be functionally checked on each car to verify: smooth movement, latching, locking, correct latch engagement/release, non-interference, freedom from sticking or excessive looseness (rattles) and proper switch activation. Secure gates and latching mechanism shall be tested for correct operation.

ii). Food service appliance operation

(1) Each appliance shall receive a functional test to verify operation. Coffee makers shall operate through a complete brew cycle.

iii). Other Devices

(1) The unit shall be tested to verify proper operation of all controls, limit switches, timing and safety functions.

iv). Refrigeration/chiller

(1) Refrigeration equipment shall undergo testing to verify:

(a) Freedom from refrigerant leaks (evacuation and "sniff test" if split system)

(b) Operation/calibration of each control device: pressure switches, thermostat, etc. - operation of each device in the defrost function: thermostats, heaters, timer, etc. - correct superheat setting

(c) No-load pull down time for each refrigerated space

(d) Correct thermostat settings for each refrigerated space

(e) Correct tracking of chiller thermometer with chilled space

(f) Correct operation of environmental controls for the condenser (if split system): damper, room exhaust fan, etc.

v). Point of Sale System

(1) Correct operation of all functions

m). Water and Waste

i). Water and waste piping

(1) All car water and waste piping shall be pressure tested for leaks on all cars. Testing may be done in sections if desired. Movement of all valves and freedom from interference shall be checked. All faucets, showers, and drinking water spigots shall be tested for correct temperature adjustment range, water flow rate and freedom from splashing. All sinks, showers, and drinking water alcove shall be tested for proper operation.

ii). Water fill and capacity

(1) Starting with the water tank empty, the water tank shall be filled while measuring the fill time and water pressure of the fill line statically. After the tank has been filled, it shall be drained while measuring the time, using the tank manual drain valve and the volume of water leaving the tank measure to verify the effective water tank capacity, The use of Amtrak SMP #47601 “Water Tank Flush” shall be demonstrated.

iii). Water raising and distribution operation

(1) The water raising system of each car shall be tested, including the correct operation pressure of each regulator in the distribution system.

(2) Freedom from backflow shall be demonstrated to verify that when the water tanks are filled and then air slowly bled off from the main reservoir, no water back-flows from the water tanks into the water-raising system.

(3) (If equipped) Demonstration of the Ozone water treatment system by use of analysis of water samples before and after treatment via the appropriate NSF/ANSI water treatment method.

iv). Water fill stations

(1) Correct operation shall be verified, including chilled water temperature and timing, and operation of the controls.

v). Water heater operation

(1) Correct operation of each water heater shall be verified, including thermostat and hot water delivery temperature. If a mixing valve is used, correct adjustment shall be verified with input supply water at two different temperatures. Polyphase water heaters shall have the correct current value of each phase verified.

vi). Toilet operation

(1) Correct operation shall be verified on each toilet of each car though 1000 cycles in a qualification test. This shall include verification that each control device is calibrated and operates correctly: pressure switches, level controls, switches, water and air pressure regulators, solenoid valves and indicators. Timing of each step of the flush sequence shall be checked. Operation of the collection tank controls, including drain and rinse cycles shall be tested. Freedom from vacuum leaks shall be verified to OEM recommendations.

vii). Waste System

(1) Waste system performance shall be verified by the following:

(a) Performance: flush times, vacuum attained and maintained, etc.

(b) Controls

(c) Safety controls

(d) effective capacity of the waste tank

n). Diagnostics and Test Equipment (where equipped)

i). The Contractor shall demonstrate fully functionality of the diagnostic and test equipment. The Central Diagnostic Unit shall display, record, and upload any failure within the car.

ii). The Contractor shall develop acceptance and qualification tests for all systems identified as diagnostics and test equipment, including but not limited to the central diagnostics unit, the portable test units, the car temperature monitoring, and any bench testers. The tests shall verify all features and components are in compliance with the requirements of this Technical Specification.

(1) Verification that all faults that are configured for all sub-systems to be displayed on the CDU are displayed properly.

(2) Verification that all faults that are configured to be reported to the CDU are so reported.

(3) Verification that fault logs of all systems are accessible from the maintenance screen of the CDU in car.

(4) Verification that the software version numbers on all non-communications subsystems in the car can be accessed from the CDU.

(5) Verification that all software changes made as a result of the CDU Factory Qualification Test have been implemented on all systems connected to the CDU.

(6) Any faults from each and every system shall be simulated and demonstrated to display properly.

(7) Simulate fault data upload and alarming.

(8) Access to system level fault information and current status parameters through the CDU terminal, the PTUs, and the online portal.

(9) Proper operation of the data recording functionality.

(10) Verification that all PTUs and bench test equipment properly connect, function, and diagnose system-level equipment. Fire and Smoke Detection

(11) Tested per manufacturers specifications

o). Completed Car

i). Weighing

(1) The Contractor shall weigh each car at the time of shipment. All cars shall be measured empty and dry, with no fresh water, waste or consumables, and with no leftover tools or materials from the production process. All parts shall be properly installed on each car prior to weighing. Each car shall be weighed by measuring the weight on each of the car's wheels. A weighing device which provides a permanent printed record of the weight shall be used, and the weight tickets shall be submitted to Amtrak and copies thereof included in the vehicle history book.

(2) The weighing device shall be maintained within an accuracy of 0.2%. If the weighing device is electronic, it shall be calibrated at intervals of no more than 60 days. If mechanical, it shall be calibrated immediately prior to weighing the first car and annually thereafter.

(3) Any total car weight deviation in excess of the maximum allowable weight specified in Chapter 1, or any car with a weight distribution not in compliance with the provisions of Chapter 1 must be documented on a nonconformance report and explained to the satisfaction of Amtrak prior to shipment. Amtrak may require that the Contractor reduce the weight of any cars exceeding the overall weight or weight distribution limits.

ii). Clearance tests

(1) Each car shall be measured to prove compliance with the Contractor's approved clearance diagram for the as-built car configuration, to verify that the car clearances while in operation will meet the requirements. In addition, the centering of the carbody with respect to the trucks shall be measured and

corrected if necessary. The completely assembled truck shall not exceed the clearance limits specified between the truck and the carbody, and the limits between the truck and the rail.

20.9 Acceptance Tests

a). Car Acceptance Tests

i). The tests specified in this Chapter are to be performed by the Contractor on Amtrak railroad, or as otherwise designated by Amtrak. The tests shall be satisfactorily completed as a condition of acceptance. All tests shall be performed on all cars (including the pilot cars) unless otherwise specified by Amtrak.

ii). After receipt of each car at Amtrak site and before it is operated, it shall be carefully inspected jointly by Amtrak and the Contractor, and any part, device or apparatus which requires adjustments, repair or replacement shall be noted by the Contractor who shall make such adjustment, repair or replacement before acceptance testing is begun. All expenses and costs incurred in any necessary removal of cars from the designated delivery point and their return there for correction of defects shall be borne by the Contractor.

b). Functional Tests

i). A complete, orderly and comprehensive check of each and every vehicle system shall be made to verify its proper operation before commencement of revenue operation. A set of diagnostic test equipment owned by the Contractor of the same design provided to Amtrak shall be used for these tests to the extent possible, but devices bypassed by the use of the DTE's (door open and door close buttons for example) shall also be checked. All aspects of wayside communications shall be tested for proper operation. All software files required for the destination sign system, automatic vehicle location system, GPS and other communications systems shall be loaded and verified for proper operation.

c). Road Brake Test/Stop Distance and Coast-Down

i). The test shall be conducted on a consist to be determined by Amtrak based on configurations selected, ready to run, both with no passenger load, to simulate actual operational performance. Other configurations may be proposed. Selected car brakes shall be disabled so as to provide a total of 80% braking capacity on the passenger cars. The test shall be conducted on flat, tangent track, with the brake application made at the same site for each test run. If necessary, to conduct the test on a slight grade, the entire braking distance shall occur at constant grade; calculations shall be made to correct the stop distance for the effect of the grade. The test shall be conducted in both directions: locomotive leading and trailing. Train brake pads/ shoes shall be worn in before conducting the test.

ii). The full set of tests shall be conducted in the following conditions:

(1) Full Service, Blended Braking

(2) Full Service, Friction Braking Only

(3) Emergency, Friction only

(4) Speeds of 125, 110, 90, 75, 60, 45, 30 and 20 mph

iii). Two stops shall be made from each speed, with sequence controlled to minimize wheel heating. Wheel and disk temperatures shall be measured to verify adequate brake system thermal capacity and to ensure the stop distance is not influenced by beginning the test with hot brake components. Thermal imaging equipment shall not be used for this.

iv). If time and track availability permit, a coast-down test shall also be conducted to determine non-braking frictional losses of the train. The test shall be conducted from the rated speed of the train, with the train allowed to coast down to a near stop.

v). Instrumentation shall include:

(1) Means to determine distance

(2) Train Speed

(3) Brake cylinder pressure of each truck on the locomotive/Multiple Unit

(4) Blended brake current on locomotive/Multiple Unit

(5) Brake cylinder pressure of each truck

(6) Longitudinal acceleration of train

(7) Switch to detect movement out of release position of automatic brake valve from the locomotive

(8) Brake pipe pressure on both ends of the train

vi). At the completion of this test, the brakes shall be reactivated, except those on the instrumented wheelsets.

20.10 Post-Delivery Testing of Pilot Cars with Other Equipment

a). After the Pilot cars have been delivered to Amtrak's facility and have undergone and passed all applicable acceptance inspections and tests, it shall be combined with other rail equipment as designated by Amtrak to verify operational, compatibility and coupler tests with other car and locomotive types that may constitute part of Amtrak's existing rail service. The specific types of rail equipment with which the Pilot Cars shall be tested for compatibility includes:

i). P32, P40, P42, ACS-64, SC-44, ALC-42 and ALC-42E Charger locomotives, as owned by Amtrak.

b). All trainline functions shall be tested and verified, including:

i). End of train identification

ii). Locomotive control

iii). HEP, power distribution, and power balancing

iv). Air brake application and release in ECP and Emulation

v). EMI/EMC requirements

c). The pilot test train shall be tested to confirm compliance with track geometry requirements, including curve and crossover negotiation. All car-to-car connections shall be verified as performing in compliance with the track geometry requirements, including:

i). Carbody clearance

ii). Truck swing

iii). Coupler swing

iv). MU, COMM, DTL/ETB, ECP, and HEP cables

v). Brake pipe and main reservoir air hoses

vi). Gangways, Diaphragms, buffer plates and curtains

vii). ECP brake inter-car cables

d). All equipment shall be tested to be fully functional on Amtrak-supplied wayside HEP power.

20.11 Reliability and Post-Delivery Tests

a). The complete operational car fleet shall be monitored by the Contractor to demonstrate conformance with the reliability requirements.

b). On a monthly basis, the Contractor shall issue a report detailing the performance of the car fleet and its equipment with regard to maintenance actions (which shall be detailed in an appendix by type) and the calculated period and cumulative Mean Distance Between Failures (MDBFs) and Mean Time Between Failures (MTBFs) as appropriate. Any component(s) or system(s) found to be causing and/or related subsystem and/or whole car MDBF/MTBF to fall below the required performance level shall be subject to redesign and modification. During the period such efforts are carried out, failures due to these component failures shall not be counted. However, upon completion, the modified car and/or subsystem shall be monitored for a period of no less than an additional 6 months or the remaining base period, whichever is greater, and the MDBF/MTBF shall be acquired. If the use or failure of the component or system is weather or temperature related, the 6 month period shall include those calendar months during which such use or failure is incurred. It shall be understood that the total test time period shall not be

assumed to be 365 consecutive calendar days in the event that modification is required.

c). Following a satisfactory completion of the test for all subsystems, the Contractor shall issue a final report summarizing the results and with all interim reports appended for completeness. **[CDRL 20-07]**

i). If a satisfactory completion cannot be obtained before the end of the specified warranty period, the Contractor and Amtrak shall resolve any outstanding issues in accordance with the Contract terms and conditions.

20.12 CDRLs

CDRL	Description	Due
CDRL 20-01	Car testing matrix	NTP + 90 days
CDRL 20-02	Master Test Plan	First submittal NTP + 180 days
CDRL 20-03	Test Procedures	Per Figure 20-1
CDRL 20-04	Test Results (Reports)	Within 5 days of test completion
CDRL 20-05	Contractor shall provide a single volume incorporating all required engineering tests associated with the pilot program, all copies of all test procedures, reports and approvals.	30 days after successful completion of testing
CDRL 20-06	All material certification and proof-of-design test procedures and reports in a single binder for each car type.	Prior to shipment of each car type
CDRL 20-07	Reliability and Post-Delivery Test Report	30 days after successful completion of testing

* End of Chapter 20 *

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

21. Tools, Consumables and Spare Parts

Revision 2

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21.1 Overview

a). This Chapter details the requirements for the Contractor to identify and provide the specialized tools, spare parts and consumables that will be needed to operate, maintain and repair the cars to be delivered to Amtrak.

b). Most of this Chapter shall be covered in the Technical Support, Spares and Supplies Agreement (TSSSA) SOW; however, in the event that the TSSSA is not executed or upon termination of the TSSSA, the following sections shall be the responsibility of the Contractor.

c). The detailed information identified in the following sections will be provided to Amtrak in a timely fashion during design review or prior to the first batch of cars delivered, but the physical delivery of materials where applicable shall only occur in the absence of or at the conclusion of the TSSSA.

d). Amtrak shall retain all specialized tools, consumables, spare parts and any subsystem mock-ups as detailed in this Chapter.

e). All information required in this Chapter shall also be included in the appropriate operating and maintenance documentation as identified in Chapter 23, including:

i). Operating Manual

ii). Running Maintenance Manual

iii). Heavy Maintenance Manual

iv). Illustrated Parts Catalogue

v). Troubleshooting Guide

21.2 Specialized Tools

a). The Contractor shall provide to Amtrak a complete set of all specialized tools, gauges, meters, diagnostic equipment (including laptop computers), etc. for each of the seven (7) Amtrak shops that will be maintaining the single level fleet that will be necessary to operate, maintain, inspect, test, troubleshoot and repair all car type configurations or subsystems throughout their forty (40) year design life.

b). These tools and equipment shall be delivered to Amtrak at all specified maintenance locations and shall be delivered to Amtrak prior to the Conditional Acceptance of the first car of each type, but no sooner than thirty (30) days prior to the submission of the first car for Conditional Acceptance.

c). All specialized tools shall be included in the base warranty as specified.

d). See Chapter 24 for additional details regarding portable test equipment.

e). Any diagnostic equipment will include spare copies of all software and source code licensed to Amtrak.

i). The license shall allow Amtrak to modify and duplicate this code without limit.

f). Throughout the vehicle design process, the Contractor shall work to minimize the number of special tools required for the maintenance of the vehicles.

g). As part of the design review process, the Contractor shall submit a list of specialized tools and drawings if applicable and diagnostic equipment that will be provided to Amtrak.

i). This list shall identify the item description, manufacturer, part number and purpose, and shall include a cross-reference to the maintenance manuals as to the tasks that require the use of the tools.

ii). This list shall include all specialized tools and diagnostic equipment required to operate, maintain and repair the cars throughout their design life, and shall include:

(1) Specialized tools for inspecting, repairing, removing, installing, maintaining or measuring components and systems on the cars;

(2) Diagnostic equipment to troubleshoot problems, determine component or system status or condition, or interpret diagnostic information;

(3) Portable computer equipment required to view, change or monitor the operating parameters, downloadable recorded data, service history or digital programming for computerized or microprocessor-controlled components or systems; and

(4) All cables, connectors, software, power supplies, carrying cases and peripherals as required for use with the portable computers or Portable Test Unit (PTU).

(5) All diagnostic download and programming software shall be provided in the Microsoft Windows professional level operating system format identified by Amtrak with no use restrictions, so that Amtrak can install the software on additional computers as needed.

h). The Contractor shall provide drawings, schematics, specifications, part numbers and prices for all special tools and maintenance equipment to enable Amtrak to purchase additional quantities.

i). Drawings shall be provided for any component or special not produced by a supplier not owned in whole or part by the Contractor.

i). Drawings shall provide sufficient information to facilitate the manufacture of the required components or special tools should the manufacturer cease to support the component or special tool.

j). During the production of the pilot cars, the Contractor shall demonstrate the usage and validate the successful operation of each proposed special tools.

i). During this validation, Amtrak shall identify any of the proposed special tools that are determined to be unsuited or incapable of performing their intended function.

ii). The Contractor shall redesign such tools until they can successfully serve their intended purpose.

k). The Contractor shall supply complete sets of each type of bench type shop test equipment to each of the seven (7) facilities that will be maintaining this Single Level fleet.

l). Training on the use of the Special Tools shall be included in the delivered Training Program (See Chapter 23).

21.3 Consumables

a). The Contractor shall provide a list of all service consumables needed to support the cars throughout its service design life.

i). Consumables are identified as those items replaced as a function of normal operation, whether the replacement is on a periodic basis or as they wear out.

ii). This list shall be provided as a component of the final design review. **[CDRL 21-01]**

b). This list should include items such as but not limited to:

i). Brake pads and shoes

ii). Filters - Heating, Ventilation and Air Conditioning (HVAC), air, water

iii). Lamps/Light Emitting Diodes (LEDs), marker lamps, indicators lamps

iv). Fuses, Diodes and Resistors

v). Air hoses

vi). All rubber / polymer components

vii). Shock absorbers

viii). Air brake and other pneumatic component overhaul kits

ix). Truck and draft gear elastomers

c). This list shall include the following information as it relates to these parts:

i). Contractor part number

ii). Part description

iii). Original Manufacturer name

iv). Original Manufacturer part number

v). Quantity required by car type

vi). Frequency of replacement

21.4 Spare Parts

a). As a part of final design review, the Contractor shall provide to Amtrak a list of strategic spare parts that Amtrak should acquire and maintain to support the fleet of equipment after the end of the warranty period. **[CDRL 21-02]**

b). This list shall include, but is not limited to the following:

i). Parts that are critical to the safe operation of the equipment;

ii). Parts with a moderate to high failure rate, based on the Contractor's reliability analysis (see Chapter 4);

iii). Parts located on the vehicle exterior or undercar and therefore subject to damage from debris strikes or accidents;

iv). Parts installed in a high-wear environment; and

v). Parts that require troubleshooting and repair off of the car, such as electronic components or LRU assemblies.

c). This list shall include the following information as it relates to these parts:

i). Contractor part number

ii). Part description

iii). Original Manufacturer name

iv). Original Manufacturer part number

v). Quantity required by car type

vi). Shelf life/maximum storage period

vii). Recommended quantity to have on hand

d). The Contractor shall be responsible to provide replacement parts for those failing under the terms of the warranty.

i). Amtrak shall not be responsible for supplying replacement parts to the Contractor for the purposes of fulfilling warranty provisions.

ii). Amtrak shall not be responsible for supplying cores or subcomponents to the Contractor for the purposes of fulfilling warranty provisions.

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21.5 CDRLs

CDRL	Description	Due
CDRL 21-01	List of all service consumables needed to support the cars throughout its service design life	FDR
CDRL 21-02	List of strategic spare parts recommended to support the fleet of equipment after the end of the warranty period	FDR

* End of Chapter 21 *

Amtrak Universal Single Level Fleet Replacement

Technical Specification

22. Shipping Preparation

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22.2 Requirements for Shipping Vehicles 22-1

22.1 Overview

a). This Chapter describes the requirements for preparing completed cars for shipment from the Contractor's final assembly facility to the Contractor's field site, where vehicle acceptance will take place by Amtrak.

b). All vehicles must receive approval for shipment from Amtrak before they can be shipped to the field site. The minimum Car shipment quantity is described in Exhibit V and the Car types must be approved by Amtrak for each batch shipment. The batch shipment will provide Amtrak with enough cars of each type to build a revenue Consist. A shipment list for car types will be provided to the Contractor.

c). The Contractor is responsible for all costs and arrangements associated with the shipment of the completed vehicles to the Contractor's field site.

d). The car clearance for all cars shipped shall be verified with all involved railroads for the delivery routing.

22.2 Requirements for Shipping Vehicles

a). The vehicle must be delivered from the factory with all outstanding issues resolved. Amtrak requires that the field delivery location not serve as an extension of the manufacturing process. It is acknowledged that certain tasks may arise and require completion in the field, including those identified during receiving inspection, vehicle commissioning, conditional acceptance inspection, or through FMIs opened after shipment.

b). All completed vehicles shall be prepared for shipping as follows:

i). All hoses and inter-car cables shall be connected between vehicles.

ii). A Single Car Air Test shall be successfully conducted within 30 days of shipment.

iii). Brake control valve selector plate shall be set to graduated release if being moved in passenger service and a transport control valve shall be installed if required for normal Brake Pipe brake control without HEP electrical power being supplied to the cars (see Chapter 9).

iv). Automated Equipment Identification (AEI) tags shall be properly programmed and installed. The Contractor is responsible for ensuring that the car's technical data is entered into the Umler/EMIS (Equipment Maintenance Information System) system prior to the release of the car (see Chapter 6).

v). New air filters shall be installed in Heating, Ventilation and Air Conditioning (HVAC) system (see Chapter 10).

vi). All required inspections must be complete, including inspections and approvals from the FRA, the FDA and Amtrak.

vii). As part of the shipping process, the following documents must be completed and signed, and be installed in the document holders in each car and in the cab of the locomotive as applicable.

(1) Amtrak MAP 100, Equipment Condition Report

(2) Amtrak MAP 1173, Class 1 Brake/Calendar Day Test

(3) Amtrak MAP 10C, Passenger Car Daily Inspection

viii). The Water and Waste systems, and Food Service Area equipment shall be drained, blown out with compressed air and winterized (see Chapter 17). All water fill ports shall be tagged as out of service.

ix). All doors and windows shall be closed but means shall be provided to access the handbrake during shipment.

x). Shipping labels and warning signs shall be applied as needed (such as do not hump, do not couple to shelf couplers, instructions for operation of parking brake, etc.)

xi). Loose jumper cables shall be included for shipment (see Chapter 15).

xii). The Contractor shall perform other shipping-related tasks as required by Amtrak.

xiii). The Contractor shall comply with the requirements of the Association of American Railroads (AAR) Specification M-1006 and Recommended Practices RP-2001 and RP-2002 regarding railroad shipping information and shall be considered the Point of Contact for additional information.

c). The following shall be set up at the discretion of Amtrak in accordance with the requirements for each shipment of cars:

i). If HEP and main reservoir trainlines are being used for shipment, fresh water may be supplied from the potable water tank for use of the toilet system while in transit. If no water is needed, the tank shall be drained and all water supply lines shall be blown dry and tagged.

ii). All circuit breakers shall be on. The main 480VAC Head End Power (HEP) breaker may be on if power will be needed while the car is in transit, or shall be off if no power will be required. Battery power may be needed for wheel slide protection during shipment.

* End of Chapter 22 *

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

23. Training and Documentation

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23.1 Overview

a). This chapter describes the requirements for the development and delivery of project documentation and for the implementation of a post-delivery training program.

b). The Contractor shall be fully responsible for the completeness, accuracy and readability of all documentation, and for ensuring that these documents and the associated parts, components, systems, subsystems, vehicles and the operation thereof meet the specification requirements for the contractually required duration.

c). The Contractor shall develop and provide a training program that accurately and completely reflects the requirements of the manuals. **[CDRL 23-01]**

i). The training program shall familiarize operating, mechanical, supervisory and administrative personnel with all aspects of the operation, inspection, maintenance, repair and supply of parts for the cars.

ii). The training program shall be structured and implemented so that Amtrak and any designated maintenance and/or operations providers have access to all necessary resources to properly and successfully operate, maintain, repair and administer the equipment as required by Amtrak, the Contractor, the FRA and others.

23.2 General Requirements

a). Organization

i). The material in the manuals, troubleshooting guide, and the illustrated parts catalog shall be organized and sequenced with a standard numbering system or alternative numbering system as approved by Amtrak.

(1) Chapter numbers shall be consistent for all documents.

ii). A complete table of contents shall be given at the beginning of each publication, and a complete page-numbered index at the end.

b). Illustrations

i). Sharp, clear drawings shall be used throughout the documents for illustration.

(1) Photographs may be used only where explicitly approved by Amtrak.

c). Language

i). All correspondence, drawings, data, manuals or other written communications pertaining to this Contract shall be in the English language.

d). Dimensions

i). All dimensions shall be shown in standard imperial units of inches and decimals, with a metric equivalent shown in parentheses adjacent to the imperial dimension.

ii). If a component or subassembly uses metric units as the primary system of measurement, then imperial equivalents shall be provided in parentheses.

e). Updates

i). As information becomes available and changes occur, the Contractor shall incorporate the changes and supply the information in updated electronic editable and Portable Document Format (PDF) files in an organized, timely manner based on a regular schedule to be approved by Amtrak.

ii). Each updated information submittal shall be accompanied by a file containing a revised list of effected pages for the manual set being changed.

f). Engineering Change Service Bulletins (ECSBs)

i). Engineering changes that affect any potential safety issue, or may significantly affect car operation in scheduled service, shall be published in the form of an Engineering Change Service Bulletin (ECSB).

ii). ECSBs shall be used in the interim until the official changes in the operator's manual, maintenance manual and illustrated parts catalog have taken place.

iii). The creation of ECSBs shall be included within the Contractor's engineering change procedures and engineering change proposal system.

iv). ECSBs shall be stand-alone documents, provided in both editable document and PDF formats.

v). Each ECSB shall detail the reason, instructions and illustrations to make the change. Associated parts information shall also be included.

vi). A system to control ECSBs shall be developed between the Contractor and Amtrak to control ECSBs, such as using note tools on the existing electronic PDF versions and/or the development of master lists of outstanding ECSBs.

g). Contractor Responsibility

i). The Contractor shall provide documents such as drawings, SolidWorks models, photographs and a family of operating and service manuals which shall provide Amtrak with the information necessary to properly operate and provide all maintenance functions for the vehicles.

ii). These include drawings and manuals to safely and properly conduct:

(1) Operation

(2) Service and inspection

(3) Troubleshooting

(4) Running maintenance

(5) Heavy repair/overhaul (vehicle and system/component level)

(6) Part identification (to the lowest repairable level)

(7) Wreck repairs

(8) Modification of equipment (documenting as-built configuration)

iii). All publications must be reviewed in detail by the Contractor to ensure completeness and accuracy of information and quality prior to any submittal to Amtrak for approval.

h). Rights To Technical Data

i). The Contractor and all of its subcontractors shall grant to Amtrak in connection with this Contract the right to use, duplicate or disclose, in whole or in part and without charge, all technical data required by Amtrak to install, operate, understand, maintain, modify, replace, test, repair or overhaul the cars and their equipment.

(1) This shall not include financial information or information of a contract administrative nature.

ii). Amtrak shall not disclose proprietary information and data being supplied under this Contract except for the limited purpose of obtaining individual part repairs or specialized testing or repair services outside the ability of its shops, and then only on a confidential basis.

iii). Technical data means information of a scientific or engineering nature, regardless of form or characteristics, to be furnished by the Contractor pursuant to this Contract. Examples are:

(1) research and engineering data,

(2) engineering drawings and associated lists,

(3) as-built drawings (regardless of restrictions contained therein),

(4) specifications,

(5) standards,

(6) process sheets,

(7) manuals,

(8) technical reports,

(9) catalog item identifications or related information.

iv). The Contractor shall not patent or copyright any original materials or information created by this procurement which will be submitted to either the Engineer or Amtrak, as per Federal procurement regulations.

23.3 Mock-Up Training Cars

a). As an option, the Contractor shall be responsible to provide instructional full system mock-ups in the design of at least four full training cars (one Coach, one Accessible Sleeper, one Diner and one Café) that are fully functional and can be used for training and troubleshooting for repair personnel and onboard crews, independent of any spares required for car maintenance.

b). The systems shall be kept up to date with all applicable software and hardware during the warranty time frame.

c). Applicable systems shall include at a minimum:

i). Air brake

ii). Waste/water/toilet

iii). HVAC

iv). Door Systems and controllers

v). On-Board Wheeled Mobility Device Lifts and Controller

vi). Trucks

vii). Diagnostic system

viii). Roomette and Sleeping Modules

ix). Food Service equipment including appliances and carts

x). Seats and other seating accommodations

xi). Lighting

xii). Communication System

xiii). Digital Technology Systems

d). The training cars should be provided at a central location for training purposes determined by Amtrak.

23.4 As-Built Drawings

a). General

i). The Contractor shall provide Amtrak with a full set of sub-component, component, system, arrangement and installation drawings, schematics and

specifications for all parts and assemblies as provided on each type of car, from both the Contractor and all of its suppliers.

(1) These drawings shall be in an Amtrak-approved 3-D CAD format utilizing the latest major version of Solid Works (SLDDRW for Mechanical and DWG for Electrical) which includes a SMART searchable index and all material characteristics.

ii). This also includes providing a complete set of all as-built drawings for top assemblies, subassemblies and detail drawings used to manufacture all equipment used therein.

(1) All assemblies and subassemblies are to be fully detailed.

(2) Outline drawings of boxes, components and devices will not be sufficient.

iii). The drawing package shall also include:

(1) Drawings of every special gage, tool, jig or fixture used to correctly install these items or to maintain the cars.

(2) Circuit board level detail, installation and connection drawings.

(3) General arrangement drawings for each car type, color schedules and clearance drawings.

iv). Each assembly, subassembly and arrangement drawing shall include a complete bill of material and parts list describing all items (including weight, original component manufacturer name and part number of the actual supplier of the part) that form a part of the assembly, and the next higher assembly.

v). A drawing template shall be approved by Amtrak prior to submittal of any drawing.

(1) The Contractor's title block must include wording that explicitly grants Amtrak full rights to use the drawing contents.

vi). Electrical schematic drawings shall indicate all wire numbers, references to other drawings of any and all manufacturers to which connections are made, nominal voltages, currents and frequencies, significant resistance values, and the rating of all loads.

vii). Devices shall be labeled in agreement with the identification appearing on the actual device, and their locations on the cars shall be shown.

viii). Pneumatic schematic drawings shall be prepared in a similar fashion.

ix). All dimensions shall be shown in standard imperial units of inches and decimals, with a metric equivalent shown in parentheses adjacent to the imperial dimension.

(1) If a component or subassembly uses metric units as the primary system of measurement, then imperial equivalents shall be provided in parentheses.

b). Drawing Availability

i). Preliminary as-built drawings needed to perform maintenance, repairs, testing or measurements shall be supplied 180 days prior to the delivery of the first completed batch of cars. **[CDRL 23-02]**

ii). A complete set of as-built drawings shall be delivered within 30 days after the delivery of the first batch of cars. **[CDRL 23-03]**

iii). A complete bill of material for each car type, in standard 8.5 in. by 11 in. size, and electronically, covering all major components and hardware, shall also be provided within 30 days after the completion of the last batch of cars of the base order.

iv). Updates to any drawings must be provided to Amtrak once every quarter (3 months) unless otherwise directed by Amtrak until the final delivery of cars.

v). The Contractor shall make available, for the life of the equipment, and without charge, hard copy drawings or electronic files that are required by Amtrak to conduct equipment modifications, conduct overhauls or make extraordinary repairs, such as those arising from accidents, etc. The contractor shall upload all drawings to the Enterprise Product Data Management (EPDM) system, Product Lifecycle Management (PLM) system and/or the latest document control system utilized by Amtrak at the acceptance of the first batch of cars.

vi). All electronic and hard copies of drawings shall be marked with a statement of “Printed Documents are Uncontrolled” to ensure personnel check the latest electronic version for updates to any drawing. The contractor shall also provide a complete set of electronic drawings in Portable Document Format (PDF) within 30 days after the delivery of the first batch of cars. PDFs shall maintain an electronic parent/child relationship to the associated Solid works drawing.

c). Drawing Originals

i). The Contractor shall submit to Amtrak for review and approval, the as-built drawings and 3-D CAD models of all assemblies, sub-assemblies and arrangements in accordance with this chapter. These shall be submitted as follows:

(1) within 30 days after completion of first car of each base type, and

(2) after completion of all modifications

ii). If the Contractor decides not to maintain the drawing originals, they shall be supplied to Amtrak at no cost.

iii). Likewise, if the Contractor terminates operations, all drawings pertaining to this project, CAD files or any other Amtrak approved media shall be provided to Amtrak free of charge.

d). Electronic Delivery

i). Within 30 days of the delivery of the last car of the base order, the Contractor shall provide an electronic file of all the drawings, 3-D CAD models and Finite Element Models (FEMs), the bill of material, as-built specification training materials and operation and maintenance manuals and car history books. **[CDRL 23-04]**

ii). The car number(s) shall be included in the filing system for car-specific data such as the history books.

23.5 Photographs

a). Photographs of Car Assembly

i). For each car type, the Contractor shall take not less than 50 different digital color photographs, large format, showing the progression of vehicle construction. **[CDRL 23-05]**

ii). Special emphasis shall be made to illustrate hidden areas which are later concealed, such as carbody structure, floor pans, ceiling structure, ducting, and electrical lockers.

iii). The views shall be approved by Amtrak.

b). Photographs of Completed Cars

i). For each car type, the Contractor shall take not less than 50 different digital color photographs, large format, showing the interior and exterior of the fully completed and painted vehicle. **[CDRL 23-06]**

ii). Photographs shall include at least the following views of each car type:

(1) Exterior full broadside view,

(2) Exterior 3/4 side view,

(3) Exterior top,

(4) Exterior rear view

(5) Overall interior view

(6) Detail views of the passenger area interior surfaces,

(7) All lockers,

(8) Rest room details,

(9) Galley,

(10) Vestibules,

(11) Open and closed side and body end doors,

(12) Water and waste servicing areas.

(13) High quality exterior views (broadside and 3/4 side view) of each car type against a non-distracting background, suitable for publicity purposes.

iii). The photograph views shall be approved by Amtrak.

c). Digital Format

i). All photographs shall be taken in digital format (jpeg), at high resolution (2400 x 3000 pixels).

ii). All photographic files will be submitted to Amtrak within 30 days following completion and acceptance of the first car of each base type.

23.6 Conformed Specification

a). Within 30 days after completion of each car type, the Contractor shall update and revise this Specification to provide an as-built specification and contract document. **[CDRL 23-07]**

b). The revised document shall require Amtrak review and approval.

c). One reproducible electronic copy in Adobe PDF format of the approved version shall be provided.

d). The conformed specification shall include all changes to the specification made via approved waivers, variances and change orders.

e). Subsequent changes to the specification made prior to the end of the warranty period shall require the conformed specification be revised.

23.7 Manuals

a). General

i). The Contractor shall provide a complete family of operating and maintenance manuals. The following manuals are required:

(1) Operator’s Manual

(2) Service and Inspection Manual

(3) Troubleshooting Guide

(4) Running Maintenance Manual

(5) Heavy Maintenance Manual

(6) Integrated Schematic Manual

(7) Illustrated Parts Catalog

ii). The manuals shall include full descriptions of all systems and components requiring maintenance or servicing.

iii). Description of systems shall be included in the nomenclature of all digital files.

iv). The manuals to be supplied shall contain information required for effectively understanding operation of all car types as well as performing scheduled maintenance including general servicing, lubrication and inspections, system equipment testing, troubleshooting and adjustments, and repair/replacement of components and major subassemblies.

v). The Contractor is responsible for ensuring that subcontractors comply with this Specification and that they also provide the appropriate manuals. Contracts between the Contractor and subcontractors shall include appropriate language to ensure these documents are provided as required.

vi). All manuals shall have at a minimum, the following information on the front cover:

(1) Contractor name

(2) Amtrak name

(3) Type of equipment

(4) Car numbers

(5) Date and level of revision

vii). Contractor manuals shall be provided electronically in an editable Adobe PDF format or other Amtrak approved language.

viii). The front of each volume of any manual type shall include a listing of the Chapter numbers and title for the complete manual.

b). Manual Review and Availability

i). Manual Development Plan

(1) The Contractor shall develop a master plan and schedule for the development and completion of the manuals. **[CDRL 23-08]**

(2) It shall include the Contractor's plan for the development and acquisition of the manual content from suppliers and vendors, the schedule for the major completion points of the manuals, and a

method to track the development of each manual that can be reviewed at the periodic project management meetings.

(3) This manual development plan shall be submitted to Amtrak no more than 180 days after NTP.

ii). First Draft of Manuals

(1) A full set of first draft manuals, including those provided to the Contractor by suppliers, shall be submitted for Amtrak review no less than 90 days prior to the completion of the first car. **[CDRL 23-09]**

(2) If the manuals require revision, as determined by Amtrak, the Contractor shall revise and resubmit the draft manuals until all requirements are met.

(3) The first car shall not be released from the Contractor's facility until Amtrak has approved the first draft of the manuals.

(4) The Contractor shall provide 10 full sets of manuals, in electronic format, to Amtrak prior to Amtrak acceptance of the first batch of cars.

c). Manual Updates

i). A digital copy of all manuals shall be provided and updated for the duration of the warranty period.

ii). Manual information shall be kept up-to-date with the car configuration and operation during the full period of the Contract.

iii). After delivery of the first car, and continuing through the end of the warranty period, should any changes to the car, components or maintenance requirements occur, the Contractor shall revise and update all affected manuals and shall submit hard and electronic copy manual updates to Amtrak.

iv). Upon the completion of the warranty period, the Contractor will issue 10 sets of finalized manuals to Amtrak, reflecting all changes made to the vehicles during production, delivery and operation, and the status of all cars at the time of warranty expiration. **[CDRL 23-10]**

v). Revisions to final draft and approved manuals shall be recorded on a control list in the front of each manual.

vi). The list shall be issued with each revision and shall show the date of each revision and the page reference. Updated lists and revisions shall be maintained in the manuals by the Contractor until the warranty period expires.

d). Work Management System

i). The manuals will be used electronically in Amtrak’s Work Management System (WMS) or successor maintenance tracking database.

ii). The Contractor shall work with Amtrak to ensure that this is implemented successfully. **[CDRL 23-11]**

e). Operator's Manual

i). The Contractor will develop operating manuals for use by train operating personnel, including the Engineer, Conductor and food service Lead Service Attendant (LSAs).

ii). Operator's manuals shall contain all information needed for the operation of each car type, including definitions giving nomenclature, function, location and operation of all indicators, controls, components and subsystems utilized in the operation of the equipment.

(1) This shall include preparing the equipment for operation, securing the equipment from operation and operation of each car type individually.

iii). Normal and rescue locomotive coupling/ uncoupling procedures to both ends of the cars shall be provided, along with coupling to equipment with completely dead batteries, and deadhead movement of equipment in freight train service.

iv). Emergency procedures and safety precautions of a specific nature applicable to the equipment shall be included.

(1) This shall include all passenger evacuation methods.

v). The manual shall give troubleshooting and diagnostic procedures sufficient to isolate faults and problems which are capable of repair by the operator and train crew, arranged in a format to allow ease of use under emergency and time-sensitive situations.

vi). The operator's manual shall be divided into chapters as follows:

(1) Introduction

(2) Communications

(3) Inspecting

(4) Operating

(5) Fault Isolation

(6) On-the-Road Repair

(7) General Description

vii). The fault isolation and on-the-road repair sections of the operator's manual shall include, in summary form, all fault isolation and on-the-road repair procedures. These two sections shall include:

(1) Index

(2) Safety instructions

(3) Instructions for communications during fault isolation

(4) Authorized fault isolation procedures

(5) Authorized on-the-road repairs

(6) Equipment location diagrams

viii). The operator's manual shall accurately portray and clearly illustrate all information required by the operator and train crew to correctly, efficiently and safely carry out their duties on the equipment in all possible configurations.

ix). Illustrations shall include layouts of the equipment, showing major components and controls referenced in the text and their locations on each type of car.

(1) This shall include all electrical, pneumatic, water and waste system cutouts and bypasses.

x). An alphabetical index of subjects and equipment not mentioned in the table of contents shall be provided.

xi). All operating conditions shall be taken into account by the manual's description of unit functions.

xii). A fault isolation section shall be provided to list all possible unit or system malfunctions that are detectable by the train crew without the aid of test equipment.

(1) This shall include fault codes and corrective information supplied by the diagnostic system.

(2) This information shall be presented in tabular format listing each symptom with corresponding potential causes, test, checks and corrective actions.

(3) The goal of these fault isolation tables shall be to allow the train crew to identify operational problems and, where possible, isolate faults from consists to car, car to system and, in some cases, from system to subsystem.

f). Service and Cleaning Manual & Maintenance and Inspection Manual

i). The Service and Cleaning (S&C) manual as well as the Maintenance and Inspection Manual (M&I) shall contain all pertinent information that operating and maintenance personnel will require in order to perform all periodic inspections on the vehicles as required by the Contractor, subcontractors, Amtrak, the FRA and FDA. **[CDRL 23-12]**

(1) All daily inspection items shall be in the S&C manual.

(2) As Amtrak transitions to Continuous Maintenance (CM), all inspections required during a periodic inspection period shall be included, i.e. those occurring every 92 days, every 184 days and annually (every 368 days) and shall be in the M&I manual.

(3) Inspections and servicing activities occurring on an interval that is not used by Amtrak may be included in the tasks shown for the next more frequent interval.

(4) The weight of each car type, and instructions for water system flushing and draining/winterization of the equipment shall be included in both manuals.

ii). The inspection tasks described in these manuals shall include, but are not limited to the following:

(1) Item or system requiring inspection

(2) Frequency or period of inspection

(3) Inspection procedure, including location and description of system being inspected

(4) Pass/fail criteria for inspection

(5) Special tools, conditions or other requirements for inspection to be performed

(6) Source of inspection requirement (Contractor, Amtrak, FRA, FDA, etc.)

(7) Reference for inspection requirement (CFR, maintenance manual, etc.)

iii). For both manuals, a summary table in order of frequency shall be provided for quick reference that lists the item or system, frequency, source and reference for all required inspections.

iv). The M&I manual will also provide complete instructions for all pertinent maintenance activities for the routine operation of the cars that are required every 92 days, or more frequently, including:

(1) Fresh water filling

(2) Waste tank draining

(3) Removal of trash and recyclables

(4) Installation and replacement of consumables

(5) Inspection and replacement of filter elements

(6) Cleaning and lubrication

(7) Replacement of brake shoes and pads

g). Troubleshooting Guide

i). This manual shall contain detailed troubleshooting procedures, including those requiring the use of diagnostic test equipment and those that do not require such equipment, for all major systems, subsystems and components in the following categories:

(1) Carbody

(2) Trucks

(3) Coupler and Draft Gear

(4) Brakes

(5) Door System

(6) Interior

(7) HVAC

(8) Lighting

(9) Communications

(10) Electrical System

(11) Food Service

(12) Water and Waste

(13) Digital Technology

(14) Emergency Equipment

(15) Diagnostics System

(16) Software and Microprocessors

(17) Cyber Security

(18) Onboard lifts

ii). This manual shall provide procedures for the identification, diagnosis and proper correction of car failures and malfunctions.

(1) Procedures shall be organized so that maintenance personnel can isolate faults down from consist to car, from car to system, and from system to subsystem, assembly, subassembly or component.

(2) These procedures shall include determination of the cause and isolation of the fault to replaceable parts, interface wiring or mechanical linkage.

(3) Diagrams of the relationships shall be provided to enhance comprehension.

(4) Troubleshooting procedural format shall include fault codes for each system with built-in diagnostics and fault information and corrective actions displayed by the diagnostic system.

(5) All fault codes are to be included, and diagnosed, in the troubleshooting manual.

(6) When there is more than one probable cause for a system or equipment malfunction, the most likely to have failed shall be considered first; however, consideration shall be given to accessibility and ease of replacement when the likelihood is equally shared by two or more causes.

iii). Each chapter of the troubleshooting procedures shall contain the following sections:

(1) Introduction, including general information, safety precautions, and definition of warnings, cautions, and notes with specific details

(2) Operational and functional system descriptions

(3) Troubleshooting

(4) Use of diagnostic test equipment

(5) Corrective maintenance procedures

iv). When there is more than one probable cause for a system or equipment malfunction, the most likely to have failed shall be considered first; however, consideration shall be given to accessibility and ease of replacement when the likelihood is equally shared by two or more causes. The troubleshooting and corrective maintenance procedures shall contain:

(1) Identification of the system covered

(2) A concise explanation of the troubleshooting format and how to use the procedure

(3) Test equipment and tools required

(4) Safety precautions that must be taken

(5) A reference to the supporting block diagrams

(6) Preliminary tasks that must be performed prior to initiating troubleshooting

v). When applicable, each section shall indicate and list the applicable safety warnings and precautions, test equipment required, special tools required, and any consumables required.

vi). The manual shall include a listing of every type of diagnostic software used on the equipment, including instructions for their use including cable connections.

vii). The manual format shall utilize diagrams and illustrations as required to enhance understanding.

viii). All procedures shall be proven in the field on the first car and shall be revised as necessary.

h). Running Maintenance Manual

i). Definition

(1) Running maintenance is defined as that maintenance that can be performed on the inspection track or does not require taking the equipment out of service.

ii). Contents

(1) The running maintenance manual shall contain an overview of the vehicle operation and a detailed description and analysis of the vehicle and its assemblies/subassemblies.

(2) The manual shall also contain, in a convenient form, all information required for on-car testing, troubleshooting, servicing and replacement of equipment down to the lowest level replaceable item.

(3) The running maintenance manual shall provide technicians with the maintenance procedures that are performed at the running repair level.

iii). Illustrations

(1) Running maintenance manual procedures shall be supported by illustrations. They shall be used to simplify, clarify or shorten the text.

(2) Illustrations shall be located on the same page or facing page of the text they support.

(3) A sequence of illustrations may be used in order to clarify or simplify a complex procedure.

(4) When one of several possible positions is described by text for a device, the position described shall be the same as the one shown by the illustration.

(5) Unless the location and access to the item is obvious, a locator view shall be included, or the assembly diagram provided at the beginning

of the chapter may be referenced to ensure that the equipment orientation is clearly described.

iv). Test Procedures

(1) Functional post-inspection testing and checkout test procedures shall be provided to verify serviceability or to detect failures of a system, subsystem, assembly, subassembly or component.

(a) Pretest setup instructions shall be included.

(2) Test procedures shall be used as a prerequisite for the generation of fault isolation procedures to fault isolate to a system, subsystem, assembly, subassembly or component.

(3) The types of tests that can be performed fall into the following categories:

(a) Operational Test

(i) An operational test procedure shall be provided, it is required to ascertain only that a system or equipment is operable.

(ii) These tests should require no special equipment or facilities other than that installed on the car and shall be comparable to the tests performed by the Operator.

(iii) It is not intended that the operational test of the unit meet the specifications and tolerances ordinarily established for overhaul or major maintenance periods.

(b) Functional Test

(i) A functional test procedure shall be provided, it is required to ascertain that a system or equipment is functioning in all aspects in accordance with minimum acceptable system or unit design specifications.

(ii) These tests may require supplemental support equipment and shall be more specific and detailed than an operational test.

(iii) The test shall contain all necessary information to ensure system or unit operational reliability, without reference to additional documents.

(c) System Test

(i) A system test procedure shall be provided, containing all adjustment specifications and tolerances required to maintain system and unit performance at maximum efficiency and within design specifications.

(ii) The test shall be self-contained and may duplicate other tests.

v). Instructions & Procedures

(1) Instructions shall be provided for the removal, addition, or rearrangement of car types.

(2) The weight and instructions for the lifting and jacking of each car type shall be provided.

i). Heavy Maintenance Manual

i). Definition

(1) Heavy maintenance is defined as the maintenance that may be performed on the shop track or one of the heavy maintenance tracks if the equipment is taken out of service.

(2) Heavy maintenance tasks will generally require more than one 8-hour shift to complete.

ii). Contents

(1) The Heavy Maintenance Manual shall contain a detailed description and analysis of all mechanical, electrical and electronic assemblies/subassemblies so that Contractor overhaul facilities can effectively and safely service, inspect, adjust, troubleshoot, repair, overhaul and test these assemblies.

(2) The Contractor and sub-suppliers shall provide all information needed for comprehensive repair and overhaul work, at least as comprehensive as that used by the suppliers' own service and repair shops, whether the car parts were manufactured by them or purchased from others.

(3) The manual shall provide information for the test, repair and overhaul of each repairable component of the assembly.

(4) No component shall be considered disposable or deemed non-repairable except where agreed to by Amtrak.

iii). Functional Descriptions

(1) The manual shall include descriptions of how each assembly/subassembly operates within the car system. Each shall include:

(a) Block diagrams

(b) Signal flow diagrams

(c) Simplified schematics

(d) Functional wiring and piping diagrams

(e) Completely detailed overhaul procedures

iv). Instructions & Procedures

(1) Procedures shall be provided for installation and removal of equipment in full detail, down to the lowest level of replacement items (assembly, subassembly or component).

(2) Prerequisites and Safety Information

(a) Prerequisite operations, inclusive of access panel or plate openings, removal of other obstructing components, and deactivation of power and other pertinent safety precautions and/or warnings shall be included or appropriately referenced.

(3) Removal Procedures

(a) The procedures shall clearly describe the step-by-step operation in a logical, work flow sequence to safely gain access to, and subsequently remove the item.

(b) Exact quantities of attaching hardware to be removed shall be included in the procedures.

(c) The statement "reverse of removal" may only be used judiciously.

(i) Installation procedures that are basically the same as the removal procedure, but require some additions, such as torque values for bolts, replacement of O-rings and lubrication of a component, can be handled within highlight statements to that effect in the removal procedure. If this is done, the statement "reverse of removal" may still be used.

(ii) If, during the prove-out or validation of a "replace" task, the highlighted data do not enable the maintenance technician to correctly install the subject item, the highlighted information shall be deleted from the removal procedure and a step-by-step installation procedure shall be added to the "replace" task.

(4) Installation Procedures

(a) Installation instructions must be provided for procedures that are complex and require additional step-by-step detail or are significantly different from that of removal procedures.

(i) Exact quantities of hardware shall be identified.

(5) Adjustments

(a) Step-by-step procedures shall be provided for any adjustment or alignment required as a result of replacement of any equipment, or to determine that a system, subsystem, assembly, subassembly or component meets required standards.

(b) Detailed procedures shall be provided to determine the accuracy of, and to correct and adjust instruments, diagnostic equipment and test measuring devices used for precision measurement.

(c) Calibrations are to be performed with an instrument that is certified to a standard of known accuracy to detect and adjust any discrepancy in the accuracy of the instrument being calibrated.

(6) Rewinding Procedures

(a) Rewinding procedures shall be provided in full detail for all rotating and wire-wound apparatus, except as agreed to otherwise by Amtrak.

(7) Disassembly/Assembly Procedures

(a) Procedures shall be provided for the disassembly and assembly of assemblies, subassemblies and components at the heavy repair level of maintenance shall be provided.

(b) Assembly instructions shall include all pertinent assembly criteria, including clearances, backlash dimensions, torque values and similar data.

(c) Final testing, with pass/fail criteria, of the end item shall be provided by reference.

(8) Test and Evaluation Procedures

(a) Test and evaluation procedures equivalent to that performed by the original manufacturer, including the requirements for specialized test equipment.

(b) The Contractor is to procure or fabricate and provide to Amtrak all such specialized test equipment and their drawings.

v). Overhaul

(1) For overhauls, the maintenance action required to restore an item to a completely serviceable and operational condition shall be indicated.

(2) Overhaul is not normally performed in the car and does not necessarily return an item to like-new condition.

vi). Rebuilds

(1) Rebuilds include those services and actions necessary for the restoration of equipment to like-new condition in accordance with original manufacturing standards.

(2) Rebuild is the highest degree of material maintenance applied.

(3) The rebuild operation allows returning to zero those age measurements including, but not limited to, hours and miles, considered in classifying Amtrak's equipment and components.

vii). Special Tools

(1) Complete instructions for use, drawings and parts information for all special tools that are required to be provided to Amtrak by the Contractor.

viii). Component and Assembly Weights

(1) The weights of all components and assemblies that weigh more than 50 lbs. shall be indicated.

(2) In addition, the weights of major component assemblies shall be supplied such as the truck, air conditioning compressor, HVAC module, etc.

ix). Diagnostic Test Equipment

(1) Maintenance, calibration and adjustment, repair and overhaul of all diagnostic test equipment.

j). Integrated Schematic and Wiring Manual

i). The integrated schematic manuals shall include all electrical, hydraulic, pneumatic, mechanical, refrigerant, water and waste water system schematic diagrams as used on each car type, broken down by major system.

ii). The manual shall provide schematic and wiring diagrams including (but not limited to) the following:

(1) Electrical power distribution

(2) Trainline assignments and connections to car-borne equipment

(3) Door control system

(4) Lighting system (interior and exterior, in normal, standby and emergency modes)

(5) Communications system, including PA, intercom and passenger information system

(6) HVAC system, including refrigeration units in the food service car (electrical, refrigerant and air flow schematics)

(7) Brake system (electrical, mechanical and pneumatic)

(8) Main reservoir air distribution system

(9) Fresh water distribution and waste retention systems (electrical, pneumatic and water routing)

(10) Onboard mobility device lift (electrical and hydraulic, if used)

(11) Food service equipment, including all appliances (electrical, water distribution)

iii). All schematic drawings will be provided electronically per Amtrak Standard 700 unless otherwise approved by Amtrak.

iv). The schematics shall include all required information for maintenance, troubleshooting and repairs, including specific identification of wires (size, type and label), circuits, components, junction boxes and termination points, locations of components, voltages and pressures, hoses and pipes (size, type and rating), filters, adjustment points, direction of flow, function, and other information as necessary.

v). The integrated schematic manual shall be supplied in tabloid format, 11 in. tall by 17 in. wide, horizontal format, spiral bound with a protective laminated cardstock front and back cover.

k). Illustrated Parts Catalog (IPC)

i). The Illustrated Parts Catalog (IPC) shall enumerate, illustrate and describe every item used on the cars, along with the diagnostic test equipment and special tools with its related parts, down to the Lowest Level Replaceable Unit (LLRU). **[CDRL 23-13]**

(1) The LLRU is defined as the lowest level of component assembly which consists of a separate individually fabricated part, including all hardware items required to assemble, disassemble, repair or overhaul the component.

ii). Parts Information

(1) Each listing must include the accepted generic modified noun-name description, the original supplier, the original supplier's part number and name, the Contractor's part number, and space reserved for the Amtrak 10 digit internal catalog number.

(2) Identical parts within the equipment, regardless of where used in the car types, shall use only one part number.

(a) Common bulk materials such as weather strip or hose used in several locations, but which is cut to specific application length

for an individual application may use one common part number, but the specific location application must identify the length in the text description.

(3) In the case of hardware such as nuts, bolts, washers, etc., information relative to material, coating if any, all dimensions and types shall be included.

(4) Providing the original supplier and its own part number for all components is of great importance to Amtrak.

(5) If provided to the Contractor, Amtrak part numbers shall be included in the IPC.

(6) An appendix giving the original supplier's contact information responsible for parts ordering shall be included.

(7) Amtrak shall have the right to make direct purchase from the sources listed by the Contractor.

iii). Assembly Break-downs

(1) Complete piece-part breakdowns of all subcontractor assemblies shall be provided, regardless if the Contractor only purchased completed assemblies.

(2) Each component that can be disassembled, including all printed circuit board components and items which may have been purchased by the Contractor as a subassembly, must be broken down in exploded view illustrations to fully indexed parts.

(3) Each part or other item shall be identified as being part of the next higher assembly.

(4) All assemblies shall be listed alphabetically by name with reference to corresponding figure number.

iv). Cross Reference Lists

(1) The IPC shall include two cross-reference lists that sort all listed parts as follows:

(a) Sorted alphanumerically by part number

(b) Sorted alphabetically by part name

(2) These cross-reference lists shall include the part name, manufacturer part number, manufacturer or supplier, Contractor part number, and the page and illustration number where found in the IPC.

v). Illustrations

(1) Illustrations shall be exploded view and located on the same page or facing page of the text they support.

(2) A sequence of illustrations must be used in order to clarify or simplify a complex assembly.

(3) All illustrations shall be properly scaled in order to show each individual part being called out.

(4) When one of several possible positions is described by text for a device, the position described shall be the same as the one shown by the illustration.

(5) Unless the location and access to the item is obvious, a locator view shall be included, or the assembly diagram provided at the beginning of the chapter may be referenced to ensure that the equipment orientation is clearly described.

(6) If the same drawing is used in both the illustrated parts catalog and either the running maintenance or heavy maintenance manual, the reference index in both manuals must identify the same parts.

l). Hardcopy Formats

i). The operator's manual binder shall be lightweight plastic, which can be easily opened for page revisions.

ii). Plastic coated tabs shall be used to segregate sections within each publication.

m). Manual Quantities to be Provided

Name	**Quantity**
Operator’s Manual	250
Service and Inspection Manual	50
Running Maintenance Manual	15 sets
Troubleshooting Manual	15 sets
Heavy Maintenance Manual	15 sets
Illustrated Parts Catalog (IPC)	15 sets
Integrated Schematic Manual	15 sets
Manual quantities are subject to change.	

n). Software

i). The Contractor shall also supply 10 sets of every type of software used on the equipment, from the Contractor and its suppliers, in an agreed-upon format.

ii). This shall include diagnostic tester software, any passenger information and Wi-Fi system software, and databus software.

iii). All such software shall be licensed in Amtrak's name and include master passwords to allow future changing of system parameters by Amtrak when necessary.

o). Inspection, Testing and Maintenance Plan

i). The Contractor shall be responsible for the creation and maintenance of the Inspection, Testing and Maintenance Plan annually in accordance with 49 CFR 238.107.

ii). The Plan shall include all detailed inspection, testing and maintenance requirements for each car.

iii). The list of activities shall be considered an all-encompassing and complete list of every inspection, testing and maintenance requirement throughout the life of the equipment.

iv). Inspection, Testing and Maintenance Plan shall be provided to Amtrak for submittal to the FRA on an annual basis.

v). This plan shall include a detailed description of the following:

(1) Inspection procedure, intervals and criteria;

(2) Test procedures and intervals;

(3) Scheduled preventive maintenance intervals;

(4) Maintenance procedures; and

(5) Special testing equipment or measuring devices required to perform inspections and tests.

23.8 Car History Books

a). General

i). The Contractor shall produce a car history book for each completed car. **[CDRL 23-14]** The car history books shall be a specific record of production, testing, inspection and relevant documentation for each individual vehicle.

ii). The car history book shall contain original documents unless specified otherwise.

iii). All documents for a car shall be marked with all carshell serial numbers, the production sequence numbers or the road numbers for the completed car.

iv). The Contractor shall provide one electronic set and one paper set of originals of the car history book for each car. The electronic set shall be color scanned at high resolution. The printed car history books shall be provided in three-ring binders. Documents shall be copied double-sided where practical.

v). At a minimum, each car history book shall contain the following:

(1) Table of contents

(2) Production control cross-reference sheets, listing:

(a) Carshell serial numbers

(b) Shop order/production sequence numbers

(c) Final car reporting marks and road numbers

(3) Production schedule for each car showing start and end dates for each major stage of manufacturing

(4) List of all production drawings by number and revision status (release date, current revision, and outstanding engineering change requests at time of production)

(5) List of all parts by supplier and part number (bill of material)

(6) List of all serialized components

(7) Truck records (separate set of records for each truck)

(a) Inspection records and component serial numbers

(b) Truck assembly sequence

(c) Truck assembly weight certificate

(d) Wheel/axle pressing graphs

(e) Truck to carbody attachment record

(8) Log of all non-conformances including status

(9) Component test certificates

(10) Test records:

(a) Master test plan

(b) Test procedures

(i) Production tests

(ii) Acceptance tests

(11) Record of measurements and results

(12) Critical dimensional inspection report

(a) Carshell dimensional inspection (prior to production)

(b) Carbody leveling, balancing and centering record

(c) Carbody overall dimension measurement, including compliance with clearance diagram

(d) Coupler height measurement

(e) Scale certificate for each completed car (dry weight)

(13) Records of all required inspections

(14) USPHS Certification forms (originals are to be installed in the appropriate certificate holder in the food service car)

(15) FRA documentation

(a) Record of compliance with FRA regulations

(16) Completed pre-shipment checklist

(17) Shipping approval form

(18) Amtrak acceptance form

(19) Transfer of title of the car from Contractor to Amtrak (with original blue-ink signature of Contractor's representative).

vi). The car history book shall be produced in an electronic format as either as a Microsoft Word, Excel, FileMaker Pro or an Adobe PDF file on a DVD. Procedures, electronic signatures and controls shall be established to ensure the validity of information in this document at all times.

vii). Each car history book shall be fully completed and presented to Amtrak prior to the car being released from the Contractor’s facility.

23.9 Training

a). General

i). The Contractor shall organize and present formal instruction programs for personnel who will operate, maintain, repair and troubleshoot the equipment.

ii). In addition, the Contractor shall provide instruction and training materials for Amtrak personnel who shall train others in the future.

iii). Training shall take place at four locations designated by Amtrak.

iv). All training shall meet the requirements of the FRA contained in 49 CFR Part 243 regarding the training and qualification of safety-related Amtrak employees. This shall include all:

(1) Train operating staff (Engineers and Conductors),

(2) Customer service personnel (On-Board Service and Lead Service Attendants),

(3) Mechanical Department maintenance personnel,

(4) Digital Technology personnel and

(5) Amtrak Police Department.

v). The regulation requires that the training plan:

(1) categorize all 'safety-related railroad employees' (SRREs);

(2) identify all training (subject to FRA regulation) that each category receives; and

(3) provides outlines for each training course, that includes learning objectives, instructional method(s), and assessment approach.

vi). All training shall also be compliant with Section 5 of Railway Passenger Handling Safety Rules from Transport Canada O-0-16.

b). Method of Presentation

i). At the choice of the Contractor, the direct training of the Amtrak employees identified above shall be performed either:

(1) by the Contractor, using a training plan which it has directly submitted to the FRA for review and approval; or

(2) by the Amtrak Safety and Technical Training Department, which shall be fully based upon a Contractor-developed and supplied training plan.

ii). The Contractor's proposal must therefore identify whether the Contractor will either be submitting a stand-alone training plan to the FRA for their approval, or if the Contractor would be requesting that Amtrak adopt the Contractor-supplied training plan.

iii). The training plan in any case must be fully approved by the FRA and ready to be presented to Amtrak personnel prior to the delivery of the first car.

c). Contractor Training Plan to FRA

i). If the Contractor intends to submit a training plan directly to the FRA for its approval, the Contractor must submit a copy of that plan to the Amtrak’s Safety and Technical Training Department no less than 90 days prior to training any Amtrak employee.

ii). Amtrak will not review, comment, or approve the plan, but will rely on FRA's approval.

d). Amtrak Adopts Contractor Training

i). If the Contractor will be relying on Amtrak to adopt its training into Amtrak's own plan, the Contractor must submit fully completed draft training materials

to the Amtrak's Safety and Technical Training department no later than 180 days prior to training any Amtrak employee.

ii). Amtrak will review the materials and provide comments within 30 calendar days.

iii). The Contractor will be expected to incorporate any comments/changes and return the materials to Amtrak within 30 days.

iv). This process will continue until the Amtrak Safety and Technical Training Department determines that the training materials meet the FRA Part 243 requirements.

e). Annual Review

i). Whichever party that performs the training (Contractor or Amtrak) is also required to perform an Annual Review, using operating rule violations, FRA inspections, NTSB incident findings, etc., to determine if the identified training was effective.

ii). If knowledge and/or skills gaps are identified in the Annual Review process, the training plan is to be suitably updated or modified, and the changes reported to the FRA.

f). General Training Requirements

i). The following provides the general requirements for the content and level of details of the training materials that shall be prepared and submitted by the Contractor.

ii). This submittal shall include the hours of classroom and "hands-on" training projected per subset, final course content, the qualifications of the instructors, a listing of training aids to be used and a description of the scope of instruction, on an individual subset level, to fulfill the program requirements.

iii). Course Contents

(1) The Contractor shall provide a program to train and educate personnel in all details of the equipment as required to enable Amtrak to satisfactorily operate, service, and maintain the equipment.

(a) The Contractor shall assume no knowledge of the features of the supplied equipment on the part of Amtrak personnel.

(b) However, the Contractor may assume that maintenance personnel have the basic skills pertinent to their crafts.

(2) The manuals shall be used as the major element of the training program.

(3) The training shall be designed to be delivered by an instructor in the classroom and, when appropriate, in the field or shop when actual equipment is used.

(4) Field instruction may also be provided in locations approved by Amtrak using actual cars or training mock-ups to provide hands-on instruction in the maintenance and operation of the equipment.

(5) The Contractor's program shall include formal and informal instruction, training mock-ups, models, manuals, diagrams and component catalogs.

iv). Training Duration and Classes

(1) Amtrak shall advise the Contractor as to how many individuals of each discipline are to be trained at each location.

(2) The program shall include 5,000 Contractor hours of classroom training at designated sites; 1,500 of which shall be for operations, 1,500 for Train the Trainer, and the remainder for maintenance.

v). Video Recordings

(1) Amtrak shall have the right to video record any classroom training sessions. Amtrak will retain ownership of the video recordings, following a final editing as mutually agreed with the Contractor and will have the right to use video recordings for future training sessions.

vi). Train the Trainer

(1) A primary objective of the program shall be to develop within Amtrak the capability to perform similar training under its own training program subsequent to the Contractor's involvement.

(2) Additional Train the Trainer classes shall be provided which is supplemental to the Contractor hours of classroom training.

vii). Training Materials

(1) All informative material, audio and video training aids and notes shall be supplied beyond that given in the instruction manuals to clearly explain all systems and subsystems that the work force will maintain.

(2) Color copies must be used where it is needed to communicate the training concepts in the document / course.

(3) An editable electronic copy of the training presentation must be provided to Amtrak after the training is approved and delivered by the contractor.

(4) Training materials shall be updated as required during the course of instruction.

(5) All instructional materials will become property of Amtrak.

(6) All materials used in the programs, such as models, manuals, mock-ups, video recordings and drawings, shall be of durable construction and shall become the property of Amtrak.

(7) Training Plan

viii). Virtual Reality Training

(1) The Contractor shall provide Virtual Reality training designed to simulate real-world operational, maintenance and emergency scenarios for the Cars. The VR system shall be used to supplement classroom and simulator-based instruction and must be compatible with Amtrak's Learning Management System (LMS).

(2) The VR system shall provide immersive, interactive 3D environments replicating interiors, equipment bays and control interfaces for each of the car types while including modules for pre-trip inspections, fault diagnostics and troubleshooting, emergency response procedures and component replacement/maintenance.

(3) The Contractor shall deliver a complete VR training curriculum, including instructor guides, student manuals and assessment tools. All content must be reviewed and approved by Amtrak's Training and Development department prior to deployment.

(4) The Contractor shall provide initial setup, calibration and testing of the VR system at designated Amtrak training facilities. A minimum of two (2) Train-the-Trainer sessions shall be conducted for Amtrak instructors.

ix). Before delivery of the first car, the Contractor shall provide Amtrak with a proposed training plan incorporating the following elements:

(1) Description of the training program, including program goals and objectives, sequence of activities, course outlines, evaluation methods, required resources and time required for each part of the program.

(2) Schedule of instruction at each location.

(3) State of the Contractor's experience in organizing and delivering similar training programs and qualifications of the designated instructors.

(4) List of training materials to be provided by the Contractor to support the training program.

(5) Instruction guides for each course to be taught within each program.

(6) Student workbooks for each course, each workbook including a syllabus, objectives, schedule, outlines, figures, lesson summaries and any other appropriate instructional information.

(7) Train the Trainer classes which is supplemental to the Contractor hours of classroom training.

g). User Training

i). The Contractor shall provide a user training program, designed for Amtrak operating, maintenance and training personnel. **[CDRL 23-15]**

(1) This is to acquaint them with the equipment in order to provide sufficient working knowledge to safely operate, inspect, service and maintain it.

(2) The training program shall include formal classroom instruction, as well as practical demonstrations and activities on the actual new vehicles.

(3) The Contractor and/or suppliers shall provide appropriate training aid in the classes as required.

ii). Class audience will be:

(1) Operating personnel

(2) Maintenance personnel

(3) Food service personnel

(4) Supervisors and management

(5) Training department personnel

(6) Amtrak representatives

(7) Amtrak Police Department and Emergency Management personnel

(8) Others as required

h). Training Requirements

i). General

(1) The courses listed below shall be accompanied with training manuals, guides, training aids, student and instructor workbooks, and operator and maintenance manuals.

(2) It is the desire of Amtrak that the content and structure of the manuals be used as direct input into the training course materials where applicable.

ii). Course 1: System Operation Instruction Training Course

(1) This course shall include:

(a) General vehicle familiarization;

(b) Location, function, and operation of pertinent controls, gauges, indicators, and switches;

(c) Subsystem operation, inspection, setup, and shutdown procedures;

(d) Trouble symptoms diagnostic and troubleshooting procedures for isolating and correcting minor faults including, at a minimum, techniques for the following:

(i) Release of brakes;

(ii) Door isolation and cut-out;

(iii) Circuit breaker and/or fuse reset or replacement;

(iv) Water and waste system failure recovery;

(v) On-Board Mobility Lifts (if equipped);

(vi) Any other techniques that would assist operators in quickly bypassing non-critical safety subsystems, allowing trains to safely depart the main line to a convenient service location;

(vii) Towing and rescue, including with completely dead batteries.

(e) Emergency Procedures including, at a minimum, techniques to respond to fire on board or emergency evacuation.

(2) This class shall be conducted four times (twice for operations personnel, twice for maintenance personnel). The first class shall be conducted at the time of the arrival of the first car. Subsequent classes shall be scheduled as approved by Amtrak. This class shall include at least 40 hours of training.

iii). Course 2: Repair and Maintenance Training Course

(1) Course 2 shall include and expand on the information furnished in course 1 and shall include theory of operation for each system, basic schematic and block diagrams to provide fault diagnosis information and training appropriate for in-service maintenance.

(2) Course 2 shall provide the training needed for the following:

(a) Troubleshooting in-service failures as described in course 1

(b) Performing running maintenance including:

(i) General servicing

(ii) Lubricating

(iii) Inspecting

(iv) Adjusting

(3) The training shall include maintenance instructions on the use of the integrated wiring diagrams.

(4) Participation shall include up to 20 electricians, mechanics and foremen. This class shall be conducted twice. The first class shall occur immediately following course 1 and be attended by maintenance personnel. The second class shall be scheduled as approved by Amtrak. This class shall include a minimum of 80 hours.

iv). Course 3: Workshop Training

(1) The workshop training course shall provide the training for in-shop repair and trouble diagnosis of each LRU to the level of the lowest replaceable component.

(a) The training shall contain detailed explanation of flow charts, schematic drawings, with system theory of operation and detailed analyses related to each LRU, so that Amtrak maintenance personnel will be able to effectively service, inspect, maintain, adjust, troubleshoot, repair, replace and overhauled the LRU.

(b) The flow charts, schematic drawings and detailed analyses shall be included in the training manuals.

(2) The training shall include maintenance instructions on the use of the integrated wiring diagrams and shall include reference to the manuals.

(3) The major sections of the workshop training course will address, at a minimum the following subsystems and products, as defined above:

(a) Carbody

(b) Trucks

(c) Coupler and Draft Gear

(d) Brakes

(e) Door System

(f) Interior

(g) Onboard Mobility Device Lifts

(h) HVAC

(i) Lighting

(j) Communications

(k) Electrical System

(l) Food Service

(m) Water and Waste

(n) Emergency Equipment

(o) Digital Technology

(p) Microprocessor-based products

(4) Participation shall include, up to 25 Amtrak Mechanical Maintenance Personnel. This class will be conducted twice. It shall follow the first course 2; others shall be conducted at dates to be scheduled as approved by Amtrak. Each class shall include a minimum of 120 hours.

v). Course 4: Diagnostic Test Equipment (DTE) and Special Tools Course

(1) This course shall provide instruction on the proper use of DTE and special tools during application, operation, usage, adjustment, inspection, maintenance, troubleshooting, repair and storage instructions.

(2) It shall be conducted twice. It shall be conducted upon the delivery of the test equipment and special tools and as agreed upon by Amtrak. It shall be a minimum of 20 hours.

(3) Subjects addressed shall include:

(a) Introduction

(b) General description of the equipment

(c) Description of controls and indicators

(d) Operation of equipment

(e) Operation of safety and emergency equipment

(f) Troubleshooting

(g) Introduction and use of operator and maintenance manuals

(h) Review

vi). Course 5: Material Control Training Course

(1) This course shall provide Amtrak Material Control personnel instruction on the use of the Illustrated Parts Catalog.

(2) Participation shall include, up to 15 Amtrak Material Control Personnel and will be conducted twice. Other classes shall be conducted at dates to be scheduled as approved by Amtrak. Each class shall include a minimum of 16 hours.

vii). Course 6: Amtrak Police and Emergency Management Training Course

(1) This course shall provide Amtrak Police Department and Emergency Management personnel with a detailed understanding of the new equipment as outlined by a Train the Trainer type syllabus.

(2) Emergency equipment and all procedures shall be provided to aid in the training of all internal department personnel as well as outside first response agencies.

viii). Course 7: Specialty Training Courses

(1) The Contractor shall be responsible for arranging specialty training courses utilizing the sub-supplier for training.

(2) Systems such as lifts would be expected to be instructed by the sub-supplier.

i). Training Materials

i). General

(1) Draft copies of the training materials shall be provided for Amtrak review and approval, with sufficient time to allow review and Contractor revision. **[CDRL 23-16]**

(a) Open discussion is encouraged early in the development process between the Suppliers, Contractor and Amtrak.

(2) The Contractor shall provide materials to support each course in the training program, including:

(a) instructor guides,

(b) training aids,

(c) student workbooks

(d) operator manuals

(e) maintenance manuals.

(3) Instructor guides and student workbooks shall be submitted for Amtrak's approval 60 days in advance of the start of the first class for each category of training.

(4) All training materials shall become the property of Amtrak.

(5) Format

(a) The instructor guides and student workbooks shall be submitted as camera-ready copy in a form that allows easy reproduction, such as, loose-leaf bound, black ink on 8.5 in. by 11 in. white paper, printed on both sides and numbered sequentially within units of training.

(b) Any Power Point presentations used in training will be supplied along with camera-ready, paper copy.

(c) Master copies of slides and other audiovisual materials shall also be provided to allow for reproduction as necessary.

(d) An editable electronic copy of the training presentation must be provided.

(e) Color copies must be used where it is needed to communicate the training concepts in the document / course.

ii). Instructor Guides

(1) The Contractor shall provide an instructor guide for each training course. **[CDRL 23-17]**

(2) The guides shall include:

(a) course agendas;

(b) course objectives;

(c) procedures for managing training sessions;

(d) resources and facilities required;

(e) guidelines for preparing for training;

(f) detailed lesson plans, including scripted or outlined presentations and discussion guides;

(g) training aids and job aids;

(h) pre-tests and post-tests;

(i) criteria and methodology for measuring performance in the classroom and in the shop/field;

(j) instructions for using any audiovisual support, training mock-ups, and scale models;

(k) detailed instructions for managing any on-the job training.

iii). Training Aids

(1) The Contractor shall provide training aids, such as training mock-ups, scale models, PowerPoint presentations, video recorded demonstrations, diagnostic testing equipment and any special tools required. **[CDRL 23-18]**

(2) These training aids shall become the property of Amtrak upon the completion of the training program.

(3) Any training mockups shall be separate and distinct from mockups provided during design review unless explicitly approved for training purposes by Amtrak.

(4) If Contractor proposes to provide a full size completed car in lieu of the mockups required in Chapter 3, Contractor must still meet the training aid requirements unless otherwise approved by Amtrak.

iv). Student Workbooks

(1) The Contractor shall provide, for each course, a student workbook **[CDRL 23-19]**, which shall include course agenda, course objectives, schedule of sessions, paper copies of PowerPoint presentations, lecture outlines, lesson summaries and any other information that will facilitate the learning process.

(a) The Contractor shall provide a copy of any course materials in the workbook.

(b) Color copies must be used where it is needed to communicate the training concepts in the document/course.

(2) The training program shall be conducted prior to the start of the new equipment in revenue service.

(3) The Contractor shall develop a training action plan and schedule and submit it to Amtrak within 90 days of Notice to Proceed (NTP), and shall update it periodically, to be submitted with program meeting minutes. **[CDRL 23-01]**

(4) Contractor shall provide paper and electronic (editable and PDF) copies of all training materials at the completion of the training program and shall become the property of Amtrak for unrestricted use for future training purposes.

23.10 Equipment Summary Report

a). In support of Amtrak providing critical information regarding the new rolling stock supplied under this contract to both host railroads and private car owners, the Contractor shall develop and submit for Amtrak review and approval an Equipment Summary Report during Final Design Review. **[CDRL 23-21]**

b). Thirty (30) days prior to the start of Final Design Review, the Contractor shall submit an outline for the Equipment Summary Report for Amtrak review and

approval. **[CDRL 23-20]**

i). The outline shall list all content topics which shall be included in the Equipment Summary Report.

c). The Equipment Summary Report shall compile all information with regarding to operation of equipment including clearance, trainlines and backward compatibility.

d). The Equipment Summary Report shall also include any information require for the modification of a private railcar for operation in consist with the new equipment.

e). At a minimum, the Equipment Summary Report shall include the following:

i). A high-level description of the cars, presenting overall capacities, accommodations, and door locations.

ii). The range of road numbers for each car type.

iii). Any waivers requested from or granted by the Federal Railroad Administration (FRA), or other Federal safety regulations required for the testing or revenue service operation of this equipment.

iv). A detailed description of the equipment, including:

(1) Clearance Outline

(2) Allowable top speed

(3) Braking control, compatibility, and performance

(4) Structural strength and crashworthiness characteristics

(5) Noise and vibration limits

(6) Cybersecurity implementation

(7) Track negotiation (e.g. minimum radius curve (both vertical and horizontal, cant deficiency, super elevation, FRA track classes)

(8) Compliance with Regulatory Agencies and Industry Standards and Recommended Practices.

(9) Trainlines including HEP, discrete and digital.

(10) Coupler, diaphragm and gangway.

v). The Equipment Summary Report shall also include a brief summary of the qualification and routine testing performed on the equipment to validated suitability for service.

(1) The testing summary shall include a description of all track testing performed both on and off Amtrak property.

vi). The Equipment Summary Report shall include a high-level summary of the Quality Control program for the equipment.

vii). The Equipment Summary Report shall summarize the development and submittal of operations and maintenance manuals, plans and training.

(1) This shall cover work to be provided by both the rolling stock and the TSSSA contracts.

viii). The Equipment Summary Report shall include an annotated plan view and elevation for each car type including outline dimensions, interior arrangement and external livery.

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23.11 CDRLs

CDRL	Description	Due
CDRL 23-01	Training Action Plan	90 days after NTP with on-going updates
CDRL 23-02	Preliminary As-Built Drawings	180 days prior to the delivery of the 1st batch of cars
CDRL 23-03	As Built Drawings	30 days after delivery of first batch of cars
CDRL 23-04	Electronic Documentation Delivery	Within 30 days after the last car of the base order is shipped
CDRL 23-05	Photographs-Car Assembly	30 days after completion and acceptance of first of each car type
CDRL 23-06	Photographs-Completed Car	30 days after completion and acceptance of first of each car type
CDRL 23-07	Conformed Specification	30 days after completion of each car type
CDRL 23-08	Master Manual Plan	90 days before completion of first car
CDRL 23-09	First Draft of Manuals	90 days before completion of first car
CDRL 23-10	Manual Updates	After delivery of the first car, and continuing through the end of the warranty period
CDRL 23-11	WMS Implementation	360 days prior to shipment of first batch of cars
CDRL 23-12	Service and Cleaning Manual & Maintenance and Inspection Manual	30 days prior to IDR with on-going updates
CDRL 23-13	Illustrated Parts Catalog	30 days prior to shipment of first batch of cars
CDRL 23-14	Car History Book	30 days prior to shipment of first batch of cars
CDRL 23-15	User Training Program	360 days prior to shipment of first batch of cars
CDRL 23-16	Draft copies of Training Material	360 days prior to shipment of first batch of cars
CDRL 23-17	Instructor Guide	360 days prior to shipment of first batch of cars
CDRL 23-18	Training Aids	360 days prior to shipment of first batch of cars
CDRL 23-19	Student Workbooks	360 days prior to shipment of first batch of cars
CDRL 23-20	Equipment Summary Report Outline	30 days prior to the start of Final Design Review
CDRL 23-21	Equipment Summary Report	Prior to the completion of Final Design Review

* End of Chapter 23 *

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

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24. Diagnostics and Test Equipment

Revision 2

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24.1 Overview

a). This chapter defines the hardware and software requirements and describes the basic structure that shall form the diagnostic and fault reporting system used on each car.

b). The system shall supply two levels of diagnostic information.

i). A simplified system using indicator lights, fault status and system status screens shall inform the train crew of failures affecting train operation, and a detailed diagnostic level shall be used by maintenance personnel which shall include detailed fault and system status information. Special consideration may be required in order to outfit each delivery batch with the minimum amount of equipment needed for a functioning diagnostic system.

c). Faults and status information shall be available remotely and shall also be downloadable utilizing standard connectors which shall function as a Portable Test Unit (PTU).

d). Fault information from the individual car systems shall be sent to the central database location on each car for storage and display, which shall allow remote status access through an online portal, downloading of the reported faults via wireless or wayside connection, or hardwire downloading via standard connections.

e). The CDU and HMI screens shall also allow consist-wide control software and database updates to car level systems and the monitoring of certain system level parameters on a real-time basis.

f). The Contractor shall submit a detailed functional description of the Diagnostic System to Amtrak for review and approval. **[CDRL 24-01]**

g). The CDU, HMI and car-level connector for the PTU shall be in Amtrak-approved interior locations, to be finalized during design review.

h). The diagnostic and fault reporting system shall provide sufficient information to enable operations and maintenance personnel to assess the operational readiness and suitability for service of each car and shall provide detailed failure information sufficient to enable maintenance personnel to troubleshoot and isolate failures down to the lowest replaceable unit level and confirm proper operation upon replacement.

i). PTU shall not be required for routine maintenance or routine replacement of components.

j). Tests, resets, or configuration adjustments during any routine maintenance activity shall be able to be accomplished through the Diagnostic System HMI displays.

k). As part of the acceptance testing of the test equipment, the Contractor shall fully demonstrate the function of each type of test equipment being supplied, once delivered and setup in the shop facility.

l). All on-board test equipment and the Central Diagnostics Unit and HMI screen shall be tested as part of the car-level First Article Inspection.

i). This shall include the demonstration of the ability to change password-protected program parameters in all available car systems.

m). Portable test equipment shall be tested on the first batch of cars following delivery.

n). All diagnostic connection ports for the PTUs throughout all cars, regardless of subsystem, shall make use of standard connections.

o). No proprietary cables, connectors, accessories or wiring shall be required to run or copy diagnostic programs, or to copy or upload new software to any piece of equipment on the cars, including at the Central Diagnostics Unit.

p). The CDU shall serve as the source of network time for all microprocessor systems connected via Ethernet, with time synchronized between CDU systems throughout the train network.

q). All carborne equipment clock time shall use the GPS obtained Coordinated Universal Time (UTC).

i). It shall be the responsibility of the Contractor to enforce this requirement for all car systems.

r). The Contractor shall make all modifications to test equipment specified herein which are required because of changes and modifications made to the cars or any of its systems or subsystems to meet the requirements of this Contract.

s). The Contractor shall maintain a master database of all software and its current revision level used for each type of diagnostic and test equipment being supplied for the fleet replacement program, including onboard and shop equipment, until the conclusion of car warranty.

t). All shop support equipment shall be covered in Exhibit G, Technical Support, Spares and Supplies Agreement (TSSSA); however, in the event that the TSSSA is not executed or terminated, the Contractor is responsible for providing all shop support equipment to Amtrak as outlined in this Chapter.

u). Passengers shall not be able to access any security ports at any time on any car. Proper attention must be paid to cabinet keys and locations to secure the car and prevent any potential threats.

24.2 Subsystem Integration

a). Each intelligent subsystem shall include status monitoring, self-diagnostic, fault-detection, recording, and troubleshooting capability including, but not limited to, the following systems:

i). Air Brake/Wheelslide

ii). Truck/Ride Quality

iii). Powered Doors, Trap Doors, & Folding Steps

iv). HVAC

v). Lighting Controllers

vi). OTIS/PA/Train Information

vii). Battery/Chargers/Power Systems

viii). Food Service Equipment (appliances)

ix). Water and Waste (tank levels, etc.)

x). Automatic Vehicle Location System/GPS

xi). Car Temperature Monitoring

xii). Smoke Detectors and Fire Suppression

b). On-board testing shall be either internal, using self-contained diagnostic routines, or external, using a portable tester, or may be a combination of both techniques.

i). Systems which are microprocessor-based shall use both techniques, incorporating an internal self-test routine which can be initiated and monitored through the CDU HMI, without use of a portable tester.

c). The built-in diagnostic test routines shall be used for the testing of all power circuit devices.

d). All power circuit devices shall be testable without the need to remove any connections to the device from the circuit.

e). The on-board test routine shall apply high current or high voltage to the device as appropriate to check calibration and perform failure diagnosis.

i). Provisions shall be supplied to accept a clamp-on current sensor for high current-in circuit calibration checks and jacks for high voltage isolated probes for in-circuit calibration checks.

f). The systems shall constantly monitor their own system health and report problems as a fault to the CDU.

g). Faults shall be stored at the CDU for remote access or later retrieval using the PTU.

h). Each stored fault shall contain car status information at the time of the fault, such as, handle position, speed, temperature, etc., in addition to the actual problem or failure.

i). The CDU shall also be designed to include a real-time data recorder capable of recording no less than 30 days worth of status information from all subsystems.

j). The data recorder shall have both pre-trigger and post trigger recording capabilities and shall be fully configurable from the PTU.

i). It shall record both analog and digital channels selectable by the PTU.

k). Triggers shall utilize the pre-assigned system faults and it shall also be possible to trigger on configurable equations based on one or more analog or digital channels when a selected threshold has been exceeded, or at a specified time interval.

l). Sampling rates shall be selectable and based on the actual sampling capabilities of the subsystem hardware, with 20 Hz being the minimum.

m). All signals, including all subsystem inputs and outputs as well as calculated values shall be transmitted to the CDU to facilitate real-time data recording.

n). Set-up parameters and data shall be stored in non-volatile memory. Recorded data shall be downloadable to the PTU, which shall convert the data into a chart recorder type display format that can be displayed, printed and saved to removable media.

i). The system design shall be approved by Amtrak during design review. **[CDRL 24-02]**

24.3 Central Diagnostics Unit

a). The Contractor shall supply a Central Diagnostics Unit (CDU) and HMI touch screen on each car for use by Amtrak personnel.

b). The HMI touch screen shall display train and car status, event and failure information useful to operations, maintenance, and engineering personnel.

c). Faults downloaded by the PTU shall not be automatically deleted from memory, so that they can be downloaded and included into the maintenance database.

d). Using the CDU and HMI screens, it shall be possible to ascertain the current software version of all software configuration items installed on the train, as approved by Amtrak.

e). From the CDU and HMI screens, it shall be possible to upload new control software to all microprocessors on a train basis (except the systems as deemed safety sensitive during design review, which require update via the subsystems local PTU port).

i). The proposed design shall allow updates to the OTIS content via methods approved by Amtrak.

f). The CDU shall also be capable of providing train-level information over the digital trainlines to the train crew using an HMI touch screen in an approved location.

g). The contractor shall utilize the HMI touch screen devices defined in Chapter 14.

h). The HMI screen shall alert the train crew of major system faults, such as brake problems, HVAC failures, HEP problems, water/waste problems, door problems,

and/or other major failures, as approved by Amtrak.

i). It is intended that this data supplied to the train crew be simplified in nature.

i). Fault information shall be given for all major system failures which require that they be reported to the Amtrak Operations Center (CNOC) or that require a change in operating procedure, as approved by Amtrak.

j). The HMI screen shall also provide train wide subsystem status information to operations and maintenance personnel.

k). The Contractor shall submit for Amtrak review and approval a Fault Management Plan. **[CDRL 24-03]**

i). The Fault Management Plan shall include a fault listing, detailed description of each fault, detailed description of the triggering condition for each fault, conditions required to reset the fault, details of any lockout imposed by the subsystem for the fault, and attributes for each fault.

ii). Attributes shall include whether a fault will be recorded by the subsystem and/or CDU, whether a snapshot will be triggered, the criticality of the fault, if the fault will trigger an alarm for the operator or crew, whether the fault is accessible to crew or maintainers, or if the fault should trigger immediate message to the wayside server.

iii). Additional attributes may be defined by Amtrak during design review. Faults shall be able to be added by use of equation base on subsystem signals and faults for multiple systems similar to the fault trigger requirements listed in section 24.2.k.

l). It is the intent to have maintenance personnel review the faults from the CDU to determine if a problem exists on a car and/or Consist.

i). The Central Diagnostics Unit shall provide the capability to monitor system status, faults and data in real time by maintenance personnel.

ii). The system data to be monitored shall be selectable by use of the PTU or through configuration on the CDU HMI screen. An approved touch screen display shall be provided to view the selected system data in real time.

iii). The CDU shall be designed to be extensible, with the understanding that additions and subtractions of systems on the vehicle will occur throughout the life of the vehicle.

iv). The CDU shall be configurable to add or remove systems using a defined interface. The car builder shall be responsible for developing and providing a CDU system interface document that can be used for future additions or subtractions to the system.

m). The Contractor shall provide a highly available database backed web-based Wayside Server system for installation at an Amtrak datacenter.

n). The CDU shall interface with the wayside and shall be capable of communication

to the server enroute.

o). This system shall enable Amtrak personnel to download faults remotely and view live status information on the cars remotely through an online portal.

p). The system shall allow automatic, scheduled, and manual requests for transfer of status, fault, software configuration and real-time data recorder information.

i). It shall be capable of configuring condition-based alerts and alarms of differing severities to various distribution lists, subject to design review.

q). Cars shall be capable of automatically reporting car number and faults at set locations for car tracking and repair.

i). This system shall also allow uploading and updating OTIS content.

ii). The system shall be utilized through an approved multi-carrier cellular and WiFi communication device which shall be configured and integrated in the vehicle which shall be as transparent to connected systems as practical to allow future technology upgrades or changes with minimal impact to ancillary systems.

iii). Wireless data communications shall be encrypted and protected against intrusion.

iv). The design and capabilities of the wayside server system and design of train to wayside interface shall be submitted to Amtrak for review and approval. **[CDRL 24-04]**

r). The Contractor shall provide an analysis of the potential effects of various possible security attacks on network transmissions and the operation and effectiveness of the measures taken to ensure the security and safety of the networks and equipment.

i). The security analysis shall be guided by IEC/ISO 27000 series standards. This document shall be submitted for Amtrak review and approval. **[CDRL 24-05]**

s). Information on the Amtrak server, communication protocols, and cyber security shall be provided.

t). For enroute communication in areas with limited communication capability, faults and diagnostic information shall be stored for transmission when communication capability returns.

24.4 Car Temperature Monitoring

a). Each food service car shall be outfitted with a remote temperature monitoring system.

i). This system shall operate as a semi-independent portion of the CDU or shall be a separate system.

ii). The temperature monitoring system shall have power provided to it by the car when Head End Power (HEP) is present and have an internal rechargeable and replaceable battery back-up power supply capable of powering the unit and transmitter for at least 12 hours without power from the HEP or car batteries.

iii). The design of the Car Temperature Monitoring system shall be submitted to Amtrak for review and approval. **[CDRL 24-06]**

b). The temperature monitoring system shall include global positioning information, a sensor to monitor whether HEP is being provided to the car, a sensor to detect whether the main water supply tank is empty, two temperature inputs, and a carbody based accelerometer.

i). One temperature input shall measure water temperature in a relatively cold location characteristic of where water would be most likely to freeze on the car.

(1) This may be on the outside of a water pipe as long as the area is well insulated outside the sensor and it is measuring the pipe temperature.

ii). The other temperature input shall be the ambient air temperature inside the car.

c). The power sensor shall include a delay feature that only signals that the HEP power is off when longer than three (3) minutes.

d). An exterior temperature sensor or Global Positioning Information shall be used to determine local ambient air temperatures.

e). The temperature monitoring system shall have a communication system to transmit data from the car via cellular and Wi-Fi communication links.

i). It shall send the car number, location, speed, direction, temperatures, HEP on/off status, and water tank status every thirty (30) minutes.

ii). When the outside temperature is below 32 F, it will transmit every fifteen (15) minutes.

f). While a proprietary database and tracking system may be provided by the Contractor for installation on Amtrak infrastructure, the database and tracking system shall be capable of communicating all information over to the same server utilized by the CDU.

g). The interface control document and a means to adjust the destination for the temperature monitoring system messages shall be provided for Amtrak review and approval.

h). The tracking system shall allow alerts to be sent to different distribution lists of personnel developed by Amtrak, such that when a car is at a facility and in danger of freezing, an urgent alert may be sent by text and/or email to the relevant Mechanical personnel at just that location.

i). It shall be possible to trigger the alert based on the status of any variable sent, or by how long any of the variables has been in a certain state or below a set threshold.

ii). Amtrak shall have the ability to change the criteria and thresholds for alerts, car makeup, and the lists they are sent to, without requiring Contractor or sub-contractor assistance.

24.5 Portable Test Equipment

a). The Contractor shall furnish eight complete sets for each Terminal Depot (including cables, connectors, associated equipment required to interface with the car, instructions, software, chargers, etc.) of all portable test equipment required to perform in-service testing necessary to verify proper operation of all car subsystems prior to the delivery of the first batch of cars. **[CDRL 24-07]**

i). Eight additional sets of all portable test equipment shall be delivered during production delivery. **[CDRL 24-08]**

b). All parts used in the construction of diagnostic test equipment shall be sufficiently rugged for a railroad shop environment and approved by Amtrak during design reviews.

i). Where necessary, it shall include cases and water-resistant seals and switches.

ii). It shall have prior successful experience in similar railroad or transit car workshops and shall use the latest version of Microsoft Windows operating system at time of delivery or approved equal.

c). Each PTU shall be supplied with a carrying case which includes a communications cable and two extra sets of extended-life rechargeable batteries.

d). The PTUs generally shall be of the highest performance level systems available in the commercial marketplace at the time of the first batch of car delivery and shall be approved by Amtrak.

i). All equipment shall be registered by the Purchaser in Amtrak's name, as directed by Amtrak.

e). The Contractor shall provide drawings of the test equipment.

i). Each piece of test equipment, excluding the PTU itself, shall be accompanied with the complete diagrams, schematics and maintenance, parts information and calibration instructions for the device and its intended use and repair.

ii). These shall be supplied as part of the maintenance manuals.

f). All portable testers shall be rugged and suitable for the shop environment.

i). Weight shall not exceed 20 pounds.

ii). There shall be no high voltage connections (greater than 150 volts) required between the car and any portable test device.

iii). It shall not be necessary to remove, dislodge, dismount or disconnect any component in order to use or connect the portable test devices.

g). The function of the portable test devices shall be to produce all of the operating commands and other input signals necessary to fully exercise all functions and components of the particular system under test, and to measure or indicate all of the signals, responses and outputs produced by a system by means of indicators such as lamps, meters, oscilloscopes, gauges, etc.

i). It will be acceptable to require a visual check for system response such as closure of a contactor or a relay, or lighting an indicator, provided that the responding item of equipment does not require the test device engineer to move more than 15 feet to make the required observation.

h). The portable testers will supplement the built-in diagnostic features specified herein for particular subsystems and in those cases shall not duplicate the specified features but shall complement them by providing deeper and more comprehensive diagnostic capability.

i). The portable test device shall not be used to calibrate high-current and high-voltage devices.

i). It shall not be permissible to require connection of external apparatus to the portable test devices without the prior written approval of Amtrak.

i). In such cases, terminals shall be provided to allow connection of the required apparatus to the portable test device.

ii). However, such apparatus shall be considered part of the portable test device and shall be supplied with it on a one-to-one basis.

iii). Portable test equipment shall be supplied for, but not limited to, the following:

(1) Air Brake/Wheelslide

(2) Truck/Ride Quality

(3) Powered Doors, Trap Doors, & Folding Steps

(4) HVAC

(5) Lighting Controllers

(6) OTIS/PA/Train Information

(7) Battery/Chargers/Power Systems

(8) Food Service Equipment (appliances)

(9) Water and Waste (tank levels, etc.)

(10) Automatic Vehicle Location System/GPS

(11) Car Temperature Monitoring

(12) Smoke Detectors and Fire Suppression

24.6 Bench Test Equipment

a). To allow the proper testing, troubleshooting and calibration of car components on a test bench in a specialized workshop environment, the Contractor shall supply 1 (one) complete sets of each type of bench type shop test equipment for each Terminal Depot, to be delivered by the fifth car. **[CDRL 24-09]**

i). Each tester shall be delivered as a completely wired and assembled unit and use shop electrical power and/or compressed air.

ii). Each tester shall have a receptacle for connecting to the device under test.

iii). The connections to the device under test, if not contained in the receptacle, shall be from the front of the tester and shall have provisions to neatly store out of the way when not needed.

iv). The Contractor shall coordinate to ensure compatibility with maintenance facilities.

b). Testers shall be used for the purposes of testing, troubleshooting, and calibrating electric, electronic, mechanical, pneumatic and electro-mechanical components of each car subsystem.

i). They shall contain provisions for the rapid testing, troubleshooting and calibration of each system LRU.

ii). Design of the testers shall be such that all inputs can be varied over the full working range of the device.

c). The bench test equipment shall be automated to the extent possible.

i). If the unit under test is defective, the bench test unit shall allow the technician to troubleshoot the unit to determine which component is defective.

ii). It shall also include a manual mode to allow application of inputs to the unit under test as selected by the technician for troubleshooting.

d). Shop test equipment shall be provided for, but not limited to, the following:

i). Wheelslide control unit

ii). Low voltage power supplies

iii). Brake units and controls

iv). All printed circuit boards

v). Plug-in relays

vi). Lighting Controllers

vii). OTIS/PA

viii). Battery/Chargers/Power Systems

ix). Food Service Equipment

x). Water and Waste

xi). Automatic Vehicle Location System/GPS

xii). HVAC units

xiii). Car wiring

xiv). Microprocessor, EPROM, EEPROM's and other electronic device reprogramming for all car systems, except as approved by Amtrak

xv). All electronic units not identified above

24.7 Air Brake Test Rack Adapters

a). The Contractor shall supply by delivery of the fifth car of two (2) sets of brake rack adapters at each Terminal Depot to allow the mounting of each car's friction brake and pneumatic system valve or control device (and coupler pneumatic control devices, if necessary) to the existing Amtrak brake test racks.

i). Each adapter shall be a complete, unitized assembly for each valve, without the need to assemble loose hoses, fittings, etc. for use.

b). The Contractor shall inspect the Amtrak current air brake test racks and inventory all current brake rack adapters.

c). Complete parts lists, drawings and tabulations giving the proper adapter for each device shall be provided.

d). The air brake system test rack adapters and its details shall be approved by Amtrak. **[CDRL 24-10]**

24.8 CDRLs

CDRL	Description	Due
CDRL 24-01	Central Diagnostics System detailed Functional Description	30 days prior to Diagnostics System PDR meeting
CDRL 24-02	Subsystem Integration Details	30 days prior to Diagnostics System PDR meeting
CDRL 24-03	Fault Management Plan	30 days prior to Diagnostics System IDR meeting.

CDRL 24-04	Wayside Server and Train to Wayside Details	30 days prior to Diagnostics System IDR meeting
CDRL 24-05	Security and Safety Analysis of the Network	30 days prior to Diagnostics System IDR meeting
CDRL 24-06	Car Temperature Monitoring system	30 days prior to Diagnostics System IDR meeting
CDRL 24-07	Eight additional sets of all portable test equipment	Prior to Delivery of First Batch of Cars
CDRL 24-08	Eight additional sets of all portable test equipment	With 5th Car Delivery
CDRL 24-09	Six complete sets of each type of bench type shop test equipment	With 5th Car Delivery
CDRL 24-10	Air Brake System Test Rack Adapters	With 5th Car Delivery

* End of Chapter 24 *

Amtrak Universal Single Level Fleet Replacement Technical Specification

25. Safety

Revision 2

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25.1 Overview

a). Safety is of primary importance in the design of these cars.

b). The cars shall present a safe, hazard-free environment to passengers, crew members and the public.

c). Compliance to the specification, as well as all applicable laws, regulations and standards must be achieved.

d). The Contractor shall research NTSB passenger train accident reports and ensure the past mistakes relevant to train design are avoided. Passage from car to car shall be easy and safe.

e). No sharp edges or corners or pinch points shall occur where passengers, crew, or maintenance personnel may come into contact with them.

f). Adequate handholds shall be provided throughout the car. Handhold placement shall consider the needs of semi-ambulatory individuals, and the risks associated with walking in a moving train.

g). Passengers and crew shall not be exposed to tripping hazards, exposed electrical voltage, toxic materials or similar hazards.

h). Location, illumination levels, colors, graphics and surface finishes shall be selected to maximize visibility of door thresholds, controls and other objects with which the passengers and crew must interface.

i). Normal and emergency equipment and controls which the passenger or crew may operate shall be clearly identified, and operating procedures shall be presented in both text and graphic formats.

j). Passenger emergency signs shall also be embossed in Braille raised typeface unless otherwise approved.

k). Power capacitors shall self-discharge.

l). Refer to signage requirements in Chapters 11 and 29.

25.2 General Safety Design Requirements

a). The general safety design requirements and the guidelines listed below shall be incorporated into the design of all car systems affecting safety.

b). Only components with high reliability and predictable failure modes, and which have been proven in conditions similar to the projected service shall be utilized.

c). Whenever possible, all systems are to be designed to prevent single point failures from negating the ability of such systems to perform safely as intended.

d). All systems that passengers or crew members interact with shall be designed with best ergonomic practices, taking into consideration human factor principles.

e). All electronic circuits shall be assumed capable of failing in permissive modes.

f). Software shall be considered capable of failing in an unsafe mode unless it is safety verified while operating in the proposed hardware.

g). All safety circuits not wholly within an enclosure shall be of a double-wire, double-break design.

h). Systems shall be based on closed circuit principles in which energized circuits result in permissive conditions, while interrupted or de-energized circuits result in restrictive conditions.

i). Any component or wire becoming grounded shall not cause a permissive condition. Safety circuits shall be kept free of any combination of grounds that will permit a flow of current equal to, or in excess of 75% of the release value of any safety device in the circuit.

j). Circuit impedance, signal encoding, shielding, layout and isolation shall be selected to reduce the effects of interference to the extent that safety is maintained under all conditions.

k). Commands that result in permissive conditions shall be propagated by no less than two independent signals, both of which must be present before the permissive condition can occur. The lack of either signal shall be interpreted as a restrictive command.

l). Systems controlled by variable level signals shall be arranged such that zero signal level results in the most restrictive condition. At least one enabling signal, however, independent from the variable control signal, shall be present before the control signal can modulate the system to a more permissive level.

m). Wires for safety critical trainline functions shall not be located at the bottom pins of cable connectors mounted in areas where water incursion may occur.

n). The location of pins and wires of safety critical circuits in connectors shall be designed to minimize the possibility of unsafe conditions resulting from shorts to adjacent pins or wires.

o). Circuit breakers shall be guaranteed by the manufacturer to successfully interrupt rated currents. Circuit breakers shall be applied such that the maximum circuit fault currents cannot exceed the manufacturer’s guaranteed operating ranges.

p). Systems that rely on structural integrity for safety shall have sufficient safety factors such that failures are not possible within the life of the car under all possible normal conditions.

q). Systems and devices subject to wear shall not wear to unsafe or permissive states within a period that is no less than three times the specified periodic maintenance interval under the worst-case combination of duty cycle, environment and all other influences. Such systems and devices shall be clearly indicated in the maintenance manuals.

r). Mechanical systems which apply force to achieve safe states shall not depend upon the application of fluid pressure or electrical energy, unless specifically approved.

s). All locks, catches, and similar devices affecting safety shall be passive with no other effort required to achieve the safe state.

t). All systems shall function safely under all combinations of supply voltages, fluid pressures, shock, vibration, dirt accumulation and the railroad environment.

u). All safety related systems, and devices within those systems, shall be clearly identified in all operation and maintenance manuals, procedures, and training materials.

v). Exposure of maintenance personnel to lethal or injurious voltages shall be minimized through compartmentalization, interlocks, lock out, tag out provisions, and similar measures.

w). Exposure of maintenance personnel to occupational injury/illness risks shall be minimized through ergonomic measures.

x). All equipment containing hazardous materials, lethal or injurious voltages, or other risks shall be clearly labeled on both the outside and inside of the equipment.

y). No sequence of operations, or the simultaneous activation of any controls, shall result in unsafe conditions.

z). All systems shall protect against unsafe conditions resulting from human error.

aa). The Amtrak maintenance facilities and storage yards only have ground-level access at track bed height. It is required that the cars have the capability for ground-level access for maintenance access, passenger emergency evacuation and fire/rescue access to the car interior.

bb). Contractor shall identify all safety enhancements to improve situational awareness and overall passenger and crew safety. Additional safety enhancements may be proposed based on emergent technologies (i.e.: alerts for locational awareness or fatigue/attention) or on innovative approaches in vehicle design.

25.3 Safety Certification Program

a). The contractor shall conduct a Safety Program throughout new design, manufacturing, testing, pre-revenue operations, and warranty to ensure that the vehicle achieves a level of safety consistent with the Amtrak network.

b). The Safety Program shall identify potential hazards and initiate actions to eliminate or control them to an acceptable level.

c). It is Amtrak’s intention to conduct a Safety Certification Program. The Contractor and sub-suppliers shall support Amtrak in the Safety Certification process.

25.4 System Safety Program Plan

a). The Contractor shall develop, implement and maintain a comprehensive System Safety Program Plan (SSPP) conforming to the Federal Transit Administration (FTA) Handbook for Transit Safety and Security Certification (FTA-MA-90-5006-02-01), Final Report," November 2002; the latest Amtrak System Safety Program Plan; and any other applicable Federal guidelines or requirements. **[CDRL 25-01]**

b). This SSPP shall assess, analyze and document the safety aspects of all components, systems, managements and materials used on the cars, and the operation, maintenance, repair and performance of those components, materials and systems, from the viewpoint of crews and passengers.

c). The SSPP shall identify all hazards related to the cars and shall impose design requirements and management controls, in addition to those identified in this Technical Specification, to prevent unsafe conditions by eliminating hazards or reducing risk to levels acceptable to Amtrak.

d). The SSPP shall be developed in the earliest phases of the Contract and shall be continuously maintained throughout, as design and construction evolve.

e). The formats for reports, listings, analyses and other required submittals shall be jointly determined between Amtrak and the Contractor.

f). The SSPP shall include a software safety section which applies to any embedded or external software or firmware which controls or monitors safety-critical functions.

g). Software safety requirements shall treat software as an integral part of a hardware/software system.

h). Functions accomplished through the use of software shall be considered safety critical unless an independent redundant hardware means is also provided to accomplish the same function. Refer to Chapters 26, 27 and 28 for more details.

i). Features of the software safety program shall include a description of how the following shall be accomplished: definition, implementation and oversight of the software design and verification process, integrity of the documentation, software hazard analysis, software safety reviews, software hazard monitoring, reporting and tracking, and software integration with hardware at each stage of the design and testing process for components, subsystems, systems, and cars. incorporating software for safety-critical functions. Refer to Chapter 26, 27 and 28 for more details.

j). All systems affecting safety shall undergo a thorough safety review as part of the design review process, with emphasis on credible faults, results, risk, etc. Requirements of 49 CFR 238.105 and other applicable parts of 49 CFR 238 Subpart - B shall be met as part of this review. It shall include, but not be limited to:

   i). Brake control/Anti-Wheel Slide

   ii). Truck

   iii). Smoke/Fire Alarm system

iv). Fire suppression

v). Emergency access & egress

vi). Door system

vii). Windows

viii). Communication (Radios & Public Address Systems)

k). The completed SSPP shall be submitted to Amtrak for review and approval within 60 days of NTP.

25.5 Preliminary Hazard List (PHL)

a). The Contractor shall within 60 days of NTP provide an initial Hazard list.

b). This hazard list shall identify all potential hazards associated with the vehicle including those caused by, mechanical failures, electrical/electronic component failures, software errors or defects, environmental impacts, human error, maintenance, and operational conditions. **[CDRL 25-02]**

25.6 Preliminary Hazard Analysis (PHA)

a). Based on the approved Hazard list the Contractor shall provide a Preliminary Hazard Analysis which defines the potential cause of the hazards, the probability of the hazard, the severity of the hazards, potential or proposed mitigation and the residual probability and severity.

b). The PHA shall be submitted 30 days prior to any Preliminary Design Reviews. **[CDRL 25-03]**

25.7 Hazard Tracking Log (HTL)

a). Based on the approved PHA the contractor shall develop a Hazard Tracking Log.

i). The HTL shall use Amtrak's preferred hazard tracking log methodology, definitions and system of entry.

b). This HTL shall track the status of all supporting documentation for each of the hazards.

c). All hazards in the Hazard Tracking Log must be closed for Safety Certification to be closed.

d). The HTL shall be submitted 30 days prior to any Final Design Reviews and be updated monthly until approved. **[CDRL 25-04]**

25.8 Failure Modes, Effects and Criticality Analysis (FMECA)

a). The Contractor shall provide a comprehensive FMECA(s) for all components on the vehicle.

b). For the purpose of this section, components shall be defined as hardware, electronic/electronic components and software at a minimum it shall be to the level of an assembly (i.e. relay, contactor, actuator, valve, switch etc.) but many be to sub assembly level if required by the authority in order to more clearly define the hazard.

c). The FMECA shall also identify if the failure is annunciated.

d). In the event that the failure is not announced, the analysis shall be extended to include subsequent failures until the subsequent failure is annunciated.

e). The FMECA shall be submitted as part of the IDR and FDR submittals. **[CDRL 25-05]**

f). Information provided in the FMECA shall include:

i). A system overview including schematics.

ii). A complete list of system and subsystem components that will be analyzed.

iii). Identification of the “modes” or ways the components can fail.

iv). Assessment of the effects of the failure on the system.

v). Determination of the severity and probability of failure.

vi). Determination whether the failure is a single-point failure.

vii). Determination of methods to eliminate or control the identified failure.

viii). Identification of single-point failures and hazard-level categorization, which should confirm the adequacy of fail-safe design features.

25.9 Fault Tree Analysis (FTA)

a). The Contractor shall provide a quantifiable Fault Tree Analysis for all Category/Severity one and two hazards.

b). These fault trees analyses shall be fully integrated across sub system such that if events span multiple sub systems the top event vehicle level hazard reflects all sub system events.

c). The FTA shall be submitted prior to FDR. **[CDRL 25-06]**

25.10 Subsystem Hazard Analysis (SSHA)

a). The Contractor shall submit a subsystem hazard analysis for each vehicle subsystem.

b). These subsystems safety analysis shall include subsystem Hazard Tracking log, FMECA, and FTA.

c). The documents shall be submitted as part of the IDR and FDR submittals. **[CDRL**

25-07]

25.11 Operating and Support Hazard Analysis (O&SHA)

a). The Contractor shall submit an Operating and Support Hazard Analysis (O&SHA) to identify and assess hazards introduced during system operation, maintenance, and support activities.

b). The O&SHA shall be submitted prior to FDR. **[CDRL 25-08]**

c). At a minimum, the analysis shall consider:

i). Hazards associated with personnel and procedures during operations, maintenance, and emergencies.

ii). Human interface during the on-car, off-car and facility-level support activities.

iii). Operations and maintenance tasks against human engineering factors, such as task complexity, system criticality, task frequency, new technology, known problems, etc.

iv). The context in which Operators and maintainers work.

25.12 Probability, Severity Risk

a). For the purpose of this Chapter, the Contractor shall utilize the following definition for hazard severity category, hazard frequency levels and acceptable risk.

b). For software failure probability rates used in the safety analysis, it shall be assumed that all software has a Safety Integrity Level (SIL) of zero as defined by EN-50128. For common mode failure of comingled or redundant software a BETA or common mode failure rate of one shall be assigned. Alternatively, if the Contractor can provide independent certification (i.e. TÜV certification) for a higher SIL level this may be used if approved by Amtrak. Refer to Chapters 26 and 27 for additional details.

c). Unless it is shown otherwise through daily test or preventative maintenance inspection the “Time at Risk” for all failures probabilities shall be design life of the vehicle. All time at risks shall be approved by Amtrak.

d). At a minimum, emergency brake application, emergency power removal, door opening, door/propulsion interlock and no motion detection shall be required to meet requirements for of Category I or II hazards for elimination of hazard or reduction of risk to an acceptable level.

e). Emergency brake control shall be fail-safe. No detectable single point failure in the friction brake system, or series of common-mode or common-cause failures added to any combination of undetected failures, can result in the availability of less than 75 percent of emergency braking effort in a train.

Figure 25-1: Hazard Severity Categories

Severity	Value	Meaning
Catastrophic	1	Risk realization expected to result in one or more of the following: death, permanent total disability, loss of passenger/crew occupied volume with equipment damage causing separations in structure, infrastructure damage due to railroad operations/activities that suspends service through the affected area for greater than 24 hours.
Critical	2	Risk realization expected to result in one or more of the following: permanent partial disability, injuries/illness that results in hospitalization, loss of passenger/crew occupied volume with equipment damage that causes openings but no separations in structure, infrastructure damage due to railroad operations/activities that suspends service through the affected area for greater than 2 and up to 24 hours.
Marginal	3	Risk realization expected to result in one or more of the following: injury or illness resulting in one or more lost workday(s), loss of passenger/crew occupied volume with equipment damage that causes no separations/openings in structure, infrastructure damage due to railroad operations/activities that suspends service through the affected area for more than 30 minutes and up to 2 hours.
Negligible	4	Risk realization expected to result in one or more of the following: injury or occupational illness that does not result in a lost workday, equipment damage that does not result in neither loss of passenger/crew occupied volume nor separations/openings in structure, infrastructure damage due to railroad operations/activities that does not suspend service or cause a delay through the affected area for more than a maximum of 30 minutes.

Figure 25-2: Hazard Frequency Levels

Likelihood	Value	Qualitative Meaning	Quantitative Meaning
Frequent	A	Opportunity for risk to be realized expected to occur often.	Probability of occurrence greater than or equal to 10^{-1} (10%) Continuously experienced throughout system life.
Probable	B	Opportunity for risk to be realized expected on a recurring basis.	Probability of occurrence less than 10^{-1} (10%) but greater than or equal to 10^{-2} (1%) Will occur frequently throughout the life of the system.
Occasional	C	Opportunity for risk to be realized expected to occur.	Probability of occurrence less than 10^{-2} (1%) but greater than or equal to 10^{-3} (0.1%) Will occur several times throughout life of the system.
Remote	D	Opportunity for risk to be realized not expected to occur but possible.	Probability of occurrence less than 10^{-3} (0.1%) but greater than or equal to 10^{-6} (0.0001%) Unlikely but can be reasonably expected to occur.
Improbable	E	Opportunity for risk to be realized not expected and almost inconceivable.	Probability of occurrence less than 10^{-6} (0.0001%) Unlikely to occur in the system life, but possible.

Figure 25-3: Risk Matrix

Risk Likelihood	**Risk Severity**			
	Catastrophic 1	Critical 2	Marginal 3	Negligible 4
Frequent – A	**1A** (Red)	**2A** (Red)	**3A** (Orange)	**4A** (Yellow)
Probable – B	**1B** (Red)	**2B** (Red)	**3B** (Orange)	**4B** (Yellow)
Occasional – C	**1C** (Red)	**2C** (Orange)	**3C** (Yellow)	**4C** (Green)
Remote – D	**1D** (Orange)	**2D** (Yellow)	**3D** (Yellow)	**4D** (Green)
Improbable – E	**1E** (Yellow)	**2E** (Yellow)	**3E** (Yellow)	**4E** (Green)

Hazard Risk Index (HRI)		
Red	1A, 2A, 1B, 2B, 1C	CEO/President approval required.
Orange	3A, 3B, 2C, 1D	CSO and Dept E3-Level approval required.
Yellow	4A, 4B, 3C, 2D, 3D, 1E, 2E, 3E	Dept E2-Level and VP Operations Safety approval required.
Green	4C, 4D, 4E	Dept E1-Level approval required

25.13 Hazard Resolution Process

a). The overall goal of a system safety program is to design systems that do not contain hazards. However, the nature of most complex systems makes it impossible or impractical to design them completely hazard-free. As hazard analyses are performed, hazards will be identified that will require resolution. Risk management is a decision-making process consisting of evaluation and control of the severity and probability of a potentially hazardous event.

i). By assigning a Hazard Risk Index (HRI), a determination can be made as to whether hazards should be eliminated, controlled, or accepted. System safety precedence is a methodology that can be used by the Program Manager to define the order to be followed for satisfying system safety requirements and reducing risks. Alternatives for eliminating the specific hazard, or for controlling its associated risk, will have to be evaluated so that an acceptable method for risk reduction can be pursued.

b). It is not possible to remove all potential hazards from the railroad, and therefore a means for determining which hazards are acceptable is required. In general, the more severe the hazard, the more unlikely it should be.

c). For these cars, the following requirements have been established:

i). Hazards with an initial Hazard Risk Index of red or orange should be mitigated such that the Hazard Risk Index is reduced to HRI of yellow or green.

ii). Where it is not possible to reduce the risk to Level yellow or green, specific detailed analysis shall be provided by the Contractor to obtain approval of Amtrak. It should be noted that Amtrak would normally expect the Contractor to introduce design changes to reduce the risk to an acceptable level.

iii). Items with an HRI of red shall not be accepted.

iv). Items with an HRI of orange will only be accepted when it is proven to the satisfaction of Amtrak that the Contractor has exhausted all reasonable alternative approaches.

25.14 Fire Safety

a). Fire safety shall be achieved through adherence to the following requirements:

i). Those materials and products generally recognized to have highly toxic products of combustion shall not be used.

ii). All non-metallic components used on the vehicle shall be smoke, flame, and toxicity tested to NFPA 130, 49 CFR part 238, and BSS 7239.

(1) Maximum smoke developed, maximum flame spread indices, and toxicity emission limits shall be detailed in the specification.

iii). Materials used to fabricate miscellaneous, discontinuous small parts that will not contribute materially to fire growth in end-use configuration may be exempt from smoke, flame, and toxicity testing requirements with waivers approved by Amtrak.

iv). Exempt parts shall be less than 16 in² (100 cm²) in surface area in end-use configuration and may include, but are not limited to, the following:

(1) Knobs

(2) Rollers

(3) Fasteners

(4) Clips

(5) Grommets

(6) Small electrical parts

v). The Contractor shall submit for approval a list of all adhesives to be used on the vehicle, with a description of the physical, chemical, and fire safety properties of each. **[CDRL 25-09]**

(1) This requirement does not apply to adhesives used in extremely small quantities.

vi). The Contractor shall furnish a combustible material matrix including all combustible materials used in the vehicles showing all combustible

properties, weight (density), total surface area, total weight per vehicle, heat value per pound and per vehicle, flame spread, and flashpoint, and documentation references. **[CDRL 25-10]**

vii). All FST Test reports shall be within five years of Notice to Proceed (NTP). Any test reports that are older than five years, the contractor shall submit a letter from the material manufacturer stating the composition of the material has not changed. The material must be approved by Amtrak before use.

viii). All heat sources on the vehicle shall be protected with redundant levels of protection so that circuits are open before unsafe temperatures exist, neither ignition temperatures at the heating elements nor unsafe touch temperatures on the adjacent surfaces.

ix). Battery boxes, electrical cabinets, and the machine rooms shall be equipped with melting thermowire or thermocable to initiate a fire suppression via aerosol system when a fire or high temperature is detected.

x). Smoke Detectors shall be located in each fresh/return air mixing plenum and supply duct. Automatic dampers shall prevent external smoke from entering the vehicle.

xi). Smoke Detectors shall be mounted on the central ceiling panel. The smoke detector used in this location shall be identical to the smoke detectors used in other locations for ease of maintenance and replacement.

(1) All the smoke detectors shall have a strobe light and a sounder and should be rated for proper application on the railroad for shock and vibration.

xii). Smoke Detectors shall be installed in each sleeping accommodation and should be in a location that will be free of dust and debris to prevent false activation.

xiii). On-Board Crew shall be alerted if a smoke detector is activated.

xiv). Fire Suppression and Smoke Detection systems shall report alerts and failures to the diagnostic system.

xv). Protection from smoke and fire originating under the vehicle floor shall be proven through successful completion of a 30-minute floor fire test in accordance with ASTM E-119, NFPA 130, and 49 CFR, part 238.

xvi). Emergency egress shall be provided through vehicle end doors to adjacent cars.

xvii). Two fire extinguishers shall be located in each car.

xviii). The option of compartmentalized fire extinguishing, i.e., fire suppression in individual rooms instead of car wide, with water vaporization shall be considered and evaluated.

(1) For this option, the Fire Equipment Services (FES) shall have manual activation, e.g., at crew rest area, in addition to automatic activation.

xix). Windows intended for emergency escape or emergency access shall be designed for easily removable by a passenger, employee or rescuer and shattering of the glazing must not be required to remove the window.

xx). Trash containers shall be fire containing and prevent the propagation of fire outside of the enclosure.

b). The Contractor shall develop a Fire Safety Analysis complaint with 49 CFR 238.103(c) for the new equipment. The Analysis shall be submitted to Amtrak for Review and approval as part of FDR. **[CDRL 25-11]**

25.15 CDRLs

CDRL	Description	Due
CDRL 25-01	System Safety Program Plan (SSPP)	NTP + 60 days
CDRL 25-02	Preliminary Hazard List (PHL)	NTP + 60 days
CDRL 25-03	Preliminary Hazard Analysis (PHA)	30 days prior to PDR
CDRL 25-04	Hazard Tracking Log (HTL)	30 days prior to FDR
CDRL 25-05	Failure Modes, Effects and Criticality Analysis (FMECA)	30 days prior to IDR
CDRL 25-06	Fault Tree Analysis (FTA)	30 days prior to FDR
CDRL 25-07	Subsystem Hazard Analysis (SSHA)	30 days prior to IDR
CDRL 25-08	Operating and Support Hazard Analysis (O&SHA)	30 days prior to FDR
CDRL 25-09	List of all adhesives	30 days prior to IDR
CDRL 25-10	Combustible material matrix	30 days prior to IDR
CDRL 25-11	Fire Safety Analysis	30 days prior to FDR

* End of Chapter 25 *

Amtrak Universal Single Level Fleet Replacement

Technical Specification

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26. Digital Technology

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26.1 Overview

a). Background

i). Amtrak shall be provided with direct access to onboard, and offboard information in near-real-time via machine-to-machine communications with as little human involvement as possible. Data for each car shall be accessible independently as interoperability with the legacy fleet is required.

ii). In the rare event of a railway incident, Amtrak has a statutory obligation to provide information to regulatory authorities in support of their post-incident investigative activities.

iii). Contractor shall provide a secure, robust, and standardized Information Technology platform supporting both API-based access and data streaming, with streaming as the preferred method, to facilitate Amtrak's access to all data generated by and for the rolling stock, its onboard systems, and any and all wayside components under this contract.

iv). These APIs and/or streaming interfaces shall provide standardized integration points between any car and Amtrak's systems for the purpose of onboarding and offboarding information.

v). These APIs and/or streaming interfaces shall facilitate Amtrak design and development of all aspects of the customer experience solutions within its own content management and other programming facilities.

vi). The rolling stock and its systems shall support receiving content updates via these Amtrak systems or intermediary vendor services via APIs and/or streaming in.

vii). The Amtrak system shall be capable of retrieving telemetry, performance, events and other data from the trains or intermediary vendor services through both API-based interfaces and data streaming, supporting push, request/response, near-real-time, and real-time streaming data delivery mechanisms.

viii). More detailed integration requirements are specified in Section 26.6.

b). Required Integrations through API's/Streaming/T2G Amtrak Existing Architecture

i). At a minimum, the following data integrations shall be provided in these APIs:

(1) Journey programming for the On-Train Information System (OTIS) and any outputs from that system.

(2) Journey performance, including GPS track, announcements made, performance of on-board display screens, and errors identified after a completed journey is detected by the OTIS.

(3) Train handling including all events in the cab, by conductor staff, and by passengers.

(4) Train telemetry and events, including access to one-time and streamed process data from all onboard networks both in response to on-demand requests, configurable periodic transmissions from the train, and configurable event-based transmissions.

(5) Video surveillance system real-time and recorded video (if equipped)

(6) Event Recorder and Positive Train Control (PTC) data

(7) All other safety-related information

(8) Equipment faults, events and occurrences

(9) Train performance

(10) Automated measurements and readings

(11) Passenger Emergency Intercom requests and calls

(12) Attendant call requests and responses

(13) Reservation Display System

(14) Electronic Room Accommodation Door Lock System

(15) Data Communication System

(16) Network Intrusion Detection System

(17) HVAC Telemetry Data

c). Data & Information Ownership

i). All Information Technology components including applications, integrations, data and the corresponding infrastructure shall be delivered according to Amtrak Standards.

ii). The Solution Architecture, Designs, and Specifications shall be submitted for review and approval by Amtrak throughout the design reviews, with approval a condition of an acceptable Final Design Review (FDR). **[CDRL 26-01]**

iii). All data collected or generated by the system is the property of Amtrak and can be reused at Amtrak's discretion.

iv). All Information Technology components shall support both Operational and Cybersecurity monitoring in alignment with Amtrak Standards.

26.2 System Continuity, Criticality and Disaster Recovery

a). Amtrak System Assessment Methodology

i). Amtrak assesses and categorizes all systems according to impact on safety and business operations based on the matrix in Figure 26-1.

(1) Contractor shall indicate which *operational continuity* tier they support, as well as any *disaster recovery* (if applicable) and the overall *criticality level* of provided on-board and wayside systems.

(2) Systems that require real-time train movement or passenger safety shall conform to C1 criticality, and systems that support customer experience shall be at a C2 criticality level.

Figure 26-1 System Assessment Categorization

Operational Continuity (Planned & Unplanned Downtime)					Disaster Recovery				
Adjusted Availability Ceiling*	Planned Downtime Acceptable	Acceptable Recovery Time (Hours)	Acceptable Data Loss (Hours)	Reduced Performance Acceptable (AZ Loss)	Recovery Time Objective (Hours)	Recovery Point Objective (Hours)	Reduced Performance Acceptable (Large Scale)		Criticality Level
Up to 99.999%	N	0	0	N	N/A	N/A	N/A		C1
Up to 99.99%	N	1	0	N	4	1	N		C2
Up to 99.9%	Y	4	0	N	24	1	Y		C3
Up to 99.8%	Y	24	1	Y	48	24	Y		C4
Up to 99.7%	Y	Best Effort	24	Y	Best Effort	24	Y		C5

26.3 Engagement

a). Program/Project Management

i). Contractor shall work with Amtrak IT to establish appropriate elements to properly manage effort including:

(1) Schedule and Key Milestones

(2) Primary Deliverables Definition and Success Criteria

(3) Resource Plan with:

(a) Contact List

(b) Working Groups Definition

(c) Roles & Responsibilities

(4) Scope Definition with Backlog/Requirements

(5) Status Reporting Mechanisms including

(a) Status Reporting Definitions

(b) Artifacts

(c) Status Meeting Cadence

(6) Meeting/Workshop Plans for Information Sharing/Discovery

b). Working Team

i). Contractor shall work with Amtrak IT to ensure Resource Plan is comprehensive including representatives from third parties providing Software or Services to the solution.

ii). Third party providers shall be required to participate in working groups unless Contractor can provide expertise, information, and documentation for the solution.

iii). Amtrak reserves the right to request direct access to third parties if deficiencies are identified in the delivery of the solutions.

c). Hosting & Environment Support

i). Amtrak recognizes four primary approaches for the operation of systems or solution:

(1) Installed and Operated in Amtrak environments

(2) Installed and Operated by the Contractor directly within Contractor's environment

(3) Installed in Third Party environments and Operated by Contractor

(4) Installed and Operated in Third Party environments on behalf of Contractor

ii). Each approach has specific requirements for utilization at Amtrak for Delivery and Operations.

iii). Contractor shall be expected to work with Amtrak to understand and align with these requirements where appropriate as agreed upon between parties.

iv). Non-Production Systems

(1) Along with a Production environment aligned to System Criticality as defined in Section 26.2, the Contractor shall support the delivery of appropriate Non-Production environments sufficient to support Delivery and ongoing Operations.

(2) This includes the establishment of Test Labs for testing onboard systems without the need to disrupt train operations.

(3) Non-Production systems shall replicate relevant Production Capabilities and Functions.

(4) Contractor and Amtrak will mutually agree to the level of support and additional compensation related to the delivery of appropriate Non-Production environments sufficient to support Delivery and ongoing Operations.

d). Testing Support

i). Contractor shall support relevant aspects of testing, as agreed upon by all parties, including:

(1) Unit Testing

(2) Integration Testing

(3) End to End (E2E) Testing

(4) Smoke/Business Acceptance Testing

(5) Performance Testing

(6) Cybersecurity Testing including vulnerability scanning and penetration testing (A Full Test will be completed to Qualify Design and subsequent testing will be based on new releases and the systems impacted by the change)

(7) Regression Testing

(8) Continuity Testing (A full test will be completed as part of Factory Testing, and subsequent testing will be defined as part of the Design effort as agreed upon by all parties.)

(9) Continuous uptime testing for electronic equipment, demonstrating the equipment remains functional without user action in the context of Amtrak long distance operations

ii). For systems utilizing third party software or services, Grey Box testing may be required to validate underlying components operate to specification.

iii). Testing process and prerequisites shall be as agreed with Amtrak. Testing shall be aligned to best practices for execution and documentation of results, where appropriate.

e). Delivery Training & Change Management

i). Contractor shall work with Amtrak IT to establish a comprehensive training and change management plan aligned to systems and/or working groups as well as business users impacted by the program.

ii). Contractor shall utilize Train-the-Trainer approach, and the training will be part of the initial training scope with the delivery of the railcars (as per Chapter 22).

(1) Optional approaches of training such as videos, graphics, etc. can be utilized with approval.

iii). Any further training will have to be priced and compensated separately. This plan shall include, but not be limited to:

(1) Communications Structure & Plan

(2) Comprehensive Documentation for relevant Systems for Utilization and Administration

(3) Training Plans & Materials, as agreed upon by all parties.

(4) Additional collateral, such as graphics, images, videos to support Change Management & Training work throughout the program.

26.4 Operational Support

a). Operational Support Shared Responsibilities

i). Per Section 26.3e), the way that the platform is delivered and operated can vary by hosting method.

ii). Contractor shall work with Amtrak IT to define a clear Operating Model for the solutions that:

(1) Work with Amtrak IT to establish Service Level and Operating Level Agreements for systems aligned to best practices, as agreed upon by all parties.

(2) Define clear roles & responsibilities for all aspects of the solution aligned with Section 26.3a).

(3) Establish mutually agreed upon Operational and Support processes that include:

(a) Incident, Problem, and Change Management aligned to best practices such as linking of incident tickets between Contractor and Amtrak.

(b) Notification criteria and methods of escalation

(c) Reporting necessary to support SLA and OLA compliance, as well as failure analysis

(d) Services provided as software as a service (SAAS) remain within Contractor's responsibility

iii). The Contractor shall identify all Contractor or Contractor sub-supplier maintenance or operation support agreements available related to the on-going support of equipment, services, or licenses of on-board and wayside software. **[CDRL 26-02]**

iv). The Contractor shall prepare and submit for Amtrak review and approval a transition to operations plan and schedule that provides a clear path for transitioning support throughout all phases of the procurement, including pre-revenue service, revenue-service, and from Contractor-maintained maintenance and licensing included as a part of the base procurement, to on-going maintenance, support, and software licensing at the conclusion of

any such periods. The plan shall provide any expectations required for Amtrak support of the transition. **[CDRL 26-03]**

b). Operations & Security Monitoring

i). For services offered as SAAS with the focus to ensure continuity and performance of solutions, the contractor shall implement monitoring and logging based on the recommendations in ISO/IEC 27017, NIST 800-82 and NIST 800-53 and as required in Chapter 28 of this specification.

(1) Based on the tenancy configuration and capabilities of the Contractor's SAAS solutions, security alerts shall be forwarded to Amtrak's Cyber Fusion Center.

ii). Contractor will work with Amtrak and report any vulnerabilities as they are related to Amtrak data and systems immediately.

iii). Contractor shall work with Amtrak IT to define data lifecycles and classifications for relevant logged information and establish testing that validates compliance to these best practices where appropriate.

c). Third Party Software & Services

i). Contractor shall disclose relevant use of third-party software and services.

ii). If Contractor identifies issues with third party software or services, Amtrak IT must be notified per the defined notification process in Section **Error! R eference source not found.**.

d). Defect & Vulnerability Management

i). Relevant defects and vulnerabilities must be disclosed, logged, and remediated per the defined Incident and Problem management processes in Section **Error! Reference source not found.**.

ii). Relevant modifications to delivered products must tested to the same test cases as defined in Section 26.3d). with identified defects and vulnerabilities remediated or provided an exception before release.

e). Software Management

i). Contractor shall provide sufficient methods and/or tools for the troubleshooting and administration of relevant software provided. These capabilities should be aligned to best practices and Amtrak tools as mutually agreed upon in Section **Error! Reference source not found.**.

ii). Contractor shall work with Amtrak IT to ensure relevant software is maintained to the latest version as mutually agreed upon in Section **Error! R eference source not found.**.

f). Ongoing Training & Change Management

i). For relevant updates to delivered products, Contractor shall work with Amtrak IT to support required training and change management related to the update aligned to methods and deliverables as defined in Section 26.4e).

ii). Additional training required from software/feature updates will be jointly assessed and priced separately.

g). Technology & Performance Audits/Reviews

i). Contractor shall work with Amtrak to complete regulatory audits and reviews as required by Amtrak or applicable Regulatory bodies and assist in the remediation and response of these audits and review.

26.5 Wayside Requirements for OTIS

a). General Capabilities

i). To the greatest extent possible, Amtrak prefers that these capabilities are delivered through commercial, off-the-shelf systems rather than customized solutions. OTIS shall be an out-of-box COTS package with an established track record in revenue service trains.

ii). Open Standards shall be used (HTML5, JavaScript, etc.).

iii). Programming in OTIS shall have access to all displays, independently addressable and by Amtrak-defined groups.

iv). Access to all Contractor APIs shall be provided to facilitate programmatic access in addition to the use of Contractor supplied user interfaces.

v). All OTIS components shall be capable of being monitored remotely, and problems should be capable of being validated locally as well as alerts and detailed errors send to remote monitoring systems.

vi). OTIS shall be able to log and store events with enough detail to analyze and diagnose root cause of faults.

vii). In the event of loss of the train to ground interface, the OTIS shall be able to continue operation with the pre-loaded mission data. Dynamic updates such as seat assignments and train statuses should automatically re-commence when T2G communication is restored.

viii). Access to On-Board Variables

(1) Amtrak experienced programmers should be able to reference and display train mission variables based on a variety of contexts (for example, in-service at origin station, in-service at a station, in-service between stations, in-service at a terminal station, under daily test, under maintenance).

(2) Through a template system, to be approved by Amtrak, displays shall be capable of being programmed to accept and display on-board variables. The list of on-board variables shall be submitted by

Contractor for approval by Amtrak. The variables shall include at a minimum:

(a) Velocity

(b) GPS Location

(c) Line Map with Current Location, direction of travel, intermediate stops, and destination in a variety of scales

(d) Origin, Current, Next (including full sequence) and Final stops

(e) Date & Time

(f) Restroom status, to facilitate identification of nearest working and unoccupied restroom to that particular sign

(g) Status of PA/IC system, including status of audio broadcast, functioning of hearing loop, PEI call information, and intercom status

(h) Smoke detector status

(i) Relevant maintenance information – including onboard system status - which could be incorporated into a special workshop display templates to facilitate maintenance and operations staff in daily, scheduled, and unscheduled maintenance.

(j) Consist arrangement data such as relative location of Quiet car, Café car, etc.

(3) In addition, the OTIS system shall support external data feeds from ground-based systems in near-real-time to facilitate weather updates, news, and service updates.

(4) To accommodate a long-distance network that has periods of cellular carrier outages, the onboard systems shall be capable of storing data received from ground for replay, contingent upon a configured data validity and expiration.

(5) OTIS shall integrate with wayside systems including all applicable Amtrak enterprise systems and supplier/vendor systems necessary for operation of the OTIS, Video Surveillance System (VSS), and Reservation Display (if equipped) and adjacent systems, as specified in Section 26.6.

(6) The wayside integration of OTIS will allow content and data from Amtrak enterprise data sources on the wayside to be delivered to trains via the Data Communications System (DCS) and stored onboard for displaying interior and exterior train displays and for audio announcements on interior and exterior speakers. The OTIS wayside integration will also support functions of the VSS.

ix). Triggers

(1) Amtrak expects to be able to program the on-board experience in an event-driven fashion. Events shall include at a minimum:

(a) Mission start and end

(b) Geolocation with geofences to trigger events

(c) Time since or time-projected-before a geofence

(d) State of operations (start of movement, cruise, emergency stop, etc.)

(e) Manual operation

x). OTIS Wayside Customer Experience Simulation Lab (Option)

(1) Amtrak must be able to simulate and validate the complete customer experience of the OTIS prior to loading the content programming to railcars, and to diagnose issues identified in the field with communication system operation, including but not limited to content issues.

(2) The Contractor shall deliver a turn-key OTIS simulation lab which shall include the full complement of onboard equipment necessary to fully simulate the on-board communication system operation. In order to reliably simulate the OTIS customer experience on the wayside, the lab shall match the OTIS capability of the train to the greatest extent possible.

(3) All OTIS equipment necessary to simulate all car types shall be supplied as a part of the OTIS simulation lab.

(4) For clarity, this includes minimally the following equipment:

(a) All types of displays, of type and quantity necessary to simulate all car types

(b) PA/IC controllers

(c) PEI units

(d) amplifiers

(e) speakers

(f) inductive audio loop system for audio accessibility

(g) Bluetooth LE Auracast broadcast for audio accessibility, if the trains are equipped with this option

(h) cameras

(i) HMI displays, including Control Terminals

(j) reservation display system components

(k) attendant call system components

(l) data communication system

(m) electronic room accommodation and door lock system components

(n) control units which make up the OTIS system

(o) Video Surveillance System / Network Video Recorders

(5) The OTIS lab shall include ancillary hardware which provides the capability to perform automated, semi-automated, and manual route simulations in the lab.

(6) The OTIS lab shall support mission simulation with playback of telemetry and events from a recorded from actual on-board journeys, and through manually prepared journeys.

(7) The OTIS lab shall:

(a) Integrate with wayside systems including all applicable Amtrak enterprise systems and supplier/vendor systems necessary for simulation of the OTIS, Video Surveillance System (VSS), an Reservation Display System (if equipped) in the lab. To ensure that the lab matches the OTIS capability in the trains, this lab integration shall follow the applicable requirements specified in Section 26.6.

(b) Interface with the same production systems used for the revenue fleet that facilitate the upload of programming and content, such that the same APIs as production are used.

(c) Provide playback of telemetry and event logs to animate the simulation in real-time, accelerated, and slow modes.

(d) Provide simulation of customer experience for samples of all interaction types (all display types, audio).

(8) The simulation shall incorporate the capability to simulate end users interaction with the on- and off-board system during all stages of the train's operation, including:

(a) Train staff operation of the Control Terminal and on-board HMIs including authentication, and operation of system integrations with the Video Surveillance System (if equipped), Public Address System, Intercom System, Attendant Call, and PEI.

(b) Train staff operation of Amtrak electronic devices, and their interaction with the OTIS equipment.

(9) The wayside OTIS simulation lab shall be implemented in a modular and extensible fashion, allowing future modifications and upgrades that occur on the vehicles being simulated in the lab, so that the lab is always maintained to match the OTIS capability in the trains.

(10) The Contractor shall be responsible for delivery, installation, configuration, documentation, training, and setup support of the lab at a location specified by Amtrak. After the lab delivery at the Amtrak designated lab site, Amtrak shall verify the lab operation, configuration, documentation, training, and accept the lab as operational after successful verification.

(11) It is Amtrak's expectation that the Contractor and Amtrak will negotiate an on-going maintenance and support agreement for the lab, that shall do into effect immediately upon acceptance of the lab by Amtrak. Under this agreement, Contractor shall provide technical support, spares, and supplies for the lab under mutually agreed terms and conditions, including support response time SLAs for different types and priorities of support incidents. A support process shall be documented, describing how the lab support incidents will flow between Amtrak and the carbuilder and/or the lab suppliers/vendors. The support process will address how support incidents will be reported by Amtrak users and will be triaged, troubleshooted and resolved by the Contractor.

(12) The detailed system description, functionality, and infrastructure requirements shall be submitted to Amtrak for review and approval. **[CDRL 26-04]**

b). Car Telemetry

i). Data telemetry includes data generated by operator inputs, onboard sensor data, event recorder data and other diagnostic and status information.

ii). Train Control and Monitoring

(1) Amtrak's assumption is that train data will first flow to Contractor's back office systems that analyzes the data and shall trigger maintenance and other actions based on analysis.

(2) In addition, Contractor shall provide a set of services that allow Amtrak to retrieve all data generated by the train using a set of API's/Services that allow Amtrak to pull data in near real-time or to push the data in near-real time to Amtrak.

(3) This does not preclude Contractor from providing a portal for Amtrak personnel to review any data analysis or data visualizations provided to enhance operational awareness of a train's condition.

(4) A data dictionary of the data feed is required. This shall include definition of all data fields, all possible data values, conditions that generate each value and/or the trigger for each field and data value.

iii). Safety/Event Related Information and Video

(1) Today Amtrak collects data in real-time during extraordinary events to understand and assess the impact of those events.

(2) Specifically, Amtrak sets trigger types based on specific input from the operator or sensors to trigger an event. When an event is triggered, the event record data and user defined segment of video data is immediately relayed to Train Operations to provide situational awareness.

(3) A typical example is when emergency braking is activated, the event recorder and video for a limited time before and after the incident are sent via the cellular network to Amtrak's network operations center for immediate review.

(4) The triggers and video lengths should be configurable as well as the type of information needed. A data dictionary of the data feed is required. This should include definition of all data fields, all possible data values, conditions that generate each value and/or the trigger for each field and data value.

(5) Refer to Chapter 14 for additional specific requirements.

iv). Data Definition

(1) Complete data dictionaries and schema shall be provided for all data recorded on the train, along with the format of any data transmitted to the wayside.

(2) Data dictionary shall provide full access to the complete fidelity of the recorded information.

(3) In addition to user operated PTU, DTE, and other software packages provided by the contractor, utilities to export all binary data into an open, machine-readable format (e.g., CSV, JSON, XML), with full fidelity of the data represented, in a way that can be interpreted by end users (e.g., in engineering units) shall be supplied by the Contractor.

(4) The tool shall provide all means necessary to decrypt and/or decode the data.

(5) The details of the data dictionaries and documentation of the tools shall be submitted along with the utilities for review and approval by Amtrak 90 days prior to delivery of the first vehicle. **[CDRL 26-05]**

(6) Updates of the data dictionaries, documentation of the tools, and the utilities shall be provided prior to the deployment of software which modifies the data formats.

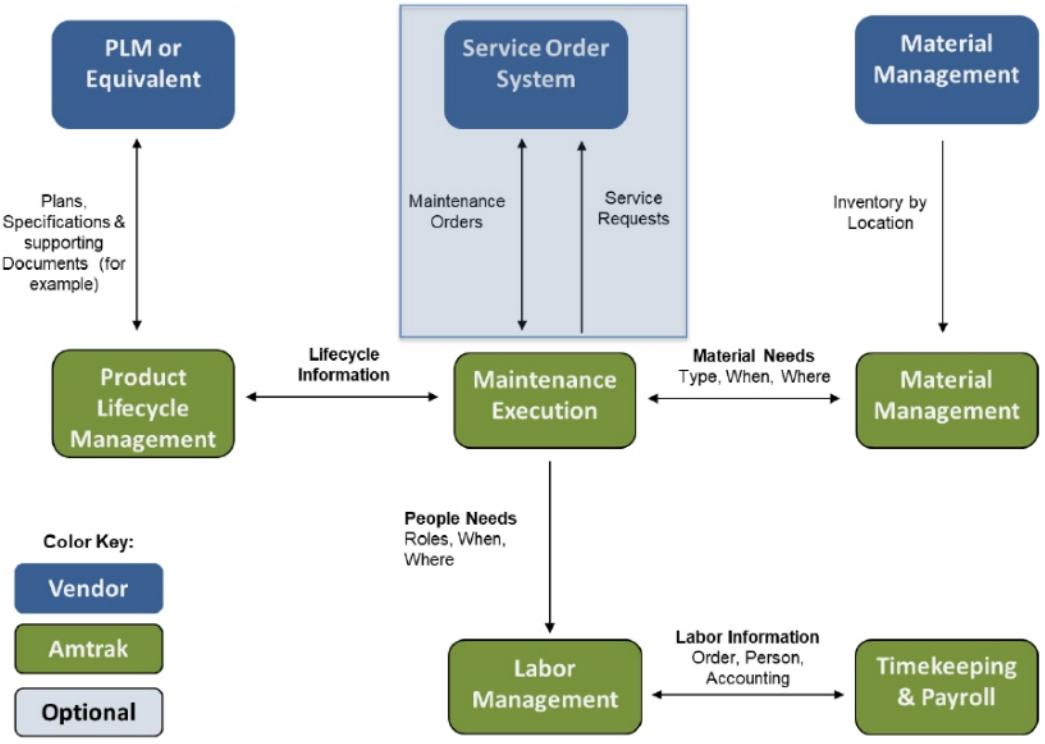
c). System Extensibility and Upgrades

i). Amtrak recognizes that many onboard systems will require technology refresh throughout the life of the rail vehicles.

ii). Display screens, data communication systems, system controllers, cameras, control terminals, passenger compartment equipment, and other customer facing onboard equipment will go through multiple upgrades or refreshes.

iii). The on-board and wayside systems provided as a part of this shall be designed in a flexible and extensible method in order to minimize the impact of these anticipated changes.

Figure 26-2: Business Process Viewpoint



iv). As shown, this is business view of the TSSSA process, with service order creation from Contractor optionally being created in their own systems.

d). Service/Work Order

i). If maintenance orders originate from Contractor, there shall be enough information provided to Amtrak to complete the work without directly referencing Contractor's systems.

ii). If Contractor will not integrate their service order system to Amtrak, work orders shall be created in Amtrak's maintenance execution system.

iii). Work order status shall be provided to Contractor.

iv). Job plans (task lists, tools, materials) should be provided with the maintenance orders.

e). Material Availability

i). Since Contractor shall provide materials to complete maintenance requests, it is assumed Contractor shall ensure materials will be available prior to the execution date(s) of the work order.

f). Back Office

i). Additional interfaces shall be required to integrate billing. These are not included in the diagram since this may differ based on the technologies used by Contractor.

g). Technical considerations

i). The following technologies are in use at Amtrak:

(1) PLM – Siemens Teamcenter

(2) Workorder Management – Maximo & EAMS Braid Mainline Rail

(3) Warehouse & Material Management – SAP

(4) Financial Systems – SAP

(5) Integration/Service Bus – MuleSoft AnyPoint

(6) EDW/Analytical Capabilities - Amazon Redshift/Tableau

(7) EDW/Analytical capabilities are available to support insights into asset condition.

(8) Genetec Security Center (Video Surveillance System, see section 14)

26.6 Train-to-Amtrak Integration Requirements

a). General Integration Requirements

i). To support Amtrak's strategic vision of a unified, modernized, and centrally managed digital ecosystem for Journey Systems across the fleet, all vendor/contractor integrations must follow a standardized, secure, API-driven architecture.

ii). Amtrak supports two primary integration patterns:

(1) Train-to-Vendor/Contractor Systems (Onboard to Offboard):

(a) Communication from railcars to vendor/contractor systems must use secure APIs.

(b) Data exchange onboard or from onboard systems to vendor/Contractor cloud endpoints must adhere to secure communication protocols.

(c) More details in Section

(2) Ground-to-Ground Integrations (Vendor/Contractor Cloud → Amtrak Cloud):

(a) Streaming is the preferred option for continuous, near real-time data exchange between vendor cloud platforms and Amtrak cloud environments.

(b) When streaming is not feasible, REST-based APIs may be used as the fallback method.

(c) Depending on vendor/Contractor solution capabilities, one or both integration patterns may be combined.

(d) For ground-to-ground integrations (Vendor/Contractor Cloud → Amtrak Cloud), streaming is the preferred method for all real-time and event-driven data exchange.

(i) Vendors/Contractors must support a modern, cloud-native streaming platform, such as:

1. Apache Kafka (example), or

2. An equivalent event-streaming technology that provides similar capabilities.

(ii) The streaming solution must provide:

1. Near real-time event delivery

2. Persistent, long-lived connections (no polling)

3. Server-initiated push of event

4. Built-in scalability and reliability

5. Authentication and secure transport

6. Error handling and reconnection support

7. Operational metrics for monitoring

b). Alignment with Amtrak T2G (Train-to-Ground) Architecture

i). Any solution that transmits data from train systems must operate within the existing Amtrak T2G architecture:

(1) The Train-to-Ground (T2G) network uses secure VPN tunnels established over a Private APN.

(2) All traffic originating from onboard systems must be routed through:

(a) Cellular Private APN/Satellite Private Layer-2 or MPLS circuits

(b) T2G VPN tunnels

(c) Amtrak perimeter firewalls

(d) Amtrak secure network zones, including internal and external (public cloud) environments.

(e) No traffic may bypass Amtrak's security perimeter. Direct access from onboard devices to vendor cloud environments is not permitted without first transiting through Amtrak's VPN and firewall layers.

(3) From T2G gateway, data may reach:

(a) Amtrak Internal Cloud (private or on-prem hybrid cloud)

(b) Amtrak-approved External Cloud Platforms

(c) API gateways, streaming gateways, or integration hubs for downstream processing.

ii). Routing is subject to architectural approval and security policy enforcement.

(1) No direction vendor-cloud connections from onboard systems are permitted without routing through the approved T2G path.

c). Architectural, Identity, and Secure Compliance

i). All proposed integrations must comply with:

(1) Amtrak's Enterprise Architectural Principles

(2) Identity and Access Management (IAM) standards

(3) Cybersecurity and Zero Trust requirements

(4) Adherence to approved encryption, authentication, and key management methods

(5) Use of current, supported versions of all technologies and frameworks

d). Certificate-based Authentication Requirements

i). To ensure strong, identity-bound access control across all T2G data flows, Amtrak requires certificate-based authentication for:

(1) Devices onboard the train

(2) Network components participating in T2G communication

(3) API endpoints or streaming endpoints connected to Amtrak systems

(4) Any vendor systems exchanging data with Amtrak over ground-to-ground interfaces.

(5) Certificates must:

(a) Be issued by an Amtrak-approved Certificate Authority (CA)

(b) Use modern cryptographic standards (e.g., TLS 1.2/1.3, 2048-bit or higher keys)

(c) Bind the identity of devices, applications, or services to the certificate.

(d) Support mutual TLS (mTLS) where applicable.

e). Certificate Management Requirements

i). Vendors must support secure and automated lifecycle management for certificates used in T2G and ground-to-ground integrations, including:

(1) Certificate provisioning and secure deployment

(2) Automated renewal mechanisms where possible

(3) Revocation processes (CRL/OCSP) that Amtrak can enforce

(4) Rotation schedules aligned with Amtrak security policy.

(5) Ensuring no certificate is hard-coded or stored in plaintext

(6) Secure key storage (e.g., TPM, HSM, encrypted keystores)

ii). Vendors must integrate with Amtrak's certificate governance standards and participate in periodic reviews to ensure certification health, validity, and rotation compliance.

f). Architectural Design Expectations (MACH Alignment)

i). Solutions must demonstrate measurable business value and adhere to modern architectural practices, including:

(1) Microservices-based decomposition

(2) API-first design

(3) Cloud-native deployment models

(4) Headless, modular components that support rapid feature deployment

(5) Scalability, maintainability, and clear total cost of ownership (TCO) evaluation.

g). Change Management and Interface Stability

i). Vendors must provide advance notification to Amtrak of any software or system modifications that could affect:

(1) Approved API specifications

(2) Streaming interfaces

(3) Data models or schemas

(4) Communication protocols

(5) Security or network requirements

ii). Changes may not be deployed without joint approval and coordinated testing.

26.7 Identity Requirements

a). General Identity Requirements

i). Amtrak has an adopted identity standard for all authentication and authorization scenarios. Amtrak's core identity solution is Microsoft Azure AD and all solutions shall conform to patterns as supported by that platform.

ii). Contractor supplied software and systems requiring authentication of Amtrak users shall incorporate Amtrak's Microsoft Azure AD for identity. This shall include:

(1) Contractor supplied SAAS applications

(2) Contractor's sub-supplier SAAS applications

(3) Software supplied to run in/on Amtrak's environments

(a) Contractor to propose alternate options for On-board OT Equipment that may not have access to Amtrak's Microsoft Azure AD. These options may be considered by Amtrak.

iii). Amtrak requires the IT solution for this solicitation to conform this standard including:

(1) Amtrak Employee or Contractor logins

(2) Non-Amtrak Personnel logins

(3) Machine-to-Machine Communications

iv). Microsoft Azure AD Reference is located at the following URL:

https://docs.microsoft.com/en-us/azure/active-directory/fundamentals/

26.8 CDRLs

CDRL	Description	Due
CDRL 26-01	Provide Solution Architecture, Designs, and Specifications for review and approval by Amtrak throughout the design reviews.	30 days prior to PDR, on-going updates
CDRL 26-02	Identify all Contactor or sub-supplier maintenance and operation support agreements related to the on-going support of equipment, services, or licenses of on-board and wayside software.	30 days prior to PDR, on-going updates
CDRL 26-03	Provide an operations plan and schedule for transitioning support throughout all phases of the procurement.	30 days prior to PDR, on-going updates
CDRL 26-04	Provide detailed system description, functionality, and infrastructure requirements for OTIS wayside customer experience simulation lab.	30 days prior to PDR, on-going updates
CDRL 26-05	Provide details of the data dictionaries and documentation of tools.	90 days prior to delivery of the first car

* End of Chapter 26 *

Amtrak Universal Single Level Fleet Replacement Technical Specification

27. Software and Microprocessor-Based Systems

Revision 2

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Figure 27-2: Required Software Documentation (Option 2) 27-7

27.1 General

a). This section applies to all software, microprocessor-based systems supplied for this project, including vehicle subsystem controls, test equipment, data analysis, fault analysis and training deliverables.

b). This section shall also apply to the programming of all programmable devices, including microprocessors, microcontrollers, Programmable Logic Devices (PLD), Application-Specific Integrated Circuits (ASIC), or Field Programmable Gate Arrays (FPGA), etc.

27.2 Software Systems Justification

a). Suppliers shall submit a life cycle cost justification for each software application not explicitly required by this specification.

b). This justification shall include, but not be limited to, a comparison between a hardware (e.g. relays, and discreet electronic) and a software-based system.

c). For this calculation, the supplier shall use an "end of life" or obsolescence of the hardware (microprocessor and associated ICs) of 10 years and Military Handbook (MIL-HDBK)-217, Ground Mobile.

d). Based on this analysis, Amtrak will approve or disapprove the use of additional software systems.

27.3 Software Systems Requirements

a). Software System Classification

i). Hardware and software requirements depend on the degree to which the hardware and/or software is custom designed for or applied to this project.

(1) "Commercially available" or "Commercially Off The Shelf" (COTS) hardware or software shall be readily available in the US through retail and wholesale sources and shall be subject to all requirements, except as noted in this section.

(2) "Non-commercially available" hardware or software shall be developed or modified according to the requirements in this section.

(3) Hardware shall be viable for a railway application in terms of robustness and security.

b). Time and Date Processing

i). All software and hardware delivered or developed under this Contract shall be capable of handling dates in the range from 2000 to 2099.

ii). The date data processing shall not experience abnormal ending and/or invalid or incorrect results from the hardware, software, data repository or firmware in operation as part of Amtrak’s business processes.

iii). Each hardware, software, data repository or firmware's date data interface shall support a four-digit year format.

iv). The master real time clock for all subsystems that are connected to the vehicle network shall be provided by the Central Diagnostics Unit (CDU). During Design Review, Contractor shall work with Amtrak to identify vehicle networks that are required especially with respect to cybersecurity.

v). All subsystems shall synchronize to the master clock.

vi). All time displayed to the train crew, maintenance personnel, or passengers shall be adjusted to the local time and shall automatically be adjusted to daylight saving time.

vii). The start and end dates for daylight savings time for all systems shall be adjustable by Amtrak via a configuration of the CDU.

27.4 Software

a). Software Development Process

i). All Non-COTS software shall be in accordance with IEEE Std 62443, Standard for Software Documentation for Rail Equipment and Systems, and the requirements stated within this specification.

ii). The IEEE Std 62443 requirements shall be for a "Type 5" procurement as defined within that standard except as noted below.

b). Backward compatibility

i). Software revisions shall maintain minimum one-version backward compatibility with existing subsystems and communication protocols unless explicitly approved by Amtrak. The Contractor shall provide a compatibility verification report for each release.

c). General Features

i). Software shall perform the following basic functions:

(1) Implement the desired control scheme such that the specified performance is achieved.

(2) Monitor all inputs for unsafe, erroneous, or unknown conditions or combinations of conditions.

(3) Sample all input conditions at rates sufficient to detect and remedy all unsafe or damaging conditions in the shortest possible time.

(a) Sampling rates and program execution times shall be such that the control system is not the limiting factor in response to unsafe or damaging conditions.

(b) All software shall be designed to ensure that the timing requirements for safety related tasks are always met.

(4) Limit all output commands to safe levels for all combinations of input conditions, to avoid equipment damage and hazards to personnel.

(5) Perform system self-diagnostic routines and respond promptly, safely, and predictably to detected faults.

(a) The self-diagnostics shall include tests for program corruption and integrity in read/write memories such as (Electronically Erasable Programmable Read Only Memory) EEPROM and flash Programmable Read Only Memory.

(6) Respond safely and predictably when powering up or recovering from power interruptions.

(a) All power interruptions likely to have corrupted temporary storage shall be detected and cause the system to reinitialize all affected routines and temporary data.

(b) Detection of power interruptions may be by hardware.

(7) Permit thorough interrogation of all input, output, and internal conditions (values calculated or computer by software or logic) by internal, system level, vehicle level and external diagnostic equipment.

ii). Undocumented software features are prohibited.

d). Contractor Activities

i). The Contractor, as system and software integrator, shall be responsible for the overall quality of all software supplied as part of this contract.

(1) If the Contractor also develops software, it shall consider the team that develops software as a supplier.

ii). Quality Control Plan **[CDRL 27-01]**

(1) The Contractor shall develop a car level software quality control plan which defines how it will manage and oversee the software development of its suppliers.

(2) The software quality control plan may be a section within the Contractor's Project Quality Plan.

iii). Software Quality Audits

(1) The Contractor shall conduct periodic software quality audits of all Non-COTS suppliers as well as at each major release/upgrade.

(a) Amtrak reserves the right to attend any audit along with the Contractor.

(2) Amtrak reserves the right to conduct a software quality audit at any time during the Contract especially during software design and development phase.

(3) At a minimum, the suppliers shall plan for an audit to be performed at the Final Design Review (FDR). **[CDRL 27-02]**

(4) The results of all audits shall be submitted to Amtrak for review and acceptance. **[CDRL 27-03]**

(5) Remedial action for all open comments from any audit shall be submitted to Amtrak for review within 90 days of the audit. **[CDRL 27-04]**

(6) The audit shall include:

(a) A software process audit – on each software supplier and its sub suppliers which shall include at a minimum

(i) Project management

(ii) Requirement Tracing

(iii) Configuration Control

(iv) Coding standards

(v) Change process and Defect tracking

(b) Physical audit as defined by IEEE, Std 730 on each SCI – This report shall be submitted with **[CDRL 05-04]**.

iv). Software Testing

(1) The Contractor shall witness all software verification and validation testing (STPr/SD) prior to the release of any software.

(2) Amtrak reserves the right to attend these tests along with the Contractor.

v). Configuration Control

(1) The Contractor shall develop a Software Configuration Control Plan (SCCP) **[CDRL 27-05]** for tracking software changes to individual cars on Amtrak property until the end of the warranty period and all retrofits are complete.

(a) This plan shall be submitted for review and acceptance by Amtrak.

(b) The SCCP shall also control software on non-car equipment such as PTU's, BTE's, and the like, and shall include a

mechanism to ensure continuing compatibility between car software and non-car software.

(c) It shall be consistent with the Contractor's approach to configuration control of hardware and require similar approvals and tests.

(d) These requirements apply to all software subcomponents as well.

(2) The Contractor shall maintain a database of the software version of every software item on each car and in each piece of non-car equipment.

(a) The database shall be kept current by the Contractor at all times and be submitted each time software is updated on any system. **[CDRL 27-06]**

(3) The software version status of every software item on the car shall be provided in the Car History Book. **[CDRL 27-07]**

(4) The software version status of every software item on each piece of non-car equipment shall be provided by the Contractor with the delivery of the equipment. **[CDRL 27-08]**

vi). Delivery of Software

(1) At the end of the warranty period and for each software release thereafter, the Contractor shall provide to Amtrak on Compact Disc Read-Only Memory (CD-ROM), USB Drive, Digital Video Disc (DVD), or an acceptable technology at the time:

(a) All executables **[CDRL 27-09]**

(b) Updated software documentation **[CDRL 27-10]**

(c) Updated user documentation **[CDRL 27-11]**

(d) Software Version Description (SVD) **[CDRL 27-12]**

(2) The requirement for CD-ROM, USB Drive or DVD copies and documentation shall apply to every delivery of software for non-car equipment.

(3) The SVD shall contain a description of problems addressed, known problems yet to be addressed, features added, requirements added or changed, design changes, compatibility between other versions of software, other system and other cars in the train, changes to related software documents and evidence of document review, test plan, and test results.

e). Software Developer Documentation

i). The Contractor shall provide complete software architecture documentation, including component diagrams, interface diagrams, state machine diagrams, network diagrams including protocols used, and API diagrams including how-to-use manuals.

ii). All suppliers who develop software shall submit for Amtrak's review and approval, documentation to ensure a mature software development process that has been fully verified and validated and can be maintained in the future. **[CDRL 27-13]** Amtrak offers two paths listed below:

(1) Submit all the documentation as required by IEEE, Std 62443, for type 5 software.

Figure 27-1: Required Software Documentation (Option 1)

Document Name	Software Type	PDR	IDR	FDR	New Software Releases
Software Project Management Plan (SPMP)	All	Yes	No	No	No
Software Quality Assurance Plan (SQAP)	All	Yes	No	No	No
Software Configuration Management Plan (SCMP)	All	Yes	No	No	No
Software Verification and Validation Plan (SVVP)	All	Yes	No	No	No
Software Verification and Validation Report (SVVR)	All Non-COTS	No	No	No	Yes
Software Requirement Specification (SRS)	All Non-COTS	Yes	Yes	Yes	Yes
Interface Control Document (ICD)	All	Yes	Yes	Yes	Yes
Software Design Description (SDD)	All Non-COTS	No	No	No	Yes
Database Design Description (DBDD)	All	Yes	Yes	Yes	Yes
Software Requirement Traceability Matrix (SRTM)	All Non-COTS	Yes	Yes	Yes	Yes
Software Test Plan (STP)	All Non-COTS	Yes	No	No	No
Software Test Procedure (STPr)	All Non-COTS	No	Yes	Yes	Yes
Software Test Report (STR)	All Non-COTS	No	No	No	Yes
Software Version Description (SVD)	All	No	No	No	Yes
Software User Manual (SUM)	All Non-COTS PTU/BTE	Yes	Yes	Yes	Yes

(2) In order to reduce the amount of submittals, the Contractor may combine the documents by IEEE, Std 1558, for type 5 software as follows:

(a) The SPMP, SQAP, SCMP, SVVP, and STP shall be combined into one document entitled Software Development Plans (SDP). This SDP shall include all the requirements of the individual documents.

(b) The SRS, SDD, DBDD, STPr, STR, and SVVR shall be combined into one document entitled Software Documentation (SD). This SD shall include all the requirements of the individual documents.

(i) It is expected that this document would be developed as a database and would be expanded and updated as the software is developed and tested.

(c) The ICD and DBDD shall be combined into one document entitled Software Interface Document (SID).

(i) This SID shall include all the requirements of the individual documents.

(d) The SVD and SUM, if required, shall be stand-alone documents.

Figure 27-2: Required Software Documentation (Option 2)

Document Name	Software Type	PDR	IDR	FDR	New Software Releases
Software Development Plan	All	Yes	No	No	No
Software Documentation (SD)	All Non-COTS	Yes	Yes	Yes	Yes
Software Interface Document (SID)	All Non-COTS	Yes	Yes	Yes	Yes
Software Version Description (SVD)	All	No	No	No	Yes
Software User Manual (SUM)	All Non-COTS PTU/BTE	Yes	Yes	Yes	Yes

iii). Regardless of which path is chosen, the Contractor or software supplier shall develop the SRS based on the technical specification requirements.

(1) The SRS shall fully link to each technical requirement.

(2) The contractor shall submit an SRTM with the first release of the SRS to Amtrak.

(3) The SRTM shall use the technical section reference identification numbers as defined in the technical specification as the reference to link to the SFD, SRS, SDD, and STPr or SD.

(4) The Contractor shall update and submit an updated version of the SRTM with each document released, strictly following the software life cycle process.

(5) The Contractor and supplier shall not proceed in the software development until the SRS document is reviewed and approved by Amtrak.

(6) The Contractor shall submit software documentation to Amtrak based on the software life cycle.

iv). In order for Amtrak to update, modify, or replace a system on the cars at a later date, the following documents shall be marked "Non-Proprietary": ICD, DBDD, SID and SUM.

v). The Contractor shall perform a demonstration to ensure that the ICD and DBDD or SID is complete and accurate. **[CDRL 27-14]**

f). Operating Systems and Languages

i). Software may be written in a high or low-level language; however, high-level languages such as C/C++ are preferred.

ii). The language, compiler, and its implementation for the selected microprocessor system shall be commercially available in English.

iii). All languages and operating systems shall have an acceptable customer base and be in widespread use.

iv). Use of commercial operating systems such as Windows™ for onboard applications is prohibited, unless approved by Amtrak on a case-by-case basis. Commercially off the shelf available software is categorized as software that can be purchased, leased, or licensed by the general public.

v). Where approved for non-onboard applications such as PTU and BTE, software running on Windows™ shall include a Windows™ format help file to provide context sensitive help to the user of the software.

vi). All compilers shall be approved by Amtrak based on previous service history.

vii). The suppliers shall have a software coding standard for each programming language which shall define header information, comment requirements, module size, etc., similar to NASA C Style Guide SEL-94-003 or MISRA C.

g). Commercial Off-the-Shelf Software

i). Some software supplied under this contract may be commercial-off-the-shelf when approved by Amtrak such as operating systems supplied for PTU and BTE.

ii). For Commercially Available Software, the following shall be supplied:

(1) The original data storage/transfer media functional and usage details **[CDRL 27-15]**

(2) All manuals and instructions to configure and install the software **[CDRL 27-16]**

(3) All licenses required for Amtrak's site use **[CDRL 27-17]**

h). Software Testing

i). Software testing shall be a prerequisite to higher level testing, such as system level and vehicle level tests.

ii). All system or subsystem level features and functions of software systems which implement system or subsystem-level requirements of the Technical Specification that are allocated to software shall be testable.

iii). Field testing shall use the PTU and procedures provided under this Contract.

iv). For features which are only testable off the car with special equipment, all such equipment shall be supplied by the Contractor as test equipment and become the property of Amtrak.

(1) This equipment shall provide the logic, sequencing, and emulation necessary to verify that the software functions as intended.

(2) In lieu of separate equipment, appropriate test functions may be provided within the PTU.

v). Unit and Module Interaction Testing

(1) The supplier shall perform unit and module interaction testing on all software components.

(2) This unit testing shall provide 100% coverage, unless approved by the Engineer.

(3) Automatic test tools, such as Vector Cast or LDRA may be used.

(4) As a minimum, full branch testing, data range and boundary testing, and error trap testing shall be completed.

(5) All unit testing results shall be fully documented in a unit testing report which shall be submitted to Amtrak for review and approval. **[CDRL 27-18]**

vi). Software Type Testing

(1) Type tests of all software systems shall verify the proper operation of all software features, including diagnostics.

(2) The type tests shall demonstrate that the system under test can successfully recognize and report all faults listed in the CDU Fault Management Plan and all other events and parameters reported to the CDU.

(3) The Contractor shall submit the results of the type tests to Amtrak for review and approval. **[CDRL 27-19]**

(4) Where such tests may result in damage to the system hardware, the fault or event may be simulated to avoid damage to the hardware. Any documented exceptions shall be provided in written communication to Amtrak.

(5) Such testing shall be performed any time the software is changed, prior to putting it into service.

vii). Software Validation Test Procedures

(1) Software validation test procedures must be approved by Amtrak prior to the execution of the tests. **[CDRL 27-20]**

viii). Testing of Software Revisions

(1) After the initial version of software is installed on the cars, all software revisions shall be tested by the supplier in the supplier's facilities (laboratory) in accordance with its testing processing and procedures.

(2) After successful completion of such tests, a test version of the software revision shall be placed on a limited number of cars and dynamically tested for a period of time as approved by Amtrak.

(3) Only after results of the dynamic tests on a limited number of cars have been approved by Amtrak shall a new software revision be applied to the fleet or any portion of the fleet.

(4) Application of any software revision to any portion of the fleet at any time shall be in conformity with the approved Configuration Control Plan of this Section 27.c.v.

i). Software Version Numbers

i). Software version numbers shall be included within the firmware code and shall be accessible via laptop Portable Test Unit (PTU), the CDU, and on the system's display.

ii). Every change to software shall be reflected in an update to the version number.

iii). If the software includes data or parameter files which can be modified by the suppliers or by Amtrak, a modification to such files must be reflected in a change to the software version number or a separate data/parameter file version number.

j). Software Security

i). The Contractor, as the systems and software integrator, shall implement disciplined security practices. The disciplined security practices shall be determined by Amtrak unless otherwise agreed upon.

ii). These security practices shall align with industry best practices and ensure the confidentiality, integrity, and availability of the delivered software systems.

iii). To demonstrate its capability, the Contractor shall submit:

(1) The results of a current, independent, BSIMM and/or OWASP SAMM software security assessment **[CDRL 27-21]**.

(2) The assessment shall evaluate the security controls, vulnerabilities, and overall security posture of the software systems implemented by the Contractor, including but not limited to, the following areas:

(a) Authentication and access control

(b) Data protection and encryption

(c) Secure coding practices

(d) Security testing and vulnerability management

(e) Incident response and recovery

(f) Security documentation and training

k). Software Update

i). It shall be possible to update all application software with the exception of approved programmable devices (E.g. ASIC, CPLD, etc.) via the PTU connected to the system directly.

ii). Any partial or interrupted software update shall automatically return the system to the previous version of software and not leave the system in an unconfigured state.

iii). The time required to upload the entire software complement for a given system, including time to replace firmware embedded in FPGAs, CPLDs, etc., shall be no more than fifteen (15) minutes.

iv). The Contractor shall provide detailed instructions/procedure to install and configure the software.

l). Transfer of Software to Replacement Devices

i). In order to ensure the long-term maintainability of programmable devices, Amtrak requires that to Contractor provide:

(1) Master copies of the compiled executable for all programmable devices such as ASICS, CPLD's, FPGA's and Read Only Memory Devices. **[CDRL 27-22]**

(2) Six (6) sets of the necessary equipment and software to transfer the compiled software to new devices and to verify the integrity of the copy. **[CDRL 27-23]**

ii). If the requirements of part i of this subsection are not possible to meet for any programmable device, the Contractor shall provide Amtrak with a sufficient number of replacement preprogrammed devices to supply the fleet for 30 years of service.

m). Software Escrow

i). The Contractor shall maintain in escrow all proprietary source code for all software used on the vehicle and the compilers, linkers, etc. used to develop it. **[CDRL 27-24]**

ii). The source code held in escrow shall be the latest version installed on the vehicles.

iii). The Contractor shall demonstrate that the source code held in escrow compiles to produce the same executive with the same CRC or checksum as installed on the vehicles. **[CDRL 27-25]**

iv). The contractor shall submit a Software Executable Generation Procedure (SEGP) **[CDRL 27-26]** that details the steps required to build the workstation and generate the executable file.

v). Should the compilation process prohibit matching of the CRC or checksum, additional techniques to inspect difference in the generated executive including the use of comparison software and functional testing on the BTE can be employed to prove equivalency.

(1) Such techniques are to be approved by Amtrak.

vi). Full instructions to assist in installation and configuration of the software development workstation, as well as building and verifying the executable software shall be provided. **[CDRL 27-27]**

vii). The Contractor shall provide sufficient documentation of the source code to allow Amtrak to maintain it, troubleshoot it and adjust parameters. **[CDRL 27-28]**

viii). The development software held in escrow, including any operating system used with the licensed development tools, shall be of the same version used to develop the software currently installed on the vehicle.

27.5 Hardware

a). Hardware Platform

i). All car borne and custom computer hardware shall be designed and constructed in accordance with the general electronic design principles of Chapter 15 Electrical System.

ii). Any computers, whether portable or not, and any microprocessor hardware shall be readily available through retail and/or wholesale outlets in the U.S.

iii). The microprocessor-based systems shall be based on an established service-proven family of microprocessors in wide use in the control system industry and the rail industry.

iv). The type and availability of each microprocessor shall be included in the design review package.

v). Any use of commercially available computer boards for on car applications must be specifically approved by Amtrak on a case-by-case basis.

vi). Such approval will be based upon a technical review of the product's suitability for use in a transit rail environment, product documentation and proof that a supply will be available for the expected life of the vehicles.

vii). Hardware Bill of Materials shall be provided to Amtrak for review and approval.

b). Microprocessor Systems Shutdown

i). A special algorithm **[CDRL 27-29]** shall be provided to ensure that:

(1) Computer shutdown and restart occur in a safe and predictable manner.

(2) Spurious faults are not generated during shutdown or restart.

(3) Stored diagnostic data is not lost during shutdown or restart.

(4) Time stamp integrity is maintained on all diagnostic data through any shutdown and restart process, including immediately after restart.

c). Program and Data Storage

i). All onboard microprocessor-based systems shall store software and diagnostic data in non-volatile flash memory, or EEPROMS.

ii). The use of mechanical hard drives or optical disks is prohibited for data storage on all systems, except the network video recorders.

iii). All flash memory and other memory devices with a finite number of read/write cycles shall be implemented in such a way that one sector or memory location is not written to repeatedly, thus shortening the life expectancy of the device.

iv). The life expectancy of such devices as used on the vehicle shall not be less than 30 years.

v). The memory and processor capacity shall be designed to allow program expansion without hardware modification.

vi). Expandability and capacity requirements are as follows:

(1) The memory needs of the installed software, backup copy, if required, during software update and data files shall not utilize more than 50 percent of the installed memory capacity at Type Test.

(a) This requirement applies individually to each type of memory installed, whether it is EEPROM, Flash PROM, or RAM.

(2) Peak processing time demands shall not be greater than 75 percent of the available processor capacity.

d). Electrical Isolation and Pre-Processing

i). All processor system input and output signals shall be isolated. High voltage inputs and outputs shall be isolated external to the microcomputer card rack.

ii). Low voltage (battery and logic voltage level) inputs and outputs shall be isolated from the supply power.

iii). The isolation for the outputs can be external to the microcomputer card rack.

iv). The isolation shall accomplish the following:

(1) Protect and isolate the system from damage due to over-voltage, under-voltage, transients, shorts and open circuits

(2) Perform necessary voltage translations

(3) Remove noise and undesired signals

(4) Pre-processing to limit, discriminate and format those signals that would otherwise require excessive processor time

v). Isolation devices shall consist of optical isolators, transformers, relays, and other circuits appropriate to the application.

e). Batteries and Super Capacitors

i). The use of super capacitors is acceptable for real time clock or other requirements typically performed by a battery, provided the super capacitor can maintain clock or data for a minimum of 90 days.

ii). The use of batteries within control units for maintenance of a real-time clock, or for safe shutdown must be approved by Amtrak.

iii). If approved by Amtrak, all batteries shall be implemented as follows:

(1) Batteries shall be sized to retain data for at least six months without charging and shall be located such that leakage cannot damage any control system components.

(2) Battery life shall be no less than 5 years, regardless of type.

(3) Systems using standby or back-up batteries shall annunciate the need for battery replacement such that the battery continues to perform its function until it can be replaced at the next periodic maintenance.

(4) Batteries shall not be connected by soldering.

iv). Necessary RAM control data shall not depend on battery back-up but shall be stored in non-volatile memory and "shadowed" to RAM for use.

f). Maintenance and Related Tools

i). Portable Test Unit (PTU) and Bench Test Equipment (BTE)

(1) For custom software that is resident in test computers, Amtrak shall be given a license for unlimited use of the software for the approved purposes of this Contract. **[CDRL 27-30]**

(2) Licenses shall not be linked to specific hardware serial numbers.

(3) In addition, PTU and BTE equipment software documentation, compliant with this chapter, shall be furnished. **[CDRL 27-31]**

(4) PTU and BTE software shall be subject to the approved Configuration Control Plan of this Section.

(5) The operating system employed for the PTU shall be the most-advanced, user-friendly system available at the time of system design and development.

(6) While it is anticipated that the system will be Microsoft Windows™ based, advances in technology may preclude this from being the best choice.

(7) Accordingly, identification of the system to be used will be made by Amtrak at the time of design review.

(8) All PTU/PTE and BTE software – shall be package for deployment through Amtrak's Software Management Repository and shall operate without requiring elevated privileges.

(9) All diagnostic software, tools, and utilities intended for use on PTU/PTE devices shall be fully tested and validated on the Amtrak-approved PTU/PTE operating system image prior to delivery.

(10) Validation shall confirm correct operation of all diagnostics, communication, configuration, and firmware-update functions under the Amtrak image's security, network, and access control constraints.

27.6 Reliability

a). If more than two unplanned maintenance releases of any individual software configuration item (SCI) are required during formal type testing through the end of the warranty, Amtrak may require the Contractor to perform a full independent software quality review.

b). This review shall include all aspects of a software audit as listed in this section plus a full independent software verification and validation of the software.

27.7 Safety

a). The use of software in safety-critical or related applications must be approved by Amtrak.

b). If Amtrak approves the use of software in a safety-critical or related application, it shall be developed in compliance with EN-50716:2023, unless approved by Amtrak.

c). In addition to the requirements of this chapter, any software, firmware, processing device or computer providing a safety-critical function shall comply with the requirements of Chapter 25, Safety.

27.8 CDRLs

CDRL	Description	Due
CDRL 27-01	Software Quality Control Plan	NTP + 60 days
CDRL 27-02	Non-COTS Software Supplier Quality Audits	FDR
CDRL 27-03	Non-COTS Software Supplier Quality Audit Results/Reports	Within 30 days of each audit
CDRL 27-04	Non-COTS Software Supplier Quality Audit Remedial Action for Open Comments	Within 90 days of each audit
CDRL 27-05	Software Configuration Control Plan (SCCP)	30 days prior to IDR
CDRL 27-06	Database of Software Versions – Cars & Non-vehicle Equipment	30 days prior to IDR, then ongoing updates
CDRL 27-07	Software Version - Cars	In Car History Book
CDRL 27-08	Software Version - Non-vehicle Equipment	With delivery of equipment
CDRL 27-09	Software – all executables	At the end of warranty period for each software release
CDRL 27-10	Software – Updated software documentation	At the end of warranty period for each software release
CDRL 27-11	Software – Updated user documentation	At the end of warranty period for each software release
CDRL 27-12	Software – Software Version Description (SVD)	At the end of warranty period for each software release
CDRL 27-13	Software Developer Documentation	30 days prior to IDR, then ongoing updates

CDRL	Description	Due
CDRL 27-14	Demonstration to ensure that the ICD and DBDD or SID is complete and accurate	FDR
CDRL 27-15	COTS Software – Original data storage/transfer media functional and usage details	30 days prior to IDR, then ongoing updates
CDRL 27-16	COTS Software – All manuals and instructions to configure and install the software	30 days prior to IDR, then ongoing updates
CDRL 27-17	COTS Software – All licenses required for Amtrak's site use	30 days prior to IDR, then ongoing updates
CDRL 27-18	Test Reports for Software Unit Tests	30 days after performance of tests
CDRL 27-19	Test Reports for Software Type Tests	30 days after performance of tests
CDRL 27-20	Software Validation Test Procedures	30 days prior to IDR, then ongoing updates
CDRL 27-21	Results of a current, independent, BSIMM and/or OWASP SAMM software security assessment of Contractor	360 days prior to shipment of first cars
CDRL 27-22	Transfer of Software to Replacement Devices – Master copies of the compiled executable for all programmable devices	180 days prior to shipment of first cars, then ongoing updates
CDRL 27-23	Transfer of Software to Replacement Devices – Six (6) sets of equipment and software to transfer the compiled software	180 days prior to shipment of first cars then ongoing updates
CDRL 27-24	Escrow of Proprietary Source Code	180 days prior to shipment of first cars, then ongoing updates
CDRL 27-25	Demonstration that source code in Escrow is same as on vehicles.	180 days prior to shipment of first cars, then ongoing updates
CDRL 27-26	Software Executable Generation Procedure (SEGP) to use Escrowed files	30 days prior to FDR, then ongoing updates
CDRL 27-27	Full Instructions for Workstation to use escrowed files	30 days prior to FDR, then ongoing updates
CDRL 27-28	Documentation of Escrowed Source Code to allow for maintenance, troubleshooting and adjustment	30 days prior to FDR, then ongoing updates
CDRL 27-29	Microprocessor System Shutdown Special Procedure	30 days prior to IDR, then ongoing updates
CDRL 27-30	License for unlimited use of software in test computers	360 days prior to shipment of first cars, then ongoing updates

CDRL	Description	Due
CDRL 27-31	PTU and BTE software documentation	30 days prior to IDR, then ongoing updates

* End of Chapter 27 *

Amtrak Universal Single Level Fleet Replacement

Technical Specification

28. Cybersecurity

Revision 2

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28.1 General

a). Overview

i). The goals of the implementation of these and all cybersecurity requirements are to maintain the safe and reliable operation of assets within the scope of Amtrak's risk posture.

ii). Amtrak's commitment to maintaining the highest standards of cybersecurity is paramount to safeguarding our industrial processes, data integrity, and protecting our people against potential cyber threats. Amtrak developed these cybersecurity requirements to establish a robust cybersecurity framework that aligns with industry best practices and regulatory guidelines, encompassing a range of security measures. By adhering to the requirements herein, Amtrak aims to create a protected and resilient environment that fortifies against potential threats and enhances our overall operational efficiency. All Amtrak vendors, suppliers, contractors, and service providers ("Contractors") shall adhere to the requirements as set out herein (collectively the "Attachment") in the delivery of supplies and/or services that may access, create, use, process, transfer, share and/or store Amtrak Data and Amtrak Operational Technology systems.

iii). Amtrak places a high priority on cybersecurity and recognizes the inherent complexities and evolving challenges associated with safeguarding both IT and OT assets.

iv). The security of Amtrak's train network, which serves as a vital transportation lifeline for millions of passengers each year, is of paramount importance to Amtrak and its customers.

v). To ensure the utmost protection, Amtrak has established a specialized organization of cybersecurity experts dedicated to preserving the security, integrity and resilience of their systems.

vi). Amtrak expects the same dedicated commitment from the Contractor and its Suppliers and sub-suppliers.

vii). By maintaining a dedicated commitment to cybersecurity, Amtrak strives to uphold the trust and confidence of their passengers, partners and stakeholders taking proactive measures to ensure availability, reliability and safety of the train network while safeguarding sensitive information entrusted to Amtrak.

viii). Normative Standards Compliance: The Contractor shall design, integrate, verify, validate, and maintain all IT/OT systems to comply with ISA/IEC 62443 (series), railway-specific cybersecurity standard CLC/TS 50701 or successor IEC 63452, and current TSA Security Directives 1580/82-2022-01 (rail) and 1582-21-01 (passenger rail/transit) in effect at Final Design Review and thereafter through delivery and the TSSSA period. Where referenced standards are updated during performance, the Contractor shall meet the current requirements or provide an Amtrak-approved equivalency mapping. Compliance shall be demonstrated through the deliverables and tests

specified in this Chapter (SBOM/HBOM, access control and crypto evidence, logging and SIEM integration, IDS provisions, vulnerability assessment and penetration testing, corrective action plans), which constitute the acceptance criteria for cybersecurity.

b). Requirements

i). This section defines cybersecurity requirements for all hardware, software, software services and firmware (hereinafter referred to as the “products” for purposes of this section) to be provided under this Contract, whether resident within a microprocessor-controlled system, provided as part of test or interface equipment, provided for the purpose of post-download data analysis and processing, incorporated within training technology and manuals, Bench Test Equipment (BTE) or supplied as a part of a software based service.

ii). These requirements apply to all systems that include processors or other programmable components such as Programmable Logic Devices (PLDs).

iii). All products that consist of programmable components, software or data for this Contract are subject to these same requirements. Contractor shall respectively transmit and enforce these requirements to all subcontractors and require that these subcontractors flow these requirements down to all of their subcontractors and sub-suppliers that handle programmable components, software or data, regardless of the tier.

iv). Thus, where the word “Contractor” is used, it includes all subcontractors and sub-suppliers, at every tier.

c). Failure to meet requirements

i). If the Contractor fails to comply with any of the requirements set forth herein and fails to remedy such non-compliance upon demand from Amtrak, Amtrak may exercise all available legal, contractual and administrative remedies for such non-compliance, up to and including a default termination in accordance with the Termination for Default article in the Contract.

ii). This applies not only to Contractors as defined in the above paragraph, but to manufacturers of all hardware, software, and firmware installed in the railcar.

iii). Further, if the results of any penetration testing, vulnerability assessment or other examination or audit of the Contractor’s cybersecurity protections yields any results that either the Federal Government or one of Amtrak’s jurisdictional partners determines to require further examination and/or audit, Amtrak may share the results of such testing with Federal, state or local authorities for the purpose of protecting national security interests, the safety and security of the riding public, or personal and real property.

d). Minimum Requirements

i). These requirements represent the minimum set of security requirements and additional security requirements may be called out in other chapters of this contract.

ii). In the following text, the terms “cybersecurity” and “security” may be used interchangeably to meet the intention of the specific requirement.

iii). Where security or cybersecurity are referenced, they are inclusive of data privacy considerations where applicable.

e). Security Governance

i). The Contractor shall define, document, and provide to Amtrak for review and approval a listing of Contractor personnel involved in the car’s development, maintenance, and operation who will be accountable for security-related decisions and actions. **[CDRL 28-01]**

ii). The document shall include:

(1) Personnel roles.

(2) Qualifications per person, including:

(a) any security industry certifications

(b) years of experience in IT and/or OT security

(c) years of experience in car security

(d) formal training in IT and/or OT security

(e) previous and current security positions held.

(3) Responsibilities per role for security-related decisions and actions.

(4) Accountabilities per role for security-related decisions and actions.

iii). Zero Trust & Segmentation Principles:

(1) The cybersecurity architecture for onboard, wayside, and cloud components shall align to a Zero Trust model: verify explicitly, enforce least-privilege access, and assume breach. Network access and data flows between security zones shall be denied by default and explicitly allowed by policy.

iv). Data Classification & Handling

(1) The Contractor shall implement Amtrak data classification (e.g., Public, Internal, Confidential, Restricted) and associated handling controls for data at rest, in transit, and in use, including retention and deletion schedules for telemetry and logs. Contractor shall provide a Data Handling Matrix for Amtrak approval.

f). Risk Management Framework

i). The NIST SP 800-37 Framework shall be used as the underlying risk management framework to identify, detect, protect from, respond to and

recover from security risks associated with the cars over their lifecycle, evolving to maintain concurrency with current versions.

ii). If the NIST SP 800-37 Framework becomes obsolete during the term of this contract, Amtrak will determine an appropriate and compatible replacement.

iii). This risk management framework shall be used as the basis for all specified security initiatives within this contract (e.g., assessments and testing, application of controls, risk mitigation, etc.), unless alternate frameworks are approved by Amtrak on a case-by-case basis.

iv). In the case of alternate frameworks being referenced within this contract on a case-by-case basis, NIST SP 800-37 and the named alternate framework shall be leveraged, with the Contractor's ability to combine testing where the requirements of each framework are compatible.

v). Security Compliance Frameworks: "Security Compliance Framework" or "framework" shall imply law, regulation, specification, directive, framework or other as applicable.

vi). In certain scenarios, demonstrating compliance with a specific framework other than NIST SP 800-37 may become necessary, such as requiring compliance to additional regulations, best practices and guidance including, but not limited to: TSA Security Directive 1580/82-2022-01D – Rail Cybersecurity Mitigation Actions and Testing (or current version of TSA Security Directive 1580/82-2022-01), ISA/IEC 62443, CLC/TS 50701, IEC 63452 upon publication, NIST SP 800-82, Rev. 3, NIST SP 800-53, Rev. 5 with the overlay for Operational Technology as specified in NIST SP 800-82, Rev. 3, PCI-DSS, HIPAA, and/or other more granular security compliance frameworks.

vii). Where demonstrating compliance to a specific framework becomes necessary based on the type of data in that environment and/or basis of the framework, the Contractor shall demonstrate compliance to the specific framework in addition to meeting all other security requirements of this contract, unless they conflict with the security compliance framework.

viii). If a conflict arises, the Contractor shall notify Amtrak, discuss the conflict, provide a recommended resolution, and Amtrak shall either approve the recommendation or provide a counter recommendation.

ix). Demonstrating compliance to specialized security compliance frameworks shall be required even if not specifically called out in any other chapter of this contract when the impact of the security compliance framework's basis on Amtrak is evident.

x). Consideration for CLC/TS 50701 and ISA/IEC 62443 Security Compliance Framework:

(1) There are well-known security compliance frameworks for Control Systems such as CLC/TS 50701 and ISA/IEC 62443 that can be applied to rail.

(2) Should the Contractor already align with one of these frameworks, they may submit a mapping of the designated framework against NIST SP 800-37 for Amtrak's review and consideration as an alternative to using NIST SP 800-37 as the primary risk management framework.

g). Supply Chain Security

i). The Contractor shall conduct a thorough assessment of all entities involve in its collective underpinning.

(1) These assessments shall follow the Shared Assessments Standard Information Gathering (SIG) questionnaire and utilize the Agreed Upon Procedures to implement and manage third-party risk assessment and management and ensure compliance with applicable security and privacy laws, regulations, frameworks.

(a) Alternate methods of assessment such as existing audits from an acceptable source or certification to an acceptable alternative will be considered if already existing (i.e. ISO 27001 certification).

(b) Where applicable the SIG Lite form may be considered based on the product being provided.

(2) The Contractor shall disqualify any Supplier and/or sub-supplier that poses an unacceptable level of risk, unless approved by Amtrak.

(3) Unacceptable risk levels shall be determined as moderate or higher, and detailed risk information shall be presented to Amtrak for consideration and approval if the Contractor wishes to proceed with the Supplier or sub-supplier.

(4) Any Supplier or sub-supplier engaged in any portion of this contract from sanctioned countries shall be identified as a critical risk.

(5) The comprehensive third-party security risk management scoring on any Supplier and sub-supplier approved for use in the car's development, maintenance, and operation shall be made available to Amtrak upon their request.

ii). Throughout the procurement and manufacturing process, the integrity and authenticity of car components shall be continuously validated.

(1) The Contractor shall implement measures to ensure that all components used in the cars are obtained from trusted sources and are free from any tampering or unauthorized modifications.

(2) This includes rigorous checks and controls at each stage of the supply chain to maintain the security and reliability of the car's components. Alternatives may be proposed regarding a chain of custody approach to be reviewed and approved by Amtrak.

iii). Software Bill of Materials / Hardware Bill of Materials

(1) The Contractor shall maintain a Software Bill of Materials (SBOM) and Hardware Bill of Materials (HBOM) throughout the design process, with regular updates throughout the warranty period.

(2) The Contractor shall submit the SBOM and HBOM format for Amtrak review and approval prior to the first design review. **[CDRL 28-02]**

(3) SBOM and HBOM shall be submitted at the following intervals:

(a) at each design review

(b) at FAI

(c) prior to the delivery of the first vehicle, and

(d) annually throughout the warranty period

(4) The SBOM shall detail all software components used to provide the required functionality of this technical specification, including all on-board software, and software supplied to support required off-board functionality.

(5) Each SBOM entry shall include:

(a) the system name

(b) the part name

(c) the software configuration item name

(d) the software component's name

(e) the version number and

(f) a cryptographic hash of the software.

(6) The SBOM shall identify any known vulnerabilities associated with each software component, referencing the Common Vulnerabilities and Exposures (CVE) identifiers where applicable.

(7) The SBOM shall be provided in an industry standard format as approved by Amtrak, such as SPDX, SWID, or CycloneDX.

(8) The HBOM shall be a comprehensive list of all hardware components which include microprocessors, programmable logic devices, or other memory and executable code. Each entry shall include the system, the component manufacturer, the component name, model, revision and any unique identifiers.

(9) The HBOM entry shall include supply-chain information including manufacturer location and places of origin for key sub-components.

iv). Country of Origin

(1) The Contractor shall identify the country (or countries) of origin of all products to be provided under this Contract, or any subcontracts, at any tier.

(2) The Contractor shall identify the countries where the development, manufacturing, maintenance, and service for the product are provided or will be provided.

(3) The Contractor must submit a list of the proposed products identifying the country of origin ("List" hereinafter) to Amtrak for approval. **[CDRL 28-03]**

(4) The Contractor shall notify Amtrak of any changes to the List no less than 90 days prior to the date that the change will be implemented.

(a) This is a mandatory requirement for all products that will be used on the project.

(b) The Contractor shall not be entitled to an equitable adjustment to the Contract for any costs incurred based upon any approved changes to this List.

h). Training and Awareness

i). All personnel performing work related to the development, operation, or maintenance of the equipment supplied as a part of this technical specification shall undergo adequate security training.

ii). This training shall cover their specific roles and responsibilities in delivering the equipment and services and effectively mitigating security risks.

iii). The Contractor shall ensure that all personnel are equipped with the necessary knowledge and skills to uphold the highest standards of security throughout the equipment's lifecycle.

iv). Regular refresher training and awareness programs shall be conducted to keep personnel up to date with evolving security practices and requirements.

v). A listing of all security training conducted with a roster of who completed the training shall be provided to Amtrak upon their request.

i). Conflict of Requirements

i). If any security requirement of this contract conflicts with a safety and/or regulatory function of the cars or any other specific contract requirement, the conflict shall be promptly raised to Amtrak.

ii). The Contractor shall provide a detailed explanation of the conflict along with a recommended approach for resolution, which will be subject to Amtrak's review, approval, and/or counter-recommendation.

28.2 Cybersecurity Practices

a). General

i). The Contractor shall adhere to the specified cybersecurity practices detailed below.

ii). In the event that the Contractor knows that it cannot comply with a requirement at the time of its proposal, it shall specify in sufficient detail the justification for non-compliance and its proposed alternative method for meeting the requirement.

iii). The Contractor has the affirmative duty to seek and identify any and all information that would result in actual or potential non-compliance during the course of Contract performance.

iv). The Contractor shall immediately notify Amtrak so that corrective action can be taken.

v). Appropriate security controls shall be implemented for all aspects of the cars that are susceptible to security risks, adhering to a minimum of NIST 800-37.

vi). These controls shall encompass a broad range of security measures and practices to ensure the protection of the cars' assets.

vii). In addition to implementing security controls based on NIST 800-37 or agreed alternative, appropriate security controls shall be implemented for all aspects of the cars that are susceptible to security risks, following industry-specific guidance where available.

viii). This guidance may include TSA Security Directive 1580/82-2022-01D – Rail Cybersecurity Mitigation Actions and Testing (or current version of TSA Security Directive 1580/82-2022-01), ISA/IEC 62443, CLC/TS 50701, IEC 63452 upon publication, NIST SP 800-82, Rev. 3, NIST SP 800-53, Rev. 5 with the overlay for Operational Technology as specified in NIST SP 800-82, Rev. 3,, PCI-DSS, HIPAA, and/or other more granular security compliance frameworks, Cloud Security Alliance for cloud-based assets, CIS for system hardening/benchmarking, OWASP for software security hardening, and other applicable standards and best practices.

ix). By considering and implementing these explicit security controls, the cars' assets shall be optimized for enhanced safeguarding and protection.

b). Software and Services

i). The Contractor shall remove and/or disable, through software, physical disconnection, or engineered barriers, all services and/or ports in the product not required for routine operations, emergency operations, or troubleshooting.

(1) This will include communication ports and physical input/output ports (e.g., USB docking ports, video ports, UART ports, and serial ports).

(2) Removing or disabling all software components, services, and applications not essential for the operation and maintenance of the device.

(3) Disabling, through software or physical means, all unnecessary communication ports and removable media drives, or providing engineered barriers, and documenting the results.

(4) Ensuring that only explicitly approved and required ports and services are enabled for normal and emergency operation and maintaining an up-to-date inventory of these configurations.

(5) The Contractor shall provide documentation of disabled ports, connectors, and interfaces to Amtrak **[CDRL 28-04]**.

ii). The Contractor shall provide summary documentation of the product's security features and security-focused instructions on maintenance, support, and reconfiguration of the product's default settings. **[CDRL 28-05]**

iii). The Contractor shall disclose the existence of all known methods for bypassing computer authentication contained in the product, often referred to as "backdoors," and provide written documentation that all such backdoors have been permanently deleted from the product. **[CDRL 28-06]**

c). Access Control

i). All access control measures from the current version of TSA Security Directive 1580/82-2022-01 series at time of Final Design Review and through delivery shall be implemented, including those for local and remote access, to secure and prevent unauthorized access to Critical Cyber Systems.

ii). The Contractor shall configure each component of the product to operate using the "Principle of Least Privilege" (POLP), including operating system permissions, file access, device access, device/user accounts, and communications/data transfer.

iii). The software shall deny access by default and allow access by specific permissions.

iv). The Contractor shall provide, for such systems, a mechanism for changing users' roles (e.g., group) or associations. The Contractor shall provide, for such systems, a mechanism for changing users' roles (e.g., group) or associations. The Contractor shall document options for defining access and security permissions, user accounts, and applications with associated roles including which accounts need to be active and those that can be disabled, removed, or modified. The Contractor shall configure these options, as specified by Amtrak. **[CDRL 28-07]**

v). The Contractor shall recommend methods for Amtrak to prevent unauthorized changes to the Basic Input/Output System (BIOS) and other firmware.

vi). If it is not technically feasible to implement the necessary controls to protect the BIOS to reduce the risk of unauthorized changes, the Contractor shall document this as a risk and provide mitigation recommendations when complying with this requirement.

vii). The Contractor shall install physical barriers on any network equipment that is public or crew accessible and hosts one or more Ethernet Ports so as to prevent Physical Access to the subject ports from unauthorized personnel.

viii). The Contractor shall secure any equipment connected to any railcar network in cabinets that use tamper resistant locking hardware.

(1) This requirement excludes any equipment that will require a direct interaction with the operator during the operation of the Railcar (e.g. operator displays, communication system HMI).

ix). The Contractor shall verify and provide documentation for the product, attesting that unauthorized logging devices are not installed (e.g., key loggers, cameras, and microphones), as specified by Amtrak **[CDRL 28-08]**

x). The Contractor shall deliver a product that enables Amtrak to configure its components to limit access to and from specific locations (e.g., security zones, business networks, and demilitarized zones [DMZs]) on the network to which the components are attached, where appropriate, and provide documentation of the product's configuration as delivered.

xi). Secure Remote Access: Contractor shall design and implement necessary access control measures to ensure that remote access to systems is executed in a way that protects against unauthorized access. Contractor shall ensure that configuration documentation for remote access control measures is provided by the trainset manufacturer for systems developed or owned by the trainset manufacturer, and by 3rd party vendors for 3rd party developed or owned systems.

(1) Remote access to onboard systems and devices shall be protected through authentication controls that comply with a minimum of NIST Authentication Assurance Level AAL2 as documented in NIST SP 800-63B.

(2) Mechanisms for secure remote access shall be implemented to ensure that only authorized individuals can access the trainset remotely.

(3) Remote access rules and permissions shall be based on principles of least privilege and separation of duties, where technically feasible.

(4) Logging mechanisms shall be in place to record and monitor remote access activities for audit and forensic purposes

(5) Remote access and related anomalous activity shall be logged and forwarded to the Amtrak enterprise SIEM platform on the wayside.

(6) IP addresses shall not be discoverable on the internet.

(7) Data transmission to and from the trainset systems including all forms of train to ground communications (cellular/wireless, Wi-Fi, T2G) shall be encrypted in compliance with the current FIPS requirements. Such encryption shall not use deprecated algorithms.

(8) Strong authentication methods, such as multi-factor authentication, shall be used to verify the identity of remote users.

(9) All remote access sessions shall be encrypted using industry standard encryption algorithms and secure communication protocols that meet strong cybersecurity and integrity requirements (e.g., FIPS compliant).

d). Authentication / Password Policy and Management

i). The Contractor shall document the levels, methods, and capabilities for authentication and authorization of passwords.

ii). The Contractor shall deliver a product that adheres to standard authentication protocols which conforms to Amtrak Authentication and Authorization standards.

iii). The Contractor shall propose an authentication method (e.g., password based, multi-factor, IP-based, Certificate based authentication) subject to review and approval by Amtrak for the following types of connections:

(1) Wired connections

(a) Local connection: temporary Connection between external equipment and a railcar subsystem (e.g., Portable Test Equipment connected to a subsystem).

(b) Network connections between railcar subsystems and railcar networks.

(c) Network connections between external equipment and railcar networks (e.g., Portable Test Units connected through Ethernet Diagnostic Port).

(2) Wireless connections – remote access

(a) Mechanisms for secure remote access shall be implemented to ensure that only authorized individuals can access the cars remotely.

(b) Strong authentication methods, such as multi-factor authentication, shall be used to verify the identity of remote users.

(c) All remote access sessions shall be encrypted using industry-standard ntra algorithms and secure communication protocols that meet strong security and integrity requirements (e.g., FIPS compliant).

(d) Logging mechanisms shall be in place to record and monitor remote access activities for audit and forensic purposes.

iv). Operator Interface Devices:

(1) Contractor Password or PIN protection shall be the preferred security authentication control to protect onboard devices and touchscreens equipped with human operator interfaces, a.k.a. user interfaces (UI) from unauthorized access.

(2) In cases where password protection may introduce operational safety risks, adequate physical security controls shall be implemented in lieu of the password or PIN protection. e.g. If adding password or PIN protection to a conductor-operated device onboard will result in an impact on safety and timely response from the conductor on operational tasks, then the password protection is not required and physical security measures such as providing a locked door or cabinet protecting access to the device / screen shall be adequate.

(3) Contractor shall provide a means for Amtrak to create a PIN or password for onboard systems.

v). User Accounts: Contractor shall implement appropriate technical and administrative controls to ensure the security and confidentiality of all user accounts. These controls must include, but are not limited to, strong authentication mechanisms, secure storage and transmission of credentials, and regular monitoring for unauthorized access or compromise.

(a) Complex passwords shall be comprised of a combination of uppercase, lowercase, numeric, and special characters.

(b) Passwords shall not be hardcoded.

(c) Passwords shall be modifiable by an administrator.

(d) Passwords shall be encrypted at rest and in transit.

(e) Default passwords on devices, systems, applications shall be changed.

(f) “Hidden” service support accounts shall not be used and must be removed.

(g) Use of shared accounts shall be limited. Principles of least privilege and separation of duties shall be implemented.

(h) The Contractor shall recommend which accounts need to be active and those that can be disabled, removed, or modified. Amtrak will review the Contractor recommendation and provide a final determination in writing. The Contractor shall disable, remove, or modify all the accounts pursuant to the approved recommendation.

(i) Contractor shall ensure that:

(i) Hidden Service Support Accounts are eliminated

(ii) Default passwords are changed to complex passwords in compliance with Amtrak requirements

(iii) Capability to support complex passwords is confirmed and documents; and

(iv) Capability to support individual user accounts is confirmed and documented.

vi). The Contractor shall protect all passwords, including, but not limited to the following methods:

(1) Contractor shall not store passwords in clear text.

(2) Contractor shall not hardcode passwords into software or scripts.

(3) All default passwords shall be changed in all components.

(4) the use of blank/null password shall not be supported unless explicitly agreed upon by Amtrak for specific component types.

e). Logging and Auditing

i). The Contractor shall provide logging capabilities or the ability to support Amtrak's logging system requirements, including transmission to Amtrak's Cyber Fusion center relevant on-board logs associated with cybersecurity.

ii). Logging capabilities provided by the Contractor shall be configurable by Amtrak and support security auditing requirements. As specified by Amtrak, the product shall cover the following events, at a minimum (as appropriate to their function):

(1) Information requests and device responses

(2) Successful and unsuccessful authentication and access attempts

(3) Account changes

(4) Privileged uses

(5) Discovery of malicious software on an IT or OT system

(6) Activity resulting in a denial of service to any IT or OT system; and/or

(7) Any cybersecurity incidents or breaches of onboard systems and defenses, or anomalous events such as unauthorized changes to approved hardware, software, or trainset configuration that result in operational disruption to the IT or OT systems or other aspects of the

Owner/Operator's rail systems or facilities, or an incident that has the potential to impact a large number of passengers, critical infrastructure, or core government functions

(8) Any other activity indicative of a real or potential cybersecurity incident is identified per Security Directive 1582-21-01B - Enhancing Public Transportation and Passenger Railroad Cybersecurity.

iii). The Contractor shall time-stamp audit trails and log files, as specified by Amtrak.

iv). The Contractor shall provide comprehensive security protection of log files.

v). The Contractor shall implement an approach for collecting and storing security log files on the railcar. The Contractor shall also implement an approach for transferring security log files from the railcar to the wayside.

vi). The Contractor shall provide a list of all log management activities that the product is capable of generating and the format of those logs. This list shall identify which of those logs are enabled by default. **[CDRL 28-09]**

f). Cryptography and Encryption

i). Cryptography/Encryption: Encryption shall be used as a security control to maintain confidentiality, verify authenticity or integrity, and provide non-repudiation.

ii). The use of encryption shall consider all relevant aspects, including but not limited to:

(1) Key Management: Procedures and controls for key generation, distribution, storage, and revocation shall be implemented.

(2) Protection of Cryptographic Keys: Measures shall be taken to protect cryptographic keys from unauthorized access, loss, theft, or compromise.

(3) Recovery of Encrypted Information: Procedures shall be implemented to enable the recovery of encrypted information in the event of key loss or compromise. Processes for key recovery shall be established.

(4) Compliance with Industry Standards: Encryption algorithms and protocols employed must adhere to industry standards for strong security and integrity. Compliance with relevant standards, such as FIPS (Federal Information Processing Standards), shall be ensured to maintain the highest level of encryption security.

g). Communication Security & Restrictions

i). Robust security measures shall be implemented to protect data transmitted between the cars' onboard systems and/or external entities. This requirement encompasses various avenues of communication including but not limited to network, wireless, satellite, cellular, and analog.

ii). Security controls shall be implemented to include, but not be limited to, the following:

(1) Network Security

(a) A comprehensive network infrastructure shall be established with the network partitioned using a “zones and conduits” architecture incorporating technologies such as firewalls, intrusion detection/prevention systems, data diodes, and other technology as approved by Amtrak.

(b) Access controls shall be enforced to prevent unauthorized network access.

(c) Encryption algorithms and secure communication protocols, compliant with industry standards for strong security and integrity (e.g., FIPS compliant), shall be employed for all networks utilized within the cars.

(2) Wireless Security

(a) Strong encryption algorithms and secure communication protocols, meeting industry standards for security and integrity (e.g., FIPS compliant), shall be employed for all wireless networks used within the cars.

(b) Wireless access points shall be securely configured, and regular firmware updates shall be performed to mitigate potential vulnerabilities.

(3) Satellite Security

(a) Encryption algorithms and secure communication protocols, compliant with industry standards for strong security and integrity (e.g., FIPS compliant), shall be implemented to safeguard data transmitted over satellite links.

(b) Physical security measures shall be established to protect satellite communication equipment, and regular patching and firmware updates shall be conducted to mitigate potential vulnerabilities.

(4) Cellular Security

(a) Robust encryption algorithms and secure communication protocols, meeting industry standards for security and integrity (e.g., FIPS compliant), shall be implemented to protect data transmitted over cellular communication.

(b) Cellular devices and modules shall be configured with secure settings, including the disabling of unnecessary services and features that may introduce vulnerabilities.

(c) Regular updates of firmware and security patches shall be applied to mitigate potential vulnerabilities.

(d) Access control mechanisms, such as strong authentication and SIM card security measures, shall be employed to prevent unauthorized use of cellular devices and/or SIM cards.

(5) Analog Security

(a) Measures shall be implemented to protect analog communication signals from unauthorized interception, interference, or disruption.

(b) This may involve the use of encryption devices attached to the analog communication line or frequency hopping techniques to change the frequency of the analog signal at regular intervals.

(c) Physical access to analog interfaces and communication equipment shall be controlled to prevent unauthorized tampering or connection of malicious devices.

(d) Physical transmission lines shall be protected against unauthorized tapping, tampering and signal interference.

(e) Analog communication ports and infrastructure (e.g., antennas, transceivers) shall be physically secured from unauthorized access, tampering and sabotage.

(f) Analog communication networks shall be segmented from other networks and isolated from digital networks.

(6) Network Segmentation

(a) A network architecture and segmentation strategy shall be implemented to isolate critical systems and components from less critical ones, preventing unauthorized access, limiting lateral movement within the zone, and mitigating potential attacks.

(b) Secure communication channels shall be established between car components to protect sensitive data and ensure secure interaction between systems.

iii). The Contractor shall provide information on all communications (e.g., protocols) required between network zones whether inbound or outbound and identify each. **[CDRL 28-10]**

iv). The Contractor shall provide a method to restrict communications traffic between different network security zones.

v). The Contractor shall provide documentation on any method or equipment used to restrict communications traffic.

vi). The Contractor shall provide Amtrak with access, including administrative access as needed, to the network components of the product.

vii). The Contractor shall document all remote access entry pathways and ensure that they can be enabled or disabled by Amtrak. **[CDRL 28-11]**

viii). The list of IP addresses assigned to each subsystem on the fleet is subject to approval by Amtrak.

ix). Asset tags, resource ids, and cloud providers of cloud-hosted Amtrak digital assets shall be provided to Amtrak.

x). The Contractor shall provide a method for managing the network components of the product and changing configurations. (e.g., addressing schemes).

xi). The Contractor shall certify that all interfaces which implement administrative management capabilities of onboard devices are managed over encrypted protocols with Amtrak compliant authentication required. **[CDRL 28-12]**

h). Data Protection

i). Robust measures shall be implemented to protect sensitive data, including passenger information, maintenance records, and operational data.

ii). Encryption of data at rest and in transit shall be implemented, meeting industry standards for strong security and integrity (e.g., FIPS compliant).

iii). Backup and recovery capabilities shall be established to ensure data availability and resilience.

iv). Data loss prevention mechanisms shall be in place to safeguard against unauthorized access, disclosure, or alteration of data.

v). Secure data disposal processes shall be implemented to permanently remove sensitive data when it is no longer required.

vi). Compliance with data privacy laws, regulations, frameworks, and directives that are impactful to Amtrak shall be demonstrated.

vii). Databases used for the cars shall undergo regular updates and patching to mitigate potential vulnerabilities.

i). Hardware Security

i). Comprehensive procedures and controls shall be implemented to address all aspects of hardware security.

ii). This includes secure hardware design practices that consider protection against tampering, unauthorized physical access, and theft.

iii). Critical hardware components shall be physically secured and access shall be restricted to authorized personnel only.

iv). A trusted supply chain shall be established to ensure the integrity and authenticity of hardware components.

v). Hardware integrity verification processes shall be implemented to validate the integrity of hardware prior to installation.

vi). Only authorized configurations and firmware/software versions shall be deployed on the car's hardware.

vii). Tamper-evident and/or tamper detection mechanisms shall be employed on critical hardware components to detect unauthorized modifications.

viii). Secure hardware lifecycle management practices, including the secure disposal of hardware, shall be established.

ix). Physical security measures shall be implemented to protect hardware from physical attacks and theft.

j). Bluetooth Security

i). The Contractor shall ensure the security of Bluetooth-enabled devices through the implementation of comprehensive procedures and controls, addressing the following aspects as required by Amtrak:

(1) Encryption: Industry-standard encryption algorithms and secure encryption modes shall be implemented (e.g., FIPS compliant) to protect data exchanged between Bluetooth-enabled devices. The encryption mechanisms shall provide strong security and integrity to safeguard the confidentiality and integrity of the transmitted data.

(2) Secure Authentication: Bluetooth devices shall implement secure authentication mechanisms to ensure that only authorized devices can connect and communicate. Robust authentication methods shall be employed to verify the identity and trustworthiness of connecting devices.

(3) Strong Pairing Methods: Devices shall use strong pairing methods to establish secure connections. These methods should employ cryptographic mechanisms to generate and exchange secure keys during the pairing process, ensuring the confidentiality and integrity of the communication.

(4) Access Control: Bluetooth devices shall employ access control mechanisms to restrict connections to trusted devices only. Unauthorized or untrusted devices shall be prevented from establishing connections with the car's Bluetooth devices to mitigate the risk of unauthorized access.

(5) Updated Bluetooth Versions: Devices shall use the latest Bluetooth version supported by the devices, avoiding the use of older Bluetooth versions that may have known vulnerabilities or weaknesses.

(6) Limited Visibility: Devices shall be configured to limit their visibility and unnecessary Bluetooth services, or profiles, shall be disabled.

(7) Secure Firmware and Software Updates: Bluetooth devices shall have a mechanism to receive and install firmware and software updates. All security patches, bug fixes, and updates provided by the device manufacturers shall be applied.

k). IoT (Internet of Things) Security

i). Robust procedures and controls shall be implemented to address the unique security challenges posed by IoT devices.

ii). These measures include the support for strong authentication mechanisms, such as unique credentials or cryptographic certificates, to ensure that only authorized entities can access and interact with IoT devices.

iii). Each IoT device shall have a unique identifier to maintain its integrity and prevent unauthorized device impersonation and tampering.

iv). Secure provisioning and configuration practices shall be followed, including changing or disabling default passwords.

v). Regular security updates and patches shall be applied to ensure ongoing protection of the devices.

vi). Additional physical security measures shall be implemented for devices deployed in public or vulnerable areas to mitigate the risk of theft or unauthorized removal.

l). Cybersecurity and Vulnerability Assessments

i). Vulnerability Assessments: Vulnerability assessments/scans to identify cybersecurity gaps shall be conducted prior to the delivery of the trainset and/or of Operational Technology to Amtrak.

(1) Amtrak and/or Contractor shall conduct vulnerability scans on all systems with jointly approved technology to ensure that all security controls specified in the design are implemented and effective.

(2) The test procedures shall include a checklist of systems to be tested, the test conditions, test data/parameters etc. This test plan shall be submitted to and approved by Amtrak prior to the scan execution

(3) Parameters and process of the assessment shall be documented and agreed prior to execution.

(4) Contractor shall submit the scan test report, associated findings, and proposed mitigations to Amtrak for review and approval prior to formal acceptance.

ii). Contractor shall document all remediation and mitigation measures employed to manage vulnerabilities for consultation with Amtrak.

(1) Contractor shall allow Amtrak to perform penetration testing. Contractor shall review Amtrak's plan for penetration testing and provide access to the trainset or system as needed to perform the penetration testing and provide other assistance as needed to facilitate such testing.

(2) Amtrak shall be given the opportunity to conduct penetration testing on all systems with jointly approved technology to ensure that all security controls specified in the design are implemented and effective.

(3) The test procedures shall include a checklist of systems to be tested, the test conditions, test data/parameters etc.

(4) Parameters and process of the assessment shall be documented and agreed prior to execution.

(5) Contractor shall provide technical and operational support during the testing process.

(6) The penetration test findings shall be documented in a formal report

(7) Contractor and Amtrak shall develop a plan for remediation measures to address the findings deemed higher than an acceptable risk by Amtrak. The plan must be approved by Amtrak before it can be considered final and implemented for the trainset and/or Operational Technology.

(8) Any residual risks requiring risk acceptance will be managed through the Amtrak GRC process.

(9) Remediation: The remediation measures to address the vulnerabilities and risks identified during the assessment shall be documented and a plan shall be developed for applying the identified measures. The plan must be approved by Amtrak before it can be considered final and implemented for the trainset.

m). Transient Assets

i). Secure Transient Assets: Transient assets such as Portable Test Equipment (PTE), Diagnostic systems, Portable Test Unit (PTU), and portable computers shall be protected from compromise by applying endpoint protection capabilities, where technically feasible:

(1) Applying and maintaining patches for associated asset operating systems and applications

(2) Applying and maintaining access control policies

(3) Applying and maintaining malicious code detection signatures

(4) Applying logging, monitoring, and alerting capability for events

(5) Encrypting data-at-rest where sensitive data is stored

ii). Asset Requirements: In the use or delivery of Transient Assets, Contractor shall:

(1) Install and configure all diagnostics software on the PTUs

(2) Coordinate with Amtrak timely to install and configure all operating system and other software upgrades, updates, maintenance and security patches on an ongoing basis for the life of the trainset to keep the PTUs up to date

(3) Provide timely technical support for the Siemens installed software on the PTUs

(4) Provide appropriate software updates and/or workarounds to mitigate all vulnerabilities associated with the flaw within a pre-negotiated period.

(5) Notify Amtrak of all problems and remediation steps regarding vulnerabilities, regardless of origin of discovery.

(6) Inform Amtrak Management in writing of flaws within applications and operating systems in a timely fashion and provide corrective actions, fixes, or monitoring guidance for vulnerability exploits associated with the flaw

n).

28.3 Physical Security

a). Contractor shall implement physical access controls commensurate with the criticality of each security zone, consistent with the security zoning model approved during Design Review (e.g., IEC 62443 / TS 50701 zone and conduit methodology). Physical controls may include, but are not limited to, disabling unneeded ports, locked cabinets or panels, tamper-resistant enclosures, or alarms on access points.

i). At least one of the following security controls must be implemented to secure onboard systems and devices.

(1) Disable all unneeded communication ports (e.g. USB ports, CD/DVD drives, and other removable media devices) through software or physical disconnection, where possible.

(2) Lockable enclosures for devices e.g. locked cabinets, racks etc.

(3) Devices with security locks and keys e.g. barrel locks for VSS NVRs

ii). Contractor shall ensure the following physical controls are implemented:

(1) Provide physically secure locations (locked cabinets, racks etc.) for cyber-assets requiring protection.

(2) Install physical locks to prevent cabinet/panel access to onboard and wayside devices

(3) Transient assets must be locked in storage when not in use

(4) Electronic access to any system shall not be accessible via lavatories

(5) Control Terminal keypads can be electronically locked

(6) Switches are physically locked behind door/cabinet/panel

(7) Install alarms on any panels containing system or network access points.

28.4 Software and Firmware Vulnerability Mitigation

a). General

i). The Contractor must demonstrate that the software products that will be delivered as a part of this procurement do not constitute a security threat to Amtrak.

b). Secure Software Coding Practices

i). The Contractor and suppliers shall ensure, by integrating robust procedures and controls and specific software security activities into their Software Development Life Cycle(s) (e.g., see Secure Software Development Framework (SSDF) Version 1.1: Recommendations for Mitigating the Risk of Software Vulnerabilities, February, 2022), that security vulnerabilities are identified and removed prior to the delivery of the source code for the Independent Assessment of Software and Firmware Quality (see Section 28.3.5, Independent Assessment of Software and Firmware Quality).

(1) These activities shall be described in the Contractor and Supplier Software Project Management Plans. These activities are subject to audit during Software Quality Assurance Audits.

ii). Code reviews, static analysis, dynamic analysis, software composition analysis, secrets scanning, and other comprehensive application security testing techniques shall be employed to identify and remediate potential security issues.

(1) While application security testing engines may leverage basic rule engine configurations during development to streamline DevOps cycles, application security testing tools shall leverage comprehensive rule engine configurations prior to functional testing and production and resolve all moderate and higher level security findings unless otherwise agreed upon by Amtrak.

iii). Secure configuration management practices shall be implemented to maintain the security of software configurations and settings.

(1) Access to software repositories shall be secured to prevent unauthorized modifications or tampering.

(2) A secure software supply chain shall be established, ensuring that only third-party software that has undergone thorough vetting and testing is used.

(3) Code signing and integrity checks shall be employed to verify the authenticity and integrity of software components.

(4) Prompt response procedures shall be in place to address any identified security issues or vulnerabilities in the car's software, including timely patching and updates.

c). NIST Checklist(s)

i). Where applicable, all software included within this procurement shall be configured in alignment with the NIST National Checklist Program.

ii). This requirement will be applied to all software components where NIST National Checklists are applicable.

(1) If no applicable checklist exists for a given system or component the Contractor may propose alternative checklists/guidelines for Amtrak's review and approval.

iii). The repository for NIST National Checklist can be found at https://nvd.nist.gov/ncp/repository. The Contractor and suppliers shall submit and identification of each system, each system SCI, and applicable NIST checklists (s) for Amtrak Review and approval prior to the first design review. **[CDRL 28-13]**

iv). The Contractor shall provide completed NIST checklists prior to the Final Design Review. **[CDRL 28-14]**

v). If it is agreed that a supplier may utilize another security framework such as IEC62443 or ISO 27001 the contractor may provide a mapping and evidence in lieu of a NIST checklist.

d). Date / Time Dependent Functions

i). For all source code that is subject to the Independent Assessment of Software and Firmware Quality (see Section 28.3.5, Independent Assessment of Software and Firmware Quality), the Contractor and suppliers shall confirm that the subject source code does not include date/time-dependent functions.

e). Independent Assessment of Software Security

i). The results of a current, independent, BSIMM and/or OWASP SAMM software security assessment shall be provided by the contractor. **[CDRL 28-15]**

(1) Also acceptable, upon approval by Amtrak are existing Contractor and vendor certifications such as IEC 62443 SDLA or ISO 27034.

ii). The assessment shall evaluate the security controls, vulnerabilities, and overall security posture of the software systems implemented by the Contractor, including but not limited to, the following areas:

(1) Authentication and access control

(2) Data protection and encryption

(3) Secure coding practices

(4) Security testing and vulnerability management

(5) Incident response and recovery

(6) Security documentation and training

iii). If the results of a current, independent, BSIMM and/or OWASP SAMM software security assessment are unavailable for the Contractor, supplier, or any entity providing software, submit:

(1) The full vulnerability reports from application security scans (SAST, DAST, SCA, secrets scanning, etc.) and manual and/or penetration testing along with a detailed description of software security practices and any technology used for the purpose for Amtrak's evaluation. For any vulnerabilities detected during application security testing, an action plan shall be provided that discusses:

(a) Finding(s) (i.e., verbatim finding text)

(b) Impact Description (i.e., a textual description of the negative consequences to the Project if the practice(s) is not implemented by a process used on the Project)

(c) Project-Specific Action

(d) Responsible Individual

(e) Progress Completion Percentage

(f) Due Date

iv). The independent BSIMM and/or OWASP SAMM appraisal shall include the use of an industry recognized assessor (e.g., Synopsys, etc.).

f). Independent Assessment of Software and Firmware Quality

i). The Contractor shall procure an independent third-party assessment of the application security lifecycle for the following categories of software and firmware:

(1) Software specifically developed or modified for this project; this requirement applies to all software provided on this project.

(2) Software re-used for this project; this requirement applies to software-based subsystems functioning on operationally critical networks only.

ii). The subject security assessment and corresponding requirements specified in this section shall be implemented as per the requirements of NIST SP 800-37.

(1) Also acceptable, upon approval by Amtrak are existing Contractor and vendor certifications such as IEC 62443 SDLA or ISO 27034.

iii). The assessment shall be performed by a qualified, independent organization.

iv). The Contractor shall provide the name of the independent assessment organization for Amtrak review and approval. **[CDRL 28-16]**

v). The Contractor shall ensure that the third-party software security and quality assurance provider shall check software and firmware to ensure that critical application security weaknesses (including SANS' Top 25 Most Dangerous Software Errors and OWASP's Top 10 as applicable) are addressed.

vi). The Contractor shall ensure that the third-party software security and quality assurance provider shall check software and firmware to ensure that the cybersecurity requirements of this contract have been met.

vii). The Contractor shall ensure that the third-party quality assurance provider performs the software security assessment using a range of security assessment testing techniques including Fuzz, Dynamic, and Static testing.

viii). The Contractor shall provide the third party's Software Security Assessment Plan for Amtrak's review and approval prior to performing the assessment. **[CDRL 28-17]**

ix). The Contractor shall ensure that the results of any independent software and firmware quality assurance assessment are sent directly from the third-party provider to Amtrak and the Contractor. **[CDRL 28-18]**

x). The Contractor shall provide a response to the third-party's assessment including plans to correct identified vulnerabilities. The Contractor's response and corrective action plan shall be sent to Amtrak for approval. **[CDRL 28-19]**

xi). This independent assessment of software and firmware quality (including the Contractor's response and Corrective Action Plan) is to be performed at any time of Amtrak's choosing, as follows:

(1) One assessment after delivery of the first set of cars, but before their conditional acceptance;

(2) One assessment prior to completion of conditional acceptance of all base order cars; and

(3) One assessment for each option exercised and additional quantities ordered

xii). The Contractor shall be responsible for implementing corrective actions to address any vulnerabilities that are identified during an independent assessment of software and firmware quality that would prevent the final product from meeting the security requirements defined in this Chapter.

g). Independent Penetration Test

i). To demonstrate compliance with specified functional and cybersecurity requirements relating to this Contract, the Contractor shall procure an independent third-party penetration test and vulnerability assessment.

ii). The Contractor shall provide the name of the independent third-party penetration test provider for Amtrak review and approval. **[CDRL 28-20]**

iii). The subject penetration test and vulnerability assessment and corresponding requirements specified in this section shall be implemented in accordance with NIST SP 800-115.

iv). This shall include tests both onboard the railcar, as well as tests on all services and software which interface with the railcar, and other services and software that are otherwise supplied to meet the Technical Specifications. Tests onboard the railcar shall include all vehicle components, including control systems, communication devices, diagnostic systems, onboard computers, sensors, and all other microprocessor or programmable devices.

v). Testing shall explicitly validate segmentation boundaries between the PTC, OBIS, and TCMS networks and shall assess all potential data exfiltration pathways to offboard or external services. The Contractor shall perform a re-test after delivering remediation to verify fixes, and the results of the re-test shall be delivered directly to Amtrak.

vi). This penetration test/vulnerability assessment shall be performed by a qualified, independent organization with a demonstrated history of performing independent penetration tests in similar passenger rail environments.

vii). The Contractor shall provide the independent third-party's test plan and associated procedures. **[CDRL 28-21]**

viii). The penetration test/vulnerability assessment shall cover all products included in or incidental to this procurement, as described in the other sections of the Technical Specifications.

ix). The Contractor shall ensure that any and all results (including trip reports, draft reports, and final reports) of any independent penetration test/vulnerability assessment are sent directly from the third-party provider to Amtrak and the Contractor. **[CDRL 28-22]**

x). The Contractor shall provide Amtrak with a response to the third-party assessment, including a Corrective Action Plan to correct identified vulnerabilities subject to Amtrak's approval. **[CDRL 28-23]**

xi). This independent penetration test/vulnerability assessment is to be performed at any time of Amtrak's choosing as follows:

(1) One assessment after delivery of the first set of cars, but before their conditional acceptance;

(2) One assessment prior to completion of conditional acceptance of all base order cars; and

(3) One assessment for each option exercised and additional quantities ordered.

xii). The Contractor shall be responsible for implementing corrective actions to address any vulnerabilities that are identified during Independent Penetration Test that would prevent the final product from meeting the security requirements defined in this Chapter.

28.5 Software Security Lifecycle

a). General

i). The onboard microprocessor equipment which includes software must be designed and delivered with consideration to the evolving cybersecurity threats, regulations, and operational requirements of Amtrak.

ii). The objective of the following technical specifications is to ensure that the software and equipment supplied as a part of the technical specification provide are built on a robust, comprehensive and resilient security architecture that provides the necessary tools and safeguards necessary to protect against security incidents, protects sensitive information, and ensures compliance with legal and regulatory obligations throughout the equipment lifecycle.

b). Asset Management

i). Comprehensive procedures and controls shall be implemented for the appropriate and secure handling of assets throughout their lifecycle.

ii). This includes processing, storing, communicating, and removing assets.

iii). For assets that are no longer required and that contain sensitive information (e.g., device with personally identifiable information), specific procedures shall be implemented and followed to ensure the secure destruction of the asset and/or its sensitive contents.

iv). These procedures shall comply with applicable privacy laws, regulations, directives, and best practices to safeguard sensitive information and prevent unauthorized access or disclosure.

v). Proper documentation and records shall be maintained to track the status and disposition of assets throughout their lifecycle.

c). Incident Response and Management

i). The Contractor shall deploy comprehensive mechanisms and capabilities shall be implemented to support the effective management of security incidents and breaches.

ii). These measures include robust detection systems to identify security incidents, efficient reporting mechanisms to promptly notify relevant stakeholders, thorough investigation procedures to determine the nature and scope of incidents, and effective mitigation strategies to contain and remediate security breaches.

d). Operations Security

i). The Contractor shall implement procedures and controls to ensure the secure operation of the cars.

ii). These measures include backup and recovery processes to ensure data and system availability in the event of disruptions or incidents.

iii). Robust malware protection mechanisms shall be deployed to safeguard against malicious software and unauthorized access.

iv). Endpoint security measures, such as secure configurations, regular patching, and secure remote access controls, shall be implemented to protect endpoints from security threats.

v). System monitoring capabilities shall be established to detect and respond to anomalies and potential security incidents.

e). Continuous Monitoring and Intrusion Detection (Onboard)

i). Contractor shall provide necessary support to Amtrak, including any applicable Amtrak cybersecurity vendor, to define specifications, and identify any current trainset constraints, for physical, electrical, and technical provisions to facilitate the installation, integration, configuration, and rail certification of the monitoring capability. Examples include provisioning appropriate physical space, power, cabling, ports, and wayside connectivity in the trainsets needed for the onboard monitoring solution and the wayside integration with the enterprise SIEM platform.

ii). The equipment and its onboard network architecture shall accommodate the installation, integration, and operation of the CylusOne Probe to enable continuous cybersecurity monitoring of all critical onboard networks, including but not limited to the Positive Train Control (PTC) network, the Onboard Information System (OBIS) network, and the Train Control and Monitoring System (TCMS) network. The Contractor shall ensure that all required SPAN ports, network access points, bandwidth capacity, power, cabling, and

mounting provisions are provided to support full CylusOne Probe functionality.

iii). Amtrak's intrusion detection and prevention systems, as well as security event logging, shall be implemented on all on-board networks incorporating communication between Software Configuration Items (SCIs) supplied by different vendors, as well as between all network security zones, to promptly identify and respond to security incidents.

iv). The monitoring infrastructure shall leverage advanced technologies and techniques to detect both known and emerging threats.

v). Regular audits of the monitoring system shall be conducted to ensure its effectiveness throughout the warranty period.

vi). The on-board monitoring, detection, and response systems shall be integrated with Amtrak's Cyber Fusion Center (CFC).

vii). In addition to Contractor-supplied on-board network logging and detection, provisions shall be provided for an on-board IDS solution selected by Amtrak.

(1) Provisions shall include power, space, software connections for Amtrak specified and supplied hardware.

(2) Connectivity shall be provided for each on-board network for passive monitoring of transmissions between devices.

(3) Connectivity to Amtrak's CFC shall be provided through the on-board Data Communication System identified in Chapter 14.

(4) The contractor shall provide the ability for the Amtrak to identify and configure specific network devices, network ports, and network traffic to be spanned and forwarded.

(a) Identification and configuration may be through direct configuration of the on-board equipment, or

(b) through an API provided by onboard network devices to the Amtrak on-board IDS solution.

viii). The Contractor shall submit their agreement of support for an Amtrak on-board IDS solution for Amtrak review and approval **[CDRL 28-24]**

f). Compliance and Issue Reporting

i). Robust mechanisms shall be established to monitor and verifying compliance with security requirements outlined in this contract.

ii). These mechanisms shall also facilitate timely and effective notification and reporting of security incidents, vulnerabilities, and breaches to Amtrak. Cybersecurity regulations in the United States mandate that Amtrak have a reporting obligation within specific timeframes. Regular audits and

assessments shall be conducted to ensure adherence to security requirements and relevant laws, regulations, frameworks, and directives.

iii). Any security incidents or breaches shall be promptly reported to Amtrak, providing comprehensive details and remediation actions.

g). Business Continuity Management (Onboard)

i). Procedures and controls shall be implemented to enable the continuity of operation of the vehicle and its critical assets during adverse conditions.

ii). In situations where existing security controls may not be sufficient to secure information during adverse conditions, alternate controls shall be implemented to maintain an acceptable level of security coverage until optimal conditions are restored.

h). Software Updates and Maintenance

i). Contractor shall provide a patch management process to include policies and procedures for the system after installation. These policies and procedures shall include the patch management process and mitigation strategies for instances when the Vendor informs the user not to apply released patches.

(1) A comprehensive process for software/system updates, patching and maintenance shall be implemented to ensure the integrity and authenticity of updates installed on the vehicle components.

(2) The Contractor shall establish a robust system for verifying the source and integrity of updates before installation, including the use of digital signatures from authorized entities.

(3) This verification process shall guarantee that updates are legitimate and have not been tampered with, maintaining the overall security and reliability of the equipment and software supplied with this contract.

ii). Contractor shall provide support for testing patch releases. This shall include the level of revision on a documented system configuration (i.e., Vendor platform, FAT system, SAT system, current production).

28.6 CDRLs

CDRL	Description	Due
CDRL 28-01	Listing of Contractor personnel involved in the cars' development, maintenance, and operation who will be accountable for security-related decisions and actions	NTP+90
CDRL 28-02	Software Bill of Materials (SBOM) and Hardware Bill of Materials (HBOM) format	30 days prior to PDR
CDRL 28-03	List of the proposed products identifying the country of origin	NTP+90

CDRL 28-04	Documentation of disabled ports, connectors, and interfaces	30 days prior to PDR, on-going updates
CDRL 28-05	Summary documentation of the product's security features and security-focused instructions on maintenance, support, and reconfiguration of the product's default settings	30 days prior to PDR, on-going updates
CDRL 28-06	List of all known methods for bypassing computer authentication contained in the product and provide written documentation that all such backdoors have been permanently deleted from the product	30 days prior to PDR, on-going updates
CDRL 28-07	Document options for defining access and security permissions, user accounts, and applications with associated roles	30 days prior to PDR, on-going updates
CDRL 28-08	Provide documentation for the product, attesting that unauthorized logging devices are not installed	30 days prior to IDR
CDRL 28-09	List of all log management activities that the product is capable of generating and the format of those logs	30 days prior to PDR, on-going updates
CDRL 28-10	Information on all communications (e.g., protocols) required between Amtrak's network security zones whether inbound or outbound and identify each	30 days prior to PDR, on-going updates
CDRL 28-11	List of all remote access entry pathways and ensure that they can be enabled or disabled by Amtrak	30 days prior to PDR, on-going updates
CDRL 28-12	Certification that all interfaces which implement administrative management capabilities of onboard devices are secure	30 days prior to FDR, on-going updates
CDRL 28-13	Preliminary NIST checklist	30 days prior to PDR
CDRL 28-14	Final completed NIST checklists	30 days prior to FDR
CDRL 28-15	The results of a current, independent, BSIMM and/or OWASP SAMM software security assessment shall be provided by the Contractor.	30 days prior to FDR, on-going updates
CDRL 28-16	Name of Independent Assessment Organization	30 days prior to PDR
CDRL 28-17	Software Security Assessment Plan	30 days prior to IDR, on-going updates
CDRL 28-18	Results of any independent software and firmware quality assurance assessment	30 days prior to FDR, on-going updates
CDRL 28-19	Contractor's response to the findings of the software and firmware quality assurance assessment	30 days prior to FDR, on-going updates
CDRL 28-20	Name of Independent Third-Party Penetration Test Provider	30 days prior to PDR

CDRL 28-21	Independent third-party's penetration test plan	30 days prior to FDR, on-going updates
CDRL 28-22	Results of the independent third-party's penetration test plan	30 days after
CDRL 28-23	Contractor's response to the findings of the independent third-party's penetration test plan	60 days after
CDRL 28-24	Design for on-board monitoring and intrusion detection and provisions	30 days prior to PDR, on-going updates

* End of Chapter 28 *

Amtrak Universal Single Level Fleet Replacement
Technical Specification

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29. Accessibility

Revision 2

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29.1 Overview

a). This chapter defines the minimum accessibility accommodations for the cars and serves as an index or reference guide to specific chapters in the rest of this specification for more information.

b). This is not intended to be an all-encompassing or exhaustive list of regulations listed in the Law. Please refer to specific standards listed for complete information and requirements.

c). In addition to compliance with the requirements of the ADA and other accessibility requirements in this specification, the Contractor shall comply with the terms of the Application for Equivalent Facilitation (EF) submitted by Amtrak and approved by the USDOT (Exhibits R-1 and R-2). The approved EF was based on a trainset configuration and will need to be revised to reflect the equipment configuration under this procurement. The Contractor with the support of Amtrak shall prepare and submit a revised EF application and shall work with Amtrak, FRA and disability community to obtain an accessibility solution that is accepted by all parties involved.

d). The plan is to create an accessible core that provides access to all amenities for all passengers. This accessible core will enhance mobility between cars and ensure all passengers have access to all train amenities.

29.2 Regulations

a). Regulatory Agencies and the specifications listed below must be referenced for complete understanding of the accessibility requirements by law.

i). ADA

(1) Vehicles must accommodate persons with disabilities in accordance with the requirements of the Americans with Disabilities Act (ADA) of 1990, the ADA Accessibility Guidelines (ADAAG), FTA Circular 4710.1, 36 CFR 1192, and 49 CFR 27, 37 and 38 as amended.

ii). FRA

(1) Vehicles must accommodate persons with disabilities in accordance with the requirements of the FTA Circular 4710.1, 36 CFR 1192, and 49 CFR 27, 37 and 38.

iii). RVAAC

(1) The Contractor shall submit a proposal to incorporate as much of the recommendations presented in the Final Report of the Rail Vehicles Access Advisory Committee (RVAAC) as is feasible.

(2) Within 60 calendar days of NTP, the Contractor shall provide a summary of the recommendations it will incorporate and those it finds to be not feasible. **[CDRL 29-01]**

29.3 Maintenance of Accessible Features

a). Accessible features outlined in this section shall be properly maintained to minimize 'down-time' for replacement and/or repair as outlined in 49 CFR 37.161.

b). From the Contractor's perspective, this means that maintenance requirements shall be clearly outlined and agreed upon, repairs and fixes shall require minimal time to repair/replace, all special tools for repair/replacement of items are made readily available.

c). Damage or maintenance to one accessibility feature shall not require that other features are also unusable.

29.4 Accessibility – Mobility

a). Accessible Path

i). The clear width of an accessible path shall be incorporated according to the recommendations from RVAAC Chapter 4, III in the Café, Diner, Diner/Lounge, Accessible Sleeper, Premium Accessible Coach, and Coach cars.

ii). The floor surface shall be incorporated according to the recommendations from RVAAC Chapter 5, VI to the extent possible.

iii). The floors along the accessible path shall be high contrast flooring to help the visually impaired follow the path through the car.

iv). Thresholds along the accessible path at each passageway between cars shall have tactile feedback built into the floor to alert a visually impaired person of the transition in floor type.

(1) This tactile feedback shall be raised such that the top of the ridge is level with the flooring surface though out the cars.

(2) The indentation shall be lower than the flooring surface to provide ridged tactile feedback for canes.

b). Entrances

i). Boarding and alighting accommodations shall be incorporated according to the recommendations from RVAAC Chapter 3 to the extent possible.

(1) Features to eliminate the gap between the car and the steps when boarding shall be incorporated.

ii). Doors

(1) Doors, steps, and thresholds shall comply with 49 CFR 38.113 and 49 CFR 38.117 within the train. This includes doorways and passageway requirements for clear openings, slip resistant floorings, and clear contrast of all steps.

(2) Lighting for entrances and doors shall comply with 49 CFR 38.119.

(3) Doors shall be incorporated according to the recommendations from RVAAC Chapter 4 to the best extent possible.

(4) Doors and passageways along the accessible path shall be wide enough to accommodate powered wheelchairs.

(5) Specific doors requirements for this fleet can be found in Chapter 12.

iii). Lifts

(1) On-board mobility lifts shall be provided on the standard coach, premium accessible coach, accessible sleeper, diner/lounge, and café cars.

(a) On-board mobility lifts shall comply with 49 CFR 38.113 (d) and 38.125 for boarding the train from any station platform.

(b) The design load for this lift shall be at least 800 lbs.

(c) The controls shall be easily operated by a crew member and emergency operation mode is required.

(d) If the utility car option is exercised, the provision for an on-board mobility lift shall be provided at a minimum. An option shall also be provided for inclusion of the lift in the utility car.

c). Grab Handles

i). All passageways, entryways and doors shall be equipped with appropriate handrails or stanchions. Handrails and stanchions shall comply with 49 CFR 38.115.

ii). Handrails and Stanchions path shall be incorporated according to the recommendations from RVAAC Chapter 4, VI to the extent possible.

iii). Specific handrail requirements for this fleet can be found in Chapters 6 and 11.

d). Inter-car Gangways

i). Between car barriers shall be provided at a minimum according to the recommendations from RVAAC Chapter 3 to the extent possible.

ii). Vertical grab handles shall be provided for ease of access for all passengers.

e). Service Animal Spaces

i). At least one service animal space per seating area shall be incorporated according to the recommendations from RVAAC Chapter 4, IX to the best extent possible.

f). Emergency

i). An evacuation chair shall be provided in the cafe car. The contractor shall provide Stryker Evacuation Chair part number 6254000000.

ii). Egress plans for passengers who have mobility and visual impairments shall be presented by the Contractor for Amtrak alignment and approval during the design review process.

g). Sleeper Cabins

i). Sleeping

(1) Accessible sleeping compartments shall be provided and equipped with all amenities listed in 49 CFR 38.127. This includes sleeping location, restroom, and controls for passenger comfort.

(2) Accessible sleeping areas within the sleeper car shall be incorporated according to the recommendations from RVAAC Chapter 5, III to the extent possible.

(3) Note that all visual and auditory recommendations from RVAAC emphasized in this specification shall be incorporated in both coach and sleeper cabins.

(4) Specific Equity sleeper room requirements for this fleet can be found in Chapter 11.

(5) Securement locations for oxygen, CPAP machines, small coolers for medications, and other medical equipment shall be provided in each sleeper cabin

h). Coach

i). Seating

(1) Accessible seating, transfer seats, wheelchair or mobility aid seating, and storage locations for mobility devices shall be provided in compliance with 49 CFR 38.125 (d) and consistent with the Alternative Design Standards in the Equivalent Facilitation.

(2) Mobility Aid Seating Locations shall be incorporated according to the recommendations from RVAAC Chapter 4, IV to the extent possible including clear space, number of seats and locations, and securement. Additionally, transfer seats shall be incorporated according to the recommendations from RVAAC Chapter 4, V to the extent possible and consistent with the Alternative Design Standards in the Equivalent Facilitation.

(3) Seats shall be reconfigurable to account for a group of passengers using wheeled mobility devices. This shall be incorporated according to the recommendations from RVAAC Appendix B, 2, to the extent possible.

(4) Accessible seating locations shall be provided near but not necessarily adjacent to accessible restrooms. Passengers requiring accessible seating locations shall not be forced to always sit adjacent to restrooms as this provides an inequity for passengers to be subjected to restroom noises and smells.

(5) Accessible seating shall be arranged such that two passengers, one using a wheeled mobility device and the other not using a device, can sit next to each other in at least one location in coach.

(6) Accessible seating shall be arranged such that a wheeled mobility device user can select to sit on either the right or left side of the train based on lateral dominant strength of the passenger to the best extent possible.

(7) Accessible seating shall be arranged such that a wheeled mobility device user can select to sit on either the right or left side of the train based on lateral dominant strength of the passenger.

(8) Specific seating requirements for this fleet can be found in Chapter 11.

ii). Tables

(1) Adjustable height workstation tables shall be provided in all accessible seating locations throughout the cars.

(2) The adjustable height workstation tables shall range from 27” to 34” and should be presented to Amtrak during PDR.

i). Access to Amenities

i). Standards

(1) General outlines and information regarding access to amenities within the train are outlined in 49CFR 38.111. The configuration of the fleet shall dictate which sections under 49 CFR 38.111 will apply.

(2) In general, all controls for passenger comfort shall be provided in an accessible manner according to the recommendations from RVAAC Chapter 5, V to the extent possible. This includes all manner of controls, control locations, buttons, and door opening.

ii). Restrooms

(1) Accessible restrooms shall be provided and equipped with all amenities listed in 49 CFR 38.123. This includes space for maneuvering and turning, height of all amenities from the floor, required grab bars, controls, doorways, and proximity to seating accommodations.

(2) Restroom locations shall follow the quantity and location recommendations from RVAAC Chapter 4, VIII and Chapter 5, I, to the extent possible.

(3) Specific ATR requirements for this fleet can be found in Chapters 11 and 17.

iii). Café

(1) The Café shall be located along the accessible path of the train.

(2) The Café shall have an ADA service counter that is between 32” and 34” tall. The area adjacent to the ADA service counter shall have a 60” minimum turnaround circle for passengers using wheeled mobility devices to turn around and travel back to their seating location.

(3) Accessible seating areas within the Café car shall be incorporated according to the recommendations from RVAAC Chapter 5, IV to the extent possible.

iv). Dining

(1) Accessible dining areas within the dining car shall be incorporated according to the recommendations from RVAAC Chapter 5, II to the extent possible.

v). Miscellaneous

(1) Designs shall incorporate accommodations and provisions for passengers of all sizes including larger passengers to fit in tight spaces such as restroom compartments, aisles, etc.

(2) As provided in the Intercity Trainset (Airo) fleet and a potential outcome if the High Capacity Coach option is exercised, six (6) RVAAC recommended seating locations shall be provided within an accessible path of the Café car with two (2) being provided in each car adjacent to the Café car and two (2) being provided in the Café car.

(3) As an option, the Contractor shall provide provisions for up to four (4) RVAAC accessible seating locations in each car type which shall be modular in design which includes any restraints, adjustable height tables, call systems, outlets, reading lights and any associated wall panels. For the purposes of modularity, the Contractor shall provide incremental option pricing to transition a seating location into an accessible seating location.

29.5 Accessibility – Visual

a). Signage

i). Standards

(1) Symbols, Signs, and Videos shall be incorporated according to the recommendations from RVAAC Chapter 2, IX, X, and XI to the extent possible.

(2) Specific signage requirements for this fleet can be found in Chapter 11.

ii). Accessible Entrance

(1) All locations equipped with accessible entrances onto the train shall be marked and indicated according to 49 CFR 38.113 (e).

b). Braille

i). Where practical and appropriate, signage shall incorporate Grade 2 Braille and/or raised lettering to accommodate visually impaired passengers.

ii). Contractor shall utilize Grade 1 Braille for simplicity and ease of comprehension.

(1) Braille characters shall be raised at a height of 0.6mm to 1.5mm

(2) Dot diameter shall be 1.5mm to 1.6mm

(3) Character spacing shall be 2.5mm to 3.5mm horizontally while 6.0mm to 7.0mm vertically.

(4) Ensure rounded corners to prevent snagging.

iii). Contractor shall incorporate tactile pictograms alongside Braille for enhanced comprehension, where practical.

(1) Pictograms shall be raised and have clear, tactile distinction from Braille characters.

iv). Contractor shall utilize high-contrast colors between Braille dots and the signage background.

v). Contractor shall work with Amtrak and/or local community organizations with proofreading all Braille signage prior to implementation on any vehicle.

vi). All proposed Braille signage shall be submitted during IDR for Interiors **[CDRL 29-02]**

(1) All proposed Braille signage shall be included on all hard mockups for stakeholder review and approval.

c). Lighting

i). In addition to the lighting requirements for entrances listed in 49 CFR 38.119, lighting of other areas in the vehicle shall be considered. Lighting shall be incorporated according to the recommendations from RVAAC Chapter 2, V to the extent possible.

ii). Lighting shall be capable of being adjusted to less than 3000K in coach reading lights.

iii). Specific lighting requirements for these cars can be found in Chapter 13.

d). Warning Alerts and Communications

i). Standards

(1) Visual warning, alerts, and public information shall be announced with a public information system that complies with 49 CFR 38.121.

ii). Route information

(1) Variable Message Signs (VMS) shall be incorporated according to the recommendations from RVAAC Chapter 2, II and VIII to the extent possible.

iii). Emergency Alerting

(1) Visual indication of emergency notification announcements shall be incorporated according to the recommendations from RVAAC Chapter 2, VI to the extent possible.

(2) Specific PIS requirements for this fleet can be found in Chapter 13.

iv). Call Buttons

(1) Visual indication that a call button has been depressed and the alert signal has been sent shall be incorporated according to the recommendations from RVAAC Chapter 2, VII to the extent possible.

29.6 Accessibility – Audio

a). Hearing Assistive Technology

i). Cars shall incorporate the latest innovative technology for hearing assistive technology (inductive hearing loops, Bluetooth, etc.) as of Preliminary Design Review.

ii). Hearing assistive technology shall be incorporated according to the recommendations from RVAAC Chapter 2, IV to the extent possible.

iii). The Contractor shall provide test equipment to Amtrak to verify that the hearing assistive technology is operating as intended during maintenance events.

b). Warning Alerts and Communications

i). Audible warning, alerts, and public information shall be announced with a public information system that complies with 49 CFR 38.121.

(1) Route Information

(a) Audible announcements for Speech to Text shall be incorporated according to the ADA accessible guidelines and to the extent

possible per the recommendations from RVAAC Chapter 2, III and VIII.

(2) Emergency Alerting

(a) Audible indication of emergency notification announcements shall be incorporated according to the recommendations from RVAAC Chapter 2, VI to the extent possible.

ii). Specific PIS requirements for this fleet can be found in Chapter 14.

c). Call Buttons

i). Audible indication that a call button has been depressed and the alert signal has been sent shall be incorporated according to the recommendations from RVAAC Chapter 2, VII to the extent possible.

29.7 CDRLs

CDRL	Description	Due
CDRL 29-01	RVAAC Compliance Summary	NTP + 60 days
CDRL 29-02	Braille Signage Package	30 days prior to IDR

* End of Chapter 29 *

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

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30. High-Capacity Coach Cars (Option)

Revision 2

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30.1 Overview

a). General

i). The intent of this section is to identify any differing requirements from the previous chapters of this technical specification in relation to the Optional High-Capacity Coach cars.

ii). Passenger capacity shall be increased on the High-Capacity Coach cars to accommodate higher ridership demand.

iii). As stated several times throughout this specification, all car types shall be reconfigurable to accommodate other classes/types of service.

(1) High-Capacity Coach Car

(a) Utilizing the same carshell design to the best extent practical, the High-Capacity Coach car shall have 2 entry doors per side with trap doors and folding steps. The minimum seat pitch requirement is 37”; however, seat pitch may be adjusted to maximize capacity with review and approval by Amtrak.

(b) Amtrak intends to utilize the same 2x2 seat design as the Standard Coach car listed throughout this technical specification.

iv). Amtrak requests that any additional concepts to increase passenger capacity be proposed by the Contractor. Additionally, the Contractor shall propose additional modifications to the base scope of work for concepts that would be advantageous to Amtrak.

30.2 Specification Changes

a). Chapter 1: Scope

i). Paragraph 1.6). is replaced by the following:

(1) Amtrak intends to have a High-Capacity Coach car that may operate with existing Amtrak equipment. Target capacities and requirements for this car type will be outlined in additional section(s) within this chapter.

(2) The High-Capacity coach car shall have 2x2 seating with a minimum seat pitch of 37” unless otherwise approved by Amtrak.

(3) The target capacities are outlined for each car type in Figure 30-1.

Figure 30-1; Target Revenue Capacities

Car Type	High-Capacity Coach
Coach Seats (2x2)	76
Standard Restroom	1
Accessible Restroom 60" turning circle	1
RVAAC Accessible Seating Location*	1*
Number of doors per car side	2
Seat Width	Minimum 20"
Seat Pitch	37"

b). Chapter 6: Carbody

i). Paragraph 6.6.a) is modified by adding the following:

(1) The requirements for the B-End of the car shall apply to the A-end of the car to ensure that the High-Capacity car type has 2 side loading doors per each side to expedite boarding and alighting from the vehicle.

c). Chapter 11: Interior

i). High-Capacity Coach Seating will be identical to Standard Coach Car Seats described in Chapter 11.

ii). Luggage Tower

(1) Each High-Capacity Coach car shall have one (1) luggage tower capable of bicycle storage that shall be of robust tubular brushed stainless steel construction and include shelves.

(2) Bumper guards shall be mechanically attached to the wall panels within the luggage rack/tower to prevent damage to walls or luggage.

(3) The rack/tower shall incorporate suitable brackets for handling garment bags. Golf bags and other larger items shall be able to be stored in this area.

(4) The luggage rack/tower shall be a convertible unit that can be reconfigured to hold two bicycles.

(5) All surfaces shall be smoothly finished to prevent damage to luggage or crew injury.

(6) Each luggage tower shall be equipped with 2 tiers of folding, tubular luggage racks.

(a) The racks shall pivot at the inner walls to allow them to be stowed to accommodate varying sizes of luggage/cargo.

(7) The load bearing surface shall be inclined upward at an angle of 3° to 4°.

(8) The lowest rack keeps baggage off the floor, protecting it from water, dust, etc. on the floor.

(9) Luggage racks and supporting structure shall be made of stainless-steel transversal tubing, with a raised edge for luggage retention.

(10) The racks shall have sufficient strength to support a load of 250 pounds midway between adjacent supports with a deflection not to exceed 1/4 inch and without permanent deformation. This shall be demonstrated at FAI.

(11) Two passive ¼ turn latches shall be provided to stow each of the racks in the raised position. The luggage racks shall be easily moveable with one hand to stow or deploy.

(12) Rack design and shelf dimensions shall provide the flexibility of having:

(a) all luggage racks lowered for luggage handling any rack lowered for luggage handling

(b) all the luggage racks stowed.

(c) enable bicycles to be secured when all luggage racks are stowed.

(13) Rutland Industries, Mini-Mum model # MMW2XMHV or Amtrak approved equivalent for securing bicycles shall be provided along the inner walls folding out as needed to support a bicycle hung on it.

(a) An instruction placard shall be provided on the wall adjacent these racks, giving instructions for proper rack use.

(14) The fully loaded luggage racks and bicycle rack, mounting hardware and associated structure shall meet the strength requirements per APTA SS-C&S-034-98 for equipment support as well as RP-C&S-006-98 for attachment strength.

(15) They shall be simple in design, operation, and maintenance without the need for springs, dampers, etc.

(16) All exposed fasteners in the area shall be countersunk or flush mount types to preclude any damage to passengers' luggage.

(17) All edges and corners shall be rounded with generous radii. Bump strips shall be incorporated along the sides of each of the spaces to avoid scuffing the wall finish or the luggage.

(18) Design of the luggage towers and bicycle racks shall be subject to design review. The final interior equipment, arrangement, dimensions,

and locations shall be developed during design review, with the aid of mockups.

iii). Train-to-Train Transfer Bridge shall be provided for each car.

(1) A dedicated storage location shall be provided on each car.

(2) To be used for disabled trains when the rescue train is parked on an adjacent track.

(3) Crew members place the bridges between the open side doors of the two trains to create a stable walkway.

(4) The bridge shall be designed to be lightweight, slip-resistant, and wide enough to accommodate rapid movement and, in some cases movement of wheeled mobility devices.

d). Chapter 12: Door Systems

i). Paragraph 12.1.b) is modified by adding the following:

(1) The side entrance doors for the High-Capacity car shall be located on the A and B-end of the car.

* End of Chapter 30 *

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Amtrak Universal Single Level Fleet Replacement

Technical Specification

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31. Interiors – Sleeper and Diner Cars with Utility (Option) Cars

Revision 2

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Part I: General Requirements

31.1 Overview

a). It is Amtrak's intention to develop car types that will be the replacement fleet for the long-distance network.

i). The fleets primarily consist of Sleepers, Diners, Coaches, Café, Lounge and Baggage cars that are coupled together to serve Amtrak's long-distance routes.

ii). These cars shall be interoperable with the Viewliner I and II Legacy Fleet and the Legacy locomotive fleet.

b). The cars shall be designed utilizing Universal or Trans-generational design, addressing the needs of a broad range of passengers.

c). In the event that the business needs change over time, these car types shall be designed to be reconfigurable to include accommodation types that may meet a new direction for Amtrak.

d). All car types are single level with:

i). Entry/exit to the car from train side are from the single vestibule located at the B-end of the car. It is equipped with powered side doors, powered trap doors, powered folding steps, and on-board mobility lifts on defined car types.

ii). A powered collision post door is provided to seal the vestibule from weather when it is oriented at the end of the consist.

iii). Power operated body end doors at both the vestibule and blind ends of the car provide access to the car interior.

iv). Ceiling lighting in the vestibule illuminates not only the vestibule, but also the station platform outside the car, meeting ADA requirements.

v). Ceiling lighting is provided along the passageway, as well as low-location exit path marking.

vi). Hinged ceiling panels shall act as cover for the overhead water distribution piping.

e). Electric/Switch Locker

i). The car electric/switch locker shall be located within the car interior. It shall contain crew temperature and lighting controls as well as circuit breaker panels and electrical equipment.

ii). The car PA system shall be located in close proximity to the electric/switch locker.

f). Emergency Tools

i). The cars shall contain an Emergency Tool Locker recessed into the exposed face unless otherwise approved by Amtrak to meet the configuration of other car types.

g). Car Types

i). These car types are:

(1) Standard Sleeper Car

(2) Accessible Sleeper Car with 32” accessible aisle

(3) Diner Car with 32” accessible aisle

(4) Diner/Lounge Car with 32” accessible aisle

(5) Utility Car with baggage compartment (Option)

ii). Reference Exhibit F for concept diagrams.

h). Accessibility

i). The accessibility areas of the car will conform to ADA requirements as listed in 49 CFR 38, Americans with Disabilities Act (ADA) Accessibility Specification for Transportation Vehicles and 2010 ADA Standard as applicable and to the best extent RVAAC recommendations.

(1) 32” accessible aisles shall be provided in the accessible sleeper, diner, and diner/lounge.

i). Compliance with preliminary design concepts included in the specification and attachments does not relieve the Contractor of all the other requirements within the specification.

31.2 General Requirements

a). This Chapter describes the basic requirements for the interior configuration of the Sleepers, Diner, Diner/Lounge, and Utility (Option) cars.

b). Each car type shall meet or exceed all requirements for ADA accessibility and general seating arrangements that provide comfort and amenities such as electrical outlets, task lighting, and individual work trays or tables.

c). The interior of the car shall be designed and constructed for maximum safety, comfort, convenience, and service to the passenger.

d). The Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design.

e). All mechanisms described below should be durable, free from jamming, and racking.

f). All operable features intended for passengers use, unless otherwise specified or

approved by Amtrak, shall comply with ADA requirements, including a maximum force of 5 lbf to operate. Operable controls shall be usable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Forward or side reach operable controls shall be mounted between 34 inches and 48 inches above the finished floor. .

g). The design should meet abuse, load, and crash criteria as described in CFR.

h). Dimensions, position, configuration, comfort, and usability of all items and features will be subject to Amtrak approval during the mockup review.

i). Walls, ceiling panels, and window masks shall be easily cleanable and designed and constructed to form a safe and attractive environment.

j). Visible fasteners shall be minimized.

k). All systems requiring maintenance shall be easily accessible and removable for cleaning and repair.

l). Final interior layouts shall be developed by the Contractor and submitted to Amtrak for review and approval during design review per the Design Review processes outlined in Chapter 3.

m). Whenever possible, common components shall be used in all car types.

n). Strength of all interior fittings and their attachment to the carbody shall meet APTA Standard SS-C&S-006-98 and 49 CFR Section 238.233.

o). All interior or occupied areas shall have Emergency Lighting and LLEPM that leads to the primary exits.

i). These areas include non-seated areas restricted to crew members including the kitchen and baggage areas.

p). The interior clear height from the top of the floor to the ceiling of cars shall be no less than 84” unless otherwise approved by Amtrak.

q). Protection shall be provided to prevent damage along the accessible path especially with respect to seats, armrests, walls, etc. Arm rests shall be designed to absorb wear and tear over the life of the assembly. Details to be reviewed and approved by Amtrak during Design Review.

31.3 Human Factors Study

a). As part of PDR, the Contractor shall submit a Human Factors Study Report for Amtrak review and acceptance **[CDRL 31-01]**.

b). The Human Factors Study shall address all key interaction points in all car types, including but not limited to:

i). seat, bed, and bunk access

ii). tables,

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iii). screens,

iv). switches,

v). cupboard access,

vi). door locks and handles.

vii). recline

viii). leg room

c). The report shall also address specific human factors for accessible rooms and restrooms, including but not limited:

i). to accessible paths,

ii). aisle and door clearances accessible reach zones,

iii). wheeled mobility device accessible features,

iv). wheeled mobility device and leg clearances,

v). handrail heights and sizes,

vi). transfer positions to seats, beds, toilets, and shower seats.

d). The Human Factors Study Report shall validate the use of all features of the cars by a 95% US male and a 5% US female.

e). Wheeled mobility device animations shall be included to validate accessible paths.

31.4 Universal Design

a). Each car shall be fully compliant at the time of manufacture, with all rules and regulations of 49 CFR 38, Americans with Disabilities Act (ADA) Accessibility Specification for Transportation Vehicles and 2010 ADA Standard as applicable.

i). No part of this specification alters or changes those requirements.

b). Review of the car's accessible features (including all drawings, calculations, and supplier information required to define the proposed installation) shall be conducted with Amtrak as part of the mockup review.

c). Each car with accessible positions shall include RVAAC recommended accessible wheeled mobility device locations, which shall allow passengers using wheeled mobility devices to remain in their wheeled mobility devices while on board the car.

i). The number of dedicated accessible areas for wheeled mobility devices is determined by the car configuration.

ii). A storage area for an unoccupied, folded wheeled mobility device, 48 in. long by 20 in. wide and 40 in. high, in close proximity to the dedicated accessible

area and to accessible seating, shall be provided on each car for each accessible space.

d). ADA-compliant car-to-car access is required along the accessible path.

i). Accessible Sleeper, Standard Sleeper, Diner, Diner/Lounge, and Utility cars shall include end doors and bulkhead doors that have a clear, unobstructed opening of no less than 36 in. wide.

ii). Overlapping gap closer or bridge plates shall be provided between coupled cars to allow wheeled mobility devices to pass from car-to-car without trapping the wheels in gaps.

e). The Accessible Sleeper and Diner/Lounge shall include an accessibility lift on each side of the car's entrance area.

i). Accessibility lifts for boarding are detailed in Chapters 6 and 12.

31.5 Arrangement Flexibility and Modularity

a). The basic car interior shall be standardized to the greatest extent possible and shall be capable of reconfiguration, upgrade, or replacement without disrupting adjacent interior elements of the car.

b). All like components and all associated assemblies (e.g. floor panels, bulkheads, side wall & ceiling panels, etc.) and their spare parts shall be designed and manufactured to be identical/ interchangeable, both as individual parts and as sub-assemblies, throughout the entire car order production.

c). All parts shall mount without modification. Replacement parts shall also be interchangeable.

d). Easy accessibility shall be provided for all items that require periodic maintenance and/or may require replacement.

i). Access doors or panels shall be secured using approved captive fasteners or locks.

ii). It shall be possible to remove these parts without damage to the individual pieces or adjoining components.

e). Likewise, it shall be possible to renew any replaceable room component, whether mounted internal or external to the module, without the need to disassemble (except service panels) or remove the module from the car.

31.6 Signage and Labels

a). The Contractor shall equip each car with adequate signage to provide passengers and crew information about the amenities and safety-related features of the cars.

b). The signage to be provided shall include, but is not limited to, the following:

i). Location of safety equipment

ii). Hazards such as high voltage or heat sources

iii). Operation of emergency exit equipment

iv). Operation of on-board equipment such as doors and door latches/locks

v). Amenities such as trash and recycling containers, potable drinking water, 120VAC outlet, etc.

vi). Toilet room amenities

vii). Room numbers

viii). Capacities for storage locations such as luggage racks and overhead luggage bins

ix). Service-related signs for maintenance and inspection

x). Vehicle road numbers on both ends of the car.

xi). Exterior signage for service points

c). The interior and exterior signage shall conform to the latest revision of Amtrak Specification #697, National On-Board Signage Manual.

i). The artwork, material, location, and specifications for each sign shall be submitted to Amtrak for approval at the design review.

d). Provisions shall be made for all seating and bedroom accommodations to have a safety card stored at each location.

e). A metallic American flag sign shall be installed in each entrance area of each car. The sign shall be light weight and corrosion free.

f). Existing Amtrak signs, in accordance with Amtrak Specification #697, shall be used where possible.

i). Where new sign designs are required, the Contractor shall develop artwork per the Amtrak Onboard Signage Guidelines and submit to Amtrak for review and approval as part of IDR.

ii). The Contractor will provide a signage application drawing for Customer approval identifying all signs and labels used on each car type, including text, as well as the mounting location.

g). Emergency Signage and LLEPM shall be installed in accordance with APTA Standards PR-PS-S-002-98 and SS-PS-004-99.

i). All HPPL signage shall be passive and shall not utilize electric components.

ii). The HPPL material shall be charged and shall maintain charge under all lighting conditions except Emergency.

iii). All HPPL shall have drawings for placement with specific part numbers.

iv). Sleeping accommodations shall not require a light to be on at all times to charge the HPPL as this will be disruptive to passengers. Contractor to propose a solution for Amtrak's approval.

h). Additional signage guidance will be supplied at NTP.

31.7 Interior Noise Levels (Passenger Areas)

a). Under all specific vehicle and operating conditions listed below, the interior noise levels on any car shall not exceed the sound levels below:

i). Vehicle Condition;

(1) Completely assembled car

(2) No passenger load

ii). Operating Conditions:

(1) Operating in any specified mode of acceleration, deceleration, or coasting at any speed up to 125 mph.

(2) On tangent, at-grade, ballast-and-tie track with clean, smooth continuous welded rail,

(3) All auxiliaries operating simultaneously at normal conditions

iii). Measurement Location:

(1) Any and all points at least one foot from the ceiling, floor, end walls, or side walls.

iv). Maximum Sound Levels:

(1) 70 Decibels (Acoustic) (dBA) in seating areas,

(2) 75 dBA in entrance areas (referred to 0.0002 microbar)

b). Compliance with this requirement shall be demonstrated using a Type 2 sound level meter as defined by ANSI Standard S1.4: American National Standard Specification for Sound Level Meters, using the slow meter scale.

31.8 Vibration

a). All car equipment shall be designed to operate without damage or degradation of performance when subjected to vibration and shocks encountered during normal service.

b). All newly designed equipment and auxiliaries mounted anywhere on any car, car body, or trucks within the consist shall not cause vertical or horizontal vibrations anywhere on the car floor, walls, ceiling panels, and seat frames in excess of:

i). 0.10 in. peak-to-peak amplitude,

ii). 0.01 acceleration due to gravity (g) peak acceleration for the frequency range from 5 Hertz (Hz) to 14 Hz, and

iii). 0.045 in. per second peak vibration velocity for the frequency range above 14 Hz.

c). Carbody-mounted components shall be designed to withstand vibrations of not less than 0.2 g at frequencies up to 100 Hz and randomly oriented shock loads of 8 g longitudinal, 4 g vertical and 4 g lateral.

d). Shock and vibration tests shall be conducted in accordance with IEC 61373 (1999) – Railway Application, Rolling Stock Equipment, Shock and Vibration Tests.

31.9 Sanitary Design

a). Cleanability

i). The car interior and all materials shall be designed so that they do not soil, stain, or show dirt easily.

ii). Interior materials shall be easy to clean using few tools and little specialized equipment.

iii). Items such as HVAC grilles shall only require opening to access the ductwork during extensive periodic cleaning.

iv). The number of items that require removal for cleaning shall be kept to a minimum.

(1) Equipment seen by the passengers and crew shall be cleanable in daily service without removal.

(2) Those items that must be removable shall be easy to remove and replace, with all like units being interchangeable.

(3) Removable items shall employ captive fasteners of a type that will not deteriorate or degrade in effectiveness with use over the life of the car.

(4) If screws are used, they shall be easy to line up with the mating hole on the fixed part.

b). Protection from Fluids

i). Great care shall be taken in design, manufacture and installation of the rooms and equipment to ensure that neither routine use, cleaning, and maintenance, nor leaks and overflows will cause fluids to seep or wick under the module's flooring or between the sub-flooring, walls, and car structure.

ii). All floors and pipe connections, etc., shall be sealed internally to prevent liquids from leaking into the car sub-floor and insulation.

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(1) This is to avoid sanitation and odor problems and minimize potential for sub-floor corrosion.

(2) Sealing design is subject to Amtrak approval.

c). FDA Requirements

i). Interior design and installation shall meet all applicable requirements of FDA for water, waste, and general sanitation issues.

31.10 Maintenance and Material Performance Expectations

a). Attachment Methods

i). Strength of all interior fittings and their attachment to the carbody shall meet APTA Standard PR-CS-S-006-98 and 49 CFR Part 238.233.

ii). Secondary structure shall be provided to securely anchor car interior items that are subject to significant loads, such as handrails, light fixtures, etc.

iii). In instances where FRP components are used, they shall be stiffened and reinforced appropriately with stainless steel, balsa panels or other materials as approved.

(1) Stiffening and reinforcing will be subject to approval by Amtrak for each application.

iv). All components shall be secured to the car auxiliary structure with machine screws, which engage stainless-steel tapping plates.

v). Floating nut assemblies may be used if they are part of a tapping plate assembly.

vi). Nut-inserts (Riv-nuts, Nut-serts etc.) are not an acceptable alternative to tapping plates. Likewise, spring type mountings are not acceptable.

vii). Where components attach to car interior materials, such as FRP, mounting shall be coordinated so the appropriate provisions are incorporated into the design of those materials.

(1) When the component is mounted on FRP, the tapping plate shall be embedded deeply into the FRP behind the primary FRP wall and completely glassed in using woven glass fabric and resin, so it never loosens for the life of the car.

(2) Mounting holes can be incorporated into the panels to which the components are mounted or drilled in place using a template.

(3) Match drilling using the component as a template is not acceptable.

(4) Components should be mounted from the exposed side of the mounting surface so that the component can be removed for repair or replacement from the front.

(5) Provisions are required to prevent squeaking between the component and mounting.

b). Access Panels

i). Easy access shall be provided for all items that require periodic maintenance, defect repair or replacement.

ii). Panels/ doors covering this equipment shall be hinged, where possible and fastened with approved captive fasteners in a manner that permits these activities.

iii). Safety catches shall be provided for access panels/doors to prevent sudden or accidental deployment.

iv). Window masks shall allow for easy window replacement.

c). Junction Boxes

i). Junction boxes shall be located within electric lockers or hidden behind access panels. See Chapter 15 for additional information.

d). Time to Repair/ Replace

i). All lowest replaceable units (LRUs) shall be replaceable in less than 30 minutes by a single maintenance worker. See Chapter 4 for additional information.

31.11 Safety

a). Fire Safety

i). The builder shall provide a Fire Safety Analysis for Amtrak review and approval, in accordance with APTA RP-PS-005-00. See Chapters 19 and 25.

ii). All interior materials shall meet the flammability and smoke emissions requirements of Amtrak Specification # 352 (which incorporates references to 49 CFR 238.103).

iii). Test reports from an independent lab showing compliance with Amtrak Specification # 352 shall be provided in advance of related FAI's.

b). Injury Prevention

i). The car interior shall be designed to provide a safe, comfortable, and convenient functional environment to the passengers, crew, and maintenance staff.

ii). Interior design shall integrate the car sidewall, transverse wall, window mask, ceiling, and other interior surfaces into a harmonious unit.

iii). Generously rounded edges and corners to guard against personnel injury by passengers, crew, and maintenance staff shall be provided.

iv). The use of visible fasteners shall be kept to a minimum, and where used, be inconspicuous.

c). Pinch Points

i). Gaps smaller than 1.5 inches, and larger than 0.5 inches shall be considered potential pinch points that shall be avoided to the maximum extent possible.

(1) Exceptions can be presented to Amtrak if the gap surface depth is less than 0.5 inches.

ii). The Contractor shall develop and submit a Pinch Point Gap Analysis **[CDRL 11-02]** document that identifies all potential pinch points and justifications.

(1) The analysis shall be submitted for Final Design Review FDR approval.

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Part II: Interior Components

31.12 Doors and Latches

a). Relevant information for doors and latches as they pertain to interiors is generally described below.

i). Further information for doors and latches can be found in Chapter 12.

b). All interior doors shall be built of robust materials to withstand repeated use without deforming or losing adjustment.

c). Doors, unless otherwise indicated as sliding doors, shall have one continuous piano hinge and shall open outward into the interior of the car unless specified otherwise.

d). All latches and hinges shall be stainless steel piano hinges unless approved by Amtrak during the design review process.

e). Access panel doors shall have stainless-steel piano hinges.

f). Cabinet doors shall be supplied with lanyard or equivalent door limiting mechanism to ensure that no collisions occur between cabinet doors and other components of the car.

i). Doors with lanyards shall be limited to 130 degree opening as a default setting with minimal adjustment. Lanyards shall be removable without the use of special tools.

g). Doors shall close securely without requiring the use of a key and shall remain closed without rattling or becoming loose during operation.

h). As necessary for proper airflow in each car according to the HVAC design, doors shall have a grille located in the lower half of the door panel for air circulation.

i). Electrical locker and utility locker doors shall have a release lever on the inside of the latch.

j). Doors that have passenger safety equipment behind them shall use paddle latches with no locking mechanism. Please refer to Chapter 18 for more information regarding emergency equipment.

k). Doors that cover PA handsets shall only have one latch or lock for access.

31.13 Windows

a). Window size should be maximized with an equal pitch where possible.

b). All seating positions and accessible spaces should have a view out of the window.

c). See requirements of Chapter 6 and Chapter 19.

31.14 Window Masks

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a). The window masks shall be either Fiberglass Reinforced Plastic (FRP) or thermoformed plastic.

b). The window edge should incorporate openings for heating vents at the window and shall not interfere with minimum accessible clearance requirements.

c). Sidewall heat vents may be separate powder coated aluminum (as appropriate for the mask to window interface), or integral to the window mask.

d). The window masks must not readily collect dust/dirt and shall be easy to clean without removal or special tools.

e). Window masks shall be wrapped in a protective film in accordance with Chapter 19. Paint is prohibited.

f). Panel construction shall allow for removal and recovering of the surface covering at overhaul without damage to the base material.

g). Window masks shall allow for easy window replacement.

31.15 Window Blinds

a). Window blinds shall be provided for all side windows, and if the option is exercised for skylight windows.

b). Blinds should cover the entirety of the window.

c). Blinds shall be replaceable within a 30 min timespan.

d). A single pull-down blind system shall be provided per window, common across all car types, capable of delivering both daytime solar / glare control and full blackout performance, as follows:

i). In daytime mode, the blind shall provide effective sun shading and glare control without creating an overly dark or opaque interior.

ii). ii) In night-time mode, the blind shall achieve full blackout and privacy suitable for sleeper accommodation.

iii). The blind system may utilize engineered fabric solutions (e.g. graduated density, variable weave, perforation, or equivalent) to enable both modes of performance within a single blind system.

e). Side window blinds shall be provided with a handle on the lower edge that is easy to use and accessible. It shall move the blind with no racking or jamming and without exceeding 5 lbf during operation.

f). Blinds shall be stored in a valance so that they can easily be accessed for maintenance.

i). Where luggage racks are provided, the blinds may instead be stored behind the luggage rack.

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g). Operation

i). Side window blinds shall be operated manually by a passenger.

ii). If the skylight window option is exercised, then the skylight window blinds shall be automated so that the conductor can deploy or retract the blinds at the push of a button. Alternatives may be proposed for Amtrak's review and approval.

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Part III: Storage Areas

31.16 Storage in Seating Areas

a). Each storage location below shall integrate into the seating area in an inconspicuous manner and shall flow seamlessly with the aesthetic of the rest of the car.

b). Each storage location shall be clearly labeled according to Amtrak Specification #697.

c). Each storage location shall be easily opened and accessed by any passenger and the use of paddle latches or push-button latches is desired.

d). Folded Wheeled Mobility Device storage spaces shall be dedicated for at least two devices per car for passengers wishing to transfer to another seat.

e). Storage space for an evacuation chair shall be included. Please refer to Chapter 29.

f). Emergency Equipment listed below shall have appropriate storage locations within the car. Please refer to Chapter 18 for more information regarding emergency equipment.

i). Trauma Kit and Stretcher

ii). Egress Ladder

iii). AED

iv). First Aid Kits

31.17 Trash and Recycling Storage

a). General:

i). Trash and Recycling Receptacles shall be provided on each car type in conspicuous locations to encourage passenger/crew use.

ii). Recycling and trash receptacles shall be provided on both ends of each car type as close as practical to bulkheads and restroom areas.

iii). The recycling and trash receptacles shall be either side-by-side in a row or directly across the aisle from one another.

iv). The recycling and trash receptacles shall meet all FDA and NSF requirements for trash containers and their materials.

v). To the extent possible, these receptacles will be designed to maximize trash capacity or at a minimum accommodate the Amtrak standard trash container, per Amtrak Drawing C-96-7591.

vi). The receptacles shall be boldly labeled with an intuitive icon for type of trash, in accordance with Amtrak Specification # 697.

vii). The inside of each trash receptacle door shall be permanently labeled with the Amtrak AMMPS number of the container required for that space.

viii). Each set of receptacles shall include two separate openings and respective bins:

(1) one for trash

(2) one for recyclables (cans, bottles, and newspapers)

b). Material and Construction:

i). Trash and recycling locker door panels shall have melamine or factory-applied laminate.

(1) Alternatively, panels may be constructed of honeycomb or plymetal wall materials.

ii). The trash locker container access door shall be secured closed with a square lock.

iii). The trash locker door shall include a recessed grab handle to be used to pull the door open when unlatched.

iv). Visible hardware and fasteners shall be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

v). Recycling and trash receptacle lockers shall be of panel construction with substructure as appropriate to support components.

vi). The locker shall include appropriate brackets and/or guides, etc. to properly index the trash containers with the openings, and as required, to keep them upright.

(1) These devices shall be rounded, etc. to protect staff handling the containers or servicing the end door from injury.

vii). The locker enclosure with walls & door material be fireproof or be lined with fire-resistant material.

viii). The locker shall use as few joints as possible in fabrication; they shall be permanently sealed against moisture and vermin.

ix). The locker shall be structurally sound and conform to requirements set out in 49 CFR 238.233.

c). Cleanability:

i). The inside of the trash locker shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

ii). Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

iii). Easy-to-clean trash guides shall be provided on the sides and back of the locker and on the inside of the locker door. The trash guides shall prevent trash and liquids from getting between the container and locker wall.

iv). Horizontally accessed recycling and trash receptacles shall include a hinged self-closing door flap of a touch-free design that is as large as practical.

(1) This flap shall be as wide as possible.

(2) It shall be possible to open the trash flap by pushing against the vertical surface and further provide for opening without touching the vertical surface.

(3) If possible, the flap should be attached to the locker top surface rather than a door-within-a-door concept.

(4) Spring tension of a stainless-steel spring should prevent the door from swinging/ banging as a result of train motion.

(5) These flaps shall avoid trapping any hands or fingers.

v). Vertically accessed recycling and trash receptacles shall have clear openings without flappers.

(1) Enclosure shall be constructed so as to not ignite, produce lingering char, or allow fire to spread to adjacent interior elements.

d). Required Tash and Recycling Volumes

i). Figure 31-1 defines required trash and recycling capacity volumes in each car section.

Figure 31-1: Trash and Recycling Quantities

Section	Location	Type	Volume
Diner/ Lounge	Entrance Area	Trash and Recycling	7.5 cu ft
	General	Trash and Recycling	20 cu ft
Sleepers	Roomette	Trash Only	0.75 cu ft
	Solo Suite	Trash Only	0.75 cu ft
	Club Bedroom	Trash Only	1 cu ft
	Accessible Bedroom	Trash Only	1 cu ft
	General	Trash and Recycling	20 cu ft
Food Service	Kitchen	Trash and Recycling	44 cu ft
	Servery	Trash and Recycling	24 cu ft

Diner	General	Trash and Recycling	20 cu ft
Utility (option)	General	Trash and Recycling	10 cu ft
	Crew Room	Trash Only	0.75 cu ft
	Crew Common Area	Trash and Recycling	10 cu ft

31.18 Linen Closets

a). General

i). Linen closets shall be located on each car that contains a sleeping compartment and premium coach seating.

(1) In sleeping cars, linens shall be stored in a full height cabinet that is at least 2.5 ft wide and 2 ft deep.

ii). These cabinets shall have adjustable shelving and retaining devices to hold equipment on the shelf.

b). Material and Construction:

i). Linen closet door panels shall have melamine or factory-applied laminate.

(1) Alternatively, panels may be constructed of honeycomb or plymetal wall materials.

ii). Adjustable shelves with retaining bars shall be provided in these linen closets.

iii). A minimum of 5 shelves per closet shall be the default for the linen closet design and the final number of shelves and installed spacing arrangement shall be determined at the mockup review.

c). Cleanability:

i). The inside of the linen closet shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

ii). Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

31.19 Consumable Supply Closet

a). General:

i). Consumable supplies shall be stored in a full-height cabinet that is at least 2.5 ft wide and 2 ft deep.

ii). One consumable supply cabinet shall be provided per car.

iii). This cabinet shall have adjustable shelving and retaining devices to hold equipment on the shelf.

iv). The cabinet shall have a light that turns on when the door is opened and light switch inside.

v). The cabinet shall have a duplex service outlet.

b). Material and Construction:

i). Consumable Supply locker door panels shall have melamine or factory-applied laminate.

(1) Alternatively, panels may be constructed of honeycomb or plymetal wall materials.

ii). Adjustable shelves with retaining bars shall be provided in these consumable supply closets. A minimum of 8 shelves per closet shall be the default for the consumable supply closet design and the final number of shelves and installed spacing arrangement shall be determined at the mockup review.

c). Cleanability:

i). The inside of the consumable supply locker shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

ii). Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

31.20 Cleaning Supply Cabinet

a). General

i). Cleaning supplies shall be stored in a full height cabinet that is at least 2.5 ft wide and 2 ft deep.

ii). One cleaning supply cabinet shall be provided per car.

iii). This cabinet shall have adjustable shelving and retaining devices to hold equipment in place and/or on the shelf.

iv). Provisions shall be made for retention of one cordless vacuum with a dedicated outlet, one broom, one dustpan, one mop, and one mop bucket in all car types.

v). The cabinet shall have a light that turns on when the door is opened and light switch inside.

vi). The cabinet shall have a duplex service outlet.

b). Material and Construction:

i). Cleaning Supply Cabinet door panels shall have melamine or factory-applied laminate.

(1) Alternatively, panels may be constructed of honeycomb or plymetal wall materials.

ii). Adjustable shelves with retaining bars shall be provided in these cleaning supply cabinets.

iii). A minimum of 3 shelves per cabinet shall be the default for the cleaning supply closet design and the final number of shelves and installed spacing arrangement shall be determined at the mockup review.

c). Cleanability:

i). The inside of the cleaning supply cabinet shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

ii). Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

31.21 Lockable Cabinet (Diner Car Only)

a). General:

i). Items shall be stored in a full height lockable cabinet that is at least 2.5 ft wide and 2 ft deep.

(1) This cabinet shall have a hasp installed for additional security.

ii). One lockable cabinet shall be provided per Diner car.

iii). This cabinet shall have adjustable shelving and retaining devices to hold equipment and/or hunting rifles in place and/or on the shelf.

iv). The cabinet shall have a light that turns on when the door is opened and light switch inside.

v). The cabinet shall have a duplex service outlet.

b). Material and Construction:

i). Cabinet door panels shall have melamine or factory-applied laminate.

(1) Alternatively, panels may be constructed of honeycomb or plymetal wall materials.

ii). Adjustable shelves with retaining bars shall be provided in these cabinets.

iii). A minimum of 3 shelves per cabinet shall be the default for the design and the final number of shelves and installed spacing arrangement shall be determined at the mockup review.

c). Cleanability:

i). The inside of the cabinet shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

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ii). Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

31.22 Emergency Equipment

a). General:

i). Emergency Equipment boxes shall be mounted on end of the car.

ii). These boxes shall contain, at a minimum:

(1) a fire extinguisher

(2) crowbar

(3) hammer

(4) snap lights

(5) first aid kit

iii). Emergency equipment boxes shall not be locked and be mounted in an area easily accessible to all passengers in the event of an emergency.

iv). The labels and gages for the fire extinguisher shall be visible and readable from either a seated or standing passenger in an aisle.

v). Further information on these emergency equipment boxes can be found in Chapter 18.

b). Material and Construction:

i). Emergency equipment locker door panels shall have melamine or factory-applied laminate.

(1) Alternatively, panels may be constructed of honeycomb or plymetal wall materials.

c). Cleanability:

i). The inside of the emergency equipment locker shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

ii). Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

31.23 Luggage Storage – General

a). General:

i). Luggage racks shall conform to 49 CFR 238.737.

ii). The Contractor shall factor in:

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(1) Safety

(2) Crashworthiness, abuse, load, and crash criteria

(3) Materials and Workmanship

(4) FDA cleaning clearances

(5) FDA cleaning radii

(6) Sanitary design

iii). All mechanisms should be durable, free from jamming, and racking.

iv). Dimensions, position, and usability will be subject to Amtrak approval during the mockup review.

b). Cleanability:

i). The inside of the luggage storage locations shall be easy to clean, with large 0.75 in radius sanitary corners and all joints sealed for good sanitation and to meet FDA requirements.

ii). Visible hardware and fasteners should be minimized to aid cleaning, reduce build-up of contaminants, and provide for pleasing aesthetics.

c). Sleeper Cars: Required Luggage Storage Volumes and Baggage Analysis

i). Baggage storage volumes shall comply with the requirements of this Specification.

ii). Luggage Tower Volume

(1) Each sleeper car shall have luggage towers with sufficient capacity for all potential passenger's suitcases.

(2) Each passenger's suitcase shall be stored on the car they are travelling in.

(3) Luggage tower capacity shall allow for one suitcase for each passenger.

(4) For calculation purposes, assume 50% of the suitcases are large and 50% are medium sized.

(5) Sizes

(a) Large suitcases measure 30" x 20" x 12"

(b) Medium suitcases measure 26" x 18" x 11"

iii). As part of PDR, the Contractor shall develop and provide an analysis of how the proposed car arrangements shall comply with the requirements of this specification. **[CDRL 31-03]**

Figure 31-2: Not Used

d). Key Features

i). Expected features for Luggage Storage areas are summarized in Figure 31-3 and detailed below.

Figure 31-3: Luggage Storage Key Features

Feature	Short Description	Qty
Trim Panels	Wall panel with provisions for mounting lighting, signage, etc.	TBD during design review
Rollstop	Retaining bar for luggage	1 per shelf level
Kick Strips	Stainless steel strips	Each exposed side
Solid Panel	HPL panel	TBD during design review
Upper Shelf	Shorter depth shelf	1
Protective Back Panel	Replaceable wear panel	1 per shelf
Shelves	Full depth shelf	TBD during design review
Bottom Shelf	Floor luggage storage for large bags	1

ii). Trim Panels

(1) Trim panels shall interface with side wall and ceiling with no gaps or dirt traps.

(2) Trim panels are made from HPL composite sandwiches.

iii). Rollstop

(1) Retaining bars or similar details shall be provided on large shelving edges that prevent luggage from falling or rolling out.

iv). Kick Strips

(1) Stainless steel kick strips at 9” high should be used on all exposed edges.

v). Solid Panel

(1) A solid panel with HPL skin and no safety glass should be used when stacks are placed up against bulkheads.

vi). Upper Shelf

(1) Upper shelf can be shallower for smaller bags and aid in passenger reach of luggage.

vii). Protective Back Panel

(1) Replaceable trim panel that protects wall from scuffing shall be provided. Panel should be easy to replace.

viii). Shelves

(1) Shelving with hard wearing finish shall be provided. Shelf should be easily replaceable, easy to clean, with no dirt traps.

ix). Bottom Shelf

(1) The bottom shelf shall be deep enough for large suitcases. It shall have an easy clean surface, no dirt traps, and a soft back corner.

31.24 Luggage Towers

a). General

i). Quantity and location of luggage towers shall be guided by the Baggage Analysis required in Section 31.23.

b). Materials and Construction

i). A luggage tower shall be of robust stainless-steel construction and include shelves.

ii). Bumper guards shall be mechanically attached to the wall panels within the luggage tower to prevent damage to walls or luggage.

iii). The towers shall have sufficient strength to support a load of 250 lbs. midway between adjacent supports with a deflection not to exceed 0.25 in. and without permanent deformation.

iv). The load-bearing surface shall not be less than 24 in. wide and shall be inclined upward from the horizontal toward the center of the car at an angle of approximately three degrees.

c). Aesthetics

i). The towers shall have plain or tinted glass that will be presented to Amtrak for approval during the design review process.

ii). Exact graphics, decals, opacity, etc. shall be determined with Amtrak during the design review process.

d). Modularity

i). Luggage towers should be built as a modular set of parts.

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ii). Various lengths of luggage tower shall be allowed for within the same modular construction.

iii). Luggage towers should be integrated with the side wall and ceiling with no gaps or dirt traps between it and the adjoining body side panels.

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Part IV: Integrated Electronics and Technology

31.25 Digital Displays

a). General

i). Digital displays shall be provided throughout the cars.

ii). Displays shall be capable of both displaying uniform content across multiple screens and displaying unique information.

(1) This should be adjustable by Amtrak employees who have access to software passwords for such activities.

iii). See Chapters 14 and 26 for additional information and requirements for displays.

b). Materials and Construction

i). All display screens shall be rail rated and/or service proven.

ii). Displays shall be integrated into an access panel for ease of maintenance and replaceability.

iii). Behind each access panel should be provisions for electrical, diagnostics, and communications connections even if the display screen is only powered by the Contractor.

iv). Displays shall be flush mounted unless otherwise agreed with Amtrak during IDR and Mockup Review.

c). Screen Placement

i). General

(1) Screens shall be located to ensure high visibility and legibility for passengers throughout the train.

(2) The intent is to provide consistent access to passenger information without prescribing exact screen sizes, orientations, or positions.

(3) Screen placement shall support dynamic wayfinding, real-time travel updates, and service information including advertising.

(4) Please refer to CMF and suggested layout attachments for further information on screen placement and examples.

ii). Visibility Guidelines by Area

(1) Entrance Areas

(a) Screens should be clearly visible upon entering and exiting the car.

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(b) Screens should be positioned to be readable from multiple angles.

(2) Sleeper Cars

(a) At each end of all sleeper car hallways or in transitional spaces screens should be provided for passenger information and way finding. (PIS/OTIS)

(b) Screens must be clearly visible from typical passenger circulation paths.

(3) Food Service Areas

(a) Screens used for digital menus, Food and Beverage Promotions, or service information must be readable from multiple positions including:

(i) While queuing (even when two or more people are in line)

(ii) Directly at the point of purchase

(iii) From seated dining positions

(4) Screen Format

(a) Aspect ratio, orientation, and mounting should be selected to support clear visibility in each context.

(b) All screens shall feature anti-glare treatments and meet accessibility standards for legibility, contrast, and resolution.

(5) Screen Selection and Placement

(a) Amtrak reserves the right to modify screen placement or suggest screen selection changes during the design review process and mock up stages of the design.

31.26 Electrical Locker and Panels

a). The car electric/ switch locker shall be located within the car interior.

b). The car PA unit is located here, recessed into the wall.

c). The locker shall have separate doors for crew operated equipment, and maintenance operated equipment. See Chapter 15.

d). Locker walls shall be of melamine faced aluminum panel construction with substructure as appropriate to support components.

e). Longitudinal walls facing into the entrance area shall be decorated with melamine or other factory-manufactured laminate material.

f). The locker wall & door material shall be fireproof or be lined with fire-blocking material.

g). The substructure shall be robust to support the numerous heavy electrical panels, etc. located within the locker.

h). The door and frame shall be robust due to frequent use and rough treatment.

i). The door lock shall be a coach key style lock with interior release latch.

j). The electrical locker shall be positively pressurized by conditioned air as part of the HVAC system to prevent dust from entering and accumulating in the electrical locker.

k). Air shall only be allowed to vent from the electrical locker through gaps and voids where dust may enter.

l). There shall not be a vent or grille in the door to the electrical locker.

m). The locker shall include a metal pocket or rack to hold the car defect report book, which is approximately 8.5 in. wide by 11 in. tall by 1 in. thick.

n). The inside face of the electrical locker door shall have an identification sign listing the car number, car weight and freshwater capacity, and an 8.5 in. wide by 11 in. tall metal surface for an FDA inspection form and stickers.

o). The surface must be smooth to allow pasting up maintenance forms i.e. extermination.

p). A Central Diagnostic Unit control and display shall be included in the locker.

q). The electric locker door shall be labeled in compliance with Amtrak Specifications # 696 & # 697.

r). When the door is opened, the locker service lights shall be illuminated by magnetic switches.

s). The locker doors shall be hinged to open to not block aisleways/passageways when open.

t). The passage side of the electric locker with the door shall contain all crew and emergency controls in one location to facilitate emergency preparedness and response.

u). At a minimum the following components shall be located on the passage side of the electric locker:

i). B-end emergency fan switch

ii). B-end body end door cutout switch

iii). B-end conductors emergency brake valve (Note: exhaust of valve must not direct onto electrical equipment in the locker, so as to avoid blowing water onto it when valve is activated)

iv). PA unit (see Chapter 14)

v). Fire extinguisher enclosure (see Chapter 18)

vi). Smoke Detector main display panel and controls, behind a transparent door, accessed with a coach key (see Chapter 25)

vii). Waste system status (see Chapter 17)

viii). System status indicator panel (See Chapter 10)

ix). All other crew operated emergency controls

v). At the top of the room adjacent to the hallway, each room shall be equipped with an electrical junction box, containing a series of terminal blocks to allow the interconnection of room module wiring with that of the car.

w). Overhead wire ducts shall carry inter-module wiring as well as the feeds from the switch locker.

x). The cover of the box shall make a dust-tight seal to the room interior and shall be secured with captive screws.

y). The electrical equipment and switch locker shall be located as appropriate near the end of each car.

z). A small switch locker shall be incorporated into the electrical locker, containing just the essential lighting and other control switches needed by the train crew for car setup for consist operation.

Figure 31-4: Not Used

31.27 Outlets

a). General

i). Convenience outlets utilizing duplex receptacles as described in Chapter 15 shall be located throughout the interior.

ii). A “120 Volts” label, in accordance with Amtrak Spec. # 697, shall be installed at each outlet location, 0.5 inch from the outlet.

b). Passenger Convenience Outlets

i). Seat Outlets

(1) A duplex receptacle shall be provided for each seat, including those at tables, in all car types. See the following sections for additional information:

(a) 31.37: Roomette

(b) 31.38: Solo Suite

(c) 31.39: Club Bedroom

(d) 31.40: Accessible Bedroom

ii). Table Outlets

(1) A duplex receptacle shall be installed on each side of each table, located such that the table or seat does not interfere with access to the outlet.

iii). Mirror Outlets

(1) A duplex receptacle shall be installed adjacent to each mirror. See the following sections for additional information:

(a) 31.35: Standard Toilet Room (STR)

(b) 11.46: Accessible Toilet Room (ATR)

(c) 31.37: Roomette

(d) 31.38: Solo Suite

(e) 31.39: Club Bedroom

(f) 31.40: Accessible Bedroom

(g) 31.41: Sleeper Cabin Communal Restrooms

(h) 31.42: Sleeper Cabin Communal Showers

31.28 Video Surveillance (Option)

a). An onboard digital video surveillance system shall be provided.

b). The video surveillance system shall monitor, and record data acquired from multiple onboard camera sources that shall be arranged to maximize the coverage of the vehicle and its operations.

c). The onboard camera system shall have day and night capabilities with performance down to at least 0.1 lux and provide high quality color video.

d). The system shall operate continuously off the low voltage power supply system and be backed up by car battery as a vital load.

e). A minimum of four (4) interior cameras shall be placed throughout each car to facilitate recognition of passengers and/or luggage onboard the rail vehicle.

f). One camera shall be mounted in each entrance area with wide angled coverage of the entrance areas, and doorways.

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g). No less than two cameras shall be mounted in the passenger seating area. Cameras mounted in the passenger seating area shall be facing in opposing directions with overlapping viewing zones to maximize coverage.

h). Failure of a single camera shall not affect system functionality.

i). The cameras shall have adjustable resolution of at least 1080p with frame rates adjustable up to thirty (30) frames per second to avoid latency and/or frame loss.

j). The cameras shall provide the latest MPEG-4 video compression commercially available, H.264 or greater.

k). Each camera shall deliver compressed video in real time to the data storage device. All video cameras provided shall have a proven history of reliable operation on rail vehicles.

l). The surveillance system shall commence recording data when the car is powered on, and continue recording until the car is powered off, unless otherwise directed by the Conductor.

m). All communications equipment shall meet the requirements in Chapter 14, Communications. See also Chapter 26.

Part V: Interior Structures

31.29 Bulkhead Walls

a). General

i). Bulkhead walls at the end of each passenger seating area shall be constructed of melamine or HPL- faced aluminum panels for durability and to be pleasing to the passenger.

ii). Any fiberglass material shall be covered with a high gloss gel coat. All seams will be sealed, using appropriate sealing materials.

iii). Fasteners shall not protrude from the wall panels but countersunk to be flush with the wall panels.

iv). Bulkheads dividing the car shall be constructed for durability. All joints shall be sealed, using appropriate sealing materials.

v). Fasteners shall not extend from the wall panels but instead countersunk to be flush with the wall panels.

vi). The bulkhead shall meet the structural strength required in APTA PR-CS-S-006-98.

vii). Panels shall be machined smooth and free of sharp edges and burrs. Like panels shall be identical.

viii). Edges and corners shall have generous radii. Finished surfaces shall be decorative laminate, Schneller G20002T or high-pressure laminate.

ix). Amtrak shall reserve the right to choose material it deems appropriate for the application.

x). Provision for textile wainscot panels or sections shall be included.

xi). Panels shall include stainless-steel kick panels equal in height to the sidewall heater grills.

xii). Kick panels shall wrap the edges of the passage/ aisle side edge of the panel.

xiii). Bulkheads shall be designed so that decorative surfaces can be changed at overhaul without damaging the substrate.

xiv). Alternate panel construction will be considered where appropriate.

xv). To keep the number of fasteners low, service panels shall be kept as small as possible while still allowing access to the necessary items requiring access.

xvi). The gaskets shall be protected from crushing through the use of metal-to-metal stops incorporated around the mounting fastener holes. Bulkheads with Doors

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(1) For bulkheads at end door or partitions, bulkheads should have a flush integrated screen and provision for Amtrak 3D branding.

b). Doors should be made from safety glass, have a minimal frame and an accessible touch button to open the door. Please refer to the attached CMF document (Exhibit F) for exact color, material, and finishes desired in bulkhead walls. Please also refer to chapter 19.

31.30 Ceilings

a). Ceiling panels shall be designed and constructed and installed to allow easy individual removal for maintenance and repair of any components included in the ceiling design, such as air ducts.

b). Ceiling panels shall be constructed of material that meets flame, smoke, toxicity, and structural standards, subject to Amtrak's approval.

c). The ceilings shall be made of a wear resistant and easy to clean material, preferably coated metal sheets or HPL panels.

d). Hallway and central ceiling panels shall be lightweight phenolic composite sandwich design or honeycomb construction.

e). Panels shall have a dense phenolic composite edge machined smooth and free of sharp edges and burrs or may employ imbedded aluminum trim.

f). Alternatively, as appropriate, honeycomb aluminum panels may be used. Finished surfaces shall be decorative laminate, Schneller G20002T or Amtrak approved equivalent.

g). Corners and edges shall be rounded.

h). Panels should be self- trimming.

i). Where trim extrusions are necessary between panels, their size should be minimized.

j). The number of visible fasteners should be minimized.

k). Piano hinged ceiling panels shall be designed, constructed, and installed to allow easy individual opening and closing to provide access for maintenance and repair of any components located above the ceiling, such as:

i). body end door operators and tracks,

ii). HVAC air ducts,

iii). lighting fixtures,

iv). PA speakers,

v). water piping,

vi). wiring, etc.

l). These panels shall be hinged along one edge in such a way that they may be hung open or easily removed from the hinge.

m). Ceiling panel size shall allow a single person to open/ close the panels safely, unaided.

n). The panels shall be secured closed with a quarter turn Southco or equal quarter turn draw-tight vice-action latches with indicators for the locked position. When in the locked/closed position the latch arm shall not move freely. The latch will be determined during the design review process. Self-adjusting compression latches are prohibited.

o). The driver required for the latch will be determined during the design phase.

p). Each panel shall include a passive self-engaging safety catch to prevent accidental panel openings.

q). These safety devices shall be stainless steel and be configured so as not to rattle in service. The safety latch shall be self-engaging when opening and closing the panel.

r). Panels shall be sealed against air leaks around their entire perimeter, with the seal on the stationary side of the joint.

s). Any components that penetrate the ceiling shall form an air-tight joint to the ceiling to avoid dirt streaking.

t). The seal on these items shall be on the component, rather than the ceiling panel.

u). The method of securing the ceiling panel to the car structure shall ensure that panels cannot drop at all due to any car motion from coupling/ uncoupling as well as under all operating conditions at all authorized speeds on any FRA class of track.

v). Hinged panels, which provide access of overhead equipment such as door operators, water heater, galley exhaust hood blower, etc., shall be equipped with a limit switch so that when the panel is opened, the associated service lights shall be illuminated.

w). Where the car ceiling panels form the bottom of the HVAC duct, they shall be hinged along one side to allow them to be easily opened for periodic duct cleaning.

31.31 Flooring

a). Floor Covering

i). The car floor shall be equipped with a combination of carpeting and anti-slip flooring to provide an aesthetically pleasing and safe environment for the passenger.

ii). Safety and installation shall be foremost in the design.

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iii). Carpeting is used not only for aesthetics, but also as a sound absorbent.

iv). All floor coverings shall be new.

v). The integration of the base floor material, carpeting, and shower/ restroom inserts shall be the subject of design review.

vi). Care shall be taken to ensure smooth transitions between flooring, carpeting, and transitions in doorways, restroom entrances, seat tracks, etc., to avoid tripping hazards.

vii). Generally, clamping thresholds should be used at these joints and longitudinal carpet-retaining tracks used to secure carpeting.

viii). Carpet-retaining track locations shall be coordinated with those of LLEPM tracks to ensure a smooth transition.

ix). Joints in the floor beneath the floor covering shall be smooth with no transmit bumps, ridges, and other irregularities through to the finished surface of the covering.

x). The builder shall provide an adhesive system suitable for railcar applications and be unaffected by the inherent flexing of vehicle interior color panels and temperature swings during train operation.

xi). The adhesive shall not degrade the flammability, smoke emissions, and toxicity characteristics of the carpet, composite flooring, or car substrate.

xii). The composite flooring, floor coverings, and their adhesive systems shall be able to withstand a wide variety of periodic and specialized stain removal cleaning typical for a passenger rail vehicle without any stretching, puckering, rippling, fraying, pulling up, or other adverse effect to the surface appearance or function.

xiii). Cleaning may occur daily and at least every 90 days using a carpet cleaning machine, hot water, and caustic or acid chemicals.

xiv). Daily specialized spot cleaning will take place using chemical cleaners, scrubbing with brushes, and application of gum remover.

xv). The base floor and floor coverings shall be installed in accordance with the best practices of the industry and OEM instructions.

xvi). Floor coverings, their trim, and the installation of these materials shall result in a smooth and flat floor covering for the life of the floor covering. Coverings shall be removable at end-of-life with no damage to the underlying floor panels.

xvii). Floor covering seams should be kept to a minimum and the plan for seam location shall be approved by Amtrak during the design review process.

(1) High-wear carpet locations especially center aisles shall be designed to be fully replaced in under 30 minutes.

xviii). The carpet vendor shall provide detailed recommended cleaning instructions for the builder to include in the maintenance manual sets.

xix). To the extent possible, floor coverings for each site shall have the same dimensions among all cars, or among like cars at a minimum, so materials can be cut to size outside of the car and be installed with minimal on-car trimming.

b). Walkoff carpets shall be installed in all entrance areas to each car to prevent damage to the interior flooring of each car. Walkoff carpets shall be designed for high-traffic environments and must function under all conditions including temperature fluctuations, vibration and continuous passenger loading.

i). The walkoff carpet system shall be easily replaceable and shall trap water and soil at the entryway to improve cleanliness and safety while providing a stable, firm and slip-resistant walking surface consistent with all accessibility requirements for floor surfaces.

c). Please refer to Figure 31-5 below for general outline of where each flooring type will be utilized and to Exhibit F for exact color, material, and finishes desired in bulkhead walls:

Figure 31-5: Floor Covering Table

Location		**Flooring Type**
Diner	Aisle by Galley	Anti-Slip Rubber Flooring 1
	Seated Area	High Traffic Carpet 2
	Galley	Anti-Slip Rubber Flooring 2
Diner/Lounge	Entrance Area	Anti-Slip Rubber Flooring 1
	Seated Area	High Traffic Carpet 2
Sleeping Car	Entrance Area	Anti-Slip Rubber Flooring 1
	Aisle/Hallway	High Traffic Carpet 2
	Inside Bedrooms	Low Traffic Carpet 3
	Bedroom Restrooms	Anti-Slip Rubber Flooring 2
Communal Restrooms	ATR, STR & Shower	Anti-Slip Rubber Flooring 2
Utility Car Areas (Option)	Aisle/Hallway	High Traffic Carpet 2
	Entrance Area	Anti-Slip Rubber Flooring 1
	Common Area	Anti-Slip Rubber Flooring 1
	Checked Bag Storage	Anti-Slip Rubber Flooring 2

d). Carpeting and Securement

i). Carpet

(1) Heavy-duty commercial carpet shall be provided as indicated including seating areas and sleeper cabins.

(2) Carpet shall be designed for modular replacement.

(3) All areas of common design shall use template cut carpets. Linear carpets such as those used for aisles shall likewise be of identical sizes within car types.

(4) Roomette and Solo Suite carpets shall be replaceable in 15 minutes each. Bedroom carpets shall be replaceable in 20 minutes.

(5) Sleeping cars, Diner/Lounge car, Dining car, and Utility car aisle carpets shall be replaceable in 30 minutes.

(6) All carpet shall be designed per Amtrak specification and shall be designed to provide maximum passenger comfort and safety as dictated by ergonomic requirements.

(7) The carpet shall be compliant with all applicable APTA and ADA guidelines.

ii). Carpet Securement

(1) Generally, the aisle and hall carpet shall be mechanically secured to the floor using longitudinal carpet-retaining tracks along both sides of the center aisle and along the outside edges of the car in the sleeper car hallway.

(2) A cove shall be provided where the carpet meets the longitudinal wall for ease of cleaning.

(3) Clamping thresholds shall be used at transitions to rubber or composite flooring and metal moldings, as required, such as at bulkheads.

(4) The carpet-retaining tracks along the aisle may be incorporated in the tracks for LLEPM.

(5) The spacing between the carpet-retaining tracks, moldings, etc. shall be identical on all cars so that carpeting does not need to be trimmed to fit a specific car.

(6) If carpet must be glued into place at certain locations, these require Amtrak approval.

e). Anti-Slip, Skid Resistant Flooring

i). Skid-resistant, waterproof composite floor covering, that has been tested and proven to meet ADA requirements, shall be used where indicated including passageways, restrooms, food service areas and other utility areas where carpet is not installed.

ii). The floor design must comply with 36 CFR Part 1192 Appendix I. and to the best extent, RVAAC VI Floor Surfaces recommendations.

iii). The floor covering shall have an integral cove of 4 in. radius, where specified, for easy cleaning, and shall extend from 2 in. to 6 in. up the wall, depending upon application.

iv). Transition strips shall be provided between composite flooring and carpeted areas.

v). Transitions between flooring types shall produce level changes in flooring surfaces less than 0.25 in.

vi). The trim strip between the wall lining and the floor covering shall be sealed to prevent harborage, accumulation of debris, or incursion of water and cleaning fluids.

vii). Floors in entrance areas and end passageways shall have a 3 in. wide high-contrast visibility strip directly adjacent to door openings to delineate the door opening for visually impaired passengers.

viii). The high-contrast strip at the side entry doors shall be made of high-performance photo-luminescent material so that it is integrated into the LLEPM system for exit pathway marking.

ix). The LLEPM material and application shall comply with APTA Standard PR-PS-S-004-99 and shall be embedded in the floor system.

x). All flooring shall be installed using an adhesive system that is approved by the flooring manufacturer and Amtrak.

31.32 Hallways

a). General

i). Hallway information shall be used in any corridor or aisle through a train car with enclosed compartments on either side.

ii). All hallways shall be designed and constructed to form a safe and attractive environment. Visible fasteners shall be minimized.

iii). Modularity shall be optimized during the design process and the outer walls of the modules shall be developed as a common component where possible.

iv). All mounted items in the area shall be secured to the module structure through the use of fully embedded tapping plates when pullout strength or expected weight is greater than 20 lbs.

v). These are expected to last the life of the car without coming loose.

vi). Consistent features shall be maintained across hallways to the extent possible.

b). Requirements for integrated systems in all hallways are listed below.

i). HVAC

(1) Supply Air Diffusers

(a) Conditioned air is delivered to the hallway via 2 supply air diffusers with adjustable air flow control and located on the windowsill of the outside window.

(2) Exhaust Grille

(a) Exhaust air is removed from the room via the exhaust air grille which is located at the upper portion of the module.

(3) Air Circulation Fans

(a) Air circulation fans with controls shall be provided at the head of each sleeping berth.

(b) The purpose is to stir car air and decrease the potential for temperature differential between upper and lower areas of the car.

(c) The air circulation fans shall have manual adjustment of the airflow direction.

ii). Communications

(1) Speaker

(a) PA speaker shall be located on the central ceiling panel.

(b) The speaker used in this location shall be identical to PA speakers used in other locations in the cars for ease of maintenance and replacement.

(2) Passenger Emergency Intercom

(a) A PEI shall be located in every car in addition to specified locations called out later in this section.

(b) The intention of this button is to notify the conductor and flag the entire train that there is an onboard emergency.

(3) All communications equipment shall meet the requirements in Chapter 14.

iii). Electrical System

(1) Electrical equipment information is shared in detail for each hallway area.

(2) All electrical equipment in the entrance area shall meet the requirements in Chapter 15.

iv). Lighting System

(1) Lighting general information is shared in detail for each area. Detailed lighting information can be found in Chapter 13.

(2) Note that all lighting part numbers, manufacturers, and temperatures shall be proposed by the Contractor and approved at Amtrak after the lighting simulation during the design review process.

v). Emergency Equipment

(1) Chapter 18 details emergency equipment requirements. Generally, the following items shall be included.

(a) Smoke Detector

(i) Smoke Detectors shall be mounted on the central ceiling panel.

(ii) The smoke detector used in this location shall be identical to the smoke detectors used in other locations in the cars for ease of maintenance and replacement.

vi). CMF

(1) Please refer to the CMF document Exhibit F for color, material, and finishes desired in this sleeper cabin area. Please also refer to Chapter 19.

(a) Wall Panels

(i) Wall panels shall be wrapped in a protective film in accordance with Chapter 19. Paint is prohibited.

(ii) Sidewall Panels along the carshell wall shall be made from molded thermoplastic or melamine resin composite with an easy to clean surface finish.

(iii) Partition Walls shall be created from a composite structure such as aluminum honeycomb, melamine resin, or HPL skinned honeycomb panels.

(iv) The finish of the wall and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(b) Ceilings

(i) Ceiling panels shall be wrapped in a protective film in accordance with Chapter 19. Paint is prohibited.

(ii) Ceiling shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels. Please refer to Section 31.30 for details on this ceiling type.

(iii) The finish of the passenger facing side of the ceiling panel and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(iv) The finish of the material on the non-passenger facing side shall be coated such that there is no risk of corrosion from moisture from steam or humidity within the car.

(c) Flooring

(i) Flooring within the hallway shall be made from high traffic carpet flooring.

c). Key Features

i). A comprehensive list of expected features in hallways is provided in Figure 31-6 and described in detail below.

ii). In addition to these requirements, the Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design. All mechanisms described below should be durable, free from jamming, and racking. The design should meet abuse load and crash criteria. Dimensions, position, and usability will be subject to Amtrak approval during the mockup review.

Figure 31-6: Key Features – Hallways

Feature	Short Description	Qty
Handholds	49 CFR 238.115 compliant handrails	Depends on car type
Trash Bin	Trash bin with push flaps and access door	At least 2
Panel Work	HPL panels and Tedlar style sidewall liners	All
Passenger Information Screens	Digital display monitor (PIS/OTIS)	2
Control Panel Doors	Access panels with seamless features to panel work	All Access panels
Kick Strips	9” high stainless steel strips	All exposed wall panels
Trim panels	Wall panel with provisions for mounting signage etc.	TBD during design review

iii). Handholds

(1) General

(a) Compliant handholds should be supplied.

(b) Grab bar positioning will be subject to mockup testing and Amtrak approval.

(c) Grab bars shall meet the requirements in 49 CFR 38.115.

(2) Horizontal Handrails

(a) Horizontal handrails shall be provided along the full length of a hallway along the window side of the aisle, if applicable.

(3) Vertical Grab Bars

(a) Vertical grab bars shall be provided between every cabin or compartment.

iv). Trash Bin

(1) Trash bins shall be provided with stainless steel push flaps.

(2) Please refer to Section 31.17 for more information on trash and recycling requirements.

v). Panel Work

(1) Hallways should be designed to have well fitted clean panels with a high tolerance build to manage split lines and cabinet edging.

(2) There should be no protruding equipment, snag point, or dirt traps.

(3) All equipment storage cabinets should be accessible using a crew key with discreet locks.

vi). Passenger Information Screen (PIS/OTIS)

(1) Display screens should be supplied on both ends of the hallways.

vii). Control Panel Door

(1) All equipment storage cabinets should be accessible using a crew key with discreet locks.

(2) These doors should use the same front panel as the other hallway wall paneling.

viii). Kick Strip

(1) Stainless steel kick strips at 9” high should be used in all hallways.

ix). Trim Panels

(1) Allowance for an area on the panel should provide suitable space to apply wayfinding signage.

(2) Trim panels differ from panel work in that trim panels are locations for wayfinding and accent lighting features to be mounted.

d). Lighting Requirements

i). General

(1) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups. Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

ii). Lighting Types and Locations

(1) Wash Lights

(a) Wall Panel Wash Light

(i) Indirect strip lights wash light onto the ceiling from the top of the compartments along the hallway.

(2) LED Panel Spotlights (White Lights)

(a) Small circular LED light panels shall act as spotlights along aisles.

(b) The frame for the spotlights shall be color matched to the ceiling.

31.33 Entrance Areas

a). General

i). Entrances for the cars shall have entrance doors on both sides of the car at the B-end.

ii). Entrance areas shall include a 60” turning circle.

iii). All entrance areas shall be designed and constructed to form a safe and attractive environment.

iv). Visible fasteners shall be minimized.

v). Modularity shall be optimized during the design process and the outer walls of the modules shall be developed as a common component where possible.

vi). All mounted items in the area shall be secured to the module structure through the use of fully embedded tapping plates when pullout strength or expected weight is greater than 20 lbs.

(1) These are expected to last the life of the car without coming loose.

vii). Consistent features shall be maintained across entrance areas to the extent possible.

b). Integrated Systems

i). HVAC

(1) Supply Air Diffusers

(a) Conditioned air is delivered to the entry area via 2 supply air diffusers with adjustable air flow control and located on the windowsill of the outside window.

(2) Exhaust Grille

(a) Exhaust air is removed from the entry area via the exhaust air grille which is located at the upper portion of the module.

(3) Air Circulation Fans

(a) Air circulation fans with controls shall be provided.

(b) The purpose is to stir air and decrease the potential for temperature differential between upper and lower areas.

(c) The air circulation fans shall have manual adjustment of the airflow direction.

ii). Communications

(1) Speaker

(a) PA speaker shall be located on the central ceiling panel.

(b) The speaker used in this location shall be identical to PA speakers used in other locations in the cars for ease of maintenance and replacement.

(2) Passenger Emergency Intercom

(a) A PEI shall be located in every car in addition to specified locations called out later in this section.

(b) The intention of this button is to notify the conductor and flag the entire train that there is an onboard emergency.

(3) All communications equipment shall meet the requirements in Chapter 14.

iii). Electrical System

(1) All electrical equipment in the entrance area shall meet the requirements in Chapter 15.

(2) Junction Box

(a) The junction box shall be located where practical and shall be presented during the design phase. It shall be easily accessible by the maintenance group.

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iv). Lighting System

(1) Lighting general information is shared in detail for each area. Detailed lighting information can be found in Chapter 13.

(2) Note that all lighting part numbers, manufacturers, and temperatures shall be proposed by the Contractor and approved at Amtrak after the lighting simulation during the design review process.

v). Emergency Equipment

(1) Chapter 25 details emergency equipment requirements.

(2) Smoke Detector

(a) Smoke Detectors shall be mounted on the central ceiling panel.

(b) The smoke detector used in this location shall be identical to the smoke detectors used in other locations in the cars for ease of maintenance and replacement.

c). Security

i). Many items within the entrance area will need to be secured.

d). Please refer to the attached CMF document (Exhibit F) for exact color, material, and finishes desired in this entrance area. Please also refer to Chapter 19.

i). The following items are identified with specific locking preferences:

(1) Crew access panels

ii). Any other locking or security items will be discussed with Amtrak during design reviews.

iii). Wall Panels

(1) Sidewall Panels along the carshell wall shall be made from molded thermoplastic or melamine resin composite with an easy to clean surface finish.

(2) Partition Walls shall be created from a composite structure such as aluminum honeycomb, melamine resin, or HPL skinned honeycomb panels.

(3) The finish of the wall and material of the outside skin meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

iv). Ceilings

(1) Ceiling shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(2) The finish of the passenger facing side of the ceiling panel and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(3) The finish of the material on the non-passenger facing side shall be coated such that there is no risk of corrosion from moisture from steam or humidity within the car.

v). Flooring

(1) Flooring within the entrance area shall be made from high traffic anti-skid flooring. Please refer to Section 31.31 for details on this flooring type.

e). Key Features

i). A comprehensive list of expected features in entrance areas is provided in Figure 31-7 and detailed below.

ii). In addition to these requirements, the Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design. All mechanisms described below should be durable, free from jamming, and racking. The design should meet abuse load and crash criteria. Dimensions, position, and usability will be subject to Amtrak approval during the mockup review.

Figure 31-7: Key Features – Entrance Areas

Feature	Short Description	Qty
Handholds	49 CFR 38.115 compliant handrails	4
Door Threshold	Anti-slip, color contrast, texturized flooring at door	2
Trash Bin	Trash bin with push flaps and access door	2
Step Stool Storage	Storage location for step stool used during boarding and alighting process	1
Panel Work	HPL panels and Tedlar style sidewall liners split horizontally into two types (See Exhibit F)	All panels
Passenger Information Screens	Digital display monitor (PIS/OTIS)	2
Control Panel Doors	Access panels with seamless features to panel work	All access panels
Kick Strips	9” stainless steel strips	All exposed panel work
Wheeled Mobility Device Lift	Wheeled mobility device lift for boarding	1
Crew Door Control Panel	Exposed crew controls and buttons for doors and lifts	1
Electrical Control Panel	Maintenance storage location behind access panel	1
PEI	Emergency Alert system with intercom	1

iii). Handholds

(1) Compliant handholds should be supplied on both sides of each door, at key access points along aisles.

(2) Grab bar positioning will be subject to mockup testing and Amtrak approval.

(3) Grab bar shall meet the requirements in 49 CFR 38.115. Handhold grab bars shall be made from stainless steel.

iv). Door Threshold

(1) Door threshold should have a slip-free surface and a contrasting floor color to the main entrance area flooring to mark the threshold.

v). Trash Bin

(1) Trash bins shall be provided with stainless steel push flaps.

(2) Please refer to Section 31.17 for more information on trash and recycling requirements.

vi). Panel Work

(1) Entrance areas should be designed to have well fitted clean panels with a high tolerance build to manage split lines and cabinet edging.

(2) There should be no protruding equipment, snag point, or dirt traps.

(3) All equipment storage cabinets should be accessible using a crew key with discreet locks.

vii). Hand Sanitizer Dispenser

(1) An infrared hand sanitizer dispenser shall be installed in each car in the entry vestibule.

(2) The dispenser shall provide a touchless and hygienic solution for dispensing hand sanitizer in public places.

(3) Infrared Sensor

(a) The dispensers shall utilize advanced infrared sensor technology for touchless operation.

(b) The IR sensor shall have an adjustable sensor range to optimize detection distance.

(4) The dispenser shall accommodate a minimum of 1000 ml of hand sanitizer.

(5) The sanitizer reservoir shall be easily refillable without the use of tools.

(6) The dispensers shall be powered via hardwired connection.

(7) The dispensing volume shall be adjustable between 1.5 ml and 3.5 ml per application.

(8) The dispensers shall be constructed using durable and easy-to-clean materials suitable for high-traffic areas and compliant with all requirements of this specification.

(9) The dispenser shall have an LED indicator for low sanitizer levels.

(10) The dispensers shall be wall-mounted and shall allow for easy removal and replacement.

(11) Dispensers shall come filled with an unscented, hand sanitizer with a minimum alcohol content of 60%.

viii). Passenger Information Screen (PIS/OTIS)

(1) Display screens should be supplied on both sides of the interior vestibule door.

ix). Control Panel Door

(1) All equipment storage cabinets should be accessible using a crew key with discreet locks.

(2) These doors should use the same front panel as the other entrance area wall paneling.

x). Kick Strip

(1) Stainless steel kick strips at 9” high should be used in all entrance areas.

xi). Wheeled Mobility Device Lift

(1) A wheeled mobility device lift shall be mounted on doors on both sides of the car, where any passenger with disabilities may board.

(2) The wheeled mobility device lift mounting shall not impede on passenger ingress or egress through the doorway.

(3) Please refer to Chapter 12 for more information.

(4) Crew door controls shall be exposed for ease of access and located on a panel near the entry and exit doors of the car. Please refer to Chapter 12 for more information.

(5) Electrical control panels shall be located behind access panel doors that are operated using a square lock, or as otherwise approved by Amtrak.

xii). PEI

(1) Intercom and alert button shall be integrated into the sidewall for emergency notification and communication. Please refer to Chapter 14 for more information.

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f). Lighting

i). General

(1) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups. Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

ii). Lighting Types and Locations

(1) LED Panel Spotlights (White Lights)

(a) Small circular LED light panels shall act as spotlights above the doors, and along aisles.

(b) The frame for the spotlights shall be color matched to the ceiling.

(2) Compartment Light

(a) Step Lights

(i) Step lights should illuminate interior threshold during boarding.

(3) Wall Panel Wash Light

(a) Indirect strip lights wash light onto the ceiling from the top of the entrance area monuments.

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Part VII: Restrooms

31.34 Restrooms - General

a). General

i). Restrooms shall comply with water and waste system equipment requirements detailed in Chapter 15.

ii). The highest levels of winterization protection in the design of the toilet room shall be provided.

iii). Accessibility requirements for labeling in the restroom from Chapter 26 shall be followed. Please also reference signage from Section 31.6.

iv). All parts of the toilet room and associated water and waste piping shall have complete maintenance access provided to all components.

v). All toilet room fixtures, dispensers and appliances shall be constructed in accordance with the requirements of the US Public Health Service and 21 CFR Part 1250 requirements and ATR shall meet the ADA requirements of 49 CFR Part 38.123.

vi). Complete details of the toilet room, including maintainability analysis and winterization details, shall be presented for Amtrak approval during design review, and they shall be included in the interior mock-ups.

b). Floor Pan

i). The floor pan of the toilet room modules shall be FRP with 1.5 in. minimum radii corners to eliminate the accumulation of debris and aid in cleaning.

(1) A stainless-steel overflow pan shall be provided under the toilet and water connections.

(2) A waterproof rubber flooring covering which reduces noise and resists accumulation of odors shall be provided.

(3) The purpose is to prevent fluids from wicking beneath the toilet room flooring, both for hygiene and to prevent degradation of the subflooring materials.

(4) This pan shall be watertight and have raised edges of at least 4 in. in height. The pan’s exposed edges shall be folded for safety and to provide stiffness.

(5) The floor pan shall be installed over the subfloor of the car, and the perimeter of the pan shall be fully sealed to prevent moisture from seeping under the pan.

(6) Attachment points to secure the floor pan to the subfloor shall be in the sides, rather than the bottom surface, and be watertight. The floor pan joint at the door opening shall be waterproof to the subfloor.

(7) Floor penetrations shall be avoided, when possible, but where required, sealed to make the joint waterproof and with an appropriate material to prevent flame propagation from underfloor flame sources.

c). Floor Covering

i). A seam-free, skid-resistant rubber floor covering, solid surface material, or approved coating shall be used in the toilet room floor area.

ii). Color and pattern selection shall be approved by Amtrak.

(1) The floor covering shall be coved a minimum 4 in. up the sidewalls to form the inside scuff/kick plate.

(2) The edges shall be sealed to form a watertight seal.

d). Drainage

i). A provision shall be provided for a floor drain in the toilet room pan that shall be reviewed with Amtrak during Design Review.

(1) The floor shall be properly may be sloped toward the drain, preferably located near the toilet and an intumescent device shall be utilized to seal the drain in case of a fire, or alternate approved design.

e). Attachment Strength of Fittings

(1) The fittings in toilet rooms shall meet the attachment strength requirements defined in 49 CFR Part 238.233.

f). CMF

i). Wall Panels

(1) Sidewall Panels along the carshell wall shall be made from molded thermoplastic or thermoset material with an easy to clean surface finish.

(2) Partition Walls shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(3) The finish of the wall and material of the outside skin shall be inspired by the CMF document (Exhibit F) and meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

ii). Ceiling

(1) Ceiling shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(2) The finish of the passenger facing side of the ceiling panel and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(3) The finish of the material on the non-passenger facing side shall be coated such that there is no risk of corrosion from moisture from steam or humidity within the car.

iii). Flooring

(1) Flooring within the restroom area shall be made from rubber flooring with a friction, no-slip texture.

(2) Flooring will be durable to withstand spills, leaks, and all methods of cleaning. Flooring shall also not become frequently damaged or worn.

(3) Flooring shall have enough give to prevent fatigue from standing.

31.35 Standard Toilet Room (STR)

a). General

i). The STR shall have the ability to be used in two orientations.

ii). A modular design that allows different door positions should provide flexibility for the layout of the interior architecture.

iii). The orientation should always prioritize seats and passenger accommodation numbers where possible, while providing options for better aisle access in other instances.

iv). To the extent possible equipment, parts, and features in the STR shall be identical to equipment, parts, and features in the restrooms for sleeper cabins.

v). The intent of this clause is to minimize spares and maintenance techniques.

b). Key Features

i). A comprehensive list of expected features in the Standard Toilet room is provided in Figure 31-8, and described in detail below.

ii). Detailed functional requirements for each feature are listed below. In addition to these requirements, the Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design.

Figure 31-8: Key Features – Standard Toilet Room

Feature	Short Description	Qty
Restroom Door	Sliding door for entrance into STR	1
Toilet	Assembly including toilet bowl, shroud, and overflow pan	1
Toilet Seat	Assembly including lid and seat for toilet	1
Toilet Flush	Push button flush and automatic flush mechanisms	1
Toilet Paper Dispenser	Protective location for dispensing toilet paper	1
Toilet Seat Cover Dispenser	Protective location for dispensing seat covers	1
Sanitary Waste	Storage location for used feminine hygiene products	1
Sharps Bin	Storage location for used needles and other medical waste	1
Sink	Solid surface sink counter and basin	1
Hand Dryer	Automatic hand dryer and paper towel dispenser	1
Vanity Mirror	Mirror for passengers to look while washing hands	1
Trash	Storage for restroom related trash	1
Grab Handles	49 CFR 38.115 compliant handrails	1
Baby Changing Table	Fold out table for infant diaper care	1
Crew Storage	Locker with square key for dedicated crew storage	1
Coat Hooks	Coat hooks that hold up to 50lbs	2
PEI- Intercom only	Speaker for emergency conversations	1
Emergency Call Button	Buttons in accessible locations that activate PEI	2
Exhaust	Adjustable exhaust grille	1

iii). Restroom Door

(1) The door should open and provide adequate space for a 95th percentile male. Airline style bi-fold and swing doors are an unacceptable solution.

(2) The door should be sealed to prevent leaking water escaping into the internal space of the car.

(3) The door should lock from the inside, with an indicator on the outside showing the door lock status.

(4) The clear width door opening shall be a minimum of 24”.

(5) The door shall be of lightweight construction, consistent with durability and be secured with stainless-steel hinges.

(6) The door shall be free from resonance and rattles when in the closed position when the train is in motion at any permissible speed.

(7) The door frame and attachment of the keeper shall be sufficiently rigid so that it does not flex when the door closes, even if it is slammed; the intention is that this interface does not deteriorate over the life of the car.

(8) Likewise, interior door construction shall incorporate interior stiffening in the area where the lock/ latch is attached to the door, so that the fasteners securing it to the leaf have a solid surface on which to clamp.

(9) The door latch, with a handle on both sides of the door, shall engage automatically when the door moves towards a closed position, but the lock requires definite action to engage.

(10) The door shall remain in the fully closed position at any permissible train speed.

(11) The lock shall be operable, in an emergency, from the outside with a standard Amtrak coach key.

(12) An instruction, in accordance with Amtrak Specification # 697, located on the interior side of the door, shall provide lock operating instructions.

iv). Toilet

(1) An elongated toilet, complete with toilet bowel assembly, shroud, and overflow pan shall be provided in the restroom.

(2) Toilet bowl Assembly

(a) A toilet stand with shroud assembly shall be located in the toilet room. Each restroom shall be equipped with a toilet bowl assembly, encased in the toilet shroud.

(3) Toilet Shroud

(a) The shape of the toilet shroud housing shall locate the toilet seat ergonomically for ease of use and comfort.

(b) Sufficient foot room shall be provided.

(c) When seated, the user's legs shall not contact the shroud.

(d) The toilet shroud shall be constructed of FRP with gel coat color to match the restroom shell or of stainless steel, with brushed finish or approved alternate.

(4) Toilet Overflow Pan

(a) The toilet bowl assembly shall be mounted on a stainless-steel overflow pan, which shall contain flooding should the toilet outlet become blocked or system leak.

(b) The overflow pan shall be watertight with raised edges of ~2 inches height, have the attachment points exterior to the pan, have all exposed edges folded for safety and to provide stiffness, and be equipped with an overflow tube.

v). Toilet Seat

(1) A standard toilet seat and toilet lid shall be provided.

(2) Toilet seat and seat lid should have soft close mechanisms.

(3) A white toilet seat with lid, meeting Amtrak Specification #352, shall be provided.

(4) The toilet seat and cover shall be constructed of reinforced fiberglass or approved alternate.

(5) The lid and seat shall be stable in the up position regardless of train motion, including braking, to prevent it from slamming down suddenly against the shroud.

vi). Toilet Flush Mechanism

(1) A two-button push flush shall be located on the back wall of the restroom above the toilet.

(2) This shall provide standard and eco-flush features for the passenger.

(3) The flush mechanism shall also incorporate an automatic flushing feature when the passenger is done using the toilet.

vii). Toilet Paper Dispenser

(1) A toilet paper dispenser shall be provided adjacent to the toilet.

(2) This dispenser shall protect the toilet paper from getting wet.

viii). Toilet Seat Cover Dispenser

(1) A dispenser for paper toilet seat covers should be located by the toilet.

ix). Sanitary Waste Disposal

(1) A sanitary waste bin shall be provided to the right of the toilet complete with modesty flap. The minimum volume for this bin shall be 7 gallons.

x). Sharps Bin

(1) Provision for a sharps bin should be provided within the room.

(2) The size, position, and method of removal of sharps should be agreed and instructed by Amtrak.

xi). Sink

(1) General

(a) A solid surface sink with hot and cold water faucet shall be provided for passengers.

(b) The sink countertop shall be made from solid surface material and shall include a marine edge, 6” backsplash, and ¾” radius for cleanability.

(c) Note that all sink countertops shall be sloped toward the basin and drain.

(2) Sink Basin

(a) The sink basin shall have minimum internal dimensions of 18" width x 10" length x 5" depth.

(b) The sink shall have a 1/2 to 1 gallon capacity and be equipped with an overflow.

(c) The sink shall be drained through a nominal 1-1/4” diameter drain.

(3) Faucet

(a) The faucet shall be mounted behind the sink.

(b) The faucet shall use IR sensor to control water dispensing.

(c) Water flow from the faucet shall be aligned directly over the drain to not splash the user and/or countertop.

(d) Faucet shall be hardwired for power with a battery backup.

(4) Soap Dispenser

(a) An automatic liquid soap dispenser which will accept a Celeste Industries liquid soap refill shall be installed and shall be located adjacent to the mirror.

(b) Power for the soap dispenser shall be hardwired with a battery backup.

(5) 120V Outlet

(a) A duplex 120VAC GFCI receptacle shall be located on a panel adjacent to the sink, preferably located to keep it dry from splashes from the sink.

xii). Hand Dryer

(1) A high velocity motion-activated hand dryer and a paper towel holder shall be mounted on the wall of near the sink in an easily accessible location.

xiii). Vanity Mirror

(1) A large 41.5” x 23” mirror shall be positioned in front of the sink. The mirror can be split into two sections as necessary.

xiv). Trash

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(1) A trash bin shall be provided under the sink with push flap cover.

(2) The minimum volume of trash for this receptacle shall be 2 cu ft.

(3) The trash flap for this receptacle shall be a minimum of 10” x10”.

xv). Grab Handles

(1) Stainless-steel grab bars shall be provided on one side of the restroom to allow passengers to steady themselves against train motion.

(2) Bars shall be directly secured to car secondary structure or module structure.

(3) These bars shall be anti-slip grab bars in accordance with Subpart F of 49 CFR Part 38.123 (a) (3) shall be provided for passengers to utilize while using the facility.

xvi). Baby Changing Table

(1) A baby-changing table should be provided.

(2) The changing table should be easy to deploy and stow with an intuitive handle. The table shall include a strap to ensure passengers with limited reach can operate the table.

(3) The mechanism should be durable, free from jamming and racking.

(4) The design should meet abuse loads.

(5) It should have a soft opening mechanism.

xvii). Crew Storage

(1) A crew storage cabinet shall be provided at high elevations in the restroom for storage of restroom and cleaning supplies.

xviii). Coat Hooks

(1) Two coat hooks shall be provided on the partition wall. Coat hooks shall be capable of supporting up to 50lbs each.

(2) These hooks are identical to the towel hooks provided in the sleeper cabin.

xix). Emergency Call Button

(1) Two waterproof Emergency Call Buttons shall interface with the Passenger Emergency Intercom (PEI) in the toilet room.

(2) The Emergency Call Buttons are providing better access for passengers if they are not able to reach the PEI unit.

(a) The Emergency Call buttons shall have illuminated and audible indications when actuated.

(b) One Emergency Call button shall be located within easy reach while seated on the toilet and not easily confused with the flush button or other controls.

(c) A second button located within 12 inches from the floor or otherwise reachable for someone who has fallen.

(d) Placement of the buttons is subject to approval during design review.

(3) The PEI in the toilet room shall interface with the Emergency Call Buttons.

(a) The PEI and Emergency Call button arrangement, including the interfaces used between them, must maintain the same safety level and a standalone PEI.

(b) The PEI and Emergency Call Buttons must remain functional under any toilet module degraded mode condition.

(c) See Chapter 14 for additional details.

xx). Exhaust

(1) An exhaust grille shall be provided in the ceiling.

(2) Negative pressure in the restroom shall be provided by the HVAC system.

c). Additional Equipment Requirements

i). HVAC

(1) Supply Air Diffusers

(a) Conditioned air is delivered to the room via 2 supply air diffusers with adjustable air flow control and located on the windowsill of the outside window.

(b) Air vents should take less than 3 lbf to operate and adjust.

(2) Exhaust Grille

(a) Exhaust air is removed from the room via the exhaust air grille which is located at the upper portion of the module.

ii). Outlet

(1) Outlet to be provided within crew storage cabinet for maintenance and cleaning access.

iii). Lighting

(1) General

(a) Lighting general information is shared in the points below.

(b) Detailed lighting information can be found in Chapter 13.

(c) All lighting part numbers, manufacturers, and temperatures shall be proposed by the Contractor and approved at Amtrak after the lighting simulation during the design review process.

(d) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups.

(i) Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

(2) Lighting Types and Locations

(a) Main Ceiling Light (White Light)

(i) A large rectangular LED panel in the ceiling provides the main source of light for the room.

(b) Compartment Light

(i) Floor Lights

1. Lights shall be provided as indirect lighting that spills out across the floor under the sink counter.

(ii) Sink Lights

1. A wash light should be used to light the sink area indirectly.

2. This light shall only be activated when the door to the restroom is locked.

(iii) Mirror Light

1. A LED light shall illuminate the mirror around the border.

2. This light shall only be activated when the door to the restroom is locked.

iv). Communications

(1) Speaker

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(a) PA speaker shall be located on the central ceiling panel.

(b) The speaker used in this location shall be identical to PA speakers used in other locations in the cars for ease of maintenance and replacement.

(2) All communications equipment shall meet the requirements in Chapter 14.

v). Emergency Equipment

(1) Smoke Detector

(a) Smoke Detectors shall be mounted on the central ceiling panel.

(b) The smoke detector used in this location shall be identical to the smoke detectors used in other locations in the cars for ease of maintenance and replacement.

vi). Security

(1) Many items within the restroom area will need to be secured.

(2) The following items are identified with specific locking preferences:

(a) Restroom Door Locking Mechanism

(3) Any other locking or security items will be discussed with Amtrak during design reviews.

d). CMF

i). Please refer to the attached CMF document (Exhibit F) for exact color, material, and finishes desired in this restroom area. Please also refer to Chapter 19.

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Part VIII: Sleeper Cabins

31.36 Accessible Sleeper and Standard Sleeper Cabin General Requirements

a). All sleeper cabins shall be designed and constructed to form a safe and attractive environment.

b). Visible fasteners shall be minimized.

c). Modularity shall be optimized during the design process and the outer walls of the modules shall be developed as a common component where possible.

d). All mounted items in the room shall be secured to the module structure through the use of fully embedded tapping plates when pullout strength or expected weight is greater than 20 lbs.

i). These are expected to last the life of the car without coming loose.

e). Space shall be incorporated, and mounting brackets be provided within the room walls to mount components required to provide functions of the adjustable features in the room, functions of the sink and functions of the toilet, but are preferably not visible.

f). Consistent features shall be maintained across sleeper cabins to the extent possible.

g). The Contractor shall provide a matrix table of interior features for each sleeper cabin and identify which items are repeatable for maintenance and maintainability management.

h). Accessibility requirements for labeling in the restrooms in sleepers from Chapter 26 shall be followed.

i). Please also reference signage from Section 31.6.

j). Noise Cancelling or Sound Proofing

i). Noise cancelling or sound proofing features shall be implemented into the construction of all wall panels for each sleeper cabin.

ii). The noise reduction can come from acoustic dampening panels, foams, or other technology.

iii). The noises from adjoining compartments, hallways, and machinery shall be dampened to at least 65 dBA.

k). Communications Equipment required in each Sleeper Cabin

i). Speaker

(1) PA speaker shall be located on the central ceiling panel.

(2) The PA speaker shall have an associated mute button.

(3) The speaker used in this location shall be identical to PA speakers used in other locations in the cars for ease of maintenance and replacement.

ii). All communications equipment shall meet the requirements in Chapter 14.

l). Emergency Equipment required in each Sleeper Cabin

i). Smoke Detector

(1) Smoke Detectors shall be mounted on the central ceiling panel.

(2) The smoke detector used in this location shall be identical to the smoke detectors used in other locations in the cars for ease of maintenance and replacement.

m). The accessible sleeper must have a 32” wide accessible path throughout. Where the aisle turns 90°, it should be 44” wide. There must be 60” turning space in vestibules and transition areas.

n). To ensure both accessibility and operational efficiency, the standard sleeper cabin should prioritize the maximization of aisle width while maintaining adequate accommodation sizes for passenger comfort. The minimum allowable aisle width is set at 24 inches, and the contractor shall confirm that this dimension does not impede the removal or maintenance of any installed components.

o). Accessible Sleeper and Standard Sleeper Minimum Accommodations

Figure 31-9: Minimum Accommodation Types for Sleeper Cabins

Car Type	Standard Sleeper Minimum Accommodations	Accessible Sleeper Minimum Accommodations
Accessible Bedroom with Restroom & Shower 60" Turning Circle		2
Club Bedroom with Restroom and Shower		4
Roomettes	7	
Attendant Roomette	1	1
Solo Suites	12	
Communal Shower	1	1
Standard Restroom	2	1
Beverage Station	1	1

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Figure 31-10: Key Features – Sleeper Cabins: General

		Roomette	SoloSuite	Club Bedroom	Accessible Bedroom	Sleeper Cabin Showers
Passengers (maximum)		2	1	4	3	n/a
Cabin Door	Standard Sleeper Cabin Door	1	1	1		
	Accessible Sleeper Cabin Door				1	
	Accessible Sleeper Cabin Door Controls				2	
Restroom Door	Standard Sleeper Cabin Restroom Door			1		
	Accessible Sleeper Cabin Restroom Door				1	
	Accessible Sleeper Cabin Restroom Door Controls				2	
Shower Room Door	Standard Sleeper Cabin Shower Room Door					1
	Accessible Sleeper Cabin Shower Room Door				1	
	Accessible Sleeper Cabin Shower Room Door Controls				2	
Fixed Glass Shower Panel						1
Side Window	Side Window	1	1	1	1	
Privacy Side Window						1
Side Window Blinds	Blackout	1	1	1	1	
SoloSuite Room Divider			1			
SoloSuite Blinds			1			
Outlets	Duplex w/USB at Seat	2	1	2	3	
	Duplex w/USB at Partition	2	2	2	3	
	120VAC GFCI at Sink	1	1	1	1	1
	Duplex w/ USB at Upper Bunk	1		1	1	
	Minimum Outlets	6	4	6	8	1
Master Light Switches (Analog)		2	1	2	2	
Master Thermostat Control (Digital)		1	1	1	1	
Floor Heat		Per Chapter 10				
Grab Bars	Standard Grab Bars	As needed				
	Restroom Grab Bars	As needed				

Figure 31-11: Key Features – Sleeper Cabins: Communications

		Roomette	SoloSuites	Club Bedroom	Accessible Bedroom	Sleeper Cabin Showers
Passengers (maximum)		2	1	4	3	n/a
Attendant Call Button	Standard	1	1	1	1	1
Emergency Call Button					2	2
PEI	PEI - Intercom Only				1	2

Figure 31-12: Key Features – Sleeper Cabins: Seating Area / Lower Sleeping Berth / Bed

		Roomette	SoloSuite	Club Bedroom	Accessible Bedroom
Passengers (maximum)		2	1	4	3
Seat	Standard Sleeper Cabin	2	1	4	2-3[1]
	Tip Up Seat				0-1[1]
	Min. Width btw Armrests:	26"	34”	48"	28"
Armrest	Standard Sleeper Cabin	2	2	2	2
	Center				1
Headboard	Standard Sleeper Cabin	2	1	2	2
Ottoman	SoloSuite		1		
	Ottoman Table		1		
Cup Holder		2	1	2	3
Bottle Holder			1	2	3
Fold Out Table	Single Leaf Table	1	1	1	3
	Double Leaf Sliding Table				
	min. Usable Surface:	18" x 18"	12.5” x22”	18" x 26"	12.5" x 22"
	Extends from Sidewall:	20"	24”	28"	24”

Figure 31-13: Key Features – Sleeper Cabins: Upper Berth

	Roomette	SoloSuite	Club Bedroom	Accessible Bedroom
Passengers (maximum)	2	1	4	3
Upper Berth	1		1	1
Upper Berth Grab Bar[2]	1		1	1
Upper Berth Steps	1		1	
Upper Berth Ladder				1

[1] The Accessible Bedroom must include three seats, Carbuilder may choose to make one of these seats a tip up seat if necessary to allow adequate space for a wheeled mobility device. Adequate space shall be allowed for a passenger to stow their wheeled mobility device while sitting in one of the three seats in the Accessible Bedroom without blocking the entrance to the hallway or restroom.

[2] Minimum qty of 1 listed here, but final quantity to be determined by Carbuilder as required to comply with 49 CFR 38.115.

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Figure 31-14: Key Features – Sleeper Cabins: Personal Care

		Roomette	Solo Suite	Club Bedroom	Accessible Bedroom	Sleeper Cabin Showers
Passengers (maximum)		2	1	4	3	n/a
Sink	Fold Out Sink	1	1			
	Solid Surface Sink			1	1	1
	Min. Width:	8”	8”	8"	15"	
	Min. Length	12”	12”	11"	11"	
	Min. Depth:	3.7”	3.7”	5"	5"	
Sink Vanity	Standard Sink Vanity Cabinet	1	1	1		
	Accessible Sink Vanity Cabinet				1	
Sink Vanity Mirror	Sink Vanity Mirror	1	1	1	1	1
	Min. Dimensions	10.5” x 30”	12” x 39”	13" x 28"	TBD	
Under Sink Cover						1
Hand Soap Dispenser		1	1	1	1	
Lotion Bottle		1	1	1	1	1
Towel Ring		1	1	1	1	
Hand Dryer		1	1	1	1	1
Shower	Shower Door			1	1	1
	Shower Curtain				1	
	Shower Seat				1	1
	Rain Shower			1	1	1
	Adjustable Shower Head			1	1	1
	Shower Control			1	1	1
	Shower Drain			1	1	1
	Shower Exhaust			1	1	1
	Soap Dish			1	1	1
	Soap Dispensing Bottles			3	3	3
Towel Hooks	On Partition Wall	2	1	1	2	
	Near Shower Door Entrance				2	
	Inside Shower					2
	Near Sink/Vanity			2		
Towel Rail					1	

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Figure 31-14: Key Features – Sleeper Cabins: Personal Care (continued)

		Roomette	SoloSuite	Club Bedroom	Accessible Bedroom	Sleeper Cabin Showers
Towel Storage	Standard			1	1	
	High Capacity Bath Towels					1
	High Capacity Hand Towels					1
High Capacity Towel Bin						1
Changing Area						1
Changing Area Bench						1
Changing Area Mirror						1
Toilet	Toilet			1	1	
	Toilet Seat			1	1	
	Toilet Flush Mechanism			1	1	
	Toilet Paper Dispenser			1	1	
	Toilet Seat Cover Dispenser			1	1	
	Shower Seat Cover			1		
Baby Changing Table					1	

Figure 31-15: Key Features – Sleeper Cabins: Trash

		Roomette	SoloSuite	Club Bedroom	Accessible Bedroom	Sleeper Cabin Showers
Passengers (maximum)		2	1	4	3	
Trash Bin	Seating Area	1	1	1	1	
	Drink Station					
	Restroom			1	1	
	Sleeper Cabin Showers					1
Sanitary Waste Bin					1	
Sharps Bin					1	

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Figure 31-16: Key Features – Sleeper Cabins: Storage

		Roomette	SoloSuite	Club Bedroom	Accessible Bedroom	Sleeper Cabin Showers
Passengers (maximum)		2	1	4	3	
Cabinet		1		1	1	
Wardrobe	Wardrobe					
	Open Wardrobe			1	1	
Coat Hooks		2	1	2	3	2
Carryon Luggage Storage		1	1	1	1	
Under-Seat Storage		1	1	1	1	
Seat Shelf					1	
Cubby	Upper Cubby	2		2	2	
	Seat Cubby				2	
	Sidewall Cubby		1	2	2	
High Storage Shelf					2	
Restroom Crew Storage					2	1

31.37 Roomette

a). General

i). The roomette provides comfortable daytime seating and night sleeping accommodations for up to two passengers.

ii). In the roomette, two seats face each other and share a window view.

iii). These seats adjust to create a sleeping area for one passenger and an upper berth can be adjusted in position to create a second sleeping space for another passenger.

b). Key Features

i). A comprehensive list of expected features in the Roomette sleeper cabin is provided in Figure 31-17 and described in detail in the subsequent sections referenced in the table.

ii). Detailed functional requirements for each feature are listed below.

c). Attendant Room (Accessible Sleeper and Standard Sleeper)

i). This is essentially a roomette, assigned permanently to the car attendant.

ii). In addition, it also incorporates an attendant call, smoke-fire detection/annunciator, and PEI panel used to identify the site of a passenger requesting service or emergency.

Figure 31-17: Key Features – Roomette

Feature	Short Description	Qty	Reference
General Items			
Standard Sleeper Cabin Door	24” sliding door that includes window, blind and door lock mechanism. Manual Operation	1	
Side Window	Lower window includes emergency egress features, upper window above deployed bunk	1	
Side Window Blinds	A single blind system that provides sunshade and blackout performance	1	
Outlets	Duplex outlets with USB	See Figure	
Master Light Switch	Light switch that can turn on or off all lights in a sleeper room (analog)	2	
Master Thermostat Control	Mechanical Interface control of temperature settings (digital)	1	
Floor Heat	Heating mechanism for room	1	
Standard Grab Bar	49 CFR38.115 compliant handrails	As Needed	
Communications			
Attendant Call Button	LED Button to page Crew	1	
Seating Area / Lower Sleeping Berth			
Sleeper Cabin Seats	Standard Sleeper Cabin Seat includes fold-down features to convert into bed	2	
Sleeper Cabin Armrest	Standard Sleeper Cabin Armrest built into sidewall	1 per seat	
Sleeper Cabin Headboard	Standard Sleeper Cabin includes a firmly cushioned panel behind the seat that serves as a headboard in the berth configuration.	2	
Cup Holder	Cupholders built into side wall	2	
Single Leaf Fold Out Table	Table built into side wall	1	
Upper Sleeping Berth			
Upper Berth	High level sleeping location with retaining straps	1	
Upper Berth Grab Bar	Grab bars/handholds in suitable positions to access upper berth.	As Required	
Upper Berth Steps	two built-in steps to allow access to the upper berth module	1	
Personal Care			
Fold Out Sink	Includes sink basin, faucet, sink open indicator light, and 120 V outlet.	1	
Vanity Cabinet	Small storage cabinet with a mirror on the front.	1	
Vanity Mirror	Mirror with LED light or backlight	1	
Hand soap Dispenser	Location for hand soap installed near vanity	1	
Lotion Bottle	Location for lotion bottle stored near vanity	1	
Towel Ring	Install near sink.	1	
Towel Hook	Two on the partition wall.	2	

Trash			
Seating Area Trash Bin	Tip out small storage for sleeper room trash	1	
Storage			
Cabinet	Storage location for personal items with a door	1	
Open Wardrobe	Open storage location with restraining strap	1	
Coat Hooks	Installed on partition wall	2	
Carryon Luggage Storage	Storage cubby for carryon sized luggage	1	
Under-Seat Storage	Open space for carryon sized luggage	1 per seat	
Storage Cubies	Small open cubbies for storing smaller items at each bed location	min 2	
Upper Room Storage	Storage for a carry-on bag in an area above the aisle or on top of the restroom, accessible from inside the room with a retention bar.	1	

d). Functional Elements

i). Seat to Lower Berth Conversion

(1) A simple unlatch mechanism is required to convert the seats into a lower bed/berth.

(2) This should be positioned in a place that is easy for people to use and designed in a way that people can understand its purpose.

(3) The latch should be free for jamming and free from any finger trap hazards.

(4) Conversion of seats to lower berth shall result in an entirely flat sleeping surface.

(5) The mattress surface should be integral to the back of the seat.

(6) A single seam between the bed surface is acceptable with a single thin topper to finish the bed surface.

(7) There shall be no movement in the lower berth structure under full loading conditions when the lower berth is deployed.

(8) Lower Berth Dimensions: Minimum width 27" x Minimum length 77”

(9) Conversion between seat and berth configuration shall require no more than 10 lbf.

ii). Deploying Upper Berth

(1) The upper berth should be stored horizontally at the maximum height in the room.

(2) When stored, the upper berth should not block any part of the window or window removal in the event of an emergency.

(3) Leading edges should be soft in form to minimize impact to any potential head strike.

(4) The berth's stored height should be maximized so head clearance is at a maximum in both seated and standing positions.

(5) A simple and easy to use handle, latch, and lock mechanism should be within easy reach from a standing position.

(6) Successful locking should be visually indicated, and safety measures should be put in place to prevent accidental deployment and prevent misuse.

(7) The upper berth deployment should lower slowly and in a controlled manner.

(8) Considerations should be made for assisted movement or counterbalances to assist people moving the upper berth down and back up into the stowed position.

(9) Mitigation should be made to avoid finger traps across any mechanism, rails, or support structures.

(10) Upper Berth Dimensions: Minimum width 27" x Minimum length 77”

(11) Deploying or storing the upper berth shall require no more than 10 lbf.

e). Lighting

i). General

(1) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups.

(a) Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

(2) Lighting controls shall be analog switches.

ii). Lighting Types and Locations

(1) Wall Wash Lights

(a) Wall wash lights for the aisle partition wall and the back walls behind the seats shall be provided along the length of each wall.

(2) LED Panel Spotlights (White Lights)

(a) Two small circular LED light panels shall act as spotlights above the steps to the upper berth.

(b) The frame for the spotlights shall be color matched to the ceiling.

(3) Compartment Lights

(a) Step Light

(i) Step shall have a strip of indirect lighting so that the entire lower step is illuminated.

(b) Under Seat Lights

(i) Under seat lights shall be provided as indirect lighting that spills out across the floor under each seat.

(4) Reading Lights (White Lights)

(a) Upper Reading Lights

(i) Upper reading lights shall be embedded into the ceiling panel above the upper berth.

(ii) These should be two mini panel lights with one light at each end of the bed. Reading light switches should be located next to the reading light.

(b) Lower Reading Lights

(i) Lower reading lights shall be provided at each seated position.

(ii) The light itself shall be adjustable so that the passenger can adjust the direction to position the light over their reading material.

(c) Reading Light Switches

(i) Reading light switches should be located next to the reading light.

31.38 SoloSuite

a). General

i). The SoloSuite is a unique, single passenger compartment that provides enhanced comforts over the roomette.

ii). The SoloSuite includes a seat that converts to a sleeping berth and a working table on the opposing side.

iii). A padded footrest lies under the opposing side that is offset to allow the nesting feature to work with the opposite SoloSuite compartment.

iv). When the seat is converted to 'bed mode', the footrest forms the foot end of the bed.

v). A mirror image SoloSuite is installed adjacent to the SoloSuite compartment.

vi). An additional feature of the SoloSuite compartments shall be the ability to combine two of the SoloSuites for face-to-face discussions but can then be closed for privacy and sleeping privately.

vii). The dividing panels shall be easily opened and stored when the two compartments are twinned but can easily be closed and locked when privacy is desired.

viii). The partition panel shall be attached in a way that prevents one passenger from being able to remove it without the opposing passenger’s permission.

b). Key Features

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i). A comprehensive list of expected features in the SoloSuite is provided in Figure 31-18 and described in detail in the subsequent sections referenced in the table.

ii). Detailed functional requirements for each feature are listed below.

Figure 31-18: Key Features – SoloSuite

Feature	Short Description	Qty	Reference
General Items			
Standard Sleeper Cabin Door	24” sliding door that includes window, blind and door lock mechanism. (Manual Operation)	1	
Side Window	lower window includes emergency egress features, upper window to match other bedrooms	1	
Side Window Blinds	A single blind system that provides sunshade and blackout performance	2	
Outlets	Duplex outlet with USB.	See Figure xxx	
Master Light Switch	Light switch that can turn on or off all lights in a sleeper room	1	
Master Thermostat Control	Mechanical Interface control of temperature settings (digital)	1	
Floor Heat	Heating mechanism for room	1	
Standard Grab Bar	49 CFR38.115 compliant handrails	As needed	
Communications			
Attendant Call Button	LED Button to page Crew	1	
Seating Area / Lower Sleeping Berth			
Sleeper Cabin Seat	Includes fold down features to convert into bed.	1	
Cabin Arm Rest	Built on both sides of the seat with one built into the side wall	2	
SoloSuite Room Divider	Retractable dividing partition that is lockable between SoloSuites	1	
SoloSuite Central Console	Footbox and central table module	1	
Standard Sleeper Cabin Headboard	Standard Sleeper Cabin includes a firmly cushioned panel behind the seat that serves as a headboard in the berth configuration	1	
SoloSuite Ottoman	Foot rest that converts into portion of bed	1	
SoloSuite Ottoman Table	Table above the ottoman for working	1	
Cup Holder	Cupholders built into side wall	1	
Bottle Holder	Small storage location in carshell side wall	1	
Single Leaf Fold Out Table	Table built into side wall	1	
Personal Care			
Fold Out Sink	Includes sink basin, faucet, soap dispenser, 120 V outlet, sink open indicator light	1	
Sink Vanity Cabinet	Small storage cabinet above the sink, with a mirror on the inside	1	
Sink Vanity Mirror	Mirror with light	1	
Hand soap Dispenser	Location for hand soap installed near vanity	1	
Lotion Bottle	Location for lotion bottle stored near vanity	1	

Towel Ring	Install near sink.	1	
Towel Hook	Installed on partition wall	1	
Trash			
Seating Area Trash Bin	Flip out storage for sleeper room trash	1	
Storage			
Open Wardrobe	Open storage location with restraining strap	1	
Coat Hooks	Installed on partition wall	2	
Carryon Luggage Storage	Storage cubby for carryon sized luggage under Ottoman	1	
Storage Cubies	Small open cubbies for storing smaller items at each bed location	1	
Baggage rack above seat	Storage rack for a carry-on bag to be provided above each seat	1	

c). Functional Elements

i). Seat to Berth Conversion

(1) A simple unlatch mechanism is required to convert the seat into a bed/berth.

(2) This should be positioned in a place that is easy for people to use and designed in a way that people can understand its purpose.

(3) The latch should be free for jamming and free from any finger trap hazards.

(4) Conversion of seat to berth shall result in an entirely flat sleeping surface.

(5) The mattress surface should be integral to the back of the seat.

(6) A single seam between the bed surface is acceptable with a single thin topper will finish the bed surface.

(7) There shall be no movement in the berth structure under full loading conditions when the berth is deployed.

(8) A folding ottoman pad should complete the seat surface between bed and ottoman.

(9) The pad should be independently operated.

(10) Care should be taken in the design and activation to avoid accidental entrapment or mitigate injury through misuse.

(11) The folding ottoman pad and ottoman table leaf should create a space large enough for a passenger to stand and deploy and stow the bed while in the room with the door closed.

(12) Lower Berth Dimensions:

(a) There should be a minimum of 82'' between the two opposite corners account for the tapering bed shape.

(b) There should be a minimum of 22'' between the inside surface of the footbox and any sidewall structure.

(c) There should be a minimum of 77'' bed length.

(d) There should be a minimum of 34'' bed width.

(e) Dimensions and usability will be subject to Amtrak approval at the mockup review.

(13) Conversion between seat and berth configuration shall require 10 (ten) pounds force or less.

ii). Opening Room Divider

(1) As the divider is deployed it must be done with a smooth and gliding motion, with little or no noise.

(2) The deployment of the divider shall be easy to use and be able to be operated safely by passengers independently. Divider operation shall take less than 10 lbf to open/close and the latch/lock shall take less than 5 lbf to operate.

(3) There should be no finger traps or hazards.

(4) When the divider is in its closed position it must provide good sound insulation to the adjoining room and noise levels from the adjoining rooms shall be less than or equal to 65 dBA.

(5) When closed, the divider must be free from rattle and movement and be securely locked in place along all edges.

(6) There should be no light spill from the adjoining room.

(7) The divider shall be installed so that damage from pushing the divider off track and into an opposing SoloSuite is prevented.

d). SoloSuite Room Divider

i). General

(1) The divider must store away neatly into a pocket, wall, or ceiling and not protrude into the room.

(2) When stored the divider must be free from rattle and movement and be securely retained in its stowed position.

(3) The divider must be designed to prevent noise attenuation from one solo suite room to another as if the divider was a solid wall when closed.

(4) The stored divider must not prevent the use of any other of the rooms' features or obscure the window.

ii). Room Divider Dimensions

(1) The room opening created when moving the divider should allow seated passengers to see each other from a seated position.

(2) The opening should be as large as possible so joining rooms feel like a single space.

(3) The opening should be maximized and be a minimum of 35" x 35".

iii). Room Divider Locking Mechanism

(1) The divider must be securely locked in place with a visual indicator on both sides of the room to show that it is locked.

(2) A solution must be found to prevent one passenger opening the divider without the others' permission, such as a double latch.

e). SoloSuite Central Console

i). A central console partition shall be provided to provide a location for footboxes for the facing SoloSuite pairs.

f). Ottoman – SoloSuite

i). A fixed ottoman should be provided inside the SoloSuite foot-box.

ii). A foldable portion of the ottoman should fold up to complete the bed surface and down to provide some standing space when the main part of the bed is deployed.

iii). Cushions for the ottoman shall be supplied and match the comfort and quality of the seat cushions.

iv). The area below the ottoman cushion shall also function as an area for trash storage. Please refer to the flip out trash bin for more information.

g). Ottoman Table

i). The ottoman table should be large enough for face-to-face dining when the seat is tracked forward.

ii). This workstation table shall be 8.5" x 37.5" and include a fold out component to extend the table by 7.5" wide for a total extended measurement of 16" x 37.5".

iii). The folding leaf shall create extra knee and turnover space for sleeping passengers.

iv). The leaf must not interfere with divider mechanism when folded back.

v). The leaf should be easy to deploy and stow with an intuitive handle.

vi). This table shall conform to APTA PR-CS-S-018-13.

h). Lighting

i). General

(1) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups.

(a) Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

ii). Lighting Types and Locations

(1) Lighting controls shall be analog switches.

(2) Wash Lights

(a) Wall Wash Lights

(i) Wall wash lights for the partition wall behind the seat shall be provided along the length of each wall.

(b) Ceiling Wash Lights

(i) Central wash lights shall light the ceiling area, illuminating a central ceiling well.

(3) LED Panel Spotlights (White Lights)

(a) Two small circular LED light panels shall act as spotlights above the entry door.

(b) The frame for the spotlights shall be color matched to the ceiling.

(4) Compartment Light

(a) Footbox Lights

(i) The ottoman footbox shall be lit with indirect lighting and shall allow the entire footbox to act as indirect lighting for the room.

(b) Under Ottoman Light

(i) Under Ottoman lights shall be provided as indirect lighting that spills out across the floor under the ottoman area.

(5) Reading Lights (White Lights)

(a) Lower Reading Lights

(i) Lower reading lights shall be provided at each seated position.

(ii) The light itself shall be adjustable so that the passenger can adjust the direction to position the light over their reading material.

(b) Reading Light Switches

(i) Reading light switches should be located next to the reading light.

i). Security

i). Many items within the sleeper cabin area will need to be secured. Unique items for this sleeper cabin type are defined below.

(1) Divider Locking Mechanism

(a) The divider shall be able to be locked by the passenger occupying one of the SoloSuite compartments.

(b) The divider locking mechanism shall be tamper proof from the adjoining SoloSuite side and shall provide the passenger with confidence that their privacy and personal space will be maintained when they have locked their side of the divider.

(c) The divider lock shall have a clear indication of the locked or unlock status of the mechanism.

31.39 Club Bedroom

a). General

i). The Club Bedroom provides comfortable daytime seating and night sleeping accommodations for up to four passengers.

ii). In the Club Bedroom, two double seats face each other and share a window view.

iii). These seats adjust to create a sleeping area for two passengers to share a sleeping space, and an upper berth can be adjusted in position to create a second sleeping space for two additional passengers.

iv). In addition to the seating and sleeping provisions, this accommodation includes a small restroom with a toilet and shower and a separate sink and vanity area.

b). Key Features

i). A comprehensive list of expected features in this type of sleeper cabin is provided in Figure 31-19 and described in detail in the subsequent sections referenced in the table.

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ii). Detailed functional requirements for each feature are listed below.

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Figure 31-19: Key Features – Club Bedroom

Feature	Short Description	Qty	Reference
General Items			
Standard Sleeper Cabin Door	24” sliding door that includes window, blind and door lock mechanism. Manual operation.	1	
Standard Sleeper Cabin Restroom Door	door between bedroom and restroom	1	
Side Window	lower window includes emergency egress features, upper window above deployed bunk	1	
Side Window Blinds	A single blind system that provides sunshade and blackout performance	1	
Outlets	Duplex outlets with USB.	See Figure 31-10	
Master Light Switch	Light switch that can turn on or off all lights in a sleeper room (analog)	2	
Master Thermostat Control	Mechanical Interface control of temperature settings (digital)	1	
Floor Heat	Heating mechanism for room	1	
Standard Grab Bars	49 CFR 38.115 compliant handrails	As needed	
Restroom Grab bars	49 CFR 38.123 compliant handrails	As needed	
Communications			
Attendant Call Button	LED Button to page Crew	1	
Seating Area / Lower Sleeping Berth			
Sleeper Cabin Seat	Seat bench suitable for 2 passengers to sit side by side, includes fold down features to convert into bed	2	
Standard Sleeper Cabin Arm Rest	Built into sidewall	1 per side	
Standard Sleeper Cabin Headboard	Includes a firmly cushioned panel behind the seat that serves as a headboard in the berth configuration	2	
Cup Holder	Cupholders built into side wall	2	
Single Leaf Fold Out Table	Table built into side wall	1	
Upper Sleeping Berth			
Upper Berth	High level sleeping location with retaining straps	1	
Upper Berth Grab Bar	Grab bars/handholds in suitable positions to access upper berth. 49 CFR 38.115 compliant handrails	as needed	
Upper Berth Steps	Three built-in steps to allow access to the upper berth module	1	
Personal Care - Vanity Unit			
Solid Surface Sink	Includes sink basin, faucet, soap dispenser, 120 V outlet, towel ring, and lotion bottle	1	
Sink Vanity Cabinet	Small storage cabinet above the sink, with a mirror on the front.	1	
Sink Vanity Mirror	Mirror with boarder LED light or backlight	1	
Handsoap Dispenser	Location for handsoap installed adjacent to the over-sink mirror.	1	
Towel Ring	Install near sink.	1	
Hand Dryer	Automatic hand dryer installed in vanity Cabinet	1	
Towel Hook	Install near vanity	2	

Personal Care - On-suite Restroom			
Rain Shower	Shower head mounted on the ceiling	1	
Adjustable Shower Head	Handheld shower head	1	
Shower Control	Adjustment for water pressure and temperature in the shower	1	
Shower Drain	Drain location for shower	1	
Shower Exhaust	Adjustable exhaust grille	1	
Soap Dish	Storage location for personal soap items in shower	1	
Soap Dispensing Bottles	Refillable soap, conditioner, and lotion bottles mounted on wall	3	
Towel Hook	Installed on partition wall inside restroom	1	
Standard Towel Storage	Elevated towel rack above toilet	1	
Toilet	Assembly including toilet bowl, shroud, and overflow pan	1	
Toilet Seat	Assembly including lid and seat for toilet	1	
Toilet Flush Mechanism	Push button flush and automatic flush mechanisms	1	
Toilet Paper Dispenser	Protective location for dispensing toilet paper	1	
Shower Seat Cover	Additional cover for toilet that converts toilet area into shower seat	1	
Trash			
Trash	Trash bin for restroom and bedroom	1	
Storage			
Open Wardrobe	Open storage location with restraining strap	1	
Coat Hooks	Installed on partition wall and open wardrobe	2	
Under-Seat Storage	Open space for carryon sized luggage	1 per seat	
Storage Cubies	Small open cubbies for storing smaller items at each bed location	4	
Upper Room Storage	Storage for a carry-on bag in an area above the aisle or on top of the restroom, accessible from inside the room with a retention bar.	1	

c). Functional Elements

i). Seat to Lower Berth Conversion

(1) A simple unlatch mechanism is required to convert the seats into a lower bed/berth.

(2) This should be positioned in a place that is easy for people to use and designed in a way that people can understand its purpose.

(3) The latch should be free for jamming and free from any finger trap hazards.

(4) Conversion of seats to lower berth shall result in an entirely flat sleeping surface.

(5) The mattress surface should be integral to the back of the seat.

(6) A single seam between the bed surface is acceptable with a single thin topper will finish the bed surface.

(7) There shall be no movement in the lower berth structure under full loading conditions when the lower berth is deployed.

(8) Lower Berth Dimensions: Minimum width 48" x Minimum length 77”

(9) Conversion between seat and berth configuration shall require 10 (ten) pounds force or less.

ii). Deploying Upper Berth

(1) The upper berth should be stored horizontally at the maximum height in the room.

(2) When stowed, the upper berth should not block any part of the window or window removal in the event of an emergency.

(3) Leading edges should be soft in form to minimize impact to any potential head strike.

(4) The berth's stored height should be maximized so head clearance is at a maximum in both seated and standing positions.

(5) A simple and easy to use handle, latch, and lock mechanism should be within easy reach from a standing position.

(6) Successful locking should be visually indicated, and safety measures should be put in place to prevent accidental deployment and prevent misuse.

(7) The upper berth deployment should be free from jamming and racking and should lower slowly and in a controlled manner.

(8) Considerations should be made for assisted movement or counterbalances to assist people moving the upper berth down and back up into the stored position.

(9) Mitigation should be made to avoid finger traps across any mechanism, rails, or support structures.

(10) Upper Berth Dimensions: Minimum width 48" x Minimum length 77”

(11) Deployment or stowage of the berth shall require 10 (ten) pounds of force or less.

d). Lighting

i). General

(1) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups.

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(a) Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

(2) Lighting controls shall be analog switches.

ii). Lighting Types and Locations

(1) Wash Lights

(a) Wall Wash lights

(i) Wall wash lights for the aisle partition wall and the back walls behind the seats shall be provided along the length of each wall.

(2) LED Panel Spotlights (White Lights)

(a) Two small circular LED light panels shall act as spotlights above the steps to the upper berth and above the open wardrobe.

(b) The frame for the spotlights shall be color matched to the ceiling.

(3) Compartment Light

(a) Step Lights

(i) Step shall have a strip of indirect lighting so that the entire lower step is illuminated.

(b) Under Seat Light

(i) Under seat lights shall be provided as indirect lighting that spills out across the floor under each seat.

(c) Sink Light

(i) A wash light should be used to light the sink area across the width of the vanity unit.

(d) Mirror Light

(i) A LED light shall illuminate the mirror around the border.

(4) Reading Lights (White Lights)

(a) Upper Reading Lights

(i) Upper reading lights shall be embedded into the ceiling panel above the upper berth.

(ii) These should be four mini panel lights with two lights at each end of the bed.

(iii) Reading light switches should be located next to the reading light.

(b) Lower Reading Lights

(i) Lower reading lights shall be provided at each seated position.

(ii) The light itself shall be adjustable so that the passenger can adjust the direction to position the light over their reading material.

(iii) Reading light switches should be located next to the reading light.

(5) Restroom Lighting

(a) Back Wall Wash Light

(i) A back wall wash light shall be mounted to the towel shelf and provide both up and down wall wash lighting.

(b) Spotlight

(i) A LED spotlight shall be located on the ceiling above the toilet and adjacent to the rain shower.

(ii) This shall only activate when the door to the restroom is locked. This shall be a white light.

e). Security

i). Unique items for this sleeper cabin type are defined below.

(1) Restroom Door Locking Mechanism

(a) This locking mechanism shall indicate to other passengers sharing the room that the restroom is occupied.

(b) Additionally, the locking of this door shall activate certain lighting fixtures as explained above.

31.40 Accessible Bedroom

a). General

i). The Accessible Bedroom is a fully accessible room for one passenger who uses a wheeled mobility device and two additional passengers.

ii). The room has three separate sleeping spaces divided into a double lower berth and one upper berth.

iii). To the extent possible without jeopardizing capacity, the accessible space is based on the RVACC recommendations to accommodate larger mobility devices.

iv). The ability to turn around in the room is facilitated by a clear 60” diameter turning circle in day conditions and a 60” diameter turning circle or other ADA compliant maneuver during nighttime conditions.

v). The room has an ensuite restroom that is also fully accessible with a lockable door separating it from the living space and a separate 60” diameter turning circle

vi). Access shall be provided in and out of the room and to the bathroom and shower when the beds are fully deployed.

vii). The Accessible Bedroom should be designed for a 32” side aisle.

viii). All features shall be reached by a person sitting in a wheeled mobility device unless otherwise listed in this section.

ix). Dimensions shall be taken from the Americans with Disabilities Act Accessibility Standards and DOT regulations.

x). The Contractor shall propose a layout that accommodates the listed items below and captures the same level of amenities and finish as the Club Bedroom.

xi). The Contractor shall share conceptual drawings prior to PDR and a detailed layout at the PDR stage for Amtrak approval.

b). Key Features

i). A comprehensive list of expected features in the Accessible Bedroom is provided in Figure 31-20 and described in detail in the subsequent sections referenced in the table.

ii). Detailed functional requirements for each feature are listed below.

Figure 31-20: Key Features – Accessible Bedroom

Feature	Short Description	Qty	Reference
General Items			
Accessible Sleeper Cabin Door	39” sliding door that includes window, blind and door lock mechanism. Automatically operated.	1	
Accessible Sleeper Cabin Door Controls	ADA accessible controls for operating sleeper cabin door	1	
Accessible Sleeper Cabin Restroom Door	36” Sliding two panel automatic door for accessible sleeper restroom	1	
Accessible Sleeper Cabin Restroom Door Controls	ADA accessible controls for operating sleeper cabin restroom door	1	

Side Windows	lower window includes emergency egress features, upper window above deployed bunk	1	
Side Window Blinds	A single blind system that provides sunshade and blackout performance	1	
Outlets	Duplex outlets with USB.	See Figure 31-10	
Master Light Switch	Light switch that can turn on or off all lights in a sleeper room (analog)	2	
Master Thermostat Control	Mechanical Interface control of temperature settings (digital)	1	
Floor Heat	Heating mechanism for room	1	
Standard Grab Bars	49 CFR 38.115 compliant handrails	As needed	
Restroom Grab Bars	49 CFR 38.123 compliant handrails	As needed	
Communications			
Attendant Call Button	LED Button to page Crew	1	
Emergency Call Button	Buttons in accessible locations that activate PEI	2	
PEI - Intercom only	Speaker for emergency conversations	1	
Seating Area / Lower Sleeping Berth			
Sleeper Cabin Seat	Two seat bench Includes fold down features to convert into bed	1	
Tip Up Seat	Wall mounted seat that can fold away when not in use as an RVACC accessible space	1	
Sleeper Cabin Armrest	Built into sidewall - one by sleeper cabin seat and one by tip up seat	2	
Center Armrest	Center armrest between the two seats	1	
Standard Sleeper Cabin Headboard	A firmly cushioned panel behind seat that serves as headboard in berth configuration.	2	
Cup Holder	Cupholders built into side wall and center armrest	2	
Single Leaf Fold Out Table	Table built into side wall.	1	
RVACC accessible space	RVACC accessible space is provided in tip up seat location	1	
Upper Sleeping Berth			
Upper Berth	Includes retaining straps,	1	
Upper Berth Grab Bar	49 CFR 38.115 compliant handrails	As needed	
Upper Berth Ladder	Rigid ladder structure for accessing upper berth in accessible sleeper room	1	
Personal Care - OnSuite Restroom			
Accessible Solid Surface Sink	Solid surface sink counter and basin	1	
Accessible Sink Vanity Cabinet	Storage cabinet in sink area	1	
Sink Vanity Mirror	Mirror with LED light or backlight	1	
Hand soap Dispenser	Base for hand soap installed adjacent to the over-sink mirror.	1	
Towel Ring	Install near sink.	1	
Hand Dryer	Automatic hand dryer and paper towel dispenser	1	
Shower Curtain	Opaque shower curtain that is adjustable	1	

Shower Seat	fold down shower seat platform with access to shower controls and handset	1	
Rain Shower	Shower head mounted on the ceiling	1	
Adjustable Shower Head	Handheld shower head	1	
Accessible Shower Control	Adjustment for water pressure and temperature in the shower within accessible reach range	1	
Shower Drainage	Drain location for shower	1	
Shower Exhaust	Adjustable exhaust grille	1	
Soap Dish	Storage location for personal soap items in shower	1	
Soap Dispensing Bottles	Refillable soap, conditioner, and lotion bottles mounted on wall	3	
Towel Hooks	Installed inside restroom	3	
Standard Towel Storage	Elevated towel rack and storage for towels in vanity unit	1	
Toilet	Assembly including toilet bowl, shroud, and overflow pan	1	
Toilet Seat	Assembly including lid and seat for toilet	1	
Toilet Flush Mechanism	Push button flush and automatic flush mechanisms	1	
Toilet Paper Dispenser	Protective location for dispensing toilet paper	1	
Toilet Seat Cover Dispenser	Protective location for dispensing seat covers	1	
Baby Changing Table	Fold out table for infant diaper care	1	
Trash			
Seating Area Trash	Flip out storage for sleeper room trash	1	
Restroom Trash	Storage for restroom related trash	1	
Sanitary Waste	Storage location for used feminine hygiene products	1	
Sharps Bin	Storage location for used needles and other medical waste	1	
Storage			
Open Wardrobe	Open storage location with restraining strap as accessible height	1	
Coat Hooks	Installed on partition wall, a maximum of 48” from the floor.	3	
Carryon Luggage Storage	Storage cubby for carryon sized luggage at low and accessible position	1	
Under Seat Storage	Open space for carryon sized luggage	1 per seat	
Upper Room Storage	Storage for a carry on bag in an area above seats, accessible from inside the room with a retention bar.	1	
Storage Cubies	Small open cubbies for storing smaller items at each bed location	2	

c). Functional Elements

i). Seat to Lower Berth Conversion

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(1) A simple unlatch mechanism is required to convert the seats into a lower bed/berth.

(2) This should be positioned in a place that is easy for people to use and designed in a way that people can understand its purpose.

(3) The latch should be free for jamming and free from any finger trap hazards.

(4) The position of the latch shall be ADA reach compliant.

(5) Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist.

(6) There should be an assisted mechanism making it easy for ADA passengers of any ability to deploy and store the bed self-sufficiently and safely.

(7) Conversion of seats to lower berth shall result in an entirely flat sleeping surface.

(8) The mattress surface should be integral to the back of the seat.

(9) A single seam between the bed surface is acceptable with a single thin topper will finish the bed surface.

(10) There shall be no movement in the lower berth structure under full loading conditions when the lower berth is deployed.

(11) A supplemental cushion shall be permanently mounted at seat level on the partition wall side of the seat below the seat shelf and shall function to expand the length of the bed.

(12) Design of the bed should allow people to sleep in both directions.

(13) Any furnishings set above the bed surface must not present a hazard or head strike when using the bed.

(14) Lower Berth Dimensions: Minimum width 48" x Minimum length 75”

(15) Conversion between seat and berth configuration shall require no more than 10 lbf.

ii). Deploying Upper Berth

(1) The upper berth should be stored horizontally at a suitable height in the room to allow easy deployment of the upper bunk.

(2) When stowed, the upper berth should not block any part of the window or window removal in the event of an emergency.

(3) Leading edges should be soft in form to minimize impact to any potential head strike.

(4) The berth's stored height should be optimized so head clearance is at a maximum in both seated and standing positions.

(5) A simple and easy to use handle, latch, and lock mechanism should be within easy reach from a standing position.

(6) Successful locking should be visually indicated, and safety measures should be put in place to prevent accidental deployment and prevent misuse.

(7) The upper berth deployment should be free from jamming and racking and should lower slowly and in a controlled manner.

(8) Considerations should be made for assisted movement or counterbalances to assist people moving the upper berth down and back up into the stowed position.

(9) Mitigation should be made to avoid finger traps across any mechanism, rails, or support structures.

(10) Upper Berth Dimensions: Minimum width 27” x Minimum length 77”.

(11) Deployment or storage of the berth shall require no more than 10 lbf.

d). Accessibility Features

i). 39” Room Door

(1) Access to the room will be subject to review and mockup user testing. Room doors should be accessed by an automatic sliding door.

(2) The door shall also be able to operate in a manual mode in the event of power loss or malfunction so that the room is not put out of service due to door operation failure.

ii). Handrail Locations

(1) Horizontal Handrails:

(a) ADA compliant horizontal handrails positioned to assist transfer through the sleeper room shall be provided.

(b) The handrail should be positioned to maximize the space between the room features while providing maximum access and support for passengers.

(i) Adjacent to aisle side seat

(ii) Adjacent to window side seat

(iii) On the cabinet near the door threshold

(iv) Adjacent to bed along partition wall and above mattress

(v) Along the underside of the window

(vi) Shower handrail along 3 walls of restroom

(2) Vertical Handrails

(a) ADA compliant vertical handrails positioned to assist transfer through the sleeper room shall be provided.

(b) The handrail should be positioned to maximize the space between the room features while providing maximum access and support for passengers.

(i) Either side of restroom door

(ii) Adjacent to toilet

(iii) Inside restroom adjacent to door

iii). Control Buttons and Locks

(1) Room Door

(a) The controls for the room door must be ADA compliant in position, size, and configuration.

(i) Door Open/Close

(ii) Door Lock

(b) The buttons should be easy and intuitive to use.

(c) An accessible manual lock should be included with an indicator to show lock condition.

(d) The buttons should have visual and haptic feedback.

(e) Dimensions, position, and usability will be subject to Amtrak approval during mockup review:

(i) Note this review will include the disability community input.

(2) Restroom and Shower Room Doors

(a) The controls for the restroom and for the shower door shall have the same features as the room door.

(i) Door Open/Close

(ii) Door Lock

iv). 60” Turning Circle

(1) A clear 60” turning circle should be provided inside the room when the seats are in an upright position.

(2) Turning circle shall be clear when fold out table and tip up seats are deployed.

(3) Alternatively, an ADA T maneuver space shall be available when the bed is deployed.

v). Adjustable Features with Clearances

(1) Tip up seat

(2) Fold out table

(a) Fold out tables should be positioned so when deployed should be clear of an RVAAC accessible space and an ADA accessible space.

vi). Accessible Spaces for Wheeled Mobility Devices

(1) A clear accessible space of 59” x 32”.

(a) This shall be provided inside the room when the seats are in an upright position.

(2) An RVACC accessible space of 59” x 32” shall be provided in each of the following locations:

(a) Beside the bed for storing a wheeled mobility device.

(b) In front of the restroom sink.

(c) Next to the toilet seat for storing a wheeled mobility device.

(d) Next to the shower seat for storing a wheeled mobility device.

e). Lighting

i). General

(1) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups.

(a) Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

(2) Unlike other sleeper cabins, the points below are not accompanied by a diagram to show approximate lighting locations and types.

(3) Instead, the Contractor shall propose lighting locations at the PDR stage for Amtrak approval.

(4) Lighting controls shall be analog switches.

ii). Lighting Types and Locations

(1) Wall Wash Lights

(a) Wall wash lights for the aisle partition and the back walls behind the seats shall be provided along the length of each wall.

(2) LED Panel Spotlights (White Lights)

(a) Two small circular LED light panels shall act as spotlights near the entrance door.

(b) The frame for the spotlights shall be color matched to the ceiling.

(3) Compartment Lights

(a) Under Seat lights shall be provided as indirect lighting that spills out across the floor under the seat.

(4) Reading Light (White Lights)

(a) Lower reading lights shall be provided at each seated position.

(b) The light itself shall be adjustable so that the passenger can adjust the direction to position the light over their reading material.

(c) Reading light switches should be located next to the reading light.

(d) A corner lamp shall wash indirect light both up and down.

(e) The switch for this light shall be located next to the lamp.

(5) Restroom Lighting

(a) A LED spotlight shall be located on the ceiling above the toilet and adjacent to the rain shower.

(i) This shall only activate when the door to the restroom is locked.

(ii) This light shall be a white only light.

(6) Floor Lights

(a) Lights shall be provided as indirect lighting that spills out across the floor under the sink counter.

(7) Sink Wash Light

(a) A wash light should be used to light the sink area indirectly.

(b) This light shall only be activated when the door to the restroom is locked.

(8) Mirror Light

(a) A rounded LED light shall illuminate the mirror around the boarder.

(b) This light shall only be activated when the door to the restroom is locked.

31.41 Sleeper Cabin Communal Restrooms

a). The restrooms for sleeper cabin passengers shall be identical in every way to the STR restrooms in coach. See Section 31.36 and Chapter 11.

31.42 Sleeper Cabin Communal Showers

a). General

i). To the extent possible equipment, parts, and features in the shower shall be identical to equipment, parts, and features in the showers for sleeper cabins.

(1) The intent of this clause is to minimize spares and maintenance techniques.

ii). The general requirements for a restroom included in Section 31.35 apply to this section as well.

iii). Modular Design

(1) The shower shall have the ability to be used in other orientations provided that the same amenities are provided within a similar footprint.

(2) A modular design that allows different door positions should provide flexibility for the layout of the interior architecture.

(3) The orientation should always prioritize passenger accommodation numbers where possible, while providing options for better aisle access in other instances.

b). Key Features

i). A comprehensive list of expected features in the sleeper cabin showers is provided in Figure 31-21 and described in detail below.

Figure 31-21: Key Features – Sleeper Cabin Shower

Feature	Short Description	Qty	Reference
General Items			
Standard Cabin Room Door	Sliding door into Shower room	1	
Restroom Grab Bars	49 CFR 38.115 compliant handrails	2	
Communications			
Emergency Call Button	Buttons in accessible locations that activate PEI	2	
PEI - Intercom only	Speaker for emergency conversations	1	
Personal Care - Changing Area			
Changing Area	Dry location within shower room of a suitable size for getting dressed	1	
Changing Area Bench	Seating platform in changing area for getting dressed	1	
Changing Area Mirror	full length mirror	1	
Solid Surface Sink	Includes sink basin, faucet	1	
Sink Vanity Cabinet	Storage cabinet above the sink, with a mirror on the front.	1	
Sink Vanity Mirror	Mirror with boarder LED light or backlight	1	
Sink Outlet	120V GFCI outlet near sink	1	
Handsoap Dispenser	Location for handsoap installed adjacent to the over-sink mirror.	1	
Towel Ring	Install near shower door	1	
Under Sink Cover	Access cover panel for sink piping	1	
High-Capacity Bath Towel Storage	Storage cabinet with door	1	
High-Capacity Towel Bin	Open bin for used towels	1	
Towel Hooks	Inside the shower for hanging wash cloths or wash bags	2	
Hand Dryer	Automatic hand dryer and paper towel dispenser	1	
Personal Care - Shower Area			
Shower Door	Safety glass door for entrance into shower (Bifold doors are prohibited)	1	
Fixed Glass Shower Panel	Safety glass panel	1	
Shower Seat	Fixed Seating platform in shower	1	
Rain Shower	Shower head mounted on the ceiling	1	
Adjustable Shower Head	Handheld shower head	1	
Shower Control	Adjustment for water pressure and temperature in the shower	1	
Shower Drain	Drain location for shower	1	
Shower Exhaust	Adjustable exhaust grille	1	
Soap Dish	Storage location for personal soap items in shower	1	
Soap Dispensing Bottles	Refillable soap, conditioner, and lotion bottles mounted on wall	3	
Trash			
Sleeper Cabin Trash	Storage for shower room trash	1	
Storage			
Restroom Crew Storage	Locker with square key for dedicated crew storage	1	
Coat Hooks	Installed on the partition wall	2	

c). Fixed Glass Shower Panel

i). Applicability: Sleeper Cabin Showers

ii). A fixed glazed panel made from safety glass should be used to keep the shower space open and bright.

iii). The lower portion can be solid to provide structure for the cantilever benches.

d). Shower Door

i). Applicability: Sleeper Cabin Showers

ii). The shower door shall be made from safety glass.

iii). Sleeper Cabin Showers:

(1) The door should be sealed to prevent shower water escaping into the changing space of the room, even when water is sprayed directly onto the back surface of the door.

e). Towel Storage – High-Capacity Bath Towels

i). A cupboard for storing a minimum of 15 clean Amtrak bath towels shall be provided.

f). Towel Storage – High-Capacity Hand Towels

i). Space should be provided on the vanity unit to stack hand towels and wash cloths.

g). High-Capacity Towel Bin

i). The space under the sink should be maximized for storing used towels with a minimum volume of 30 Gal.

ii). The bin should be lined, prevent water ingress and buildup of mold.

h). Changing Area

i). The standing changing area in front of the changing bench should be a minimum of 24” x 30”.

i). Changing Area Bench

i). A cantilevered bench should be provided in the changing area with space kept free under the seat for a bag.

ii). The bench should have a minimum depth of 11.5” running the full width of the changing area.

j). Changing Area Mirror

i). A mirror constructed from safety glass shall be located above the changing bench.

ii). The mirror on the front of the vanity unit should extend higher as a separate panel suitable for people to see their reflection while standing.

iii). The mirror area should be suitably lit, and two concepts shall be presented at PDR, lighted perimeter and backlighted mirror.

(1) Amtrak shall give guidance at the PDR and Mockup review for final mirror configuration.

k). Additional Equipment Requirements

i). HVAC

(1) Supply Air Diffusers

(a) Conditioned air is delivered to the room via two (2) supply air diffusers with adjustable air flow control and located on the windowsill of the outside window.

(2) Exhaust Grille

(a) Exhaust air is removed from the room via the exhaust air grille which is located at the upper portion of the module.

ii). Electrical

(1) Detailed electrical requirements can be found in Chapter 15.

(2) Outlets

(a) Outlet to be provided near the crew storage and the sink.

iii). Lighting

(1) General

(a) General lighting information is described below. Detailed lighting information can be found in Chapter 13.

(b) All lighting part numbers, manufacturers, and temperatures shall be proposed by the Contractor and approved at Amtrak after the lighting simulation during the design review process.

(c) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups.

(i) Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

(2) Lighting Types and Locations

(a) Wall Wash Light

(i) Changing Area Wall

1. Indirect light on the back wall shall be provided.

2. This shall be activated only when the door is locked from the inside.

(b) Main Ceiling Light (White Light)

(i) A large rectangular LED panel in the ceiling provides the main source of light for the room.

(c) Spotlight (White Lights)

(i) Small circular LED light panels act as spotlights to provide the master lighting conditions for this room - frame to be color matched.

(ii) At least one in the changing area and at least one in the shower enclosure.

(iii) Position, number, and style to be approved by Amtrak during the design review process.

(d) Compartment Light

(i) Floor Light

1. Lights shall be provided as indirect lighting that spills out across the floor under the sink counter.

(ii) Sink Light

1. A wash light should be used to light the sink area indirectly. This light shall only be activated when the door to the restroom is locked.

(iii) Mirror

1. A rounded LED light shall illuminate the mirror around the boarder.

2. This light shall only be activated when the door to the restroom is locked.

iv). Communications

(1) Speaker

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(a) PA speaker shall be located on the central ceiling panel.

(b) The speaker used in this location shall be identical to PA speakers used in other locations in the cars for ease of maintenance and replacement.

(c) All communications equipment shall meet the requirements in Chapter 14.

v). Emergency Equipment

(1) Smoke Detector

(a) Smoke Detectors shall be mounted on the central ceiling panel.

(b) The smoke detector used in this location shall be identical to the smoke detectors used in other locations in the cars for ease of maintenance and replacement.

(2) Security

(a) Many items within the coach area will need to be secured.

(b) The following items are identified with specific locking preferences.

(c) Any other locking or security items will be discussed with Amtrak during design reviews.

(i) Shower Door Locking Mechanism

31.43 Sleeper Cabin CMF

a). Please refer to Chapter 19 and Exhibit F for more information.

b). Wall Panels

i). Sidewall Panels along the carshell wall shall be made from molded thermoplastic with an easy to clean surface finish.

ii). Partition Walls shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

iii). The finish of the wall and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

iv). Noise cancelling or sound proofing features shall be implemented into the construction of all wall panels for each sleeper cabin.

v). The noise reduction can come from acoustic dampening panels, foams, or other technology.

vi). The noises from adjoining compartments, hallways, and machinery shall be dampened to at least 65 dBA.

c). Ceilings

i). Ceiling shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

ii). The finish of the passenger facing side of the ceiling panel and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

iii). The finish of the material on the non-passenger facing side shall be coated such that there is no risk of corrosion from moisture from steam or humidity within the car.

d). Flooring

i). Flooring within the sleeper cabin shall be made from carpet.

ii). Flooring will be durable to withstand spills, leaks, and all methods of cleaning. Flooring shall also not become frequently damaged or worn.

iii). Flooring shall have enough give to prevent fatigue from standing.

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Part IX: Sleeper Cabin Key Features

31.44 Sleeper Cabin Key Features – General

a). Available space shall be optimized for passenger comfort and utility where possible. This includes integrating storage pockets, bottle holders, and other methods to maximize passenger spaces.

b). Cabin Door – Standard Sleeper Cabin

i). Applicability: Roomette, SoloSuite, Club Bedroom and Shower Room

ii). Sliding Door

(1) A sliding door shall be provided for access to the room.

(2) The door shall not rattle and shall allow smooth sliding operation.

(3) Measures should be made to prevent any delamination of finish and surface finish protected by runners or guides.

(4) The door should be free from jamming.

(5) Door shall be manually operated.

(6) Clear Opening dimension of the door shall be maximized and shall not be less than 24” wide.

iii). Sliding Door Window

(1) Windows shall be included in the cabin doors to provide natural light and enhance the spaciousness of the room.

(2) Windows shall be made of safety glass, each ¼” thick.

(3) They shall have a minimum width of 21” and shall be long enough that the lower portion of the window is not more than 18” from the floor.

(4) The door window shall be removable from either side using a pry-out rubber zip strip as an emergency escape route should the door be jammed closed.

iv). Sliding Door Window Blind

(1) An integrated blackout blind for the window in the door shall be provided.

(2) The blind shall be manually operated by the passenger.

(3) Blinds shall be able to be replaced within a 30 min timespan.

v). Sliding Door Lock

(1) Electronic Lock

(a) An electronic door locking mechanism shall be implemented into the door.

(b) This locking mechanism shall default to the unlocked position with loss of power as a safety feature.

(2) Manual Lock

(a) Additionally, an accessible, stainless-steel, manual lock shall be mounted to the inside of the sliding door with an indicator to show lock condition.

(b) The lock shall engage with a stainless-steel mechanism in the partition wall of the sleeper cabin.

vi). Sliding Door Handle

(1) Stainless-steel door handles shall be provided in the sliding door.

(2) They shall be positioned to slide door easily from a standing position for a 5th percentile female and a 95th percentile male.

(3) The door handle shall be recessed into the door.

c). Accessible Cabin Door

i). Applicability: Accessible Bedroom

ii). The Accessible Sleeper Cabin Door shall meet all requirements of the Standard Sleeper Cabin Door, except for the following:

(1) Door Operating Mode: Automatic with manual back up

(2) Clear Opening shall not be less than 39” wide.

d). Accessible Cabin Door Controls

i). Applicability: Accessible Bedroom

ii). The controls for the room door must be ADA compliant in position, size, and configuration.

(1) Door Open/Close

(2) Door Lock

iii). The buttons should be easy and intuitive to use.

iv). An accessible manual lock should be included with an indicator to show lock condition.

v). The buttons should have visual and haptic feedback.

vi). Dimensions, position, and usability will be subject to Amtrak approval during mockup review.

(1) Note this review will include the disability community input.

e). Cabin Restroom Door – Standard Sleeper

i). Applicability: Club Bedroom

ii). The door should be sealed to prevent shower water escaping into the internal living space of the room, even when water is sprayed directly onto the back surface of the door.

iii). To keep the room carpet dry, a “water deflector” shall be provided on the inside of the door at the bottom to direct any water running down the door into the floor drain, rather than onto the threshold.

iv). The door should lock from the inside, with an indicator on the outside showing the door lock status.

(1) Sleeper Cabin Shower: An instruction, in accordance with Amtrak Specification # 697, located on the interior side of the door, shall provide lock operating instructions.

v). The clear width door opening shall be a minimum of 24”.

vi). The door shall be of lightweight construction, consistent with durability and consistent appearance with the shower module and be secured with stainless-steel hinges.

vii). The door shall be free from resonance and rattles when in the closed position when the train is in motion at any permissible speed.

viii). The door frame and attachment of the keeper shall be sufficiently rigid so that it does not flex when the door closes, even if it is slammed; the intention is that this interface does not deteriorate over the life of the car.

ix). Likewise, interior door construction shall incorporate interior stiffening in the area where the lock/ latch is attached to the door, so that the fasteners securing it to the leaf have a solid surface on which to clamp.

x). The door latch, with a handle on both sides of the door, shall engage automatically when the door moves towards a closed position, but the lock requires definite action to engage.

xi). The door shall remain in the fully closed position at any permissible train speed.

xii). The lock shall be operable, in an emergency, from the outside with a standard Amtrak coach key.

xiii). An instruction, in accordance with Amtrak Specification # 697, located on the interior side of the door, shall provide lock operating instructions.

xiv). A grille in the door shall provide a path for ventilation air to enter the room, and flush odors before being exhausted to the car's exterior.

f). Accessible Restroom / Shower Room Door – Accessible Sleeper Cabin

i). Applicability: Accessible Bedroom

ii). The Accessible Sleeper Cabin Restroom Door shall be an automatic sliding door; this can be achieved with two leaves.

iii). The door shall operate in manual mode as well so that the event of power loss does not prevent the use of the restroom.

iv). The door shall be positioned to create space for a T-maneuver when the door is open and the bed is deployed.

v). The clear width door opening shall be a minimum of 36".

vi). The door should be sealed to prevent shower water escaping into the internal living space of the room, even when water is sprayed directly onto the back surface of the door.

vii). To keep the room carpet dry, a "water deflector" shall be provided on the inside of the door at the bottom to direct any water running down the door into the floor drain, rather than onto the threshold.

viii). The door should lock from the inside, with an indicator on the outside showing the door lock status.

(1) Sleeper Cabin Shower: An instruction, in accordance with Amtrak Specification # 697, located on the interior side of the door, shall provide lock operating instructions.

ix). The door shall be of lightweight construction, consistent with durability and consistent appearance with the shower module and be secured with stainless-steel hinges.

x). The door shall be free from resonance and rattles when in the closed position when the train is in motion at any permissible speed.

xi). The door frame and attachment of the keeper shall be sufficiently rigid so that it does not flex when the door closes, even if it is slammed; the intention is that this interface does not deteriorate over the life of the car.

xii). Likewise, interior door construction shall incorporate interior stiffening in the area where the lock/ latch is attached to the door, so that the fasteners securing it to the leaf have a solid surface on which to clamp.

xiii). The door latch, with a handle on both sides of the door, shall engage automatically when the door moves towards a closed position, but the lock requires definite action to engage.

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xiv). The door shall remain in the fully closed position at any permissible train speed.

xv). The lock shall be operable, in an emergency, from the outside with a standard Amtrak coach key.

xvi). An instruction, in accordance with Amtrak Specification # 697, located on the interior side of the door, shall provide lock operating instructions.

xvii). A grille in the door shall provide a path for ventilation air to enter the room, and flush odors before being exhausted to the car's exterior.

g). Accessible Restroom/ Shower Room Door Controls – Accessible Sleeper Cabin

i). Applicability: Accessible Bedroom

ii). The controls for the restroom door must be ADA compliant in position, size, and configuration.

(1) Door Open/Close

(2) Door Lock

iii). The buttons should be easy and intuitive to use.

iv). An accessible manual lock should be included with an indicator to show lock condition.

v). The buttons should have visual and haptic feedback.

vi). Dimensions, position, and usability will be subject to Amtrak approval.

(1) Note this review will include the disability community input.

h). Side Window

i). Applicability: All sleeper cabins

ii). Each window shall be an emergency exit window and rescue access window complying with 49 CFR 238.113 and 238.114.

iii). Windows in all sleeper cabins shall be of the same size, except for the windows in the SoloSuite.

iv). SoloSuite windows shall be smaller than those in the other sleeper cabins as the SoloSuite has a smaller length along the carshell wall.

v). Sleeper Bedrooms shall include a side window that functions as an emergency exit and rescue access window. When deployed, the bunk shall not obstruct any portion of this window or prevent its operation or removal in an emergency.

vi). A secondary window of the same width shall be provided above the deployed upper bunk, to provide light and views for passengers in upper bunk positions.

i). Side Window Blinds

i). Applicability: All sleeper cabins

ii). Side window blinds shall meet the requirements of Section 31.15.

j). Outlets

i). Applicability: All sleeper cabins, and Sleeper Cabin Showers

ii). There shall be a minimum number of duplex outlets in each cabin, as shown in Figure 31-22. This shall include:

(1) Seat Outlets

(a) Two duplex outlets with two USB sockets shall be provided for each seated passenger.

(b) The outlets shall be located above the armrest height and in easy reach of people while seated.

(2) Partition Wall Outlets

(a) Two duplex outlets with two USB sockets shall be provided on the aisle partition wall near the vanity.

(3) Sink Outlet

(a) A duplex 120VAC GFCI receptacle shall be located on a panel adjacent to the sink, preferably located to keep it dry from splashes from the sink.

(4) Upper Bunk Outlets

(a) In rooms with upper bunks, one duplex outlet with two USB sockets shall be provided in the upper bunk cubbies.

Figure 31-22: Minimum Outlets by Cabin Type

Cabin Type	Duplex w/USB at Seat	Duplex w/USB at Partition	120VAC GFCI at Sink	Minimum Outlets
Roomette	2	2	1	**5**
SoloSuite	1	1	1	**3**
Club Bedroom	2	2	1	**5**
Accessible Bedroom	3	3	1	**7**

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Sleeper Cabin Showers			1	**1**

k). Master Light Switch(es)

i). Applicability: All sleeper cabins

ii). Master light switches shall be supplied at the following two locations near the door:

(1) At standing height

(2) At upper berth reach height

iii). The master light switches shall default to turn on a preset lighting condition and turn off all lights.

iv). All master light switches shall be analog.

l). Master Thermostat Control

i). Applicability: All sleeper cabins

ii). A digital mechanical method of controlling the room temperature shall be mounted to the wall.

m). Floor Heat

i). Applicability: All sleeper cabins

ii). Floor heating elements shall be provided as specified in Chapter 10.

n). Grab Bars – Standard

i). Applicability: All sleeper cabins

ii). Grab bar(s) shall be provided for a standing passenger to steady themself against train motion.

iii). Bars shall be directly secured to car secondary structure or module structure.

iv). Grab bar shall meet the requirements in 49 CFR 38.115.

v). Grab bar positioning shall be subject to mockup testing and Amtrak approval.

o). Grab Bars – Restroom

i). Applicability: Club Bedroom, Accessible Bedroom, Sleeper Cabin Showers

ii). Stainless steel grab bars shall be provided on one side of the restroom to allow passengers to steady themselves against train motion while using the facility.

iii). Bars shall be directly secured to car secondary structure or module structure.

iv). These bars shall be anti-slip grab bars in accordance with Subpart F of 49 CFR Part 38.123 (a) (3).

v). Grab bar positioning shall be subject to mockup testing and Amtrak approval.

31.45 Sleeper Cabin Key Features – Communications

a). Passenger Information Screen (PIS/OTIS)

i). Space should be provided for an additional passenger information screen in all accessible rooms.

ii). Electrical, diagnostic, and mechanical interfaces shall be provided to this area regardless of Amtrak's decision to provide a screen at this location.

iii). The screen provided shall be a minimum of 21".

b). Attendant Call Button

i). Button in the room used to page the service attendant in non-emergency uses.

c). Emergency Call Button

i). Two waterproof Emergency Call Buttons shall interface with the Passenger Emergency Intercom (PEI) in the toilet room.

ii). The Emergency Call Buttons provide better access for passengers if they are not able to reach the PEI unit.

(1) The Emergency Call buttons shall have illuminated and audible indications when actuated.

(2) One Emergency Call button shall be located within easy reach while seated on the toilet and not easily confused with the flush button or other controls

(3) A second button located within 12 inches from the floor or otherwise reachable for someone who has fallen.

(4) Placement of the buttons is subject to approval during design review.

d). Passenger Emergency Intercom (PEI)

i). The PEI in the toilet room shall interface with the Emergency Call Buttons.

ii). The PEI and Emergency Call button arrangement, including the interfaces used between them, must maintain the same safety level and a standalone PEI.

iii). The PEI and Emergency Call Buttons must remain functional under any toilet module degraded mode condition.

iv). See Chapter 14 for additional details.

31.46 Sleeper Cabin Key Features – Seating Area / Lower Sleeping Berth / Bed

a). Seats – Standard Sleeper Cabin

i). Applicability

(1) This shall be used in all sleeper cabins. This includes the: Roomette, SoloSuite, Club Bedroom, Accessible Bedroom.

ii). General

(1) Seats shall be optimized with strong consideration for safety, comfort, and longevity.

(2) Attachment of the seats shall meet requirements of APTA SS-C&S-016.

(3) Seats shall be mounted so that they can be readily removed for maintenance and/ or overhaul.

(4) Seats shall be subject to full design review and testing, in accordance with the seat specification.

(5) The design will be subject to Amtrak approval.

(a) All seat dimensions, cushion shore hardness will be subject to mockup review and approval of Amtrak.

(6) Space under the seats should be easy to clean and maintain.

iii). Seat

(1) The Contractor shall install adjustable reclining sleeper seat(s).

(2) When folded down, the seat becomes the lower berth.

(3) The conversion between the seat and the berth shall require 10 (ten) pounds of force or less.

(4) The seat shall be optimized to fill the available space with strong consideration for safety, comfort, and longevity.

(5) In accessible cabins the seat shall also be optimized to maximize clear floor area, aid wheeled mobility device transfer and facilitate an accessible and self-sufficient bed deployment.

(6) The seat shall be supported from the side wall sleeper seat rail via a seat bracket on the outboard end and a suitable bracket attached to the floor structure on the inboard end.

iv). Dimensions

(1) Dimension of seats (between inside surface of armrests), cushions and headrests vary by car type, as shown in Figure 31-23.

Figure 31-23: Standard Sleeper Cabin Seat Widths

Sleeper Cabin Type	Minimum Seat Width*
Roomette	26”
SoloSuite	34”
Club Bedroom	48”
Accessible Bedroom	28” per person
* Width between inside surfaces of armrests/side pads.	

v). Seat Movement

(1) Applicability: SoloSuite

(a) Seat shall track forward so customers can utilize the large central console table.

(b) The result will provide some recline for the seat.

(2) Applicability: Accessible Bedroom

(a) The seat height shall be 18”-19” from the floor.

(b) When folded down to the lower berth position, the bed height from the top of the mattress shall be 22”-23” from the floor.

vi). Seat Pan

(1) Applicability: SoloSuite

(a) The seat pan should be profiled to maintain ingress and egress clearance (chamfered edge).

(b) This is a high wearing area of the seat surfaces in this area should be suitably designed to be durable and free from snagging or entrapment.

vii). Headrest

(1) Seat headrest should be adjustable in height for the span of seated passenger heights from the 95th percentile male to the 5th percentile female.

(2) The headrest shall have adjustable wings that fold outwards to adjust the width of the headrest while also providing lateral support for the head while resting and sleeping in an upright seated position.

(3) Headrest dimensions shall match those of the associated seat.

viii). Cushions

(1) Seat cushions should be contoured to aid seat comfort.

(2) Seat cushions shall provide ergonomic support in the following locations:

(a) lumbar,

(b) side bolsters,

(c) back support,

(d) seat back and

(e) seat pan pillowing.

(3) Dimensions shall match those of the associated seat.

(4) Cushioning, seat trim, and detailing will be evaluated during the design review process.

(5) Final seat configuration and comfort shall be subject to Amtrak approval based on documentation and mockup information presented by the Contractor.

ix). Side Pad

(1) A soft seat side pad shall be located on the inside side of the seat (opposite the window-side armrest) to:

(a) balance the seat

(b) cushion the inside edge to soften joining panel work

(c) create a soft finish bumper around the bed when deployed.

(2) The side pad shall be provided on all Standard Sleeper Cabin Seats, with the exception of those in the SoloSuite which shall instead have a second armrest.

b). Seats – Tip Up

i). Applicability: Accessible Bedroom

ii). Tip up seat should fold up flush with the side wall to provide a clear and unobstructed space for wheeled mobility devices.

iii). Spaces when folded should be durable and suitable to back a wheeled mobility device against.

iv). When deployed the seat should reveal a soft cushioned seat back and headrest so when deployed it should have similar comfort levels as the other seats in the room.

v). The seat should be positioned to have good access to the fold-out table with a minimum seat width of 21” and minimum seat pan depth of 19”.

c). Armrest – Standard Sleeper Cabin

i). Applicability: This shall be used in all sleeper cabins. This includes the: Roomette, SoloSuite, Club Bedroom, Accessible Bedroom

ii). A full and cushioned armrest of 3.5” width shall be provided on the window side.

iii). The armrest should be of a suitable length for a 5th percentile female and a 95th percentile male seated passenger to rest their forearm on the cushioned section.

iv). It is acceptable for the armrest to be integrated or wrap over a sidewall shelf.

v). In SoloSuite Only: An armrest shall be provided on both sides of the seat as this seat does not have a side pad.

d). Armrest – Center

i). Applicability: Accessible Bedroom

ii). An additional full and cushioned armrest of 8” minimum should be provided between the two seats.

iii). The armrest should be of a suitable length for seated passengers to rest their forearm on the cushioned section.

iv). The armrest should be provision for two cup holders.

(1) The through hole diameter should be a minimum of 3.5”.

(2) The cup holders and surrounding area should be hardwearing and spill proof.

e). Headboard – Standard Sleeper Cabin

i). Applicability: This shall be used in all sleeper cabins. This includes the: Roomette, SoloSuite, Club Bedroom, Accessible Bedroom.

ii). The armrest and seat side pad should continue and connect to form a thin, soft headboard around the back of the seat when the bed for the lower berth is down.

iii). In SoloSuite Only: The headboard shall be the same as the standard headboard except that it shall be formed by two armrests rather than an armrest and a sidepad.

f). Cup Holder

i). Applicability: All sleeper cabins

ii). Cup holders shall be accessible from a seated positioning, easy to deploy, and intuitive to use.

iii). Cup holders should be able to fold out when in use and fold away discreetly.

iv). They should be made from stainless-steel, be self-supporting, and structurally sound.

v). The through hole diameter should be a minimum of 3.5” and with a landing area for the cup to sit of at least 4”.

g). Fold Out Table – Single Leaf

i). Applicability: This shall be used in all sleeper cabins except the Crew Sleeper Cabin.

ii). This includes the: Roomette, SoloSuite, Club Bedroom, and Accessible Bedroom.

iii). Table height should provide adequate knee clearance for seated passengers.

iv). The height from the floor to the surface of the table shall be between 27” and 29”.

v). The table should be easy to deploy and stow with an intuitive handle.

vi). The table shall slide out to rest in a position that is usable from the seated position.

vii). The table in its stored position should not prevent the conversion of the seat to a bed or impact bed length.

viii). A single leaf table shall be stored and deployed from the side wall.

ix). The table shall support a 50lbf point load on the end of the table without damage.

x). Fold out table in the Accessible Bedroom shall allow for passenger(s) in a wheeled mobility device to adequately access the table.

xi). Table dimensions vary by sideboard, as listed in

xii). Figure 31-24.

xiii). Each table shall operate independently of the other.

Figure 31-24: Single Leaf Fold Out Table Dimensions

Sleeper Cabin Type	Minimum Usable Surface	Extends from Sidewall
Roomette	18" x 18"	20"
SoloSuite	12.5” x 22”	24”
Club Bedroom	18" x 26"	28"
Accessible Bedroom	18” x 26"	28”

31.47 Sleeper Cabin Key Features – Upper Sleeping Berth

a). Upper Berth

i). Applicability: Roomette, Club Bedroom, Accessible Bedroom.

ii). A pull-down upper berth with safety restraint shall be provided. The upper berth shall latch into the stored position and also be able to latch into the deployed position.

iii). This berth shall be stored in the horizontal position against the ceiling lining and shall be pulled down along a wall-mounted, stainless-steel track to be used as a sleeping berth.

iv). The berth height when deployed will be evaluated and judged carefully during the design review process.

v). The distance between the top of the mattress surface and the underside of the ceiling should be a minimum of 24”.

vi). The seated area below the berth should still be usable by seated passengers when the upper berth is deployed.

vii). While restricted access to the area is expected, the area should still be well lit and tables and other amenities should not be restricted by a deployed berth bed.

viii). The access to the upper berth should be free from obstructions and snagging points to allow a person to climb onto the upper bunk freely and safely.

ix). There should be a minimum distance of 14” between the side of the bunk when deployed and the outer wall of the room to allow a clear route to the upper bunk.

x). Key dimensions and access to the upper berth will be subject to mockup testing and Amtrak approval.

xi). Upper berth restraint straps, that engage with the upper berth and the ceiling restraint shall be attached to module structure for strength.

xii). These should retract into the ceiling and be easily pulled down and click into place using an automatic locking retractor belt system (similar to a car seat belt system).

xiii). The upper berth shall be counter-balanced so that the total force to deploy or stow the berth shall be no more than 10 lbf to operate

xiv). The berth shall be subject to full design review and testing at the mockup review.

b). Upper Berth Grab Bar

i). Applicability: Roomette, Club Bedroom, Accessible Bedroom

ii). An upper berth grab bar, secured to module structure, shall be provided as a grab point for steadying passengers entering/exiting the upper berth.

iii). Grab bar positioning will be subject to mockup testing and Amtrak approval.

iv). Grab bar shall meet the requirements in 49 CFR 38.115.

c). Upper Berth Steps

i). Applicability: Roomette, Club Bedroom

ii). Built-in steps shall be provided to allow passengers to enter/ exit the upper berth.

iii). Integrated steps should be built into the area beside the seat to allow people to safely transit to the upper berth.

(1) Roomette shall have at least two (2) steps.

(2) Club Bedroom shall have at least three (3) steps.

iv). Step surfaces shall be free from trip hazards and have an anti-slip finish to the tread surfaces.

v). Steps shall be designed in such a way that the seat cushions, armrests, or any soft furnishings are protected and clear of tread surfaces.

vi). Design of this function shall be part of the mockup and be part of the preliminary design review.

d). Upper Berth Ladder

i). Applicability: Accessible Bedroom

ii). The ladder shall be provided with an identified storage location.

iii). It should be durable and lightweight.

iv). It should not have any sharp corners or edges.

v). It must be intuitive to use and locate.

vi). The fixation method should be robust and easy to lock and unlock.

vii). Successful locking should be visually indicated, and safety measures should be put in place to prevent accidental unlatching and prevent misuse.

viii). The ladder should be usable in multiple positions based on user specific needs and preference.

ix). Each step should clearly contrast the floor and it should also have integrated battery powered lights for safe use during low level light conditions.

31.48 Sleeper Cabin Key Features – Personal Care

a). Sink – Fold Out Style

i). Applicability: Roomette and SoloSuite.

ii). General

(1) A fold-down Solid Surface Material sink with hot and cold water shall be provided for roomette and SoloSuite passengers.

(2) The retractable pins on which the sink pivots shall engage stainless steel “keepers”, securely fastened to the recess housing, and remain secure for the life of the car.

(3) When not in use, the sink shall be retained in the up position through the use of an approved ¼ turn tab-type latch, pressing against a metal area of the sink.

(4) An easy to clean, captive stainless-steel screen shall be provided over the sink drain cavity behind/ below the sink to catch items that might be inadvertently left on the sink surface before closing and would otherwise be lost down the drain.

(5) The design of the sink hinge shall allow removal of the sink and its re-installation to be done in a maximum of one minute.

(6) The ability to do this, as well as interchangeability of 3 replacement sinks shall be demonstrated in room FAI.

iii). Fold Out Sink Basin

(1) The sink basin shall have the minimum internal dimensions shown in Figure 31-25.

(a) The sink shall be lipped to prevent splashing from train motion.

(b) The sink shall have a 1/2 to 1 gallon capacity, be equipped with an overflow and shall be easily removable, without tools, for cleaning.

(c) The sink is drained through a nominal 1-1/4” diameter drain by the user by closing it back into its alcove.

Figure 31-25: Fold Out Sink Basin Minimum Internal Dimensions

Sleeper Cabin Type	Minimum Dimension		
	W	L	D
Roomette	8”	12”	3.7”
SoloSuite	8”	12”	3.7”

iv). Fold Out Sink Faucet

(1) The faucet shall be mounted behind the sink in the sink alcove.

(2) The faucet shall use IR sensor to control water dispensing. The faucet shall not activate when the sink is moved to the open usable position or back to the stored position.

(3) Water flow shall be directly aligned with the drain and shall be directed into the sink and not splash the user.

v). Fold Out Sink Open Indicator Light

(1) A red, wide viewing angle LED “Sink Open” indicator light shall illuminate when the sink is open, as sensed by a limit switch located in the sink alcove housing.

(2) This is to encourage the user to close the sink when it is left open.

(3) The switch shall be accessible for replacement.

b). Sink – Solid Surface Style

i). Applicability: Club Bedroom, Accessible Bedroom, Sleeper Cabin Shower Room

ii). General

(1) A solid surface sink with hot and cold water faucet shall be provided.

(2) The sink countertop shall be made from solid surface material and shall include a marine edge, 6” backsplash, and ¾” radius for cleanability.

(3) Note that all sink countertops shall be sloped toward the basin and drain.

iii). Sink Basin

(1) The sink basin shall have minimum internal dimensions as shown in Figure 31-26.

Figure 31-26: Solid Surface Sink Basin Minimum Internal Dimensions

Sleeper Cabin Type	Minimum Dimension		
	W	L	D
Club Bedroom	8”	11”	5”
Accessible Bedroom	15”	11”	5”
Sleeper Cabin Shower Room	15”	11”	5”

(2) The sink shall have a 1/2 to 1 gallon capacity, be equipped with an overflow.

(3) The sink is drained through a nominal 1-1/4” diameter drain.

iv). Faucet

(1) The faucet shall be mounted behind the sink.

(2) The faucet shall use IR sensor to control water dispensing.

(3) Water flow from the faucet shall be directed into the sink and not splash the user.

c). Sink Vanity Cabinet – Standard

i). Applicability: Roomette, SoloSuite, Club Bedroom and Shower Room

ii). Vanity cabinets shall be provided in each designated room location, with size, configuration, and exact positioning permitted to vary to suit room layout

iii). Cabinets shall be located behind the sink and aligned with the washbasin zone.

iv). A safety-glass mirror shall be integrated on or within the vanity cabinet and located above the sink

v). The mirror shall be positioned at a usable and appropriate height, with the mirror area maximized within the available envelope.

vi). The mirror shall be suitably lit by integrated LED perimeter lighting or backlighting.

vii). Cabinets shall provide maximized storage capacity and functional organization within the available volume.

viii). 3131Contents

(1) The vanity shall provide a place for a passenger to place small toiletries.

(2) Additionally, Amtrak supplied towels and facecloths shall be provided and stored in this location as shown in Figure 31-27.

Figure 31-27: Compact Vanity Towel Capacity

Sleeper Cabin Type	Towel Storage Capacity
Roomette	2 hand towels 2 facecloths
SoloSuite	1 hand towel 1 facecloth
Accessible Bedroom	3 hand towels 3 facecloths
Club Bedroom	4 hand towels 4 facecloths

d). Sink Vanity Cabinet – Accessible

i). Applicability: Accessible Bedroom.

ii). The vanity cabinet shall be provided at an accessible height and within accessible reach ranges.

iii). Where this cannot be achieved, a shelf or suitable alternative storage for hand towels and facecloths shall be provided within an accessible reach range.

iv). Mirrors shall comply with ADA requirements for height and usability.

e). Under Sink Cover

i). Applicability: Sleeper Cabin Shower Room

ii). Sink pipes should be covered with a panel that is accessible for maintenance behind the towel bin.

f). Hand soap Dispenser

i). Applicability: All sleeper cabins with sinks

ii). An automatic liquid soap dispenser which will accept a Celeste Industries liquid soap refill shall be installed and shall be located adjacent to the over-sink mirror.

g). Lotion Bottle

i). A lotion bottle shall be provided near the sink in all sleeper cabins with sinks.

h). Towel Ring

i). Applicability: Club Bedroom, Accessible Bedroom

ii). A stainless-steel combination towel ring/coat hook shall be provided.

iii). It shall be capable of supporting up to 25lbs each.

i). Hand Dryer

i). Applicability: Club Bedroom, Accessible Bedroom, and Sleeper Cabin Showers

ii). A high velocity motion-activated hand dryer shall be mounted on the wall near the sink in an easily accessible location.

j). Shower Curtain

i). Applicability: Accessible Bedroom

ii). A shower curtain should be provided to control water spread in the room while the shower is on.

iii). It should also provide a modesty screen for users.

iv). The curtain should be easy to deploy and stow with an intuitive handle.

v). The mechanism should be durable, free from jamming and racking.

vi). The design should meet abuse loads. Dimensions, position, and usability will be subject to Amtrak approval at the mockup review.

k). Shower Seat

i). Applicability: Accessible Bedroom, Sleeper Cabin Showers

ii). A fold down shower seat shall be provided.

iii). Sleeper Cabin Shower Room:

(1) A fixed cantilevered shower seat should be provided inside the shower with an anti-slip finish with a minimum depth of 11.5” running the full width of the shower enclosure.

l). Rain Shower

i). Applicability: Club Bedroom, Accessible Bedroom, Sleeper Cabin Showers

ii). A rain shower in the ceiling provides a shower above head height.

iii). Rain shower should be seamlessly integrated into the ceiling in order to maximize head room in the restroom.

m). Adjustable Shower Head

i). Applicability: Club Bedroom, Accessible Bedroom, Sleeper Cabin Showers

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ii). A commercial grade shower with hose-mounted wand and controls shall be provided.

iii). A shower hose clip shall also be provided.

n). Shower Control

i). Applicability: Club Bedroom, Accessible Bedroom, Sleeper Cabin Showers

ii). An on/off button and temperature control are located on the restroom wall close to the door.

iii). The shower control should prevent any accidental activation when using the toilet.

iv). In the Accessible Bedroom, shower controls shall be located within ADA-compliant reach ranges.

o). Shower Drain

i). Applicability: Club Bedroom, Accessible Bedroom, Sleeper Cabin Showers

ii). A round drain shall be provided in the shower stall to collect shower water. The drain shall be recessed as standing water is not acceptable.

iii). Shower water shall drain to the ground.

iv). The drain strainer shall be easily removable for cleaning.

v). Fasteners, if required, shall be captive.

vi). The shower tray should be designed to prevent water from escaping into the main area of the room during train movement.

vii). Club Bedroom and Sleeper Cabin Showers:

(1) The restroom floor shall have a built-in shower tray with a raised lip.

(2) A slatted platform finishes flush with the top of the tray to allow the shower water to drain out underneath and prevent the floor remaining wet after use as a shower.

p). Shower Exhaust

i). Applicability: Club Bedroom, Accessible Bedroom, Sleeper Cabin Showers

ii). An exhaust grille shall be provided in the ceiling.

iii). Negative pressure in the restroom shall be provided by the HVAC system.

q). Soap Dish

i). Applicability: Club Bedroom, Accessible Bedroom, Sleeper Cabin Showers

ii). A self-draining soap dish with lip shall be provided in a convenient location to a seated or standing passenger in the shower.

r). Soap Dispensing Bottles

i). Applicability: Club Bedroom, Accessible Bedroom, Sleeper Cabin Showers

ii). Three refillable Amtrak bottles dispensing shampoo, conditioner and body wash shall be provided in the shower.

s). Towel Hook

i). Applicability: All sleeper cabins, Sleeper Cabin Showers

ii). Towel hooks shall be capable of supporting up to 25lbs each.

t). Towel Storage - Standard

i). Applicability: Roomette, SoloSuite, Club Bedroom, Accessible Bedroom

ii). A wall mounted towel holder of hotel quality shall be provided.

iii). The holder shall be stainless steel with capacity as shown in Figure 31-28.

Figure 31-28: Towel Storage Capacity by Cabin Type

Sleeper Cabin Type	Towel Storage Capacity
Roomette	2 of each type
Solo Suite	1 of each type
Club Bedroom	4 folded towels
Accessible Bedroom	3 of each type

iv). The shelf and towels are to be placed out of the direction of any shower water when the shower is in use.

v). The shelf should be free from any potential head strike while using the shower or toilet.

u). Toilet

i). Applicability: Club Bedroom, Accessible Bedroom

ii). An elongated toilet, complete with toilet bowel assembly, shroud, and overflow pan shall be provided in the restroom.

iii). Toilet Bowl Assembly

(1) A toilet stand with shroud assembly shall be located in the toilet room.

(2) Each restroom shall be equipped with a toilet bowl assembly, encased in the toilet shroud.

iv). Toilet Shroud

(1) The shape of the toilet shroud housing shall locate the toilet seat ergonomically for ease of use and comfort.

(2) The toilet shroud shall be constructed of FRP with gel coat color to match the restroom shell or of stainless steel, with brushed finish or approved alternate.

(3) Standard Shroud:

(a) Applicability: Club Bedroom

(b) Sufficient foot room shall be provided. When seated, the user's legs shall not contact the shroud.

(4) Accessible Shroud

(a) Applicability: Accessible Bedroom

(b) The form of the toilet is undercut at the bottom to maximize wheeled mobility device clearance.

v). Toilet Overflow Pan

(1) The toilet bowl assembly shall be mounted on a stainless-steel overflow pan, which shall contain flooding should the toilet outlet become blocked or system leak.

(2) The overflow pan shall:

(a) be watertight with raised edges of ~2 inches height

(b) have the attachment points exterior to the pan

(c) Have all exposed edges folded for safety and to provide stiffness

(d) be equipped with an overflow tube

v). Toilet Seat

i). Applicability: Club Bedroom, Accessible Bedroom

ii). A standard toilet seat and toilet lid shall be provided.

iii). Toilet seat and seat lid should all have soft close mechanisms.

iv). A white toilet seat with lid, meeting Amtrak specification # 352, shall be provided.

v). The toilet seat and cover shall be constructed of reinforced fiberglass or approved alternate.

vi). The lid and seat shall be stable in the up position regardless of train motion, including braking, to prevent it from slamming down suddenly against the shroud.

w). Toilet Flush Mechanism

i). Applicability: Club Bedroom, Accessible Bedroom

ii). A two-button push flush shall be located on the back wall of the restroom above the toilet.

iii). This shall provide standard and eco-flush options for the passenger.

iv). The flush mechanism shall also incorporate an automatic flushing feature when the passenger is done using the toilet.

x). Toilet Paper Dispenser

i). Applicability: Club Bedroom, Accessible Bedroom

ii). A toilet paper dispenser shall be provided adjacent to the toilet.

iii). This dispenser shall protect the toilet paper from getting wet when the restroom is used as a shower.

y). Toilet Seat Cover Dispenser

i). Applicability: Club Bedroom, Accessible Bedroom

ii). A dispenser for paper toilet seat covers should be located by the toilet.

iii). This dispenser shall protect the toilet seat covers from getting wet when the restroom is used as a shower.

z). Shower Seat Cover

i). Applicability: Club Bedroom

ii). The toilet seat shall be covered by a lid that covers the toilet seat and acts as a shower seat.

iii). The shower seat cover shall have a slow close mechanism.

iv). While the restroom is being used as a shower, the lid should disguise the toilet seat forming a bench across the width of the room.

v). The form of the toilet shall be undercut at the bottom to maximize standing space in the shower area.

vi). The design of the toilet, access and lid design will be subject to Amtrak approval during the mockup review.

aa). Baby Changing Table

i). Applicability: Accessible Bedroom

ii). A baby changing table should be provided with an RVAAC compliant clear space in front of it.

iii). The changing table should be easy to deploy and stow with an intuitive handle. The table shall include a strap to ensure passengers with limited reach can operate the table.

iv). The mechanism should be durable, free from jamming and racking.

v). The design should meet abuse loads.

vi). It should have a soft opening mechanism.

31.49 Sleeper Cabin Key Features – Trash

a). Trash Bin – Seating Area

i). Applicability: Roomette, SoloSuite, Accessible Bedroom

ii). A “flip out” Trash Receptacle shall be provided in the room, at an Amtrak approved location.

iii). The trash receptacle shall have a spring-loaded hinged door and be clearly labeled.

iv). The operation and maintenance of the bin should not result in any snagging or finger traps.

v). The bin should be watertight in case of a spill and shall prevent any water escapement.

vi). The trash bin shall meet the requirements of Section 31.17: Trash and Recycling Storage

b). Trash Bin – Restroom

i). Applicability: Club Bedroom, Accessible Bedroom

ii). A trash storage area with accompanying trash bin shall be provided below the sink.

iii). The trash bin shall meet the requirements of Section 31.17: Trash and Recycling Storage, and accommodate the volume indicated in Figure 31-1.

iv). The operation and maintenance of the trash flaps and bin should not result in any snagging or finger traps.

v). The bin should be watertight in case of a spill preventing any water escapement.

c). Trash Bin – Sleeper Cabin Showers

i). Applicability: Sleeper Cabin Showers

ii). A trash bin shall be provided under the sink with push flap cover.

iii). The minimum volume of trash for this receptacle shall be 14 gallons.

iv). The trash flap for this receptacle shall be a minimum of 10” x10”.

d). Sanitary Waste

i). Applicability: Accessible Bedroom

ii). A sanitary waste bin shall be provided to the right of the toilet complete with modesty flap.

e). Sharps Bin

i). Applicability: Accessible Bedroom

ii). Provision for a sharps bin should be provided within the restroom.

iii). The size, position, and method of removal of sharps should be agreed and instructed by Amtrak.

31.50 Sleeper Cabin Key Features – Storage

a). Open Wardrobe

i). Applicability: Club Bedroom, Accessible Bedroom

ii). A dedicated space shall be allocated for an open wardrobe.

iii). This area shall have a coat rod for hanging items and a retaining bar to hold personal items in the open wardrobe area.

b). Coat Hooks

i). Applicability: All sleeper cabins, Sleeper Cabin Showers

ii). Coat hooks shall be capable of supporting up to 50lbs each.

iii). In accessible cabins the coat hooks shall be installed no more than 48” from the floor.

c). Carryon Luggage Storage

i). Applicability: All sleeper cabins

ii). A space shall be dedicated for carryon-sized luggage storage.

iii). The space shall be located as follows:

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Figure 31-29: Carry-on Luggage Storage Location by Sleeper Cabin Type

Sleeper Cabin Type	Carryon Luggage Storage Location
Roomette	between seat and aisle partition wall and under seats and high-level storage above the aisle
SoloSuite	Overhead rack and under the ottoman
Club Bedroom	under the seats and high-level storage above aisle or restroom
Accessible Bedroom	between seat and aisle partition wall and upper-level storage above the seats

iv). Carryon luggage is defined as a bag with dimensions: 22” x 14” x 9”.

v). This area shall be protected from the seat area so luggage can be stored discretely.

vi). This area shall be free from structure or protrusions that may interfere with luggage storage.

vii). This area shall also be easy to clean.

viii). In SoloSuite an overhead rack shall be used for carryon storage:

(1) The rack should be within easy reach for 5th percentile female passengers.

d). The rack should be designed to prevent luggage falling off in typical railroad conditions, i.e. with lip or retention strap.

e). Under Seat Storage

i). Applicability: Roomette, Club Bedroom, Accessible Bedroom

ii). Unobstructed luggage storage space for carryon sized luggage shall be provided under the seat, regardless of seat recline or seat/ berth mode.

iii). This area shall be free from structure or protrusions, including seat operating mechanisms, that may interfere with luggage storage.

iv). This area shall also be easy to clean.

f). Passenger Storage – Cabinets and Cubbies

i). Applicability: All Sleeper Cabins

ii). Storage shall be provided for clothing and personal items, integrated into cabinets, cubbies, or equivalent features, with configuration, quantity, and location permitted to vary by room type.

iii). Storage shall be usable in all intended room modes (e.g. seating and sleeping), without obstruction or loss of function.

iv). In Accessible Bedrooms, storage shall be provided within ADA-compliant reach ranges for use by seated passengers.

v). Storage shall be safe, intuitive to use, and easy to clean, with appropriate retention to prevent items from falling during operation.

vi). Final dimensions, positioning, and usability of storage solutions shall be subject to Amtrak review and approval at mock-up stage.

31.51 Sleeper Cabin Integrated Systems

a). HVAC

i). Supply Air Diffusers

(1) Conditioned air is delivered to the room via two (2) supply air diffusers with adjustable air flow control and located on the windowsill of the outside window.

ii). Exhaust Grille

(1) Exhaust air is removed from the room via the exhaust air grille which is located at the upper portion of the module.

iii). Air circulation fans

(1) Air circulation fans with controls shall be provided at the head of each sleeping berth.

(2) The purpose is to stir room air and decrease the potential for temperature differential between upper and lower areas of the room especially when the upper berth is down.

(3) The air circulation fans shall have manual adjustment of the airflow direction.

b). Communications

i). Speaker

(1) PA speaker shall be located on the central ceiling panel.

(2) The PA speaker shall have an associated mute button.

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(3) The speaker used in this location shall be identical to PA speakers used in other locations in the cars for ease of maintenance and replacement.

ii). Attendant Call Button

(1) An attendant call button shall be located within each room.

(2) The intention of this call button is to direct non-emergency crew to a given location.

iii). Passenger Emergency Intercom

(1) A PEI shall be located in every bathroom floor and wall within a sleeper cabin and shall be located in each accessible sleeper cabin as well.

(2) The intention of this button is to notify the conductor and flag the entire train that there is an onboard emergency.

(3) All communications equipment shall meet the requirements in Chapter 14.

c). Electrical System

i). Electrical equipment information is shared in detail for each room.

ii). All electrical equipment in the sleeper cabins shall meet the requirements in Chapter 15.

iii). Junction Box

(1) The junction box shall be located where practical and shall be presented during the design phase.

(2) It shall be easily accessible by the maintenance group.

d). Lighting System

i). Lighting general information is shared in detail for each room. Detailed lighting information can be found in Chapter 13.

ii). Note that all lighting part numbers, manufacturers, and temperatures shall be proposed by the Contractor and approved at Amtrak after the lighting simulation during the design review process.

e). Emergency Equipment

i). Chapter 18 details emergency equipment requirements. Generally, the following items shall be included in each room.

(1) Smoke Detector

(a) Smoke Detectors shall be mounted on the central ceiling panel.

(b) The smoke detector used in this location shall be identical to the smoke detectors used in other locations in the cars for ease of maintenance and replacement.

(2) Window Egress

(a) Each window on the carshell in a sleeper cabin shall be considered an emergency egress window and shall comply with 49 CFR 238.113.

f). Security

i). Many items within the sleeper cabin area will need to be secured.

ii). The following items are identified with specific locking preferences.

iii). Any other locking or security items will be discussed with Amtrak during design reviews.

(1) Door Locking Mechanism

(a) There shall be an automatic door locking system in place for each sleeper cabin.

(b) This locking mechanism shall default to ‘locked’ when the power is on in the car and default to ‘unlocked’ when no power is provided on the car. Momentary HEP loss situations shall be addressed during design review; however, delayed locking mechanisms should be utilized to account for these situations.

(c) Additionally, this locking mechanism shall be unlocked/activated by the keycard and keyless entry feature that is described in Section 31.12.

(2) Door Locking Mechanism

(a) There shall also be a manual locking system for a passenger to maintain privacy and block inadvertent access into their sleeper cabin.

(b) This shall be in the form of a deadbolt type lock or latch.

31.52 Additional Storage in Sleeper Cars

a). General

i). See Chapter 1 for quantity of storage units desired across the cars and suggested layouts.

ii). Storage lockers shall be locked with crew keys or as otherwise approved by Amtrak.

b). Required Storage Types

i). Electrical Cabinets

(1) See Chapter 15 for electrical storage requirements.

ii). Linen Storage Closets

(1) See Section 31.18 for requirements.

iii). Consumable Supply Storage

(1) See Section 31.19 for requirements.

iv). Cleaning Supply Storage

(1) See Section 31.20 for requirements.

c). CMF

i). General

(1) Storage lockers shall match the CMF of the adjacent wall paneling and countertop surfaces.

(2) Refer to Exhibit F for more information.

ii). Wall Panels

(1) Sidewall Panels along the carshell wall shall be made from molded thermoplastic or melamine resin composite with an easy to clean surface finish.

(2) Partition Walls shall be created from a composite structure such as aluminum honeycomb, melamine resin, or HPL skinned honeycomb panels.

(3) The finish of the wall and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

Part X: Common Use Areas

31.53 Beverage Stations

a). General Requirements

i). Beverage stations shall be incorporated in storage areas within sleeper cars.

ii). The beverage station shall utilize the same amenities and appliances in the food service areas – refer to Chapter 16 for complete requirements and information.

iii). To the extent possible equipment, parts, and features in the beverage station shall be identical to equipment, parts, and features in the first-class bar self service area.

(1) The intent of this clause is to minimize spares and maintenance techniques.

iv). Beverage stations in cars with accessible sleeper cabins shall be ADA accessible.

b). Proposed layout

i). The Contractor shall use Exhibit F as the basis for the beverage station design and make adjustments as necessary to provide complete functionality.

ii). The final layouts will be approved by Amtrak during the design review process.

c). Appliances

i). The table below lists the desired appliances along with an example part number and the quantity required within the beverage station area.

ii). Note that example part numbers are given to establish a starting place for appliance performance and will be finalized during the design reviews.

iii). The car builder will propose the exact manufacturer and part number for each appliance based on functionality, shock and vibration, service history, power requirements, and ability to meet crashworthiness requirements for mounting.

Figure 31-30: Beverage Station Appliances

Appliance	Description	Exact Part Number	Quantity Desired
Countertop Workspace	Clear available workspace for food preparation with 6” backsplash and 0.25” radii.		As Space Allows
Coffee Maker	Twin coffee brewer with 1.5-gallon satellite servers	Wilbur Curtis GEMTS16A 1000	1
Water Dispenser	Recessed Water Dispenser with Drain		1
Storage	storage space with built in condiment storage compartments		1

iv). Detailed functional requirements for each appliance are listed below.

(1) Countertop Workspace

(a) All features for the countertop workspace shall be identical to the countertop workspace described in the kitchen Chapter 16.

(i) With the following exception: In this food service area, the minimum surface area for workspace required is 1 sq ft.

(2) Coffee Maker

(a) A purchased off the shelf item that meets or exceeds the features from the example part number.

(b) Example part number listed as Wilbur Curtis GEMTS16A-1000.

(c) Twin coffee brewer

(d) 1.5-gallon satellite servers

(e) Coffee maker drain shall handle both warmers emptying at the same time with no liquid splashing outside of the drain channel

(3) Water Dispenser

(a) Recessed water dispenser with drain.

(b) An access side panel secured with quarter-turn fasteners for access to the water valves for maintenance.

(c) ADA compliant design.

(d) The dispenser shall be arranged to permit passengers to easily refill a 1-quart water container.

(e) The design shall be in compliance with 21 CFR Part 1250 and US Public Health Service (USPHS) requirements, arranged for ease of sanitation, and approved by Amtrak. Alternative designs can be provided for review and approval by Amtrak.

(4) Storage Cabinets

(a) Storage cabinets shall be constructed from stainless-steel or approved alternative to be discussed during the design review process.

(b) These modules shall be designed to retain goods while the train is in motion.

(c) Storage in this location shall be open shelving with retaining bars and include built in condiment storage compartments.

(d) This will depend on the item stored in each location and shall be determined with Amtrak during the design reviews.

(e) Option for adjustable shelving to accommodate varying products.

(f) Stainless steel retention bars to prevent items from sliding off the shelf while the train is in motion.

(g) Built in condiment storage shall include but not be limited to cups, lids, creamers, stirrers, and sweeteners.

d). Evaluation Criteria

i). Sanitary Design

(1) Sanitary design shall be evaluated with the following criteria:

(a) Appropriate cleaning radii of at least 0.25” on worksurfaces and 0.75” on sink areas.

(b) Backsplashes of at least 6” on worksurfaces and sink areas.

(c) Appropriate cleaning clearances around appliances such that a 95th percentile male can fit their hand and a rag easily between objects for cleaning.

(d) All edges and seams are sealed with silicone sealant and gaps greater than 1/32” are sealed.

(e) Floor drains are provided for locations prone to spills and leaks, especially near water piping.

(f) Openings are protected from allowing pests and vermin to congregate

(g) Proper sealing methods are used to prevent moisture from corroding or otherwise damaging the food service area

(h) All drain pans and catches are accessible for cleaning

(i) No tools are required to move objects subject to daily cleaning Rituals.

31.54 Diner/Lounge

a). General

i). The Diner/Lounge shall include all of the elements listed in this Chapter; however, the arrangement of these elements can be modified by the Contractor to best meet the design requirements for the car as a whole.

ii). Amtrak envisions half of the car to be Diner seating and the other half Lounge seating; however, the Contractor has the flexibility to provide the optimal general arrangement to Amtrak for review and approval.

b). Key Features

i). A comprehensive list of expected features in the Diner/Lounge is provided in Figure 31-31 and described in detail below.

(1) Detailed functional requirements for each feature are listed below.

(2) In addition to these requirements, the Contractor shall factor in safety, crashworthiness, materials and workmanship, FDA cleaning clearances, radii, and sanitary design.

(3) All mechanisms described below should be durable, free from jamming, and racking.

(4) The design should meet abuse, load, and crash criteria.

(5) Dimensions, position, and usability will be subject to Amtrak approval during the mockup review.

Figure 31-31: Key Features – Diner/Lounge

Feature	Short Description	Qty
Accessibility		
Accessible Path	32” continuous aisle through entire car for ADA regulated aisle	1
RVAAC Accessible Space in Diner	Location for a passenger using a wheeled mobility device to dine and remain using device- including 60" diameter turning circle	1
RVAAC Accessible Space in Lounge	Location for a passenger using a wheeled mobility device to dine and remain using device- including 60" diameter turning circle	2
Folded Wheeled mobility device Storage in Diner	Open storage location for wheeled mobility devices	1
Folded Wheeled mobility device Storage in Lounge	Open storage location for wheeled mobility devices	2
60” Turning Circle	60” diameter turning circle for accessibility at each end of the car	1 in diner area, + 1 in lounge area + 1 in vestibule
Interior Structures		
Beverage Sation in Lounge Area	Standard beverage station with vended coffee machine and water fountain	1
Service Station in Diner Area	Convenience station for LSA in the diner	1
Windows	Aligned to booth tables and includes emergency egress features	TBD
Skylights (Option)	Aligned to booth tables - in diner area	1 per window
Blinds	A single blind system that provides sunshade and blackout performance	1 per window (+ skylight option)
Doors	Vestibule with a passenger door each side	1
Seating and Tables		
Diner Booth Seating	Repeatable and modular bench seating for 2 passengers each - minimum 40" width	18 booth seats (36 passengers)
Dining Table Module	Repeatable dining table for 4 passengers	9
Accessible Table	Modified version of table module with flip up portion	1
Privacy Divider	Safety glass divider between booths with hand grab features	1 between each booth
Lounge Seating	Repeatable and modular seating for 1 passenger arranged as twin seats in bays or longitudinal benches	30 single seats
Coffee Table Module	Small cantilevered coffee tables for resting beverages between face to face bay seats	4
Side Tables	Small side tables on longitudinal benches	4

Accessible Coffee Table	Modified version of coffee table module with flip up portion	2
Privacy Divider	Short privacy divider between booths with hand grab features	1 between each back-to-back twin
Lighting (Car Specific)		
Wall Lamps	Light fixtures mounted to each available window pillars in dining area	1 on each window pillar in Diner and Lounge
Table Lamps	Light fixtures mounted to tables	1 per dining table

i). Accessible Table

(1) Provisions for integrating a new accessible table or changing the booth table at the accessible space location shall differ from the standard booth table but shall meet the same strength requirements.

(2) In order to utilize the space to its full extent, fold-down seats may be incorporated.

(3) In this instance, the accessible space shall also include a foldout seat from the side wall in this location so that if a person using a wheeled mobility device is not occupying the space, another passenger can opt to utilize the area instead.

ii). Folded Wheeled Mobility Device Storage

(1) A storage space for two folded wheeled mobility devices shall be located at the Lounge end of the Diner/Lounge car for passengers wishing to transfer to another seat.

iii). Accessible Space

(1) Provisions for two accessible spaces with RVAAC compliant dimensions shall be provided as part of the lounge seating arrangement and one accessible space with RVAAC compliant dimensions as part of the diner seating arrangement.

(2) When reconfigured, the accessible space should include access to a coffee table and side table that aesthetically and functionally matches the coffee table and side table used in other locations in the lounge. The accessible coffee table and side table shall conform to all ADA reach and height requirements.

iv). Accessible Path

(1) The Diner/Lounge car should be fully accessible end to end.

(2) There should be a 32” wide accessible path between seating booths.

(3) Where a 90° turn is required across the car, the aisle should be 44” wide.

v). 60” Turning Circle

(1) There should be two 60” accessible turning spaces in the lounge.

vi). Skylight Windows (Option)

(1) Skylight windows shall be included for the diner/lounge car, café car and diner car in table and booth seating areas.

(2) Please refer to Section 31.13 for window requirements.

vii). Skylight Blinds (Option)

(1) Skylight blinds shall be provided that meet the requirements of Section 31.15.

viii). Skylight Valance (Option)

(1) Skylight design should incorporate a valance without a luggage shelf, that contains only blinds, and coat hooks.

ix). Windows shall be provided that meet the requirements of Section 31.13.

(1) Side window blinds shall be provided that meet the requirements of Section 31.15.

x). Side Rails

(1) Side rails under each window shall include a tideline.

xi). Lower Sidewall Panels

(1) Lower side wall panels shall be provided such that the trim panel has minimized thickness to take advantage of full width of the car body.

(2) These should be designed to have well-fitted clean panels with a high tolerance build to manage split lines and cabinet edging.

(3) Lower side wall panels shall define a material split, with the lower panel in a wood finish.

(4) There should be no protruding equipment, snag point, or dirt traps.

xii). Kick Strips

(1) Stainless steel kick strips at 9” high should be used in all coach areas.

xiii). Hand Grab

(1) Where possible, a compliant accessible grab for passenger navigation shall be available.

(2) Grab bar positioning will be subject to mockup testing and Amtrak approval. Grab bar shall meet the requirements in 49 CFR 38.115.

xiv). Window Pillar

(1) Window pillar width should be minimized.

(2) In the case of a car with skylights the pillar trim should continue over the side ceiling to create an arched aesthetic.

xv). HVAC Gondola

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(1) Gondola shall be designed to maximize headroom and be suitable to accommodate skylight windows.

(2) Lighting washes both centrally into gondola and across side ceilings shall be provided.

(3) The gondola should terminate and transition to a separate lower ceiling section if any equipment or junction in the interior architecture prevents the gondola from completing a full uninterrupted run.

(4) At these junctions the gondola should terminate in a straight line with architecture that creates a visual ring at the termination point.

(5) The transition between ceiling profiles should be treated with clean and well considered intersections.

(6) These lower ceilings should have their own lighting light wells and HVAC vents.

xvi). Wall Lamps

(1) Wall lamps should be provided on every window pillar.

xvii). Lounge Seat

(1) Lounge seats should purposefully differ in style to booth seats and should utilize modular design so that they can be repeated to form both bay and longitudinal seating arrangements.

(2) These structures should allow for creation of groups of seats that create a mix of private and convivial settings.

(3) The furniture system should be simple to maintain and repair, with robust detailing designed for heavy usage.

(4) The system shall allow seats to be arranged in a variety of seating positions to provide a full range of viewing experiences.

(5) All individual seat modules should have the same dimensions but can be orientated differently either by rotating them through 90 or 180 degrees.

(6) Creating a mirrored instance is also acceptable.

(7) Twin seats should be arranged to form couches for two in combination with single seats for one.

(8) Seating orientations should be created so that passengers can be seated in positions that look out both sides of the train.

(9) Lounge seats should have a minimum seat pan depth of 20” and a minimum seat width of 20”. Seat pan height should be a minimum of 18”.

xviii). Outlets

(1) Duplex outlets with two USB sockets shall be provided for each seated passenger.

(2) The outlets shall be located in easy reach of people while seated.

xix). Lounge Coffee Table

(1) Coffee tables should be provided within lounge booths.

(2) Coffee tables shall follow the same requirements as the work station table modules but be shorter in length.

(3) Coffee tables should have marine edge milled into the solid surface material.

xx). Lounge Side Tables

(1) Any longitudinal arrangements of lounge seats shall provide small integrated side tables - side tables should have marine edges built into the top surface or created using a trim edge.

xxi). Lounge Privacy Dividers

(1) Privacy dividers should be included where seating is back-to-back or where passengers' heads are in close proximity.

(2) The height of the divider will need to be managed carefully as to be low enough not to obstruct view out of the windows, yet high enough to provide some level of privacy for seated passengers.

(3) Dividers should include different levels of transparency and material selections to break up volumes and to allow spread of light.

(4) Divider edges are protected by a trim detail which should be strong enough to act as a proxy handhold.

(5) Purposeful and compliant handholds integrated with the divider should be located on entry and exit points to lounge booths.

xxii). Trash Bin

(1) Trash bins shall be provided with stainless steel push flaps.

(2) Please refer to section 31.17 for more information on trash and recycling requirements.

xxiii). Dining Table Modules

(1) A repeatable 'workstation' table module shall be used for diner seating.

(2) A high-quality table surface should be used and shall have a protective edge trim detail.

(3) Split lines should be managed to a high tolerance and sealed to create a flush finish and prevent any potential dirt build up in edges.

(4) A minimum usable table length of 32” shall be provided.

(5) Access in and out of the seat should be evaluated carefully. A tapered leading edge may be required to aid access to the seat.

(6) Top of table surface should be between 27” and 28” while also allowing 3” clearances in height for the legs for a 95th percentile male.

(7) Table leg location shall be positioned as to not provide a knee clash for passengers.

(8) All table dimensions will be subject to mock-up review, testing and approval by Amtrak.

(9) A fixed workstation table shall be provided compliant with APTA Standard PR-CS-S-018-13.

(10) Although APTA Standard PR-CS-S-018-13 excludes cafe and diner tables, it shall apply for the purposes of this Contract.

(11) Energy absorption features shall be built into the workstation table and/or its attachments such that human injury criteria for the 50th percentile HIII male ATDs are not exceeded during dynamic sled testing, per the requirements specified in APTA Standard PR-CS-S-018-13, Section 5.2.1, modified for testing with a workstation table installed.

(12) The table must meet the performance requirements specified in Section 5.2.1.3 of APTA Standard PR-CS-S-018-13.

(13) The table must not become detached from its mountings and the ATDs must remain compartmentalized between the table and the launch seat.

(14) Workstation tables shall be attached to the carbody via the wall seat track and to the floor seat track.

xxiv). Dining Booth Seating

(1) Arrangement and Dimensions

(a) A repeatable booth module of back-to-back seating shall be provided in the diner.

(b) Booths should be 2x2 across the aisle.

(c) Seats shall be mounted to the seat tracks in accordance with the strength and crashworthiness requirements of 49 CFR Section 238.233 (a) and APTA standard PR-CS-S-016-99 as applicable.

(d) Seat width shall be maximized with a minimum acceptable dimension of 40” wide for a seat suitable for two passengers.

(e) To achieve a 32” accessible path between diner seats the side wall detail/clearance will need to be minimized and tolerances will need to be tightly controlled.

(f) Seat pan height shall be between 18” and 19” with a seat pan depth of no less than 18”.

(g) Seat back height from finished floor should be a minimum of 38” with a higher divider no lower than 44”.

(h) All seat dimensions, cushion density/ shore hardness will be subject to mock-up review, testing and approval by Amtrak.

(i) Booths shall be located on either side of a table in the diner.

(j) The table shall be centered in the window alignment.

(k) The privacy dividers in each booth shall align with the window pillars in a repeating 81” pitch.

(2) Under Seat Storage

(a) Each booth seat shall be designed such that under the seat cushion there is a storage compartment for crew and diner emergency storage items.

(b) The access to these seats should not impact the seat comfort or aesthetic.

(c) The actions required to access the storage location should take the average person under 30 seconds.

(3) Seat Cushions

(a) Booth seat cushions should be contoured to aid seat comfort.

(b) Seat cushions shall provide ergonomic support in the following locations: back support, seat back and seat pan pillowing.

(c) Cushioning, seat trim, and detailing will be evaluated during the design review process.

(4) Pedestals

(a) Booth seats shall be mounted on a pedestal that is seamless with the floor, with no dirt traps, or protruding edges.

(b) Pedestals shall be undercut from the seat base to provide a floating seat aesthetic.

(5) Materials

(a) The seat structure should be finished with high-quality, hard-wearing laminates and veneers.

(b) Laminate edges shall be protected with delicate trim details.

(6) Amtrak Approval

(a) Booth seating details shall be presented for Amtrak approval during the PDR.

(b) Final seat configuration and comfort shall be subject to Amtrak approval based on documentation and mockup information presented by the Contractor.

xxv). Dining Privacy Dividers

(1) A glazed privacy divider shall be provided between back-to-back booth seats. The divider frame shall be integrated with handholds.

(2) Handholds complying with 49 CFR 38.115 shall be provided as part of the privacy divider on the aisle side of every booth seat.

xxvi). Service Station

(1) A service station should be provided within the Diner/Lounge.

(2) The purpose of this station is to assist crew with performing an efficient food service.

(3) Crew will use the station to replenish the tables so should be designed to store provisions needed for table settings including cutlery, napkins (standard and small beverage) menus and items to support coffee service.

(4) It should have open storage and closed storage and may also require a trash bin.

(5) The detailed design and service strategy will be defined further during PDR.

(6) The exact design, use, and purpose of the cubbies in the service station shall be developed with Amtrak during the PDR.

(7) A single large opening in the solid surface countertop where smaller bins, trays, or tubs can be stored shall function as the starting place.

c). CMF

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i). Please refer to Chapter 19 and Exhibit F for more information.

ii). Wall Panels

(1) Sidewall Panels along the carshell wall shall be made from molded thermoplastic with an easy to clean surface finish.

(2) Partition Walls shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(3) The finish of the wall and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

iii). Ceiling

(1) Ceiling shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(2) The finish of the passenger facing side of the ceiling panel and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(3) The finish of the material on the non-passenger facing side shall be coated such that there is no risk of corrosion from moisture from steam or humidity within the car.

iv). Flooring

(1) Flooring within the diner/lounge area shall be carpet flooring as listed in Section 31.31.

(2) Flooring shall be durable to withstand spills, leaks, and all methods of cleaning. Flooring shall also not become frequently damaged or worn.

(3) Flooring shall have enough give to prevent fatigue from standing.

v). Lighting

(1) General

(a) Lighting general information is shared in detail.

(b) Detailed lighting information can be found in Chapter 13, Lighting System.

(c) Note that all lighting part numbers, manufacturers, and temperatures shall be proposed by the Contractor and approved at Amtrak after the lighting simulation during the design review process.

(d) Ceiling lighting shall match the ceiling lighting in the coach cars.

(e) A digital controller shall be provided allowing for crew to adjust the brightness and color temperature of the lighting in the room in grouped sections.

(2) Lighting Types and Locations

(a) Compartment Lighting

(i) Under Table and Seat Lighting

1. Wash lighting under the table or seats shall provide indirect light.

(ii) Wall Lamps

1. On each window pillar, a wall lamp shall be provided that casts indirect light on the pillar.

2. The lamp is intended to be a premium design feature that contributes to the overall lighting of the space.

3. Lamp design, spread of light, lamp materials, and detail design will be subject to Amtrak's approval.

(iii) Table-mounted Booth Lamps (Diner tables)

1. A table lamp shall be provided at every table against the side wall.

2. The lamp is intended to be a premium design feature that contributes to the overall lighting levels of the space.

3. Lamp design, spread of light, lamp shade material and detail design will be subject to Amtrak's approval.

31.55 Diner

a). General

i). The diner shall include all of the elements listed in this section; however, the arrangement of these elements can be modified by the Contractor to best meet the design requirements for the car as a whole.

ii). If the final layout for the diner area differs from the suggested layout, the Contractor shall propose the new layout at the PDR with the justification for differences in design and layout.

iii). The suggested layout for the diner area shown in Exhibit F shall be used as a reference when designing this area of the car.

b). Key Features

i). A comprehensive list of expected features in the diner is provided in Figure 31-32 and described in detail below.

(1) Detailed functional requirements for each feature are listed below.

Figure 31-32: Key Features – Diner

Feature	Short Description	Qty
Accessibility		
Accessible Path	32” continuous aisle through entire car for ADA regulated aisle	1
RVAAC Accessible Space	Location for a passenger using a wheeled mobility device to dine and remain using device- including 60" diameter turning circle	1
Folded Wheeled Mobility Device Storage	Open storage location for wheeled mobility devices	1
60” Turning Circle	60” diameter turning circle for accessibility at each end of the car	2
Interior Structures		
Galley	Food service Area described in Chapter 16	1
Service Station	Crew convenience station in the diner	1
Windows	Aligned to booth tables and includes emergency egress features	TBD
Skylights (Option)	Aligned to booth tables - in diner area	1 per window
Blinds	A single blind system that provides sunshade and blackout performance	1 per window (+ skylight option)
Doors	Central loading doors on each side	1
Seating and Tables		
Booth Seating	Repeatable and modular bench seating for 2 passengers each - minimum 40" width	9 booth seats
Table Module	Repeatable dining table for 4 passengers	4
Accessible Table	Modified version of table module with flip up portion	1
Privacy Divider	Safety glass divider between booths with hand grab features	1 between each booth
Lighting (Car Specific)		
Wall Lamps	Light fixtures mounted to each available window pillars in dining area	1 on each window pillar
Table Lamps	Light fixtures mounted to tables	1 per table

ii). Table Module

(1) A repeatable ‘workstation’ table module shall be used in the diner.

(2) A high-quality table surface should be used and shall have a protective edge trim detail.

(3) Split lines should be managed to a high tolerance and sealed to create a flush finish and prevent any potential dirt build up in edges.

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(4) A minimum usable table length of 32” shall be provided.

(5) Access in and out of the seat should be evaluated carefully. A tapered leading edge may be required to aid access to the seat.

(6) Top of table surface should be between 27” and 28” while also allowing 3” clearances in height for the legs for a 95th percentile male.

(7) Table leg location shall be positioned as to not provide a knee clash for passengers.

(8) All table dimensions will be subject to mock-up review, testing and approval by Amtrak.

(9) A fixed workstation table shall be provided compliant with APTA Standard PR-CS-S-018-13.

(10) Although APTA Standard PR-CS-S-018-13 excludes cafe and diner tables, it shall apply for the purposes of this Contract.

(11) Energy absorption features shall be built into the workstation table and/or its attachments such that human injury criteria for the 50th percentile HIII male ATDs are not exceeded during dynamic sled testing, per the requirements specified in APTA Standard PR-CS-S-018-13, Section 5.2.1, modified for testing with a workstation table installed.

(12) The table must meet the performance requirements specified in Section 5.2.1.3 of APTA Standard PR-CS-S-018-13.

(13) The table must not become detached from its mountings and the ATDs must remain compartmentalized between the table and the launch seat.

(14) Workstation tables shall be attached to the carbody via the wall seat track and to the floor seat track.

iii). Booth Seating

(1) Arrangement and Dimensions

(a) A repeatable booth module of back-to-back seating shall be provided in the diner.

(b) Booths should be 2x2 across the aisle.

(c) Seats shall be mounted to the seat tracks in accordance with the strength and crashworthiness requirements of 49 CFR Section 238.233 (a) and APTA standard PR-CS-S-016-99 as applicable.

(d) Seat width shall be maximized with a minimum acceptable dimension of 40” wide for a seat suitable for two passengers.

(e) To achieve a 32” accessible path between diner seats the side wall detail/clearance will need to be minimized and tolerances will need to be tightly controlled.

(f) Seat pan height shall be between 18” and 19” with a seat pan depth of no less than 18”.

(g) Seat back height from finished floor should be a minimum of 38” with a higher divider no lower than 44”.

(h) All seat dimensions, cushion density/ shore hardness will be subject to mock-up review, testing and approval by Amtrak.

(i) Booths shall be located on either side of a table in the diner.

(j) The table shall be centered in the window alignment.

(k) The privacy dividers in each booth shall align with the window pillars in a repeating 81” pitch.

(2) Under-Seat Storage

(a) Each booth seat shall be designed such that under the seat cushion there is a storage compartment for crew and diner emergency storage items.

(b) The access to these seats should not impact the seat comfort or aesthetic.

(c) The actions required to access to the storage location should take the average person under 30 seconds.

(3) Seat Cushions

(a) Booth seat cushions should be contoured to aid seat comfort.

(b) Seat cushions shall provide ergonomic support in the following locations: back support, seat back and seat pan pillowing.

(c) Cushioning, seat trim, and detailing will be evaluated during the design review process.

(4) Pedestals

(a) Booth seats shall be mounted on a pedestal that is seamless with the floor, with no dirt traps, or protruding edges.

(b) Pedestals shall be undercut from the seat base to provide a floating seat aesthetic.

(5) Materials

(a) The seat structure should be finished with high-quality, hard-wearing laminates and veneers.

(b) Laminate edges shall be protected with delicate trim details.

(6) Amtrak Approval

(a) Booth seating details shall be presented for Amtrak approval during the PDR.

(b) Final seat configuration and comfort shall be subject to Amtrak approval based on documentation and mockup information presented by the Contractor.

iv). Accessible Table

(1) Provisions for integrating a new accessible table or changing the booth table at the accessible space location shall differ from the standard booth table but shall meet the same strength requirements.

(2) In order to utilize the space to its full extent, fold-down seats may be incorporated.

(3) In this instance, the accessible space shall also include a foldout seat from the side wall in this location so that if a person using a wheeled mobility device is not occupying the space, another passenger can opt to utilize the area instead.

(4) The accessible table shall be adjustable in height between 27” and 34”.

v). Folded Wheeled Mobility Device Storage

(1) A storage space for two folded wheeled mobility devices shall be located at the end of the diner car for passengers wishing to transfer to another seat.

vi). Accessible Space

(1) Provisions for an accessible space with RVAAC compliant dimensions shall be provided at the accessible table.

(2) The accessible space shall also include a fold out seat from the side wall in this location so that if a person using a wheeled mobility device is not occupying the space, another passenger can opt to utilize the area instead.

vii). Accessible Path

(1) The diner car should be fully accessible end to end. There should be a 32” wide accessible path between seating booths and down the side of the kitchen. Where a 90° turn is required across the car, the aisle shall be 44” wide.

viii). 60” Turning Circle

(1) There should be two 60” accessible turning spaces.

ix). Service Station

(1) A service station should be provided within the Diner.

(2) The purpose of this station is to assist crew with performing an efficient food service.

(3) Crew will use the station to replenish the tables so should be designed to store provisions needed for table settings including cutlery, napkins (standard and small beverage) menus and items to support coffee service.

(4) It should have open storage and closed storage and may also require a trash bin.

(5) Service station should provision for a countertop POS Ticket Screen Outlet

(6) The detailed design and service strategy will be defined further during PDR.

(7) The exact design, use, and purpose of the cubbies in the service station shall be developed with Amtrak during the PDR.

(8) A single large opening in the solid surface countertop where smaller bins, trays, or tubs can be stored shall function as the starting place.

x). Windows

(1) Side window shall be provided that meet the requirements of Section 31.13.

(2) Each window shall be an emergency exit window and rescue access window. Windows shall comply with 49 CFR 238.113 and 238.114.

xi). Skylight Windows (Option)

(1) Skylight windows shall be included for the diner/lounge car, café car and diner car in table and booth seating areas.

(2) Please refer to Section 31.13 for window requirements.

xii). Skylight Blinds (Option)

(1) Skylight blinds shall be provided that meet the requirements of Section 31.15

xiii). Skylight Valance (Option)

xiv). Skylight design should incorporate a valance without a luggage shelf, that contains only blinds, and coat hooks.

xv). Windows shall be provided that meet the requirements of Section 31.13

xvi). Blinds

(1) Side window blinds shall be provided that meet the requirements of Section 31.15.

xvii). Wall Lamps

(1) Wall lamps shall be provided on every window pillar.

xviii). Table Lamps

(1) A table lamp shall be provided at every table against the side wall.

(2) An integrated condiment basket or rail shall be provided on the base of the lamp suitable to store a varied arrangement of condiments to be defined during PDR.

xix). Privacy Dividers

(1) A glazed privacy divider shall be provided between back-to-back booth seats. The divider frame shall be integrated with handholds.

(2) Handholds complying with 49 CFR 38.115 shall be provided as part of the privacy divider on the aisle side of every booth seat.

c). Diner Interior Structures

i). Side Rails

(1) Side rails shall be included under the windows along the side walls. The side rails shall include a tideline features with integrated lighting to wash lower side wall panel.

ii). Lighting and HVAC Gondola

(1) The lighting and HVAC gondola features should match the coach interior structure specification in Chapter 11.

(2) Ceiling profiles should transition to an alternate section to accommodate the Servery architecture.

(3) Ceiling profiles should transition to an alternate section to accommodate electrical cupboard, plenum chambers or crew cupboards.

iii). Window Pillars

(1) Window pillar width should be minimized. The pillar trim should continue over the side ceiling to create an arched aesthetic.

iv). Kick Strips

(1) 9” tall stainless steel kick strips shall be mounted along the length of the diner.

v). Side Wall Panels

(1) Side wall panels shall include trim panels with minimized thickness to take advantage of full width of the car body.

d). CMF

i). Please refer to Chapter 19 and Exhibit F for more information.

ii). Wall Panels

(1) Sidewall Panels along the carshell wall shall be made from molded thermoplastic with an easy to clean surface finish.

(2) Partition Walls shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(3) The finish of the wall and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

iii). Ceiling

(1) Ceiling shall be created from a composite structure such as aluminum honeycomb or HPL skinned honeycomb panels.

(2) The finish of the passenger facing side of the ceiling panel and material of the outside skin shall meet all structural requirements for crashworthiness based on mounting and attached loads to the panel.

(3) The finish of the material on the non-passenger facing side shall be coated such that there is no risk of corrosion from moisture from steam or humidity within the car.

iv). Flooring

(1) Flooring within the diner area shall be anti-slip flooring in the hallway by the kitchen and high traffic carpet through the seated area in Section 31.31.

(2) Flooring shall be durable to withstand spills, leaks, and all methods of cleaning. Flooring shall also not become frequently damaged or worn.

(3) Flooring shall have enough give to prevent fatigue from standing.

v). Lighting

(1) General

(a) Lighting general information is shared in detail for each room.

(b) Detailed lighting information can be found in Chapter 13.

(c) Note that all lighting part numbers, manufacturers, and temperatures shall be proposed by the Contractor and approved at Amtrak after the lighting simulation during the design review process.

(2) Lighting Types and Locations

(a) Ceiling Lighting

(i) Ceiling lighting shall match the ceiling lighting in the coach cars.

(b) Compartment Lighting

(i) Table Booth Lamp

1. A table lamp shall be provided at every table against the side wall.

2. An integrated condiment basket or rail shall be provided on the base of the lamp suitable to store a varied arrangement of condiments to be defined during PDR.

3. The lamp is intended to be a premium design feature that contributes to the overall lighting levels of the space.

4. Lamp design, spread of light, lamp shade material and detail design will be subject to Amtrak's approval.

(ii) Wall Lamp

1. On each window pillar a wall lamp shall be provided that casts indirect light onto the pillar.

2. The lamp is intended to be a premium design feature that contributes to the overall lighting levels of the space.

3. Lamp design, spread of light, lamp shade material and detail design will be subject to Amtrak's approval.

Part XI: Utility Car (Option)

31.56 Utility Car (Option)

a). The utility car shall be constructed using a carshell selected from one of the proposed car types to maintain a modular build approach. The baggage area will be physically separated from the crew sleeping quarters by a reinforced, hinged, and lockable door to ensure room security. Located at the B-end of the car, the baggage compartment will feature powered doors, a trap door, folding steps, and HVAC, along with additional amenities to support the modular design concept. The A-end of the car will accommodate at least six roomettes, two standard restrooms, one communal shower, and a dedicated crew break area.

31.57 Utility Crew Accessible Baggage Area

a). General

i). The baggage room occupies the B-end half of the car and is divided from the crew area with a reinforced hinged locked door to provide security to the room. Likewise, a lockable collision post door is provided at the blind end of the room to access an adjacent car. Outside access is provided by side loading doors located at the B-end of the car

(1) The baggage room shall be 1770 cu ft.

ii). The baggage area will be used in Amtrak's long-distance passenger trains and will be loaded with a mix of baggage types, such as checked baggage, carry-on baggage, bicycles, etc.

iii). Configuration of the interior shall provide flexibility to handle different baggage types with relative ease and not require tools to reconfigure.

iv). Functionality of various equipment within the car shall be intuitive and obvious. Design and assembly of the interior shall be clean and integrated with easy access for routine maintenance.

v). The car's interior shall be designed for safety, modularity, functionality, reliability, durability and require minimal maintenance.

b). Configuration

i). Provided in 8 sections, folding tubular luggage racks are provided along both sides of a central aisle. Under the racks, a raised perforated platform places luggage slightly above floor level to keep it dry, etc. These platforms are typically down but shall be hinged and foldable against the side walls. In each section, two robust tubular racks fold outward from the wall (similar to the Viewliner II) to accommodate luggage of varying sizes, or if retracted, to expose bicycle racks, two per each rack section. All folding devices shall be secured by passive latches, which cannot be accidentally deployed. Dividers are included between the rack sections to compartmentalize cargo so it does not shift.

c). CMF

i). Car interior walls, end sheets and ceiling shall be painted gloss white to improve visibility in the room.

ii). Interior ends and side walls as well as the ceiling of the Baggage car shall be austenitic stainless steel painted gloss white with a durable paint to enhance artificial and natural lighting within the car.

d). Lighting

i). Lighting for the side loading doors areas shall be LED type fixtures, designed and located to illuminate not only the area inside the car, but also to shine outward onto the station/ shop platform to facilitate the loading/unloading process during the trip.

31.58 Utility Baggage Area Luggage Racks

a). A luggage tower shall be of robust tubular brushed stainless steel construction and include shelves.

b). Bumper guards shall be mechanically attached to the wall panels within the luggage rack/tower to prevent damage to walls or luggage.

c). The rack/tower shall incorporate suitable brackets for handling garment bags. Golf bags and other larger items shall be able to be stored in this area.

d). This feature shall only be present in luggage racks located in the baggage car.

e). The luggage rack/tower shall be a convertible unit that can be reconfigured to hold two bicycles.

i). This feature shall only be present in luggage racks located in the baggage car.

f). All surfaces shall be smoothly finished to prevent damage to luggage or crew injury.

g). Each luggage tower shall be equipped with 2 tiers of folding, tubular luggage racks.

i). The racks shall pivot at the inner walls to allow them to be stowed to accommodate varying sizes of luggage/cargo.

h). The load bearing surface shall be inclined upward at an angle of 3° to 4°.

i). Steel cables enclosed in weather resistant jacket shall provide for each folding shelf as secondary support.

j). The lowest rack keeps baggage off the floor, protecting it from water, dust, etc. on the room floor.

k). Dividers are included between the luggage towers to compartmentalize cargo, so it

does not shift.

l). Luggage racks and supporting structure shall be made of stainless-steel transversal tubing, with a raised edge for luggage retention.

m). The racks shall have sufficient strength to support a load of 250 pounds midway between adjacent supports with a deflection not to exceed 1/4 inch and without permanent deformation. This shall be demonstrated at FAI.

n). Two passive ¼ turn latches shall be provided to stow each of the racks in the raised position. The luggage racks shall be easily moveable with one hand to stow or deploy.

o). Rack design and shelf dimensions shall provide the flexibility of having:

i). all luggage racks lowered for luggage handling any rack lowered for luggage handling

ii). all the luggage racks stowed.

iii). enable bicycles to be secured when all luggage racks are stowed.

iv). racks of different luggage towers function mutually independently of each other.

p). Rutland Industries, Mini-Mum model # MMW2XMHV or Amtrak approved equivalent for securing bicycles shall be provided along the inner walls folding out as needed to support a bicycle hung on it.

i). An instruction placard shall be provided on the wall adjacent these racks, giving instructions for proper rack use.

q). The fully loaded luggage racks and bicycle rack, mounting hardware and associated structure shall meet the strength requirements per APTA SS-C&S-034-98 for equipment support as well as RP-C&S-006-98 for attachment strength.

r). Due to anticipated harsh environment exposure, rough handling of luggage/cargo, the luggage racks, bicycle racks and associated support structure and mounting hardware shall be robust and corrosion resistant.

i). They shall be simple in design, operation, and maintenance without the need for springs, dampers, etc.

ii). Likewise, the interior walls, bulkheads and cargo nets shall be designed for durability in handling heavy luggage and various sizes of bicycles.

iii). The entire baggage room installation of racks shall be designed, manufactured, and installed to prevent rattles, etc., resulting from car movement at any speed.

iv). All exposed fasteners in the area shall be countersunk or flush mount types to preclude any damage to passengers' luggage.

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v). All edges and corners shall be rounded with generous radii. Bump strips shall be incorporated along the sides of each of the spaces to avoid scuffing the wall finish or the luggage.

s). Design of the luggage towers and bicycle racks shall be subject to design review. The final interior equipment, arrangement, dimensions, and locations shall be developed during design review, with the aid of mockups.

31.59 Utility Baggage Area - Gun Case Modules

a). Gun Case Modules (GCM) shall be provided in the baggage area of the utility car.

b). Gun Case modules shall be McMaster Carr part number E.33.54.601

c). Each GCM shall Measure approximately 78” H x 48” W x 24” D.

d). Each utility car shall incorporate one (1) GCM in the baggage area.

e). The final arrangement of the GCM and their application to the cars will be submitted to Amtrak for review and approval during the design review process.

31.60 Utility Baggage Area – Miscellaneous Storage Areas

a). General

i). The baggage area shall also serve as a storage area for additional trash, electrical equipment, and as a location for supply storage to be distributed throughout the car.

ii). The distribution of various storage capacities will be finalized during the Design Review Process.

iii). Utility cars shall also include the electrical cabinets and storage lockers, as described below.

b). Electrical Cabinets

i). See Chapter 15 for details.

c). Storage Lockers/Closets

i). Storage lockers shall be locked with crew keys or as otherwise approved by Amtrak.

ii). Storage lockers shall match the CMF of the adjacent wall paneling and countertop surfaces.

iii). Please refer to Chapter 19.

iv). Storage Lockers/Closets include the following:

(1) Trash Storage

(a) See Section 31.17 for details.

(2) Linen Storage Closets

(a) See Section 31.18 for details.

(3) Consumable Supply Storage

(a) See Section 31.19 for details.

(4) Cleaning Supply Storage

(a) See Section 31.20 for details.

(5) Dirty Linen Storage

(a) Dirty or used linens shall be stored exclusively in the utility car for ease of unloading at designated laundry stops.

(b) Used linen storage shall come in the form of a large hamper that can be easily stored or carried off the car.

(c) The reserved area shall be large enough to store up to 6 days of used linens throughout the consist. This includes tablecloths, napkins, pillowcases, sheets, etc.

(d) Exact dimensions and configuration for dirty linen storage shall be developed in conjunction with Amtrak during the design review process.

31.61 Utility Crew Sleeper

a). The Crew Area located in the A-End half of the car is essentially a simplified version of the Standard Sleeper. It includes the same body end door, electric/ switch locker, and emergency tools. Likewise, the center aisle is similar, with up to six (6) Roomettes located along both sides of the car. These rooms will be utilized by on-board personnel. A small “kitchenette” space for crew shall be provided between the Roomettes on the A-End and the checked baggage area on the B-end including dedicated, securable crew storage lockers, countertop space, a sink, a microwave and refrigerated storage.

b). The Roomettes, shower, restrooms and booth seats for the crew shall be identical in every way to the amenities used in the proposed car types.

Figure 31-33: Key Features – Utility Crew Sleeper

Feature	Short Description	Qty
Accessibility		
Aisle	22" minmium aisle between bedrooms	1
Interior Structures		
STR	Standard Toilet Room	2
Communal Shower	Communal Shower	1

Windows	Upper and lower windows- includes emergency egress features in each room	1 in each room
Blinds	A single blind system that provides sunshade and blackout performance	1 per window
Doors	Vestibule with a passenger door on each side	1
Baggage Area	Dedicated Baggage area with baggage racks totaling a minimum of 1600 cubic feet. Access is provided with both external doors and an internal doorway from crew area.	1
Kitchenette	Small crew Kitchenette with crew lockers	1
Linen Closet	Linen closet full height cabinet that is at least 2.5 ft wide and 2 ft deep.	1
Cleaning Supply Closet	See section 31.20 f	1
Consumable Supply Closet	See section 31.19 & 31.20 for details	1
Dirty Linen Storage	Used linen storage in the form of a large hamper	1
Accommodation		
Roomettes	Roomette for a single crew member	6
Seating & Tables		
Booth Seating	Repeatable and modular bench seating for 2 crew each - minimum 40" width	4 booth seats (8 seats)
Table Module	Repeatable dining table for 4 passengers	2

31.62 Lactation Room (Option)

a). A lactation room is defined as a hygienic place that is:

i). Not part of a bathroom

ii). Shielded from view

iii). Free from intrusion

iv). Accessible to disabled individuals including wheeled mobility device users

v). Contains a seat and a working surface

vi). Easy to locate

vii). Clearly defined with signage

viii). Contains an electrical outlet

ix). Available to employees and passengers for expressing breast milk

b). As an option, a lactation room shall be provided. This room shall have the following features:

i). Lactation Compartment Door

(1) The door to the compartment shall be the same manually operated, sliding door as is used for a standard sleeper compartment. (see Section 31.44a)

(2) The door latch, with a handle on both sides of the door, shall engage automatically when the door moves towards a closed position, but the lock requires definite action to engage.

(3) The door shall remain in the fully closed position at any permissible train speed.

(4) The lock shall be operable, in an emergency, from the outside with a standard Amtrak coach key.

(5) An instruction, in accordance with Amtrak Specification # 697, located on the interior side of the door, shall provide lock operating instructions.

ii). Outlets

(1) Three duplex outlets with three USB sockets shall be provided in the lactation room.

(2) The outlets shall be located above the armrest height and in easy reach of passengers while seated.

iii). Attendant Call Button

(1) A backlit button that pages the attendant assigned to this sleeper cabin. Please refer to Chapter 14 for complete information on this call button.

iv). Cup Holder

(1) A cup holder shall be provided as described in Section 31.46f).

v). Vanity Area

(1) A vanity surface shall be provided to support lactation and infant-care activities.

(2) A safety-glass mirror shall be provided above or adjacent to the vanity surface, positioned at a usable height and, where practicable, common with other mirrors used in the train.

(3) Storage provision shall be provided for personal items and infant-care accessories.

(4) A fold-out baby changing table shall be provided, integrated into the surrounding structure and designed to be safe, hygienic, and easy to clean.

(5) Final dimensions, configuration, and usability shall be subject to Amtrak review and approval at mock-up stage.

vi). Baby Cradle

(1) Cradle shall have 4 sides so that a baby can be retained within the cradle in a hands-free manner.

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vii). Facial Tissue Dispenser

(1) A facial tissue dispenser with a finished front plate shall be integrated into the vanity space.

viii). Hand Sanitizer Dispenser

(1) A base for a liquid hand sanitizer dispenser shall be installed adjacent to the mirror.

(2) The base shall one that will accept a Celeste Industries liquid hand sanitizer refill.

ix). Lighting

(1) General

(a) All lighting shall be dimmable, with a fixed color temperature to be determined during design review and mockups.

(i) Color temperature shall be determined per light fixture and may not be the same temperature for all fixtures within the compartment.

(2) Lighting Types and Locations

(a) Wash Lights in the Lactation Room

(i) Wall wash lights for both carshell walls shall be provided along the length of each wall above the windows and shall illuminate the sidewall and blinds.

(b) LED Panel Spotlights (White Lights)

(i) Two small circular LED light panels shall act as spotlights above the entry door. The frame for the spotlights shall be color matched to the ceiling.

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Part XII: CDRLS

31.63 CDRLs

CDRL	Description	Due
CDRL 31-01	Human Factors Study Report	30 days prior to PDR
CDRL 31-02	Pinch Point Gap Analysis	30 days prior to FDR
CDRL 31-03	Luggage and Baggage Analysis	30 days prior to PDR

Amtrak Universal Single Level Fleet Replacement

Technical Specification

32. Cab Car and Train Controls (Option)

Revision 2

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32.1 Overview

a). This chapter describes the design and functionality of the optional cab car to be included in this procurement, including control equipment, instruments and gauges for systems necessary for the safe and efficient operation of rail cars and trailing propulsion vehicles from the Engineer's cab, and ancillary equipment for crew comfort and safety.

b). The Cab Car F-End shall include streamlined styling for reduced wind resistance to reduce fuel consumption and enhance locomotive performance at high speeds when the consist is operated in push mode. An end door, if provided for egress, must not detract from the end of train strength and safeguards for train crew protection from accidents at highway grade crossings.

c). Space behind the operating cab shall be physically separated by a door and used for revenue seating of coach class seats in a 2x2 configuration, with an accessible seating location and accessible restroom with a 60 inch turning circle identical to the High Capacity Coach Car. The materials and workmanship shall comply with Chapter 19.

32.2 Cab Arrangement

a). This chapter provides details regarding the Engineer's operating cab while the passenger seating area shall closely resemble the seating arrangement provided for the High-Capacity Coach Car.

b). The Engineer's cab compartment shall conform to FRA requirements and be sized for three crew members (Engineer, Assistant and extra observer), using two fixed seats and a jump seat, at the F-end. This cab compartment shall extend the full carbody width. The Cab mockup submittal will be subject to Amtrak's review and approval during the design review process. **[CDRL 32-01]**

c). The Engineer shall be located on the right side of the cab in the direction of travel, with the Assistant on the left side of the cab. It is of great importance that the cab compartment be designed to provide maximum comfort and alertness for the Engineer and Assistant for long periods of duty, as well as have the highest level of durability, reliability and maintainability.

d). The cab area shall be laid out so as to be neat and orderly in appearance, with all apparatus designed and arranged in a manner that will not cause confusion to the Engineer.

e). The layout shall maximize the use of available space and shall employ sound ergonomic and industrial design principles in its development yet designed to be rugged and easily maintained.

f). The more critical displays as identified herein shall meet human machine interface standards.

i). The displays shall be located adjacent to the windshield, in the Engineer's plane of normal forward vision, for ease of viewing.

g). Utility shall not be sacrificed to aesthetics, although a pleasing and comfortable

environment for the Engineer shall be a design objective.

h). Controls shall be arranged so that those which are most often used, or are of critical importance, are the most convenient to the Engineer, and others shall be located such that the hazard of misuse is minimized.

i). The cab arrangement shall be in compliance with the Tier I cab requirements of 49 CFR Part 238. All cab designs, materials and workmanship shall comply with the requirements of the appropriate chapters of this Specification and shall be submitted to Amtrak for approval during the design review process. A cab mock-up shall be constructed for review and approval by Amtrak in the same fashion as the requirements in Chapter 3.

j). Adequate space shall be provided on the cab console for maintenance personnel to place a standard laptop computer (10 in. by 15 in.) for operation during vehicle tests.

k). The Engineer's cab shall be isolated from passenger access, and shall be configured, including its door and locking provisions, to be in compliance with all applicable security guidelines. The cab shall be configured so that it may be closed off and locked when not in use.

l). The cab compartment linings shall be highly durable, scuff and scratch resistant materials, such as fiberglass reinforced plastic or melamine covered with Tedlar composite laminate or other Amtrak approved materials.

m). Modular console construction shall be used, with quick-opening captive black-finished stainless-steel fasteners used for attachment of console panels.

n). All interior panels shall be designed with large radius corners [0.5 in. (12.7 mm) minimum] and smooth transitions to facilitate cleaning and prevent injuries. The number of exposed fasteners, seams and moldings shall be minimized.

o). The control panels facing a seated Engineer shall be provided with a dull black finish to eliminate glare.

p). Exposed fasteners used to retain components shall be captive and have a black anodized finish to match the surrounding area.

q). The cab shall be arranged and finished to minimize injury to the Engineer and Assistant in the event of an accident or collision, and shall be free of sharp edges, protruding objects, safety hazards and floor obstructions as required by Military Standard MIL- STD-1472, latest revision. Areas in which newspapers and other debris can accumulate are not permitted.

r). Cab equipment and controls shall be mounted in modules and/or panels to be easily replaceable from the front or top of the installed position.

s). Electrical control panels shall have all wiring for the panel electrical devices terminate in an approved keyed quick-disconnect interface to the carbody wiring, so as to permit ease of panel removal.

t). All pressure switches and sensors, and all pneumatic cutout cocks, shall be arranged for ease of complete crew and/or maintenance access. Innovative

methods to facilitate cab equipment servicing and troubleshooting shall be proposed, such as mounting equipment panels using hinges and hold-open hydraulic pistons for access to electrical terminations.

u). All modules and panels, however, shall be designed for rapid complete removal from the car.

v). Pneumatic devices shall be fed from a non- kinking hose to permit ready panel removal and have in-line connections for removal, arranged to prevent incorrect connections of adjacent hoses. As it is expected over the life of the cars that future regulations will mandate additional controls and indicators be added to the cab consoles, the Contractor as an aspect of its design must provide adequate spare room on all panels for future additions. Ergonomic control layout, maintainability access and provisions for future additions shall be key aspects of the cab design review and the cab mock-up.

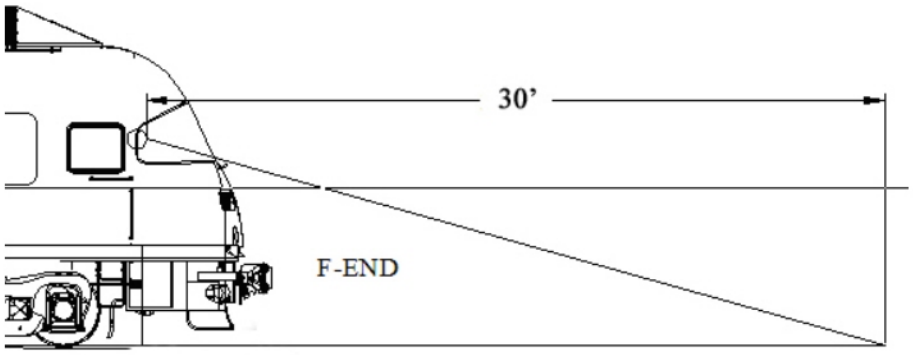
w). All annunciator lights and shall have a self-test feature or separate test switch to verify operation.

x). All indicator lights and controls shall be either permanently engraved white paint filled identification signs on a flat epoxy powder coat black background, switch label inserts protected by a clear durable plastic cover, panels protected by a clear Tedlar overlay, or other approved techniques with equal permanence.

y). Indicator and warning lights shall have sufficient brightness to be distinguished in peak daylight brighness, but not so bright as to cause hotspots or distraction during nighttime operation. A dimming function may be implemented as a solution.

z). The Engineer's minimum clear viewing distance from the seated position shall be no more than 30 ft (9.15 m) to the top of rail as shown in Figure 16-1, which may also be achieved by a camera and an additional display, subject to Amtrak's approval.

Figure 32-1: Engineer's Minimum Clear Viewing Distance from the Seated Position



aa). The cab layout shall also be arranged so as to provide the Engineer with an effective field of view to the right and left of the direction of travel. Obstructions to the field of view caused by required collision and corner post structural members shall be minimized. F-end operator Line-of-Sight Drawing submittal will be subject to Amtrak's review and approval during the design review process. **[CDRL 32-06]**

i). The arrangement of the cab shall be under the direction of the Contractor's Industrial Designer, who shall verify all human factors data.

ii). The Contractor shall submit for design review and Amtrak approval a series of general arrangement diagrams of the interior of the Engineer's cab compartment.

iii). Cab arrangement shall meet all necessary compliance to accommodate a 5th percentile female and a 95th percentile male.

iv). They shall include the location of all features and appointments, as well as general arrangement diagrams of the Engineer's control consoles, Assistant's work station, and jump seat illustrating the location of all features, appointments, controls, switches, gauges, meters and indicators.

bb). Fields of view, legroom provisions and ranges of arm movement for a seated Engineer and Assistant of the specified percentile range shall be included.

i). The review period for these initial cab and controls arrangement drawings shall permit internal review by Amtrak personnel.

ii). The final console arrangement shall be submitted for approval during drawing and design review and at cab mock-up reviews. **[CDRL 32-05]**

cc). The entire cab area shall be properly heated, ventilated and cooled, be draft-free, and insulated against noise and thermal loss.

dd). The cab compartment arrangement and all controls shall be approved in detail by Amtrak during design review.

ee). Cab installation, arrangement and design submittal will be subject to Amtrak's review and approval during the design review process. **[CDRL 32-04]**

32.3 Cab Windows

a). Windshield

i). Two FRA Type I windshields consisting of triple-laminated high impact untinted glass shall be provided at the Engineer's Cab of the cab car for the Engineer and Assistant positions. The windshields shall be a Frame type installation, with the glazing installed so that it is not unduly stressed by frame or carbody flexure.

ii). The windshield dimensions shall permit a maximum field of view for a seated Engineer.

iii). The design and installation of the windshield shall minimize external glare as well as reflections from inside the car. When the car is operated at night or in tunnels, no reflections shall be visible in the windshield.

iv). The windshields shall be installed in an anodized aluminum frame. Mounting shall be designed to prevent the glazing from being pushed into the car interior and shall be arranged for replacement from outside the car. Design by spall shield or other approved means shall be provided.

v). The windshields shall be electrically heated using cab switch control. When activated, a clear and unobstructed view shall be provided.

vi). A two part “Emergency” handle shall be provided for both cab end windshields to allow for removal of the windshields from inside of the car in the event of an emergency. The design of the glazing rubber shall also allow removal of the windshields from the outside of the car by emergency responders. Identification and removal instructions shall be provided.

b). Sliding Side Window

i). Each side of the Engineer’s Cab in the cab car shall have a sliding side window for Engineer and Assistant use. The sash shall be designed to permit an Engineer to easily lean out, when either seated or standing, and be able to view a station platform or the wayside in either direction. An alternate design hinged side window may be proposed for review and approval. When in any position, the side window shall not interfere with any cab controls or engineer’s field of view, operation of controls or movement.

ii). The minimum clear opening shall be 16” wide by 18.4” high. Locks and keepers shall not encroach into this opening.

iii). The sash shall use FRA Type II untinted window glazing, installed in the frame with elastomer sections to form a watertight seal. Easy reglazing of the sash shall be a required design feature.

iv). The sliding portion of the sash shall be designed to slide freely in either direction

v). The sash shall be secured by a rugged latch assembly of an approved design, easily reached by a seated Operator.

vi). The sash design shall be such to allow the sliding portion to maintain any derived opening during normal operating conditions.

vii). Positive latching in the closed position is required as well as positive retention in any of the designated open positions.

viii). All window functions shall require less than 5 lbf to operate.

ix). The latch handle shall be designed and positioned to provide the best ergonomic condition for closing, locking, latching and opening movements.

32.4 Emergency Egress/Ingress

a). A means for emergency egress or ingress of the cab shall be incorporated into the design of the Engineer’s cab.

b). The Contractor shall design the layout incorporating provisions for the cab occupants to exit in an emergency via normal exit doors and another Amtrak approved alternative method.

i). Exit pathways must be considered in the design by not locating other cab equipment in the exit pathway(s).

ii). Emergency lighting shall comply with AAR and APTA standards for Cab Cars, The provisions shall also incorporate a means for outside emergency personnel to enter the cab area.

c). Provisions shall also be incorporated in the design of the cab area for emergency exit or ingress and an emergency evacuation ladder or another Amtrak approved alternative method from the cab to the track level at the end of the train, for situations when there is no side access to the cars.

d). There shall be one roof hatch emergency access point located in the Engineer's Cab area. The designs shall comply with 49 CFR Part 238.123 requirements.

e). Emergency Egress and Ingress submittal will be subject to Amtrak's review and approval during the design review process. **[CDRL 32-07]**

32.5 Cab Enclosure

a). The cab shall be completely enclosed and shall contain an Engineer's control console located below the windshield, a right and left side vertical panel on either side of the windshield, an overhead panel located above the windshield and a circuit breaker panel in an approved location.

b). To the Engineer's and Assistant's rear shall be a transverse partition extending across the full carbody width, incorporating a door, centered transversely, and exiting to the passenger area.

i). This partition wall shall completely separate the passenger area from the cab enclosure. The cab will be arranged as to allow the Engineer visibility to observe the far left side of the track such as at grade crossings.

c). Cab layout, materials and coatings shall be used to make the view through the windshield as distortion and glare free as possible.

d). The carbody, adjacent roof, end and sidewalls shall be fully sound insulated throughout the cab to achieve the lowest possible cab interior ambient noise level of less than 80 dBA.

e). All cab components shall be evaluated individually for their noise contribution such as windows, cab seats, doors, lighting fixtures and hardware.

i). Air ducts shall be baffled as required to control wind noises and to attenuate exterior noises.

ii). Use of components that cause noise, vibration or oil canning will not be acceptable. If noise from vibration is caused by any part of the vehicle equipment, the Contractor shall modify and revise the design to eliminate this condition.

iii). Under all normal conditions of operation, vibration of interior components such as partitions, walls, doors, ceiling panels, light fixtures, etc., shall not be visible nor audible.

f). Design and styling shall seek to improve safety, ergonomics and ease of operation. Engineer's right and Assistant's left side operable windows and shall

incorporate an exterior rain deflection gutter.

g). The cab partitions shall be securely mounted to run from floor to ceiling and be of adequate structural integrity to withstand all normal or extraordinary loading from passenger contact, such as from vandalism.

i). Each partition, when mounted, shall withstand a horizontal load of 330 lbs. (149.82 kg) applied at any location without permanent deformation. The exterior face shall match the styling of the car interior, and the interior face shall match the Engineer compartment styling.

h). Incorporated into the rear wall of the cab in an approved, easily accessed location, shall be lockers for the Engineer's and Assistant's personal effects.

i). These lockers shall be solidly constructed and lined with stainless steel or similar finishes and have a hinged door.

ii). The door shall have a compression latch with an integrated padlock hole.

iii). The doors shall be mounted with a stainless-steel piano hinge and have an external face treatment matching the cab decorative effect. The minimum inside dimensions shall be 22.7 in. wide by 20 in. high by 21 in. deep (576 mm wide by 511 mm high by 555 mm deep), unless otherwise approved by Amtrak. An open doorstop shall be provided.

iv). A second, smaller storage locker shall also be located on the rear wall, without a hasp.

(1) It shall contain an intermediate shelf, and be used for storage of crew individual portion water bottles, crew kit, paper towels, etc.

i). All interior appurtenances and surfaces shall not create glare in the interior glazing and control console. If there is not space for locked lockers in the cab, it can be installed in the optional crew space or in a location immediately adjacent to the cab as proposed by the Contractor and approved by Amtrak.

j). A rugged fold-down jump seat for a third crew member shall be installed at an appropriate location in the cab.

32.6 Cab Door

a). The center-rear of the Engineer's cab shall have a fully hinged door which shall swing outward, toward the passenger area. The door design, hardware and location shall facilitate rapid Engineer evacuation in the event of an emergency. The door operation shall require less than 10 lbf to operate.

b). The cab door shall contain an emergency removable panel at the bottom of the door. The door shall be of hollow stainless-steel or painted aluminum unless otherwise approved by Amtrak.

c). Each door shall be provided with adequate stainless-steel reinforcements for the attachment of all hardware. The door shall be bound on all four edges by welding, rolled seams, or a combination.

d). The cab door shall be hung on a continuous, full length, stainless steel self-closing hinges having a stainless-steel hinge pin, located at the outboard edge of the door. When closed, the door shall bear against a neoprene elastomer cushioned door stop across the top and both sides. The cab door shall be of sufficiently rigid and strong construction to withstand, when mounted and closed, a horizontal load of 330 lbf (1,468 N) applied at any point without permanent deformation.

e). The door shall not rattle or squeak in any position and shall be sealed when closed to provide a highly soundproof barrier.

f). The cab door shall have a window in its upper portion of the door frame.

g). The clear viewing area shall be approximately maximized in both lower and upper portion, but not less than 30 in. (762 mm) vertically by 8 in. (203.2 mm) horizontally so that the crew members, whether seated or standing can look back into the passenger area.

h). The window material shall be a minimum of 0.25 in. (6.35 mm) thick mar-resistant polycarbonate or other approved material.

i). The window shall be glazed in a neoprene rubber section and mounted to the door using a two-piece frame (inner and outer) aluminum extrusion or by the silicon rubber sealing profile so that it provides security and can only be replaced from the inside of the cab.

ii). The exterior face shall either have no exposed fasteners or fasteners with tamperproof heads.

iii). An opaque roller curtain or similar approved arrangement shall be provided on the inner face to permit an Engineer to block any light transmission through the door window into the cab.

i). Unless a dedicated HVAC system is provided to the cab car, a sight-tight, louvered, heavy-duty, nonadjustable stainless steel or anodized aluminum air grille shall be located in the lower part of the cab door for ventilation.

i). The size of the grille shall be approximately 7 in. (177.8 mm) vertically by 9 in. (228.6 mm) horizontally and located on the centerline of the door, at least 12 in. (304.8 mm) above the floor.

j). The cab door shall have an approved snap-type lock, which shall hold the door closed and can only be opened from the passenger area side by a JL Howard 2555 coach key, unless otherwise approved by Amtrak.

i). The design of the lock case on the aisle side shall have a security cover plate to preclude any unauthorized entry into the cab by forcing the latch head back.

ii). A large horizontal push-type panic bar handle shall be provided on the cab side of the door to facilitate rapid unlatching and exit without the use of the key.

iii). The door lock mechanism shall be easy to access for repair or replacement.

k). The cab door shall have a center aisle ceiling mounted recessed metallic latch, which will hold the door in the open position when desired. An elastomer bumper shall cushion the door when fully opened.

32.7 Windshield Wiper

a). An Amtrak approved, heavy-duty, automatic electric windshield wiper powered by the low voltage power system shall be installed at the top of the Engineer's and Assistant's windshield at each cab.

b). The wiper motor shall be brushless, be thermally protected against stall conditions, have Radio Frequency Interference (RFI) suppression, and shall be easily accessed and removable from inside the end of the car, using quick disconnect fittings.

c). A heavy-duty transit quality tubular low wind lift pantograph wiper arm shall be used, with all visible parts having a black finish.

i). A curved-glass type black finished heavy-duty wiper blade with a replaceable rubber element sufficiently, long to wipe at least 80% of the glass, shall be used, mounted with a saddle type connector.

d). The system shall operate successfully in rain or snow at all vehicle speeds.

e). Windshield wiper control knobs shall be located on the Engineer's side.

f). The windshield wiper shall have an off position, two fixed delays of 3.8 sec (from Off to Int) and 6.7 sec (from Slow to Int), and either a variable speed of approximately 30 to 90 cycles per minute or two fixed speeds.

g). The wipers shall automatically move to the park position (edge of the windshield opposite of the camera location) when turned off.

h). The wiper mechanisms shall operate smoothly without hesitation throughout its cycle under all conditions, including clearing rain and snow at vehicle speeds up to 125 mph (201.1 km).

i). Wiper operating mechanisms and drive units shall be accessible for repair and replacement.

ii). The operating mechanisms shall be enclosed.

i). An Amtrak approved, service proven electrically operated windshield washer, with fan-type pattern spraying nozzles mounted on each windshield wiper arm, shall be provided.

i). The washer system shall effectively cover the entire portion of the windshield within the sweep range of the wiper.

ii). A windshield washer reservoir using corrosion-resistant materials and fittings, of minimum 5 gallon (18.93 L) capacity shall be mounted under the car.

iii). The design shall allow refilling without the need for step ladders or tools.

32.8 Sun Visor

a). An Amtrak approved, adjustable sun visor shall be installed in each cab for the Engineer and Assistant which meets flammability smoke and toxicity emission requirements.

b). Roller blinds are acceptable for cab window sun visors. Blinds must have the ability to stop/stay fixed in every intermediate position and allowed to raise upwards when required using a spring-operated mechanism which winds the blind up. A similar visor will be provided for the Assistant as well as visors mounted for windows on the left and right side of the cab.

c). The sun visor construction shall be consistent with 49 CFR Part 238.103. The design and placement shall be approved by Amtrak.

32.9 Mirror

a). On both sides of the cab at the forward edge of the side window, shall be an exterior locomotive style combination adjustable windshield wing and mirror.

b). It shall contain an integral vertical tilt mirror and be arranged to swing flat against the carbody.

c). The mirror mounting, and support shall be designed so that when overloaded the mirror will break away without damage, scuffing or deformation of the carbody.

d). Final location and arrangement of all mirrors shall be approved by Amtrak and determined at the front-end mock-up.

32.10 Engineer’s Seat

a). Each cab shall be equipped with heavy-duty, high-back style Engineer and Assistant locomotive seats, each supported on a center pedestal designed to provide satisfactory comfort and proper access to cab controls with good visibility.

b). The cab seats shall be mounted symmetrically about the longitudinal centerline of the car, between the collision and corner posts in order to optimize viewing and ergonomic interaction with the car controls.

c). They shall also be even with each other and accommodate the clear view distance defined in Chapter 16.2. There will be a minimum of 0.5 in. (12.7 mm) clearance from the back wall when in the rearmost position. Cab seat will be designed in a way which will not cause damage to cab console.

d). The seat design shall take into account the limited amount of space available in the cab, and also the possible standing of the Engineer/Assistant to look out of the side cab window.

e). The seat assembly shall incorporate failsafe operating features and adjustment methodology to prevent sudden seat failures during the life of the car to avoid Engineer/Assistant injuries.

i). All mounting hardware to the cab floor shall be stainless steel.

ii). The seat frame shall be of tubular steel construction designed for hard usage. The seat bottom and back cushions shall be properly contoured to provide adequate lumbar, back, side and thigh support, and shall be constructed from foam material meeting the requirements of Chapter 19.

iii). The Contractor shall make every reasonable effort to minimize the number of unique parts (especially adjustment mechanisms and knobs) used in its construction and installation. No seat component shall be removable without tools.

f). All strength, performance, and other criteria defined within this Chapter shall be considered minimums.

i). The seat and its attachment shall comply with the requirements of 49 CFR Part 238.233 (FRA Tier I vehicle).

ii). In addition, the seat shall comply with the requirements of APTA Standard PR-CS-S-011-99 but may be supplied without a rotation feature. Where conflicts exist, the most restrictive shall apply.

g). The seat assembly shall meet the smoke and flammability requirements of Chapters 2 and 19.

h). Heavy-duty transportation grade upholstery having an approved color shall be used. All seams shall have high mechanical strength, and bottom cushion transverse seams in the area of the top front corner are to be avoided.

i). The details and colors of the seat design shall be reviewed and approved by Amtrak.

ii). The Contractor shall consider utilizing darker colors in areas that tend to accumulate dirt and stains, such as the head rests and the armrest caps.

i). As part of the design review efforts, the Contractor shall present an ergonomic analysis and report of the seating system. One sample seat shall be submitted by the Contractor for approval by Amtrak prior to testing**. [CDRL 32-08]**

j). The seat suspension shall have a scissor mechanism with a pendulum design to eliminate lateral wobble and shall use service-proven bearings at all moving points.

i). A protective bellows shall encase the suspension system mechanism.

ii). The seat back height shall be coordinated with the cab arrangement.

iii). The seat back shall have an infinitely adjustable mechanical lumbar support and a back shell to protect the rear cab wall from damage.

iv). There shall be no sharp edges or surfaces which could cause injury.

k). The seats shall contain mechanical components only and shall provide simple, smooth adjustments while an Engineer is seated.

l). The seats shall have a minimum of 6 in. (152.4 mm) fore/aft adjustment [9 in.

(228.6 mm) being desirable if the cab arrangement permits] with roller bearing slides each having locking mechanisms.

m). The seat height adjustment range shall be a minimum of 5 in. (127 mm) and shall not allow the seat to free fall.

n). The seat bottom cushion shall have a range of 8° of tilt, and the back cushion shall have a range of 8° of tilt past the vertical, if cab arrangement permits.

o). Recliner mechanisms shall be double gear with a tooth and sprocket on both sides of the seat. Adjustment devices using simple notched cam plates with flat sides for setting heights or pitch are prohibited.

p). A wall or partition-mounted folding Observer's seat shall be provided in the cab area. It shall be padded and upholstered similar to the Engineer's seat and shall be approved by Amtrak.

32.11 Horn

a). A roof mounted heated pneumatic horn, Nathan/Airchime model K-5LA, with bell frequencies of 311, 370, 415, 494 and 622 Hz, with all bells facing outward, shall be installed on the roof at the Cab car F-end.

b). Each horn bell shall be provided with the manufacturer's stainless steel conical debris/snow filter to prevent accumulation and packing of debris and snow in the bell mouth. The method of debris and snow deflection shall be subject to the approval of Amtrak.

c). To reduce vibrations transmitted into the carbody, the horn shall be mounted on a 0.25 in. (6.4 mm) thick elastomer mounting pad.

i). The horn mounting location on the car roof shall take into account airflow patterns and snow accumulations, in both the leading and trailing modes, to minimize snow and ice accumulation.

d). The horn shall be operated by an electronic switch located on both the Engineer's and Assistant's center cab console controlling a dual-volume electro-pneumatic horn valve.

i). The valve shall be a Graham-White Manufacturing Company model 412 series or approved equivalent manual metering horn valve, with prior successful use in this application, and a high cycle life.

e). In addition, a foot pedal activated switch shall be located on the floor beneath the Engineer's center cab console which shall automatically produce a standard grade crossing warning signal sequence (long - long - short - long), with adjustable timing settings.

i). The switch function shall be inoperative below 3 mph. Pressing the switch again during the automatic horn sequence shall instantly cancel the remainder of the sequence and silence the horn.

ii). The foot pedal switch shall be finished in a contrasting color.

f). The air supply to the valves shall be on Horn manifold cutouts inside the control cabinet.

i). All control valves and supply piping shall be sized to handle the required air flow, so that there is no delay in the buildup to full horn volume when activated.

g). The horn as installed shall comply with the requirements of 49 CFR Part 229.129. The horn volume shall be compliant with both “high” and “low” volume activation. A restriction choke shall be installed in the base of the horn as required to prevent excessive sound level. Activation of the horn as sensed by an appropriately located pressure switch shall cause the bell control in Section 32.12 and the auxiliary light control in Section 32.17 to operate as approved by Amtrak.

h). All valves, switches and controls shall be completely accessible for maintenance. Details of the horn installation shall be approved by Amtrak.

32.12 Bell

a). An electronic bell shall be located under the Cab car near the F-end. Its mounting location shall minimize the accumulation of snow and ice in either travel direction.

b). A momentary contact two position (On/Off) yellow push button control switch shall be located on the left side of the Engineer's console.

c). The method of actuation shall be approved by Amtrak. Activation of the bell shall cause the auxiliary light control in Section 32.17 to operate as approved by Amtrak. All switches and controls shall be completely accessible for maintenance. Details of the bell installation shall be approved by Amtrak.

32.13 Miscellaneous Cab Items

a). The following shall be provided in each cab and require approval by Amtrak, exceptions for standardized cab subject to Amtrak approval:

i). A Cab Signal/ACSES/I-ETMS and provisions for ITCS and IITS for the Engineer, and I-ETMS display screens for the Assistant.

ii). White reading lights using LEDs for both Engineer and Assistant, with individual switch controls.

iii). Alerter system and both dashboard and foot pedal reset switch.

iv). A ceiling air diffuser, a floor heater element and a forced air heater or radiant heat system as approved by Amtrak.

v). A Conductor communications signal system pushbutton and alarm shall be located in the cab, along with a crew intercom speaker with integral volume control which cannot be muted.

vi). The cab windshield shall be heated electrically with a clear film.

vii). A permanent car number identification plate shall be applied to the console in a prominent location near the speedometer.

viii). Three flush, heavy-duty, spring loaded coat hooks with integral rubber bumper shall be located on the rear partition.

ix). One 8.5 in. by 11 in. (216.9 mm by 279.4 mm) "blue form" inspection card frame with transparent cover, conforming to FRA document size requirements, shall be located on the inside face of the rear partition electric circuit breaker locker door, as directed by Amtrak and in accordance with 49 CFR Part 229.23(d).

x). An 8.5 in. by 11 in. (216.9 mm by 279.4 mm) "air slip" inspection form holder for a daily inspection form shall be located on the rear partition wall near the cab door.

xi). Clipboard-type spring loaded holders shall be installed with clear areas sufficient to hold 8.5 in. by 11 in. (216.9 mm by 279.4 mm) bulletin orders shall be located within easy reach of the Engineer and Assistant. Spring loaded holders shall be replaceable.

xii). A cup holder to retain a large coffee cup or soft drink container shall be mounted on the side wall below the side window sliding sash and forward of the Engineer's seat. It shall be a rugged design with a bottom drain hole, designed for ease of cleaning. A similar cup holder will be provided for the Assistant.

xiii). One 120VAC grounded duplex GFI-protected receptacle, protected for 20 amps service, and a 74VDC receptacle, shall be located in the lower cab wall.

xiv). Flat writing surfaces sufficiently large to hold 8.5 in. by 11 in. (216.9 mm by 279.4 mm) paper shall be located directly in front of the Engineer and Assistant, at the base of the windshield, in order to permit the Engineer or Assistant to write Track Warrants and Form D papers. These surfaces shall also be sufficiently large to allow a (10 in. by 15 in.) laptop computer to be used by maintenance personnel.

xv). For train crew use during backing movements, a two-position key switch operated by a standard coach key shall be included in the cab console in an approved location, for use by the Conductor and train crew in a trailing cab of the train. When this switch is turned 90 degrees to the right, it shall activate the controls for the headlights, cab ceiling lights and cab gauges and the communications system (radio, public address and crew intercom). The key shall be captive in the on position.

xvi). For train crew use during backing movements, a conductor's emergency brake valve shall be provided in an approved location. It may be located immediately outside the cab door.

xvii). A flag holder and a fireproof closed metal container for fuses shall be provided in accordance with 49 CFR Part 229.119(f).

xviii). A small trash container, approximately 18 in. by 12 in. by 6 in. (457.2 mm by 304.8 mm by 152.4 mm) in size shall be provided that uses a standard-sized trash liner.

xix). Exterior FRA marker lights at end of the car, with the lights at the cab end controlled by a switch on the cab console.

xx). Appliances, fully loaded, shall be restrained against accelerations of up to: 8g in the car longitudinal direction, 4g in the car lateral direction and 4g in the vertical direction with an approved restraint system.

xxi). A refrigerator shall be provided with a minimum capacity of 2 cu ft.

32.14 Cab Controls

a). Arrangement of Controls

i). The Engineer's cab shall feature a desk-type, primary control console centered below the Engineer’s windshield, with an additional vertical instrument and control panel located to the Engineer’s right by the cab corner, and to the left.

ii). The layout of the cab shall be coordinated with Amtrak, shall be incorporated into the cab mock-up and shall be subject to review and final approval by Amtrak.

iii). Consoles and panels shall be neat in appearance, with all equipment, indicators, devices and controls arranged in an orderly manner.

iv). The console and panels shall be constructed of a stain, burn and corrosion-resistant, integrally colored, non- glare material as approved by Amtrak.

v). The console cabinet color and design shall match the adjacent cab lining scheme.

(1) Indicator and annunciator lights shall be positioned centrally to the Engineer's forward line of sight, arranged so they do not cause reflections in the Engineer's windshield, shaded against direct sunlight and readily visible under all ambient light conditions, and provided with intensity adjustment capability.

(2) The cab console shall be illuminated for day and night operation without causing reflections on the windshield.

vi). The console lighting shall be located so as to properly illuminate all switches and gauges necessary for train operation and shall be LED dimmer controlled.

vii). The consoles shall be designed and shaped in such a manner to permit the Engineer or Assistant to open and lean out of the cab side windows to inspect the train.

(1) The center console shall extend to the bottom of the windshield (no dead areas in cab to collect debris and dirt).

viii). The arrangement of controls to satisfy the ergonomics of a wide range of Engineer physical sizes (from the 95-percentile male to the 5-percentile female) shall be given particular attention by the Contractor.

ix). The speedometer, cab signal aspect display unit, I-ETMS CDU, car number sign and air pressure gauges shall be positioned from the horizontal to 15 degree downward range of a 50th percentile adult male Engineer's eye position.

x). The Contractor shall also provide provisions for the ITCS CLD.

xi). Locomotive traction power shall be controlled by the Engineer by means of a master controller, positioned for ease of operation by the left hand, which shall contain a reverser control handle and a controller handle for power level selection. It is desired that the master controller shall generally be patterned after the ACS-64 locomotive units now in use on Amtrak.

xii). The cab console must provide sufficient space for reverser handle movement. Braking shall be controlled by the Engineer by means of a brake controller, located for ease of operation by the right hand. Between the two controllers shall be a flat area suitable for use as a writing surface by the Engineer.

xiii). The cab master controller key shall be used by the Engineer to activate the cab electrical controls and propulsion system master controller.

xiv). The vertical instrument and control panels flanking the windshield shall be arranged to be angled toward the Engineer, so that critical displays are located at a 90° angle to the Engineer’s field of view. All indicators and annunciator lights shall be LEDs, which shall have a lamp test feature.

xv). All operating controls displays, and all indicators shall be positioned within the Engineer's normal reach and normal line-of-sight when seated.

(1) Controls or indicators, associated with a specific side of the train, shall be positioned on the associated side of the console or indicator panel. Cab Signal/ACSES ADU, IETMS CDU and provisions for future ITCS CLD will require an HMI study. **[CDRL 32-02]**

xvi). All displays, switches, controls and indicators on the control console or adjacent panels shall be rugged, high-quality devices suitable for rail vehicle application and readily available from commercial sources.

(1) A minimum number of different types of devices shall be used, and individual functional designations shall not be marked on the device.

(2) Designations shall be permanently attached to or engraved on the console. Multi-position controls shall have all positions identified. Adhesive bonded tags shall not be permitted.

(3) All device types shall be subject to approval by Amtrak.

(4) See Table 32-1 at the end of this Chapter for control locations. Note that the Switch Type/Colors in the table are representative, acceptable parts; the Contractor may propose using equivalent parts or locations subject to Amtrak approval.

b). Center Console

i). The center console located in front of the Engineer and Assistant at the bottom of the windshield shall be generally arranged as a flat desk sloped downward toward the user.

ii). All control devices shall be logically installed to provide an integrated appearance. Mounting hardware and all interface connections for the propulsion and braking controllers shall provide ease of access for maintenance or removal. The console shall be designed so that liquid spilled on the surface will not damage or interfere with operation of components, apparatus, equipment under the console, or wiring. Its finish shall be easily cleaned with a soap and water solution.

iii). The Engineer's side center desktop console shall contain the following, generally from left to right:

(1) Bell ringer pushbutton switch (On/Off)

(2) Master controller

(3) Sanding switch/push button

(4) Writing space for train orders

(5) Headlight control switch

(6) Cab Signal/ACSES, acknowledge pushbutton and ITCS provisions

(7) Horn control valve lever

(8) Reading light/cab lighting rocker switches and dimmers

(9) Brake controller with integral display screen

(10) Auxiliary light control switch

(11) Windshield wiper control

c). Other Controls, Switches and Gages

i). The following controls, switches and gages shall be positioned at appropriate locations in proximity to the Engineer to provide optimum access to the Engineer, with minimal hindrance to visibility.

(1) Potential areas include the vertical control panel on the right and the upper panel. Alternate arrangements for a standardized cab may be proposed, subject to Amtrak approval.

(2) Fault display panel

(3) Conductor communicating signal pushbutton switch

(4) Fault reset switch

(5) Gauge LED dimmer control

(6) Heated windshield switch

(7) Cab HVAC control

(8) Car number plate (at optimum viewing location)

(9) Two duplex air gauges (at optimum viewing location). Digital representation of air gauges can be proposed for review and Amtrak approval.

(10) main reservoir/equalizing reservoir

(11) brake pipe/brake cylinder

(12) Radio and communications control

(13) Emergency engine shutdown pushbutton (This button shall shut down a diesel or electric locomotive)

(14) Locomotive alarm bell silence pushbutton switch (bell inside panel)

(15) Main circuit breaker (electric) toggle switch

(16) Pantograph Control

(17) Bulletin order clipboard

(18) Cab signal departure test panel

(19) Cab signal cutout and bypass switches

(20) Cab signal train type selector switch

(21) Indicator LED and annunciator panel

(22) Alerter acknowledgement button, yellow

(23) Alerter panel

(24) Speedometer

(25) Non-cab signal territory mode switch

(26) Marker light switch

(27) Headlight/auxiliary light status indicators (centered)

(28) Locomotive dynamic brake/wheel slide warning buzzer

(29) Locomotive alarm bell pushbutton switch (bell inside panel)

ii). The following switches are to be sealed in the normal (down) position using a secure plastic tie seal method. A 0.1015 in. (2.5781 mm) (No. 38 drill) diameter hole shall be provided in each switch toggle and in an adjacent sealing wire standoff for each switch:

(1) Propulsion/doors interlock bypass switch

(2) Propulsion/ADA interlock bypass switch

(3) Cab Signal, ACSES, I-ETMS, ITCS and IITS cut out switches

(4) Spare switch location

(5) Train control bypass

(6) Alerter

iii). Ideally, a vertical control panel to the left of the Engineer shall be avoided to provide improved visibility.

iv). The area above the windshield shall be used for infrequently used devices, if required.

d). Desktop Console – Assistant's Side

i). The Assistant's desktop console will contain the following equipment and controls with deviations approved by Amtrak through the design review process:

(1) Bell pushbutton (On/Off)

(2) Modulating horn valve with cushioned lever

(3) Conductor's Emergency brake valve

(4) Track warrant holder with spring clip

e). Other Controls, Switches and Gages – Assistant's Side

i). The Assistant's side will contain the following equipment and controls with deviations approved by Amtrak through the design review process:

(1) Radio handset, control panel and handset storage cradle

(2) Radio keypad

(3) Car number plate

(4) Reading light switch

(5) Ceiling light switch

(6) Speedometer

(7) Cab reading light dimmer

(8) Cab Signal/ACSES display units, and provisions for I-ETMS, ITCS and IITS display units

f). Lower Cab

i). The area under the console and above the floor shall be clear of all piping and obstructions to provide room for the Crew members' feet and legs.

ii). A raised platform, approximately 6 to 8 in. (152.4 to 203.2 mm) above the floor, shall be provided in front of the cab seat.

iii). An approved full-width footrest, e.g., stainless steel tubular bars for both the Engineer and Assistant, at least 9 in. (228.6 mm) long shall be provided.

iv). Foot switches specified by Amtrak shall be installed on the Engineer's side.

v). A properly identified and recessed horn system pneumatic cutout cock and associated pressure switches (if provided) shall be located below the center console or similar location where it can be easily reached by the Engineer.

g). Master Controller

i). The propulsion commands for the train shall be produced by manipulation of a compact, all electric master controller provided in each cab. Activation of the master controller and the cab controls shall be accomplished by use of the reverser handle.

ii). The proper ergonomics of the design and operation of the master controller is of great importance and shall be approved by Amtrak.

iii). The master controller shall directly produce trainline command signals through the actuation of heavy-duty cam switches.

iv). The camshaft shall be directly driven by a single handle to control all operations of the propulsion system.

v). A mechanically interlocked reverser activated by the reverser handle driving a smaller camshaft shall select the direction of motion.

vi). The master controller handle axis of rotation shall be horizontal, with an ergonomically comfortable arc travel.

(1) The controller shall be rugged and designed for the railroad or transit cab environment.

(2) Rubbing surfaces shall be enclosed to exclude dust and dirt. Internal components shall, as much as possible, consist of parts common to the propulsion system of other recently produced cars, and where not possible shall be of an equal quality level.

vii). The master controller top plate shall be removable without any disassembly of the controller mechanism other than handle and knob removal.

viii). An alternate master controller may be proposed for a standardized cab, subject to Amtrak approval.

ix). The master controller shall have a coast position, which shall be closest to the Engineer, and eight power positions (power level 1-8).

(1) Each position shall have a medium detent tactile indicator sufficient for the Engineer to sense that the controller contacts are fully closed. The coast position shall have a more noticeable detent that is readily detectable.

x). The controller top shall have approved raised and painted markings to easily identify each position. Power shall be applied by moving the handle forward away from the Engineer. The master controller handle shall not have a deadman feature.

xi). The Contractor may provide a cruise control feature, subject to Amtrak approval. The design interface between the master controller and brake controller/system shall prohibit any braking application when the master controller is in propulsion notches 1-8.

xii). The reverser and main controller handle shall be interlocked mechanically as described below.

(1) The main controller handle shall be permanently attached.

(2) It shall be possible to move the reverser handle only with the master controller handle in the coast position. With the reverser handle in the neutral position or in the off position, the master controller handle shall be mechanically immobilized in the coast position.

xiii). The mechanical interlocking mechanism shall be robust and require no lubrication, cleaning or maintenance other than at the major overhaul periods for the rest of the car equipment.

xiv). The electrical connections between the controller and the car wiring shall be by means of electrical connectors per Chapter 19.

xv). The controller shall be bolted to the cab. The bolts shall have open access, and the entire controller shall be easily removed and replaced for maintenance purposes. The details of the controller shall be approved by Amtrak.

h). Control Functions

i). The reverser handle interface of the master controller shall have four positions, out, reverse, neutral and forward, and shall control other cab equipment (other than the cab air brake system) to produce the following functions.

(1) In the out position, the cab shall have all cab operating systems de-energized other than the train control systems, and the master controller handle shall remain mechanically locked.

(2) In neutral, all operating systems other than propulsion control shall be powered.

(3) In forward and in reverse, all systems shall be operable. The reverser handle shall be removable in the out positions. The cab air brake

system shall be controlled by the brake handle controller, per Chapter 9.

ii). Circuits needed to establish the controlling cab and provide the interface with all the other car systems, such as doors, annunciators, etc., shall be carefully designed for safety, reliability and simplicity. Since such circuits can contain single-point failure locations that are capable of incapacitating a cab or a train, the Contractor shall treat them as a subsystem worthy of special attention and include consistency check diagnostics. In evolving its designs, the Contractor shall treat the need to operate from other than the lead cab of the train as potentially hazardous and as a solution of last resort. The Contractor shall prepare a document which contains four items for Amtrak's approval during design review **[CDRL 32-03]**:

(1) An analysis of potential failures, their operational importance and how they will be annunciated to Amtrak.

(2) Explanation of how each of the identified failures can be overcome by the train crew, i.e., what provisions have been incorporated in the design for reestablishing train operability.

(3) Explanation of how the recommended troubleshooting procedures, test equipment supplied, and features of the basic circuit design will direct the attention of maintenance personnel to the point of failure.

(4) A Preliminary Hazard Analysis (PHA) and Failure Mode and Effects Analysis (FMEA) to confirm that no hazardous failure modes exist.

iii). Alternate arrangements for a standardized cab may be proposed, subject to Amtrak approval.

i). Audible Alarms

i). All required audible alarms and signals shall be electronic and shall be provided in the cab, located so as to be clearly audible to the Engineer and Assistant under conditions of loud ambient noise, and be readily accessible for maintenance.

ii). Audible signals requiring different actions shall have different sounds as specified below. Audible signals shall be no louder than necessary to be clearly audible in the cab under worst case conditions such as passing another train in a tunnel. The final audio levels shall be determined during acceptance testing.

iii). Provisions shall be provided to announce a digital verbal one-time message to the Engineer and Assistant at the beginning of each of the below audible alarms. This functionality shall be non-vital and not integrated in any manner with the system being announced. There shall be a volume control settable by the Engineer for these messages. The minimum db setting is to be determined by Amtrak.

(1) Cab Signal - TBD at Design Review

(2) ACSES - TBD

(3) I-ETMS - TBD

(4) ITCS - TBD

(5) Engine Fire activation alarm - 2.9 KHz intermittent fast pulse tone

(6) Conductor communicating signal (Buzzer) 4.5 KHz continuous tone

(7) Wheel slip/brake warning (Sonalert) 1.9 KHz continuous tone

(8) Alerter audible alarm (yelp) - TBD

(9) Overspeed Alarm - TBD

j). Indicator Lights

i). The indicator lights shall be provided in the left and right-side panels the approved locations and groupings.

ii). Each indicator shall be backlit with the specified color when illuminated.

(1) It shall be possible to change the indicator color at a later date if required.

iii). Activation of each indicator must be clearly discerned by the Engineer even under conditions of bright sunlight or other ambient illumination.

iv). Each indicator shall be a long-life LED. Note that some cab signal system indicators will be contained in the alerter display unit.

Light Group	Condition	Indicator Light Color
Operating Status Indicator	MU Control (power on)	Green
	PCS Open	White
	Sanding (Cab Car)	White
	Wheel Slip / Slide (Cab Car)	White
	Wheel Slip / Slide (Locomotive)	White
	Dynamic Brake Warning	Red
	Trailing Fault Alarm	Red
	Overspeed	Red
Safety Equipment Status Indicator	ATS Overspeed/Penalty	Red
	Alerter Cut-Out	Red
	Suppression	Amber
	No Motion	Blue
	Spare	Red
Cab Car Status Indicator	Heated Windshield On	Amber
	HEP On	Blue
	HEP Off	Red

	Battery Charge Fail	Red
	Spare	Red
	Spare	Amber
Train Status Indicator	Brakes Applied	Amber
	Brakes Released	Green
	Car Doors Closed	Green
	Car Hot Journal Alarm	Red
	Handbrake Applied	Blue

32.15 Electrical Circuits

a). Cab Switch Panels

i). Low voltage cab setup switches, circuit breakers, etc. shall be mounted on a panel on the upper console in the cab or an approved equivalent location, accessible to the seated Engineer, in a location approved by Amtrak. All devices will be clearly labeled by name and position.

ii). Switches shall be provided, at a minimum, for the following with deviations as approved by the customer through design reviews:

(1) Circuit Breakers

(a) Locomotive control

(b) Heated windshield

(c) Auxiliary lights

(d) Number signs

(e) Voice Radio

(f) Indicator and gauge lights

(g) I-ETMS

(h) I-ETMS Data Radio

(i) Cab Signal/ACSES

(j) ACSES Data Radio

(k) ITCS

(l) Event recorder (load side connected to battery)

(m) Alerter (load side connected to battery)

(n) Low voltage DC receptacle

(o) Headlights

(p) MU 13T

(q) Aux Cab Heater (low voltage DC)

(r) ECP Brake system

(s) Spare

(2) Switches

(a) Engine run

(b) Engine shut down button

(c) Generator field

(d) Door interlock bypass switch (sealed)

(e) Headlight

(f) Marker Light

(g) Pantograph Up/Down

(h) MCB Open

(i) Cab Light

(j) Order Light

(k) Aux Cab Heat

(l) Number Lights

(m) Step Lights

(n) Territory Switch Cab/Non-Cab

(o) ITCS Territory

(p) Train Control Territory Selector

(q) Windshield Wiper/Washer

(3) HVAC Controls

(a) Low Heat

(b) High Heat

(c) Fan Low

(d) Fan High

(e) Low Cool

(f) High Cool

(4) Cut-Out Switches

(a) Dynamic Brake

(b) Alerter

b). Propulsion (MU) Control Circuits

i). Trainline Requirements

(1) Cab Cars will be used to control a locomotive used to propel the train in Push mode.

ii). Trainline circuit protection

(1) A two pole, 20-amp circuit breaker shall be provided between the number 13 (positive control) and number 4 (negative control) MU control trainlines.

(a) This circuit breaker shall protect the cab equipment from faults in the MU trainline system and shall be used to provide an on/off switch function to activate or deactivate the cab.

(b) A green MU control power indicator light shall be provided on the load side of this circuit breaker, to provide the Engineer an indication that MU trainline power is available from the locomotive.

(c) Alternative circuit arrangements may be approved by the customer after design review.

c). Power Knockout functions

i). Power knockout (PKO) to disable locomotive propulsion shall occur in response to emergency or penalty brake applications in the Cab car.

ii). The MU propulsion control system shall remove traction power by de-energizing MU Control trainlines 6 (GF), 15 (AV), 12 (BV), 7 (CV) and 3 (DV), and illuminate the "PCS Open" indication on the cab console. Operation of this interface will be subject to design review.

iii). To restore locomotive traction from an emergency brake application after PKO occurs, the Engineer must be required to perform the following actions:

(1) Place brake handle in emergency brake position;

(2) Wait for brake system timeout from the application of emergency brakes;

(3) Place throttle handle in coast;

(4) Move brake handle to release position; and

(5) Move throttle handle to a power position.

iv). To restore locomotive traction from a penalty brake application after PKO occurs, the Engineer must be required to perform the following actions:

(1) Place brake handle in suppression position;

(2) Place throttle handle in coast;

(3) Perform actions that satisfy the system that initiated penalty (i.e., acknowledge alerter)

(4) Move brake handle to release position; and

(5) Move throttle handle to a power position.

d). Digital Trainline

i). The Contractor shall provide a digital trainline.

ii). Digital trainline shall provide redundancy and other non-critical functions such as passenger information displays, announcements, video, computer networking, system monitoring and data logging.

32.16 Heating, Ventilation and Air Conditioning

a). Climate Control

i). The cab shall be provided with a quiet, forced air supply of conditioned air from the car's main HVAC system (or separate cab HVAC system, at Amtrak's request), along with a separate cab heater system. See Chapter 10 for additional details.

ii). Full climate control with air supply through an individual fully adjustable ceiling diffuser shall be provided.

iii). The local cab heater shall be controlled independently of the HVAC unit using the car battery, with an adjustable digital thermostat control. Care shall be taken to avoid all drafts. The Cab HVAC system shall provide sufficient heat automatically when 480 Volts Head End Power is available to keep the cab temperature similar to the passenger car interior.

b). Air Distribution

i). The cab shall have durable individually adjustable diffusers for the Engineer and Assistant with manual direction and volume, infinite adjustment between maximum and minimum air volume and direction.

ii). The diffusers shall not create drafts on the Engineer's or Assistant's back or neck.

(1) The diffusers shall not allow complete blockage of the cab air.

(2) The volume of conditioned air delivered to the cab through each diffuser shall not exceed 30 cubic feet per minute (cfm) (0.85 m3/min) when the diffuser is in a minimum position and shall be a minimum of 175 cfm (4.96 m3/min) when the diffuser is fully opened.

(3) Other arrangements meeting the intent of this specification may be proposed for approval.

32.17 Cab Lighting

a). Headlights and Auxiliary Lights

i). Two LED headlights located at the upper center of the carbody, and two LED auxiliary lights located approximately at the bottom of the end sheet, one toward each outboard edge, shall be provided at the F-end of Cab Car using approved fixtures, located such that they produce a triangular lighting appearance.

ii). The lights shall be suitable located to prevent damage when the F-end of the Cab car is coupled to other equipment (including another Cab car) and operated under all track conditions identified in PRIIA Specification 305-912.

iii). The fixtures shall comply with the requirements of 49 CFR Parts 229.125 and 229.133. All exterior lighting shall be powered from the low voltage power supply. All lamps shall be designed for ease of replacement from the car interior by access hatches, unless otherwise approved by Amtrak.

iv). All lighting fixtures shall be weather tight, of stainless steel construction and hardware. Fixtures shall be designed to avoid snow and ice buildup and preclude snagging of car washer brushes.

v). Headlight and auxiliary light lenses shall contain thermostat-controlled heating elements to protect against frosting, or be recessed behind heated cover heaters.

vi). Materials surrounding and facing the headlights and auxiliary lights, including a coupled car, shall be capable of withstanding the heat caused by leaving these lights on bright indefinitely on a clear summer day with maximum ambient temperature.

vii). The headlight and auxiliary lights shall comply with 49 CFR Part 229.125 and AAR standard for LED headlights.

(1) The color temperature shall be between 2600K and 3200K unless otherwise approved by Amtrak during Design Review.

viii). Failure of a single lamp shall not cause the other lamps to be subjected to increased voltage. Rated lamp life shall be a minimum of 50,000 hours.

ix). The headlight and auxiliary light fixtures shall be easily adjustable for horizontal and vertical alignment and shall be provided with a locking device. Bezel design shall assure correct rotational alignment. The design and location of the light fixtures shall be approved by Amtrak.

x). The headlights shall be under the control of an easily-reached Engineer's cab console mounted four position switch (off, bright ditch, bright, dim).

(1) The headlight switch in the bright position shall automatically turn on the ditch lights. In auto flash position, the auxiliary lights will flash in accordance with 49 CFR Part 229.133.

(2) In all three operating modes the sounding of the horn or activation of the bell, as detected by a pressure switch downstream of the horn or bell control switch, shall cause the auxiliary lights to immediately flash alternately until the bell is silenced

(3) A set of four green indicator LEDs telltales in an approved arrangement shall be provided in the cab above the windshield to indicate the functional status of each headlight and auxiliary light bulb (on steady, flashing, etc.).

(4) An approved momentary contact switch shall be provided to permit the Engineer to dim the auxiliary lights for an adjustable time period, initially set for 20 seconds, to avoid blinding an oncoming train Engineer.

(5) The exterior lighting layout submittal will be subject to Amtrak's review and approval during the design review process. **[CDRL 32-09]**

xi). All cab switches shall be clearly identified with permanent labels.

b). Interior Cab Lighting

i). For general area illumination, the cab area shall have at least two white lens light fixtures, suitably placed in the ceiling to illuminate the Engineer's console, Assistant's console and the general cab area and avoid glare on the windshield.

ii). LED light fixtures shall be used.

(1) These lights shall be controlled by a rotary dimmer control switch.

(2) The minimum lighting intensity provided by the white ceiling lights shall be 15 foot-candles on both the floor and the console.

iii). For reading purposes, 5 additional lights shall be located in the console as approved by Amtrak during design review process.

(1) The reading lights shall be controlled by a rotary dimmer control switch. These lights shall not reflect onto the windshield or interfere with outside observation during night operation and shall be capable of location adjustment by the Engineer/Assistant.

iv). All lights shall be powered by the battery circuit. All light fixtures shall be dust tight, designed for ease of relamping. The type and location of the lights shall be approved by Amtrak.

v). The duplex air pressure gauges and the speedometer illumination shall be dimmable.

vi). All non-essential buttons and switches which are illuminated shall have the option to turn off the backlighting for night operation or hardware light diffusers.

c). Road Number Signs

i). Two illuminated back lighted road number signs shall be provided at the F-end of the Cab car, arranged to be easily visible from the wayside. Signs shall be located on each side of the car as near to the cab end as possible and shall be located on the front cab F-end at an approved location.

ii). Each number sign shall have four (4) digits. The digits in the number signs shall be at least 5 in. (127mm) high.

iii). The design and location shall be approved by Amtrak.

32.18 Alerter and Event Recorder System

a). Alerter System

i). The Engineer's activities shall be monitored over a specified time period as listed in 49 CFR Part 229.

(1) If the Engineer is inactive during this time period and no system reset is generated, the alerter system display shall issue a combination pulsing audible/visual alarm for a specified time interval.

(2) Continued lack of Engineer activity shall result in a continuous audio alarm, a continuous visual alarm and a penalty brake application with power knockout.

ii). It shall be possible to perform a self-test of the system with the car stationary. If the alerter system fails, the Engineer shall be able to cutout the system through the use of a sealed switch or sealed cutout cock. Activation of the alerter cutout shall provide an indication on the cab console indicator.

b). Event Recorder

i). The event recorder system location shall be approved by Amtrak.

ii). The event recorder shall be Wi-Tronix VIOLET 800.

(1) The line side of the event recorder circuit breaker shall be connected to the Cab Car battery.

(2) Event recorder data shall be downloadable via a standard laptop computer, remote memory card download ports or wirelessly. The event recorder shall be easily identified following an accident.

(3) All Vehicle Fault conditions should be communicated over the communications network and integrated with Wi-Tronix VIOLET.

iii). Amtrak shall approve the actual channels of data to be recorded during design reviews.

iv). The event recorder shall be crash hardened and be in full compliance with 49 CFR Part 229.135.

v). Reasonably secure and tamper resistant means that the system shall have data retention during extended loss of power to the system, provide physical protection during vehicle catastrophic occurrences, be flame resistant and contain constraints against accidental or deliberate data erasure or overwriting. Incorporating data streams from the following systems: I-ETMS, ACSES, ITCS, ECP and Inward/Outward Cameras, shall be discussed during the design review process. Vehicle control system architecture submittal will be subject to Amtrak's review and approval during the design review process. **[CDRL 32-10]**

c). Positive Train Control (PTC)

i). Amtrak requires several different types of Positive Train Control (PTC) systems, including a Siemens Advanced Civil Speed Enforcement System (ACSES), Wabtec Interoperable Electronic Train Management System (I-ETMS) and KB-Signaling Incremental Train Communication System (ITCS).

ii). Each Cab car shall be designed to be equipped with these three Positive Train Control (PTC) systems. Each PTC system shall conform to all applicable Amtrak, AAR, APTA, and FRA Standards and Code of Federal Regulations (49 CFR), and be fully functional and interoperable with the host railroads where Amtrak trains operates.

iii). The vehicle shall include an overspeed function.

(1) Overspeed shall be provided for operations above 79 mph if the PTC system is disabled.

(2) Should the car with the active cab exceed the allowed speed, the overspeed indicator will flash. After 3 MPH overspeed there will be a Power Knock Out and at 4 MPH overspeed a penalty brake will occur.

iv). To recover brake control, the brake controlled must be brought to suppression position and the train brought down below overspeed. After the PCS light goes out, the brakes can then be released. It is not necessary to stop the train. Overspeed will be dormant when the brake valve is cutout.

(1) It shall be possible to do a self-test on the overspeed when the car is stationary. Adjustment for wheel size shall be done easily.

v). Positive Train Control System Architecture submittal will be subject to Amtrak's review and approval during the design review process. **[CDRL 32-11]**

d). Cab Signal/ACSES

i). The Contractor shall provide a fully tested, Amtrak approved, Siemens combined Advanced Civil Speed Enforcement System (ACSES) and Nine (9) Aspect Cab Signal System that complies with 49 CFR Part 236 Subpart I and H.

ii). The Cab Signal/ACSES system shall comply with Amtrak's latest hardware and software revisions and include the latest Secure Positive Train Stop Release functionality.

iii). The Contractor shall provide and install Sti-Co HDLP-NB-220 216–218 MHz antenna, a single Cellular/ GPS/Wi-Fi Antenna capable of 5G LTE connectivity, GNSS/GPS and Wi-Fi antenna. A Polyphaser RRF-ACE-220-NFF (217-219MHz) Narrowband Filter shall be used for the ACSES 220 Radio.

iv). Amtrak will provide the Contractor a fully operational ACSES Communication Package (ACP), and/or a Mobile Communication Package (MCP) consisting of a 220MHz data radio, and cellular modem/router. The functionality of the Contractor's prototype Cab Signal and ACSES systems shall be validated.

v). The Contractor shall host design reviews with Amtrak during the design and installation of this system.

e). I-ETMS

i). The Contractor shall provide a full Wabtec Interoperable Electronic Train Management System (I-ETMS) and all ancillary equipment including two (2) Polyphaser RRF-ITC-219-NFF (219.5-222MHz) Narrowband Filters.

ii). This system shall be tested using the Wabtec Validation Test Procedure prior to delivery to Amtrak. Amtrak will supply the I-ETMS TMC Slot 10 software image, MeteorComm 220 MHz Data Radio, Wabtec Ancillary Card Cage.

iii). The TMC used shall be a 41015 that includes a CPU Slot 4.

iv). GoLINC Precision Navigation Modules (PNMs) with Wabtec Tri-Mode 5G Cell/GNSS/Wi-Fi antennas shall be used in place of the standard NSMs.

v). An additional CDU shall be provided for the Assistant.

vi). Two speed sensor inputs for I-ETMS shall be provided to meet requirements of Wabtec I-ETMS Protect.

vii). The Contractor shall host design reviews with Amtrak during the design and installation of this system.

f). ITCS Provisions

i). Provisions shall be made in the design of the cab to allow full equipment space for installation of an Alstom Incremental Train Control System (ITCS) including the location and mounting of equipment and Engineer/Assistant displays.

ii). Provisions shall be made for conduits, switches, antenna, active speed sensors and other required items as required.

iii). The ITCS Systems must be tested to the extent practical with the associated OEM supplied hardware and software.

iv). The ITCS shall also contain an inline Polyphaser RRF-ATC-220-NFF (217-219MHz) Narrowband Filter. The Contractor shall supply Amtrak validation test reports prior to removing the hardware for shipment. **[CDRL 32-04]**

g). Data Collection

i). Train operating parameters along with train control data shall also be provided to a Crash Hardened Event Recorder (CHER) in accordance with 49 CFR 229.135 and 236. Minimum scan rate occurs as a result of a change in any train operating parameter or any train control system event.

ii). Data retained shall cover a period of at least 48 hours in normal railroad operation. Recorded data will be capable of conveniently being downloaded on demand to a compatible computer, memory device or wirelessly.

h). Data Retrieving

i). Event recorder download capability shall be available at any time, including when the train is not in motion. Train operating data shall also be retrievable to monitor operational performance.

ii). Downloaded data shall be in compliance with 49CFR229.135 and approved by Amtrak. The format of downloaded data shall also in compliance with 49CFR229.135 and approved by Amtrak.

i). Delivering

i). Prior to the delivery of the first cab car, the Contractor shall deliver to Amtrak one complete set of all system diagnostic software with license as agreed per service contract to Amtrak to use the software, required for retrieving and manipulating the recorder data, all proper download connection cables and memory devices. Instructions for using the software will be provided.

ii). The software packages shall incorporate all methods to download data.

iii). All deliverables shall comply with the Materials and Workmanship requirements of Chapter 19 and shall be updated as required until the expiration of the warranty period. Any further costs or restrictions associated with this software to Amtrak are subject to agreements and service contracts between the Contractor and customer.

j). Speed Signal

i). The Contractor shall provide dedicated active speed signals for the speedometer, alerter, event recorder, cab signal/ACSES system I-ETMS, and ITCS systems as required for each individual system. Speed sensors shall be electrically isolated.

ii). The design of the speed sensor and associated wiring shall minimize the vulnerability of damage from wayside debris and be reviewed during the design process.

iii). Speed Sensor installation and mounting design shall not require any manual adjustment to meet air gap requirements.

32.19 Radio System

a). The Cab car shall be equipped with a Clean Cab 160 MHz VHF voice radio that is independent of the train's passenger communications systems. Amtrak Ritron Radio [RCCR-151-NX-AM] is required.

b). The voice radio shall consist of a single transmitter/receiver (T/R) including operation controls and a handset.

c). The radio shall be flush mounted in an approved location on the Engineer side of the cab.

d). The radio mounting shall be arranged to facilitate easy removal and replacement. The radio handset shall also be easily accessible to the assistant in a seated position or a second handset shall be provided. It is critical that the radio be located for ease of single hand operation by the Engineer. This shall be verified during design review and in the cab mock-up.

e). All wiring, connector plugs, and mounting systems shall be compatible with the Clean cab locomotive radios currently used by Amtrak.

f). The electrical power input of the Clean cab radio shall also be circuit breaker protected. The line side of the circuit breaker shall be connected to the car battery.

g). The mountings shall provide adequate access for servicing in compliance with AAR Specification 12-10, Figures 122-2 and 122-3. Sufficient cable slack shall be provided for ease of servicing or replacement. The Clean cab radio shall be mounted in the console panel in a way that allow easy replacement without removal of unrelated parts such as through slide-out or other methods approved by Amtrak.

h). A 160 MHz inline bandpass filter shall be installed to prevent RF interference with other systems. All equipment must meet or exceed the standards of the Electronic Industries Association and the rules and regulations of the Federal Communications Commission in addition to those specified herein.

i). The radio system components and design shall be approved by Amtrak.

j). Antennas

i). Low-profile voice, ACSES, I-ETMS, ITCS, Cellular, Wi-Fi, GPS and Violet antennas shall be installed on the roof. None of these antennas shall be shared.

ii). The coaxial cable from radio antennas shall be routed to the connected to radio transceiver through an inline, wideband and narrowband filters. Orientation of the antennas on the roof shall minimize damage from mechanical carwash brushes and maximize signal strength.

iii). The antenna shall be designed for severe environmental conditions. The antenna and coaxial cabling shall be approved by Amtrak.

iv). The voice and PTC antennas ground planes shall meet the suppliers' installation requirements including the recommended ground plane.

v). Sinclair products shall not be used.

k). Voice Radio Backup Power Supply

i). The cab voice radio system shall be powered from the low voltage power supply with automatic backup by the battery in the event of power loss and shall have sufficient capacity to meet all peak power requirements.

32.20 Locomotive Digital Video Recorder System

a). Inward/Outward Facing Camera Systems

i). The inward/outward facing camera systems shall be a Wi-Tronix VIOLET 800.

ii). There shall be a minimum of three (3) cab cameras to record the engineer's face, conductors face, general cab area including console switches and indicators, and the right-of-way forward facing camera in compliance with CFR229.136 and Transport Canada SOR/2020-178 Locomotive Voice and Video Recorder regulations.

iii). The right-of-way forward facing camera shall have a connected microphone for recording actuation of the horn and bell. The horn shall be clearly audible in recordings at 125mph vehicle operation, and the bell shall be clearly audible at 110mph or above. The forward-facing microphone shall not record conversation from the vehicle operators.

iv). The inward-facing cameras shall have integrated or connected microphones for recording cab conversation and shall meet the requirements in Transport Canada SOR/2020-178 Locomotive Voice and Video Recorder.

v). There shall be two (2) sideview cameras, one on each side for the engineer and conductor sides.

32.21 Train Communication and Data System

a). The onboard train communication and data system shall communicate wirelessly with Amtrak's Wi-Tronix Communication and Data System sever. This interface shall support at a minimum the following systems:

i). Event Recorder

ii). Cameras (Camera viewing area shall not be obscured by equipment, final placement to approved by Amtrak)

iii). Ride Quality

iv). GPS Coordinates

32.22 Cab Controls Testing

a). Proof of Design Tests

i). Train control, event recorder, train data system and video camera

(1) The train control system, event recorder, forward-facing camera, train data system and associated components in the cab car shall be subjected to qualification tests to verify that they comply with the requirements.

(2) As a minimum, these tests shall include complete functional tests before and after the equipment is subjected to the simulated environmental conditions such as appropriate extremes of temperature, vibration and shock. Tests shall also confirm resistance to interference limits as specified.

(3) Equipment so tested shall conform to the manufacturing drawings.

b). Operation of Positive Train Control (PTC)

i). Where cab signal and/or positive train control is provided, the Contractor shall develop proof-of-design test procedures that validate all systemic, operational and programming designs, functions and requirements for the Positive Train Control (PTC) system, including component performance, integrity of system architecture, data collection and retention functions, and train status evaluation. These procedures shall be developed in accordance with system requirements as established by the system manufacturer, the FRA and railroads, and shall include evaluation and verification of compliance with requirements for:

(1) Accurate determination of train location, speed, direction of travel and status of all operating systems;

(2) Communication to wayside signal systems and railroad data centers;

(3) System monitoring of train performance;

(4) Display of graphic data as received from the railroad;

(5) Initiation of service or penalty brake applications and locomotive PKO functions;

(6) Interface between the PTC system and on-board systems, including event recorders, train

(7) monitoring systems and others;

(8) Data recording, security and download requirements; and

(9) Compliance with all applicable regulations, standards and system requirements.

ii). Additional railroad-specific data transfer and uploading to the system may occur after the cars have been delivered to Amtrak if necessary. The PTC system as designed and installed shall be subject to review and approval by Amtrak, the FRA, Amtrak and representatives of the host railroads over which the cars will operate

c). Cab audio alarm levels performance

i). The audio level of all cab alarms: locomotive failure, wheelslip/brake warning, alerter, overspeed, PTC and conductor signal shall be tested to verify suitable loudness.

d). Event recorder (FRA) performance

i). Tests shall verify proper operation of the entire integrated system hardware and software. They shall show correct interpretation of each input, including combinations (such as throttle) through the use of the verifier function on a laptop. Resolution, set point and calibration of all analogue inputs shall be shown at zero, midscale and maximum values, which will include applying pneumatic pressure to those inputs by manipulating the brake system. All modes of downloading shall be demonstrated.

ii). After downloading, graphic and tabular readings shall be compared in detail to verify all channels show activity consistent with the test code and that graphic and tabular values of analogue functions match: speed, brake pipe, brake cylinder pressures at zero, full scale and mid-scale values.

iii). Operation of self-test and health monitoring functions shall be demonstrated. A disk of the download, labeled for car number and date, shall be provided for each car.

e). Event recorder-video performance

i). Tests shall verify operation of the entire integrated system hardware and software. They shall show correct interpretation of each input. Video focus and resolution, and other inputs shall be demonstrated.

ii). All modes of downloading shall be demonstrated. Software demonstration shall include validation of inputs and their calibration as a "real time" display as well as data analysis software playback. Operation of self-test and health monitoring functions shall be demonstrated.

f). Horn and bell performance

i). The horn shall be tested to verify compliance with FRA 49 CFR Part 229 loudness requirement. The bell shall be tested to measure loudness and proper continued operation.

g). Engineer’s Seats

i). The seat and its attachment shall be tested to verify compliance with 49 CFR Part 238.233 (FRA Tier I vehicle).

ii). The seat shall shall be tested to verify compliance with APTA Standard PR-CS-S-011-99

h). Emergency Egress/Ingress

i). Emergency Exit Windows Egress shall be tested to verify compliance with 49 CFR .238.113 and 49 CFR 238.121.

ii). Emergency Rescue Ingress shall be tested to verify compliance with 49 CFR 238.114 for windows and windshield.

32.23 Production Tests

a). Alerter Performance

i). Tests shall verify proper timing, operation of each input and output, including at various simulated vehicle speeds. They shall demonstrate all modes of operation, including self-test.

b). Speedometer/overspeed performance

i). Tests shall verify all modes of operation, including self-test. Each input and output shall be demonstrated.

ii). Calibration at zero, mid-scale and maximum speed shall be shown. Calibration and action at each overspeed set point shall be verified.

c). Event recorder performance

i). Tests shall verify operation of the entire integrated system hardware and software according to 49 CFR 229.135.

ii). They shall show correct interpretation of each input, including combinations (such as throttle).

iii). Resolution, set point and calibration of all analogue inputs shall be shown at zero, midscale and maximum values, which will include applying pneumatic pressure to those inputs. All modes of downloading shall be demonstrated.

iv). Software demonstration shall include validation of inputs and their calibration as a "real time" display as well as data analysis software playback, both graphic and tabular. Comparison of the graphic and tabular values must be included. Operation of self-test and health monitoring functions shall be demonstrated.

d). Locomotive Digital Video Recorder performance

i). Tests shall verify operation of the entire integrated system hardware and software according to 49 CFR 229.136 and Transport Canada SOR/2020-178.

ii). They shall show correct interpretation of each input. Video focus and resolution, and other inputs shall be demonstrated. All modes of downloading shall be demonstrated.

iii). Software demonstration shall include validation of inputs and their calibration as a "real time" display as well as data analysis software playback. Operation of self-test and health monitoring functions shall be demonstrated.

e). Positive train control system

i). Where provided, perform a test of the cab signal/PTC system in accordance with manufacturer and railroad requirements.

ii). Tests shall verify all modes of operation, including self-test. Each input and output shall be demonstrated. Calibration of pickup and drop out of each parameter of the carrier shall be demonstrated. Interaction with the brake system to produce a penalty brake application, with associated PCS shall be demonstrated, along with the inability to suppress it. Overspeed, failure to acknowledge and overspeed with failure to acknowledge shall all be demonstrated. Permanent suppression shall be demonstrated. Diagnostics and data-logger shall be demonstrated.

f). Locomotive and air brake control

i). Tests shall verify performance of the integrated system of cab controls, including traction and braking.

ii). They shall include complete demonstration of all interface signals between the brake equipment and other vehicle equipment. All inputs and outputs shall be exercised. Calibration and resolution of all analog signals at zero, midrange and maximum values shall be demonstrated. **[CDRL 32-02]**

g). Brake control operation

i). Note: All compressed air which is connected to the car or its air components shall meet the air quality requirements of APTA Standard PR-M-S-011-99.

(1) Calibration of air pressure gauges shall be verified, and values recorded

(2) Verify operation of each mode of operation shall be demonstrated, in accordance with OEM

(3) brake supplier test code, including but not limited to:

(4) Passenger mode, Freight mode (if equipped), Trail, Test

(5) Parking brake, including effect of cutting out automatic brake and penalty brake

(6) Calibration of brake valve settings of release, min, suppression, full service and emergency

(7) measured on brake pipe and brake cylinder. Values shall be recorded.

(8) Penalty application; non-suppressible and suppressible

(9) Emergency application; local and remote (all sites on car and remote in consist)

(10) PCS function

(11) Operation of pressure switches

h). Cab indicator operation

i). The test shall verify proper operation of all indicator lights and audio alarms.

i). MU and COMM trainline function operation

i). The test shall verify the correct transmit/receive function, including controls, indicators and alarms of each trainline wire. Interaction of PCS/PCR shall also be included.

ii). Windshield wipers operation

iii). The test shall verify proper operation of each wiper unit, including: smooth movement, sweep over the required area of the windshield, speed control, parking position, noise and freedom from air leaks. Also test proper operation of washer.

j). Defroster/heated windshield operation

i). Proper function of the defroster and heated windshield, their controls and indicators shall be verified. Windshield heaters shall have an auto turn-off feature to protect from overheating and potential damage.

k). Horn and bell operation

i). The test shall verify proper operation of devices and all controls, including automatic sequencer and speed input to it.

l). Cab and radio tests

i). Each cab radio shall be tested and adjusted to meet all technical parameters, and the proper certificates supplied in the vehicle history book. Additionally, the antenna shall be verified for conformance with its specified radiation pattern.

m). Headlight and crossing light tests

i). The headlights and crossing lights on each cab/baggage car shall be tested and adjusted in accordance with 49 CFR Part 229.125 for proper illumination, orientation, aim and operation.

32.24 Passenger Area (Option)

a). Overview

i). The passenger area shall be designed using the high capacity coach requirements found in this specification. The seating arrangement shall be modular, allowing flexibility to change configurations.

(1) Expected configurations are business seating, coach seating, long-distance seat pitch and short-distance seat pitch.

32.25 Passenger/Baggage Area (Option)

a). Overview

i). The baggage area shall be located behind the engineer's cab using the utility car requirements for the baggage area found in this specification with a minimum capacity of 1000 cubic feet.

ii). The passenger area shall be designed using the same coach requirements found in this specification. The seating arrangement shall be modular, allowing flexibility to change configurations.

(1) Expected configurations are business seating, coach seating, long-distance seat pitch and short-distance seat pitch.

32.26 Operators Manuals

a). The operator manuals submittal will be subject to Amtrak's review and approval during the design review process. **[CDRL 32-12]**

32.27 Test Matrix

Tests	**Type**	**Type**
Air Brake Test	Production/Acceptance	Acceptance
Event Recorder	Component/Production	Acceptance
Alerter	Component/Production	Acceptance
Positive Train Control (PTC) and/or Automatic Train Control (ATC) if equipped	Production/Acceptance	Acceptance
Cab Car Compatibility with the Locomotive	Production/Acceptance	Acceptance
Radio/PA	Component/Production	Acceptance
Headlights, Misc. Light Adjustment	Production	Acceptance
Horn Test per 49CFR 229.129	Production	Acceptance

32.28 CDRLs

CDRL	**Description**	**Due**
CDRL 32-01	Cab Mockup Development and Review	During PDR, IDR, & FDR
CDRL 32-02	Air Brake System Apparatus & Pneumatic Drawing	During FDR
CDRL 32-03	Cut-Out Cock Location Diagram(s)	During FDR
CDRL 32-04	Cab Installation & Arrangement – Design Detail	During PDR, IDR, & FDR
CDRL 32-05	Console Arrangement	During PDR, IDR, & FDR
CDRL 32-06	F-End Operator Line-of-Sight Drawing	During FDR
CDRL 32-07	Emergency Egress & Ingress Provisions	During PDR, IDR, & FDR
CDRL 32-08	Cab Seat	During PDR, IDR, & FDR
CDRL 32-09	Exterior Lighting Location Layout	During PDR, IDR, & FDR

CDRL 32-10	Vehicle Control System Architecture (Event Recorder)	During PDR, IDR, & FDR
CDRL 32-11	Positive Train Control System Architecture	During PDR, IDR, & FDR
CDRL 32-12	Operator Manuals Development Plan	During FDR

* End of Chapter 32 *

CDRL	Description	Due
CDRL 3-01	Project Management Plan (PMP)	NTP + 30 days
CDRL 3-02	System Integration Plan (SIP)	60 days prior to 1st PDR meeting
CDRL 3-03	Interface Control Document (ICD)	60 days prior to 1st PDR meeting
CDRL 3-04	Kickoff Meeting Presentation	At least 5 days before kickoff meeting and within 10 days of NTP
CDRL 3-05	Baseline Project Schedule (Baseline PS) and Narrative	NTP + 30 days
CDRL 3-06	Design Review Plan	NTP + 30 days
CDRL 3-07	Detailed Drawing Tree	30 days prior to 1st PDR meeting
CDRL 3-08	Compliance Matrix	Contract Award and 30 days prior to each design review
CDRL 3-09	Preliminary Design Review (PDR)	90 days after Contract Award
CDRL 3-10	PDR – Compliance Matrix	30 days prior to 1st PDR meeting
CDRL 3-11	PDR – Drawing Tree and Schedule	30 days prior to 1st PDR meeting
CDRL 3-12	PDR – System Functional Description	30 days prior to 1st PDR meeting
CDRL 3-13	PDR – Arrangement Drawings and Related Documents	30 days prior to 1st PDR meeting
CDRL 3-14	PDR – Detailed Technical Specification	30 days prior to 1st PDR meeting
CDRL 3-15	PDR – Detailed Technical Specification covering methods, materials and arrangements for pilot car construction.	30 days prior to 1st PDR meeting
CDRL 3-16	PDR – Table of suppliers and products	30 days prior to 1st PDR meeting
CDRL 3-17	PDR – Weight Analysis	30 days prior to 1st PDR meeting
CDRL 3-18	Intermediate Design Review (IDR)	60 days after the closure of PDR
CDRL 3-19	IDR – All Drawings in the Drawing Tree	30 days prior to IDR meeting
CDRL 3-20	IDR – Drawing Tree: 2 Additional Levels	30 days prior to IDR meeting
CDRL 3-21	IDR – Draft Single Line Control Schematic	30 days prior to IDR meeting

CDRL	Description	Due
CDRL 3-22	IDR – Functional Block Diagrams	30 days prior to IDR meeting
CDRL 3-23	IDR – Electrical Wiring Diagrams & Schematics	30 days prior to IDR meeting
CDRL 3-24	IDR – Clearance Drawings	30 days prior to IDR meeting
CDRL 3-25	IDR – Piping Diagrams	30 days prior to IDR meeting
CDRL 3-26	IDR – Manufacturer's Data and Spec Sheets for all Control items	30 days prior to IDR meeting
CDRL 3-27	IDR – Updated Compliance Matrix	30 days prior to IDR meeting
CDRL 3-28	IDR – Updated Interior Renderings	30 days prior to IDR meeting
CDRL 3-29	IDR – Updated Exterior Renderings	30 days prior to IDR meeting
CDRL 3-30	IDR – CMF Palette	30 days prior to IDR meeting
CDRL 3-31	IDR – Interior Material Samples	30 days prior to IDR meeting
CDRL 3-32	IDR – Layout of Product Accommodations	30 days prior to IDR meeting
CDRL 3-33	IDR – Draft Maintenance Requirements and Procedures	30 days prior to IDR meeting
CDRL 3-34	Final Design Review (FDR)	90 days after the close of IDR
CDRL 3-35	FDR – Weight Analysis	30 days prior to FDR meeting
CDRL 3-36	FDR – Detailed Technical Specification	30 days prior to FDR meeting
CDRL 3-37	FDR – Functional Analysis	30 days prior to FDR meeting
CDRL 3-38	FDR – Drawing Schedule	30 days prior to FDR meeting
CDRL 3-39	FDR – Arrangement Drawings	30 days prior to FDR meeting
CDRL 3-40	FDR – Supplier Identification	30 days prior to FDR meeting
CDRL 3-41	FDR – All Drawings in the Drawing Tree	30 days prior to FDR meeting
CDRL 3-42	FDR – Single Line Control Schematic	30 days prior to FDR meeting
CDRL 3-43	FDR – Functional Block Diagrams	30 days prior to FDR meeting

CDRL	Description	Due
CDRL 3-44	FDR – Electrical Wiring Diagrams & Schematics	30 days prior to FDR meeting
CDRL 3-45	FDR – Clearance Drawings	30 days prior to FDR meeting
CDRL 3-46	FDR – Piping Diagrams	30 days prior to FDR meeting
CDRL 3-47	FDR – Graphs and Curves of Response and Functional Characteristics	30 days prior to FDR meeting
CDRL 3-48	FDR – Manufacturer's Data and Spec Sheets for all Control items	30 days prior to FDR meeting
CDRL 3-49	FDR – Maintenance Requirements and Procedures	30 days prior to FDR meeting
CDRL 3-50	FDR – Finite Element Stress Analysis	30 days prior to FDR meeting
CDRL 3-51	FDR – Final Interior Renderings	30 days prior to FDR meeting
CDRL 3-52	FDR – Final Exterior Renderings	30 days prior to FDR meeting
CDRL 3-53	FDR – CMF Boards & Samples	30 days prior to FDR meeting
CDRL 3-54	All documentation required by 49 CFR 238.110 as listed in the NPRM.	30 days prior to IDR
CDRL 3-55	Mockup and Rendering Review Plan	NTP + 30 days
CDRL 3-56	1st Round of Soft Mockups	15 days prior to the first PDR stakeholder review
CDRL 3-57	Updated Soft Mock-ups	15 days prior to the first IDR stakeholder review
CDRL 3-58	1st Round Hard Mock-Ups	15 days prior to the first IDR stakeholder review
CDRL 3-59	Updated Hard Mock-ups	15 days prior to the first FDR stakeholder review
CDRL 3-60	VR – PDR Submittal	30 days prior to PDR
CDRL 3-61	VR – IDR Submittal	30 days prior to IDR
CDRL 3-62	VR – FDR Submittal	30 days prior to FDR
CDRL 3-63	1st Round Renderings	30 days prior to PDR
CDRL 3-64	Updated Renderings	30 days prior to IDR
CDRL 3-65	Renderings	30 days prior to FDR
CDRL 3-66	Livery Artworks	30 days prior to FDR
CDRL 3-67	All Approved Physical Material Samples	30 days prior to FDR

CDRL	Description	Due
CDRL 3-68	Initial Color Material and Finish (CMF) Boards	30 days prior to PDR
CDRL 3-69	Sampling and Color Boards	30 days prior to IDR
CDRL 3-70	Color Material and Finish Boards	30 days prior to FDR
CDRL 3-71	Material Suppliers and detailed Material Specifications and Data Sheets	30 days prior to each Design Review
CDRL 3-72	Interior Schedule of Finish documentation	30 days prior to each Design Review
CDRL 3-73	Draft Formats – Electrical Schematics	30 days prior to IDR
CDRL 3-74	Draft Formats – Pneumatic Schematics	30 days prior to IDR
CDRL 3-75	Draft Formats – Electrical Component / Device Table	30 days prior to IDR
CDRL 3-76	Draft Formats – Wiring Diagram	30 days prior to IDR
CDRL 3-77	Draft Formats – Wire Run List	30 days prior to IDR
CDRL 4-01	Reliability Program Plan	NTP + 30 days
CDRL 4-02	Reliability Progress Reports	Within 90 days following the 1st FRB,
CDRL 4-03	Reliability Prediction Analysis	30 days prior to PDR
CDRL 4-04	Reliability Demonstration Report	Reliability Demonstration Test +
CDRL 4-05	Reliability Demonstration Plan	30 days prior to start of FDR
CDRL 4-06	Maintainability Program Plan	30 days prior to PDR
CDRL 4-07	Maintainability Analysis	30 days prior to FDR
CDRL 4-08	Life Cycle Cost Analysis	30 days prior to IDR
CDRL 4-09	Maintainability Demonstration Plan	180 days prior to qualification testing of 1st car
CDRL 4-10	Maintainability Demonstration Report	Within 30 days after completion of the Maintainability Demonstration Test
CDRL 4-11	FMI Plan	90 days prior to
CDRL 5-01	Project Quality Plan (PQP)	NTP + 60 days
CDRL 5-02	Revision Management Procedure	30 days prior to PDR
CDRL 5-03	Internal Audit Schedule	NTP + 30 days
CDRL 5-04	Monthly Quality Report (MQR)	NTP + 60 days, then monthly
CDRL 5-05	Documentation of Initiatives to Promote Sustainability	NTP + 30 days
CDRL 5-06	Waste Reduction Program Quarterly Reports	NTP + 90 days
CDRL 5-07	FAI Plan	NTP + 90 days
CDRL 5-08	FAI – Technical data for maintenance manuals and parts catalogs	Prior to full acceptance of FAI

CDRL	Description	Due
CDRL 5-09	FAI Documentation	30 business days before FAI
CDRL 5-10	FAI Binder	After conclusion of FAI
CDRL 5-11	FAI Report	Within 10 business days of FAI
CDRL 5-12	Complete set of FAI photographs	With 1st shipment of cars delivered
CDRL 5-13	Inspection and Test Log for each car	Before release for shipment
CDRL 5-14	Inspection and Test 1-Week Look Ahead	14 days prior to initiation of any manufacturing activities then, every weekly
CDRL 5-15	PQP – List of Hold Point Inspections for each car type	NTP + 60 days
CDRL 6-01	Method of Corrosion Prevention for Interior Surfaces of Enclosed Structural Sections	30 days prior to PDR
CDRL 6-02	Carshell Drawings	30 prior to initiation of any component fabrication
CDRL 6-03	Three Samples of all Exterior Finishes	30 days prior to FDR
CDRL 6-04	Detailed Fatigue Analysis	30 days prior to PDR and on-going through each DR
CDRL 6-05	Documented Engineering Analysis (Coupling system and supporting structure verification)	NTP + 30 days
CDRL 6-06	PDR – Cross sections of the emergency roof access locations	30 days prior to PDR
CDRL 6-07	IDR – Cross sections of the emergency roof access locations	30 days prior to IDR
CDRL 6-08	FDR – Cross sections of the emergency roof access locations	30 days prior to FDR
CDRL 6-09	FAI – Cross sections of the emergency roof access locations	30 days prior to FAI
CDRL 6-10	Emergency Egress Plan and Emergency Responder Ingress Procedure	30 days prior to PDR
CDRL 6-11	Jacking Pad Locations	30 days prior to PDR
CDRL 6-12	Safety Appliance Placement Ergonomic Evaluation	30 days prior to PDR
CDRL 6-13	FRA Sample Car Inspection for Safety Appliance Applications	30 days prior to FAI
CDRL 6-14	Equipment Compartment Access Points and Attachments to the Carbody – Final Dimensions and Arrangement	30 days prior to PDR and on-going through each DR
CDRL 6-15	Glazing Design	30 days prior to PDR

CDRL	Description	Due
CDRL 6-16	Exterior Surface Treatment Plans	30 days prior to PDR
CDRL 6-17	Carbody Structure Stress Analysis and Test Plan	NTP + 120 Days
CDRL 6-18	PDR – Finite Element Model Electronic Copies	30 days prior to PDR
CDRL 6-19	FDR – Finite Element Model Electronic Copies	30 days prior to FDR
CDRL 6-20	FAI – Finite Element Model Electronic Copies	30 days prior to FAI
CDRL 6-21	PDR – Preliminary Stress Analysis Results	60 days after approval of Stress analysis and Test Plan [CDRL 6-15]
CDRL 6-22	Stress Analysis Result Report Format	30 days prior to PDR
CDRL 6-23	Stress Analysis Result Report	30 days prior to FDR
CDRL 6-24	FEA Model Verification – Tabulation of Test Results to Analysis	Prior to carshell FAI
CDRL 7-01	Vehicle Dynamic Performance Qualification Plan	NTP + 120 days
CDRL 7-02	Vehicle Dynamic Simulation Plan	PDR
CDRL 7-03	Vehicle Dynamic Simulation Report	IDR
CDRL 7-04	Vehicle Dynamic Model Validation Plan	IDR
CDRL 7-05	Vehicle Dynamic Model Validation Report	Post Type Tests
CDRL 7-06	Structural Validation Plan	NTP + 120 days
CDRL 7-07	Truck Stress Analysis Plan	PDR
CDRL 7-08	Truck Stress Analysis Report	IDR
CDRL 7-09	Truck Stress Test – Laboratory, Plan	FDR
CDRL 7-10	Truck Stress Test – Laboratory, Report	Post Type Test
CDRL 7-11	Truck FEA Structural Model Validation Plan	IDR
CDRL 7-12	Truck FEA Structural Model Validation Report	Post Type Test
CDRL 7-13	Truck Stress Test – On-Track, Plan	FDR
CDRL 7-14	Truck Stress Test – On-Track, Report	Post Type Test
CDRL 7-15	Fatigue Assessment Validation Report	Post Type Test
CDRL 7-16	Manufacturing Validation Report	IDR
CDRL 7-17	Detailed drawings of all truck components	FDR
CDRL 7-18	Analyses demonstrating the effect of asymmetric forces from braking	IDR
CDRL 7-19	Coil spring design stress calculations	IDR
CDRL 7-20	Axle design and application theoretical stress calculations	IDR
CDRL 7-21	Wheel design analysis for combined mechanical and thermal overload conditions per AAR S-660	IDR
CDRL 7-22	Design analysis verifying roller bearing estimated L10 life	IDR
CDRL 8-01	Proposed mounting arrangement for couplers	During PDR
CDRL 9-01	Design of ECP brake system inter-car cable and junction connection	30 days prior to Brake System PDR meeting

CDRL	Description	Due
CDRL 9-02	Brake system delay/dead time, build-up time, response time and equivalent deceleration rates for all speeds from maximum speed to full stop.	30 days prior to Brake System IDR meeting
CDRL 9-03	Brake System design and performance analysis	30 days prior to Brake System IDR meeting
CDRL 9-04	Disc Brake Thermal Capacity Analysis from supplier	30 days prior to Brake System IDR meeting
CDRL 9-05	Brake Disc Natural Frequency Analysis	30 days prior to Brake System IDR meeting
CDRL 9-06	Brake Disc Fatigue Life Estimate	30 days prior to Brake System IDR meeting
CDRL 9-07	Brake Disc FEA Report	30 days prior to Brake System IDR meeting
CDRL 9-08	Wheel Slide System Detection Logic and Criteria	30 days prior to Brake System IDR meeting
CDRL 9-09	Wheelslide System Diagnostic Software (5 electronic copies for PTU)	With Pilot Car Delivery
CDRL 9-10	Wheelslide PTU Connection Cables (qty. 40 minimum)	With Pilot Car Delivery
CDRL 10-01	Detailed heating and cooling load analysis	30 days prior to PDR, on-going updates for each DR
CDRL 10-02	In-rush mitigation control scheme	30 days before IDR
CDRL 10-03	Leak and Charging procedure for Refrigeration System	30 days before IDR
CDRL 10-04	Fault detection and diagnostic features of heated floor panels	30 days before IDR
CDRL 10-05	Temperature Control Schedule	30 days before IDR
CDRL 10-06	Thermal Response Analysis	30 days before IDR
CDRL 11-01	Human Factors Study Report	30 days prior to PDR
CDRL 11-02	Pinch Point Gap Analysis	30 days prior to FDR
CDRL 11-03	Luggage and Baggage Analysis	30 days prior to PDR
CDRL 12-01	Tone and Volume of Audible Signal	30 days prior to PDR
CDRL 12-02	Engineering analysis of side door operator’s ability to operate over full HEP voltage range without damage.	30 days prior to IDR
CDRL 12-03	Side Door System Failure Mode and Effects Criticality Analysis (FMECA) and Fault Tree Analysis (FTA)	30 days prior to IDR

CDRL	Description	Due
CDRL 12-04	Proposed door signage samples, location and adhesive	30 days prior to IDR
CDRL 13-01	Interior and Exterior Lighting Plan	30 days prior to Lighting PDR
CDRL 13-02	Drawing of lighting arrangement for each car type	30 days prior to Lighting IDR
CDRL 13-03	Identification of standby and/or emergency lighting fixtures	30 days prior to Lighting PDR
CDRL 13-04	Details of lighting fixtures, luminaries, circuit breakers, controls and switches.	30 days prior to Lighting IDR
CDRL 13-05	Required charging light levels for HPPL and HPPL Emergency markings	30 days prior to Lighting IDR
CDRL 13-06	Physical examples of each lighting fixture	At FDR
CDRL 13-07	Certification to Amtrak that the car's lighting system meets all standards and regulations	30 days prior to Conditional Acceptance
CDRL 13-08	Suggested Light Color Plan	30 days prior to Lighting PDR
CDRL 13-09	Emergency Lighting Plan	30 days prior to Lighting IDR
CDRL 13-10	Demonstration and Written Certification of Compliance for Emergency Lighting	30 days prior to Complete car FAI
CDRL 13-11	Toilet Room artwork for labels	30 days prior to Lighting PDR
CDRL 13-12	LLEPM and HPPL Emergency signage details, including integration	30 days prior to Lighting IDR
CDRL 14-01	The Contractor shall identify the fault tolerance capabilities, recovery time, and user interaction required to maintain system operation.	30 days prior to PDR
CDRL 14-02	Plan identifying the approach to reducing the attenuation of the carbody, on-board equipment, and glazing impact on cellular telephone reception	30 days prior to PDR
CDRL 14-03 CDRL 14-04	Documentation and calculations for all individual components, and for the system as a whole, demonstrating the conformance to the requirements in this technical specification and referenced standards. Comprehensive architecture and design package	30 days prior to PDR 30 days prior to PDR
CDRL 14-05	Documentation defining the capabilities of the OTIS self-test functions	30 days prior to PDR
CDRL 14-06	Document identifying the standard interface which would allow the integration of a replacement or additional DCS communications channels	30 days prior to PDR

CDRL	Description	Due
CDRL 14-07	Design of the Provision for Wireless Internet	30 days prior to PDR
CDRL 14-08	Diagrams of the antenna locations and the bolt hardware specification	30 days prior to IDR
CDRL 14-09	RF propagation study	30 days prior to IDR
CDRL 14-10	The IP addressing scheme, and a list of all IP devices shall be submitted for review and approval by Amtrak.	30 days prior to PDR
CDRL 14-11	Description of the ETB and ECN control and architecture	30 days prior to PDR
CDRL 14-12	Network Interface Control Documents	30 days prior to IDR
CDRL 14-13	Integration and Fault Tolerance Testing Procedure	30 days prior to IDR
CDRL 14-14	Integration and Fault Tolerance Testing Results	30 days prior to FDR
CDRL 14-15	Capabilities of the Protocol Analyzer for each Network	30 days prior to PDR
CDRL 14-16	Electromagnetic Compatibility (EMC) Control plan	30 days prior to PDR
CDRL 14-01	The Contractor shall identify the fault tolerance capabilities, recovery time, and user interaction required to maintain system operation.	30 days prior to PDR
CDRL 15-01	Network interface control document	30 days prior to Electrical PDR
CDRL 15-02	Transformer capacity and lifespan analysis	30 days prior to Electrical PDR
CDRL 15-03	Battery Charger Function description	30 days prior to Electrical IDR
CDRL 15-04	Emergency Backup System Details	30 days prior to Electrical PDR
CDRL 15-05	Battery Charger Load budget assessment	30 days prior to Electrical IDR
CDRL 15-06	Battery disconnect concept and arrangement	30 days prior to Electrical PDR
CDRL 15-07	Low voltage power distribution arrangement concept	30 days prior to Electrical PDR
CDRL 15-08	Electrical locker arrangement, including separation details of crew operated devices and maintenance operated devices.	30 days prior to Electrical PDR
CDRL 15-09	Integrated schematic diagram package	30 days prior to Electrical PDR
CDRL 16-01	FDA Approvals	Prior to revenue service

CDRL	Description	Due
CDRL 16-02	Food Service Layouts	During PDR, IDR, and FDR
CDRL 16-03	Type Tests for Refrigeration and Freezer systems	During FDR
CDRL 16-04	Type Tests for all Warming Equipment	During FDR
CDRL 16-05	Ventilation Plan	During IDR
CDRL 16-06	Passenger Flow	During IDR
CDRL 17-01	Documentation of FDA Compliance	Prior to system Qualification Testing
CDRL 17-02	FDA Approval of Water System Construction	30 days before IDR
CDRL 17-03	Details of Freeze Protection System	30 days before IDR
CDRL 17-04	FDA Approval of Toilet and Waste Retention System	30 days before IDR
CDRL 17-05	Flush Control Unit Details	30 days before IDR
CDRL 17-06	Status Indicator Designs	30 days before IDR
CDRL 17-07	Matrix of all Conditions (normal, abnormal and fault) and the Water and Waste System response.	30 days before IDR
CDRL 18-01	AED Location and Installation Details	During PDR
CDRL 18-02	Seatback Safety Card Electronic Artwork	30 days prior to PDR
CDRL 19-01	Material description and test lab results	During IDR
CDRL 19-02	Joining and fastening data	During IDR
CDRL 19-03	Dissimilar metals report	During IDR
CDRL 19-04	Passivation process details	During IDR
CDRL 19-05	Visual inspection criteria for laminated glazing	During IDR
CDRL 19-06	Paint Process Documentation	During IDR through FDR
CDRL 19-07	Smoke Flammability and Toxicity Matrix	During IDR through FDR
CDRL 19-08	Design and product line for electrical connections	During PDR
CDRL 19-09	Design and product line for conduit fittings and junction boxes	During PDR
CDRL 20-01	Car testing matrix	NTP + 90 days
CDRL 20-02	Master Test Plan	First submittal NTP + 180 days
CDRL 20-03	Test Procedures	Per Figure 20-1

CDRL	Description	Due
CDRL 20-04	Test Results (Reports)	Within 5 days of test completion
CDRL 20-05	Contractor shall provide a single volume incorporating all required engineering tests associated with the pilot program, all copies of all test procedures, reports and approvals.	30 days after successful completion of testing
CDRL 20-06	All material certification and proof-of-design test procedures and reports in a single binder for each car type.	Prior to shipment of each car type
CDRL 20-07	Reliability and Post-Delivery Test Report	30 days after successful completion of testing
CDRL 21-01	List of all service consumables needed to support the cars throughout its service design life	FDR
CDRL 21-02	List of strategic spare parts recommended to support the fleet of equipment after the end of the warranty period	FDR
CDRL 23-01	Training Action Plan	90 days after NTP with on-going updates
CDRL 23-02	Preliminary As-Built Drawings	180 days prior to the delivery of the 1st batch of cars
CDRL 23-03	As Built Drawings	30 days after delivery of first batch of cars
CDRL 23-04	Electronic Documentation Delivery	Within 30 days after the last car of the base order is shipped
CDRL 23-05	Photographs-Car Assembly	30 days after completion and acceptance of first of each car type
CDRL 23-06	Photographs-Completed Car	30 days after completion and acceptance of first of each car type
CDRL 23-07	Conformed Specification	30 days after completion of each car type
CDRL 23-08	Master Manual Plan	90 days before completion of first car
CDRL 23-09	First Draft of Manuals	90 days before completion of first car
CDRL 23-10	Manual Updates	After delivery of the first car, and continuing through the

CDRL	Description	Due
		end of the warranty period
CDRL 23-11	WMS Implementation	360 days prior to shipment of first batch of cars
CDRL 23-12	Service and Cleaning Manual & Maintenance and Inspection Manual	30 days prior to IDR with on-going updates
CDRL 23-13	Illustrated Parts Catalog	30 days prior to shipment of first batch of cars
CDRL 23-14	Car History Book	30 days prior to shipment of first batch of cars
CDRL 23-15	User Training Program	360 days prior to shipment of first batch of cars
CDRL 23-16	Draft copies of Training Material	360 days prior to shipment of first batch of cars
CDRL 23-17	Instructor Guide	360 days prior to shipment of first batch of cars
CDRL 23-18	Training Aids	360 days prior to shipment of first batch of cars
CDRL 23-19	Student Workbooks	360 days prior to shipment of first batch of cars
CDRL 23-20	Equipment Summary Report Outline	30 days prior to the start of Final Design Review
CDRL 23-21	Equipment Summary Report	Prior to the completion of Final Design Review
CDRL 24-01	Central Diagnostics System detailed Functional Description	30 days prior to Diagnostics System PDR meeting
CDRL 24-02	Subsystem Integration Details	30 days prior to Diagnostics System PDR meeting
CDRL 24-03	Fault Management Plan	30 days prior to Diagnostics System IDR meeting.

CDRL	Description	Due
CDRL 24-04	Wayside Server and Train to Wayside Details	30 days prior to Diagnostics System IDR meeting
CDRL 24-05	Security and Safety Analysis of the Network	30 days prior to Diagnostics System IDR meeting
CDRL 24-06	Car Temperature Monitoring system	30 days prior to Diagnostics System IDR meeting
CDRL 24-07	Eight additional sets of all portable test equipment	Prior to Delivery of First Batch of Cars
CDRL 24-08	Eight additional sets of all portable test equipment	With 5th Car Delivery
CDRL 24-09	Six complete sets of each type of bench type shop test equipment	With 5th Car Delivery
CDRL 24-10	Air Brake System Test Rack Adapters	With 5th Car Delivery
CDRL 25-01	System Safety Program Plan (SSPP)	NTP + 60 days
CDRL 25-02	Preliminary Hazard List (PHL)	NTP + 60 days
CDRL 25-03	Preliminary Hazard Analysis (PHA)	30 days prior to PDR
CDRL 25-04	Hazard Tracking Log (HTL)	30 days prior to FDR
CDRL 25-05	Failure Modes, Effects and Criticality Analysis (FMECA)	30 days prior to IDR
CDRL 25-06	Fault Tree Analysis (FTA)	30 days prior to FDR
CDRL 25-07	Subsystem Hazard Analysis (SSHA)	30 days prior to IDR
CDRL 25-08	Operating and Support Hazard Analysis (O&SHA)	30 days prior to FDR
CDRL 25-09	List of all adhesives	30 days prior to IDR
CDRL 25-10	Combustible material matrix	30 days prior to IDR
CDRL 25-11	Fire Safety Analysis	30 days prior to FDR
CDRL 26-01	Provide Solution Architecture, Designs, and Specifications for review and approval by Amtrak throughout the design reviews.	30 days prior to PDR, on-going updates
CDRL 26-02	Identify all Contactor or sub-supplier maintenance and operation support agreements related to the on-going support of equipment, services, or licenses of on-board and wayside software.	30 days prior to PDR, on-going updates
CDRL 26-03	Provide an operations plan and schedule for transitioning support throughout all phases of the procurement.	30 days prior to PDR, on-going updates
CDRL 26-04	Provide detailed system description, functionality, and infrastructure requirements for OTIS wayside customer experience simulation lab.	30 days prior to PDR, on-going updates
CDRL 26-05	Provide details of the data dictionaries and documentation of tools.	90 days prior to delivery of the first car
CDRL 27-01	Software Quality Control Plan	NTP + 60 days
CDRL 27-02	Non-COTS Software Supplier Quality Audits	FDR

CDRL	Description	Due
CDRL 27-03	Non-COTS Software Supplier Quality Audit Results/Reports	Within 30 days of each audit
CDRL 27-04	Non-COTS Software Supplier Quality Audit Remedial Action for Open Comments	Within 90 days of each audit
CDRL 27-05	Software Configuration Control Plan (SCCP)	30 days prior to IDR
CDRL 27-06	Database of Software Versions – Cars & Non-vehicle Equipment	30 days prior to IDR, then ongoing updates
CDRL 27-07	Software Version - Cars	In Car History Book
CDRL 27-08	Software Version - Non-vehicle Equipment	With delivery of equipment
CDRL 27-09	Software – all executables	At the end of warranty period for each software release
CDRL 27-10	Software – Updated software documentation	At the end of warranty period for each software release
CDRL 27-11	Software – Updated user documentation	At the end of warranty period for each software release
CDRL 27-12	Software – Software Version Description (SVD)	At the end of warranty period for each software release
CDRL 27-13	Software Developer Documentation	30 days prior to IDR, then ongoing updates
CDRL 27-14	Demonstration to ensure that the ICD and DBDD or SID is complete and accurate	FDR
CDRL 27-15	COTS Software – Original data storage/transfer media functional and usage details	30 days prior to IDR, then ongoing updates
CDRL 27-16	COTS Software – All manuals and instructions to configure and install the software	30 days prior to IDR, then ongoing updates
CDRL 27-17	COTS Software – All licenses required for Amtrak's site use	30 days prior to IDR, then ongoing updates
CDRL 27-18	Test Reports for Software Unit Tests	30 days after performance of tests
CDRL 27-19	Test Reports for Software Type Tests	30 days after performance of tests
CDRL 27-20	Software Validation Test Procedures	30 days prior to IDR, then ongoing updates
CDRL 27-21	Results of a current, independent, BSIMM and/or OWASP SAMM software security assessment of Contractor	360 days prior to shipment of first cars
CDRL 27-22	Transfer of Software to Replacement Devices – Master copies of the compiled executable for all programmable devices	180 days prior to shipment of first cars, then ongoing updates

CDRL	Description	Due
CDRL 27-23	Transfer of Software to Replacement Devices – Six (6) sets of equipment and software to transfer the compiled software	180 days prior to shipment of first cars then ongoing updates
CDRL 27-24	Escrow of Proprietary Source Code	180 days prior to shipment of first cars, then ongoing updates
CDRL 27-25	Demonstration that source code in Escrow is same as on vehicles.	180 days prior to shipment of first cars, then ongoing updates
CDRL 27-26	Software Executable Generation Procedure (SEGP) to use Escrowed files	30 days prior to FDR, then ongoing updates
CDRL 27-27	Full Instructions for Workstation to use escrowed files	30 days prior to FDR, then ongoing updates
CDRL 27-28	Documentation of Escrowed Source Code to allow for maintenance, troubleshooting and adjustment	30 days prior to FDR, then ongoing updates
CDRL 27-29	Microprocessor System Shutdown Special Procedure	30 days prior to IDR, then ongoing updates
CDRL 27-30	License for unlimited use of software in test computers	360 days prior to shipment of first cars, then ongoing updates
CDRL 27-31	PTU and BTE software documentation	30 days prior to IDR, then ongoing updates
CDRL 28-01	Listing of Contractor personnel involved in the cars' development, maintenance, and operation who will be accountable for security-related decisions and actions	NTP+90
CDRL 28-02	Software Bill of Materials (SBOM) and Hardware Bill of Materials (HBOM) format	30 days prior to PDR
CDRL 28-03	List of the proposed products identifying the country of origin	NTP+90
CDRL 28-04	Documentation of disabled ports, connectors, and interfaces	30 days prior to PDR, on-going updates
CDRL 28-05	Summary documentation of the product's security features and security-focused instructions on maintenance, support, and reconfiguration of the product's default settings	30 days prior to PDR, on-going updates
CDRL 28-06	List of all known methods for bypassing computer authentication contained in the product and provide written documentation that all such backdoors have been permanently deleted from the product	30 days prior to PDR, on-going updates
CDRL 28-07	Document options for defining access and security permissions, user accounts, and applications with associated roles	30 days prior to PDR, on-going updates
CDRL 28-08	Provide documentation for the product, attesting that unauthorized logging devices are not installed	30 days prior to IDR

CDRL	Description	Due
CDRL 28-09	List of all log management activities that the product is capable of generating and the format of those logs	30 days prior to PDR, on-going updates
CDRL 28-10	Information on all communications (e.g., protocols) required between Amtrak's network security zones whether inbound or outbound and identify each	30 days prior to PDR, on-going updates
CDRL 28-11	List of all remote access entry pathways and ensure that they can be enabled or disabled by Amtrak	30 days prior to PDR, on-going updates
CDRL 28-12	Certification that all interfaces which implement administrative management capabilities of onboard devices are secure	30 days prior to FDR, on-going updates
CDRL 28-13	Preliminary NIST checklist	30 days prior to PDR
CDRL 28-14	Final completed NIST checklists	30 days prior to FDR
CDRL 28-15	The results of a current, independent, BSIMM and/or OWASP SAMM software security assessment shall be provided by the Contractor.	30 days prior to FDR, on-going updates
CDRL 28-16	Name of Independent Assessment Organization	30 days prior to PDR
CDRL 28-17	Software Security Assessment Plan	30 days prior to IDR, on-going updates
CDRL 28-18	Results of any independent software and firmware quality assurance assessment	30 days prior to FDR, on-going updates
CDRL 28-19	Contractor's response to the findings of the software and firmware quality assurance assessment	30 days prior to FDR, on-going updates
CDRL 28-20	Name of Independent Third-Party Penetration Test Provider	30 days prior to PDR
CDRL 28-21	Independent third-party's penetration test plan	30 days prior to FDR, on-going updates
CDRL 28-22	Results of the independent third-party's penetration test plan	30 days after
CDRL 28-23	Contractor's response to the findings of the independent third-party's penetration test plan	60 days after
CDRL 28-24	Design for on-board monitoring and intrusion detection and provisions	30 days prior to PDR, on-going updates
CDRL 29-01	RVAAC Compliance Summary	NTP + 60 days
CDRL 29-02	Braille Signage Package	30 days prior to IDR
CDRL 31-01	Human Factors Study Report	30 days prior to PDR
CDRL 31-02	Pinch Point Gap Analysis	30 days prior to FDR
CDRL 31-03	Luggage and Baggage Analysis	30 days prior to PDR
CDRL 32-01	Cab Mockup Development and Review	During PDR, IDR, & FDR
CDRL 32-02	Air Brake System Apparatus & Pneumatic Drawing	During FDR
CDRL 32-03	Cut-Out Cock Location Diagram(s)	During FDR

CDRL	Description	Due
CDRL 32-04	Cab Installation & Arrangement – Design Detail	During PDR, IDR, & FDR
CDRL 32-05	Console Arrangement	During PDR, IDR, & FDR
CDRL 32-06	F-End Operator Line-of-Sight Drawing	During FDR
CDRL 32-07	Emergency Egress & Ingress Provisions	During PDR, IDR, & FDR
CDRL 32-08	Cab Seat	During PDR, IDR, & FDR
CDRL 32-09	Exterior Lighting Location Layout	During PDR, IDR, & FDR
CDRL 32-10	Vehicle Control System Architecture (Event Recorder)	During PDR, IDR, & FDR
CDRL 32-11	Positive Train Control System Architecture	During PDR, IDR, & FDR
CDRL 32-12	Operator Manuals Development Plan	During FDR

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NATIONAL RAILROAD PASSENGER CORPORATION

AMTRAK®

AIR BRAKE, EQUIPMENT AND TRAIN HANDLING RULES AND INSTRUCTIONS

DRAFT

These instructions govern the testing and operation of air brake and other equipment on Amtrak trains and must be observed by all employees whose duties are in any way affected by them.

These instructions apply to all Train and Engine service employees, QPs, QMPs, QMIs, Mechanical employees, certain Engineering employees, Yardmasters, and Supervisors. Amtrak employees governed by these instructions are not governed by the air brake and train handling rules/instructions of Host Railroads or Tenant Railroads. All Amtrak employees will be governed by these instructions unless a more restrictive rule or special instruction of the railroad over which you are operating specifically conflicts with these instructions.

Employees whose duties require that they understand and comply with these instructions must attend the required classes.

Employees who are governed by these instructions will be provided with a copy, must maintain same and have it with them while on duty.

NOTE: Due to infrequent AMT-3 publication, if conflicting information is found between the current AMT-3 version and General Orders or Special Instructions, then the employee will be governed by the most recent General Orders or Special Instructions in effect.

This document is divided into five (5) major sections: (1) General, (2) Operations, (3) Equipment Inspections / Brake Tests, (4) Train Control Systems and (5) Tables and Forms.

Stephen Reaves
System General Road Foreman

Tony Parolisi
Director, Quality Management

Edited by
System General Road Foreman Office

Effective 04/01/2022



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NATIONAL RAILROAD PASSENGER CORPORATION

AMTRAK®

General Section

1.0 General

- 1.1 Definitions
- 1.2 Equipment - General Instructions
- 1.3 Equipment - Speeds
- 1.4 Equipment - Locomotive and Car Bearings
- 1.5 Equipment - Locomotives, Cars, and Other Equipment
- 1.6 Equipment – Head End Power (HEP)
- 1.7 Equipment – Diesel Engines - General
- 1.8 Equipment – Diesel Engines – Automatic Engine Start Stop System (AESS)

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1.1 Definitions

ACTUATE: A term used to indicate the release of locomotive brake cylinder pressure that develops as a result of an automatic brake application.
AFTER COOLER: Radiating piping, which cools compressed air before it flows to the brake system.
AIR BRAKE: A combination of parts operated by compressed air and controlled manually, pneumatically, or electronically, which will slow or stop a car or locomotive.
AIR BRAKE INSPECTION AND TEST RECORD: This written record indicates that air brakes have been properly tested and inspected and must include the following information:

- All locomotives – including cab cars that will be used to operate train
- Number of cars inspected
- Date
- Time
- Location tested
- Name & Signature of Qualified Person who performed the test
- Selector volume handle position
- Interior/Exterior Inspection
- Communication signal status
- GRA/DIR release status
- EOT tested
- Total Train Weight and Length- Non-Passenger Only
- Any special weight distribution requiring special train handling- Non-Passenger Only
- 10C Summary portion

The MAP 1173/10C Summary is the form issued when a Class I brake test is performed at the originating point or a scheduled Class I brake test location for the train. When multiple MAP 1173 forms are issued only one will be used as the "Summary" form and will be indicated by writing the word "Summary" at the top of the form (see instruction 3.8.4). Engineer must list defective car number(s) on reverse side of Summary MAP 1173 indicating condition EN ROUTE and initialize form.

The 10C Summary is used by the mechanical department to list cars in a passenger train consist that received a calendar day inspection. The 10C Summary is part of MAP 1173/10C Summary form. A train MUST not be delayed for missing or conflicting information on 10C summary or missing MAP 10C Summary.

NOTE: When MAP 1173 is referenced in the AMT-3, Metrolink may use SMP 1173 form, MARC may use ECR 1173 form.
AIR COMPRESSOR: A rotary or reciprocating device for compressing air.
AIR GAUGE: An instrument that indicates the amount of air pressure.
AIR RESERVOIR: A reservoir or tank found on passenger or freight locomotive and car brake systems for storing a supply of air.
ALERTER: A device, which detects frequency of movement of the Engineer and initiates a penalty brake application when required frequency of movement is not maintained.
ANGLE COCK: A device used to open and close the brake pipe on locomotives and cars. To open, move the handle in line with the brake pipe. To close, move the handle at a right angle (crosswise) to the brake pipe. Note that these positions are the opposite of other cutout cock positions.
AUTOMATIC BRAKE VALVE (ABV): A manually operated device positioned by the Engineer to control the flow of air into the brake pipe for charging, applying, and releasing the automatic brake system on each car or locomotive.
AUTOMATIC DRAIN VALVE: Automatic device, which assists in draining condensation from the compressed air system.
AUTOMATIC SLACK ADJUSTER: A device to maintain brake cylinder piston travel within a predetermined range.
BACK-UP HOSE: A device consisting of a manually operated valve with a warning whistle, length of hose, and standard brake pipe hose coupling. When properly coupled to the brake pipe hose on the leading end of a car or cars being pushed, provides a means of sounding a warning whistle and/or applying the brakes in emergency.
BIND: Restrict the intended movement of one or more brake system components by reduced clearance, by obstruction, or by increased friction.
BLENDED BRAKE: Simultaneous use of air and dynamic braking controlled by the automatic brake valve and mixed automatically, to provide a retarding force on engines and self-propelled cars.
BLOCK OF CARS: One car or multiple cars in a solid unit coupled together for the purpose of being added to or removed from a train as a solid unit.
BRAKE APPLICATION (AUTOMATIC): A reduction of brake pipe pressure of sufficient amount to cause the control valve to move to the service or emergency position, which, if made in the service position (or zone) of the ABV, may consist of one or more reductions. A BRAKE APPLICATION IS NOT COMPLETE UNTIL BRAKE PIPE EXHAUST HAS COMPLETELY STOPPED.

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BRAKE CYLINDER: A cylinder in which compressed air acts on a piston that transmits the force of the compressed air to the associated brake rigging.

BRAKE CYLINDER PRESSURE LIMITING VALVE: A feature built into the 26-C or 26-F control valve, which limits service and emergency brake cylinder pressure to a predetermined amount.

BRAKE CYLINDER RELEASE VALVE: A manually operated valve on brake equipment, which permits the brake cylinder to be released without draining the reservoirs.

BRAKE, EFFECTIVE: A brake that is capable of producing its required designed retarding force on the train. A car's air brake is not considered effective if it is not capable of producing its designed retarding force or if its piston travel exceeds; (a) 10 ½ inches for cars equipped with nominal 12-inch stroke brake cylinders; or (b) the piston travel limits indicated on the stencil, sticker, or badge plate for that brake cylinder.

BRAKE INDICATOR: A device actuated by brake cylinder pressure (light or plunger), which indicates whether brakes are applied or released.

BRAKE PIPE: The system of piping including branch pipes, angle cocks, cutout cocks, dirt collectors, hose, and hose couplings, used for connecting locomotives and cars for the passage of air to control the locomotive and car brakes.

BRAKE PIPE CUTOFF (PILOT) VALVE/SWITCH: Manually operated device used to cut in or cut out the ABV on locomotive brake equipment.

BRAKE PIPE VENT VALVE: A device connected to the brake pipe, which propagates an emergency brake pipe reduction by rapidly venting the brake pipe pressure locally.

BRAKE, PRIMARY: Those components of the train brake system necessary to stop the train within the signal spacing distance without thermal damage to friction braking surfaces.

BRAKE, SECONDARY: Those components of the train brake system which develop supplemental brake retarding force that is not needed to stop the train within signal spacing distances or to prevent thermal damage to wheels.

BRAKE SYSTEM: Includes all brake apparatus such as air, electro-pneumatic, electronic brake, related piping, hand brake, foundation brake rigging, and dynamic brake.

BRAKE TEST TYPES:

Passenger

- Class I: Complete passenger train brake system test and inspection performed by a QMP to ensure air brake system is 100% effective. This test fulfills the requirements of a Passenger-Class IA and a Passenger-Class II brake test.
- Class IA: Test and inspection performed by QP or QMP to ensure that brakes apply and release on each car in a passenger train in response to train line commands. This test fulfills the requirements of a Passenger-Class II brake test.
- Class II: Test and inspection performed by QP or QMP to determine brake pipe integrity and continuity from the controlling locomotive to the rear passenger equipment of a passenger train.

Non-Passenger

- Class I: Complete non-passenger train brake system test and inspection performed by a QP or QMI to ensure air brake system is 100% effective. This test fulfills the requirements of a Non-Passenger Class II and a Non-Passenger-Class III brake test.
- Class II: Test and inspection performed by QP or QMI to ensure that brakes apply and release on each car in a non-passenger train in response to train line commands. This test fulfills the requirements of a Non-Passenger-Class III brake test.
- Class III: Test and inspection performed by QP or QMI to determine brake pipe integrity and continuity from the controlling locomotive to the rear equipment of a non-passenger train.
- Transfer Train: Test and inspection performed by QP or QMI to ensure that brakes apply and release on each car in a non-passenger train which is a transfer train.

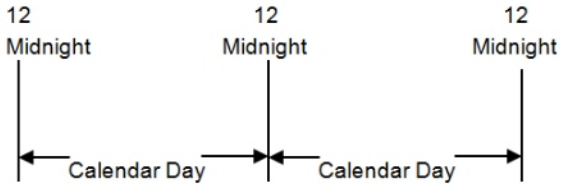
Passenger & Non-Passenger

Running Brake Test: A test performed by a locomotive engineer while the train is in motion to verify that the brake system functions as intended.

BUFF FORCES: The forces caused by compression such as during dynamic or independent braking, helper locomotive on rear of train, back-up movements, or run-in of slack.

CAB CAR: A Passenger Carrying Car equipped with a control compartment from which a train can be operated while being pushed by a locomotive. A cab car is considered a locomotive when it is the controlling locomotive.

CALENDAR DAY: A time period running from one midnight to the next midnight on a given date.



CHARGING CUTOFF PILOT VALVE (A-1): Provides the following features during an emergency application of brakes: automatic sanding, dynamic brake cutoff, power knock out (PCS), and cuts off brake pipe charging.

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CHECK VALVE: A device so designed that it permits air to flow in one direction while preventing the air from flowing in the opposite direction.

CHOCK: A wedge or block of sufficient size used to block the movement of a wheel (holding a wheel motionless).

CLASP BRAKE: An arrangement of brake rigging in which two brake shoes/pads per wheel/disc are used to clasp the braking surface.

COMMUNICATING SIGNAL SYSTEM: A manually operated device used to transmit an electronic signal to the operating cab. If electronic communication signal system is inoperative or not equipped, operative two-way radio system may be substituted.

COMPRESSOR GOVERNOR: A device to automatically control the operation of an air compressor.

COMPUTER CONTROLLED BRAKE (CCB): Microprocessor locomotive or cab car air brake control system commonly referred to as E-Brake.

CONTROL VALVE: A device on locomotives and cars to apply and release brake cylinder control pressure in response to a reduction or increase of brake pipe pressure.

- **Direct Release:**
  A feature of the control valve that provides for the total release of brake cylinder control pressure when brake pipe pressure is increased.
- **Graduated Release:**
  A feature of the control valve that provides for the incremental release of brake cylinder control pressure proportionate to increases in brake pipe pressure.

CONTROLLING LOCOMOTIVE: The locomotive from which the engineer exercises control over the train.

CUTOUT COCK: A device used to cut in or cut out certain air brake functions. To open “cut in” the cock, move the handle at a right angle (crosswise) to the pipe. To close “cut out” the cock, move the handle in line with the pipe. Note that these positions are the opposite of angle cock positions.

DEAD ENGINE FEATURE: A manually positioned device for charging the main reservoir on a locomotive from the brake pipe when main reservoir pressure is not available.

DEADMAN FOOT VALVE: A device on some locomotives which will initiate a penalty brake application shortly after the foot pedal is released on the locomotive and brake cylinder pressure is at least 25 psi.

DECELOSTAT: A wheel slide system that automatically releases brake cylinder pressure rapidly upon detection of wheel slide and restores brake cylinder pressure as soon as wheel begins to revolve.

DEFECTS – RUNNING GEAR - Any condition not in compliance with CFR49 Part 238, which involves:

- Suspension.
- Draft System.
- Trucks.
- Wheels.

DEFECTS – NON RUNNING GEAR - Any condition not in compliance with CFR49 Part 238, which involves:

- Exhaust gases released outside cab or other compartments.
- Batteries properly vented.
- Jumper cables – May not hang free, no exposed wire, no broken plugs, or receptacles.
- High voltage safety labels for exterior doors and cover plates marked
- Buffer plates in place.
- Diaphragms in place and aligned
- Exposed moving parts and electrical equipment both equipped with guards.
- Floors, etc. free from oil, water, waste, or any obstruction
- Manual door releases are in place.
- Emergency equipment… as applicable, in place.
- Safety related signage in place and legible.
- High voltage safety labels for interior doors and cover plates marked
- Emergency brake valves stenciled.
- Trap doors safely operate and securely latch.
- Vestibule steps are illuminated.
- End doors and side doors operate.
- Seats or attachments not broken or loose.

DISC BRAKES: An arrangement of brake cylinders and levers, which force brake pads against a disc fastened to the wheel or axle.

DISTRIBUTING VALVE: A device which applies and releases brakes and automatically maintains pressure in brake cylinders after a brake application. Also known as a RELAY VALVE.

DOUBLE CHECK VALVE: A valve with two seats arranged so that air flowing past either seat cannot flow out past the other seat but will flow through a third common delivery connection.

DRAFT FORCE: A term used to describe coupler forces in a state of tension.

DUAL PORTED CUTOUT COCK: A device on some locomotive brake equipment that cuts in or out the IBV.

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DUPLEX RELEASE VALVE: An appliance permitting manual depletion of auxiliary reservoir pressure alone, or auxiliary and emergency reservoir pressure together.

DYNAMIC BRAKING: A means of using traction motors to create a braking effect.

ELECTRONIC EMAP 21A and MAP 21A: En route defect reporting.

ELECTRONICALLY CONTROLLED PNEUMATIC BRAKE (ECP BRAKE): A train powered braking system actuated by compressed air and controlled by electronic signals from the locomotive, cab car, or an ECP-EOT to the cars in the consist for service and emergency brake applications in which the brake pipe is used to provide a constant supply of compressed air to the reservoirs on each car but does not convey braking signals to the car. ECP brake systems include dual mode and stand-alone ECP brake systems.

ELECTRO-PNEUMATIC BRAKE: A system consisting of an interface unit on a locomotive and magnet valves on each car, which vents or recharges the brake pipe on each car electrically, at the same time a pneumatic application or release is taking place.

EMERGENCY APPLICATION: A rate of brake pipe reduction fast enough to cause the control valves to move to emergency position.

EMERGENCY BRAKE VALVE: A valve for the purpose of initiating an emergency brake application on all locomotives and passenger carrying cars.

EQUALIZING RESERVOIR: Serves as reference volume for the brake pipe relay valve portion. The relay valve portion establishes a pressure in the brake pipe equal to the pressure in the equalizing reservoir.

EQUIPMENT CONDITION REPORT: Inspection record for locomotive calendar day and brake test inspections**:** Amtrak MAP 100, MARC ECR 100, Metrolink SMP 100. When MAP 100 is referenced in the AMT-3, Metrolink locomotives and cab cars may use Calendar Day Inspection Forms SMP 100. MARC locomotives and cab cars may use the Calendar Day Inspection Form ECR 100.

FACE-TO-FACE RELIEF: The exchange of information between employees when taking charge of equipment. When any of the following occurs, it is considered Face-To-Face Relief**:**

- When the inbound Engineer does not leave the equipment unattended and communicates with the outbound Engineer the condition of the brakes and the status (location) of the MAP 1173(s).
- When the inbound Conductor or Assistant Conductor does not leave the equipment unattended and communicates with the outbound Engineer the condition of the brakes and the status (location) of the MAP 1173(s).
- When a mechanical department employee who is a QMP or QP who participated in the required brake test does not leave the equipment unattended and communicates with the outbound Engineer the condition of the brakes and the status of the MAP 1173(s) (located on the locomotive, possession of conductor, etc.).

When FACE-TO-FACE RELIEF does not occur as described above, a Passenger-Class II brake test is required.

NOTE: See definition of **UNATTENDED EQUIPMENT**.

FOUL: Any condition which restricts the intended movement of one or more brake system components because the component is snagged, entangled, or twisted.

FREIGHT EQUIPMENT: Railroad locomotives and cars not included in the definition of **PASSENGER EQUIPMENT**.

FULL SERVICE REDUCTION: The amount of brake pipe reduction necessary to obtain maximum brake cylinder pressure during service brake application.

GRADIENT, BRAKE PIPE: The difference in brake pipe pressure between front and rear of train.

HAND BRAKE: A brake apparatus used to manually apply the brakes on a car or locomotive, if so equipped.

HEAD END POWER (HEP): The system on a locomotive that supplies electrical power to a train for air conditioning, heat, light, etc.

HST DEPARTURE TEST: Passenger-Class I Brake Test and Locomotive Departure Test equivalent for Tier II equipment.

INDEPENDENT BRAKE VALVE (IBV): A device to operate air brakes on the locomotive, or locomotive consist if MU'd, independently of train brakes.

INITIAL TERMINAL: Place where train is originally made up or a locomotive receives its Calendar Day Inspection. If locomotive power is changed en route, the previous "Initial Terminal" location of the train does not change.

INTERCOM SYSTEM: Two-way voice communication system

INTERCOOLER: Radiating piping which cools compressed air between stages of compression.

LOCOMOTIVE: On-track equipment, other than hi-rail, specialized maintenance, or other similar equipment, which may consist of one or more units operated from a single control stand with one or more propelling motors designed for moving other passenger equipment, with one or more propelling motors designed to transport freight or passenger traffic, or both, or without propelling motors but with one or more control stands.

LOCOMOTIVE INSPECTION AND REPAIR REPORT (Blue Form/MAP 816): Federal form (FRA F6180-49A) that records the locomotive's inspections and repairs for the calendar year.

MAGNET VALVE: A device for controlling the flow of air, which is dependent on a magnetic coil being energized or de-energized.

MAIN RESERVOIRS: One or more reservoirs on locomotives or cars for storing the main supply of compressed air.

MAP 816: See definition of Locomotive Inspection and Repair Report.

MAP 1173/10C SUMMARY: See **AIR BRAKE INSPECTION AND TEST RECORD**

MINIMUM REDUCTION: Handle position on 26, 30, and E-type ABVs that produces a brake pipe reduction of 6-8 psi at a service rate.

MIXED CONSIST TRAIN: A train consisting of passenger carrying cars and two or more non-passenger carrying cars.

MU-2, MU-2A VALVE: A two or three-position valve, which cuts the IBV IN or OUT.

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MU EQUIPMENT: Self-propelled diesel or electric passenger equipment with one or more control stands and seating for carrying passengers. MU equipment may be operated as a single unit or coupled in multiples to provide added passenger capacity. MU equipment with a control stand is considered an MU locomotive.

MU HOSES: Air hoses that are only common to locomotives including: main reservoir equalizing, actuating (if equipped), and application and release.

NON-PASSENGER CARRYING CAR: A car designed to handle Mail, Baggage, and Express (MB&E) that is operated as part of a passenger train consist. e.g., Baggage car (BAG), Material Handling Car (MHC), Express (EXP), Auto Carriers.

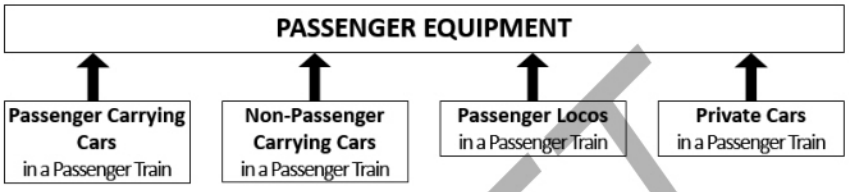
OFF AIR: Not connected to a continuous source of compressed air of at least 60 pounds per square inch.

ORIGINATING PASSENGER TERMINAL: The passenger terminal where a train first receives passengers, in the same city or terminal where it is initially made up.

PARKING BRAKE: A spring applied and air released brake found on certain cab cars and locomotives.

PASSENGER CARRYING CAR: A car designed to carry passengers and/or to provide on-board services, e.g., coaches, sleepers, food service, or cars designed with a combination of passenger facilities. This definition includes Cab Cars and MU Equipment. This term does NOT include a Private Car.

PASSENGER EQUIPMENT: All Passenger Carrying Cars, Non-Passenger Carrying Cars, Private Cars, and Passenger Locomotives in a Passenger Train. This definition does NOT include a freight locomotive when used to haul a passenger train due to failure of a Passenger Locomotive.



PASSENGER TRAIN: A train consisting of any combination of Passenger Equipment. A passenger train may transport passengers only when required passenger train brake tests and mechanical inspections have been performed.

PA SYSTEM (PUBLIC ADRESS SYSTEM): A one-way voice communication system.

PENALTY BRAKE APPLICATION: An automatic service application of air brakes caused by Overspeed Control, Train Control Systems, or Alerter/Deadman.

PNEUMATIC CONTROL SWITCH (PCS): Indication on a locomotive control console that represents power loss/knockout. It displays whenever a penalty or emergency brake application occurs.

POWER CAR: Rail vehicle that propels a Tier II passenger train or is the lead vehicle in a Tier II passenger train or both. A Power Car is considered a locomotive for the purposes of these instructions.

PRESSURE MAINTAINING: A feature of certain types of ABVs which compensates brake pipe pressure against maximum permissible leakage during a service application.

PRESSURE RETAINING VALVE: A manually positioned valve found on freight, Non-Passenger Carrying Cars (MB&E), and Private Cars that will control release of brake cylinder pressure.

PRIVATE CAR: Rail rolling equipment that is used only for excursion, recreational or private transportation purposes. A Private Car is not a Passenger Carrying Car.

P-2-A APPLICATION VALVE: A valve which provides a full service penalty brake application when actuated by any one of the following features: Overspeed Control, Train Control Systems, or Alerter/Deadman.

QUALIFIED EMPLOYEE: An employee who is classified as a QP, QMP, or QMI.

QUALIFIED MAINTENANCE PERSON (QMP): A person who has received instruction and training that includes "hands-on" experience in one or more of the following functions:

- Troubleshooting
- Inspection
- Testing
- Maintenance or repair of specific train brake and other components and systems for which the person is assigned responsibility.

The person's primary responsibility includes work in the functions listed above and is designated to:

- Conduct Class I Brake Tests.
- Conduct exterior calendar day mechanical inspections.
- Determine whether defective equipment may be moved.

QMP qualifications are valid for three years. Employee's qualifications may be revoked if he/she demonstrates insufficient knowledge or skills to perform assigned duties. It is the employee's responsibility to attend required classes and maintain their qualifications.

NOTE: T&E employees are NOT considered QMPs.

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QUALIFIED MECHANICAL INSPECTOR (QMI): A "Qualified Person" who has received instruction and training that includes "hands-on" experience in one or more of the following functions:

- Troubleshooting.
- Inspection.
- Testing.
- Maintenance or repair of specific locomotive equipment/train brake components and systems for which the person is assigned responsibility.

Each QMI shall also possess a current understanding of what is required to properly repair and maintain the safety-critical brake components/locomotive equipment for which the person is assigned responsibility. The person's primary responsibility includes work generally consistent with the functions listed above

QMI qualifications are valid for three years. Employee's qualifications may be revoked if he/she demonstrates insufficient knowledge or skills to perform assigned duties. It is the employee's responsibility to attend required classes and maintain their qualifications.

NOTE: T&E employees are NOT considered QMIs.

QUALIFIED PERSON (QP): Person who has received instruction and training to perform various functions as determined by the railroad. Qualified Supervisors and T&E crews are considered QPs. This individual may perform a/an:

- Interior Calendar Day Mechanical Inspection on Tier I Passenger Carrying Cars
- Class IA Brake Test for Passenger Trains
- Class II Brake Test for Passenger Trains
- Class I Brake Test for Non-Passenger Trains
- Class II Brake Test for Non-Passenger Trains
- Class III Brake Test for Non-Passenger Trains
- Transfer Train Brake Test for Non-Passenger Trains

QUICK SERVICE VALVE: A device connected to the brake pipe for the purpose of propagating quick service by making a brake pipe reduction on each car so equipped.

REDUCING VALVE: A valve designed to reduce and maintain air pressure to a predetermined amount.

REDUCTION RELAY VALVE: A device comprising a quick service valve and a vent or emergency valve mounted on a common pipe bracket. It is connected to the brake pipe to provide additional local venting of brake pipe air on each car so equipped, during both service and emergency brake applications. This device is auxiliary to the control valve and utilized on cars having a great amount of brake pipe volume.

REGULATING VALVE: A device which controls pressure and maintains it at a predetermined setting. The regulating valve is usually found within the automatic brake valve.

REPAIR POINT: Location designated by a railroad where inspections and/or repairs of the type necessary occur on a regular basis. A repair point has or should have the facilities, tools, and personnel qualified to make the necessary repairs.

RESERVOIR RELEASE VALVE: An appliance permitting manual depletion of control reservoir pressure.

ROLL BY INSPECTION: An inspection performed while equipment is moving.

RUNNING BRAKE TEST: A test performed by a locomotive engineer while the train is in motion to verify that the brake system functions as intended.

SAFETY VALVE: A valve designed to open and close at predetermined pressures.

SERVICE APPLICATION: A brake application consisting of one or more brake pipe reductions at a service rate.

SERVICE RATE OF REDUCTION: A reduction of brake pipe pressure at a rate fast enough to cause control valves to move to the service position, but not fast enough to cause them to move to emergency.

SERVICE ZONE: That portion of the brake valve quadrant on 26, 30, and E-types ranging from minimum reduction position to full service position that produces a self-lapping brake pipe reduction at a service rate proportional to handle position.

SPEEDOMETER OVERSPEED: A device that initiates a penalty brake application when the speed indicated on the speed indicator exceeds maximum allowed.

SPLIT REDUCTION: Automatic brake application consisting of an initial reduction of 6-8 psi followed 20-30 seconds later with additional reductions to the desired amount.

SUPPRESSION POSITION: Handle position on 26, 30, and E-type ABVs used to forestall or recover from a penalty brake application.

SWITCHING (YARD) OPERATIONS: Assembling or changing the position of cars for train movements; for the purposes of loading, unloading, or servicing; or placing of locomotives or cars for repair or storage. During switching operations, brake pipe must be charged, except when brake pipe is defective or damaged. SWITCHING is NOT considered a TRAIN MOVEMENT.

TERMINAL: Starting point or ending point of a single scheduled trip for a train, where passengers may get on or off a train. Normally, this location is a point where the train would reverse direction or change destinations.

TIER I TRAIN: Operating at speeds not exceeding 125 mph.

TIER II TRAIN: Operating at speeds exceeding 125 mph but not exceeding 160 mph.

TIER III TRAIN: Operating in a shared right-of-way at speeds not exceeding 125 mph, and in an exclusive right-of-way without grade crossings at speeds exceeding 125 mph but not exceeding 220 mph.

TRAIN: One or more locomotives, coupled with or without cars.

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TRAIN, COMMUTER: Passenger train providing commuter service within an urban, suburban, or metropolitan area.

TRAIN CONTROL SYSTEMS:

- **Automatic Train Control (ATC):** A train control system which consists of Cab Signals, Speed Control, and ATS. Engineer is required to maintain speed associated with each cab signal aspect. Any overspeed condition will require suppression within 8 seconds.
  - **Cab Signal:** A signal that is located in the engine control compartment which indicates track occupancy or condition. The cab signal is used in conjunction with interlocking signals and with or in lieu of block signals.
  - **Speed Control:** A device on an engine which will cause a penalty application of the brakes if the engineer fails to reduce the train's speed to the speed required by the cab signal indication.
- **Automatic Train Stop (ATS):**
  - **Continuous:** A component of the Automatic Train Control (ATC) system. Any downward change in the cab signal aspect results in an audible alarm and requires acknowledgment within eight seconds to avoid a penalty brake application.
  - **Intermittent Inductive Train Stop (IITS):** A system which enforces acknowledgment as a train passes over a wayside inductor. If the signal is clear no action is required. If the signal displays a more restrictive indication than clear, the audible alarm will sound, and engineer is required to acknowledge within 8 seconds to avoid a penalty brake application.
  - **Inert Inductor Automatic Train Stop (IIATS):** Wayside inductors not connected with a block signal system; positioned to provide advance warning to trains of certain permanent speed restrictions and designed to apply the brakes automatically until train stops.
- **Advanced Civil Speed Enforcement System (ACSES):** A transponder and data radio-based train control system that supplements the ATC system by enforcing permanent speed restrictions, temporary speed restrictions, and a positive stop at interlocking and controlled point signals displaying Stop Signal.
  - **Interlocking Area:** An interlocking or closely located group of interlockings served by a single Base Communication Package (BCP).
- **Grade Crossing - Incremental Train Control System (X-ITCS):** A Differential Global Positioning Satellite (DGPS) and data radio based train control system that monitors grade crossing protection status and enforces conditional speeds at which a train may approach and occupy a grade crossing. The system also enforces entrance to and exit from X-ITCS territory.
- **Incremental Train Control System (ITCS):** A Differential Global Positioning Satellite (DGPS) and data radio based train control system that supplements the underlying method of operation and fixed signal system by enforcing permanent speed restrictions, temporary speed restrictions, entrance to out-of-service tracks, and speeds required by fixed signal indications.
- **Interoperable Electronic Train Management System (I-ETMS):** A Differential Global Positioning Satellite (DGPS) and data radio based positive train control system that supplements the underlying method of operation and fixed signal system by enforcing permanent speed restrictions, temporary speed restrictions, known highway crossing malfunctions, working limit authorities and speeds required by fixed signal indications.

TRAIN CONTROL SYSTEM TESTS:

- **Departure Test:** Train Control System Test required on all locomotives, which will enter train control system territory, 24 hours or less before locomotive departs its initial terminal.

NOTE: Successful On-Board Self-Test and a Daily Mechanical Inspection both qualify as a successful Departure Test.

- **On-Board Self-Test:** Performs functionality test of the On-Board Train Control System.
- **MAP 8 Periodic Inspection:** Train Control System Inspection required to be performed after a failure or during scheduled maintenance intervals.

TRAIN, LONG DISTANCE INTERCITY: Passenger train that provides service between large cities more than 125 miles apart and is not operated exclusively on Amtrak's NEC.

TRAIN MOVEMENT: Movement of equipment BETWEEN yards and/or terminals on tracks which require:

- Authority to occupy, or
- Movement over public road crossings.

Before making any "Train Movement", applicable train brake tests are required.

NOTE: A "Train Movement" is NOT considered switching.

TRAIN, PASSENGER or TRAIN SET, PASSENGER: See **PASSENGER TRAIN**

TRAIN, SHORT DISTANCE INTERCITY: Passenger train that provides service exclusively on Amtrak's NEC or between cities that are not more than 125 miles apart.

TRAIN CONTROL TIMING DEVICE: Device used to provide a 6 second warning whistle and delay time which, if not acknowledged within 8 seconds, will produce a penalty brake application.

TRANSFER TRAIN: A train that travels between a point of origin and a point of destination not exceeding 20 miles. Such trains may pick up or deliver freight equipment while en route to destination.

TWO-WAY END-OF-TRAIN DEVICE: A system consisting of a head end or locomotive control unit (LCU) and a rear end or end of train unit (EOT). This system monitors brake pipe pressure, motion, marker light status, and battery condition at the rear of the train and transmits this information to the locomotive cab for display. Activating an emergency toggle switch in the locomotive cab initiates an emergency brake application from the rear of the train.

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UNATTENDED EQUIPMENT: Equipment left standing and unmanned in such a manner that would hinder immediate application of hand/parking brakes or air brakes by a qualified employee to prevent equipment from moving.
UNDESIRED EMERGENCY (UDE): Emergency brake application on a train for which no apparent cause can be determined.
WHEEL SLIDE CONTROL SYSTEM: A system that automatically releases or reduces brake cylinder pressure rapidly upon detection of an impending wheel slide. Brake cylinder pressure is restored as soon as the wheel begins to revolve or after a preset safety timeout.
YARD: System of tracks within defined limits provided for the making up of trains, storing of cars, or other purposes.

1.2 Equipment - General Instructions

NOTE: When CNOC mechanical desk is referenced in the following instructions, Metrolink T&E employees will contact Metrolink MOC at 909-593-0661, and MARC T&E employees will contact the Amtrak Commuter Operations Center at 202-906-2772.

1.2.1 Reporting Non-Complying Conditions (Defects)

A. Engineer must report any known locomotive non-complying conditions (defects) per instruction 3.1.15.
B. Conductor must report any known car defects on EMAP 21A **and** contact the CNOC mechanical desk at 1-800-424-0217.
C. Communication of Defects – Inbound.
1. Inbound Engineers will inform relieving Engineers of any known defects in their train either personally or on prescribed form.
2. With Face-to-Face relief, inbound Conductors will personally inform relieving Conductors of any known defect in their train.
3. Without Face-to-Face relief, outbound Conductors must check with outbound Engineer for any defects noted on MAP 1173/10C Summary and, during the performance of their duties, must check each car of their train for any Out of Service tags. If an Out of Service tag is found, Conductors must verify that the defect is been documented on the EMAP 21A. If the defect is not documented on the EMAP 21A, add the defect on the EMAP 21A and contact CNOC mechanical desk at 1-800-424-0217.

D. Engineers and Conductors are jointly responsible for reporting all cases of undesired emergency brake application.
E. The conductor or engineer must immediately notify the train dispatcher after any train parting with the following information:
1. Location where parting occurred.
2. Position in train and identification of equipment involved.
3. Position of knuckles at parting, if determinable.
4. Distance between parted sections and whether or not any run-in occurred following parting.
5. Throttle position, speed, type/amount of air applied, if any.
6. Apparent reason for parting.
7. Any other unusual conditions.
8. Notify CNOC Mechanical Desk (1-800-424-0217) as soon as possible without delaying train.

1.2.2 Safety Alert Regarding Class P-40BH, P-42BH and P32AC-DM Locomotives

A. The bottom rung of the F-end ladder on Amtrak Class P-42BH, Class P-40BH, and Class P32AC-DM locomotives is in close proximity to F-end truck components. To avoid personal injury, employees MUST NOT use this rung while the locomotive is in motion. This rung is only for mounting or dismounting the locomotive while the train is stopped.

1.2.3 Safety Alert Regarding Class HHP-8 Locomotives and HST Power Cars

A. Cab Door - In the application of "Employee Safety Rules", employees must be aware of pinch-point when using the door handle to the cab.
B. Carbody Entrance Door Ladders Bottom Step - In the application of "Employee Safety Rules", employees **must not ride** on entrance door ladders while HHP-8 Locomotive or HST Power Car is in motion. The bottom rung of the ladder is not designed to stand on while the train is in motion; the bottom rung is for mounting and dismounting equipment only.

1.2.4 Flat Spots

A. All flat spots must be reported to CNOC mechanical desk at 1-800-424-0217 and on MAP 100 for locomotives and EMAP 21A for cars.

NOTE: When more restrictive railroad rules or instructions are in effect concerning flat spots, those instructions will apply.

B. Wheels must not have a single flat or shelled spot 2 ½ inches or more in length. When these dimensions are exceeded, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning flat spots.
C. Wheels must not have two adjoining flat or shelled spots that are each 2 inches or more in length. When these dimensions are exceeded, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the defect.

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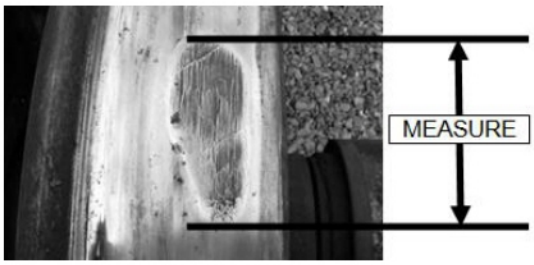
D. Wheels must not have defects such as broken, gouged, chipped, or cracked rim or flange. When these conditions exist, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the defect. Contact QMP at CNOC mechanical desk at 1-800-424-0217.



Single Flat Spot

EXAMPLE

Flat Spot measures 2 ½ inches or more:

- QMP must be contacted before equipment is moved.

1.3 Equipment - Speeds

1.3.1 Freight Locomotive in Passenger Train Consist

A. Unless otherwise restricted, passenger trains with a freight locomotive in the locomotive consist will operate at passenger speeds, not exceeding the maximum speed of the freight locomotive. Prior to movement of a passenger train with a freight locomotive, the maximum authorized speed of the freight locomotive must be determined by contacting the train dispatcher or appropriate supervisor.

NOTE: When locomotive or equipment is not listed in the System General Order, the maximum speed must be determined by contacting the appropriate supervisor, train dispatcher, and/or CNOC mechanical desk.

NOTE: Locomotives and equipment may be further restricted by Timetable General Order and/or Special Instructions of the railroad over which the train is operating; in these instances, those railroad instructions take precedence.

1.3.2 Speed Table

TIME PER MILE		SPEED MPH	TIME PER MILE		SPEED MPH
MINS	SECS		MINS	SECS	
0	22.5	160	0	48.0	75
0	23.2	155	0	51.1	70
0	24.0	150	0	55	65
0	24.8	145	1	00	60
0	25.7	140	1	5.5	55
0	26.6	135	1	12	50
0	28.8	125	1	20	45
0	30.0	120	1	30	40
0	31.3	115	1	43	35
0	32.8	110	2	00	30
0	34.3	105	2	24	25
0	36.0	100	3	00	20
0	37.9	95	4	00	15
0	40.0	90	6	00	10
0	42.4	85	12	00	5
0	45	80			

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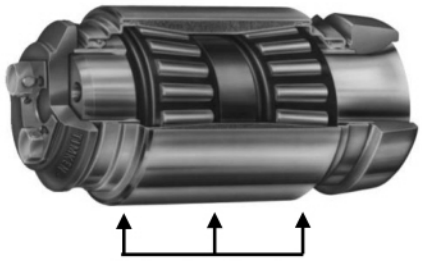
1.4 Equipment - Locomotive and Car Bearings

1.4.1 Locomotives and Cars - Checking for Hot Journal Bearings

A. Carry and use a 219-degree Tempilstik to check for hot bearings. Employees inspecting High Speed Trainsets will also carry a 200-degree Tempilstik and use it on that equipment exclusively.

B. Use the tempilstick to mark the surface of the bearing housing/adapter.

C. Make a visible mark with the tip of the tempilstick on or as close to the bearing cup as possible. If the roller bearing cup is not accessible, use the tempilstick on the top surface of the adapter where the heat is concentrated.



Roller Bearing Cup

D. Except for Amfleet cars, all Amtrak passenger-carrying cars currently in use have rotating end caps on the journals. Should you encounter equipment not described above, such as a locomotive or private car without a rotating end cap, place the tempilstick on both the roller bearing adapter and the roller bearing end cap or bearing housing cover.

E. If the surface marked with the tempilstick exceeds 219 degrees (200-degrees on High Speed Trainsets), the end of the tempilstick will melt on the surface.

F. When tempilstick melts, indicating a hot or failed journal bearing, comply with the following:

1. QP or QMP must visually inspect equipment,
2. Train must not move until QMP determines if safe for movement. Communicate to QMP any host railroad rules, speed restrictions or any other instructions concerning the defect. If communication with QMP not immediately available, contact QMP at CNOC mechanical desk at 1-800-424-0217,
3. QMP will determine whether car is to be set out, maximum speed and any other restrictions necessary for safe movement.

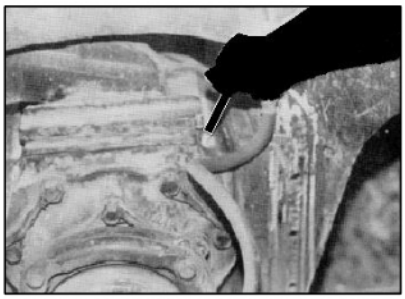
G. Journal Bearing Illustrations:

1. Amtrak Heritage Car with Timken EE Roller Bearing on GSI style truck.



Reach in through adapter and end cap to touch bearing cup.

2. Amtrak Heritage Car with Timken EE Roller Bearings and Decelostat Housing Bolted to Roller Bearing Adapter.



Place tempilstick on top of adapter just above bearing location

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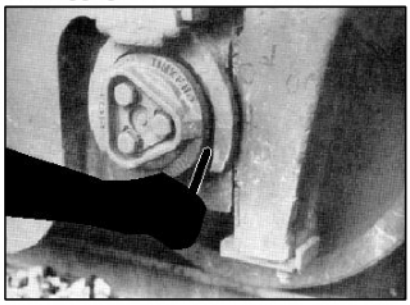
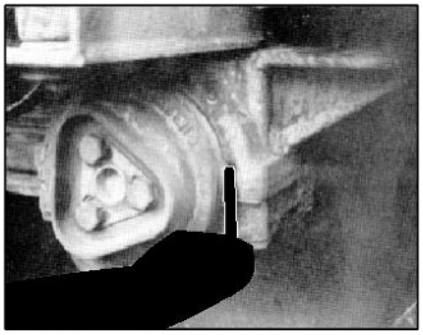
3. GSI Truck Used on Auto Train Auto Carriers, Material Handling Cars, Viewliner, Superliner II, and Some Types of Baggage Cars.



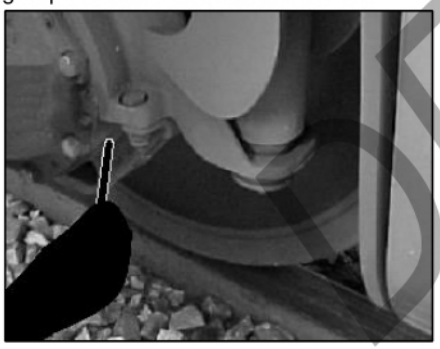
Reach in behind roller bearing end cap to place tip of tempilstick on roller bearing cup

4. MD-76 Truck Used on Amtrak Superliner I Cars.

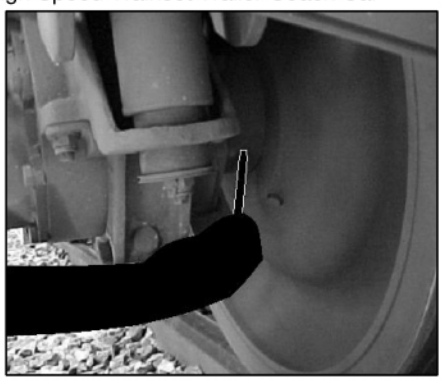


Reach in behind roller bearing end cap to place tip of tempilstick on roller bearing cup.

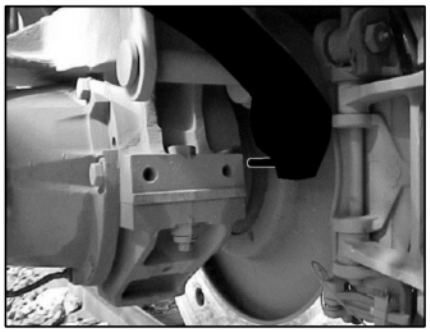
5. High Speed Trainset Trailer Coach Car



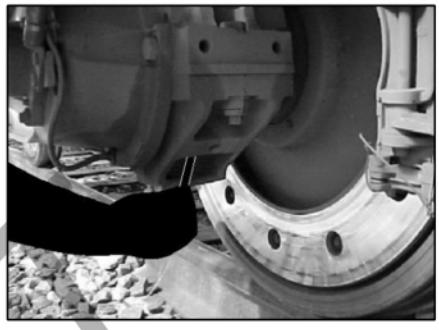
6. High Speed Trainset Trailer Coach Car



7. High Speed Trainset Power Car/ HHP-8 Locomotive



8. High Speed Trainset Power Car/ HHP-8 Locomotives



9. ACS-64 / Charger SC-44 / ALC-42 Locomotives



10. P-32ACDM & P-40/42 Locomotives



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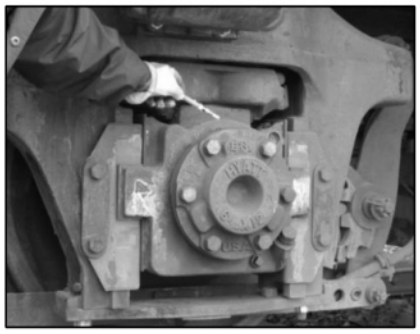
11. F-59PHI Locomotive

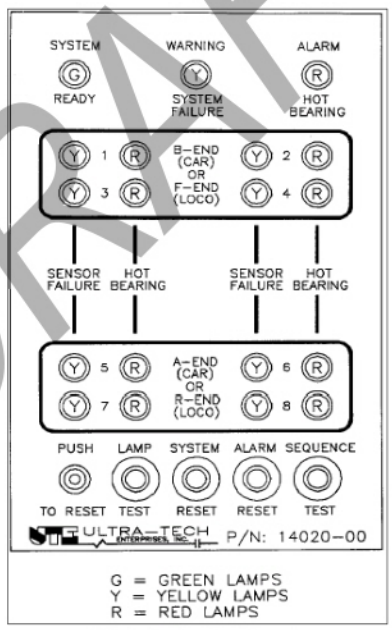


1.4.2 On-Board Hot Bearing Detection System

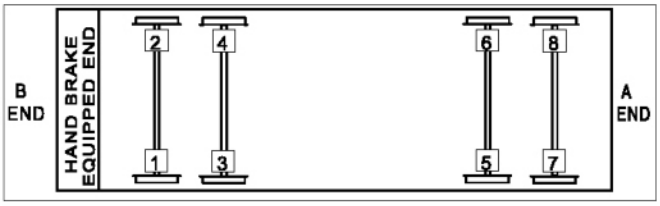
A. Amfleet cars and CDTX Comet Cars 5001 to 5014 are equipped with an On-Board Hot Bearing Detection (OBHBD) system, which is designed to give the crew an audible and visual alarm if the system detects an overheated journal bearing. The system operates with the following components:

1. Journal bearing heat sensor probes that are mounted on each of the car's bearings and connected by cables to a Main Indicator Panel.
2. Trainline connection to enable equipped locomotives to indicate when a hot bearing or problem with the detection system is detected.
3. An alarm panel that is located above the electric locker door. This panel contains a red alarm light and an audible alarm device.
4. Main Indicator Panel (black box) is located on the wall inside the electric locker.

NOTE: Under normal conditions, the only light that is illuminated is the “SYSTEM READY” light.



Main Indicator Panel



Amfleet Journal Bearing Position Numbers

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B. Actions Employees Must Take In Response to Air Alarms:

1. Stop the train as soon as safe handling will permit.
2. Open the electric locker door on the car with the alarm actuation.
3. Press the "ALARM RESET" button to silence the audible alarm in the car. This will also extinguish the "Hot Journal" warning light on the locomotive.
4. Look at the detector's Main Indicator Panel to determine which alarm light is illuminated (e.g., Wheel 5 Sensor Failure light).
5. Record alarm light information on EMAP 21A, indicating specific location and car number, then verbally report it to the Dispatcher and CNOC mechanical desk at 1-800-424-0217.
6. Take the specific actions listed below, based on the alarm light type.

NOTE: Before going under equipment to inspect bearings, employees must obtain "Three Point Protection". Employees must ensure that they **apply the Tempilstik to the proper location** on roller bearing adaptor or seal, as illustrated below.

7. Notify the Dispatcher and the Engineer of the results of any inspections.
8. When an alarm occurs before a crew change location, the incoming crew must be advised of any alarm light that remains illuminated, any speed restriction that is in effect, and whether a mechanical inspection is required. If the outgoing crew cannot personally give this information to the incoming crew, they must ask the Dispatcher to relay it.

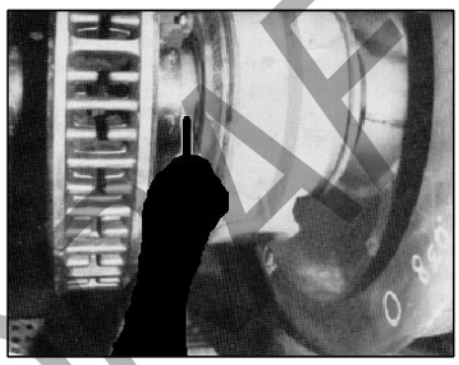
C. Actions Employees Must Take Based on Alarm Light Type.

1. **Red "Hot Bearing" Alarm Light:**

a. Inspect all bearings on the **affected truck** with a 219-degree Tempilstik, starting with the bearing that actuated the alarm.

(1) Place Tempilstik on either:

- The adapter on the side of the roller bearing housing facing the disc brake rotor, or
- The roller bearing seal ring next to the adapter.



CAUTION: USE CARE, AS THE DISC BRAKE ROTOR AND THE AREA AROUND THE JOURNAL BEARING MAY BE VERY HOT.

b. Take the following additional actions while performing bearing inspections:

(1) Look for signs of a hot bearing smoke bomb actuation (i.e., violet colored smoke or dye, and rotten egg smell).

(2) Look for damage to the heat sensor probe cable that is connected to the bearing, and to the wiring that runs from the heat sensor probe cable to the car body.

(3) Hand tighten the connectors on the heat sensor probe cable, and the connector on the Main Indicator Panel located in the electric locker.

c. When tempilstick melts, indicating a hot or failed journal bearing, comply with the following:

(1) QP or QMP must visually inspect equipment.

(2) Train must not move until QMP determines if safe for movement.

(3) If communication with QMP not immediately available, contact QMP at CNOC mechanical desk at 1-800-424-0217.

(4) QMP will determine whether car is to be set out, maximum speed and any other restrictions necessary for safe movement.

d. If **no** hot bearing is found, try to reset the detector by pressing the "SYSTEM RESET" button on the Main Indicator Panel.

e. If the red "Hot Bearing" alarm light goes out, proceed at NORMAL SPEED. Defect must be recorded on EMAP 21A, noting location and car number.

(1) If a red "Hot Bearing" alarm light comes on again at the same bearing location, reduce train speed to not exceeding 80 MPH to the next location where mechanical forces are available to inspect car.

(2) If at this mechanical inspection location, mechanical forces determine there is no hot bearing, and that the On-Board Hot Bearing Detection (OBHBD) system is defective, train may proceed at NORMAL SPEED.

(3) If mechanical forces determine that bearing is hot, train will be terminated.

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f. If the red "Hot Bearing" alarm light remains illuminated after pressing the "SYSTEM RESET" button on the Main Indicator Panel:

(1) Proceed not exceeding 80 MPH to the next location where mechanical forces are available to inspect the car.

(2) If at this mechanical inspection location, mechanical forces determine there is no hot bearing, and that the On-Board Hot Bearing Detection (OBHBD) system is defective, train may proceed at NORMAL SPEED.

(3) If mechanical forces determine that bearing is hot, train will be terminated.

g. When a "Hot Bearing" alarm occurs before a crew change location, the incoming crew must be advised of any alarm light that remains illuminated, any speed restriction that is in effect, and whether a mechanical inspection is required. If the outgoing crew cannot personally give this information to the incoming crew, they must ask the Dispatcher to relay it.

2. **Yellow "Sensor Failure" Alarm Light:**

a. Proceed at NORMAL SPEED. The Main Indicator Panel displays a yellow "Sensor Failure" alarm light when an electrical fault is detected, such as a loose connection in the detector wiring, or a shorted or grounded sensor probe. Since yellow "Sensor Failure" alarms do not indicate that there is a hot bearing, all cars have been modified so that a yellow "Sensor Failure" alarm will not actuate the audible and visual alarm outside the car's electric locker door, or the red "Hot Journal" light on equipped engines. The yellow "Sensor Failure" light is simply an indication that the OBHBD system needs to be repaired.

b. Crewmembers discovering an illuminated yellow "Sensor Failure" alarm light must notify the Train Dispatcher, Engineer and CNOC mechanical desk at 1-800-424-0217 of the defect, and record it on EMAP 21A , indicating specific location and car number.

3. **Yellow "Warning System Failure" Alarm Light:**

a. Check for a problem with the detector's computer system by pressing the "SYSTEM RESET" button (bottom center).

b. If the "WARNING SYSTEM FAILURE" light goes out, proceed at NORMAL SPEED.

c. If "WARNING SYSTEM FAILURE" light remains illuminated, proceed not exceeding 80 MPH to the next location where mechanical forces are available to repair the detector.

d. If mechanical forces cannot repair the detector, proceed not exceeding 80 MPH to the final terminal.

e. Crewmembers discovering an illuminated "Warning System Failure" alarm light must notify the Train Dispatcher, Engineer and CNOC mechanical desk at 1-800-424-0217 of the defect, and record it on EMAP 21A , indicating location and car number.

4. **No Lights Illuminated on Main Indicator Panel:**

a. The following instructions apply when an OBHBD alarm actuation has occurred on the alarm panel outside the electric locker door, and no lights are illuminated on the Main Indicator Panel inside the electric locker.

NOTE: If no OBHBD alarm has occurred, and the Main Indicator Panel is dark simply because of an HEP failure or loss of DC power on a specific car, the train may proceed at NORMAL SPEED.

b. Check for a circuit breaker trip on the detector by pressing the "PUSH TO RESET" button. (bottom left corner)

c. If the green "SYSTEM READY" light illuminates, check all lamps by pressing the "LAMP TEST" button. If no sensor or bearing lights illuminate, proceed at NORMAL SPEED.

d. If the "SYSTEM READY" light remains out, check all lamps by pressing the "LAMP TEST" button:

(1) If all lamps illuminate except the "SYSTEM READY", proceed at NORMAL SPEED.

(2) If all lamps illuminate except the "SYSTEM READY" light and one of the hot bearing lights, follow the instructions for a Red "Hot Bearing" alarm light.

(3) If all lamps illuminate except the "SYSTEM READY" light and one of the sensor failure lights, follow the instructions in 1.4.2C.2.

(4) If NO lamps illuminate, proceed not exceeding 80 MPH to the next location where mechanical forces are available to repair the detector. If mechanical forces cannot repair the detector, proceed not exceeding 80 MPH to the final terminal.

e. Crewmembers discovering defective OBHBD lamp(s) must record the defect on EMAP21A, indicating location(s) and car number.

1.4.3 Diesel Locomotive Traction Motor Support Bearing Monitor System

A. The following instructions will be used to correct Traction Motor Support Bearing Faults on diesel locomotives equipped with the system.

B. Hot Support Bearing Detection System.

1. The traction motor support bearing detector system consists of a Hot Support Bearing Detector Box and an IFD screen (GE), DID panel (GE) or DDS panel (EMD).
2. In the event of an overheated TRACTION MOTOR SUPPORT BEARING, the locomotive screen or panel (IFD/DID/DDS) will display one of the following messages:

a. "WARNING! Hot Axle Bearing On This Loco"

b. "WARNING! Hot Journal On This Loco"

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c. "WARNING! Hot Support Bearing On This Loco"
d. "Hot TM Support Bearings On This Locomotive"
e. "WARNING! Axle Problem On Other Loco"
f. "Axle Problem On Other Locomotive"

NOTE: The messages above DO NOT pertain to the journal bearings on the locomotive; only the traction motor support bearings.

NOTE: Letter e. and f. above would be displayed on the LEAD unit in the event of an overheated traction motor support bearing or other axle problem on a TRAILING unit in the consist.

3. When a hot traction motor support bearing is detected, the message must be reset on the screen or panel (IFD/DID/DDS) **AND** the Hot Support Bearing Detector Box must be checked and reset. **If BOTH are not reset, and the locomotive is moved, an alarm bell will ring, and a continuous wheel slip light will be displayed.**
4. Location of the Hot Support Bearing Detector Box
   a. GE P-32BWH, GE P-32ACDM, P-40DC, P-42DC - Inside the electrical cabinet door (CA1) on the rear cab wall. It is connected to the 8 traction motor support bearing sensors and to the locomotive computer. Flashing red LEDs indicate the location of a suspected hot support bearing.
   b. EMD F-59 - Inside the upper right door of the electrical control cabinet in the locomotive cab.

C. Inspection Procedure
1. Safely stop the train and determine which locomotive is causing the alarm.
2. Determine which support bearing is hot by observing the LEDs on the detector box to see which is illuminated and flashing red.
3. Perform a visual inspection of the identified support bearing for failure. If the support bearing is moist from water or oil and vapor or mist is not observed, the temperature is not critical. If a failure is indicated by smoke, burnt odor, discoloration and/or flames originating from the bearing area – SET LOCOMOTIVE OUT.
4. If no obvious signs of overheating are present and a question still remains as to the condition of the support bearing, a "FEEL" test may be conducted. Using only your hand, protected with a glove, reach out to lightly brush the support bearing area. If heat is radiating from the support bearing area– SET LOCOMOTIVE OUT.

D. Failure Found – Setting Locomotive Out
1. Isolate locomotives with evidence of a failed support bearing and cutout the traction motor circuit to the effected motor. Follow reset procedures shown below to silence alarm and allow unit to load. The locomotive should then be moved **not to exceed 10 MPH to the next point where the locomotive can be set out**. Defect must be noted on the MAP 100.

E. Reset Procedure
1. Press the "Alarm Reset" button located at the bottom of the detector box. This will cause the LED which is indicating the hot support bearing to stop flashing and illuminate continuously. The "Alarm Hot Bearing" light will also turn off.
2. Press the "System Reset" button located at the bottom of the detector box. This will cause all detector box LEDs to reset (turn off).
3. If the Bearing Indicator LED's do not reset (turn off) and the system will not reset after completing steps 1 and 2 above, proceed with the following steps.
4. Press the "Sequence Test" button located at the bottom of the detector box. This will begin a system sequence test.
5. As soon as the sequence test begins (all LED's will be lit), press the "System Reset" button. This will stop the sequence test and reset all LED's and related circuitry.
6. Reset the fault on the screen or panel (IFD/DID/DDS).
7. GE locomotives - If, after resetting the Hot Support Bearing Detector Box AND the screen or panel (IFD/DID), the alarm continues to sound and/or a continuous wheel slip light is displayed, separate the cable from the bottom of the Hot Support Bearing Box by unscrewing and removing it from the receptacle. Notify Train Dispatcher and CNOC mechanical desk. NOTATION MUST BE MADE ON MAP 100 (Failure En Route / Equipment Condition).
8. EMD F-59 locomotives - If, after resetting the Hot Support Bearing Detector Box AND DDS panel, the alarm continues to sound and/or a continuous wheel slip light is displayed, shut off power to the system by opening the "HOT BEARING" circuit breaker in the electrical control cabinet. Notify Train Dispatcher and CNOC mechanical desk. NOTATION MUST BE MADE ON MAP 100.

F. No Failure Found – Further Movement
1. Upon inspection, if nothing is found to indicate a failed support bearing:
   a. Follow the reset procedures above to silence alarm, extinguish LEDs and allow unit to load.
   b. Verify that all wheels are seen to be rolling freely.
   c. The locomotive may then proceed not exceeding 50 MPH for a distance of at least 10 miles. The support bearing must then be reinspected.
   d. After reinspecting, if nothing is found to indicate a hot or failed traction motor support bearing, movement may continue at **normal speed**.
   e. All faults must be noted on MAP 100.

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1.5 Equipment - Locomotives, Cars and Other Equipment

1.5.1 Amfleet Cars – Air Bellows

A. When Under-Inflated – No action necessary except to report on EMAP 21-A.
B. When Over-Inflated – Speed of train reduced per System General Order and bellows deflated as soon as practicable.
C. Deflating Air Bellows
1. Locate “Air Spring Cutout“ badge plate on car side sill (each end of car).
2. Close both “Air Supply Cocks“ on affected end. (Located near badge plate, have yellow handles, and are tagged.)
3. Open “Deflate Air Spring Valve“. (Located near air spring supply cocks and has a red handle.)
4. After bellows are deflated resume normal speed.

D. Cars Not Equipped With “Deflate Air Spring Valve”
1. Locate “Air Spring Cutout“ badge plate on car side sill (each end of car).
2. Close both “Air Supply Cocks“ on affected end. (Located near badge plate, have yellow handles, and are tagged.)
3. Operate at speeds per System General Order to next terminal.
4. Notify Train Dispatcher as soon as possible.

1.5.2 Passenger Cars – Main Reservoir

A. If M/R hose or pipe is damaged en route, close M/R cock ahead of damaged car.
B. If M/R tank is damaged and cannot readily be repaired
1. Close M/R cock ahead of damaged car.
2. Cut out control valve cutout cock on damaged car.
3. Cut out brake cylinders on each truck on damaged car.
4. Report car number and incident to train dispatcher.

1.5.3 Defective Bolster Anchor/Radius Rod En Route

A. Train must not exceed 30 MPH.
B. Notify Train Dispatcher as soon as possible.
C. Train Dispatcher will designate where car is to be set off.

1.5.4 Overriding Buffer Plates – Action to Be Taken

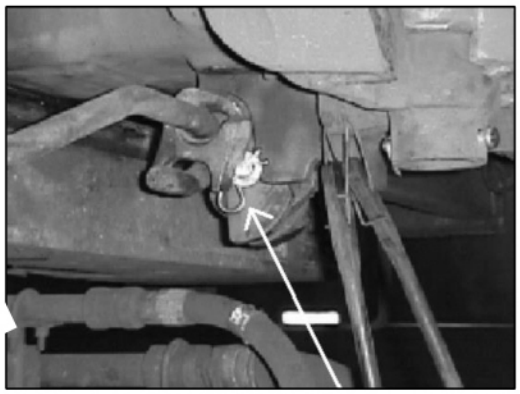
A. Notify Train Dispatcher immediately.
B. Train must not exceed 15 MPH and when moving through crossovers and turnouts, 5 MPH.
C. Employees and passengers must not occupy or pass-through vestibule area while train is in motion.

1.5.5 Coupler Locking Pins

A. To preclude the unintentional uncoupling of automatic H-type couplers of Amtrak cars, the H-coupler locking mechanism will be pinned. These pins are located in the “rotary lock lift” mechanism underneath the coupler and are secured with a “hair pin” which is placed through a hole drilled in the end of the bolt. This “pin” should be visible from the operating side of the cut lever. All trains with passenger equipment operating on main tracks are required to have their couplers pinned.

NOTE: All Metrolink trains are pinned.

EXCEPTION: Trains conducting Switching Operations (instruction 2.21.13), trains operating exclusively in yard facilities on other than main track, trains moving freight type equipment, and lite locomotive moves are not required to have their couplers pinned.



Hair Pin

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B. The transportation, or mechanical crew, that makes up a train or couples cars to a train is responsible for removing and inserting pins on the cars they couple to the train. Requirements for HEP shutdown and blue signal protection are in effect during this procedure.

C. If it becomes necessary to uncouple any cars from these trains en route, employees must:

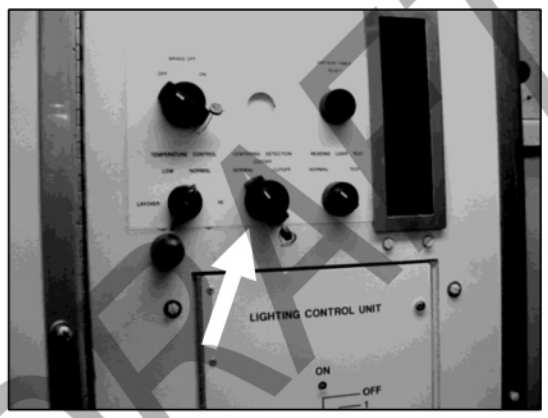
1. Visually check for locking pins before attempting to operate the cut lever. If none are visible, carefully operate cut lever to avoid injury if lever does not fully rotate.
2. If locking pin is visible, ensure that protection against equipment moving is provided, then remove “hair pin” from end of locking pin. Locking pin may be removed by pulling it out from opposite side of coupler. DO NOT USE FINGER TO PUSH PIN OUT OF THE ROTARY LOCK LIFT.

D. Pinning of cars has been added to the Mechanical Inspection prior to release into revenue service. Employees must expect trains to be pinned and take precautions to avoid injury when uncoupling locomotives and cars.

1.5.6 High-Speed Trainset (HST) Tilting Fault “Car Not Centered”

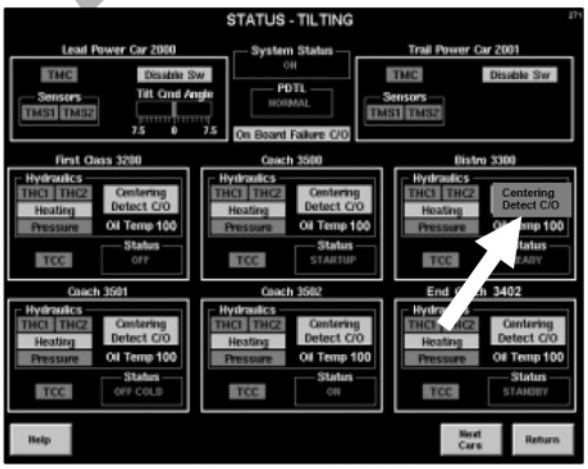
A. If a High-Speed Trainset (HST) receives a Level 1 fault on the Primary Operating Display (POD) indicating a “Car Not Centered” accompanied by an audible alarm, the following instructions must be followed:

1. The alarm block on Multi-Function Display (MFD-1) will display the fault “Car Not Centered” car number XXXX.
2. Engineer will acknowledge the alarm with the soft keys (F-7 or F-8) and notify the Conductor of the “Car Not Centered” fault.
3. A 20 mph maximum speed restriction will be enforced.
4. Crew must go to the electric locker on the affected car, break the seal on the Centering Detection Switch, and move it to the “CUTOUT” position. This will release the train speed restriction of 20 MPH.
5. Engineer will continue at Train Type C speeds.



Car Centering Switch Located in Passenger Car Electric Locker

6. The sub system status of the tilting system on the affected car must be checked to ensure that the centering detection C/O block is highlighted. The Conductor must check on MFD-B as soon as practical and the Engineer must check on MFD-2 at next location where the train is stopped.



Centering Detect C/O

7. Engineer will also have a message on the MFD-1 Alarm section that centering detection is cut out on the affected car.

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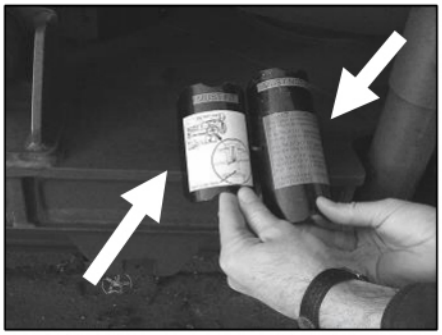
8. If the car is not centered and seating capacity permits, the Conductor will offer passengers seating in another car to avoid discomfort related to off center car condition.
9. Report the condition to the Dispatcher and operate at Train Type "C" speeds with the centering detection switch cutout.
10. Engineer must report these conditions on the MAP 100, *Equipment Condition Report*, and Conductors are required to report the conditions on the Record of Defect and Repair - EMAP 21A.

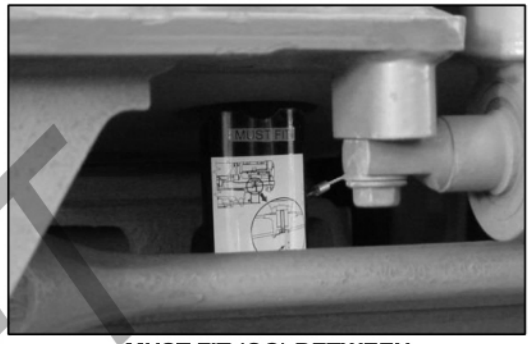
B. If the "Car Not Centered" fault can be reset with the "Portable Test Equipment" the train may proceed at Train Type A speeds. Centering switch must be cut back in. Notify Dispatcher that "Car Not Centered" fault is reset.

C. If the "Car Not Centered" fault is not reset en route by a Mechanical Technician or Road Foreman the train may proceed at Train Type C Speeds to its final destination, unless directed by a QMP to inspect the affected car. If so directed, perform the inspection as follows:

1. The "Car Not Centered" tools are stored on each Power Car in the tool locker directly behind the Engineer on the cab rear wall.



MUST FIT (GO) GAUGE **MUST NOT FIT (NO/GO) GAUGE**



MUST FIT (GO) BETWEEN TRUCK FRAME AND BOLSTER

2. After notifying the Dispatcher of the "Car Not Centered" fault, and receiving the required protection if required, a member of the train crew will go to the affected Trailer Car (Coach) that triggered the "Car Not Centered" alarm and check either side of the truck with both the Must Fit (GO) Gauge and the Must Not Fit (NO GO) Gauge.
3. On the affected Trailer Car (Coach) place the Must Fit (GO) Gauge between the truck frame and bolster. If the Must Fit (GO) Gauge does not fit, the car is NOT Centered. Proceed at train type C Speeds.
4. Take the Must Not Fit (NO GO) Gauge and place between the truck frame and bolster. If the gauge fits, this also confirms that the car is NOT centered. Both gauges must be used in the vertical position. It will be visible to the eye that the car is NOT centered and is slightly tilted, compared to the rest of the cars in the Trainset.
5. Check both trucks on the affected car with the (GO/NO GO) gauges.
6. If car is centered (GO) gauge fits, proceed at train type B speeds.

1.5.7 Operation of Dead General Electric Locomotives P32-BWH, P32AC-DM, P-40BH or P-42BH in Lead with a Multiple Unit Consist

A. When the lead GE P32-BWH, P32AC-DM, P-40BH or P-42BH Locomotive shuts down (prime mover shut down) and cannot be restarted, it is necessary to provide a charging circuit to the batteries of the lead locomotive. This is accomplished by properly connecting and setting up HEP from a trailing unit in the consist. If the proper HEP connections and settings are not made between the units in the consist, the batteries will discharge causing the **NO BATTERY CHARGE** circuit feature to disconnect safety critical components – e.g., IFC screens, horn, and headlight.

B. Proper HEP arrangement is as follows:

1. Connect all HEP cables between all units in consist.
2. If GE locomotive is trailing unit and will supply HEP:
   - **a.** HEP Mode Switch – Normal
   - **b.** HEP Locomotive Position Switch – Trail
3. If F-59PHI locomotive is trailing unit and will supply HEP:
   - **a.** HEP Source Switch – Local
   - **b.** HEP Trainline Setup Switch – Single Bus
4. Lead (Dead) GE unit:
   - **a.** HEP Mode Switch – Off
   - **b.** HEP Locomotive Position Switch – Lead

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c. After ensuring proper setup of HEP, engineer must observe battery charge ammeter for charging and note that **NO BATTERY CHARGE** indicator light is not lit.

C. If the **NO BATTERY CHARGE** light is "on", after HEP is properly connected and setup, reset the Battery Connect Pushbutton (BCPB) on electrical control panel. If the BCPB will not reset and battery ammeter indicates batteries are not charging, locomotive consist will have to be shifted or another lead unit added to consist.

D. Pneumatic operation requires all multiple unit hoses to be coupled for air supply and air brake control of the consist.

NOTE: DO NOT CUT IN THE DEAD ENGINE FEATURE

1.5.8 Fuel Transfer / Balancing on General Electric Locomotives P-40 and P-42

A. The fuel tank on General Electric P-40 and P-42 locomotives is divided into four compartments. Located inside the engine compartment on each side of the locomotive are supply and return shut-off valves for each compartment. These valves are used to open and close fuel supply and return to individual fuel compartments.

B. The fuel tank is equipped with two sensors to calculate the total fuel available. One sensor is located in the right-front compartment, the other sensor is located in the left-rear compartment. Total fuel is calculated by adding the amount of fuel in the right-front and left-rear compartments, then multiplying by two. This is the amount of fuel you see on the digital displays on each side of the locomotive as well as on the IFD screen. The digital displays are accurate only if fuel is being drawn from all four fuel compartments at the same rate. If fuel is being used at a higher rate from one compartment, especially the left-front or right-rear, the digital display will not accurately indicate total fuel available.

C. To determine the amount of fuel in individual compartments, the fuel sight glasses on each side of the locomotive must be used. Each fuel compartment is equipped with four sight glasses. The approximate fuel levels per sight glass are as follows:

1. Top Sight Glass – 500 Gallons
2. Second Sight Glass – 315 Gallons
3. Third Sight Glass – 150 Gallons
4. Bottom Sight Glass – 30 Gallons

D. If the fuel level in a compartment is at or below the bottom sight glass, it is likely that air will be drawn into the fuel system causing engine shut-down. **It is important to note that sufficient fuel may be remaining in the other three compartments to operate the diesel engine to the final destination or fueling point.** When this condition exists, the following procedure should be followed to identify the empty fuel compartment and restart the diesel engine:

1. Make certain that train is stopped in a safe location and properly secured.
2. Observe the fuel sight glasses on both sides **from the ground** to determine which compartment is empty or low.
3. In the engine compartment, close the supply and return valves to the compartment which is empty or low.
4. Open the vent petcock on top of the fuel filter housing. The fuel filter housing is located in the engine compartment, at floor level, on the engineer's side, at approximately the middle of the diesel engine.
5. Move the Fuel Prime/Engine Start switch to the Fuel Prime position and hold.
6. Observe fuel and air exhausting from the vent petcock on the fuel filter housing.
7. Continue holding the Fuel Prime/Engine Start switch in the Fuel prime position until all air is exhausted from the fuel system.
8. When fuel flows clear from the vent petcock, close it.
9. Continue priming until the fuel sight glass, located at floor level, adjacent to the Fuel Prime/Engine Start switch, is clear of bubbles.
10. If the sight glass does not clear, open vent petcock on fuel filter housing again to expel air. Close vent petcock when air is expelled.
11. Repeat steps as necessary until fuel flows clear in fuel sight glass.
12. Restart diesel engine.

E. Make note on MAP 100 when a fuel compartment is isolated as described in the steps above. This must be done in order to have the valves positioned correctly at the next mechanical facility. This also serves to document the occurrence of this problem on a particular locomotive.

F. When fuel is added to the locomotive, the following items must be taken into consideration before opening the supply and return valves to the isolated compartment:

1. The two compartments are first filled on the side which has the fuel hose connected. When these compartments are full, fuel then flows to the opposite side of the locomotive to fill the remaining two compartments.
2. If the locomotive is only partially filled with fuel, observe the fuel sight glasses on the sides of the locomotive to make certain that fuel is in the isolated compartment before opening the supply and return valves.
3. If the locomotive is completely filled with fuel at a fueling point, all supply and return valves must be opened.

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4. When in doubt about the fuel levels in each compartment, observe the sight glasses on the side of the locomotive.

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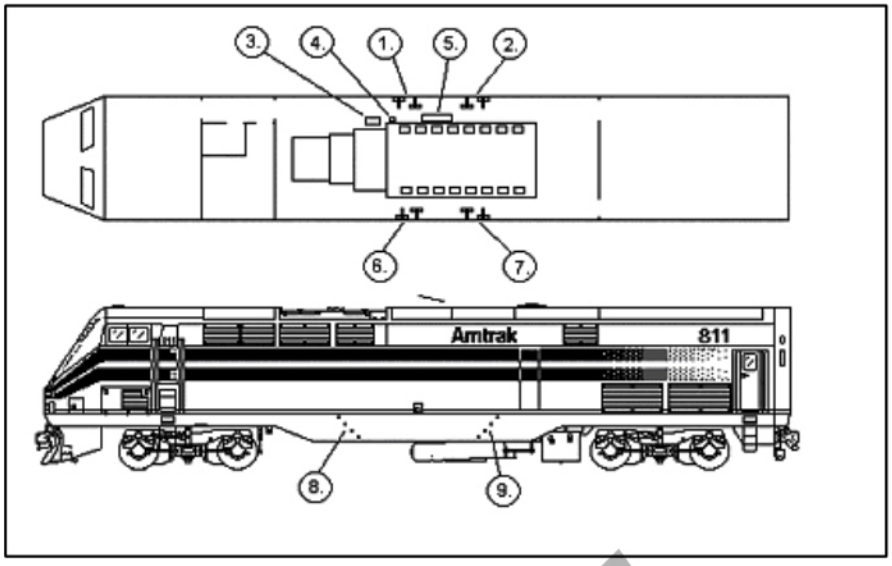

1. Butterfly type Supply Valves for right front and rear compartments (Non-modified units - Supply and Return Valves for right-front compartment)	6. Butterfly type Supply Valves for left front and rear compartments (Non-modified units - Supply and Return Valves for left-front compartment)
2. Butterfly type Return Valves for right front and rear compartments (Non-modified units - Supply and Return Valves for right-rear compartment)	7. Butterfly type Return Valves for left front and rear compartments (Non-modified units - Supply and Return Valves for left-rear compartment)
3. Engine Start Station	8. Left-Front Compartment Sight Glasses
4. Fuel Sight Glass	9. Left-Rear Compartment Sight Glasses
5. Fuel Filter Housing & Petcock	

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1.5.9 Parking Brake Cut-Out Cocks on General Electric Locomotives P-40DC, P-42DC and P32ACDM

A. The General Electric P-40DC, P-42DC and P-32ACDM locomotives are not equipped with the conventional hand brake. It has a spring-applied, air-released parking brake. When the parking brake handle in the operator's cab is moved to the RELEASED position, main reservoir air is sent to all eight parking brake units (four per truck). The main reservoir air pressure overcomes spring pressure to release the parking brake. When the parking brake handle is moved to the APPLIED position, air is vented at the handle. When the air is vented, a large spring on each brake unit applies the parking brakes.

B. There have been reported incidents that when adding or cutting off locomotive(s), the parking brake cut-out cock on the front of the locomotive has been closed. When the parking brake cut-out cock is closed, the parking brake will apply and not release regardless of what position the parking brake handle in cab.

C. To prevent inadvertent closure of the parking brake cut-out cock, the handle has been painted bright orange or red. Do not confuse the brake cylinder cut-out cock (outboard) with the parking brake cut-out cock (inboard).

1.5.10 Door Close By-Pass Function on General Electric Locomotives P-42 and P-32BWH

A. General Electric P-42 and P-32 BWH locomotives are modified for operation with cars equipped with a door closed sensing circuit. This modification includes installation of a Door Closed By-Pass Switch (DCBS), a Coach Door Closed Light (CDCL) and a Door Override Light (DORL).

B. P-42 Equipment Description:

1. Door Closed By-Pass Switch (DCBS) – This switch, which is labeled "Normal / By- Pass Door Closed", is located on the Engine Control Panel, adjacent to the MU Headlight switch. When locomotive is used with cars equipped with a door closed sensing circuit, the DCBS will be sealed in the Normal (Up) position.

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2. Coach Door Closed Light (CDCL) – This light (green), which is located on the panel above the engineer's side windshield, illuminates to indicate that the doors are closed throughout the train when cars are equipped with a door closed sensing circuit.
3. Door Override Light (DORL) – This light (red), which is located on the panel above the engineer's side windshield, illuminates to indicate that the DCBS is in the By- Pass position.

C. P-32 BWH Equipment Description:

1. Door Closed By-Pass Switch (DCBS) – This switch, which is labeled "Door Override", is located on the Engineer's Console, adjacent to the gauge light switch. When locomotive is used with cars equipped with a door closed sensing circuit, the Door Override Switch will be in the Normal (Up) position.
2. Coach Door Closed Light (CDCL) – This light (green) which is located on the Engineer's console next to the Ditch Light toggle switch, illuminates to indicate that the doors are closed throughout the train when cars are equipped with a door closed sensing circuit.
3. Door Override Light (DORL) – This light (red), which is located on the Engineer's console next to the Ditch Light toggle switch, illuminates to indicate that the DCBS is in the By-Pass position.

D. During normal operation with cars equipped with a door sensing circuit, the locomotive will not load until all doors are closed in the train. When all doors are closed the CDCL illuminates, allowing the locomotive to load. If a fault occurs, door won't close, or the door sensor fails, the CDCL will not illuminate, preventing the locomotive from loading.

E. When the CDCL is not illuminated, due to fault, door won't close or door sensor failure the DCBS may be operated to allow locomotive loading as follows:

1. Contact the train crew to establish a clear understanding that the DCBS will be operated, and
2. When it is known that the train crew understands that the door close sensing circuit will be by-passed, operate DCBS by placing it in the By-Pass (down) position.

F. While in operation with cars NOT equipped with a door closed sensing circuit, place the DCBS in the By-Pass (down) position, breaking the seal if necessary.

1.5.11 Crossing Light Pulsing Manual Stop on General Electric Locomotives P-40, P-42 ,P-32DM, and P32-BWH

A. General Electric locomotives have been retrofitted with an upgraded Crossing Light (Ditch Light) controller. This pushbutton, labeled "Crossing Light Pulsar Stop", is located on the right side of the Engineer's console, just above the Crossing Light Switch.

B. If the Crossing Lights are activated by sounding the horn, the flashing of the Crossing Lights can be deactivated by pushing the Crossing Light Pulsar Stop button.

C. The Crossing Lights will start flashing again with the next activation of the horn. Crossing Lights can still be activated manually using the Crossing Light switch; no changes have been made to the functionality of the Crossing Light Switch.

1.5.12 Locomotive Car Body Doors

A. Engine crews must ensure that all locomotive car body doors are kept closed. Failure to keep these doors closed can cause leaves and debris to restrict or stop air flow causing equipment failure.

1.6 Equipment – Head End Power (HEP)

1.6.1 HEP Short Looping Procedures

A. A train must not depart its originating terminal with HEP cables short looped when qualified mechanical forces are on duty to make the necessary repairs.

B. A train may be short looped en route only:

1. When other corrective actions have failed to restore HEP to train consist, and
2. After it is determined that there are no damaged or dragging cables.

C. Short Looping Procedure

1. Short loop behind locomotive on side which trainline complete indication is not displayed.
2. Be sure to short loop cable back into remaining receptacle on car.
3. Ensure that locking ring on receptacle is engaged if equipped.
4. Notify CNOC mechanical desk at 1-800-424-0217 that train is short looped.
5. Notify relieving Engineer and Conductor that train is short looped and location.

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1.6.2 HEP Set Up Procedures on EMD F-59 Locomotives

A. EMD F59PHI locomotives used in Amtrak service must have the "HEP Trainline Set-Up" switch in the "Single Bus" position.

NOTE: If the "HEP Trainline Set-Up" switch is placed in the "Dual Bus" position, the TLC protection is nullified.

1.6.3 HEP Used as Ground/Wayside Power

A. When available, Ground/Wayside power will be used instead of using a locomotive to provide HEP.

B. When Ground/Wayside power is used for HEP source with General Electric locomotives P-32BWH, P40 or P-42 in a train, set up must be as follows:

1. HEP Mode switch must be in the "OFF" position on all units in a locomotive consist, except the unit which will later provide HEP to the train.
2. HEP Mode switch must be in the "WAYSIDE" position on the unit which will later provide HEP to the train.
3. All trailing units in a locomotive consist must have Locomotive Position switch positioned to the "TRAIL or WAYSIDE" position.
4. When ground or wayside power will be connected to the rear of the train, the Locomotive Position switch on the lead locomotive will be set to the "Lead" position.
5. When ground or wayside power will be connected to the front of the lead locomotive, the Locomotive Position switch on the lead locomotive will be set to the "TRAIL or WAYSIDE" position.

C. When Ground/Wayside power is used for HEP source with EMD F-59 locomotive(s) in train, set up must be as follows:

1. Close the layover protection system circuit breakers located on the LAYOVER circuit breaker panel.
2. Ensure that the HEP source switch is placed in the "TRAIN-LINED" position.
3. Place the LAYOVER switch in the "LAYOVER ON" position. This will allow for battery charging and protection of both the main engine and HEP engine during low ambient temperatures by heating and circulating cooling water and lube oil.
4. Ensure battery trickle charger located in short hood (nose) is on.

D. When Ground/Wayside power is used for HEP source with a Siemens Charger locomotive, set up must be as follows:

1. Shut down HEP on Charger on cab rear wall panel.
2. Set HEP SELECTOR switch in Electrical Room to "Feed Thru'.
3. When ground or wayside power is connected, verify Train Operators Display TOD indicates "HEP ON (EXT)"

1.6.4 Locomotive HEP Operation Troubleshooting Guidelines

NOTE: BEFORE PERFORMING ANY WORK ON HEP AND/OR TRAINLINE, REVIEW ALL APPLICABLE SAFETY INSTRUCTIONS AND REQUEST THREE POINT PROTECTION!

A. If a train loses HEP while on the line of road, the train electrical system will shut down. Head End Power loss can be caused by many different problems; the first step is to determine whether to troubleshoot the HEP source in the locomotive, or the 480v cable system.

1. Indicator(s) show 480v HEP trainline circuit is complete.
   a. Possible Cause: HEP Failure.
   b. Action: Refer to HEP troubleshooting section of appropriate locomotive operator's manual for DC units.

NOTE: AC locomotives will automatically use a traction inverter to provide HEP when the HEP inverter has a fault condition.

2. No Trainline Complete Indication
   a. Possible Cause: A loose or defective 480v cable or receptacle.
   b. Action:
   (1) SHUT DOWN AND ISOLATE HEP.
   (2) Visually inspect each 480v receptacle for an unseated or loose cable.
   (3) If no defective cables can be seen, the fault may be corrected by "short looping" one side of the train. Short loop behind the locomotive when practical, unless conditions require short looping in another location.
   (4) Report any troubleshooting steps taken and note where the fault is located on the appropriate MAP 100.

CAUTION: Amtrak locomotives are equipped with a 5 mph trainline complete function. This will allow HEP output to continue at train speeds above 5 mph even though trainline complete is lost. At train speeds below 5 mph, HEP will

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shut down. Any time trainline complete is lost, visually inspect each 480v receptacle for an unseated, loose, or dragging cable. 26-FOI-00415 00000006203 "UNCLASSIFIED" 4/30/2026

NOTE: On GE locomotives, if train speed is below 5 mph for more than 20 minutes without trainline complete, HEP will NOT restart. Cause of no trainline complete must be corrected before HEP can be restarted.

1.7 Equipment – Diesel Engines - General

NOTE: BEFORE PERFORMING ANY WORK ON HEP AND/OR TRAINLINE, REVIEW ALL APPLICABLE SAFETY INSTRUCTIONS AND REQUEST THREE POINT PROTECTION!

1.7.1 Diesel Engine Restart. Whenever a diesel locomotive shuts down and cannot be restarted after ONE attempt, the following procedure will apply:

A. Single Unit Consist

1. Shut down and isolate HEP if it is not a separate HEP system.
2. Disconnect all communication and MU jumper cables(s) between dead unit and train due to possible ground.
3. Restart the dead unit.
4. Reconnect the jumper cable(s).
5. Restore HEP.

B. Multiple Unit Consist

1. Shut down and isolate HEP if it is not a separate HEP system.
2. Disconnect all communication and MU jumper cables(s) from the dead unit.
3. Restart the dead unit.
4. Reconnect the jumper cable(s). If the unit shuts down again and cannot be restarted, isolate the dead unit, and drain if necessary.
5. Restore HEP.

1.7.2 Diesel Engine Protective Devices. The following pertains to Crankcase Over-Pressure and Low Water Pressure protective devices used on diesel-electric locomotives.

A. General Electric - Crankcase Overpressure Monitoring

1. A crankcase overpressure fault is indicated by a summary message on the DID panel or IFD screen.
2. Unit may not shut down after crankcase overpressure fault occurs.
3. This fault must **NOT** be reset by engine crews unless specifically instructed to do so by the Mechanical Department.
4. Affected unit should be isolated to silence the alarm and drain if necessary.
5. Report occurrence on the MAP 100 for that unit.
6. Notify Train Dispatcher/CNOC as quickly as possible.

B. EMD - Crankcase Overpressure Monitoring

1. Once tripped, the crankcase overpressure device must **NOT** be reset, and the engine must not be restarted. Device must not be blocked or otherwise prevented from functioning as intended.
2. This device is located near the main engine start station.
3. Affected unit should be isolated to silence the alarm and drain if necessary.
4. Report occurrence on the MAP 100 for that unit.
5. Notify Train Dispatcher/CNOC as quickly as possible.

C. General Electric – Low Water Pressure Monitoring

1. A low water pressure fault is indicated by a summary message on the DID panel or IFD screen.
2. Diesel engine load and speed reduces progressively until water pressure or temperature reaches a certain level at which time the diesel engine shuts down.
3. This fault may be reset by engine crews provided that a sufficient level of water is indicated in the sight glass.
4. The fault is reset using either the DID panel or IFD screen.

CAUTION — If low water pressure fault occurs after engine is restarted, such condition may indicate a water pump failure which could cause serious damage to the engine. In such cases, DO NOT RESTART THE ENGINE. If unit is to remain shut down, isolate unit to silence the alarm and drain if necessary.

5. Notify Train Dispatcher/CNOC as quickly as possible. Report must also be made on the MAP 100 for effected unit.

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D. EMD – Low Water Pressure Monitoring

1. Once tripped, this device/fault may be reset, and the engine restarted provided that a sufficient level of water is indicated in the sight glass.
2. Older EMD units:
   - **a.** This device shares a common housing with the crankcase overpressure device which is located near the main engine start station.
   - **b.** The low lube oil button on the engine governor must also be reset to restart engine.
   - **c.** The "test cock" connected to the low water pressure device may need to be opened and closed in order for reset button to remain reset.
   - **d.** The low water pressure reset button may be temporarily held in until engine reaches idle speed and water pressure is restored. However, this device must not be blocked or otherwise prevented from functioning as intended.
3. Newer "EMDEC" equipped units:
   - **a.** Locate the "Fuel Injection" switch handle on the annunciator (fault) panel near the main engine start station.
   - **b.** Move the switch to the "STOP" position and return the switch to the "RUN" position to reset the fault.
   - **c.** Restart the engine.
   - **d.** Notify Train Dispatcher/CNOC as quickly as possible. Report must also be made on the MAP 100 for effected unit.

CAUTION — If low water pressure device trips after engine is restarted, such condition may indicate a water pump failure which could cause serious damage to the engine. In such cases, DO NOT RESTART THE ENGINE. If unit is to remain shut down, isolate unit to silence the alarm and drain if necessary.

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1.7.3 Diesel Engines utilizing Diesel Exhaust Fluid (DEF).

The following pertains to Siemens SC-44 and ALC-42 type locomotives.

A. SC-44 and ALC-42 locomotives require the use of Diesel Exhaust Fluid (DEF) to operate the main engine's Aftertreatment System to achieve the required EPA Compliance (Tier 4) for the locomotive. To consistently meet this EPA requirement, the locomotive DEF tank fluid level should be checked daily by accessing the Train Operator Display (TOD) screens in the locomotive cab or utilizing the DEF Tank fluid level indicator.

B. To monitor the DEF level utilizing the TOD, perform the following steps at the Main Menu Screen:

1. Press "System" soft key.
2. Press "Engine" Soft Key.
3. The DEF Tank level will be shown as a percentage on the bottom right.



Engine System			
Ambient temperature	70 °F	0.00 A	Alt. excitation current
Fuel tank content	491 gal.	1 A	Alternator current
Fuel temperature	79 °F	67 °F	Alternator temperature
Oil temperature	82 °F	0 V	DC-link voltage
Coolant temperature	82 °F	-1 V	Ground fault detect. volt.
Air starter pressure	81 psi	no request	ACM
Engine setpoint speed	600 RPM	denied	ACM interlock
Engine speed	0 RPM	100 %	DEF tank level
Engine shaft power	0 hp	66 °F	DEF temperature
Engine cooling power	0 hp	0h	Engine running w/o DEF

C. Fluid Level Indicators on the side of the DEF Tank can also be used to confirm the tank level.

D. If DEF runs out (0% in the DEF tank), Engineers are required to report this to the CNOC Mechanical Desk (302-737-2082 or 2083) and note it on the MAP 100 in the Failure En Route / Equipment Conditions section.

E. The locomotive can continue to be operated to its final destination or to the next location where DEF can be added.

Note: For most passenger line-haul applications, the nominal DEF consumption rate will be approximately 10% of the Diesel Fuel consumption rate.

1.7.4 Draining the Diesel Engine Conditions

A. When the diesel engine is shut down and cannot be restarted, with outside temperature less than 40 degrees Fahrenheit, the cooling system must be drained to prevent freezing.

1.7.5 Diesel Engine Fuel Conservation - Shutting Down Diesel Engines

A. Manually shut down trailing units after arrival (Including AESS and SmartStart equipped units).

1. When temperature is above 40 degrees Fahrenheit and is not expected to fall below 40 degrees Fahrenheit, engineers of inbound trains will shut down all trailing units upon arrival at the train's final terminal. When necessary to provide HEP on train due to passenger detraining or employees working on train with P-42/P-40/P-32 locomotives, place HEP on the lead engine in STANDBY mode.

B. Manually shut down all units not scheduled to be used within ONE Hour (Including AESS and SmartStart equipped units).

1. When temperature is above 40 degrees Fahrenheit and is not expected to fall below 40 degrees Fahrenheit, all locomotives that are not scheduled to be placed in service within ONE hour must be shut down. When necessary to provide HEP on train due to passengers de-training, food service refrigeration or employees working on train, place HEP on the lead engine in STANDBY mode.

C. Securing Shut Down Units NOT on Ground/Wayside Power.

1. Secure equipment in accordance with instruction 2.14.
2. Turn off all unnecessary auxiliaries (i.e., heater, lights, etc.).
3. **DO NOT** turn off the Turbo Lube Pump circuit breaker on turbocharged EMD locomotives.
4. **DO NOT** turn off the Computer circuit breaker on F-59PHI locomotives.
5. Open Generator Field switch.
6. If equipped, move Isolation switch to Isolate position (GE units to Start position).
7. Open the battery switch except as follows:
   - **a.** **DO NOT** open battery switch when HEP will be connected to locomotive. HEP will charge batteries on locomotive.
   - **b.** **DO NOT** open battery switch when Train Control System must remain energized. If battery switch is opened, train control system must be retested.

D. On EMD units, except F-59PHI locomotives, wait 35 minutes prior to opening the battery switch unless it is known that the turbo lube pump is directly connected to the batteries.

1.7.6 Diesel Engine Fuel Conservation – Standby HEP Actions

A. When a unit is providing HEP and the train is expected to be standing for more than 15 minutes, place HEP in STANDBY mode. If the trailing unit cannot be reached by walking through the locomotive consist, change mode to STANDBY only if operating conditions do not present a safety hazard.

B. HEP Mode Change Procedure:

1. Press the HEP Off button (HEP contactor will open).
2. Move the HEP Mode switch to the desired position (Normal or Standby).
3. Wait one minute.

NOTE: If extreme outside air temperature (hot or cold) would affect passenger comfort while waiting one minute to restart HEP, do not change mode from Normal to Standby.

4. Press and hold the HEP On button (HEP contactor closes).
5. When the locomotive unit is supplying HEP in the Standby mode, it will be considered "Isolated" for the purposes of securing equipment per instruction 2.14. (The locomotive cannot provide power while in Standby mode).

1.8 Equipment – Diesel Engines – Automatic Engine Start Stop System (AESS)

1.8.1 Engineers must ensure that the AESS system is active on all units so equipped.

A. When a locomotive will be standing for more than 5 minutes, Engineers must ensure that the control stand settings are correct on the controlling locomotive in order for the AESS system to function.

1.8.2 AESS Equipment Description

A. Auto Start Disable Switch (ASDS). This switch is located in Control Area 1, on the left side of the cab, behind the access door to the traction motor support bearing monitor. This switch is used to turn the system ON (up) and OFF (down) on the local unit only (the function is not MU trainlined). This switch must be ON (up) on all units in the locomotive consist and all push-pull units for normal operation.

B. Diesel engine "Auto Stop Override" (SASS) pushbutton. This pushbutton is located on the Engine Control Panel above the traction motor cut-out switches. This pushbutton is used to suspend (delay) automatic diesel engine shutdown for

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approximately 120 minutes on the locomotive on which it was pressed (the function is not MU trainlined). The pushbutton can also be used to force the system to shut down the diesel engine sooner that the normal programmed time.

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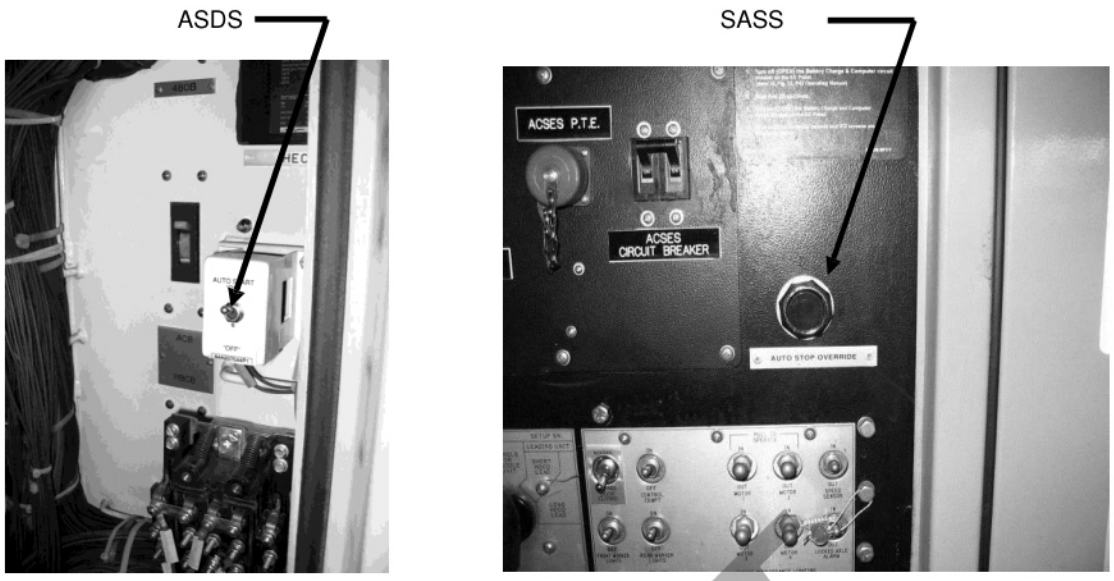

1.8.3 AESS Basic Functions

A. When the Auto Start Disable Switch (ASDS) is OFF (down), the Automatic Engine Start/Stop (AESS) system will not shut down the diesel engine on that locomotive only (function NOT MU trainlined).

NOTE: If the diesel engine is running and the Auto Start Disable Switch (ASDS) is OFF (down), the IFD message "**Engine Stop Control NOT ACTIVE**" is displayed on the affected locomotive only.

NOTE: If power (load) is attempted with the Auto Start Disable Switch (ASDS) OFF (down), a continuous alarm bell will ring on the affected locomotive only.

B. The Auto Start Disable Switch (ASDS) and the Auto Stop Override (SASS) pushbutton function on the local locomotive only (function NOT MU trainlined). Therefore, activation of either switch or pushbutton affects only the locomotive on which it was activated.

C. All IFD messages and alarm bells related to the Automatic Engine Start/Stop system are displayed/sounded on the local locomotive only (this function is not MU trainlined). Therefore, when units in a multiple unit consist automatically shut down and start up, the engineer will only see/hear indications for the unit on which he/she is located.

D. Automatic diesel engine shutdown will NOT occur on locomotives supplying HEP.

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1.8.4 AESS Automatic Diesel Engine Shutdown

A. Engineers must ensure that the control stand settings are correct on the controlling locomotive for automatic shutdown/startup to occur. Proper set up is:

1. Throttle is in IDLE position.
2. Independent brake applied (IBS closed).
3. Reverser handle is in NEUTRAL position.

NOTE: The AESS system determines Reverser position ONLY while the Generator Field Breaker is CLOSED (up).

NOTE: If necessary to OPEN (down) the Generator Field Breaker, the Reverser position defaults to Neutral regardless of actual handle position.

B. When the system determines that the control stand settings are correct, "**Auto Stop May Occur: MMM:SS Minutes**" is displayed on the IFD with a 10-minute countdown. If the control stand settings do not change, automatic engine shutdown will occur when the 10-minute countdown expires on the affected unit(s) as follows:

1. An alarm bell will ring for 30 seconds.
2. IFD message displayed "Auto Engine Start/Stop in Process".
3. Diesel engine shuts down.

NOTE: If predefined locomotive system conditions (temperature, battery voltage, pressure) are out of limits, the diesel engine may not shut down until the conditions are within limits, even though control stand settings are correct.

C. After the diesel engine has been shut down by the system, "**Auto Engine Start Control ACTIVE**" is displayed on the IFD accompanied by an alarm bell ring for 1 second every 5 minutes.

D. To automatically shut down the diesel engine without waiting the 10-minute period (fast shutdown) as described above:
1. Press the Auto Stop Override (SASS) pushbutton twice within 30 seconds.
2. If the control stand settings and other system limits are within range, in 60 seconds an automatic shutdown will occur on the unit on which the pushbutton was pressed (local unit only, this function is not MU trainlined).

1.8.5 AESS Suspend (Delay) Automatic Diesel Shutdown (Local Unit Only)

A. To suspend automatic shutdown for 120 minutes (2 hours):
1. Press the Auto Stop Override (SASS) pushbutton (local unit only, this function is not MU trainlined).
2. When shutdown is suspended, the following IFD message is displayed with a countdown: "**AESS SUSPENDED for MMM:SS Minutes**".
3. Each time the Auto Stop Override (SASS) pushbutton is pressed the countdown is reset to 120 minutes (2 hours).

1.8.6 AESS Automatic Diesel Engine Startup

NOTE: Automatic diesel engine restart will only function on units which were shut down automatically by AESS. If diesel engine was shut down by another means, manual restart is required.

A. Careful consideration must be given to physical characteristics, especially grade, prior to movement of train/equipment with automatically shut down locomotives in consist.

NOTE: Approximately 2 minutes is required for diesel engine restart.

B. To automatically restart ALL the diesel engines of MU'ed locomotives (includes multiple unit consists and push-pull equipment), do the following:
1. Close (up) Generator Field Breaker.
2. Move the reverser handle to FORWARD or REVERSE.
3. Wait approximately 2 minutes for diesel engine restart.

NOTE: If independent brake is released, automatic restart will also occur. However, it is prohibited to intentionally release the independent brake solely for the purpose of causing automatic engine restart.

C. Automatic engine restart occurs on all equipped locomotives as follows:
1. An alarm bell will ring for 30 seconds.
2. IFD message displayed – "Auto Engine Start/Stop in Process".
3. Diesel engine restarts.

NOTE: Automatic engine restart will occur any time predefined locomotive system conditions (temperature, battery voltage, pressure) are out of limits.

1.8.7 AESS Troubleshooting

A. If an IFD message "**Auto Engine Start Control NOT ACTIVE**" is displayed on affected unit while the diesel engine is running, move the ASDS switch to the ON (up) position on affected unit for normal operation.

B. If automatic shutdown does not occur when the control stand settings are correct, check that the following locomotive settings are correct:
1. ASDS switch in "ON" (up).
2. Auxiliary cab door is closed.
3. Battery knife switch is closed.
4. Engine Control Switch is in RUN, START, or ISOLATE.

C. After auto shutdown has occurred, IFD message "**Auto Engine Start Control NOT ACTIVE**" is displayed accompanied by a 30 second alarm bell on the affected unit, this indicated that at least one locomotive setting has changed, and a manual

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engine restart is required. Ensure that the locomotive settings are correct as indicated below and manually restart the diesel engine from the start station.

1. ASDS switch is “ON” (up).
2. Auxiliary cab door is closed.
3. Battery knife switch is closed.
4. Engine Control Switch is in RUN, START, or ISOLATE.

D. If an IFD message “AESS OFF: Turn ON to Silence Alarm” is displayed on the affected unit, accompanied by a continuous alarm bell when the throttle is moved out of IDLE, this indicated that the ASDS switch is OFF (down) on the affected unit. Correct the condition by positioning the ASDS switch ON (up) on all units in the locomotive consist.

E. If the diesel engine does not restart automatically on the affected unit after an automatic shutdown due to a system fault or other condition, manually restart the diesel engine from the start station and place the ASDS switch in the ON (up) position.

1.8.8 AESS on Siemens Charger Locomotives SC-44 and ALC-42

A. The engineer can control the AESS by a rotary type switch located on the rear wall control panel in the cab to either cut in or cut out status. AESS will stop the diesel engine automatically if all the following criteria is met:

1. Engine in idle mode for more than 30 minutes
2. Reverser set to N (neutral) position or OUT and removed
3. Master Controller in position 0 (idle)
4. Parking brake is applied
5. Vehicle speed is 0 mph
6. Coolant temperature allows normal engine operation (above +30°C/+86°F)
7. Outside air temperature is high (above +10°C/+50°F)
8. Battery voltage is OK
9. Air pressure reservoir for engine start is OK (= 8.5 bar/123.3 psi)
10. Isolation switch in position START/STOP/ISOLATE
11. DEF temperature above +5°C/41°F

B. The diesel engine will be started automatically by AESS, if any one of the following criteria is met:

1. Coolant temperature is low (below +12°C/+53.6°F)
2. Outside air temperature is low (below +10°C/+50°F)
3. Traction lever not in position 0
4. DEF temperature is low (below 0°C/+32°F)
5. Air pressure reservoir for engine start is low (less than 6.5 bar/94.3 psi)
6. Battery voltage is not okay
7. Vehicle speed is not 0 mph
8. Parking brake released
9. AESS shutdown time expired

C. If an override of the AESS shutdown becomes necessary, it can be accomplished in one of the following ways:

1. Turn AESS rotary switch to CUT OUT status
2. Move traction lever out of Neutral (N) position
3. ISOLATION SWITCH placed in RUN position
4. Release parking brake
5. Driving direction selected with reverser

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Operations Section

2.0 Operations

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2.1 Locomotives - Non-Complying Condition (Defect) Discovered En Route at Other Than Calendar Day Inspection Point

NOTE: For instructions 2.1.1 through 2.1.35, any non-complying condition (defect) discovered en route must be documented per instruction 3.1.15. In addition to particulars noted in instructions 2.1.1 through 2.1.35, the following must also be complied with:

A. Locomotive may continue in use to next Amtrak locomotive repair facility,
B. Complete non-complying tag per instruction 3.1.15,
C. Note defect on MAP 100,
D. In multiple unit consists or push/pull operations, note on MAP 100 of lead unit that non-complying locomotive is in consist or train,
E. Notify the CNOC mechanical desk at 1-800-424-0217 as soon as possible without delaying train.
1. If applicable, notify the Siemens mechanical desk at CNOC at 1-302-683-2753.
2. If applicable, MARC locomotive issues are to be reported to the Amtrak Commuter Operations Center at 1-202-906-2772.

2.1.1 Hand/Parking brakes are in a safe and suitable condition for service.

2.1.2 Cab seats properly secured to the floor or sides.

A. Verbally notify all crewmembers of non-complying condition. Switch locomotive to trailing position if unsafe to continue as lead unit. At next Calendar Day Inspection location, repair, or switch to trailing position.

2.1.3 Cab windows and wipers provide clear vision and windows are free of broken areas.

A. Verbally notify all crewmembers of non-complying condition. Switch locomotive to trailing position if unsafe to continue as lead unit. At next Calendar Day Inspection location, repair, or switch to trailing position.

2.1.4 Cab heaters and Air Conditioning (if equipped) function as intended.

A. Switch locomotive to trailing position if unsafe to continue as lead unit. At next Calendar Day Inspection location, repair, or switch to trailing position.

2.1.5 Cab lights and gauge lights are operative and provide sufficient illumination.

A. At next Calendar Day Inspection location, repair, or switch to trailing position.

2.1.6 Speed indicator and related apparatus is undamaged.

A. The performance and accuracy of the speed indicator can only be ascertained after departure (10 mph to 30 mph +-3 mph; above 30 mph +- 5 mph). If found in non-compliance or out of limits as indicated above, at next Calendar Day Inspection location, repair, or switch to trailing position.

2.1.7 Deadman/Alerter functions as intended.

A. An alerter will be considered as having failed only when it will not acknowledge by pressing the “Alerter Acknowledge Button/Switch”.

EXCEPTION: When ATC is cut out on High Speed Trainset or HHP-8 Locomotive, the alerter cannot be acknowledged using the alerter switch or foot pedal. In this case the alerter will **not** be considered as having failed.

NOTE: Alerter cycle times vary. Alerters which seem to cycle with short or long times must be reported on the MAP 100.

B. If deadman/alerter fails en route, the locomotive may continue in use to the next Amtrak locomotive repair facility when the following is complied with in a “single engineer” operation:
1. An employee trained to apply the emergency brake MUST be IMMEDIATELY positioned in the operating control compartment with the Engineer.
2. When qualified employee, as described above, is not available to position in operating control compartment, the Engineer shall be in constant communication with a second crewmember as follows:
a. Engineer will communicate with a designated train crewmember, either verbally or by radio, the name of all block/interlocking signals, the approach to the limits of authority (DTC blocks, Track Warrants, Form D, etc.) and temporary speed restrictions.

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b. A designated train crewmember will be alert for and acknowledge these communications. If the Engineer does not remain in communication as described above, the designated train crewmember must determine the cause and if necessary, take action to stop the train.

NOTE: The Conductor will designate the train crewmember who will be positioned in the operating control compartment with the Engineer.

C. Alerter may be cut out electronically or pneumatically,
D. Place non-complying tag on control stand or engine control panel indicating “Defective Alerter”.
E. At next Calendar Day Inspection location, repair, or switch to trailing position.

2.1.8 Air brake gauges register variations in pressure when brake valves are manipulated.

A. At next Calendar Day Inspection location, repair, or switch to trailing position.

2.1.9 Air compressor or compressors control main reservoir pressure, as indicated by cab gauges, within range specified for type locomotive.

A. At next Calendar Day Inspection location, repair, or switch to trailing position.

2.1.10 Headlights operate properly and can be dimmed as required. One defective bulb of an Incandescent or LED **IS NOT** considered non-compliant.

A. Locomotive may continue in use until next calendar day inspection,
B. At next Calendar Day Inspection location repair or switch to trailing position.

2.1.11 All auxiliary (ditch) lights operate as intended.

A. If (1) defective auxiliary light is discovered at initial/originating terminal of train, repair, or switch locomotive to trailing position, and repair no later than next Locomotive Calendar Day Inspection,
B. If (1) auxiliary light is defective, proceed and repair no later than next Locomotive Calendar Day Inspection,
C. If (2) auxiliary lights are defective:
1. Proceed, not exceeding 20 mph over public road crossings, to the next point where repairs can be made or the next Locomotive Calendar Day Inspection, whichever occurs first, or
2. Switch locomotive to the trailing position.

NOTE: Auxiliary lights are considered non-complying if one or more lightbulbs are burned out. A failure of the flashing function is not considered a failure of the auxiliary lights but must be reported on MAP 100.

2.1.12 Locomotive radio operates as intended.

A. Repair, or replace with another operative radio if available,
B. At next Calendar Day Inspection location, repair, replace radio or switch to trailing position.

2.1.13 Inward and Forward Facing Cameras are securely mounted and not damaged.

NOTE: Damage or defective conditions of any part of the system (cameras, bracket, cables, LDVR) must be reported on MAP 100. Employees must not disconnect, disable, or tamper with the Locomotive Camera Recorder or components.

2.1.14 Dynamic brake equipment is in place and cut in if locomotive is equipped. Locomotives with non-complying dynamic brake equipment will proceed as follows:

A. Place inoperative dynamic brakes (NRPC 3129) tag on control stand or Engine Control panel indicating locomotive number, date, location, and signature of person who discovered (instruction 2.18.7),
B. Conventional locomotives must be repaired within 3 calendar days.
C. MU locomotives must be repaired by the next Locomotive Calendar Day Inspection.

2.1.15 Horn and bell operate as intended. If either found to be non-complying:

A. At next Calendar Day Inspection location, repair, or switch to trailing position.

2.1.16 Sanitation, Toilet Compartment, and Toilet:

A. Locomotive can be used as a lead unit only until unsanitary condition can be corrected, replaced with another locomotive, or the next Locomotive Calendar Day Inspection.
B. Note on MAP 100 date toilet or toilet compartment becomes unsanitary or defective.

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C. If toilet compartment door lock is defective, lock must be repaired on or before the next 92-day inspection. Note on MAP 100 date toilet compartment becomes defective.

2.1.17 Sanders function on each locomotive to deliver sand to each rail in front of the first power operated wheel set in the direction of movement.

2.1.18 No traction motor is cut out. If traction motor is cut out comply with the note in instruction 2.1.

2.1.19 Emergency Brake Valve (Conductor's Valve) properly labeled and accessible.

2.1.20 Doors and cover plates that are marked "Danger" and covering high voltage electrical apparatus must be secured in their proper locations.

A. Verbally notify all crewmembers of non-complying condition. Switch locomotive to trailing position if unsafe to continue as lead unit.

2.1.21 Fan openings, exposed gears and pinions, and exposed moving parts protected to prevent injury.

A. Verbally notify all crewmembers of non-complying condition. Switch locomotive to trailing position if unsafe to continue as lead unit.

2.1.22 No accumulations of oil, water, fuel, debris, and other items in passageways, walkways, cab compartment floors, and engine compartment floors which present an unsafe condition such as a slipping hazard.

A. Verbally notify all crewmembers of non-complying condition. Switch locomotive to trailing position if unsafe to continue as lead unit

2.1.23 No battery gas leaks in cab or engine compartment.

A. Verbally notify all crewmembers of non-complying condition. Switch locomotive to trailing position if unsafe to continue as lead unit.

2.1.24 No obvious diesel engine exhaust gas leaks into the engine compartment.

A. Verbally notify all crewmembers of non-complying condition. Switch locomotive to trailing position if unsafe to continue as lead unit.

2.1.25 Brake rigging properly secured.

A. Set out locomotive if unsafe to continue,
B. Determine any operating restrictions (rules or equipment) which apply.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

2.1.26 No part of trucks, brake rigging, and running gear, with the exception of the wheels and non-metallic sand hoses, are less than 2-1/2 inches above top of rail. Determination can be made by inspecting under side of the locomotive from outside the gage of the rail.

A. Set out locomotive if unsafe to continue,
B. Determine any operating restrictions (rules or equipment) which apply.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

2.1.27 Pilots, snowplows, end plates properly secured and not less than 3 inches nor more than 6 inches above top of rail.

A. Set out locomotive if unsafe to continue,
B. Determine any operating restrictions (rules or equipment) which apply.

2.1.28 Draft gear and uncoupling mechanisms properly secured and not bent, cracked, broken, or missing parts.

A. Set out locomotive if unsafe to continue,
B. Determine any operating restrictions (rules or equipment) which apply.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

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2.1.29 Brake shoes are properly applied and aligned with tread of wheels or other braking surfaces.

A. Set out locomotive if unsafe to continue,

B. Determine any operating restrictions (rules or equipment) which apply.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

2.1.30 Visible traction motor, HEP cables and cable connections are free from damage.

A. If unsafe to continue under power, locomotive MUST be set up to prohibit propulsion (isolated).

2.1.31 Trucks, shocks, spring rigging, and associated parts in proper position and free of cracks and breaks.

A. Set out locomotive if unsafe to continue,

B. Determine any operating restrictions (rules or equipment) which apply.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

2.1.32 Any wheel does not have a single flat or shelled spot 2 ½ inches or more in length. Any wheel does not have adjoining flat or shelled spots that are each 2 inches or more in length. Any wheel does not have defects such as broken, gouged, chipped, or cracked rim or flange. When more restrictive railroad rules or instructions are in effect concerning wheel defects, those instructions will apply.

A. Set out locomotive if unsafe to continue,

B. Determine any operating restrictions (rules or equipment) which apply.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

2.1.33 Emergency fuel cutoff devices and pantograph down devices are properly marked and free of any impediment which could prevent their operation.

2.1.34 Fuel tank is not leaking.

A. If leak is severe, stop train, and notify train dispatcher and CNOC mechanical desk at 1-800-424-0217 as soon as possible,

B. Determine actions to be taken from train dispatcher and/or CNOC mechanical desk, setting out locomotive if necessary.

2.1.35 Brake cylinder travel must provide proper clearance when the brakes are released. Piston travel, if applicable, may not exceed 1 ½ inches less than total piston travel as indicated on Blue Form/MAP 816.

A. Set out locomotive if unsafe to continue,

B. Determine any operating restrictions (rules or equipment) which apply.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

2.2 Locomotives - Double Heading and Helper Locomotives

2.2.1 When more than one locomotive is attached to a train, Engineer on leading locomotive in direction of movement will operate train air brakes.

2.2.2 All brake valve cutout cocks, and handles shall be positioned as specified in instruction 2.6 and Table A (Air Brake Handle Positions & Cutouts).

2.2.3 When necessary for leading locomotive to give up control of air brakes, perform a brake test per instruction 3.9.4 (Passenger Train Class II Brake Test) from new controlling locomotive.

2.2.4 In case of emergency, brakes can be applied by moving the ABV handle or Emergency Brake Valve on any unit in the consist to “EMERGENCY” position.

2.2.5 Before detaching power, train must be brought to a complete stop.

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2.3 Locomotives - Dead Locomotive(s) in a Train

2.3.1 If main reservoir supply is available, make up hoses and set up brake valves per instruction 2.6 and Table A (Air Brake Handle Positions & Cutouts); OR

2.3.2 If NO main reservoir supply is available, drain main reservoir pressure to 0 psi and cut out automatic drain valves (stem is recessed in knob);cut in dead engine feature and set up brake valves per instruction 2.6 and Table A (Air Brake Handle Positions & Cutouts); AND

2.3.3 Automatic and independent brake handles must be removed or secured in proper position per instruction 2.6 and Table A (Air Brake Handle Positions & Cutouts).

2.3.4 Dead locomotive in consist, must have all control breaker in the on position, 480 volt to the battery changer and the battery charger in the on position, MU cables applied to the live locomotive.

2.4 Locomotives - Charging a Train

2.4.1 Before air hoses are coupled, condensation must be blown from brake pipe and main reservoir supply hoses of locomotive.

2.4.2 No chemicals, which are known to degrade or harm brake system components, shall be placed in the train air brake system.

2.4.3 While charging train, independent brake must remain fully applied.

2.4.4 Charge train using “RELEASE” position of ABV handle. Pressure maintaining feature must be cut in.

2.5 Locomotives - Recovery from Penalty Brake Application

2.5.1 When a penalty brake application occurs, acknowledge and place ABV handle in “LAP” or “SUPPRESSION” position.

2.5.2 Ensure throttle/controller is in “Idle” or “OFF” position.

2.5.3 Penalty brake application may be recovered while moving provided there is sufficient time to recharge train before next brake application is required.

NOTE: I-ETMS penalty brake application can only be recovered after the train comes to a complete stop.

2.6 Locomotives - Locomotive Air Brake and Equipment Set Up

2.6.1 Handles of brake valves, brake valve cutout cocks, and other brake devices must be in position as indicated by Table A (Air Brake Handle Positions & Cutouts).

2.6.2 Single locomotives, multiple units (including push/pull) or dual cab locomotives must have one control stand set up as a lead unit unless being hauled dead in train.

A. Trailing units must have the ENGINE RUN, GENERATOR FIELD, and CONTROL/FUEL PUMP switches in the Off, Open or Down position.

2.6.3 Ensure all air and electrical connections are properly configured.

A. For movements Over-The-Road, connect M.U., Main Reservoir, and Brake Pipe hoses per Table B and open associated angle cocks and cutout cocks. Install MU cable (black), communication cable (blue), and any other require electrical connections such as HEP or EP.

B. Movements may be made within the confines of a yard or terminal without connecting the MU hoses, as long as the Brake Pipe and Main Reservoir hoses are connected with associated angle and main reservoir cocks open.

C. When uncoupling locomotives, ensure that all air cutout cocks and angle cocks are closed.

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2.6.4 On P-42DC and P-32ACDM locomotives, the Brake Pipe Cutoff (Pilot) Valve/Switch must be in the "TRL" position when NOT set up as the controlling brake valve or when Table A requires the use of "OUT" position. The "TEST" position will only be used during required standing brake tests or to comply with the instructions in 2.6.6.

2.6.5 P-42DC and P-32ACDM locomotives are not equipped with MU2, MU2A, or Dual Ported Cutout Cocks.

2.6.6 Complete the following procedure to prevent trapped air in the independent brake system when setting up the air brakes on a P-42DC or a P-32ACDM to be used:

- In Push Service,
- In Double Heading (Helper) Service, or
- In a train consist, with MU hoses NOT connected to the unit controlling the air brakes.

A. Secure equipment per instruction 2.14.
B. Make a full service brake application with the ABV handle.
C. Wait for air exhaust to stop.
D. Place the Independent Brake handle in the "RELEASE" position **(DO NOT BAIL OFF BRAKE CYCLINDER PRESSURE)**
E. Move the brake pipe cutoff pilot switch to the "TEST" position for 10 seconds.
F. Move the brake pipe cutoff pilot switch to "TRL" position.
G. Move the ABV handle to the "HANDLE OFF" position.
H. Ascertain, that brake cylinder pressure fully releases on the Push, Double Heading, or In-Train locomotive when train brakes are released. If brake cylinder pressure does not fully release, perform the following from the Push, Double Heading, or In-Train locomotive brake valve:
1. Move brake pipe cutoff pilot switch to "TEST" position.
2. Bail off brake cylinder pressure.
3. Return brake pipe cutoff pilot switch to "TRL" position.

I. If a P-32ACDM or P-42DC locomotive is Double Headed (Helper) Service or in a train consist with no MU cables connected, an employee must immediately take position in the operating control compartment to observe for a locked axle indication.

2.7 Locomotives - Sealing of Protective Devices on Locomotives

2.7.1 Mechanical forces will verify cutouts (switches and cocks) or enclosures for safety devices are properly positioned, then apply seals and record numbers on the MAP 100 form:

A. ACSES Cutout Cock/Switch
B. Cab Signal Cutout Cock/Switch
C. ITCS/X-ITCS Cutout Cock/Switch
D. IITS
E. I-ETMS Penalty Brake Cutout Cock/Switch
F. I-ETMS Emergency Cutout Cock/Switch
G. I-ETMS Horn Cutout Cock/Switch
H. Alerter Cutout Cock/Switch
I. ATC/IITS Transfer Switch
J. Speedometer (Locomotive) Overspeed (OS) Cutout Cock/Switch
K. Speed Control Cutout Cock/Switch
L. Door Bypass Switch
M. Multiple Penalty Brake Device Switch
N. Event Recorder
O. Amtrak/MNRR Territory Switch
P. Overspeed Selector Switch

2.7.2 If seal numbers are not recorded on the MAP 100, train is not to be delayed. Engineer must note on MAP 100 that no numbers were recorded when taking charge of locomotive.

2.7.3 Any time a seal is broken the following information must be entered on MAP 100:

A. Select reason for cutting out.
B. Device/system cut out.
C. Geographic location(s) where cut out and cut in.
D. To whom report was made.

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2.8 Locomotives - Failure of Locomotive Air Brakes

2.8.1 All locomotives must leave terminal points with air brakes in operative condition.

2.8.2 In the event that locomotive brakes become inoperative while locomotive is moving lite, the following procedure applies:

A. Locomotives with dynamic braking should be stopped by use of dynamic brake and hand/parking brake.
B. Locomotives without dynamic braking, rail cars, and other equipment must be stopped with hand/parking brake, if practicable.
C. It not practicable to stop with hand/parking brake, locomotives may be stopped by “plugging the motors“.

CAUTION: THIS MUST ONLY BE USED AS A LAST RESORT. THE RETARDING FORCE WILL BE SEVERE WHEN POWER IS APPLIED IN REVERSE ON A MOVING LOCOMOTIVE. CREWS MUST ANTICIPATE THIS FORCE AND PROTECT THEMSELVES FROM INJURY.

D. To “plug the motors“: Place throttle lever in “IDLE” position; place reverse lever in position opposite direction of movement; move throttle lever to first notch; locomotive must be secured with hand/parking brakes immediately after movement is stopped, secure equipment per instruction 2.14.

NOTE: Plugging locomotives on certain Amtrak locomotives may not be effective due to protection by electrical interlocks.

2.9 Locomotives - Emergency Brake Application

2.9.1 Emergency Brake Application - General

A. Full emergency brake effort must be allowed to apply.
B. Leave handle in “EMERGENCY” position until stopped.
C. Ensure throttle/controller is in “IDLE” or “OFF” position.

2.9.2 When equipped with Two-Way End-Of-Train device

A. Engineer or other train crewmembers must activate the two-way end-of-train device using the “EMERGENCY” toggle switch when any emergency application occurs.

2.9.3 Recovery from emergency after stopping

A. Move ABV handle to “RELEASE” position.
B. Inspect ENTIRE train for derailed cars, shifted loads, etc.
C. Perform a Class II brake test per instruction 3.9.4 for Passenger Train Operations.
D. Perform a Class III brake test per instruction 3.9.6 for Non-Passenger Train Operations.

2.9.4 After proceeding, a Train Running Brake Test must be performed per instruction 3.9.8.

2.10 Train Make Up - General

2.10.1 A safety stop must be made (approximately 50 feet) just prior to coupling to any equipment. A safety stop is not required when distance, between **standing** equipment to be coupled, is less than 50 feet.

2.10.2 When coupling equipment, care must be taken to prevent injury or damage. Coupling must be made at the minimum speed required to complete the coupling but not exceeding 4 mph. ACS-64, Charger SC-44, ALC-42, HHP-8 Locomotives, HST Power Cars, and equipment with spear type couplers must be coupled at a speed NOT to exceed 2 MPH.

2.10.3 After coupling equipment, ensure that:

A. Both coupler operating rods (cut levers) are properly secured in the down position, with the knuckle locked.
B. The coupler telltale hole or recess (inverted V) is fully visible, and the rotary lock lift has fully dropped.
C. Each coupling must be double stretched.
D. In the event the equipment does not couple as intended, uncouple and inspect both couplers. Open and close each knuckle to check for proper lock drop and engagement, free of binding. Attempt to couple equipment again and if another failed coupling occurs, equipment must be moved to a repair or servicing track for proper repair.
E. Once the train is assembled and switching is complete, the requirements of instruction 1.5.5 Coupler Locking Pins apply.

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2.10.4 Before air hoses are coupled, condensation must be blown from brake pipe and main reservoir supply hoses of locomotive.

2.10.5 Connect all brake pipe and main reservoir air hoses.

2.10.6 Cut in main reservoir supply by opening cutout cocks slowly.

2.10.7 Cut in brake pipe by opening angle cocks slowly, beginning with cock closest to locomotive.

2.10.8 Connect required HEP cables, MU, and communication jumpers.

2.10.9 Release all hand/parking brakes unless required.

2.10.10 Cars equipped with pressure retaining valves must be set in "DIRECT EXHAUST" position or as specified in Timetable Special Instructions.

2.10.11 Train blocking for mixed consist trains

A. Private Cars may be blocked anywhere in train consist. Private Cars ARE NOT classified as Passenger Carrying Cars (See Definition for "Passenger Carrying Car"). Private Cars are classified as Passenger Equipment (See Definition for "Passenger Equipment).

B. Passenger Carrying Cars (except Private cars) must be blocked ahead of any car not equipped with Head End Power.

C. When EOT is required, rear car of train consist must be capable of accepting the device in the proper location on the coupler.

NOTE: 2.10.11 does not apply to Non-Passenger train movements (e.g., switching, shop moves).

2.10.12 Superliner, High-Level, and other cars with high diaphragms <u>MUST NOT</u> be coupled to cars with low diaphragms except:

A. When coupling the low diaphragm end of a Transition car to any car with low diaphragm(s).

B. When coupling the high diaphragm end of a car to a low-level car equipped with tubular type diaphragm(s).

C. When permission is received from person in charge of train and engine movements **AND** coupling/movement will not be made on curves or diverging movements through switches.

2.10.13 Set equipment to Graduated or Direct Release according to the instructions below.

A. Passenger equipment in a freight train must have the DIR/GRA cap on the control valve set in "DIRECT RELEASE".

B. All locomotive control valve service portions are to be set in "GRADUATED RELEASE".

Train Consist (excluding Locomotives)	# of Direct Release Cars in Train	Set-Up Balance of train in:
25-56 cars	-	Always Direct Release
7-24 cars	3 or more cars	Direct Release
7-24 cars	2 or less cars	Graduated*
1-6 cars	1 or more cars	Direct Release
1-6 cars	None	Graduated*

NOTE: Train may be set up in Direct Release if additional direct release cars will be added later.

2.10.14 Train consists in Passenger service must not exceed 56 cars.

2.10.15 Car(s) set in "DIRECT RELEASE" may be positioned anywhere in the consist, subject to the train blocking requirements provided in instruction 2.10.11 and compatibility with cars with high diaphragms prescribed in instruction 2.10.12.

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2.11 Train Make Up - Graduated Release Operation

2.11.1 Brake pipe cutoff pilot valve/switch on controlling locomotive must be set to "PASS" position.

EXCEPTION: When a passenger train which is set to graduated release is assisted by a controlling locomotive not equipped with a "PASS" position on the brake pipe cutoff pilot valve/switch (or IFD/locomotive screen) comply with the following:

- Leave the train consist set to graduated release,
- Place the brake pipe cutoff pilot valve/switch (or IFD/locomotive screen) in the "FRT" or "IN" position,
- Note on "Conditions En Route" portion of MAP 1173/10C Summary that "brake pipe cutoff pilot valve/switch is set to FRT position with train consist set to graduated release.

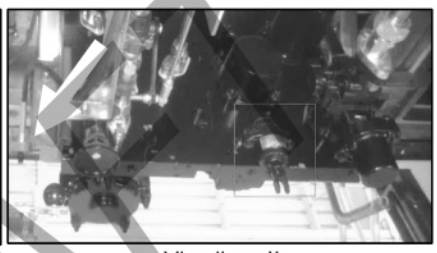
A. If unable to adjust the brake pipe pressure of the controlling locomotive to 110 psi:

1. Secure the train per instruction 2.14,
2. Place the train in "Emergency" and ensure the brake pipe drops to 0 psi,
3. Activate the reservoir release valve (see pictures below) on each piece of equipment in consist until all air pressure is depleted (air stops blowing),
4. Charge the brake pipe of the train and perform a walking inspection of the entire train, ensuring that all operable brakes apply and release. Perform a Train Running Brake Test per instruction 3.9.8.

EXAMPLES



Amfleet and Horizon Cars



Viewliner II

NOTE: When operating in the above configuration, the train will function as a direct release train even though the train consist is set to graduated release ("Graduating off" will have no effect; a brake release will only occur in the "RELEASE" position of the ABV handle).

2.11.2 When operating train consists in graduated release, all cars equipped with "GRADUATED RELEASE" brake systems must have the DIR/GRA cap on the control valve set in "GRADUATED RELEASE".

2.11.3 All cars (including private cars) equipped with a supplemental selector volume must have selector volume cock cut out.

2.11.4 If assistance is needed to verify car brake equipment, contact CNOC mechanical desk via:

A. 1-800-424-0217 and follow voice prompts,
B. TMU communication system, or
C. Train Dispatcher.

2.12 Train Make Up - Direct Release Operation

2.12.1 Train consists in Passenger service must not exceed 56 cars.

2.12.2 Train consists exceeding 30 cars will comply with the following:

A. All cars (including private cars) that are equipped with 26-C control valves must also be equipped with a supplemental selector volume reservoir.
B. Must have supplemental selector volume reservoir "cut in".
C. Viewliners and Superliner II cars must have the badge plate located on the air brake rack set to "EXPRESS" position.

2.12.3 Brake pipe cutoff pilot valve/switch on controlling locomotive must be set to "FRT" position.

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2.12.4 When operating trains in direct release, all cars equipped with "GRADUATED RELEASE" brake system must have the DIR/GRA caps on the control valves set in "**DIRECT RELEASE**".

2.12.5 Auto Train consists, with cars so equipped, must have the badge plate located on the air brake rack set to "AUTO TRAIN" position.

2.12.6 All train consists operating on the Northeast Corridor are limited to a maximum of 24 cars.

2.12.7 If assistance is needed to verify car brake equipment, contact CNOC mechanical desk via:

A. 1-800-424-0217 and follow voice prompts,
B. TMU communication system, or
C. Train Dispatcher.

2.13 Train Make Up - Cutting Off Car(s) or Locomotive(s)

2.13.1 SHUT DOWN AND ISOLATE HEP AND ECP, IF EQUIPPED.

2.13.2 Cutting off locomotives ONLY

A. Secure equipment per instruction 2.14.
B. Locomotives must be set up per instruction 2.6.
C. Mechanical Employees MUST reference SMP-MEC-17-50403 "Winterization of Locomotives" for freeze protection.

2.13.3 Cutting off cars ONLY

A. Secure equipment per instruction 2.14.
B. Mechanical Employees MUST reference SMP-MEC-17-50601 "Winter Protection – Freeze Damage Prevention" for freeze protection.
C. Make a 20 psi brake pipe reduction; and 30 seconds after application is completed, signal crewmember to close angle cock and main reservoir cutout cock on equipment to be moved.
D. Leave brake pipe angle cock open on equipment left standing. Close main reservoir cutout cock (if equipped).
E. Disconnect all jumpers, cables, and other connections (vestibule curtains, chains, etc.) between cars to be uncoupled.
F. When equipment is fitted with a Two-Way End of Train Device (EOT), place equipment left standing in "EMERGENCY" using this device before uncoupling.
G. When not equipped with an EOT device and equipment to be left standing is equipped with an accessible emergency brake valve on the first or second car, use this valve to place the equipment to be left standing in "EMERGENCY" before uncoupling. After emergency brake application, return emergency brake valve to "CLOSED" position.
H. When emergency brake application cannot be attained with the EOT or emergency brake valve on the first or second car, then emergency application on equipment left standing must take place during the uncoupling process.
I. Before lifting uncoupling lever, ensure coupler is not pinned per instruction 1.5.5.
J. Lift uncoupling lever and turn away from equipment in order to avoid flying debris during hose separation. Stop equipment to be moved after separation and secure hose(s).

2.13.4 Cutting off locomotives coupled to cars with locomotive supplying compressed air.

A. Locomotives must be set up per instruction 2.6.
B. Secure equipment per instruction 2.14.
C. Lift uncoupling lever and turn away from equipment in order to avoid flying debris during hose separation. Stop equipment to be moved after separation and secure hose(s).
D. On locomotive left standing

1. Make a Full Service automatic brake reduction.
2. Place independent brake in "FULL APPLICATION" position, if equipped.
3. Throttle/controller in "IDLE" or "OFF" position.
4. Place reverser in "NEUTRAL" and remove. If not removable, place in "OFF" position.
5. Place generator field switch/breaker in "Off/DOWN" position (if equipped).
6. Isolate all locomotives.

2.13.5 When cutting off locomotives coupled to cars with locomotive DEAD or NOT supplying compressed air, instruction 2.13.3 will apply.

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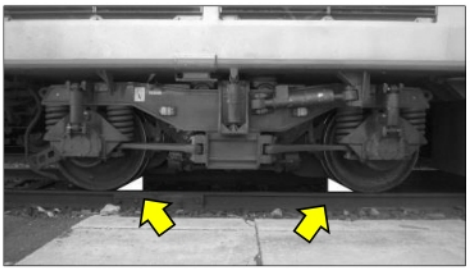
2.14 Train Make Up - Securing Equipment

NOTE: ALL EMPLOYEES ARE RESPONSIBLE FOR PROPERLY SECURING EQUIPMENT.

NOTE: Unattended Equipment is equipment left standing and unmanned in such a manner that would hinder immediate application of hand/parking brakes or air brakes by a qualified employee to prevent equipment from moving.

- **PROPER CHOCKING METHODS:** Chocks must be in good working order. Chocks that are crushed or broken must not be used. Chock both sides of at least one truck or one wheel and two additional wheels as necessary to prevent movement. Chocks must be placed flush against the wheel. Chocks must not be removed until proper coupling is made.

PROPER CHOCK POSITIONING



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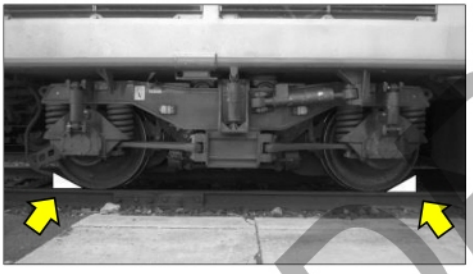

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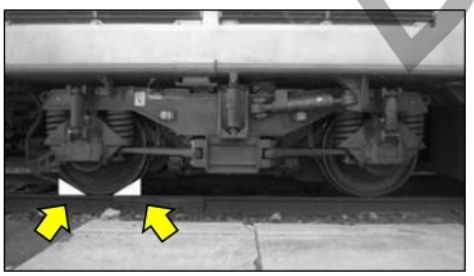

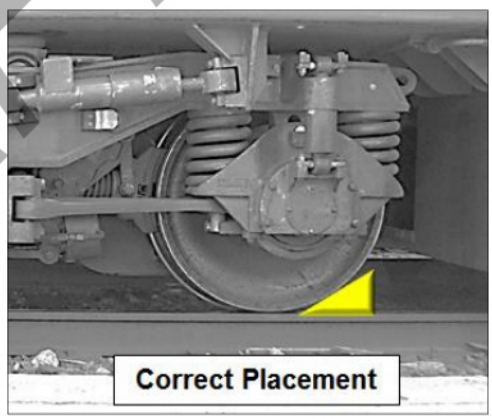

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Equipment to be Secured	On Level Track	On a Grade
One car	1. Apply hand/parking brake. 2. Release air brakes. 3. Wait one minute. 4. If car does not move, hand/parking brake is effective. 5. Apply air brakes. 6. Chock both sides of one truck or one wheel. 7. If hand/parking brake is not effective, chock both sides of one additional truck or wheel. Repeat steps 2-6. 8. If car does not move, chocks are effective.	1. Apply hand/parking brake. 2. If engine is on downhill side of car, stretch slack. If engine is on uphill side of car, bunch slack. 3. Release air brakes on car only. 4. If car does not move for one minute, hand/parking brake is effective. 5. Chock both sides of one truck or one wheel. 6. If hand/parking brake is not effective, chock both sides of one additional truck or wheel. Repeat steps 2-6. 7. If car does not move, chocks are effective.
Two or more cars	1. Apply hand/parking brake on at least two cars. 2. Release air brakes. 3. Wait one minute. 4. If cars do not move, hand/parking brake is effective. 5. Apply air brakes. 6. Apply more hand/parking brakes on cars if hand/ parking brake is not effective. Repeat steps 2-5. 7. If hand/parking brakes are not effective or cannot be tested, chock both sides of one truck or one wheel. 8. If cars do not move, chocks are effective.	1. Apply hand/parking brake on at least two cars. 2. If engine is on downhill side of car, stretch slack. If engine is on uphill side of car, bunch slack. 3. Release air brakes on cars only. 4. If cars do not move for one minute, hand/parking brake is effective. 5. Apply more hand/parking brakes on cars if hand/parking brakes is not effective. Repeat steps 2-4. 6. If hand/parking brakes are not effective or cannot be tested, chock both sides of one truck or one wheel
Locomotives (single or multiple)	1. Apply hand/parking brakes on all locomotives. 2. Fully release automatic and independent brake, if equipped. Release parking brake on Cab Cars. 3. Wait one minute. 4. If locomotive(s) do not move, hand/parking brake is effective. 5. If hand/parking brake is not effective, chock both sides of one truck or one wheel. Repeat steps 2-4.	1. Apply hand/parking brakes on all locomotives. 2. Fully release automatic and independent brake, if equipped. Release parking brake on Cab Cars. 3. If locomotives(s) do not move, hand/parking brake is effective. 4. If hand/parking brake is not effective, chock both sides of one wheel or truck. Repeat steps 2-4.
	a. Chock both sides of one wheel or truck when securing a single locomotive. b. Make a Full Service brake application with the ABV handle. c. Place the independent brake in the "Full Application" position, if equipped. d. Place the throttle / controller in "IDLE" or "OFF" position. e. Place reverser in "NEUTRAL" position and remove, if removable. f. Place generator field switch/breaker in the "OFF" or "DOWN" position, if equipped. g. Place the isolation switch in the "ISOLATE" position, if equipped. **NOTE:** GE P-32BWH, P-40BH, and P-42BH locomotives will be considered isolated when unit is providing "STANDBY HEP".	
Locomotives with cars coupled together	Apply all hand/parking brakes on all locomotives. No less than a total of two hand/parking brakes must be applied (Locomotives + cars = total hand/parking brakes).	
	1. Fully release the automatic and independent brake, if equipped. Release parking brake on Cab Cars. 2. Wait one minute. 3. If equipment does not move, hand/parking brakes are effective. 4. Apply more hand/parking brakes if equipment moves. Repeat steps 2-4. 5. If equipment moves after all hand/parking brakes are applied, apply chocks to one wheel or one truck and to additional wheels as necessary to prevent movement.	1. Fully release the automatic and independent brake, if equipped. Release parking brake on Cab Cars. 2. If equipment does not move, the hand/parking brakes are effective. 3. Apply more hand/parking brakes if equipment moves. Repeat steps 2 and 3. 4. If equipment moves after all hand/parking brakes are applied, apply chocks to one wheel or one truck and to additional wheels as necessary to prevent movement.
	a. Make a Full Service brake application with the ABV handle. b. Place the independent brake in the "Full Application" position, if equipped. c. Place the throttle / controller in "IDLE" or "OFF" position. d. Place reverser in "NEUTRAL" position and remove, if removable. e. Place generator field switch/breaker in the "OFF" or "DOWN" position, if equipped. f. Place the isolation switch in the "ISOLATE" position, if equipped. **NOTE:** GE P-32BWH, P-40BH, and P-42BH locomotives will be considered isolated when unit is providing "STANDBY HEP".	

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2.14.1 Attended equipment must be secured per instruction 2.14 when required by Rule, Special instruction, General Order, Bulletin Order, other Directive, or when physical characteristics require.

2.14.2 Unattended equipment must be secured according to the applicable part of instruction 2.14. Dependence must never be placed on air brakes to hold equipment left unattended.

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2.14.3 During switching operations in a yard or terminal, chocks or blocks may be used to secure unattended equipment instead of hand/parking brakes, but only when directed by Rule, Special Instruction, General Order, Bulletin Order, or other Directive. When switching operations conclude, unattended equipment must be secured according to the applicable part of instruction 2.14.

2.14.4 Unattended Locomotives/Cars must be secured per instruction 2.14 unless hand/parking brake is defective or when the hand/parking brakes are being repaired. Under these conditions, chocks or blocks must be used to secure equipment.

2.14.5 Securing Equipment Left Unattended

NOTE: For the purpose of securing equipment, Cab Cars and NPCUs are considered as locomotives when their position in the train would allow use as a controlling unit.

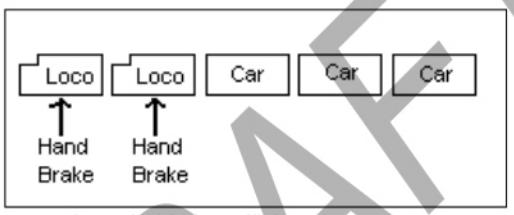
NOTE: When Cab Cars are set up as Lead, both hand brake and parking brake, if equipped, must be applied when securing equipment. When Cab Cars are set up as Trail, apply only hand brake when securing equipment.

NOTE: Report defective hand/parking brake per instruction 1.2.1.

NOTE: The following equipment will not develop tractive effort with the parking brake applied: P-32ACDM, P-40, P-42, F-125, SC-44, ALC-42, ACS-64, and High Speed Trainsets.

EXAMPLE 1

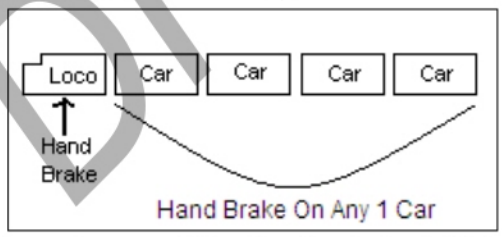
Unattended consist is 2 locomotives and 3 cars



Apply hand/parking brakes on both locomotives. If this is sufficient to prevent movement, no other hand/parking brakes are required.

EXAMPLE 2

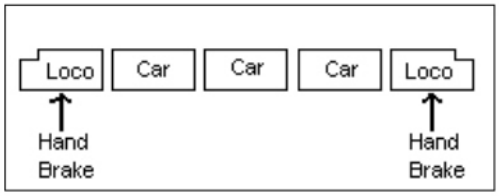
Unattended consist is 1 locomotive and 4 cars



Apply hand/parking brake on locomotive and one car (2 hand/parking brakes). If this is sufficient to prevent movement, no other hand/parking brakes are required.

EXAMPLE 3:

Unattended Push/Pull 2 locos; 3 cars consist



Apply hand/parking brakes on both locomotives. If this is sufficient to prevent movement, no other hand/parking brakes are required.

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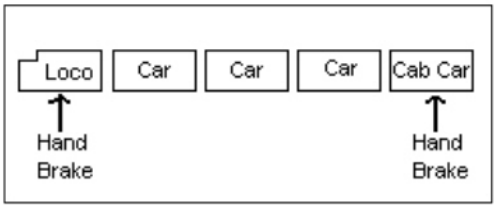
EXAMPLE 4:

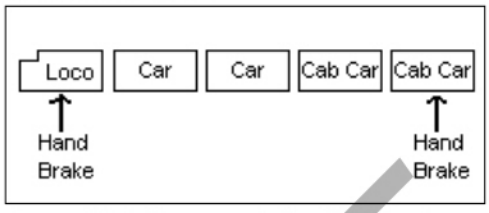
Unattended Push/Pull 1 loco; 3 cars;1 Cab Car consist



Apply hand/parking brakes on locomotive and Cab Car. If this is sufficient to prevent movement, no other hand/parking brakes are required.

EXAMPLE 5:

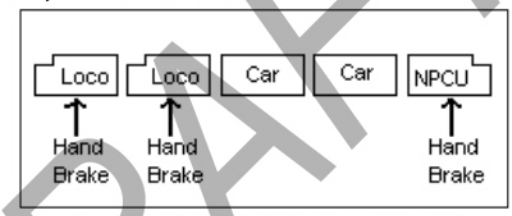
Unattended Push/Pull 1 loco; 2 cars; 2 Cab Cars consist



Apply hand/parking brakes on locomotive and Cab Car on end of train (2nd cab car cannot be used as controlling unit). If this is sufficient to prevent movement, no other hand/parking brakes are required.

EXAMPLE 6:

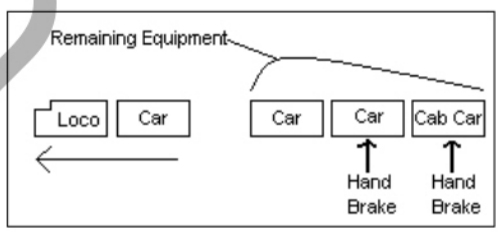
Unattended Push/Pull 2 locos; 2 cars; 1 NPCU consist



Apply hand/parking brakes on both locomotives and NPCU. If this is sufficient to prevent movement, no other hand/parking brakes are required.

2.14.6 When uncoupling equipment which is already secured, ensure remaining equipment is secured according to the requirements of this instruction 2.15.

EXAMPLE:



2.14.7 Apply and Release Hand/Parking Brake on a Grade

A. Hand/parking brakes must be applied starting at lowest level of grade.
B. When ready to proceed, hand/parking brakes remain applied until air brake system is charged and required test made.
C. Hand/parking brakes are to be released starting at highest level of grade.

2.14.8 Securing Equipment During Brake Tests

A. Lite locomotives
1. Apply hand/parking brake on lead locomotive and chock wheels as necessary to prevent movement during testing of Lite locomotives.
2. After chocking wheels, test that lite locomotive(s) are secure by releasing the air brakes on the locomotive(s). No movement should occur.
3. If necessary, in addition to chocking wheels, apply enough hand/parking brake(s) to secure lite locomotives during test.

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4. After testing, a full service reduction must be made, and independent brake applied in full application (if equipped).
5. If lite locomotive(s) will be left unattended, secure per instruction 2.14.

B. Locomotives Attached To Other Equipment

1. When locomotive(s) are to be tested, two or more cars must always have a minimum of two hand/parking brakes applied and thereafter sufficient numbers to prevent movement.
2. When train/equipment is to be tested:
   a. Fully apply locomotive independent brake if equipped.
   b. If locomotive is not equipped with independent brake or independent brake is not sufficient to secure train/equipment during test, apply a minimum of two hand/parking brakes and thereafter-sufficient numbers to prevent movement.
3. After testing, a full service reduction must be made and independent brake applied in full application (if equipped).
4. If locomotive(s) and/or cars will be left unattended, secure according to the applicable part of instruction 2.14.

2.14.9 Locking Locomotive Doors

A. Locomotives and Cab Cars, including multiple unit consists, that are left unattended on a mainline track or mainline siding must have all doors locked to protect against unauthorized entry. This instruction applies even if Locomotives and/or Cab Cars are coupled to other equipment.

B. If Locomotive or Cab Car Doors will not lock due to a defect, note defect on MAP 100 and notify CNOC mechanical desk at 1-800-424-0217.

2.15 Train Handling – General

2.15.1 These instructions are to provide Engineers with approved standards for operating Amtrak trains. They are designed for the Engineer to use these acceptable train-handling techniques to maximize smooth handling, safe operation, and for energy conservation while operating trains.

NOTE: Conductor must, at once, inform the Engineer when train handling is not smooth in order that technique may be changed.

2.15.2 The following are examples of actions which will cause the most severe slack action and should be avoided.

A. Sudden heavy brake application.

B. Sudden movement of throttle/controller in either direction to “IDLE”, “OFF” or “ZERO”.

2.15.3 Locomotive Engineers must handle trains and engines in a safe and fuel/energy efficient manner, taking full advantage of throttle modulation and dynamic braking where conditions permit.

A. Throttle Use on Diesel Locomotives

1. To control in-train forces and improve passenger ride quality, the throttle on diesel locomotives must be advanced one position at a time with a minimum delay of 1 second per notch.
2. The throttle on diesel locomotives must be reduced one position at a time with a minimum delay of 1 second per notch. (Exception: the throttle on diesel locomotives may be reduced at a quicker rate when emergency or hazardous conditions require immediate train speed reduction.)

B. Throttle Use on Electric Locomotives

1. To control in-train forces and improve passenger ride quality, the throttle/master controller on electric locomotives must be advanced in a manner that creates gradual increase in pounds of effort.
2. The throttle/master controller on electric locomotives must be reduced in a manner that allows for gradual decreases in pounds of effort. (Exception: the throttle/master controller on electric locomotives may be reduced at a quicker rate when emergency or hazardous conditions require immediate train speed reduction.)

2.15.4 The Engineer must be familiar with physical characteristics of the territory and plan ahead for action to be taken.

2.15.5 The Engineer must make frequent on-board visual inspections of both sides of a train while moving, looking out for hot bearings, sticking brakes, sliding wheels, dragging equipment or evidence of fire.

2.15.6 The following factors will affect the slowing and stopping ability of trains: speed, weight, length of train, grade, weather conditions, brake pipe leakage, brake pipe gradient, and operative brakes.

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2.15.7 Where conditions permit, slowdowns or stops should be made with not more than 15 psi total brake pipe reduction. This reduces in-train forces and provides reserve braking capability in the event that additional retardation is required.

2.15.8 Prolonged use of locomotive air brakes or excessive brake cylinder pressure, especially at high speeds, is prohibited. Such action will cause burned and damaged brake shoes/pads and overheated wheels.

2.15.9 During switching operations, throttle and independent brake must be handled in a manner that will permit slack to be adjusted smoothly.

2.15.10 Control of Train Speed

A. Locomotive engineers must operate trains in accordance with operating rule, track, and equipment speed limits. Trains will be considered exceeding maximum authorized speed if:
1. Train exceeds maximum authorized speed limit for more than 30 seconds; Or,
2. Train exceeds maximum authorized speed limit by 5 mph for any period of time.

B. If train exceeds the maximum authorized speed limit, the locomotive engineer must take action to control train speed consistent with AMT-3 train handling rules.

2.15.11 Use of Sand / Handling of Wheel Slip

A. When necessary to use sand, number 1 truck or lead axle sand switch, if equipped, should be used to prevent slipping of locomotive wheels.

B. Slipping of locomotive wheels causes severe stress to draft systems and damage to rails and should be avoided.

C. Do not apply sand while wheels are slipping. Throttle must be reduced to stop wheel slip, and then start sanding and advance throttle slowly (Does NOT apply on ACS-64, Charger SC-44, and ALC-42 Locomotives).

D. Where conditions require, sand should be used as the train is stopping to avoid slipping when starting.

E. Unnecessary Actuation of Locomotive Sanders in Stations
1. Unless equipment designs or specific instructions require otherwise, do not place equipment in “EMERGENCY” and thereby cause sanders to discharge unnecessarily.
2. In the event that locomotive sanders are activated by emergency brake applications, every effort must be taken to reset the emergency brake application as quickly as equipment will permit, **without releasing the train brakes**.

2.15.12 Operating Diesel Locomotives over Rail Crossings and Drawbridges

A. Diesel Locomotives
1. When operating the locomotive(s) at speeds exceeding 25 MPH, do not exceed throttle position No. 4 for at least eight seconds prior to the locomotive reaching a rail crossing at grade or moveable span of a drawbridge.
2. When operating the locomotive(s) at speeds less than 25 MPH, or in throttle position No. 4 or lower, place the throttle in the next lower position at least eight seconds prior to the locomotive reaching a rail crossing at grade or moveable span of a drawbridge.
3. If operating conditions permit, advance the throttle after all units of the consist have passed over the rail crossing at grade or moveable span of a drawbridge.

2.15.13 Train Handling Over Disturbed Track

A. When going through the limits of a track bulletin where track work may have affected track stability, to minimize in train forces the engineer must use the following train handling techniques when possible:
1. Use throttle modulation or low dynamic brake amperage.
2. Avoid making slack adjustments.
3. Avoid applying or releasing automatic brake.
4. Make power and brake adjustments before or after the restriction.

2.15.14 Dynamic Braking

A. Engineers must utilize dynamic brake on descending grades to control train speed when conditions permit. Engineers will carefully consider other locations where dynamic brake may be used without sacrificing schedule time or causing excessive buff or draft forces.

B. Dynamic brake must be used with consideration given to locomotive dynamic brake capability, train consist, and physical characteristics of the territory involved.

C. Exercise care by applying and releasing dynamic brake gradually to avoid unnecessary slack action.

D. When operating through turnouts and crossovers with more than 3 units in consist with effective dynamic brake, limit dynamic brake effort to 50% of maximum (dynamic controller position 4). Limit dynamic brake effort until one-third of train is through turnout or crossover.

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E. Automatic brake may be used during dynamic braking. Ensure that locomotive brake cylinder pressure does not develop during the use of dynamic brake except as provided in 2.16.4F, below.

F. Independent brake must NOT be applied during dynamic braking. If speed is less than 15 mph and dynamic brake effort is insufficient, the independent brake may be used to supplement dynamic braking effort. Locomotive brake cylinder pressure must never exceed 15 psi while manual dynamic brake is applied.

2.15.15 Independent Brake must NOT be used in conjunction with blended brake operation.

2.15.16 Independent Brake Quick Release Feature

A. Hold handle in quick release (actuating) position until brake cylinder pressure is 0 psi.

B. After brake cylinder pressure reaches 0 psi, allow three seconds for each additional unit in consist.

C. Tampering with any device or appliance, introducing any object or means to create or maintain any locomotive in a condition to constantly bail off (actuate) brake cylinder pressure, is prohibited.

2.15.17 Train Braking

A. Train braking must be handled in a manner that will ensure passenger safety and prevent damage to cars and lading, keeping brake shoe/pad, wheel wear, and fuel\energy consumption to a minimum.

B. The procedures outlined in instruction 2.16 will be used to slow or stop trains.

1. When operating electric locomotives, do not use the procedures in instruction 2.16.4 unless dynamic brake is inoperative.
2. In order to conserve fuel/energy, do not use the procedures in instruction 2.16.6 unless train handling using other procedures in instruction 2.18 cannot be done smoothly.

C. When equipped, Slow Speed Backing may be used in conjunction with the automatic brake when backing a train.

D. When using air or dynamic braking to slow for speed restrictions, air brakes must not be released, or dynamic braking reduced, until train speed is at, below or within 4 mph of the speed restriction limit.

E. When using the automatic brake to slow or stop a train, the automatic brake valve handle must not go beyond the “Full Service” brake valve position unless placing the train in Emergency. Use of the “Handle Off” brake valve position for train braking is prohibited.

2.15.18 Throttle Placement While Stopped

A. While train is stopped, the throttle must be placed in the “IDLE” position to prevent traction motor damage.

2.16 Train Handling – Starting and Stopping

2.16.1 Starting Trains

A. Power must not be applied until minimum time required for the braking system to recharge has elapsed to insure release of brakes.

NOTE: Push-Pull trains being operated from the control car will be governed by instructions **G** and **H** of this rule as appropriate.

B. Train must be started in lowest throttle position possible.

C. If the train does not start after applying reasonable power, the throttle must be returned to Idle, and the cause determined. Further advancement of throttle may cause train separation, damage to traction motors, or damage to the rail.

D. While the train is being started, locomotive speed must be kept slow and uniform until entire train is moving.

E. When starting a train on a curve, avoid high throttle/controller settings.

F. With slack bunched on level track, slowly open the throttle until entire train is moving, then accelerate.

G. With slack bunched on a descending grade, release the brakes, allow the train to start moving, advance the throttle to run 1 until train is stretched, then accelerate.

NOTE: For Push-Pull trains being operated from the control car, the brakes will be graduated down to the Minimum Reduction position on the Automatic Brake Valve, then advance the throttle to run 1 and fully release the brakes once the slack is bunched and the entire consist is moving, then continue to accelerate.

H. With slack stretched, advance the throttle to the lowest throttle position necessary to start the train, allow amperage to increase, release the brakes, and accelerate smoothly avoiding high draft forces.

NOTE: For Push-Pull trains being operated from the control car, the brakes will be graduated down to the Minimum Reduction position on the Automatic Brake Valve, then advance the throttle to run 1 and fully release the brakes once the slack is bunched and the entire consist is moving, then continue to accelerate.

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2.16.2 Accelerating

A. Throttle must be advanced one position at a time (Instruction 2.15.3).
B. Ample time should be allowed between each increase in throttle to prevent high draft forces.

2.16.3 Slowing or Stopping Using Blended Brake

A. Move throttle/controller to “Idle”, “Off, or “Zero”.
B. Allow slack to adjust.
C. Make a minimum automatic brake pipe reduction.
D. Make additional reductions as required.
E. Where conditions permit, slowdowns or stops should be made with not more than 15 psi total automatic brake pipe reduction.
F. When stopping, gradually reduce brake application as train is stopping. Leave a minimum 12 psi reduction on train while stopped and apply the independent brake.

2.16.4 Slowing or Stopping Using Dynamic Brake

A. Move throttle/controller to “Idle”, “Off” or “Zero”.
B. Wait 10 seconds before going into dynamic brake mode.
C. Move dynamic brake controller to setup and allow train slack to bunch.
D. When slack is bunched, gradually move dynamic brake controller to obtain the desired braking effort.
E. If dynamic brake effort is not sufficient, supplement it by making the necessary brake pipe reductions to obtain the required braking effort. DO NOT allow locomotive brake cylinder pressure to develop except as provided in 2.16.4G, below.
F. As speed decreases, dynamic brake effort decreases, which may require additional brake pipe reductions to maintain the desired braking effort.
G. At very low speeds (less than 15 mph), the independent brake may be used to supplement dynamic braking effort and to prevent locomotive slack run-out. **Locomotive brake cylinder pressure must never exceed 15 psi while manual dynamic brake is applied.**
H. When releasing brakes, release air brakes and allow time to release before releasing the dynamic brake.

2.16.5 Slowing or Stopping Using Air Brakes

A. Move throttle/controller to no greater than Notch 2.
B. Make a minimum automatic brake pipe reduction and actuate (bail off) locomotive brake cylinder pressure.
C. Reduce throttle to Idle within 10 seconds.
D. Make additional reductions as required.
1. Trains with less than 10 cars must not actuate (bail off) and utilize Blended Brake.
2. Trains with 10 or more cars may be actuated (bail off) or utilize Blended Brake.

E. Where conditions permit, slowdowns or stops should be made with not more than 15 psi total automatic brake pipe reduction.
F. Leave a minimum 12 psi reduction on train while stopped and independent brake to full application, if equipped.

NOTE: When speed is less than 20 mph, the throttle may remain in Notch 1 or 2 in order to spot station stops.

2.16.6 Slowing or Stopping Using Braking with Power Applied (Mixed Consist Trains)

A. In order to conserve fuel/energy, do not use the procedures in this section unless train handling using other procedures in instruction 2.18 cannot be done smoothly.
B. Where conditions permit, dynamic brake and/or throttle reductions must be used in lieu of braking with power applied to reduce train speed.
C. When in Direct Release, minimum automatic brake pipe reductions of less than 8 psi must not be attempted.
D. Braking should be started at a sufficient distance from objective point to allow use of a split reduction.
E. Reduce throttle to no greater than Notch 2.

EXCEPTION: Auto Train may use throttle notches greater than 2. When braking with power applied, Auto Train engineers must use the lowest throttle position necessary to control slack and conserve fuel.

F. When conditions permit, the minimum automatic brake pipe reduction position should be used for the initial brake pipe reduction.
G. When conditions permit, wait 20 seconds after the brake pipe exhaust stops blowing from initial reduction, then follow with additional reductions as required.
H. Locomotive brakes should not be permitted to apply. After the initial reduction, maintain only enough power to control slack.
I. Where conditions permit, slowdowns or stops should be made with not more than 15 psi total automatic brake pipe reduction.
J. Leave a minimum 12 psi brake pipe reduction on train while stopped, and independent brake to full application.

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2.16.7 Releasing Brakes

A. Brake applications must not be released while brake pipe exhaust is blowing.
B. After desired braking has been accomplished, brakes may be released. In the event of sticking brakes, not less than a 12 psi brake pipe reduction must be made, and brakes on entire train will be released before train speed is reduced to 10 mph.
C. If train slack is bunched when brake valve is moved to “RELEASE” position, dynamic brake or independent brake must be used to prevent run out of slack until train brakes are fully released.
D. If power is applied when ABV handle is moved to “RELEASE” position, engineer must not increase throttle/controller until train brakes are completely released.

2.16.8 Stopping Immediately After Starting

A. Make an initial automatic brake reduction (when in direct release, no less than 8 psi).
B. Reduce power gradually, maintain only enough power to control slack.
C. Gradually increase reduction until train stops.
D. DO NOT allow locomotive brakes to apply until train stops.
E. Leave a minimum 12 psi reduction on train while stopped, and independent brake to full application.

2.17 Train Handling - Back Up Moves

2.17.1 Backing/Shoving Train Movements

A. When shoving or backing trains, no more than two locomotives may be working in a consist. Isolate any excess locomotives before starting a shoving or backing move unless additional power is necessary due to an ascending grade.
B. Air brakes must be controlled by the Locomotive Engineer at all times except when testing the back-up hose or when conditions require an emergency application of air brakes.
C. Start smoothly, avoid high buff forces by using lower throttle/controller settings; giving consideration to physical characteristics, train consist, prescribed speed, and distance involved.
D. All crewmembers involved with movement must remain alert for any indication of unusual conditions such as: sudden, harsh slack action, or loss of communication and take immediate action(s) at once, using good judgment, to ensure safe movement.
E. Back-up movements adjacent to station platforms must not exceed 5 mph until leading end of movement is clear of platform.
F. When backing onto stub end tracks, a preliminary stop must be made 250 feet from bumping post/ end of track. After making the preliminary stop, do not exceed 2 mph until the final stop.
G. When preliminary stop is required, Conductors and Assistant Conductors must, before arrival in station, advise passengers and attendants not to detrain until final stop is made.

2.17.2 Back-Up Hose

A. After installing a back-up hose on equipment, it must be tested in EMERGENCY as described in instruction 2.17.2C, below.
B. A Back-Up Hose must be used for back up movements at locations required by Rule, Special Instruction, General Order, Bulletin Order, or other directive.
1. Back-up hose MUST be applied to leading end of lead car at locations where back-up hose is required.
2. When required to use a back-up hose for back up movements, it must be tested in EMERGENCY at locations where back up movements will be made as described in instruction 2.17.2C, below.

NOTE: Once tested, additional back-up hose tests are not required in the same city or terminal unless the crew changes, equipment changes, or back-up hose is replaced or moved to other equipment.

3. Test the back-up hose whistle prior to making back up move. Back-up whistle must be sounded to give warning as prescribed by applicable rules. In addition, it must be sounded when passing bridge abutments, walls, and when entering or moving on station tracks. If back-up hose whistle is found defective, it alone will not cause the back-up hose to be considered defective. However, this defect must be reported.
4. Before commencing back-up move, employee handling back-up hose will communicate with Engineer to determine signaling method to be used to start back-up movement.
5. Back-up hose or emergency brake valve must be used to apply air brakes in EMERGENCY should conditions require.

C. Back-Up Hose Emergency Test

1. Equipment must be stopped.
2. QP or QMP will initiate an emergency brake application using the back-up hose.
3. Locomotive Engineer will inform QP or QMP when locomotive is in emergency.
4. QP or QMP will close back-up hose.

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5. Locomotive Engineer will recover from the emergency brake application when signal is given.
6. If back-up hose does not place train in emergency, determine cause.
7. If back-up hose is defective (will not place train in emergency) and no replacement back-up hose is readily available, comply with instruction 2.17.3.
8. When testing the back-up hose, train inspection, and standing train brake test requirements per instruction 3.9.4 A6 or 3.9.6 A3 do not apply.
9. Locomotive Engineer will make a Running Brake Test per instruction 3.7.

2.17.3 Defective Back-Up Hose, No Back-Up Hose Available, or Locomotive leading the back-up movement.

A. If back-up hose is defective, no back-up hose is available or locomotive is leading the back-up movement and the use of a back-up hose is required, the following will apply:
1. Conductor will inform Engineer that back-up hose is defective, that no back-up hose is available, or locomotive is leading back up movement.
2. When properly pointed locomotive (including Cab Car or NPCU) is on the leading end of the backup movement, the emergency brake valve on that equipment will be used to apply the air brakes in EMERGENCY **should conditions require**.
3. When a Passenger Carrying Car or Private Car is on the leading end of the backup movement, the emergency brake valve on that equipment will be used to apply the air brakes in EMERGENCY **should conditions require**.

NOTE: Test of the emergency brake valve on a car or locomotive is not required prior to making a backup move.

2.18 Train Handling – En Route Conditions

2.18.1 Inadequate Performance of Train Brakes

A. If brake performance is found to be inadequate for the brake application made, train must be stopped, and a walking inspection of a brake application must be performed to determine cause.
B. If no defects are found, train may proceed, making periodic running brake tests.
C. When equipped with Two-Way End of Train Device, verify changes in brake pipe pressure at rear of train during running brake tests.

2.18.2 Failure to Maintain Required Pressure

A. If pressure required for safe handling of the train cannot be maintained, the train must be stopped, secured and the train dispatcher notified.
B. If main reservoir pressure falls below 100 psi, immediately bring the train to a safe stop.

NOTE: If brake pipe pressure falls below 50 psi, you will not be able to transmit an emergency brake application.

2.18.3 Sticking Brakes

A. Train and engine crews must keep a lookout for brakes sticking on their train and on trains being met or passed.
B. They must advise one another of location in train of cars with sticking brakes.
C. Probable causes of sticking brakes:
1. Hand/parking brake not fully released.
2. Overcharged brake system.
3. Binding or fouling brake rigging.
4. Retaining valve not in “Release” position.
5. Defective control valve.
6. Excessive brake pipe leakage.
7. Improper handling of ABV.

D. If brakes are stuck from improper handling of ABV, usually an additional heavy automatic brake reduction and release will correct condition.

2.18.4 If Train Breaks in Two

A. SHUT DOWN AND ISOLATE HEP, IF EQUIPPED, AS SOON AS POSSIBLE.
B. After train is re-coupled and brake system has been recharged, perform a:
1. Class II brake test for a Passenger train, or,
2. Class III brake test for a Non-Passenger train.

C. After proceeding, as soon as speed of train permits, a Train Running Brake Test must be made, per instruction 3.9.8.

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2.18.5 Reporting Defects - Report defects per instruction 1.2.1.

2.18.6 Emergency Brake Application

A. ABV handle initiated:
1. Full emergency brake effort must be allowed to apply.
2. Leave handle in "EMERGENCY" until stopped.
3. Ensure throttle is in "IDLE" or "OFF" position.

B. When equipped with Two-Way End-Of-Train device, engineer or other train crewmembers must activate the Two-Way End-Of-Train device using the "EMERGENCY" toggle switch when any emergency brake application occurs.

C. Conductor's valve or back-up hose.
1. Open valve quickly.
2. Leave valve open until stopped.
3. Do not attempt to release brakes until stopped.

D. Recovery from emergency brake application after stopping.
1. If conditions required use of conductor's valve, caboose valve, or back-up hose, reset it.
2. Move ABV handle to "RELEASE".
3. Inspect ENTIRE train for derailed cars, shifted loads, etc.
4. Perform a:
   - **a.** Class II brake test for a Passenger train, or,
   - **b.** Class III brake test for a Non-Passenger train.

E. After proceeding, a Running Brake Test must be made.

2.18.7 Inoperative Locomotive Dynamic Brake

A. On locomotive so equipped, Engineer will be informed of the operational status of the dynamic brake when first taking charge of the train.

B. If the locomotive is found to have an inoperative dynamic brake, see instruction 2.1.14.

2.18.8 Winter Weather Conditions

A. Due to ice and snow buildup on the braking surfaces, stopping distances may increase during winter operating conditions. Brake equipment must also be kept free of ice and snow buildup. It is imperative that the locomotive engineer is aware of the potential for ice buildup, and to make sure proper braking effort is being provided.

B. During winter weather conditions, train brakes should be conditioned by performing a Running Brake Test to warm the brake equipment and dislodge ice and snow buildup.

C. During winter weather conditions, perform a Running Brake Test every 10 miles at a speed greater than 20 mph by:
1. Making a 10 PSI Automatic Brake reduction, and
2. Allowing locomotive Brake Cylinder pressure to build to a maximum of 10 PSI for brief periods of time.

D. Operating conditions may require a Running Brake Test more frequently than 10 miles.

E. When leaving a train unattended, or when setting off cars:
1. Apply brakes on cars while moving to reduce ice and snow buildup, and
2. Verify that no ice or snow is between brake shoes/wheels or discs/pads after handbrakes are applied.

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2.19 Train Handling - Movement Restrictions

2.19.1 Adding Passenger Equipment En Route

A. Crews must not add Passenger Equipment unless instructions are received to do so.

B. Instructions will not be given to crew unless required inspections and Class I brake test are completed. Inspections and Class I brake test will be valid until next scheduled inspection.

C. Instructions can be conveyed verbally, electronically or in writing.

D. When QMP participates in adding equipment:

1. QMP will perform required test and inspections.
2. QMP will perform Class I or Class IA brake test on Passenger Equipment added to the train when these cars have been off compressed air for more than 4 hours prior to being added.
3. QMP will issue an additional MAP 1173/10C Summary covering the equipment added.
4. Engineer will enter required information on Summary MAP 1173 per instruction 3.8.4.

E. When QMP does NOT participate in adding equipment:

1. Perform Class IA brake test on Passenger Equipment added when these cars have been off compressed air for more than 4 hours prior to being added (date and time shown on MAP 1173/10C Summary may be used for this purpose).
2. Perform Class II brake test.
3. Class II brake test may be made at same time added equipment is tested.
4. Engineer will enter required information on Summary MAP 1173 per instruction 3.8.4.

2.19.2 Air Brake - En Route Movement Restrictions

A. Passenger trains in passenger service must not leave a designated Amtrak repair point with less than 100% operative brakes.

B. Passenger trains MUST HAVE at least 85% operative brakes, unless the provisions of Instructions 3.8.1 are complied with.

C. When operative brakes become less than 85%, **BEFORE PROCEEDING,** notify train dispatcher and contact QMP at CNOC mechanical desk for instructions. CNOC may be contacted either directly at 1-800-424-0217 or through the train dispatcher.

1. Trains with 84%-75% operative brakes must comply with QMP instructions but not exceeding one-half the maximum timetable speed or 40 mph whichever is less.
2. Trains with 74%-50% operative brakes must comply with QMP instructions but not exceeding one-half the maximum timetable speed or 20 mph whichever is less.
    - **a.** Every effort must be made to increase operative brake percentage above 74% by setting out the defective car(s).
    - **b.** If not possible to increase operative brake percentage above 74% by setting out defective car(s):
    - **c.** Train may be moved in passenger service to the next location where passengers can be safely detrained.
    - **d.** After all passengers are discharged, the equipment will be moved to the nearest location where the necessary repairs can be made.

D. When brakes become completely inoperative (Brakes are inoperative on all axles, brake or control valves cut out) on front or rear passenger equipment (including locomotives), proceed as follows:

1. If occupied, passengers MUST be moved to another car.
2. Car shall be locked out except for employees in the performance of duty.
3. Speed must not exceed 20 mph.
4. Proceed to first point where car can be:
    - **a.** Set out,
    - **b.** Switched ahead of a car with operative brakes, or
    - **c.** Repaired.
5. When hand/parking brake is located **INSIDE** equipment, proceed with hand/parking brake manned.

NOTE: Defective brakes on front or rear semi-permanently attached passenger equipment (i.e., High Speed Trainset or rear of Talgo) does not constitute defective brakes on front or rear passenger equipment.

E. When Class I brake test has expired and Mechanical Department personnel are not available to perform test, the following applies:

1. Commuter & Short Distance Intercity Passenger Trains which miss a scheduled Class I brake test due to delay en route.
    - **a.** Train may be moved in passenger service to the next location where passengers can be safely detrained.
    - **b.** After all passengers are discharged, perform a Class IA brake test. The equipment will then be moved to the nearest location where the required tests and inspections can be made.

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2. Long-Distance Intercity Passenger Trains which miss a scheduled Class I brake test due to delay en route may continue in passenger service to the location where the next test and inspections were scheduled to be performed.

NOTE: Locomotives must be inspected and tested per Instructions 3.1 and 3.2 each calendar day.

F. Anytime brakes are cut out, comply with the following:

1. Notify the train dispatcher and CNOC mechanical desk, communicating car number/s and number of axles cut out. CNOC may be contacted either directly at 1-800-424-0217 or through the train dispatcher.
2. If locomotive brakes are cut out, **BEFORE PROCEEDING**, notify train dispatcher and contact QMP at CNOC mechanical desk for instructions (each cut out locomotive axle counts as two cut out axles). CNOC may be contacted either directly at 1-800-424-0217 or through the train dispatcher.

NOTE: Cab Cars and NPCUs are considered cars (not locomotives) for the purpose of determining operative brakes. Therefore, count each cut out axle on this equipment as 1 cut out axle.

3. Passenger trains MUST NOT have two cars in succession with their control valves cut out. If control valve is cut out on front or rear passenger equipment, comply with instruction 2.19.2D.
4. QP or QMP must determine percent of operative brakes (See Operative Brake Chart).
5. Confirm percent of operative brakes by performing a walking inspection of a brake application.
6. Perform Class II brake test.
7. Prior to change of engine crew, inbound engineer will indicate on “Condition En Route” section of Summary MAP 1173 the car numbers and number of axles cut out of any equipment with brakes cut out.

G. EP (Electro Pneumatic) Brake becomes inoperative.

1. No train may depart its originating passenger terminal with inoperative EP brake.
2. If EP brake fails en route train may continue in service until next calendar inspection point or when next class I brake test is required.
3. Report defective EP brake to Train Dispatcher and note on “Conditions En Route” portion of MAP 1173/10C Summary.

2.19.3 Determining Percent Operative Brakes

A. Divide the total number of axles with operative brakes by the total number of axles in the train, including locomotives.
B. Each cut out axle on a locomotive in passenger service counts as 2 cut out axles.
C. Each cut out axle on other than locomotives count as 1 cut out axle.

EXAMPLE 1

1 Locomotive (4 axles)
6 Cars (4 axles each=24 axles)
24 axles + 4 axles = 28 total axles

Cut out 1 truck on 1 Passenger Carrying Car (2 axles)
28 total axles – 2 cutout axles=26 axles with operative brakes.
26 axles with operative brakes divided by 28 total axles = .93 or 93% operative brakes.

EXAMPLE 2

1 Locomotive (4 axles)
6 Cars (4 axles each=24 axles)
24 axles + 4 axles = 28 total axles

Cut out lead truck on locomotive (2 axles cut out = 4 axles cut out)
28 total axles – 4 cutout axles=24 axles with operative brakes.
24 axles with operative brakes divided by 28 total axles = .86 or 86% operative brakes.

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85% OPERATIVE BRAKE CHART		75 % OPERATIVE BRAKE CHART	
MAXIMUM NUMBER OF AXLES CUTOUT TO MAINTAIN AT LEAST 85% OPERATIVE BRAKES (Count Locos & Cars) **NOTE:** Each Cutout Loco Axle Counts as 2.		**MAXIMUM NUMBER OF AXLES CUTOUT TO MAINTAIN AT LEAST 75% OPERATIVE BRAKES** (Count Locos & Cars) **NOTE:** Each Cutout Loco Axle Counts as 2.	
TOTAL AXLES (Including Locomotives)	**NUMBER OF AXLES ALLOWED CUTOUT TO MAINTAIN 85%**	**TOTAL AXLES** (Including Locomotives)	**NUMBER OF AXLES ALLOWED CUTOUT TO MAINTAIN 75%**
1 - 6	0	1 - 3	0
7 - 12	1	4 - 6	1
13 - 19	2	7 – 11	2
20 - 25	3	12 - 15	3
26 - 32	4	16 - 19	4
33 - 38	5	20 - 23	5
39 - 45	6	24 - 27	6
46 - 51	7	28 - 31	7
52 - 58	8	32 - 35	8
59 - 64	9	36 - 39	9
65 - 70	10	40 - 43	10
71 - 77	11	44 - 47	11
78 - 83	12	48 - 50	12
84 - 90	13	51 - 54	13
91 - 96	14	55 - 58	14
97 - 103	15	59 - 62	15
104 - 109	16	63 - 66	16
110 - 116	17	67 - 70	17
117 - 122	18	71 - 74	18
123 - 129	19	75 - 78	19
130 - 135	20	79 - 82	20
136 - 141	21	83 - 86	21
142 - 148	22	87 - 90	22
149 - 154	23	91 - 94	23
155 - 161	24	95 - 98	24
162 - 167	25	99 - 100	25
168 - 174	26	-	-
175 - 180	27	-	-
181 - 187	28	-	-
188 - 193	29	-	-
194 - 199	30	-	-
200 - 206	31	-	-
207 - 212	32	-	-
213 - 219	33	-	-
220	34	-	-

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2.19.4 Non-Passenger Cars and Locomotives with Operative Brakes

A. Trains must have at least 85% operative air brakes.

B. Determine percent operative brakes by dividing the total number of OPERATIVE control valves in the train by the total number of control valves in the train (see table below).

C. The following table shows the maximum number of cut out control valves to maintain not less than 85% operative brake:

D. Cars with more than one control valve require each control valve to be counted when determining operative brakes.

E. For the purposes of determining operative brakes, a car/locomotive with either or both trucks cut out shall be counted as having its control valve cut out.

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Control Valves	Number of Control Valves Cut Out
6 control valves or less	0
7 - 13 control valves	1
14 - 19 control valves	2
20 - 26 control valves	3
27 - 33 control valves	4
34 - 39 control valves	5
40 - 46 control valves	6
47 - 53 control valves	7
54 - 59 control valves	8

2.19.5 Non-Passenger Inoperative Brakes

A. A car/locomotive with inoperative brakes must not be placed as the rear car of the train.

B. A train that has air brakes that become inoperative EN ROUTE and complies with 3.9.2 may proceed to the next repair point where repairs and brake test, if required, can be made. When air brakes become inoperative EN ROUTE, contact CNOC mechanical desk (1800-424-0217) for specific instructions and repair point.

C. If air brake on rear car becomes totally inoperative (both trucks cut out or control valve cut out) EN ROUTE:

1. Train may proceed with hand/parking brake manned, to a point where car can be repaired, switched ahead of a car with operative brakes or set out. Train dispatcher must be notified prior to movement of train.

D. Trains must have NO MORE than two consecutive control valves cut out.

E. A train must not leave maintenance location with air brakes inoperative on rear car.

F. A car with an inoperative hand brake must never be the rear car of a train.

G. Anytime brakes are cut out, perform a Class III brake test, and note on MAP 1173/10C Summary or other written document.

2.19.6 Non-Air Brake - En Route Movement Restrictions

A. Use the following table (A) to determine En Route Running Gear Defects and the necessary actions to be taken.

(A) EN ROUTE RUNNING GEAR DEFECT / ACTION TABLE
Defect Description
• Suspension Components (includes Air Bellows)
• Draft System Components
• Trucks and Components (includes Bolster Anchor Radius Rods)
• Wheels and Components (includes hot journals and locomotive support bearings)
Action
1. Stop train, QP or QMP must visually inspect equipment to determine nature of defect.
2. If communication with QMP not immediately available, contact QMP at CNOC mechanical desk via 1-800-424-0217 following voice prompts, Qualcomm communication system or Train Dispatcher with description of running gear defect. Additional numbers: 1-302-683-2082 or 2083, ATS 734-2082 or 2083.
3. Train must not move until QMP determines if safe for movement in passenger service.
4. QMP will determine maximum speed and any other restrictions necessary for safe movement. Alert QMP to any host railroad rules, speed restrictions or any other instructions concerning the defect.
5. Whenever a Running gear defect occurs en route, equipment may continue to next calendar day mechanical inspection point, provided QMP determines that it is safe to remain in passenger service.
6. Comply with instructions 1.2.1, 1.2.4, 1.4, and System General Orders.
7. As clarification, the following conditions are NOT considered defects which require a QMP's approval before the train can proceed:
• Actuation of an on-board or wayside hot journal bearing detector. A QMP need only be contacted if the crew's Tempilstik inspection of affected engine(s) or car(s) indicates an overheated bearing.
• Wheel flat spots of less than 2 ½ inches in length, or two adjoining flat spots of less than 2 inches each in length. A QMP need only be contacted if a flat spot exceeds these dimensions, or if the crew is not sure that they have measured the flat spot correctly.
• Underinflated or overinflated air bellows on cars. Crew will be governed by applicable Timetable instructions and/or 1.5.1. In the case of overinflated air bellows on Amfleet cars, QMP must be contacted if crew is unable to manually deflate air bellows.

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B. Use the following table (B) to determine En Route Non-Running Gear Defects and the necessary actions to be taken.

(B) EN ROUTE NON-RUNNING GEAR DEFECT/ACTION TABLE
Defect Description
• Suspension Components (includes Air Bellows)
• Draft System Components
• Trucks and Components (includes Bolster Anchor Radius Rods)
• Wheels and Components (includes hot journals and locomotive support bearings)
• Exhaust gases released inside cab or other compartments.
• Batteries not properly vented.
• Jumper cables – hanging free, exposed wire, broken plugs, or receptacles.
• High voltage safety labels for exterior doors and cover plates missing.
• Buffer plates not in place.
• Diaphragms not in place or not aligned.
• Exposed moving parts and electrical equipment not equipped with guards.
• Floors that contain oil, water, waste, or any obstruction.
• Manual door releases not in place.
• Emergency equipment… as applicable, missing.
• Safety related signage missing or not legible.
• High voltage safety labels for interior doors and cover plates missing.
• Emergency brake valves not stenciled.
• Trap doors that do not safely operate or securely latch.
• Vestibule steps that are not illuminated.
• End doors and side doors that do not operate safely or as intended.
• Baggage car side doors or lighting does not function as intended.
• Seats or attachments broken or loose.
• Public Address/Intercom system inoperative.
Action
1. QP or QMP must visually inspect equipment to determine nature of defect.
2. QP or QMP will determine if safe for movement in passenger service.
3. QP or QMP will determine maximum speed and any other restrictions necessary for safe movement.
4. Whenever a Non-Running gear defect occurs en route, equipment may continue to next calendar day mechanical inspection point, provided a QP or QMP determines that it is safe to remain in passenger service.
5. Report defects on EMAP 21A and notify CNOC Mechanical desk (1-800-424-0217) as soon as possible without delaying train.
6. The specific defects indicated below must be complied with as follows:
• Defective trap door must be secured by locking out door for which it is used.
• Vestibule must be used solely at high platforms when steps are non-illuminated.
• At least one operative and accessible door must be available on each side of car. A notice must be displayed directly on each defective door (see Tables and Forms section).
• Broken or loose seats or seat attachments must be rendered unusable and display a notice indicating defect directly on seat (See Tables and Forms section).
• Whenever a Public Address/Intercom system is found defective, an out of service notice must be displayed directly on the defective Public Address/ Intercom system (see Tables and Forms section).
1. **Short Distance Intercity Trains:** Cars may continue in service 4 calendar days until repaired or replaced.
2. **Long Distance Intercity Trains:** Cars may continue in service 8 calendar days until repaired or replace.

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2.20 Train Handling - Two-Way End-Of-Train Device

2.20.1 Two-Way End-Of-Train Device Components

A. A two-way end-of-train device consists of:

1. A Locomotive Control Unit (LCU),
2. An End-of-Train (EOT) Unit,
3. The ability to monitor various train-related functions,
4. The ability to initiate an emergency brake application from the rear of the train, and
5. Satisfies the rear of train marker light requirement.

B. The LCU:

1. Consists of a telemetry receiver/transmitter, provides displays and controls in the locomotive cab to monitor and communicate with the associated EOT. This may be a separate unit or displayed on the GE Integrated Function Display (IFD) screens.

C. The EOT:

1. Consists of a telemetry transmitter/receiver attached to the rear of car coupler and brake pipe,
2. Transmits brake pipe pressure, motion, battery condition and marker light status to the associated LCU, and,
3. Responds to a radio signal command from the LCU to initiate an emergency brake application at the rear of the train.

2.20.2 Two-Way End-Of-Train Device Requirements for Passenger Trains

A. Amtrak passenger trains are **NOT** required to have a two-way end-of-train device, regardless of consist size, when:

1. All cars in the train are equipped with an emergency brake valve readily accessible to a crewmember, or,
2. The rear car of the train is equipped with an emergency brake valve readily accessible to a crewmember in radio contact with the engineer.

B. Amtrak passenger trains must have an operable two-way end-of-train device whenever one or more of the following occurs:

1. The train has 25 or more cars, and a crewmember does not have access to an emergency brake valve on the last car of the train.
2. The train has 13 to 24 cars, and a crewmember does not have access to an emergency brake valve on the last car of the front two-thirds (or further back) of the train consist.
3. The train has 12 or fewer cars, and a crewmember does not have access to an emergency brake valve on the last car of the front half (or further back) of the train consist.
4. Use the following table to determine if a two-way end-of-train device is required. If your train exceeds the maximum number of inaccessible cars on the rear, a two-way end-of-train device is required.

Number of Cars in Train	Two-Way End-of-Train Device is NOT Required If Crewmember Has Access to This Car	Maximum Number of Inaccessible Cars on Rear
1	1	0
2	1	1
3	2	1
4	2	2
5	3	2
6	3	3
7	4	3
8	4	4
9	5	4
10	5	5
11	6	5
12	6	6
13	9	4
14	10	4
15	10	5
16	11	5
17	12	5
18	12	6
19	13	6
20	14	6
21	14	7
22	15	7
23	16	7
24	16	8
25 or more	Rear	0

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NOTE: Count back from the locomotives (do not count any locomotive).

C. Location of Crewmembers on Trains Not Equipped with a Two-Way End-of-Train Device. Crewmembers must take the following actions when a train, that is not required to be equipped with a two-way end-of-train device (due to meeting the criteria shown in the previous table), will descend a section of track on which the average grade is 2% or greater for at least two continuous miles:

1. At least 10 minutes prior to descending the specified grade, the engineer must communicate with the conductor to ensure that a crewmember with a working two-way radio is stationed in the rearmost car equipped with a readily accessible emergency brake valve when the train begins its descent.
2. The crewmember must remain stationed at this location, and remain in constant radio communication with the engineer, until the train has completely traversed the grade.

EXCEPTION: This requirement does not apply to trains which have all cars in the train equipped with a readily accessible emergency brake valve, or to those in which the rear car has a readily accessible emergency brake valve.

D. En Route Failures

1. An en route failure of the two-way end-of-train device is defined as the inability to initiate an emergency brake application from the rear of the train due to a communication failure or other reasons.
2. A communication failure is considered a loss of communication between the LCU and EOT for a continuous period of 16 minutes and 30 seconds.

E. Operating Restrictions EN ROUTE Failure - If a train which is required to have a two-way end-of-train device experiences an EN ROUTE failure, the train may proceed to the next location where repairs can be made, or where the next required train brake test is to be performed (whichever point is reached first) and must comply with all of the following:

1. Train must not descend a section of track on which the average grade is 2% or greater over a distance of two continuous miles until:
    - **a.** An operable two-way end-of-train device is installed, or,
    - **b.** An alternative method of initiating an emergency brake application from the rear of the train is achieved.
2. At locations other than those specified in item 1. above - A member of the crew equipped with an operable two-way radio that communicates with the engineer must occupy the rearmost passenger carrying car equipped with a readily accessible emergency brake valve.
3. The engineer must make periodic Running Brake Tests until the failure is corrected.

F. When brake pipe continuity is lost, as indicated by any of the following, stop train immediately and determine the cause:

1. Low air audible alarm and low air indicator light.
2. No increase or decrease in brake pipe pressure at rear of train in response to movement of the ABV handle.
3. “0” or “***” brake pipe pressure at rear of train.
4. After determining cause for brake pipe continuity loss and making necessary repairs if possible, perform a Passenger Class II Brake Test using two-way end-of-train device.

NOTE: Determine the cause of loss of continuity by inspecting train brake pipe for air loss and angle cocks/cutout cocks for proper positioning.

G. Marker Light failure does not render the two-way end-of-device inoperative. If the EOT unit’s marker light fails, train may proceed to the next designated terminal for repair. If repairs cannot be made, a portable marker must be placed on rear of train.

H. Circumstances requiring emergency brake application using Two-Way End-Of-Train Device:

1. Whenever it becomes necessary to place the train air brakes in emergency using either the ABV handle or the emergency brake valve, engineer or other train crewmembers must also activate the two-way end-of-train device on trains equipped with the device, using the “EMERGENCY” toggle switch.
2. The two-way end-of-train device must also be activated whenever an undesired emergency brake application of the train air brakes occurs.

2.20.3 Two-Way End-Of-Train Device Requirements for Non-Passenger Trains

A. Use the table below to determine when a Non-passenger train is required to be operated with a functioning Two-Way End-of-Train Device.

B. The alternative method to meet the requirement of a functioning Two-Way End-of-Train Device is a caboose, Passenger Carrying Car or other equipment with an emergency brake valve located at the rear of the train and manned by a crewmember in radio communication with the controlling locomotive.

C. Lite and multiple lite locomotive movements are not required to operate with a Two-Way End-of-Train Device.

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Non-Passenger Two-Way End-of-Train Device Table			
Step	Determination	Yes	No
1	Is train weight greater than 4000 tons?	Proceed to Step 3.	Proceed to Step 2.
2	Will train operate over grade of 2% or more for a distance of 2 continuous miles?	Two-Way EOT or alternative method IS Required.	Proceed to Step 4.
3	Will train operate over grade of 1% or more for a distance of 3 continuous miles?	Two-Way EOT or alternative method IS Required.	Proceed to Step 5.
4	Is train classified as a Work Train?	Two-Way EOT or alternative method IS NOT Required.	Proceed to Step 5.
5	Will speed exceed 30 mph?	Two-Way EOT or alternative method IS Required.	Two-Way EOT or alternative method IS NOT Required.

2.20.4 Two-Way End-Of-Train Device En Route Failures

A. An en route failure of the two-way end-of-train device is defined as the inability to initiate an emergency brake application from the rear of the train due to a communication failure or other reasons.

B. A communication failure is considered a loss of communication between the LCU and EOT unit for a continuous period of 16 minutes and 30 seconds.

C. Operating Restrictions during En Route Failure - If a train which is required to have a two-way end-of-train device experiences an EN ROUTE failure:

1. The train may proceed, not exceeding 30 mph, to the next location where repairs can be made or an alternative method of operation is achieved (See instruction 2.20.3B), AND
2. Train must not descend a section of track on which the average grade is 2% or greater over a distance of two continuous miles until:
   - **a.** An operable two-way end-of-train device is installed, or,
   - **b.** An alternative method of initiating an emergency brake application from the rear of the train is achieved (See instruction 2.20.3B).

D. When brake pipe continuity is lost, as indicated by any of the following, stop train immediately and determine the cause:

1. Low air audible alarm and low air indicator light.
2. No increase or decrease in brake pipe pressure at rear of train in response to movement of the ABV handle.
3. “0” or “***” brake pipe pressure at rear of train.
4. After determining cause for brake pipe continuity loss, perform a Class III Brake Test using two-way end-of-train device.

NOTE: Determine the cause of loss of continuity by inspecting train brake pipe for air loss and angle cocks/cutout cocks for proper positioning.

E. Marker Light failure does not render the two-way end-of-device inoperative. If the EOT marker light fails, train may proceed to the next designated terminal for repair. If repairs cannot be made, a portable marker must be placed on rear of train.

F. Circumstances requiring emergency application Using Two-Way End-Of-Train Device:

1. Whenever it becomes necessary to place the train air brakes in emergency using either the ABV handle or the emergency brake valve, engineer or other train crewmembers must also activate the two-way end-of-train device on trains equipped with the device, using the “emergency” toggle switch.
2. The two-way end-of-train device must also be activated whenever an undesired emergency application of the train air brakes occurs.

2.20.5 Two-Way End-Of-Train Device Set Up and Arming the System

A. This procedure requires two individuals; one each positioned at the EOT unit and at the LCU/IFD.

B. Once the EOT Unit ID Code Number is communicated to the individual positioned at the LCU/IFD, it is entered either:

1. On the LCU using the thumbwheel, or,
2. On the IFD using the “F“ keys by:

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a. Pressing F1-F5 selecting unit I.D. code, then,
b. Pressing F6 “ENTER CODE“ key, then,
c. Pressing F7 “COMM TEST“ key, and,
d. Verifying “COMM TEST PASSED“ message is displayed.

3. Press “TEST“ button on the EOT unit to effect “ARM NOW“ message on the LCU/IFD display, then immediately press either the:
   a. “Communication Test/Arm” button on the LCU, or,
   b. F7 “Arm Two-Way“ key on the IFD screen.

C. The device is ARMED when either the:
1. LCU displays “ARMD“ and the “EMERG ENABLED“ LED is lit, or
2. IFD screen displays “ARMED AND ENABLED“.

2.20.6 Two-Way End-of-Train Device Emergency Function Test

A. Test must be conducted at point of installation or whenever the LCU or EOT unit is changed.
B. Brake pipe readouts between the LCU and EOT unit must be compared for accuracy.
C. Brake pipe pressure indicated on LCU must be within 3 psi of that indicated on EOT unit or a properly calibrated air gauge.
D. Test Procedure:
1. Charge train to within 15 psi of regulating valve setting.
2. Close angle cock between the last car and the EOT unit.
3. Initiate two-way end-of- train device emergency brake application from locomotive cab using emergency toggle switch.
4. EOT unit must vent a brief exhaust of air.
5. Press EOT unit test button to verify brake pipe pressure is “0".
6. Allow approximately 60 seconds for EOT unit to reset.
7. Slowly open angle cock between last car and EOT unit.
8. If EOT unit fails to respond to an LCU-initiated emergency signal after two attempts, the two-way end-of- train device is considered inoperative, until repaired or replaced and retested.
9. Add info to MAP 1173/10C Summary.

2.20.7 Passenger Train Class II Brake Test Using Two-Way End-of-Train Device

A. The two-way end-of-train device must be utilized to perform the Class II Brake Test.
B. Test Procedure:
1. Observe the display on the LCU/IFD for continuous readout of brake pipe pressure from the EOT unit.
2. Charge system to required pressure.
3. Make a 20 psi brake pipe reduction.
4. Observe appropriate LCU/IFD indications for brake pipe reduction on last car of train.
5. Release brakes.
6. Observe appropriate LCU/IFD indications for brake pipe pressure increase on last car of train.
7. Notify conductor that test was successful.

2.20.8 Non-Passenger Train Class III Brake Test Using Two-Way End-Of-Train Device

A. The two-way end-of-train device must be utilized to perform the Class III Test.
B. Test Procedure:
1. Observe the display on the LCU/IFD for continuous readout of brake pipe pressure from the EOT unit.
2. Charge system to required pressure.
3. Make a 20 psi brake pipe reduction.
4. Observe appropriate LCU/IFD indications for brake pipe reduction on last car of train.
5. Release brakes.
6. Observe appropriate LCU/IFD indications for brake pipe pressure increase on last car of train.
7. Notify conductor that test was successful.

2.20.9 EOT Unit’s Battery

A. The following indications pertain to the condition of the EOT unit’s battery:
1. LCU Messages:
   a. “DEAD BAT” (Dead Battery)
   b. “REPL BAT” (Replace Battery)
2. IFD Screen:
   a. “EOT BATTERY” Yellow (Weak)
   b. “EOT BATTERY” Red (Dead)

B. Replacement procedure:

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1. Ensure EOT unit's replacement battery is charged.
2. Remove EOT unit's battery hasp, securing device.
3. Unlatch battery compartment door.
4. Pull battery straight out.
5. Fit replacement battery into the enclosure cavity, aligning the connectors.
6. Push battery fully into the enclosure, then latch and secure battery compartment door.

2.20.10 Disarming Two-Way End-of-Train Device

A. Armed two-way end-of-train device must be disarmed when:
1. Either the EOT unit or LCU is changed, and/or,
2. When train arrives at its final terminal.

B. Disarming Procedure using LCU:
1. Set all thumbwheel numbers to "0", and,
2. Press "Communications Test/Arm" button.

C. Disarming Procedure using IFD:
1. From IFD EOT setup screen, press F6 "EOT 00000" key and,
2. Immediately press F7 "DISARM TWO WAY" key.

D. The system is disarmed when either:
1. LCU displays "DISARMD", and "EMERG ENABLED" LED is off or,
2. IFD screen displays "NOT ARMED AND DISABLED".

2.20.11 Mechanical Department Tracking and Annual Inspection

A. EOT Devices are tracked by the 5-digit ID number located on the dated ID sticker on each unit.

B. Locomotive Control Units (LCU) are tracked by their serial numbers located on the unit.

C. EOT Unit shall be removed from service and tested for accuracy at least every 368 days. The 368 days shall not include a shelf life of up to 92 days.
1. Test and inspection of the EOT unit shall be conducted per CFR 49 Part 232.409, and Amtrak SMP-MEC-12-11004 *Procedures for End-of-Train (EOT) Telemetry Systems.*
2. The date and location of the last calibration or test as well as the name of the person performing the calibration or test shall be legibly displayed on a weather resistant sticker or other marking device affixed to the outside of the EOT unit.

D. LCU shall be removed from service and tested for accuracy at least every 360 days.
1. Test and inspection of the LCU shall be conducted per CFR 49 Part 232.409, and Amtrak SMP-MEC-12-11004 *Procedures for End-of-Train (EOT) Telemetry Systems.*
2. The date and location of the last calibration or test as well as the name of person performing the calibration or test shall be legibly displayed on weather resistant sticker or other marking device affixed to the outside of the front unit; however, if the front unit (LCU) is an integral part of the locomotive or is inaccessible, then the information may be recorded on Blue Form/MAP 816 provided that the serial number of the unit is recorded.

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2.21 Train Handling - Yard Service Switching

2.21.1 Ensure Blue Signal protection and associated derails are removed per operating rules.

2.21.2 Brake pipe must be charged on entire train when switching, except when brake pipe is defective or damaged.

2.21.3 Ensure hand/parking brakes are released before moving equipment.

2.21.4 Ensure chocks and/or skates are removed before moving equipment.

2.21.5 Before placing car(s) in a track, determine if there is sufficient room to hold the car(s).

2.21.6 Watch for close clearance. Stop movement if unsure whether equipment will clear.

2.21.7 Before coupling to standing equipment, verify that equipment is properly secured per instruction 2.14 to prevent rolling if coupling is not made. Chocks must not be removed until coupling is made.

2.21.8 When possible, cars must be uncoupled on straight track instead of curves or in turnouts.

2.21.9 When coupling equipment, especially in curves and turnouts, ensure that couplers are properly positioned to prevent damage.

2.21.10 Before coupling or moving passenger equipment, occupants of such cars must be notified that movement will be made.

2.21.11 A safety stop must be made (approximately 50 feet) just prior to coupling to any equipment. A safety stop is not required when distance between **standing** equipment to be coupled is less than 50 feet.

2.21.12 When coupling equipment, care must be taken to prevent injury or damage. Coupling must be made at the minimum speed required to complete the coupling but not exceeding 4 mph. ACS-64, Charger SC-44, ALC-42, HHP-8 Locomotives, HST Power Cars, and equipment with spear type couplers must be coupled at a speed NOT to exceed 2 MPH.

2.21.13 After coupling equipment ensure that:

A. Both coupler operating rods (cut levers) are properly secured in the down position, with the knuckle locked.
B. The coupler telltale hole or recess (inverted V) is fully visible and the rotary lock lift has fully dropped.
C. The train must be double stretched after each coupling.
D. Once the train is assembled and switching is complete, the requirements of instruction 1.5.5 Coupler Locking Pins apply.
E. In the event the equipment does not couple as intended, uncouple, and inspect both couplers. Open and close each knuckle to check for proper lock drop and engagement, free of binding. Attempt to couple equipment again and if another failed coupling occurs, equipment must be moved to a repair or servicing track for proper repair.

2.21.14 Prior to uncoupling equipment, disconnect all cables, chains, and curtains between equipment that is to be uncoupled.

2.21.15 Prior to shoving or pulling equipment, crews must ensure that all cables and air hoses have been disconnected from 480V, Yard Plant (ground air), Telephone, Ground Power, etc.

2.21.16 When switching, equipment must not be placed in the foul until switch / switches are properly aligned.

2.21.17 Secure unattended equipment per instruction 2.14.

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Equipment Inspections / Brake Tests Section

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3.0 Equipment Inspections / Brake Tests

- 3.1 Locomotives - Employee Responsibility – Locomotive Inspection, Testing, and Documentation
- 3.2 Locomotives - Locomotive Calendar Day Inspection Procedure When Performed By Engineer
- 3.3 Locomotives - Locomotive Calendar Day Air Brake Test
- 3.4 Locomotives - Mechanical Department Locomotive Air Brake Daily Inspection
- 3.5 Locomotives - Locomotive Consist Air Brake Test
- 3.6 Locomotives – Standing Locomotive Brake Test
- 3.7 Locomotives - Locomotive Running Brake Test
- 3.8 Brake Tests – General
- 3.9 Train Brake Tests & Mechanical Inspection

3.0 Equipment Inspections / Brake Tests

3.1 Locomotives - Employee Responsibility – Locomotive Inspection, Testing, and Documentation

3.1.1 When first taking charge of a locomotive, the Engineer will check that a MAP 100 is located on each locomotive in consist and determine that Locomotive Calendar Day Inspection remains valid.

NOTE: When MAP 100 is referenced in the following instructions, Metrolink Locomotives and Cab Cars will use Calendar Day Inspection Forms SMP 100, SMP 1173, and SMP 101. MARC Locomotives and Cab Cars may use the Calendar Day Inspection Form ECR 100. Trains that originate in Canada may use the Via Rail Train Safety Inspection Checklist Form 85-J0099 AF (00-05).

3.1.2 Determining Level of Fuel on Diesel Locomotives

A. Engine service employees will determine the level of fuel on each unit as soon as possible after taking charge of a diesel locomotive consist.

B. Without delay to the train and when safe conditions exist, observe the fuel sight glasses, fuel gauge or fuel monitor to determine if sufficient fuel exists to reach final terminal or next scheduled fueling point. After determining fuel level, note on the back of the MAP 100 of each unit the total gallons, location, date and time.

C. When conditions indicate that sufficient fuel is not available to reach the final terminal or next scheduled fueling point, contact CNOC and/or train dispatcher and inform them of conditions as soon as possible. For the purpose of estimating fuel consumption, several factors must be considered including the size of the train, number of units, weather conditions and expected delays.

3.1.3 Locomotive Calendar Day Inspection Requirements

NOTE: This instruction also applies to non-complying locomotives.

A. Each locomotive must receive a Locomotive Calendar Day Inspection each calendar day, regardless of whether delayed en route.

B. The date on which a locomotive(s) receives the last calendar day inspection and test will be determined by the MAP 100 information entered in the “Signature Of Supervisor approving unit for service and all work complete”, ”Occupation”, “Place”, “Date”, “Time”. The information of the previous calendar day inspection in accordance with 49 CFR 229 will be entered in the “Previous Calendar Day Inspection” box in the top right corner of the MAP 100.

C. If a locomotive has NOT been inspected today and will be in service past 11:59PM tonight, a Locomotive Calendar Day Inspection is required before 11:59PM tonight.

D. When Locomotive Calendar Day Inspection has expired and Mechanical Department personnel are not available, Engineer will perform inspection according to instruction 3.2 before placing locomotive in service.

E. When Locomotive Calendar Day Inspection will be required before 11:59PM tonight and Mechanical Department personnel are not available, engineer will perform inspection as per instruction 3.2 after:

1. Contacting train dispatcher to arrange for location to perform inspection, OR
2. When communication is not available with train dispatcher; perform inspection at any point prior to 11:59PM tonight.

F. When Locomotive Calendar Day Inspection is not current on locomotive(s) within a Mechanical Facility, the locomotive(s) may be moved to a repair or servicing track in order to perform the inspection within the same mechanical facility. Before movement is made:

1. Determine that locomotive is safe to move,
2. Perform locomotive air brake tests as prescribed by instructions 3.5, 3.6 and 3.7,
3. Movement must not exceed 5 mph.

3.1.4 Mechanical Department Employees

A. Mechanical department personnel who are employed to perform locomotive calendar day inspections, air brake daily inspections, and the locomotive departure brake test must perform the above-mentioned inspections / tests in accordance with all applicable Standard Maintenance Procedures and the current edition of this AMT-3 instruction manual.

B. Mechanical Department personnel must perform the air brake daily inspection as outlined in instruction 3.4 and the locomotive air brake departure test as outlined in instruction 3.3 prior to dispatching the locomotive for service.

C. Mechanical Department personnel shall submit a written report of the air brake daily inspection and air brake departure test. Use appropriate MAP form(s) or WMS template.

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3.1.5 Each locomotive placed in service must receive all required inspections to ensure compliance with the requirements listed in 49 CFR Part 229.

A. Each locomotive in service must receive the following inspections:
1. Periodic (once each 92 or 184 days depending on locomotive type).
2. Annual (Does not exceed 368 calendar days).
3. Biennial (Does not exceed 736 calendar days).

3.1.6 All inspections, other than the daily inspection will be noted on Form F6180.49A (Blue Form/MAP 816) or "Blue Form") and must be checked for proper dates.

3.1.7 Trains/Locomotives must not enter any Train Control System Territory with defective or cut out Train Control System or "Acknowledger" unless relieved by Rule, Special Instruction, General Order, Bulletin Order, or other directive.

3.1.8 The "Acknowledger" must be tested prior to entering any Train Control System territory. Perform test by briefly depressing the "Acknowledger" for greater than three seconds to verify sounding of the audible alarm.

3.1.9 Engineer must verify that train control system has been tested as per instruction 4.1 prior to operation in any Train Control System Territory. Engineer will accept mechanical forces inspections and tests as documented by MAP 100.

3.1.10 When train control system test(s) is required and Mechanical Department personnel are not available, engineer will perform test(s) according to instruction 4.0.

3.1.11 Any time a seal is broken from the list in section 2.7.1, the following information must be entered on MAP 100:

A. Device cut out.
B. Seal number if available.
C. Reason for cutting out.
D. Geographic location where cut out.
E. To whom report was made.

3.1.12 Engineers must keep a supply of MAP 100s available while on duty.

3.1.13 Engineers must, before going off duty, complete the bottom section of the current MAP 100 by indicating any defects, signature, location, and date. If a non-complying condition exists, comply with instruction 3.1.15.

3.1.14 Missing MAP 100 Forms

A. Missing MAP 100
1. Locomotives must not depart an initial terminal without a current MAP 100 on each locomotive.
2. At other than initial terminal, locomotive may proceed without a MAP 100, provided it will not be used as controlling locomotive in train control system territory.
3. At other than initial terminal, if locomotive will be used as controlling locomotive in train control system territory, comply with one of the following:
   a. Obtain a copy of the current MAP 100 that indicates train control system test(s) was performed, OR
   b. Perform required Train Control System test(s) and complete a new MAP 100 as per instruction 4.0, OR
   c. Verify that the proper train control system test(s) was performed by contacting the mechanical desk at CNOC either directly at 1-800-424-0217 or through the train dispatcher. Record on the "Failures En Route" section of the current MAP 100 or a new MAP 100 the type of test, name of employee who performed test and place, date, and time of test.

NOTE: Every effort must be made to use the option which causes the least train delay.

B. Missing Previous Calendar Day Inspection Information
1. Locomotives must not depart an initial terminal without the "Previous Calendar Day Inspection" section (box 36) information.
2. At other than initial terminal, before proceeding, verify place, date, and time of previous Locomotive Calendar Day Inspection by contacting the mechanical desk at CNOC either directly at 1-800-424-0217 or through the train dispatcher. Enter the place, date, and time of the last inspection on "Previous Calendar Day Inspection" section (box 36) section of the current MAP 100.

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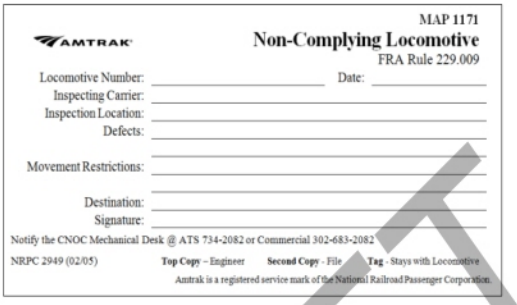
NOTE: If unable to verify "Previous Calendar Day Inspection" information, a train en route must not be delayed.

C. Locomotive Engineers must immediately report missing MAP 100 or "Previous Calendar Day Inspection" information by contacting the mechanical desk at CNOC either directly at 1-800-424-0217 or through the train dispatcher.

3.1.15 Any locomotive with a non-complying condition must be documented as follows:

A. Attach a completed MAP 1171 *Non-Complying Locomotive Tag* to the control stand, isolation switch or engine control panel.
B. Describe defect on MAP 100. If non-complying tag is not available, write "Non-Complying Locomotive" on "Failure En Route / Equipment Condition" section of MAP 100 in addition to describing defect and any restrictions.
C. In multiple unit consists or push/pull operations, note on MAP 100 of lead unit that non-complying locomotive is in consist or train.
D. Notify CNOC mechanical desk at 1-800-424-0217 as soon as possible without delaying train.

NOTE: SMP 130 *Non-Complying Locomotive Tag* must be used when a non-complying condition exists on Metrolink locomotives.



MAP 1171

AMTRAK

Non-Complying Locomotive

FRA Rule 229.009

Locomotive Number: _____ Date: _____

Inspecting Carrier: _____

Inspection Location: _____

Defects: _____

_____

Movement Restrictions: _____

_____

Destination: _____

Signature: _____

Notify the CNOC Mechanical Desk @ ATS 734-2082 or Commercial 302-683-2082

NRPC 2949 (02/05) **Top Copy** – Engineer **Second Copy** - File **Tag** - Stays with Locomotive

Amtrak is a registered service mark of the National Railroad Passenger Corporation

3.1.16 Non-complying locomotives may be moved to the next Amtrak locomotive repair facility, if safe to do so, only as:

A. Lite locomotives, OR
B. In a train either dead or with propelling motors cut out/isolated.

EXCEPTION: A locomotive that develops a non-complying condition en route may continue to utilize its propelling motors, provided instruction 2.1 is complied with.

3.1.17 Locomotive Calendar Day Inspection Documentation for Trains Originating in Canada

A. Supervisors and Locomotive Engineers must ensure that locomotive calendar day inspection remains valid when operating:
1. Foreign line locomotives used to haul Amtrak trains, and,
2. On locomotives hauling Amtrak trains entering the United States from Canada.

B. Foreign line locomotive documents which indicate the date, time, and location of the last locomotive calendar day inspection will be accepted by Amtrak in place of standard Amtrak documents (MAP 100).
C. Canadian locomotive documents which indicate the date, time, and location of the last locomotive calendar day inspection will be accepted by Amtrak in place of standard Amtrak documents (MAP 100).
D. If the last locomotive calendar day inspection has expired or cannot be determined, a locomotive calendar day inspection must be performed on the affected locomotive.

3.2 Locomotives - Locomotive Calendar Day Inspection Procedure When Performed by Engineer

NOTE: If a non-complying condition is discovered at a location where locomotive cannot be repaired or replaced on a revenue passenger train, comply with instruction 2.1.

NOTE: As indicated by instruction 3.2.41, the Locomotive Calendar Day Air Brake Test (instruction 3.3) is part of the Locomotive Calendar Day Inspection and MUST be performed in addition to instruction 3.2.

NOTE: For instructions 3.2.4 through 3.2.40, any non-complying condition discovered during this inspection must be documented per instruction 3.1.15. In addition to particulars noted in instructions 3.2.4 through 3.2.40, the following must also be complied with:

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A. Complete non-complying tag per instruction 3.1.13;
B. Note defect on MAP 100,
C. In multiple unit consists or push/pull operations, note on MAP 100 of lead unit that non-complying locomotive is in consist or train.

3.2.1 Locomotive must be secured per instruction 2.14.

3.2.2 Verify that Locomotive Inspection and Repair Report, F6180.49A (Blue Form), is displayed on locomotive and complies with 3.1.4 and 3.1.5.

3.2.3 Verify cutouts (switches and cocks) or enclosures for safety devices listed on MAP 100 are properly positioned and sealed, with numbers recorded on MAP 100 form:

A. ACSES Cutout Cock/Switch
B. Cab Signal Cutout Cock/Switch
C. ITCS/X-ITCS Cutout Cock/Switch
D. IITS
E. I-ETMS Penalty Brake Cutout Cock/Switch
F. I-ETMS Emergency Cutout Cock/Switch
G. I-ETMS Horn Cutout Cock/Switch
H. Alerter Cutout Cock/Switch
I. ATC/IITS Transfer Switch
J. Speedometer (Locomotive) Overspeed (OS) Cutout Cock/Switch
K. Speed Control Cutout Cock/Switch
L. Door Bypass Switch
M. Multiple Penalty Brake Device Switch
N. Event Recorder
O. Amtrak / MNRR Switch
P. Overspeed Selector Switch

3.2.4 Hand/Parking brakes are in a safe and suitable condition for service.

3.2.5 Cab seats properly secured to the floor or sides.

A. Repair or use as trailing locomotive to next Amtrak locomotive repair facility.

3.2.6 Cab windows and wipers provide clear vision and windows are free of broken areas.

A. Repair or use as trailing locomotive to next Amtrak locomotive repair facility.

3.2.7 Cab heaters and Air conditioning (if equipped) function as intended.

A. If cannot be repaired and weather conditions create an unsafe environment switch to trailing position and continue in use until next Amtrak locomotive repair facility.

3.2.8 Cab lights and gauge lights are operative and provide sufficient illumination.

3.2.9 Speed indicator and related apparatus is undamaged. The performance and accuracy of the speed indicator can only be ascertained after departure (10 mph to 30 mph +-3 mph; above 30 mph +-5 mph).

A. Repair or use as trailing locomotive to next Amtrak locomotive repair facility.

3.2.10 Air brake gauges register variations in pressure in relation to brake valve handle position.

A. Repair or use as trailing locomotive to next Amtrak locomotive repair facility.

3.2.11 Air compressor or compressors control main reservoir pressure, as indicated by cab gauges, within range specified for type locomotive.

A. Repair or use as trailing locomotive to next Amtrak locomotive repair facility.

3.2.12 Headlights operate properly and can be dimmed as required. One defective bulb of a two-bulb Incandescent or LED headlight **IS NOT** considered non-compliant. If found non-compliant (defective):

A. Repair or use as trailing locomotive to next Amtrak locomotive repair facility.

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3.2.13 All auxiliary (ditch) lights operate as intended.

A. If 1 defective auxiliary light is discovered at initial/originating terminal of train, repair, or switch locomotive to trailing position.

NOTE: Auxiliary lights are considered non-complying if one or more lightbulbs are burned out. A failure of the flashing function is not considered a failure of the auxiliary lights but must be reported on MAP 100.

3.2.14 Locomotive radio operates as intended.

A. Repair, substitute another radio or use as trailing locomotive to next Amtrak locomotive repair facility.

3.2.15 Inward and Forward Facing Cameras are securely mounted and not damaged.

NOTE: Damage or defective conditions of any part of the system (cameras, bracket, cables, LDVR) must be reported on MAP 100. Employees must not disconnect, disable, or tamper with the Locomotive Camera Recorder or components.

3.2.16 Dynamic brake equipment is in place and cut in if locomotive is equipped. Locomotives with defective dynamic brake will proceed as follows:

A. Place tag on control stand or Engine Control panel indicating “Inoperative Dynamic Brakes”, locomotive number, date, location, and signature of person who discovered (see instruction 2.1.14),

B. Conventional locomotives must be repaired within 3 calendar days.

C. MU locomotives must be repaired by the next Locomotive Calendar Day Inspection.

3.2.17 Horn and bell operate as intended. If either found non-complying:

A. Repair or use as trailing locomotive to next Amtrak locomotive repair facility.

3.2.18 Sanitation, Toilet Compartment, and Toilet:

A. No significant amount of filth, trash, or human waste in toilet compartment.

B. No strong, persistent, chemical, or human waste odor from toilet compartment

C. Adequate ventilation in toilet compartment.

D. Toilet not defective and flush mechanism functions as intended.

E. Toilet compartment door closes.

F. Toilet compartment door lock functions as intended.

G. Sufficient quantity of toilet paper and trash bags.

H. Sufficient quantity of antibacterial agents such as antibacterial soap and water or antibacterial towelettes and sufficient quantity of paper towels for employee sanitation needs.

I. If toilet or toilet compartment is unsanitary, complete non-complying tag per instruction 3.1.15 and comply with the following:

1. Use locomotive as trailing unit in consist, or
2. Locomotive can be used as a lead unit only until unsanitary condition can be corrected, replaced with another locomotive, or the next Locomotive Calendar Day Inspection, provided all of the following are met:
   - **a.** No other locomotive is available (cannot switch to trail),
   - **b.** Toilet could not have been made sanitary since last Locomotive Calendar Day Inspection,
   - **c.** Toilet compartment door is closed and adequately ventilated so locomotive cab is habitable, and
   - **d.** Engineer is provided other toilet facilities upon reasonable request.
3. Note on MAP 100 date toilet or toilet compartment becomes unsanitary.

J. If toilet is defective but sanitary, complete non-complying tag as per instruction 3.1.15 and comply with the following:

1. When not in switching service, use locomotive as trailing unit in consist, or
2. When not in switching service, locomotive can be used as a lead unit only until defective condition can be corrected, replaced with another locomotive, or the next Locomotive Calendar Day Inspection, provided all of the following are met:
   - **a.** No other locomotive is available (cannot switch to trail),
   - **b.** Toilet could not have been repaired since last Locomotive Calendar Day Inspection, and
   - **c.** Engineer is provided other toilet facility upon reasonable request.
3. Locomotive can be used as a lead unit in switching service for 10 days after toilet becomes defective.
4. Note on MAP 100 date toilet becomes defective.

K. Inadequate ventilation of toilet compartment or defective toilet compartment door

1. If toilet compartment inadequately ventilated locomotive must be repaired, be used as a trailing unit or in switching service.
2. If toilet compartment door is defective or will not close locomotive must be repaired, used as a trailing unit or in switching service.

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L. If toilet compartment door lock is defective, lock must be repaired on or before the next 92-day inspection. Note on MAP 100 date toilet compartment becomes defective.

M. If locomotive has insufficient quantity of toilet paper, trash bags, or sanitary washing needs, obtain prior to use of locomotive.

3.2.19 Sanders function on each locomotive to deliver sand to each rail in front of the first power operated wheel set in the direction of movement.

A. Repair if possible. If not, locomotive MUST be set up to prohibit propulsion (isolated), switch to trailing position, and continue in use to next Amtrak locomotive repair facility.

3.2.20 No traction motor is cut out. If traction motor is cut out:

A. Locomotive MUST be set up to prohibit propulsion (isolated), switch to trailing position, and continue in use to next Amtrak locomotive repair facility.

NOTE: This instruction does not apply to HHP-8, HST, ACS-64, SC-44, ALC-42 and P32ACDM locomotives. However, when traction motor is cut out on this equipment note must be made on MAP 100.

3.2.21 Emergency brake valve (conductor valve) properly labeled and accessible.

A. Repair or use as trailing locomotive to next Amtrak locomotive repair facility.

3.2.22 Doors and cover plates that are marked "Danger" and covering high voltage electrical apparatus must be secured in their proper locations.

A. Repair if possible. If not, shut down locomotive, switch to trailing position and continue in use to next Amtrak locomotive repair facility.

3.2.23 Fan openings, exposed gears and pinions, and exposed moving parts protected to prevent injury.

A. Repair if possible. If not, shut down locomotive, switch to trailing position, and continue to next Amtrak locomotive repair facility.

3.2.24 No bent/broken grab irons or accumulations of oil, water, fuel, debris, and other items in passageways, walkways, cab compartment floors, and engine compartment floors which presents an unsafe condition such as a slipping hazard.

A. Repair if possible. If not, shut down locomotive, switch to trailing position, and continue to next Amtrak locomotive repair facility.

3.2.25 No battery gas leaks in cab or engine compartment.

A. Repair if possible. If not, shut down locomotive, switch to trailing position, and continue to next Amtrak locomotive repair facility.

3.2.26 No obvious diesel engine exhaust gas leaks into the engine compartment.

A. Repair if possible. If not, shut down locomotive, switch to trailing position, and continue to next Amtrak locomotive repair facility.

3.2.27 Water and oil drained from main reservoirs if not equipped with automatic drain valves.

3.2.28 Brake rigging properly secured.

A. Determine any operating restrictions (rules or equipment) which apply,

B. Set out locomotive immediately or move to the next point where it can be set out,

C. Notify CNOC mechanical desk at 1-800-424-0217 as soon as possible without delaying train.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

3.2.29 No part of trucks, brake rigging, and running gear, with the exception of the wheels and non-metallic sand hoses, are less than 2-1/2 inches above top of rail. Determination can be made by inspecting under side of the locomotive from outside the gauge of the rail.

A. Determine any operating restrictions (rules or equipment) which apply,

B. Set out locomotive immediately or move to the next point where it can be set out,

C. Notify CNOC mechanical desk at 1-800-424-0217 as soon as possible without delaying train.

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NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

3.2.30 Pilots, snowplows, and end plates properly secured and not less than 3 inches not more than 6 inches above top of rail.

A. Determine any operating restrictions (rules or equipment) which apply,
B. Set out locomotive immediately or move to the next point where it can be set out,
C. Notify CNOC mechanical desk at 1-800-424-0217 as soon as possible without delaying train.

3.2.31 Draft gear and uncoupling mechanisms secure and not bent, cracked, broken, or missing parts.

NOTE: This instruction does not apply to the High Speed Trainset (HST).

A. Determine any operating restrictions (rules or equipment) which apply,
B. Set out locomotive immediately or move to the next point where it can be set out,
C. Notify CNOC mechanical desk at 1-800-424-0217 as soon as possible without delaying train.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

3.2.32 Jumper cables are properly stored (ends of cables should not be hanging free) and do not create a tripping hazard.

3.2.33 Brake shoes are properly applied and aligned with tread of wheels or other braking surfaces.

A. Determine any operating restrictions (rules or equipment) which apply,
B. Set out locomotive immediately or move to the next point where it can be set out,
C. Notify CNOC mechanical desk at 1-800-424-0217 as soon as possible without delaying train.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

3.2.34 Visible traction motor, HEP cables, and cable connections are free from damage.

A. Repair if possible. If not, locomotive MUST be set up to prohibit propulsion (isolated), switched to trailing position, and continue in use to next Amtrak locomotive repair facility.

3.2.35 Trucks, shocks, spring rigging, and associated parts in proper position and free of cracks and breaks.

A. Determine any operating restrictions (rules or equipment) which apply,
B. Set out locomotive immediately or move to the next point where it can be set out,
C. Notify CNOC mechanical desk at 1-800-424-0217 as soon as possible without delaying train.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

3.2.36 Any wheel does not have a single flat or shelled spot 2 ½ inches or more in length. Any wheel does not have adjoining flat or shelled spots 2 inches or more in length. Any wheel does not have defects such as broken, gouged, chipped, or cracked rim or flange. When more restrictive railroad rules or instructions are in effect concerning wheel defects, those instructions will apply.

A. Determine any operating restrictions (rules or equipment) which apply,
B. Set out locomotive immediately or move to the next point where it can be set out,
C. Notify CNOC mechanical desk at 1-800-424-0217 as soon as possible without delaying train.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

3.2.37 Emergency fuel cutoff devices and pantograph down devices and MCB are properly marked and free of any impediment which could prevent their operation.

A. Repair if possible. If not, shut down locomotive, switch to trailing position, and continue to next Amtrak locomotive repair facility.

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3.2.38 Fuel tank (transformer on electric locomotives) is not leaking.

A. Determine any operating restrictions (rules or equipment) which apply,
B. Set out locomotive immediately or move to the next point where it can be set out,
C. Notify CNOC mechanical desk at 1-800-424-0217 as soon as possible without delaying train.

3.2.39 Brake cylinder travel must provide proper clearance when the brakes are released. Piston travel, if applicable, may not exceed 1 ½ inches less than total piston travel as indicated on Blue Form/MAP 816.

A. Determine any operating restrictions (rules or equipment) which apply,
B. Set out locomotive immediately or move to the next point where it can be set out,
C. Notify CNOC mechanical desk at 1-800-424-0217 as soon as possible without delaying train.

NOTE: When locomotive is in passenger service, a QMP must be contacted before equipment is moved. Communicate to QMP any host railroad rules or instructions concerning the non-complying condition.

3.2.40 Pantograph/carbon strip on electric locomotives and 3rd rail shoe on dual mode locomotives not broken or damaged.

A. Locomotive may be moved to next Amtrak locomotive repair facility,
B. Change to undamaged pantograph on electric locomotives.

3.2.41 Perform a Locomotive Calendar Day Air Brake Test, as per instruction 3.3, from the controlling locomotive.

3.2.42 Complete a new MAP 100 to be left on each locomotive, as follows (Tables and Forms section):

A. MAP 100
1. Complete the first line, Unit # (box 1).
2. Enter your signature, occupation, place, date, time of the inspection in the boxes on the line with the heading “Daily Mechanical Inspection” (boxes 2-6).
3. On the MAP 100 of the CONTROLLING locomotive, check the applicable space for “F-End” or “R-End” under heading “Locomotive Calendar Day Air Brake Test” (box 7 or 8).

NOTE: Only complete box 7 or 8 on the MAP 100 of the controlling locomotive. On trailing unit, check “N/A” for boxes 7 and 8.

4. On the MAP 100 of all locomotives in consist, check the applicable “Pass”, “Fail”, or “N/A” (box 9) if the ECP brake equipment has been inspected and tested (box 9). Check “N/A” if not applicable.
5. On the MAP 100 of all locomotives in consist, enter your signature, occupation, place, date, time of the brake test in the boxes on the line with the heading “Locomotive Calendar Day Air Brake Test” (boxes 10-14).
6. Enter a description of any defective or non-complying condition in the “Failure En Route / Equipment Condition” section.
7. Copy “Location” (box 26), “Date” (box 27), and “Time Completed” (box 28) information from “Supervisor/QMP Verifying All Work Completed and Approving Unit for Service” box of the old MAP 100 to the “Previous Calendar Day Inspection” section (box 36) on top right corner of the new MAP 100. This will serve as an inspection record per 49 CFR 229.21. In case the engineer performed the inspection per instruction 2.2 and the “Supervisor/QMP Verifying All Work Completed and Approving Unit for Service” box is not filled, the information in the “Daily Mechanical Inspection” box (boxes 4-6) of the old Map 100 will be used to complete the “Previous Calendar Day Inspection” section (box 36) on top right corner of the new MAP 100.

B. Contact CNOC mechanical desk at 1-800-424-0217 before going off duty to report that inspection has been performed and whether any defects were noted.

3.3 Locomotives - Locomotive Calendar Day Air Brake Test

3.3.1 Preparation

A. Apply Blue Signal protection when required.
B. Secure equipment per instruction 2.14.
C. All MU, main reservoir, and brake pipe hoses properly coupled between locomotive(s) and/or car(s) or on end of locomotives placed in proper receptacles or dummy couplings.
D. All angle cocks, cutout cocks, and end cocks properly positioned, including truck cutout cocks.
E. Charge system to required pressure.

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3.3.2 Independent Brake Test

A. Release independent brake.
B. Full application in 10 psi increments.
C. Full release in 10 psi decrements.
D. Note that full independent brake cylinder pressure is correct and holds in 10 psi increments/decrements.

3.3.3 Brake Pipe Leakage Test

A. With the brake system fully charged, make a 20 psi brake pipe reduction.
B. Cut out pressure maintaining feature: move brake pipe cut off pilot valve/switch to “TEST” or “OUT” position.

NOTE: Brake pipe leakage must not exceed 3 psi /minute.

C. Move ABV handle to “Release” position.

NOTE: Brake pipe pressure must not increase for 1 minute.

D. Cut in pressure maintaining feature: move brake pipe cut off pilot valve/switch to “PASS, “FRT“, or “IN” position.

3.3.4 Emergency Brake Test (For locomotives NOT equipped with Dynamic Brake Interlock)

NOTE: On locomotives equipped with Dynamic Brake Interlock (DBI), proceed to instruction 3.3.5.

A. Make emergency brake application with ABV handle. Brake pipe pressure must reduce to 0 psi at emergency rate. PCS light must illuminate on units so equipped.
B. Emergency brake cylinder pressure is obtained within 4 seconds and determine that brakes have applied.
C. Recover from emergency brake application.
D. Determine that brakes have released.

3.3.5 Dynamic Brake Interlock (DBI) Test

NOTE: Does not apply to NPCU.

A. Ensure system is fully charged.
B. Make a full service brake application.
C. Place reverser handle in forward or reverse.

NOTE: On GE units, generator field switch must be “ON”.

D. Move dynamic brake handle to “SET UP“, wait 10 seconds.
E. Move dynamic brake handle to “No. 2” position.
F. Ensure brake cylinder pressure drops to 0 psi.
G. Move ABV handle to “EMERGENCY” position. Brake pipe pressure must reduce to 0 psi at an emergency rate. PCS light must illuminate on units so equipped.

NOTE: Ensure brake cylinder pressure is restored in 4 seconds.

H. Move dynamic brake handle to “OFF” position.
I. Move Reverser to “NEUTRAL” position.
J. Recover from emergency brake application.

NOTE: On GE units, turn generator field switch to “OFF”.

3.3.6 Deadman/Alerter Test

A. Release brake cylinder pressure.
B. If equipped with an Alerter:
1. Allow Alerter to begin cycling or initiate the Alerter test using the on-screen program.
2. Acknowledge by pressing the “Acknowledge” button/switch.
3. Allow Alerter to cycle again.

C. If equipped with a Deadman:

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1. Release Deadman foot pedal.

D. Allow penalty application to occur. PCS light must illuminate on units so equipped.

NOTE: Full service brake application should occur.

E. Move ABV handle to “SUPPRESSION” or “LAP” position.
F. Recover from penalty brake application.

3.3.7 Train Control (If equipped and is destined for Train Control System territory)

A. Move ABV handle to “SUPPRESSION” or “LAP” position.
B. Depress train control acknowledger and do not release for at least 8 seconds.

NOTE: Penalty should be suppressed.

C. Continue to acknowledge and move ABV handle to “RELEASE” position.

NOTE: Penalty brake application must occur. PCS light must illuminate on units so equipped.

D. Release acknowledger and move ABV handle to “SUPPRESSION” position.
E. Recover from penalty brake application and recharge system.

3.3.8 Emergency Brake Valve Test

A. Open emergency brake valve. PCS light must illuminate on units so equipped.

NOTE: Brakes should apply at an emergency rate.

B. Activate independent quick release feature and note that brake cylinder pressure drops to zero.
C. Release independent quick release feature.

NOTE: Emergency brake cylinder pressure must be restored.

D. Recover from emergency brake application.
E. Ensure all emergency brake valves operate as intended.

3.3.9 Graduated Release

A. Ensure brake mode is set to “Passenger”
B. Charge brake system to required pressure.
C. Make a full service brake application.
D. Move ABV handle to “RELEASE” position in 6 psi decrements.

NOTE: Brake pipe and Equalizing reservoir should increase and hold at each decrement. Brake cylinder pressure must decrease and hold at each decrement. At least three brake cylinder pressure decreases must be observed.

3.3.10 Direct Release

A. Ensure brake mode is set to “Freight”, if equipped.
B. Charge brake system to required pressure.
C. Make a 20 psi brake pipe reduction.
D. Move ABV handle towards “RELEASE” position and stop movement within the “SERVICE ZONE“.
E. Check for one minute and ensure equalizing pressure does not change.
F. Move ABV handle to “RELEASE” position and note that equalizing reservoir and brake pipe pressures recharge.

3.3.11 Determine That Brakes Apply/Release:

A. Place ABV handle in “FULL SERVICE” position. Independent brake must be in “RELEASE” position. Brake must apply. It must be observed that all brake shoes/disc pads are firmly seated against the wheels or discs.
B. Piston travel must be within prescribed limits.
C. Place ABV handle in ““RELEASE” position. Brake must release and sufficient shoe/pad clearance must be achieved
D. Fully apply independent brake. Brake must apply. It must be observed that all brake shoes/disc pads are firmly seated against the wheels or discs.

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3.3.12 ECP Brake System

A. Perform ECP brake setup and initialization.
B. Move ABV handle to REL and verify the ECP Train Brake Command display is 0%. ER and BP remain 110 ± 3 psi.
C. Move ABV handle to MIN and verify the ECP Train Brake Command display is 10%. ER and BP remain 110 ± 3 psi.
D. Move ABV handle to SUPP and verify the ECP Train Brake Command display is 53-56%. ER and BP remain 110 ± 3 psi.
E. Move ABV handle to FS and verify the ECP Train Brake Command display is 100%. ER and BP remain 110 ± 3 psi.
F. Move ABV handle to HO and verify the ECP Train Brake Command display is 120% and PCS is lit. ER and BP remain 110 ± 3 psi.
G. Wait 60 seconds for emergency to reset and then move the ABV to EMER and verify ECP Train Brake Command is 120% and PCS must illuminate. ER and BP reduces to 0 psi.
H. Wait 60 seconds for emergency to reset and then move the ABV to REL and verify ECP Train Brake Command is 120% and PCS must illuminate. ER and BP charge to 110 ± 3 psi.
I. Move ABV handle to FS to reset the emergency interlock and verify the ECP Train Brake Command display is 100% and PCS light goes out. ER and BP remain 110 ± 3 psi.
J. Move ABV to REL and over-acknowledge the Train Control System and verify ECP Train Brake Command is 100% and the PCS light must illuminate.
K. Suppress penalty by moving the ABV to SUPP and verify the PCS light goes out.
L. Move the ABV to REL and verify ECP Train Brake Command is 0%.
M. Shutdown ECP by moving the ABV to EMER and follow prompts to end ECP.

3.3.13 If any of the test procedures in instructions 3.3.1 thru 3.3.12 fail, retest the procedure which failed.

3.3.14 If any of the test procedures in instructions 3.3.1 thru 3.3.12 fail after retesting, locomotive must not be used until repaired, except as noted in instructions 3.3.15 and 3.3.16.

NOTE: Any non-complying condition discovered during this test must be documented per instruction 3.1.15.

3.3.15 If the procedures in instruction 3.3.6 fail after retesting, the following will govern:

A. If the Deadman/Alerter test fails procedure per instruction 3.3.6 at an Amtrak locomotive repair facility, locomotive must be repaired before being used.
B. If the Deadman/Alerter test fails procedure per instruction 3.3.6 at other than an Amtrak locomotive repair facility:
1. Unit must not be used as controlling locomotive,
2. Place tag on control stand or engine control panel indicating “Defective Alerter”,
3. Note defect on MAP 100, and
4. In multiple unit consists or push/pull operations, note on MAP 100 of lead unit that locomotive with defective alerter is in consist or train.

3.3.16 If the procedures in instruction 3.3.7 fail after retesting, the following will govern:

A. If the Train Control test fails per instruction 3.3.7 at an Amtrak locomotive repair facility, locomotive must be repaired before being used in Train Control System territory.
B. If the Train Control test fails per instruction 3.3.7 at other than an Amtrak locomotive repair facility and unit is destined for Train Control System territory:
1. Unit must not be used as controlling locomotive,
2. Note defect on MAP 100, and
3. In multiple unit consists or push/pull operations, note on MAP 100 of lead unit that locomotive with defective Train Control System acknowledger is in consist or train.

3.4 Locomotives - Mechanical Department Locomotive Air Brake Daily Inspection

3.4.1 General Information

A. Air brake and signal equipment on locomotives and cab cars must be inspected, maintained, and tested in accordance with current federal regulations, and Amtrak maintenance procedures.
B. Locomotives and cab cars must be inspected at least once each calendar day that the unit is in service.
C. Locomotives / cab cars must not depart a location where a unit received a Locomotive Air Brake Inspection (see instruction 3.4) and/or Locomotive Calendar Day Air Brake Test (see instruction 3.3) without a current, signed MAP 100.

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3.4.2 Preparation

A. During the inspection, if a defect is found and this defect cannot be corrected in a timely manner by the employee performing the inspection, it must be reported immediately to your supervisor.
B. Apply proper Blue Signal Protection.
C. Secure equipment per instruction 2.14.
D. Apply handbrake.
E. Fully apply independent brake or make full service brake application.

3.4.3 Air Compressors

A. Check compressor oil level. Ensure oil is up to full mark or with in operating range.
B. Compressor must not produce undue vibration or pounding, or otherwise make unusual noises that could indicate compressor damage or malfunction.
C. Compressor must operate to control main reservoir pressure 5 pounds above or below standard operating pressure.
D. Main reservoir pressure must increase 10 psi during the compressor loading cycle.
E. Compressor governor shall be adjusted so that the compressor will start when the main reservoir pressure is not less than 15 psi above the maximum brake pipe pressure fixed by the carrier.
F. Water and oil must be drained from the compressor inter-cooler, and after-cooler, if possible.
G. Each air compressor on passenger equipment so equipped must be in effective and operative condition. MU passenger equipment found with an inoperative or ineffective air compressor at the time of its exterior calendar day inspection must be removed from service unless the railway company has in place procedures designed to protect the integrity of the air brake system as outlined in CFR Title 49, Part 238.303.e (17).

3.4.4 Water and oil must be drained from all main reservoirs.

3.4.5 Automatic main reservoir drain valves and air dryers are functioning properly.

3.4.6 Condensation is blown from end brake pipe, main reservoir, and MU hoses before coupling to another hose or attaching to dummy couplings.

NOTE: No chemicals, which are known to degrade or harm brake system components, shall be placed in the train air brake system.

3.4.7 All MU, main reservoir, and brake pipe hoses must be properly coupled between locomotives, stored in proper receptacles, or attached to their proper dummy couplings.

3.4.8 All angle cocks, end cocks, and cutout cocks must be properly positioned for service.

3.4.9 Air regulating devices must function properly and be adjusted to the prescribed pressures.

3.4.10 Air pressure gauges must not be in error more than 3 psi or 5% whichever is less.

3.4.11 Equalizing reservoir pressure must be within 3 psi of brake pipe pressure.

3.4.12 Cutouts for various safety devices and/or enclosures to such devices must be properly positioned and sealed, with numbers recorded on MAP 100.

3.4.13 Brake shoes and pads are properly applied and aligned with tread of wheel or brake disc.

3.4.14 Ensure brake shoes have adequate service material.

3.4.15 Piston travel is properly adjusted.

A. Piston travel must provide proper brake shoe clearance when the brakes are released.
B. Piston may not exceed limits posted in instruction MS.1.0. If locomotive is not listed travel may not exceed 1.5 inches less than the total possible piston travel. Total possible travel is recorded on Blue Form/MAP 816 in cab of locomotive.

3.4.16 Brake equipment and safety supports, where used, are in a safe and suitable condition for service, with no part of foundation rigging or safety supports less than 2-1/2" above the rail.

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3.4.17 Brake rigging.

A. Ensure that brake levers, rods, beams, hangers, and pins do not bind or foul.
B. All pins are properly applied and secured.
C. Brake levers, rods, or pins may not be cracked or broken.
D. Brake levers, rods, or pins may not be worn more than 30%.

3.4.18 Brake disc must be inspected per current Mechanical Department instructions.

3.4.19 Hand/parking brakes are in a safe and suitable condition for service.

A. At each daily inspection the hand/parking brake assembly and all of its associated parts shall be inspected and tested (applied and released) to determine that it functions as intended.
B. Locomotives operating in non-passenger service must have hand/parking brake stenciled with date of last annual inspection, as outlined in CFR Title 49 Part 232.105c. Locomotives subject to this regulation shall also have the hand/parking brake assembly inspected, tested, and stenciled every 368 days.
C. Except for MU locomotives, locomotives operating in passenger service must have the hand/parking brake assembly (including all of its parts and connections) inspected and tested as often as the service requires but not less frequently than every 368 days. The date of the last inspection shall be entered on Blue Form/MAP 816, suitably stenciled or tagged on the equipment or maintained electronically provided the FRA has access to the record upon request. Amtrak locomotives shall have the handbrake inspection dates entered and tracked in the corporation's Work Management System (WMS).

3.4.20 Communicating signal system on passenger locomotives must be tested and known to be in a safe suitable condition for service before each trip.

3.4.21 Ensure the words "Emergency Brake Valve" are legibly stenciled or marked near each brake pipe vent valve or adjacent badge plate.

3.4.22 FRA / Amtrak leakage limits.

A. Main Reservoir: Average of 3 pounds per minute over a period of 3 minutes.
B. Brake Pipe: 3 pounds per minute.
C. Brake Cylinder: Brakes must remain applied for 5 minutes with a full service brake application in effect, and communication to the brake cylinders closed.
D. Control Air System: Average of 3 pounds per minute over a period of 3 minutes.

3.4.23 Main Reservoir Safety Valve: Must not allow pressure to rise more than 15 psi above maximum standard main reservoir pressure.

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3.5 Locomotives - Locomotive Consist Air Brake Test

3.5.1 A Locomotive Consist Air Brake Test is required when a locomotive consist changes. Consist changes include coupling or uncoupling locomotive(s), including push-pull equipment. The test will be performed from the controlling locomotive (controlling cab on dual cab locomotives).

A. If a locomotive being added to the consist is due a Calendar Day Inspection, and will be the new controlling locomotive, perform the Locomotive Calendar Day Air Brake Test (Instruction 3.3) from the new controlling locomotive after performing the Locomotive Consist Air Brake Test

B. A Locomotive Consist Air Brake Test is not required when consist movements will only be made within the confines of a yard or terminal.

3.5.2 Follow the steps in the table below to perform a Locomotive Consist Air Brake Test.

Locomotive Consist Air Brake Test	
Step	**Action**
1	Secure locomotive consist against movement.
2	Verify that all required cables and MU hoses are connected and cut in and brakes are cut in on each truck. Visually observe brake cylinders applied, brakes shoes against wheels, brake indicators applied or any other device for the purpose of determining that truck brakes are cut in and applied.
Independent Brake Test	
3	Place independent and automatic brakes in Release position.
4	Confirm that air brakes are released on all locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes release. Brake cylinder pressure goes to zero.
5	Place independent brake in Full Application position.
6	Confirm that the air brakes apply on all locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes apply. Brake cylinder pressure applies.
7	Place independent brake in release position.
Automatic Brake Test	
8	Confirm that the air brakes are released on all locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes release. Brake cylinder pressure is zero.
9	Make a 10-PSI brake pipe reduction.
10	Confirm that the air brakes are applied on all locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes apply. Brake cylinder pressure is applied.
Air Brake Actuation Test	
11	Activate the independent quick release feature (bail off).
12	Confirm that the air brakes release on all locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes release. Brake cylinder pressure goes to zero.
13	Make an additional 10-PSI brake pipe reduction (total 20-PSI reduction)
14	Confirm that the air brakes are applied on all locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes apply. Brake cylinder pressure is applied.
15	Move Automatic Brake Valve to release position.
16	Confirm that the air brakes release on all locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes release. Brake cylinder pressure goes to zero.
17	Before movement, verify that all hand/parking brakes are released and all chocks, skates, or chains are removed.
18	Upon initial movement, perform a Running Brake Test.
Note: If brakes fail to apply or release during any step, check that all MU hoses are coupled and cut in, Automatic and Independent Brakes are cut in; then retest.	

3.5.3 When picking up locomotives en route, add the locomotive(s) to the 1173/10 Summary in the “Additional Loco and Cab Car” section.

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3.6 Locomotives – Standing Locomotive Brake Test

3.6.1 A Standing Locomotive Brake Test is required before initial movement of any lite or multiple lite locomotive consists.

3.6.2 Follow the steps in the table below to perform a Standing Locomotive Brake Test.

Standing Locomotive Brake Test	
Step	**Action**
1	Secure locomotive(s) against movement.
2	Verify that all required hoses are connected and cut in, and brakes are cut in on each truck. Visually observe brake cylinders applied, brakes shoes against wheels, brake indicators applied or any other device for the purpose of determining that truck brakes are cut in and applied.
3	Place independent and automatic brakes in Release position.
4	Confirm that air brakes are released on all locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes release. Brake cylinder pressure goes to zero.
Independent Brake Test	
5	Place independent brake in Full Application position.
6	Confirm that the air brakes apply on controlling unit and all MU'ed locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes apply. Brake cylinder pressure applies.
7	Place independent brake in release position.
8	Confirm that air brakes are released on all locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes release. Brake cylinder pressure goes to zero.
Automatic Brake Test	
9	Make a 20-PSI Automatic Brake pipe reduction.
10	Confirm that the air brakes apply on all locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes apply. Brake cylinder pressure applies.
11	Move Automatic Brake Valve to release position.
12	Confirm that the air brakes release on all locomotives. If parking brake is applied on locomotives with parking brakes that apply brakes to all wheels, use the brake cylinder gauge to verify brakes release. Brake cylinder pressure goes to zero.
13	Test is complete. Fully apply the Independent Brake.
14	Before movement, verify all hand/parking brakes are released and all chocks, skates, or chains are removed.
15	Upon initial movement, perform a Locomotive Running Brake Test (Instruction 2.6).
Note: If brakes fail to apply or release during any step, check that all necessary hose are coupled and cut in, Automatic and Independent Brakes are cut in; then retest.	

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3.6.3 Lite and Multiple Lite Movements within Yards or Terminals

A. Lite and multiple lite locomotives may be moved within the confines of a yard or terminal without connecting the MU hoses or cables, as long as the brake pipe and main reservoir hoses are connected with associated angle and main reservoir cocks open.

1. When coupling locomotives, for movements only within a yard or terminal, perform a Standing Locomotive Brake Test on the locomotive(s) being coupled to from the controlling locomotive.
2. Hoses and cables not connected to another piece of equipment should be placed in the proper receptacles to prevent damage.

3.7 Locomotives - Locomotive Running Brake Test

3.7.1 Required on locomotives operated lite or multiple lite upon:

A. Initial movement.
B. Change in consist of lite locomotives.
C. Changing control stations.
D. Frequently, with sufficient force, when snow or ice conditions exist.
E. Any point where a brake pipe angle cock or end cock has been turned.

3.7.2 To determine effectiveness of brakes while locomotive is moving, as soon as speed permits but not exceeding 20 mph:

A. Apply independent brake sufficiently to develop noticeable brake cylinder pressure and retarding force.
B. Release independent brake and make service application with automatic brake. Check brake cylinder pressure/dynamic brake effort and retarding force.
C. Actuate independent brake handle.
D. Check that brake cylinder pressure releases / dynamic brake effort drops and locomotive rolls freely.

3.8 Brake Tests - General

3.8.1 Responsibility

A. Only a Qualified Maintenance Person (QMP) may perform:
1. A Passenger Train Class I Brake Test or HST Departure Test. A locomotive engineer may participate in a Passenger Train Class I brake test by manipulating the ABV handle, checking leakage and testing alerter.
2. An Exterior Calendar Day Mechanical Inspection.
3. Interior Calendar Day Mechanical Inspection on High Speed Trainsets.

B. Either a Qualified Maintenance Person (QMP) or a Qualified Person (QP) may perform:
1. A Passenger Train Class IA brake test.
2. A Passenger Train Class II brake test.
3. An Interior Calendar Day Mechanical Inspection on other than High Speed Trainsets.

C. Either a Qualified Person (QP) or Qualified Mechanical Inspector (QMI) may perform:
1. A Non-Passenger Train Class I brake test.
2. A Non-Passenger Train Class II brake test.
3. A Non-Passenger Train Class III brake test.
4. A Non-Passenger Train Transfer Train Brake Test.

D. Supervisors are jointly responsible with Inspectors, Engineers, Conductors and Assistant Conductors for:
1. Performing Class I, Class IA, Class II, Class III, and Transfer Train Brake Tests on locomotives and cars and detecting defects determined by these tests; and
2. Performing Interior Calendar Day mechanical inspections on other than High Speed Trainsets and detecting defects determined by these inspections.

E. A Running brake test may only be performed by a Locomotive Engineer.

NOTE: Conductor MUST have knowledge that Running Brake Test has been performed.

3.8.2 Signal for Brake Application

A. During standing tests, brake must not be applied or released until proper signal is given or a clear understanding is obtained.

3.8.3 Condition of Brakes

A. Passenger Trains
1. Must have 100% operative brakes on all cars and locomotives at any point where a Class I, HST Departure or Class IA brake test is performed.
2. Must not depart a terminal or yard, which is a repair point, where a Class II brake test has been performed with brakes cutout, inoperative or defective.
3. MUST HAVE at least 85% operative brakes, unless the provisions of instruction 2.19.3 are complied with.
4. Must not leave a designated Amtrak repair point with less than 100% operative brakes.

B. Non-Passenger Trains
1. Must have at least 85% operative brakes.
2. Must have 100% operative brakes on all cars and locomotives at any point where a Class I brake test is performed.

3.8.4 MAP 1173\10C Summary Documentation for Brake Tests and Mechanical Inspections.

NOTE: A train must not be delayed for missing or conflicting information on 10C Summary portion.

NOTE: When MAP 1173/10C Summary is referenced in these instructions, Metrolink T&E employees will use Metrolink Form SMP 1173; MARC T&E Employees will use MARC Form 1173/10C.

A. MAP 1173/10C Summary Requirements

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1. The QMP(s) that completed the Passenger Train Class I brake test or HST departure test must document and complete the "MAP 1173 – Class I Train Brake Test/Lite Locomotive Consist Brake Test" portion of the MAP 1173/10C Summary.
2. The QMP that completed the exterior and interior daily passenger car inspections must document and complete the 10C Summary portion of the MAP 1173/10C Summary.

NOTE: The Passenger Train Class I Brake test and Passenger Car Interior and Exterior daily Inspections are not considered complete until the "Supervisor/QMP Verifying All Work Completed and Approving Unit for Service" portion of the MAP 1173/10C Summary is filled out and approved by the supervisor. This timestamp will start the clock for the cars' mechanical inspections and the Class I Brake Test.

3. The total number of cars (including Cab Cars) in "Number of Cars" box and all other required information on MAP 1173/10c Summary.
   - **a.** For Passenger Trains, the QMP must enter the information.
   - **b.** For Non-Passenger Trains, the QMI or QP must enter the information.
4. Passenger trains must not leave any point where a Class I brake test or HST Departure test was performed without MAP 1173/10C Summary for equipment tested at that point, except per instruction 3.8.4D.
5. Commuter / Short-Distance Intercity Passenger Trains - MAP 1173/10C Summary, once completed, is valid until the next scheduled Class I Brake Test, which is required once each calendar day.
6. Long-Distance Intercity Passenger Trains – MAP 1173/10C Summary, once completed, is valid until the next scheduled Class I Brake Test, which is required every 1500 miles or once each calendar day whichever occurs first.
7. High Speed Trainsets - MAP 1173/10C Summary, once completed, is valid until the next scheduled HST Departure Test, which is required every 1500 miles or once each calendar day whichever occurs first.
8. The MAP 1173/10C Summary remains valid if any one, or more than one, of the following train consist changes occur:
   - **a.** Adding or removing a block of cars from the train. When adding cars, an additional MAP 1173/10C Summary for the added cars is required.
   - **b.** Changing motive power, changing controlling cabs with MU'ed locomotives, changing cabs on locomotives with double end control, changing ends on push-pull trains or running around train with locomotive(s).
9. If the controlling locomotive changes and MAP 1173/10C Summary otherwise remains valid, a QMP or QP will draw a line through (Line Out) the previous controlling locomotive number, write the new locomotive number, and the word "Replaced" and initial the changes.
10. MAP 1173/10C Summary
    - **a.** The MAP 1173/10C Summary is the one issued when a Class I brake test is performed at the originating point or a scheduled Class I brake test location for the train.
    - **b.** Additional MAP 1173/10C Summary forms may be issued at other locations when cars are added between the originating point and scheduled Class I brake test locations.
    - **c.** When multiple MAP 1173/10C Summary forms are issued, only one will be used as the Summary Form. The Engineer must write the word "Summary" at the top of the form that was issued at the originating point or a scheduled Class 1 Brake Test location for the train. (See instruction 3.8.4A.10).

NOTE: When MAP 1173/10C Summaries are issued for both ends of commuter/turnaround service, the requirement to write "Summary" at the top does not apply.

   - **d.** The MAP 1173/10C Summary will be used by Locomotive Engineers to summarize the train consist/brake information as required by instruction 3.8.5.
   - **e.** Only one MAP 1173/10C Summary will be considered the Summary MAP 1173 even though multiple MAP 1173 forms were issued.
   - **f.** All additional MAP 1173/10C Summary forms must remain with the Summary MAP 1173.
   - **g.** When another Class I brake test is performed at a scheduled Class I brake test location, QMP will issue a new MAP 1173/10C Summary which will become the new Summary MAP 1173.

B. 10C Summary Portion

1. The 10C Summary portion is part of MAP 1173/10C Summary and is used by the mechanical department to list cars in a passenger train consist that received a Class I brake test and calendar day interior/exterior inspection without any operational restrictions.
2. Cars with defective side doors, end doors and/or PA/Intercom will be listed by car number.
3. Locomotives with a defective dynamic brake and/or air compressor will be listed by Locomotive number.
4. Train and Engine crews are not responsible for information on 10C Summary portion and must not delay departure of a train with missing or conflicting information on 10C Summary portion.

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C. Location of MAP 1173/10C Summary forms

1. The MAP 1173/10C Summary must remain in cab of controlling locomotive (also refers to cab cars in this instruction).
2. When Conductor is in possession of MAP 1173/10C Summary, the forms must be placed in cab of the controlling locomotive at earliest point, without delaying train.
3. When controlling locomotive changes, MAP 1173/10C Summary forms must be moved to cab of controlling locomotive. In commuter/turnaround service, when MAP 1173/10C Summary is placed on both ends of equipment, forms need not be moved to controlling end.
4. When inbound engineer is unable to move MAP 1173/10C Summary forms to cab of controlling locomotive due to crew and locomotive change, forms will be moved to required location by terminal services, mechanical foreman or designated representative.

D. Missing MAP 1173/10C Summary Forms

1. Passenger trains must not leave any point where a Class I brake test or HST Departure test was performed without MAP 1173/10C Summary for equipment tested at that point except as follows:
    - **a.** Movement may be made between maintenance facility where the train was assembled and the originating passenger terminal of the train after performing a Passenger Class IA brake test. Passenger train must not depart initial terminal without required inspections, brake test, and MAP 1173/10C Summary.
    - **b.** When adding cars En Route per instruction 2.19.1E, and MAP 1173/10C Summary is not available.
2. If MAP 1173/10C Summary is lost or missing after leaving a point where a Class I brake test or HST Departure test was performed, another available MAP 1173/10C Summary may be used as the Summary MAP 1173.
3. With Face-To-Face relief, if MAP 1173/10C Summary is not available, report missing form to CNOC mechanical desk either directly at 1-800-424-0217 or through the train dispatcher at earliest point, without delaying train.
4. Without Face-To-Face relief, if MAP 1173/10C Summary is not available, verify condition of brakes (whether any brakes are cut out):
    - **a.** By contacting CNOC mechanical desk either directly at 1-800-424-0217 or through the train dispatcher, or
    - **b.** When CNOC cannot be contacted, by performing a walking inspection of a brake application.

E. For Non-Passenger Trains, completion of the Class I brake test must be documented by completion of the MAP 1173/10C Summary. When MAP 1173/10C Summary is not available, a written document must be provided to the engineer containing the information described in instruction 3.8.6C.

3.8.5 Change of Crew - Determining Condition of Brakes

A. Prior to change of engine crews, inbound engineer will complete the appropriate portion of Summary MAP 1173, adjusting for any equipment added (multiple MAP 1173/10C Summary forms may exist) or removed as follows:

1. Locomotive/Cab Car numbers.
2. Date.
3. Time.
4. Number of Cars –Total number of cars in the train.
5. For Non-Passenger Trains, the total train length and weight.
6. For Non-Passenger Trains, any special weight distribution requiring special train handling.
7. Condition of Brakes:
    - **a.** Passenger Trains: Acceptable – at least 85% operative brakes.
    - **b.** Passenger Trains: Unacceptable - less than 85% operative brakes – trains in Passenger service proceed per instruction 2.19.3C.
    - **c.** Non-Passenger trains must not proceed with less than 86% operative brakes.
8. Communication Signal:
    - **a.** Operative – An operative 2-way radio is considered as an operative communication signal.
    - **b.** Inoperative – Any inoperative condition noted.
9. Engineer's Signature.

B. Whenever a Class IA Brake Test is performed, the following information must be noted on "Condition En Route" section of the MAP 1173/10C Summary: Class IA Brake Test Performed, Date, Time, Location, and Initials of QP or QMP.

C. Prior to change of engine crew, inbound engineer will indicate on "Condition En Route" section of MAP 1173/10C Summary the car numbers and number of axles cut out of any equipment with brakes cut out.

D. After change of engine crew, outbound engineer will review "Condition En Route" portion of ALL MAP 1173/10C Summary forms to determine whether any brakes are cut out. If it is determined that any brakes have been cut out, notify the train dispatcher and CNOC mechanical desk as soon as possible without delaying train, communicating car number/s and number of axles cut out. CNOC may be contacted either directly at 1-800-424-0217 or through the train dispatcher.

E. With Face-to-Face relief, outbound engineer will ascertain condition of brakes and perform a Running Brake Test.

F. Without Face-to-Face relief, outbound engineer will determine condition of brakes by reviewing MAP 1173/10C Summary, perform a Class II Passenger Brake Test , and perform a Running Brake Test.

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G. After change of engine crew, outbound engineer will review "Conditions En Route" portion of ALL MAP 1173/10C Summary forms to determine if brake pipe cutoff valve/switch on the controlling locomotive is in the "FRT" position.

H. For Non-Passenger Trains, the outbound Engineer and Conductor taking charge of a train will ascertain from incoming engineer and conductor, either personally or by MAP 1173/10C Summary or other written document, that the Class I brake test has been performed and the condition of the brakes.

I. For Non-Passenger Trains, prior to change of engine crew, inbound Engineer will indicate on "Condition En Route" portion of MAP 1173/10C Summary or written document the car numbers and number of control valves/trucks cut out of any equipment with brakes cut out.

3.8.6 Non-Passenger Train Notification of Completion of Class I Air Brake Test

A. The Engineer and Conductor will be notified that required air brake test and inspection is complete.

B. Notification must be made by a QMI or QP who participated in the test and inspection.

C. Notification of Class I brake test must be provided to the locomotive engineer on the MAP 1173/10C Summary. When MAP 1173/10C Summary is not available, a written document must be provided to the engineer containing the following information concerning the Class I brake test:

1. All locomotives
2. Date.
3. Time.
4. Number of cars inspected.
5. Name of the Qualified Person who performed the test.
6. Location where test was performed.
7. Total Train Weight and Length.
8. Any special weight distribution requiring special train handling.
9. EOT Tested.

NOTE: Total Train Weight and Length; Any special weight distribution requiring special train handling must be entered in the "Conditions En Route" portion of the MAP 1173/10C Summary or other written document.

D. The notification of Class I brake test, (either MAP 1173/10C Summary or other written document) once completed, is valid until a train completes its trip.

E. In no case will a train be started until Engineer and Conductor are notified that air brake test and inspection is complete.

F. The Air Brake Inspection and Test Certificate remains valid if any one, or more than one, of the following train consist changes occur:

1. Adding or removing a block of cars from the head end or rear end of train.
2. Changing motive power, changing controlling cabs with MU'ed locomotives, changing cabs on locomotives with double end control, changing ends on push-pull trains or running around train with locomotive(s).

G. If the controlling locomotive changes and Air Brake and Test Certificate otherwise remains valid, a QMI or QP will "Line Out" the previous controlling locomotive number and write in the new controlling locomotive number.

3.8.7 Train Air Brake and Inspection Documentation on Trains Originating in Canada

A. On trains originating in Canada and entering the United States, Amtrak crews will accept Canadian issued train brake test and inspection documents in place of standard Amtrak documentation (MAP 1173). In order to be valid, the Canadian documentation must be dated the current day or the previous calendar day.

B. After entering the United States, if a MAP 1173 is issued, it will become the Summary MAP 1173. The information required by instruction 3.9.5 will be transferred to the Summary MAP 1173 from the Canadian documentation.

3.9 Train Brake Tests & Mechanical Inspection

3.9.1 Passenger Train Class I Brake Test / HST Departure Test

A. Class I Brake Test Requirements

1. Commuter & Short-Distance Intercity Passenger Trains:
   - **a.** Once each calendar day that the train is placed or continues in passenger service.
   - **b.** If a train has not been inspected today and will be in passenger service past 11:59pm tonight a Class I brake test and mechanical inspections are required before 11:59pm tonight.
2. Long-Distance Intercity Passenger Train:
   - **a.** Prior to train's departure from originating/initial terminal, and
   - **b.** Every 1,500 miles or once each calendar day, whichever occurs first, that the train remains in continuous passenger service.
3. When Class I brake test has expired proceed per instruction 2.19.3E.

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B. Class I Brake Test Procedure (Engineer may participate in test by manipulating ABV handle, performing leakage and alerter test.

1. Apply proper Blue Signal protection.
2. Secure equipment per instruction 2.14.
3. Fully apply locomotive independent brake.
4. Electro-pneumatic brake disabled/turned off, if equipped.
5. Angle cocks / cutout cocks and retaining valve handles must be properly positioned.
6. Each brake disc is free of any condemnable defect.
7. Charge train to required pressure. Check state of charge by cutting out the pressure-maintaining feature. If brake pipe pressure drops within 5 seconds, the train is not fully charged, or excessive leakage exists. Find and correct any source of leakage. Before proceeding with test, be sure to cut in the pressure-maintaining feature.
8. Await signal to apply.
9. When signal is given to apply, make 20 psi brake pipe reduction.
10. After exhaust has stopped, cut out pressure-maintaining feature.
11. Wait 45 seconds.
12. Check brake pipe leakage-must not exceed 5 psi per minute.
13. Determine that brakes are applied on each car and all brake shoes / pads are firmly seated against the wheel or disc.
14. Each brake shoe or pad is not below the minimum thickness (varies depending on length of trip).
15. Each brake shoe or pad is securely fastened and correctly aligned in relation to the wheel / disc.
16. Brake rigging does not bind or foul.
17. Piston travel is within prescribed limits.
18. Brake indicators operate as intended (indicate brakes applied).
19. The communication of brake pipe pressure changes at the rear of the train is verified (by an application and release of the brakes on the last car in the train).
20. Await signal to release automatic brake.
21. When signal to release is given, release automatic brake.
22. Cut in pressure-maintaining.
23. Determine that all brakes release on each car. Ensure proper shoe / pad clearance exists.
24. Brake rigging must not bind or foul.
25. Brake indicators must operate as intended. (indicate brakes released)
26. Await signal to enable / turn on electro-pneumatic brake, if equipped.
27. When signal is given enable / turn on electro-pneumatic brake.
28. Test EP brake in accordance with local railroad procedures.
29. Make a walking inspection of electro-pneumatic application and release.
30. Communicating (Conductor's) Signal System must be tested and known to be operating as intended. A tested and operating two-way radio system meets this requirement.
31. MU equipment - Emergency Brake application, Alerter, Dead Man Pedal, or other emergency control devices must be tested if not indicated on the MAP 100. (Locomotives, MU equipment, and Cab Cars).

C. HST Departure Test Requirements

NOTE: The High-Speed trainset Class I Brake Test is a combination of a Class I and Locomotive Brake Test.

1. Prior to train's departure from originating/initial terminal, and
2. Every 1,500 miles or once each calendar day, whichever occurs first, that the train remains in continuous passenger service.
3. A High Speed Trainset that misses a scheduled HST Departure test due to delay en route may continue in service to the location where the inspection was scheduled to be performed.

NOTE: Locomotives, including Power Cars must be inspected and tested per Instructions 3.1 and 3.2 each calendar day, regardless if train was delayed en route.

D. HST Departure Test Procedure

1. HST Departure Test will be performed by a Tier II QMP in accordance with Standard Maintenance Procedure.

3.9.2 Non-Passenger Train Class I Brake Test

A. Test Requirements

1. Where train is originally assembled (initial terminal).
2. Where train consist is changed except as indicated below (3.9.2A.3).
3. Test is NOT required when:
   - **a.** Adding previously tested solid block of cars that remains in the same relative order that has NOT been OFF AIR for more than 4 hours.
   - **b.** Removing a car or solid block of cars.
   - **c.** Changing motive power
   - **d.** Removing or changing rear car.

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e. Removing car(s) with air brake defects (inoperative brakes or excessive piston travel).

f. Any combination of the above occurs.

B. Charging and Inspection - Inspect train brake system to determine that:

1. Apply proper blue signal protection or roadway worker protection (RWP). Secure equipment per instruction 2.14.
2. Charge system to the pressure which the train will be operated, and the pressure of the rear of the train shall be within 15 psi of the pressure the train will be operated but not less than 75 psi as indicated by an accurate gauge or EOT unit at the rear.
3. All air hoses are coupled and in suitable condition for service.
4. Angle cocks, cutout cocks, retaining valves and retaining valve pipes (if equipped) are properly positioned and in proper condition for service. All retaining valves must be set in "Direct Exhaust "position during initial terminal brake test.
5. Reservoir drain cocks are closed.
6. Necessary repairs are made to reduce leakage to a minimum.
7. Brake rigging does not bind or foul and all parts of equipment are properly secured.
8. Hand/parking brakes are released unless required.
9. If equipped with operational electro-pneumatic brake, brake circuit cables are properly connected.
10. Each brake disc is free of condemnable defects.

C. Class I Train Brake Test

1. Charge system to the pressure which the train will be operated, and the pressure of the rear of the train shall be within 15 psi of the pressure the train will be operated but not less than 75 psi as indicated by an accurate gauge or EOT unit at the rear.
2. Brake test procedures.
   - **a.** Await signal to apply.
   - **b.** Make 20 psi brake pipe reduction.
   - **c.** After exhaust has stopped, cut out pressure-maintaining feature.
   - **d.** Wait 45 seconds.
   - **e.** Check brake pipe leakage-not to exceed 5 psi per minute.
   - **f.** Inspector (QP) shall take a position on each side of each car to examine and observe the functioning of all moving parts of the brake system of each car.
   - **g.** Brake rigging shall be secure and not bind or foul.
   - **h.** Determine that brakes apply on each car.
   - **i.** Check piston travel on each car.
   - **j.** Await signal to release.
   - **k.** Release automatic brake.
   - **l.** Cut in pressure maintaining.
   - **m.** Determine that brakes release on each car. A "Roll By" inspection may be used to determine brake release but not exceeding 10 mph.
   - **n.** Qualified Person performing "Roll By" must communicate results of inspection to the engineer.

D. Class I Train Retest Procedure After Class I Brake Test

1. A car found to have brakes that do not apply during the Class I Brake Test may be retested.
2. Retest brakes per instruction 3.9.2C, except brakes must remain applied for no less than 3 minutes on cars being retested.

E. Piston Travel

1. Cars equipped with 8 ½ inch or 10 inch diameter brake cylinders, piston travel shall be within 6 to 9 inches. If piston travel is less than 6 inches or more than 9 inches, it must be adjusted to 7 ½ inches.
2. For cars not equipped with brake cylinders as described above, piston travel shall be within the piston travel stenciled or marked on the car or badge plate.
3. Truck mounted brake cylinders must provide sufficient brake shoe clearance when brakes are released.

3.9.3 Passenger Train Class IA Brake Test

NOTE: This test does NOT apply to High Speed Trainsets.

A. Class IA Brake Test Requirements

1. When adding Passenger Equipment En Route per instruction 2.19.1.
2. When Commuter or Short-Distance Intercity Passenger Train equipment has not been used in passenger service for more than 12 hours since the last Class I brake test, unless MAP 1173/10C Summary indicates that Class IA brake test has been performed.
3. When equipment has been off a source of compressed air for more than four hours since the last Class I brake test.
4. When equipment will be moved between the maintenance facility and originating passenger terminal without a MAP 1173/10C Summary per Definition "Passenger Equipment" and instruction 3.9.4D.
5. When required by instruction 2.19.2E.

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6. Whenever a Class IA brake test is performed, the following information must be noted on "Condition En Route" section of the Summary MAP 1173/10C Summary: Class IA Brake Test Performed, Date, Time, Location, and Initials of QP or QMP.

B. Class IA Brake Test Procedure

1. Fully apply locomotive independent brake.
2. Angle cocks, cutout cocks, and retaining valve handles must be properly positioned.
3. Charge train to required pressure. Check state of charge by cutting out the pressure-maintaining feature. If brake pipe pressure drops within 5 seconds, the train is not fully charged, or excessive leakage exists. Find and correct any source of leakage. Before proceeding with test, be sure to cut in the pressure-maintaining feature.
4. Await signal to apply.
5. Make 20 psi automatic brake reduction.
6. After exhaust has stopped, cut out pressure-maintaining feature.
7. Wait 45 seconds.
8. Check brake pipe leakage – must not exceed 5 psi per minute.
9. Determine that brakes are applied on each car and all brake shoes/pads are firmly seated against the wheel or disc.
10. Brake indicators may be used instead of directly observing the brake application/release at each car ONLY if a QP determines that direct observation poses a safety hazard. See definition of Brake Indicator.
    - **a.** When using brake indicators, employees must position themselves in each car or as close as possible to each car to accurately observe each indicator.
    - **b.** When using brake indicators to determine application/release at each car, indicators must change during application and release (plungers-in/out; lights-amber/green).
11. Await signal to release.
12. Release automatic brake.
13. Cut in pressure-maintaining feature.
14. Verify that brakes release on each car by walking train to directly observe release.
15. Communicating (conductor's) signal system must be tested and known to be operating as intended. A tested and operating two-way radio system meets this requirement.
16. For MU locomotives that utilize an electric signal to communicate a service brake application and only a pneumatic signal to propagate an emergency brake application, the emergency brake application functions as intended.
17. Verify communication of brake pipe pressure changes at the rear of the train by use of gauge, Two-Way End of Train Device, or observe application and release of brakes on rear unit.

3.9.4 Passenger Train Class II Brake Test

A. Class II Brake Test Requirements

1. Whenever control stand is changed or air brake computer is de-energized (circuit breaker turned off).
2. When previously tested and inspected cars/locomotives that received a Class I brake test within the previous calendar day and have not been removed from a source of compressed air for more than 4 hours are added to a passenger train.
3. When cars or equipment are removed from the train.
4. When Engineer first takes charge of train except for Face-to-Face relief.

NOTE: When any of the following occurs, it is considered FACE-TO-FACE RELIEF:

- **a.** When the inbound Engineer does not leave the equipment unattended and communicates with the outbound Engineer the condition of the brakes and the status (location) of the MAP 1173/10C Summary.
- **b.** When the inbound Conductor or Assistant Conductor does not leave the equipment unattended and communicates with the outbound Engineer the condition of the brakes and the status (location) of the MAP 1173/10C Summary.
- **c.** When a mechanical department employee who is a QMP or QP who participated in the required brake test does not leave the equipment unattended and communicates with the outbound Engineer the condition of the brakes and the status of the MAP 1173/10C Summary (located on the locomotive, or in possession of conductor, etc.).

5. When train is equipped with ECP Brake, Class II Brake Test is required to be done in ECP mode after a successful Class I Brake Test is completed in Emulation Mode.
6. After any emergency brake application.
7. Where indicated by rule or special instructions.
8. When control valve or brakes are cut out.
9. After determining cause for brake pipe continuity loss, make Class II brake test using Two-Way End-of-Train device.
10. Any point where a brake pipe angle cock has been turned except when performing the Two-Way-End-Of-Train device emergency function test or when adding a Back-up hose per instruction 2.17.2A.

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NOTE: Passenger trains must not depart a terminal or yard, which is a repair point, where a Class II brake test has been performed with brakes cutout, inoperative or defective. To determine a repair point for a particular train, contact CNOC mechanical desk either directly at 1-800-424-0217 or through the train dispatcher.

B. Class II Brake Test Procedure for Other Than High Speed Trainsets

1. Charge system to required pressure.
2. Await signal to apply.
3. 20 psi automatic brake reduction.
4. Brakes apply on rear passenger equipment. It is permissible to verify application at the rear most wheel set/axle. Brake shoe/pad must be firmly seated against the wheel or disc.
5. Await signal to release.
6. Brakes release on rear passenger equipment. It is permissible to verify release at the rear most wheel set/axle. Brake shoe/pad clearance must be observed.
7. For MU locomotives that utilize an electric signal to communicate a service brake application and only a pneumatic signal to propagate an emergency brake application, the emergency brake application functions as intended.
8. When rear passenger equipment is equipped with a device (gauge or EOT unit) capable of indicating/displaying brake pipe pressure, device **must** be used to determine application and release of brakes on rear passenger equipment.
    a. When using the gauge on a locomotive or cab car, in addition to observing brake pipe pressure, QP or QMP must verify that the Brake Cylinder pressure goes to zero when brakes are released.
9. When rear passenger equipment is not equipped with a device (gauge or EOT unit) capable of indicating/displaying brake pipe pressure, brake indicators may be used instead of directly observing the brake application/release at rear car ONLY if a QP determines that direct observation poses a safety hazard. See definition of Brake Indicator.
    a. When using brake indicators, employees must position themselves in the rear car or as close as possible to the rear car to accurately observe each indicator.
    b. When using brake indicators to determine application/release at the rear car, indicators must change state during application and release (plungers-in/out; lights-amber/green).
10. Communicating signal and/or two-way radio system tested and operating.

C. Class II Brake Test Procedure for High Speed Trainsets

1. Engineer or QMP will apply Parking Brake.
2. Engineer or QMP will charge system to required pressure.
3. Engineer or QMP will open CB74 “EP Assist” circuit breaker on lead power car located on electrical locker No. 3.
4. Conductor, Assistant Conductor, QP or QMP will give signal to apply air brakes.
5. Engineer, QP or QMP will make a 20 psi automatic brake reduction.
6. Conductor, Assistant Conductor, QP or QMP observes 20 psi brake pipe pressure drop on MFD-2 of rear power car.
7. Conductor, Assistant Conductor, QP or QMP will give signal to release air brakes.
8. Conductor, Assistant Conductor, QP or QMP observes brake pipe pressure restored on MFD-2 of rear power car.
9. Engineer or QMP will close CB74 “EP Assist” circuit breaker on lead power car located on electrical locker No. 3.
10. Conductor, Assistant Conductor, QP or QMP will give signal to apply air brakes.
11. Engineer, QP or QMP will make a 20 psi automatic brake reduction.
12. Conductor, Assistant Conductor, QP or QMP observes 20 psi brake pipe pressure drop on MFD-2 of rear power car.
13. Conductor, Assistant Conductor, QP or QMP will give signal to release air brakes.
14. Conductor, Assistant Conductor, QP or QMP observes brake pipe pressure restored on MFD-2 of rear power car.
15. Engineer, Conductor, Assistant Conductor, QP or QMP will ensure that two-way radio system is tested and operating.

NOTE: When MFD-2 on the rear power car is inoperative, Conductor, Assistant Conductor, QP, or QMP will go to the MFDB screen in the Conductor’s office to observe the rear Power Car brake application and release. Simultaneously, a second employee assisting with the brake test (Conductor, Assistant Conductor, QP, or QMP) must observe the brake indicators (RED) on the rear Power Car for application and release of the brakes.

D. Class II Brake Test Procedure for ECP Brake

1. ECP Brake is on and in Run Mode.
2. Await signal to apply.
3. Move ABV to make a 70% Train Brake Command.
4. Brakes apply on rear passenger equipment. It is permissible to verify application at the rear most wheel set/axle. Brake shoe/pad must be firmly seated against the wheel or disc.
5. Await signal to release
6. Brakes release on rear passenger equipment. It is permissible to verify release at the rear most wheel set/axle. Brake shoe/pad clearance must be observed.

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7. When rear passenger equipment is equipped with a ECP display capable of indicating/displaying ECP Train Brake Command, device **must** be used to determine application and release of brakes on rear passenger equipment.
8. When rear passenger equipment is not equipped with an ECP Display capable of indicating/displaying ECP Train Brake Command, brake indicators may be used instead of directly observing the brake application/release at rear car ONLY if a QP determines that direct observation poses a safety hazard. See definition of Brake Indicator.
    - **a.** When using brake indicators, employees must position themselves in the rear car or as close as possible to the rear car to accurately observe each indicator.
    - **b.** When using brake indicators to determine application/release at the rear car, indicators must change state during application and release (plungers-in/out; lights- amber/green).
9. Communicating signal and/or two-way radio system tested and operating.

3.9.5 Non-Passenger Train Class II Brake Test

A. Class II Brake Test Requirements

1. Other than where train is originally assembled (initial terminal).
2. Test is required when:
    - **a.** Adding car or solid block of cars that has not previously received a Class I brake test, or
    - **b.** Adding car or solid block of cars that has been OFF AIR for more than 4 hours.

B. Class II Brake Test

1. Charge system to the pressure which the train will be operated, and the pressure of the rear of the train shall be within 15 psi of the pressure the train will be operated but not less than 75 psi as indicated by an accurate gauge or EOT unit at the rear.
2. Brake test procedures.
    - **a.** Await signal to apply.
    - **b.** Make 20 psi automatic brake reduction.
    - **c.** After exhaust has stopped, cut out pressure-maintaining feature.
    - **d.** Wait 45 seconds.
    - **e.** Check leakage-not to exceed 5 psi per minute.
    - **f.** Determine that brakes apply on each added car.
    - **g.** Await signal to release.
    - **h.** Release automatic brake.
    - **i.** Cut in pressure maintaining.
    - **j.** Determine that brakes release on each added car. A “Roll By” inspection may be used to determine brake release but not exceeding 10 mph.
    - **k.** Qualified Person performing “Roll By” must communicate results of inspection to the engineer.
    - **l.** Ensure brake pipe pressure is being restored at rear of train.

C. Retest Procedure After Class II Brake Test

1. A car found to have brakes that do not apply during the Class II Brake Test may be retested.
2. Retest brakes per instruction 3.8.5B, except brakes must remain applied for no less than 3 minutes on cars being retested.

D. Class III brake test may be made at same time added cars are tested.

E. Cars added to the train which have not received a Class I brake test must receive a Class I brake test at the next forward location where facilities are available.

3.9.6 Non-Passenger Train Class III Brake Test

A. Class III Brake Test Requirements

1. When locomotive, control stand, caboose, or block of cars are cut off or changed.
2. After coupling to a previously inspected and tested train which has not been off air for more than 4 hours.
3. After any emergency brake application.
4. When indicated by rule or Special Instruction.
5. When control valve or brakes are cut out.
6. After determining cause for brake pipe continuity loss (see instruction 2.20.2F), make a Class III brake test using Two-Way End-Of-Train device, if equipped.
7. Any point where a brake pipe angle cock has been turned except when performing the Two-Way-End- Of-Train device emergency function tests.

B. Class III Brake Test Procedure

1. Charge system to the pressure which the train will be operated, and the pressure of the rear of the train shall be within 15 psi of the pressure the train will be operated but not less than 75 psi as indicated by an accurate gauge or EOT unit at the rear.
2. Await signal to apply.
3. 20 psi automatic brake reduction.
4. Brakes apply on rear car.

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5. Await signal to release.
6. Brakes release on rear car.
7. When rear car is equipped with a device (gauge or EOT unit) capable of indicating/displaying brake pipe pressure, device **must** be used to determine application & release on rear car.
    a. When using the gauge on a locomotive or cab car, in addition to observing brake pipe pressure, QP or QMP must verify that the Brake Cylinder pressure goes to zero when brakes are released.

3.9.7 Non-Passenger Train Transfer Train Brake Test

A. Movements Not Exceeding 20 Miles
1. Couple all hoses between all cars.
2. Charge brake system to not less than 60 psi as indicated by a gauge or EOT unit at the rear.
3. Make 20 psi automatic brake reduction.
4. Determine that brakes apply on each car.
5. Determine that brakes release on each car.

B. Retest Procedure After Transfer Train Brake Test
1. A car found to have brakes that do not apply during the Transfer Train Brake Test may be retested.
2. Retest brakes per instruction 3.9.7A, except brakes must remain applied for no less than 3 minutes on cars being retested.

C. Movements Exceeding 20 Miles
1. Perform Class I brake test.

3.9.8 Train Running Brake Test

A. Running Brake Test Requirements
1. After leaving initial terminal.
2. Any point where motive power, engine crew or train crew has been changed.
3. Any point where a brake pipe angle cock or end cock has been turned.
4. After any standing brake test has been made.
5. After striking debris or unknown object(s) on tracks. For the purpose of performing a Running Brake Test, debris is defined as:
    a) An object hung up or dragging from the train; or,
    b) An object that causes damage to the brake system or MU hoses; or,
    c) An object that causes a drop in Brake Pipe pressure.
6. Electro-pneumatic brake circuit cables between power units and/or cars are disconnected.
7. Periodically, when communication of the two-way end of train device fails en route.
8. When indicated by Special Instructions.
9. When inadequate brake performance is detected per instruction 2.18.2.
10. After test of back-up hose/valve.

B. Running Brake Test Procedure
1. Must be made as soon as speed of train permits but not exceeding 20 mph. A Running Brake Test may be made at speeds greater than 20 mph after striking debris, when communication of two-way end of train device fails en route or indicated by special instruction.
2. During test, locomotive and/or dynamic brake MUST NOT be permitted to apply except when locomotive and/or dynamic brake cannot be released due to equipment configuration.
3. Apply train air brakes with sufficient force to ascertain whether or not brakes are operating correctly.
4. If air brakes do not operate properly, train must be stopped, perform walking inspection of a brake application, cause of failure ascertained, corrected, Class II and Running Brake test repeated.

NOTE: Conductors and Engineers must communicate that each running brake test per instruction 3.9.8 has been performed.

3.9.9 Passenger Train Class I Test from Yard Plant

A. Engineer's brake valve or standard test device must be used.
B. Test device must be connected to end which will be nearest controlling locomotive.
C. Brake system must be charged, tested, and inspected per Class I brake test requirements listed in instruction 3.9.1.
D. When road power is coupled, make a Class II brake test before proceeding.
E. If air supply is disconnected for more than 4 hours, train must again be given a Class I brake test per instruction 3.9.1
F. Yard test device must charge the brake pipe / train brake system to the pressure listed in instruction 1.2 (Standard Air Pressures).
G. Mechanical yard air test devices and gauges must be calibrated every 92 days.
H. Electronic yard air test devices and gauges must be calibrated annually.
I. If used to test a train, a yard air test device and any yard air test equipment shall be accurate and function as intended.

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3.9.10 Non-Passenger Train Class I Test from Yard Plant

A. Engineer's brake valve or standard test device must be used.
B. Test device must be connected to end, which will be nearest controlling locomotive.
C. Brake system charged, tested and inspected per Instructions 3.9.2B, C, D, E.
D. When road power is coupled, perform a Class III before proceeding.
E. If air supply is disconnected for more than 4 hours, train must again be tested per instructions 3.9.2B, C, D, E.
F. If yard test device is less than 80 psi, then a brake pipe leakage test must be conducted when locomotive(s) are coupled per instruction 3.9.2C Item 2.
G. Mechanical yard air test devices and gauges must be calibrated every 92 days.
H. Electronic yard air test devices and gauges must be calibrated annually.
I. If used to test a train, a yard air test device and any yard air test equipment shall be accurate and function as intended.

3.9.11 Trainman Test Gauges

A. While on duty, train service, mechanical and engineering employees will have access to a trainman test gauge for determining brake pipe pressure at the rear of a train.
B. Use of trainman test gauge is required when rear car is not equipped with a device (gauge or EOT) capable of indicating/displaying brake pipe pressure.
C. Employees will verify the accuracy of trainman's test gauge each day, prior to its use, by one of two methods as follows:

1. **Locomotive method:**
   - **a.** Close angle cock between locomotive and train.
   - **b.** Determine locomotive brake pipe pressure setting from employee operating the controls of the locomotive.
   - **c.** Connect trainman test gauge to end of locomotive not coupled to train and slowly open angle cock.
   - **d.** Verify that pressure indicated by trainman test gauge is within 3 psi of locomotive brake pipe pressure setting.
   - **e.** When trainman test gauge does **NOT** indicate pressure within 3 psi of locomotive brake pipe pressure setting, gauge must be removed from service and replaced.
   - **f.** Accuracy of replacement trainman test gauge must be verified by either the Locomotive or Train Brake Test method.
2. **Train Brake Test method:**
   - **a.** Determine locomotive brake pipe pressure setting from employee operating the controls of the locomotive prior to opening angle cock between controlling locomotive and train.
   - **b.** Open angle cock between locomotive and train.
   - **c.** Connect trainman test gauge to rear car of train and slowly open angle cock.
   - **d.** **FULLY** charge train until pressure indicated by trainman test gauge is within 3 psi of locomotive brake pipe pressure setting.
   - **e.** When train is **FULLY** charged and trainman test gauge does **NOT** indicate pressure within 3 psi of locomotive brake pipe pressure setting, retest gauge using Locomotive method above.
   - **f.** When trainman test gauge is within 3 psi of locomotive brake pipe pressure setting, proceed with required train brake test.

D. Trainman test gauges that have been damaged must be replaced and verified for accuracy.

3.9.12 Exterior Calendar Day Mechanical Inspection

A. Inspection Requirements

1. Performed by a QMP once each calendar day on passenger equipment in accordance with Amtrak Standard Maintenance Procedures and inspections.
2. A Long-Distance Intercity passenger train that misses a scheduled Exterior Calendar Day Mechanical Inspection due to delay en route may continue in service to the location where the inspection was scheduled to be performed.
3. A High Speed Trainset that misses a scheduled Exterior Calendar Day Mechanical Inspection due to delay en route may continue in service to the location where the inspection was scheduled to be performed.

B. Inspection Procedure

1. Use tables below to determine Running gear and/or Non-Running gear defects and necessary action to be taken.

3.9.13 Interior Calendar Day Mechanical Inspection

A. Inspection Requirements

1. Other than High Speed Trainsets - Performed by QMP or QP once each calendar day on passenger carrying cars in accordance with Amtrak Standard Maintenance Procedures and inspections.
2. High Speed Trainsets - Performed by QMP once each calendar day in accordance with Amtrak Standard Maintenance Procedures and inspections.
3. A Long-Distance Intercity passenger train that misses a scheduled Interior Calendar Day Mechanical Inspection due to delay en route may continue in service to the location where the inspection was scheduled to be performed.

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4. A High Speed Trainset that misses a scheduled Interior Calendar Day Mechanical Inspection due to delay en route may continue in service to the location where the inspection was scheduled to be performed.

B. Inspection Procedure for Other Than High Speed Trainsets

1. Use the following table to determine Non-Running gear defects and necessary action to be taken.

C. Inspection Procedure for High Speed Trainsets

1. Performed by QMP in accordance with Standard Maintenance Procedures.

EXTERIOR CALENDAR DAY MECHANICAL INSPECTION DEFECT/ACTION AT TIME OF INSPECTION		
Defect Type	**Defect Description**	**Action**
Running Gear	• Suspension Components (including Air Bellows) • Draft System Components • Trucks and Components (including Bolster Anchor Radius Rods) • Wheels and Components (including hot journals and locomotive support bearings)	1. Repair 2. Move for repair in a non-revenue train not in passenger service, or 3. Set Out
Non-Running Gear	• Exhaust gases released inside cab or other compartments. • Batteries not properly vented. • Jumper cables – hanging free, exposed wire, broken plugs, or receptacles. • High voltage safety labels for exterior doors and cover plates missing • Buffer plates not in place. • Diaphragms not in place or not aligned	• May be moved for repair, in passenger service provided: 1. QMP determines that it is safe to do so including all movement restrictions, and 2. Car is locked out and empty. 3. Car may be occupied by crewmember only in the performance of duty
INTERIOR CALENDAR DAY MECHANICAL INSPECTION DEFECT/ACTION AT TIME OF INSPECTION		
Defect Type	**Defect Description**	**Action**
Non-Running Gear	• Exposed moving parts and electrical equipment not equipped with guards. • Floors that contain oil, water, waste, or any obstruction • Manual door releases not in place. • Emergency equipment… as applicable, missing.	• May be moved for repair, in passenger service provided: 1. QP or QMP determines that it is safe to do so, and 2. Car is locked out and empty. 3. Car may be occupied by crewmember only in the performance of duty.
	• Safety related signage missing or not legible. • High voltage safety labels for interior doors and cover plates missing • Emergency brake valves not stenciled.	• May remain in passenger service until the next interior calendar day inspection, provided QP or QMP determines: 1. That the repairs cannot be made, and 2. Equipment is safe to move.
	• Trap doors that do not safely operate or securely latch.	• May remain in passenger service until the next interior calendar day inspection, provided QP or QMP determines: 1. That the repairs cannot be made, and 2. Equipment is safe to move. 3. Defective trap doors must be secured by locking out door for which it is used.
	• Vestibule steps that are not illuminated.	• May remain in passenger service until the next interior calendar day inspection, provided QP or QMP determines: 1. That the repairs cannot be made, and 2. Equipment is safe to move. 3. Vestibule may be used solely at high platforms when steps are non-illuminated
	• End doors and side doors that do not operate safely or as intended.	• May remain in passenger service until the next interior calendar day inspection, provided QP or QMP determines: 1. That the repairs cannot be made, and 2. Equipment is safe to move. 3. At least one operative and accessible door must be available on each side of car. A notice must be displayed directly on each defective door
	• Seats or attachments broken or loose.	• May remain in passenger service until the next interior calendar day inspection, provided QP or QMP determines: 1. That the repairs cannot be made, and 2. Equipment is safe to move. 3. Broken or loose seats or seat attachments must be rendered unusable and display a notice indicating defect directly on seat.

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NATIONAL RAILROAD
PASSENGER CORPORATION

Train Control Systems Section

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4.0 Train Control Systems

- 4.1 General
- 4.2 Automatic Train Control System (ATC)
- 4.3 Automatic Train Stop (ATS); Intermittent Inductive Train Stop (IITS)
- 4.4 Advanced Civil Speed Enforcement System (ACSES)
- 4.5 Incremental Train Control System (ITCS) & Grade Crossing – ITCS (X-ITCS)
- 4.6 Interoperable – Electronic Train Management System (I-ETMS)
- 4.7 Speedometer Overspeed System
- 4.8 Multiple Penalty Brake Device (MPBD)

4.0 Train Control Systems

4.1 General

NOTE: When MAP 100 is referenced in the following instructions, Metrolink Locomotives and Cab Cars will use Metrolink Calendar Day Inspection Form SMP 100; MARC Locomotives and Cab Cars will use MARC Locomotive Calendar Day Inspection Form ECR 100.

NOTE: When CNOC mechanical desk is referenced in the following instructions, Metrolink T&E employees will contact Metrolink MOC at 1-909-593-0661; MARC T&E employees will contact the Amtrak Commuter Operations Center at 202-906-2772.

4.1.1 Trains/Locomotives must not enter any Train Control System Territory with defective or cut out Train Control System or "Acknowledger" unless relieved by Rule, Special Instruction, General Order, Bulletin Order, or other directive.

NOTE: If the train control system was cut out due to an on-board locomotive failure in accordance with applicable operating rules, the "Failure" box of the MAP 100 must be checked. If the train control system was cut out for any reason other than on-board locomotive failure, the "Temporary Operating Exception" box of the MAP 100 must be checked. This includes wayside PTC equipment failure of cutting out the train control system due to a temporary suspension of PTC operating rules. All other operating rules regarding reporting a cutout PTC system still apply. Checking the proper box will help the mechanical department to better identify the cause and may reduce the amount of time a locomotive spends at a repair facility.

4.1.2 If equipped, the "Acknowledger" must be tested prior to entering any Train Control System territory. Perform test by briefly depressing the "Acknowledger" to verify sounding of the audible alarm.

NOTE: On locomotives equipped with ACSES, the alarm has 2 distinct tones. The first tone is the ACSES alarm. The second tone is the ATC alarm. If ACSES is cut out, the alarm will be silent for approximately 3 seconds before sounding. On HST and HHP-8 Locomotives the acknowledger will need to be depressed for 3 seconds before the audible alarm will sound.

4.1.3 Valid Train Control System Departure Test(s) is required on all locomotives which will enter train control system territory. Test(s) will be verified by reviewing completed MAP 100. The start date and time of the 24-hour time period will be found in box 18 of the MAP 100. Boxes 19-23 will indicate who performed the work as indicated and must be filled out for any Train Control System Departure Test(s) to be valid.

4.1.4 Applicable Train Control System Departure Test (ATC, ATS (IITS), ACSES, ITCS, X-ITCS, I-ETMS) is required 24 hours or less before locomotive departs its initial terminal. Once locomotive departs initial terminal, Train Control System Departure Test (ATC, ATS (IITS), ACSES, ITCS, X-ITCS, I-ETMS) is valid until the final destination of the train unless failure en route occurs.

A. Mechanical forces will perform ATC, ATS (IITS), ACSES, ITCS, X-ITCS and I-ETMS Departure Test at locations where mechanical forces are available.

B. Engineer will perform On-Board Self-Test as outlined in appropriate instruction when mechanical forces are not available.

C. If this is the initial terminal for the train, check each MAP 100 in locomotive consist to determine that departure test(s) has been completed within 24 hours.

D. If a departure test has NOT been made within 24 hours, a new Train Control System Departure Test (ATC, ATS (IITS), ACSES, ITCS, X-ITCS, I-ETMS) is required.

E. When ATC, ATS (IITS), ACSES, ITCS, X-ITCS or I-ETMS Departure Test is performed at the same time as the Locomotive Calendar Day Inspection, record the required information on the same MAP 100 used for the Locomotive Calendar Day Inspection.

NOTE: When Train Control System Departure Test update is required, complete an additional MAP 100 to be left with the current MAP 100 on each locomotive tested. Supervisor/QMP Verifying All Work Completed and Approving Unit for Service section must be completed.

F. When engineer performs On-Board Self-Test (ATC, ATS (IITS), ACSES, ITCS, X-ITCS, I-ETMS), as soon as possible but before end of tour of duty, contact Train Dispatcher and CNOC mechanical desk at 1-800-424-0217 to report that test has been performed and whether any defects were noted.

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G. Trains which will operate through ITCS/X-ITCS territory must, prior to departing originating passenger terminal, ensure that the correct train type is selected by observing the CLD. Change train type by using the SCROLL button on the CLD. A new system departure test is NOT required provided previous departure test remains valid. Train type is selected based on maximum allowed consist train speed.

2. ITCS: PSGR125, PSGR110, PSGR100, PSGR 90, and LT ENG.
3. X-ITCS: PSGR 110, PSGR90, PSGR79.

4.1.5 Any time a Train Control seal is broken the following information must be entered on MAP 100:

A. Select reason for cutting out (Failure or Temporary Operating Exception).
B. Train Control System(s) cut out.
C. Geographic location(s) where cut out and cut in.
D. To whom report was made.

4.1.6 If a Train Control system is cut out using the electrical cutout switch due to a Temporary Operating Exception, a Train Control System Departure Test is required at the next scheduled Calendar Day Inspection.

4.1.7 The Train Control System is required to have a MAP 8 Periodic Inspection performed if the system was cut out due to an On-Board Failure.

4.2 Automatic Train Control System (ATC)

4.2.1 ATC Equipment

A. Acknowledger

1. Switch/Button used by the engineer to acknowledge a more restrictive ATC condition.

B. Audible Alarm – Sounds when ATC operating conditions change.

C. Territory Switch

1. Locomotives are equipped with a two position Territory Switch with “OUT” and “IN” positions.
2. “OUT” Position is used:
   a. In non-ATC territory
   b. In ATC territory, when running against the current of traffic.
   c. In ATC territory, when ATC rules are out of service (suspended).
   d. In ATC territory, when wayside signals are out of service (signal suspension).

NOTE: When entering ATC territory and cab signal aspect is more favorable than restricting, switch must be moved from “OUT” to “IN” position within 8 seconds to prevent a penalty brake application.

NOTE: When Cab Territory Switch is in the “OUT” position with ATC cut in, equipment overspeed is enforced at 79 mph.

NOTE: When Cab Territory Switch is in the “OUT” position, some ADUs will be extinguished as indicated in TABLE 1.

3. “IN” POSITION is used in ATC territory for normal operation.
4. An ATC system Departure Test **IS NOT** required when the Cab Territory switch is moved from “OUT” to “IN” position.

D. ATC Cutout Switches/Cocks

1. Speed Control cut out switch
   a. Cuts out the ATC speed control system.
   b. Some Amtrak locomotives are not equipped with a Speed Control cutout switch.
   c. An ATC system departure test **IS NOT** required when the Speed Control cutout switch is cut in after being cut out.
2. ATC Electric cutout switch
   a. Cuts out the ATC system electrically
   b. Some Amtrak locomotives are not equipped with an ATC Electric cutout switch.
   c. An ATC MAP 8 Periodic Inspection **IS** required when the switch is cut in after being cut out due to system failure. Otherwise, ATC MAP 8 Periodic Inspection **IS NOT** required.
3. ATC Pneumatic cutout cock/switch
   a. Cuts out the ATC system pneumatically
   b. All Amtrak locomotives which operate in ATC territory An ATC MAP 8 Periodic Inspection IS required when the ATC Pneumatic cutout switch/cock is cut in after being cut out.
4. Cab Signal Transfer Switch (If equipped)

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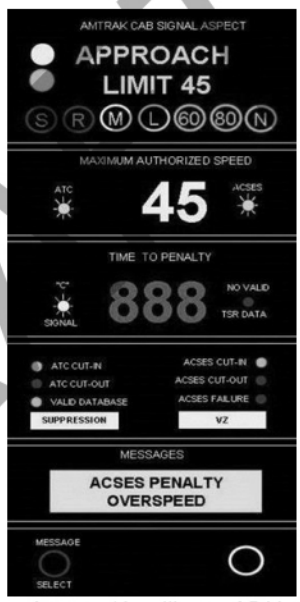
a. Selects the Train Control System to be used on the locomotive (either ATC or IITS).
b. An ATC system departure test IS required when the switch is moved to the “CAB SIGNAL” position after having been in the “IITS” position and equipment will be operated in ATC territory.
c. Aspect Display Unit (ADU)
d. Amtrak locomotives are equipped with four (4) aspect or nine (9) aspect / Intelligent display units (all cab signal aspects must be tested).
e. ADU displays cab signal aspect corresponding to code from receiver bars.
f. Are equipped an ATC Pneumatic cutout cock/switch.

5. Amtrak/MNRR Territory Switch
a. Select the method (Automatic or Manual) the ATC/ACSES system will change between Amtrak and Metro-North territories.
b. AUTO will read the ACSES transponder information and enforce MNRR or Amtrak territory ATC speeds. This is the normal position of the switch.
c. If ACSES is cut-out, the Amtrak/MNRR Territory Switch must be positioned manually when crossing the boundary between MN and Amtrak.
d. If ACSES fails to change modes to the correct railroad after passing the first interlocking on the other side of the boundary or one (1) mile, whichever is less, the Engineer will need to stop the train and manually change the mode by moving the switch to the correct territory position.

NOTE: After manually changing the Amtrak/MNRR Territory Switch and the corresponding cab signal aspects are not correctly displayed, the ATC system must be cut-out and considered failed.



4 Aspect Display Unit



9 Aspect / Intelligent ADU

E. ATC (Cab Signal) Receiver Bars

1. Bars are attached to the front or both ends of the locomotive close to the rail in front of the leading wheels in order to receive cab signal code from the rails.



P-42 ATC Receiver Bars

4.2.2 ATC Operation

A. Leading locomotive or unit of consist must be set up in the following manner:

1. Cab Signal Transfer switch, if equipped, must be in the "CAB SIGNAL" position whenever operating in ATC territory.
2. Territory Switch must be in the "IN" position on both ends, if so equipped, at all times while on track where ATC (cab signal) rules are in effect for direction of movement.
3. Speed Control Cutout Switch, if equipped, must be sealed in the "IN" position.
4. ATC Cutout Cock/Switch must be sealed in the "IN" position.

B. Speed Limits

1. Speed control imposes limits according to cab signal indication.
2. When cab signal changes to a more restrictive indication, corresponding speed is enforced.

C. Suppression of Penalty Application

1. Acknowledgement is required when cab signal changes more restrictive aspect and speed is at or below limit imposed by cab signal indication and audible alarm sounds.
2. Sounding of alarm when speed is above limit imposed by cab signal requires acknowledgment and positioning ABV handle to "SUPPRESSION" within 8 seconds.
3. Brakes may be released when cab signal speed is achieved and overspeed light goes out.

D. Recovery from Penalty Application

1. When a penalty application occurs, acknowledge and place ABV handle in "LAP" or "SUPPRESSION" position.
2. Ensure throttle/controller is in "IDLE" or "OFF" position.
3. When PCS/Penalty indication turns off, penalty application may be recovered.
4. Penalty application may be recovered while moving provided there is sufficient time to recharge train before next brake application is required.

4.2.3 ATC (Cab Signal) Departure Test

A. ATC (Cab Signal) Daily Departure Test

1. Test must be performed in non-coded territory.
2. Locomotive must be stopped.
3. Apply independent brake if equipped. If not, apply hand/parking brake (HHP-8/HST parking brake must be applied).
4. The velocity zero (VZ) light must be illuminated on the ADU.

EXCEPTION: On HST power cars, HHP-8 locomotives and 9800 Series cab cars the POD must display a "No Motion" indication, or the MFD-2 status of the ATC, Speed Sensing, and ACSES "No Motion" light must be illuminated.

5. If equipped, inspect that the Cab Signal Transfer Switch is in the "CAB SIGNAL" position and sealed.
6. Inspect to determine that the following devices are cut in and sealed:
   a. ATC Pneumatic cutout cock/switch
   b. ATC Electric cutout switch
   c. Speed Control cutout switch or Speedometer (Overspeed) cutout pneumatic cock/switch
7. Visually inspect cab signal receiver (pickup) bars for proper alignment. Also inspect for exposed wires and junction box damage.
8. Position reverser in "FORWARD" or "REVERSE" for corresponding cab signal receiver bars to be tested. If locomotive will be used in both directions both F-End and R-end receivers must be tested.
9. Territory switch must be cut in.
10. Move ABV handle to "RELEASE".
11. Activate On-Board Self-Test with toggle switch, button, or display screen soft keys.
12. Audible alarm will sound, and aspect display unit will go through self-test of ADU lamps. No action is required.
13. The self-test will then progress upward through the cab signal aspects, checking overspeed setting and alarm for each aspect. No acknowledgment is required.
14. When the least restrictive aspect ("CLEAR" on 4 ADU; "CLEAR, 150" on 9 ADU, and Intelligent ADU) is displayed, cab signal audible alarm will sound, and a penalty application will occur. **The penalty brake application must occur less than eight (8) seconds after audible alarm begins.** PCS/Penalty indication will illuminate, and brake pipe will reduce at a service rate at least 26 psi.
15. Move ABV handle to the "SUPPRESSION" or "LAP" position. Penalty will reset and PCS/Penalty indication will turn off.
16. MOVE ABV handle to "RELEASE".
17. ATC (Cab Signal) test continues with downward aspect changes.
18. Acknowledge each downward change, except for change from "Approach" to "Restricting".
19. On downward change from "Approach" to "Restricting", without acknowledging, move ABV handle to "SUPPRESSION" position to forestall penalty application. Penalty must not occur.

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NOTE: On GP38H-3, GP38-2, and GP-15 locomotives the cab signal self-test toggle switch must be held in the "UP" position during the entire cab signal self-test with one exception, when the cab signal changes from "Approach" to "Restricting", the cab signal self-test toggle switch must be released.

20. Without acknowledging, move ABV handle to "RELEASE" position. Penalty brake application must occur with PCS/Penalty indication illuminated and a service brake pipe reduction of at least 26 psi will occur.
21. Acknowledge and move ABV handle to "SUPPRESSION" position. Penalty will reset and PCS/Penalty indication will turn off.
22. Move ABV handle to "RELEASE" position to ensure that brakes release.
23. When ATC (Cab Signal) System Departure Test is successful complete MAP 100 as follows:
    a. Enter seal numbers (boxes 17) for electrical switch and pneumatic cutout.
    b. Enter "Date" and "Time" of test (boxes 18)
    c. Complete "Train Control Test" portion of the MAP 100; fill out "Signature"' "Occupation", "Location", "Date" and "Time" boxes. (boxes 19-23)
    d. Check mark "F-End", "R End", or both (boxes 15 and 16).

B. ATC (Cab Signal) System Departure Test will be considered as failed when any of the following conditions/faults are discovered during the test.

NOTE: ATC (Cab Signal) may be re-tested no more than 2 times to ensure test passed.

1. Visible damage to cab signal track receivers.
1. Audible alert does not function.
2. Acknowledger does not function.
3. All lamps not functioning on Aspect Display Unit.
4. Test overspeed condition at "Clear 150" on 9 Aspect/Intelligent Display Unit does not initiate a penalty application of the brakes within 8 seconds.
5. Test overspeed condition at "Clear" on 4 Aspect Display Unit does not initiate a penalty application of the brakes within 8 seconds.
6. Penalty application cannot be suppressed using the ABV handle in "SUPPRESSION" position.
7. Penalty application does not occur within 8 seconds during step 4.2.3A.20 above.
8. Penalty application cannot be recovered after 4.2.3A.20 above.
9. Velocity Zero Light or No Motion light is not illuminated after test is complete.

4.2.4 Criteria for Determining ATC (Cab Signal) En Route Failure

A. Damage or fault occurs to any part of the ATC system

B. Cab Signal Failure

1. Cab Signal fails to conform at 2 fixed signal locations in succession.
2. When approaching a fixed signal displaying "Approach" or more favorable aspect in ATC territory without fixed automatic block signals, the cab signal displays "Restricting" and fails to conform after passing the fixed signal.
3. When approaching a fixed signal displaying "Slow Clear", "Slow Approach", "Stop and Proceed", "Restricting", or "Stop Signal" and the cab signal displays an aspect more favorable than "Approach".

EXCEPTION: This procedure does not apply when fixed signal being approached is imperfectly displayed.

C. Speed Control Failure

1. Cab signal aspect allows a greater speed than aspect authorizes.
2. Cab signal aspect enforces a lower speed than aspect authorizes.
3. Overspeed indication remains illuminated and penalty application occurs on a downward change of cab signal aspect when engineer fulfills the following:
    a. Acknowledge within 8 seconds
    b. "SUPPRESSION" position of ABV handle
    c. Authorized speed achieved
4. Unrecoverable penalty brake application.
5. Velocity Zero (VZ) Light remains illuminated when speed is above 12MPH.
6. "NO MOTION" light on HST power cars and HHP-8 locomotives remain illuminated when locomotive speed is above 3MPH.

D. Automatic Train Stop (ATS) Failure

1. The audible indicator fails to sound when the cab signal changes to more restrictive aspect.
2. The audible indicator continues to sound even though the cab signal change was acknowledged, and the speed of the train was reduced to the speed required by the cab signal indication.

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NOTE: When necessary to correct a fault by opening the battery switch, the ATC (cab signal) system DOES NOT have to be retested.

4.2.5 Automatic Train Control (ATC) Cutout Procedures

A. Follow instructions in TABLE 1.

B. If ATC Pneumatic cutout cock is cut out the ATC system is required to have a MAP 8 Periodic Inspection performed.

C. Record on MAP 100 Failure En Route section.

1. Select reason for cutting out (Failure or Temporary Operating Exception).
2. Train Control System(s) cut out.
3. Geographic location(s) where cut out and cut in.
4. To whom report was made.

D. Notify Train Dispatcher promptly and CNOC mechanical desk at 1-800-424-0217 as soon as possible but before end of tour of duty.

E. Proceed according to applicable operating rule(s).

4.3 Automatic Train Stop (ATS); Intermittent Inductive Train Stop (IITS)

4.3.1 ATS (IITS) Equipment

A. Acknowledger

1. Switch/Button used by the engineer to acknowledge a more restrictive ATS (IITS) condition.

B. Audible Alarm – Sounds when ATS operating conditions change.

C. Territory Switch

1. Some locomotives are equipped with a two position Territory Switch with “OUT“ and “IN“ positions.
2. “OUT” Position is used in non-ATS (IITS) territory. Territory Switch must remain in the “OUT” position until the train enters ATS (IITS) territory.
3. “IN” Position is used in ATS (IITS) territory for normal operation
4. An ATS (IITS) System Departure Test **IS NOT** required when the Cab Territory switch is moved from “OUT” to “IN” position.

D. ATS (IITS) Cutout Switches/Cocks

1. ATS Pneumatic cutout cock/switch
   a. Cuts out the ATS system pneumatically
   b. All Amtrak locomotives which operate in ATS (IITS) territory are equipped an ATS Pneumatic cutout cock/switch.
   c. An ATS (IITS) System Departure Test **IS** required when the ATS Pneumatic cutout switch/cock is cut in after being cut out.
2. Cab Signal Transfer Switch (If equipped)
   a. Selects the Train Control System to be used on the locomotive (Either ATC or IITS).
   b. An ATS (IITS) System Departure Test **IS** required when the switch is moved to the “IITS” position after having been in the “CAB SIGNAL” position and equipment will be operated in ATS (IITS) territory.

E. ATS (IITS) Indicator Light

1. Illuminates when an ATS (IITS) operating condition exists which requires acknowledgement.



P-42 IITS Indicator Light

F. ATS (IITS) Receiver Bar

1. Receiver Bar is attached to the right front of the locomotive close to the rail in order to be activated when passing over a wayside inductor.

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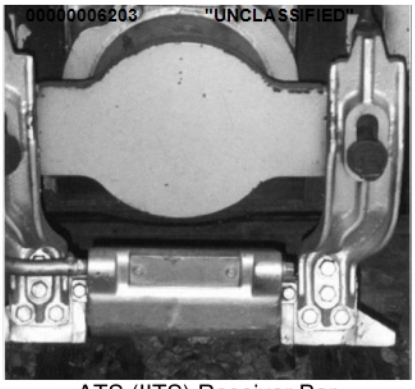

ATS (IITS) Receiver Bar

4.3.2 ATS (IITS) Operation

A. Leading locomotive MUST be set up in the following manner:

1. Cab Signal Transfer switch, if equipped, must be in the "IITS" position whenever operating in ATS (IITS) territory.
2. Cab Territory Switch must be in the "IN" position, if so equipped, at all times while on track where ATS (IITS) rules are in effect.
3. ATS (IITS) Pneumatic Cutout Cock/Switch must be sealed in the "IN" position.

B. Suppression of Penalty Application

1. After passing signal or wayside inductor, the audible alarm will sound and visual indication lights.
2. Acknowledgment must be made within 8 seconds to prevent a penalty application.

C. Recovery from Penalty Application

1. Ensure combined power handle/throttle is in "IDLE" or "OFF".
2. Place ABV handle to "SUPPRESSION" or "LAP" position.
3. Depress and hold the acknowledgment button for approximately 2 seconds.
4. Depress and hold the ATS reset button for approximately 2 seconds.
5. Release the brakes after penalty messages clear and the PCS light goes out.

4.3.3 ATS (IITS) System Departure Test

A. On-Board Self-Test

1. Test must be performed in non-coded territory.
2. Locomotive must be stopped.
3. If equipped, inspect that the Cab Signal Transfer Switch is in the "IITS" position and sealed.
4. Inspect to determine that the ATS (IITS) Pneumatic Cutout Cock/Switch is cut in and sealed.
5. Visually inspect ATS (IITS) receiver (pickup) bars for proper alignment and height. Also inspect for exposed wires and junction box damage.
6. Equipped with two buttons marked "90" and "60" located on right-hand side of the box.
7. Push and release the "90" button. System simulates train passing inductor. No action is required.
8. Push and release the "60" button. Alarm will sound.
9. Without acknowledging, move the ABV handle to "Suppression" position within 8 seconds in order to forestall the penalty.
10. Without acknowledging, move the ABV handle to "RELEASE". A penalty brake application must occur.
11. Recover from penalty application. Acknowledge and move ABV handle to "SUPPRESSION" position. Penalty will reset and penalty indication will turn off.
12. When ATS (IITS) System Departure Test is successful, complete MAP 100 as follows:
    a. Enter seal numbers (boxes 17) for electrical switch and pneumatic cutout.
    b. Enter "Date" and "Time" of test (boxes 18)
    c. Complete "Train Control Test" portion of the MAP 100; fill out "Signature"' "Occupation", "Location", "Date" and "Time" boxes. (boxes 19-23)
    d. Check the End(s) that were successfully inspected and tested. (boxes 15 and 16).

B. ATS (IITS) System Departure Test Using Wayside Inductors

1. If equipped, inspect that the Cab Signal Transfer Switch is in the "IITS" position and sealed.
1. Inspect to determine that the ATS (IITS) Pneumatic Cutout Cock/Switch is cut in and sealed.
2. Pass over the first inductor. Acknowledge audible alarm within 8 seconds. No penalty should occur.
3. Pass over second inductor. When alarm sounds move ABV handle to "SUPPRESSION" position within 8 seconds without acknowledging, avoiding penalty application.
4. Without acknowledging, move the ABV handle to "RELEASE". A penalty brake application must occur.

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5. Recover from penalty application. Acknowledge and move ABV handle to "SUPPRESSION" position. Penalty will reset and penalty indication will turn off.
6. When ATS (IITS) System Departure Test is successful, complete MAP 100 as follows:
   a. Enter seal numbers (boxes 17) for electrical switch and pneumatic cutout.
   b. Enter "Date" and "Time" of test (boxes 18)
   c. Complete "Train Control Test" portion of the MAP 100; fill out "Signature"' "Occupation", "Location", "Date" and "Time" boxes. (boxes 19-23)
   d. Check the End(s) that were successfully inspected and tested. (boxes 15 and 16).

4.3.4 Criteria for ATS (IITS) En Route Failure

1. ATS (IITS) will be considered as having failed with two (2) consecutive malfunctions when passing over inert inductors, or
2. When passing a signal within ATS (IITS) limits whose aspect requires acknowledging and any one of the following occurs:

A. ATS (IITS) alarm light does not illuminate.
B. Audible alarm does not sound.
C. Failure to acknowledge warning results in no penalty application.

1. When operating rule or special instruction defines failure other than that listed above.

4.3.5 Cut Out Procedure

A. Follow instructions in TABLE 2.
B. If ATS failure, an ATS MAP 8 Periodic Inspection is required.
C. Record on MAP 100 Failure En Route section.
D. Select reason for cutting out (Failure or Temporary Operating Exception).
E. Geographic location(s) where cut out and cut in.
F. To whom report was made.
G. Notify Train Dispatcher promptly and CNOC mechanical desk at 1-800-424-0217 as soon as possible but before end of tour of duty.
H. Proceed according to applicable operating rule(s).

4.4 Advanced Civil Speed Enforcement System (ACSES)

4.4.1 ACSES Equipment

A. Acknowledger – Switch/Button used by the engineer to acknowledge a more restrictive ACSES condition.
B. Audible Alarm – Sounds when ACSES operating conditions change.
C. ACSES Cutout Switches/Cocks

1. ACSES Electric cut out switch
   a. Cuts out the ACSES system electrically
   b. An ACSES System Departure Test **IS** required when the switch is cut in after being cut out due to system failure. Otherwise, ACSES System Test **IS NOT** required.
2. ACSES Pneumatic cutout cock/switch
   a. Cuts out the ACSES system pneumatically
   b. An ACSES System Departure Test **IS** required when the ACSES Pneumatic cock/switch is cut in after being cut out.
3. Train Type Selector Switch (If Equipped)
   a. Selects one of either train type B, C, D or E as defined by Rule, Special Instruction, General Order, Bulletin Order, or other directive.
   b. An ACSES System Departure test **IS** required when different train type is selected and equipment will be operated in ACSES territory.

D. Aspect Display Unit (ADU)

1. Amtrak locomotives are equipped with nine (9) aspect display units.
2. The ACSES civil and temporary speed restrictions are displayed in the ACSES portion of the ADU.

E. ACSES Scan Antenna

1. Antenna is attached under the front or both ends of the locomotive between the rails.
2. The antenna receives speed and location information from transponders located between the rails.

F. Data Radio Equipment

1. Wayside and on-board equipment which transmits and receives speed, signal, and WIU information.

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4.4.2 ACSES Operation

A. All trains operating in ACSES territory must be equipped with ACSES apparatus unless authorized by Special Instructions to operate non-equipped.

B. ACSES must be cut in before entering ACSES territory.

C. When ACSES is cut IN and ATC is cut OUT:

1. The cab signal portion of the Aspect Display Unit is dark.
2. The ACSES portion of the Aspect Display Unit indicates "– –" .

D. Speed Limits

1. ACSES enforces speed and speed restrictions, both temporary and permanent, according to timetable speed tables.

E. ACSES is direction dependent and requires the reverser to be in forward or reverse. If the reverser is centered in ACSES territory, a penalty application will occur.

F. ACSES determines direction of travel by passing transponders. If direction of reverser is changed, the ACSES portion of the Aspect Display Unit will indicate "– –". After the change of direction, the first set of transponders passed will cause the ACSES portion of the Aspect Display Unit to change from "– –" to the current track speed.

G. ACSES may not indicate current track speed when:

1. Entering ACSES territory at a hand operated switch until passing over the next set of transponders.
2. Diverting at an interlocking until passing over the next set of transponders on the exit track from the interlocking.
3. A locomotive passes over transponders at less than 3 mph (missing transponder indication is displayed "– –").

H. Permanent (Civil) Speed Restriction Enforcement.

1. ACSES will enforce all permanent speeds based on the train type as set by the Train Type Selector Switch.

NOTE: HST train type is automatically set.

2. When approaching a speed restriction and train speed is less than the restriction, the audible alert sounds and the ACSES portion of the Aspect Display Unit changes to the lower speed at the location where the speed changes. Engineer must acknowledge the audible alert within 8 seconds to avoid a penalty.
3. When approaching a speed restriction and train speed exceeds that allowed by the braking curve, the audible alert sounds and the ACSES portion of the Aspect Display Unit changes to the lower speed prior to reaching the restriction. Engineer must acknowledge and initiate braking with the ABV handle within 8 seconds to avoid a penalty.

NOTE: When ATC is cut out, the ACSES portion of the ADU displays "– –" instead of the enforced speed .

4. When enforced speed increases after a permanent or temporary restriction, a short audible alert sounds to inform the engineer of the speed increase. Acknowledgement is not required.

NOTE: The ACSES audible tone is different from the ATC audible tone.

I. If reverser position is changed, the Aspect Display Unit will display "– –" continuously.

J. When direction of travel is changed, the current TSR information is no longer enforced and the Aspect Display Unit No Valid TSR DATA LED will illuminate. As soon as new TSR information is received for the current direction of travel, (usually in the vicinity of the next interlocking) the Aspect Display Unit No Valid TSR DATA LED will extinguish and enforce TSR speeds normally.

K. If data radio communication is lost approaching an Interlocking Area, TSRs on adjacent tracks may be displayed and enforced.

L. Interlocking Route Speed Enforcement.

1. ACSES will enforce route speeds through the entire interlocking in the same manner as Permanent Speed Restrictions described in instruction 4.4.2H.

EXCEPTION: When Data Radio is not functioning, ACSES will not enforce route speeds at interlockings (ATC will continue to enforce route speeds at interlockings).

NOTE: When ATC is cut out, the ACSES portion of the Aspect Display Unit remains at "– –" .

M. ACSES Positive Stop

1. Positive Stop Enforcement
   a. ACSES will enforce a positive stop at Interlocking and CP signals displaying STOP SIGNAL.

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EXCEPTION: When Data Radio is not functioning a positive stop may be enforced at signals displaying other than STOP SIGNAL.

b. When train speed is greater than allowed by the braking curve, the audible alert sounds, the cab signal immediately changes to STOP SIGNAL and a penalty application is applied.

NOTE: When speed is reduced below the braking curve, the cab signal **MAY** change to a more favorable aspect, allowing recovery of the penalty.

c. An ACSES Positive Stop penalty application cannot be recovered until:
   1. Cab Signal changes to a more favorable aspect, or
   2. The Stop Bypass button is pressed.

NOTE: If a cab signal flip occurs while approaching an interlocking/CP, an ACSES Positive Stop may be enforced with a penalty brake application. These occurrences must be reported to the Train Dispatcher and note on MAP 100.

2. When the Stop Bypass button is pressed:
   a. Cab Signal will change to RESTRICTING, and
   b. ACSES enforces 15 mph speed until locomotive clears interlocking or CP.

N. Suppression of Penalty Application

1. Sounding of alarm when speed is above limit imposed by ACSES requires acknowledgement and positioning ABV handle to "SUPPRESSION" position within 8 seconds.
2. Brakes may be released when target speed is achieved and overspeed indication goes out.

O. Recovery from Penalty Application

1. When a penalty application occurs, acknowledge and place ABV handle in "LAP" or "SUPPRESSION" position.
2. Ensure throttle/controller is in "IDLE" or "OFF" position.
3. When PCS/Penalty indication turns off, penalty application may be recovered.
4. Penalty application may be recovered while moving provided there is sufficient time to recharge train before next brake application is required.

P. Construction Zone

1. If the "Construction Zone" text message on the ADU remains displayed after clearing the limits of the Construction Zone, ACSES must be recycled as follows:
   a. Stop the train as soon as safe train handling will permit, clear of tunnels and interlocking limits,
   b. Place ABV handle in "SUPPRESSION",
   c. Open ACSES circuit breaker and wait 30 seconds,
   d. Close ACSES circuit breaker,
   e. Perform ACSES On-Board Self-Test per instruction 4.4.3.

NOTE: Trains may stop to recycle the ACSES system within Interlocking limits while making a station stop or when authorized by the Train Dispatcher.

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4.4.3 ACSES On-Board Self-Test

A. Once initial departure test has been performed, ACSES system must remain cut in, unless train does not enter ACSES territory or is exempt per Special Instruction

B. The independent brake must be fully applied and the automatic brake must be released. On the HST power car, the parking brake must be applied.

C. Visually inspect the ACSES antenna for exposed wires and junction box damage.

D. Inspect that the ACSES Pneumatic cutout cock in cut in and sealed.

E. On a locomotive equipped with a train type selector switch, verify that the blinking light on the switch panel represents the proper train type **(B, C, D, or E)**. If not, move the selector knob to the train type required. Completing the ACSES Departure test will lock in the type of train selected.

F. On a locomotive equipped with a train type selector switch, recycle the ACSES circuit breaker.

G. Activate the ACSES On-Board Self-Test by using either a push-button, on screen buttons or spring-loaded toggle switch.

H. On the ACSES Message Display of the Aspect Display Unit (ADU), a letter **B, C, D, or E** will appear. This letter verifies the train type your locomotive is set up for. On HHP-8 locomotives or HST power cars, no train type is illuminated on the ADU.

I. Actuate the cab signal acknowledger.

J. Observe that all LED segments are lit on the ACSES ADU, and that the number "188" is illuminated.

K. In four to five seconds, the audible alarm for ACSES will sound. This will result in a penalty application of the brakes.
L. Move the ABV handle to “SUPPRESSION” position.
M. Acknowledge.
N. This will silence the alarm.
O. Wait for PCS to reset. On HHP-8 locomotive and HST power car, wait for penalty application light to reset.
P. Move ABV handle to “RELEASE” position.
Q. Acknowledge.
R. In two to three seconds a penalty application will occur. This will change the cab signal aspect to “STOP SIGNAL”. This is applicable only where a combined cab signal and ACSES ADU is used.
S. Move the ABV handle to “SUPPRESSION” position.
T. Acknowledge and silence the audible alarm.
U. ADU Message Display will have “DEPARTURE TEST PASSED” and the ACSES ADU is indicating "– –." This completes the test.
V. When ACSES On-Board Self-Test is successful complete MAP 100 as follows:

a. Circle ACSES Train Type **(A, B, C, D, & E)**
b. Enter seal numbers (boxes 17) for electrical switch and pneumatic cutout.
c. Enter “Date” and “Time” of test (boxes 18)
d. Complete “Train Control Test” section of the MAP 100; fill out ”Signature”’ “Occupation”, “Location”, “Date” and “Time” blocks. (boxes 19-23)
e. Check mark “F-End”, “R End” or both (boxes 15 and 16).

Step	Operation	Action
1	TRAIN TYPE CHECK: The speed limit portion of the ADU shows a letter indication the current train type	Observe and verify correct train type is displayed on the ADU – PRESS ACKNOWLEDGE
2	TRAIN TYPE ACCEPTED:	No action – The speed limit will display “188”
3	ANTENNA CHECK: Power is applied to the Transponder Antenna and on-board BIT test verifies antenna sub-system is working properly. If the test passes the power will turn off and proceed to step 4	No action – If this test fails it remains suspended at this step; ACSES power must be cycled before any other functions operate
4	PENALTY OUTPUT AND PERMANENT SUPPRESSION CHECK: ACSES de-energizes its penalty magnet valve to create a penalty brake application. The alarm is continuously activated	The operator must achieve Permanent Suppression and press acknowledge to silence alarm and proceed to next step
5	PERMANENT SUPPRESSION CHECK: ACSES re-energizes its penalty output to clear a penalty brake application	The operator must recover the brakes and release the brake to remove Permanent Suppression. Press acknowledge to proceed to next step
6	POSITIVE TRAIN STOP CHECK: ACSES sends PTS request to the ATC system. Under Restricting signal the ATC system responds to the PTS request by immediately de-energizing its own Penalty Output	The ATC aspect displays STOP. With Permanent Suppression on, press acknowledge to revoke the PTS request
7	RADIO CHECK: ACSES interrogates the health of the MCM radio link	If the test remains suspended at this step longer than 2 minutes, ACSES power must be cycled.
8	Departure Test completed successfully	ADU displays “Departure Test Passed”

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4.4.4 ACSES Cut Out Procedures

A. If ACSES displays anything other than the Missing Transponder Symbol in territory where ACSES is not in effect, the ACSES electric cutout switch located on the side of the ACSES equipment box must be placed in the “cut out” position. Once ACSES has been electrically cut out in this manner, HSTs and HHP-8s will display “ACSES Cut Out” in the alarm box of the MFD1 screen. On other ACSES equipped engines, the red “Track Speed Cut Out” light will illuminate. Prior to entering ACSES equipped territory, ACSES must be cut back in without delay to the train. An ACSES On-Board Self-Test is **not** required when the system is cut out and cut in electrically unless a failure is declared.
B. Follow instructions in TABLE 3.
C. If ACSES failure, an ACSES MAP 8 Periodic Inspection is required.
D. Record on MAP 100 Failure En Route section.
E. Select reason for cutting out (Failure or Temporary Operating Exception).

F. Geographic location(s) where cut out and cut in.

G. To whom report was made.

H. Notify Train Dispatcher promptly and CNOC mechanical desk at 1-800-424-0217 as soon as possible but before end of tour of duty.

I. Proceed according to applicable operating rule(s).

4.5 Incremental Train Control System (ITCS) & Grade Crossing – Incremental Train Control System (X-ITCS)

4.5.1 ITCS/X-ITCS Equipment

A. Acknowledger

1. Switch/Button used by the engineer to acknowledge a more restrictive ITCS/X-ITCS condition.

B. Audible Alarm – Sounds when ITCS/X-ITCS operating conditions change.

C. ITCS/X-ITCS In/Out Switch

1. Locomotives are equipped with a two position ITCS In/Out Switch with “OUT” and “IN” or “NORMAL” positions.
2. Switch must remain in the “OUT” position until the train enters ITCS/X-ITCS territory.
3. “IN” or “NORMAL” Position is used in ITCS/X-ITCS territory for normal operation
4. An ITCS/X-ITCS System Departure Test **IS NOT** required when the ITCS/X-ITCS In/Out Switch is moved from “OUT” to “IN” or “NORMAL” position.

D. ITCS/X-ITCS Cutout Switches/Cocks

1. ITCS/X-ITCS Pneumatic cutout cock/switch.
   a. Cuts out the ITCS/X-ITCS system pneumatically
   b. All Amtrak locomotives which operate in ITCS/X-ITCS territory are equipped an ITCS/X-ITCS Pneumatic cutout cock/switch.
   c. An ITCS/X-ITCS System Departure Test **IS** required when the ITCS/X-ITCS Pneumatic cut out switch/cock is cut in after being cut out.

E. ITCS/X-ITCS Compact Locomotive Display (CLD)

1. ITCS/X-ITCS speed restrictions, time to penalty and distance to target are displayed by the CLD.



ITCS/X-ITCS Compact Locomotive Display (CLD)

4.5.2 ITCS/X-ITCS Operation

A. Prior to entering ITCS/X-ITCS territory, Engineer must verify that correct engine type has been selected and displayed on ITCS/X-ITCS Compact Locomotive Display (CLD).

B. Leading locomotive must be set up in the following manner:

1. ITCS/X-ITCS “IN” or “NORMAL/OUT” switch must be placed in the “IN” or “NORMAL” position when prompted.
2. X-ITCS Pneumatic Cut Out Switch/Cock must be sealed in the “CUT IN” position.

C. Entering and Leaving ITCS/X-ITCS Territory

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1. When entering a track on which ITCS/X-ITCS rules are in effect for the direction of movement, ITCS/X-ITCS IN/OUT Switch or "NORMAL/OUT" switch must be moved to the "IN" or "NORMAL" position within 8 seconds after prompt.
2. In ITCS/X-ITCS territory, after CLD (Compact Locomotive Display) indicates "ITCS OUT", move ITCS/X-ITCS IN/OUT Switch or "NORMAL/OUT" switch to the "OUT" position within 8 seconds to avoid a penalty application.

D. Suppression of Penalty Application

1. Sounding of alarm when speed is above limit imposed by ITCS/X-ITCS requires acknowledgement.
2. Speed must be reduced prior to "Time-To-Penalty" indication reaching "0" using the ABV handle.

E. Recovery from Penalty Application

1. When a penalty application occurs, acknowledge and place ABV handle in "LAP" or "SUPPRESSION" position.
2. Ensure throttle/controller is in "IDLE" or "OFF" position.
3. When PCS/Penalty indication turns off, penalty application may be recovered.
4. Penalty application may be recovered while moving provided there is sufficient time to recharge train before next brake application is required.

4.5.3 ITCS/X-ITCS Departure Test

A. Prior to initiating ITCS/X-ITCS Departure Test, ensure that:

1. Lead locomotive is at zero speed.
2. Reverser handle is centered.
3. Independent brake is fully applied.
4. On-Board Computer (OBC) power is ON.
5. Generator field switch/breaker is ON.
6. Automatic brake valve is cut in.

NOTE: If ITCS departure test is to be performed during a station stop within ITCS territory, no more than a 15 psi reduction is to be maintained on equipment. If ITCS Departure Test fails to initiate a brake application, contact the conductor to determine if safe to release train brakes. If safe to release train brakes, move ABV handle to "RELEASE" position and restart Departure Test.

NOTE: X-ITCS/ITCS Departure Tests can only be performed at Initial terminals where ITCS departure test servers are located (Chicago, St. Louis, Port Huron, Pontiac). The system cannot pass a departure test in any other location. See appropriate General Order for information.

7. Engine isolation switch is in RUN position.

B. Initiate the Departure Test by pressing and releasing the Departure Test button on the ITCS/X-ITCS Compact Locomotive Display unit. The Departure Test will consist of an ITCS/X-ITCS Compact Locomotive Display Unit Verification test, Operational verification tests, TD220 Radio tests, GPS Location test, and Transfer Data Recorder Log.

C. TD220 Radio Tests.

1. Observe TD220 radio tests. While the test is processing, the LCD indicator displays ***TESTING***.
2. Observe the target type display change from TRMRCV to DBLOAD to WAY REV.
3. If the departure test is being performed in an area that the TD220 radio cannot communicate with a local departure test server, the target type will display F-RAD 0 or LOOPBAK. If no loop back signal is received, the target type display changes to TIMEOUT and after a short time, the departure test proceeds to the next test.

D. ITCS/X-ITCS Compact Locomotive Display Unit Verification Test – Verify and indicate individual ITCS/X-ITCS display unit tests passed or failed by pressing and releasing either the:

- SELECT Pushbutton for PASS, or
- SCROLL Pushbutton for FAIL

1. Verify and indicate the LED TEST / passed or failed.
2. Verify and indicate the LED DIMMING TEST / passed or failed.
3. Verify and indicate the LCD TEST / passed or failed.
4. Verify alerter sounds for 1 second / passed or failed.
5. PUSHBUTTON TEST / press and release each pushbutton when prompted.
6. X-ITCS Displayed / passed or failed.

E. Operational Verification Tests

1. Verify and indicate software version / passed or failed.
2. Enter and/or verify the engine type. (Press and release the SCROLL button to change engine type. Press and release the SELECT button to enter engine type. Press and release SELECT button again to save.)

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3. Enter and/or verify the train type. (Press and release the SCROLL button to change train type. Press and release the SELECT button to enter train type. Press and release SELECT button again to save.)
4. Enter and/or verify the Train ID. (Press and release the SELECT button to set the Train ID. Press and release the SCROLL button to change the assigned digits.)
5. Move the reverser handle when prompted to confirm hood selection. (This portion of the test is only available if freight locomotive type is selected.)
6. Enter and/or verify the vehicle unit number (VUN). (Press and release the SELECT button to set the VUN. Press and release the SCROLL button to change the assigned digits.)
7. Observe speed sensor tests.
8. Observe speed simulation tests.
9. Observe speed warning tests.
10. Observe over-speed tests.
11. BRK ON test - When prompted, press and release Acknowledge button.
12. SIGNAL downgrade test - When prompted, press and release Acknowledge button.
13. Observe HOME signal test.
14. When prompted, place ITCS/X-ITCS IN/OUT Switch in the “IN” or “NORMAL” position.
15. When prompted, place ITCS/X-ITCS IN/OUT Switch in the “OUT” position.
16. When prompted, move reverser handle to proper position.

F. GPS Location Tests

1. Observe test of A and B GPS receivers.

G. ITCS/X-ITCS Departure Test – PASSED

1. Record successful completion of the Departure Test on the MAP 100 as follows:
   a. Enter seal numbers (boxes 17) for electrical switch and pneumatic cutout.
   b. Enter “date” and “Time” of test (boxes 18)
   c. Complete “Train Control Test” portion of the MAP 100; fill out ”Signature”’ “Occupation”, “Location”, “Date” and “Time” blocks. (boxes 19-23)
   d. Check mark “F-End”, “R-End”, or both (boxes 15 and 16).
2. Report time Departure Test performed and results to the Train Dispatcher.

H. Transfer Data Recorder Log

1. After the ITCS/XITCS departure test passes, the target type indicator displays SENDLOG as the OBC transmits the data recorder logs to the terminal server. No action is required. Locomotive can be operated while SENDLOG is displayed.

I. ITCS/X-ITCS Departure Test – FAILED

1. Press SCROLL to identify failure(s).
2. Record Departure Test failure(s) on MAP 100.
3. Report time Departure Test performed and failure(s) to the Train Dispatcher.

4.5.4 ITCS/X-ITCS Cutout Procedures

A. Follow instructions in TABLE 4.
B. If ITCS/X-ITCS fails, an ITCS/X-ITCS MAP 8 Periodic Inspection is required.
C. Record in the MAP 100 Failure En Route section:
D. Select reason for cutting out (Failure or Temporary Operating Exception).
E. Geographic location(s) where cut out and cut in.
F. To whom report was made.
G. Notify Train Dispatcher promptly and CNOC mechanical desk at 1-800-424-0217 as soon as possible but before end of tour of duty.
H. Proceed according to applicable operating rule(s).

4.6 Interoperable – Electronic Train Management System (I-ETMS)

4.6.1 I-ETMS Equipment

A. Audible Alarm – Sounds when I-ETMS operating conditions change.
B. I-ETMS Cut Out Switch and Breaker

1. I-ETMS Pneumatic Cutout switch/valve
   a. Pneumatically cuts out the I-ETMS system.
   b. All Amtrak locomotives which operate in I-ETMS territory are equipped an I-ETMS Pneumatic Cutout switch/valve.

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c. An I-ETMS Departure Test **IS** required when the I-ETMS Pneumatic Cutout switch is transitioned from the cutout position to the cut in position.

2. I-ETMS Circuit Breaker
   a. Turns power ON or OFF to the I-ETMS System.
   b. All Amtrak locomotives which operate in I-ETMS territory are equipped an I-ETMS Circuit Breaker.
   c. An I-ETMS Departure Test **IS** required when the I-ETMS Circuit Breaker is transitioned from the "OFF" position to the "ON" position.
3. I-ETMS System Cutout Toggle Switches (Hard Cutouts)
   a. Emergency Cutout – Cuts out the emergency brake application function.
   b. Penalty Cutout – Cuts out the penalty brake application function.
   c. Horn Cutout – Cuts out the automatic horn actuation function.



I-ETMS System Cutout Switches (Hard Cutouts)

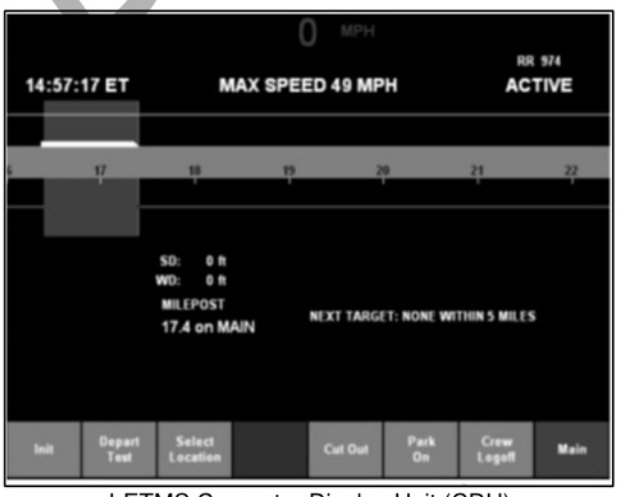
NOTE: Changing the position of the electrical or pneumatic switches may require an I-ETMS Departure Test.

C. I-ETMS Departure Test – PASSED

1. Record successful completion of the Departure Test on the MAP 100 as follows:
   a. Enter seal numbers (boxes 17) for electrical switch and pneumatic cutout.
   b. Enter "date" and "Time" of test (boxes 18)
   c. Complete "Train Control Test" portion of the MAP 100; fill out "Signature"' "Occupation", "Location", "Date" and "Time" blocks. (boxes 19-23)
   d. Check mark "F-End", "R-End" or both (boxes 15 and 16).

D. I-ETMS Computer Display Unit (CDU)

1. I-ETMS system states, track line, grade profile, permanent and temporary speed restrictions, Restricted Speed targets, Stop targets, warning time to penalty braking and distance to target are displayed by the Computer Display Unit (CDU). In addition, the CDU is used to initialize the I-ETMS system for operation and acknowledge target prompts.



I-ETMS Computer Display Unit (CDU)

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4.6.2 I-ETMS Operation

A. Leading locomotive must be set up in the following manner:

1. I-ETMS Pneumatic Cutout switch/valve must be sealed in the IN position.
2. I-ETMS Circuit Breaker must be positioned to the “ON’ position.
3. I-ETMS 220 Mhz Data Radio Circuit Breaker must be positioned to the “ON” position.
4. I-ETMS System Cutout switches:
   a. Emergency Cutout – Cut “IN” and sealed
   b. Penalty Cutout – Cut “IN” and sealed
   c. Horn Cutout – Cut “IN” and sealed

B. Entering and Leaving I-ETMS Territory

1. I-ETMS territory must not be entered without I-ETMS in ACTIVE state unless system has failed and authority to proceed has been received in accordance the rules.
2. When approaching “PTC Entry” track to I-ETMS territory, engineer must select the track on which the train is operating using the CDU.
3. When leaving I-ETMS territory, engineer must acknowledge the “Leaving System Coverage” prompt using the CDU.

C. Suppression of Penalty and Emergency Brake Applications

1. Sounding of alarm when speed is above limit imposed by I-ETMS DOES NOT require acknowledgement.
2. Speed must be reduced prior to system initiating Penalty or Emergency brake application.

D. Recovery from Penalty and Emergency Brake Applications

1. When a penalty application occurs, place ABV handle in “SUPPRESSION” position.
2. Ensure throttle is in “IDLE” position.
3. When PCS/Penalty indication turns off and train has stopped, penalty application may be recovered.

4.7 Speedometer Overspeed System

4.7.1 Amtrak locomotives are equipped with a speedometer overspeed system used outside of Train Control System territory.

4.7.2 These locomotives are equipped with a pneumatic cutout to be used in the event that the system becomes defective.

4.7.3 The system will be considered defective when an overspeed condition is enforced more than 5 mph less than the maximum authorized speed. (Example: enforcement at 73 mph when maximum speed is 79 mph).

4.7.4 Speedometer overspeed equipped locomotives include: P-32BWH, P-32ACDM, P-40, P-42, GP-38-2, GP-38-3, MP15, 9600 series cab cars, NPCU and Surfliner Cab Cars.

4.7.5 All Siemens Charger Diesel locomotives, except MARC locomotives, are equipped with a sealed Overspeed Selector switch which must be set for the proper train type and the seal number must be recorded on the MAP 100.

Train Type	E	D	CC	CC	CC	C	C	C	C	B	B	B	B
ATC IN/OUT										CUT-OUT	CUT-OUT	CUT IN	CUT IN
ACSES IN/OUT										CUT-IN	CUT-OUT	CUT-OUT	CUT-IN
ITCS IN/OUT Switch						IN	IN	OUT	OUT				
ITCS CUT OUT						CUT IN	CUT OUT	CUT IN	CUT OUT				
IITS Equipped			Yes	Yes	No								
IITS CUT OUT			CUT IN	CUT OUT	CUT IN/OUT								
Operating Speed	59	79	90	79	90	110	79	79	79	79	79	125	125
Traction Lock Speed	62	82	93	82	93	113	82	82	82	82	82	128	128
Overspeed/Penalty	63	83	94	83	94	114	83	83	83	83	83	129	129

Charger Overspeed Logic Table

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4.8 Multiple Penalty Brake Device (MPBD)

4.8.1 A Multiple Penalty Brake Device has been installed on Diesel Locomotives with multiple Train Control Systems. This MPBD is not part if the train control system and will not initiate a Penalty Brake Application but will assist the engineer in determining which Train Control System did.

4.8.2 The following components are part of the MPBD:



Display Unit located in the locomotive cab.



Remote Cutout Box

4.8.3 The seal numbers will be recorded on the MAP 100.

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NATIONAL RAILROAD PASSENGER CORPORATION

AMTRAK®

Tables and Forms Section

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5.0 Tables and Forms

- 5.1 Standard Air Pressures
- 5.2 Amtrak Car Data Table
- Table 1 ATC Devices and Cutouts
- Table 1a MNRR Overspeed Territory Switch
- Table 2 ATS Devices and Cutouts
- Table 3 ACSES Devices and Cutouts
- Table 4 ITCS Devices and Cutouts
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- Table 5 I-ETMS Devices and Cutouts
- Table A Air Brake Handle Positions and Cutouts
- Table B Locomotive Air Hose Connections
- Table C Passenger Standing Air Brake Test Table
- MS 1.0 Piston Travel – Shoe/Pad Clearance
- MS 2.0 Passenger Car Tread Brake Unit Slack Adjuster Inspection Procedure
  - MS Table A Maximum Brake Shoe Clearance
  - MS Table B Wrench Socket Sizes
  - MS Table C Brake Shoe Clearances
- MS 3.0 Locomotive Air Brake Pressures
- MS 4.0 Passenger Car Air Brake Pressures
- MS 5.0 Freight Car Air Brake Pressures
- MS 6.0 Mechanical Department Periodic Brake Maintenance Requirements
- Amtrak Forms
- Other Railroad Forms

5.1 Standard Air Pressures

Air pressure regulating devices on locomotives and cars must be adjusted to the standard pressures indicated in this instruction.

EQUIPMENT	POUNDS PRESSURE (PSI)		
	Brake Pipe	Brake Cylinder	Main Reservoir
5.1.1 Locomotives			
Passenger Service Tier I	110		130-140
Passenger Service – VIA	100		130-140
Passenger Service – Tier II (HST)	110		140-150
Non-Passenger Service	90		130-140
NEC Welded Rail Train	90		130-140
Rocky Mountaineer Train	90		130-140
When train brake pipe pressure has been increased to other than standard pressure, the increased pressure will be carried to final destination of the train.			
5.1.2 Cab Cars	110		130-140
5.1.3 Talgo	110		130-140
5.1.4 Electric MU Cars	110		130-140
5.1.5 Independent Brake			
ACS-64, Charger SC-44,Charger ALC-42		72-75	
HHP-8, P32BWH, P40, P42, P32ACDM, GP38, & NPCU		72	
5.1.6 Safety Valves			
• Tier I			150-155
• Tier II (HST)			160
• Locomotive compressor			
○ Intercooler		60	
○ Discharge Pipe (If equipped)		185	
5.1.7 Control Air Pressure			
EMD Locomotives		90	
GE Locomotives		80	
5.1.8 Car Water Raising System			
	Superliner Horizon & Viewliner I	Heritage	Viewliner II
Governor valve	80	60	80
Reducing valve	45	25	45
Safety valve	50	35	60
5.1.9 Timing Reservoir, Speed Control System			
		45	

5.1.10 Brake Pipe Equalization Pressure For Freight Type Control Valves

Brake Pipe Pressure (PSI)	Brake Pipe Full Service Reduction (PSI)	Service Equalization Pressure (PSI)	Emergency Equalization Pressure (PSI)
90	26	64	76
100	29	71	84
110	32	78	93

5.1.11 FREIGHT LOCOMOTIVES IN PASSENGER SERVICE

When a freight locomotive is the only source of compressed air and will be used to haul a passenger train, brake pipe pressure must be increased to not more than 15 psi below the minimum main reservoir pressure of that locomotive before coupling to the train. Brake pipe pressure must not exceed 110 psi:

- If minimum main reservoir pressure is 120 psi, brake pipe pressure must be increased to 105 psi.
- If minimum main reservoir pressure is 130 psi, brake pipe pressure must be increased to 110 psi.

When a power unit, crane, or other piece of machinery will be used to haul non-passenger cars with freight type brake equipment, the maximum brake pipe pressure shall not be greater than15 psi less than the air compressor starting or loading pressure set on the power unit, crane, or other piece of machinery.

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5.2 Amtrak Car Data Table

Car Numbers	# Of Cars	Car Type/AMTK	Length (Feet)	Loaded Weight (Tons)	Empty Weight (Tons)
11300-11399	37	HOP. STL. BALLAST	37	77	24
11500-11581	20	HOP. STL. BALLAST	40	100	28
11582-11731	110	HOP. STL. BALLAST	40	100	29
11800-11875	75	HOP. STL. BALLAST	40	100	29
11901-11938	37	HOP. STL. BALLAST	40	100	29
13028-13039	8	MAINT OF WAY REEL GONDOLAS	54	100	33
13200-13400	200	GOND. STL. FIXED END	55	100	31
13900-13904	3	MAINT OF WAY SIDE DUMP	34	55	29
13909-13914	1	GOND. STL. SIDE DUMP	46	100	46
13915-13967	50	GOND. STL. SIDE DUMP	42	100	38
15003-15009	6	MAINT. OF WAY	54	77	34
15020-15029	10	MAINT. OF WAY	54	55	29
15030	1	MAINT. OF WAY special flat	57	100	34
15050-15062	7	MAINT OF WAY	41	55	27
15201-15223	11	MAINT OF WAY	41	55	28
15225	1	MAINT OF WAY	41	55	22
15233	1	MAINT. OF WAY	53	70	25
15241-15248	5	MAINT OF WAY	57	55	30
15250-15251	2	flat stl. Specially equip. cwr	56	55	34
15252	1	flat cwr threader car	61	67	43
15260-15316	21	flat special equipped cwr	54	77	29
15500-15594	94	flats equipped tie concrete	57	95	37
15600-15603	4	FLATS RAIL PICK UP	57	44	44
15610-15619	10	MAINT OF WAY FLATS	93	58	32
15650-15653	4	MAINT OF WAY FLATS	93	58	39
15655-15699	28	MAINT OF WAY	57	100	36
15700-15725	26	MAINT OF WAY	57	100	53
15726-15798	63	MAINT OF WAY	57	100	36
15800-15824	25	MAINT OF WAY	54	100	36
Refer to System General Order		Superliner I	85	80	80
Refer to System General Order		Superliner II	85	85	85
Refer to System General Order		Amfleet I	85	58	58
Refer to System General Order		Amfleet II	85	57	57
Refer to System General Order		Horizon	85	57	57
Refer to System General Order		MHC	64	81	39
Refer to System General Order		Baggage	71	67	67
Refer to System General Order		Viewliner	85	65	65
Refer to System General Order		Viewliner II (LDSL)	85	77	77
Refer to System General Order		Amtrak Bilevel Autocarriers	93	82	42

NOTE: If cars are not listed in table above, contact CNOC mechanical desk for lengths and weights.

NOTE: Add lengths and weights of cars in consist for information to be entered on MAP 1173/10C Summary.

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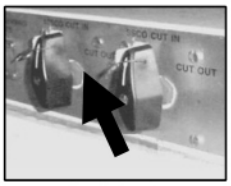
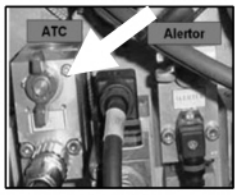
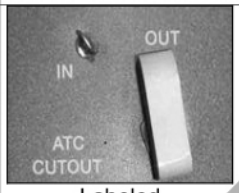
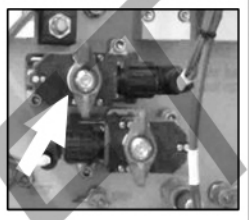
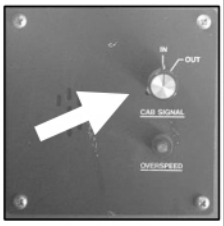
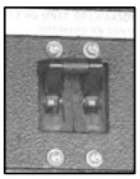
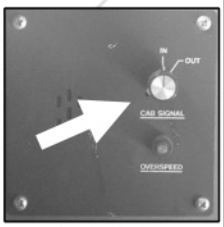
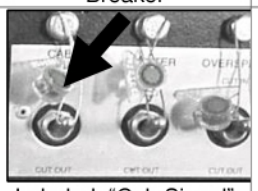
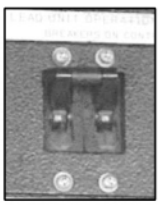
TABLE 1 – ATC DEVICES & CUTOUTS						
	Territory Switch	**Speed Control Cutout Switch**	**ATC Electric Cutout Switch**	**ATC Pneumatic Cutout Cock/Switch**		
Function	Sets locomotive onboard equipment to operate inside (IN) or outside (OUT) ATC territory.	Cuts out Speed Control Portion of Automatic Train Control System	Cuts out Automatic Train Control System Electrically	Cuts out Automatic Train Control System Pneumatically	**Speed Control Failure**	**ATC (Cab Signal or ATS) Failure**
Sealed	-	YES	YES	YES	-	-
HHP-8 / HST P/C	 Labeled "Cab Territory"	Not Equipped With A Separate Cut Out	 Labeled: "ATSCO"	 Labeled "ATC"	Cut out ATC Electric Cutout Switch "ATSCO". If penalty cannot be recovered, then cut out ATC Pneumatic Cutout Cock. **ADU Status= DARK**	Cut out ATC Electric Cutout Switch "ATSCO". If penalty cannot be recovered, then cut out ATC Pneumatic Cutout Cock. **ADU Status= DARK**
ACS-64/ ALC-42	 Labeled "Cab/Non-Cab Territory"	Not Equipped With A Separate Cutout	 Labeled "ATC Cutout"		Cut out ATC Electric Cutout Switch "ATC". **ADU Cab Signal portion = DARK** If penalty cannot be recovered, then cut out ATC Pneumatic Cutout Cock. **ADU Status = DARK**	Cut out ATC Electric Cutout Switch "ATC". **ADU Cab Signal portion = DARK** If penalty cannot be recovered, then cut out ATC Pneumatic Cutout Cock. **ADU Status = DARK**
GE P-40DC	 Labeled: "Cab Signal"	Not Accessible By Engineer	Not Equipped With A Separate Cutout	 ATC Pneumatic Cut Out Labeled: "CSMV"  Cab Signal Circuit Breaker	Cut out ATC Pneumatic Cutout Cock "CSMV" then cut out CAB SIGNAL circuit breaker. **ADU Status= DARK**	Cut out ATC Pneumatic Cutout Cock "CSMV" then cut out CAB SIGNAL circuit breaker. **ADU Status= DARK**
GE P-42DC	 Labeled: "Cab Signal"	Not Accessible By Engineer	Not Equipped With A Separate Cutout	 Labeled: "Cab Signal"  Cab Signal Circuit Breaker	Cut out ATC Pneumatic Cutout Switch "CAB SIGNAL" then turn off Cab Signal circuit breaker. **ADU Status= DARK**	Cut out ATC Pneumatic Cutout Switch "CAB SIGNAL" then turn off Cab Signal circuit breaker. **ADU Status= DARK**

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TABLE 1 – ATC DEVICES & CUTOUTS

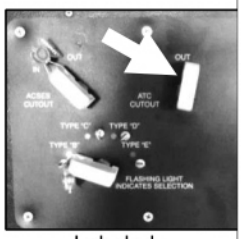
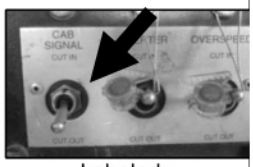
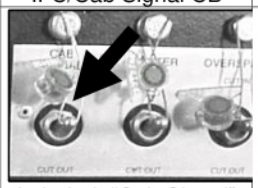
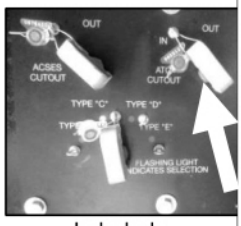
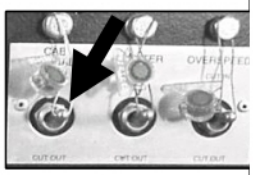
	Territory Switch	Speed Control Cutout Switch	ATC Electric Cutout Switch	ATC Pneumatic Cutout Cock/Switch		
Function	Sets locomotive onboard equipment to operate inside (IN) or outside (OUT) ATC territory.	Cuts out Speed Control Portion of Automatic Train Control System	Cuts out Automatic Train Control System Electrically	Cuts out Automatic Train Control System Pneumatically	**Speed Control Failure**	**ATC (Cab Signal or ATS) Failure**
Sealed	-	YES	YES	YES	-	-
GE P-42DC (with ACSES only)	 Labeled: "Cab Signal Mode"	Not Accessible By Engineer	 Labeled: "ATC Cutout"	 Labeled: "Cab Signal"	Cut out ATC cutout switch If unable to recover form Penalty Brake, use ATC Pneumatic Cutout; **both** Cab Signal and ACSES are cut out. **ADU Status= DARK**	Cut out ATC cutout switch. If unable to recover from Penalty Brake, use ATC Pneumatic Cutout; **both** Cab Signal and ACSES are cut out. **ADU Status= DARK**
GE P-32 ACDM 700-709	 Labeled: "Cab Signal"	Not Accessible By Engineer	Not Equipped With A Separate Cutout	 Labeled: "CSVCO"  IFC/Cab Signal CB	Cut out ATC Pneumatic Cutout Switch "CSVCO" then turn off IFC/CAB SIGNAL circuit breaker. **ADU Status= DARK**	Cut out ATC Pneumatic Cutout Switch "CSVCO" then turn off IFC/CAB SIGNAL circuit breaker. **ADU Status= DARK**
GE P-32 ACDM 710-717	 Labeled: "Cab Signal"	Not Accessible By Engineer	Not Equipped With A Separate Cutout	 Labeled: "Cab Signal"  IFC/Cab Signal CB	Cut out ATC Pneumatic Cutout Switch "Cab Signal" then turn off IFC/CAB SIGNAL circuit breaker. **ADU Status= DARK**	Cut out ATC Pneumatic Cutout Switch "Cab Signal" then turn off IFC/CAB SIGNAL circuit breaker. **ADU Status= DARK**
GE P-32 ACDM	 Labeled: "Cab Signal Mode"	Not Accessible By Engineer	 Labeled: "ATC Cutout"	 Labeled: "Cab Signal"	Cut out ATC cut out switch If unable to recover form Penalty Brake, use ATC Pneumatic Cutout; **both** Cab Signal and ACSES are cut out **ADU Status= DARK**	Cut out ATC cut out switch If unable to recover form Penalty Brake, use ATC Pneumatic Cutout; **both** Cab Signal and ACSES are cut out. **ADU Status= DARK**

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TABLE 1 – ATC DEVICES & CUTOUTS

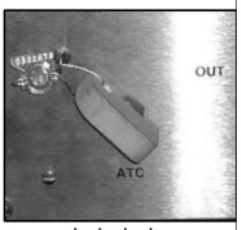
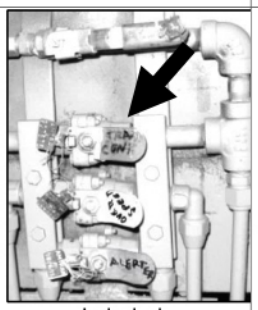
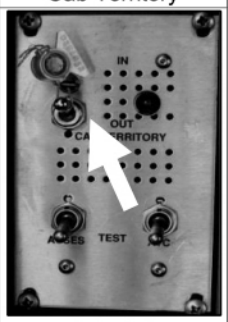
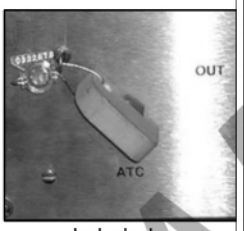
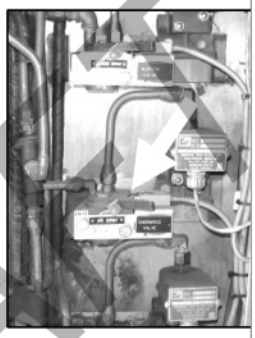
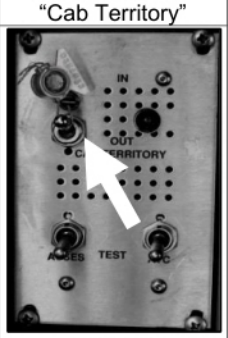
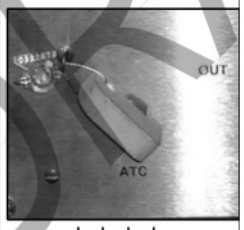
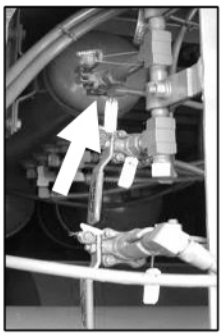
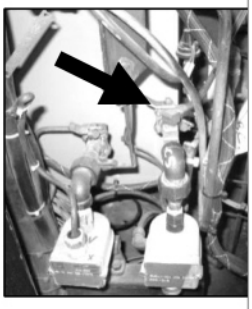
	Territory Switch	Speed Control Cutout Switch	ATC Electric Cutout Switch	ATC Pneumatic Cutout Cock/Switch		
Function	Sets locomotive onboard equipment to operate inside (IN) or outside (OUT) ATC territory.	Cuts out Speed Control Portion of Automatic Train Control System	Cuts out Automatic Train Control System Electrically	Cuts out Automatic Train Control System Pneumatically	**Speed Control Failure**	**ATC (Cab Signal or ATS) Failure**
Sealed	-	YES	YES	YES	-	-
GP38 H3	 Labeled "Cab Territory"	Speed Control switch has been removed	 Labeled: "ATC"	 Labeled: "Train Control"	Cut out Speed Control Switch "OVERSPEED" **ADU Status= Cab Signals Displayed**	Cut out ATC Electric Cut Out Switch "ATC". If penalty cannot be recovered, then cut out ATC Pneumatic Cutout Cock. **ADU Status= DARK**
9600 CAB CAR	 Labeled "Cab Territory"	Speed Control switch has been removed	 Labeled: "ATC Cutout"		Cutout Speed Control Switch "OVERSPEED" **ADU Status= Cab Signals Displayed**	Cut out ATC Electric Cut Out Switch "ATC". If penalty cannot be recovered, then cut out ATC Pneumatic Cutout Cock. **ADU Status= DARK**
GP15	 Labeled "Cab Territory"	Speed Control switch has been removed	 Labeled: "ATC"		Cut out Speed Control Switch "OVERSPEED". **ADU Status= Cab Signals Displayed**	Cut out ATC Electric Cut Out Switch "ATC". If penalty cannot be recovered, then cut out ATC Pneumatic Cutout Cock. **ADU Status= DARK**
MP15	 Labeled "Territory Switch"	Not Equipped With A Separate Cutout	Not Equipped With A Separate Cutout		Cut out ATC Pneumatic Cutout Cock. **ADU Status= DARK**	Cut out ATC Pneumatic Cutout Cock. **ADU Status= DARK**

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TABLE 1 – ATC DEVICES & CUTOUTS

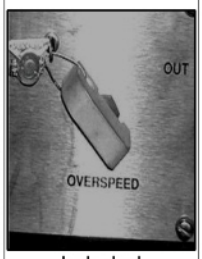
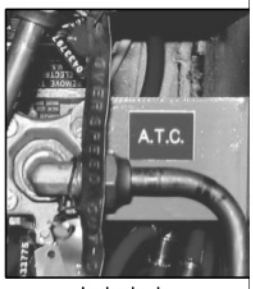
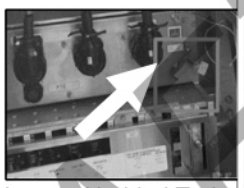
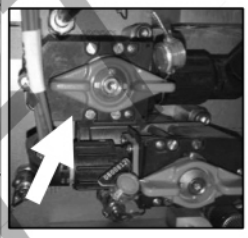
	Territory Switch	Speed Control Cutout Switch	ATC Electric Cutout Switch	ATC Pneumatic Cutout Cock/Switch		
Function	Sets locomotive onboard equipment to operate inside (IN) or outside (OUT) ATC territory.	Cuts out Speed Control Portion of Automatic Train Control System	Cuts out Automatic Train Control System Electrically	Cuts out Automatic Train Control System Pneumatically	**Speed Control Failure**	**ATC (Cab Signal or ATS) Failure**
Sealed	-	YES	YES	YES	-	-
GP38-2	 Labeled "Territory Switch"	 Labeled "Overspeed"	 Labeled: "ATC"	 Labeled: "ATC"	Cut out ATC Pneumatic Cutout Cock. **ADU Status= DARK**	Cut out ATC Pneumatic Cutout Cock. **ADU Status= DARK**
SC-44 Charger		Not Equipped with A Separate Cutout	 Located behind Train Control Rack Door		Cut out Electric Cut Out Switch. If penalty cannot be recovered, then cut out Pneumatic Cutout Cock.	Cut out Electric Cut Out Switch. If penalty cannot be recovered, then cut out Pneumatic Cutout Cock.

TABLE 1a – MNRR OVERSPEED TERRITORY SWITCH

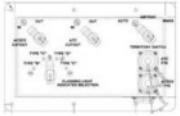
	Territory Switch	Location				
Function	Sets locomotive onboard equipment to operate inside (IN) or outside (OUT) ATC territory.					
HST		On the side of the LDRS-V Bracket				
ACS-64/ ALC-42		On the On-Board Equipment Enclosure				

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TABLE 1a – MNRR OVERSPEED TERRITORY SWITCH						
	Territory Switch	**Location**				
Function	Sets locomotive onboard equipment to operate inside (IN) or outside (OUT) ATC territory.					
GE P-42 P-32DM **CTDOTR P-40**		Above the Engineer Windscreen				
9600 CAB CAR		Electrical Room below PTE Connector				
GP15D GP38H GP39H3		In the nose of the locomotive				
CT GP40		On the left side of the ADU				

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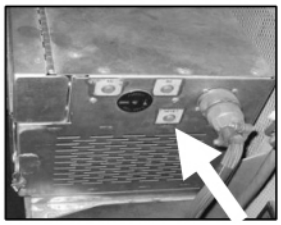
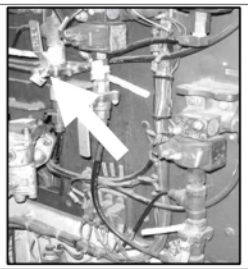
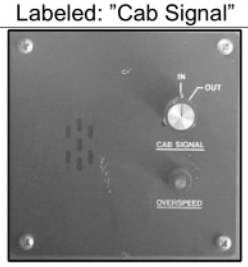
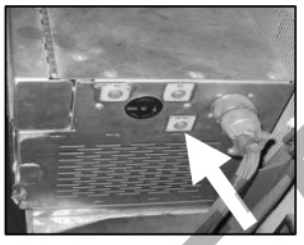
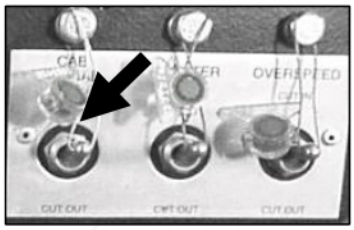
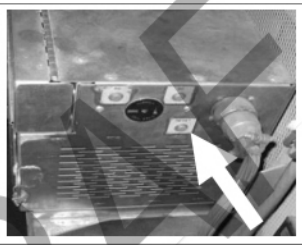
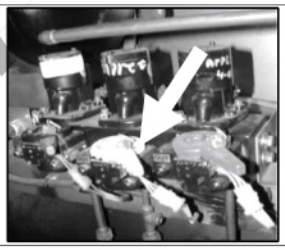
TABLE 2 – ATS DEVICES & CUTOUTS				
	Territory Switch	**ATS Reset Button**	**ATS Pneumatic Cutout Cock/Switch**	
Function	Sets locomotive onboard equipment to operate inside (IN) or outside (OUT) ATS (IITS) territory.	Resets ATS (IITS) after Penalty brake application	Cuts out Automatic Train Stop (IITS) System Pneumatically	**ATS (IITS) Failure**
Sealed	-	-	YES	-
GE P-32 BWH	 Labeled: "Cab Signal"			Cut out ATS Pneumatic Cutout Cock.
GE P-42DC	 Labeled: "Cab Signal"		 Labeled: "Cab Signal"	Cut out ATS Pneumatic Cutout Switch.
Surfliner Cab Car	Not Equipped With A Territory Switch			Cut out ATS Pneumatic Cutout Cock.

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TABLE 3 – ACSES DEVICES & CUTOUTS

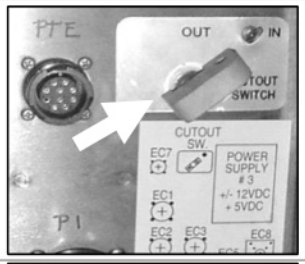
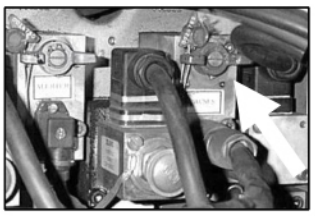
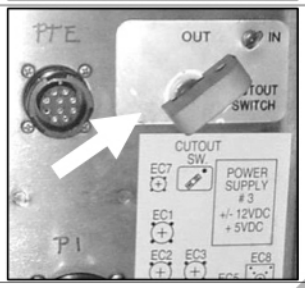
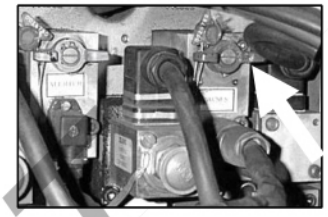
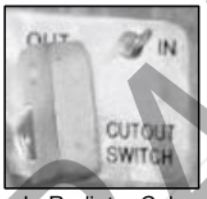
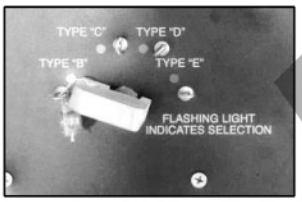
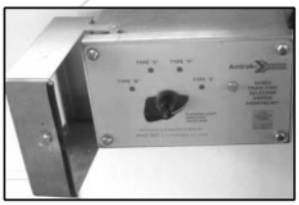
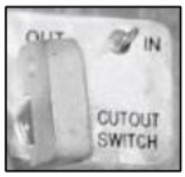
	Territory Switch	ATS Reset Button	ATS Pneumatic Cutout Cock/Switch	
Function	Selects one of either train type B, C, D, or E	Cuts out ACSES System Electrically	Cuts out ACSES System Pneumatically	**ACSES Failure**
Sealed	-	YES	YES	-
HST	Not Equipped With A Train Type Selector Switch			Cut out ACSES Electric Cutout Switch. If penalty cannot be recovered, then cut out ACSES Pneumatic Cutout Cock. **ADU Status= ACSES portion "— —"**
HHP-8				Cut out ACSES Electric Cutout Switch. If penalty cannot be recovered, then cut out ACSES Pneumatic Cutout Cock. **ADU Status= ACSES portion "— —"**
GE P-42DC		 In Radiator Cab	 Labeled: "Train Control CCB Air brake Interface Cutout Switch"	Cut out ACSES Electric Cutout Switch. If penalty cannot be recovered, then cut out ACSES Pneumatic Cutout Switch. **ADU Status= ACSES portion "— —"**
GE P-42DC	 Located on Engineer Control Panel	 Located on Engineer Control Panel	 Labeled: "Cab Signal" **Note:** Cuts out **both** Cab Signal and ACSES; ADU will go dark	Cut out ACSES Cutout Switch. If unable to recover form Penalty Brake, use ACSES Pneumatic Cutout; **both** Cab Signal and ACSES are cut out **ADU Status= DARK**
GE P-40DC		ACSES Electric Cutout In Radiator Cab  In Cab 		Cut out ACSES Electric Cutout Switch. If penalty cannot be recovered, then cut out ACSES Pneumatic Cutout Cock. **ADU Status= ACSES portion "— —"**

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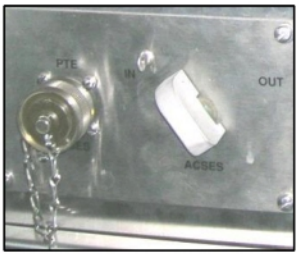
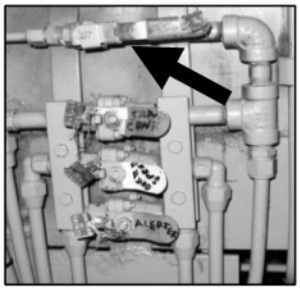
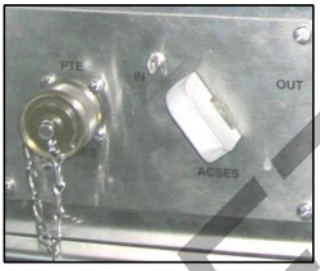
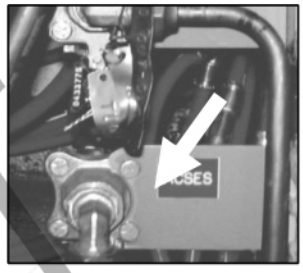
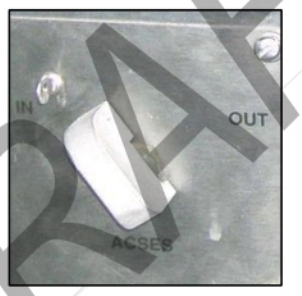
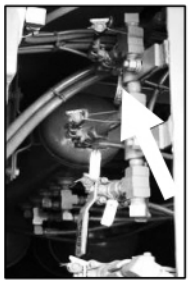
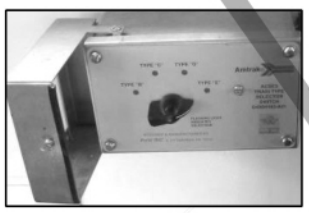
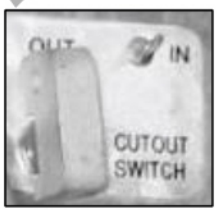
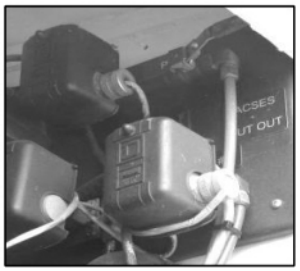
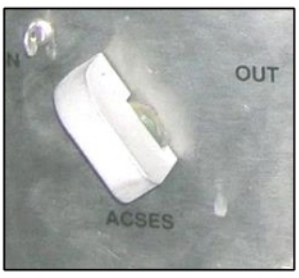
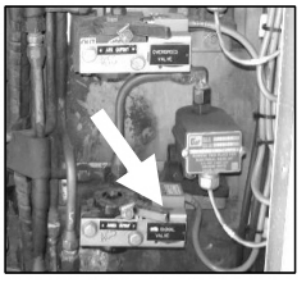
TABLE 3 – ACSES DEVICES & CUTOUTS				
	Territory Switch	**ATS Reset Button**	**ATS Pneumatic Cutout Cock/Switch**	
Function	Selects one of either train type B, C, D, or E	Cuts out ACSES System Electrically	Cuts out ACSES System Pneumatically	**ACSES Failure**
Sealed	-	YES	YES	-
GP38 H3				Cut out ACSES Electric Cutout Switch. If penalty cannot be recovered, then cut out ACSES Pneumatic Cutout Cock. **ADU Status= ACSES portion "— —"**
GP38-2				Cut out ACSES Electric Cutout Switch. If penalty cannot be recovered, then cut out ACSES Pneumatic Cutout Cock. **ADU Status= ACSES portion "— —"**
GP15				Cut out ACSES Electric Cutout Switch. If penalty cannot be recovered, then cut out ACSES Pneumatic Cutout Cock. **ADU Status= ACSES portion "— —"**
MP15				Cut out ACSES Electric Cutout Switch. If penalty cannot be recovered, then cut out ACSES Pneumatic Cutout Cock. **ADU Status= ACSES portion "— —"**
9600 CAB CAR				Cut out ACSES Electric Cutout Switch. If penalty cannot be recovered, then cut out ACSES Pneumatic Cutout Cock. **ADU Status= ACSES portion "— —"**

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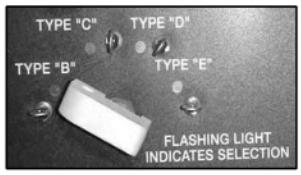
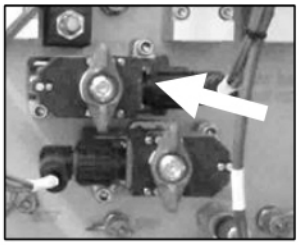
TABLE 3 – ACSES DEVICES & CUTOUTS				
	Territory Switch	**ATS Reset Button**	**ATS Pneumatic Cutout Cock/Switch**	
Function	Selects one of either train type B, C, D, or E	Cuts out ACSES System Electrically	Cuts out ACSES System Pneumatically	**ACSES Failure**
Sealed	-	YES	YES	-
ACS-64/ ALC-42				Cut out ACSES Electric Cutout Switch. ADU Maximum Authorized Speed = DARK If penalty cannot be recovered, then cut out ACSES Pneumatic Cutout cock. **ADU Status= DARK**
GE P-32 ACDM	 Located on Engineer Control Panel	 Located on Engineer Control Panel	 Labeled: “Cab Signal” **Note:** Cuts out **both** Cab Signal and ACSES; **ADU will go DARK**	Cut out ACSES cutout switch. If unable to recover form Penalty Brake, use ACSES Pneumatic Cutout; both Cab Signal and ACSES are cut out **ADU Status= DARK**

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TABLE 4 – ITCS DEVICES & CUTOUTS

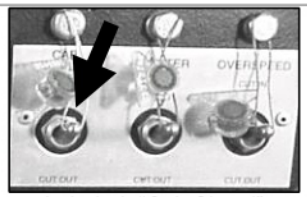
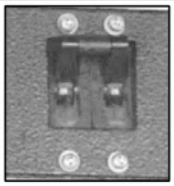
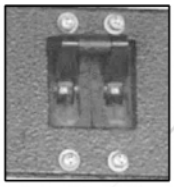
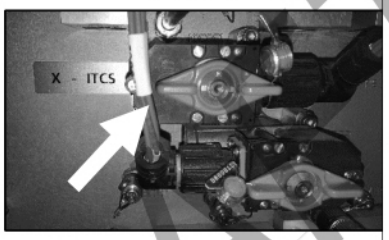
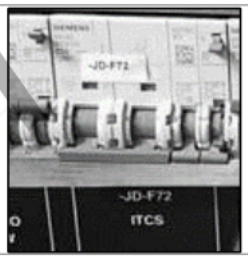
	ITCS IN/OUT SWITCH	ITCS CUTOUT COCK/SWITCH	ITCS CIRCUIT BREAKER	
Function	Sets locomotive onboard equipment to operate inside (IN) or outside (OUT) ITCS territory.	Cuts out ITCS System	Turns off ITCS System Electrically	**ITCS Failure**
Sealed	-	YES	YES	-
GE P-42DC		 Labeled: “Cab Signal”	 ITCS Circuit Breaker	Cut out ITCS Cutout Switch, then turn off ITCS Circuit Breaker.
GE P32-8			 Labeled: “Train Control”	Cut out ITCS Cutout Cock, then turn off ITCS Circuit Breaker.
SC-44 ALC-42 Charger				Cut out ITCS Cutout Cock, then turn off ITCS Circuit Breaker.

TABLE 4a - X-ITCS DEVICES & CUT OUTS

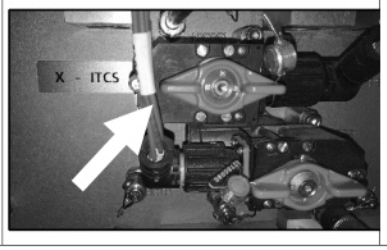
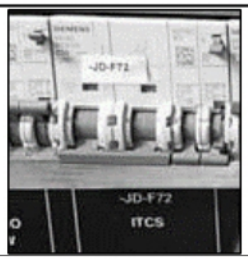
	X-ITCS IN/OUT SWITCH	X-ITCS CUT OUT SWITCH	X-ITCS CIRCUIT BREAKER	
Function	Enables locomotive onboard X-ITCS equipment to operate inside (IN) or outside (OUT) X-ITCS territory.	Cuts out X-ITCS System	Turns power off to the X-ITCS System	**X-ITCS Failure**
Sealed		YES	YES	
GE P-42DC	X-ITCS In/Out Switch Labeled “ITCS” 	 X-ITCS Cut Out Switch	X-ITCS Circuit Breaker 	Set X-ITCS CUT OUT SWITCH to CUT OUT position and then set the X-ITCS CIRCUIT BREAKER to the OFF position.
SC-44 ALC-42 Charger				Cut out ITCS Cutout Cock, then turn off ITCS Circuit Breaker.

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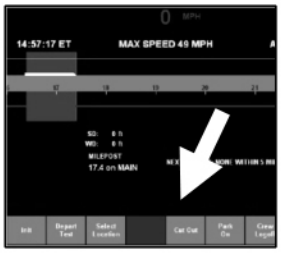
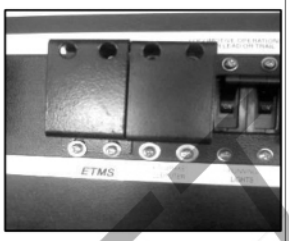
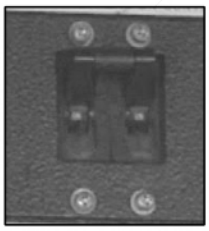
TABLE 5 – I-ETMS DEVICES & CUTOUTS					
	I-ETMS Cut Out Switches	**I-ETMS CDU Soft Key Cut Out**	**I-ETMS CIRCUIT BREAKER**	**I-ETMS PTC Radio Circuit Breaker**	
Function	Cuts out I-ETMS Emergency, Penalty Brake application functions, and Automatic horn functions	Cuts out I-ETMS enforcement/ transitions system to “Cut Out” state	Powers off the I-ETMS System	**Powers up 220 MHZ Data Radio**	**I-ETMS Failure**
Sealed	YES	N/A	NO	NO	-
-					Applicable railroad operating rules will govern I-ETMS system failure and cutout requirements.

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TABLE A

AIR BRAKE HANDLE POSITIONS & CUTOUTS					
All Amtrak Locomotives, High Speed Power Cars, Cab Cars, and NPCUs					
Control Stand Set Up	**ABV Handle**	**ABV Cutoff Valve***	**IBV Handle****	**MU 2 MU 2A****	**Dual Ported Cutout Cock****
Single / Leading	Full Service	FRT / Pass / In / LEAD	Fully Applied	Lead / Dead	In /Open
Push	Handle Off	Out / TRL	Release	Lead / Dead	In / Open
Trailing a No. 24, No. 26 or No. 30 CDW	Handle Off	Out / TRL	Release	Trail 24/26 or Trail 26	Out / Closed
Towed MU. Hoses Not Connected	Handle Off	Out / TRL	Release	Lead / Dead	In / Open

* Locomotives equipped with CCB brake have a switch instead of a valve.

** If equipped

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TABLE B

LOCOMOTIVE AIR HOSE CONNECTIONS						
Brake Pipe and Main Reservoir must always be connected and cut in between the equipment listed below.						
TRAIL \ LEAD	**ACS-64**	**HHP-8**	**HST**	**All Diesels**	**CAB CAR**	**NPCU**
ACS-64	ALL	Actuating Application & Release	Brake Pipe Main Reservoir only	ALL	Brake Pipe Main Reservoir only	ALL
HHP-8	Actuating Application & Release	ALL	Brake Pipe Main Reservoir only	Actuating Application & Release	Brake Pipe Main Reservoir only	Actuating Application & Release
HST	Brake Pipe Main Reservoir only	Brake Pipe Main Reservoir only	ALL	Brake Pipe Main Reservoir only	Brake Pipe Main Reservoir only	Brake Pipe Main Reservoir only
All Diesels	ALL	Actuating Application & Release	Brake Pipe Main Reservoir only	ALL	Brake Pipe Main Reservoir only	ALL
CAB CAR	Brake Pipe Main Reservoir only	Brake Pipe Main Reservoir only	Brake Pipe Main Reservoir only	Brake Pipe Main Reservoir only	ALL	Brake Pipe Main Reservoir only
NPCU	ALL	Actuating Application & Release	Brake Pipe Main Reservoir only	ALL	Brake Pipe Main Reservoir only	ALL

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TABLE C

Passenger Standing Air Brake Test Table

Train Air Brake Test instructions apply to all movements which are considered Train Movements (see definition)

Train Movements Definitions	Class I	Class IA	Class II	Notes
• Commuter and Short Distance Intercity passenger trains - Once each calendar day.	X			-
• Long Distance Intercity passenger trains - Prior to departure at initial/originating terminal.	X			-
• Long Distance Intercity passenger trains - Every 1500 miles or once each calendar day, whichever occurs first.	X			-
• Commuter and Short Distance Intercity passenger trains which have not been used in passenger service for more than 12 hours since the last Passenger-Class I brake test, unless MAP 1173 indicates that Class IA brake test has been performed.		X		-
• When instructed to add (pick up) Passenger Equipment without an accompanying MAP 1173.		X		Not necessary to perform Class IA test on entire train; only added equipment. Class II test is required on entire train. Both tests may be performed at the same time.
• When instructed to add (pick up) Passenger Equipment accompanied by a MAP 1173 and it cannot be determined whether equipment has been "Off Air" for more than 4 hours.		X		Not necessary to perform Class IA test on entire train; only added equipment. Class II test is required on entire train. Both tests may be performed at the same time.
• When equipment will be moved between the maintenance facility and originating terminal without a MAP 1173.		X		-
• When Class I Brake Test has expired on a Commuter or Short Distance Intercity passenger train and Mechanical Department personnel are not available to perform test.		X		Train may only be moved in passenger service to the next location where passengers can be safely detrained.
• When instructed to add (pick up) Passenger Equipment accompanied by a MAP 1173 and it is known that equipment was connected to a source of compressed air within the last 4 hours.			X	-
• Whenever the control stand or controlling locomotive is changed.			X	When controlling locomotive is changed, perform required Locomotive Brake Test.
• When the Engineer first takes charge of the train without face-to-face relief.			X	-
• When cars or equipment are removed from a passenger train.			X	-
• After any emergency application of the brakes on a passenger train, except when testing the back-up hose.			X	-
• After determining cause for brake pipe continuity loss. Use EOT to perform test.			X	-
• When control valve or brakes are cut out			X	-
• When indicated by rule or special instruction			X	-
• At any point where a brake pipe angle cock has been turned except when performing the two-way-end-of-train device emergency function test.			X	-

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MS 1.0 Piston Travel- Shoe/Pad Clearances

NOTE: These instructions apply to mechanical employees only.

Piston Travel- Shoe/Pad Clearances	
MS1.1 Amtrak Required Piston Travel for Locomotives / NPCU Cab Cars:	
F-40, GP-40, GP-15, GP-38, F-59, Dash - 8, NPCU.	2-1/2" – 3-1/2"
A. Amtrak required tread brake unit and disc pad clearances for locomotives:	
HHP-8 and ACS-64 Disc Brake.	Approximately 1/32" to 3/16"
HHP-8 Tread Brake Units.	Approximately 1/4"to 1/2"
P40BH, P-42, and P32ACDM (Genesis Series) Tread Brake Units.	1/4" to 3/8"
MS1.2 Piston Travel Shoe/Pad Clearances – All Cars:	
A. For vehicles equipped with nominal 12 inch stroke (8-1/2 or 10 inch diameter) car body mounted brake cylinders, piston travel shall be within 6 to 9 inches. If piston travel is found to be less than 6 inches or more than 9 inches, it must be adjusted to nominally 7-1/2 inches.	
B. For vehicles equipped with ***other than*** nominal 12 inch stroke (8-1/2 or 10 inch diameter) car body mounted brake cylinders, piston travel shall be adjusted per the brake cylinder piston travel stencil, decal, badge plate, or sticker located on the car.	
C. Amtrak Required Piston Travel for Passenger Cars	
Heritage Fleet / Truck Mounted Tread Brakes	3-1/2" to 4"
Bi-Level Auto Carriers	7" to 7-1/2
D. Amtrak Required Tread Brake Unit Maximum Clearance for Passenger Cars	
Amfleet I, Amfleet II, 1500/1600 MHC, Viewliner II, and Surfliner with Wabtec GB - 4-1/2 Tread Brake Unit.	3/4"
Capitoliner Cab Cars. with Wabtec GJ - 5 Tread Brake Unit	3/4"
Superliner I, Knorr or SAB Tread Brake Units	5/8"
Horizon, Viewliner I, and Superliner II with Knorr TBU-264-SPF Tread Brake Unit	3/8"
E. Amtrak Required Disc Pad Clearance for Passenger Cars	
Capitoliner Cab Cars, Amfleet I, Amfleet II, Viewliner I, Viewliner II, Horizon, 1500 MHC, and Superliner.	Approximately 1/4"
MS1.3 Inspection for Proper Release	
Proper release of the brakes can be determined by observation of the clearance between the brake shoe and the wheel or between the brake pad and the brake disc. (Manual inspection may be required).	

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MS 2.0 Passenger Car Tread Brake Unit Slack Adjuster Inspection Procedure

MS2.1. This procedure is to be used upon replacement of brake shoes or upon excessive brake shoe clearance found on inbound inspection.
MS2.2 Apply proper Blue Signal Protection.
MS2.3 Secure Equipment per instruction 3.5 before going under or fouling car and then release the handbrake. Ensure brakes are released.
MS2.4 Visually inspect the following tread brake units for brake shoe clearance greater than listed in the MS Table A.

A. If necessary, measure clearance at top of shoe and at bottom of shoe. Actual clearance will be the average of these two values.

MS TABLE A - MAXIMUM BRAKE SHOE CLEARANCE		
Car Type	**Tread Brake Unit Type**	**Maximum Brake Shoe Clearance**
Amfleet I & II, Viewliner II, Surfliner,1500 Series MHC, and MW 16800 - 16808	Wabtec GB - 4-1/2"	3/4 "
Capitoliner Cab Cars (9600 series).	Wabtec GJ - 5	3/4 "
Horizon, Viewliner I, and Superliner II	KNORR 264 SPF	3/8 "
Superliner I (See instruction MS2.8).	KNORR or SAB	5/8 "

MS2.5 If the tread brake units are in excess of the dimensions listed in MS Table A, perform the following inspection procedure:

A. Inspect brake rigging and handbrake for binding. Confirm loose play of the brake rigging by shaking the handbrake linkage on top of the tread brake unit.

B. This operation is performed using the following wrench/socket sizes as shown in MS Table B.

MS TABLE B - WRENCH / SOCKET SIZES		
Car Type	**Tread Brake Unit Type**	**Wrench / Socket**
Viewliner II	Wabtec GB – 4-1/2"	1 1/2"
Amfleet I & II, Surfliner, 1500 series MHC, MW 16800 - 16808	Wabtec GB – 4-1/2"	1 1/8" & 1 1/2"
Capitoliner Cab Cars (9600 series).	Wabtec GJ - 5	9/16"
Horizon, Viewliner I, Superliner II	KNORR 264 SPF	1 5/8"

C. Rotate the slack adjuster nut clockwise and counterclockwise (You must depress to engage the adjuster nut on GJ-5 tread brake units before rotating the nut).

1. The nut should move freely with no binding. Counterclockwise rotation should move the brake head toward the wheel and clockwise rotation should retract the brake head away from the wheel.

D. Rotate the slack adjuster nut until the brake shoe fully contacts the wheel. Now rotate slack adjuster nut to obtain proper brake shoe clearance as listed in MS Table C.

E. If the slack adjuster nut does not rotate freely or adjustment cannot be made, then the unit is defective. Report defective unit to your supervisor.

MS TABLE C - BRAKE SHOE CLEARANCES		
Car Type	**Tread Brake Unit Type**	**Brake Shoe Clearance**
Amfleet I, II, Viewliner II, Surfliner, 1500 series MHC	Wabtec GB 4 - 4.5"	1 1/2" – 5/8"
Capitoliner Cab Cars (9600 series)	Wabtec GJ - 5	1/2" – 5/8"
Horizon, Viewliner I, Superliner II	KNORR 264 SPF	1/4" – 1/8"

MS2.6 Once the unit is adjusted, apply the brake and ensure effective brake shoe force by shaking the brake head or tapping on the wheel.
MS2.7 Release the brake and ensure brake shoe clearance complies with MS Table C.
MS2.8 Superliner I Knorr and SAB tread brake units do not have manual adjustment nuts. Perform the following procedure:
MS2.8.1 Pry back the brake head.
MS2.8.2 Apply the brakes and ensure effective brake shoe force by shaking the brake head or tapping on the wheel.
MS2.8.3 Release the brakes and inspect brake shoe clearance not to exceed 5/8"maximum.

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MS 3.0 Locomotive Air Brake Pressures

Locomotive Air Brake Pressure Chart		
Independent Brake		**Pressure**
#24 and #26 Brake Equipment with J-1 Relay		45
HHP-8, HST Power Cars,GP Locomotives, DASH-8, Genesis Series, NPCU Cab Car		72
ACS-64, SC-44, ALC-42		70-75
New Acela		
Parking Brake		**Pressure**
DASH-8,P32ACDM		100
Capitoliner Cab Car (9600 Series)		52-56
New Acela		
Service Brake Cylinder		**Pressure**
DASH-8, P32ACDM		58-62
26L and 26LIC Brake Equipment		58-62
HHP-8, HST Power Cars?		58-62
ACS-64,SC-44, ALC-42		62-70
Capitoliner Cab Cars (9600 Series)		36-42
NPCU Cab Cars (“Cabbage Cars”).		46-48
New Acela		
Emergency Brake Cylinder		**Pressure**
DASH-8,P32ACDM Locomotives		88-94
26L Brake Equipment: 110 psi Brake Pipe or 130 – 140 psi Auxiliary reservoir.		88-94
26L Brake Equipment: 90 psi Brake Pipe with Brake Pipe Fed (90 psi) Auxiliary Reservoir.		84-86
26LIC Brake Equipment		72-76
HHP-8 , HST Power Cars?		69-71
ACS-64 ,SC-44, ALC-42		74-82
Capitoliner Cab Cars (9600 Series)		45-50
NPCU Cab Cars (“Cabbage Cars”).		68-70
New Acela		
Safety Valves	**Location**	**Pressure**
Control & Distributing Valves	Control Valve	60
Locomotive Main Reservoir / Tier I Equipment	Under Loco with Main Reservoir piping / Equipment Room	150-155
Locomotive Main Reservoir / Tier II (HST) Equipment	Equipment Room	160
Locomotive Air Compressor Intercooler	On Locomotive Compressor	65
Discharge Pipe (where equipped)	On Locomotive Compressor	185
Dead Engine Feature - Service Portion must *be in Direct Release*		**Pressure Settings**
26L Equipment		25 psi
DASH-8, Genesis		45 psi
HHP-8 and HST Power Cars		45 psi (adjustable).
ACS-64, SC-44, ALC-42		84 psi
Capitoliner Cab Cars (9600 Series)		40 psi
New Acela?		
Location of Dead Engine cutout cocks		
GP-38, DASH-8, NPCU Cab Car, Switcher Type Locomotives are located under the floor of the cab on engineer’s side. Access from outside panel (engineer’s side).		
Genesis Locomotives are located under the floor panel behind the engineer’s seat. Access is through floor or outside panel (engineer’s side).		
ACS-64, SC-44, ALC-42, HHP-8, HST Power Cars, New Acela? and 9600 Series Cab Cars are located in the equipment room on the air rack. **NOTE:** Dead Engine feature on 9600 Series Cab Car is in the air brake enclosure in the coach area.		

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MS 4.0 Passenger Car Air Brake Pressures

MS4.1 Passenger Equipment

NOTE: All pressures listed are for equipment that has been charged to 110 psi.

Passenger Car Air Brake Pressure Chart				
Car Type	**Brake Cylinder: Full Service**	**Brake Cylinder: Emergency**	**#16 Pipe: Full Service**	**#16 Pipe: Emergency**
Amfleet I and II	38-42	48-52	60-65	74-79
Superliner I (Normal)	43-45	61-64	55-57	78-81
Superliner I (Auto Train)	30-34	42-48	55-57	78-81
Superliner II (Normal)	42-46	55-60	55-57	78-81
Superliner II (Auto Train)	28-30	35-39	55-57	78-81
Horizon	40-43	47-52	62-64	75-78
California / Surfliner	71-77	88-94	56-58	44-50
Viewliner I Normal	47-51	58-62	62-64	75-78
Viewliner I (Auto Train)	28-30	33-36	62-64	75-78
Viewliner II	59-65	74-80	60-65	74-79
Venture				
Heritage / 100% Relay	58-62	88-94	58-62	88-94
Heritage / 60% Relay	35-37	53-57	58-62	88-94
Heritage / 80% Relay	46-50	72-74	58-62	88-94
Heritage / 40% Relay	22-25	35-37	58-62	88-94
Material Handling / 1500 or 16800 Series	29-33	35-39	60-65	74-79
Surfliner	44-48	71-77	56-58	88-94

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MS 5.0 Freight Car Air Brake Pressures

MS 5.1 Cars with freight type brake equipment

Freight Car Air Brake Pressure Chart			
Brake Pipe Pressure	**Brake Pipe Pressure Reduction Needed to Achieve a Full Service Brake Application**	**Brake Cylinder Pressure: Full Service**	**Brake Cylinder Pressure: Emergency**
90 psi	26 psi	64 psi	76 psi
100 psi	29 psi	71 psi	84 psi
110 psi	32 psi	78 psi	93 psi

MS 6.0 Mechanical Department Periodic Brake Maintenance Requirements

MS 6.1 Periodic Brake Maintenance Requirements for Equipment in Passenger Service

MS 6.1.1 Single Car Test Requirements

A. A Single Car Brake test may only be performed by a Qualified Maintenance Person (QMP).

B. A Single Car Brake Test is required when any of the conditions listed below are discovered:

1. A car found with one of the following defects:
   - **a.** Build up tread
   - **b.** Slid flat wheel
   - **c.** Thermal crack
   - **d.** Overheated wheel
   - **e.** Shelling

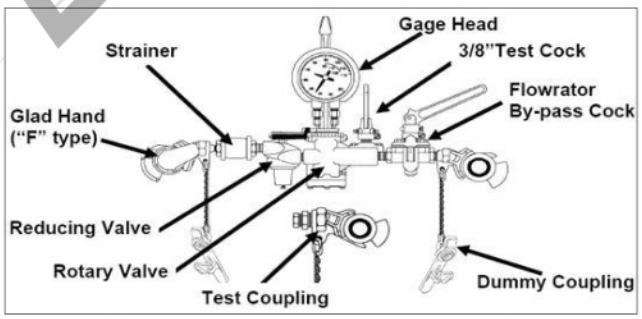
NOTE: A railroad need not perform the single car test required in this paragraph if the wheel defect is other than a built up tread and is due to a cause other than a defective brake system on the car.

2. One or more of the following conventional air brake equipment items is removed, replaced, or repaired.
   - **a.** Service Portion
   - **b.** Pipe Bracket
   - **c.** Emergency Portion or,
   - **d.** Relay Valve
3. A car or vehicle is placed in service after having been out of service for 30 days or more. (Private cars are exempt except for private cars leased by Amtrak).

C. If one or more of the following conventional air brake equipment items is removed, replaced or repaired, only that portion which is renewed or replaced must be tested:

1. Brake Reservoir
2. Brake Cylinder
3. Piston Assembly
4. Vent Valve
5. Quick service valve
6. Brake cylinder release valve
7. Modulating valve or slack adjuster
8. Angle cock or cutout cock

D. If the single car test cannot be made at the point where repairs are made, the car may be moved in passenger service to the next forward location where the test can be made. A railroad may move a car in this fashion only after visually verifying an application and release of the brakes on both sides of the car that was repaired, and provided that the car is appropriately tagged to indicate the need to perform a single car test. The single car test shall be completed prior to, or as a part of, the car's next calendar day mechanical inspection.



Passenger Type Single Car Test Device

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MS 6.1.1 Passenger Service Periodic Brake Equipment Maintenance (CFR 49 Part 238.309 & 229.29)

Passenger Service Periodic Brake Equipment Maintenance Chart	
Passenger coaches and other un-powered vehicles	
AB Type Equipment	2,208 days
26C Type Equipment or equivalent	1,476 days
Equipment other than AB, ABD, ABDW, ABDX, 26C or equivalent systems	1,104 days
Conventional Locomotives	
26L or equivalent systems	1,104 days
26L or equivalent systems equipped with air dryer	1,472 days
Other than 26L or equivalent	736 days
CCBI (Amtrak Owned)	FRA-2005-21613
CCBII (Amtrak Owned)	FRA-2005-21613
HHP-8 Locomotives	FRA-2008-0065
CCB-1 and CCB-2 (except Amtrak locomotives), CCB-26, EPIC 1, EPIC 3102D2, EPIC 2, KB-HS1 and Fast Brake Systems	1,840 days
Cab Cars	
That portion of the brake system that uses brake valves identical to the 26C passenger coach brake system.	1,476 days
That portion of the brake system that uses brake valves identical to the 26L locomotive brake system.	1,104 days
That portion of the brake system that uses brake valves identical to the 26L locomotive brake system and is operated with locomotives equipped with Air Dryers	1,472 days
CCB-1 and CCB-2 (except Amtrak Cab Cars), CCB-26, EPIC 1, EPIC 3102D2, EPIC 2, KB-HS1 and Fast brake systems	1,840 days
CCB-2 (Amtrak Owned)	FRA-2005-21613
All other types of cab car brake valves.	736 days
9644 and 90200 Fast Brake	FRA-2005-21613
MU Locomotives	
Locomotive is part of a fleet that is not 100 percent equipped with air dryers.	736 days
Locomotive is part of a fleet that is 100 percent equipped with air dryers and equipped with PS-68, 26C, 26L, PS-90, CS-1, RT-2, RT-5A, GRB-1, CS-2, or 26R brake systems.	1,104 days
Locomotive is part of a fleet that is 100 percent equipped with air dryers and equipped with KB-HL1, KB-HS1 and KBCT1 brake systems	1,840 days
All other MU locomotives.	736 days

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MS 6.1.2 Records of Periodic Maintenance

A. The date and place of the cleaning, repairing, and testing required by this section shall be recorded on Blue Form/MAP 816 or a similar form developed by the railroad containing the same information, and the person performing the work and that person's supervisor shall sign the form, if possible. Alternatively, the railroad may stencil the vehicle with the date and place of the cleaning, repairing, and testing and maintain an electronic record of the person performing the work and that person's supervisor.

B. A record of the parts of the air brake system that are cleaned, repaired, and tested shall be kept in the railroad's files, the cab of the locomotive, or a designated location in the passenger car until the next such periodic test is performed.

MS 6.2 Periodic Brake Maintenance Requirements for Equipment in Freight or Non Passenger Service

MS 6.2.1 Repair Track Brake Test (CFR 49 Part 232.305)

A. A Repair Track Brake Test may only be performed by a Qualified Person (QP).
B. A Repair Track Air Brake Test is required anytime a car is on a shop or repair track.
C. Any car that fails the repair track brake test must receive a single car test (CFR 49 Part 232.305).
D. Repair Track Test Procedure

NOTE: An approved test device maintained in accordance with CFR 49 Part 232.309 must be used.

1. Apply proper Blue Signal protection.
2. Secure equipment per instruction 3.5.
3. Inspect the following components on the car:
   - **a.** The brake pipe and any other pneumatic trainlines must be securely clamped.
   - **b.** Angle cocks are properly located with suitable clearance and properly positioned to allow maximum airflow.
   - **c.** Valves, reservoirs, and cylinders are tight on supports and securely attached to the car.
   - **d.** Hand brakes are tested, inspected and operate as intended.
   - **e.** Brake indicators on cars so equipped are accurate and operate as intended.
4. Charge air brake system to 90 psi.
5. Release hand brake.
6. Reduce brake pipe pressure 30 psi.
7. Reduction must not result in an emergency brake application. Brake must apply. Inspect car to make sure all brake shoes are firmly seated against their braking surfaces. Brake rigging must not bind or foul.
8. Check piston travel.
   - **a.** Cars with 8.5 inch or 10 inch diameter brake cylinders; piston travel shall be within 6 to 9 inches. If travel is less than 6 inches or more than 9 inches, piston travel must be adjusted to nominally 7.5 inches.
   - **b.** For cars not equipped with 8.5 inch or 10 inch diameter brake cylinders, piston travel must be adjusted to the limits stenciled on the car or badge plate marking.
9. Move test device to “Release” position.
   - **a.** Brake must fully release. There must be adequate clearance between all brake shoes and their braking surfaces. Brake rigging must not bind or foul.

MS 6.2.2 Single Car Brake Test Requirements

A. A Single Car Brake Test may only be performed by a Qualified Person (QP).
B. A single car brake test is required when any of the conditions listed below are discovered:

1. A car is found with one of the following wheel defects:
   - **a.** Thermal cracks
   - **b.** Slid flat wheel (unless known to be caused by hand brake left applied).
   - **c.** Built up tread (unless known to be caused by hand brake left applied).
2. One or more of the following conventional air brake equipment items is removed, repaired, or replaced:
   - **a.** Brake reservoir
   - **b.** Control valve mounting gasket
   - **c.** Pipe bracket stud
   - **d.** Service portion
   - **e.** Emergency portion or;
   - **f.** Pipe bracket
3. A car has its brakes cut out or inoperative when removed from a train or when placed on a shop or repair track.
4. A car is on a shop or repair track for any reason and has not received a single car test within the previous 12-month period.
5. Each car (except for cars subject to paragraph 6) shall receive a single car test no less than every five years.
6. New or rebuilt cars shall receive a single car test no less than eight years from the date the car was built or rebuilt.
7. New or rebuilt cars shall receive a single car test before the car is placed in revenue service.
8. A car is found with missing or incomplete single car test information.

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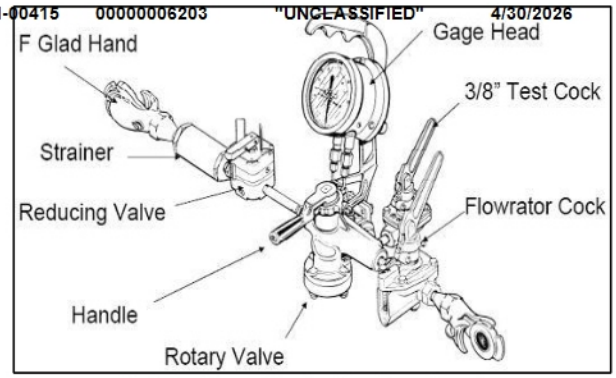

Freight Type Single Car Test Device

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Amtrak Forms		
Form	**Description**	**Example on Page Number**
MAP 100 (NRPC 2947)	Equipment Condition Report	140
MAP 1173/10C Summary (NRPC 3294)	Class I Brake Test and Calendar Day Inspection Report	141 - 142
MAP 21A (NRPC 2775)	Car Defect Report	143
MAP 1171 (NRPC 2949)	Non-Complying Locomotive Tag	144
NRPC 3128	Defective Seats, Doors & Toilets Tag (Out of Service Tag)	144
NRPC 3129	Inoperative Dynamic Brake Tag	144

Other Railroad Forms		
Form	**Description**	**Example on Page Number**
MARC ECR 100	Equipment Condition Report	145
MARC ECR 1173/10C	Class I Brake Test and Calendar Day Inspection Report	146
Metrolink SMP 100	Equipment Condition Report	147
Metrolink SMP 101	Daily Inspection Record	148
Metrolink SMP 130	Non-Complying Locomotive Tag	148
Metrolink SMP 1173	Class I Brake Test and Calendar Day Inspection Report	149
Metrolink SMP 129	Car Defect Report	150
Metrolink SMP 175	Defective Door Tag	150
Metrolink SMP 176	Car Out of Service Tag	150
VIA RAIL 85-J0099 AF (00-05)	Train Safety Inspection Checklist	151 - 152

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MAP 100
Equipment Condition Report

UNIT # _____

Each Locomotive Unit and Cab Car shall be inspected in accordance with 49 CFR Part 229.21, 236.586, and 236.587.

Previous Calendar Day Inspection Location _____ Time Complete ____:____ AM PM Date _____

Daily Mechanical Inspection

Time Complete ____:____ AM PM Date _____ Location _____

QMP/QMI/QP Signature _____ Occupation _____

Locomotive Calendar Day Air Brake Test

F-End ☐ Pass ☐ Fail ☐ N/A R-End ☐ Pass ☐ Fail ☐ N/A ECP ☐ Pass ☐ Fail ☐ N/A

Time Complete ____:____ AM PM Date _____ Location _____

QMP/QMI/QP Signature _____ Occupation _____

TRAIN CONTROL SYSTEMS - Daily Departure Test(s) *inspected in accordance with 49 CFR Part 236.586 & 236.587.*

System	Train Type	Pass	Fail	N/A	Date	Time	Seal Numbers: Penalty Brake Electric C/O Switch	Penalty Brake Pneumatic C/O Cock
ACSES	A B C D E	F-End ☐ R-End ☐	☐ ☐	☐	_____	____:____ AM PM	_____ N/A	_____ N/A
Cab Signal		F-End ☐ R-End ☐	☐ ☐	☐	_____	____:____ AM PM	_____ N/A	_____ N/A
ITCS		☐	☐	☐	_____	____:____ AM PM	_____ N/A	_____ N/A
IITS		☐	☐	☐	_____	____:____ AM PM	_____ N/A	_____ N/A
I-ETMS		☐	☐	☐	_____	____:____ AM PM	_____ N/A	_____ N/A

Seal Numbers

- Overspeed Selector Switch (B C CC D E) _____ N/A
- ATC/IITS Transfer Switch _____ N/A
- Speedometer OS _____ N/A
- Event Recorder _____ N/A
- Amtrak / MNRR _____ N/A
- Mult. Penalty Brake Device _____ N/A
- Speed Control _____ N/A
- Alertor
  - *Electric* _____ N/A
  - *Pneumatic* _____ N/A
- I-ETMS Emergency Brake _____ N/A
- I-ETMS Horn _____ N/A
- Door Bypass
  - *F-end* _____ N/A
  - *R-end* _____ N/A

Time Complete ____:____ AM PM Date _____ Location _____

Signature _____ Occupation _____

Supervisor/QMP Verifying All Work Completed and Approving Unit for Service

Time Complete ____:____ AM PM Date _____ Location _____

Signature _____ Occupation _____

The Daily Mechanical Inspection, Locomotive Calendar Day Air Brake Test, and Train Control Systems Daily Departure Tests are not considered complete until the supervisor/QMP approves and signs this form. This timestamp will start the clock for the locomotive's mechanical inspections.

Failure En Route / Equipment Condition		Engineer Initials	Repaired By
Train Controls Cut Out ☐ ☐ Temporary Failure Operating Exception			

Locomotive Engineer Signature	Location	Date	Time	Locomotive Engineer Signature	Location	Date	Time
			____:____ AM PM				____:____ AM PM
			____:____ AM PM				____:____ AM PM
			____:____ AM PM				____:____ AM PM
			____:____ AM PM				____:____ AM PM

INSTRUCTIONS: *Complete form and obtain signatures. Use reverse side for additional comments or details. Use separate form for each unit in consist. Original is to be retained in the locomotive's cab and a Copy is to be retained at the location performing the inspection.*

NOTE: *Locomotive can be on either a 92-day or 184-day periodic inspection schedule. Units on 184-day inspection schedule require a Daily Inspection by a Qualified Mechanical Inspector (QMI) at least once every 33 days. Locomotives on 92-day inspection schedule do not require QMI inspections.*

NRPC 2947 (04/2019)

AMTRAK is a registered service mark of the National Railroad Passenger Corporation.

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Amtrak MAP 100 (NRPC Form 2947)

AMTRAK

MAP 1173/10C Summary
Equipment Condition Report
Mechanical – Page 1

Powering Loco # _____ *Equipment noted on this form has received a daily inspection in accordance with 49 CFR 238.303 & 306.*

MAP 1173 - Class I Train Brake Test/Lite Locomotive Consist Brake Test

Additional Loco and Cab Car #s _____ Number of Cars, (Including Cab Cars) ____

End of Train Device ☐ N/A
EOTD # _____
Time ____:____ ○AM ○PM
Location _____

Select Volume Position ☐ Cut In ☐ Cut Out ☐ N/A

Communication Signal ☐ Operative ☐ Inoperative

Train Set For ☐ Graduated ☐ Direct ☐ ECP

Lite Loco Move per AMT-3 2.16 ☐

Date _____ Time ____:____ ○AM ○PM Location _____ Signature _____

10C Summary - Passenger Car Daily Inspection

Inspector Signature	Occupation	Date	Time	Interior	Exterior	Location
			AM PM	☐	☐	
			AM PM	☐	☐	
			AM PM	☐	☐	
			AM PM	☐	☐	
			AM PM	☐	☐	

List of equipment WITHOUT Operating Restrictions (Include Cab Cars)

List of equipment WITH Operating Restrictions (Include Cab Cars)

Loco/Car #	Defect(s)	Repairs Made	Date Repaired	Signature

NOTE: *Add detailed description of defects and locations of defects.*

Examples:	*E/S Side Loading Door* -Won't open or close -Blocked close	*A-end F/S Door* - Won't open or close -Broken	*PA/Intercom System* - Inoperative - Too loud/soft	*Air Compressor* -Inoperative -Low Air Pressure	*Dynamic Brake* - Inoperative - Cutout

Supervisor/QMP Verifying All Work Completed and Approving Unit for Service

Time Completed ____:____ ○AM ○PM Date _____ Location _____

Signature _____ Occupation _____

NOTE: *The Class I Train Brake Test and Passenger Car Interior and Exterior Daily Inspections are not considered complete until the supervisor/QMP approves and signs this form. This timestamp will start the clock for the cars' mechanical inspections and the Class I Train Brake Test.*

FRA Rule 238 requires that inoperative side doors, end doors, PA/intercom systems, air compressors, & dynamic brakes be reported in writing to the train's crew. This form, MAP1173/10C Summary, NRPC 3294 serves as written notification.

NRPC 3294 (Rev. 06/2018) AMTRAK is a registered service mark of the National Railroad Passenger Corporation. Page 1

DRAFT

Amtrak MAP 1173/10C Summary (NRPC Form 3294) (Front)

AMTRAK

MAP 1173/10C Summary
Equipment Condition Report
Transportation – Page 2

Class I Brake Test/Lite Locomotive Consist Brake Test *Equipment noted on this form has been tested in accordance with AMT-3 Instructions 2.16, P4.2.1, or NP4.2.1*

Loco/ Cab Car #	Date	Time		# of Cars	Condition of Brakes Acceptable	Condition of Brakes Unacceptable	Communication Signal Operative	Communication Signal Inoperative	Engineer Signature
			AM PM		☐	☐	☐	☐	
			AM PM		☐	☐	☐	☐	
			AM PM		☐	☐	☐	☐	
			AM PM		☐	☐	☐	☐	
			AM PM		☐	☐	☐	☐	
			AM PM		☐	☐	☐	☐	
			AM PM		☐	☐	☐	☐	
			AM PM		☐	☐	☐	☐	

Condition En Route

Defect(s)	Engineer's Initials

NOTE: *Add detailed description of defects and locations. (Examples: A-end F/S door will not open; F-end Door will not close; PA inoperative; PA too loud).*

DRAFT

FRA Rule 238 requires that inoperative side doors, end doors, PA/intercom systems, air compressors, & dynamic brakes be reported in writing to the train's crew. This form, MAP1173/10C Summary, NRPC 3294 serves as written notification.

NRPC 3294 (Rev. 06/2018) AMTRAK is a registered service mark of the National Railroad Passenger Corporation. Page 2

Amtrak MAP 1173/10C Summary (NRPC Form 3294) (Back)

AMTRAK

G

MAP 21A **Unit No.** _____ **Dispatched as Train No.**_____

Inbound Train #	Date	Defect Description	Action Taken	By (Initials)	WMS W.O. #	LOC	Part Number

White – Retained at Facility Completing Repair **Yellow** – Conductor **Pink** – Retain in Book

NRPC 2775 (05/03)

Amtrak is a registered service mark of the National Railroad Passenger Corporation.

DRAFT

Amtrak MAP 21A (NRPC 2775) (Front)

Unit No. _____

	Date And Location	Date And Location	Date And Location	Date And Location	Date And Location	Date And Location	Date And Location	Date And Location	Date And Location
Last Filter Change	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___
Last Filter Change	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___
Last PM	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___	__/__/___

Amtrak MAP 21A (NRPC 2775) (Back)

MAP 1171

AMTRAK

Non-Complying Locomotive

FRA Rule 229.009

Locomotive Number: _____ Date: _____

Inspecting Carrier: _____

Inspection Location: _____

Defects: _____

_____

Movement Restrictions: _____

_____

Destination: _____

Signature: _____

Notify the CNOC Mechanical Desk @ ATS 734-2082 or Commercial 302-683-2082

NRPC 2949 (02/05) **Top Copy** – Engineer **Second Copy** - File **Tag** - Stays with Locomotive

Amtrak is a registered service mark of the National Railroad Passenger Corporation.

Amtrak MAP 1171 (NRPC 2949)

Amtrak

OUT OF SERVICE

Do not use!

Date: / /	Location:
Time: : ☐ AM ☐ PM	Train:

NRPC 3128

Amtrak Out of Service Tag (NRPC 3128)

Amtrak **INOPERATIVE DYNAMIC BRAKES**

Locomotive Number: _____

Inspecting Carrier: _____

Inspection Location: _____

Shall be repaired in three calendar days

Signature:	Date: / /

NRPC 3129

Amtrak Inoperative Dynamic Brake Tag (NRPC 3129)

DRAFT

MARC

Use Separate Report for Each Locomotive in Consist.
LOCOMOTIVE NUMBER:

Locomotive Calendar Day Inspection ECR 100

Locomotive Calendar Day Mechanical Inspection

Daily Inspection has been satisfactorily completed as required by **49CFR§229.21**

Signature of Employee Performing **Calendar Day Mechanical** Inspection	Occupation	Location	Date (MM/DD/YY)	Time (HHMM)

Locomotive Air Brake Departure Test

Locomotive Departure Test has been satisfactorily completed

Signature of Employee Performing **Locomotive Air Brake Departure** Test	Occupation	Location	Date (MM/DD/YY)	Time (HHMM)

SEAL NUMBERS

ATC Pneumatic		ATC Electric	
I-ETMS / ACSES Pneumatic		I-ETMS/ ACSES Electric	
Overspeed Pneumatic		PTC Horn	
Alerter Pneumatic		Alerter Electric	
Door Override Switch		Speedometer	

Cab Signal / PTC Daily or After Trip Test

Cab Signal / Positive Train Control Test has been satisfactorily completed as required by **49CFR§236.586**

Cab Signal Daily or After Trip Test:	**I-ETMS** Daily or After Trip Test:	**ACSES** Daily or After Trip Test:
☐ PASS ☐ FAIL	☐ PASS ☐ FAIL ☐ N/A	☐ PASS ☐ FAIL ☐ N/A

Signature of Employee Performing **Daily or After Trip** Tests	Occupation	Location	Date (MM/DD/YY)	Time (HHMM)

Condition of Equipment – To be completed by Engineer

Speed Indicator:	Radio:	Cab Signals:	Brake Pipe Pressure: PSI
HEP:	Sanders:	Speed Control:	
Dynamic / Blended Brake:	Crossing Bell:	Deadman / Alerter:	Main Reservoir Pressure: PSI
Brakes & Rigging:	Horn:	Wipers:	

EDR – Equipment Defect Report

The Vehicles listed below have the following defects and **May Cause Operating Restrictions**, continue listings on back of this form if more entries are required.

Prime Systems

- ATC/PTC/EVENT REC.	- CAR DOOR SYSTEM	- COUPLER/DRAFT	- HVAC	- LIGHTING	- PRIME MOVER
- CAB EQUIPMENT	- COMMUNICATIONS	- ELECTRICAL	- INTERIOR FURNISH	- MICROPROCESSOR	- TRUCK/SUSPENSION
- CARBODY	- COMPRESSED AIR	- HEAD END POWER	- LAYOVER	- PROPULSION / DYN.BRAKE	- WATER AND WASTE

Prime System	Defect Description	Reported By	Repaired By

The above work has been performed, except as noted, the report is approved and the locomotive is available for service

Signature of Locomotive Engineer	Location	Date	Time

White Copy – Retain in Cab

Yellow Copy – Retain in Location Performing the Inspection

Copy must be retained for a minimum of one year

ECR-100

DRAFT

MARC ECR 100

MARC

Class I Brake Test and Calendar Day Inspection
ECR 1173/10C

ECR 1173 – Class I Brake Test

Class I Brake Test has been satisfactorily completed as required by **49CFR§238.313** or Initial Terminal Test required by **49CFR§232.205**

Controlling Locomotive#	Loco#	Loco#	Cab Car#	Number of Cars

Train set for: Graduated Release ☐ Direct Release ☐ Communication Signal: ☐ Operative ☐ Inoperative

Signature of Employee Performing **Class I Brake** Test	Location	Date (MM/DD/YY)	Time (HHMM)

Class I Brake Test – Additional Inspection has been satisfactorily completed as required by **49CFR§238.313(j)**. This portion need only be filled out if the Additional (5 day) Inspection was performed, otherwise it should be left blank.

Signature of Employee Performing **Class I Brake – Additional Inspection**	Location	Date (MM/DD/YY)	Time (HHMM)

Condition of Equipment – To be completed by Engineer

Loco / Cab Car #	Date (MM/DD/YY)	Time (HHMM)	Number of Cars	Condition of Brakes	Communication Signal	Engineer's Signature
				☐ ACCEPTABLE ☐ UNACCEPTABLE	☐ OPERATIVE ☐ INOPERATIVE	
				☐ ACCEPTABLE ☐ UNACCEPTABLE	☐ OPERATIVE ☐ INOPERATIVE	
				☐ ACCEPTABLE ☐ UNACCEPTABLE	☐ OPERATIVE ☐ INOPERATIVE	
				☐ ACCEPTABLE ☐ UNACCEPTABLE	☐ OPERATIVE ☐ INOPERATIVE	

ECR 10C Summary – Passenger Car Calendar Day Inspection

Following Vehicle(s) has received an **Interior and Exterior Calendar Day Mechanical Inspection** as required by **49CFR§238.303** and **238.305**.

Car #	Car #	Car #	Car #	Car #	Car #	Car #	Car #	Car #	Car #

	Location	Date (MM/DD/YY)	Time (HHMM)
Interior Calendar Day Inspection			
Exterior Calendar Day Inspection			

Inspector: I / E	Inspectors Signature	Inspector: I / E	Inspectors Signature
Inspector: I / E	Inspectors Signature	Inspector: I / E	Inspectors Signature

Following Vehicle(s) were added after departing the consists originating terminal per **49CFR§238.303(b)(1)** and **238.305**

Car #	Location of Insp	Date	Time	Inspection Type	Car #	Location of Insp	Date	Time	Inspection Type
				I / E / C-1 / A-I					I / E / C-1 / A-I
				I / E / C-1 / A-I					I / E / C-1 / A-I
				I / E / C-1 / A-I					I / E / C-1 / A-I
				I / E / C-1 / A-I					I / E / C-1 / A-I

Location Vehicles were Added	Number of Cars in Train	Validated By

Vehicle(s) above **Have No Operating Restrictions**

I = Interior Inspection (QP) **E = Exterior Inspection (QMP)** **C-1 = Class I Brake Test (QMP)** **A-I Additional Inspection (QMP)**

EDR - EQUIPMENT DEFECT REPORT

The Vehicles listed below have the following defects and **May Cause Operating Restrictions**, continue listings on back of this form if more entries are required.

Prime Systems

- ATC/PTC/EVENT REC.	- CAR DOOR SYSTEM	- COUPLER/DRAFT	- HVAC	- LIGHTING	- PRIME MOVER
- CAB EQUIPMENT	- COMMUNICATIONS	- ELECTRICAL	- INTERIOR FURNISH	- MICROPROCESSOR	- TRUCK/SUSPENSION
- CARBODY	- COMPRESSED AIR	- HEAD END POWER	- LAYOVER	- PROPULSION / DYN.BRAKE	- WATER AND WASTE

Vehicle #	Prime System	Description of Defects	Reported By	Repaired By

White Copy – Retain in Cab Yellow / Pink Copy – Retain in Location Performing the Inspection

Copy must be retained for a minimum of one year

ECR-1173/10C

DRAFT

MARC ECR 1173/10C

Southern California Regional Rail Authority

Equipment Condition Report

SMP 100

LOCOMOTIVE NUMBER: SCAX-_____ POSITION IN CONSIST: ☐ LEAD ☐ TRAIL DATE: _____

USE SEPARATE REPORT FOR EACH UNIT IN CONSIST.

CONDITION OF EQUIPMENT

SPEED INDICATOR _____ CROSSING BELL _____

HEP _____ HORN _____

DYNAMIC BRAKES _____ ATS _____

BRAKES & RIGGING _____ ALERTOR _____

RADIO _____ WIPERS _____

SANDERS _____ MAIN RESERVOIR PRESSURE _____ PSI

BRAKE PIPE PRESSURE _____ PSI

IN ROUTE FAILURES	ENGR. INT.	REPAIRED BY

TO BE COMPLETED AND SIGNED BY INBOUND ENGINEER

LOCOMOTIVE OR CAB CAR NO.	DATE	TIME	NO.of CARS	CONDITION OF BRAKES	ENGINEERS SIGNATURE
				☐ ACCEPTABLE ☐ UNACCEPTABLE	
				☐ ACCEPTABLE ☐ UNACCEPTABLE	
				☐ ACCEPTABLE ☐ UNACCEPTABLE	
				☐ ACCEPTABLE ☐ UNACCEPTABLE	
				☐ ACCEPTABLE ☐ UNACCEPTABLE	

SIGNATURE OF LOCOMOTIVE ENGINEER	LOCATION	DATE	TIME

USE REVERSE SIDE FOR ADDITIONAL COMMENTS OR DETAILS

ORIG. - MECHANICAL MAINTENANCE FACILITY/COPY - RETAINED AT ENGINES INITIAL TERMINAL

DRAFT

Metrolink SMP 100

BOMBARDIER *TRANSPORTATION*

BOMBARDIER MASS TRANSIT
FRA RULE NO. 229 INSPECTION RECORD
SERVICE OPERATION

SMP 101
REV. 7/98

Unit No. _____

DATE	TIME	LOCATION	DATE	TIME	LOCATION	DATE	TIME	LOCATION	DATE	TIME	LOCATION
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
	M			M			M			M	
DIESEL LOCOMOTIVES TAKE ENGINE LUBE OIL SAMPLE EVERY 15 DAYS DATE _____ LOCATION _____			DIESEL LOCOMOTIVES TAKE ENGINE LUBE OIL SAMPLE EVERY 15 DAYS DATE _____ LOCATION _____			DIESEL LOCOMOTIVES TAKE ENGINE LUBE OIL SAMPLE EVERY 15 DAYS AND GEARBOX AND AIR COMPRESSOR AT 45th DAY DATE _____ LOCATION _____			DIESEL LOCOMOTIVES TAKE ENGINE LUBE OIL SAMPLE EVERY 15 DAYS DATE _____ LOCATION _____		

THIS RECORD CARD TO BE CARRIED IN LOCOMOTIVE

Metrolink SMP 101

DRAFT

METROLINK

SMP130

NON-COMPLYING LOCOMOTIVE

Locomotive Number _____

Inspecting Carrier _____

Inspection Location _____ Date _____

Defects (s) _____

_____

Movement Restrictions _____

_____

Destination _____

Signature _____

Original - Engineer; 1st Copy - File; Hard Copy - Locomotive FRA Rule 229.9

Metrolink SMP 130

Southern California Regional Rail Authority

SMP 1173

Class 1 Brake Test and Inspection Certificate

LOCOMOTIVE NUMBER: SCAX- _____ POSITION IN CONSIST: ☐ LEAD ☐ TRAIL DATE: _____

USE SEPARATE REPORT FOR EACH UNIT IN CONSIST.

Each locomotive unit shall be inspected in accordance with CFR title 49 parts 229.21 and 236.587.
Cab Card SMP 101 must be signed.

EMPLOYEE MAKING DAILY INSPECTION	EMPLOYEE #	OCCUPATION	PLACE	DATE	TIME

CLASS 1 BRAKE TEST

Class 1 Brake Test has been satisfactorily performed as required by CFR 49 Part 238.313 or 232.12 for freight/work trains

EMPLOYEE PERFORMING TEST	EMPLOYEE #	OCCUPATION	PLACE	DATE	TIME

LOCO#	LOCO#	LOCO#	CAB CAR#	NUMBER OF CARS

EXTERIOR & INTERIOR INSPECTION

Following equipment has received an Exterior and Interior Calendar Day Mechanical Inspection as required by CFR 49 Part 238.303 and 238.305.

CAR#	CAR#	CAR#	CAR#	CAR#	CAR#	CAR#

EMPLOYEE PERFORMING EXTERIOR INSPECTION	EMPLOYEE #	OCCUPATION	PLACE	DATE	TIME

EMPLOYEE PERFORMING INTERIOR INSPECTION	EMPLOYEE #	OCCUPATION	PLACE	DATE	TIME

COMMUNICATIONS SYSTEM: ☐ OPERATIVE ☐ INOPERATIVE TRAIN SET FOR: ☐ GRADUATED RELEASE ☐ DIRECT RELEASE

CLASS 1A. BRAKE TEST

Class 1A Brake Test has been satisfactorily performed as required by CFR 49 Part 238.315

EMPLOYEE PERFORMING TEST	EMPLOYEE #	OCCUPATION	PLACE	DATE	TIME

ATS DEPARTURE TEST

EMPLOYEE PERFORMING TEST	EMPLOYEE #	OCCUPATION	PLACE	DATE	TIME

ATS DEPARTURE TEST

EMPLOYEE PERFORMING TEST	EMPLOYEE #	OCCUPATION	PLACE	DATE	TIME

PTC DEPARTURE TEST

EMPLOYEE PERFORMING TEST	EMPLOYEE #	OCCUPATION	PLACE	DATE	TIME

SEAL NUMBERS

ATS _____ EVENT RECORDER _____

ALERTOR _____ SPEEDOMETER OVERSPEED _____

PTC PNEUMATIC PENALTY _____ DOOR OVERRIDE _____

PTC EMERGENCY _____ ZERO SPEED _____

PTC PENALTY _____ HORN _____

PTC HORN _____

DRAFT

Metrolink SMP 1173

CAR MAINTENANCE TASKS

METROLINK

133975

Car Number

Date	Train Number	Task (Defect)	Corrective Action	Employee Signature

Report all Defects and Corrective Action on SMP Form 101

SMP FORM 129

Metrolink SMP 129

DRAFT

TO EXPOSE ADHESIVE REMOVE LINER

DOOR
OUT OF SERVICE

PUERTA
FUERA DE SERVICIO

SMP 175

Metrolink SMP 175

TO EXPOSE ADHESIVE REMOVE LINER

CAR OUT OF SERVICE
DO NOT OCCUPY
FOR EMERGENCY EXIT ONLY

VEHICULO FUERA DE SERVICIO
FAVOR DE NO OCUPAR
PARA SALIDA DE EMERGENCIA SOLAMENTE

SMP 176

Metrolink SMP 176

VIA Rail Canada

TRAIN SAFETY INSPECTION CHECK LIST
INSPECTION DE SÉCURITÉ PRÉ-USAGE DU TRAIN

DATE:											
TIME/*HEURE*											
TRAIN #:											
LOCATION:											

This completed form confirms that all safety items below have been inspected and tested in accordance with the passenger car and locomotive safety and brakes rules from Transport Canada* and also from Via rail inspection standards.

Le présent imprimé dûment rempli atteste que tous les éléments de sécurité ci-dessous fûrent vérifiés selon les règlements relatif à l'inspection de sécurité et essai de frein à air des voitures passager et des locomotives venant de Transport Canada ainsi que les normes d'inspection de Via rail.*

Upper deck inspection/*Inspection du haut*

Governor oil level *Niveau d'huile du régulateur*											
Water level *Niveau d'eau*											
Check all oil levels *Vérifier tout les niveaux d'huiles*											
RSC (reset safety control) DSEM											
Dynamic brake seal *Scellés du frein rhéostatique*											
Traction motor seal *Scellés du moteur de traction*											
Ground relay seal *Scellés du relais de masse*											
Annun. panel & status board *Panneau d'alarme & indication d'état*											
Radio test *Essai radio* *											
Bell - horn *Cloche & avertisseur* *											
Headlights & ditchlight *Phares avant et latérales* *											
Event recorder *Enregistreur d'événement* *											
Hot bearing detec. system *Syst. de boîte chaude* *											
Banking system ☐ *Oper.* ☐ *Inoper.* *Système d'inclinaison*											
Doors *Portes* *											
Stretcher *Civière* *											
Fire extinguishers *Extincteurs* *											
First aid kit *Trousse de premiers soins* *											
Trauma kit/Megaphone *Trousse d'urgence* *											
Tool box *Coffre à outils* *											
Infrared Thermometer *Thermomètre infrarouge*											

Brake inspection/*Inspection des freins*

Hand brake *Frein à main* *											
#3 Brake test *Essai de frein #3* *											
#2 Brake test *Essai de frein #2* *											
#1A Brake test *Essai de frein #1A* *											
#1 Brake test *Essai de frein #1* *											
#1 Brake test locomotive *Essai de frein #1 locomotive* *											

Bottom deck inspection/*Inspection de la sous caisse*

Trucks & wheels car *Bogies et roues voiture* *											
Trucks & wheels locomotive *Bogies et roues locomotive* *											
Car body *Caisse de la voiture* *											
Couplers and safety pins *Attelages et goupilles* *											
Fuel level *Niveau carburant*											
Safety appliance *Dispositif de sécurité* *											

85-J0099 AF (00-05)

DRAFT

VIA RAIL 85-J0099 AF (00-05) Front Page

TRAIN CONSIST IN ACCORDANCE WITH THE PASSENGER CARS AND LOCOMOTIVE SAFETY INSPECTION AND BRAKE RULES
CONSISTE DU TRAIN EN CONFORMITÉ AVEC L'INSPECTION DE SÉCURITÉ ET ESSAI DE FREIN À AIR DES VOITURES VOYAGEURS ET LOCOMOTIVE.

ORIGINAL CONSIST *CONSISTE ORIGINAL*	SETOFF EQUIP. *ÉQUIP. ENLEVÉ*	ADDED EQUIP. *ÉQUIP. AJOUTÉ*	LOCATION *LOCATION*	REMARKS / *REMARQUES*

REMARKS / *REMARQUES*

DRAFT

"certified car inspector" means a person who is trained and qualified to perform safety inspections of passenger cars pursuant to subsection 6.1;

"qualified person" means, in respect of a specified duty, a person who, because of his/her knowledge, training and experience is qualified to perform that duty safely and properly;

«inspecteur de wagons autorisé» désigne une personne qui a reçu la formation nécessaire et qui est qualifiée pour faire les inspections de sécurité des voitures voyageurs conformément à l'article 6.1 ;

«personne qualifiée» désigne, par rapport à une tâche précise, une personne qui, grâce aux connaissances, à la formation et à l'expérience qu'elle possède, est qualifiée pour exécuter la tâche correctement et de façon sécuritaire ;

TRAIN CREW / *PERSONNEL DE CONDUITE*

VIA RAIL 85-J0099 AF (00-05) Back Page

TIME PER MILE		SPEED MPH	TIME PER MILE		SPEED MPH
MINS	SECS		MINS	SECS	
0	22.5	160	0	48.0	75
0	23.2	155	0	51.1	70
0	24.0	150	0	55	65
0	24.8	145	1	00	60
0	25.7	140	1	5.5	55
0	26.6	135	1	12	50
0	28.8	125	1	20	45
0	30.0	120	1	30	40
0	31.3	115	1	43	35
0	32.8	110	2	00	30
0	34.3	105	2	24	25
0	36.0	100	3	00	20
0	37.9	95	4	00	15
0	40.0	90	6	00	10
0	42.4	85	12	00	5
0	45	80			

DRAFT

0

1

2

3

4

5

6

7

8

DRAFT

*Ruler is for quick reference only

C	D-65-7449
REV.	DRAWING NUMBER

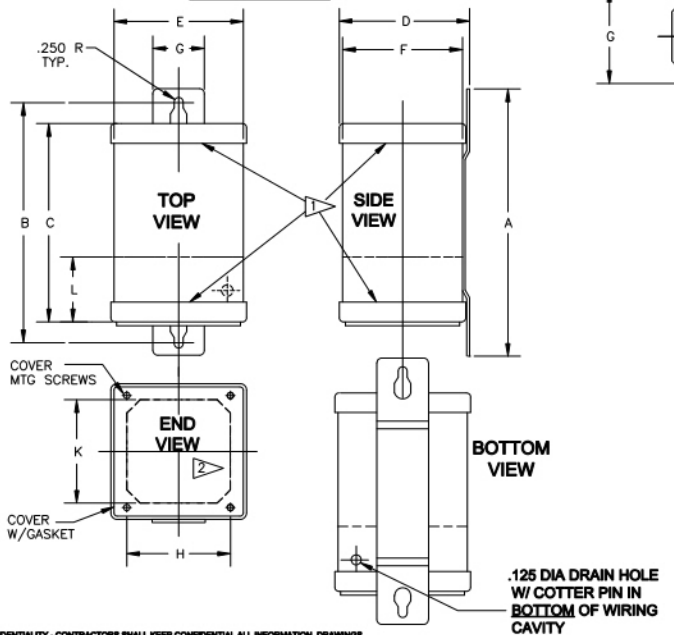
TRANSFORMER DATA TABULATION

ITEM NO	KVA	V PRIM	V SEC	IMP % (TYP) @100°C	TEMP CLASS °C (MIN)	USED ON ①	F.G. NO
1	1.5	480	240	3.7	80	AMF	1
2	2.0	480	240	3.42	80	AMF	
3	2.0	480	120	3.42	80	AMF	
6	5.0	480	120	2.31	80	HEP	2
7	10.0	480	240	1.41	80	HEP	
8	10.0	480	120	1.41	80	AMF	
9	15.0	480	240x120	②1.85	115	HEP	
10	25.0	480	120	②1.65	115	HEP	

① AMF = AMFLEET CARS
HEP = HERITAGE CARS

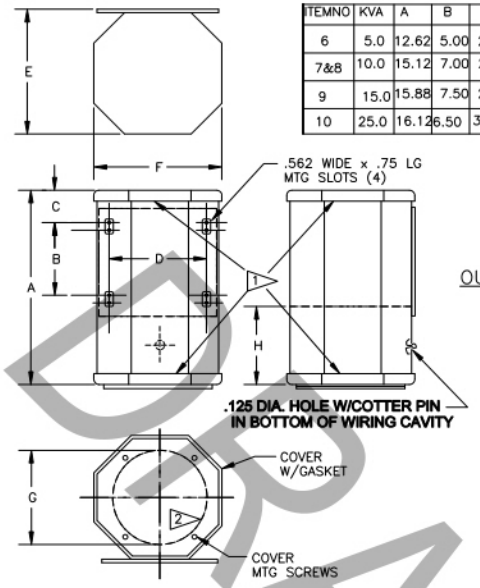
② MEASURED @ 135°C

OUTLINE FIG.1



ITEM	1	2, 3
KVA	1.5	2.0
A	12	13
B	10.75	11.75
C	8.81	9.81
D	6.12	6.12
E	6.25	6.25
F	5.75	5.75
G	2.50	2.50
H	5.00	5.00
K	4.25	4.25
L**	2.50	2.50

** = DEPTH OF WIRING SPACE (MIN)



OUTLINE FIG. 2

ITEMNO	KVA	A	B	C	D	E	F	G	H *
6	5.0	12.62	5.00	2.19	7.50	9.00	9.44	6.00	5.00
7&8	10.0	15.12	7.00	2.50	10.12	10.62	12.06	8.00	5.50
9	15.0	15.88	7.50	2.50	10.12	10.62	12.06	8.00	6.00
10	25.0	16.12	6.50	3.00	13.25	13.75	15.25	10.00	6.00

*= DEPTH OF WIRING SPACE(MIN)

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
A	-	ITEM 3 XFMR DATA TAB WAS HEP	5/13/88	5/13/88
B		ADDED VENDOR PART NO. ITEM 9 WAS 240/120. #9 WAS 24 952 68007.	9/16/92	R. BRUSS 9/16/92
C		ADDED MORE VIEWS. CHANGED VENDOR NAME. ADDED METAL GAUGES. MORE INFO ABOUT DRAIN HOLE. CHANGED RADIUS OF HOLE IN MOUNTING FOOT.	3/12/10	M. DEL. 3/19/10

NOTES:

1. CAP TO BE SEALED WATERPROOF ALL AROUND
2. GASKET TO BE GLUED TO BACK OF COVER
3. TRANSFORMER TO BE EMBEDDED IN EPOXY RESIN AND SAND MIXTURE, MECHANICAL AND ELECTRICAL CONSTRUCTION OF ASSEMBLY SUITABLE FOR EXTERIOR APPLICATION TO UNDER CAR STRUCTURE OF RAILCAR PER AMTRAK SPECIFICATION NO,429: ELECTRICAL & ELECTROMECHANICAL OPERATING ENVIRONMENT
4. "NAMEPLATE" (MECHANICALLY FASTENED TO FRONT OF COVER) MUST CONTAIN THE FOLLOWING AS A MIN:
   MANUFACTURER
   MANUFACTURER'S PART NO.&DATE OF MFG
   NOM KVA RATING
   PRIMARY & SECONDARY NOMINAL VOLTAGE & FREQUENCY
   INSULATION CLASS
   COIL/CONNECTION DIAGRAM
   AMTRAK PART NO.
5. TRANSFORMER CONNECTIONS: THREADED STUD OR WIRE PIGTAIL TYPE TO BE LABELED PER NAMEPLATE DIAGRAM
6. HI POT TEST: 4 KV PRIMARY TO SECONDARY & GROUND
7. DRAIN HOLE ON BOTTOM OF XFMR. SAME SIDE AS MOUNTING FEET.
8. FOR ITEMS 1, 2, & 3 MOUNTING FOOT 12 GA. STL. BODY & COVER 16 GA. STL.

QTY	PART NUMBER	DESCRIPTION	GALAXY TRANSFORMER MFG/SPEC	OLSUN ELECTRICS MFG/SPEC	AAMPS NUMBER	ITEM
	-10	TRANSFORMER, 25.0KVA, 120V	BX-9757	GS 14194	25 951 45022	10
	-9	TRANSFORMER, 15.0KVA, 240/120V	BX-9756	GS 14195	24 952 62852	9
	-8	TRANSFORMER, 10.0KVA, 120V	BX-9755	GS 13645	25 951 02565	8
	-7	TRANSFORMER, 10.0KVA, 240V	BX-9754	GS 14196	24 952 62801	7
	-6	TRANSFORMER, 5.0KVA, 120V	BX-9719	GS 12019	25 951 45100	6
	-3	TRANSFORMER, 2.0KVA, 120V	BX-9752	GS 15437	25 951 02418	3
	-2	TRANSFORMER, 2.0KVA, 240V	BX-9751	GS 12600	24 952 76111	2
	-1	TRANSFORMER, 1.5KVA, 240V	BX-9750	GS 12599	25 951 02717	1

LIST OF MATERIAL

PROGRAM	NEXT ASS'Y	USED ON
		SUPERLINER
		AMFLEET
		HERITAGE

REFERENCE DRAWINGS

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

DO NOT SCALE DRAWING

TOLERANCES

Remove all burrs & break sharp edges.

AMTRAK

Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
400 Market Ave. West, Suite 300

TITLE: TRANSFORMER ENCAPSULATED, 1-PHASE EXTERIOR UNDERCAR

Drawn G.A. Date 3-10-88 Approved
Checked Date 3-10-88 Approved For Issue G. W.

Scale NONE DRAWING NUMBER D-65-7449 REV. C

SHT. 1 OF 1

D-65-7449_rB.dwg

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DRAFT

26-FOI-00415 0000006206 "UNCLASSIFIED" 4/30/2026

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27 POINT COMMUNICATION FUNCTION CHART

PIN#	WIRE DESIGNATION	WIRE GAUGE	FUNCTION NAME	VOLTAGE RANGE (VDC)	FUNCTION	CURRENT REQUIRED (MA)
1	SHLD		SHIELD (COMMON)	NA	NA	XX
2	TB−	10	BATTERY NEGATIVE ④	0	COMMON	XX
3	PA1 ①	14]	PA/TAPE MUSIC−1 (BLK) ③	0dB*	A	XX
4	PA2 ①	14]	PA/TAPE MUSIC−1 (WHT) ③		A	XX
5	PA3	14]	INTERCOM (BLK)	0dB*	A	XX
6	PA4	14]	INTERCOM (WHT)		A	XX
7	PA5	14]	PA CONTROL (BLK)	±13] ②	C	XX
8	PA6	14]	PA CONTROL (WHT)	±13] ②	C	XX
9	RA1	14]	MUSIC−3 (RADIO) (BLK)	0dB*	A	XX
10	RA2	14]	MUSIC−3 (RADIO) (WHT)		A	XX
11	EP1	12	BRAKE APPLICATION (SPARE)	■ 74	C	XX
12	EP2	12	BRAKE RELEASE (SPARE)	■ 74	C	XX
13	EP3	12	BRAKE NEGATIVE (SPARE)	■ 0	COMMON	XX
14	D1	12	OPEN DOORS RH	74**	C	XX
15	D2	12	OPEN DOORS LH	74**	C	XX
16	D3	12	CLOSE DOORS RH	74**	C	XX
17	D4	12	CLOSE DOORS LH	74**	C	XX
18	DC1	12	DOOR CLOSED LT	74	I	XX
19	BR	12	BRAKE RELEASED LT	74	I	XX
20	BA	12	BRAKE APPLIED LT	74	I	XX
21	HJ	12	HOT JOURNAL LT	74	I	XX
22	CS	12	CONDUCTOR SIGNAL	74	C	XX
23	DC2	12	DOOR CLOSE LT	74	I	XX
24	PA7	14]	TAPE−MUSIC 2	0dB*	A	XX
25	PA8	14]	TAPE−MUSIC 2		A	XX
26	BLS	12	CONDUCTOR DOOR LT FEED	74	I	XX
27	AN	12	ATTENDANT CALL	74	C	XX

REVISION			
LTR	DESCRIPTION	DATE	APP'D
A	ADDED SHEET #1;SEE SHEET #2 FOR OTHER REVISIONS.	7−18−96	
B	PIN# 3 & 4 WAS "PA/TYPE−−−−" PIN# 26 WAS "CONDUCTOR DOOR CLOSED LT"	6−24−99	
C	ADDED NOTE 1&3 FLAG TO PINS 3&4, REVISED NOTE "ALL SIGNALS ARE OFF−ON" WAS "ON−OFF" ADDED NOTE 5	3−16−00	

NOTES :

① SHIELD COMMON FOR ALL 5 SHIELDED PAIRS 1−POINT GROUND TO CARBODY; SHIELD IS CONTINUOUS OVER LENGTH OF LOCOMOTIVE / CAR.

② DERIVED FROM PA UNIT

③ TRANSFORMER COUPLED] → 600 OHM BALANCED LINE

④ THE NEGATIVE SIDE OF EACH CAR 74 VDC SYSTEM IS COMMON TO ALL CARS VIA THIS WIRE. THE NEGATIVE IS GROUNDED TO THE CARBODY IN EACH CAR AT THE BATTERY.

5 #14/15, 16/17, 18/23 CROSS WITHIN THE CAR AND ALSO IN THE COMMUNICATION JUMPER.

FUNCTION
C=COMMAND
I=INDICATION
A=AUDIO
F=FUTURE

NOTES :

UNLESS NOTED, ALL SIGNALS ARE OFF−ON MAINTAINED AT 0 OR 74 VDC DERIVED FROM CAR BATTERY SYSTEM.

■ THESE 3 ARE POWERED FROM LOCOMOTIVE BATTERY SYSTEM.

* COMMUNICATION LINE MEASURED IN dB.

** MOMENTARY +74 V SIGNAL (PUSH BUTTON).

] 2−CONDUCTOR SHIELDED

DRAFT

Amtrak
EQUIPMENT DESIGN
National Railroad Passenger Corporation

Dimesions are in inches unless otherwise specified. TOLERANCES: Decimals xx+/− xxx+/− ; Angles ±½°
Remove all burrs & break sharp edges.

TITLE
TRAINLINE STANDARD : 27 POINT COMMUNICATION SYSTEM

Drawn	Approved	Approved	Approved
TWM 7−18−96			For Issue
Checked	Approved	Approved	

Scale NONE
SHT. 1 OF 2
DRAWING NUMBER A 63−7676−1
REV. C

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REVISION			
LTR	DESCRIPTION	DATE	APP'D
A	REDRAWN ON A-SIZE SHEET WITHOUT CHANGE WAS C-SIZE DWG.	7-18-96	
B	SEE SHEET 1		
C	SEE SHEET 1		

PIN	WIRE DESIG	FUNCTION	VOLTAGE	BAGGAGE 1100's	BAGGAGE 1200's E-01-911	MATERIAL HANDLING 1400's E-63-7302	MATERIAL HANDLING 1500's E-63-7454	HERITAGE E-01-526 & 602	VIEWLINER		CAB CAR 9630-9642 & 9800 E-63-9225	AMFLEET-1	AMFLEET-2	HORIZON	SUPERLINER-1	SUPERLINER-2
1	SHLD	SHIELD	–	A	A	–	–	A	A		A	A	A	A	A	A
2	TB–	BATTERY NEGATIVE	0	C	C	–	–	C	C		C	C	C	C	C	C
3	PA1	PA/TAPE MUSIC-1 (BLK)	0	A	A	–	–	A	A		A	A	A	A	A	A
4	PA2	PA/TAPE MUSIC-1 (WHT)	db	A	A	–	–	A	A		A	A	A	A	A	A
5	PA3	INTERCOM (BLK)	0	–	–	–	–	A	A		A	A	A	A	A	A
6	PA4	INTERCOM (WHT)	db	–	–	–	–	A	A		A	A	A	A	A	A
7	PA5	PA CONTROL (BLK)	+/–	–	–	–	–	C	C		C	C	C	C	C	C
8	PA6	PA CONTROL (WHT)	13	–	–	–	–	C	C		C	C	C	C	C	C
9	RA1	MUSIC-3 (RADIO) (BLK)	0	–	–	–	–	A	A		A	A	A	–	A	A
10	RA2	MUSIC-3 (RADIO) (WHT)	db	–	–	–	–	A	A		A	A	A	–	A	A
11	EP1	BRAKE APPLICATION	+74	–	–	–	–	F	F		F	F	F	F	F	F
12	EP2	BRAKE RELEASE	+74	–	–	–	–	F	F		F	F	F	F	F	F
13	EP3	BRAKE NEGATIVE	0	–	–	–	–	F	F		F	F	F	F	F	F
14	D1	OPEN DOORS RH	+74	–	–	–	–	–	–		–	C	–	–	–	–
15	D2	OPEN DOORS LH	+74	–	–	–	–	–	–		–	C	–	–	–	–
16	D3	CLOSE DOORS RH	+74	–	–	–	–	–	–		–	C	–	–	–	–
17	D4	CLOSE DOORS LH	+74	–	–	–	–	–	–		–	C	–	–	–	–
18	DC1	DOOR CLOSED LIGHT	+74	–	–	–	–	–	–		–	I	–	I	–	–
19	BR	BRAKE RELEASED LIGHT	+74	I	I	–	–	I	I		I	I	I	I	I	I
20	BA	BRAKE APPLIED LIGHT	+74	I	I	–	–	I	I		I	I	I	I	I	I
21	HJ	HOT JOURNAL	+74	–	–	–	–	F	F		F	I	I	F	F	F
22	CS	CONDUCTOR SIGNAL	+74	C	C	–	–	C	C		C	C	C	C	C	C
23	DC2	DOOR CLOSE LIGHT	+74	I	I	–	–	I	I		I	I	I	I	I	I
24	PA7	TAPE – MUSIC 2	0	–	–	–	–	A	A		A	A	A	–	A	A
25	PA8	TAPE – MUSIC 2	db	–	–	–	–	A	A		A	A	A	–	A	A
26	BLS	CONDUCTOR DOOR CLOSED LT	+74	I	I	–	–	I	I		I	I	I	I	I	I
27	AN	ATTENDANT CALL	+74	–	–	–	–	F	F		–	–	–	–	C	C

DRAFT

SEE DWG E-63-7674 FOR COMMUNICATION TRAINLINE FUNCTION CHART (BY RAILROAD)

C	COMMAND
A	AUDIO
I	INDICATION
F	FUTURE
–	PASS THROUGH NOT CONNECTED TO CAR EQUIPMENT

REFER TO DWGS:

Amtrak

EQUIPMENT DESIGN
National Railroad Passenger Corporation

TITLE
27 PT COMMUNICATION TRAINLINE FUNCTION (BY AMTRAK CAR TYPE)

Drawn TWM 7-18-96	Approved	Approved	Approved
Checked	Approved	Approved	For Issue

Dimesions are in inches unless otherwise specified. TOLERANCES: Decimals xx+/– ——— xxx+/– ——— Angles ± ½°

Remove all burrs & break sharp edges.

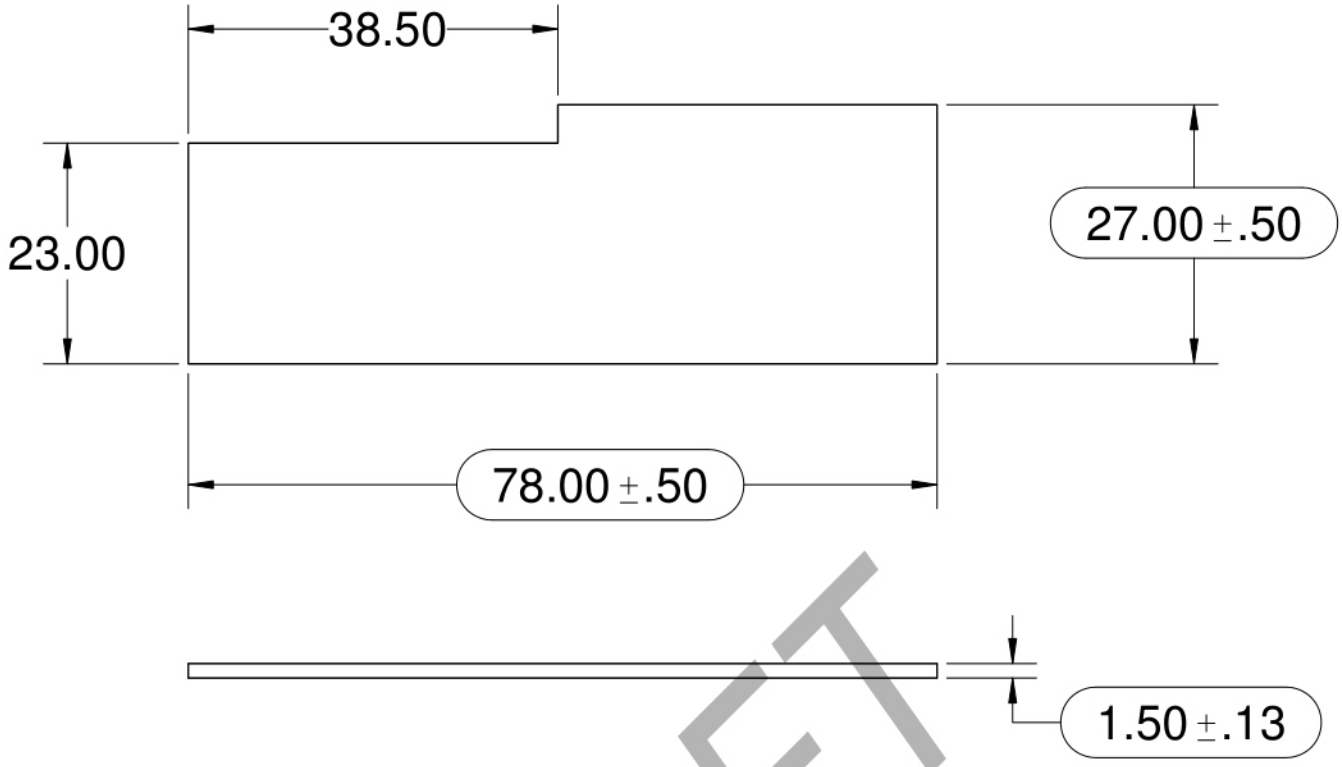
Scale NONE

SHT. 2 OF 2

DRAWING NUMBER A 63-7676-2

REV. C

26-FOI-00415 00000006208 "UNCLASSIFIED" 4/30/2026



DRAFT

MATERIAL: PER AMTRAK SPECIFICATION #364 REV. F
(SLEEPING CAR MATRESS)

AAMPS NO. 24 195 30106

VIEWLINER CAR SERIES 62000-62049
ROOMETTES 1 THRU 13 13/CAR

DIMENSIONS MARKED WITH
THE INSPECTION SYMBOL ⬭
ARE TO BE USED FOR THE
FIRST ARTICLE INSPECTION.

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REFERENCE DRAWINGS

AMTRAK

Mechanical Department
Bureau of Rolling Stock Engineering
National Railroad Passenger Corporation
4001 Vandever Ave. Wilmington DE 19802

TITLE
MATRESS PAD
COTTON TICKING
VIEWLINER SLEEPER

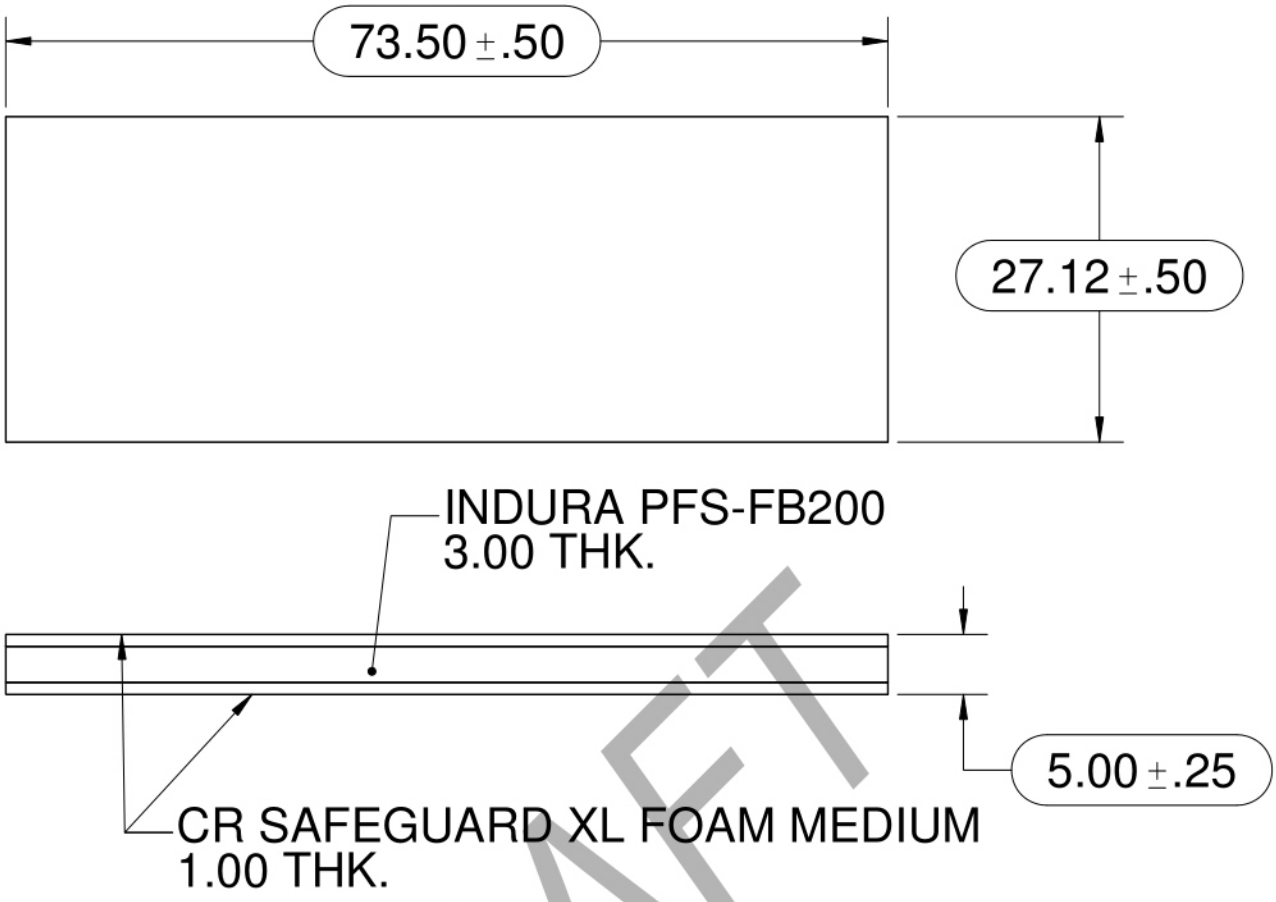
ORIGINALS ARE SIGNED ON FILE COPY

Approved D.COPLAND For Issue

				Drawn C.O'SHEA	Checked J. CAMPBELL	Approved	Issue Date 6/30/11
RSE-001038		VIEWLINER	REPORT ALL CHANGES TO ENGINEERING DEPARTMENT	Dimensions are in inches unless otherwise specified	TOLERANCES Decimals XX ±.03 XXX ±.010 Angles ± 1/2 °	Scale 1:20	DRAWING NUMBER A-87-7496 REV. C
PROGRAM	NEXT ASSY	USED ON	DO NOT SCALE DRAWING	Remove all burrs & break all sharp edges		SHT. 1 OF 1	

FILED AS A-87-7496

26-FOI-00415 00000006209 "UNCLASSIFIED" 4/30/2026



DRAFT

MATERIAL: PER AMTRAK SPECIFICATION #364 REV. F
(SLEEPING CAR MATTRESS)

AAMPS NO. 24 195 30077

VIEWLINER CAR SERIES 62000-62049
ROOMS A-B-H 3/CAR

DIMENSIONS MARKED WITH
THE INSPECTION SYMBOL ⬭
ARE TO BE USED FOR THE
FIRST ARTICLE INSPECTION.

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REFERENCE DRAWINGS

AMTRAK

Mechanical Department
Bureau of Rolling Stock Engineering
National Railroad Passenger Corporation
4001 Vandever Ave. Wilmington DE 19802

TITLE
MATTRESS
COTTON TICKING
VIEWLINER SLEEPER

ORIGINALS ARE SIGNED ON FILE COPY

Approved D. COPLAND — For Issue

Drawn	Checked	Approved	Issue Date
C. O'SHEA	J. CAMPBELL		6/30/11

RSE-001038		VIEWLINER	REPORT ALL CHANGES TO ENGINEERING DEPARTMENT
PROGRAM	NEXT ASSY	USED ON	DO NOT SCALE DRAWING

Dimensions are in inches unless otherwise specified

TOLERANCES: Decimals XX ±.03, XXX ±.010; Angles ± 1/2°

Remove all burrs & break all sharp edges

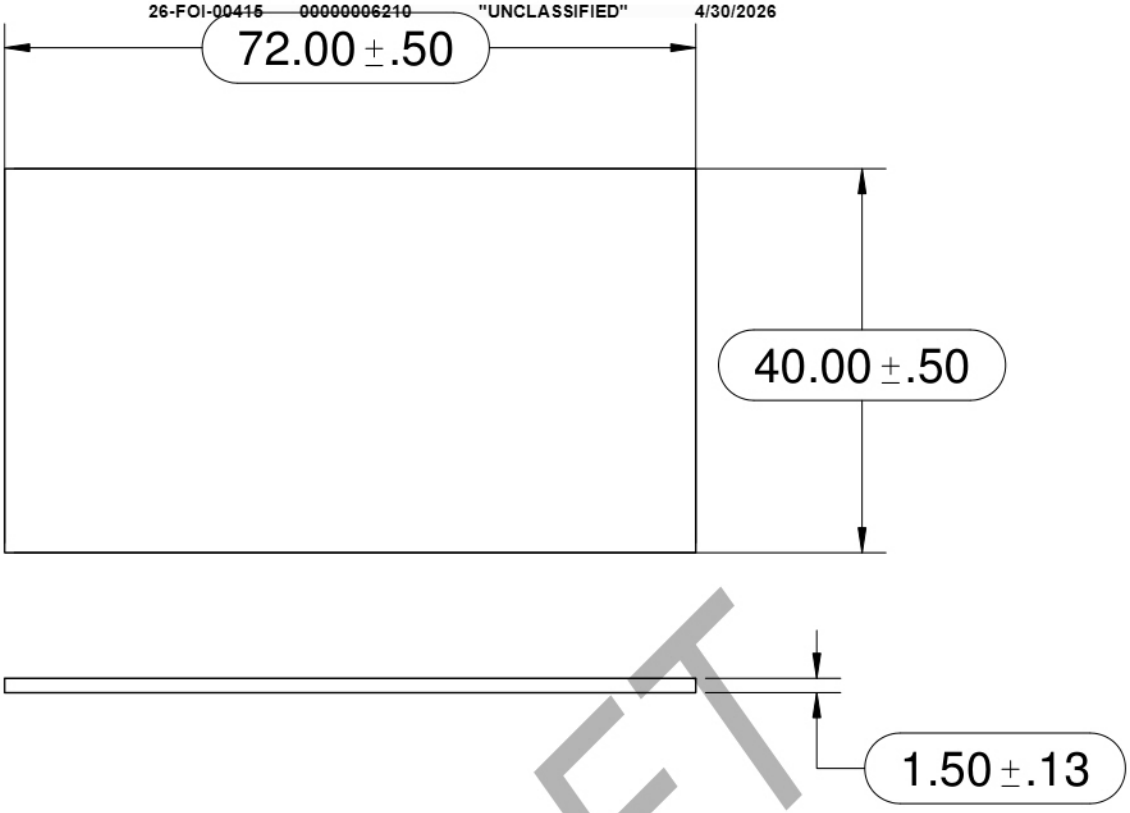
Scale 1:20

SHT. 1 OF 1

DRAWING NUMBER **A-87-7500**

REV. **B**

FILED AS A-87-7500



MATERIAL: PER AMTRAK SPECIFICATION #364 REV. F
(SLEEPING CAR MATTRESS)

AAMPS NO. 24 195 30093

VIEWLINER CAR SERIES 62000-62049
(ROOMS A-B-H 3/CAR)

DIMENSIONS MARKED WITH THE
INSPECTION SYMBOL ⬭
ARE TO BE USED FOR THE FIRST
ARTICLE INSPECTION.

DRAFT

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REFERENCE DRAWINGS

AMTRAK

Mechanical Department
Bureau of Rolling Stock Engineering
National Railroad Passenger Corporation
4001 Vandever Ave. Wilmington DE 19802

TITLE
MATTRESS PAD
COTTON TICKING
VIEWLINER SLEEPER

ORIGINALS ARE SIGNED ON FILE COPY

Approved D. COPLAND For Issue

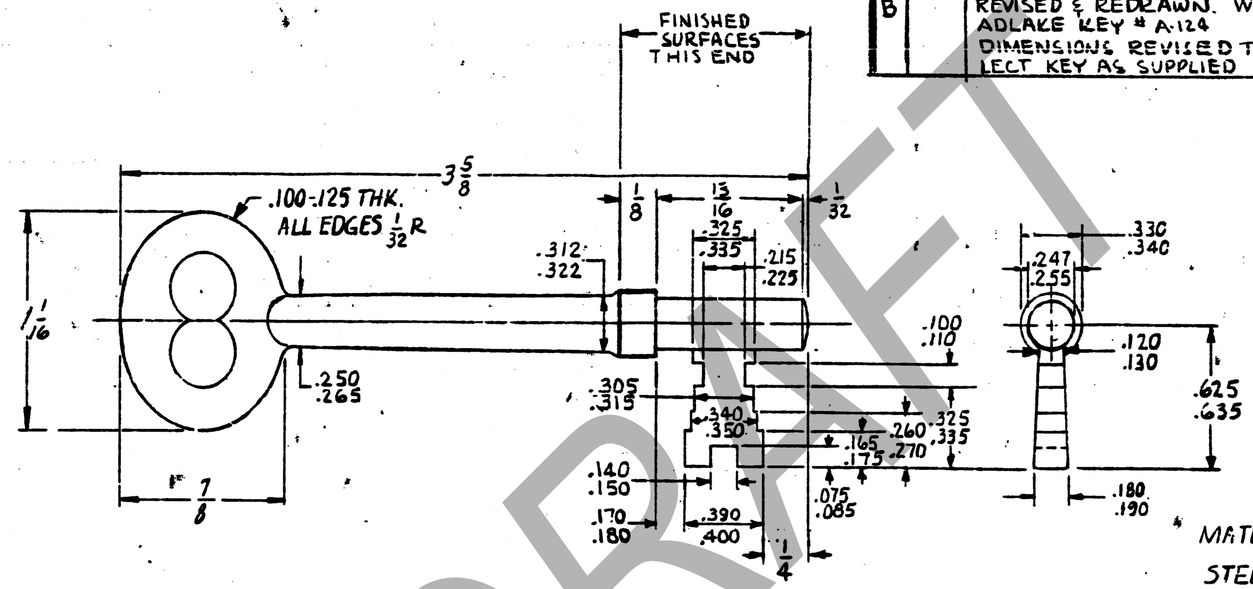
Drawn	Checked	Approved	Issue Date
C. O'SHEA	J. CAMPBELL		6/30/11

PROGRAM	NEXT ASSY	USED ON	REPORT ALL CHANGES TO ENGINEERING DEPARTMENT	Dimensions are in inches unless otherwise specified	TOLERANCES	Scale	DRAWING NUMBER	REV.
RSE-001038		VIEWLINER			Decimals XX ±.03 XXX ±.010 Angles ± 1/2°	1:20	A-87-7501	C
			DO NOT SCALE DRAWING	Remove all burrs & break all sharp edges		SHT. 1 OF 1		

FILED AS A-87-7501

B-144

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
B		REVISED & REDRAWN. WAS ADLAKE KEY # A-124 DIMENSIONS REVISED TO REFLECT KEY AS SUPPLIED	4/30/87	[illegible] 4/30/87



MATERIAL:
STEEL-ZINC PLATED

AMMS NO. 24 601 07430

QTY/CAR	USED ON

REFERENCE DRAWINGS
J.L.HOWARD CO.
DWG # 2555

DO NOT SCALE DRAWING

EQUIPMENT ENGINEERING
Amtrak
National Railroad Passenger Corporation
400 North Capitol Street, N.W. Washington, D.C. 20001

Dimensions are in inches unless otherwise specified.
TOLERANCES
Decimals xx +/- xxx +/-
Angles ± ½°
Remove all burrs & break sharp edges.

TITLE
STANDARD END DOOR KEY

Drawn 2/20/74 GDO	Approved	Approved	Approved 3/4/74 DM Brown For Issue
Checked 3/4/74	Approved	Approved	

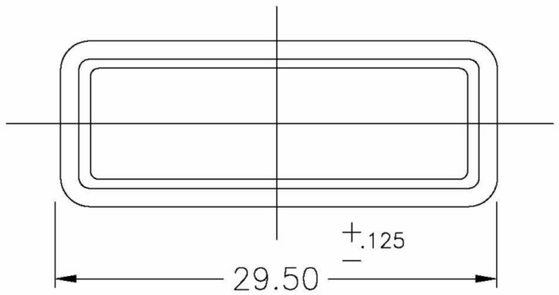
Scale —
SH 1 OF 1
DRAWING NUMBER B-144
REV B

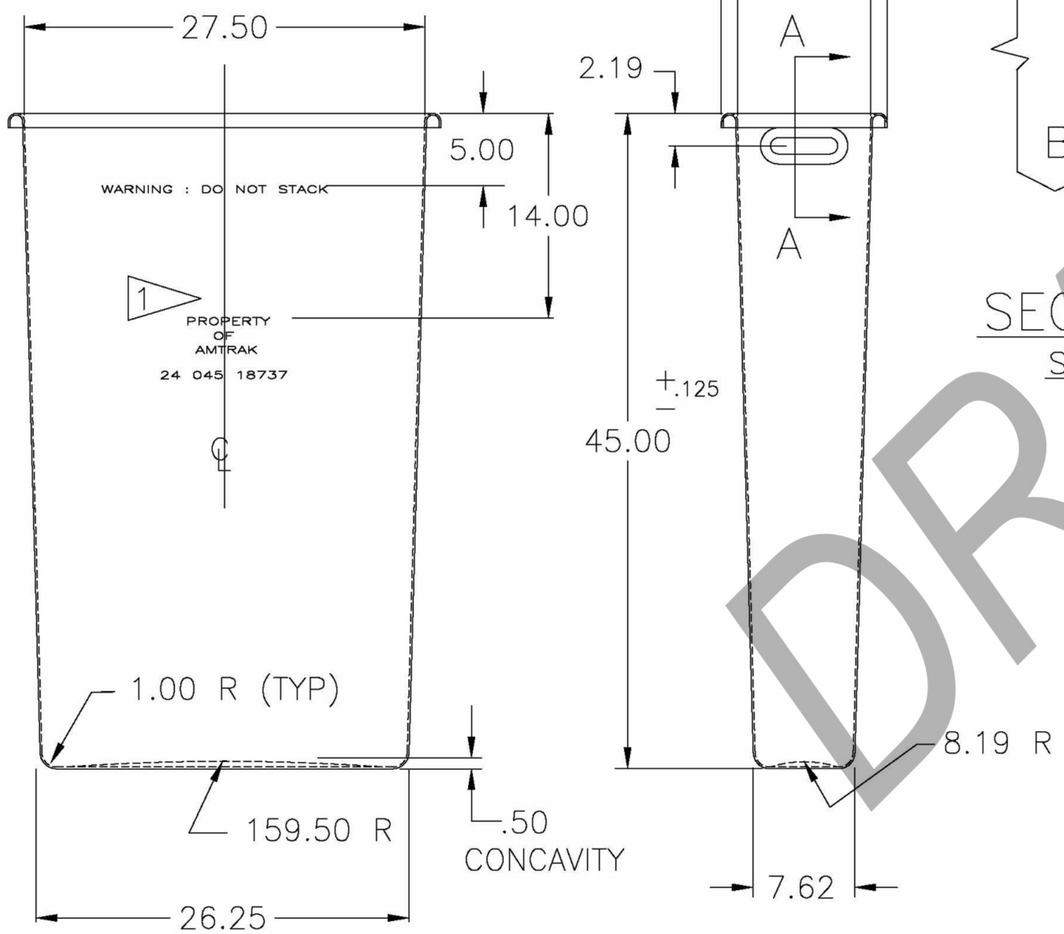
DRAFT

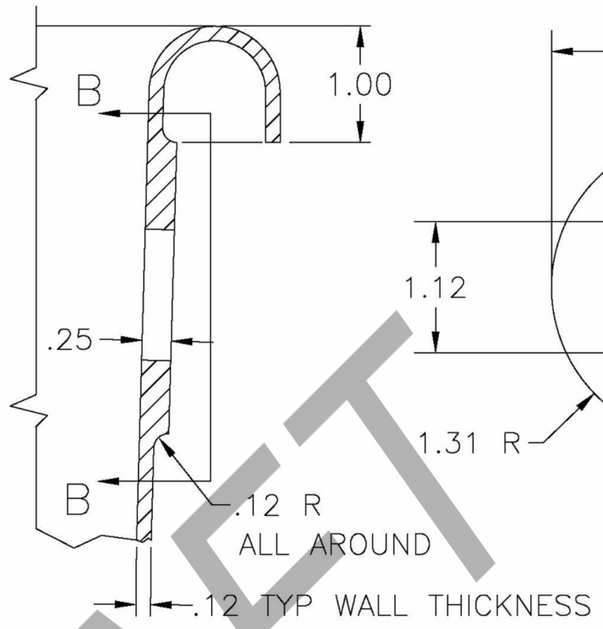
26-FOI-00415 00000006212 "UNCLASSIFIED" 4/30/2026

DRAWING NUMBER C-96-7591 REV B

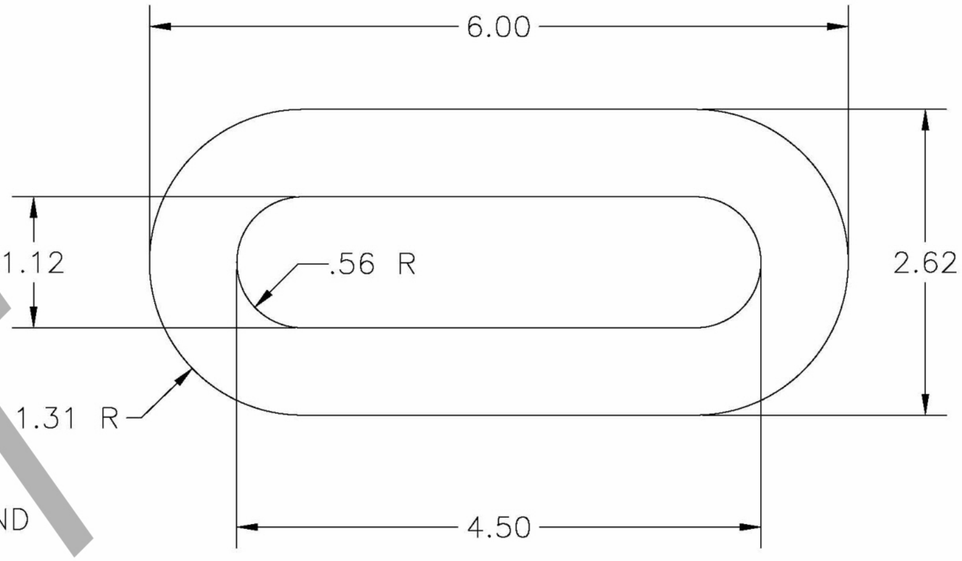
REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
A		MATERIAL DESCRIPTION DELETED	9/17/93	DK
B		29.50 WAS 30.00 & 10.88 WAS 11.38	10/3/96	DK







SECTION A–A
SCALE : FULL



VIEW B–B
SCALE : FULL
HAND HOLD REINFORCEMENT
TYPICAL 2 PLACES

NOTES:

1. LETTERING TO BE .50" HIGH, SAME ON BOTH SIDES.
2. MATERIAL SHALL BE FLAME RESISTANT, CAPABLE OF PASSING THE "RADIANT PANEL" TEST ASTM E–162 WITH A FLAME PROPAGATION (I_S) INDEX NOT EXCEEDING 35, AND SHALL NOT EXHIBIT FLAME DRIPPING OR RUNNING DURING TEST.
   MATERIAL SHALL BE RESISTANT TO A HIGH LEVEL OF SMOKE RELEASE DURING BURNING, AND SHALL PASS ASTM E–662 WITH THE SPECIFIC OPTICAL DENSITY (D_S) NOT EXCEEDING 200 AT FOUR MINUTES OR 100 AT NINETY SECONDS.
3. COLOR TO MATCH WESTINGHOUSE #90M95 (ALMOND CchampagNE).

DRAFT

AMMS NO	QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	P/L ITEM NO	ITEM
24 045 18737			STANDARD TRASH CONTAINER				

LIST OF MATERIAL

QTY/CAR	USED ON

REFERENCE DRAWINGS: GEN–D–008–001

DO NOT SCALE DRAWING

EQUIPMENT DESIGN

Amtrak®

National Railroad Passenger Corporation
30th Street Station, 4th Flr. South, Philadelphia, PA 19104

Dimesions are in inches unless otherwise specified. TOLERANCES: Decimals xx+/–, xxx+/–; Angles ±½°

Remove all burrs & break sharp edges.

TITLE: STANDARD TRASH CONTAINER

Drawn 8/28/92 JC	Approved	Approved	Approved
Checked 8/31/92 DK	Approved	Approved	For Issue

Scale 1–1/2"=1'–0" SH 1 OF 1

DRAWING NUMBER C–96–7591 REV. B

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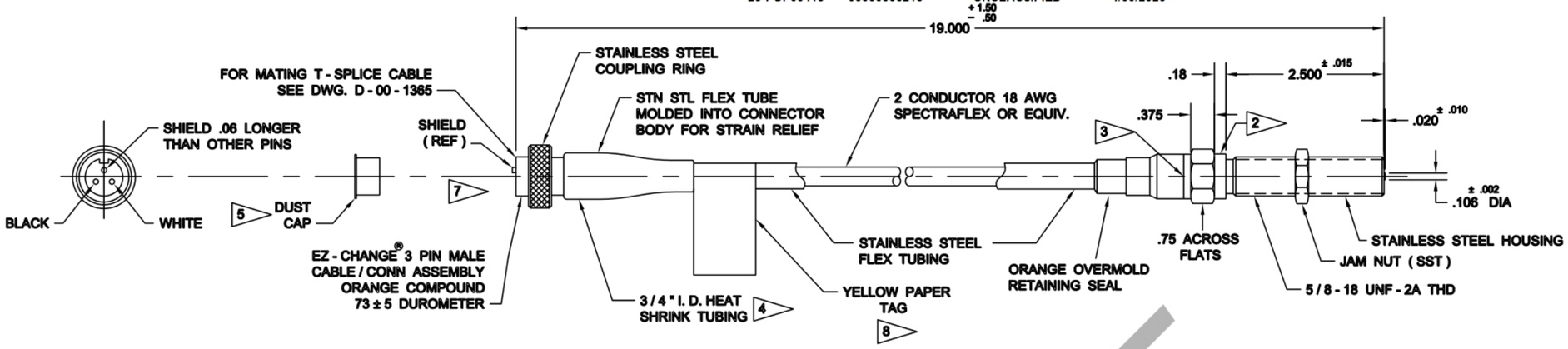
DRAWING NUMBER	REV.
D 00 - 1359	M

26-FOI-00415 00000006213 "UNCLASSIFIED" 4/30/2026

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
K		REVISED & REDRAWN TO AGREE WITH PART FURNISHED BY MANUFACTURER SMITH SYS P/N WAS 260040	JC 9/23/04	
L		ADDED "YELLOW PAPER TAG" & NOTE 8	JC 9/23/04	
M		NOTE 6 1050 ± 10% WAS 1200 OHM	JC 10/24/07	



ITEM	AMTRAK P/N	SMITH SYS P/N	ELECTRO P/N
-1	24 519 0100X	A260798	725835

DRAFT

NOTES

1 - PICKUP ASSY TO CONTAIN ELECTRO CORP'S 3030 ASSY (Q COIL) OR EQUIVALENT WITH THE FOLLOWING OUTPUT:

190 VOLTS (MIN) @ 1000 INCHES/SEC. WITH A 20° PITCH, 30 TOOTH GEAR @ 0.005 INCH GAP AND A 100 K OHM LOAD.

2 AMTRAK AND MANUFACTURERS P/N' S AND DATE TO BE PERMANENTLY MARKED ON SHELL.

3 CONNECTOR ASSY & STAINLESS STEEL FLEX TUBING TO BE POTTED (FLUSH) TO PICKUP SHELL.

4 SHRINK TUBING TO BE SEALED TO CONNECTOR ASSY & STAINLESS STEEL FLEX TUBING USING A WATER PROOF FLEXIBLE SEALANT UNDER THE SHRINK TUBING ENDS.

5 DUST CAP TO BE APPLIED TO CONNECTOR TO KEEP PINS CLEAN UNTIL MATED WITH COMPANION CONNECTOR.

6 - NOMINAL RESISTANCE, 1050 ±10% OHMS.

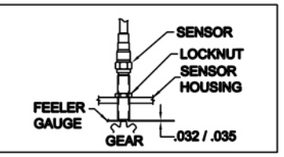
7 PINS SHALL BE SILVER PLATED AND WILL PASS 50 LB PULL TEST; COUPLING RING WILL PASS A 75 LB. PULL OFF TEST.

8 YELLOW PAPER TAG (2 1/4 WIDE X 5 1/2 LG) WITH ADHESIVE & PEEL OFF BACK TO BE MARKED IN BLACK & INCLUDE THE FOLLOWING INFORMATION:

SPEED SENSOR AMMS NO. 24 519 0100X

ATTENTION

SENSOR DOES NOT HAVE GAPPING WASHER.
SENSOR MUST BE GAPPED .032 TO .035.
USE GAPPING TOOL AMMS NO. 45 946 59625.



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QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
	-1	SPEED SENSOR & CABLE ASSY			SEE TABULATION	1

LIST OF MATERIAL

REFERENCE DRAWINGS

CAPITOLINER
HERITAGE
SUPERLINER

PROGRAM	NEXT ASS'Y	USED ON
D-04-1369		

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

DO NOT SCALE DRAWING

TOLERANCES
Dimensions are in inches unless otherwise specified.
Decimals .xx ± .03 .xxx ± .010
Angles ± 2°
Remove all burrs & break sharp edges.

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4501 Wardner Ave. Wilmington DE 19802

TITLE: SPEED SENSOR & CABLE ASSEMBLY

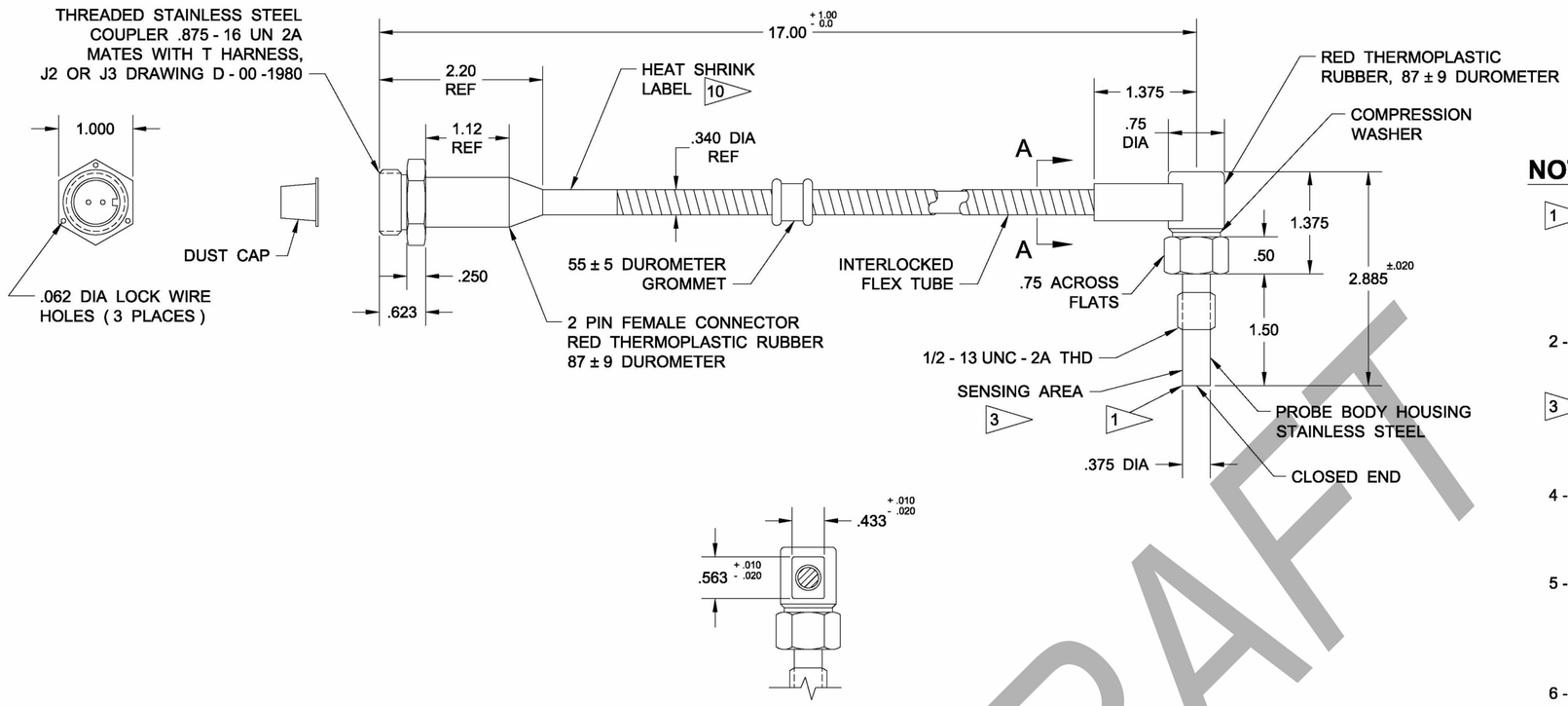
Drawn J. CABRY — Date 9/23/04 — Approved — Approved
Checked — Date — Approved — For Issue
Scale 1:1
SHT. 1 OF 1
DRAWING NUMBER D 00 - 1359
REV. M

FILED AS 1359-1 M

26-FOI-00415 00000006214 "UNCLASSIFIED" 4/30/2026

DRAWING NUMBER	REV.
D 00 - 7075	H

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
H		REVISED & REDRAWN TO AGREE WITH PART FURNISHED BY MANUFACTURER SMITH SYS P / N WAS T260270 ADDED ULTRA - TECH P / N	JC 9/22/04	TK 11/30/04



SECTION A - A

SUPERSEDES { AMMS NO. 20 045 08900; DWG D - 00 -1901
AMMS NO. 20 240 37958; DWG D - 00 -1902

ITEM	AMTRAK P/N	SMITH SYS P / N	ULTRA - TECH P / N	
1	20 240 37966	T260625	14679 - 51	

NOTES

1 PROBE RESISTANCE CURVE :
RO @ 25° C - 5K NORMAL
RO @ 125° C - 170.85 OHMS (± .75 OHMS)
RT CURVE - 5K UNI - CURVE

2 - INSULATION RESISTANCE :
1000 MEGOHMS @ 200 VOLTS DC

3 MAXIMUM TEMPERATURE :
THE MAXIMUM TEMPERATURE IN AREA FROM HEX TO SENSING TIP SHALL BE 150° C. THE BALANCE OF THE SENSOR SHALL NOT SEE A TEMPERATURE GREATER THAN 110° C.

4 - STABILITY :
THE STATED TOLERANCE FOR RO @ 125° C PERTAINS ONLY IF THE SENSED TEMPERATURE DOES NOT EXCEED 150° C FOR 2 HOURS.

5 - LEAD OUT :
LEAD OUT TO BE 2 CONDUCTORS, 18 GA TPR WITH OUTER PROTECTIVE STAINLESS STEEL FLEX TUBE MOLDED INTO A WATERPROOF EZ - CHANGE® CONNECTOR (PER DWG). CABLE / CONN ASSY TEMP RATING = 105° C OR GREATER.

6 - VIBRATION :
ASSEMBLY SHALL PASS THE REQUIREMENTS OF MIL - STD - 202, VIBRATION TEST METHOD 204, TEST CONDITION D.

7 - INSTALLATION :
MAXIMUM INSTALLATION TORQUE NOT TO EXCEED 48 INCH POUNDS.
RECOMMENDED THREAD LUBRICATE : MOLY LUBE COAT.

8 - CONNECTOR PINS :
CONNECTOR PIN SOCKETS WILL BE GOLD PLATED, PER QQS - 365 TYPE II GRADE A, AND WILL PASS 40 LB. PUSH TEST (MINIMUM).

9 - DIELECTRIC : 500 VOLTS RMS AT 60 HZ.

10 AMTRAK & MANUFACTURERS P / N' S AND DATE CODE TO BE PERMANENTLY MARKED ON HEAT SHRINK LABEL.

DRAFT

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QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
	- 1	TEMPERATURE SENSOR PROBE & CONNECTOR			SEE TABULATION	1

LIST OF MATERIAL

PROGRAM	NEXT ASS'Y	USED ON
	E - 04 - 1764	AMF I & II

REFERENCE DRAWINGS

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

DO NOT SCALE DRAWING

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4001 Vandever Ave. Wilmington DE 19802

TITLE TEMPERATURE SENSOR PROBE & CONNECTOR

Drawn	Date	Approved	Approved
J. CABRY	9/22/04		T. KRAUSE
Checked	Date	Approved	For Issue 11/30/04
TK	11/30/04		

TOLERANCES
Dimensions are in inches unless otherwise specified. Decimals xx ± .03, xxx ± .010. Angles ± 2°
Remove all burrs & break sharp edges.

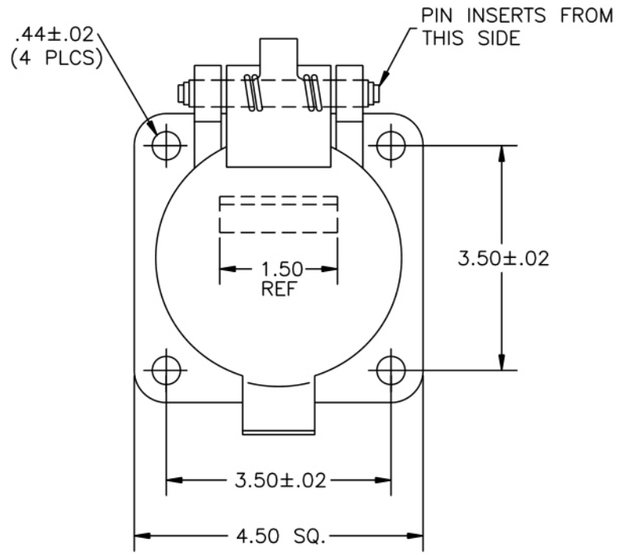
Scale NONE | DRAWING NUMBER D 00 - 7075 | REV. H
SHT. 1 OF 1

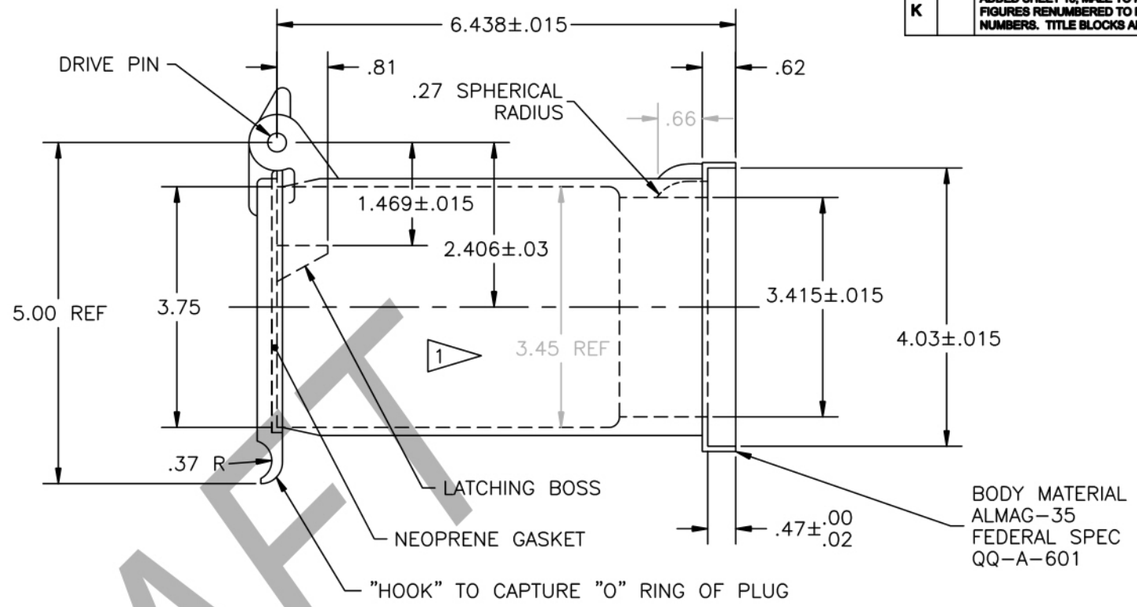
FILED AS 7075 - 1H

DRAWING NUMBER	REV.
D-12-7191	K

26-FOI-00415 00000006215 "UNCLASSIFIED" 4/30/2026

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
J		SHEETS 1 THRU 8 & 10 THRU 12 REDRAWN WITHOUT CHANGE. SHEET 9, ADDED ITEM 12. ADDED CLEMENTS NATIONAL & GE TO TABULATION. DWG TITLE WAS 'CONNECTION JUMPER CABLE ASS'Y'.	JC 1/15/98	RFB 4/15/98
K		ADDED SHEET 13, MALE TO MALE JUMPER. FIGURES RENUMBERED TO MATCH SHEET NUMBERS. TITLE BLOCKS ALL ALIKE.	GM 9/03/08	MD 9/08/08





ITEM	AMTRAK P/N	PYLE NATIONAL	ANDERSON	CLEMENTS NATIONAL	G & G TRANSIT	
1	25 426 02806	RPC-17-WO		MRA-H	~~55001520~~	

FIGURE 1
480V, 400A, OUTLET HOUSING

NOTES

1. VENDOR NAME, AMMS NO. AND DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROXIMATELY WHERE SHOWN.
2. HOUSING TO BE PAINTED OSHA RED.

DRAFT

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QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

REFERENCE DRAWINGS

SPEC 223

PROGRAM | NEXT ASS'Y | USED ON

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

DO NOT SCALE DRAWING

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4501 Vandever Ave, Wilmington, DE 19809

TOLERANCES
Dimensions are in inches unless otherwise specified. Decimals .xx ± .03, .xxx ± .010. Angles ±1°
Remove all burrs & break sharp edges.

TITLE: 480V TRAINLINE JUMPERS, PLUGS AND RECEPTACLES

Drawn	Date	Approved	Approved
G. MARZILI	10/29/08		D.C.
Checked	Date	Approved	For Issue
M. DELIZIO	11/05/08		

Scale: SCALE | DRAWING NUMBER: D-12-7191 | REV.: K

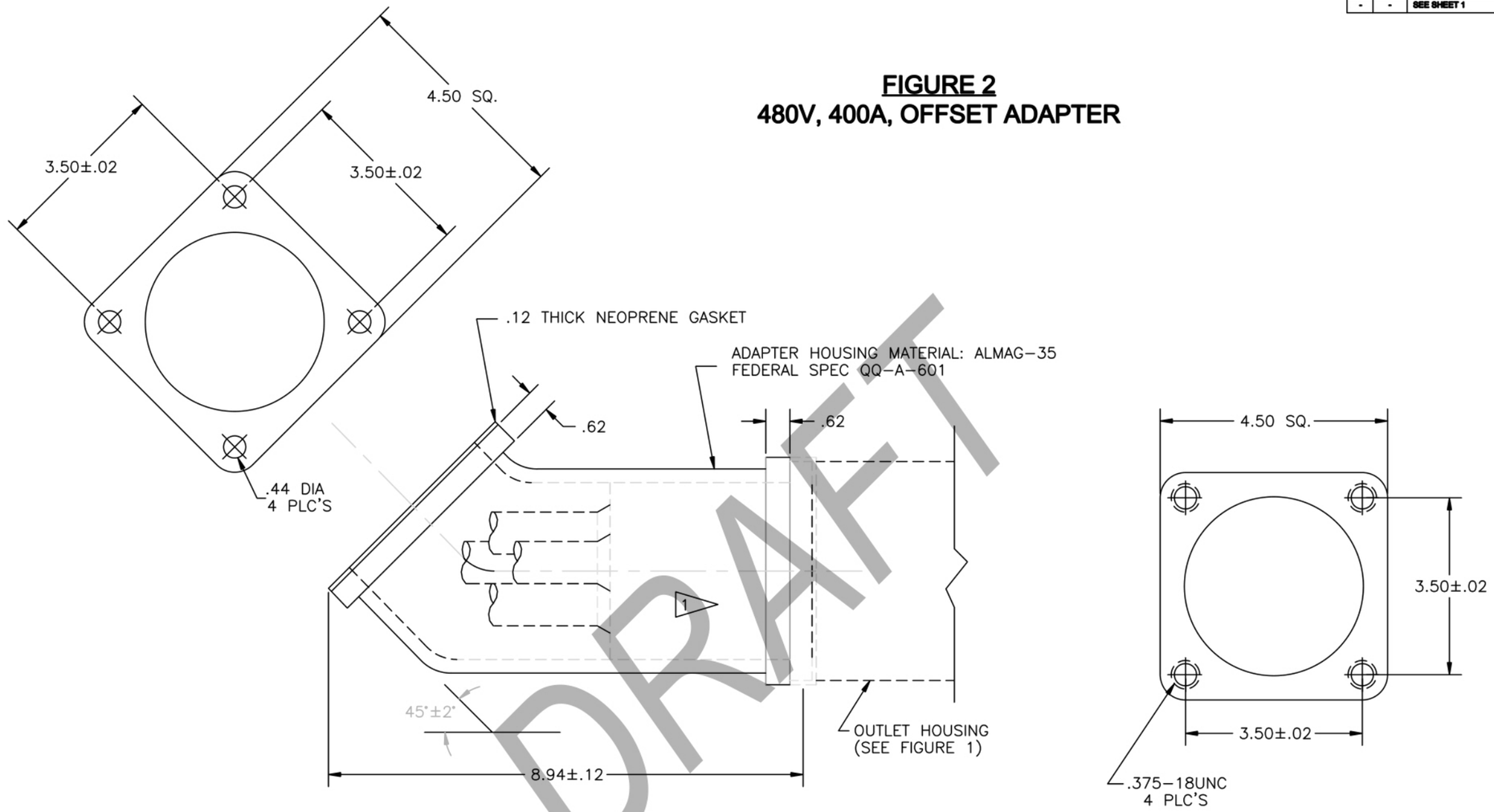
SHT. 1 OF 13

D-12-7191.dwg

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-	-	SEE SHEET 1		-

DRAWING NUMBER	REV.
D-12-7191	K

FIGURE 2
480V, 400A, OFFSET ADAPTER



DRAFT

ITEM	AMTRAK P/N	ANDERSON	PYLE-NATIONAL	CLEMENTS NATIONAL		
1						

NOTES

1. VENDOR NAME, AMMS NO. AND DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROXIMATELY WHERE SHOWN.
2. HOUSING TO BE PAINTED OSHA RED.

QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

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REFERENCE DRAWINGS

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

DO NOT SCALE DRAWING

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4001 Vandever Ave. Wilmington DE 19802

TOLERANCES
Dimensions are in inches unless otherwise specified.
Decimals .xx ± .03 .xxx ± .010
Angles ± 1°
Remove all burrs & break sharp edges.

TITLE 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES

Drawn	Date	Approved	Approved
G. MARZILI	10/28/08		D.C.
Checked M. DELIZIO	11/05/08		For Issue

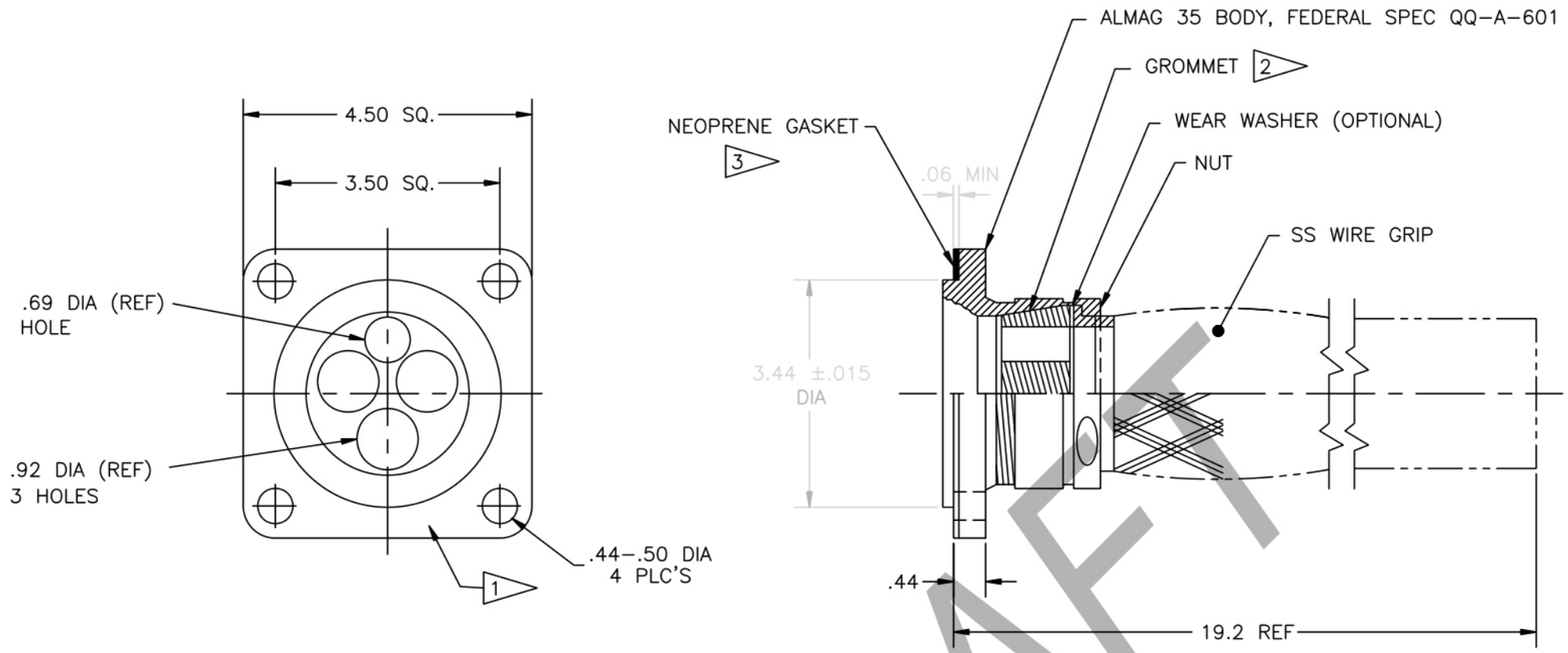
Scale SCALE — SHT. 2 OF 13 — DRAWING NUMBER D-12-7191 — REV. K

SPEC 223			
PROGRAM	NEXT ASS'Y	USED ON	

D-12-7191.dwg

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-	-	SEE SHEET 1		-

DRAWING NUMBER	REV.
D-12-7191	K



ITEM	AMTRAK P/N	ANDERSON	PYLE NATIONAL	CLEMENTS NATIONAL	G & G TRANSIT	
1	25 789 80008		RPC–2124	MPA–SR	55001312	

NOTES

1. VENDOR NAME, AMMS NO. AND DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROXIMATELY WHERE SHOWN.
2. WHEN INSTALLED, THE GROMMET MUST FORM A WATERTIGHT SEAL AGAINST 30 PSIG BETWEEN ITSELF AND THE BODY, AS WELL AS ITSELF AND THE CABLES UTILIZED IN THE ASSEMBLIES SPECIFIED APPENDIX A.
3. FLANGE GASKET SHALL SEAL AGAINST 30 PSIG AIR PRESSURE.

ESTIMATED WEIGHT 1.5 LBS.

FIGURE 3
FLANGE-MOUNTED CABLE GRIP
(FIXED JUMPER)

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QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

REFERENCE DRAWINGS

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

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SPEC 223

PROGRAM	NEXT ASS'Y	USED ON

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4001 Vandever Ave. Wilmington DE 19802

TOLERANCES
Dimensions are in inches unless otherwise specified.
Decimals .xx ± .03 .xxx ± .010
Angles ±1°
Remove all burrs & break sharp edges.

TITLE 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES

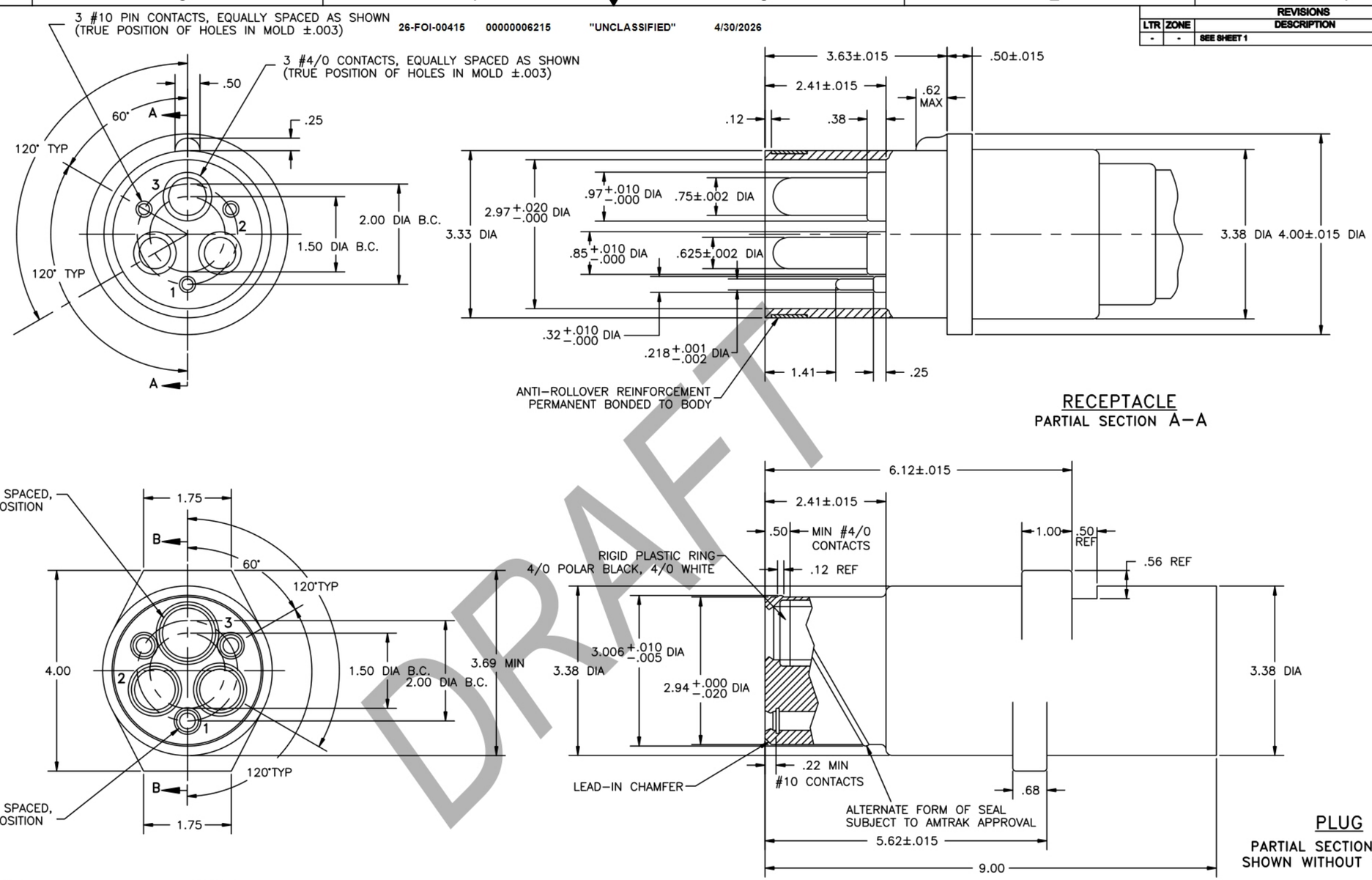
Drawn G. MARZILI Date 10/29/08 Approved Approved D.C.
Checked M. DELIZIO Date 11/05/08 Approved For Issue
Scale SCALE
SHT. 3 OF 13
DRAWING NUMBER D-12-7191
REV. K

D-12-7191.dwg

26-FOI-00415 00000006215 "UNCLASSIFIED" 4/30/2026

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-	-	SEE SHEET 1		-

DRAWING NUMBER	REV.
D-12-7191	K



DRAFT

FIGURE 4
480V, 400A, PLUG AND RECEPTACLE INTERFACE DIMENSIONS

QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

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REFERENCE DRAWINGS

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DO NOT SCALE DRAWING

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4501 Vandover Ave. Wilmington DE 19802

TOLERANCES
Dimensions are in inches unless otherwise specified.
Decimals .xx ± .03 .xxx ± .010
Angles ±1°
Remove all burrs & break sharp edges.

TITLE 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES

Drawn	Date	Approved	Approved
G. MARZILI	10/29/08		D.C.
Checked	Date	Approved	For Issue
M. DELIZIO	11/05/08		

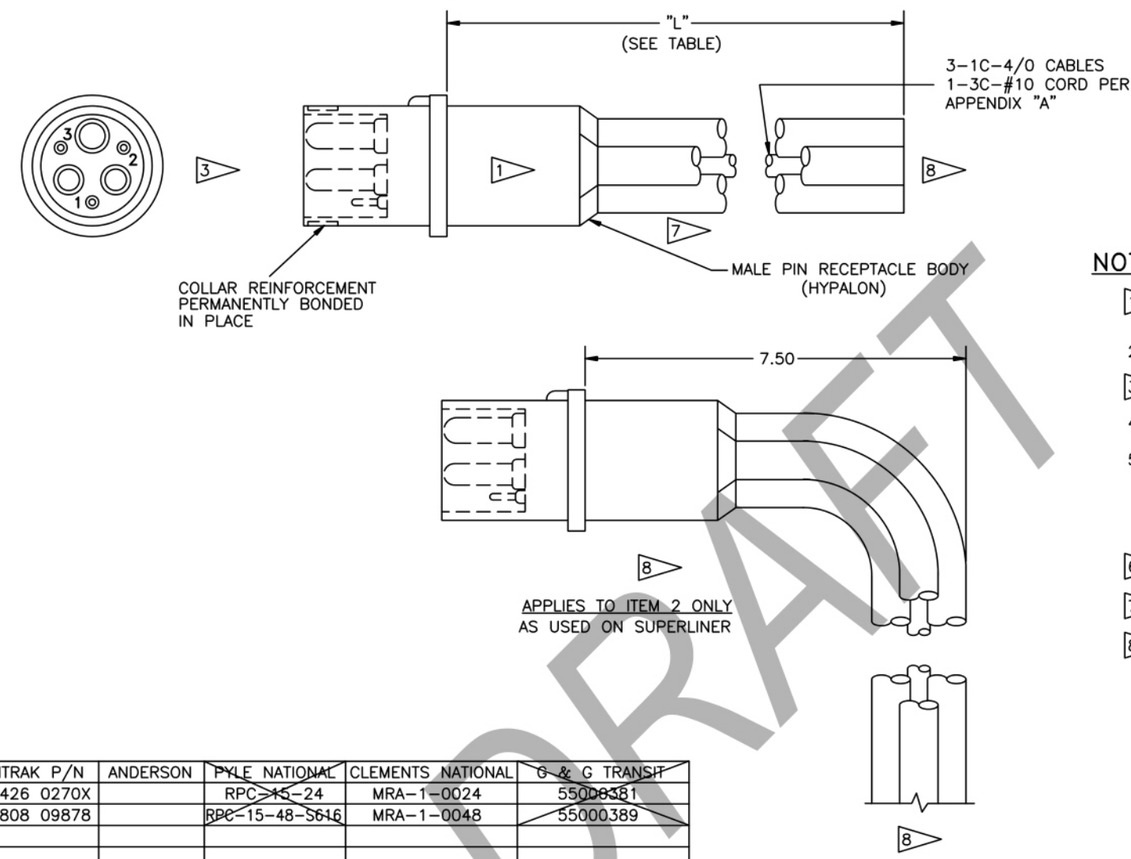
Scale SCALE
DRAWING NUMBER D-12-7191
REV. K
SHT. 4 OF 13

SPEC 223			
PROGRAM	NEXT ASS'Y	USED ON	

D-12-7191.dwg

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-	-	SEE SHEET 1		-

DRAWING NUMBER D-12-7191 REV. K



NOTES

1. VENDOR NAME, AMMS NO., & DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROXIMATELY WHERE SHOWN.
2. INTEGRALLY MOLDED BODY TO BE RED IN COLOR, 60-70 DUROMETER.
3. REFER TO FIGURE 4, SHEET 4 FOR INTERFACE DIMENSIONS.
4. PHASE ROTATION 1, 2, 3.
5. COLOR CODE OF 4/0 & #10 CONDUCTORS:
   - #1 BLACK
   - #2 WHITE
   - #3 RED
6. PIGTAIL SUBJECT TO SHARP BEND AS INSTALLED IN SUPERLINER.
7. INDIVIDUAL #10 CONDUCTORS SHALL BE PROTECTED AGAINST PHYSICAL DAMAGE.
8. APPLY HEAT SHRINK TUBING BAND, 3/4" WIDE, AT 1" IN FROM FREE END OF 4/0 CABLE COLOR PER NOTE 5.

ITEM	LENGTH	WEIGHT "LBS"	AMTRAK P/N	ANDERSON	PYLE NATIONAL	CLEMENTS NATIONAL	G & G TRANSIT
1	24"±2"	10.0	25 426 0270X		RPC-15-24	MRA-1-0024	55000381
2	48"±2"	17.5	24 808 09878		RPC-15-48-S616	MRA-1-0048	55000389
3	180"±2"						

DRAFT

FIGURE 5
480V, 400A, OUTLET CABLE ASS'Y

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QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

REFERENCE DRAWINGS

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

DO NOT SCALE DRAWING

SPEC 223

PROGRAM | NEXT ASS'Y | USED ON

AMTRAK

Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4001 Vandever Ave. Wilmington DE 19802

TOLERANCES

Dimensions are in inches unless otherwise specified.

Decimals .XX ± .03 .XXX ± .010 Angles ±1°

Remove all burrs & break sharp edges.

TITLE 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES

Drawn G. MARZILI Date 10/29/08 Approved Approved D.C.

Checked M. DELIZIO Date 11/05/08 Approved For Issue

Scale SCALE

SHT. 5 OF 13

DRAWING NUMBER D-12-7191 REV. K

D-12-7191.dwg

26-FOI-00415 00000006215 "UNCLASSIFIED" 4/30/2026

DRAWING NUMBER	REV.
D-12-7191	K

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-		SEE SHEET 1		-

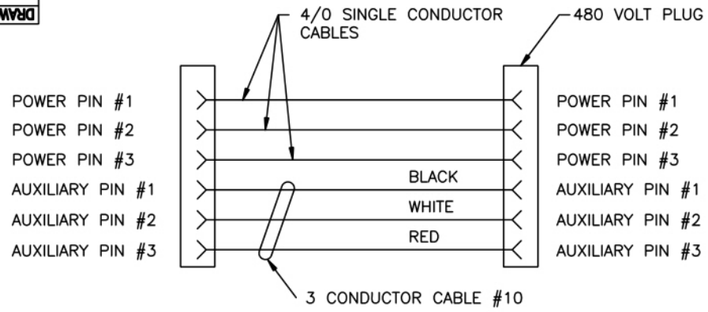

FIGURE 6
480V, 400A, PORTABLE JUMPER CABLE ASSEMBLY

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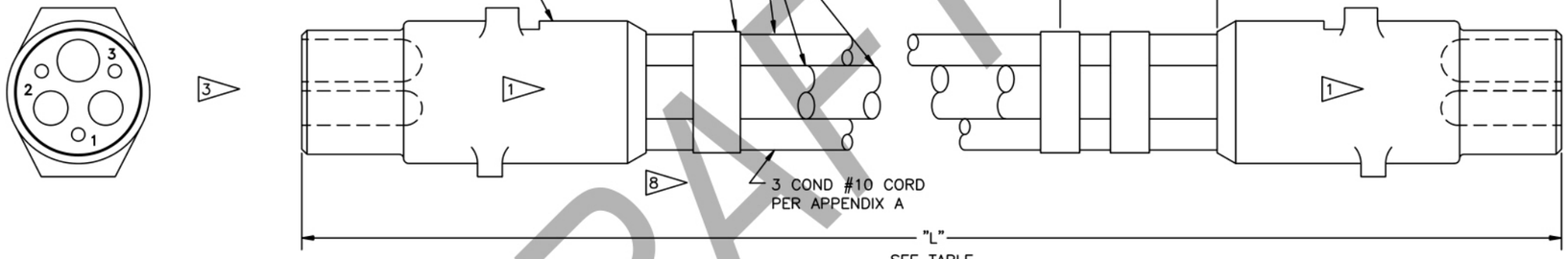
JUMPER CABLE ASSEMBLY WIRING SCHEMATIC



DRAFT

NOTES:

1. VENDOR NAME, AMMS NO., & DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROXIMATELY WHERE SHOWN.
2. INTEGRALLY MOLDED BODY TO BE YELLOW IN COLOR, 60-70 DUROMETER.
3. REFER TO FIGURE 4, (SHEET 4) FOR INTERFACE DIMENSIONS.
4. PHASE ROTATION 1, 2, 3.
5. COLOR CODE OF 4/0 & #10 CONDUCTORS:
   - #1 BLACK
   - #2 WHITE
   - #3 RED
6. MINIMUM OF THREE WRAPS 1.50" WIDE PVC TAPE COLORED (OSHA COLORS) AS SHOWN ABOVE

YEAR ENDING IN	COLOR
1, 4, 7	BLUE
2, 5, 8	YELLOW
3, 6, 9	RED
0	GREEN

7. PROVIDE SLACK IN 3/C CORD FOR STRAIN RELIEF (4/0 CABLE TAKES STRAIN).
8. INDIVIDUAL #10 CONDUCTORS SHALL BE PROTECTED AGAINST PHYSICAL DAMAGE.

ITEM	LENGTH	AMTRAK P/N	WEIGHT "LBS"	ANDERSON	PYLE NATIONAL	CLEMENTS NATIONAL	G & G TRANSIT
1	51"±1/2"	25 426 02603	20.0		RPC-10-051	MPA-2-0051	55000358
2	84"±1/2"	25 426 02507	28.0		RPC-10-084	MPA-2-0084	55000361
3	10'±1"	24 422 07040	37.0		RPC-10-120	MPA-2-0120	55000354
4	25'±2"	25 426 01408	82.0		RPC-10-300	MPA-2-0300	55000357
5	50'±2"	24 045 0057X	157.0		RPC-10-600	MPA-2-0600	55000359
6	100±2"	25 426 01301	307.0		RPC-10-1200	MPA-2-1200	55000355

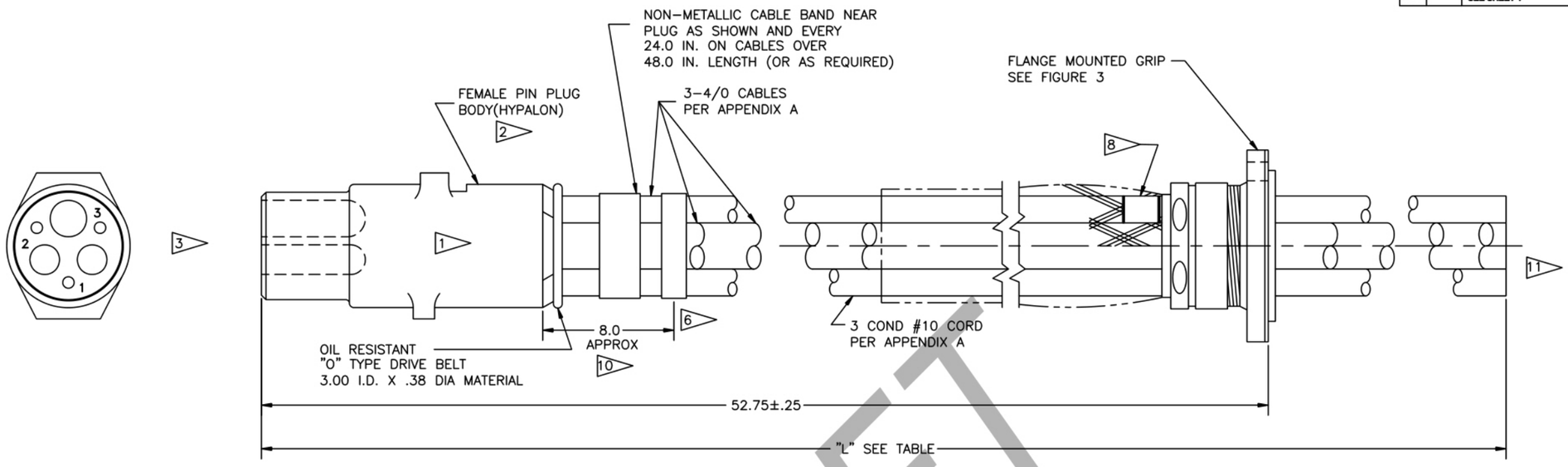
QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

SPEC 223		REFERENCE DRAWINGS	AMTRAK Mechanical Department, Bureau of Rolling Stock Engineering, National Passenger Railroad, 4501 Vandever Ave. Wilmington DE 19809	TITLE: 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES
PROGRAM	NEXT ASS'Y / USED ON	REPORT ALL CHANGES TO ENGINEERING DEPARTMENT / DO NOT SCALE DRAWING	TOLERANCES: Dimensions are in inches unless otherwise specified. Decimals .XX ±.03 .XXX ±.010. Angles ±1°. Remove all burrs & break sharp edges.	Drawn G. MARZILI 10/29/08; Checked M. DELIZIO 11/05/08; Approved; Approved D.C. For Issue; Scale; DRAWING NUMBER D-12-7191; REV. K; SHT. 6 OF 13

D-12-7191.dwg

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-		SEE SHEET 1		-



NOTES

1. VENDOR NAME, AMMS NO., & DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROXIMATELY WHERE SHOWN.
2. INTEGRALLY MOLDED BODY TO BE YELLOW IN COLOR, 60-70 DUROMETER.
3. REFER TO FIGURE 4 (SHEET 4) FOR INTERFACE DIMENSIONS.
4. PHASE ROTATION 1, 2, 3.
5. COLOR CODE OF 4/0 & #10 CONDUCTORS: #1BLACK, #2 WHITE, #3 RED.
6. MINIMUM OF THREE WRAPS 1.50" WIDE PVC TAPE COLORED (OSHA COLORS) AS SHOWN ABOVE

YEAR ENDING IN	COLOR
1, 4, 7	BLUE
2, 5, 8	YELLOW
3, 6, 9	RED
0	GREEN

7. PROVIDE SLACK IN 3/C CORD FOR STRAIN RELIEF (4/0 CABLE TAKES STRAIN).
8. APPLY WHITE TAPE OR HEAT SHRINK TUBING : TO BE FLUSH WITH GROMMET FACE WHEN CABLE LENGTH SET TO 52.75". SET CABLE LENGTH & TIGHTEN FLANGE-MOUNTED GRIP NUT FIRMLY.
10. INDIVIDUAL #10 CONDUCTORS SHALL BE PROTECTED AGAINST PHYSICAL DAMAGE.
11. APPLY HEAT SHRINK TUBING BAND 3/4" WIDE AT 1" IN FROM FREE END OF 4/0 CABLE COLOR PER NOTE 5.

ITEM	LENGTH	AMTRAK P/N	WEIGHT "LBS"	ANDERSON	PYLE NATIONAL	CLEMENTS NATIONAL	G & G TRANSIT
1	85.0"±2.0"/0.0"	24 240 20514	26.5		RPC-14-85	MPA-1SR-0085	55001377
2	110.0"±2.0"/0.0"	24 808 00179	29.5		RPC-14-096	MPA-1SR-0110	55001379
3							
4							
5							

FIGURE 7
480V, 400A, FIXED JUMPER CABLE ASSEMBLY

DRAFT

QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

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THE AMTRAK DRAWING IS THE GOVERNING DOCUMENT, AND SUPERSEDES ANY LIKE INFORMATION ON REFERENCE DRAWINGS, PART NUMBERS, SPECIFICATIONS, ETC.

REFERENCE DRAWINGS

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

DO NOT SCALE DRAWING

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4001 Vandover Ave. Wilmington DE 19802

TOLERANCES
Dimensions are in inches unless otherwise specified.
Decimals .xx ± .03 .xxx ± .010
Angles ±1°
Remove all burrs & break sharp edges.

TITLE 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES

Drawn	Date	Approved	Approved
G. MARZILI	10/29/08		D.C.
Checked M. DELIZIO	11/05/08		For Issue

Scale SCALE — SHT. 7 OF 13 — DRAWING NUMBER D-12-7191 — REV. K

SPEC 223		
PROGRAM	NEXT ASS'Y	USED ON

D-12-7191.dwg

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-		SEE SHEET 1		-

K	D-12-7191
REV.	DRAWING NUMBER

26-FOI-00415 00000006215 "UNCLASSIFIED" 4/30/2026

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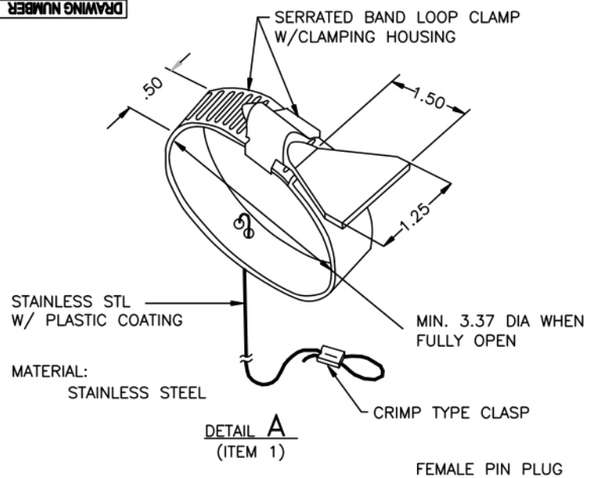
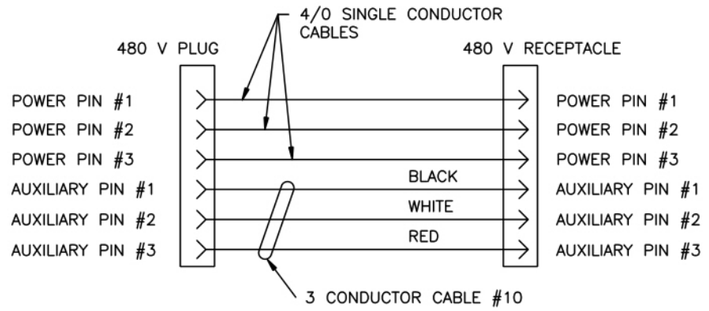
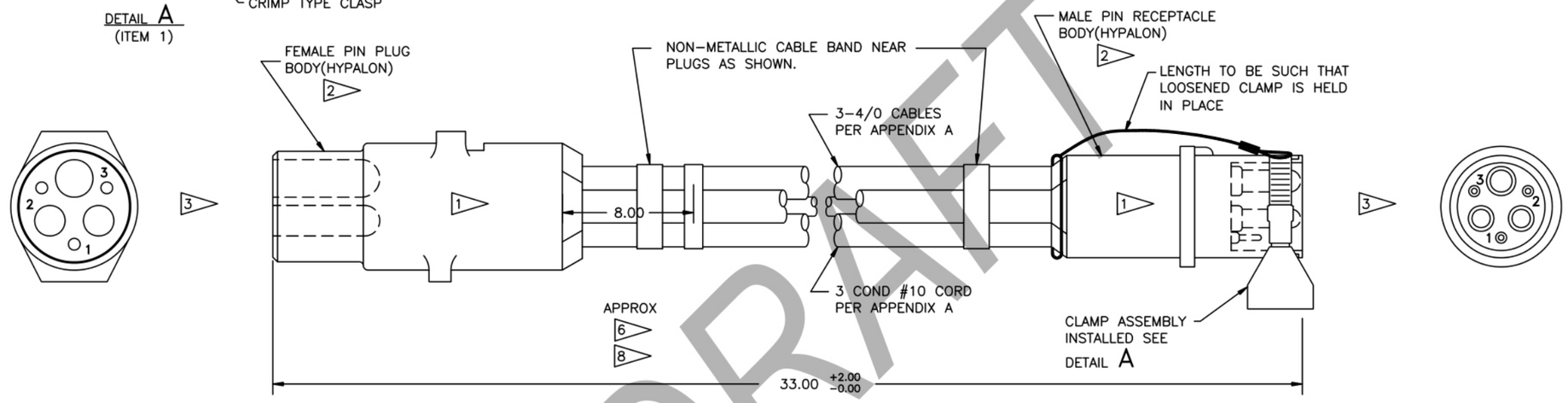




JUMPER CABLE ASSEMBLY WIRING SCHEMATIC



DRAFT

NOTES

1. VENDOR NAME, AMMS NO., & DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROXIMATELY WHERE SHOWN.
2. INTEGRALLY MOLDED PLUG BODY TO BE YELLOW IN COLOR, 60-70 DUROMETER; INTEGRALLY MOLDED RECEPTACLE TO BE RED IN COLOR.
3. REFER TO FIGURE 4 (SHEET 4) FOR INTERFACE DIMENSIONS.
4. PHASE ROTATION 1, 2, 3.
5. COLOR CODE OF 4/0 & #10 CONDUCTORS: #1BLACK, #2 WHITE, #3 RED.
6. MINIMUM OF THREE WRAPS 1.50" WIDE PVC TAPE COLORED (OSHA COLORS) AS SHOWN ABOVE

YEAR ENDING IN	COLOR
1, 4, 7	BLUE
2, 5, 8	YELLOW
3, 6, 9	RED
0	GREEN

7. PROVIDE SLACK IN 3/C CORD FOR STRAIN RELIEF (4/0 CABLE TAKES STRAIN).
8. INDIVIDUAL #10 CONDUCTORS SHALL BE PROTECTED AGAINST PHYSICAL DAMAGE.

ITEM	NAME	AMTRAK P/N	WEIGHT "LBS"	ANDERSON	PYLE NATIONAL	CLEMENTS NATIONAL	~~G & G TRANSIT~~
1	CLAMP ASSEMBLY	24 808 02481	1.7 OZ.		RPC-90-CP	MPA-C	~~55008731~~
2	ADAPTER ASSEMBLY	24 045 00537	15.5		RPC-13-33-S568	MPRA-2-0033	~~55000363~~

FIGURE 8
480V, 400A, ADAPTER JUMPER CABLE ASSEMBLY

QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

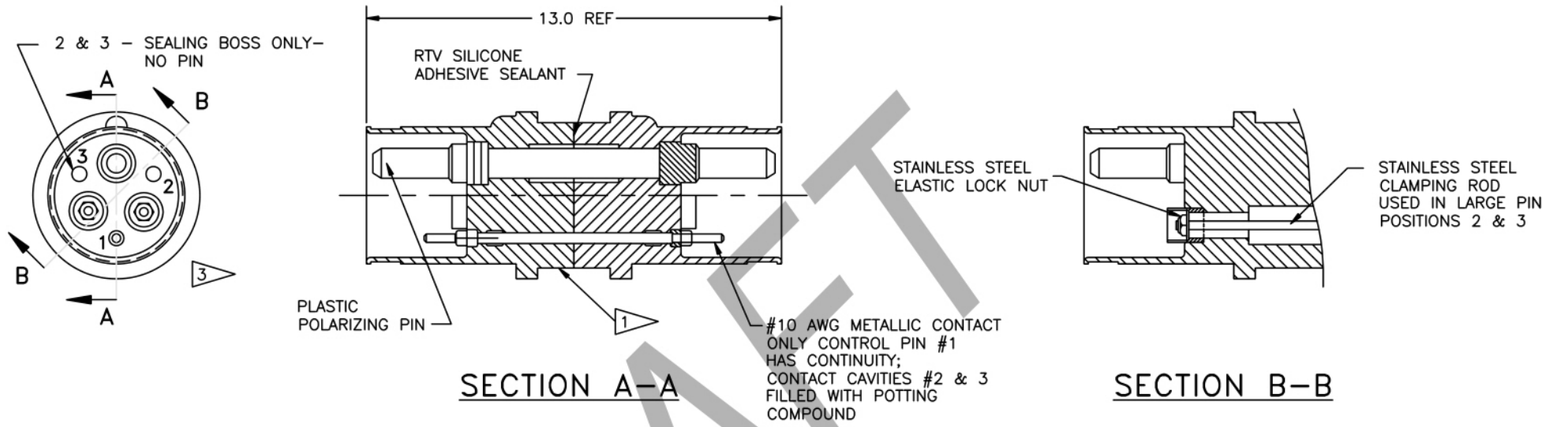
LIST OF MATERIAL

SPEC 223		REFERENCE DRAWINGS	AMTRAK Mechanical Department, Bureau of Rolling Stock Engineering, National Passenger Railroad, 4501 Wanderer Ave, Washington DC 10002	TITLE: 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES
PROGRAM	NEXT ASS'Y / USED ON	REPORT ALL CHANGES TO ENGINEERING DEPARTMENT / DO NOT SCALE DRAWING	TOLERANCES: Dimensions are in inches unless otherwise specified. Decimals .XX ±.03 .XXX ±.010 Angles ±1° Remove all burrs & break sharp edges.	Drawn G. MARZILI Date 10-29/08 Approved D.C. Checked M. DELIZIO Date 11/05/08 Approved For Issue Scale SCALE DRAWING NUMBER D-12-7191 REV. K SHT. 8 OF 10

REV.	DRAWING NUMBER
K	D-12-7191

26-FOI-00415 00000006215 "UNCLASSIFIED" 4/30/2026

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-		SEE SHEET 1		-



SECTION A–A

SECTION B–B

AMTRAK P/N	PYLE NATIONAL	CLEMENTS NATIONAL			GE
24 808 00160	RPC–16	MRRA–AMTK			

NOTES

1. VENDOR NAME, AMMS NO. AND DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROXIMATELY WHERE SHOWN.
2. MOLDED BODY TO BE RED IN COLOR, 60–70 DUROMETER.
3. REFER TO FIGURE 4, (SHEET 4) FOR INTERFACE DIMENSIONS.

ESTIMATED WEIGHT 5.0 LBS.

DRAFT

FIGURE 9
480V, 400A, CONNECTOR
(480V LOOP - CLOSING)

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THE AMTRAK DRAWING IS THE GOVERNING DOCUMENT, AND SUPERSEDES ANY LIKE INFORMATION ON REFERENCE DRAWINGS, PART NUMBERS, SPECIFICATIONS, ETC.

QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

REFERENCE DRAWINGS

SPEC 223

PROGRAM | NEXT ASS'Y | USED ON

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

DO NOT SCALE DRAWING

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4501 Vandever Ave, Wilmington, DE 19809

TOLERANCES
Dimensions are in inches unless otherwise specified. Decimals .xx ±.03 .xxx ±.010 Angles ±2°
Remove all burrs & break sharp edges.

TITLE: 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES

Drawn	Date	Approved	Approved
G. MARZILI	10/29/08		D.C.
Checked	Date	Approved	For Issue
M. DELIZIO	11/05/08		

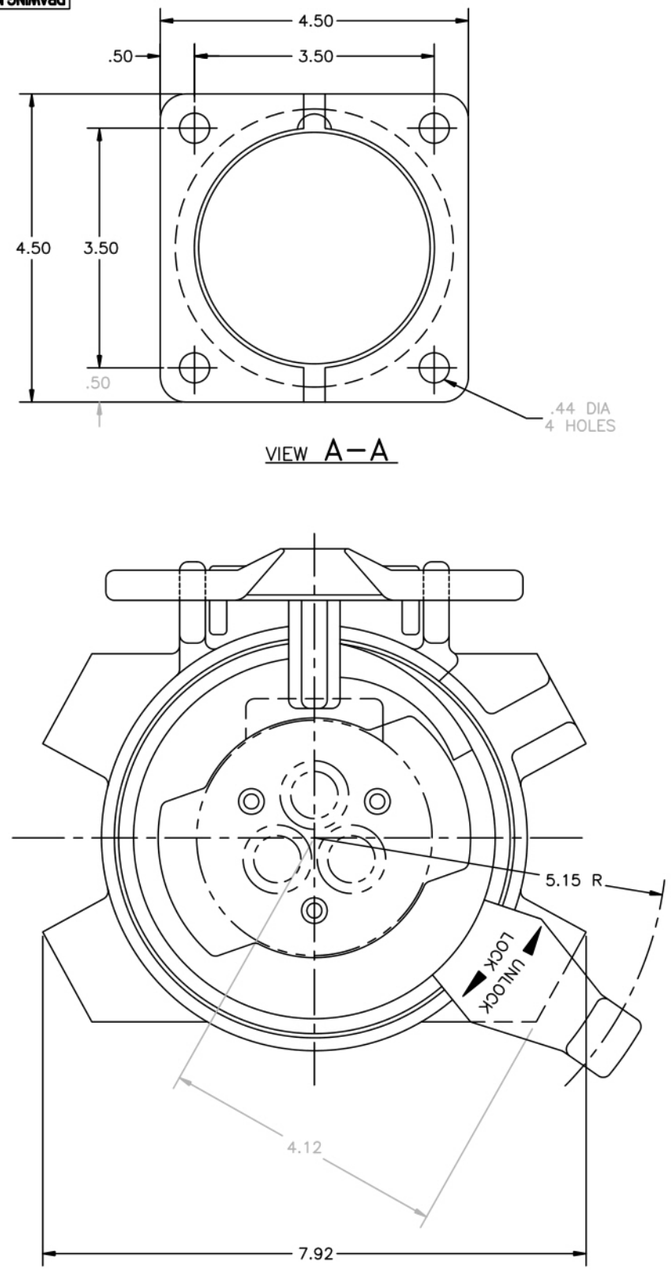
Scale: SCALE | DRAWING NUMBER: D-12-7191 | REV.: K

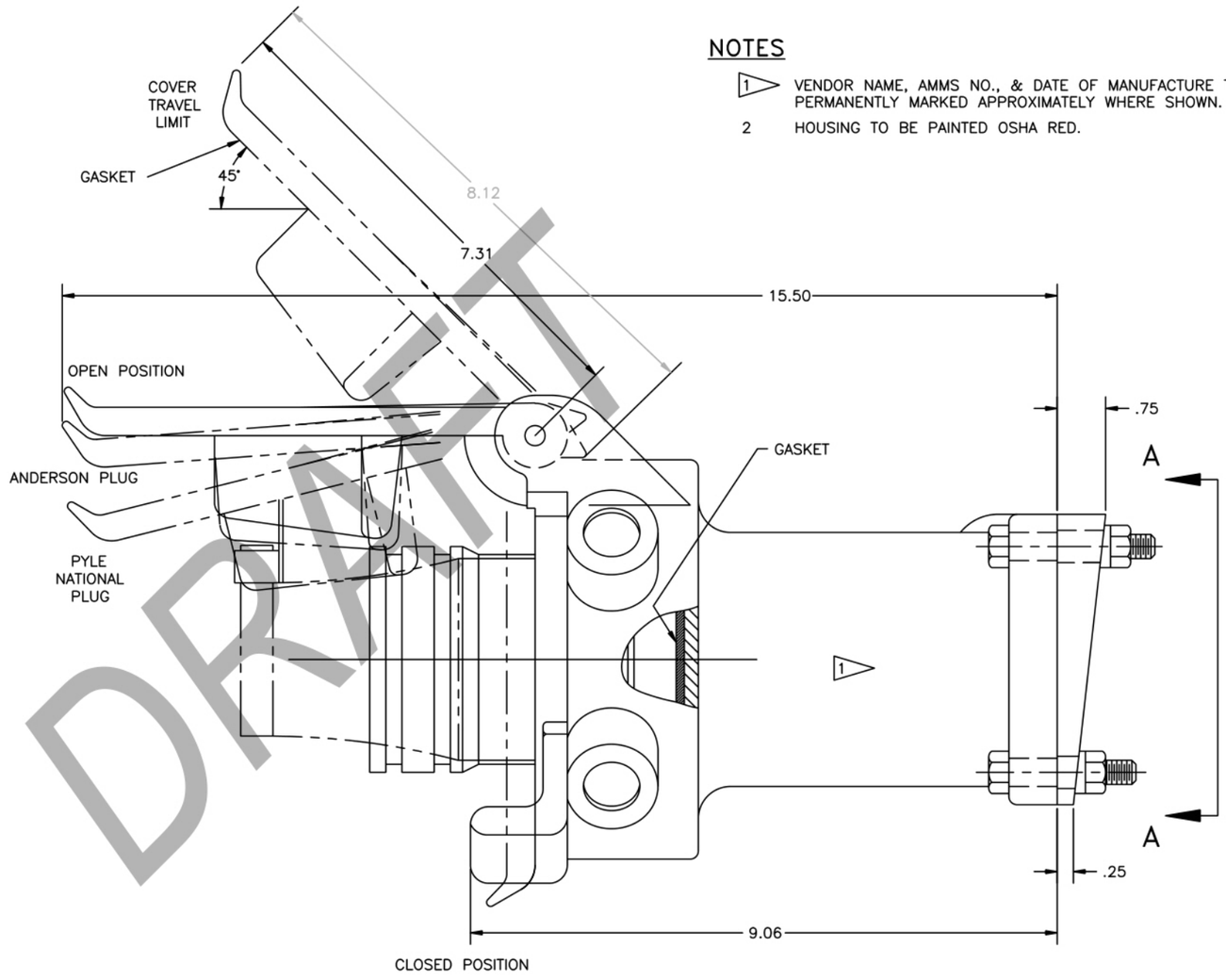
SHT. 9 OF 13

26-FOI-00415 00000006215 "UNCLASSIFIED" 4/30/2026

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-		SEE SHEET 1		-

DRAWING NUMBER	REV.
D-12-7191	K





NOTES

1. VENDOR NAME, AMMS NO., & DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROXIMATELY WHERE SHOWN.
2. HOUSING TO BE PAINTED OSHA RED.

DRAFT

FIGURE 10
480V, 400A, TWIST-LOCK HOUSING ASSEMBLY

QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

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REFERENCE DRAWINGS

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

DO NOT SCALE DRAWING

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4001 Vandever Ave. Wilmington DE 19802

TOLERANCES
Dimensions are in inches unless otherwise specified.
Decimals .xx ± .03 .xxx ± .010
Angles ±1°
Remove all burrs & break sharp edges.

TITLE 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES

Drawn G. MARZILI	Date 10/29/08	Approved	Approved D.C.
Checked M. DELIZIO	Date 11/05/08	Approved	For Issue
Scale SCALE	DRAWING NUMBER D-12-7191		REV. K
SHT. 10 OF 13			

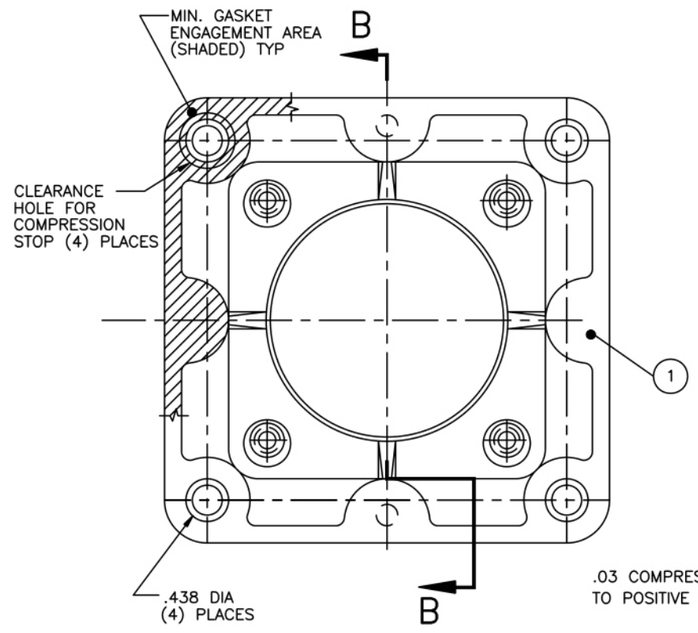
SPEC 223			
PROGRAM	NEXT ASS'Y	USED ON	

FILED AS

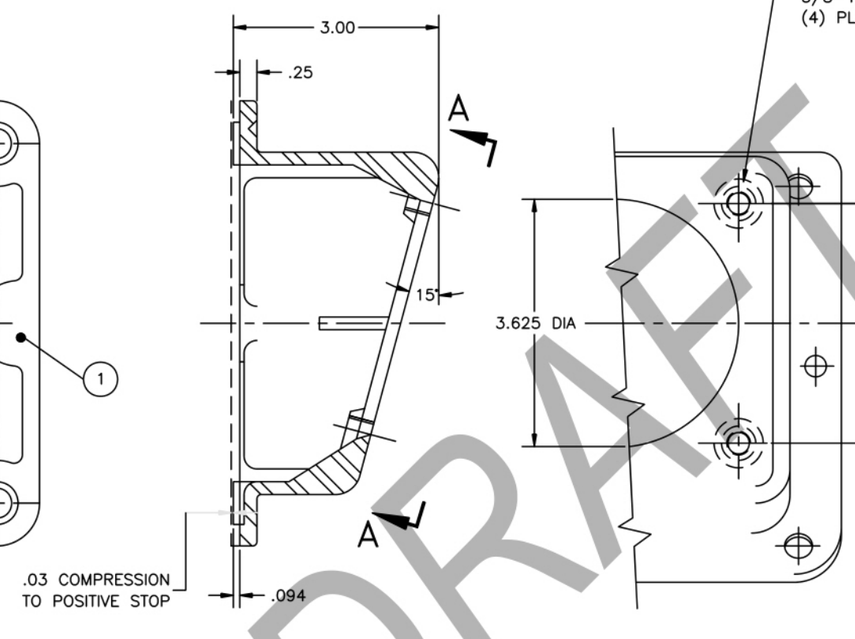
REV.	DRAWING NUMBER
K	D-12-7191

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-		SEE SHEET 1		-

FIGURE 11
ADAPTER - FIXED JUMPER MOUNTING (SUPERLINER CARS)

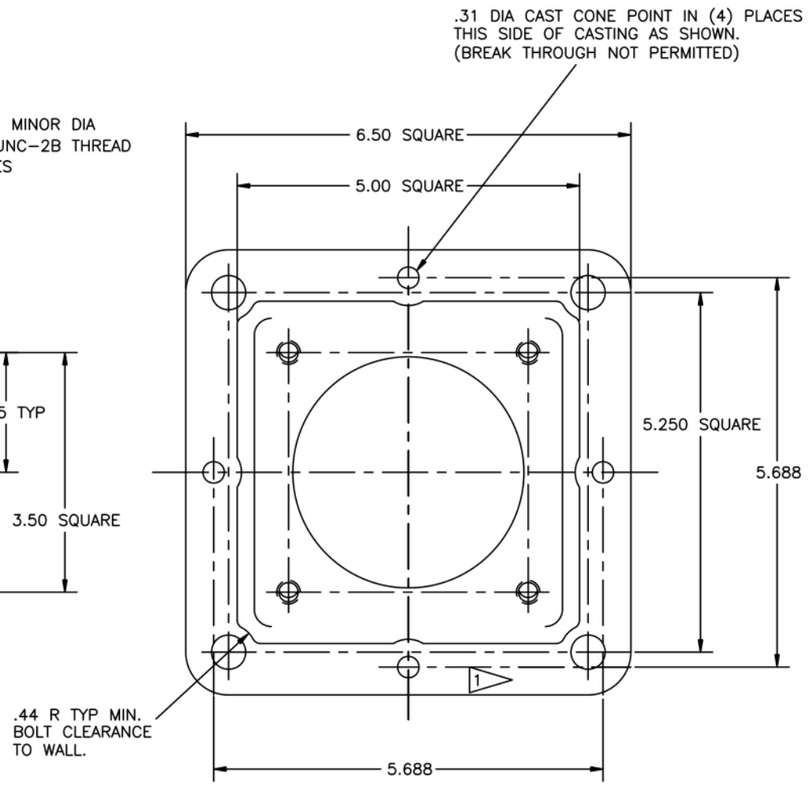


REAR VIEW



SECTION B–B

VIEW A–A
HALF VIEW SHOWN



FRONT VIEW

(1) ADAPTER

ESTIMATED WEIGHT_____LBS

APPROVED VENDORS	
NAME	PART NO.
PYLE NATIONAL	RPC–2125
CLEMENTS	MPA–AA
ANDERSON	

NOTES

1. VENDOR NAME, AMMS NO., & DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROXIMATELY WHERE SHOWN.
2. THIS SHEET WAS D–00–7080 REVISION D.

QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
1		ADAPTER	ALMAG35	QQ–A–601		3
1		GASKET, .125 THK	NEOPRENE	DURO		2
1		ADAPTER			24 808 02625	1

LIST OF MATERIAL

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REFERENCE DRAWINGS
MOD#M-WST
SUPER-9155
D 00-7090
SUP'RLNR

SPEC 223 | PROGRAM | NEXT ASS'Y | USED ON

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT
DO NOT SCALE DRAWING

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4501 Vandever Ave, Wilmington DE 19809

TOLERANCES
Dimensions are in inches unless otherwise specified. Decimals .xx ± .05 .xxx ± .010 Angles ± 1°
Remove all burrs & break sharp edges.

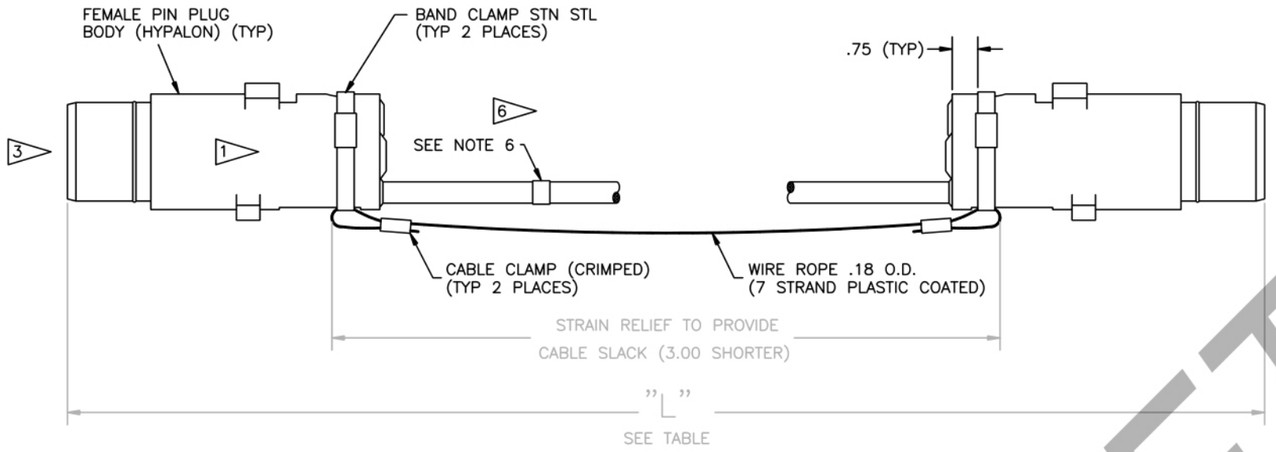
TITLE 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES

Drawn G. MARZILI Date 10/29/08 Approved Approved D.C.
Checked M. DELEDO Date 11/05/08 Approved For Issue
Scale SCALE DRAWING NUMBER REV.
SHT. 11 OF 13 D-12-7191 K

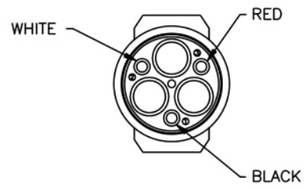
D-12-7191.dwg

DRAFT

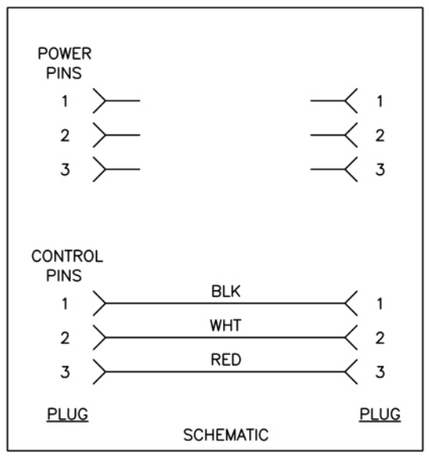
REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-		SEE SHEET 1		-



1 JUMPER, 480V FOR LOOPING LOCOMOTIVE



TYPICAL BOTH ENDS



SCHEMATIC

NOTES

1 VENDOR NAME, AMMS NO. & DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROX. WHERE SHOWN.

2– MOLDED BODY TO BE YELLOW IN COLOR, 60–70 DUROMETER.

3 REFER TO FIGURE 4, (SHEET 4) FOR INTERFACE DIMENSIONS.

5– COLOR CODE OF #10 CONDUCTORS:
#1 BLACK #2 WHITE #3 RED

6 MINIMUM OF 3 WRAPS 1.50 WIDE PVC TAPE COLORED (OSHA COLORS) AS SHOWN BELOW

YEAR ENDING IN	COLOR
1, 4, 7	BLUE
2, 5, 8	YELLOW
3, 6, 9	RED
0	GREEN

ITEM	LENGTH "L"	AMTRAK P/N	WEIGHT (LBS)	G.E.	PYLE NATIONAL	CLEMENTS	ANDERSON
1	30.00 +1.00 −0.00	26 568 50648		41B517757P1		MPA–2–0030–E60	2–7158G1

DRAFT

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FIGURE 12
480V JUMPER, MOTOR ALTERNATOR (FOR LOOPING LOCOMOTIVE)

QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
	-1	JUMPER FOR LOOPING LOCOMOTIVE			26 568 50648	1

LIST OF MATERIAL

REFERENCE DRAWINGS

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

DO NOT SCALE DRAWING

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4001 Vandover Ave. Wilmington DE 19802

TOLERANCES
Dimensions are in inches unless otherwise specified.
Decimals .xx ± .05 .xxx ± .010
Angles ± 1°
Remove all burrs & break sharp edges.

TITLE 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES

Drawn G. MARZILI Date 10/29/08 Approved Approved D.C.
Checked M. DELIZIO Date 11/05/08 Approved For Issue
Scale SCALE DRAWING NUMBER D-12-7191 REV. K
SHT. 12 OF 13

SPEC 223
PROGRAM | NEXT ASS'Y | USED ON

D-12-7191.dwg

REV.	DRAWING NUMBER
K	D-12-7191

26-FOI-00415 00000006215 "UNCLASSIFIED" 4/30/2026

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
-	K	SEE SHEET 1		-

CONFIDENTIALITY - CONTRACTORS SHALL KEEP CONFIDENTIAL ALL INFORMATION, DRAWINGS, SPECIFICATIONS, OR OTHER DATA FURNISHED BY AMTRAK, OR PREPARED BY THE CONTRACTOR, OR SUB-CONTRACTOR. THEY SHALL NOT DIVULGE OR USE SUCH INFORMATION, DRAWINGS, SPECIFICATIONS OR DATA FOR THE BENEFIT OF ANY OTHER PARTY. CONTRACTORS SHALL NOT IN ANY MANNER ADVERTISE OR PUBLISH THE FACT THAT THEY HAVE FURNISHED, OR CONTRACTED TO FURNISH, TO AMTRAK THE GOODS OR SERVICES HEREIN MENTIONED WITHOUT PRIOR WRITTEN CONSENT OF AMTRAK.

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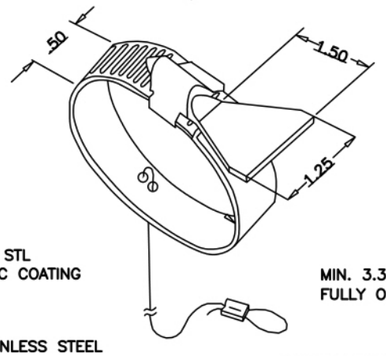
SERRATED BAND LOOP CLAMP
W/CLAMPING HOUSING



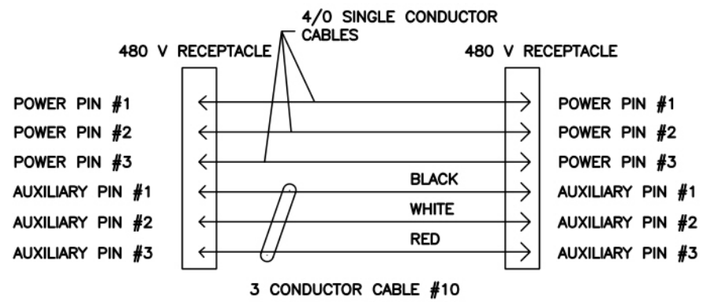
STAINLESS STL
W/ PLASTIC COATING

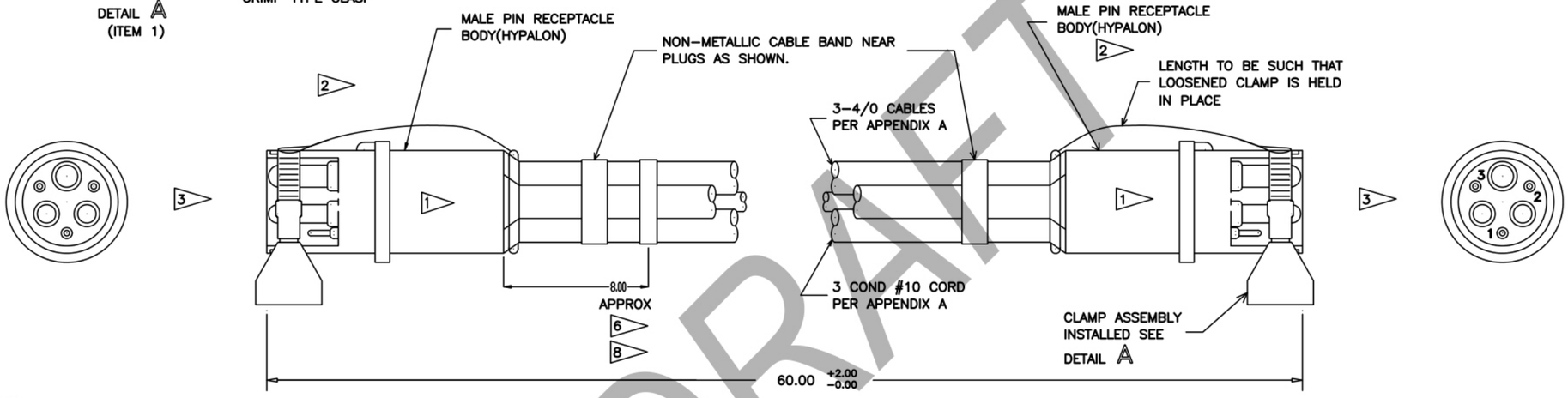
MATERIAL:
STAINLESS STEEL

MIN. 3.37 DIA WHEN
FULLY OPEN

CRIMP TYPE CLASP

DETAIL A
(ITEM 1)





NOTES

1. VENDOR NAME, AMMS NO., & DATE OF MANUFACTURE TO BE PERMANENTLY MARKED APPROXIMATELY WHERE SHOWN.
2. INTEGRALLY MOLDED RECEPTACLE TO BE RED IN COLOR, 60–70 DUROMETER;
3. REFER TO SHEET 4 FOR INTERFACE DIMENSIONS.
4. PHASE ROTATION 1, 2, 3.
5. COLOR CODE OF 4/0 & #10 CONDUCTORS: #1BLACK, #2 WHITE, #3 RED.
6. MINIMUM OF THREE WRAPS 1.50" WIDE PVC TAPE COLORED (OSHA COLORS) AS SHOWN ABOVE

YEAR ENDING IN	COLOR
1, 4, 7	BLUE
2, 5, 8	YELLOW
3, 6, 9	RED
0	GREEN

7. PROVIDE SLACK IN 3/C CORD FOR STRAIN RELIEF (4/0 CABLE TAKES STRAIN).
8. INDIVIDUAL #10 CONDUCTORS SHALL BE PROTECTED AGAINST PHYSICAL DAMAGE.

ITEM	NAME	AMTRAK P/N	WEIGHT "LBS"	ANDERSON	PYLE NATIONAL	CLEMENTS NATIONAL	~~G & G TRANSIT~~
1	CLAMP ASSEMBLY	24 808 02481	1.7 OZ.		RPC-90-CP	MPA-C	~~55008731~~
2	JUMPER ASSEMBLY	**24 457 00589**	XX		~~RPC-13-33-S568~~	MRA-2-0060	~~55000363~~

FIGURE 13
480V, 400A, JUMPER CABLE ASSEMBLY PLUGS (MALE PINS) BOTH ENDS

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QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

REFERENCE DRAWINGS

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Passenger Railroad
4501 Woodland Ave, Wilmington DE 19803

TITLE: 480V TRAINLINE JUMPERS, PLUGS, AND RECEPTACLES

Drawn G. MARZILI	Date 10/29/08	Approved	Approved D. C.
Checked M. DELEDO	Date 11/05/08	Approved	For Issue

TOLERANCES
Dimensions are in inches unless otherwise specified. Decimals .xx ± .05 .xxx ± .010 Angles ±1°
Remove all burrs & break sharp edges.

SPEC 223			REPORT ALL CHANGES TO ENGINEERING DEPARTMENT	SCALE	DRAWING NUMBER	REV.
PROGRAM	NEXT ASS'Y	USED ON	DO NOT SCALE DRAWING	SHT. 13 OF 13	D-12-7191	K

FILED AS

Amtrak
Mechanical Department
Rolling Stock Equipment

SPECIFICATION
AMTRAK
Shunt Enhancement Device

SPECIFICATION No. 1118

Issue Date: 4/29/2020
Revision No. 0

DRAFT

Approved By: 5/5/20 Date:

5/5/2020 VP/Chief Mechanical Officer

5/5/20 AVP/Deputy Chief Mechanical Officer

4/30/2020 Director System Engineering & Specifications

4-29-20 Sr. Manager Equipment/Engineering

4/24/20 Originator & Creation Date

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Specification Change Sheet

Revision	Date	Section(s)	Description	Approver
0	4/29/2020	ALL	Initial Release	D PARSONS

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Amtrak
Rolling Stock Equipment

AMTRAK Diesel Locomotives
Shunt Enhancement Device

Specification No. 1118
Revision No. 0

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Amtrak
Rolling Stock Equipment

AMTRAK
Shunt Enhancement Device

Specification No. 1118
Revision No. 0

1.0 Scope

This Specification defines the vendor's general technical requirements applicable for the design, purchase and installation of locomotive or passenger vehicle shunt improvement device(s), component(s), assembly or equipment on Amtrak's Fleet.

The intent of this specification is to provide a scope of requirements which meet or exceeds the Railroad Shunting and/or Wayside Signal Standards as these requirements specifically noted below:

Expected Shunt Level or Wayside Signal standards:

1. Ohmic value should be less than 10 milli-Ohms (0.000 to 0.010 Ohms) of Resistance over the vehicle from rail to rail. This can be accomplished by a device that:
    a. Mechanically contacts the rails directly
    b. Mechanically contacts the wheels, provided necessary resistance is made to rail
    c. Is contactless via antenna or equivalent device

Given the lighter and shorter locomotive and car consists normally operated by Amtrak, Rolling Stock Equipment (RSE) is requiring a simple, efficient, inexpensive and effective method to improve all Shunting or Wayside Signal paths caused by the nature or configuration of our equipment consists as they travel during normal passenger operations.

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1.1 General

This Specification is intended to be used in conjunction with any associated Amtrak drawings and/or CADD models, the Amtrak Procurement Department purchase orders, and other contractual documents issued to the vendor. It is Amtrak's intention that all components supplied under this Specification, unless improvements are otherwise identified, be functionally interchangeable with those currently in use at Amtrak in terms of form, fit, function, general appearance, durability and operation. Any food service, sanitation or other public health items supplied under this Specification must comply with the applicable requirements of the Food and Drug Administration (FDA) of the US Department of Health and Human Services, and also the National Sanitation Foundation (NSF).

As basic work under this Specification, each item produced must be completely functionally tested, cleaned, sanitized as required, properly packaged for shipment to Amtrak, and have documentation submitted. Amtrak will perform a series of First Article Inspections on the first item

produced by a vendor, in order to verify that the process and materials used are in compliance with this Specification and drawings.

The design criteria and constraints that are known to Amtrak have been specified. If other factors require definition after Contract award, the vendor shall be responsible for making those definition requirements known to the Amtrak Contracting Agent in a timely manner for mutual investigation and satisfactory resolution, with any revision approved in writing by the Amtrak Contracting Agent. The vendor shall not be relieved of the overall responsibility of providing an adequate design for the Amtrak service conditions. Wherever possible, this Specification has been developed on the basis of equipment performance required, rather than specific hardware to be provided. Where specific hardware is mentioned, it is for the purpose of providing an example of concepts or designs acceptable to the Amtrak Engineer, in order to allow vendors to employ innovation and advanced technology, where appropriate. Preference, to the extent practicable and economically feasible, will be given for products and services that conserve natural resources, protect the environment and are energy efficient.

Whenever in this Specification an article or material is defined by using a trade name or the name and catalog number of a particular manufacturer or vendor, or a limited description, the term "or approved equal" if not written thereafter shall be implied. Any reference to a particular manufacturer's product, either by trade name or limited description, is only for the purpose of setting a standard of performance, quality, composition, construction or size. The term "or approved equal" means any other manufactured product or article which is equivalent in material, workmanship and service and is as efficient and economical in operation in the opinion of the Amtrak Engineer. Amtrak's written opinion as to whether the proposed alternate is equal to the specified items for Amtrak's specified use and purposes shall be final and conclusive. The vendor shall not subcontract the design and manufacturing work under this Specification without the written authorization of the Amtrak Contracting Agent. The vendor shall not patent or copyright any original materials or information created by this procurement which will be submitted to Amtrak.

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Any items of material or equipment, which are not fully described or are omitted in this Specification or the accepted vendor Technical Proposal, but are necessary for the completion of the item being supplied, shall be considered a part of the scope of supply. In this Specification, all references to "number of days" shall mean calendar days unless otherwise stated.

Safety shall be of primary importance in the design of any items being supplied. They shall present a safe, hazard-free environment to the extent practical. No sharp edges or corners or pinch points shall occur where any personnel may come into contact with them. Smooth surfaces and avoidance of protrusions shall be used to minimize injury.

1.2 Amtrak Ownership Rights

Unless specifically waived in writing by the Amtrak Contracting Agent, all drawings, bills of materials, catalog lists, mockups, CAD models, documentation and all other engineering and design materials related to this Specification shall become the property of Amtrak, and shall be delivered by the vendor in total as part of the First Article Inspection or other process. If any patented items are used, Amtrak must be granted an unrestricted license to use, copy or otherwise manufacture the item by itself or a third party.

1.3 Vendor's Technical Proposal

As a condition of contract award unless otherwise indicated in the Amtrak Procurement documents, the vendor must submit a written and detailed Technical Proposal to the designated Amtrak Contracting Agent. This Technical Proposal must identify the vendor's interpretation of what it considers to be the scope of Basic Work to be performed, present a complete technical description of the components to be supplied, fully describe the operation and maintenance requirements of the components, include a copy of the vendor's Quality Assurance program, describe any Design Review process, present a step-by-step work plan for construction, include a project schedule by major events starting from the Notice to Proceed, and a Bill of Material of all components to be supplied.

1.4 Exceptions

The vendor shall explicitly identify to the Amtrak Contracting Agent any exceptions being taken to this Specification, referencing the Specification Section number and the exact wording in question. It will otherwise be assumed by Amtrak that the vendor takes no exception to this Specification and is completely compliant with all Specification requirements.

1.5 Legal Requirements

All items being supplied under this Specification must comply with all applicable Federal government requirements, in particular those identified in 36 CFR Part 1192, Subpart F (ADA Requirements for InterCity Rail Cars), 49 CFR Part 223 (Glazing Standards), 49 CFR Part 229 (Locomotive Safety Standards) and 49 CFR Part 238 (Passenger Equipment Safety Standards), among others. This shall include all design aspects, as well as required submittals for approval. It is mandatory that all required materials used by the vendor for application in passenger cars or the cab interior of passenger service locomotives comply with the flammability and smoke emissions requirements of the latest edition of 49 CFR Parts 238.103 (a)(2) and (b)(2), and the Appendix B requirements (including referenced notes) for the category and function of material so listed. Prior to the First Article Inspection and any delivery of material, the vendor must supply the Amtrak Contracting Agent with a report by a recognized third-party independent testing laboratory certifying that all required materials used comply with the 49 CFR Part 238 Appendix B flammability requirements, if applicable.

1.6 Engineer

The Engineer or Amtrak Engineering, as referenced in this Specification or any drawings, is defined as the Senior Manager of Equipment Engineering within its Mechanical Department, or its written designee. The vendor may be submitting items for the Engineer's approval as required by the Specification. The vendor shall not interpret this process to mean that the Engineer will function as an arm of the vendor's Project Management or Engineering staff. Submissions shall be structured to show how the vendor is responding to all of the requirements of the Specification, and not on the basis of requiring the Engineer to discover how the vendor is not meeting those requirements. Submissions shall contain sufficient detail to confirm that Specification requirements are being met. However, the vendor shall use judgment as to what level is appropriate and shall communicate with the Engineer when guidance is needed on a case-by-

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case basis. Submittals requiring the Engineer's approval prior to implementation shall be reviewed and classified by the Engineer within 30 days from the day the submittal is received based on a rate of submittal that is reflective of the pace of an orderly, properly managed program. Priorities will be given to special cases when possible.

1.7 Cost Items

Any individual extra work items regarding the items being supplied shall be handled in accordance with the purchase order and other contractual documents issued to the vendor by the Amtrak Procurement Department. The vendor must contact the Amtrak Contracting Agent, and not solely the Engineer, regarding all such issues. The vendor agrees that no payment will be made by Amtrak for any additional work outside the basic work scope of the contract documents unless such work is first preapproved in writing by the Amtrak Contracting Agent in accordance with the contract documents.

1.8 Vendor Quality Assurance Program

The vendor is required to have in place a documented Quality Assurance Program that is modeled after an established industry quality standard, such as the ISO, AAR, or other organization. The vendor's facility is required to be equipped with equipment, personnel and management completely sufficient to assemble, inspect and test each item being supplied under this Specification. The vendor shall have suitable equipment to diagnose any failure mode, and perform all adjustments and tests required to confirm proper operation. The vendor's Quality Assurance staff shall be active participants in the assembly, inspection, testing and documentation phases of the work. The vendor is required to submit a copy of its Quality Assurance Program as part of its Technical Proposal, as explained in Section 1.3. While it not a mandatory requirement under this Specification, it is highly desirable that the vendor's quality assurance program be certified under ISO 9001:2000 or an equivalent recognized standard.

Amtrak Quality Assurance personnel may conduct random audits of the vendor's quality assurance program to verify that these Specification requirements are being achieved. The vendor shall fully cooperate in such audits. Specific attention shall be paid to the areas of management responsibility, quality system, contract review, design control, document control (including drawings), purchasing, purchaser-supplied product, product traceability and identification, process control (including procedures, testing and equipment), inspection and testing, measuring and test equipment (including calibration programs), control of nonconforming products (applied controls), corrective and preventative actions, handling, storage, packaging and delivery, quality records, internal quality audits, training, servicing and statistical techniques.

1.9 Critical to Quality (CTQ) Part Criteria

It is mandatory that the vendor comply with Amtrak procedure PD 3.7.4.02, Critical to Quality (CTQ) Part Criteria, which applies to all products identified by either the Engineer or the designated Amtrak Contracting Agent that Amtrak considers to have aspects identified that are Critical To Quality (CTQ). CTQs shall be Critical to Quality (CTQ) characteristic are defined as "Those characteristics of an item which, if non-conforming, may prevent or seriously affect the unit performance, reliability, producibility, or customer satisfaction of a component." This

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procedure defines the methodology when qualifying parts or processes to assure that the critical to quality product criteria meet Amtrak requirements by:

- Implementing a rigorous Part/Process qualification to ensure the participation, communications of all related departments and the quality acceptance.
- Support the Quality process by involving the vendor early in the project/design process.
- Assure that the vendor is supplying materials that meet the quality, cost, delivery and reliability requirements.

1.10 Components

The vendor shall use only new parts for all components, unless otherwise specified on the drawings or contract documents. It is Amtrak's desire that all materials, to the greatest extent possible, be of commonly available commercial items and hardware. The vendor shall maintain drawings for each component, and where necessary, patterns, jigs and fixtures, to assure identical manufacture. All elastomers used shall have a design life of 10 years in service unless otherwise approved by the Engineer.

1.11 Conducting Tests

The vendor shall be equipped and responsible to fully test the items being supplied in accordance with this Specification and any referenced drawings as part of basic work. All testing apparatus shall be calibrated on a periodic basis as recommended by the apparatus supplier, and the vendor shall maintain documentation of such calibrations.

1.12 Workmanship

All workmanship shall be of high grade and shall conform to the best of manufacturing practices. Skilled, qualified, well motivated personnel, with appropriate experience, training and aptitude shall be utilized to assure high quality of workmanship at all levels. Foremen, supervisors, inspectors, and shop managers shall be well integrated within the project team and be fully experienced and capable in their fields. They shall manage their teams in a competent and professional manner. The vendor is required to have on hand in its facility this Specification, and all other referenced drawings and documents.

1.13 Documentation Records

The vendor shall maintain an electronic database and/or approved logbook of information regarding all components supplied to Amtrak under this Specification. At a minimum, records shall identify the Amtrak purchase order number, any serial number of the assembly, Amtrak "SAP" internal catalog number (if known), copies of any written authorizations by the Amtrak Contracting Agent, inspection and test data, shipping date and shipping location. In addition, it shall include a copy of the flammability and smoke emission laboratory certification report, if required, under 49 CFR Part 238 Appendix B for the components being supplied. The vendor shall include any applicable fire safety analysis and all certifications such as by the U.S. Public

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Health Service, the U.S. Food and Drug Administration, Underwriters' Laboratories and the National Sanitation Foundation.

1.14 Referenced Documents

The latest revision level of all referenced drawings and documents are to be considered to be the applicable version.

- Amtrak Procedure PD 3.7.3.01, Design Review and Control Procedure
- Amtrak Procedure PD 3.7.4.02, Critical to Quality (CTQ) Part Criteria
- Amtrak Specification 323, Wire and Cable
- Amtrak Specification 328, Materials and Workmanship
- Amtrak Specification 352, Flammability, Smoke Emissions and Toxicity
- Amtrak Specification 866, CAD Model Standards
- Amtrak Specification 867, Amtrak Drawing Standards for CAD
- Amtrak Specification 963: Environmental Conditions for Rolling Stock
- Code of Federal Regulations 36 CFR Part 1192; 49 CFR Parts 223, 229, 236 and 238
- AAR S-9409 Railway Electronic Environmental Requirements
- ISO 9001:2000, Quality Management Systems - Requirements
- Amtrak drawings and models provided with the bidding and contract documents.

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2.0 General Requirements

2.1 Design Considerations

Any components being supplied under this Specification shall be designed and manufactured to perform satisfactorily for a minimum design life of 10 years, unless otherwise specified. To the extent possible, only readily available components, hardware and fasteners shall be used. Any assembly hardware visible to passengers shall be recess mounted stainless steel.

The design and components shall comply with the flammability, smoke emissions and toxicity requirements of Amtrak Specification 352. Any water systems being supplied shall comply with the design requirements of Amtrak Specification 339. All water and waste systems shall have freeze protection systems provided in compliance with Amtrak Specification 531. All wire and cable shall comply with Amtrak Specification 323. All materials and workmanship shall comply with the requirements of Amtrak Specification 328. Components shall be selected for maximum endurance between inspections, and for ease and quickness of inspection. All items of electronic hardware and software proposed by the vendor to control or monitor any safety functions must have a safety program meeting the requirements of 49 CFR Part 238.105 submitted to the Engineer for approval and compliance along with all other applicable regulations to the device.

As appropriate, the overheating of apparatus and overall fire safety design shall be addressed by use of thermal cutouts, selection and use of materials meeting flammability, smoke generation and toxicity requirements, and by means of fire detection and suppression. All food service galley systems and auxiliary equipment shall be equipped with overheat sensors and thermal cutouts.

Any items being supplied under this Specification for use either by passengers or train crew staff shall be designed to provide maximum comfort and safety as dictated by ergonomic requirements. All items shall be designed utilizing Universal or Transgenerational design, considering the needs of a broad range of users and citizens. This is particularly critical for the very young and the elderly who, while not considered "disabled" are often less stable or lack strength in situations considered "normal" by manufacturers. Applying these concepts need not complicate or add expense to the component but einsure its continued utility and safety over time regardless of the demographics of the service area. Special attention shall be given to passengers with reduced visual acuity by providing them with visual cues as required. Floor support surfaces should have high contrast colors in this regard, and high contrast signage and striping patterns shall be provided where necessary, as approved by the Engineer.

All apparatus being supplied which requires inspection or maintenance must be readily accessible and replaceable, and shall be arranged to provide simple, easy access. Special attention shall be given such that opened covers, access doors, etc., provide sufficient room for a maintainer to easily gain access to equipment within lockers or enclosures. Secondary safety latches shall be used for all overhead ceiling covers, and any car exterior enclosure cover. In general, frequency of required service shall determine the degree of equipment accessibility.

For newly designed systems being supplied under this Specification, the vendor shall prepare for Engineer approval a Maintainability Analysis for the components being supplied. The analysis shall be the basis for development of maintenance tasks procedures, methods, and techniques. This analysis shall establish the maintenance concepts to be incorporated in the design, taking into consideration the requirements for safety, reliability, accessibility of apparatus, and the skills available for performing maintenance. Maintainability Analysis shall include all tasks required at each level of maintenance (daily, periodic, annual and overhaul), the task frequency, the time required, required labor resource, skill levels, and the necessary tools and support equipment. The Maintainability Analyses shall be a continuing effort during design and shall provide data for consideration in the review of the design.

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2.2 Environmental Conditions

Any components being supplied under this Specification shall be designed to comply with the conditions listed in Amtrak Specification 963, Environmental and Operating Conditions, and must be suitable for use up to 10,000 feet elevation above sea level. They shall also be designed and mounted to have structural integrity and be operationally reliable for the vibration environment at the point of attachment, and shall prevent unacceptable vibration inputs to the attachment structure. The component structure and mounting shall be designed to prevent amplification through component resonance beyond a level twice that of the attachment point. The vibration force output of any rotating component shall not exceed the vibration environment specified for the component.

All carbody mounted equipment shall be designed to withstand continuous vibrations of at least 0.2 g at frequencies up to 100 Hertz in all directions, as well as randomly orientated shock loads of at least 5 g's longitudinally, 3 g's vertically and 3 g's laterally. Truck components located above the primary suspension shall be designed to withstand continuous vibrations of at least 6 g's at frequencies up to 100 Hertz in all directions, as well as randomly orientated shock loads of at least 8 g's. Truck components directly carried on the axles shall withstand continuous vibrations of at least 50 g's up to 100 Hertz in all directions, as well as randomly oriented daily shock loads

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of at least 200 g's. Vibration resistance shall be verified by analysis, to the satisfaction of the Engineer.

2.3 Interchangeability

All similar parts on each item being supplied, and among all other assemblies and their spare parts, shall be designed and manufactured to be identical, both as individual parts and as subassemblies. All assemblies shall mount to the vehicle without modification. Model numbers for identical components shall be identical. Replaceable components of any such apparatus shall be fully interchangeable, without adjustments to any part being necessary.

2.4 Dimensions

All designs, components, dimensions and fasteners used on the components being supplied under this Specification, unless otherwise stated in the bidding and contract documents, shall be of United States inch-standards. Due to potential compatibility issues with existing Amtrak rolling stock, any components and fasteners using metric dimensions shall not be supplied unless approved in writing by the Engineer.

The vendor shall provide English dimensioning for its drawings and other communications which are generated. Fractional measurements shall be expressed as a decimal value. Drawings prepared by the vendor shall be made using third angle projections. First angle projection shall be allowed provided all views are labeled, including the front, top, bottom and side views. Dimensional tolerancing shall be appropriately applied for the part being manufactured.

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2.5 Cleaning and Maintenance

All components being supplied under this Specification shall be easy to clean and maintain. They shall not require maintenance or adjustments at internals of less than four years, unless approved in writing by the Engineer. Pockets where dirt and debris can collect shall be minimized; those that exist shall be made easy to clean with standard vacuum cleaner equipment. Light fixtures shall be fully gasketed, including diffuser covers, to prevent dirt entry into the fixtures. Where possible, components requiring maintenance or replacement at overhaul shall be replaceable as individual units. The design shall ensure that items that require repair and or service are easily accessed, removed and replaced and that this is possible with the use of standard hand tools. Variations of fastener thread size, thread length and head style shall be minimized to ease overhaul and regular maintenance. The number of fasteners shall be kept to a minimum. All paints, coatings and corrosion protection shall meet the requirements of Amtrak Specification 328.

2.6 Interference and Transient Suppression

All electrical components and wiring being supplied shall be carefully planned and selected to avoid electrical interference in the operation of train crew and maintenance department portable radios, public address and any other frequency sensitive systems. Likewise, these components shall be immune to the EMI/RFI effects of electrical interference from Amtrak's electrically and diesel-electrically propelled trainsets, passenger cars and locomotives. The vendor shall include

the use of shielded cables, chokes, filters, and capacitors, as required by good design standards, to avoid possible interference with these systems. Adequate voltage transient suppression shall be provided for the protection of circuitry involving semiconductor devices. Low voltage circuits shall be capable of withstanding 1.5 joules, unless otherwise approved by the Engineer.

Apparatus creating EMI emissions shall be designed to contain these emissions within their package area. Suppressors shall be incorporated across inductive devices to minimize switching transients. All suppression devices shall be selected on the basis of their ability to absorb the amount of energy available in the connected circuit, for the number of cycles of operation expected in service, without requiring replacement prior to scheduled overhaul. All magnet valves and relay/contactor coils shall have free-wheeling diode or metal-oxide varistor voltage spike suppression, or other suppression means, except where this results in deterioration of performance. Coil suppression devices shall be located physically on or as close as possible to the coil it protects (preferably directly at the coil terminal). Wherever possible, the suppression of transients shall be at the source. Provided device must comply with North American rail environment operations including signal and wayside interference with the onboard technology.

3.0 Specific Requirements

As a requisite of any pre-bid proposal, the vendor(s) shall be required to provide to Amtrak Engineering, a concept of the prototype device that demonstrates that the prototype will improve the ability of the Amtrak's fleet to exceed all shunting and wayside signal requirements. It is expected that this proposal includes theory, application, material requirements, installation method/guidelines expected cost of installation and maintenance of provided device. The device must have a design life of a minimum of 10 years with no less than 6 months between required changeout of wear components.

The vendor shall provide a concept prototype device prior to production that will improve the ability of the Amtrak equipment to meet all shunting and wayside signal requirements outlined within this specification.

Safety shall be of primary importance in the design of any items being supplied. All equipment shall present a safe, hazard-free environment to the extent practical. No sharp edges or corners or pinch points shall occur where any personnel may come into contact with them. Smooth surfaces and avoidance of protrusions shall be used to minimize injury.

Amtrak Engineering will perform a series of First Article Inspections on the prototype item produced by a vendor in order to verify that the process and materials used are in compliance with this specification and drawings. In addition, supplier will provide all support necessary – including but not limited to engineering resources, materials, specialized tooling and or equipment – to ensure testing of the device meets the Amtrak specification and complete combability with the North America railroad network and operating environment.

The vendor shall provide in its technical proposal and at its own expense, all design concepts, drawings, technical data and schematics, installation, shipment and delivery, planned production, method of installation and expected lead times for all required materials and costs.

It is Amtrak's intention that all components supplied under this Specification, unless improvements are otherwise identified, be functionally interchangeable with those currently in use at Amtrak in terms of form, fit, function, general appearance, durability and operation.

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As basic work under this Specification, the vendor shall be responsible for the concept and prototype device design and manufacture for evaluation and testing to prove the performance, durability, practicality, usefulness, maintainability, ease of installation and performance of the prototype Locomotive Shunt Improvement Device and the devices ability to improve and provide the Amtrak equipment to meet and exceed this requirements in this Specification.

Should any part of the proposed device contact any moving part of the Locomotive or Passenger Car or Rails/Track that the Locomotive rides upon, care must be taken to eliminate any possible resulting source of possible undesirable interaction, snag, impediment, operational obstacle, thermal "hot spot", thermal elevation of device or development or potential spark generation, shock, or possible sources of ignition that may be generated or develop during the operation and testing of the device.

Should any part of the device contact any moving part of the Locomotive or Rails, no sparks or possible sources of ignition may be generated or develop during the testing and operation of the device.

All prototype devices used to improve the performance of Locomotive shunting must be able to be applied without operational compromise to Amtrak's current safety, electrical, mechanical, environmental or government requirements and systems on the Amtrak Fleets. All devices must meet or exceed all existing Amtrak operating requirements, clearances, equipment allowances and constraints or federal regulations.

The vehicle onboard device should, at a minimum, be capable of:

Maximum Speed Range	90 MPH
Rail to Rail Resistance over Vehicle	0.010 Ohms
Rail Gauge	4 ft 8.5 in.
Minimum Horizontal Curve	250 ft radius horizontal curve (23 degree curve) for coupled locomotives and for a locomotive coupled to an 85 ft car. No. 8 crossovers per Amtrak Drawing No. AM 73195-A on 12-foot track centers. No. 7 crossovers on 13-foot track centers; Facing No. 8 turnouts per Amtrak Drawing No. AM 73195-A arranged to form a "S" curve with a minimum of 5 feet of tangent between switch points; Two 400-foot radius reverse curves with zero tangent in-between. No. 6.5 turnout with 12' track center
Minimum vertical curve	1000 ft radius (concave or convex) for coupled locomotives and for a locomotive coupled to an 85 ft car.
Maximum Track Super Elevation	7 in.
Possible Vehicle Cant Deficiency	6 in.
Onboard Device Clearance	Amtrak D-05-1355

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Environmental Conditions	Amtrak Specification 963
Locomotive Wheel Diameter	40" to 44"
Car Wheel Diameter	33" to 36"
Wheel Profile	Amtrak NRCC6
Power Options	72V DC Low Voltage Power Supply; Max Current Draw 10 Amps
	90 PSI pneumatic supply with regulator; Max CFM 10

Activation of this device should be provided by means in the locomotive operator cab (remote), manually on/at the device (local) or automated logic onboard the vehicle to be determined in design reviews as approved by Amtrak.

Note: if 480 volts 60HZ from the locomotive is used to power the device; there must be phase balance load between all 3 phases"

The contractor shall implement a weight optimization program in order to produce the lightest device consistent with the requirements of this Specification.

Amtrak will provide vehicle arrangement drawings as necessary to design mounting applications.

The Contractor is responsible for ensuring that all applicable published regulations, standards and Specifications are followed when complying with the requirements of this document. Various industry standards such as those published by AAR, APTA, ASME, ASTM, ANSI, IEC and IEEE documents mentioned in this Specification are examples acceptable to Amtrak. Material standards and Specifications which are used by the Contractor, unless otherwise approved by Amtrak, shall be of those organizations which are based in the United States, or are generally used on a commercial basis in the United States. The specified standards of this Specification may be replaced with Amtrak approved equivalent standards proposed by the Contractor after Notice to Proceed (NTP). The Contractor shall be required to establish the equivalency and to obtain explicit approval from Amtrak for any substituted documents.

Nothing in this Specification shall relieve the Contractor from ensuring that all applicable regulations, standards and Specifications are followed. The Contractor shall provide proof of compliance for those items so governed before the first device is accepted. The Contractor shall provide a compliance matrix for all applicable CFRs. Note that Amtrak will work with Contractor for necessary regulation waivers for such instances as CFR 229.71 and top-of-rail clearance for designed device if necessary.

4.0 Packaging and Shipment

For all components produced, following all assembly the vendor is required to perform and fully document a complete verification test and evaluation of each component being supplied, prior to shipment to Amtrak. The results of this final testing shall be recorded in the documentation record. When successfully completed, the vendor may be directed by the Engineer to apply a permanent Engineer-approved identification label in an inconspicuous agreed-upon area, which shall include the name and location of the vendor, any serial number used by the vendor, any Amtrak "AAMPS" internal catalog number, and the date of manufacture.

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All packaging and shipping requirements shall be performed by the vendor. It is required that the vendor properly prepare all components being supplied under this Specification for shipment to Amtrak so that they are ready to install following unpacking. Any food service item being supplied shall be completely cleaned and sanitized in accordance with all requirements of the latest edition of the Food Code, issued by the Food and Drug Administration (FDA) of the US Department of Health and Human Services.

All components being supplied prior to shipping shall be completely winterized and drained by the vendor of all internal water, so as to be undamaged by freezing temperatures. The vendor shall package the components, unless otherwise instructed by the Amtrak Contracting Agent, to be suitable for continuous storage prior to unpacking in unheated (subfreezing), dusty indoor storage conditions. Fabric and soft goods shall be wrapped in plastic for protection against water exposure. Components shall be appropriately packaged for their weight and size. Special efforts must be used to protect unusually fragile or plastic items from damage during shipping and handling. Large and bulky items shall be secured to a shipping skid or other commercial shipping media suitable to allow the use of fork lift trucks for handling.

The shipping package shall have an identification label. This label shall include the vendor's name and address, purchase order number, date released for shipment, Amtrak "AAMPS" internal catalog number, and any component assembly serial number. This information shall also appear in the vendor's invoice, and be included in the documentation record.

The vendor shall retain a copy of the shipping documentation record, and shall make three copies for Amtrak. One copy shall be included within the shipping container for the assembly, one copy shall be sent to the Amtrak Contracting Agent (or as otherwise designated in the purchase order), and the third copy shall be sent to the attention of the Amtrak Quality Assurance inspector in care of the Amtrak "ship to" address.

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5.0 Product Support

5.1 Program Schedule

If required by the contract documents, any vendor-produced Program Schedule shall include all program milestones, design reviews, production schedule, delivery schedule, and any other pertinent information that will assist with tracking program progress. Any requested changes to the Program Schedule must be presented to the Amtrak Contracting Agent for review and approval.

5.2 First Article Inspections

To verify that any components being supplied under this Specification meet all Specification and drawing requirements, and are truly interchangeable with existing components, Amtrak will conduct a series of two (initial and as-installed) First Article Inspections (FAI) on the first complete assembly manufactured by a vendor, prior to allowing unrestricted manufacturing work to start. It is the intention of the FAI process that every function and feature of the items being supplied under this Specification be fully exercised and tested for proper operation under all normal,

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abnormal and fault conditions, both in the vendor's workshop and as applied on the vehicle.

The initial FAI shall consist of a pre-shipment inspection and testing of a prototype assembly at the vendor's facility. This shall be an active test, and the vendor shall provide all mounting fixtures, electrical and pneumatic power, etc, as required to fully functionally exercise all components and features. A complete range of operating voltages, currents, pressures, loads, etc. shall be applied to simulate both normal and abnormal conditions, and the response of the components to these conditions.

Once this FAI is successfully completed at the vendor's facility, the vendor shall ship the same assembly to the Amtrak maintenance facility identified by the Amtrak Bidding and Contract Documents or the Engineer, where Amtrak will install the assembly onto an Amtrak vehicle. A second "as-installed" FAI shall then be performed to verify proper operation of the assembly in the "as-installed" configuration. This shall in particular verify all component interface conditions with the vehicle.

Each FAI shall have Amtrak Engineering and/or Quality Assurance personnel as well as the vendor in attendance. They shall include, but not be limited to, a mechanical and electrical inspection to determine compliance with the specifications and the drawings, complete testing of the functionality of the component, demonstration of maintainability and troubleshooting, and verification of proper operation and complete compatibility/interoperability when installed on a vehicle. Approval by the Engineer following successful completion of the FAI process, as communicated through the Amtrak Contracting Agent, shall constitute final system approval.

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5.3 Delivery of All CAD Models and Drawings

Following the successful completion of the First Article Inspections, and as a precondition to permit production delivery of material to commence, the vendor must supply to the Amtrak Bureau of Rolling Stock Engineering, via the Amtrak Contracting Agent, an electronic set of every fully-developed CAD model and dimensioned drawing and Bill of Material which may have been created for every individual part used for the manufacture of all items being supplied under this Specification. All models and drawings shall comply with Amtrak Specifications 866 and 867. Refer to Section 5.4 for additional details. Any later modifications as a result of warranty or other actions must include the affected models and drawings being revised as necessary and resubmitted to Amtrak.

5.4 Production Changes Require Engineer Approval

Once final system approval is granted by the Engineer and production has commenced, the vendor is forbidden to make any changes in the design, material or configuration of the items being supplied, unless approved in writing by the Amtrak Contracting Agent as per Amtrak Procedure PD 3.7.3.01, Design Review and Control Procedure. This shall include any modifications required as a result of warranty actions, so as to provide complete documentation.

5.5 Spare Parts List

The vendor shall supply to the Engineer, via the Amtrak Contracting Officer, a Microsoft Excel

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spreadsheet list in Engineer approved format of any spare or consumable parts which are recommended to be stocked by Amtrak for maintenance of the components being supplied. Such lists shall contain for each item an item number, the spare part name (in noun, adjective format), the name of the Original Equipment Manufacturer (OEM), the OEM part number, approximate cost for each item, and recommended stocking quantity. The vendor shall also supply any revisions in this data up to the conclusion of the warranty period.

5.6 CAD Models, Drawings, Manuals and Parts Lists

All CAD models and drawings prepared by the vendor under this Specification shall be in full compliance with Amtrak Specification 866, CAD Model Standards and Amtrak Specification 867, Amtrak Drawing Standards for CAD. All CAD models and drawings shall be in Engineer-approved formats, and shall include a complete set of all "as-built" drawings of every part, component and assembly used for all items being supplied to Amtrak of all levels, not only the top assembly level. All CAD models shall identify all materials, surface finish and fasteners. Each drawing shall include a complete Bill of Material, providing quantities, original component manufacturer name and part number of the actual supplier of the part. Every part on the Bill of Material must be fully identified regarding its characteristics including material, plating, finishing, heat treatment, secondary operations, etc. Amtrak drawing formats and number series shall be used as agreed upon with the Engineer. The drawing package shall also include drawings of every special tool, jig or fixture required to install, maintain or overhaul the assembly, and if referenced in any of the maintenance manuals. The final CAD models shall be delivered as 3 sets of DVDs or CDs in SolidWorks 2004 or above. The as-built drawings shall be delivered as 3 sets of DVDs or CDs of all drawings in electronic format in SolidWorks 2004 or above (DXF and AutoCAD 2000 format files shall be accepted only with prior approval of the Engineer) along with 3 sets of CDs of all drawings in Adobe Acrobat read-only PDF file format. The vendor shall also supply any revisions in this data up to the conclusion of the warranty period.

One set of software (including any diagnostic tester software) used for any microprocessor system being supplied under this Specification shall be included with each assembly, with an additional complete set on CDs or DVDs to be provided to the Engineer via the Amtrak Contracting Agent. Amtrak shall be identified as the license holder for any commercial software used. Complete operations, programming, and diagnostic tester documentation shall be provided to the Engineer, including procedures for Amtrak to revise all user-changeable software settings. The vendor shall also supply any revisions in this data up to the conclusion of the warranty period.

The vendor shall also submit in electronic format to the Amtrak Bureau of Rolling Stock Engineering, via the Amtrak Contracting Agent, a complete set of all documentation including the operating manual, maintenance manual, and parts list. All documentation data must be compatible with Microsoft Office 2000 or newer applications. The parts list shall identify all individual parts used (in noun, adjective format) in the items being supplied under this Specification, and must include the original equipment manufacturer (OEM) name and part number; use of an intermediate supplier or distributor's name or part number is not acceptable. The parts list shall indicate quantities for each item within each assembly, use exploded isometric-view parts diagrams if possible, use separate pages for parts diagrams and tabular data if possible, and be sufficiently complete to permit Amtrak to order individual replacement spare parts direct from the actual parts manufacturer. The maintenance manual shall include complete information from installation, through troubleshooting, repair and complete overhaul. The manuals shall include maintenance and parts information for every special tool, jig, fixture or

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diagnostic test equipment used to repair or overhaul the assembly. The vendor shall also supply in electronic format all other manuals and other support documentation it has available for the components being supplied under this Specification. All documentation data must be delivered as 3 sets of CDs in Adobe Acrobat read-only PDF file format, distilled in Acrobat 5.0 or higher, and in addition 3 sets of CDs in its original Microsoft Office applications format, for internal use by Amtrak for future revision of the data. The vendor shall also supply any revisions in this data up to the conclusion of the warranty period.

All PDF files (other than drawings) shall be distilled from the authoring documents, resulting in PDF documents that can be indexed and searched. All authoring electronic data files making up the manuals shall be delivered formatted such as to not cause pagination errors during the PDF distillation process. The PDF file produced from the distillation process shall match any published version of the authoring document. All files shall be editable by Amtrak for future document maintenance. All columnar data found within word processing files shall be presented in a table format. Any fonts used on the creation of authoring and/or PDF files shall be embedded and not restricted for use. PDF documents with definable chapters, sections and/or subsections shall be linked to their individual locations with bookmarks internal to the file in the fashion of a hierarchical format such as a Table of Contents. Creation of PDF files from scanned images only, resulting in non-searchable or non-indexable documents, will be restricted to only those allowed by the Engineer. Scanned information in the form of document attachments may be allowed to be imported into an existing PDF file that is searchable and capable of indexing, if the information is supplemental to context to the file and not the primary means of communicating the subject's information. If documents are scanned, careful attention will be taken to not allow misalignment of the pages. Opening options in the PDF file format should be set to show bookmarks and page, with magnification at "Set Width" and "Continuous Page" settings. Distillation settings shall be "E Book" or "Print", with DPI settings set to produce quality printing from a desktop printer without overly increasing the size of the file.

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5.7 Training

If required by the Bidding and Contract Documents, following the successful conclusion of the First Article Inspection, the vendor shall provide complete on-site training at the Amtrak maintenance location identified in the Bidding and Contract Documents. The training shall highlight both the operation, maintenance and calibration procedures for the components being supplied. This shall include a minimum of 8 hours of classroom time and "hands-on" training, to be scheduled as mutually agreed between the vendor and the Engineer. The training program shall be presented in written format and shall include the written manuals that are provided for operation and maintenance.

5.8 Failure Analysis

A Failure Analysis to determine the cause and frequency of defects occurring during the warranty shall be performed by the vendor and submitted to the Engineer and the Amtrak Contracting Agent for concurrence. Such analysis shall be performed and reported within 30 days from the date of each failure.

6.0 Source Inspection

6.1 Purpose

Amtrak will perform periodic source inspection of vendor materials and components being supplied. The following is intended to be used as an outline defining activities and responsibilities of the vendor performing the source inspections.

6.2 Professionalism

All inspections, test observations, and other activities performed in the fulfillment of the contract are to be conducted in a professional and ethical manner. The vendor is representing Amtrak in the performance of the contract and therefore must remain courteous, conscientious and professional under all circumstances arising from performance of the contract.

6.3 Scope of Work

Amtrak has implemented a multi-faceted supplier management program of which source inspection is an integral part. Amtrak identifies vendors and materials/components through various methods which will be subject to source inspection. By performing source inspections, Amtrak expects to benefit by use of vendor facilities, measuring and testing equipment to verify materials/components, through rejecting noncompliant materials/components before shipment and receipt by Amtrak, presence of Amtrak representative periodically to ensure continuing good performance, and assist to communicate Amtrak intentions and interpretations of specifications and resolve issues. The vendor will conduct inspection or verify through observation, product compliance with drawings, specifications, standards or Amtrak contract documents and report findings of said inspections to Amtrak.

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6.4 Services

6.4.1 Scheduling Inspections

The vendor shall conduct observations and verifications on Amtrak identified materials and components produced by the vendors for Amtrak. Inspections must be scheduled to coincide with final inspection of said materials/components due for shipment to Amtrak. The vendor may use random sampling where large quantities of material are subject to shipment and note sampling method in associated reports. The vendor must perform all dimensional and operational inspections in accordance with the Quality Plan prior to source inspection, and make all inspection records available for review by the Amtrak source inspector, with focus on CTQ items.

6.4.2 Dimensional Inspection

The vendor must witness and verify conformance with dimensional characteristics per drawings

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identified in the Amtrak contract documents. The vendor must witness and verify conformance with regulatory standards and requirements including material certification as cited in specification or other reference documents identified in Amtrak contract documents.

6.4.3 Operational Inspection

The vendor must witness and verify conformance with operational tests as cited in specifications, operators manual or other reference documents identified in Amtrak contract documents.

6.4.4 Inspection Reports

The vendor must provide a report documenting the vendor source inspection and the inspection results. The report must include the name of the vendor, the date of the inspection, the material or component name, Amtrak (AAMPS) ID number(s) for items inspected, the quantities of each item inspected, the inspection results, and the actions taken where nonconforming materials/components are found. Reports should reference appropriate drawings, specifications, standards, requirements, or Amtrak contract document as appropriate.

6.5 Qualification of Personnel

It is the responsibility of the vendor to provide personnel with adequate training and experience to perform all the activities of the source inspections described above. Personnel must also conduct their activities with professionalism.

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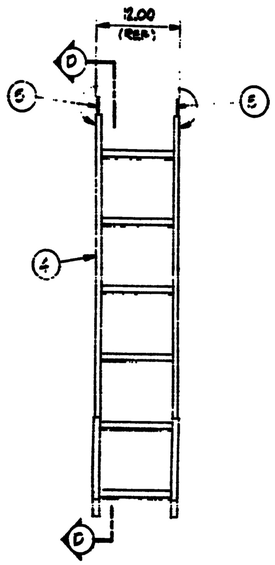
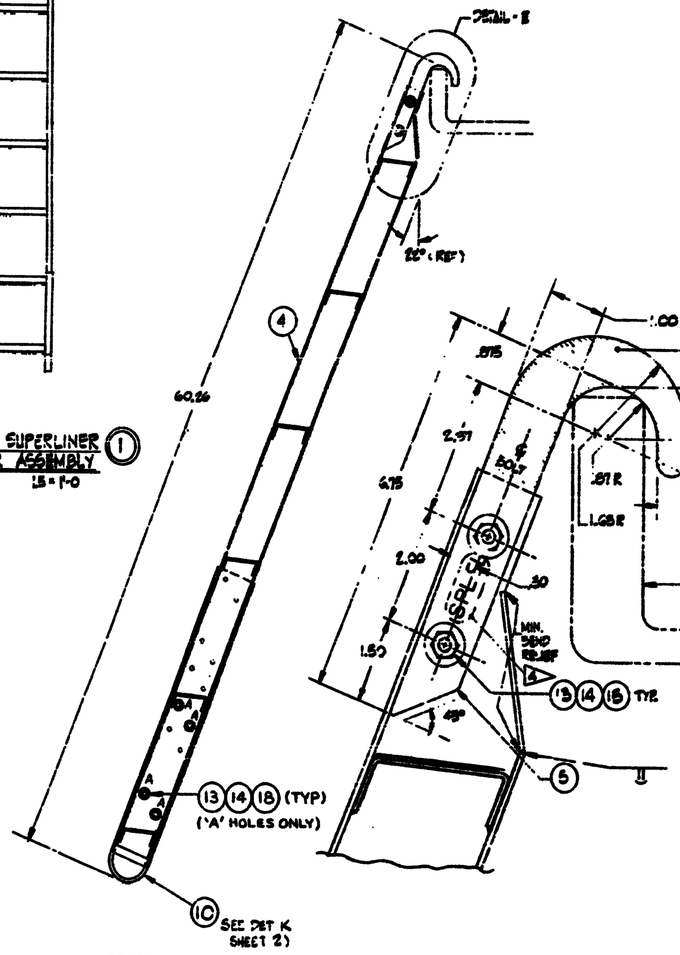
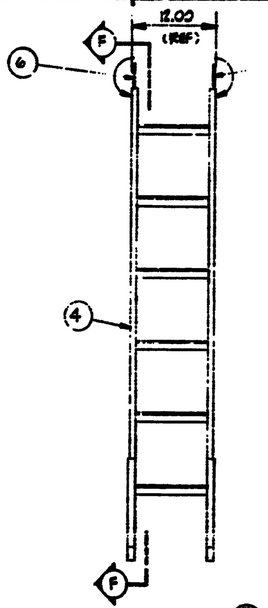


FRONT VIEW - SUPERLINER BUNK LADDER ASSEMBLY (1)
SCALE: 1.5 = 1'-0

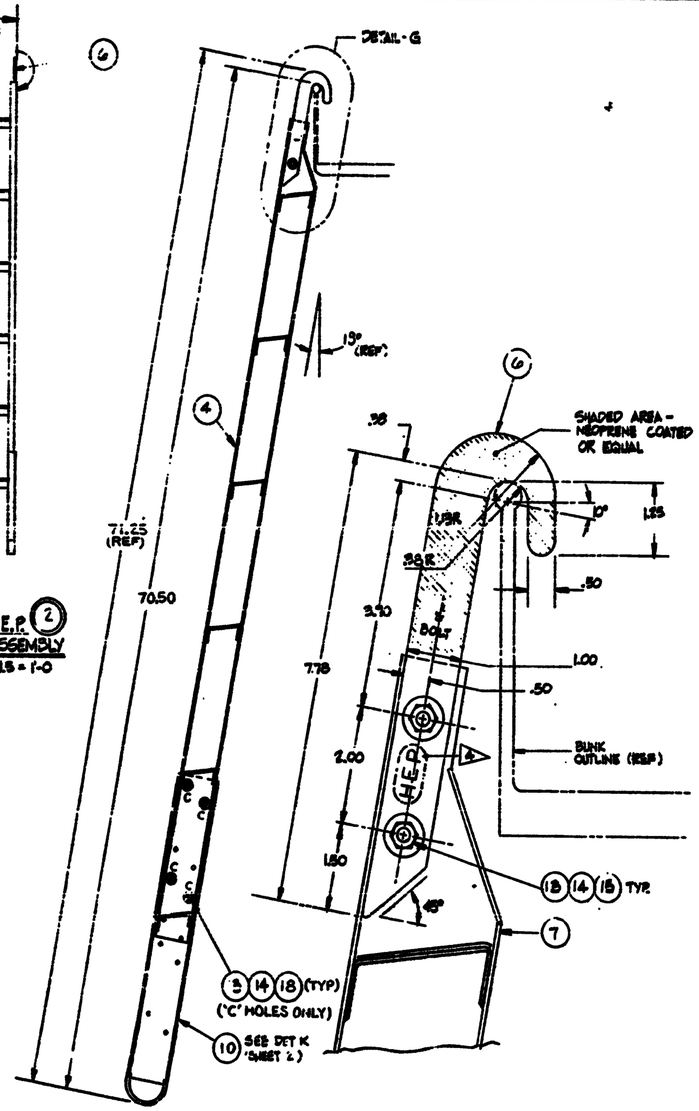


SECTION D-K
SCALE: 1.0 = 1'-0

DETAIL - E
FULL SCALE
(FOR SUPERLINER & SINGLE LEVEL APPLICATION)



FRONT VIEW - H.E.P. (2)
BUNK LADDER ASSEMBLY
SCALE: 1.5 = 1'-0



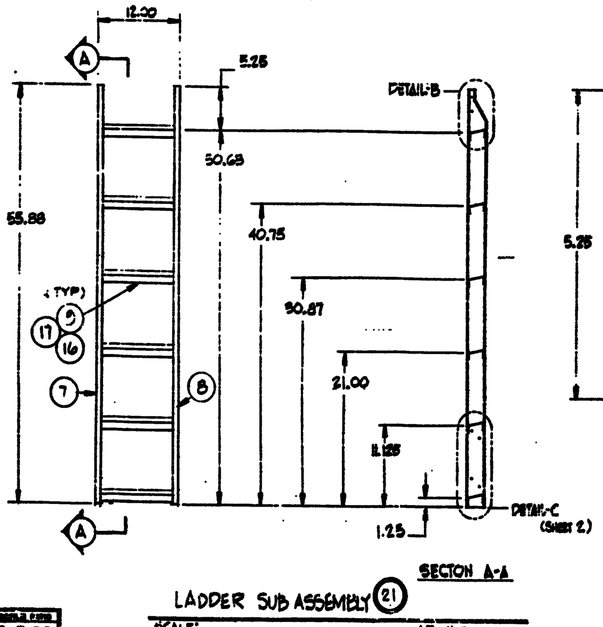
SECTION F-F
SCALE: 1.0 = 1'-0

DETAIL - G
FULL SCALE

LTR	ZONE	REVISIONS DESCRIPTION	DATE	APPD
A		1. DELETE ITEM 10 (RIVET, 36 PL.) 2. ITEM 8 WAS CARPET 3. ITEM 9 WAS "SCRATCHPAD #1199 ADHESIVE 4. NOTE 1 WAS SHERWIN WILLIAMS POLANE 5. NOTE 2 WAS SHERWIN WILLIAMS WASH PRIMER P-60G2 6. NOTE 4 WAS BOND (RIVET/ CARPET TO RUNG)	[illegible]	
B		ADDED ASMS # TO IT. 13&14 IT'S WAS "LADDER ASS'Y SUPERLINER" IT'S WAS "LADDER ASS'Y H.E.P."	[illegible]	
C		[illegible]	[illegible]	
D		ADDED SHEET 2 TO SHOW -B DETAILS, ADDED NOTE 5 & 6 ADJUST -/M QTY'S	[illegible]	
E		ADD ASMS NO. TO ITEMS 1, 2 & 3	[illegible]	
F		INCREASE "HEP"-2 HEIGHT TO 71.25 OVERALL, & 18° ANGLE. REVISED EXTENDER FOOT & ADDED EXTRA MTG HARDWARE	[illegible]	

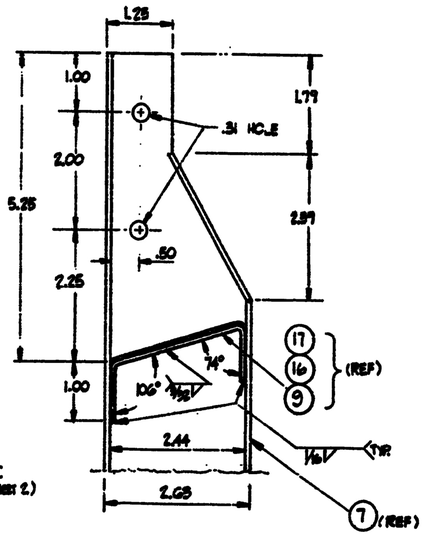
NOTES:
1. PAINT TO BE POWDER COAT BROWN (FULLERS IF 9240 BROWN TEXTURE).
2.
3. THIS DRAWING SUPERSEDES DRAWING # HEP-D-014-003
4. STEEL STAMP (APPROX WHERE SHOWN) IN .25 LETTERS EITHER H.E.P. OR SPL-SL APPROPRIATE WITH HOOK (ITEM 5 - SPL., ITEM 6 - H.E.P.) BEING USED.
5. BASIC LADDER (ITEM 4) CONSISTS OF LADDER SUB ASSEMBLY (ITEM 21), L.H. EXTENTION FOOT (ITEM 10) R.H. EXTENSION FOOT (ITEM 19).

   LADDER SHALL BE ASSEMBLED ACCORDING TO APPLICABLE DETAILS:
   - (1) SUPERLINER: SEE SECT. E-E (SHT 1) 'A' HOLES
   - (2) H.E.P.: SEE SECT. F-F (SHT 1) 'C' HOLES
   - (3) SINGLE LEVEL: SEE SECT. L-L (SHT 2) 'B' HOLES
6. APPROVED SOURCE:
   MECH-TECH
   704 VANCE DR.
   GLENSIDE, PA. 19038



SECTION A-A

LADDER SUB ASSEMBLY (21)
SCALE: 1.5 = 1'-0



DETAIL - B
FULL SCALE

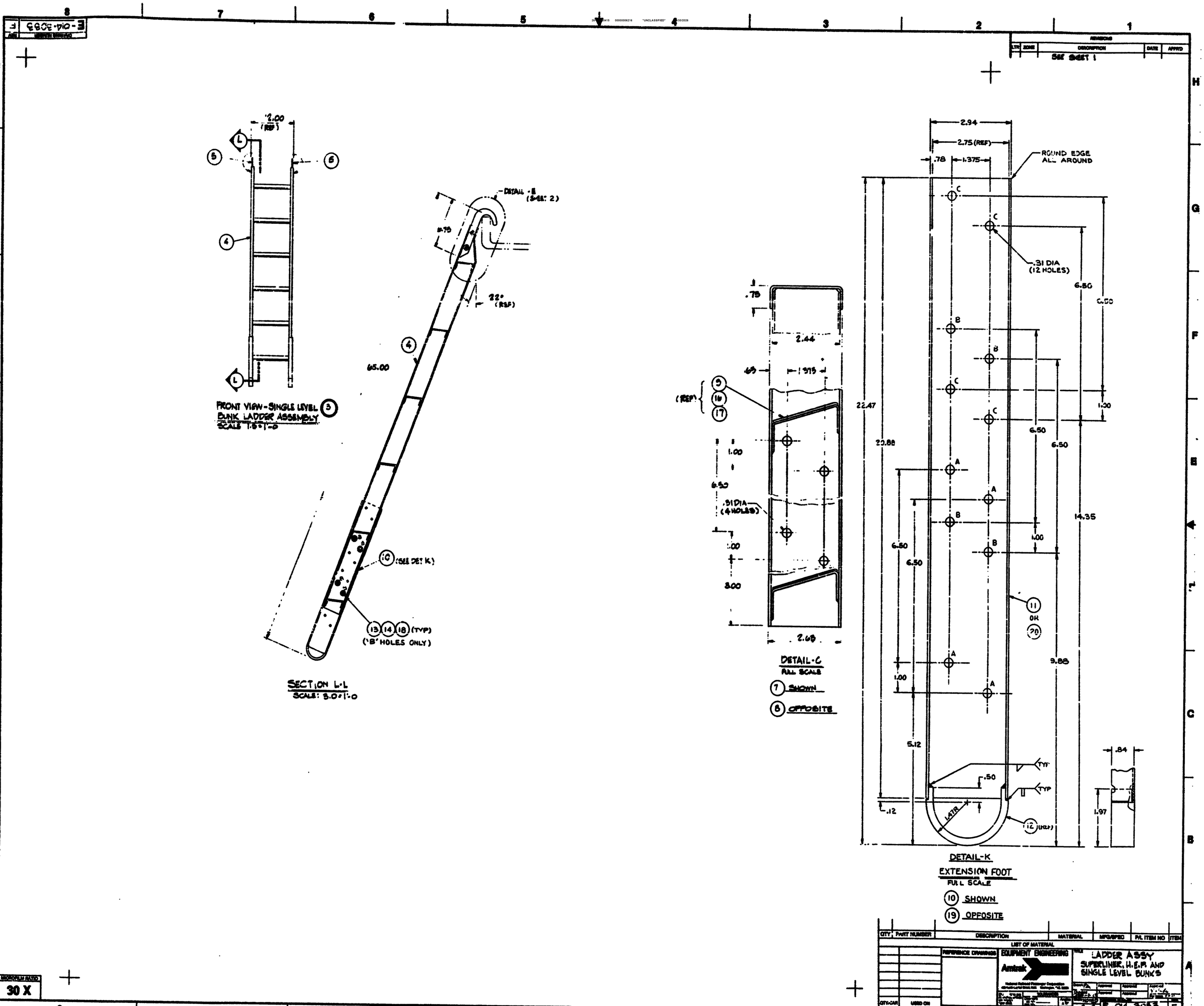
AMMS NO.	-21 QTY	-10 QTY	-18 QTY	-4 QTY	-5 QTY	-2 QTY	-1 QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFR/SPEC	ITEM
									LIST OF MATERIAL			
	X	-	-	1	-	-	-	-21	LADDER, SUB ASSEMBLY			21
	-	-	1	-	-	-	-	-20	CHANNEL R.H.	.09 THK AL ALY	5052-H32	20
	-	-	X	1	-	-	-	-19	EXTENSION FOOT R.H.	.09 THK AL ALY	5052-H32	19
	-	-	-	-	8	8	8		BOLT, 1/4-16 UNC x .75	SST		18
	AR	-	-	-	-	-	-		EPOXY ADHESIVE			17
	AR	-	-	-	-	-	-	*707	TREAD, RUBBER, RIBBED	1/16 RIBBED TRANS FLEX	R.C.A.	16
	-	-	-	-	4	4	4		BOLT, 1/4-16 UNC x 1.00	SST		15
	-	-	-	-	12	12	12		WASHER	SST		14
	-	-	-	-	12	12	12		NUT, LK, HEX 1/4-16 UNC	SST		13
	-	1	1	-	-	-	-	-12	FOOT	.25 THK ALCAST	D 712	12
	-	1	-	-	-	-	-	-11	CHANNEL L.H.	.09 THK AL ALY	5052-H32	11
	-	X	-	1	-	-	-	-10	EXTENSION FOOT L.H.	.09 THK AL ALY	5052-H32	10
	6	-	-	-	-	-	-	-9	RUNG	.09 THK AL ALY	5052-H32	9
	1	-	-	-	-	-	-	-8	SIDE RAIL, RIGHT HAND	.09 THK AL ALY	5052-H32	8
	1	-	-	-	-	-	-	-7	SIDE RAIL, LEFT HAND	.09 THK AL ALY	5052-H32	7
2412009916	-	-	-	-	-	2	-	-6	HOOK, H.E.P.	.25 THK ALUM CAST	D 712	6
2412009924	-	-	-	-	2	-	2	-5	HOOK, SUPERLINER, SINGLE LEVEL	.25 THK ALUM CAST	D 712	5
2418007816	-	-	-	X	1	1	1	-4	LADDER BASIC			4
2418000004	-	-	-	-	X	-	-	-3	LADDER ASSY (SINGLE LEVEL)			3
2418000810	-	-	-	-	-	X	-	-2	LADDER ASS'Y (H.E.P.)			2
2418000588	-	-	-	-	-	-	X	-1	LADDER ASSY (SUPERLINER)			1

REFERENCE DRAWINGS:

EQUIPMENT ENGINEERING
Amtrak
National Railroad Passenger Corporation

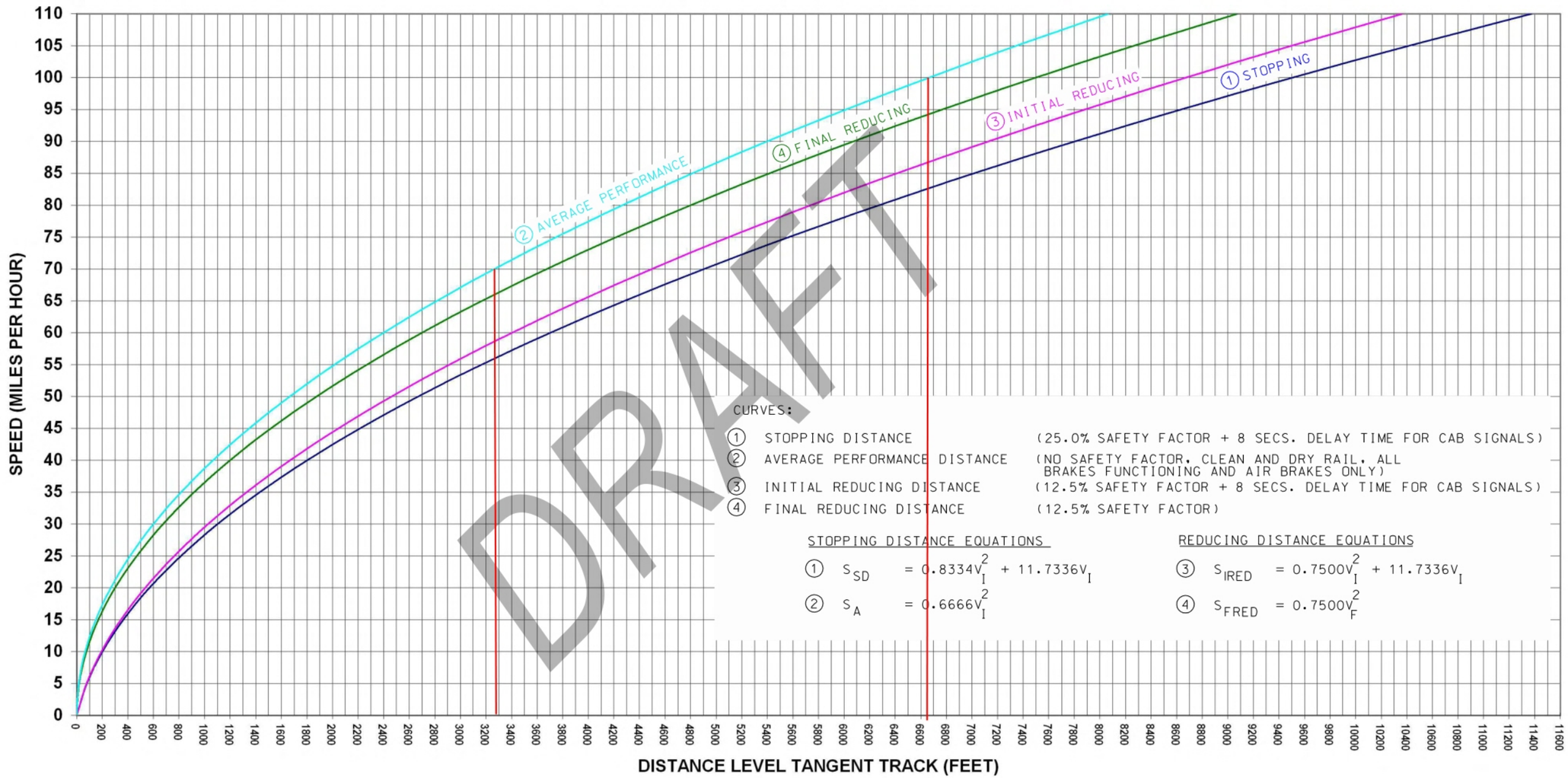
TITLE: LADDER ASSY
SUPERLINER, H.E.P. AND SINGLE LEVEL BUNKS

SIZE: D



E-014-3083
SEE SHEET 1
FRONT VIEW-SINGLE LEVEL BUNK LADDER ASSEMBLY
SCALE 1.5=1'-0
DETAIL-E (SHEET 2)
22° (REF)
65.00
(SEE DET K)
(TYP) ('B' HOLES ONLY)
SECTION L-L
SCALE: 3.0=1'-0
DETAIL-C
FULL SCALE
7 SHOWN
8 OPPOSITE
ROUND EDGE ALL AROUND
.31 DIA (12 HOLES)
.31 DIA (4 HOLES)
DETAIL-K
EXTENSION FOOT
FULL SCALE
10 SHOWN
19 OPPOSITE
LIST OF MATERIAL
EQUIPMENT ENGINEERING
Amtrak
LADDER ASSY
SUPERLINER, H.E.P. AND SINGLE LEVEL BUNKS
30 X

CE-205 BRAKING DISTANCE CURVES FOR ALL PASSENGER TRAINS LISTED IN THE SPECIAL INSTRUCTIONS OF THE TIMETABLE WHOSE SPEEDS ARE LESS THAN OR EQUAL TO 110 MPH.



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CURVES:

①	STOPPING DISTANCE	(25.0% SAFETY FACTOR + 8 SECS. DELAY TIME FOR CAB SIGNALS)
②	AVERAGE PERFORMANCE DISTANCE	(NO SAFETY FACTOR, CLEAN AND DRY RAIL, ALL BRAKES FUNCTIONING AND AIR BRAKES ONLY)
③	INITIAL REDUCING DISTANCE	(12.5% SAFETY FACTOR + 8 SECS. DELAY TIME FOR CAB SIGNALS)
④	FINAL REDUCING DISTANCE	(12.5% SAFETY FACTOR)

STOPPING DISTANCE EQUATIONS

① $S_{SD} = 0.8334V_I^2 + 11.7336V_I$

② $S_A = 0.6666V_I^2$

REDUCING DISTANCE EQUATIONS

③ $S_{IRED} = 0.7500V_I^2 + 11.7336V_I$

④ $S_{FRED} = 0.7500V_F^2$

No.	Revisions	Date	By
		.	
		.	
		.	
		.	
		.	

AMT-STD SP603.002

AMTRAK

OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Holt

STANDARD SIGNAL PLAN
BRAKING DISTANCE CURVES

(CE-205: NON-AMFLEET EQUIPMENT)

Designed: GE	Drawn: GE	Checked: JEH	Date: FEB 01, 2012

Dwg. No. SP603001

Sheet No. 1 OF 12

MPH	Stop	IRED	FRED	APER
0	0	0	0	0
1	13	12	1	1
2	27	26	3	3
3	43	42	7	6
4	60	59	12	11
5	80	77	19	17
6	100	97	27	24
7	123	119	37	33
8	147	142	48	43
9	173	166	61	54
10	201	192	75	67
11	230	220	91	81
12	261	249	108	96
13	293	279	127	113
14	328	311	147	131
15	364	345	169	150
16	401	380	192	171
17	440	416	217	193
18	481	454	243	216
19	524	494	271	241
20	568	535	300	267
21	614	577	331	294
22	662	621	363	323
23	711	667	397	353
24	762	714	432	384
25	814	762	469	417
26	868	812	507	451
27	924	864	547	486
28	982	917	588	523
29	1041	971	631	561
30	1102	1027	675	600
31	1165	1084	721	641
32	1229	1143	768	683
33	1295	1204	817	726
34	1362	1266	867	771
35	1432	1329	919	817
36	1502	1394	972	864
37	1575	1461	1027	913
38	1649	1529	1083	963
39	1725	1598	1141	1014
40	1803	1669	1200	1067
41	1882	1742	1261	1121
42	1963	1816	1323	1176
43	2046	1891	1387	1233
44	2130	1968	1452	1291
45	2216	2047	1519	1350
46	2303	2127	1587	1411
47	2392	2208	1657	1473
48	2483	2291	1728	1536
49	2576	2376	1801	1601
50	2670	2462	1875	1667

MPH	Stop	IRED	FRED	APER
51	2766	2549	1951	1734
52	2864	2638	2028	1802
53	2963	2729	2107	1872
54	3064	2821	2187	1944
55	3166	2914	2269	2016
56	3271	3009	2352	2090
57	3377	3106	2437	2166
58	3484	3204	2523	2242
59	3593	3303	2611	2320
60	3704	3404	2700	2400
61	3817	3506	2791	2480
62	3931	3610	2883	2562
63	4047	3716	2977	2646
64	4165	3823	3072	2730
65	4284	3931	3169	2816
66	4405	4041	3267	2904
67	4527	4153	3367	2992
68	4652	4266	3468	3082
69	4777	4380	3571	3174
70	4905	4496	3675	3266
71	5034	4614	3781	3360
72	5165	4733	3888	3456
73	5298	4853	3997	3552
74	5432	4975	4107	3650
75	5568	5099	4219	3750
76	5705	5224	4332	3850
77	5845	5350	4447	3952
78	5986	5478	4563	4056
79	6128	5608	4681	4160
80	6272	5739	4800	4266
81	6418	5871	4921	4374
82	6566	6005	5043	4482
83	6715	6141	5167	4592
84	6866	6278	5292	4704
85	7019	6416	5419	4816
86	7173	6556	5547	4930
87	7329	6698	5677	5045
88	7486	6841	5808	5162
89	7646	6985	5941	5280
90	7807	7131	6075	5399
91	7969	7279	6211	5520
92	8133	7427	6348	5642
93	8299	7578	6487	5765
94	8467	7730	6627	5890
95	8636	7883	6769	6016
96	8807	8038	6912	6143
97	8980	8195	7057	6272
98	9154	8353	7203	6402
99	9330	8512	7351	6533
100	9507	8673	7500	6666

MPH	Stop	IRED	FRED	APER
101	9687	8836	7651	6800
102	9868	9000	7803	6935
103	10050	9165	7957	7072
104	10234	9332	8112	7210
105	10420	9501	8269	7349
106	10608	9671	8427	7490
107	10797	9842	8587	7632
108	10988	10015	8748	7775
109	11181	10190	8911	7920
110	11375	10366	9075	8066

DRAFT

FOR STOPPING DISTANCES:

A) SELECT INITIAL SPEED IN MPH COLUMN
B) FIND DISTANCE TO STOP ON SAME LINE IN STOP COLUMN

FOR REDUCING DISTANCES:

A) SELECT INITIAL SPEED IN MPH COLUMN
B) FIND DISTANCE ON SAME LINE IN IRED COLUMNS
C) SELECT FINAL SPEED IN MPH COLUMN
D) FIND DISTANCE ON SAME LINE IN FRED COLUMN
E) SUBTRACT IRED DISTANCE FROM FRED DISTANCE FOR REDUCING DISTANCE

AMT-STD SP603.002

No.	Revisions	Date	By

AMTRAK

OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Abbott

STANDARD SIGNAL PLAN
BRAKING DISTANCE TABLE

(CE-205: NON-AMFLEET EQUIPMENT)

Designed: GE | Drawn: GE | Checked: JEH | Date: FEB 01, 2012

Dwg. No. SP603002

Sheet No. 2 OF 12

26-FOI-00415 00000006217 "UNCLASSIFIED" 4/30/2026

GRADE FACTORS FOR CONVERTING ACTUAL DISTANCES BETWEEN SIGNALS TO EQUATED DISTANCES

% Grade	Ascending	Decending
0.00	1.0000	1.0000
0.01	1.0025	0.9975
0.02	1.0050	0.9950
0.03	1.0075	0.9925
0.04	1.0100	0.9900
0.05	1.0125	0.9875
0.06	1.0150	0.9850
0.07	1.0175	0.9825
0.08	1.0200	0.9800
0.09	1.0225	0.9775
0.10	1.0250	0.9750
0.11	1.0275	0.9725
0.12	1.0300	0.9700
0.13	1.0325	0.9675
0.14	1.0350	0.9650
0.15	1.0375	0.9625
0.16	1.0400	0.9600
0.17	1.0425	0.9575
0.18	1.0450	0.9550
0.19	1.0475	0.9525
0.20	1.0500	0.9500
0.21	1.0525	0.9475
0.22	1.0550	0.9450
0.23	1.0575	0.9425
0.24	1.0600	0.9400
0.25	1.0625	0.9375
0.26	1.0650	0.9350
0.27	1.0675	0.9325
0.28	1.0700	0.9300
0.29	1.0725	0.9275
0.30	1.0750	0.9250
0.31	1.0775	0.9225
0.32	1.0800	0.9200
0.33	1.0825	0.9175
0.34	1.0850	0.9150
0.35	1.0875	0.9125
0.36	1.0900	0.9100
0.37	1.0925	0.9075
0.38	1.0950	0.9050
0.39	1.0975	0.9025
0.40	1.1000	0.9000
0.41	1.1025	0.8975
0.42	1.1050	0.8950
0.43	1.1075	0.8925
0.44	1.1100	0.8900
0.45	1.1125	0.8875
0.46	1.1150	0.8850
0.47	1.1175	0.8825
0.48	1.1200	0.8800
0.49	1.1225	0.8775
0.50	1.1250	0.8750
0.51	1.1275	0.8725
0.52	1.1300	0.8700
0.53	1.1325	0.8675
0.54	1.1350	0.8650
0.55	1.1375	0.8625
0.56	1.1400	0.8600
0.57	1.1425	0.8575
0.58	1.1450	0.8550
0.59	1.1475	0.8525
0.60	1.1500	0.8500
0.61	1.1525	0.8475
0.62	1.1550	0.8450
0.63	1.1575	0.8425
0.64	1.1600	0.8400
0.65	1.1625	0.8375
0.66	1.1650	0.8350
0.67	1.1675	0.8325
0.68	1.1700	0.8300
0.69	1.1725	0.8275
0.70	1.1750	0.8250
0.71	1.1775	0.8225
0.72	1.1800	0.8200
0.73	1.1825	0.8175
0.74	1.1850	0.8150
0.75	1.1875	0.8125
0.76	1.1900	0.8100
0.77	1.1925	0.8075
0.78	1.1950	0.8050
0.79	1.1975	0.8025
0.80	1.2000	0.8000
0.81	1.2025	0.7975
0.82	1.2050	0.7950
0.83	1.2075	0.7925
0.84	1.2100	0.7900
0.85	1.2125	0.7875
0.86	1.2150	0.7850
0.87	1.2175	0.7825
0.88	1.2200	0.7800
0.89	1.2225	0.7775
0.90	1.2250	0.7750
0.91	1.2275	0.7725
0.92	1.2300	0.7700
0.93	1.2325	0.7675
0.94	1.2350	0.7650
0.95	1.2375	0.7625
0.96	1.2400	0.7600
0.97	1.2425	0.7575
0.98	1.2450	0.7550
0.99	1.2475	0.7525
1.00	1.2500	0.7500
1.01	1.2525	0.7475
1.02	1.2550	0.7450
1.03	1.2575	0.7425
1.04	1.2600	0.7400
1.05	1.2625	0.7375
1.06	1.2650	0.7350
1.07	1.2675	0.7325
1.08	1.2700	0.7300
1.09	1.2725	0.7275
1.10	1.2750	0.7250
1.11	1.2775	0.7225
1.12	1.2800	0.7200
1.13	1.2825	0.7175
1.14	1.2850	0.7150
1.15	1.2875	0.7125
1.16	1.2900	0.7100
1.17	1.2925	0.7075
1.18	1.2950	0.7050
1.19	1.2975	0.7025
1.20	1.3000	0.7000
1.21	1.3025	0.6975
1.22	1.3050	0.6950
1.23	1.3075	0.6925
1.24	1.3100	0.6900
1.25	1.3125	0.6875
1.26	1.3150	0.6850
1.27	1.3175	0.6825
1.28	1.3200	0.6800
1.29	1.3225	0.6775
1.30	1.3250	0.6750
1.31	1.3275	0.6725
1.32	1.3300	0.6700
1.33	1.3325	0.6675
1.34	1.3350	0.6650
1.35	1.3375	0.6625
1.36	1.3400	0.6600
1.37	1.3425	0.6575
1.38	1.3450	0.6550
1.39	1.3475	0.6525
1.40	1.3500	0.6500
1.41	1.3525	0.6475
1.42	1.3550	0.6450
1.43	1.3575	0.6425
1.44	1.3600	0.6400
1.45	1.3625	0.6375
1.46	1.3650	0.6350
1.47	1.3675	0.6325
1.48	1.3700	0.6300
1.49	1.3725	0.6275
1.50	1.3750	0.6250
1.51	1.3775	0.6225
1.52	1.3800	0.6200
1.53	1.3825	0.6175
1.54	1.3850	0.6150
1.55	1.3875	0.6125
1.56	1.3900	0.6100
1.57	1.3925	0.6075
1.58	1.3950	0.6050
1.59	1.3975	0.6025
1.60	1.4000	0.6000
1.61	1.4025	0.5975
1.62	1.4050	0.5950
1.63	1.4075	0.5925
1.64	1.4100	0.5900
1.65	1.4125	0.5875
1.66	1.4150	0.5850
1.67	1.4175	0.5825
1.68	1.4200	0.5800
1.69	1.4225	0.5775
1.70	1.4250	0.5750
1.71	1.4275	0.5725
1.72	1.4300	0.5700
1.73	1.4325	0.5675
1.74	1.4350	0.5650
1.75	1.4375	0.5625
1.76	1.4400	0.5600
1.77	1.4425	0.5575
1.78	1.4450	0.5550
1.79	1.4475	0.5525
1.80	1.4500	0.5500
1.81	1.4525	0.5475
1.82	1.4550	0.5450
1.83	1.4575	0.5425
1.84	1.4600	0.5400
1.85	1.4625	0.5375
1.86	1.4650	0.5350
1.87	1.4675	0.5325
1.88	1.4700	0.5300
1.89	1.4725	0.5275
1.90	1.4750	0.5250
1.91	1.4775	0.5225
1.92	1.4800	0.5200
1.93	1.4825	0.5175
1.94	1.4850	0.5150
1.95	1.4875	0.5125
1.96	1.4900	0.5100
1.97	1.4925	0.5075
1.98	1.4950	0.5050
1.99	1.4975	0.5025
2.00	1.5000	0.5000
2.01	1.5025	0.4975
2.02	1.5050	0.4950
2.03	1.5075	0.4925
2.04	1.5100	0.4900
2.05	1.5125	0.4875
2.06	1.5150	0.4850
2.07	1.5175	0.4825
2.08	1.5200	0.4800
2.09	1.5225	0.4775
2.10	1.5250	0.4750
2.11	1.5275	0.4725
2.12	1.5300	0.4700
2.13	1.5325	0.4675
2.14	1.5350	0.4650
2.15	1.5375	0.4625
2.16	1.5400	0.4600
2.17	1.5425	0.4575
2.18	1.5450	0.4550
2.19	1.5475	0.4525
2.20	1.5500	0.4500
2.21	1.5525	0.4475
2.22	1.5550	0.4450
2.23	1.5575	0.4425
2.24	1.5600	0.4400
2.25	1.5625	0.4375
2.26	1.5650	0.4350
2.27	1.5675	0.4325
2.28	1.5700	0.4300
2.29	1.5725	0.4275
2.30	1.5750	0.4250
2.31	1.5775	0.4225
2.32	1.5800	0.4200
2.33	1.5825	0.4175
2.34	1.5850	0.4150
2.35	1.5875	0.4125
2.36	1.5900	0.4100
2.37	1.5925	0.4075
2.38	1.5950	0.4050
2.39	1.5975	0.4025
2.40	1.6000	0.4000
2.41	1.6025	0.3975
2.42	1.6050	0.3950
2.43	1.6075	0.3925
2.44	1.6100	0.3900
2.45	1.6125	0.3875
2.46	1.6150	0.3850
2.47	1.6175	0.3825
2.48	1.6200	0.3800
2.49	1.6225	0.3775
2.50	1.6250	0.3750
2.51	1.6275	0.3725
2.52	1.6300	0.3700
2.53	1.6325	0.3675
2.54	1.6350	0.3650
2.55	1.6375	0.3625
2.56	1.6400	0.3600
2.57	1.6425	0.3575
2.58	1.6450	0.3550
2.59	1.6475	0.3525
2.60	1.6500	0.3500
2.61	1.6525	0.3475
2.62	1.6550	0.3450
2.63	1.6575	0.3425
2.64	1.6600	0.3400
2.65	1.6625	0.3375
2.66	1.6650	0.3350
2.67	1.6675	0.3325
2.68	1.6700	0.3300
2.69	1.6725	0.3275
2.70	1.6750	0.3250
2.71	1.6775	0.3225
2.72	1.6800	0.3200
2.73	1.6825	0.3175
2.74	1.6850	0.3150
2.75	1.6875	0.3125
2.76	1.6900	0.3100
2.77	1.6925	0.3075
2.78	1.6950	0.3050
2.79	1.6975	0.3025
2.80	1.7000	0.3000
2.81	1.7025	0.2975
2.82	1.7050	0.2950
2.83	1.7075	0.2925
1.88	1.4700	0.5300
2.89	1.7225	0.2775
2.90	1.7250	0.2750
2.91	1.7275	0.2725
2.92	1.7300	0.2700
2.93	1.7325	0.2675
2.94	1.7350	0.2650
2.95	1.7375	0.2625
1.96	1.4900	0.5100
2.97	1.7425	0.2575
2.98	1.7450	0.2550
2.99	1.7475	0.2525
3.00	1.7500	0.2500

NOTES:

1) CURVE FACTORS:
   1°CURVE = 0.05% UPGRADE
   2°CURVE = 0.10% UPGRADE
   10°CURVE = 0.50% UPGRADE

2) ACTUAL DISTANCES ARE DETERMINED AS FOLLOWS:

EQUATED ASCENDING = ACTUAL X $\frac{4+\%G}{4}$

EQUATED DESCENDING = ACTUAL X $\frac{4-\%G}{4}$

DRAFT

No.	Revisions	Date	By

AMT-STD SP603.003

AMTRAK

OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Hoff

STANDARD SIGNAL PLAN
BRAKING DISTANCE
GRADE FACTOR ACTUAL TO EQUATED
(CE-205: NON-AMFLEET EQUIPMENT)

Designed: GE | Drawn: GE | Checked: JEH | Date: FEB 01, 2012

Dwg. No. SP603003

Sheet No. 3 OF 12

26-FOI-00415 00000006217 "UNCLASSIFIED" 4/30/2026

GRADE FACTORS FOR CONVERTING EQUATED DISTANCES INTO ACTUAL DISTANCES REQUIRED FOR SIGNAL SPACING

% Grade	Ascending	Decending
0.00	1.0000	1.0000
0.01	0.9975	1.0025
0.02	0.9950	1.0050
0.03	0.9926	1.0076
0.04	0.9901	1.0101
0.05	0.9877	1.0127
0.06	0.9852	1.0152
0.07	0.9828	1.0178
0.08	0.9804	1.0204
0.09	0.9780	1.0230
0.10	0.9756	1.0256
0.11	0.9732	1.0283
0.12	0.9709	1.0309
0.13	0.9685	1.0336
0.14	0.9662	1.0363
0.15	0.9639	1.0390
0.16	0.9615	1.0417
0.17	0.9592	1.0444
0.18	0.9569	1.0471
0.19	0.9547	1.0499
0.20	0.9524	1.0526
0.21	0.9501	1.0554
0.22	0.9479	1.0582
0.23	0.9456	1.0610
0.24	0.9434	1.0638
0.25	0.9412	1.0667
0.26	0.9390	1.0695
0.27	0.9368	1.0724
0.28	0.9346	1.0753
0.29	0.9324	1.0782
0.30	0.9302	1.0811
0.31	0.9281	1.0840
0.32	0.9259	1.0870
0.33	0.9238	1.0899
0.34	0.9217	1.0929
0.35	0.9195	1.0959
0.36	0.9174	1.0989
0.37	0.9153	1.1019
0.38	0.9132	1.1050
0.39	0.9112	1.1080
0.40	0.9091	1.1111
0.41	0.9070	1.1142
0.42	0.9050	1.1173
0.43	0.9029	1.1204
0.44	0.9009	1.1236
0.45	0.8989	1.1268
0.46	0.8969	1.1299
0.47	0.8949	1.1331
0.48	0.8929	1.1364
0.49	0.8909	1.1396
0.50	0.8889	1.1429
0.51	0.8869	1.1461
0.52	0.8850	1.1494
0.53	0.8830	1.1527
0.54	0.8811	1.1561
0.55	0.8791	1.1594
0.56	0.8772	1.1628
0.57	0.8753	1.1662
0.58	0.8734	1.1696
0.59	0.8715	1.1730
0.60	0.8696	1.1765
0.61	0.8677	1.1799
0.62	0.8658	1.1834
0.63	0.8639	1.1869
0.64	0.8621	1.1905
0.65	0.8602	1.1940
0.66	0.8584	1.1976
0.67	0.8565	1.2012
0.68	0.8547	1.2048
0.69	0.8529	1.2085
0.70	0.8511	1.2121
0.71	0.8493	1.2158
0.72	0.8475	1.2195
0.73	0.8457	1.2232
0.74	0.8439	1.2270
0.75	0.8421	1.2308
0.76	0.8403	1.2346
0.77	0.8386	1.2384
0.78	0.8368	1.2422
0.79	0.8351	1.2461
0.80	0.8333	1.2500
0.81	0.8316	1.2539
0.82	0.8299	1.2579
0.83	0.8282	1.2618
0.84	0.8264	1.2658
0.85	0.8247	1.2698
0.86	0.8230	1.2739
0.87	0.8214	1.2780
0.88	0.8197	1.2821
0.89	0.8180	1.2862
0.90	0.8163	1.2903
0.91	0.8147	1.2945
0.92	0.8130	1.2987
0.93	0.8114	1.3029
0.94	0.8097	1.3072
0.95	0.8081	1.3115
0.96	0.8065	1.3158
0.97	0.8048	1.3201
0.98	0.8032	1.3245
0.99	0.8016	1.3289
1.00	0.8000	1.3333
1.01	0.7984	1.3378
1.02	0.7968	1.3423
1.03	0.7952	1.3468
1.04	0.7937	1.3514
1.05	0.7921	1.3559
1.06	0.7905	1.3605
1.07	0.7890	1.3652
1.08	0.7874	1.3699
1.09	0.7859	1.3746
1.10	0.7843	1.3793
1.11	0.7828	1.3841
1.12	0.7813	1.3889
1.13	0.7797	1.3937
1.14	0.7782	1.3986
1.15	0.7767	1.4035
1.16	0.7752	1.4085
1.17	0.7737	1.4134
1.18	0.7722	1.4184
1.19	0.7707	1.4235
1.20	0.7692	1.4286
1.21	0.7678	1.4337
1.22	0.7663	1.4388
1.23	0.7648	1.4440
1.24	0.7634	1.4493
1.25	0.7619	1.4545
1.26	0.7605	1.4599
1.27	0.7590	1.4652
1.28	0.7576	1.4706
1.29	0.7561	1.4760
1.30	0.7547	1.4815
1.31	0.7533	1.4870
1.32	0.7519	1.4925
1.33	0.7505	1.4981
1.34	0.7491	1.5038
1.35	0.7477	1.5094
1.36	0.7463	1.5152
1.37	0.7449	1.5209
1.38	0.7435	1.5267
1.39	0.7421	1.5326
1.40	0.7407	1.5385
1.41	0.7394	1.5444
1.42	0.7380	1.5504
1.43	0.7366	1.5564
1.44	0.7353	1.5625
1.45	0.7339	1.5686
1.46	0.7326	1.5748
1.47	0.7313	1.5810
1.48	0.7299	1.5873
1.49	0.7286	1.5936
1.50	0.7273	1.6000
1.51	0.7260	1.6064
1.52	0.7246	1.6129
1.53	0.7233	1.6194
1.54	0.7220	1.6260
1.55	0.7207	1.6327
1.56	0.7194	1.6393
1.57	0.7181	1.6461
1.58	0.7168	1.6529
1.59	0.7156	1.6598
1.60	0.7143	1.6667
1.61	0.7130	1.6736
1.62	0.7117	1.6807
1.63	0.7105	1.6878
1.64	0.7092	1.6949
1.65	0.7080	1.7021
1.66	0.7067	1.7094
1.67	0.7055	1.7167
1.68	0.7042	1.7241
1.69	0.7030	1.7316
1.70	0.7018	1.7391
1.71	0.7005	1.7467
1.72	0.6993	1.7544
1.73	0.6981	1.7621
1.74	0.6969	1.7699
1.75	0.6957	1.7778
1.76	0.6944	1.7857
1.77	0.6932	1.7937
1.78	0.6920	1.8018
1.79	0.6908	1.8100
1.80	0.6897	1.8182
1.81	0.6885	1.8265
1.82	0.6873	1.8349
1.83	0.6861	1.8433
1.84	0.6849	1.8519
1.85	0.6838	1.8605
1.86	0.6826	1.8692
1.87	0.6814	1.8779
1.88	0.6803	1.8868
1.89	0.6791	1.8957
1.90	0.6780	1.9048
1.91	0.6768	1.9139
1.92	0.6757	1.9231
1.93	0.6745	1.9324
1.94	0.6734	1.9417
1.95	0.6723	1.9512
1.96	0.6711	1.9608
1.97	0.6700	1.9704
1.98	0.6689	1.9802
1.99	0.6678	1.9900
2.00	0.6667	2.0000
2.01	0.6656	2.0101
2.02	0.6645	2.0202
2.03	0.6633	2.0305
2.04	0.6623	2.0408
2.05	0.6612	2.0513
2.06	0.6601	2.0619
2.07	0.6590	2.0725
2.08	0.6579	2.0833
2.09	0.6568	2.0942
2.10	0.6557	2.1053
2.11	0.6547	2.1164
2.12	0.6536	2.1277
2.13	0.6525	2.1390
2.14	0.6515	2.1505
2.15	0.6504	2.1622
2.16	0.6494	2.1739
2.17	0.6483	2.1858
2.18	0.6472	2.1978
2.19	0.6462	2.2099
2.20	0.6452	2.2222
2.21	0.6441	2.2346
2.22	0.6431	2.2472
2.23	0.6421	2.2599
2.24	0.6410	2.2727
2.25	0.6400	2.2857
2.26	0.6390	2.2989
2.27	0.6380	2.3121
2.28	0.6369	2.3256
2.29	0.6359	2.3392
2.30	0.6349	2.3529
2.31	0.6339	2.3669
2.32	0.6329	2.3810
2.33	0.6319	2.3952
2.34	0.6309	2.4096
2.35	0.6299	2.4242
2.36	0.6289	2.4390
2.37	0.6279	2.4540
2.38	0.6270	2.4691
2.39	0.6260	2.4845
2.40	0.6250	2.5000
2.41	0.6240	2.5157
2.42	0.6231	2.5316
2.43	0.6221	2.5478
2.44	0.6211	2.5641
2.45	0.6202	2.5806
2.46	0.6192	2.5974
2.47	0.6182	2.6144
2.48	0.6173	2.6316
2.49	0.6163	2.6490
2.50	0.6154	2.6667
2.51	0.6144	2.6846
2.52	0.6135	2.7027
2.53	0.6126	2.7211
2.54	0.6116	2.7397
2.55	0.6107	2.7586
2.56	0.6098	2.7778
2.57	0.6088	2.7972
2.58	0.6079	2.8169
2.59	0.6070	2.8369
2.60	0.6061	2.8571
2.61	0.6051	2.8777
2.62	0.6042	2.8986
2.63	0.6033	2.9197
2.64	0.6024	2.9412
2.65	0.6015	2.9630
2.66	0.6006	2.9851
2.67	0.5997	3.0075
2.68	0.5988	3.0303
2.69	0.5979	3.0534
2.70	0.5970	3.0769
2.71	0.5961	3.1008
2.72	0.5952	3.1250
2.73	0.5944	3.1496
2.74	0.5935	3.1746
2.75	0.5926	3.2000
2.76	0.5917	3.2258
2.77	0.5908	3.2520
2.78	0.5900	3.2787
2.79	0.5891	3.3058
2.80	0.5882	3.3333
2.81	0.5874	3.3613
2.82	0.5865	3.3898
2.83	0.5857	3.4188
2.84	0.5848	3.4483
2.85	0.5839	3.4783
2.86	0.5831	3.5088
2.87	0.5822	3.5398
1.88	0.6803	1.8868
2.89	0.5806	3.6036
2.90	0.5797	3.6364
2.91	0.5789	3.6697
2.92	0.5780	3.7037
2.93	0.5772	3.7383
2.94	0.5764	3.7736
2.95	0.5755	3.8095
1.96	0.6711	1.9608
2.97	0.5739	3.8835
2.98	0.5731	3.9216
2.99	0.5722	3.9604
3.00	0.5714	4.0000

NOTES:

1) CURVE FACTORS:
   1 CURVE = 0.05% UPGRADE
   2 CURVE = 0.10% UPGRADE
   10 CURVE = 0.50% UPGRADE
2) ACTUAL DISTANCES ARE DETERMINED AS FOLLOWS:

ACTUAL ASCENDING = EQUATED X $\frac{4}{4+\%G}$

ACTUAL DESCENDING = EQUATED X $\frac{4}{4-\%G}$

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AMT-STD SP603.004

No.	Revisions	Date	By
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AMTRAK

OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Hoff

STANDARD SIGNAL PLAN
BRAKING DISTANCE
GRADE FACTOR EQUATED TO ACTUAL
(CE-205: NON-AMFLEET EQUIPMENT)

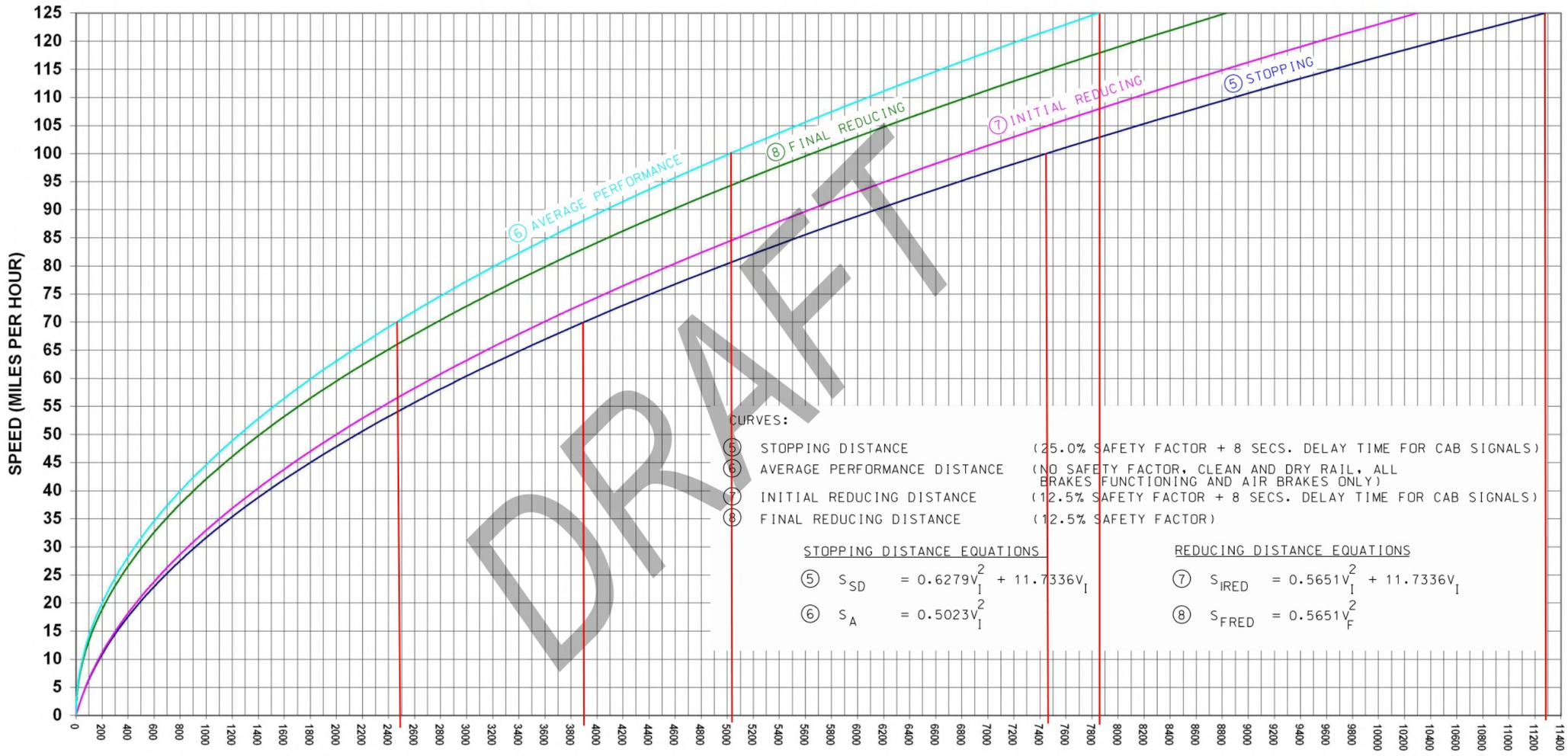
Designed: GE | Drawn: GE | Checked: JEH | Date: FEB 01, 2012

Dwg. No. SP603004

Sheet No. 4 OF 12

26-FOI-00415 00000006217 "UNCLASSIFIED" 4/30/2026

AEM-7 BRAKING DISTANCE CURVES FOR ALL PASSENGER TRAINS LISTED IN THE SPECIAL INSTRUCTIONS OF THE TIMETABLE WHOSE SPEEDS ARE MORE THAN 110 MPH



DRAFT

CURVES:

⑤ STOPPING DISTANCE (25.0% SAFETY FACTOR + 8 SECS. DELAY TIME FOR CAB SIGNALS)

⑥ AVERAGE PERFORMANCE DISTANCE (NO SAFETY FACTOR, CLEAN AND DRY RAIL, ALL BRAKES FUNCTIONING AND AIR BRAKES ONLY)

⑦ INITIAL REDUCING DISTANCE (12.5% SAFETY FACTOR + 8 SECS. DELAY TIME FOR CAB SIGNALS)

⑧ FINAL REDUCING DISTANCE (12.5% SAFETY FACTOR)

STOPPING DISTANCE EQUATIONS

⑤ $S_{SD} = 0.6279V_I^2 + 11.7336V_I$

⑥ $S_A = 0.5023V_I^2$

REDUCING DISTANCE EQUATIONS

⑦ $S_{IRED} = 0.5651V_I^2 + 11.7336V_I$

⑧ $S_{FRED} = 0.5651V_F^2$

No.	Revisions	Date	By
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AMT-STD SP603.005

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OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Holt

STANDARD SIGNAL PLAN
BRAKING DISTANCE CURVES

(AEM-7: AMFLEET EQUIPMENT)

Designed: GE | Drawn: GE | Checked: JEH | Date: FEB 01, 2012

Dwg. No. SP603005

Sheet No. 5 OF 12

MPH	Stop	IRED	FRED	APER
0	0	0	0	1
1	12	12	1	1
2	26	26	2	2
3	41	40	5	5
4	57	56	9	8
5	74	73	14	13
6	93	91	20	18
7	113	110	28	25
8	134	130	36	32
9	156	151	46	41
10	180	174	57	50
11	205	197	68	61
12	231	222	81	72
13	259	248	96	85
14	287	275	111	98
15	317	303	127	113
16	348	332	145	129
17	381	363	163	145
18	415	394	183	163
19	450	427	204	181
20	486	461	226	201
21	523	496	249	222
22	562	532	274	243
23	602	569	299	266
24	643	607	325	289
25	686	647	353	314
26	730	687	382	340
27	775	729	412	366
28	821	772	443	394
29	868	816	475	422
30	917	861	509	452
31	967	907	543	483
32	1018	954	579	514
33	1071	1003	615	547
34	1125	1052	653	581
35	1180	1103	692	615
36	1236	1155	732	651
37	1294	1208	774	688
38	1353	1262	816	725
39	1413	1317	860	764
40	1474	1374	904	804
41	1537	1431	950	844
42	1600	1490	997	886
43	1666	1549	1045	929
44	1732	1610	1094	972
45	1800	1672	1144	1017
46	1868	1735	1196	1063
47	1939	1800	1248	1110
48	2010	1865	1302	1157
49	2083	1932	1357	1206
50	2156	1999	1413	1256

MPH	Stop	IRED	FRED	APER
51	2232	2068	1470	1306
52	2308	2138	1528	1358
53	2386	2209	1587	1411
54	2465	2281	1648	1465
55	2545	2355	1709	1519
56	2626	2429	1772	1575
57	2709	2505	1836	1632
58	2793	2582	1901	1690
59	2878	2659	1967	1749
60	2964	2738	2034	1808
61	3052	2818	2103	1869
62	3141	2900	2172	1931
63	3231	2982	2243	1994
64	3323	3066	2315	2057
65	3416	3150	2388	2122
66	3510	3236	2462	2188
67	3605	3323	2537	2255
68	3701	3411	2613	2323
69	3799	3500	2690	2391
70	3898	3590	2769	2461
71	3998	3682	2849	2532
72	4100	3774	2929	2604
73	4203	3868	3011	2677
74	4307	3963	3094	2751
75	4412	4059	3179	2825
76	4519	4156	3264	2901
77	4626	4254	3350	2978
78	4735	4353	3438	3056
79	4846	4454	3527	3135
80	4957	4555	3617	3215
81	5070	4658	3708	3296
82	5184	4762	3800	3377
83	5299	4867	3893	3460
84	5416	4973	3987	3544
85	5534	5080	4083	3629
86	5653	5189	4179	3715
87	5773	5298	4277	3802
88	5895	5409	4376	3890
89	6018	5520	4476	3979
90	6142	5633	4577	4069
91	6267	5747	4680	4160
92	6394	5862	4783	4251
93	6522	5979	4888	4344
94	6651	6096	4993	4438
95	6781	6215	5100	4533
96	6913	6334	5208	4629
97	7046	6455	5317	4726
98	7180	6577	5427	4824
99	7316	6700	5539	4923
100	7452	6824	5651	5023

MPH	Stop	IRED	FRED	APER
101	7590	6950	5765	5124
102	7729	7076	5879	5226
103	7870	7204	5995	5329
104	8012	7332	6112	5433
105	8155	7462	6230	5538
106	8299	7593	6349	5644
107	8444	7725	6470	5751
108	8591	7859	6591	5859
109	8739	7993	6714	5968
110	8888	8128	6838	6078
111	9039	8265	6963	6189
112	9191	8403	7089	6301
113	9344	8542	7216	6414
114	9498	8682	7344	6528
115	9653	8823	7473	6643
116	9810	8965	7604	6759
117	9968	9108	7736	6876
118	10127	9253	7868	6994
119	10288	9399	8002	7113
120	10450	9545	8137	7233
121	10613	9693	8274	7354
122	10777	9842	8411	7476
123	10943	9993	8549	7599
124	11110	10144	8689	7723
125	11278	10296	8830	7848

FOR STOPPING DISTANCES:

A) SELECT INITIAL SPEED IN MPH COLUMN
B) FIND DISTANCE TO STOP ON SAME LINE IN STOP COLUMN

FOR REDUCING DISTANCES:

A) SELECT INITIAL SPEED IN MPH COLUMN
B) FIND DISTANCE ON SAME LINE IN IRED COLUMNS
C) SELECT FINAL SPEED IN MPH COLUMN
D) FIND DISTANCE ON SAME LINE IN FRED COLUMN
E) SUBTRACT IRED DISTANCE FROM FRED DISTANCE FOR REDUCING DISTANCE

DRAFT

AMT-STD SP603.006

No.	Revisions	Date	By

AMTRAK

OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Holt

STANDARD SIGNAL PLAN
BRAKING DISTANCE TABLE

(AEM-7: AMFLEET EQUIPMENT)

Designed: GE | Drawn: GE | Checked: JEH | Date: FEB 01, 2012

Dwg. No. SP603006

Sheet No. 6 OF 12

GRADE FACTORS FOR CONVERTING ACTUAL DISTANCES BETWEEN SIGNALS TO EQUATED DISTANCES

% Grade	Ascending	Decending
0.00	1.0000	1.0000
0.01	1.0019	0.9981
0.02	1.0038	0.9962
0.03	1.0056	0.9944
0.04	1.0075	0.9925
0.05	1.0094	0.9906
0.06	1.0113	0.9887
0.07	1.0132	0.9868
0.08	1.0151	0.9849
0.09	1.0169	0.9831
0.10	1.0188	0.9812
0.11	1.0207	0.9793
0.12	1.0226	0.9774
0.13	1.0245	0.9755
0.14	1.0264	0.9736
0.15	1.0282	0.9718
0.16	1.0301	0.9699
0.17	1.0320	0.9680
0.18	1.0339	0.9661
0.19	1.0358	0.9642
0.20	1.0377	0.9623
0.21	1.0395	0.9605
0.22	1.0414	0.9586
0.23	1.0433	0.9567
0.24	1.0452	0.9548
0.25	1.0471	0.9529
0.26	1.0490	0.9510
0.27	1.0508	0.9492
0.28	1.0527	0.9473
0.29	1.0546	0.9454
0.30	1.0565	0.9435
0.31	1.0584	0.9416
0.32	1.0603	0.9397
0.33	1.0621	0.9379
0.34	1.0640	0.9360
0.35	1.0659	0.9341
0.36	1.0678	0.9322
0.37	1.0697	0.9303
0.38	1.0716	0.9284
0.39	1.0734	0.9266
0.40	1.0753	0.9247
0.41	1.0772	0.9228
0.42	1.0791	0.9209
0.43	1.0810	0.9190
0.44	1.0829	0.9171
0.45	1.0847	0.9153
0.46	1.0866	0.9134
0.47	1.0885	0.9115
0.48	1.0904	0.9096
0.49	1.0923	0.9077
0.50	1.0942	0.9058

% Grade	Ascending	Decending
0.51	1.0960	0.9040
0.52	1.0979	0.9021
0.53	1.0998	0.9002
0.54	1.1017	0.8983
0.55	1.1036	0.8964
0.56	1.1055	0.8945
0.57	1.1073	0.8927
0.58	1.1092	0.8908
0.59	1.1111	0.8889
0.60	1.1130	0.8870
0.61	1.1149	0.8851
0.62	1.1168	0.8832
0.63	1.1186	0.8814
0.64	1.1205	0.8795
0.65	1.1224	0.8776
0.66	1.1243	0.8757
0.67	1.1262	0.8738
0.68	1.1281	0.8719
0.69	1.1299	0.8701
0.70	1.1318	0.8682
0.71	1.1337	0.8663
0.72	1.1356	0.8644
0.73	1.1375	0.8625
0.74	1.1394	0.8606
0.75	1.1412	0.8588
0.76	1.1431	0.8569
0.77	1.1450	0.8550
0.78	1.1469	0.8531
0.79	1.1488	0.8512
0.80	1.1507	0.8493
0.81	1.1525	0.8475
0.82	1.1544	0.8456
0.83	1.1563	0.8437
0.84	1.1582	0.8418
0.85	1.1601	0.8399
0.86	1.1620	0.8380
0.87	1.1638	0.8362
0.88	1.1657	0.8343
0.89	1.1676	0.8324
0.90	1.1695	0.8305
0.91	1.1714	0.8286
0.92	1.1733	0.8267
0.93	1.1751	0.8249
0.94	1.1770	0.8230
0.95	1.1789	0.8211
0.96	1.1808	0.8192
0.97	1.1827	0.8173
0.98	1.1846	0.8154
0.99	1.1864	0.8136
1.00	1.1883	0.8117

% Grade	Ascending	Decending
1.01	1.1902	0.8098
1.02	1.1921	0.8079
1.03	1.1940	0.8060
1.04	1.1959	0.8041
1.05	1.1977	0.8023
1.06	1.1996	0.8004
1.07	1.2015	0.7985
1.08	1.2034	0.7966
1.09	1.2053	0.7947
1.10	1.2072	0.7928
1.11	1.2090	0.7910
1.12	1.2109	0.7891
1.13	1.2128	0.7872
1.14	1.2147	0.7853
1.15	1.2166	0.7834
1.16	1.2185	0.7815
1.17	1.2203	0.7797
1.18	1.2222	0.7778
1.19	1.2241	0.7759
1.20	1.2260	0.7740
1.21	1.2279	0.7721
1.22	1.2298	0.7702
1.23	1.2316	0.7684
1.24	1.2335	0.7665
1.25	1.2354	0.7646
1.26	1.2373	0.7627
1.27	1.2392	0.7608
1.28	1.2411	0.7589
1.29	1.2429	0.7571
1.30	1.2448	0.7552
1.31	1.2467	0.7533
1.32	1.2486	0.7514
1.33	1.2505	0.7495
1.34	1.2524	0.7476
1.35	1.2542	0.7458
1.36	1.2561	0.7439
1.37	1.2580	0.7420
1.38	1.2599	0.7401
1.39	1.2618	0.7382
1.40	1.2637	0.7363
1.41	1.2655	0.7345
1.42	1.2674	0.7326
1.43	1.2693	0.7307
1.44	1.2712	0.7288
1.45	1.2731	0.7269
1.46	1.2750	0.7250
1.47	1.2768	0.7232
1.48	1.2787	0.7213
1.49	1.2806	0.7194
1.50	1.2825	0.7175

% Grade	Ascending	Decending
1.51	1.2844	0.7156
1.52	1.2863	0.7137
1.53	1.2881	0.7119
1.54	1.2900	0.7100
1.55	1.2919	0.7081
1.56	1.2938	0.7062
1.57	1.2957	0.7043
1.58	1.2976	0.7024
1.59	1.2994	0.7006
1.60	1.3013	0.6987
1.61	1.3032	0.6968
1.62	1.3051	0.6949
1.63	1.3070	0.6930
1.64	1.3089	0.6911
1.65	1.3107	0.6893
1.66	1.3126	0.6874
1.67	1.3145	0.6855
1.68	1.3164	0.6836
1.69	1.3183	0.6817
1.70	1.3202	0.6798
1.71	1.3220	0.6780
1.72	1.3239	0.6761
1.73	1.3258	0.6742
1.74	1.3277	0.6723
1.75	1.3296	0.6704
1.76	1.3315	0.6685
1.77	1.3333	0.6667
1.78	1.3352	0.6648
1.79	1.3371	0.6629
1.80	1.3390	0.6610
1.81	1.3409	0.6591
1.82	1.3427	0.6573
1.83	1.3446	0.6554
1.84	1.3465	0.6535
1.85	1.3484	0.6516
1.86	1.3503	0.6497
1.87	1.3522	0.6478
1.88	1.3540	0.6460
1.89	1.3559	0.6441
1.90	1.3578	0.6422
1.91	1.3597	0.6403
1.92	1.3616	0.6384
1.93	1.3635	0.6365
1.94	1.3653	0.6347
1.95	1.3672	0.6328
1.96	1.3691	0.6309
1.97	1.3710	0.6290
1.98	1.3729	0.6271
1.99	1.3748	0.6252
2.00	1.3766	0.6234

% Grade	Ascending	Decending
2.01	1.3785	0.6215
2.02	1.3804	0.6196
2.03	1.3823	0.6177
2.04	1.3842	0.6158
2.05	1.3861	0.6139
2.06	1.3879	0.6121
2.07	1.3898	0.6102
2.08	1.3917	0.6083
2.09	1.3936	0.6064
2.10	1.3955	0.6045
2.11	1.3974	0.6026
2.12	1.3992	0.6008
2.13	1.4011	0.5989
2.14	1.4030	0.5970
2.15	1.4049	0.5951
2.16	1.4068	0.5932
2.17	1.4087	0.5913
2.18	1.4105	0.5895
2.19	1.4124	0.5876
2.20	1.4143	0.5857
2.21	1.4162	0.5838
2.22	1.4181	0.5819
2.23	1.4200	0.5800
2.24	1.4218	0.5782
2.25	1.4237	0.5763
2.26	1.4256	0.5744
2.27	1.4275	0.5725
2.28	1.4294	0.5706
2.29	1.4313	0.5687
2.30	1.4331	0.5669
2.31	1.4350	0.5650
2.32	1.4369	0.5631
2.33	1.4388	0.5612
2.34	1.4407	0.5593
2.35	1.4426	0.5574
2.36	1.4444	0.5556
2.37	1.4463	0.5537
2.38	1.4482	0.5518
2.39	1.4501	0.5499
2.40	1.4520	0.5480
2.41	1.4539	0.5461
2.42	1.4557	0.5443
2.43	1.4576	0.5424
2.44	1.4595	0.5405
2.45	1.4614	0.5386
2.46	1.4633	0.5367
2.47	1.4652	0.5348
2.48	1.4670	0.5330
2.49	1.4689	0.5311
2.50	1.4708	0.5292

% Grade	Ascending	Decending
2.51	1.4727	0.5273
2.52	1.4746	0.5254
2.53	1.4765	0.5235
2.54	1.4783	0.5217
2.55	1.4802	0.5198
2.56	1.4821	0.5179
2.57	1.4840	0.5160
2.58	1.4859	0.5141
2.59	1.4878	0.5122
2.60	1.4896	0.5104
2.61	1.4915	0.5085
2.62	1.4934	0.5066
2.63	1.4953	0.5047
2.64	1.4972	0.5028
2.65	1.4991	0.5009
2.66	1.5009	0.4991
2.67	1.5028	0.4972
2.68	1.5047	0.4953
2.69	1.5066	0.4934
2.70	1.5085	0.4915
2.71	1.5104	0.4896
2.72	1.5122	0.4878
2.73	1.5141	0.4859
2.74	1.5160	0.4840
2.75	1.5179	0.4821
2.76	1.5198	0.4802
2.77	1.5217	0.4783
2.78	1.5235	0.4765
2.79	1.5254	0.4746
2.80	1.5273	0.4727
2.81	1.5292	0.4708
2.82	1.5311	0.4689
2.83	1.5330	0.4670
2.84	1.5348	0.4652
2.85	1.5367	0.4633
2.86	1.5386	0.4614
2.87	1.5405	0.4595
1.88	1.3540	0.6460
2.89	1.5443	0.4557
2.90	1.5461	0.4539
2.91	1.5480	0.4520
2.92	1.5499	0.4501
2.93	1.5518	0.4482
2.94	1.5537	0.4463
2.95	1.5556	0.4444
1.96	1.3691	0.6309
2.97	1.5593	0.4407
2.98	1.5612	0.4388
2.99	1.5631	0.4369
3.00	1.5650	0.4350

NOTES:

1) CURVE FACTORS:
   1°CURVE = 0.05% UPGRADE
   2°CURVE = 0.10% UPGRADE
   10°CURVE = 0.50% UPGRADE

2) ACTUAL DISTANCES ARE DETERMINED AS FOLLOWS:

EQUATED ASCENDING = ACTUAL X $\frac{5.31+\%G}{5.31}$

EQUATED DESCENDING = ACTUAL X $\frac{5.31-\%G}{5.31}$

DRAFT

AMT-STD SP603.007

No.	Revisions	Date	By
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AMTRAK

OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Hilt

STANDARD SIGNAL PLAN
BRAKING DISTANCE
GRADE FACTOR ACTUAL TO EQUATED
(AEM-7: AMFLEET EQUIPMENT)

Designed: GE	Drawn: GE	Checked: JEH	Date: FEB 01, 2012

Dwg. No. SP603007

Sheet No. 7 OF 12

26-FOI-00415 00000006217 "UNCLASSIFIED" 4/30/2026

GRADE FACTORS FOR CONVERTING EQUATED DISTANCES INTO ACTUAL DISTANCES REQUIRED FOR SIGNAL SPACING

% Grade	Ascending	Decending
0.00	1.0000	1.0000
0.01	0.9981	1.0019
0.02	0.9962	1.0038
0.03	0.9944	1.0057
0.04	0.9925	1.0076
0.05	0.9907	1.0095
0.06	0.9888	1.0114
0.07	0.9870	1.0134
0.08	0.9852	1.0153
0.09	0.9833	1.0172
0.10	0.9815	1.0192
0.11	0.9797	1.0212
0.12	0.9779	1.0231
0.13	0.9761	1.0251
0.14	0.9743	1.0271
0.15	0.9725	1.0291
0.16	0.9707	1.0311
0.17	0.9690	1.0331
0.18	0.9672	1.0351
0.19	0.9655	1.0371
0.20	0.9637	1.0391
0.21	0.9620	1.0412
0.22	0.9602	1.0432
0.23	0.9585	1.0453
0.24	0.9568	1.0473
0.25	0.9550	1.0494
0.26	0.9533	1.0515
0.27	0.9516	1.0536
0.28	0.9499	1.0557
0.29	0.9482	1.0578
0.30	0.9465	1.0599
0.31	0.9448	1.0620
0.32	0.9432	1.0641
0.33	0.9415	1.0663
0.34	0.9398	1.0684
0.35	0.9382	1.0706
0.36	0.9365	1.0727
0.37	0.9349	1.0749
0.38	0.9332	1.0771
0.39	0.9316	1.0793
0.40	0.9299	1.0815
0.41	0.9283	1.0837
0.42	0.9267	1.0859
0.43	0.9251	1.0881
0.44	0.9235	1.0903
0.45	0.9219	1.0926
0.46	0.9203	1.0948
0.47	0.9187	1.0971
0.48	0.9171	1.0994
0.49	0.9155	1.1017
0.50	0.9139	1.1040

% Grade	Ascending	Decending
0.51	0.9124	1.1063
0.52	0.9108	1.1086
0.53	0.9092	1.1109
0.54	0.9077	1.1132
0.55	0.9061	1.1155
0.56	0.9046	1.1179
0.57	0.9031	1.1203
0.58	0.9015	1.1226
0.59	0.9000	1.1250
0.60	0.8985	1.1274
0.61	0.8970	1.1298
0.62	0.8954	1.1322
0.63	0.8939	1.1346
0.64	0.8924	1.1370
0.65	0.8909	1.1395
0.66	0.8894	1.1419
0.67	0.8880	1.1444
0.68	0.8865	1.1469
0.69	0.8850	1.1494
0.70	0.8835	1.1518
0.71	0.8821	1.1543
0.72	0.8806	1.1569
0.73	0.8791	1.1594
0.74	0.8777	1.1619
0.75	0.8762	1.1645
0.76	0.8748	1.1670
0.77	0.8734	1.1696
0.78	0.8719	1.1722
0.79	0.8705	1.1748
0.80	0.8691	1.1774
0.81	0.8676	1.1800
0.82	0.8662	1.1826
0.83	0.8648	1.1853
0.84	0.8634	1.1879
0.85	0.8620	1.1906
0.86	0.8606	1.1933
0.87	0.8592	1.1959
0.88	0.8578	1.1986
0.89	0.8565	1.2014
0.90	0.8551	1.2041
0.91	0.8537	1.2068
0.92	0.8523	1.2096
0.93	0.8510	1.2123
0.94	0.8496	1.2151
0.95	0.8482	1.2179
0.96	0.8469	1.2207
0.97	0.8455	1.2235
0.98	0.8442	1.2263
0.99	0.8429	1.2292
1.00	0.8415	1.2320

% Grade	Ascending	Decending
1.01	0.8402	1.2349
1.02	0.8389	1.2378
1.03	0.8375	1.2407
1.04	0.8362	1.2436
1.05	0.8349	1.2465
1.06	0.8336	1.2494
1.07	0.8323	1.2524
1.08	0.8310	1.2553
1.09	0.8297	1.2583
1.10	0.8284	1.2613
1.11	0.8271	1.2643
1.12	0.8258	1.2673
1.13	0.8245	1.2703
1.14	0.8233	1.2734
1.15	0.8220	1.2764
1.16	0.8207	1.2795
1.17	0.8194	1.2826
1.18	0.8182	1.2857
1.19	0.8169	1.2888
1.20	0.8157	1.2920
1.21	0.8144	1.2951
1.22	0.8132	1.2983
1.23	0.8119	1.3015
1.24	0.8107	1.3047
1.25	0.8095	1.3079
1.26	0.8082	1.3111
1.27	0.8070	1.3144
1.28	0.8058	1.3176
1.29	0.8045	1.3209
1.30	0.8033	1.3242
1.31	0.8021	1.3275
1.32	0.8009	1.3308
1.33	0.7997	1.3342
1.34	0.7985	1.3375
1.35	0.7973	1.3409
1.36	0.7961	1.3443
1.37	0.7949	1.3477
1.38	0.7937	1.3511
1.39	0.7925	1.3546
1.40	0.7914	1.3581
1.41	0.7902	1.3615
1.42	0.7890	1.3650
1.43	0.7878	1.3686
1.44	0.7867	1.3721
1.45	0.7855	1.3756
1.46	0.7843	1.3792
1.47	0.7832	1.3828
1.48	0.7820	1.3864
1.49	0.7809	1.3901
1.50	0.7797	1.3937

% Grade	Ascending	Decending
1.51	0.7786	1.3974
1.52	0.7775	1.4011
1.53	0.7763	1.4048
1.54	0.7752	1.4085
1.55	0.7741	1.4122
1.56	0.7729	1.4160
1.57	0.7718	1.4198
1.58	0.7707	1.4236
1.59	0.7696	1.4274
1.60	0.7685	1.4313
1.61	0.7673	1.4351
1.62	0.7662	1.4390
1.63	0.7651	1.4429
1.64	0.7640	1.4469
1.65	0.7629	1.4508
1.66	0.7618	1.4548
1.67	0.7607	1.4588
1.68	0.7597	1.4628
1.69	0.7586	1.4669
1.70	0.7575	1.4709
1.71	0.7564	1.4750
1.72	0.7553	1.4791
1.73	0.7543	1.4832
1.74	0.7532	1.4874
1.75	0.7521	1.4916
1.76	0.7511	1.4958
1.77	0.7500	1.5000
1.78	0.7489	1.5042
1.79	0.7479	1.5085
1.80	0.7468	1.5128
1.81	0.7458	1.5171
1.82	0.7447	1.5215
1.83	0.7437	1.5259
1.84	0.7427	1.5303
1.85	0.7416	1.5347
1.86	0.7406	1.5391
1.87	0.7396	1.5436
1.88	0.7385	1.5481
1.89	0.7375	1.5526
1.90	0.7365	1.5572
1.91	0.7355	1.5618
1.92	0.7344	1.5664
1.93	0.7334	1.5710
1.94	0.7324	1.5757
1.95	0.7314	1.5804
1.96	0.7304	1.5851
1.97	0.7294	1.5898
1.98	0.7284	1.5946
1.99	0.7274	1.5994
2.00	0.7264	1.6042

% Grade	Ascending	Decending
2.01	0.7254	1.6091
2.02	0.7244	1.6140
2.03	0.7234	1.6189
2.04	0.7224	1.6239
2.05	0.7215	1.6288
2.06	0.7205	1.6338
2.07	0.7195	1.6389
2.08	0.7185	1.6440
2.09	0.7176	1.6491
2.10	0.7166	1.6542
2.11	0.7156	1.6594
2.12	0.7147	1.6646
2.13	0.7137	1.6698
2.14	0.7128	1.6751
2.15	0.7118	1.6804
2.16	0.7108	1.6857
2.17	0.7099	1.6911
2.18	0.7089	1.6965
2.19	0.7080	1.7019
2.20	0.7071	1.7074
2.21	0.7061	1.7129
2.22	0.7052	1.7184
2.23	0.7042	1.7240
2.24	0.7033	1.7296
2.25	0.7024	1.7353
2.26	0.7015	1.7410
2.27	0.7005	1.7467
2.28	0.6996	1.7525
2.29	0.6987	1.7583
2.30	0.6978	1.7641
2.31	0.6969	1.7700
2.32	0.6959	1.7759
2.33	0.6950	1.7819
2.34	0.6941	1.7879
2.35	0.6932	1.7939
2.36	0.6923	1.8000
2.37	0.6914	1.8061
2.38	0.6905	1.8123
2.39	0.6896	1.8185
2.40	0.6887	1.8247
2.41	0.6878	1.8310
2.42	0.6869	1.8374
2.43	0.6860	1.8438
2.44	0.6852	1.8502
2.45	0.6843	1.8566
2.46	0.6834	1.8632
2.47	0.6825	1.8697
2.48	0.6816	1.8763
2.49	0.6808	1.8830
2.50	0.6799	1.8897

% Grade	Ascending	Decending
2.51	0.6790	1.8964
2.52	0.6782	1.9032
2.53	0.6773	1.9101
2.54	0.6764	1.9170
2.55	0.6756	1.9239
2.56	0.6747	1.9309
2.57	0.6739	1.9380
2.58	0.6730	1.9451
2.59	0.6722	1.9522
2.60	0.6713	1.9594
2.61	0.6705	1.9667
2.62	0.6696	1.9740
2.63	0.6688	1.9813
2.64	0.6679	1.9888
2.65	0.6671	1.9962
2.66	0.6662	2.0038
2.67	0.6654	2.0114
2.68	0.6646	2.0190
2.69	0.6638	2.0267
2.70	0.6629	2.0345
2.71	0.6621	2.0423
2.72	0.6613	2.0502
2.73	0.6604	2.0581
2.74	0.6596	2.0661
2.75	0.6588	2.0742
2.76	0.6580	2.0824
2.77	0.6572	2.0906
2.78	0.6564	2.0988
2.79	0.6556	2.1071
2.80	0.6547	2.1155
2.81	0.6539	2.1240
2.82	0.6531	2.1325
2.83	0.6523	2.1411
2.84	0.6515	2.1498
2.85	0.6507	2.1585
2.86	0.6499	2.1673
2.87	0.6491	2.1762
1.88	0.7385	1.5481
2.89	0.6476	2.1942
2.90	0.6468	2.2033
2.91	0.6460	2.2125
2.92	0.6452	2.2218
2.93	0.6444	2.2311
2.94	0.6436	2.2405
2.95	0.6429	2.2500
1.96	0.7304	1.5851
2.97	0.6413	2.2692
2.98	0.6405	2.2790
2.99	0.6398	2.2888
3.00	0.6390	2.2987

NOTES:

1) CURVE FACTORS:
   1°CURVE = 0.05% UPGRADE
   2°CURVE = 0.10% UPGRADE
   10°CURVE = 0.50% UPGRADE

2) ACTUAL DISTANCES ARE DETERMINED AS FOLLOWS:

EQUATED ASCENDING = ACTUAL X $\frac{5.31}{5.31+\%G}$

EQUATED DESCENDING = ACTUAL X $\frac{5.31}{5.31-\%G}$

DRAFT

AMT-STD SP603.008

No.	Revisions	Date	By
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AMTRAK

OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Holt

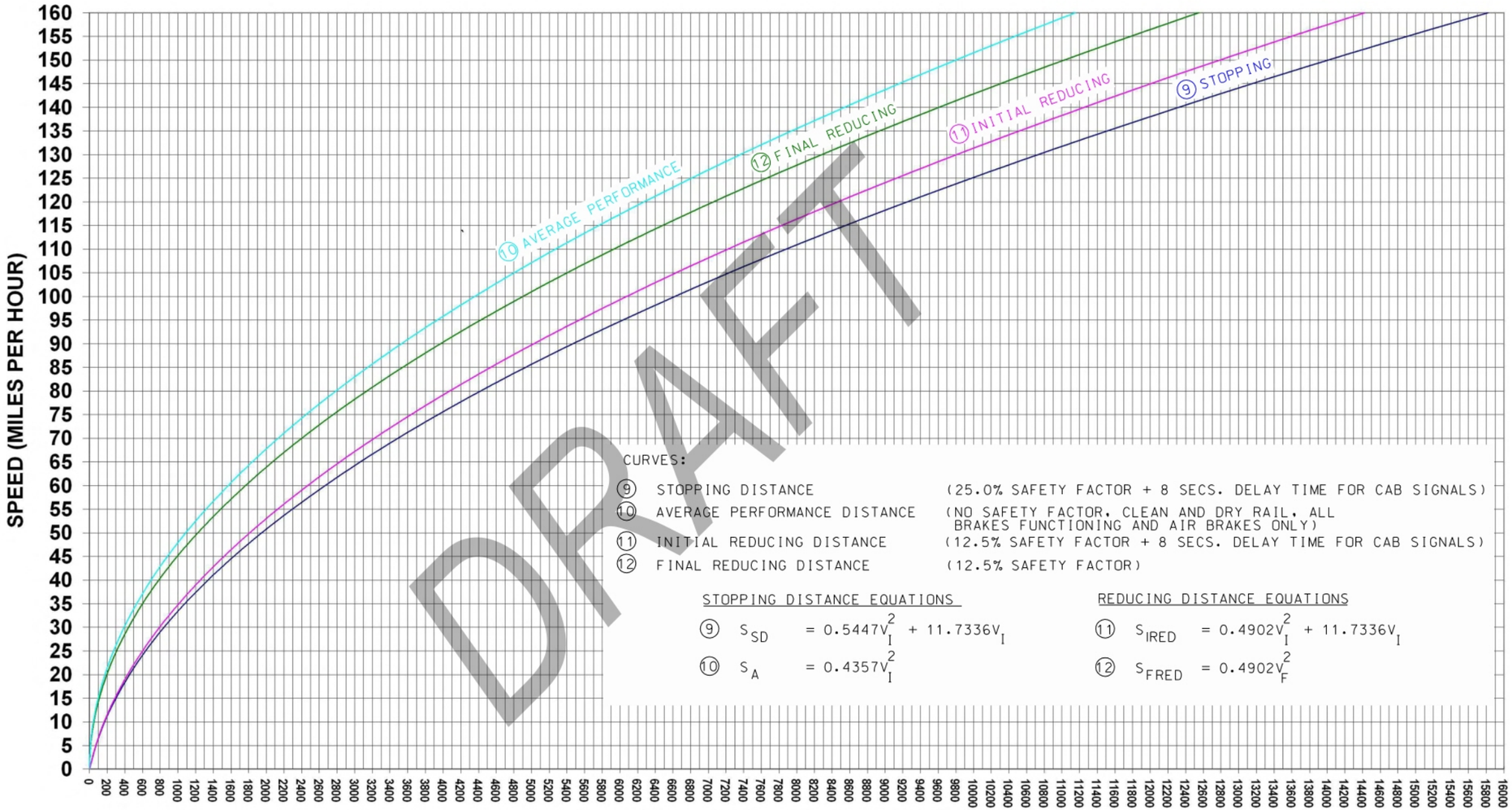
STANDARD SIGNAL PLAN
BRAKING DISTANCE
GRADE FACTOR EQUATED TO ACTUAL
(AEM-7: AMFLEET EQUIPMENT)

Designed: GE | Drawn: GE | Checked: JEH | Date: FEB 01, 2012

Dwg. No. SP603008

Sheet No. 8 OF 12

ACELA BRAKING DISTANCE CURVES FOR ALL PASSENGER TRAINS LISTED IN THE SPECIAL INSTRUCTIONS OF THE TIMETABLE WHOSE SPEEDS ARE MORE THAN 125 MPH



CURVES:

⑨	STOPPING DISTANCE	(25.0% SAFETY FACTOR + 8 SECS. DELAY TIME FOR CAB SIGNALS)
⑩	AVERAGE PERFORMANCE DISTANCE	(NO SAFETY FACTOR, CLEAN AND DRY RAIL, ALL BRAKES FUNCTIONING AND AIR BRAKES ONLY)
⑪	INITIAL REDUCING DISTANCE	(12.5% SAFETY FACTOR + 8 SECS. DELAY TIME FOR CAB SIGNALS)
⑫	FINAL REDUCING DISTANCE	(12.5% SAFETY FACTOR)

STOPPING DISTANCE EQUATIONS

⑨ $S_{SD} = 0.5447V_I^2 + 11.7336V_I$

⑩ $S_A = 0.4357V_I^2$

REDUCING DISTANCE EQUATIONS

⑪ $S_{IRED} = 0.4902V_I^2 + 11.7336V_I$

⑫ $S_{FRED} = 0.4902V_F^2$

No.	Revisions	Date	By
1	AVERAGE PERFORMANCE FULL	OCT 15, 2012	JEH
	SERVICE BRAKE RATE CHANGED	,	
	ACCOUNT OF ACTUAL BRAKE TESTS	,	
		,	
		,	

AMT-STD SP603.009

AMTRAK®

OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Holt

STANDARD SIGNAL PLAN
BRAKING DISTANCE CURVES

(ACELA EQUIPMENT)

Designed: GE	Drawn: GE	Checked: JEH	Date: FEB 01, 2012

Dwg. No. SP603009

Sheet No. 9 OF 12

26-FOI-00415 00000006217 "UNCLASSIFIED" 4/30/2026

MPH	Stop	IRED	FRED	APER
0	0	0	0	0
1	12	12	0	0
2	26	25	2	2
3	40	40	4	4
4	56	55	8	7
5	72	71	12	11
6	90	88	18	16
7	109	106	24	21
8	129	125	31	28
9	150	145	40	35
10	172	166	49	44
11	195	188	59	53
12	219	211	71	63
13	245	235	83	74
14	271	260	96	85
15	299	286	110	98
16	327	313	125	112
17	357	341	142	126
18	388	370	159	141
19	420	400	177	157
20	453	431	196	174
21	487	463	216	192
22	522	495	237	211
23	558	529	259	230
24	595	564	282	251
25	634	600	306	272
26	673	636	331	295
27	714	674	357	318
28	756	713	384	342
29	798	753	412	366
30	842	793	441	392
31	887	835	471	419
32	933	877	502	446
33	980	921	534	474
34	1029	966	567	504
35	1078	1011	600	534
36	1128	1058	635	565
37	1180	1105	671	596
38	1232	1154	708	629
39	1286	1203	746	663
40	1341	1254	784	697
41	1397	1305	824	732
42	1454	1358	865	769
43	1512	1411	906	806
44	1571	1465	949	844
45	1631	1521	993	882
46	1692	1577	1037	922
47	1755	1634	1083	962
48	1818	1693	1129	1004
49	1883	1752	1177	1046
50	1948	1812	1226	1089
51	2015	1873	1275	1133
52	2083	1936	1326	1178
53	2152	1999	1377	1224
54	2222	2063	1429	1271
55	2293	2128	1483	1318
56	2365	2194	1537	1366
57	2439	2261	1593	1416
58	2513	2330	1649	1466
59	2588	2399	1706	1517
60	2665	2469	1765	1569
61	2743	2540	1824	1621
62	2821	2612	1884	1675
63	2901	2685	1946	1729
64	2982	2759	2008	1785
65	3064	2834	2071	1841
66	3147	2910	2135	1898
67	3231	2987	2201	1956
68	3317	3065	2267	2015
69	3403	3143	2334	2074
70	3490	3223	2402	2135
71	3579	3304	2471	2196
72	3669	3386	2541	2259
73	3759	3469	2612	2322
74	3851	3553	2684	2386
75	3944	3637	2757	2451
76	4038	3723	2831	2517
77	4133	3810	2906	2583
78	4229	3898	2982	2651
79	4326	3986	3059	2719
80	4425	4076	3137	2788
81	4524	4167	3216	2859
82	4625	4258	3296	2930
83	4726	4351	3377	3002
84	4829	4444	3459	3074
85	4933	4539	3542	3148
86	5038	4635	3626	3222
87	5144	4731	3710	3298
88	5251	4829	3796	3374
89	5359	4927	3883	3451
90	5468	5027	3971	3529
91	5578	5127	4059	3608
92	5690	5229	4149	3688
93	5802	5331	4240	3768
94	5916	5434	4331	3850
95	6031	5539	4424	3932
96	6146	5644	4518	4015
97	6263	5750	4612	4100
98	6381	5858	4708	4184
99	6500	5966	4804	4270
100	6620	6075	4902	4357
101	6742	6186	5001	4445
102	6864	6297	5100	4533
103	6987	6409	5201	4622
104	7112	6522	5302	4713
105	7237	6636	5404	4804
106	7364	6752	5508	4896
107	7492	6868	5612	4988
108	7621	6985	5718	5082
109	7751	7103	5824	5177
110	7882	7222	5931	5272
111	8014	7342	6040	5368
112	8147	7463	6149	5465
113	8281	7585	6259	5563
114	8417	7708	6371	5662
115	8553	7832	6483	5762
116	8691	7957	6596	5863
117	8829	8083	6710	5964
118	8969	8210	6826	6067
119	9110	8338	6942	6170
120	9252	8467	7059	6274
121	9395	8597	7177	6379
122	9539	8728	7296	6485
123	9684	8859	7416	6592
124	9830	8992	7537	6699
125	9978	9126	7659	6808
126	10126	9261	7782	6917
127	10276	9397	7906	7027
128	10426	9533	8031	7139
129	10578	9671	8157	7250
130	10731	9810	8284	7363
131	10885	9949	8412	7477
132	11040	10090	8541	7592
133	11196	10232	8671	7707
134	11353	10374	8802	7823
135	11511	10518	8934	7941
136	11671	10663	9067	8059
137	11831	10808	9201	8178
138	11993	10955	9335	8297
139	12155	11102	9471	8418
140	12319	11251	9608	8540
141	12484	11400	9746	8662
142	12650	11551	9884	8785
143	12816	11702	10024	8910
144	12985	11854	10165	9035
145	13154	12008	10306	9161
146	13324	12162	10449	9287
147	13495	12318	10593	9415
148	13668	12474	10737	9544
149	13841	12631	10883	9673
150	14016	12790	11030	9803
151	14191	12949	11177	9934
152	14368	13109	11326	10066
153	14546	13270	11475	10199
154	14725	13433	11626	10333
155	14905	13596	11777	10468
156	15086	13760	11930	10603
157	15268	13925	12083	10740
158	15452	14091	12237	10877
159	15636	14258	12393	11015
160	15822	14426	12549	11154

DRAFT

FOR STOPPING DISTANCES:

A) SELECT INITIAL SPEED IN MPH COLUMN
B) FIND DISTANCE TO STOP ON SAME LINE IN STOP COLUMN

FOR REDUCING DISTANCES:

A) SELECT INITIAL SPEED IN MPH COLUMN
B) FIND DISTANCE ON SAME LINE IN IRED COLUMNS
C) SELECT FINAL SPEED IN MPH COLUMN
D) FIND DISTANCE ON SAME LINE IN FRED COLUMN
E) SUBTRACT IRED DISTANCE FROM FRED DISTANCE FOR REDUCING DISTANCE

No.	Revisions	Date	By
1	AVERAGE PERFORMANCE FULL	OCT 15, 2012	JEH
	SERVICE BRAKE RATE CHANGED	,	
	ACCOUNT OF ACTUAL BRAKE TESTS	,	
		,	
		,	

AMT-STD SP603.010

AMTRAK

OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Hall

STANDARD SIGNAL PLAN
BRAKING DISTANCE TABLE

(ACELA EQUIPMENT)

Designed: GE | Drawn: GE | Checked: JEH | Date: FEB 01, 2012

Dwg. No. SP603010

Sheet No. 10 OF 12

26-FOI-00415 00000006217 "UNCLASSIFIED" 4/30/2026

GRADE FACTORS FOR CONVERTING ACTUAL DISTANCES BETWEEN SIGNALS TO EQUATED DISTANCES

% Grade	Ascending	Decending
0.00	1.0000	1.0000
0.01	1.0016	0.9984
0.02	1.0033	0.9967
0.03	1.0049	0.9951
0.04	1.0065	0.9935
0.05	1.0082	0.9918
0.06	1.0098	0.9902
0.07	1.0114	0.9886
0.08	1.0131	0.9869
0.09	1.0147	0.9853
0.10	1.0163	0.9837
0.11	1.0180	0.9820
0.12	1.0196	0.9804
0.13	1.0212	0.9788
0.14	1.0229	0.9771
0.15	1.0245	0.9755
0.16	1.0261	0.9739
0.17	1.0278	0.9722
0.18	1.0294	0.9706
0.19	1.0310	0.9690
0.20	1.0327	0.9673
0.21	1.0343	0.9657
0.22	1.0359	0.9641
0.23	1.0376	0.9624
0.24	1.0392	0.9608
0.25	1.0408	0.9592
0.26	1.0425	0.9575
0.27	1.0441	0.9559
0.28	1.0458	0.9542
0.29	1.0474	0.9526
0.30	1.0490	0.9510
0.31	1.0507	0.9493
0.32	1.0523	0.9477
0.33	1.0539	0.9461
0.34	1.0556	0.9444
0.35	1.0572	0.9428
0.36	1.0588	0.9412
0.37	1.0605	0.9395
0.38	1.0621	0.9379
0.39	1.0637	0.9363
0.40	1.0654	0.9346
0.41	1.0670	0.9330
0.42	1.0686	0.9314
0.43	1.0703	0.9297
0.44	1.0719	0.9281
0.45	1.0735	0.9265
0.46	1.0752	0.9248
0.47	1.0768	0.9232
0.48	1.0784	0.9216
0.49	1.0801	0.9199
0.50	1.0817	0.9183

% Grade	Ascending	Decending
0.51	1.0833	0.9167
0.52	1.0850	0.9150
0.53	1.0866	0.9134
0.54	1.0882	0.9118
0.55	1.0899	0.9101
0.56	1.0915	0.9085
0.57	1.0931	0.9069
0.58	1.0948	0.9052
0.59	1.0964	0.9036
0.60	1.0980	0.9020
0.61	1.0997	0.9003
0.62	1.1013	0.8987
0.63	1.1029	0.8971
0.64	1.1046	0.8954
0.65	1.1062	0.8938
0.66	1.1078	0.8922
0.67	1.1095	0.8905
0.68	1.1111	0.8889
0.69	1.1127	0.8873
0.70	1.1144	0.8856
0.71	1.1160	0.8840
0.72	1.1176	0.8824
0.73	1.1193	0.8807
0.74	1.1209	0.8791
0.75	1.1225	0.8775
0.76	1.1242	0.8758
0.77	1.1258	0.8742
0.78	1.1275	0.8725
0.79	1.1291	0.8709
0.80	1.1307	0.8693
0.81	1.1324	0.8676
0.82	1.1340	0.8660
0.83	1.1356	0.8644
0.84	1.1373	0.8627
0.85	1.1389	0.8611
0.86	1.1405	0.8595
0.87	1.1422	0.8578
0.88	1.1438	0.8562
0.89	1.1454	0.8546
0.90	1.1471	0.8529
0.91	1.1487	0.8513
0.92	1.1503	0.8497
0.93	1.1520	0.8480
0.94	1.1536	0.8464
0.95	1.1552	0.8448
0.96	1.1569	0.8431
0.97	1.1585	0.8415
0.98	1.1601	0.8399
0.99	1.1618	0.8382
1.00	1.1634	0.8366

% Grade	Ascending	Decending
1.01	1.1650	0.8350
1.02	1.1667	0.8333
1.03	1.1683	0.8317
1.04	1.1699	0.8301
1.05	1.1716	0.8284
1.06	1.1732	0.8268
1.07	1.1748	0.8252
1.08	1.1765	0.8235
1.09	1.1781	0.8219
1.10	1.1797	0.8203
1.11	1.1814	0.8186
1.12	1.1830	0.8170
1.13	1.1846	0.8154
1.14	1.1863	0.8137
1.15	1.1879	0.8121
1.16	1.1895	0.8105
1.17	1.1912	0.8088
1.18	1.1928	0.8072
1.19	1.1944	0.8056
1.20	1.1961	0.8039
1.21	1.1977	0.8023
1.22	1.1993	0.8007
1.23	1.2010	0.7990
1.24	1.2026	0.7974
1.25	1.2042	0.7958
1.26	1.2059	0.7941
1.27	1.2075	0.7925
1.28	1.2092	0.7908
1.29	1.2108	0.7892
1.30	1.2124	0.7876
1.31	1.2141	0.7859
1.32	1.2157	0.7843
1.33	1.2173	0.7827
1.34	1.2190	0.7810
1.35	1.2206	0.7794
1.36	1.2222	0.7778
1.37	1.2239	0.7761
1.38	1.2255	0.7745
1.39	1.2271	0.7729
1.40	1.2288	0.7712
1.41	1.2304	0.7696
1.42	1.2320	0.7680
1.43	1.2337	0.7663
1.44	1.2353	0.7647
1.45	1.2369	0.7631
1.46	1.2386	0.7614
1.47	1.2402	0.7598
1.48	1.2418	0.7582
1.49	1.2435	0.7565
1.50	1.2451	0.7549

% Grade	Ascending	Decending
1.51	1.2467	0.7533
1.52	1.2484	0.7516
1.53	1.2500	0.7500
1.54	1.2516	0.7484
1.55	1.2533	0.7467
1.56	1.2549	0.7451
1.57	1.2565	0.7435
1.58	1.2582	0.7418
1.59	1.2598	0.7402
1.60	1.2614	0.7386
1.61	1.2631	0.7369
1.62	1.2647	0.7353
1.63	1.2663	0.7337
1.64	1.2680	0.7320
1.65	1.2696	0.7304
1.66	1.2712	0.7288
1.67	1.2729	0.7271
1.68	1.2745	0.7255
1.69	1.2761	0.7239
1.70	1.2778	0.7222
1.71	1.2794	0.7206
1.72	1.2810	0.7190
1.73	1.2827	0.7173
1.74	1.2843	0.7157
1.75	1.2859	0.7141
1.76	1.2876	0.7124
1.77	1.2892	0.7108
1.78	1.2908	0.7092
1.79	1.2925	0.7075
1.80	1.2941	0.7059
1.81	1.2958	0.7042
1.82	1.2974	0.7026
1.83	1.2990	0.7010
1.84	1.3007	0.6993
1.85	1.3023	0.6977
1.86	1.3039	0.6961
1.87	1.3056	0.6944
1.88	1.3072	0.6928
1.89	1.3088	0.6912
1.90	1.3105	0.6895
1.91	1.3121	0.6879
1.92	1.3137	0.6863
1.93	1.3154	0.6846
1.94	1.3170	0.6830
1.95	1.3186	0.6814
1.96	1.3203	0.6797
1.97	1.3219	0.6781
1.98	1.3235	0.6765
1.99	1.3252	0.6748
2.00	1.3268	0.6732

% Grade	Ascending	Decending
2.01	1.3284	0.6716
2.02	1.3301	0.6699
2.03	1.3317	0.6683
2.04	1.3333	0.6667
2.05	1.3350	0.6650
2.06	1.3366	0.6634
2.07	1.3382	0.6618
2.08	1.3399	0.6601
2.09	1.3415	0.6585
2.10	1.3431	0.6569
2.11	1.3448	0.6552
2.12	1.3464	0.6536
2.13	1.3480	0.6520
2.14	1.3497	0.6503
2.15	1.3513	0.6487
2.16	1.3529	0.6471
2.17	1.3546	0.6454
2.18	1.3562	0.6438
2.19	1.3578	0.6422
2.20	1.3595	0.6405
2.21	1.3611	0.6389
2.22	1.3627	0.6373
2.23	1.3644	0.6356
2.24	1.3660	0.6340
2.25	1.3676	0.6324
2.26	1.3693	0.6307
2.27	1.3709	0.6291
2.28	1.3725	0.6275
2.29	1.3742	0.6258
2.30	1.3758	0.6242
2.31	1.3775	0.6225
2.32	1.3791	0.6209
2.33	1.3807	0.6193
2.34	1.3824	0.6176
2.35	1.3840	0.6160
2.36	1.3856	0.6144
2.37	1.3873	0.6127
2.38	1.3889	0.6111
2.39	1.3905	0.6095
2.40	1.3922	0.6078
2.41	1.3938	0.6062
2.42	1.3954	0.6046
2.43	1.3971	0.6029
2.44	1.3987	0.6013
2.45	1.4003	0.5997
2.46	1.4020	0.5980
2.47	1.4036	0.5964
2.48	1.4052	0.5948
2.49	1.4069	0.5931
2.50	1.4085	0.5915

% Grade	Ascending	Decending
2.51	1.4101	0.5899
2.52	1.4118	0.5882
2.53	1.4134	0.5866
2.54	1.4150	0.5850
2.55	1.4167	0.5833
2.56	1.4183	0.5817
2.57	1.4199	0.5801
2.58	1.4216	0.5784
2.59	1.4232	0.5768
2.60	1.4248	0.5752
2.61	1.4265	0.5735
2.62	1.4281	0.5719
2.63	1.4297	0.5703
2.64	1.4314	0.5686
2.65	1.4330	0.5670
2.66	1.4346	0.5654
2.67	1.4363	0.5637
2.68	1.4379	0.5621
2.69	1.4395	0.5605
2.70	1.4412	0.5588
2.71	1.4428	0.5572
2.72	1.4444	0.5556
2.73	1.4461	0.5539
2.74	1.4477	0.5523
2.75	1.4493	0.5507
2.76	1.4510	0.5490
2.77	1.4526	0.5474
2.78	1.4542	0.5458
2.79	1.4559	0.5441
2.80	1.4575	0.5425
2.81	1.4592	0.5408
2.82	1.4608	0.5392
2.83	1.4624	0.5376
2.84	1.4641	0.5359
2.85	1.4657	0.5343
2.86	1.4673	0.5327
2.87	1.4690	0.5310
2.88	1.4706	0.5294
2.89	1.4722	0.5278
2.90	1.4739	0.5261
2.91	1.4755	0.5245
2.92	1.4771	0.5229
2.93	1.4788	0.5212
2.94	1.4804	0.5196
2.95	1.4820	0.5180
2.96	1.4837	0.5163
2.97	1.4853	0.5147
2.98	1.4869	0.5131
2.99	1.4886	0.5114
3.00	1.4902	0.5098

NOTES:

1) CURVE FACTORS:
   1°CURVE = 0.05% UPGRADE
   2°CURVE = 0.10% UPGRADE
   10°CURVE = 0.50% UPGRADE

2) ACTUAL DISTANCES ARE DETERMINED AS FOLLOWS:

EQUATED ASCENDING = ACTUAL X $\frac{6.12+\%G}{6.12}$

EQUATED DESCENDING = ACTUAL X $\frac{6.12-\%G}{6.12}$

DRAFT

No.	Revisions	Date	By
1	AVERAGE PERFORMANCE FULL	OCT 15, 2012	JEH
	SERVICE BRAKE RATE CHANGED	,	
	ACCOUNT OF ACTUAL BRAKE TESTS	,	
		,	
		,	

AMT-STD SP603011

AMTRAK

OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Holt

STANDARD SIGNAL PLAN
BRAKING DISTANCE
GRADE FACTOR ACTUAL TO EQUATED
(ACELA EQUIPMENT)

Designed: GE | Drawn: GE | Checked: JEH | Date: FEB 01, 2012

Dwg. No. SP603011

Sheet No. 11 OF 12

26-FOI-00415 00000006217 "UNCLASSIFIED" 4/30/2026

GRADE FACTORS FOR CONVERTING EQUATED DISTANCE INTO ACTUAL DISTANCES REQUIRED FOR SIGNAL SPACING

% Grade	Ascending	Decending
0.00	1.0000	1.0000
0.01	0.9984	1.0016
0.02	0.9967	1.0033
0.03	0.9951	1.0049
0.04	0.9935	1.0066
0.05	0.9919	1.0082
0.06	0.9903	1.0099
0.07	0.9887	1.0116
0.08	0.9871	1.0132
0.09	0.9855	1.0149
0.10	0.9839	1.0166
0.11	0.9823	1.0183
0.12	0.9808	1.0200
0.13	0.9792	1.0217
0.14	0.9776	1.0234
0.15	0.9761	1.0251
0.16	0.9745	1.0268
0.17	0.9730	1.0286
0.18	0.9714	1.0303
0.19	0.9699	1.0320
0.20	0.9684	1.0338
0.21	0.9668	1.0355
0.22	0.9653	1.0373
0.23	0.9638	1.0390
0.24	0.9623	1.0408
0.25	0.9608	1.0426
0.26	0.9592	1.0444
0.27	0.9577	1.0462
0.28	0.9563	1.0479
0.29	0.9548	1.0497
0.30	0.9533	1.0515
0.31	0.9518	1.0534
0.32	0.9503	1.0552
0.33	0.9488	1.0570
0.34	0.9474	1.0588
0.35	0.9459	1.0607
0.36	0.9444	1.0625
0.37	0.9430	1.0643
0.38	0.9415	1.0662
0.39	0.9401	1.0681
0.40	0.9387	1.0699
0.41	0.9372	1.0718
0.42	0.9358	1.0737
0.43	0.9344	1.0756
0.44	0.9329	1.0775
0.45	0.9315	1.0794
0.46	0.9301	1.0813
0.47	0.9287	1.0832
0.48	0.9273	1.0851
0.49	0.9259	1.0870
0.50	0.9245	1.0890
0.51	0.9231	1.0909
0.52	0.9217	1.0929
0.53	0.9203	1.0948
0.54	0.9189	1.0968
0.55	0.9175	1.0987
0.56	0.9162	1.1007
0.57	0.9148	1.1027
0.58	0.9134	1.1047
0.59	0.9121	1.1067
0.60	0.9107	1.1087
0.61	0.9094	1.1107
0.62	0.9080	1.1127
0.63	0.9067	1.1148
0.64	0.9053	1.1168
0.65	0.9040	1.1188
0.66	0.9027	1.1209
0.67	0.9013	1.1229
0.68	0.9000	1.1250
0.69	0.8987	1.1271
0.70	0.8974	1.1292
0.71	0.8960	1.1312
0.72	0.8947	1.1333
0.73	0.8934	1.1354
0.74	0.8921	1.1375
0.75	0.8908	1.1397
0.76	0.8895	1.1418
0.77	0.8882	1.1439
0.78	0.8870	1.1461
0.79	0.8857	1.1482
0.80	0.8844	1.1504
0.81	0.8831	1.1525
0.82	0.8818	1.1547
0.83	0.8806	1.1569
0.84	0.8793	1.1591
0.85	0.8780	1.1613
0.86	0.8768	1.1635
0.87	0.8755	1.1657
0.88	0.8743	1.1679
0.89	0.8730	1.1702
0.90	0.8718	1.1724
0.91	0.8706	1.1747
0.92	0.8693	1.1769
0.93	0.8681	1.1792
0.94	0.8669	1.1815
0.95	0.8656	1.1838
0.96	0.8644	1.1860
0.97	0.8632	1.1883
0.98	0.8620	1.1907
0.99	0.8608	1.1930
1.00	0.8596	1.1953
1.01	0.8583	1.1977
1.02	0.8571	1.2000
1.03	0.8559	1.2024
1.04	0.8547	1.2047
1.05	0.8536	1.2071
1.06	0.8524	1.2095
1.07	0.8512	1.2119
1.08	0.8500	1.2143
1.09	0.8488	1.2167
1.10	0.8476	1.2191
1.11	0.8465	1.2216
1.12	0.8453	1.2240
1.13	0.8441	1.2265
1.14	0.8430	1.2289
1.15	0.8418	1.2314
1.16	0.8407	1.2339
1.17	0.8395	1.2364
1.18	0.8384	1.2389
1.19	0.8372	1.2414
1.20	0.8361	1.2439
1.21	0.8349	1.2464
1.22	0.8338	1.2490
1.23	0.8327	1.2515
1.24	0.8315	1.2541
1.25	0.8304	1.2567
1.26	0.8293	1.2593
1.27	0.8281	1.2619
1.28	0.8270	1.2645
1.29	0.8259	1.2671
1.30	0.8248	1.2697
1.31	0.8237	1.2723
1.32	0.8226	1.2750
1.33	0.8215	1.2777
1.34	0.8204	1.2803
1.35	0.8193	1.2830
1.36	0.8182	1.2857
1.37	0.8171	1.2884
1.38	0.8160	1.2911
1.39	0.8149	1.2939
1.40	0.8138	1.2966
1.41	0.8127	1.2994
1.42	0.8117	1.3021
1.43	0.8106	1.3049
1.44	0.8095	1.3077
1.45	0.8085	1.3105
1.46	0.8074	1.3133
1.47	0.8063	1.3161
1.48	0.8053	1.3190
1.49	0.8042	1.3218
1.50	0.8031	1.3247
1.51	0.8021	1.3275
1.52	0.8010	1.3304
1.53	0.8000	1.3333
1.54	0.7990	1.3362
1.55	0.7979	1.3392
1.56	0.7969	1.3421
1.57	0.7958	1.3451
1.58	0.7948	1.3480
1.59	0.7938	1.3510
1.60	0.7927	1.3540
1.61	0.7917	1.3570
1.62	0.7907	1.3600
1.63	0.7897	1.3630
1.64	0.7887	1.3661
1.65	0.7876	1.3691
1.66	0.7866	1.3722
1.67	0.7856	1.3753
1.68	0.7846	1.3784
1.69	0.7836	1.3815
1.70	0.7826	1.3846
1.71	0.7816	1.3878
1.72	0.7806	1.3909
1.73	0.7796	1.3941
1.74	0.7786	1.3973
1.75	0.7776	1.4005
1.76	0.7766	1.4037
1.77	0.7757	1.4069
1.78	0.7747	1.4101
1.79	0.7737	1.4134
1.80	0.7727	1.4167
1.81	0.7718	1.4200
1.82	0.7708	1.4233
1.83	0.7698	1.4266
1.84	0.7688	1.4299
1.85	0.7679	1.4333
1.86	0.7669	1.4366
1.87	0.7660	1.4400
1.88	0.7650	1.4434
1.89	0.7640	1.4468
1.90	0.7631	1.4502
1.91	0.7621	1.4537
1.92	0.7612	1.4571
1.93	0.7602	1.4606
1.94	0.7593	1.4641
1.95	0.7584	1.4676
1.96	0.7574	1.4712
1.97	0.7565	1.4747
1.98	0.7556	1.4783
1.99	0.7546	1.4818
2.00	0.7537	1.4854
2.01	0.7528	1.4891
2.02	0.7518	1.4927
2.03	0.7509	1.4963
2.04	0.7500	1.5000
2.05	0.7491	1.5037
2.06	0.7482	1.5074
2.07	0.7473	1.5111
2.08	0.7463	1.5149
2.09	0.7454	1.5186
2.10	0.7445	1.5224
2.11	0.7436	1.5262
2.12	0.7427	1.5300
2.13	0.7418	1.5338
2.14	0.7409	1.5377
2.15	0.7400	1.5416
2.16	0.7391	1.5455
2.17	0.7382	1.5494
2.18	0.7373	1.5533
2.19	0.7365	1.5573
2.20	0.7356	1.5612
2.21	0.7347	1.5652
2.22	0.7338	1.5692
2.23	0.7329	1.5733
2.24	0.7321	1.5773
2.25	0.7312	1.5814
2.26	0.7303	1.5855
2.27	0.7294	1.5896
2.28	0.7286	1.5938
2.29	0.7277	1.5979
2.30	0.7268	1.6021
2.31	0.7260	1.6063
2.32	0.7251	1.6105
2.33	0.7243	1.6148
2.34	0.7234	1.6190
2.35	0.7226	1.6233
2.36	0.7217	1.6277
2.37	0.7208	1.6320
2.38	0.7200	1.6364
2.39	0.7192	1.6408
2.40	0.7183	1.6452
2.41	0.7175	1.6496
2.42	0.7166	1.6541
2.43	0.7158	1.6585
2.44	0.7150	1.6630
2.45	0.7141	1.6676
2.46	0.7133	1.6721
2.47	0.7125	1.6767
2.48	0.7116	1.6813
2.49	0.7108	1.6860
2.50	0.7100	1.6906
2.51	0.7092	1.6953
2.52	0.7083	1.7000
2.53	0.7075	1.7047
2.54	0.7067	1.7095
2.55	0.7059	1.7143
2.56	0.7051	1.7191
2.57	0.7043	1.7239
2.58	0.7034	1.7288
2.59	0.7026	1.7337
2.60	0.7018	1.7386
2.61	0.7010	1.7436
2.62	0.7002	1.7486
2.63	0.6994	1.7536
2.64	0.6986	1.7586
2.65	0.6978	1.7637
2.66	0.6970	1.7688
2.67	0.6962	1.7739
2.68	0.6955	1.7791
2.69	0.6947	1.7843
2.70	0.6939	1.7895
2.71	0.6931	1.7947
2.72	0.6923	1.8000
2.73	0.6915	1.8053
2.74	0.6907	1.8107
2.75	0.6900	1.8160
2.76	0.6892	1.8214
2.77	0.6884	1.8269
2.78	0.6876	1.8323
2.79	0.6869	1.8378
2.80	0.6861	1.8434
2.81	0.6853	1.8489
2.82	0.6846	1.8545
2.83	0.6838	1.8602
2.84	0.6830	1.8659
2.85	0.6823	1.8716
2.86	0.6815	1.8773
2.87	0.6808	1.8831
2.88	0.6800	1.8889
2.89	0.6792	1.8947
2.90	0.6785	1.9006
2.91	0.6777	1.9065
2.92	0.6770	1.9125
2.93	0.6762	1.9185
2.94	0.6755	1.9245
2.95	0.6748	1.9306
2.96	0.6740	1.9367
2.97	0.6733	1.9429
2.98	0.6725	1.9490
2.99	0.6718	1.9553
3.00	0.6711	1.9615

NOTES:

1) CURVE FACTORS:
   1°CURVE = 0.05% UPGRADE
   2°CURVE = 0.10% UPGRADE
   10°CURVE = 0.50% UPGRADE

2) ACTUAL DISTANCES ARE DETERMINED AS FOLLOWS:

EQUATED ASCENDING = ACTUAL X $\frac{6.12}{6.12+\%G}$

EQUATED DESCENDING = ACTUAL X $\frac{6.12}{6.12-\%G}$

No.	Revisions	Date	By
1	AVERAGE PERFORMANCE FULL	OCT 15, 2012	JEH
	SERVICE BRAKE RATE CHANGED	,	
	ACCOUNT OF ACTUAL BRAKE TESTS	,	
		,	
		,	

AMTRAK®

OFFICE OF THE
DEPUTY CHIEF ENGINEER C&S

Phila., PA Date: February 01, 2012 Approved: E. K. Hall

STANDARD SIGNAL PLAN
BRAKING DISTANCE
GRADE FACTOR EQUATED TO ACTUAL
(ACELA EQUIPMENT)

Designed: GE | Drawn: GE | Checked: JEH | Date: FEB 01, 2012

Dwg. No. SP603012

Sheet No. 12 OF 12

AMT-STD SP603.012

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Amtrak
Mechanical Department
Bureau of Rolling Stock Engineering

SPECIFICATION

For

Thermally Actuated Automatic Drain Valve For Freeze Protection on Passenger Cars

DRAFT

SPECIFICATION No. 1004

Initial Issue

Issue Date: November 16, 2012

APPROVED	DATE	
	11/30/12	Chief Mechanical Officer
	11/28/2012	Deputy Chief Mechanical Officer - Engineering
	11/19/12	Senior Director - Rolling Stock Engineering
John J. Raila		Director – Fleet Manager
		Originator
Originator: Yakov Goldin		
		Originator
Originator: Dave Skillman		

SPECIFICATION CHANGE SHEET

REVISION	DATE	DESCRIPTION	PAGE	APPROVER
	11/16/2012	Initial Issue		

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Amtrak

Bureau of Rolling Stock Engineering

Specification for **Thermally Actuated Automatic Drain Valve for Freeze Protection on Passenger Cars**

Specification No. 1004

Initial Issue

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Amtrak

Bureau Of Rolling Stock Engineering

Specification for **Thermally Actuated Automatic Drain Valve for Freeze Protection on Passenger Cars**

Specification No. 1004

Initial Issue

1.0 Scope

1.1 Purpose

This Specification defines the vendor general design criteria requirements applicable for the manufacture of an *Thermally Actuated Automatic Drain Valve for Freeze Protection* used on Amtrak rail passenger cars. This Specification is intended to be used in conjunction with the Amtrak Procurement Department contract documents, purchase orders and other contractural documents issued to the vendor. It is Amtrak's intention that any new Thermally Actuated Automatic Drain Valve for Freeze Protection be functionally interchangeable with the Thermally Actuated Automatic Drain Valve for Freeze Protection currently in use at Amtrak in terms of form, fit, function, general appearance, durability and operation.

The design criteria and constraints that are known to Amtrak have been specified. If other factors require definition after Contract award, the vendor shall be responsible for making those definition requirements known to Amtrak in a timely manner for mutual investigation and satisfactory resolution. The vendor shall not be relieved of the overall responsibility of providing an adequate design for the Amtrak service conditions. Wherever possible, this Specification has been developed on the basis of car performance required, rather than specific hardware to be provided. Where specific hardware is mentioned, it is for the purpose of providing an example of concepts or designs acceptable to the Engineer. This approach will allow vendors to employ innovation and advanced technology where appropriate.

Whenever in this Specification an article or material is defined by using a trade name or the name and catalog number of a particular manufacturer or vendor, or a limited description, the term “or approved equal” if not written thereafter shall be implied. Any reference to a particular manufacturer’s product either by trade name or limited description is only for the purpose of setting a standard of performance , quality, composition, construction or size. The term “or approved equal” means any other manufactured product or article which is equivalent in material, workmanship and service and is as efficient and economical in operation in the opinion of the Amtrak Engineer. Amtrak’s opinion as to whether the proposed alternate is equal to the specified items for Amtrak’s specified use and purposes shall be final and conclusive.

Any items of material or equipment, which are not fully described or are omitted in this Specification or the accepted Technical Proposal, but are necessary for the completion of the diaphragm and faceplate assembly, shall be considered a part of the scope of supply. In this Specification all references to "number of days" shall mean calendar days unless otherwise stated.

Safety shall be of primary importance in the design of the items being supplied. They shall present a safe, hazard-free environment to passengers and the operating and maintenance personnel to the extent practical. No sharp edges or corners or pinch points shall occur where

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passengers, crew, or maintenance personnel may come into contact with them. Smooth surfaces and avoidance of protrusions shall be used to minimize passenger injury.

1.2 Exceptions

The vendor shall explicitly identify to the Amtrak Procurement officer any exceptions being taken to this Specification, referencing the Specification paragraph and exact wording in question.

1.3 Scope of Work

It is the vendor's responsibility under this Specification, and fully expected by Amtrak, to supply a *Thermally Actuated Automatic Drain Valve for Freeze Protection* consisting of all new materials. It is Amtrak's desire that all materials, to the greatest extent possible, be of commonly available commercial items and hardware. All drawings, bills of materials, catalog lists, documentation and other engineering and design materials related to this Specification shall become the property of Amtrak, and shall be delivered by the vendor in total as part of the First Article Inspection process. If any patented items are used, Amtrak must be granted an unrestricted license to use, copy or otherwise manufacture the item by itself or a third party.

As basic work under this Specification each item produced must be completely functionally tested, cleaned and properly packaged for shipment to Amtrak, and documentation submitted. Amtrak will perform a series of First Article Inspections on the first item manufactured by a vendor, in order to verify that the process and materials used are in compliance with this Specification and drawings.

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1.4 Legal Requirements

It is mandatory that all materials used by the vendor in the item being supplied to Amtrak must comply with the flammability and smoke emissions requirements of the latest edition of 49 CFR Parts 238.103 (a)(2) and (b)(2), and also its Appendix B requirements (including all referenced notes) for all material types listed. All components being supplied must also comply with all applicable requirements identified in 49 CFR Part 238.

It is required that prior to the First Article Inspection and any delivery of material, the vendor must supply the Amtrak Procurement officer with: i) a report by a recognized independent testing laboratory certifying that all materials used comply with the 49 CFR Part 238 Appendix B requirements, if applicable, and ii) certification by the vendor that all components being supplied also comply with all applicable requirements identified in 49 CFR Part 238.

1.5 Engineer

The Engineer, as referenced in this Specification, is defined as the Senior Director of the Amtrak Bureau of Rolling Stock Engineering within its Mechanical Department, or its written designee. During the course of the project the vendor may be submitting items for the Engineer's approval as required by the Contract and Specification. The vendor shall not interpret this process to mean that the Engineer will function as an arm of the vendor's Project Management or Engineering staff. Submissions shall be structured to show how the vendor is responding to the requirements of the Specification, and not on the basis of requiring the Engineer to discover how the vendor is not meeting those requirements. All material being submitted shall have been reviewed by qualified vendor personnel and judged to be suitable for submission prior to doing so, and this shall be so stated in the letter of transmission or on the document, particularly as regards material passed through from subcontractors. Test results shall receive vendor staff

review and signature prior to submission. Submissions found to be deficient with regard to any of the above shall be immediately returned without review to the vendor.

Submissions shall contain sufficient detail to confirm that specification requirements are being met. However, the vendor shall use judgment as to what level is appropriate and shall communicate with the Engineer when guidance is needed on a case-by-case basis. Documents with levels of detail and information considered to be beyond what is needed or is time-effective to confirm compliance shall be given cursory review by the Engineer and considered as background information and shall not receive formal approval. Individual submissions shall not contain material from multiple subsystems or subcontractors and such submissions will be returned without review to the vendor.

Submittals requiring the Engineer's approval prior to implementation shall be reviewed and classified by the Engineer within 30 days from the day the submittal is received based on a rate of submittal that is reflective of the pace of an orderly, properly managed program. Priorities will be given to special cases when possible. However, the vendor shall consider the 30 days criteria and the time requirements involved for mailing when scheduling submittals. The days used by the Engineer in Design Review meetings or in travel to or from such meetings shall not be included in the 30 days figure. Delays caused by the Engineer's failure to review and approve drawings or schedules in a timely fashion as listed above shall be treated as an excusable delay, provided that the vendor can demonstrate to the satisfaction of the Amtrak Procurement officer that actual production delays have been caused by the Engineer and there is no other concurrent cause for delay.

1.6 Cost Items

Any individual extra work items regarding the items being supplied shall be handled in accordance with the contract and purchase order documents issued to the vendor by the Amtrak Procurement Department. The vendor must contact the Amtrak Procurement officer regarding all such issues. The vendor agrees that no payment will be made by Amtrak for any additional work outside the basic work scope of the contract documents unless such work is first preapproved in writing by the Amtrak Procurement officer in accordance with the contract documents.

1.7 Vendor Quality Policy

It is mandatory under this Specification that the vendor have established and maintain a Quality policy system. The vendor's shop is required to be equipped with equipment, personnel and management completely sufficient to assemble, inspect and test each item being supplied under this Specification. The shop shall have suitable equipment to diagnose any failure mode, and perform all adjustments and tests required to confirm proper operation. The vendor's Quality Assurance staff shall be active participants in the assembly, inspection, testing and documentation phases of the work. It is required that the vendor have a quality assurance program deployed that, at a minimum, be modeled after an established quality standard. It is highly desirable that the vendor's quality assurance program be certified under ISO 9001:2000, or an equivalent recognized standard.

Amtrak Quality Assurance personnel will conduct random audits of the vendor's quality assurance program to verify that these Specification requirements are being achieved. The vendor shall fully cooperate in such audits. Specific attention shall be paid to the areas of management responsibility, quality system, contract review, design control, document control (including drawings), purchasing, purchaser-supplied product, product traceability and identification, process control (including procedures, testing and equipment), inspection and testing, inspection, measuring and test equipment (including calibration programs), control of

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nonconforming products (applied controls), corrective and preventative actions, handling, storage, packaging and delivery, quality records, internal quality audits, training, servicing and statistical techniques.

1.8 Components

The vendor shall use only new parts for all components. Unless stated otherwise in this Specification, all threaded fasteners shall be vibration-proof stainless steel fasteners using selflocking
Nylon insert nuts. Stainless steel washers shall be used under the head of all bolts and nuts. The vendor shall maintain drawings for each component, and where necessary, patterns, jigs and fixtures, to assure identical manufacture. All elastomers used shall have a design life of 10 years in service unless otherwise approved by the Amtrak Procurement officer.

1.9 Conducting Tests

The vendor shall be equipped to fully test the items being supplied in accordance with this Specification and any referenced drawings as part of basic work. All testing apparatus shall be calibrated on a periodic basis as recommended by its supplier.

1.10 Workmanship

All workmanship shall be of high grade and shall conform to the best of manufacturing practices. Skilled, qualified, well motivated personnel, with appropriate experience, training and aptitude shall be utilized to assure high quality of workmanship at all levels. Foremen, supervisors, inspectors, and shop managers shall be well integrated within the project team and be fully experienced and capable in their fields. They shall manage their teams in a competent and professional manner. The vendor is required to have on hand in his facility for reference this Specification and all referenced Amtrak drawings.

1.11 Documentation Records

The vendor shall maintain a logbook of information regarding all components manufactured by it for Amtrak. As a minimum, records shall identify the Amtrak purchase order number, serial number of the assembly, copies of any written authorizations by the Amtrak Procurement officer, inspection and test data, shipping date and shipping location. In addition, it shall include a copy of the flammability and smoke emission laboratory certification report if required under 49 CFR Part 238 Appendix B for the components being supplied.

1.12 Rights to Technical Data

Amtrak shall be granted by the vendor full delivery and ownership rights of all drawings, documentation, parts information, test data, etc. associated with this Specification. In addition, the vendor and its subcontractors shall grant to Amtrak in connection with this Specification and any Contract the right to use, duplicate or disclose, in whole or in part and without charge, all technical data required by Amtrak to install, operate, understand, maintain, modify, replace, test, repair or overhaul the components being supplied. Amtrak shall not disclose proprietary information and data being supplied under this Specification and any Contract except for the limited purpose of obtaining individual part repairs or specialized testing or repair services outside the ability of its Shops, and then only on a confidential basis. Technical data means information of a scientific or engineering nature, regardless of form or characteristics, to be furnished by the vendor pursuant to this Specification and any Contract. Examples are research and engineering data, engineering drawings and associated lists, specifications, standards, process sheets, manuals, technical reports, catalog item identifications or related information.

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This shall not include financial information or information of a contract administrative nature. The vendor shall not patent or copyright any original materials or information created by this procurement which will be submitted to Amtrak, as per Federal procurement regulations.

1.13 Referenced Documents

Code of Federal Regulations 49 CFR Part 238
ISO 9001:2000, Quality Management Systems - Requirements
Spec ?? - Quality and Workmanship

2.0 General Requirements

2.1 Design Considerations

The *Thermally Actuated Automatic Drain Valve for Freeze Protection* shall incorporate into its design or meet the following design criteria:

1. Must not have dead end seat that can be damaged or take set in extended high temperature conditions. (ex. 140 degree F with heater active)
2. Housing must be made out of brass or stainless steel.
3. Must have an external heated override that prevents valve from opening.
4. Thermal Actuator must fit the standard Ogontz Corporation 120 VAC, model 2265020/3/08 heating element . (The heater maximum temperature in ambient air is 150 degrees F +/- 5 degrees. Temperature on valve is approximately 126 degrees F.). Alternate heater maybe acceptable but must be approved by Amtrak Rolling Stock Engineering (RSE).
5. Installation of heater cannot prevent ambient sensing of actuator.
6. Maximum housing size must fit into the envelope shown in Figure 1.
7. Inlet and outlet must be in the positions shown in Figure 1.
8. Valve must operate in ambient temperature range of -30 degree F to +140 Degree F with Ogontz Corp. heater or Amtrak RSE approved alternate in place and active.
9. Valve life is expected to be 10 years, continuous operation, with no failures under normal operation. All components shall be designed to withstand different conditions of potable water. No internal components shall cease even with the calcification build-up.
10. Valve must work as designed through pressure ranges from 0 psig to 60 psig.
11. Valve should be able to be rebuilt, while installed, with a manufacturer's kit and simple tools by Amtrak personnel.
12. Flats measuring maximum 1-5/8 inches across must be incorporated into housing at inlet and outlet openings to assist during installation.
13. Valve to begin opening at 43 degrees F +/- 2.
14. Valve to flow full capacity at 35 degrees F +/- 1.
15. Valve must provide ability to test in place by maintenance personnel.
16. Valve actuator to sense ambient temperature not internal water temperature.
17. Maintenance personnel should be able to detect leaking seal on valve under normal operating conditions.

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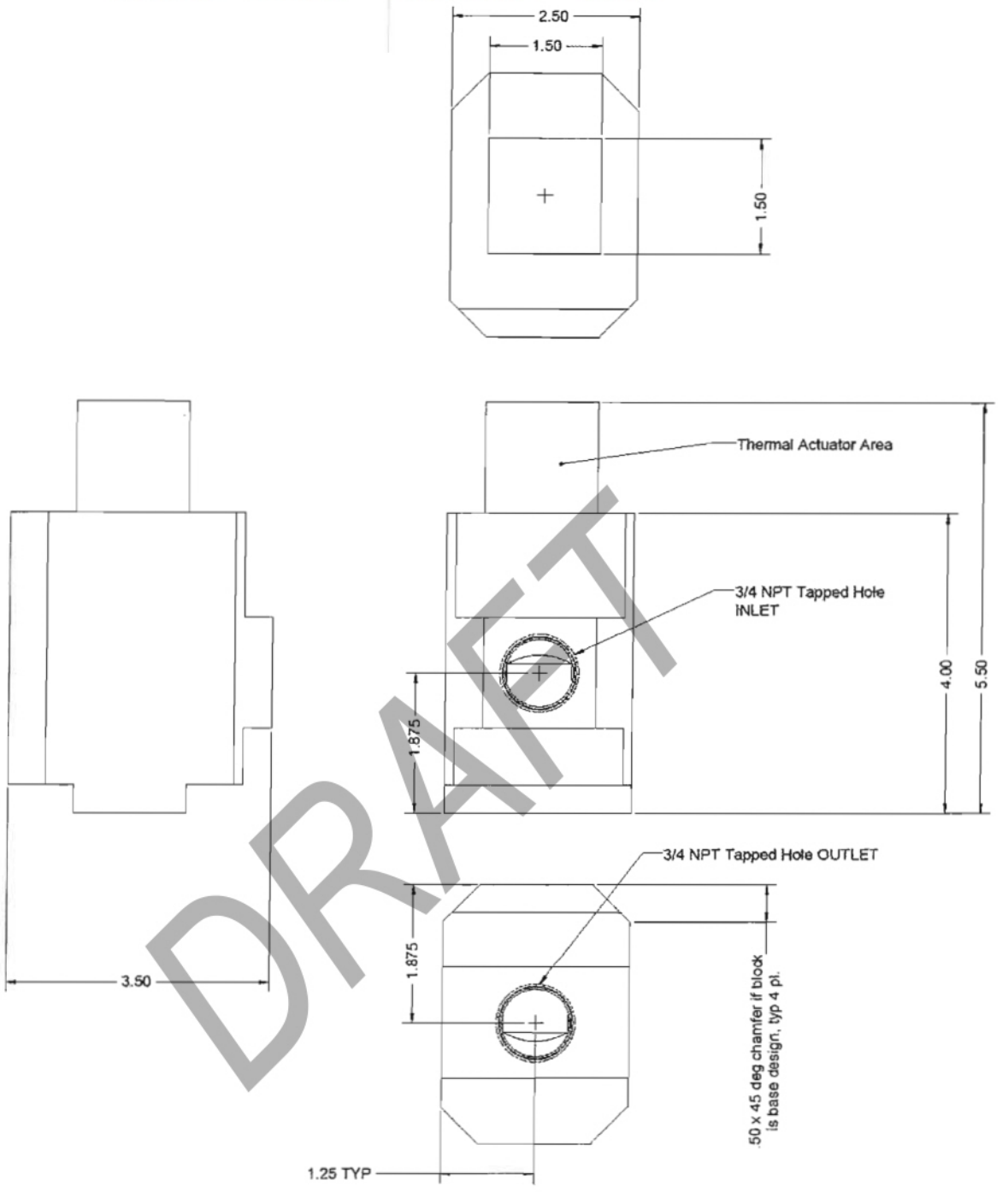

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Figure 1
Outline dimensions of the freeze protection valve without heater attached.

2.2 Vibration

All carbody mounted equipment shall be designed to withstand continuous vibrations of at least 0.2 g at frequencies up to 100 Hertz in all directions, as well as randomly orientated shock loads of 5 g's longitudinally, 3 g's vertically and 3 g's laterally.

2.3 Interchangeability

All similar parts on each item being supplied, and among all other assemblies and their spare parts, shall designed and manufactured to be identical, both as individual parts and as subassemblies. All assemblies shall mount to the car without modification. Model numbers for identical components shall be identical. Replaceable components of any such apparatus shall be fully interchangeable, without adjustments to any part being necessary. Specific approval shall be obtained from the Engineer for each part whose replacement may require an adjustment, and such approval may be granted only where it can be shown to be absolutely necessary.

2.4 Inch-Standard

The vendor is advised that the existing passenger cars used by Amtrak are entirely composed of inch-standard components and fasteners. All designs, components, dimensions and fasteners used on the components being supplied under this Specification shall be of United States inch-standards, unless otherwise approved in writing by the Engineer.

2.5 Design Life

The components being supplied under this Specification shall be designed and manufactured to perform satisfactorily for a minimum design life of 10 years, 12 years preferred.

2.6 Dimensions

The vendor shall provide English dimensioning for its drawings and other communications which are generated. Fractional measurements shall be expressed as a decimal value, and unless otherwise noted and approved drawings shall be made using third angle projections. First angle projection shall be allowed provided all views are labeled, including the front, top, bottom and side views.

2.7 Cleaning and Maintenance

The components being supplied under this Specification shall be easy to clean and maintain. They shall not require maintenance or adjustments at internals of less than four years. To the extent possible, only readily available components, hardware and fasteners shall be used. Any assembly hardware visible to passengers shall be recess mounted stainless steel. There shall not be any sharp or exposed edges in the entire assembly which could cause injury to passengers or workmen, or snag passenger's clothing.

Pockets where dirt and debris can collect shall be minimized; those that exist shall be easy to clean with standard vacuum cleaner equipment. Design shall ensure that items that require repair and or service are easily accessed, removed and replaced and that this is possible with the use of standard hand tools. Variations of fastener thread size, thread length and head style shall be minimized to ease overhaul and regular maintenance. The number of fasteners shall be kept to a minimum.

2.8 Manufacturing

All finished assemblies and individual components shall be of high quality workmanship and free of burrs and debris. Sharp edges shall be eliminated except where necessary for specific workings or design criteria.

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The vendor is required as basic work to perform and fully document a complete verification test and evaluation of each component being supplied under this Specification, prior to shipment to Amtrak. The results of this final testing shall be recorded in the documentation record. When successfully completed, the vendor shall apply a metalized identification label in an inconspicuous area, generally as identified in the drawings, providing as a minimum the name and location of the vendor, any serial number used by the vendor, and the date of manufacture.

4.0 Packaging and Shipment

All packaging and shipping requirements shall be performed as basic work by the vendor. It is required that the vendor properly prepare all components being supplied under this Specification for shipment to Amtrak so that they are ready to install following unpacking. Items shall be appropriately packaged for their weight and size, such as using a cardboard enclosure within a shipping skid or other commercial shipping media suitable to allow the use of fork lift trucks for handling. For large or bulky items enclosed in a container, the top of the item shall be indicated on the package as appropriate.

The vendor shall apply an identification label on the shipping package. This label shall include the vendor's name and address, telephone number, name of contact person, purchase order number, date released for shipment, Amtrak "AAMPS" (internal catalog) number, and the component assembly serial number. This information shall also appear in the vendor's invoice, and be included in the vendor's documentation record.

The vendor shall retain a copy of the shipping documentation record, and shall make three copies for Amtrak. One copy shall be included within the shipping container for the assembly, one copy shall be sent to the Amtrak Procurement officer (or as otherwise designated in the purchase order), and the third copy shall be mailed to the attention of the Amtrak Quality Assurance inspector in care of the Amtrak "ship to" address.

5.0 Product Support

5.1 First Article Inspections

To verify that the components being supplied under this Specification meet all Specification and drawing requirements, and is truly interchangeable with existing components, Amtrak will conduct a series of two First Article Inspections (FAI) on the first complete assembly manufactured by a vendor, prior to allowing unrestricted manufacturing work to start. It is the intention of the FAI process that every function and feature of the items being supplied under this Specification be fully exercised and tested for proper operation under all normal, abnormal and fault conditions, both in the vendor's workshop and as applied on the vehicle. This shall consist of a pre-shipment inspection and witnessing of the specified final testing of a prototype manufactured assembly performed at the vendor's facility. This shall be an active test, and the vendor shall provide mounting fixtures, electrical and pneumatic power, etc, as appropriate to fully functional exercise all components and features.

Once this is successfully completed at the vendor's facility, the vendor shall then ship this assembly to the Amtrak maintenance facility identified by the Engineer, where Amtrak will install the assembly onto an Amtrak vehicle. A second "as-installed" inspection and test FAI shall then be performed to verify proper operation of the assembly in the "as-installed" configuration.

Each FAI shall have Amtrak Engineering and/or Quality Assurance personnel as well as the vendor in attendance. These First Article Inspections shall include, but not be limited to, a

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mechanical and electrical inspection to determine compliance with the specifications and the drawings, complete testing of the functionality of the component, demonstration of maintainability and troubleshooting, and verification of proper operation and complete compatibility/interoperability when installed on a car. Approval by the Amtrak Rolling Stock Engineering following successful completion of the two phases of First Article Inspections, as communicated through the Amtrak Procurement officer, shall constitute final system approval. No vendor changes shall be made in the configuration of the items being supplied following final approval unless approved in writing by the Amtrak Procurement officer. If desired, the vendor may conduct an informal Hardware Review prior to the first formal FAI at its facility, to review design, manufacturing and test issues.

5.2 Drawings, Manuals and Parts List

Following the successful completion of the First Article inspections, and as a precondition to permit production delivery of material to commence, the vendor shall supply to the Amtrak Bureau of Rolling Stock Engineering via the Amtrak Procurement officer an electronic set of every dimensioned drawing and bill of material for every individual part used for the manufacture of all items being supplied under this Specification. Drawings shall be in Engineer-approved formats, and shall include a complete set of "as-built" drawings of every part, component and assembly used for all items being supplied to Amtrak. Each drawing shall include a complete Bill of Material, providing original component manufacturer name and part number of the actual supplier of the part. Amtrak drawing formats and number series shall be used as agreed upon with the Engineer. The drawing package shall also include drawings of every special tool, jig or fixture required to install, maintain or overhaul the assembly, and if referenced in any of the maintenance manuals. The as-built drawings shall be delivered as 3 sets of CDs of all drawings in electronic format in DXF, AutoCAD 2000 and SolidWorks 2004 or above; and 3 sets of CDs of all drawings in electronic format in Adobe read-only PDF files.

The vendor shall also submit in electronic format to the Amtrak Bureau of Rolling Stock Engineering, via the Amtrak Procurement officer, a maintenance manual as well as a parts list of all individual parts used in the items being supplied under this Specification, which shall include the actual component manufacturer (OEM) name and part number; use of an intermediate supplier or distributor's name or part number is not acceptable. The parts list shall be sufficiently complete to permit Amtrak to order individual replacement spare parts direct from the actual parts manufacturer. The maintenance manual shall include complete information from installation, through troubleshooting and complete overhaul. The vendor shall also supply in electronic formal all operators manuals and other support documentation it has available for the components being supplied under this Specification. All documentation shall be delivered as 3 sets of CDs.

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6.0 Warranty

Warranty shall be provided as per the terms of the Amtrak Procurement documents.

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AMTRAK

SPECIFICATION

FOR

HIGH PERFORMANCE WIRE AND CABLE

FOR USE ON PASSENGER VEHICLES

DOCUMENT NUMBER: 323

(Replaces Q-78-7)

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ORIGINAL ISSUE DATE: 3/23/1990

REVISION: C REV. DATE: 5/15/2003

ABSTRACT:
This document describes the physical and electrical properties for 110°C rated wire and cable, multi conductor cable and high temperature wire used on Amtrak Rolling Stock.

KEY WORDS: Wire, cable, multi conductor cable, high temperature wire

PREPARED BY:	Helmut Kolig	**DATE:**	3/23/1990
REVIEWED BY:	Richard Bruss	**DATE:**	3/23/1990
APPROVED BY:	C.J. Engelhardt	**DATE:**	3/23/1990

REVISION HISTORY

Revision	Description of Change	Date	App'd
--	Original release	3/23/90	CJE
A	-Champlain was Haveg; -Added Approved Vendors: Brand-Rex and Rockbestos -Corrected Page Numbers	3/11/92	RFB
B	-Disapproved Champlain; -Combined Rockbestos with Suprenant	11/21/97	RFB
C	-Reformatted; Added 3 drawings; added multi conductor & Hi temp wire	5/15/03	RFB

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D-12-7205-G Wire: Single Conductor
D-04-7229-E Multiconductor Cable Characteristics: Cross Linked Polyolefin 600V 110°C
D-12-7228-B High Temperature Wire Characteristics: Abrasion Resistant Teflon 600V, 260°C

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1. OVERVIEW

1.1 Scope

This document describes the physical and electrical properties for 110°C rated wire and cable, multi conductor cable and high temperature wire used on Amtrak Rolling Stock.

1.2 Purpose

The purpose is to establish a standard for general purpose car and locomotive wire.

2. GENERAL

All wire and cable procured under this specification must exhibit the properties outlined in the specification and must either be on Amtrak's approved source list, (paragraph 7.0) or must be approved, in writing, by Amtrak Design Engineering Department.

3. WIRE CONSTRUCTION

Conductor:	Soft Annealed Copper
Coating:	Tin
Stranding:	Per AAR 589 (See paragraph 5.0)
Insulation:	Crosslinked Polyolefin

4. PROPERTIES

4.1 Applicable Documents

The wire and cable manufactured under this specification shall be tested and inspected in accordance with the latest issues of the following standards, as applicable or as modified herein:

ASTM B-33	Tinned Soft or Annealed Copper Wire
ASTM D-149	Test for Dielectric Breakdown Voltage and Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies
IPCEA S-19-81	Rubber Insulated Wire & Cable
IPCEA S-66-524	Cross-Linked-Thermosetting-Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
UL 44	Standard for Rubber Insulated Wire and Cable

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IEEE Std.383-1974 Type Test of Class 1E Electrical Cable, Field Splices & Connectors for Nuclear Power Generating Stations

4.2 Electrical

-Dielectric Strength per ASTM D-145	700V/Mil Minimum
-Insulation Resistance	5000 megohms Minimum
-Insulation Resistance K	17,500 Minimum
-Accelerated Water Absorption:	
Gravimetric 7 days @ 70°C	8mg/in 2 Maximum
Electrical SIC 24 hours @ 75°C	6.0 Maximum
Increase in Capacitance	
1-14 Days (% of Original)	7.5 Maximum
7-14 Days (% of Original)	1.5 Maximum
Stability Factor after 14 days	1.0

4.3 Physical

-Unaged	
Tensile Strength, Min PSI	2000 Minimum
Elongation at Rupture, Min. %	250 Minimum
-Aged	
After air oven 7 days @ 158°C ±2°C	
Tensile Strength (% of original)	90 Minimum
Elongation (% of original)	55 Minimum
-Heat Distortion, 1 hour @ 200°C Clause 4.3.6.1 CSA Std. C22.2 No. 0.3	20 Maximum
-Cold Bend, 120 hours @-55°C	* 6KV-5 Minutes
-Cold Bend, 2 inch Mandrel – 85°F (per Paragraph 4.7.4.15 MIL-C-22759)	* Pass

* Must Not Exhibit Cracking

4.4 Qualification

Tension Set:
Test per-IPCEA-S-66-524, Paragraph 6.4.11.4 (.Except with gauge marks 4" apart).

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Requirement: 30% Maximum

Ozone Resistance:
After 24 hours exposure to an ozone concentration of 0.03% by volume at 90°C ±2%, there shall be no insulation cracks.

Flammability Requirements:
Insulated conductors shall pass the flame tests described in Paragraph 6.19.6 of IPCEA S-19-81 and the VW-1 vertical flame test described in UL Subject 44. The maximum afterburn after each flame application shall be no greater than 3 seconds.

Corrosion Tests:

A. Copper Mirror
(Ref. ASTM 2671) A 0.4 gram sample of insulation shall be placed in the bottom of a 1/2 inch 12 inch test tube. A copper-coated glass mirror shall be suspended 6 inches over the sample by a thin copper wire. The lower two inches of the test tube shall be heated to 175°C for 16 hours.
Requirements: Shall not remove more than 5% of the copper film.

B. Acid Gas Detection
A 1.0 mg sample shall be heated to combustion in a closed quartz tube. The resulting gases shall be drawn through a detector tube (MSA #91636) using a special air sampling pump manufactured by Mine Safety Apparatus Company. The amount of acid gas shall be determined by measuring the length of the color change in the detector tube.
Requirement: 300 ppm/mg maximum average. (350 ppm/mg maximum any single sample).

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Oil Resistance:
Hot Oil Swell Tests - Insulated wires shall be pre-measured and immersed in a hot oil bath. After the required exposure time, they shall be removed and measured for the amount of swell.
Requirement:

A.	ASTM No. I-Oil 100 Hours @150°C Max. % Swell	20
B.	ASTM No. 2-Oil 100 hours @150°C Max. % Swell	40
C.	ASTM No. 3-Oil 100 hours @150°C Max. % Swell	50
D.	Diesel Oil 120 hours @60°C Max. % Swell	15

Note: When tested in accordance with AAR589 (ASTM =2 oil at 121°C for 18 hours) the retention of tensile and elongation shall be: Tensile - 70% Minimum, Elongation 90% Minimum.

Smoke Emission: The test shall be performed in an N.B.S. Smoke Chamber using #l2 AWG wire insulated with 45 mils of insulation. The procedures shall be per NFPA Standard 258 in the

flaming (F) and non-flaming (N) modes.

	Dm	T16	T.9DM
(F) Flaming plus Radiant Furnace	447	1.05	7.15
(N) Non-Flaming Radiant Furnace	199	11.6	27.1

Dm = Max. Specified Optical Density
T16 = Time to reach critical Ds (Specified Optical Density)
T.9DM = Time to reach 90% of Dm

Abrasion Resistance:
Rotating Scrape Abrader (Ref. Mil-C-915). A 24 inch specimen shall be draped over an 8 inch rotating drum with two (2) 90° vee edge abrading tools 180° apart. Failure shall be detected by electrical contact between abrading tool and conductor. The cable shall be weighted with a 450 gram mass.
Requirement: 2500 cycles minimum.

Cut-Through Penetration:
Specimen of insulated wire shall be preconditioned at 125°C for 1 hour. While at this temperature, a weighted (1000 gm) 90°C chisel cutting edge shall be applied perpendicular to the longitudinal axis of the specimen. Detection of cut-through shall be monitored with a 12 volt lamp circuit connected in series with the plunger and conductor in the specimen.
Requirement: 10 minutes minimum.

Crush Resistance:
A wire sample shall be placed between two (2) parallel flat plates and compressed until electrical contact is detected across conductor to the plate.
Requirement: 7500 lbs. minimum.

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5. CABLE CONSTRUCTION

Area	Size	Each Wire	Type	Dia.	Thickness (Mils)		Max. Dia. (In)	
(CM)	AWG/MCM	In Strand	Strand	Inches	600V	2000V	600V	2000V
1900	18	19/30	Conc	.052	30	45	.120	.150
2413	16	19/29	Conc.	.062	30	45	.130	.160
3831	14	19/27	Conc.	.074	30	45	.145	.175
6088	12	19/25	Conc.	.094	30	45	.165	.195
10910	10	27/24	Bunch	.128	30	45	.200	.230
14950	8	37/24	Conc.	.147	45	55	.250	.270
24640	6	61/24	Conc.	.207	45	55	.310	.330
36760	5	91/24	Rope	.248	45	55	.345	.365
42420	4	105/24	Rope	.268	45	55	.367	.385
50550	3	125/24	Rope	.292	45	55	.394	.410
60600	2	150/24	Rope	.330	45	55	.430	.450
90900	1	225/24	Rope	.395	55	65	.515	.535
111100	1/0	275/24	Rope	.445	55	65	.565	.585
131300	2/0	325/24	Rope	.490	55	65	.615	.635
181800	3/0	450/24	Rope	.565	55	65	.695	.715
222200	4/0	550/24	Rope	.620	55	*105	.750	.850
262600	262	650/24	Rope	.665	65	75	.810	.835
313100	313	775/24	Rope	.740	65	75	.880	.900
373700	373	925/24	Rope	.795	65	75	.960	.980
444400	444	1100/24	Rope	.870	65	75	1.025	1.045
535300	535	1325/24	Rope	.970	80	90	1.160	1.185
646400	646	1600/24	Rope	1.070	80	90	1.250	1.270
777700	777	1925/24	Rope	1.140	80	90	1.325	1.345
929200	929	2300/24	Rope	1.230	80	90	1.435	1.455
1111000	1111	2750/24	Rope	1.370	95	120	1.595	1.645

* double wall thickness: 50 mil inner wall; 55 mil outer wall

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6. IDENTIFICATION

The surface of the-cable shall be printed with the following information at intervals not greater than two feet:

- Manufacturer
- Insulation Type
- Conductor Size
- Voltage Rating.

7. APPROVED VENDORS AND PRODUCTS

1.	Rockbestos- Suprenant:	Exane per Specification DAA1068A
2.	Brand-Rex-	Polyrad XT

APPENDIX

The following drawings define properties of the wire and cable covered in this document.

D-12-7205-G Wire: Single Conductor
D-04-7229-E Multiconductor Cable Characteristics: Cross Linked Polyolefin 600V 110°C
D-12-7228-B High Temperature Wire Characteristics: Abrasion Resistant Teflon 600V, 260°C

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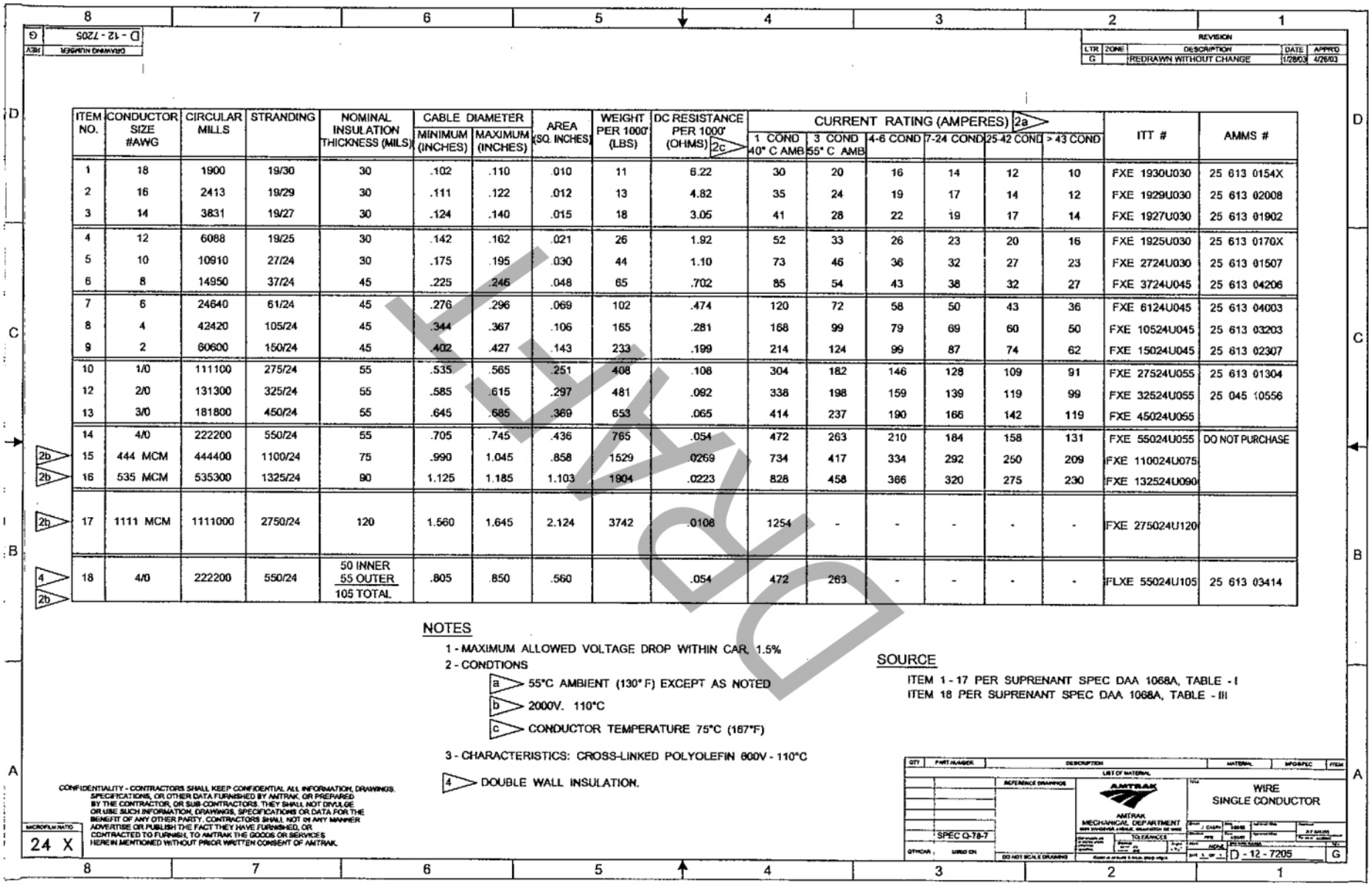

REVISION				
LTR	ZONE	DESCRIPTION	DATE	APPRD
G		REDRAWN WITHOUT CHANGE	1/28/03	4/26/03

ITEM NO.	CONDUCTOR SIZE #AWG	CIRCULAR MILLS	STRANDING	NOMINAL INSULATION THICKNESS (MILS)	CABLE DIAMETER MINIMUM (INCHES)	CABLE DIAMETER MAXIMUM (INCHES)	AREA (SQ. INCHES)	WEIGHT PER 1000' (LBS)	DC RESISTANCE PER 1000' (OHMS) 2c	CURRENT RATING (AMPERES) 2a: 1 COND 40° C AMB	3 COND 55° C AMB	4-6 COND	7-24 COND	25-42 COND	> 43 COND	ITT #	AMMS #
1	18	1900	19/30	30	.102	.110	.010	11	6.22	30	20	16	14	12	10	FXE 1930U030	25 613 0154X
2	16	2413	19/29	30	.111	.122	.012	13	4.82	35	24	19	17	14	12	FXE 1929U030	25 613 02008
3	14	3831	19/27	30	.124	.140	.015	18	3.05	41	28	22	19	17	14	FXE 1927U030	25 613 01902
4	12	6088	19/25	30	.142	.162	.021	26	1.92	52	33	26	23	20	16	FXE 1925U030	25 613 0170X
5	10	10910	27/24	30	.175	.195	.030	44	1.10	73	46	36	32	27	23	FXE 2724U030	25 613 01507
6	8	14950	37/24	45	.225	.246	.048	65	.702	85	54	43	38	32	27	FXE 3724U045	25 613 04206
7	6	24640	61/24	45	.276	.296	.069	102	.474	120	72	58	50	43	36	FXE 6124U045	25 613 04003
8	4	42420	105/24	45	.344	.367	.106	165	.281	168	99	79	69	60	50	FXE 10524U045	25 613 03203
9	2	60600	150/24	45	.402	.427	.143	233	.199	214	124	99	87	74	62	FXE 15024U045	25 613 02307
10	1/0	111100	275/24	55	.535	.565	.251	408	.108	304	182	146	128	109	91	FXE 27524U055	25 613 01304
12	2/0	131300	325/24	55	.585	.615	.297	481	.092	338	198	159	139	119	99	FXE 32524U055	25 045 10556
13	3/0	181800	450/24	55	.645	.685	.369	653	.065	414	237	190	166	142	119	FXE 45024U055	
14	4/0	222200	550/24	55	.705	.745	.436	765	.054	472	263	210	184	158	131	FXE 55024U055	DO NOT PURCHASE
2b 15	444 MCM	444400	1100/24	75	.990	1.045	.858	1529	.0269	734	417	334	292	250	209	FXE 110024U075	
2b 16	535 MCM	535300	1325/24	90	1.125	1.185	1.103	1904	.0223	828	458	366	320	275	230	FXE 132524U090	
2b 17	1111 MCM	1111000	2750/24	120	1.560	1.645	2.124	3742	.0108	1254	-	-	-	-	-	FXE 275024U120	
4 2b 18	4/0	222200	550/24	50 INNER / 55 OUTER / 105 TOTAL	.805	.850	.560		.054	472	263	-	-	-	-	FLXE 55024U105	25 613 03414

NOTES

1 - MAXIMUM ALLOWED VOLTAGE DROP WITHIN CAR, 1.5%

2 - CONDTIONS

a > 55°C AMBIENT (130° F) EXCEPT AS NOTED

b > 2000V. 110°C

c > CONDUCTOR TEMPERATURE 75°C (167°F)

3 - CHARACTERISTICS: CROSS-LINKED POLYOLEFIN 600V - 110°C

4 > DOUBLE WALL INSULATION.

SOURCE

ITEM 1 - 17 PER SUPRENANT SPEC DAA 1068A, TABLE - I
ITEM 18 PER SUPRENANT SPEC DAA 1068A, TABLE - III

CONFIDENTIALITY - CONTRACTORS SHALL KEEP CONFIDENTIAL ALL INFORMATION, DRAWINGS, SPECIFICATIONS, OR OTHER DATA FURNISHED BY AMTRAK, OR PREPARED BY THE CONTRACTOR, OR SUB-CONTRACTORS. THEY SHALL NOT DIVULGE OR USE SUCH INFORMATION, DRAWINGS, SPECIFICATIONS OR DATA FOR THE BENEFIT OF ANY OTHER PARTY. CONTRACTORS SHALL NOT IN ANY MANNER ADVERTISE OR PUBLISH THE FACT THEY HAVE FURNISHED, OR CONTRACTED TO FURNISH, TO AMTRAK THE GOODS OR SERVICES HEREIN MENTIONED WITHOUT PRIOR WRITTEN CONSENT OF AMTRAK.

MICROFILM RATIO 24 X

SPEC O-78-7

AMTRAK MECHANICAL DEPARTMENT

WIRE SINGLE CONDUCTOR

D - 12 - 7205 G

HELD

This drawing defines single conductor wire.

26-FOI-00415 0000000619 "UNCLASSIFIED" 4/30/2026

REVISION				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
E		REDRAWN WITHOUT CHANGE	1/28/03	4/25/03

ITEM NO.	CABLE DESIGNATION		CONDUCTOR CIRCULAR MILLS	STRANDING	6 COND INSUL THICKNESS (MILS)	CONDUCTOR DIAMETER INCLUDING INSULATION		SHIELDING			JACKET NOMINAL THICKNESS (MILS)	CABLE DIAMETER		AREA (SQ. INCHES)	WEIGHT PER 1000' (LBS)	DC RESISTANCE PER 1000' OHMS 1		AMMS #
	COND #AWG	SHIELDING				MINIMUM (INCHES)	MAXIMUM (INCHES)	% COVER	STRANDING	DRAIN (TINNED COPPER)		MINIMUM (INCHES)	MAXIMUM (INCHES)					
1	2/C #14	YES	3831	19/27	30	.124	.140	100	1 MIL ALUM/ MYLAR TAPE	19/29 (#16)	45	.370	.400	.126		3.2	2	
2	5-2/C #14	YES / PAIR	3831	19/27	30 7	.124	.140	100	1 MIL ALUM/ MYLAR TAPE & 1 MIL MYLAR TAPE	19/29 (#16)	60	.740	.790	.490		3.2	8	25 613 01523
3	2/C #16	NO	2413	19/29	30	.111	.122	—	—	—	45	.315	.345	.093		4.9	3	
4	2/C #16	YES	2413	19/29	30	.111	.122	85	1 MIL ALUM/ MYLAR TAPE	19/30 (#18)	30	.300	.330	.085		4.9	4	25 613 01531
5	3/C #16	YES	2413	19/29	30	.111	.122	85	#36 TINNED COPPER	19/30 (#18)	45	.360	.390	.119		4.9		25 613 01515
6	4/C #16	YES	2413	19/29	30	.111	.122	85	#36 TINNED COPPER	19/30 (#18)	45	.365	.395	.123		4.9		
7	8/C #16	NO	2413	26/30	30	.120	.124	—	—	—	45	.480	.520	.212		4.9	10	25 045 00008

TABLE A

CONDUCTOR	COLOR
FIRST	BLACK
SECOND	WHITE
THIRD	RED
FOURTH	GREEN

TABLE B

PAIR	COLOR	WIRE LABEL
1	BLK WHT	PA1 PA2
2	BLK WHT	PA3 PA4
3	BLK WHT	PA5 PA6
4	BLK WHT	PA7 PA8
5	BLK WHT	RA1 RA2

NOTES

1. CONDUCTOR TEMPERATURE 20° C (68° F)
2. REPLACES BELDEN # 8720
3. REPLACES BELDEN # 8471
4. REPLACES BELDEN # 8719
5. SHIELDS OF INDIVIDUAL PAIRS TO BE ELECTRICALLY INSULATED
6. CONDUCTOR COLORS (SOLID) PER TABLE A
7. WIRE DESIGNATIONS PER TABLE B PRINTED EVERY 2" ALONG WIRE
8. REPLACES 5 BELDEN # 8720
9. JACKET TO BE IDENTIFIED WITH MANUFACTURER, PRODUCT NAME / SPEC #, PART NUMBER, WIRE GAUGE, VOLTAGE & TEMPERATURE
10. NO HALOGEN JACKET

SOURCE:

- SUPRENANT
- BRAND REX
- ROCKBESTOS

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MICROFILM RATIO 24 X

AMTRAK MECHANICAL DEPARTMENT

MULTICONDUCTOR CABLE CHARACTERISTIC CROSS LINKED POLYOLEFIN 600V 110° C

D - 04 - 7229 E

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This drawing defines the requirements for multiconductor cable employing cross-linked insulation

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ITEM NO.	CONDUCTOR SIZE # AWG	CIRCULAR MILLS	STRANDING	NOMINAL INSULATION THICKNESS (MILS)	CABLE DIAMETER MINIMUM (INCHES)	CABLE DIAMETER MAXIMUM (INCHES)	AREA (SQ. INCHES)	WEIGHT PER 1000' (LBS)	DC RESIST (OHMS) PER 1000' @ 20° C	CURRENT RATING (AMPERES) 1 COND 40° C AMB [1]	3 COND 55° C AMB [2]	4-6 COND [3]	7-24 COND [3]	25-42 COND [3]	> 43 COND [3]	ITT #	AMMS #
1	16	2413	19/29	35	.121	.127	.012	17	4.69	38	25	20	18	15	12.5	JET 1929NIC	
2	14	3838	19/27	37	.138	.144	.015	23	2.94	60	40	32	28	24	20	JET 1927NIC	
3	12	6070	19/25	37	.156	.164	.020	32	1.93	80	55	44	39	33	27.5	JET 1925NIC	25 613 01718
4	10	9410	37/26	38	.178	.186	.026	46	1.21	110	75	60	56	45	37.5	JET 3726NIC	
5	8	16851	133/29	40	.244	.254	.049	82	.690	145	95	76	66	57	47.5	JET 13329NIC	
6	6	26880	133/27	40	.291	.303	.069	120	.432	210	120	96	84	72	60	JET 13327NIC	

NATIONAL ELECTRICAL CODE

[1] TABLE 310 - 19 250°C COLUMN

[2] TABLE 310 - 18 250°C COLUMN

[3] THESE VALUES BASED ON NOTE 8 OF "NOTES TO TABLES 310-16 THRU 310-19".

4 CONDITIONS:
a. 55°C AMBIENT (130°F) EXCEPT AS NOTED.

SOURCE

MIL - SPEC W 22759 / 6B
(SUPRENANT SPEC CAA 1002)

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MICROFILM RATIO 24 X

LIST OF MATERIAL

AMTRAK
MECHANICAL DEPARTMENT

HIGH TEMPERATURE WIRE CHARACTERISTICS ABRASION RESISTANT TEFLON 600V, 260°C

TOLERANCES

DO NOT SCALE DRAWING

D - 12 - 7228 B

This drawing defines high temperature wire used for baseboard and duct/ overhead heater applications

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AMTRAK SPECIFICATION

for

Rail Passenger Car Diaphragm and Face Plate

SPECIFICATION No. 332

Revision 4

Issue Date: July 21, 2014

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APPROVED DATE

8/8/14 Chief Mechanical Officer

8/5/14 DCMO - Rolling Stock Engineering

7/29/14 Senior Director - Rolling Stock Engineering

Fleet Director – Amfleet Cars

Originator

Originator: Derek A. Maier

SPECIFICATION CHANGE SHEET

REVISION	DATE	DESCRIPTION	SECTION	APPROVER
0	6/27/89	Initial issue	- -	T.G. Donkin
1	12/15/92	Added A&A Mfg. Co., deleted Spec DM-77-22	2	T.G. Donkin
2	4/20/05	Completely revised	all	M.L. Burshtin
3	8/20/10	Removed all references to p/n 24-577-03514; Changed Revised dimensions of gasket at rear mounting plate from 0.3125" thick by 3" wide to 0.375" thick by width of plate; Change requirements for electronic drawing format to Solidworks 2009 from 2004, .DXF, and AutoCad; Deleted Section 6.0.	Cover; 1.1; 1.7; 1.13; 3.0; 2.1; 4.0; 5.2; 6.0	K. B. Myles
4	7/21/14	Updated D-00-2031 to Rev. I and changed all references to most recent version. Standardized use of "shear mount" throughout. Changed requirements for electronic drawing format from Solidworks 2009 to 2013. Removed FAI references to Bear, DE and Amfleet in Sec. 5.1.	Cover; 1.1; 1.7; 1.8; 1.9; 1.13; 2.2; 3.0; 5.1; 5.2	D.A. Maier

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Amtrak

Bureau of Rolling Stock Engineering

Specification for Rail Passenger Car Diaphragm and Face Plate

Specification No. 332
Revision 4

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Amtrak

Bureau of Rolling Stock Engineering

Specification for Rail Passenger Car Diaphragm and Face Plate

Specification No. 332
Revision 4

1.0 Scope

1.1 Purpose

This Specification defines the vendor general design criteria requirements applicable for the manufacture of the diaphragm and faceplate assembly (Amtrak drawing D-00-2031, revision I or later issue) used on Amtrak rail passenger cars. This Specification is intended to be used in conjunction with the Amtrak Procurement Department contract documents, purchase orders and other contractual documents issued to the vendor. The diaphragm and faceplate assembly is installed at each end of each car and completely encloses the intercar walkway, in order to provide maximum passenger safety, to protect from weather and noise, and provide a positive seal between cars. It is Amtrak's intention that any new diaphragm and faceplate assembly be functionally interchangeable with the diaphragm and faceplates currently in use at Amtrak in terms of form, fit, function, general appearance, durability and operation.

The design criteria and constraints that are known to Amtrak have been specified. If other factors require definition after Contract award, the vendor shall be responsible for making those definition requirements known to Amtrak in a timely manner for mutual investigation and satisfactory resolution. The vendor shall not be relieved of the overall responsibility of providing an adequate design for the Amtrak service conditions. Wherever possible, this Specification has been developed on the basis of car performance required, rather than specific hardware to be provided. Where specific hardware is mentioned, it is for the purpose of providing an example of concepts or designs acceptable to the Engineer. This approach will allow vendors to employ innovation and advanced technology where appropriate.

Any items of material or equipment, which are not fully described or are omitted in this Specification or the accepted Technical Proposal, but are necessary for the completion of the diaphragm and faceplate assembly, shall be considered a part of the scope of supply. In this Specification all references to "number of days" shall mean calendar days unless otherwise stated.

Safety shall be of primary importance in the design of the diaphragm and faceplate assembly. They shall present a safe, hazard-free environment to passengers and the operating and maintenance personnel to the extent practical. No sharp edges or corners or pinch points shall occur where passengers, crew, or maintenance personnel may come into contact with them. Smooth surfaces and avoidance of protrusions shall be used to minimize passenger injury.

1.2 Exceptions

The vendor shall explicitly identify to the Amtrak Procurement officer any exceptions being taken to this Specification, referencing the Specification paragraph and exact wording in question.

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1.3 Scope of Work

It is the vendor's responsibility under this Specification, and fully expected by Amtrak, to supply a completely equipped diaphragm and faceplate assembly consisting of all new materials. It is Amtrak's desire that all materials, to the greatest extent possible, be of commonly available commercial items and hardware. All drawings, bills of materials, catalog lists, documentation and other engineering and design materials related to this Specification shall become the property of Amtrak, and shall be delivered by the vendor in total as part of the First Article Inspection process. If any patented items are used, Amtrak must be granted an unrestricted license to use, copy or otherwise manufacture the item by itself or a third party.

As basic work under this Specification each diaphragm assembly produced must be completely functionally tested, cleaned and properly packaged for shipment to Amtrak, and documentation submitted. Amtrak will perform a series of First Article Inspections on the first diaphragm assembly manufactured by a vendor, in order to verify that the process and materials used are in compliance with this Specification and drawings.

1.4 Legal Requirements

It is mandatory that all elastomer materials used by the vendor in the diaphragm assembly must comply with the flammability and smoke emissions requirements of the latest edition of 49 CFR Parts 238.103 (a)(2) and (b)(2), and also its Appendix B requirements (including all referenced notes) for elastomers.

It is required that prior to the First Article Inspection and any delivery of material, the vendor must supply the Amtrak Procurement officer with: i) a report by a recognized independent testing laboratory certifying that all elastomer materials used comply with the 49 CFR Part 238 Appendix B requirements, and ii) certification by the vendor that the buffer plate and diaphragm, when properly installed on a car, will be in place and properly aligned in accordance with 49 CFR Parts 238.303 (e)(13) and (e)(14).

1.5 Engineer

The Engineer, as stated in this Specification, is defined as the Senior Director of the Amtrak Bureau of Rolling Stock Engineering within its Mechanical Department, or its written designee. During the course of the project the vendor will be submitting items for the Engineer's approval as required by the Contract and Specification. The vendor shall not interpret this process to mean that the Engineer will function as an arm of the vendor's Project Management or Engineering staff. Submissions shall be structured to show how the vendor is responding to the requirements of the specifications, and not on the basis of requiring the Engineer to discover how the vendor is not meeting those requirements. All material being submitted shall have been reviewed by qualified vendor personnel and judged to be suitable for submission prior to doing so, and this shall be so stated in the letter of transmission or on the document, particularly as regards material passed through from subcontractors. Test results shall receive vendor staff review and signature prior to submission. Submissions found to be deficient with regard to any of the above shall be immediately returned without review to the vendor.

Submissions shall contain sufficient detail to confirm that specification requirements are being met. However, the vendor shall use judgment as to what level is appropriate and shall communicate with the Engineer when guidance is needed on a case-by-case basis. Documents with levels of detail and information considered to be beyond what is needed or is time-effective

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to confirm compliance shall be given cursory review by the Engineer and considered as background information and shall not receive formal approval. Individual submissions shall not contain material from multiple subsystems or subcontractors and such submissions will be returned without review to the vendor.

Submittals requiring the Engineer's approval prior to implementation shall be reviewed and classified by the Engineer within 30 days from the day the submittal is received based on a rate of submittal that is reflective of the pace of an orderly, properly managed program. Priorities will be given to special cases when possible. However, the vendor shall consider the 30 days criteria and the time requirements involved for mailing when scheduling submittals. The days used by the Engineer in Design Review meetings or in travel to or from such meetings shall not be included in the 30 days figure. Delays caused by the Engineer's failure to review and approve drawings or schedules in a timely fashion as listed above shall be treated as an excusable delay, provided that the vendor can demonstrate to the satisfaction of the Engineer that actual production delays have been caused by the Engineer and there is no other concurrent cause for delay.

1.6 Cost Items

Any individual extra work items regarding the diaphragm assembly shall be handled in accordance with the contract and purchase order documents issued to the vendor by the Amtrak Procurement Department. The vendor must contact the Amtrak Procurement officer regarding all such issues. The vendor agrees that no payment will be made by Amtrak for any additional work outside the basic work scope of the contract documents unless such work is first preapproved in writing by the Amtrak Procurement officer in accordance with the contract documents.

1.7 Vendor Quality Policy

It is mandatory under this Specification that the vendor has established and maintains a Quality policy system. The vendor's shop is required to be equipped with equipment, personnel and management completely sufficient to assemble, inspect and test each diaphragm assembly, including meeting or exceeding all performance parameters specified on Amtrak drawing D-00-2031, revision I or later issue. The shop shall have suitable equipment to diagnose any failure mode, and perform all adjustments and tests required to confirm proper operation. The vendor's Quality Assurance staff shall be active participants in the assembly, inspection, testing and documentation phases of the work. It is required that the vendor have a quality assurance program deployed that, at a minimum, be modeled after an established quality standard. It is highly desirable that the vendor's quality assurance program be certified under ISO 9001:2000, or an equivalent recognized standard.

Amtrak Quality Assurance personnel will conduct random audits of the vendor's quality assurance program to verify that these Specification requirements are being achieved. The vendor shall fully cooperate in such audits. Specific attention shall be paid to the areas of management responsibility, quality system, contract review, design control, document control (including drawings), purchasing, purchaser-supplied product, product traceability and identification, process control (including procedures, testing and equipment), inspection and testing, inspection, measuring and test equipment (including calibration programs), control of nonconforming products (applied controls), corrective and preventative actions, handling, storage, packaging and delivery, quality records, internal quality audits, training, servicing and statistical techniques.

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1.8 Components

The vendor shall use only new parts for all components. All exposed metal components shall be stainless steel, and all threaded fasteners shall be vibration-proof stainless steel fasteners using self-locking Nylon insert nuts. Stainless steel washers shall be used under the head of all bolts and nuts. The vendor shall maintain drawings for each component, and where necessary, patterns, jigs and fixtures, to assure identical manufacture. The diaphragm material shall have a weatherproof elastomeric upper and lower face, with a fabric core reinforcement. Exposed elastomer surfaces shall be colored black. The elastomer used in the face and the core fabric and number of plies shall be selected to meet the flammability and smoke emission requirements discussed in Legal Requirements, and to obtain the mechanical stiffness characteristics discussed in Final Testing. Radiused sections of the diaphragm at the upper corners shall be die-formed of this material and vulcanized to the straight portions. Foam filler may be used within the diaphragm cross section as required to obtain the desired mechanical stiffness characteristics of the diaphragm assembly. All elastomers used, including diaphragm and shear mounts, shall have a design life of 10 years in service unless otherwise approved by the Amtrak Procurement officer.

As information, the current diaphragm elastomer is a Nylon-fiber reinforced chloroprene (Neoprene) material of 0.30 inch overall thickness, with a minimum tensile strength of 1,700 pounds/square inch, a minimum elongation of 300 percent in 2 inches, an average durometer (Shore A) of 62 and an average density of 1.33 grams/cubic centimeter.

1.9 Conducting Tests

The vendor shall be equipped to fully test the diaphragm faceplate loading forces specified in Amtrak drawing D-00-2031, revision I or later issue, as part of the final assembly basic work. Testing apparatus shall be calibrated on a periodic basis as recommended by its supplier.

1.10 Workmanship

All workmanship shall be of high grade and shall conform to the best of manufacturing practices. Skilled, qualified, well motivated personnel, with appropriate experience, training and aptitude shall be utilized to assure high quality of workmanship at all levels. Foremen, supervisors, inspectors, and shop managers shall be well integrated within the project team and are fully experienced and capable in their fields. They shall manage their teams in a competent and professional manner. The vendor is required to have on hand in his facility for reference this Specification and all referenced Amtrak drawings.

1.11 Documentation Records

The vendor shall maintain a logbook of information regarding all diaphragm assemblies manufactured by it for Amtrak. As a minimum, records shall identify the Amtrak purchase order number, serial number of the assembly, copies of any written authorizations by the Amtrak Procurement officer, inspection and test data, shipping date, shipping location, and a copy of the elastomer flammability and smoke emission laboratory certification report.

1.12 Rights to Technical Data

Amtrak shall be granted by the vendor full delivery and ownership rights of all drawings, documentation, parts information, test data, etc. associated with this Specification. In addition,

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the vendor and its subcontractors shall grant to Amtrak in connection with this Specification and any Contract the right to use, duplicate or disclose, in whole or in part and without charge, all technical data required by Amtrak to install, operate, understand, maintain, modify, replace, test, repair or overhaul the components being supplied. Amtrak shall not disclose proprietary information and data being supplied under this Specification and any Contract except for the limited purpose of obtaining individual part repairs or specialized testing or repair services outside the ability of its Shops, and then only on a confidential basis. Technical data means information of a scientific or engineering nature, regardless of form or characteristics, to be furnished by the vendor pursuant to this Specification and any Contract. Examples are research and engineering data, engineering drawings and associated lists, specifications, standards, process sheets, manuals, technical reports, catalog item identifications or related information. This shall not include financial information or information of a contract administrative nature. The vendor shall not patent or copyright any original materials or information created by this procurement which will be submitted to Amtrak, as per Federal procurement regulations.

1.13 Referenced Documents

Amtrak drawing D-00-2031, revision I or later issue, Diaphragm & Faceplate Assembly
Code of Federal Regulations 49 CFR Part 238
ISO 9001:2000, Quality Management Systems - Requirements

2.0 General Requirements

2.1 Design Considerations

The diaphragm and faceplate assembly must not be damaged by, or cause damage to, an opposing diaphragm or locomotive buffer under any normal operating conditions. The diaphragm assembly shall make a tight seal with an opposing diaphragm under all conditions of track curvature, turnouts and crossovers, both in draft and in buff, under any normal operating conditions. The spring force on the diaphragm assembly faceplate shall comply with all Amtrak drawing requirements. In order to minimize the use of any sealants at the time of car installation, the vendor shall provide a self-adhesive sponge seal gasket on the rear mounting plate, with gasket dimensions to be a minimum 0.375 inch thick by the width of the mounting plate or as approved by the Engineer, to provide a weatherseal between the mounting plate and the carbody. When in use the diaphragm assembly shall not vibrate. Where possible, components requiring maintenance or replacement at overhaul shall be replaceable as individual units.

The diaphragm and faceplate assembly shall be designed to provide maximum passenger comfort and safety as dictated by ergonomic requirements. Special attention shall be given to passengers with reduced visual acuity by providing them with visual cues as required. Floor support surfaces should have high contrast colors in this regard, and high contrast signage and striping patterns shall be provided where necessary, as approved by the Engineer.

2.2 Interchangeability

All similar parts on each diaphragm and faceplate assembly, and among all other assemblies and their spare parts, shall be designed and manufactured to be identical, both as individual parts and as subassemblies. All assemblies shall mount to the car without modification. Model numbers for identical components shall be identical. Replaceable components of any such

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apparatus shall be fully interchangeable, without adjustments to any part being necessary. Specific approval shall be obtained from the Engineer for each part whose replacement may require an adjustment, and such approval may be granted only where it can be shown to be absolutely necessary.

2.3 Inch-Standard

The vendor is advised that the existing passenger cars used by Amtrak are entirely composed of inch-standard components and fasteners. All designs, components, dimensions and fasteners used on the new diaphragm and face plate assembly shall be of United States inch-standards.

2.4 Design Life

The diaphragm and faceplate assembly shall be designed and manufactured to perform satisfactorily for a minimum design life of 10 years, 12 years preferred. Each Amtrak passenger car will typically receive an annual inspection, and a four year light overhaul cycle.

2.5 Dimensions

The vendor shall provide English dimensioning for its drawings and other communications which are generated. Fractional measurements shall be expressed as a decimal value, and unless otherwise noted and approved drawings shall be made using third angle projections. First angle projection shall be allowed provided all views are labeled, including the front, top, bottom and side views.

2.6 Cleaning and Maintenance

The diaphragm and faceplate assembly shall be easy to clean and maintain. It shall not require maintenance or adjustments at intervals of less than four years. To the extent possible, only readily available components, hardware and fasteners shall be used. Any assembly hardware visible to passengers shall be recess mounted stainless steel. There shall not be any sharp or exposed edges in the entire assembly which could cause injury to passengers or workmen, or snag passenger's clothing. Pockets where dirt and debris can collect shall be minimized; those that exist shall be easy to clean with standard vacuum cleaner equipment. Design shall ensure that items that require repair and or service are easily accessed, removed and replaced and that this is possible with the use of standard hand tools.

The diaphragm and faceplate assembly design shall include provisions for lifting from overhead with overhead conveying devices such that the assembly remains balanced and upright. This will facilitate handling during overhaul. Variations of fastener thread size, thread length and head style shall be minimized to ease overhaul and regular maintenance. The number of fasteners shall be kept to a minimum.

2.7 Manufacturing

Any heat used to assemble the diaphragm shall be sufficiently low to not result in damage to the stainless steel components. The components of the diaphragm and faceplate assembly exposed to passenger view, either inside or outside the car, shall be either black or natural stainless steel in color. Stainless steel shall not be painted. The diaphragm and faceplate

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assembly upon shipment shall be in a ready to install condition without any additional work required by Amtrak.

3.0 Final Testing

Following all assembly, the vendor is required as basic work to perform and fully document a complete verification test and evaluation of each diaphragm assembly. Inspect and document all interface dimensions for conformance with Amtrak drawing D-00-2031, revision I or later issue. Perform and document a load test of the complete assembly. The diaphragm assembly must meet the load requirements at points A and B as shown on Amtrak drawing D-00-2031, Note 5. These loading requirements are functions both of the stiffness of the diaphragm fabric, and of the shear mounts. Particular attention must be given to the selection of the characteristics of these components, in order to develop the specified loading characteristics of the completed assembly.

The results of this final testing shall be recorded in the documentation record. When successfully completed, the vendor shall apply a metalized identification label in an inconspicuous area, generally as identified in the drawings, providing as a minimum the name and location of the vendor, any serial number used by the vendor, and the date of manufacture.

4.0 Packaging and Shipment

All packaging and shipping requirements shall be performed as basic work by the vendor. It is required that the vendor properly prepare the diaphragm and faceplate assembly for shipment to Amtrak so that it is ready to install following unpacking. The assembly shall be packaged into a cardboard enclosure within a shipping skid or other commercial shipping media suitable to allow the use of fork lift trucks for handling. The top of the diaphragm assembly shall be indicated on the package.

The vendor shall apply an identification label on the shipping package. This label shall include the vendor's name and address, telephone number, name of contact person, purchase order number, date released for shipment, applicable Amtrak "AAMPS" (internal catalog) number, and the diaphragm assembly serial number. This information shall also appear in the vendor's invoice, and be included in the vendor's documentation record.

The vendor shall retain a copy of the diaphragm assembly documentation record, and shall make three copies for Amtrak. One copy shall be included within the shipping container for the assembly, one copy shall be sent to the Amtrak Procurement officer (or as otherwise designated in the purchase order), and the third copy shall be mailed to the attention of the Amtrak Quality Assurance inspector in care of the Amtrak "ship to" address for the diaphragm assembly.

5.0 Product Support

5.1 First Article Inspections

To verify that the diaphragm and faceplate assembly meets all Specification and drawing requirements, and is truly interchangeable with existing diaphragms, Amtrak will conduct a series of two First Article Inspections (FAI) on the first diaphragm assembly manufactured by a

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vendor, prior to allowing unrestricted manufacturing work to start. This shall consist of a pre-shipment inspection and witnessing of the specified final testing of a prototype manufactured diaphragm assembly performed at the vendor's facility. Once this is successfully completed, the vendor shall then ship this diaphragm assembly to the Amtrak maintenance facility selected by the Engineer where Amtrak will install the assembly onto a car. A second "as-installed" inspection and test FAI shall then be performed to verify proper operation of this car while coupled to another car and negotiating minimum radius curvature. Particular emphasis shall be placed on verifying that the faceplate loading forces are balanced between the two diaphragms while in contact with one another.

Each FAI shall have Amtrak Engineering and/or Quality Assurance personnel as well as the vendor in attendance. These First Article Inspections shall include, but not be limited to, a mechanical inspection to determine compliance with the specifications and the drawings, performance of a load test and verification of proper operation when installed on a car. Approval by the Amtrak Bureau of Rolling Stock Engineering following successful completion of the two phases of First Article Inspections, as communicated through the Amtrak Procurement officer, shall constitute final system approval. No vendor changes shall be made in the configuration of the diaphragm and faceplate assembly following final approval unless approved in writing by the Amtrak Procurement officer. If desired, the vendor may conduct an informal Hardware Review prior to the first formal FAI at its facility, to review design, manufacturing and test issues.

5.2 Drawings, Manuals and Parts List

Following the successful completion of the First Article inspections, and as a precondition to permit production delivery of material to commence, the vendor shall supply to the Amtrak Bureau of Rolling Stock Engineering via the Amtrak Procurement officer an electronic set of every dimensioned drawing and bill of material for every individual part used for the manufacture of the diaphragm assembly. Drawings shall be in Engineer-approved formats, and shall include a complete set of "as-built" drawings of every part, component and assembly used for the complete diaphragm and faceplate assembly. Each drawing shall include a complete Bill of Material, providing original component manufacturer name and part number of the actual supplier of the part. Amtrak drawing formats and number series shall be used as agreed upon with the Engineer. The drawing package shall also include drawings of every special tool, jig or fixture required to install, maintain or overhaul the assembly, and, if referenced, in any of the maintenance manuals. The as-built drawings shall be delivered as 3 sets of CDs of DVDs of all drawings in electronic format that is compatible with Solidworks 2013 or above; and 3 sets of CDs or DVDs of all drawings in electronic format in Adobe read-only PDF files.

The vendor shall also submit in electronic format a maintenance manual as well as a parts list of all individual parts in the diaphragm and faceplate assembly, which shall include the actual component manufacturer name and part number. The parts list shall be sufficiently complete to permit Amtrak to order individual replacement spare parts direct from the actual parts manufacturer. This documentation shall be delivered as 3 sets of CDs.

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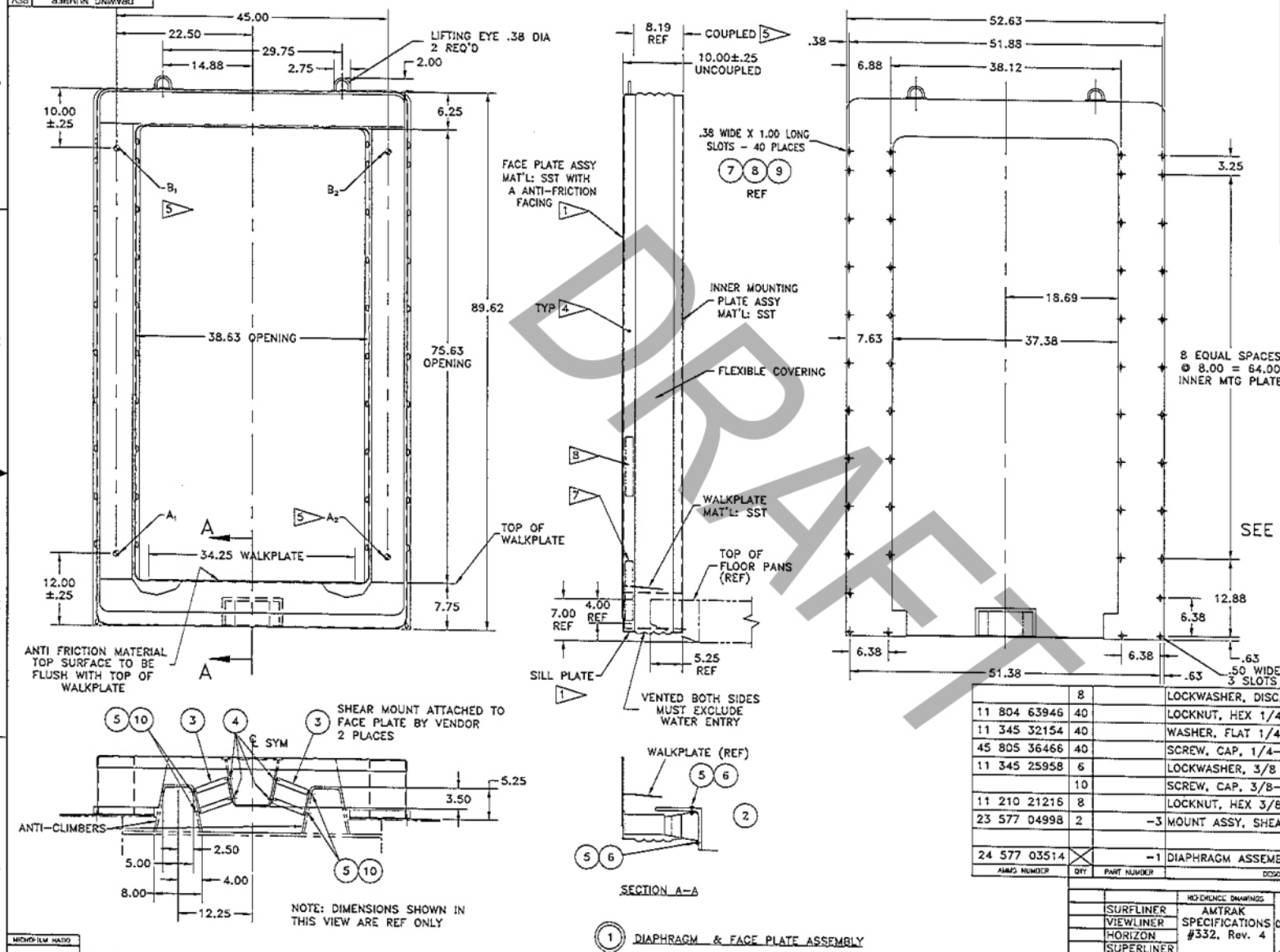

REVISION				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
G		REVISED & REDRAWN ADDED ITEMS 2 THRU 10 ADDED SHEET 2 ADDED NOTES 7 THRU 12 ADDED MANUFACTURE/REMANUFACTURE MONTH/YEAR MARKING TO EXTERIOR OF FACE PLATE DELETED ALUM 6061-T6 MAT'L OPTION FROM INNER MTG PLATE REVISED NOTE 6 ADDED "THE CONSTRUCTION__" ETC	JC 4/25/01	
H		REMOVE ITEM 2, CENTERPIECE; CHANGE SPEC. REF. TO REV. 3; CHANGE ASS'Y. AAMPS REF.; DELETE NOTE 9; MOD NOTE 1; ADD LAST NOTE.	KBM 8/23/10	
I		MODIFY NOTE 1; CHANGE SPEC. REF TO REV. 4; ADJUST LAYOUT OF DWG	DAM 6/30/14	

AMMS NUMBER	QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	ITEM
	8		LOCKWASHER, DISC, 3/8	SSTL		10
11 804 63946	40		LOCKNUT, HEX 1/4-20	SSTL	ESNA 79NU-040	9
11 345 32154	40		WASHER, FLAT 1/4	SSTL		8
45 805 36466	40		SCREW, CAP, 1/4-20 X 1" LG	SSTL		7
11 345 25958	6		LOCKWASHER, 3/8 HELICAL SPRING	SSTL		6
	10		SCREW, CAP, 3/8-16 X 1 1/8 LG	SSTL		5
11 210 21216	8		LOCKNUT, HEX 3/8-16 UNC-3B	STEEL ZINC PLATED	ESNA 21-NU-066	4
23 577 04998	2	-3	MOUNT ASSY, SHEAR DIAPHRAGM	SEE SHEET 2		3
						2
24 577 03514	X	-1	DIAPHRAGM ASSEMBLY			1

LIST OF MATERIAL

QTY/CAR	USED ON
	SURFLINER
	VIEWLINER
	HORIZON
	SUPERLINER
	AMFLEET

REFERENCE DRAWINGS
AMTRAK SPECIFICATIONS #332, Rev. 4

DO NOT SCALE DRAWING

Amtrak
CORPORATE EQUIPMENT ENGINEERING AND MECHANICAL DEPARTMENT
National Railroad Passenger Corporation
15 South Poplar Street, Wilmington, DE 19801

TOLERANCES
.03

Remove all burrs & break sharp edges

TITLE DIAPHRAGM & FACEPLATE ASSEMBLY

H.J.CLEMBOCKI

SHT. 1 OF 2 D-00-2031 1

MICROFILM RATIO 24 X

DRAWING NUMBER D-00-2031 REV 1

26-EOI-00415 00000006220 "UNCLASSIFIED" 4/30/2026

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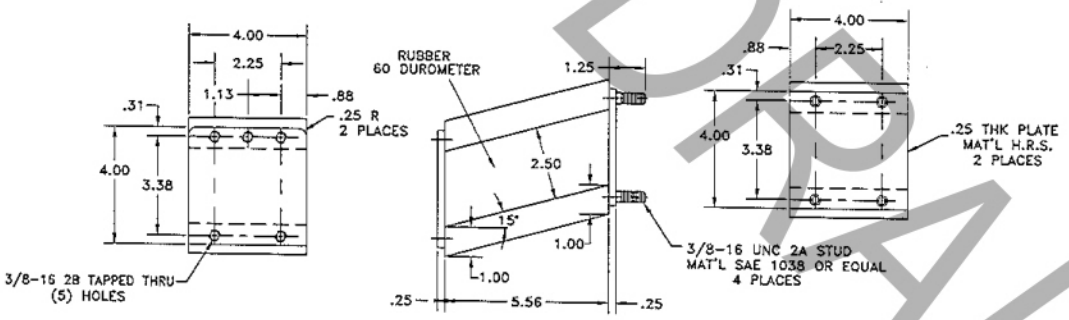
DRAWING NUMBER D-00-2031 REV 1

REVISION				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
		SEE SHEET 1		



③ SHEAR MOUNT ASSY – DIAPHRAGM

NOTES

1. FACE PLATE ASSY TOLERANCES & FINISH:
   FACE PLATE ASSY MUST BE FLAT WITHIN 0.10" TOTAL WHEN CHECKED ON A SURFACE PLATE.
   FOR THE ANTI-FRICTION PLATES:
   ROUGHNESS: 125 MU IN (MICRO INCHES) MAX.
   WAVINESS: .002" IN 2"
   STRAIGHTNESS: .060" MAX DEFLECTION ACROSS MAX. HEIGHT.
   .015" MAX DEFLECTION ACROSS MAX. WIDTH.
2. ALL RELIEF CUTS TO BE WELDED 100 PERCENT PENETRATION.
3. WELD AREAS TO BE FLUSH ON BOTH SIDES – GRIND IF NECESSARY. 100 PERCENT PENETRATION IS REQUIRED.
4. FINISH: U.S.S. #3 (100 GRIT) ON ALL EXPOSED SURFACES.
5. MAXIMUM ALLOWABLE FORCES AS MEASURED AT POINTS A & B WHEN COMPRESSED TO 8.38 ±.25 DIMENSION ARE:
   $\Phi A_1 + \Phi A_2 =$ 800 LB – 1050 LB
   $\Phi B_1 + \Phi B_2 =$ 200 LB – 300 LB
6. THE CONSTRUCTION OF THE DIAPHRAGM SHALL PRECLUDE THE ENTRY OF WATER AND DIRT INTO THE DIAPHRAGM & PASSAGEWAY, AS WELL AS INTO THE ASSEMBLY ITSELF.
7. MANUFACTURE DATE (MONTH/YEAR), VENDOR I.D., PART NUMBER & SERIAL NUMBER AND AMTRAK PART NO. 24 457 00709 TO BE STAMPED ON THE FLANGE OF THE FACE PLATE WHERE INDICATED, IN 1/4" HIGH NUMERALS.
8. WHEN REMANUFACTURED VENDOR TAG TO BE APPLIED WHERE INDICATED (NOT TO DISTURB ORIGINAL LABEL).
   THE PERMANENT LABEL WILL INCLUDE:
   SHOP NAME
   LOCATION
   TYPE OF REPAIR: REPAIR OR OVERHAUL
   DATE OF REPAIR (DAY, MONTH, YEAR)
9. ENVIRONMENTAL NOTE:
   SEE AMTRAK SPEC. 429 PARTS 1, 2, 3.1, 3.1.2 (VITAL), 3.2 & 3.2.1.
10. ALL DISSIMILAR METAL JOINTS SHALL USE SUITABLE TECHNOLOGIES TO PREVENT CORROSION.
11. ALL MATERIALS USED MUST MEET AMTRAK SPECIFICATION #352 LATEST REVISION.
12. SEE OEM DRAWINGS FOR ASSEMBLY DETAILS

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QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	ITEM

LIST OF MATERIAL

REFERENCE DRAWINGS

AMTRAK SPECIFICATIONS #332, Rev. 4

QTY/CAR	USED ON
	SURFLINER
	VIEWLINER
	HORIZON
	SUPERLINER
	AMFLEET

DO NOT SCALE DRAWING

Amtrak
CORPORATE EQUIPMENT ENGINEERING AND MECHANICAL DEPARTMENT
National Railroad Passenger Corporation
10 South Master Street, Wilmington, DE 19801

DIAPHRAGM & FACEPLATE ASSEMBLY

DRAWN	CHECKED	APPROVED	APPROVED
ACTIVITY SIGNAL			
DO 01/01			
DATE 1"=1"			M.J.GLEMBOCKI 4/27/02

SHT 2 OF 2 D-00-2031 1

MICROFILM RATIO 24 X

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ACS-64 Knorr Air Brake Training - Wilmington, DE.

July 21 to July 24, 2014

	Last Name	First Name	Employee ID Number	Job Title	Work Location	Comments
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Amtrak
Mechanical Department
Rolling Stock Equipment

SPECIFICATION

for
Passenger Vehicle
Sash and Glazing Materials

SPECIFICATION No. 336

Issue Date: 02/11/2020
Revision No. F

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Approved By: 3/6/20 Date:

3/6/20 VP/Chief Mechanical Officer

3/6/20 AVP/Deputy Chief Mechanical Officer

2/19/2020 Director System Engineering & Specifications

Sr. Manager Equipment/Engineering

Originator & Creation Date

28-PCI-00416 0000000822 UNCLASSIFIED 4/30/2026

Specification Change Sheet

Revision	Date	Section(s)	Description	Approver
Initial	11/15/1989			D. Karan
A	11/17/1989		Updated glazing material properties: a, b, c, d, .460 was .470	
B	4/30/2003	2.1 2.1.1 2.2 2.3 2.4.	2.1: Removed "pressure polished"; specified glazing material part number; rewrote 2.1.1 2nd para, added silicone & aluminum tape; general rewording of 2.2 & 2.3 to clarify; rewrote 2.4. Added drawing D-00-8417 rev. E.	Bruss/Slaughter
C	10/21/2005	1 2.1. 2.1 (i) 2.4. 2.4.2. 2.5 5. 7.	Changed all drawing references to latest revision. Added date of manufacturing identification to glazing rubber handle in Section 2.4.2. General Provisions updated in Section 1. Added clear 0.25" light transmission to Section 2.1. Added extrusion markings in Section 2.1 (i). Added handle details and markings in Section 2.4. Clarified marking requirements in Section 2.5. Revised and clarified testing and product support requirements in Section 5. Added warranty in Section 7.	Cabry/Copland/Burshtin
D	08/04/2008	1.1 1.2 1.5 1.7 1.12 1.13 1.14 2.0 2.1.1 2.1.2 2.1.3 2.1.4 2.1.5 2.4.1 2.4.2 2.5.1 2.6 5.2 6.15 6.16 8 9	Sections rearranged and amended: 1.1 added subcontracting and exception requirements; added 1.2, remainder of Section 1 renumbered; 1.5 was reworded; added 1.7; 1.12 was renamed and reworded; added 1.13 and 1.14; added 2.0 text; 2.1.1 became "Polycarbonate"; 2.1.2 became "Glass" and added Engineer approval; old 2.1.1 became 2.1.3 "Side Windows – Polycarbonate"; Added 2.1.4 "Side Passenger Windows/Glass / Polycarbonate"; Old 2.1.2 became 2.1.5 "Door Windows; Revised Section 2.1.3, added description of spacer bar / desiccant. Added "dead soft" to the aluminum foil description.; Revised section 2.4.1, added HPPL to photoluminescent. Removed aluminum from the material description. Revised handle attachment to adhesive from mechanical fastener; Revised Section 2.4.2, added paint color definition,	

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			added Amtrak sign 428NS reference. Revised Section 2.5.1 so that drawing description of marking and the specification are the same, and added sample marking illustration. Moved 2.6 into 2.0; Added 5.2 to 5.4, renumbered old 5.2 to 5.5; added Sections 8 and 9. Added reference to drawings in 6.15 and 6.16	
E	9/25/2013	2.4.1 2.5.1 4.1	Revised Section 2.4.1 to include full application of how handle is applied. Revised section 2.5.1 to include "Amtrak Engineering approved" thus giving the engineering department final approval on what is classified as a "permanent marking", revised Section 4.1 – abrasion test	
F	02/11/2020	1.1 2.4.2. 2.6 3.2.2 3.2.4	Reworded 1.1 - general requirements. Revised section 2.4.2. Added section 2.6 for gasket material, Increased speed requirements in 3.2.2 and added section 3.2.4 - water retention. Updated reference drawing numbers. Fixed errors and clarified wording.	Slaughter

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Amtrak
Rolling Stock Equipment

Specification for Passenger Vehicle Sash and Glazing Materials

Specification No. 336
Revision No. F

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Amtrak
Rolling Stock Equipment

Specification for
Passenger Vehicle Sash and Glazing Materials

Specification No. 336
Revision No. F

1.0 General

1.1 Purpose

This Specification defines the third-party vendor general requirements for sash assemblies and glazing material used on Amtrak railroad passenger car windows, including side passenger windows, door windows, and car end facing windows. This Specification is to be used in conjunction with the Amtrak Procurement Department contract documents, purchase orders and other contractual documents issued to the vendor. It is Amtrak's intention that any new sash and glazing materials be functionally interchangeable with those currently in use at Amtrak in terms of form, fit, function, general appearance and operation.

The design criteria and constraints that are known to Amtrak have been specified. If other factors require definition after Contract award, the vendor shall be responsible for making those definition requirements known to Amtrak in a timely manner for mutual investigation and satisfactory resolution. The vendor shall not be relieved of the overall responsibility of providing an adequate design for the Amtrak service conditions. Wherever possible, this Specification has been developed based on car performance required, rather than specific hardware to be provided. Where specific hardware is mentioned, it is for the purpose of providing an example of concepts or designs acceptable to the Engineer. This approach will allow vendors to employ innovation and advanced technology where appropriate.

Whenever in this Specification an article or material is defined by using a trade name or the name and catalog number of a particular manufacturer or vendor, or a limited description, the term “or approved equal” if not written thereafter shall be implied. Any reference to a particular manufacturer’s product either by trade name or limited description is only for the purpose of setting a standard of performance, quality, composition, construction or size. The term “or approved equal” means any other manufactured product or article, which is equivalent in material, workmanship and service and is as efficient and economical in operation in the opinion of the Amtrak Engineer. Amtrak’s opinion as to whether the proposed alternate is equal to the specified items for Amtrak’s specified use and purposes shall be final and conclusive.

Any items of material or equipment, which are not fully described or are omitted in this Specification or the accepted Technical Proposal but are necessary for the completion of the sash assemblies and glazing materials, shall be considered a part of the scope of supply. In this Specification all references to "number of days" shall mean calendar days.

The vendor shall not subcontract the design and manufacturing work under this Specification without the written authorization of the Amtrak Contracting Agent. The vendor shall not patent or copyright any original materials or information created by this procurement which will be submitted to Amtrak.

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The vendor shall explicitly identify to the Amtrak Contracting Agent any exceptions being taken to this Specification, referencing the Specification Section number and the exact wording in question. It will otherwise be assumed by Amtrak that the vendor takes no exception to this Specification and is completely compliant with all Specification requirements.

Safety shall be of primary importance in the design of the items being supplied. They shall present a safe, hazard-free environment to passengers and the operating and maintenance personnel to the extent practical. No sharp edges or corners or pinch points shall occur where passengers, crew, or maintenance personnel may come into contact with them. Smooth surfaces and avoidance of protrusions shall be used to minimize passenger injury and the collection of dust and dirt.

1.2 Vendor's Technical Proposal

As a condition of contract award, the vendor must submit a written and detailed Technical Proposal to the designated Amtrak Contracting Agent. This Technical Proposal must identify the vendor's interpretation of what it considers to be the scope of Basic Work to be performed, present a complete technical description of the components to be supplied, fully describe the operation and maintenance requirements of the components, include a copy of the vendor's Quality Assurance program, describe the Design Review process, present a step-by-step work plan for construction, include a project schedule by major events starting from the Notice to Proceed, and a Bill of Material of all components to be supplied.

1.3 Cost Items

Any extra work items beyond the scope of this Specification regarding the supply of sash, gaskets and glazing materials shall be handled in accordance with the contract and purchase order documents issued to the vendor by the Amtrak Procurement Department. The vendor must contact the Amtrak Contracting Agent regarding all such issues. The vendor agrees that Amtrak will make no payment for any additional work outside the scope of the contract documents unless such work is first preapproved in writing by the Amtrak Contracting Agent in accordance with the contract documents.

1.4 Legal Requirements

It is mandatory that all materials used by the vendor in the item being supplied to Amtrak must comply with all applicable Federal requirements identified in 49 CFR Part 223 for passenger cars, and also in 49 CFR Part 238 for Tier I passenger equipment. All components being supplied must also comply with the flammability and smoke emissions requirements of the latest edition of 49 CFR Parts 238.103 (a)(2) and (b)(2), and also its Appendix B requirements (including all referenced notes) for all material functions listed. It is required that prior to the First Article Inspection and any delivery of material, the vendor must supply the Amtrak Procurement officer with: i) certification by the vendor that all components being supplied comply with all applicable requirements identified in 49 CFR Parts 223 and 238, and ii) a report by a recognized independent testing laboratory certifying that all materials used comply with the 49 CFR Part 238 Appendix B requirements.

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1.5 Engineer

The Engineer, as referenced in this Specification, is defined as the Senior Director of the Amtrak Bureau of Rolling Stock Engineering within its Mechanical Department, or its written designee. During the course of the project the vendor may be submitting items for the Engineer's approval as required by the Contract and Specification. The vendor shall not interpret this process to mean that the Engineer will function as an arm of the vendor's Project Management or Engineering staff. Submissions shall be structured to show how the vendor is responding to the requirements of the Specification, and not on the basis of requiring the Engineer to discover how the vendor is not meeting those requirements. Submittals requiring the Engineer's approval prior to implementation shall be reviewed and classified by the Engineer within 30 days from the day the submittal is received. Delays caused by the Engineer's failure to review and approve drawings or schedules in a timely fashion as listed above shall be treated as an excusable delay, provided that the vendor can demonstrate to the satisfaction of the Amtrak Procurement officer that actual production delays have been caused by the Engineer and there is no other concurrent cause for delay.

1.6 Vendor Quality Assurance Program

The vendor is required to have in place a documented Quality Assurance Program that is modeled after an established industry quality standard, such as the ISO, AAR, or other organization. The vendor's facility is required to be equipped with equipment, personnel and management completely sufficient to assemble, inspect and test each item being supplied under this Specification. The vendor shall have suitable equipment to diagnose any failure mode, and perform all adjustments and tests required to confirm proper operation. The vendor's Quality Assurance staff shall be active participants in the assembly, inspection, testing and documentation phases of the work. The vendor is required to submit a copy of its Quality Assurance Program as part of its Technical Proposal, as explained in Section 1.2.

While it not a mandatory requirement under this Specification, it is highly desirable that the vendor's quality assurance program be certified under ISO 9001:2000 or an equivalent recognized standard.

Amtrak Quality Assurance personnel may conduct random audits of the vendor's quality assurance program to verify that these Specification requirements are being achieved. The vendor shall fully cooperate in such audits. Specific attention shall be paid to the areas of management responsibility, quality system, contract review, design control, document control (including drawings), purchasing, purchaser-supplied product, product traceability and identification, process control (including procedures, testing and equipment), inspection and testing, measuring and test equipment (including calibration programs), control of nonconforming products (applied controls), corrective and preventative actions, handling, storage, packaging and delivery, quality records, internal quality audits, training, servicing and statistical techniques.

1.7 Critical to Quality (CTQ) Part Criteria

It is mandatory that the vendor comply with Amtrak procedure PD 3.7.4.02, Critical to Quality (CTQ) Part Criteria, which applies to all products identified by either the Engineer or the designated Amtrak Contracting Agent that Amtrak considers to have aspects identified that are Critical To Quality (CTQ). CTQs shall be Critical to Quality (CTQ) characteristic are defined as

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"Those characteristics of an item which, if non-conforming, may prevent or seriously affect the unit performance, reliability, producibility, or customer satisfaction of a component." This procedure defines the methodology when qualifying parts or processes to assure that the critical to quality product criteria meet Amtrak requirements by:

- Implementing a rigorous Part/Process qualification to ensure the participation, communications of all related departments and the quality acceptance.
- Support the Quality process by involving the vendor early in the project/design process.
- Assure that the vendor is supplying materials that meet the quality, cost, delivery and reliability requirements.

1.8 Components

The vendor shall use only new parts for all components. The vendor shall maintain drawings for each component, and where necessary, patterns, jigs and fixtures, to assure identical manufacture. All elastomers used shall have a design life of 10 years in service unless otherwise approved by the Amtrak Procurement officer.

1.9 Conducting Tests

The vendor shall be equipped to fully test the items being supplied in accordance with this Specification and any referenced drawings as part of basic work. All testing apparatus shall be calibrated on a periodic basis as recommended by its supplier.

1.10 Workmanship

All workmanship shall be of high grade and shall conform to the best of industry manufacturing practices. Skilled, qualified, well-motivated personnel, with appropriate experience, training and aptitude shall be utilized to assure high quality of workmanship at all levels. Foremen, supervisors, inspectors, and shop managers shall be well integrated within the project team and be fully experienced and capable in their fields. They shall manage their teams in a competent and professional manner. The vendor is required to have on hand in his facility for reference this Specification and all referenced Amtrak drawings.

1.11 Documentation Records

The vendor shall maintain an electronic database and/or approved logbook of information regarding all components supplied to Amtrak under this Specification. At a minimum, records shall identify the Amtrak purchase order number, serial number of the assembly, Amtrak "SAP" internal catalog number, copies of any written authorizations by the Amtrak Contracting Agent, inspection and test data, shipping date and shipping location. In addition, it shall include a copy of the test certification required by 49 CFR Part 223, and the flammability and smoke emission laboratory certification report under 49 CFR Part 238 Appendix B for the components being supplied.

1.12 Amtrak Ownership Rights

Unless specifically waived in writing by the Amtrak Contracting Agent, all drawings, bills of materials, catalog lists, mockups, CAD models, documentation and all other engineering and

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design materials related to this Specification shall become the property of Amtrak, and shall be delivered by the vendor in total as part of the First Article Inspection or other process. If any patented items are used, Amtrak must be granted an unrestricted license to use, copy or otherwise manufacture the item by itself or a third party.

1.13 Interchangeability

All similar parts on each item being supplied, and among all other assemblies and their spare parts, shall be designed and manufactured to be identical, both as individual parts and as subassemblies. All assemblies shall mount to the vehicle without modification. Model numbers for identical components shall be identical. Replaceable components of any such apparatus shall be fully interchangeable, without adjustments to any part being necessary.

1.14 Dimensions

All designs, components, dimensions and fasteners used on the components being supplied under this Specification, unless otherwise stated in the bidding and contract documents, shall be of United States inch-standards. Due to potential compatibility issues with existing Amtrak rolling stock, any components and fasteners using metric dimensions shall not be supplied unless approved in writing by the Engineer.

The vendor shall provide English dimensioning for its drawings and other communications which are generated. Fractional measurements shall be expressed as a decimal value. Drawings prepared by the vendor shall be made using third angle projections. First angle projection shall be allowed provided all views are labeled, including the front, top, bottom and side views. Dimensional tolerancing shall be appropriately applied for the part being manufactured.

2.0 Design Requirements

All designs and all components shall comply with the environmental requirements identified in Amtrak Specification 429. The emergency window components shall be designed utilizing Universal or Transgenerational design, considering the needs of a broad range of users and citizens. This is particularly critical for the very young and the elderly who, while not considered "disabled" are often less stable or lack strength in situations considered "normal" by manufacturers. Applying these concepts need not complicate or add expense to the component but insure its continued utility and safety over time regardless of the demographics of the service area.

In addition to compliance with the Federal flammability requirements in Section 1.4, all materials must also comply with the flammability, smoke emissions and toxicity requirements of Amtrak Specification 352 with the following additional criteria:

a) The minimum combustion temperature shall be 1000°F (538°C) as tested to ASTM D 1929 criteria.

b) The burn rate shall meet the criteria of ASTM D 635 classification CC-1.

c) The smoke density shall be less than 75 when tested to ASTM D 2843 using a XP-2 smoke chamber.

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2.1 Glazing Material

2.1.1 Polycarbonate

All non-glass glazing material shall be mar-resistant, transportation grade polycarbonate and approved by the Engineer, provided in nominal thicknesses of 0.250" and 0.460", and conforming to the following requirements:

a) Light Transmittance (±5%): 0.250" thick Tinted = 27%
0.250" thick Clear = 80%
0.460" thick Tinted = 27%
0.460" thick Clear = 75%

b) Solar Transmittance: 0.250" thick Tinted = 37%
0.460" thick Tinted = 37%
0.460" thick Clear = 81%

c) Solar Shading Coefficient: Clear 0.250" thick = 1.02
Tinted 0.250" thick = 0.60
Clear 0.460" thick = 0.96
Tinted 0.460" thick = 0.60

d) U-Value: 0.250" thick = 0.90 BTU/Hour/Square Foot (Summer Heat Gain)
0.250" thick = 0.96 BTU/Hour/Square Foot (Winter Heat Loss)
0.460" thick = 0.77 BTU/Hour/Square Foot (Summer Heat Gain)
0.460" thick = 0.82 BTU/Hour/Square Foot (Winter Heat Loss)

e) Sound Transmittance (STC Rating): 0.250" thick = 31
0.460" thick = 34

f) Impact Resistance

0.250 inch thick polycarbonate sheet shall withstand an impact of 200 foot-pounds with no visible loss of structural integrity. See Section 4.3 for additional criteria.

g) Tinting

The material shall be supplied either as clear (untinted), or as tinted. All 0.250 inch thick tinted material shall be identical in appearance to "Lexan Bronze" GE #51076 or approved equal. All 0.460 inch thick tinted material shall be identical in appearance to "Lexan Bronze" GE #51077 or approved equal. Tinted material shall be integrally tinted with no appreciable variation in color over the entire area of each glazing and between panel of like color designation and thickness. Measurements for determining color shall be taken with a spectrometer.

h) Protective Coating

A permanent protective abrasion resistant coating shall be applied to the surfaces of all glazing material. The purpose is to significantly improve the abrasive resistant qualities of the glazing to abrasive materials, natural atmospheric acids, strong cleaning chemicals, and cleaning brushes encountered during normal operating and cleaning conditions.

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i) Extruding Marks

The extruding marks shall run horizontally for both the inner and outer glazing as installed in the vehicle.

2.1.2 Safety Glass

Safety glass may only be used in certain applications such as Talgo equipment, Surfliner side windows and curved glass applications such as Superliner Lounges, as approved by the Engineer.

Safety glass shall meet the requirements under Item 1, Table 1 of ANSI Z26.1, "American National Standard for Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways - Safety Code" and FRA Type I or II as approved by the Engineer. Glass shall meet the following requirements:

a) All safety glass shall be of the laminated sheet type.

b) When an individual pane of glass is laid on a truly flat surface, such as a surface plate, the glass shall not indicate a bow of more than 0.030 inch per linear foot.

c) The overall dimensions of individual panes as supplied shall be held within 0.060 inch of the dimensions ordered.

d) The overlap of one laminate of the pane with respect to the other at an edge shall not exceed 0.030 inch. Corners and burrs shall be ground smooth and all edges shall be treated in accordance with ANSI Z26.1, Section 6.

e) The color of the glass shall be as identified in Section 2.1.1-g. When new, there shall be no more than ± 4% variation in the color of individual panes of laminated sheet glass when examined over a white background.

f) All the laminates of the safety glass shall be so nearly free from haze that the glass shall have approximately the same clarity as a pane of the same nominal thickness of plate glass when viewed against a north light.

g) Occasional specks of foreign material and scratches are permissible, provided such specks do not exceed 0.020 inch in greatest dimension and scratches do not exceed a total of 3 inches in length and neither are within the central three-quarters area of the pane.

h) The bond between two sheets of glass and the membrane shall be of such quality that when the glass is broken by twisting or by direct impact, there will be no separation between the glass sheets. Glass panes that contain unbonded areas (let-go's) shall not be used.

2.1.3 Side Passenger Windows - Polycarbonate

The side passenger windows shall be a sealed unit constructed of an outer sheet of 0.250" ± 0.005" thick tinted polycarbonate, and an inner sheet of 0.250" ± 0.005" thick clear polycarbonate as described in Section 2.1.1. The two pieces of glazing shall be separated by a

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nominal 0.250 inch air gap. A black, 0.25 inch self-adhesive sealant/spacer bar filled with a desiccant, Edgetech Superspacer Premium Plus or Engineer approved equal, shall be placed within the air gap, parallel and adjacent to the edges of the plastic material. A secondary sealant of either hot melt butyl or RTV silicone sealant shall be applied along the entire perimeter, filling all voids. Butyl and silicone shall not be used in the same assembly to avoid reactivity. Two mil (.002") thick soft aluminum tape with acrylic adhesive shall be applied along the perimeter of the assembly. Refer to Amtrak drawing 00-8417, revision M or newer for additional details. The glazing assembly must meet all applicable requirements of 49 CFR Part 223.

In some instances, such as privacy windows which use a privacy film, the inner polycarbonate sheet may be 0.236 inch thick clear transportation grade FRA compliant polycarbonate. Such instances will be specifically called out on the appropriate glazing drawings.

2.1.4 Side Passenger Windows – Glass / Polycarbonate

When specified in particular Amtrak drawings, 0.75" thick glazing assemblies shall be constructed with the outer glazing layer of tinted safety glass. Unless otherwise specified on the part drawing, the assembly shall be constructed in the same fashion as described in Section 2.1.3. All materials must comply with 49 CFR Part 223.

2.1.5 Door Windows

All door windows shall consist of a single 0.460" (+.005", -.020") thick piece of polycarbonate as described in Section 2.1. End door windows shall be clear. Side door windows shall be tinted as described in Section 2.1. All door glazing shall meet all applicable requirements of 49 CFR Part 223.

2.2 Frame

2.2.1 Side Passenger Windows

The window frame shall be constructed from extruded aluminum 6063-T5 alloy. The extrusion cross section shall conform to Amtrak drawing B-00-2063, latest revision. Most windows include two panes divided by a mullion; some windows employ a single pane Refer to Amtrak drawing 00-8417, revision M or newer for additional details.

2.2.2 Doors

All door frames shall be an integral part of the door structure. They shall be capable of retaining the window in the door opening when subjected to the both the impact requirements applicable to the window location described in 49 CFR Part 223 and also Section 3.2.2.

2.3 Glazing Retention

2.3.1 Side Passenger Windows

A rubber extrusion, as shown on Amtrak drawing C-00-2064, latest revision, shall be used to retain the glazing material in the frame. A "pound-in" gasket shall secure the glazing from the

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inside of the car (Amtrak drawing 0062489 for emergency windows and the same profile for non-emergency windows). A "locking strip" (Amtrak drawing 0059785) on the outside section of the rubber extrusion shall allow installation and/or removal of the main rubber extrusion from the carbody frame. This arrangement shall be designed to allow the glazing pane to be removed from the inside of the car, and the entire window assembly to be removed from the outside the car.

2.3.2 Door Windows

All door windows shall be retained in the door frame by use of a rubber extrusion and "zip strip" (Amtrak drawing 0059864) combination which will allow installation and removal of the glazing from either side of the door. Structural requirements for the end door must meet the impact requirements of 49 CFR Part 223. Side door windows must also meet the requirements of Section 3.2.2.

2.4 Emergency Handles

Certain windows shall be designated as Emergency Windows on the drawings and contract documents. These Emergency Windows are similar to the side passenger windows, but shall also include one emergency handle set, provided on one interior pane assembly. The handle set shall be composed of two separate handles - an extruded aluminum handle for the glazing rubber gasket and a stainless steel glazing handle. The rubber gasket handle is to remove the glazing rubber gasket ("pound-in" rubber) from inside the car. The glazing handle is used to remove the glazing unit from the sash during emergencies. The glazing handle assembly shall wrap over and capture both pieces of the assembled glazing pane to ensure that the glazing assembly remains intact during the removal. All handles shall be smoothly finished. Refer to the appropriate contract drawings for the quantity and locations of emergency windows, and the handle locations.

2.4.1 Glazing Handle

The glazing handle shall be stainless steel with a nominal thickness of 0.0355", configured to wrap over and capture both glazing sheets (Amtrak drawing 069-0101). The handle shall have black lettering reading "PULL GLASS" on a HPPL photoluminescent substrate in right-reading and inverted (Amtrak drawing 106-00096-I-NS Rev. E or later). The handle shall be secured to the assembly using 3M VHB #5925 adhesive. The surface of the polycarbonate window must be properly prepared to locally remove any coating. The glazing and handle surfaces must be properly cleaned to remove residue or oils prior to applying the adhesive using the following procedure:

Sand, using 120 grit paper, the interior clear polycarbonate in the area where the handle contacts the window. Apply a 3" long strip of acrylic foam tape to this area. Install handle & clamp with minimum of 15 lbs. to bleed out the adhesive. Cure the window assembly for a minimum of 72 hours in a temperature-controlled room. Note – The emergency handle must be free of all machining oils by cleaning thoroughly with denatured alcohol or approved Amtrak equivalent.

Refer to Amtrak drawing 00-8417, revision M or newer for additional details.

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2.4.2 Rubber Gasket Handle

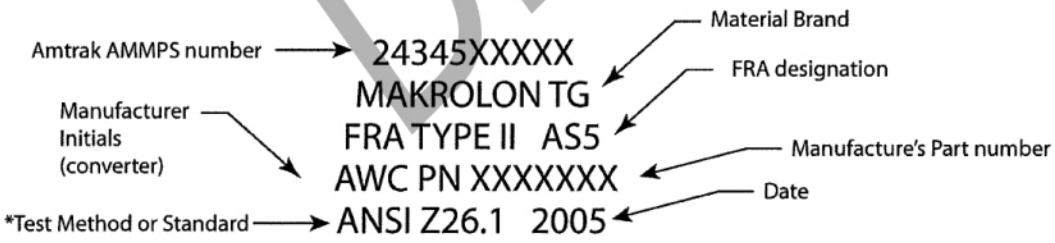
The rubber gasket handle shall be of extruded aluminum using a 6063-T5 alloy with a baked red paint finish to match color to Federal Standard FS 11105 or Pantone PMS 186C. The handle shall be attached to the rubber gasket (strip) according to Amtrak drawing 0060753. All parts shall be applied to ensure that the gasket applied properly into the window frame and to ensure the removal of the strip when the handle is pulled. The handle shall have Amtrak sign 428NS applied reading "EMERGENCY EXIT. Pull Handle. Remove Rubber" applied in the right-reading orientation for the particular application. Other methods of attachment must satisfy at least 200 lbs pulling force without breakage and must be approved by the Amtrak Engineer. For full gasket assemblies see Amtrak drawing 0062489.

2.5 Markings

2.5.1 Glazing Material

Each piece of glazing material shall have an Amtrak Engineering approved permanent marking on an inside surface as installed, in accordance with the Appendix A requirement of 49 CFR Part 223. The FRA requires FRA type designation, material manufacturer and brand name. Additionally, the marking shall include the glazing assembly manufacture's name, part number, Amtrak SAP part number, date of manufacture (at minimum "year") and test methods used*. The identification markings shall be applied and located in two opposed corners so that one label will be legible following installation regardless of how the window is installed in the car. Location of these markings must be visible for identification after installation. Abbreviations may be used to reduce the overall size of the marking. Vendors should provide samples of the intended marking for approval by the Engineer prior to commencing production. See the sample below:

(*Test method marking may be omitted if it is included as part of FRA compliance or compliance to Amtrak's specification. See the sample below.)



Typical window marking

2.5.2 Protective Covering

Protective plastic sheeting shall be applied to both sides of the completed sash assembly to protect the unit until its installation in the car. All tinted glazing material shall be clearly marked on this removable protective sheeting with 1" letters "THIS SIDE OUT", to indicate correct orientation of glazing with respect to its installation (i.e. tinted side toward outside).

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2.5.3 Emergency Pull Handle (Rubber Gasket Handle)

The vendor shall permanently mark on the inner (hidden from passenger view) face of the handle the month and year of manufacture of the glazing rubber handle assembly. Refer to Amtrak drawing 0060753, latest revision for additional details.

2.6 Rubber Gasket Material

2.6.1 Durometer

Gasket material shall be 60-70 durometer

2.6.2 UV Performance

Gasket material shall be formulated or otherwise manufactured to resist ultraviolet degradation in North America for at least 10 years with no cracks or other defects that affect the performance of the gasket. In no case shall the gasket develop cracks exceeding 0.25 inch from the edge.

2.6.3 Workmanship

The following workmanship standards shall be followed:

a) Splices limited to the minimum required to produce a continuous gasket.

b) All mechanical alterations of the gasket must be made so that they cannot precipitate damage to the gasket.

c) Corners and splices must be vulcanized or otherwise permanently joined.

3.0 Performance

3.1 Materials

All sash and glazing materials shall withstand the testing specified in Section 4 and shall show no physical damage or degradation of optical qualities when exposed to the environment encountered in rail passenger service for a minimum period of six years. This shall include, but shall not be limited to:

a) Daily washing with alkaline/acid detergents and exposure to rotary car wash brushes.

b) Exposure to industrial strength cleaning agents, body oils and chemicals use in personal cosmetics (i.e., hair dressings, lipsticks, etc.).

c) Prolonged exposure to ultraviolet radiation in all geographic areas of the U.S.

d) Exposure to the conditions identified within Amtrak Specification 429 "Environmental Operating Conditions", with ambient temperature variations of minus 40 to 120 degrees F and humidity of 5 to 100 percent.

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3.2 Glazing Rubber

3.2.1 Removal

The design of the glazing rubber shall allow removal of the entire window assembly from the outside the car by technical or emergency personnel (police, fire departments, etc.), see Section 2.3.1 for additional information.

3.2.2 Retention

The frame and glazing rubber of the side passenger window and side door window shall be so designed that the glazing material shall be securely held in place and withstand the air pressure differences caused when two trains operating at high speed (135 mph) pass each other in opposite directions (closing speed 270 mph) with the trains spaced 2 feet apart.

3.2.3 Leakage

The glazing assembly (including frame, rubber and glazing material) shall not leak during carbody water tests.

3.2.4 Water Retention

The Sash Assembly shall be designed so that water will not be retained in the frame or gaskets. and shall drain to the exterior of the car.

4.0 Testing

The manufacturer shall perform all tests specified herein. The description of equipment for the abrasion test is included as a guide. Actual equipment used by the manufacturer must be approved by the Engineer prior to testing. Results of these tests shall be documented per Section 5.1.

4.1 Abrasion Test

4.1.1 Abrasion Test Equipment

The abrasion test cell shall be constructed as follows:

a) Drum

An 18.85 foot circumference revolving steel drum shall be used and positioned in a manner to allow the drum to rotate at a controllable speed and in contact with the brush (See Figure 1 for general configuration). 2" wide test panel supports shall be installed horizontally around the periphery of the drum at a center to center distance of 9". The 12" by 20" test specimens shall be mounted vertically on the drum and secured at 4 corners, maintaining a 1" edge distance. The additional supports are used to maintain rotational speed as the brush rotates the drum.

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b) Brush

The brush shall meet the requirements of Amtrak Specification 76. The brush fibers shall be type No. 1.

c) Chemical

The test car wash chemical shall be Lexol OE or Engineer approved equivalent. The chemical shall be introduced to the test fixture at a ratio of (1) part chemical to ten (10) parts water.

4.1.2 Procedure

A minimum of two production material samples selected at random shall be used in the test. Tests shall not be conducted using laboratory sample materials. Amtrak has the option of reviewing the production facilities of any manufacturer submitting glazing material for Amtrak approval. Each panel tested shall receive 500 hours high intensity UV energy exposure as outlined in ASTM G 26, method #1 before abrasion testing commences. Haze readings of the virgin samples shall be taken. A minimum of 2 samples shall be used in the test.

4.1.3 Testing

Using the test fixture outlined in Section 4.1.1, adjust the brush to overlap the test panels by 3.5" and the power unit to rotate the drum at 14 RPM. Introduce the wash chemical through a 1:10 chemical-to-water ratio. The solution shall be directed slightly above the brush/glazing interface. Every 75 cycles introduce a mixture of dirt and fine metallic particles (approximately a 50:1 weight ratio) into the brush-glazing interface.

The samples shall be periodically checked for haze development and coating adhesion. After 3000 cycles, if all the requirements for haze development and coating adhesion are met, (less than 5% haze), the test samples shall be subjected to an additional 1000 hours of high intensity UV energy exposure as outlined in ASTM G 26, method #1. Haze reading shall be recorded before and after the 1000-hour exposure.

The test shall continue for 48,000 cycles, or until the haze development exceeds 5% of the original unabraded value, or until the first indication of coating adhesion failure, whichever occurs first.

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4.2 Adhesion of Coating Material

The glazing abrasion resistant coating material shall retain adhesion to the substrate material when subjected to a 100 foot-pounds impact as specified in Section 4.3. The coating must pass the standard cross-cut adhesion test. This test consists of scribing a grid of four horizontal and four vertical 1" long lines through the coating with a sharp steel blade. Pressure sensitive tape is then pressed over the scribed area and is then pulled away at a 90-degree angle to the sample sheet. The coating shall pass the test if no coating is removed from the substrate material.

4.3 Weathering

Material shall withstand exposure for a total of 1500 hours of high intensity UV energy testing per ASTM G 26, method #1 (500 hours as indicated in Section 4.1.2, and 1000 hours as

indicated in Section 4.1.3). The material shall not show any loss of impact qualities or change in percentage haze exceeding 5 (ASTM D 1003) after completion of the weathering cycle. The sample size shall not be smaller than 12" by 20" with a thickness of 0.470".

Prior to weathering, two 12" by 20" samples shall be subjected to a falling dart test similar to ANSI Z26.1 Test No. 9 with the exception that the dart weigh 5 pounds and the height be 20 feet. The size of the test specimen shall be as listed above. This procedure will be repeated after weathering and on the samples used in the abrasion test after conclusion of that test. No failure (penetration) of the material is allowed. Surface cracking will be reviewed by the Engineer and evaluated with other test results.

4.4 Flammability

Third-party testing laboratory reports shall be submitted to verify the flammability requirements of Sections 1.4 and 2.0.

4.5 Chemical Resistance

Samples shall be prepared and tested according to Test 19, Article 5.19, of ANSI Z26.1. The exposed fabricated edges of the test samples may be coated with the same material as the face surfaces by the manufacturer. In addition to those chemicals specified in this test, the test shall also include, but not be limited to, such car cleaning solutions as 1/2 strength Neleco Products Subway Soil Solvent Parts 1 and 2 and Electrosol. The exposure time of the test shall be increased to one hour of intimate contact with the test chemicals. Any tackiness, crazing or apparent loss of transparency shall be cause for rejection. After immersion, a change in percent haze greater than 5, as measured by ASTM D 1003, shall be cause for rejection.

To produce the specified one-half strength solution of Subway Soil Solvent, mix parts 1 and 2 in the following ratio:

Part 1 - One (1) gallon (U.S.) liquid - acid solution as received.

Part 2 - Two (2) lbs. of the crystalline and catalyst mix dissolved in ten (10) gallons of water.

4.6 Impact and Ballistic

The sash and glazing material, as an assembly, shall be tested and meet all applicable impact and ballistic requirements of Appendix A of 49 CFR Part 223.

5.0 Product Approval

5.1 First Article Inspections

The vendor, unless otherwise specified in the bidding and contract documents, is responsible for the performance of all inspection requirements in this Specification. Except as otherwise specified, the vendor must utilize independent commercial laboratory third-party facilities approved by the Engineer. All testing shall be submitted in report form to the Amtrak Contracting Agent a minimum of 10 days prior to the First Article Inspection.

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To verify that the sash and glazing material components being supplied under this Specification meet all Specification and drawing requirements, and is truly interchangeable with existing components, Amtrak will conduct a series of two First Article Inspections (FAI) on the first complete sash assembly of each type manufactured by a vendor, prior to allowing unrestricted manufacturing work to start. It is the intention of the FAI process that every function and feature of the items being supplied under this Specification be fully exercised and tested for proper operation under all normal, abnormal and fault conditions, both in the vendor's workshop and as applied on the vehicle. This shall consist of a pre-shipment inspection and witnessing of the specified final testing of a prototype manufactured assembly performed at the vendor's facility. The vendor shall provide measurement devices as required to perform the tests and inspections. Such inspections shall include, but not be limited to, the following:

a) Dimensional Tolerances: The length and width overall dimensions of individual units as supplied shall be within plus or minus 0.03 inch of the dimension shown on the drawings unless otherwise specified. Glazing material thickness shall be per Section 2.1.

b) Flatness: When an individual pane is placed on a truly flat surface, the material shall not indicate a bow of more than L/100 measured in length and width, in full-size as-manufactured sheet.

c) Edge Work: All edges of the plastic material shall be straight and perpendicular to the face surface and shall be sawed or routed and free of burrs.

d) Optical Quality or Visibility Distortions: Optical quality of the plastic glazing materials shall be in accordance with Test No. 15, Article 5.15.2.2, of ANSI Z26.1. Under the specified procedure, no light and patches, existent over the entire area, shall appear in the shadow of the unmasked area of the specimen before the specimen shall have been moved a distance of at least 14 inches from the screen. Optical quality shall be equivalent to a piece of safety plate glass rated AS-2 per ANSI Z26.1 and shall produce no visible distortion in either horizontal or vertical planes when viewed at an angle of 30 degrees from the plane of the window.

e) Scratches shall be cause for rejections of the material. Fine scratches which are detectable only when viewed in bright back lighting are acceptable to the extent that they do not penetrate completely through the mar-resistant coating.

f) Sash assemblies shall comply with all testing requirements identified in this Specification.

g) Color Verification: Color match shall be verified when compared to Amtrak's master color sample.

Once this initial FAI is successfully completed at the vendor's facility, the vendor shall then ship this assembly to the Amtrak maintenance facility identified by the Engineer, where Amtrak will install the assembly onto an Amtrak vehicle. This second "as-installed" inspection and test FAI shall verify proper fit, water tightness, and operation of emergency windows.

Each FAI shall have Amtrak Engineering and/or Quality Assurance personnel as well as the vendor in attendance. Approval by the Amtrak Bureau of Rolling Stock Engineering following successful completion of the two phases of First Article Inspections, as communicated through the Amtrak Contracting Agent, shall constitute final system approval. No vendor changes shall be made in the configuration of the items being supplied following final approval unless

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approved in writing by the Amtrak Contracting Agent. If desired, the vendor may conduct an informal Hardware Review prior to the first formal FAI at its facility, to review design, manufacturing and test issues.

5.2 Delivery of all CAD Models and Drawings

Following the successful completion of the First Article Inspections, and as a precondition to permit production delivery of material to commence, the vendor must supply to the Amtrak Bureau of Rolling Stock Engineering, via the Amtrak Contracting Agent, an electronic set of every fully-developed CAD model and dimensioned drawing and Bill of Material created for every individual part used for the manufacture of all items being supplied under this Specification. All models and drawings shall comply with Amtrak Specifications 866 and 867. Refer to Section 5.5 for additional details. Any later modifications as a result of warranty or other actions must include the affected models and drawings being revised as necessary and resubmitted to Amtrak.

5.3 Production Changes Require Engineer Approval

Once final system approval is granted by the Engineer and production has commenced, the vendor is forbidden to make any changes in the design, material or configuration of the items being supplied, unless approved in writing by the Amtrak Contracting Agent as per Amtrak Procedure PD 3.7.3.01, Design Review and Control Procedure. This shall include any modifications required as a result of warranty actions, so as to provide complete documentation.

5.4 Failure Analysis

A Failure Analysis to determine the cause and frequency of defects occurring during the warranty shall be performed by the vendor and submitted to the Engineer and the Amtrak Contracting Agent for concurrence. Such analysis shall be performed and reported within 30 days from the date of each failure.

5.5 Drawings and Parts List

Drawings shall be in Engineer-approved formats and shall include a complete set of "as-built" drawings of every part, component and assembly used for all items being supplied to Amtrak. Each drawing shall include a complete Bill of Materials, providing the original component manufacturer name and part number of the actual supplier of the part. Amtrak drawing formats and number series shall be used as agreed upon with the Engineer. The drawing package shall also include drawings of every special tool, jig or fixture required to install, maintain or overhaul the assembly, and if referenced in any of the maintenance manuals. The as-built drawings shall be delivered in electronic format in DXF or other Solidworks 2017 compatible file formats and in Adobe PDF files.

The vendor shall also submit in electronic format to the Amtrak Bureau of Rolling Stock Engineering, via the Amtrak Contracting Agent, a maintenance manual as well as a parts list of all individual parts used in the items being supplied under this Specification, which shall include the actual component manufacturer (OEM) name and part number; use of an intermediate supplier or distributor's name or part number is not acceptable. The parts list shall be sufficiently complete to permit Amtrak to order individual replacement spare parts direct from the actual parts manufacturer. The maintenance manual shall include complete information from

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installation, through troubleshooting and complete overhaul. The vendor shall also supply in electronic formal all operators' manuals and other support documentation it has available for the components being supplied under this Specification. All documentation shall be delivered as PDF files.

6.0 Applicable Documents

The following documents of latest issue shall form part of this Specification:

- American National Standards Institute No. Z26.1, "Safety Code for Glazing Materials for Glazing Motor Vehicles Operating on Land Highways," Item #4, Test #2, #9, #19, #20, and #21
- ASTM D 2565 - Standard Recommended Practice for Xenon Arc-Type (water-cooled) Light and Water Exposure Apparatus for Exposure of Plastics
- ASTM D 1003-61 (Re-approved 1977) - Standard Method of Test for Haze and Luminous Transmittance of Transparent Plastics
- Amtrak Specification 352 - Flammability, Smoke Emission and Toxicity
- FRA Regulations - 49 CFR Parts 223 and 238
- Amtrak Specification 327 - General Vendor Requirements
- Amtrak drawing C-00-2064, Window Sash Retaining Rubber
- Amtrak drawing B-00-2063, Window Sash Frame Rail
- Amtrak drawing 00-8417 Rev. M, Glazing, Double Flat
- ASTM G 26 - Standard Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
- Amtrak drawing 00-8461 Rev. E, Side Privacy window, Viewliner
- Amtrak drawing D-035-00219 Rev. D, Glazing Double Flat, Surfliner
- Amtrak drawing 0059785, Window Gasket Locking Strip Profile
- Amtrak drawing 0059864, Locking Strip Profile. End, Side and Collision Doors
- Amtrak drawing 0060753, Emergency Window Handle Attachment Assembly
- Amtrak drawing 0062489, Emergency Window Gasket
- Amtrak drawing 106-00096-I-NS Rev. E, Pull Glass Decal
- Amtrak drawing 069-0101 Rev. A, Handle Emergency Window Universal

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7.0 Warranty

Warranty shall be provided for a period of 6 years following delivery in accordance with Section 3.1 requirements, as per the terms of the Amtrak Procurement documents. Warranty shall be provided for a 2-year period against water incursion due to seal failure on properly installed units.

8.0 Packaging and Shipment

For all components produced, following all assembly the vendor is required to perform and fully document a complete inspection and evaluation of each component being supplied, prior to shipment to Amtrak. The results of this final inspection shall be recorded in the documentation record.

All packaging and shipping requirements shall be performed by the vendor. It is required that the vendor properly prepare all components being supplied under this Specification for shipment

to Amtrak so that they are ready to install following unpacking. The vendor shall package the components to be suitable for continuous storage prior to unpacking in unheated (subfreezing), dusty indoor storage conditions. Components shall be appropriately packaged for their weight and size, and special efforts must be used to protect components from damage during shipping and handling. Large and bulky items shall be secured to a shipping skid or other commercial shipping media suitable to allow the use of fork lift trucks for handling.

The shipping package shall have an identification label. This label shall include the vendor's name and address, purchase order number, date released for shipment, Amtrak SAP internal catalog number, and any component assembly serial number. This information shall also appear in the vendor's invoice and be included in the documentation record.

The vendor shall retain a copy of the shipping documentation record and shall make three copies for Amtrak. One copy shall be included within the shipping container for the assembly, one copy shall be sent to the Amtrak Contracting Agent (or as otherwise designated in the purchase order), and the third copy shall be sent to the attention of the Amtrak Quality Assurance inspector in care of the Amtrak "ship to" address.

9.0 Source Inspection

9.1 Purpose

Amtrak will perform periodic source inspection of vendor materials and components being supplied. The following is intended to be used as an outline defining activities and responsibilities of the vendor performing the source inspections.

9.2 Professionalism

All inspections, test observations, and other activities performed in the fulfillment of the contract are to be conducted in a professional and ethical manner. The vendor is representing Amtrak in the performance of the contract and therefore must remain courteous, conscientious and professional under all circumstances arising from performance of the contract.

9.3 Scope of Work

Amtrak has implemented a multi-faceted supplier management program of which source inspection is an integral part. Amtrak identifies vendors and materials/components through various methods which will be subject to source inspection. By performing source inspections, Amtrak expects to benefit by use of vendor facilities, measuring and testing equipment to verify materials/components, through rejecting noncompliant materials/components before shipment and receipt by Amtrak, presence of Amtrak representative periodically to ensure continuing good performance, and assist to communicate Amtrak intentions and interpretations of specifications and resolve issues. The vendor will conduct inspection or verify through observation, product compliance with drawings, specifications, standards or Amtrak contract documents and report findings of said inspections to Amtrak.

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9.4 Services

9.4.1 Scheduling Inspections

The vendor shall conduct observations and verifications on Amtrak identified materials and components produced by the vendors for Amtrak. Inspections must be scheduled to coincide with final inspection of said materials/components due for shipment to Amtrak. The vendor may use random sampling where large quantities of material are subject to shipment and note sampling method in associated reports. The vendor must perform all dimensional and operational inspections in accordance with the Quality Plan prior to source inspection and make all inspection records available for review by the Amtrak source inspector, with focus on CTQ items.

9.4.2 Dimensional Inspection

The vendor must witness and verify conformance with dimensional characteristics per drawings identified in the Amtrak contract documents. The vendor must witness and verify conformance with regulatory standards and requirements including material certification as cited in specification or other reference documents identified in Amtrak contract documents.

9.4.3 Operational Inspection

The vendor must witness and verify conformance with operational tests as cited in specifications, operator's manual or other reference documents identified in Amtrak contract documents.

9.4.4 Inspection Reports

The vendor must provide a report documenting the vendor source inspection and the inspection results. The report must include the name of the vendor, the date of the inspection, the material or component name, Amtrak (SAP) ID number(s) for items inspected, the quantities of each item inspected, the inspection results, and the actions taken where nonconforming materials/components are found. Reports should reference appropriate drawings, specifications, standards, requirements, or Amtrak contract document as appropriate.

9.5 Qualification of Personnel

It is the responsibility of the vendor to provide personnel with adequate training and experience to perform all the activities of the source inspections described above. Personnel must also conduct their activities with professionalism.

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Amtrak
Mechanical Department
Bureau of Rolling Stock Engineering

SPECIFICATION

for

Sleeper Seats
For Use on Amtrak Sleepers

SPECIFICATION No. 345

Revision A

Initial Issue: 02/27/1990

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Approved Date

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12/28/09 Deputy Chief Mechanical Officer
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ABSTRACT

This document identifies requirements for seat pairs which convert into lower sleeping berths in sleeper car rooms used on Amtrak Superliner bi-level and Viewliner single level cars. Facing single seats and double sofa seats are included.

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SPECIFICATION NO. 345 CHANGE SHEET

REVISION	DATE	PAGE	DESCRIPTION
A	11/11/09		General revisions and updates
		5-6	Revised 2.2 and 4.1.3 to include width differences between Superliner and Viewliner

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1.0 SCOPE

1.1 Purpose

This specification defines the design, performance, and acceptance criteria for convertible seating used in various sleeping rooms of passenger rail equipment. The seats provide reclining passenger seating during waking time and convert into a lower berth for sleeping.

The seats shall be ergonomically designed to provide maximum passenger comfort, safety, and convenience with ease of operation, maximum reliability and ease of maintenance as primary considerations.

1.2 Vendor Responsibilities

This specification is subordinate to Specification # 327 "General Vendor Responsibilities" and Specification # 340 "Car Interiors General Requirements." Vendor shall comply with all provisions therein. For Viewliner-2, instead of # 327 and 340, this specification is subordinate to Amtrak Specification 769 and the Vendor is responsible to adhere to the requirements of Specification 769B as it relates to Upper Berth Assemblies.

2.0 GENERAL

2.1 Safety Standards

The seats shall comply with 49CFR238. The seats shall be absolutely free of sharp edges, protrusions, or any element that would potentially cause injuries to passengers, crews or maintenance personnel.

2.2 Features and Dimensions

Passenger comfort, safety, enduring appearance, rugged construction, ease of installation, maintenance, and parts interchangeability shall be basic considerations.

There shall be three basic seat applications:

(1) In the Superliner "Double Roomette", the configuration shall consist of two identical seat assemblies facing each other. Both shall be easily converted by the passenger or crew from the two seat configuration into a single berth with each seat forming half of the berth.

(2) In the Viewliner "Double Roomette", the configuration shall consist of two seat assemblies of different width facing each other. The seat adjacent to the toilet and sink (sink only on Viewliner II) will be narrower while the opposite seat will be the same as those used on Superliners and Viewliner II. Both shall be easily converted by the passenger or crew from the two seat configuration into a single berth with each seat forming half of the berth.

(3) The Bedrooms and Accessible Bedroom sleeper seat shall consist of two identical seat

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assemblies mounted side by side which form a sofa-like seat. The seats shall recline independently with each seat forming half of the lower berth

3.0 DESIGN CONSIDERATIONS

3.1 Design Objectives

The supplier shall furnish two sleeper seat configurations: (1) "Double Roomette" seat assembly, and (2) a "Bedroom" or "Accessible Bedroom" seat assembly, each as generally defined in paragraph 2.2.

It is the supplier's responsibility to standardize hardware and tooling to maximize parts interchangeability between the seat designs. The "Deluxe Bedroom" seat assembly and seat cushions, excluding the headrest shall, by "form, fit and function", be interchangeable with the Amtrak Superliner car counterpart. The "Double Roomette" seat assemblies and cushions where applicable shall interchangeable, for use in the Viewliner I, Superliner I and II cars.

Design and manufacture of the sleeper seat and its securement to the carbody shall ensure they survive 8/4/4g loading without breaking free from carbody.

Except for cushions, seat and mechanisms and components shall be designed to withstand normal passenger use-period of thirty (30) years.

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4.0 SUBSYSTEMS

4.1 Seat Frame

The sleeper frame assembly shall be a steel construction. All exposed metal parts, not subject to wear, shall be primed and painted with DuPont Corlar epoxy. All exposed metal parts, subject to wear, shall be stainless steel with a 180 grit brush finish. The seat frame shall have a wall bracket from carbody structure and a pedestal on free end.

All operating mechanisms shall be integrally designed as part of the frame assembly. Wear components and surfaces shall be renewable.

4.1.1 Deluxe and Accessible Bedroom Seat

The Bedrooms and Accessible Bedroom sleeper seat shall consist of two identical seat assemblies mounted side by side which form a sofa-like seat. The seats shall recline independently with each seat forming half of the lower berth. Each seat frame shall allow for passenger baggage under the seat in any position. Headrests shall be a separate unit securely mounted on the room partition while giving the appearance of being integral part of the seat.

4.1.2 Double Roomette "Twin Seat" Arrangement

Roomette sleeper seats for Viewliners shall consist of two seat assemblies of unequal width mounted facing each other. Roomette sleeper seats for Superliners shall consist of two seat assemblies of equal width mounted facing each other The seats shall recline independently with each seat forming half of the full length lower berth. Each seat frame shall allow for passenger baggage under the seat in any position. Headrests shall be a separate unit securely mounted on the room partition while giving the appearance of being integral part of the seat.

4.1.3 Recline

Each seat shall include a variable mechanical recline mechanism. The seat bottom shall slide forward and the seat back shall thereby be reclined to a maximum of 25 degrees. The recline control shall be located at the front edge of, and under, the seat bottom cushion to be easily operable by a seated passenger. The seat/ berth latch mechanism shall automatically and definitively latch the seat/ berth in the selected position. The design shall ensure that the mechanism requires no adjustments for at least 5 years.

4.1.4 Bed Mode

A passenger operated mechanism shall allow converting the seat from sitting to bed mode. This control shall be separate and distinct from the recline control. The bed mode control shall be located at the front edge of and under the seat bottom cushion, on the inboard side of the seat and shall be easily operated by the passenger's hand or foot pressure. To aid in the berth-to-seat transition, the seat back shall automatically rise at least 12" from the berth position when the release control is activated. (You do not need to pull up the seat back to convert the berth back into a seat.) A method of grabbing the seat back frame to aid in raising the back during this conversion shall be available in case the back resists rising.

4.1.5 Storage Provisions

Each seat frame shall allow for passenger storage under the seat, with unrestricted under-seat clearance of min 9-1/2" over entire open area beneath seat, regardless of seat/ berth position. The space provided shall permit easy storage and removal as a minimum, of a 22.00 inch x 26.00 inch x 9.50 inch piece of luggage, in any recline position. No protrusion, sharp edges, or any element that may damage the luggage will be permitted.

4.2 Headrests

The headrests shall be a separate unit securely mounted on the room partition while giving the appearance of being integral with the seat. The headrest foam and cover shall be per paragraph 4.3.

4.3 Cushions

The seat cushions (bottoms and backs) are to be flexible cellular foam meeting the criterion of Amtrak Specifications #665 The covers for both cushions shall be wool nylon fabric. Both cushion covers for each seat shall be one piece.

Cushion covers shall be pullover type with zipper or hook & loop type closures and shall be capable of

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replacement in ten (10) minutes for each seat (back and bottom) by one person.

The seat back and bottom cushions shall be held in proper position utilizing hook & loop strips and retained by positive fastening devices, not visible to the passenger, to prevent cushion slippage or unauthorized removal. Seat cushion assemblies are to be supplied by the seat manufacturer complete. Change out time for upper and lower cushion to sleeper seat shall not exceed 2 minutes, including removal of original back and bottom and installation and complete securement of replacement back and bottom. FAI will include demonstration of time of both operations.

4.4 Seat Mounting System

The seat structure shall be designed for mounting with a floor pedestal and sidewall bracket for direct bolt down installation. Miscellaneous sidewall mounting bracket and floor pedestal hardware shall be furnished by the seat manufacturer. Structural requirements for seat, cushions and the attachment to the carbody shall be designed to withstand peak accelerations of 8g longitudinally (along the train principal axis), 4g laterally and 4g vertically.

5.0 TESTING

Seats shall be tested as appropriate to APTA SS- C&S-016-99.
The following tests shall be conducted with no fracture or failure of any seating system component and no permanent deformation which could affect the operation of the seats. A stress analysis shall be made available to Amtrak at the same time that prototype seats are available for inspection

5.1 Backrest Test

5.1.1 Dynamic Test

Swing a 200 pound, 11 inch diameter steel ball from a 96 inch arm oriented so as to impact the centerline of the backrest at a point 2 inches below the top of seat back structure on the cushioned side of the seat. The pivot of the arm will be located at a point 96 inches above and in vertical alignment with the impact point. The horizontal distance of the swing shall be 18 inches. This test shall be conducted on the seat while the unit is attached to a test fixture simulating a carbody installation. This test shall also be performed impacting the back of the seat using the same impact point.

5.1.2 Pull Test

A pull of 300 pounds force shall be applied at the center top of backrest in both directions, fore and aft. This test shall be conducted on the seat units while seat units are attached to the test fixture.

5.2 Bottom Cushion Tests

A 300 pound weight shall be placed on the geometric center of each bottom cushion and left in place for a minimum of 24 hours. The cushion shall return completely to original shape upon removal of weight.

When cushions are in the bed mode, there shall be no more than a .25 inch deflection at the interface of

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the seat bottoms when a 200 pound weight is placed on the center of the bed.

5.3 Floor and Sidewall Attachment Test

The seats and their attachments, when installed in [various arrangements] shall be capable of withstanding a horizontal impact of 185 pound load possessing 1,700 foot lbs. of kinetic energy. The seat shall be occupied by as many 185 pound weights as the passenger capacity of the particular seat is designed for. The point of impact shall be on the seat base, 6 inches inboard of the edge of the seat furthest from the sidewall attachment. This test shall be repeated with only one 185 pound weight located in the seat furthest from the sidewall attachment. There shall be no failure of the seat or its attachments. Seat belts and FAA type body blocks shall be used in these tests.

This test shall also be performed by subjecting the seat and its attachments to a 4g vertical acceleration with the seat loaded in the above-mentioned manner.

5.4 Seat Mechanism Tests

The seat mechanisms for recline and for conversion of seats into bed mode shall be tested to simulate five (5) years of operation in a railroad environment. These tests shall include, but not be limited to, a minimum of 20,000 cycles for the recline mechanism and 5,000 cycles for the bed mode conversion mechanism.

5.5 Seat Frame Test

The seat frames shall be capable of withstanding a force equivalent to that produced by dropping a fully assembled unit, i.e., frame with shell and cushions attached, from a height of 24 inches as measured vertically from the bottom of the pedestal with seat rotated to an angle of 20 degrees from horizontal, to the floor. The point of impact shall be the seat pedestal. No fracture, yielding of material, or any failure of the seat frame or pedestal shall result from the test.

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6.0 SYSTEM APPROVAL

6.1 General

The complete sleeper seat system shall be subject to Amtrak approval. All major components shall be submitted for Amtrak approval.

6.2 Design Reviews

At least three design reviews shall be held at times mutually agreed upon between Amtrak and the manufacturer; such reviews are intended to convey design concepts not readily shown on drawings.

6.3 Documentation

For approval, the manufacturer shall submit, as a minimum, the following drawings and documents:

6.3.1 Component (Assembly) Drawings

6.3.2 Mounting Interface Drawings

6.3.3 Qualification Test Plan (one time)

6.3.4 Acceptance Test Plan (Quality Control - all units)

Amtrak reserves the right to request additional drawings and documents as required for system approval.

6.3.5 Stress Analysis

6.4 First Article Inspection

Prior to the delivery of the first production assembly, a production assembly shall be subjected to a first article inspection. Such inspection shall include, but not be limited to:

6.4.1 A mechanical inspection to determine compliance with the specification and the approved drawings.

6.4.2 Demonstration of cushion change-out time, both to/from seat and removing/ installing foam in cushion.

6.4.3 The performance of an Acceptance Test.

6.4.4 The performance of the Qualification Test. Successful completion of the first article inspection shall constitute final system approval.

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7.0 PRODUCT SUPPORT

7.1 Drawings

All assembly, subassembly, and arrangement drawings shall include a complete bill of material and parts list on the field of the drawing describing all items, including vendor's parts and material description, which form a part of the assembly. Amtrak shall reserve the right to review and approve all drawings prior to construction.

AMTRAK shall be supplied, upon completion of the system design, with one set of printed drawings and electronic files in accordance with section 3.5 of Amtrak Specification 769B.

7.2 Operating Instructions, Maintenance and Parts Manuals

The equipment manufacturer shall provide manual data in accordance with Amtrak Specification #353.

8.0 APPLICABLE DOCUMENTS

Spec. No. 352 - Flammability, Smoke Emission and Toxicity
Spec. No. 328 - Material and Workmanship (For Viewliner II components see Spec 769B, Chapter 16)
Spec. No. 353 - Suppliers Manual Data
Spec. No. 665- - Seat Cushion Foam
Spec No. 769 Figures 8-18, 8-19 - Double Roomette Arrangement
Spec No. 769 Figures 8-13 - Bedroom Arrangement

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Amtrak
Mechanical Department
Bureau of Rolling Stock Engineering

SPECIFICATION

for

Booth Seating
For Use On
Amtrak Passenger Cars

SPECIFICATION No. 347

Revision A

Initial Issue: 02/22/1990

Revision Issue Date: 11/19/2009

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Approved	Date	
	1/4/10	Chief Mechanical Officer
	12/28/09	Deputy Chief Mechanical Officer Engineering
	12/21/09	Senior Director - Rolling Stock Engineering
	11-24-09	Director Industrial Design
	11-23-09	Originator

Originator: Doug Karan

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ABSTRACT

This document identifies requirements for two and four person booth seat units for food service cars for Amtrak. This document defines both single sided (two-person) and double sided (four-person) fiberglass booth units with hardware to accommodate application to Amfeet I & II, Superliner I & II, Horizon Cars and Viewliner Single Level cars.

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SPECIFICATION NO. 347 CHANGE SHEET

REVISION	DATE	PAGE	DESCRIPTION
REV A	11/18/09		General revisions and updates

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1.0 SCOPE

1.1 Purpose

This specification defines the design, performance, and acceptance criteria for two and four person booth seat for dining and lounge booth seating used on passenger rail equipment. Both single sided (two-person) and double sided (four-person) are included as well as hardware to accommodate application to Amfeet I & II, Superliner I & II, Horizon Cars and Viewliner Single Level cars.

The seats shall be ergonomically designed to provide maximum passenger comfort, safety, and convenience. The seats shall be designed as a component system with the versatility of being installed in a variety of interior arrangements. The seat assembly, including options, shall be designed for maximum reliability and ease of maintenance as primary considerations.

1.2 Vendor Responsibilities

This specification is subordinate to Amtrak Specification 769 . The Vendor is responsible to adhere to the requirements of Specification 769 as it relates to Upper Berth Assemblies.

2.0 GENERAL

2.1 Safety Standards

2.1.1 Mechanical Safety

The seats shall comply with 49CFR 238. The seats shall be absolutely free of sharp edges, protrusions, or any element that would potentially cause injuries to passengers, crews, or maintenance personnel.

2.1.2 Sanitation

The seats shall be designed to prohibit harborage or rodents. The seat shall be designed for easy cleaning with all inside corners configured for easy wiping. The seat base shall not have any perforation or penetrations that might allow spilled liquids to flow into the underside of the seat structure.

2.1.2 Fire Safety

In addition to the requirements of Amtrak Specification 352 All materials used in the booth seat construction, except for materials used in small parts (such as knobs, rollers, fasteners, clips, grommets, and small electrical parts) that would not contribute significantly to fire propagation or to smoke or toxic gas generation, shall be tested for toxicity using Boeing Specification Support Standard BSS-7239. Materials shall meet the following maximum toxic gas release limits (ppm) as determined per BSS-7239.

Carbon Monoxide (CO)	3500 ppm
Hydrogen Fluoride (HF)	200 ppm
Nitrogen Dioxide (NO_2)	100 ppm
Hydrogen Chloride (HCL)	500 ppm
Hydrogen Cyanide (HCN)	150 ppm
Sulfur Dioxide (SO_2)	100 ppm

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The tests shall be run in the flaming mode after 240 seconds using the NBS Smoke Density Chamber for sample combustion. The gas sampling may be conducted during the smoke density test. The test report shall indicate the maximum concentration (ppm) for each of the above gases at the specified sampling time.

2.2 Features and Dimensions

Passenger comfort, safety, enduring appearance, rugged construction, ease of installation, maintenance, and parts interchangeability shall be basic considerations. In addition, seating bases shall not inhibit access to the floor heat grilles, which shall be removable without disturbing the seating

The booth seat assemblies shall be of high quality design and manufacture. A properly installed seat shall not produce rattles, vibration, or independent motion apart from the carbody when operated in new or existing passenger rail cars under the most severe track conditions.

3.0 DESIGN CONSIDERATIONS

3.1 Design Objective

Booth seat assemblies by design shall be interchangeable, via mounting bracket replacements, with all Amtrak carbody configurations. The seat assembly and subassemblies shall by function, form and fit be completely interchangeable as furnished with existing Amtrak equipment.

Design and manufacture of the seat, cushions and its securement to the carbody shall ensure they survive 8/4/4g loading without breaking free from carbody.

Except for cushions, the seat shall be designed to withstand normal passenger use-period of thirty (30) years.

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4.0 SUBSYSTEMS

4.1 Single Seat Shell (Two Passenger)

The single seat shell shall be a fiberglass construction with a high gloss gel coat finish. The booth shell primary structure shall be constructed of steel or FRP. The exposed fiberglass shall have either a laminate or high-gloss gel finish. The primary structure shall be clad with panels of upholstered or laminated surfaces. The seat back shall be completely finished. A separate fiberglass or formed metal cap shall be employed to hide the cushion mounting fasteners and provide a visually appealing finish to the top of the seat back. A combination of mechanical fasteners and Velcro shall be utilized to retain cushions firmly in position.

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4.2 Double Seat Shell (Four Passenger)

The double seat shell shall be a fiberglass construction with a high gloss gel coat finish. The booth shell primary structure shall be constructed of steel or FRP. The exposed fiberglass shall have either a laminate or high-gloss gel finish. The primary structure shall be clad with panels of upholstered or laminated surfaces. A separate fiberglass cap shall be employed to hide the cushion mounting fasteners and provide a visually appealing finish to the top of the seat back. The shell seat and backrest areas shall be designed to employ stretched Dymatrol fabric as the cushion support. A combination of mechanical fasteners and Velcro shall be utilized to retain cushions firmly in position. Double seat shells shall have provisions for underseat storage.

4.3 Cushions

Seat cushions and backs shall be upholstered in vinyl, woven fabric or leather; and be constructed in accordance with Amtrak Specification # 665. The seat bottom cushion shall be secured to the booth frame with a U-channel in the back and using a heavy-duty hook and loop arrangement in the front. Likewise, the seat back shall be secured to the booth frame with a U-channel on the top and using a heavy-duty hook and loop arrangement at the bottom. The seat back cushion shall be mounted flush to the seat bottom cushion without a gap to ensure a secure attachment and ease of cleaning. Cushions shall be attached to the primary seat structure so that they retain their proper shape and are easily removable for repair, cleaning or replacement. Cushion assemblies shall be attached so that they will not detach in an accident whether empty or fully loaded

Seats shall be designed so that at overhaul, all cushions and decorative treatments can be renewed without removing the seat from the car.

Removal of a back and bottom cushion and their installation with a replacement shall be possible in less than two minutes total for the process, including engagement of all attachments. A demonstration of this for each unique booth configuration shall be included in the booth FAI.

Cushion covers shall be pullover type with zipper or hook & loop type closures and shall be capable of replacement in ten (10) minutes for each seat by one person. A demonstration of this for each unique booth configuration shall be included in the booth FAI.

Final color and material for the seat shall be made in accordance with Amtrak Specification 769.

4.4 Seat Mounting System

The seat structure shall be designed for mounting with a floor pedestal and sidewall bracket for direct bolt-down installation or attachment to seat tracks, whichever is appropriate for the car type. Access to mounting hardware shall be from inside seat base frame. Sidewall mounting bracket and floor pedestal fittings shall be furnished by the seat manufacturer.

Each aisle pedestal shall be furnished with cut-outs drilled for future application of aisle lighting. Attractive

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cover plates matching the pedestal shall be furnished attached to the pedestal covering the cut-out and mounting holes. Fasteners shall be captive stainless steel machine screws, mating with weld-nuts or tapping plates on pedestal.

5.0 TESTING

Seats shall be tested as appropriate to APTA SS- C&S-016-99.

The following tests shall be conducted with no fracture or failure of any seating system component and no permanent deformation which could affect the operation of the seats when installed in any of the planned seating arrangements. A stress analysis and test report shall be made available to Amtrak at the same time that prototype seats are available for inspection.

5.1 Backrest Test

5.1.1 Dynamic Test

Swing a 200 pound, 11 inch diameter steel ball from a 96 inch arm oriented so as to impact the centerline of the backrest at a point 2 inches below the top f seatback structure on the cushioned side of the seat. The pivot of the arm will be located at a point 96 inches above and in vertical alignment with the impact point. The horizontal distance of the swing shall be 18 inches. This test shall be conducted on the seat while the unit is attached to a structural mounting base simulating a carbody installation. This test shall also be performed impacting the back of the seat using the same impact point.

5.1.2 Pull Test

A pull of 300 pounds force shall be applied at the center top of backrest in both directions, fore and aft. This test shall be conducted on the seat units while seat units are attached to a structural base mounting.

5.2 Bottom Cushion Tests

A 300 pound weight shall be placed on the geometric center of each bottom cushion and left in place for a minimum of 24 hours in place. The cushion shall return completely to original shape upon removal of weight.

5.3 Floor and Sidewall Attachment Test

The seats and their attachments, when installed in (various arrangements) shall be capable of withstanding a horizontal impact of 185 pound (84 kg) load possessing 1,700 foot lbs. The seat shall be occupied by as many 185 pound (84 kg) weights as the passenger capacity of the particular seat is designed for. The point of impact shall be on the seat base, 6 inches (152 (mm) inboard of the edge of the seat furthest from the sidewall attachment. This test shall be repeated with only one 185 pound (84 kg) weight located in the seat furthest from the sidewall attachment. There shall be no failure of the seat or its attachments. Seat belts and FAA type body blocks shall be used in these tests.

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This test shall also be performed by subjecting the seat and its attachments to a 4G vertical acceleration with the seat loaded in the above-mentioned manner.

5.4 Seat Frame Test

The seat frames shall be capable of withstanding a force equivalent to that produced by dropping a fully assembled unit, i.e., frame with shell and cushions attached, from a height of 24 inches as measured vertically from the bottom of the pedestal with seat rotated to an angle of 20 degrees from horizontal, to the floor. The point of impact shall be the seat pedestal. No fracture, yielding of material, or any failure of the seat frame or pedestal shall result from the test.

6.0 SYSTEM APPROVAL

6.1 General

The complete booth seat system shall be subject to Amtrak approval. All major components shall be submitted for Amtrak approval.

6.2 Design Reviews

At least three design reviews shall be held at times mutually agreed upon between Amtrak and the manufacturer; such reviews are intended to convey design concepts not readily shown on drawings.

6.3 Documentation

For approval, the manufacturer shall submit, as a minimum, the following drawings and documents:

6.3.1 Component (Assembly) Drawings

6.3.2 Mounting Interface Drawings

6.3.3 Qualification Test Plan (one time)

6.3.4 Acceptance Test Plan (all units)

Amtrak reserves the right to request additional drawings and documents as required for system approval.

6.3.5 Stress Analysis

6.3.6 Test Report

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6.4 First Article Inspection

Prior to the delivery of the first production assembly, a production assembly shall be subjected to a first article inspection. Such inspection shall include, but not be limited to:

6.4.1 A mechanical inspection to determine compliance with the specification and the approved drawings.

6.4.2 Demonstration of cushion change-out time, both to/ from seat and removing/ installing foam in cushion

6.4.3 The performance of an Acceptance Test.

6.4.4 The performance of the Qualification Test. Successful completion of the first article inspection shall constitute final system approval.

7.0 PRODUCT SUPPORT

7.1 Drawings

All assembly, subassembly, and arrangement drawings shall include a complete bill of material and parts list on the field of the drawing describing all items, including vendor's parts and material description, which form a part of the assembly. Amtrak shall reserve the right to review and approve all drawings prior to construction of a prototype system.

AMTRAK shall be supplied, upon completion of the system design, with one set of printed drawings and electronic files in accordance with section 3.5 of Amtrak Specification 769

7.2 Operating Instructions, Maintenance and Parts Manuals

The equipment manufacturer shall provide manual data in accordance with Amtrak Specification #353.

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8.0 APPLICABLE DOCUMENTS

Specification No. 352 - Flammability and Smoke Emission
Spec. No. 353 - Suppliers Manual Data
Spec. No. 328 - Material and Workmanship (For Viewliner II components see Spec 769, Chapter 16)
Specification No. 665- Seat Cushion Assemblies
APTA SS-C&S-016-99 Standards for Seating in Commuter Rail Cars

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Amtrak

SPECIFICATION

FOR

VENDOR

MAINTENANCE

MANUALS

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DOCUMENT NUMBER: 353

ORIGINAL ISSUE DATE: MARCH 5, 1990

REVISION: A; REV. DATE: 4/24/03

ABSTRACT:
This document defines vendor responsibility and requirements to provide product maintenance/ part manuals to Amtrak or a car builder. It describes the content, timing of deliverables as well as the review and approval process. This is a companion document to #354 "Builder Operating & Maintenance Manual Family".

KEY WORDS:
Maintenance manual, part manual

PREPARED BY: R. F. Bruss **DATE:** 3/5/1990

APPROVED BY: C. J. Engelhardt **DATE:** 3/6/1990

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REVISION HISTORY

Revision	Description of Change	Date	Approved
A	Rewritten	4/24/03	R.F. Bruss

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Appendix A: Amtrak Electronic Parts and Service Catalog Specification

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1. SCOPE

1.1 Purpose

This document defines vendor responsibility and requirements to provide product maintenance/ part manuals to Amtrak or a car builder. It describes the content and timing of deliverables as well as the review and approval process. This is done in an effort to provide a timely delivery of complete and accurate manuals.

The manuals described here may be provided directly to Amtrak as self-contained books for equipment purchased by Amtrak, or they may be provided to a builder for his insertion into the Vehicle Maintenance Manual family. The companion document #354 "Builder Operating & Maintenance Manual Family" describes the latter situation.

1.2 Function

The maintenance/ part manuals will provide Amtrak with the information necessary to properly operate and provide all maintenance functions for the given system or equipment.

2. REFERENCES

All references listed below shall be the latest revision.

Amtrak Specifications:
354 Builder Operator and Maintenance Manual Family

3. DEFINITIONS

Builder
The prime contractor solely responsible to Amtrak for the construction, quality and proper functioning of the complete car and its components.

Supplier or Vendor
The provider to Amtrak or a Builder of any services or material for incorporation into the vehicle design, construction, spare parts, manuals or other contract deliverables.

4. GENERAL REQUIREMENTS

4.1 Vendor Approval

Subcontractors used to develop the manuals described in this specification shall be subject to Amtrak approval. The supplier shall provide sample work of the proposed subcontractor for Amtrak review in advance of approval.

4.2 Considerations and Content

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4.2.1 Considerations

The manual shall be written with the following as primary considerations:

- Safety
- Clarity
- Conformance to Amtrak Operating and Maintenance practices
- Content written in a system consistent with user, i.e., suitable technical level

The subject material shall be prepared and presented in such a manner as to encourage the use of the Manuals.

Where applicable, the manuals shall highlight the precautions to be taken by operating, service, maintenance personnel to ensure safety while performing the procedures described in these manuals.

4.2.2 Content

The Manual(s) shall include all systems and components requiring maintenance or servicing. Manual(s) shall be supplied that contain information required for effectively understanding operation of the system or equipment as well as performing scheduled maintenance including general servicing, lubrication and inspections, system/ equipment testing, troubleshooting and adjustments, and repair/replacement. These needs include information to safely and properly conduct:

- Operation
- Service and inspection
- Trouble shooting
- Running maintenance (performed with the vehicle “in line” or in a shop; typically only about a day duration)
- Heavy repair/ overhaul (system/ component level) (performed at car heavy repair facility or in a component overhaul shop, on or off site)
- Part identification
- Wreck repairs: some equipment only, such as trucks (welding procedures, structural methods, such as Huck bolting, etc.)

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The entire manual is to be held to the same level of quality- whether written by the vendor or by a component supplier. No matter who is the technical provider, the supplier shall be responsible for delivering a complete and quality product.

Amtrak will not accept “The component supplier did not provide that information.” or “The supplier manual did not cover that.” as excuses for inadequate manual content.

Supplier manuals shall be provided electronically in an Amtrak approved language. The manuals will be used electronically in Amtrak’s Work Management System; the builder shall work with Amtrak to ensure successful implementation of this.

The part portion of the manual shall be provided to Amtrak in LinkOne format, in accordance with Appendix A, in addition to the hard-copy and electronic format forms.

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All components/ systems must be defined to the lowest repairable level, which includes all parts bought by the system supplier.

Electronic Equipment
Unless contractually specified otherwise by Amtrak, the supplier shall provide maintenance information to allow Amtrak to repair Printed Circuit Boards in-house. This includes for each PC board:

- PCB component layout
- part list
- PCB schematic
- PCB foil layout
- software

4.3 Audience

Manuals will be used by the following personnel:

Maintenance Department

- Reference for daily Service & Inspection
- Reference for daily maintenance work and repairs
- Reference for performing heavy repair/ overhaul
- To initiate procedures for the implementation of planned preventative maintenance, service routines, car record keeping procedures, scheduled overhauls, and scheduled heavy overhauls.
- Reference for creating standard maintenance procedures.

Equipment Engineering

- To assist in the day to day analysis of field problems and course of action for equipment service and repair.
- As Reference for future equipment design and specifications.

Technical Training

- Teaching aid for new employees, and to introduce new equipment to existing maintenance staff
- As information in refresher courses for maintenance staff.

Quality Control

- As reference and background to determine adequacy of repair and maintenance work

Material Control and Purchasing

- To identify parts required for maintenance inventory.

Supplier Field Service

- For reference in performing field assistance.

4.4 Manual Development Plan

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4.4.1 Manual Plan

In an effort to clearly understand the expectations for the manual right from the beginning, the supplier shall provide a Manual Plan and Schedule for Amtrak approval. The manual plan shall be submitted to Amtrak for review and approval within 90 days of Notice to Proceed and revised within 30 days of any change in the plan.

4.4.2 Manual Development

To ensure that manual is being developed concurrently with the equipment, the Supplier shall provide the following deliverables:

- breakdown of the chapter organization
- organization of the chapter: introduction, system description, controls, etc
- detailed table of contents, showing divisions and subdivisions of each chapter

4.5 Manual Availability

The Supplier shall develop the manual for review by Amtrak during the time between preliminary and final design reviews of the system design.

A draft version of the manual shall be drafted and submitted to Amtrak for comment and/or approval thirty (30) days following the final design review for the respective system(s).

Since an approved manual is required in advance of putting the first system in service, it is essential that the draft version of this document be provided in a timely fashion. This will allow appropriate Amtrak review as well as time for the Supplier to address any deficiencies noted.

The status of the manual shall be updated monthly and presented as an attachment to the program meeting minutes.

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4.6 Document Progression

The Supplier manuals shall be written jointly by the supplier engineering and technical writing departments. They shall be thoroughly reviewed to ensure compliance with the requirements of this as well as the system specifications and shall then be submitted to Amtrak for approval.

It is the supplier's responsibility to integrate his and the subcontractor information to ensure every device and all functions of all equipment are adequately described.

Discussion of the manual approach and content with Amtrak Equipment Engineering during development is encouraged to expedite the approval process.

For manuals provided directly to Amtrak, the supplier shall develop the manual and then employ the following review process:

1. tech writer develops the manual
2. supplier engineer responsible for that equipment reviews the manual, whether written internally or by someone else, indicating necessary revisions to tech writer
3. tech writer corrects document accordingly, returns to engineer
4. engineer reviews and approves draft-level document
5. manual submitted to Amtrak for review

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6. Amtrak reviews and provides comments to supplier
7. supplier engineer reviews Amtrak comments, forwarding necessary guidance info to tech writer
8. process repeats within supplier organization.

The process for supplier manuals provided to a builder is described in Amtrak specification #354, section 4.6.

4.7 Approval Process

Manuals, including both those provided directly to Amtrak as well as those to the Builder by suppliers, shall be submitted for Amtrak approval. If deficiencies are identified, the manuals shall be revised and resubmitted for approval. If, in Amtrak's sole judgment, the manual is still deficient, the revision and resubmittal processes shall be repeated until the requirements are met. Primary points of evaluation include, but are not limited to:

- Safety
- Completeness of subject
- Inclusion of all equipment
- Conformance to standard organization Outline
- Compatibility with Amtrak shops and standard practices
- Suitability for the end user

Normally, the process has three iterations between the supplier or builder and Amtrak: draft, preliminary and final. However, should a manual be missing sections, those sections are still subject to the 3 pass process. **Amtrak will not accept as final any manual that contains new sections of material.** Each submittal shall include a sign-off sheet, including the name of the author, the name of the engineer responsible for the review and review date.

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Submittals:

Draft Submittal

This is the first iteration from the supplier to the customer. It is expected to be > 60% complete.

Preliminary Submittal

This is the second iteration from the supplier and is expected to be >95% compete.

Final Submittal

This is the final iteration from the supplier and is expected to be >99% complete. As noted above, a manual submitted with new sections at this time is **NOT** defined as "final". Should the document not yet be sufficient, or be otherwise inadequate, **as determined solely by Amtrak**, additional iterations will be required before the contractual requirements are met.

Approval of the draft maintenance manual is a prerequisite for product First Article Inspection approval.

4.8 Revision Process

Should any changes to the system, its components or maintenance requirements occur during the

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warranty period, manual updates shall be provided by the supplier to update/ revise the manual accordingly.

4.9 Product Support
The supplier shall provide Amtrak in a timely manner with corrections and updates to the maintenance manual as required to keep the manual current with equipment. Service bulletins shall also be provided as may be required by Amtrak.

5. DESIGN DETAILS

5.1 Section Numbering System
For manuals supplied directly to Amtrak, manual content shall conform in principle to Figure 1. Some minor adjustments to the outline may be required to customize the manual content to the particular equipment; such proposed changes require Amtrak approval.

Manuals provided to the builder for inclusion into vehicle-level manual may require different manual organization, though the content requirement is similar. Refer to Amtrak specification #354, sections 6 & 7 for those requirements.

5.2 Page Numbering System, Headers & Footers
Paragraph numbering
Paragraphs are numbered with the chapter as the first digit(s), followed by the section and subsection: "5.3.1"

Figures and tables
These are numbered with the chapter as the first digit(s), with the items then numbered sequentially.

Page numbering
Pages are numbered with the chapter as the first digit(s), then a dash followed by the page number of the chapter:
"6 – 3"

Each page of the manual will be numbered. Blank pages shall be so indicated either through the use of the work "blank", or by double numbering the preceding page, such as for foldouts.

Headers
A header will be used on the top of each page, including:
"Amtrak"
Equipment name, such as "Amfleet" (if manual for use by carbuilder) or "battery charger" (if vendor manual)
Chapter #, Chapter name

Footers
A footer will be used on the bottom of each page, including:
Manual type, such as "Running Maintenance" (if more than one type is supplied)

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Revision letter and date
Page number as above

Revision indication
When a page is revised, the changed section text shall be identified in the margin, along with the revision letter associated with it, such as "B". Only the changes from the latest revision will be identified.

5.3 Configuration: 8-1/2 x 11" Pamphlet

Smaller manuals may take the form of a pamphlet, as follows:

Cover
The cover shall be cardboard or plastic. It will be labeled with the following information at a minimum:

- "Amtrak"
- Equipment name such as "Amfleet I"
- Vehicle number series / model number
- Name of book: Running Maintenance, etc, as applicable
- Supplier (or Builder)

Paper
The manual will be black print on white, 60-pound paper, printed by lithograph-offset method. Printing will be on both sides of the paper.

5.4 Configuration: 8-1/2" x 11" Binder Type Manuals

Larger manuals shall be provided, in loose-leaf binders, in 8-1/2 x 11" format, as follows:

Binder
The binder shall be a 3-ring heavy-duty type, with tab-locked rings (so they won't open accidentally). It shall include clear front and spine pockets for display of printed manual designation inserts. The ring shape will be such that the binder can be opened flat, and remain opened to the selected page. Ring spacing shall be 4-1/4 center-to- center.

Binder size shall be 3-1/4" spine or less, and shall allow for 10% expansion in number of pages.

The binder shall be labeled on the spine and cover with the following information at a minimum:

- "Amtrak"
- Equipment name such as "Amfleet I"
- Vehicle number series / model number
- Name of book: Running Maintenance, etc, as applicable
- Supplier (Builder)

Tabs
Manuals shall be subdivided using plastic-edge tabs. The tabs will be labeled with section name and number.

Paper

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The manual will be black print on white 8-1/2 x 11", 60-pound paper, printed by lithograph-offset method. Printing will be on both sides of the paper, except drawings, which will be on one side of the paper only. Paper will be punched with 3 - 3/8" holes on 4-1/4" centers. Suitable hole reinforcement shall be provided to resist page tear out for all foldout and any schematics and part pages. Reinforcement shall be no thicker than an average page.

Assembly

Manuals shall be shipped with the binders empty, but packaged with binders and paper for a complete set in the same shipping container. All material shall be complete with tabs, and collated with colored printer's blank separators used to separate each complete volume of data.

6. MANUAL CONTENT AND ORGANIZATION

The general content of the manuals supplied directly to Amtrak shall conform to Figure 1. Amtrak will consider alternative formats for approval, such as for “off the shelf” manuals, however the content must meet the all the items identified in the Amtrak outline.

Manuals supplied to builders must include the same content, however organization must meet the requirements of the builder as well as those of Amtrak specification #354.

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FIGURE 1
STANDARD TABLE OF CONTENTS:
VENDOR MAINTENANCE MANUAL

Forward (title page, Table of contents, etc)

Introduction to Book

1. Introduction to System
2. Installation/ Removal
3. Operation
4. Theory of Operation
5. Schematics and Connection Drawings
6. Periodic Maintenance
7. Trouble Shooting
8. Field Repair Procedures: each procedure will include:
9. Shop Repair Procedures: each procedure will include:
10. Overhaul Procedure
11. Special Tools and Test Equipment
12. Drawing List and Reference
13. Factory Repairs and Warranty
14. Part Identification and Part Lists

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Material

The following are explanations of the content required for each of the outline entries of Figure 1:

Forward

- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables
- List of Procedures

Introduction to Book

- Safety warnings
- "This manual does not supercede …."
- Overview of book
- How to Use This Book
- Errors, Corrections, Updates, and Distributions
- Who to Contact for Help

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1. Introduction to System

1.1 Scope

Brief description of purpose of maintenance manual, system it describes, i.e., "This maintenance manual describes maintenance and repair requirements for the ACME-1234 HVAC unit, as used on Amtrak Viewliner equipment".

1.2 Component Description

(include photos/illustrations, envelope drawings with dimensions)

- Function
- Size
- Weight
- Mechanical, electrical, etc., connections

1.3 Specifications

(reference Amtrak specification number if applicable).

Complete equipment specifications covering performance, function, materials, rating, power consumption by individual rating, motors, heaters, etc., capacity, air and water flow rates.

2. Installation/ Removal

2.1 Installation/ Removal

Description of how to handle and install and remove the equipment, including special precautions for human safety, as well as to prevent equipment damage. Include in here such

information as brazing procedures, types of copper tubing, cleaning out procedures, etc., as may apply. Installation drawings may be required.

2.2 Installation tests and adjustments

Provide complete procedures for adjusting all components, proper fluid levels, etc., as may be required for initial operation. Tests should include step-by-step procedure to check complete operation of equipment - all features: all controls, all valves, control devices, floats, solenoids, etc. It should also include list of defects to watch for, such as over-under charging of a refrigeration system.

2.3 Initial Operation

This section should include procedure and observations personnel should make to ensure equipment operates properly during and after break-in period. It should also include any adjustments that may be required, and appropriate warnings: "If pressure exceeds 450 PSI, shut unit off immediately", etc.

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3. Operation

This section describes how the equipment is controlled and operates in normal operation, from the viewpoint of the user.

3.1 Description of Operation - Controls and Indicators

This section should describe each switch, selector, etc., its function, and what the equipment does in each switch position. Each indicator should be described, and the meaning of the indication explained. Include illustrations of control panels.

3.2 Operating Instructions

Explain how to operate the equipment, including any specific procedures as might be required. For equipment, which uses a portable test unit (laptop), such as wheel slide controller, event recorder, etc, operating instructions explaining the features and use of the software for these units shall be provided.

3.3 Typical Operating Characteristics

This section should describe all normal operating modes of the equipment - say for an air conditioning system, the general series of events the system undergoes as the car interior temperature drops and rises. This description should be reasonably non-technical, but still describe normal characteristics - say battery charger output voltage. Include operating charts, such as temperature chart for temperature control system, typical pressures, timing, etc.

4. Theory of Operation

4.1 Theoretical

Describe technically how the equipment works - for example, the refrigerant cycle in a refrigeration system. For an electronic system, the operating concept, say the controlled phase rectifier battery charger.

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4.2 How it's applied here

Describe how the theory of 4.1 is used in the actual system. For electronic equipment, describe the blocks of the circuit.

4.3 Technical Description of System

This section provides system details, such as on a battery charger - typical circuit waveforms, voltage levels at test points, etc.

4.4 Component descriptions

In a complicated system, such as refrigeration, this section would describe each section - evaporator with defrost function, condenser unit, enclosure environmental control, etc.

5. Schematics and Connection Drawings

5.1 Schematics

This section shall include a full-system schematic, and schematics of each complete subassembly. Each circuit board shall have its own schematic. Wire and terminal names shall be included. All devices shall be labeled, including switch positions, activation pressures for pressure switches, thermostat settings, float switch settings, etc. Electronic schematics will show appropriate wave forms, nominal operating voltages/currents at all test points. Air and fluid schematics shall show pressure settings and normal operating pressures. Electrical schematics shall include maximum and normal operating currents.

5.2 Connections

This section will include connection diagrams both internal and external for water, air, electric, refrigerant, etc. Each subassembly shall have its own connection diagram. Diagrams shall include wire and terminal designations. These drawings shall be sufficient to completely rewire (re-pipe, etc.) the given unit.

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6. Periodic Maintenance

Amtrak periodic maintenance is generally performed on the following basis, however these intervals are subject to change:

- Trip (every day or two, minor inspections, servicing; primarily a check that all equipment operates)
- 180 (?)Day (car is removed from service for several days and serviced in the shop. A reasonably thorough inspection is made, repairs and adjustments performed.)
- 4 (?)Year Overhaul (medium overhaul)
- 8 (?) Year Overhaul (major overhaul, all mechanical systems removed from car, overhauled or replaced).

6.1 Inspections and Servicing

The manual should provide sufficient information for Amtrak to set up a schedule for servicing and inspection; including a list of tasks to be performed. Inspection schedules planned for these vehicles should be in the form of tables and include:

- Inspections
- Lubrication and lubricant changes
- Filter changes
- Adjustments
- Basic functional tests

Trip Inspection and Service

Show items requiring inspection, cleaning, resupplying, replacement (consumables), and testing or checking prior to placing car in service for that trip.

180 Day Inspection and Service

Show items requiring inspection, replacement, testing, lubricating, etc. on a 180 day basis; especially those items of safety which may be required by F.R.A. rules. Specific location for lubrication should be identified on a photograph or illustration. Also include such items as normal operating pressure, current, etc.

4-Year Overhaul

Show items requiring inspection, service and overhaul. (Also refer to section 10 of index).

8-Year Overhaul

Show items requiring inspection, service and overhaul. (Also refer to section 10 of index).

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6.2 Tests

This section should include step-by-step tests as may be required to periodically confirm system performance on a trip, 180 day, 4 year and 8 year basis.

6.3 Service Procedures

This section defines step-by-step periodic service procedures - such as lubrication (where, what type, how much), cleaning, etc; requiring explicit instructions.

7. Trouble Shooting

Troubleshooting guides, presented as a fault tree or matrix, shall consist of a listing of the most probable symptoms of degradation and/or failure of the equipment to operate or perform properly. Each symptom shall be accompanied by a number of probable causes, how to check for the cause, and how to repair and re-inspect the repaired equipment.

An important goal of troubleshooting is to allow service personnel to determine the level of the defect and whether the vehicle can be repaired “in line”, or whether it must be shopped.

- Symptoms
- Defect
- Corrective Action
- Cause of Failure

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8. Field Repair Procedures

This section describes adjustments/ calibrations and repairs done to equipment while it is still on the car. As appropriate, the manual shall include warning against special danger, such as spilled battery electrolyte, spring-loaded parts, etc.

The Repair Process shall be described by a step- by-step adjustment/ calibration, disassembly, repair, and/or replacement process. All special requirements for bolt and fastener torques, settings and means of applying lubricants and sealants shall be included. The detail presented shall be sufficient for qualified technicians, supervisors, and inspectors to successfully complete the work. Recommendations, based upon a probable combination of symptoms, shall be included for in-place repairs and/or lubrication and adjustments, removal of subassemblies for bench testing and repair, and/or removal of major systems for disassembly, inspection, repair, reassembly, testing, and replacement.

Information describing maintenance procedures, use of diagnostic equipment, special tools to facilitate disassembly and reassembly, and advice based on the supplier's experience with similar equipment, will be included. The section shall include complete data for setting, tuning, adjusting and operating the equipment.

Each procedure will include:

1. Purpose
2. Special Tools
3. Materials
4. Precautions
5. Preparation
6. Procedure (Disassembly, Replacement of Parts, Reassembly)
7. Adjustments
8. Tests
9. Follow-Up

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9. Shop Repair Procedures:

This section is similar to section 8 in style, but describes OFF-car repairs done with the equipment in a shop or lab. This section will include procedures to set/adjust every adjustable device on the system (those not described in 8 above), including every adjustment on each printed circuit board in the system. This section shall include procedures to fully test the operation of each control, switch sensor, etc., of the entire system.

Each procedure will include:

1. Purpose
2. Special Tools
3. Materials
4. Precautions
5. Preparations
6. Procedures (Disassembly, Replacement of Parts, Reassembly)

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7. Adjustments
8. Tests
9. Follow-up

10. Overhaul Procedure

This section shall include sufficient information for Amtrak or another outside qualified repair shop to conduct a complete system overhaul, following a major accident, and/or for periodic overhaul. Instructions shall include: welding and torque specifications, special tooling, fixtures, test gear, plating and painting surface finish specification and part wear tolerances.

It shall include disassembly, assembly, and installation procedures necessary for repair of heavy damage and/or long-term wear and tear. The instructions shall provide for complete full load system check as well as a check of all equipment devices.

The section shall include procedures for surface cleaning & preparation, priming, surfacing and painting all equipment that is painted or powder coated. A detailed paint schedule showing the equipment to be painted, paint type and manufactures, recommended thickness and other pertinent information shall be included.

Overall, the section will include:

1. Frequency of Overhaul
2. Scope
3. Preparation for Shipment
4. External Preparation and Cleaning
5. Inspection
6. Disassembly
7. Internal Cleaning
8. Part Inspection & wear limits
9. Routine Part Renewal
10. Retrofits/Modification
11. Reassembly
12. Adjustments
13. Tests
14. Preparation for Shipment

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11. Special Tools and Test Equipment

This section describes any special tools, fixtures or instruments required to efficiently test and/or overhaul car systems. Information shall be sufficient for Amtrak to either build or purchase this equipment.

1. Test Fixtures
2. Test Instruments

12. Drawing List and Reference

This section is a list of drawings, both supplier and Amtrak, which provide information useful to Amtrak maintenance or engineering department.

For example, supplier envelope and part list drawings are necessary, whereas manufacturing drawings are not required, in general.

1. Supplier Drawing List
2. Amtrak Drawing List

13. Factory Repairs and Warranty

This section describes vendor's warranty, service policy and procedures followed to make a warranty claim.

1. Who to Contact
2. How to Ship
3. Documentation
4. Warranty

14. Part Identification and Part List

The Parts section shall contain the information required to effectively locate, identify, and order all replaceable units **down to the lowest repairable level**, including assemblies, sub-assemblies, components, printed circuit boards and parts of the system/ component from the original equipment manufacturer. This section is intended to provide Amtrak with information to:

- Identify any user-replaceable part
- Identify Amtrak part number for it
- Plan a spare part inventory, including stocking locations

It should be organized as follows:

Introduction

- Manufacturer names, addresses and telephone numbers
- Abbreviations

Body of manual

- Part identification

Note: This section shall include **all** the information shown below in "Format"

- Numerical index
- Common commercial hardware

The manual must also identify (as applicable):

- Consumables:
  - Lamps/ light bulbs
  - Lubricants
  - Anti-seize compounds
  - Fluids
  - Brake pads, shoes
  - Wheel sets,
  - Adhesives

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- Sealants
- Paints & primer
- Wire
- Electrical lugs
- Brazing alloys
- Etc.

- Gages used to check equipment
- Software and instructions for using it for portable test equipment
- Adapter cables for using portable test equipment
- Overhaul/ rebuild kits where available, not merely individual parts.

Format

The following provides details of the required content and format.

Part Identification Illustrations

Illustrations should be provided with sufficient detail to identify all listed parts, including the order of assembly. Phantom lines may be used to reference parts that are not part of the illustrated assembly, but need to be shown for clarity. Phantom lines must be used sparingly and should be lightweight so as to avoid "clutter".

Index numbers keyed to the part list and leader lines should be used to locate all listed parts.

Hardware should be exploded only when needed to show detail parts. Where attaching hardware is obvious, one leader line with stacked index numbers is used.

Subassemblies broken down within their overall assembly should be identified with an index number and note, such as "See Detail A" on the main illustration, with a separate detail showing the additional breakdown.

Part List

This section shall include a compete list of all parts identified on the illustration, in accordance with Figure 2. Part numbers for labels and instruction sheets shall be included. (These should include the part number on the label itself, as well.) Casualty parts used only in repairing severely damaged equipment (such as the main frame, structural elements, etc.) are not normally stocked and need not be identified.

The cross references provide vital information to the mechanic to easily identify the OEM number on the part, the system vendor's number and the Amtrak number. An example is a plug-in relay, which is typically not identified with the supplier's part number, but only with the OEM's.

The maximum number of parts should not exceed 25 per 8-1/2 x 11" page. To the extent possible, illustrations and the corresponding parts list should be on facing pages of the manual to avoid having to turn the page.

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Numerical Index

This index lists in alphanumeric order all the part numbers in the listing. A separate column identifies the applicable figure and index number for the part.

Common Commercial Hardware

This is a list of hardware used through the system, organized by type of fastener and then size.

Samples of all the above formats should be presented at or before the first meeting discussing part manuals.

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FIGURE 2

PART MANUAL BASIC FORMAT SHOWING STOCKING LOCATION

Fig. Index	Qty	Description *	Amtrak P/N	Supplier / Builder P/N	OEM & Component P/N	Used On Code	Stocking Location				
							S&I	Minor Running Maint. Shop	Major Running Maint. Shop	Back Shop	Unit Overhaul Shop
1	1	A/C compressor		23x233335	Carrier 06D825				X	X	X
2	2	Unloader		23x234345	Carrier 123543				X	X	X
3	2 pts.	Compressor oil		33x23443z	Shell 02X		X		X	X	X
4	4	Air Filter, 16x20”		13z12345	Harris 1515x		X	X	X	X	
5	2	Marker light lamp		23x98765	GE75R3		X	X	X	X	

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*** Note:** Description of common commercial hardware shall be complete; for example a bolt would be defined with the following characteristics:

- Bolt
- Hex head
- Galvanized steel
- 3/8”
- 16UNC
- 2A
- 1.5” long
- Grade, as required

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APPENDIX A

AMTRAK ELECTRONIC PARTS AND SERVICE CATALOG SPECIFICATION

The Electronic Parts and Service Book will be Published in LinkOne®. If the Builder does not have LinkOne® Software in-house, it may be necessary to subcontract the work to an Authorized LinkOne® Publisher. Information will be provided about the Distributor Publisher, who is currently contracted to Amtrak for technical support. The Builder is not limited to a sole source situation.

LinkOne® is an international graphical parts book system formerly called Mincom ImageLink. Mincom Inc.'s corporate office is located in Australia, and there is a worldwide network of Distributor Publishers. Mincom's U.S. office is located in Denver, Colorado.

To locate the Electronic Parts Catalog Exchange Standard ("EPCES"), the Builder will be required to log onto the Internet and access the NAPM Rail Industry Forum's WEB Site **www.napmrif.org/infostnd/epces/index.html**. Compliance with this standard will be required as it applies to the EPCES, Documentation Type Definition ("DTD"), defined terms and allowable graphic standards. Actual Standard Generalized Markup Language ("SGML") tagging will not be required.

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General Information

The LinkOne® Parts Book purchased with the equipment is to include copyright privileges that will authorize Amtrak to update the Parts Book, make changes to it and any disposition of the LinkOne® Parts Book without notification or consent of the Builder.

LinkOne® Parts Books built for Amtrak will reference Builder's Part Numbers, Vendor Part Numbers, - i.e., usually the OEM - Original Equipment Manufacturer Part Numbers (applicable to all Builder purchased components) and Amtrak (AAMPS) Corporate item numbers.

The process for establishing AAMPS numbers will be as follows:

In the early stages of documenting the Parts Book, the Builder will convey applicable catalog part number information to Amtrak utilizing an Amtrak provided Excel Spread Sheet. The data to be provided to Amtrak is to include the Noun Descriptions, the identification of the applicable system on which it is used, the Builder's Part Numbers, and the OEM Part Numbers for all parts purchased by the Builder from another source. Amtrak will use this information to identify existing AAMPS numbers or to create new AAMPS item numbers when none are found to exist.

Amtrak will respond and supply the Builder with applicable AAMPS numbers within a reasonable turnaround timeframe, normally 5 working days after the Builder has provided complete, accurate data. This procedure should allow the Builder to provide the Publisher of the Source Book Data in a timely manner and expedite Publication of the LinkOne® Parts Book.

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The Builder is solely responsible to ensure the accuracy and integrity of its supplied books. It is the responsibility of the Builder to maintain their source books through the complete manufacturing process and until the last Unit in the Contract has been delivered and accepted by Amtrak. The Builder will be obligated to provide Amtrak with updates to their original LinkOne® Parts Book whenever the Builder makes a revision or modification under warranty to the Equipment for the life of the Equipment.

A Preliminary Draft version of the LinkOne® Book must be made available within 60 days of the start of Publication to verify compliance with the Amtrak requirements. Delivery of the Preliminary and Final Versions of the Book are to be made to the Amtrak Catalog Dept. (Catalog Dept. Address and Contact Name will be furnished by Amtrak's Contract Representative upon request). Upon final version acceptance, the Builder will be notified, and the billing invoice is to be submitted for payment.

Delivery of the final version of the LinkOne® books constructed for Amtrak must include both the Target and Source Books. These books will remain the property of Amtrak.

The Builder is also required to deliver a duplicate copy of all source data used to make the LinkOne® books. The data contained on CD(s) is to be delivered to Amtrak's Catalog Department.

Amtrak reserves the right to reject any books that it deems substandard as to quality of content provided by the Builder or if the finished product of the Publisher fails to meet any part of this Specification.

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General Description:

Format and content required in the Equipment Parts Catalog

Front Matter

Cover Page: Graphic of the Equipment Unit
Equipment Name
Equipment Model Number
Contract Information: Contract Number, with information regarding the number of units, Road Numbers, etc.

General Table of Contents, listing:
Front Cover Page
Title Page
Chapter Index
List of All Vendors
List of the Common Commercial Hardware
List of Abbreviations and Glossary
Any Other Applicable Front Matter

Chapter Index – Listing Individual Chapter Numbers and Titles
List of Vendors: With Corporate Name, Address, Phone Number, E-mail Address,

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Contact Person and Vendor Code.

List of Common Commercial Hardware:
This should be a key list of all parts not manufactured by the Builder. The list is to be in the Builder's part numbers sequence. It is to include all common Fasteners, Electrical and Plumbing Hardware items and must be identified by:
Either A: The complete physical description required for purchase.
Or B: The OEM Names and OEM part numbers or Mil. Specs.

List of Abbreviations
Any Other Front Matter, if Applicable

Chapters

The Builder will coordinate with Amtrak's Catalog Department when determining the Book Chapter Titles and the order of sequence of Chapters. This Is required in order to assure concurrence with Amtrak's Work Management System ("WMS").

Each chapter should begin with a list of included figures, (illustrations), with titles, in numerical order. The list is to be followed by the first Figure on the list, which will contain one or more illustrations, followed immediately by an associated list of components of the illustration. The equipment shown on the first illustration will be the top-level view of an equipment system or assembly. It will be followed in logical sequence by lower-level views called the "drill down" or NLA, (next lower assembly). The figure usually will include "callout" numbers identifying sub-parts or detail parts of the Assembly. Each "callout" item number will appear on the Parts List on the following page. The Parts List is identified by the Figure number it is associated with, and the parts are identified with the "callout" numbers.

Example: Figure 1-1 may be the first figure in Chapter 1. The associated Parts List may be identified as Fig/Index No. 1-1, and the items on the parts list will follow in numerical order corresponding with the "callout" item numbers shown on the illustration.

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Information for the LinkOne® Publisher: Include the following in the Book:

LinkOne® Book Date of Publication:_____ Date of Revision:_____

Below is the manner in which Amtrak prefers the Parts List and column headings to be listed in the LinkOne® Book.

Fig./Index (Or similar terminology – i.e., Asm./Ref. No. is acceptable)
Amtrak Item No.
Description
Qty.
U/M
Builders Part No.
Vendor Code
Vendor Part No. (OEM)

Chapter 1 – Car Body							
Fig/Index No. 1-1	**Amtrak Item No.**	**DESCRIPTION**	**QTY.**	**U/M**	**Builders Part No.**	**Vendor Code**	**Vendor Part No.**
1							
2							
3							
4							

List of Vendors and Vendor Codes

Amtrak established Vendor Codes are to be used in the LinkOne® Book.

In the event any of the Equipment Builder's Vendor Codes are different from Amtrak's and this requirement poses a serious problem, it should be listed as an exception in the Equipment Builders' proposal. Amtrak will attempt to negotiate an acceptable compromise to resolve this issue.

LinkOne® Searches that are required to be available for Amtrak Books

Page Titles
Part Descriptions
Part Numbers
Documents
AAMPS Item Numbers
Vendor Part Numbers
Vendor Codes
Part Number/Description
Vendor Code/Description

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Amtrak
Mechanical Department
Rolling Stock Equipment

SPECIFICATION

For

480VAC Head End Power Jumper and Receptacle Hardware for Passenger Cars and Standby Equipment

SPECIFICATION

No. 223, Formerly D-77-24

Issue Date: 3-25-20

Revision P

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Approved 4/21/20 Date

4/21/20
VP/Chief Mechanical Officer

4/15/20
AVP/Deputy Chief Mechanical Officer

4/7/2020
Director System Engineering & Specifications

4/7/2020 Senior Manager Equipment/Engineering

Originator & Date 3-30-20

3/30/2020

Specification Change Sheet

Revision	Date	Section(s)	Description	Approver
P			See Pages 4-5 for revisions	
O			See Page 4 for Revisions	
N			See Pages 3-4 for Revisions	
J-M			See Page 3 for Revisions	

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Record of Revisions

Revisions prior to Revision P may not be accurate due to a change in spec template.

REV	DATE	PAGE	CHANGE
J	11/03/83		Replaced over center clamp on Figure 8 with thumb screw type.
			Replaced Figure 10 clamp thumb screw type.
			Added date code to outlet cable assembly, fixed jumper and adapter jumper.
K	11/28/84		Rewritten - major changes include: New wire/cable requirements; More definition in test section; Dimensional changes on mating surfaces on plug & receptacles & housing.
L	6/17/85	ALL	Revised to incorporate Vendor comments to Rev. K, added Sections 4.1.4, 4.2.5, replaced Figures 1-14.
M	6/30/87		Corrected index (4.1.4 & 4.2.5 were missing).
			Section 3.3 "d" was 120 MPH.
			Section 4.1.3 Added sentence "The compression nut... means". Section 4.2.1 Added sentence "As applicable... chemicals".
			Section 4.2.2 Deleted sentence "Contacts and cables... reparability". Added sentence "Contacts shall float...forces".
			Section 4.2.2 Added sentence "Cable and cord...CHEMICALS".
			Section 9 Deleted Molded Electric Products and Brad Harrison. Figure 13 - Redrawn.
N	11/04/91	2	Added "Viewliner" and "Horizon fleet" to first paragraph.
		5	Section 4.2.2 first paragraph "yellow" was "red".
			Deleted "Individual #10 conductors beyond the breakout from the cord jacket, if exposed, shall be protected from physical damage".
			Deleted "with an appropriate sealant or other Amtrak approved means". (After "shall be sealed").
		6	Section 4.2.3 2nd paragraph Deleted "shall be equipped with an approved hanging device and the". Deleted "hanging device" from the last sentence.
		7	Section 5.2 "six" was "two".

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		8	Section 5.2.2 Added "the test... at -20°F".
		9	Section 5.2.7 Added "six" as first word. Section 5.2.8 Added "the six" in the first line.
		13	Section 8 Added "D-12-7191 Amtrak drawing".
	Drawing D-12-7191		Added 2nd boss to plug, Figure 5. Drawing number of Figure 2 was originally D-00-7080.
O	05/08/96	2	Section 3.1, 1st paragraph, Deleted "fleet". Section 3.2, Added "The integrally molded cable and connector assembly shall provide a watertight union of cable and connector at the rear end of both plug and receptacle connectors".
		4	Section 4.2.1, 1st paragraph, Added "an integrally molded". Deleted "Individual #10 conductors...Amtrak approved means".
		5	Section 4.2.1, 3rd paragraph, Deleted "or removable. If molded", and "the maximum possible clearance". Added "appropriate dielectric and heat protection". Section 4.2.1, 4th paragraph, Changed 400 lbs to 600 lbs and 40 lbs to 150 lbs. Section 4.2.2, 3rd paragraph, Changed 100 lbs to 600 lbs, and 40 lbs to 150 lbs.
		10	Section 5.2.11, Changed 450 lbs to 1200 lbs and 80 lbs to 150 lbs. Section 5.3.1, Changed 5 Ma to 1 Ma.
		12	Section 7.1 and 7.2, 2nd paragraph, Changed Amtrak Specification #Q-76-20 to Amtrak Specification #199.
		13	Section 8.0, Changed Amtrak Specification #Q-76-20 to Amtrak Specification #199. Section 9, Added "Clements National as an approved vendor. Deleted " Anderson Power Products and Power Parts" as an approved vendor.
P	3-24-20	18, 19	Corrected index, added Sections 3.4.2.6 & 3.4.2.7
		14	Section 3.2.1, Changed reference to 'Figures C & D'
		15	Section 3.3.1, Para. 3, Changed reference to "Figures C & D'
		15-18	Sec. 3.4.1.1 to 3.4.2.5, Revised Figure #'s & dates where Applicable
		16-19	Section 3.4.2 Change integrally molded plugs to pre-molded

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	plugs
20	Section 3.5.2.5, Changed reference to Figure 'A'
21	Section 3.5.2.6, added 'power pins' & 'control pins'
33	Figure 11 changed to Figure 'A'
34	Figure 12 changed to Figure 'B'
35	Figure 13 changed to Figure 'C'
36	Figure 14 changed to Figure 'D'

Drawing: D-12-7191 Rev. K, Added Sheet 13, added Jumper Cable Ass'y (Receptacles both ends), revised figure numbers (1-13), Unified all title blocks

Drawing: D-12-7191 Rev. L, Changed integrally molded plugs to pre-molded plugs.

Drawing: D-12-7192 Added reference to standby power connections

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Specification No. 223 (Formerly D-7724)

1.0 Scope

1.1 General

This Specification is intended to be used in conjunction with any associated Amtrak drawings and/or CAD models, the Amtrak Procurement Department purchase orders, and other contractual documents issued to the vendor. It is Amtrak's intention that all components supplied under this Specification, unless improvements are otherwise identified, be functionally interchangeable with those currently in use at Amtrak in terms of form, fit, function, general appearance, durability and operation

As basic work under this Specification, each item produced must be completely functionally tested, properly packaged for shipment to Amtrak, and have documentation submitted. Amtrak will perform a series of First Article Inspections on the first item produced by a vendor, in order to verify that the process and materials used are in compliance with this Specification and drawings.

The design criteria and constraints that are known to Amtrak have been specified. If other factors require definition after Contract award, the vendor shall be responsible for making those definition requirements known to the Amtrak Contracting Agent in a timely manner for mutual investigation and satisfactory resolution, with any revision approved in writing by the Amtrak Contracting Agent. The vendor shall not be relieved of the overall responsibility of providing an adequate design for the Amtrak service conditions. Wherever possible, this Specification has been developed on the basis of equipment performance required, rather than specific hardware to be provided. Where specific hardware is mentioned, it is for the purpose of providing an example of concepts or designs acceptable to the Amtrak Engineer, in order to allow vendors to employ innovation and advanced technology, where appropriate. Preference, to the extent practicable and economically feasible, will be given for products and services that conserve natural resources, protect the environment and are energy efficient.

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Whenever in this Specification an article or material is defined by using a trade name or the name and catalog number of a particular manufacturer or vendor, or a limited description, the term “or approved equal” if not written thereafter shall be implied. Any reference to a particular manufacturer’s product, either by trade name or limited description, is only for the purpose of setting a standard of performance, quality, composition, construction or size. The term “or approved equal” means any other manufactured product or article which is equivalent in material, workmanship and service and is as efficient and economical in operation in the opinion of the Amtrak Engineer. Amtrak’s written opinion as to whether the proposed alternate is equal to the specified items for Amtrak’s specified use and purposes shall be final and conclusive. The vendor shall not subcontract the design and manufacturing work under this Specification without the written authorization of the Amtrak Contracting Agent. The vendor shall not patent or copyright any original materials or information created by this procurement which will be submitted to Amtrak.

Any items of material or equipment, which are not fully described or are omitted in this Specification or the accepted vendor Technical Proposal, but are necessary for the completion of

the item being supplied, shall be considered a part of the scope of supply. In this Specification, all references to "number of days" shall mean calendar days unless otherwise stated.

Safety shall be of primary importance in the design of any items being supplied. They shall present a safe, hazard-free environment to the extent practical. No sharp edges or corners or pinch points shall occur where any personnel may come into contact with them. Smooth surfaces and avoidance of protrusions shall be used to minimize injury.

1.2 Amtrak Ownership Rights

Unless specifically waived in writing by the Amtrak Contracting Agent, all drawings, bills of materials, catalog lists, mockups, CAD models, documentation and all other engineering and design materials related to this Specification shall become the property of Amtrak, and shall be delivered by the vendor in total as part of the First Article Inspection or other process. If any patented items are used, Amtrak must be granted an unrestricted license to use, copy or otherwise manufacture the item by itself or a third party.

1.3 Vendor's Technical Proposal

As a condition of contract award unless otherwise indicated in the Amtrak Procurement documents, the vendor must submit a written and detailed Technical Proposal to the designated Amtrak Contracting Agent. This Technical Proposal must identify the vendor's interpretation of what it considers to be the scope of Basic Work to be performed, present a complete technical description of the components to be supplied, fully describe the operation and maintenance requirements of the components, include a copy of the vendor's Quality Assurance program, describe any Design Review process, present a step-by-step work plan for construction, include a project schedule by major events starting from the Notice to Proceed, and a Bill of Material of all components to be supplied.

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1.4 Exceptions

The vendor shall explicitly identify to the Amtrak Contracting Agent any exceptions being taken to this Specification, referencing the Specification Section number and the exact wording in question. It will otherwise be assumed by Amtrak that the vendor takes no exception to this Specification and is completely compliant with all Specification requirements.

1.5 Legal Requirements

All items being supplied under this Specification must comply with all applicable Federal government requirements, in particular those identified in 49 CFR Part 229 (Locomotive Safety Standards) and 49 CFR Part 238 (Passenger Equipment Safety Standards), among others. This shall include all design aspects, as well as required submittals for approval. It is mandatory that all required materials used by the vendor for application in passenger cars or the cab interior of passenger service locomotives comply with the flammability and smoke emissions requirements of the latest edition of 49 CFR Parts 238.103 (a)(2) and (b)(2),

1.6 Engineer

The Engineer or Amtrak Engineering, as referenced in this Specification or any drawings, is defined as the Senior Director of the Amtrak Bureau of Rolling Stock Engineering within its Mechanical Department, or its written designee. The vendor may be submitting items for the Engineer's approval as required by the Specification. The vendor shall not interpret this process to mean that the Engineer will function as an arm of the vendor's Project Management or Engineering staff. Submissions shall be structured to show how the vendor is responding to all of the requirements of the Specification, and not on the basis of requiring the Engineer to discover how the vendor is not meeting those requirements. Submissions shall contain sufficient detail to confirm that Specification requirements are being met. However, the vendor shall use judgment as to what level is appropriate and shall communicate with the Engineer when guidance is needed on a case-by-case basis. Submittals requiring the Engineer's approval prior to implementation shall be reviewed and classified by the Engineer within 30 days from the day the submittal is received based on a rate of submittal that is reflective of the pace of an orderly, properly managed program. Priorities will be given to special cases when possible.

1.7 Cost Items

Any individual extra work items regarding the items being supplied shall be handled in accordance with the purchase order and other contractual documents issued to the vendor by the Amtrak Procurement Department. The vendor must contact the Amtrak Contracting Agent regarding all such issues. The vendor agrees that no payment will be made by Amtrak for any additional work outside the basic work scope of the contract documents unless such work is first preapproved in writing by the Amtrak Contracting Agent in accordance with the contract documents.

1.8 Vendor Quality Assurance Program

The vendor is required to have in place a documented Quality Assurance Program that is modeled after an established industry quality standard, such as the ISO, AAR, or other organization. The vendor's facility is required to be equipped with equipment, personnel and management completely sufficient to assemble, inspect and test each item being supplied under this Specification. The vendor shall have suitable equipment to diagnose any failure mode, and perform all adjustments and tests required to confirm proper operation. The vendor's Quality Assurance staff shall be active participants in the assembly, inspection, testing and documentation phases of the work. The vendor is required to submit a copy of its Quality Assurance Program as part of its Technical Proposal, as explained in Section 1.3. While it is not a mandatory requirement under this Specification, it is highly desirable that the vendor's quality assurance program be certified under ISO 9001:2000 or an equivalent recognized standard.

Amtrak Quality Assurance personnel may conduct random audits of the vendor's quality assurance program to verify that these Specification requirements are being achieved. The vendor shall fully cooperate in such audits. Specific attention shall be paid to the areas of management responsibility, quality system, contract review, design control, document control (including drawings), purchasing, purchaser-supplied product, product traceability and

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identification, process control (including procedures, testing and equipment), inspection and testing, measuring and test equipment (including calibration programs), control of nonconforming products (applied controls), corrective and preventative actions, handling, storage, packaging and delivery, quality records, internal quality audits, training, servicing and statistical techniques.

1.9 Critical to Quality (CTQ) Part Criteria

It is mandatory that the vendor comply with Amtrak procedure PD 3.7.4.02, Critical to Quality (CTQ) Part Criteria, which applies to all products identified by either the Engineer or the designated Amtrak Contracting Agent that Amtrak considers to have aspects identified that are Critical To Quality (CTQ). CTQs shall be Critical to Quality (CTQ) characteristic are defined as "Those characteristics of an item which, if non-conforming, may prevent or seriously affect the unit performance, reliability, , or customer satisfaction of a component." This procedure defines the methodology when qualifying parts or processes to assure that the critical to quality product criteria meet Amtrak requirements by:

- Implementing a rigorous Part/Process qualification to ensure the participation, communications of all related departments and the quality acceptance.
- Support the Quality process by involving the vendor early in the project/design process.
- Assure that the vendor is supplying materials that meet the quality, cost, delivery and reliability requirements.

1.10 Components

The vendor shall use only new parts for all components, unless otherwise specified on the drawings or contract documents. It is Amtrak's desire that all materials, to the greatest extent possible, be of commonly available commercial items and hardware. The vendor shall maintain drawings for each component, and where necessary, patterns, jigs and fixtures, to assure identical manufacture. All elastomers used shall have a design life of 10 years in service unless otherwise approved by the Engineer.

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1.11 Conducting Tests

The vendor shall be equipped to fully test the items being supplied in accordance with this Specification and any referenced drawings as part of basic work. All testing apparatus shall be calibrated on a periodic basis as recommended by the apparatus supplier, and the vendor shall maintain documentation of such calibrations.

1.12 Workmanship

All workmanship shall be of high grade and shall conform to the best of manufacturing practices. Skilled, qualified, well-motivated personnel, with appropriate experience, training and aptitude shall be utilized to assure high quality of workmanship at all levels. Foremen, supervisors, inspectors, and shop managers shall be well integrated within the project team and be fully experienced and capable in their fields. They shall manage their teams in a competent and

professional manner. The vendor is required to have on hand in its facility this Specification, and all other referenced drawings and documents.

1.13 Documentation Records

The vendor shall maintain an electronic database and/or approved logbook of information regarding all components supplied to Amtrak under this Specification. At a minimum, records shall identify the Amtrak purchase order number, any serial number of the assembly, Amtrak "SAP" internal catalog number (if known), copies of any written authorizations by the Amtrak Contracting Agent, inspection and test data, shipping date and shipping location. In addition, it shall include a copy of the flammability and smoke emission laboratory certification report, if required, under 49 CFR Part 238 Appendix B for the components being supplied. The vendor shall include any applicable fire safety analysis and all certifications such as by the U.S. Public Health Service, the U.S. Food and Drug Administration, Underwriters' Laboratories and the National Sanitation Foundation.

1.14 Referenced Documents

The latest revision level of all referenced drawings and documents are to be considered to be the applicable version.

- Amtrak Procedure PD 3.7.3.01, Design Review and Control Procedure
- Amtrak Procedure PD 3.7.4.02, Critical to Quality (CTQ) Part Criteria
- Amtrak Specification 323, Wire and Cable
- Amtrak Specification 328, Materials and Workmanship
- Amtrak Specification 352, Flammability, Smoke Emissions and Toxicity
- Amtrak Specification 429, Environmental and Operating Conditions
- Amtrak Specification 867, Amtrak Drawing Standards for CAD
- Code of Federal Regulations; 49 CFR Parts 223, 229 and 238
- ISO 9001:2000, Quality Management Systems - Requirements
- D-12-7191 Amtrak 480V Trainline Jumpers, Plugs, & Receptacles (Vendor to verify latest revision.)- Amtrak drawings and models provided with the bidding and contract documents.
- Appendix A Cable and Wire Specification
-APTA PR-E-RP-018-99 “Recommended Practice for 480VAC Head End Power Jumper and Receptacle Hardware.”

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2.0 General Requirements

2.1 Design Considerations

Any components being supplied under this Specification shall be designed and manufactured to perform satisfactorily for a minimum design life of 10 years, unless otherwise specified. To the extent possible, only readily available components, hardware and fasteners shall be used.

The design and components shall comply with the flammability, smoke emissions and toxicity

requirements of Amtrak Specification 352. All wire and cable shall comply with Amtrak Specification 323 All materials and workmanship shall comply with the requirements of Amtrak Specification 328. Components shall be selected for maximum endurance between inspections, and for ease and quickness of inspection.

As appropriate, the overheating of apparatus and overall fire safety design shall be addressed by use of thermal cutouts, selection and use of materials meeting flammability, smoke generation and toxicity requirements, and by means of fire detection and suppression

2.2 Environmental Conditions

Any components being supplied under this Specification shall be designed to comply with the conditions listed in Amtrak Specification 429, Environmental and Operating Conditions, and must be suitable for use up to 10,000 feet elevation above sea level. They shall also be designed and mounted to have structural integrity and be operationally reliable for the vibration environment at the point of attachment, and shall prevent unacceptable vibration inputs to the attachment structure. The component structure and mounting shall be designed to prevent amplification through component resonance beyond a level twice that of the attachment point. Vibration resistance shall be verified by analysis, to the satisfaction of the Engineer.

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2.3 Interchangeability

All similar parts on each item being supplied, and among all other assemblies and their spare parts, shall be designed and manufactured to be identical, both as individual parts and as subassemblies. All assemblies shall mount to the vehicle without modification. Model numbers for identical components shall be identical. Replaceable components of any such apparatus shall be fully interchangeable, without adjustments to any part being necessary.

2.4 Dimensions

All designs, components, dimensions and fasteners used on the components being supplied under this Specification, unless otherwise stated in the bidding and contract documents, shall be of United States inch-standards. Due to potential compatibility issues with existing Amtrak rolling stock, any components and fasteners using metric dimensions shall not be supplied unless approved in writing by the Engineer.

The vendor shall provide English dimensioning for its drawings and other communications which are generated. Fractional measurements shall be expressed as a decimal value. Drawings prepared by the vendor shall be made using third angle projections. First angle projection shall be allowed provided all views are labeled, including the front, top, bottom and side views. Dimensional tolerancing shall be appropriately applied for the part being manufactured.

2.5 Cleaning and Maintenance

All components being supplied under this Specification shall be easy to clean and maintain. They shall not require maintenance or adjustments at intervals of less than four years, unless approved in writing by the Engineer. Pockets where dirt and debris can collect shall be minimized; those that exist shall be made easy to clean with standard vacuum cleaner equipment. Where possible, components requiring maintenance or replacement at overhaul shall be replaceable as individual units. The design shall ensure that items that require repair and or service are easily accessed, removed and replaced and that this is possible with the use of standard hand tools. Variations of fastener thread size, thread length and head style shall be minimized to ease overhaul and regular maintenance. The number of fasteners shall be kept to a minimum. All paints, coatings and corrosion protection shall meet the requirements of Amtrak Specification 328.

2.6 Interference and Transient Suppression

All electrical components and wiring being supplied shall be carefully planned and selected to avoid electrical interference in the operation of train crew and maintenance department portable radios, public address and any other frequency sensitive systems. Likewise, these components shall be immune to the EMI/RFI effects of electrical interference from Amtrak's electrically and diesel-electrically propelled trainsets, passenger cars and locomotives.

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3. Specific Requirements

3.1. SCOPE

This specification defines the requirements for 480 Volt, 3 Phase, 50/60 Hz pre-molded cable assemblies, outlet housings, and accessories for Amtrak head end powered equipment.

3.2. EQUIPMENT CONFIGURATION

3.2.1. General

Jumper cable assemblies and receptacles are used for transmission of 480 Volt, 3 Phase, 50/60 Hz "Head End Power" locomotive-to-locomotive, locomotive-to-car and car-to-car. In this arrangement, 4 cables are generally used in a parallel arrangement between each vehicle. Cable assemblies are also used to provide wayside power to a consist; this is generally done with 2 cables in a parallel arrangement. See Figures ‘C’ and ‘D’.

3.2.2. Ratings

All current carrying elements shall be rated at 395 amps (continuous) for each of the three power conductors and 40 amps (continuous) for each of the auxiliary conductors, all conductors operating at rating simultaneously, at 600 VAC in a 110°F ambient.

3.3. DESIGN CONSIDERATIONS

3.3.1. Usage and Compatibility

The equipment described in this specification is for new equipment and for operating and maintaining Amtrak's present locomotives and passenger cars and head end power converted conventional cars used in the Amtrak network.

All ratings and requirements of this specification (including, but not limited to, watertightness and water proofness) shall also hold when equipment supplied under this specification is utilized in conjunction with existing equipment which Amtrak is using or anticipates using.

Cable assemblies supplied under this specification will be used with housings supplied under this specification and existing components previously manufactured. This specification shall be compatible in all respects with existing equipment used for supplying 480 volt power to Amtrak's trains (See Figure 'C' and 'D').

When applied to a vehicle or standby power station, the jumper shall be the weakest link of the jumper/ receptacle marriage. The connection should separate without damage to plug or receptacle should the car be uncoupled or moved before the jumper(s) is(are) disconnected.

It is the supplier's responsibility to insure that equipment supplied under this specification is compatible in all respects with existing equipment used for supplying 480 Volt power to Amtrak trains.

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3.3.2. Watertightness and Weatherproofness

The integrally molded collar on the receptacle body (D-12-7191, Shts. 4-5 located 3-5/8" from the front end of the connector) shall seal between the housing and the mounting surface. The housing recess which retains the receptacle body shall have a dimension slightly less than that of the collar in order that the collar be compressed and the joint be sealed after mounting. The mating of cable assemblies shall provide a weatherproof connection. With a jumper fully seated in an outlet, a watertight seal shall be provided between the mated parts. The sealing bosses at the base of each contact pin in conjunction with the sealing lip in the contact entry of the mating plug shall form the primary seal between contacts. The secondary seal shall be between the circumference of the plug body and bore of the outlet or receptacle body.

3.3.3. Mating Force

Mating forces for complete insertion and complete retraction shall be 50 ± 20 lbs.

3.4. COMPONENT DESCRIPTIONS

3.4.1. Housings

3.4.1.1. Outlet Housing

Outlet housing (D-12-7191, Sht. 1, Figure 1) shall consist of a housing body and spring loaded hinged cover. The hinged cover shall be provided with a latching boss to hold a mated plug in a retained position; the cover shall also contain a gasket to provide watertightness when the receptacle is unmated. Materials and dimension requirements shall be as shown in Figure 1.

3.4.1.2. Offset Adapter

Offset adapter (D-12-7191, Sht. 2, Figure 2) shall consist of a flange mounted housing to allow for 45 deg. connector/ cable entry when used with outlet housing defined under 3.4.1.1. A gasket shall be provided to achieve a seal at the mounting flange. Materials and dimensions shall be as shown in Figure 2.

3.4.1.3. Flange-Mounted Cable Grip

Flange-mounted cable grip (D-12-7191, Sht. 3, Figure 3) shall consist of a flange threaded body to accept a 4-hole cable sealing grommet, grommet compression nut and stainless steel cable grip. The flange portion shall be provided with a sealing gasket. The compression nut shall be secured against unintentional loosening through the use of a locking setscrew or other Amtrak-approved means. Materials and dimensions shall be as shown in Figure 3.

3.4.1.4. Fixed Jumper Mounting Adapter

Fixed jumper mounting adapter (D-12-7191, Sht. 11, Figure 11) shall consist of a flange-mounted housing with gasket. The assembly accepts the flange-mounted cable grip defined under Section 3.4.1.3. Materials and dimensions shall be as shown in Figure 11, Sht. 11.

3.4.2. Cable Assemblies

3.4.2.1. Outlet

Outlet (D-12-7191, Shts. 4 & 5, Figures 4 & 5) shall consist of a pre-molded receptacle body and contacts crimped to three 4/0 cables and each conductor of three #10 conductor cords. After all pin-cable assemblies are completed they are inserted into the receptacle body and completely potted with an insulated elastomeric molding compound. The compound shall have a dielectric strength of 950 V/mil, a thermal conductivity of 0.48 W/m-K and a temperature range at least -40ºF to 150ºF. The vendor must insure there are no internal voids or air gaps when the potting process is complete. This will be verified during the First Article Inspection by cutting the connectors into several segments 1” to 2” thick.

The receptacle body shall be made from a resilient material red in color, capable of meeting the performance requirements specified over a temperature range of -40°C to +60°C (-40°F to +140°F).). Contacts shall be copper alloy, 90% conductivity minimum; silver plated, and should be inserted with the cable attached and then secured in position with the elastomeric molding compound. The individual #10 conductor breakout from the cable jacket shall be integral to the body. The three 4/0 cables and the control cable shall have watertight bonds between the cable jacket and

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the connector body to prevent entrance of water that may otherwise wick into the body from extended and repeated exposure to moisture - rain, snow, ice or car wash chemicals.

The engaging front end of the receptacle shall be reinforced with an integrally molded circular stiffener to resist buckling during engagement of plugs.

4/0 pin contacts shall each withstand a pull-out or push-in force of 600 lbs minimum and #10 contacts shall each withstand a pull-out or push-in force of 150 lbs minimum.

The receptacle shall withstand 1960 volts RMS 60 Hz between all contacts, and contacts and receptacle body. Materials, cable, cord and dimensions shall be as shown in Figures 4 & 5 and Appendix A, Table II.

The body shall be permanently marked with the manufacturer's name and date code (month and year, i.e., 12/08), and Amtrak SAP Number..

3.4.2.2. Portable Jumper

Portable jumper (D-12-7191, Sheets 4 & 6, Figures 4 & 6) shall consist of 2 pre-molded plug bodies and contacts crimped to three 4/0 cables and each conductor of three #10 conductor cords. After all pin-cable assemblies are completed they are inserted into the plug body and completely potted with the insulated elastomeric molding compound. The compound shall have a dielectric strength of 950 V/mil, a thermal conductivity of 0.48 W/m-K and a temperature range at least -40ºF to 150ºF. The vendor must insure there are no internal voids or air gaps when the potting process is complete. This will be verified during the First Article Inspection by cutting the connectors into several segments 1” to 2” thick.

The heat shrink tubing should be applied over the back of the plug and the cables. The plug body shall be made from a resilient material, yellow in color, capable of meeting the performance requirements specified, over a temperature range of -40°C to +60°C (-40°F to +140°F). Contacts shall be copper alloy 90% conductivity minimum, silver plated. Contacts shall "Float" within the jumper head to accommodate any pin/socket misalignment and thus maintain reasonable mating forces.

Rigid insulation shall be provided between the forward end of the socket contacts and the plug face to preclude any possible contact between any plug contact and any receptacle contact unless plugs and receptacles are properly aligned, i.e., such as might occur in standby wayside service operations.

4/0 socket contacts shall withstand a pull-out or push-in force of 600 lbs minimum and #10 contacts shall withstand a pullout or push in force of 150 lbs minimum.

The plug mating end shall effect a circumferential seal in addition to the interfacial seal when mated with a receptacle. Cable and cord entry into body shall be sealed to prevent entrance of water that may otherwise wick into body from extended and repeated exposure to moisture - rain, snow, ice or car wash chemicals.

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The jumper shall withstand 1960 volts RMS 60 Hz between all contacts, and contacts and receptacle body. Materials, cable, cord and dimensions shall be as shown in Figures 4 & 6 and Appendix A, Table II.

The body shall be permanently marked with the manufacturer's name and date code (month and year i.e., 12/08), Amtrak SAP number and the jumper shall be color banded (See Figure 6).

3.4.2.3. Fixed Jumpers

Fixed jumpers (D-12-7191, Sheets 4 & 7, Figures 4 & 7) shall consist of a pre-molded plug body and contacts crimped to three 4/0 cables and each conductor of three #10 conductor cords. The plug body and contacts shall be the same as supplied for portable jumpers under Section 3.4.2.2.

The fixed jumper connector body shall be marked with the manufacturer's name and date code (month and year, i.e., 12/08), Amtrak SAP number Material, cable, cord and dimensions shall be as shown in Figures 4 & 7 and Appendix A, Table II.

3.4.2.4. Adapter Jumpers

Adapter jumper (D-12-7191, Sheets 4 & 8, Figure 4 & 8) shall consist of a pre-molded plug body and a pre-molded receptacle body with contacts crimped to three 4/0 cables and each conductor of three #10 conductor cords. The plug body and contacts shall be same as supplied for portable jumpers under Section 3.4.2.2. The receptacle shall be the same as supplied under Section 3.4.2.1 except the reinforcement at the mating end is replaced with a clamp assembly (Figure 8) to hold mated connectors in the secured position.

The connector body shall be marked with the manufacturer's name and date code (month and year, i.e., 12/08), Amtrak SAP number Materials and dimensions shall be as shown in Figures 4 & 8, and Appendix A, Table II.

3.4.2.5. Connector Jumper Cable

Connector jumper cable (D-12-7191, Sheets 4 & 9, Figure 4 & 9) shall consist of a double-ended pre-molded receptacle body with plastic polarizing phase pin and only one control circuit contact connected.
The adapter jumper connector bodies shall be marked with the manufacturer's name and date code (month and year, i.e., 12/08), and Amtrak SAP number. Material and dimensions shall be as shown in Figures 4 & 9, and Appendix A, Table II.

3.4.2.6. Motor Alternator Jumper Cable

Connector jumper cable (D-12-7191, Sheets 4 & 12, Figure 4 & 12) shall consist of a pre-molded receptacle body at both ends with only the control circuit contacts connected.
The connector bodies shall be marked with the manufacturer's name and date code (month and year, i.e., 12/08), and Amtrak SAP number. Material and dimensions shall

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be as shown in Figures 4 & 12, and Appendix A, Table II

3.4.2.7. Jumper Cable

Jumper Cable (D-12-7191, Sheets 4 & 13, Figure 4 & 13) shall consist of a pre-molded receptacle body at both ends with contacts crimped to three 4/0 cables and each conductor of three #10 conductor cords. The receptacle shall be the same as supplied under Section 3.4.2.1 except the reinforcement at the mating end is replaced with a clamp assembly (Figure 13) to hold mated connectors in the secured position.

The receptacle bodies shall be marked with the manufacturer's name and date code (month and year, i.e., 12/08), and Amtrak SAP number. Materials and dimensions shall be as shown in Figures 4 & 13, and Appendix A, Table II.

3.5. TESTING

3.5.1. Qualification Test

The vendor shall submit, for Amtrak's approval, the qualification test plan (QTP). The plan shall be submitted at least 30 days prior to the manufacturer's intent to perform the test. This test is an engineering procedure, executed on sample parts to ensure compliance with specification. The test consists of two sections:

- lab tests
- one year in-service test.

The vendor shall provide Amtrak with seven working days advance notice of testing to permit Amtrak to witness tests.

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3.5.1.1. Lab Test

The test shall, as a minimum, demonstrate the following, in order:

1. Mechanical inspection
2. Mating and unmating forces
3. Insulation resistance
4. Dielectric withstand voltage
5. Current rating/temperature rise
6. Contact resistance
7. Physical shock tolerance
8. Watertightness
9. Insulation Resistance/Dielectric Withstand
10. Contact retention force
11. Crimp tensile strength

All required testing shall be performed at no additional cost to Amtrak. The vendor shall furnish a written report of the test results.

3.5.1.2. One Year In-Service Test

Upon successful completion of the lab qualification tests, the 480V cable assemblies will be road tested for a period of one year. This test will be done, generally on ten cars, in normal revenue service.

Amtrak reserves the right to request additional tests as may be required.

3.5.2. Qualification Test Procedures

Prior to the first shipment, Amtrak shall be furnished with six production samples of each item for inspection and testing.

A production sample of all assemblies shall be given tests as follows:

3.5.2.1. Mechanical Inspection

A mechanical inspection shall be made to determine compliance with approved drawing, including a check of all dimensions, and proper level of workmanship.

3.5.2.2. Mating/Unmating Force

A check shall be made to determine that the force necessary to mate and unmate plugs and receptacles shall be as stated in this specification. A suitable measuring instrument shall be used. The test shall be conducted at 70°F, and after 8 hour minimum cold soak at -20°F.

3.5.2.3. Insulation Resistance

Using a 1000 volt megger or similar instrument, insulation resistance of the mated pair shall be measured. Measurement shall be between each contact and all other contacts, and also between contacts and the housing. At 77ºF, readings shall be a minimum of 50 Megohms.

3.5.2.4. Dielectric Withstand Voltage

A mated pair shall be high potential tested at 1960 VAC for 1 minute. There shall be no evidence of flashover or breakdown. Leakage current between any pair of contacts or between contacts and housing shall not exceed 1 mA.

3.5.2.5. Current Rating/Temperature Rise (Figure ‘A’)

A continuous current of the 395 amperes shall be applied simultaneously through each of the three power conductors. The mated assemblies (with the housing) shall be supported in still air, two feet above floor level. Temperatures shall be monitored by means of thermocouples positioned as shown on Figure ‘A’.

Temperature shall be continuously monitored and recorded at thirty minute intervals. Upon stabilization of all temperatures to within 1°F over a one hour period, temperatures shall be recorded at three minute intervals for 30 minutes. The cable assemblies will be considered acceptable if the temperature rises recorded in this test satisfactorily demonstrates to Amtrak that continuous operation at 395 amperes in an

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ambient of 110°F will not produce temperatures in excess of the insulation materials capability.

3.5.2.6. Contact Resistance (Figure 'B')

The millivolt drop across mated male and female contacts including the cable crimps shall be measured at rated current (395 Amps - Power Pins and 40 Amps - Control Pins) to check that the voltage across the contact pair does not exceed 75 millivolts and 33 millivolts respectively for the 4/0 and #10 AWG cables. Refer to Figure 'B' for locations of the test probes. This test shall be performed before and after the Physical Shock Test described below.

3.5.2.7. Physical Shock

Six mated assemblies (less housings) shall be subjected to a physical shock test by dropping the mated assembly onto a concrete surface from an elevation of six feet. Mated assemblies shall be dropped in a horizontal position a total of eight times. After the drop test, the contact voltage drop of the mated assembly shall be measured. There shall be no change in the insertion and withdrawal force or in the voltage drop after the shock test.

3.5.2.8. Watertightness

After the drop test is complete, the six mated assemblies shall be immersed horizontally in 6 inches of tap water for 30 minutes to verify sealing between cable and connector body and primary secondary sealing of the mated pair of connectors.

3.5.2.9. Insulation Resistance/Dielectric Withstand

Following successful completion of the above test, the assemblies shall again be subjected to a megger test and a high potential test in accordance with current IEEE, ANSI, and DOT standards. The insulation resistance shall not be less than 50 Megohms.

3.5.2.10. Contact Retention Force

The contact pullout and push-in forces shall be measured for each contact type on the plug and receptacle body. Forces shall meet or exceed those required in this specification, applied at a rate of 1 ± 1/4 inch per minute.

3.5.2.11. Crimp Tensile Strength

The minimum axial load to separate the wire from the contacts either by pulling the wire out of the wire barrel or breaking the wire within the wire barrel shall not be less than shown in the table below:

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Contact Size	Axial Load
4/0	1200 lbs.
10	150 lbs.

Contacts crimped to the cable shall be removed from the connector. The cable length shall be sufficient in length for adapting to a Tinius Olsen or similar test device. The rate of applying the load shall be 1 ± 1/4 inch per minute.

3.5.3. Acceptance Test

An Acceptance Test Plan (ATP) shall be submitted for Amtrak's approval at the same time the Qualification Test Plan is submitted. This test is a quality control procedure, executed on production run parts to ensure high manufacturing standards are maintained.

3.5.3.1. Minimum Requirements

In-process inspection shall be conducted along with product testing which shall consist at a minimum of the following tests, to be done on all cable assemblies:

1) Visual for conformance to approved product drawings.

2) High Potential - 1960V RMS 60 Hz, for 1 minute between contacts, and between contacts and ground. Leakage current to be less than 1 mA on a cable.

3) Continuity check for proper termination and cable/conductor marking.

4) Mating force check to confirm complete insertion and complete retraction forces are 50 ± 20 lbs.

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3.6. SYSTEM APPROVAL

3.6.1. General

Samples of cable assemblies and outlet housings shall be submitted for Amtrak's approval. Documentation supporting cable qualification shall be submitted to Amtrak for approval.

3.6.2. Design Reviews

Design reviews shall be held at times mutually agreed upon between Amtrak and the manufacturer; such reviews are intended to convey design concepts not readily shown on drawings.

3.6.3. Documentation

Prior to manufacturing, three copies of each of the following shall be submitted for

Amtrak's approval.

- Assembly Drawings
- Qualification Test Plan
- Acceptance Test Plan

Amtrak's approval does not relieve the vendor of the requirements of this specification, particularly Section 3.4 (Component Descriptions). Amtrak reserves the right to request additional drawings and documents as required for system approval.

3.6.4. First Article Inspections

To verify that any components being supplied under this Specification meet all Specification and drawing requirements, and are truly interchangeable with existing components, Amtrak will conduct a series of two (initial and as-installed) First Article Inspections (FAI) on the first complete assembly manufactured by a vendor, prior to allowing unrestricted manufacturing work to start. It is the intention of the FAI process that every function and feature of the items being supplied under this Specification be fully exercised and tested for proper operation under all normal, abnormal and fault conditions, both in the vendor's workshop and as applied on the vehicle.

The initial FAI shall consist of a pre-shipment inspection and testing of a prototype assembly at the vendor's facility. This shall be an active test, and the vendor shall provide all mounting fixtures, electrical and pneumatic power, etc, as required to fully functionally exercise all components and features. A complete range of operating voltages, currents, pressures, loads, etc. shall be applied to simulate both normal and abnormal conditions, and the response of the components to these conditions.

Once this FAI is successfully completed at the vendor's facility, the vendor shall ship the same assembly to the Amtrak maintenance facility identified by the Amtrak Bidding and Contract Documents or the Engineer, where Amtrak will install the assembly onto an Amtrak vehicle. A second "as-installed" FAI shall then be performed to verify proper operation of the assembly in the "as-installed" configuration. This shall in particular verify all component interface conditions with the vehicle.

Each FAI shall have Amtrak Engineering and/or Quality Assurance personnel as well as the vendor in attendance. They shall include, but not be limited to, a mechanical and electrical inspection to determine compliance with the specifications and the drawings, complete testing of the functionality of the component, demonstration of maintainability and troubleshooting, and verification of proper operation and complete compatibility/interoperability when installed on a vehicle. Approval by the Engineer following successful completion of the FAI process, as communicated through the Amtrak Contracting Agent, shall constitute final system approval.

3.6.5. Approved Products

Only products which have operated successfully in Amtrak service for one year will be considered for use in production quantities.

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4.0 Packaging and Shipment

For all components produced, following all assembly, the vendor is required to perform and fully document a complete verification test and evaluation of each component being supplied, prior to shipment to Amtrak. The results of this final testing shall be recorded in the documentation record. When successfully completed, the vendor may be directed by the Engineer to apply a permanent Engineer-approved identification label in an inconspicuous agreed-upon area, which shall include the name and location of the vendor, any serial number used by the vendor, any Amtrak "SAP internal catalog number, and the date of manufacture.

All packaging and shipping requirements shall be performed by the vendor. It is required that the vendor properly prepare all components being supplied under this Specification for shipment to Amtrak so that they are ready to install following unpacking.

The vendor shall package the components, unless otherwise instructed by the Amtrak Contracting Agent, to be suitable for continuous storage prior to unpacking in unheated (subfreezing), dusty indoor storage conditions. Components shall be appropriately packaged for their weight and size. Special efforts must be used to protect unusually fragile or plastic items from damage during shipping and handling. Large and bulky items shall be secured to a shipping skid or other commercial shipping media suitable to allow the use of fork lift trucks for handling.

The shipping package shall have an identification label. This label shall include the vendor's name and address, purchase order number, date released for shipment, Amtrak SAP internal catalog number, and any component assembly serial number. This information shall also appear in the vendor's invoice, and be included in the documentation record.

The vendor shall retain a copy of the shipping documentation record, and shall make three copies for Amtrak. One copy shall be included within the shipping container for the assembly, one copy shall be sent to the Amtrak Contracting Agent (or as otherwise designated in the purchase order), and the third copy shall be sent to the attention of the Amtrak Quality Assurance inspector in care of the Amtrak "ship to" address.

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5.0 Product Support

5.1 Program Schedule

If required by the contract documents, any vendor-produced Program Schedule shall include all program milestones, design reviews, production schedule, delivery schedule, and any other pertinent information that will assist with tracking program progress. Any requested changes to the Program Schedule must be presented to the Amtrak Contracting Agent for review and approval.

5.2 Delivery of All CAD Models and Drawings

Following the successful completion of the First Article Inspections, and as a precondition to permit production delivery of material to commence, the vendor must supply to the Amtrak Bureau of Rolling Stock Engineering, via the Amtrak Contracting Agent, an electronic set of every fully-developed CAD model and dimensioned drawing and Bill of Material which may have been created for every individual part used for the manufacture of all items being supplied under this Specification. All models and drawings shall comply with Amtrak Specification 867. Refer to Section 5.5 for additional details. Any later modifications as a result of warranty or other actions must include the affected models and drawings being revised as necessary and resubmitted to Amtrak.

5.3 Production Changes Require Engineer Approval

Once final system approval is granted by the Engineer and production has commenced, the vendor is forbidden to make any changes in the design, material or configuration of the items being supplied, unless approved in writing by the Amtrak Contracting Agent as per Amtrak Procedure PD 3.7.3.01, Design Review and Control Procedure. This shall include any modifications required as a result of warranty actions, so as to provide complete documentation.

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5.4 Spare Parts List

The vendor shall supply to the Engineer, via the Amtrak Contracting Officer, a Microsoft Excel spreadsheet list in Engineer approved format of any spare or consumable parts which are recommended to be stocked by Amtrak for maintenance of the components being supplied. Such lists shall contain for each item an item number, the spare part name (in noun, adjective format), the name of the Original Equipment Manufacturer (OEM), the OEM part number, approximate cost for each item, and recommended stocking quantity. The vendor shall also supply any revisions in this data up to the conclusion of the warranty period.

5.5 CAD Models, Drawings, Manuals and Parts Lists

All CAD models and drawings prepared by the vendor under this Specification shall be in full compliance with Amtrak Specification 867, Amtrak Drawing Standards for CAD. All CAD models and drawings shall be in Engineer-approved formats, and shall include a complete set of all "as-built" drawings of every part, component and assembly used for all items being supplied to Amtrak of all levels, not only the top assembly level. All CAD models shall identify all materials, surface finish and fasteners. Each drawing shall include a complete Bill of Material, providing quantities, original component manufacturer name and part number of the actual supplier of the part. Every part on the Bill of Material must be fully identified regarding its characteristics including material, plating, finishing, heat treatment, secondary operations, etc. Amtrak drawing formats and number series shall be used as agreed upon with the Engineer. The final CAD models shall be delivered electronically CDs in DXF or DWG format. The as-built drawings shall be delivered as 3 sets of

all drawings in electronic format in DXF or DWG format (files) along with 3 sets of CDs of all drawings in Adobe Acrobat read-only PDF file format. The vendor shall also supply any revisions in this data up to the conclusion of the warranty period.

All documentation data must be compatible with Microsoft Office 2010 or newer applications.

The vendor shall also submit in electronic format to the Amtrak Bureau of Rolling Stock Engineering, via the Amtrak Contracting Agent, a complete set of all documentation including the maintenance manual, and parts list.
The parts list shall:

- Identify all individual parts used (in noun, adjective format) in the items being supplied under this Specification, and must include the original equipment manufacturer (OEM) name and part number; use of an intermediate supplier or distributor's name or part number is not acceptable.

- Indicate quantities for each item within each assembly, use exploded isometric-view parts diagrams if possible, use separate pages for parts diagrams and tabular data if possible, and be sufficiently complete to permit Amtrak to order individual replacement spare parts direct from the actual parts manufacturer.

- Cross reference all vendor part numbers with Amtrak SAP number

The maintenance manual shall:

- Include complete information from installation, through troubleshooting, repair and complete overhaul.
- Include repair instructions, where applicable

All documentation data must be delivered as 3 sets of CDs in Adobe Acrobat read-only PDF file format, distilled in Acrobat 9.0 or higher, and in addition 3 sets of CDs in its original Microsoft Office applications format, for internal use by Amtrak for future revision of the data. The vendor shall also supply any revisions in this data up to the conclusion of the warranty period.

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All PDF files (other than drawings) shall be distilled from the authoring documents, resulting in PDF documents that can be indexed and searched. All authoring electronic data files making up the manuals shall be delivered formatted such as to not cause pagination errors during the PDF distillation process. The PDF file produced from the distillation process shall match any published version of the authoring document.
All files shall be editable by Amtrak for future document maintenance. All columnar data found within word processing files shall be presented in a table format. Any fonts used on the creation of authoring and/or PDF files shall be embedded and not restricted for use. PDF documents with definable chapters, sections and/or subsections shall be linked to their individual locations with bookmarks internal to the file in the fashion of a hierarchical format such as a Table of Contents. Creation of PDF files from scanned images only, resulting in non-searchable or non-indexable documents, will be restricted to only those allowed by the Engineer. Scanned information in the form of document attachments may be allowed to be imported into an existing PDF file that is searchable and capable of indexing, if the information is supplemental to context to the file and not the primary means of communicating the subject's information. If documents are scanned, careful attention will be taken to not allow misalignment of the pages. Opening options in the PDF file format should be set to show bookmarks and page, with magnification at "Set Width" and "Continuous Page" settings. Distillation settings shall be "E Book" or "Print", with DPI settings set

to produce quality printing from a desktop printer without overly increasing the size of the file.

5.6 Failure Analysis

A Failure Analysis to determine the cause and frequency of defects occurring during the warranty shall be performed by the vendor and submitted to the Engineer and the Amtrak Contracting Agent for concurrence. Such analysis shall be performed and reported within 30 days from the date of each failure.

6.0 Source Inspection

6.1 Purpose

Amtrak will perform periodic source inspection of vendor materials and components being supplied. The following is intended to be used as an outline defining activities and responsibilities of the vendor performing the source inspections.

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6.2 Professionalism

All inspections, test observations, and other activities performed in the fulfillment of the contract are to be conducted in a professional and ethical manner. The vendor is representing Amtrak in the performance of the contract and therefore must remain courteous, conscientious and professional under all circumstances arising from performance of the contract.

6.3 Scope of Work

Amtrak has implemented a multi-faceted supplier management program of which source inspection is an integral part. Amtrak identifies vendors and materials/components through various methods which will be subject to source inspection. By performing source inspections, Amtrak expects to benefit by use of vendor facilities, measuring and testing equipment to verify materials/components, through rejecting noncompliant materials/components before shipment and receipt by Amtrak, presence of Amtrak representative periodically to ensure continuing good performance, and assist to communicate Amtrak intentions and interpretations of specifications and resolve issues. The vendor will conduct inspection or verify through observation, product compliance with drawings, specifications, standards or Amtrak contract documents and report findings of said inspections to Amtrak.

6.4 Services

6.4.1 Scheduling Inspections

The vendor shall conduct observations and verifications on Amtrak identified materials and components produced by the vendors for Amtrak. Inspections must be scheduled to coincide with final inspection of said materials/components due for shipment to Amtrak. The vendor may use random sampling where large quantities of material are subject to shipment and note sampling method in associated reports. The vendor must perform all dimensional and operational inspections in accordance with the Quality Plan prior to source inspection, and make all inspection records available for review by the Amtrak source inspector, with focus on CTQ items.

6.4.2 Dimensional Inspection

The vendor must witness and verify conformance with dimensional characteristics per drawings identified in the Amtrak contract documents. The vendor must witness and verify conformance with regulatory standards and requirements including material certification as cited in specification or other reference documents identified in Amtrak contract documents.

6.4.3 Operational Inspection

The vendor must witness and verify conformance with operational tests as cited in specifications, operators manual or other reference documents identified in Amtrak contract documents.

6.4.4 Inspection Reports

The vendor must provide a report documenting the vendor source inspection and the inspection results. The report must include the name of the vendor, the date of the inspection, the material or component name, Amtrak (SAP) ID number(s) for items inspected, the quantities of each item inspected, the inspection results, and the actions taken where nonconforming materials/components are found. Reports should reference appropriate drawings, specifications, standards, requirements, or Amtrak contract document as appropriate.

6.5 Qualification of Personnel

It is the responsibility of the vendor to provide personnel with adequate training and experience to perform all the activities of the source inspections described above. Personnel must also conduct their activities with professionalism.

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APPENDIX A

ENGINEERING DESIGN PERFORMANCE SPECIFICATION
CABLE AND WIRE

1. SCOPE

1.1. This specification covers the design and performance requirements for single conductor #4/0 AWG and three conductor #10 AWG head-end power cables rated 600 volts, designed for heavy duty service where severe flexing is encountered. The normal operating temperature range is -55° to +90°C (-67°F to +194°F).

2. APPLICABLE DOCUMENTS

2.1. The following specifications or standards form a part of this specification to the extent specified herein:

- ASTM B-3 Soft or Annealed Copper Wire
- ASTM B-172 Rope-Lay-Stranded Copper Conductors Having Bunched Stranded Members, For Electrical Conductors
- UL Subject 62 Thermoplastic Wire and Cable
- I.C.E.A. S-19-81 Rubber Insulated Wire and Cable

3. REQUIREMENTS AND TEST METHODS

3.1. Conductor: The conductor shall be bare or tinned annealed copper conforming to the requirements of ASTM B-3. Stranding shall be in accordance with ASTM B-172 for Class M Rope-Lay conductor. Conductors to meet the dimensions and DC resistance specified in Table 1.

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TABLE 1 - CONDUCTOR DATA

Conductor Size AWG	Coating	Area CMILS	No. & Size Each Wire In Strand	Strand Construction	Conductor Diameter (Max.)	D.C. Resistance @20°C(Ohms/Mft)
4/0	Bare	211,600	5320/34	19 x 7 x 40/34	.645"	.0524
10	Tinned	10,380	259/34	7 x 37/34	.132"	1.04

3.2. Primary Insulation: The primary insulation shall be an Amtrak approved single extrusion of thermoplastic elastomer (TPE) (or other material with equal or superior properties), specially compounded to have good electrical properties, flame resistance, excellent low temperature properties

and extreme flexibility. The insulation shall be tight fitting over the stranded conductors, but shall strip freely using manual mechanical stripping tools.

3.2.1. Thickness: The average insulation wall thickness and minimum insulation thickness shall be as specified in Table II.

3.2.2. Physical Properties-Unaged: When tested according to Paragraph 86.1-89.19, UL Subject 62, the minimum acceptable values shall be as follows:

- Tensile Strength, Min. PSI - 800
- Elongation, Min. Percent - 300

3.2.3. Physical Properties-Aged: When tested according to Paragraphs 82.1-89.19, UL Subject 62, insulation samples which have been aged in a circulating air oven for 168 hours at 120°C ±1°C (248°F ± 2°F) shall retain the following minimum physical property values:

- Tensile Strength - 80% of unaged value
- Elongation - 80% of unaged value

3.3. Reinforcement: A reinforcing seine twine or other Amtrak approved material shall be applied in the form of a cross wrap over the primary insulation on the 4/0 cable.

3.4. Jacket: The jacket shall be an Amtrak approved black polychloroprene (Neoprene), or other material with equal or superior properties, specially compounded for heavy duty applications. The material must be compounded to exhibit excellent resistance to: moisture, oils, and fluids, abrasion, tearing, compression, flexing, ozone, sunlight, flame, and heat. The jacket shall be extruded tightly over the primary insulation (and reinforcing twine) but adhesion between the two layers is not a requirement.

3.4.1. Thickness: The average jacket thickness and minimum jacket thickness shall not be less than specified in Table II.

3.4.2. Physical Properties-Unaged: When test according to Paragraph 6.4.14, ICEA S-19-81, the minimum acceptable values shall be as follows:

- Tensile Strength, Min. PSI - 1800
- Elongation, Min. Percent - 250

3.4.3. Physical Properties-Aged: When tested according to Paragraph 6.4.14, ICEA S-19-81, samples of the jacket material which have been aged in a circulating air oven for 168 hours at 100°C ±1°C (212°F ± 2°F) shall retain the following minimum physical property values:

- Tensile Strength - 50% of unaged value
- Elongation - 50% of unaged value

4. QUALIFICATION TESTS

4.1. Dielectric Test: One inch of insulation shall be removed from each end of a 24-inch sample of finished cable and the two ends secured together. The loop thus formed shall be immersed in tap water so that not more than 1 1/2 inches of each end of the insulation will protrude above the surface of the water for a period of 4 hours. At the conclusion of the 4 hour period of immersion and while the application of 3000V at 60 Hz between the conductor and water for a 1 minute period, there shall

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be no rupture or puncture of the insulation or jacket.

4.2. High Temperature Tests: One inch of insulation shall be removed from each end of a 24 inch sample of finished cable. The sample shall be suspended around cylindrical mandrel 5 times the outside diameter of the cable and a 6 pound weight attached to each end of the sample. The sample on the mandrel with the weights freely suspended shall be placed in a circulating air oven maintained at a temperature of 212°F for a period of 120 hours. At the end of the conditioning period, the sample shall be removed from the oven and allowed to cool to room temperature. When cool, the weights shall be removed and the sample bent not less than 180 degrees around the mandrel in the reverse direction at a uniform rate for a complete 180 degrees in 30 seconds. The sample shall then be subjected to the Dielectric Test as specified in Paragraph 4.1.

4.3. Shock Test: An 18 inch sample of finished cable shall be conditioned in an air oven at a temperature of 71°C ±1°C (160°F ± 2°F) for a period of 72 hours. At the end of the conditioning period the sample shall be removed from the oven and allowed to remain at room temperature for 24 hours. The shock consists of dropping a 23 pound weight a distance of 6.5 inches on the center portion of the sample while it is clamped flat on a smooth metal plate. The drops shall be made at a rate of 25 per minute. There shall be a continuous current of 15 amps through the conductor and metal plate to detect open or short circuit. Failure of a sample will be considered as the time when current ceases to flow, from open or short circuit. Required: 1550 shocks, minimum.

4.4. Cold Bend: A sample of finished cable shall be placed in a cold chamber and conditioned at -54^{0}C ±2°C (-65°F ± 3°F) for 48 hours. While at this temperature the sample shall be bent around a mandrel equal to 5 times the outside diameter cable at a uniform rate of 5 turns per minute for 2 complete turns. Fracture shall constitute failure. The sample shall then be subjected to the Dielectric Test as specified in Paragraph 4.1.

4.5. Cold Impact: A sample of finished cable shall be placed in a cold chamber and conditioned at -54°C ±2°C (-65°F ± 3°F) for 48 hours. While at this temperature the cable shall be placed on a 3/8 inch steel plate and subjected to a 3 ft-lb impact by dropping a weight having a ball-shaped end with a 1/2 inch radius through a tube at right angles to the sample. Three drops shall be made at the same spot on the sample. Fracture shall constitute failure. The sample shall then pass the Dielectric Test as specified in Paragraph 4.1.

4.6. Scrape Abrasion: A 24 inch sample of finished cable shall be tested using the abrading apparatus specified in Paragraph 4.8.1.2, MIL-C-915E. The test sample shall be laid over the drum of the abrading apparatus so as to extend approximately half way around the drum. One end of the sample shall be secured to the base of the drum support, and a one pound weight fastened to the other end. The direction of rotation shall be away from the fixed end of the sample, toward the weighted end. Rate of rotation shall be approximately 17 revolutions per minute. An 11-volt potential is applied between the conductor and the abrading tool. Electrical contact between the abrading tool and the conductor constitutes failure. Required: 1300 cycles, minimum.

4.7. Flame Test: When tested according to Paragraph 18.64 of the Code of Regulations, Title 30 U.S. Bureau of Mines, the maximum flame travel shall not exceed 6 inches and the sample shall not continue to burn for more than 4 minutes after removal of the burner flame.

4.8. Fluid Immersion: Two individual samples shall have one inch of insulation removed from each end of 24 inch samples of finished cable and formed into a loop not less than 5 times the diameter of the cable. A minimum of 18 inches of the cable shall then be placed in Hydrocarbon Fluid and Isopropyl Alcohol for a 4 hour period and allowed to air dry for a 2 hour period. Upon completion of the

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soaking and air drying, the increase in cable diameter shall be less than 15 percent. The sample shall then be subjected to the Dielectric Test as specified in Paragraph 4.1.

4.9. Insulation Resistance: A sample of finished cable shall be tested for insulation resistance after a 4 hour immersion in water. While still immersed, the conductor shall be connected to the negative terminal of the test equipment and a reading taken after an electrification period of 1 minute with a constant direct current potential of not less than 100 volts nor more than 500 volts applied. The insulation resistance in Megohms - 1000 feet at 60°F shall not be less than the value of R calculated as follows:

R = K Log D/d
R = Insulation resistance in Megohms - 1000 feet
K = 2000
D = Diameter over primary insulation
d = Diameter under primary insulation

If the temperature at the time of measurement differs from 60°F, the resistance shall be corrected to that at 60°F by multiplying the measured value by the proper correction factor supplied by the manufacturer.

5. IDENTIFICATION

5.1. The outer jacket shall be surface printed in white ink, at intervals not exceeding two feet, with the following information: (for single conductor #4/0 AWG) - "BRAND NAME 600 VOLT #4/0 AWG" (for three conductor #10 AWG) - "BRAND NAME 600 VOLT 3/C #10 AWG".

6. PREPARATION FOR DELIVERY

6.1. Packaging: The cable shall be shipped on sturdy non-returnable wooden reels suitably covered to protect the cable from damage during transit. Normally, only one length shall be allowed on each reel. However, if more than one length is packaged per reel, the number and quantity of each length shall be clearly marked on the outside of the reel.

6.2. Marking: Each reel shall be plainly marked with the following information; plus any other information called out on the purchase order:

- Name of Manufacturer
- Date of Manufacture
- Customer Purchase Order Number
- Manufacturer's Order Number
- Product Description: Wire Size, 600 Volt, insulation type, etc.
- Manufacturer's Part Number
- Amtrak AMMS Number
- Lot or Serial Number
- Warning Labels as Appropriate (for shipping and storage, etc.)

Preparation for shipping shall assure arrival at the destination without degradation of the cable.

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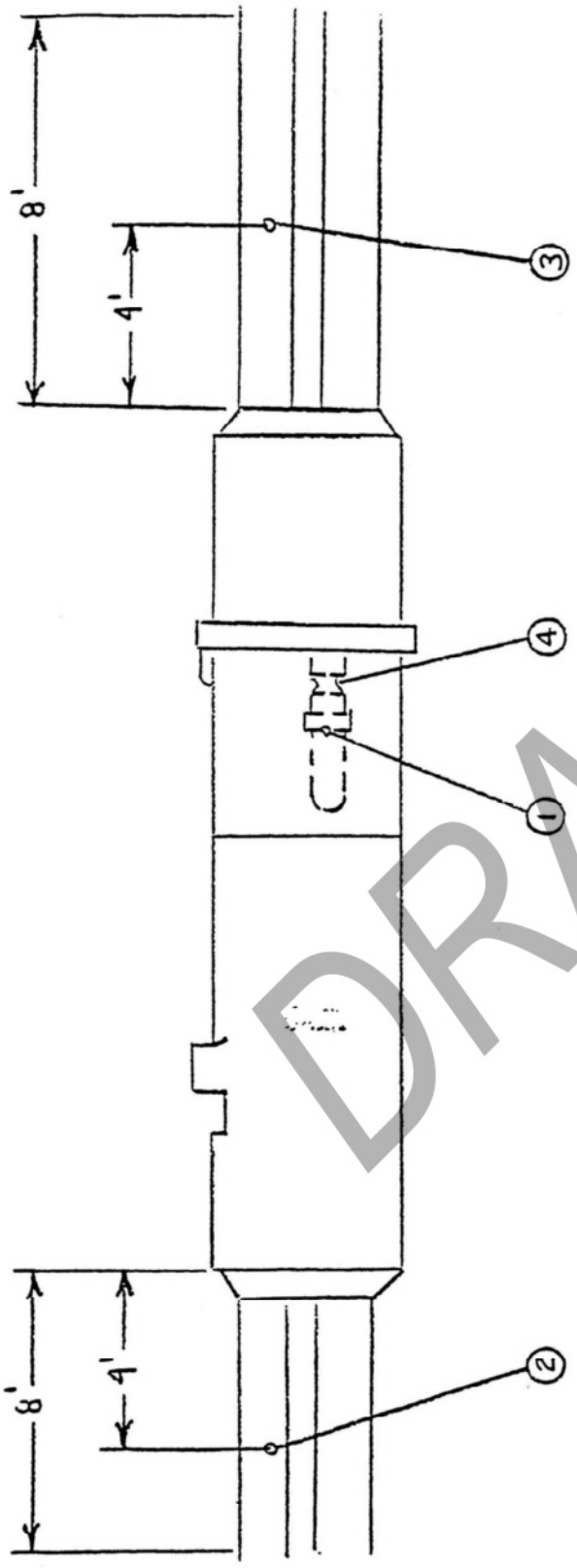

(1) within the outlet between the insulation material and the receptacle contact at a depth of approximately 2-1/2 inches, PIN #1 or 2.

(2) at the surface of one of the cable assembly power cables approximately four feet from the outlet.

(3) at the surface of one of the cable assembly power conductors (beneath the insulation and jacket) approximately four feet from the outlet.

(4) at the juncture of the crimp well and the body of a 4/0 socket contact, pin #1 or 2.

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Figure 'A' – Temperature Rise Test: Location of Thermocouples

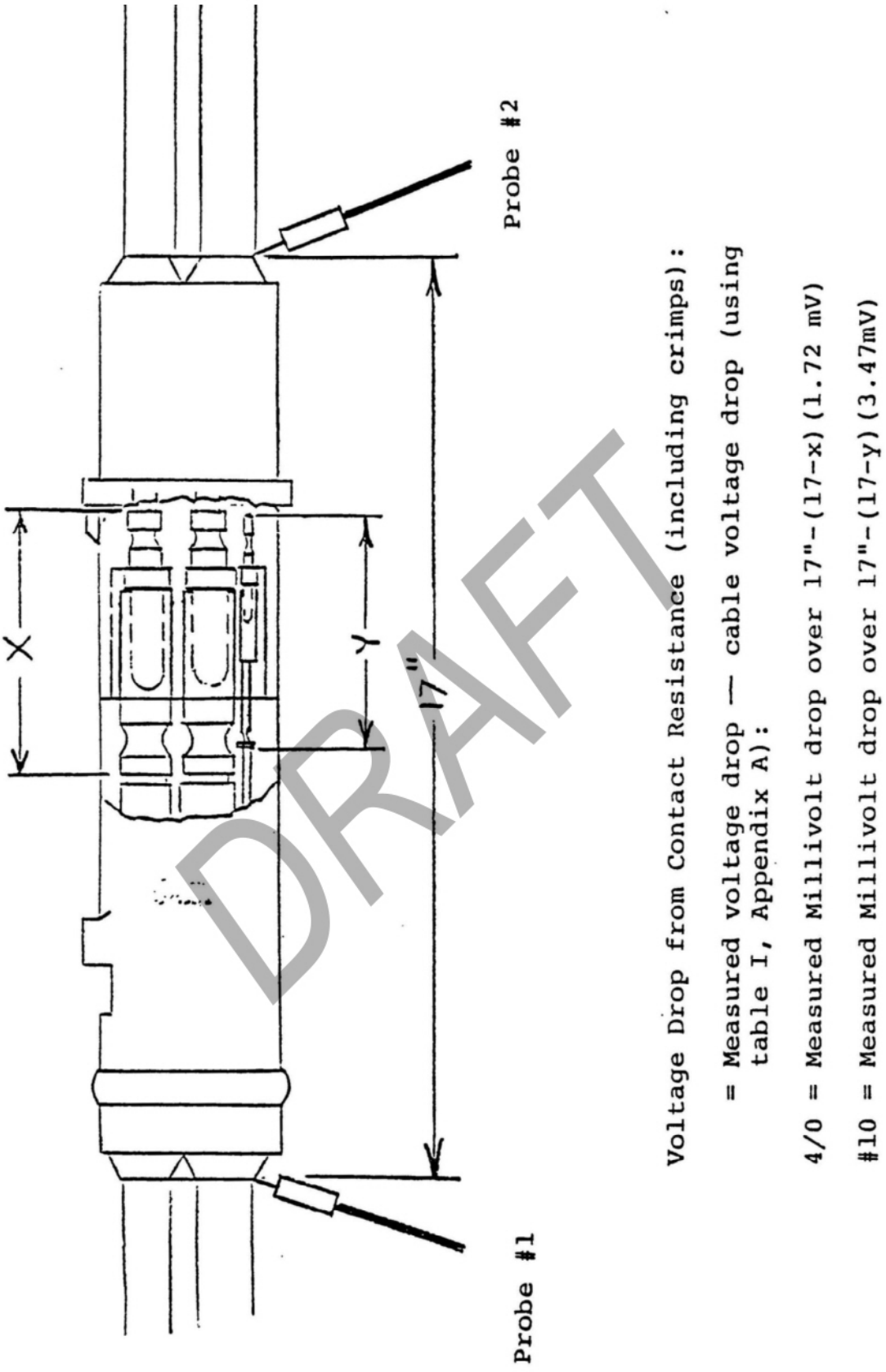

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Figure 'B' – Contact Resistance Millivolt Drop Test: Measurement Points

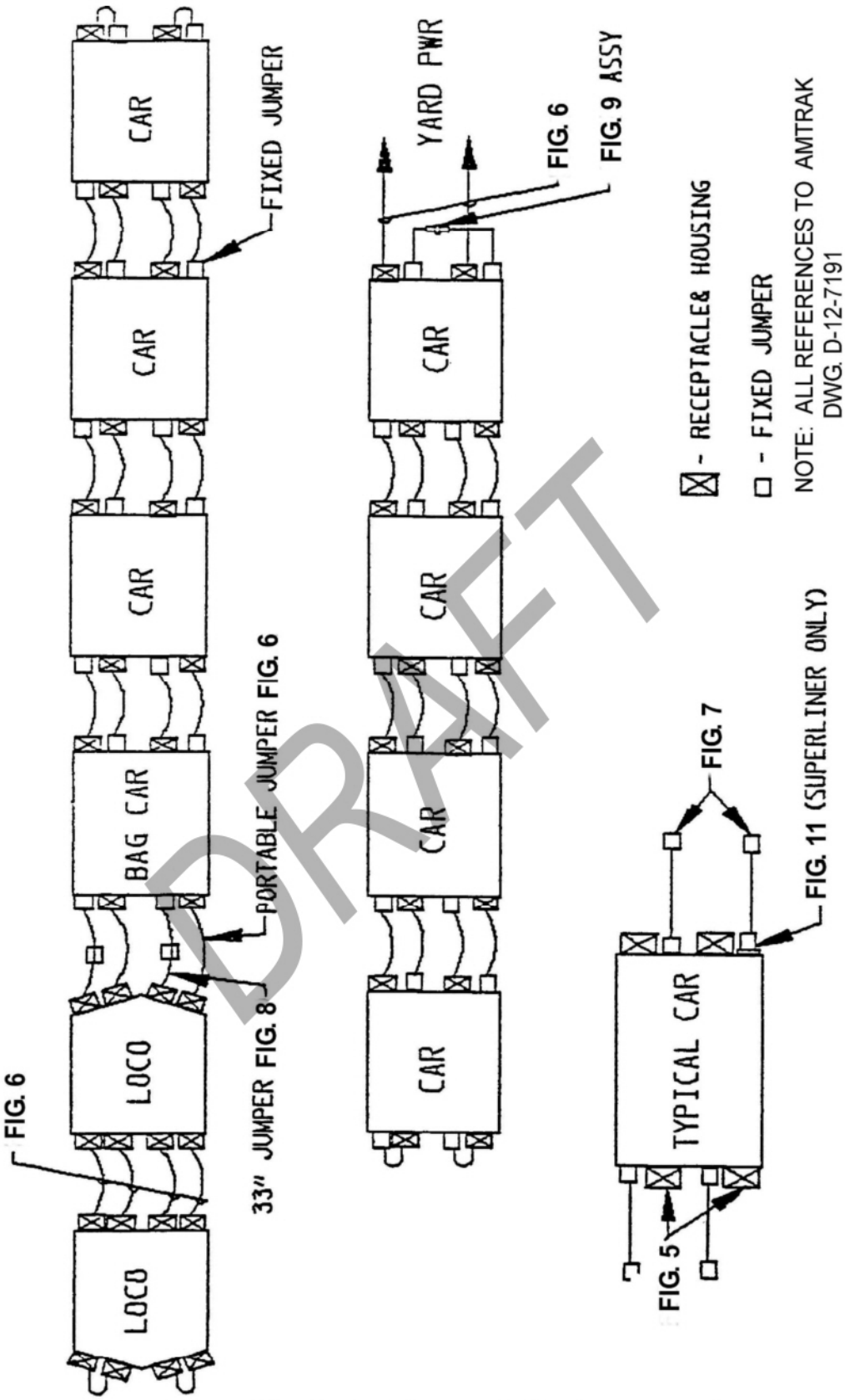

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Figure 'C' – Typical Jumper Cable Arrangement

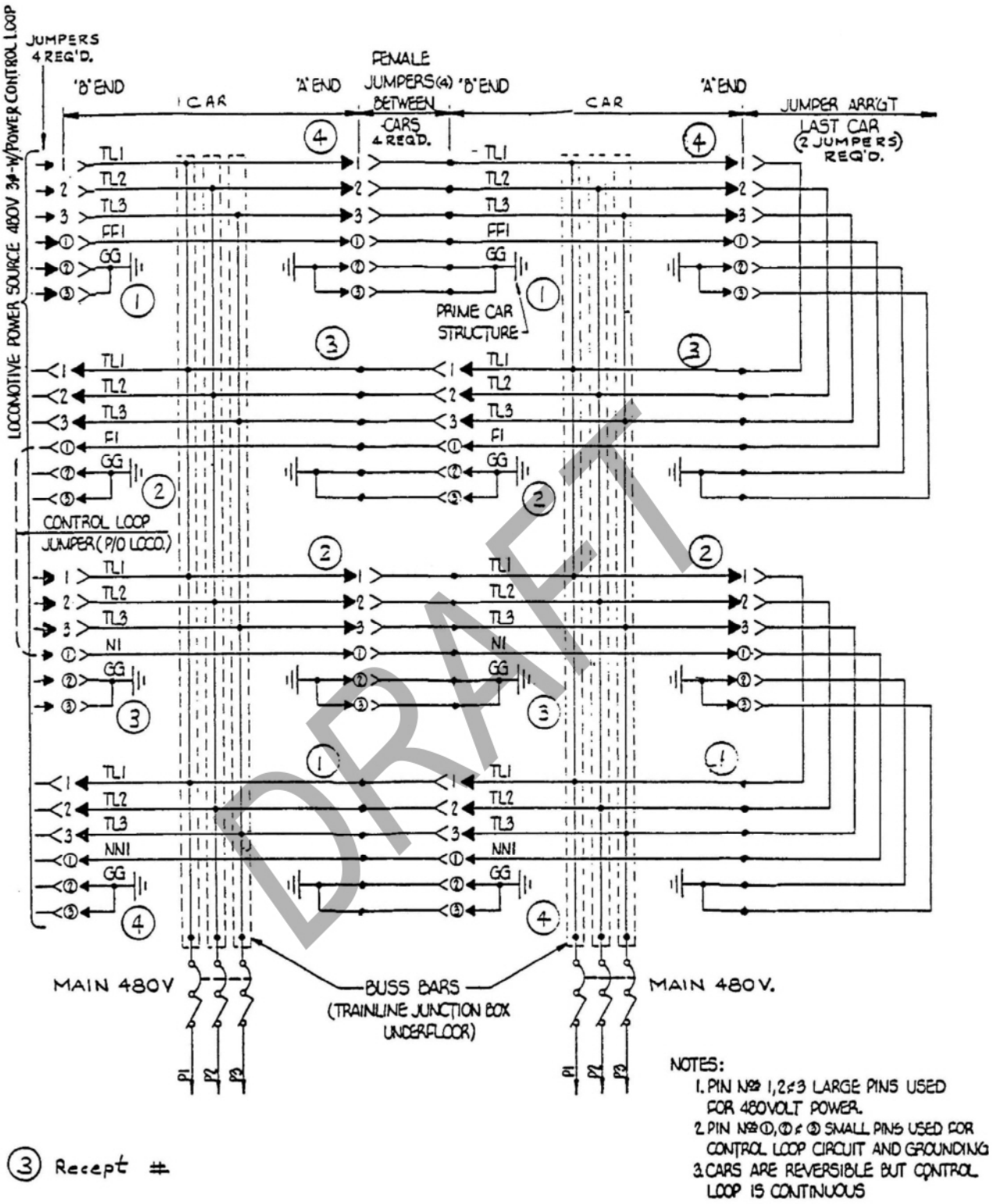

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Figure 'D' Typical 480 Volt Trainline Wiring

TABLE II – CABLE DIMENSIONS

For Single Conductor #4/0 AWG:					
Conductor Diameter (Nominal)	Average Insulation Thickness	Minimum Insulation Thickness	Average Jacket Thickness	Minimum Jacket Thickness	Cable Diameter
605"	0.60"	0.54"	.085"	.068"	.895" ± .025"

For Three Conductor #10 AWG:								
Conductor Diameter (Nominal)	Average Insulation Thickness	Minimum Insulation Thickness	Single Insulated Compound Diameter (Nominal)	Fillers	Binders	Jacket Thickness	Cable Diameter	Color Code
.132"	.045"	.042"	.229"	Nylon Filaments as required to Maintain Circular Cable Cross-section	Mylar Tape Spirally Applied .001" thick 25% min. overlap	.083" Min.	.685±.015"	Black White Red

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Amtrak
Mechanical Department
Bureau of Rolling Stock Engineering

SPECIFICATION

for

Upper Berth Assemblies For Use on Single Level Sleepers

SPECIFICATION No. 358

Revision B

Initial Issue: 02/27/1990

Revision Issue Date: 11/11/2009

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Approved	Date	
	3/11/10	Chief Mechanical Officer
	12/28/09	Deputy Chief Mechanical Officer Engineering
	12/21/09	Senior Director - Rolling Stock Engineering
	11-24-09	Director Industrial Design
	11/23/2009	Originator

Originator: Doug Karan

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ABSTRACT

This document identifies requirements for upper berths for single level sleeper cars (Viewliners) for long-distance railway operation by Amtrak. This document defines both hinged folding berths for bedrooms and vertically sliding berths for roomettes.

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SPECIFICATION NO. 358 CHANGE SHEET

REVISION	DATE	PAGE	DESCRIPTION
A	11/05/93	4	"square inches" to inches square
B	11/11/09		General revisions and updates

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1.0 SCOPE

This Specification defines the design, performance, and acceptance criterion for upper berth assemblies installed in single level sleeper cars (Viewliners) for long-distance railway operation. This document defines both hinged folding berths for bedrooms and vertically sliding berths for roomettes.

The berths shall be designed to provide maximum passenger comfort, safety, and convenience using the latest agronomic design criterion. An emphasis shall also be placed on ease of operation, maximum reliability, and ease of maintenance.

1.1 Vendor Responsibilities

This specification is subordinate to Amtrak Specification 769 . The Vendor is responsible to adhere to the requirements of Specification 769 B as it relates to Upper Berth Assemblies.

2.0 GENERAL

2.1 Safety Standards

The upper berth systems shall comply with 49CFR 238. All materials used shall conform to the requirements in Section 5.0 of this specification. Certified test results from an independent testing laboratory shall be supplied prior to production of the upper berths. The berths shall be absolutely free of sharp edges, pinch points, protrusions, or any element that would potentially cause injuries to passengers, crews or maintenance personnel.

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2.2 Features and Dimensions

Passenger comfort, safety, enduring appearance, rugged construction, ease of installation, operation and maintenance, and part interchangeability shall be basic considerations.

The berths and operating mechanism shall be so designed and manufactured to eliminate any looseness or rattling of parts. An unoccupied berth shall not have rattles, in the stowed or down position, when the railroad equipment is in operation.

The upper berths shall be easily operated by either the passenger or crew when converting the room from day to night mode or vice versa. The force required to raise or lower the upper berth shall not exceed 40 pounds with the berth loaded with its mattress, linens, blanket, pillows and lower berth mattress pad. The latch/hinge operating mechanism shall securely latch the berth in the full down "bed mode", full up "stored mode", and an intermediate "safety stop". Motions required to store or deploy shall be complimentary rather than opposing.

Clear operating instructions shall be provided for each upper berth in accordance with Amtrak specification # 697. The instruction placards shall be located near the operating handles. Appropriate safety warning

signs for counterbalance springs, or other devices shall be applied to access plates for those devices.

3.0 DESIGN CONSIDERATIONS

3.1 Design Objectives

The SUPPLIER shall furnish two (2) upper berth configurations; hinged, and horizontal "pull down". The berths shall be furnished with the mattress, safety harness, and all operating hardware (where applicable). It is the SUPPLIER's responsibility to standardize hardware and tooling to maximize part interchangeability between the two designs. The two berth configurations should be interchangeable as replacements units for the existing Viewliner I Sleepers. To the greatest extent practical, the new berths should have common hardware and wear parts with the existing Viewliner I Sleepers.

Design and manufacture of the complete berth system shall ensure the system survives 8/4/4g loading without breaking free from carbody.

The berth and mechanisms shall be designed to withstand normal passenger use for the 30 years.

It shall be possible to conduct the following repairs/ adjustments to the upper berth without the need for dismounting the berth from the room:

- Repair/ replace berth release handle
- Repair/ replace the berth latch pawls and associated linkage to the release handle
- Repair/ replace counterbalance mechanism
- Repair/ replace hinge (hinged berths only)
- Repair/ replace the keeper (holding the berth up or down, hinged berths only)
- Repair/ replace berth guides at wall tracks (roomette berths only)
- Repair/ replace wall-mounted track
- Repair/ replace mechanism that keeps the berth horizontal during up/ down motion.

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4.0 SUBSYSTEMS

4.1 Hinged Berth

The hinged berth is located in the deluxe and handicapped bedrooms. The berth is to hinge down from the near-vertical to horizontal for use in the night mode.

The latch/hinge operating mechanism shall have an integral spring assembly that shall restrict the berth's unattended movement to approximately 40 degrees from the horizontal. The mechanism shall also definitively latch the berth in three (3) positions during operation; 1) full down or "bed mode", 2) full up or "stowed position" and 3) intermediate "safety stop". Operating mechanism shall not employ cables. The latching system shall be designed so that the berths will not passively close or open when the vehicle is exposed to 8g's longitudinally, 4g's transverse and 4g's vertically.

Latching surfaces shall be durable metal and designed so that wearing portions can be renewed. The design shall ensure that the latch, hinge or track mechanism requires no adjustments for at least 7000 cycles. This shall be demonstrated in an endurance test, cycling between all 3 positions of the berth, fully loaded. The complete berth assembly, including latches will be cycle tested through the full range of motion to 10,000 cycles.

The shell/pan assembly shall be designed and composed of materials that meet the criteria of Paragraph 5.0. Exposed surfaces shall be durable, maintenance free, and compatible with the aesthetics of the room modules. The bottom and front shall be covered with Tedlar laminate, Schneller or approved equal.

4.2 Horizontal "Pull Down" Berth

The pull down berth is located in the double roomette. The berth is stored in the horizontal position against the ceiling lining and is pulled down along a side frame track/support assembly to the bed mode position.

The latch operating mechanism shall have an integral spring assembly that shall restrict the berth unattended downward movement to approximately 76 inches above the floor. The mechanism shall also definitively latch the berth in three (3) positions during operation; 1) pull down or "bed mode", 2) pull up or "stowed position" and 3) intermediate "safety stop". Berth shall be easily operated by average passengers or train attendants. The latching system shall be designed so that the berths will not passively deploy or close when the vehicle is exposed to 8g's longitudinally, 4g's transverse and 4g's vertically.

Latching surfaces shall be durable metal and designed so that wearing portions can be renewed. The design shall ensure that the latch, hinge or track mechanism requires no adjustments for at least 7000 cycles. This shall be demonstrated in an endurance test, cycling between all 3 positions of the berth, fully loaded. The complete berth assembly, including latches will be cycle tested through the full range of motion to 10,000 cycles.

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4.3 Safety Harness

The safety harness, furnished with the upper berth assemblies for passenger safety, and its attachments shall be in accordance with Federal Motor Vehicle Safety Standard for Seat Belt Assemblies No. 571.209. This shall include, but not be limited to, belt material, sewing, and misc. hardware.

The safety harness shall also be used as a device to secure the berth ladder in place when it is stored in the berth.

The safety restraint system shall be capable of safely restraining a 95th percentile male at 4 g's in roomettes and 8g's in the Bedrooms and Accessible Bedrooms

4.4 Mattress

Refer to Specification No. 364, Sleeping Car Mattresses.

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5.0 TESTING

The following test shall be conducted with no fractures or failures of any system component and no permanent deformation which could affect the operation of the berth. The berth configurations shall be tested with the berth mounted/supported to simulate actual "in car" installation. A stress analysis shall be made available to AMTRAK three (3) weeks prior to "First Article Inspection".

5.1 Deflection Test

a) A 600 pound weight shall be uniformly applied over the entire mattress pan of the berth. The maximum temporary deflection at any point shall not exceed .75 inches.

b) An 18" wide, 600 pound weight shall be applied to the top of the leading edge of the berth, at its centerline. Maximum temporary deflection shall not exceed .75 inches.

5.2 Live Load Test

The purpose of the following tests are performed to simulate two and three passengers sitting on the berth at different points.

a. An 1125 pound weight shall be uniformly applied over the entire pan of the berth, and held in place for five (5) minutes. There shall be no failure, permanent set or noticeable creep.

b. An 1125 pound weight shall be uniformly applied on the entire leading edge of the berth, and held in place for five (5) minutes. There shall be no failures, permanent set or noticeable creep.

c. A 975 pound force shall be applied on the left or right hand corner, on an area covering one third the length of the leading edge and one third the width at the end, and held for 5 minutes. There shall be no failure, permanent set or noticeable creep.

The corner selected for the test shall be at the discretion of AMTRAK.

5.3 Dynamic Test

a. A 185 pound weight with an impact area no larger than 20 inches square shall be dropped from a height of 3 feet, striking the left or right leading edge of the berth at the midpoint of its length while the berth is in the down position.

b. A 185 pound weight with an impact area no larger than 20 inches square shall be dropped from a height of 3 feet, striking the center of the pan of the berth while in the down position.

c. A 185 pound weight with an impact area no larger than 20 inches square shall be impacted horizontally at the centerline (vertical and horizontal) of the leading edge of the berth at a speed sufficient to induce a 5 g load on the berth (925 pound force).

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d. A 185 pound weight with an impact area no larger than 20 inches square shall be impacted horizontally at the centerline (vertical and horizontal) of the end of the berth at a speed sufficient to induce a 5 g load on the berth (925 Pound Force).

There shall be no damage incurred, other than local deformation at the impact area, to the berth, its attachments, or operating mechanisms after completing these tests.

5.4 Destruction Test

The purpose of the following test is to determine the "weak link" in the composite structure. At the point that failure(s) occur, all conditions of the failure(s) are to be documented. No deflection values need be taken.

a. A force of 1,400 pounds shall, be uniformly applied to the berth pan and increased in 200 pound increments until failure occurs or a 3,000 pound load is achieved.

b. If failure does not occur in test 5.4a, remove load. Then apply a 1,400 pound force uniformly on the entire length of the leading edge of the front of the berth and increase load in 200 pound increments until failure occurs, or a 3,000 pound load is achieved.

c. If failure does not occur in test 5.4b, remove load. Then apply a 1,400 pound force to either the left or right front corner covering an area of one forth the distance of each length, and increase in increments of 200 pounds until failure occurs, or a 3,000 pound load is achieved.

The site selected for the test shall be at the discretion of Amtrak.

d. If failure does not occur in test 5.4c, remove load. Then apply a 1,400 pound force to either the left or right front quadrant (25%) uniformly loaded on the pan as well as both edges, increase increments of 200 pounds until failure occurs or 3,000 pounds is achieved.

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6.0 SYSTEM APPROVAL

6.1 General

All upper berth assemblies shall be subjected to AMTRAK approval. All major components shall be submitted for AMTRAK approval.

6.2 Design Reviews

At least three design reviews shall be held at times mutually agreed upon between AMTRAK and the manufacturer; such reviews intended to convey design concepts not readily shown on drawings.

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6.3 Documentation

For approval, the manufacturer shall submit, as a minimum the following drawings and documents:

6.3.1 Component (Assembly Drawings)

6.3.2 Mounting Interface Drawings

6.3.3 Qualification Test Plan (one time) (Including cycle endurance tests of both types of berths)

6.3.4 Acceptance Test Plan (all units)

AMTRAK reserves the right to request additional drawings and document as required for system approval.

6.3.5 Stress Analysis

6.4 First Article Inspection

Prior to the delivery of the first production assembly, a production assembly shall be subjected to a first article inspection. Such inspection shall include, but not be limited to:

6.4.1 A mechanical inspection to determine compliance with the specification and the approved drawings.

6.4.2 Demonstration of repairs/ adjustments accessibility (Section 3.1)

6.4.3 The performance of an Acceptance Test.

6.4.4 The performance of the Qualification Test. Successful completion of the first article inspection shall constitute final system approval.

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7.0 PRODUCT SUPPORT

7.1 Drawings

All assembly, subassembly, and arrangement drawings shall include a complete bill of material and parts list on the field of the drawing describing all items, including Vendor's parts and material description, which form a part of the assembly. AMTRAK shall reserve the right to review and approve all drawings prior to construction of a prototype system.

AMTRAK shall be supplied, upon completion of the system design, with one set of printed drawings and electronic files in accordance with section 3.5 of Amtrak Specification 769B.

7.2 Operating Instructions, Maintenance and Parts Manuals

The equipment manufacturer shall provide manual data in accordance with AMTRAK specification No. 353. The manual shall also include instructions for how to preload the counterbalance system.

8.0 APPLICABLE DOCUMENTS

Spec. No. 352 - Flammability, Smoke Emission and Toxicity
Spec. No. 328 - Material and Workmanship (For Viewliner II components see Spec 769B, Chapter 16)
Spec. No. 364 - Sleeping Car Mattresses
Spec. No. 353 - Suppliers Manual Data

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AMTRAK SPECIFICATION

FOR

BUILDER

OPERATING & MAINTENANCE

MANUAL FAMILY

SPECIFICATION NO. 354

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Revision A: 4/16/2003

Prepared by: R. F. Bruss 3/26/1990

Approved by: C. J. Engelhardt 3/27/1990

(signature page follows)

This specification has been adopted by the Passenger Rail Improvement and Investment Act (PRIIA) Next Generation Equipment Committee (NGEC) for use in its vehicle specifications. If changes to this document are made, please contact the PRIIA Revision Control Coordinator (RCC) so that the NGEC can evaluate changing its version for use in vehicle specifications. The RCC's contact information can be found on the AASHTO web site http://www.highspeed-rail.org/Pages/default.aspx, then follow the link to documents and the Document Management Process procedure.

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AMTRAK

SPECIFICATION

FOR

BUILDER

OPERATING & MAINTENANCE

MANUAL FAMILY

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DOCUMENT NUMBER: 354

ORIGINAL ISSUE DATE: APRIL 16, 1990

REVISION: A; REV. DATE: 4/24/03

ABSTRACT:
This document describes the content, timing of deliverables as well as the review and approval process for providing a family of maintenance manuals for a car or locomotive program. This is done in an effort to provide a timely delivery of complete and accurate manuals.

KEY WORDS:
Maintenance manual, part manual, operator manual

PREPARED BY:	R. F. Bruss	**DATE:**	3/26/1990
APPROVED BY:	C. J. Engelhardt	**DATE:**	3/27/1990

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REVISION HISTORY

Revision	Description of Change	Date	Approved
A	Rewritten	4/24/03	R.F. Bruss

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Figure 7.1: Organization and Content: Operator Manual-Operator (Engineer)
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Appendix A: Amtrak Electronic Parts and Service Catalog Specification

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1. SCOPE

1.1 Purpose

This specification defines Builder responsibility and requirements to provide a family of bound and loose-leaf bound maintenance and reference manuals. It describes the content and timing of deliverables as well as the review and approval process. This is done in an effort to provide a timely delivery of complete and accurate manuals. This document addresses the following:

Field Manuals

- Operator Manual-Operator (Engineer)
- Operator Manual-Conductor
- Operator Manual-Food Service
- Service and Inspection Manual
- Fuel pad Manual
- Running Maintenance Manual
- Heavy Repair/ Overhaul Manual
- Illustrated Part Manual
- Drawing Manual

Engineering Manuals

- Test Manual
- Vehicle History Book
- Equipment Plan and Data Book Sheets (loose-leaf sheets only no binder).
- Photograph Book

This specification is a companion to Amtrak specification # 353 "Vendor Maintenance Manuals, which defines the requirements for the manuals provided to the builder by the system suppliers, which will be used in these builder manuals.

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1.2 Function

The Builder manual family is a set of manuals that will provide Amtrak with the information necessary to properly operate and provide all maintenance functions for the given fleet of vehicles.

2. REFERENCES

All references listed below shall be the latest revision.

Amtrak Specifications:
353 Vendor Maintenance Manuals

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3. DEFINITIONS

Builder
The prime contractor solely responsible to Amtrak for the construction, quality and proper functioning of the complete car and its components.

Supplier
The provider to the Builder of any services or material for incorporation into the car design, construction, spare parts, manuals or other contract deliverables.

4. GENERAL REQUIREMENTS

4.1 Vendor Approval

Subcontractors used to develop the manuals described in this specification shall be subject to Amtrak approval. The builder shall provide samples of work done by the proposed manual subcontractor in advance of this approval.

4.2 Considerations and Content

4.2.1 Considerations

The manual shall be written with the following as primary considerations:

- Safety
- Clarity
- Conformance to Amtrak Operating and Maintenance practices
- Content written in a system consistent with user, ie., suitable technical level

The subject material shall be prepared and presented in such a manner as to encourage the use of the Manuals.

Where applicable, the manuals shall highlight the precautions to be taken by operating, service, maintenance personnel to ensure safety while performing the procedures described in these manuals.

4.2.2 Content

The Manuals shall include all systems and components requiring maintenance or servicing. Manuals shall be supplied that contain information required for effectively understanding operation of the vehicle as well as performing scheduled maintenance including general servicing, lubrication and inspections, system equipment testing, troubleshooting and adjustments, and repair/replacement. These needs include information to safely and properly conduct:

- Operation
- Service and inspection
- Trouble shooting

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- Running maintenance (performed with the vehicle "in line" or in a shop; typically only about a day duration)
- Heavy repair/ overhaul (vehicle and system/ component level) (performed at car heavy repair facility or in a component overhaul shop, on or off site)
- Part identification
- Wreck repairs (welding procedures, structural methods, such as Huck bolting, etc.)

The entire manual is to be held to the same level of quality- whether written by the Builder or by a supplier. No matter who is the technical provider, the Builder shall be responsible for delivering a complete and quality product.

The Builder is responsible for ensuring that suppliers comply with this Specification and that they also provide the appropriate documentation. Amtrak will not accept "The supplier did not provide the manual." or "The supplier manual did not cover that." as excuses for inadequate manual content. Contracts between the Builder and suppliers shall include appropriate language to ensure these documents are provided as required. All manuals are subject to Amtrak Equipment Engineering approval prior to distribution to the field.

Builder (and Supplier) manuals shall also be provided electronically in an Amtrak approved language. The manuals will be used electronically in Amtrak's Work Management System; the builder shall work with Amtrak to ensure successful implementation of this.

All components/ systems must be defined to the lowest repairable level, which includes all parts bought by the system supplier.

Electronic Equipment
Unless contractually specified otherwise by Amtrak, the supplier shall provide maintenance information to allow Amtrak to repair Printed Circuit Boards in-house. This includes for each PC board.

- PCB component layout
- part list
- PCB schematic
- PCB foil layout
- software

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4.3 Audience

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Manuals will be used by the following personnel:

Maintenance Department
- Reference for daily Service & Inspection
- Reference for daily maintenance work and repairs
- Reference for performing heavy repair/ overhaul
- To initiate procedures for the implementation of planned preventative maintenance, service routines, car record keeping procedures, scheduled overhauls, and scheduled heavy overhauls.
- Reference for creating standard maintenance procedures.

Equipment Engineering
- To assist in the day to day analysis of field problems and course of action for equipment service and repair.
- As Reference for future equipment design and specifications.

Technical Training
- Teaching aid for new employees, and to introduce new equipment to existing maintenance staff
- As information in refresher courses for maintenance staff.

Quality Control
- As reference and background to determine adequacy of repair and maintenance work

Material Control and Purchasing
- To identify parts required for maintenance inventory.

Carbuilder Field Service
- For reference in performing field assistance.

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4.4 Manual Development Plan

4.4.1 Master Manual Plan

In an effort to clearly understand the expectations for the manuals right from the beginning, the Builder shall provide a Master Manual Plan and Schedule for Amtrak approval, identifying all manuals required in the vehicle specification. The plan shall include manual sections, both from the Builder and suppliers. The plan shall be recorded in a spreadsheet form, updated periodically, showing the basic information identified on Figure 1. The manual plan shall be submitted to Amtrak for review and approval within 90 days of Notice to Proceed and revised within 30 days of any change in the plan.

4.4.2 Manual Development

To ensure that manuals are being developed concurrently with the vehicle and its systems, the Builder shall provide the following deliverables:

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For each manual type: Operator, Service and Inspection, Running Maintenance, Heavy Maintenance, Drawing, Parts, etc:

- breakdown of the chapter organization
- organization of the chapter: introduction, system description, controls, etc
- detailed table of contents, showing divisions and subdivisions of each chapter
- explanation of how supplier information will be incorporated from each supplier
- explanation of who will provide the manual information for every system: supplier or builder's text.

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FIGURE 1
MANUAL REQUIREMENTS

NAME	QUANTITY	PRELIMINARY DUE DATE	FINAL DUE DATE
Operator Manual – Operator (Engineer)			
Operator Manual – Conductor			
Operator Manual – Food Service			
Service and Inspection Manual			
Fuel Pad Manual			
Running Maintenance Manual			
Heavy Repair/Overhaul Manual			
Illustrated Part Manual			
Drawing Manual			
Test Manual	1 Set		
Vehicle History Book	1 Per Car		
Equipment Plan and Data Book Sheets	1 Per Car Type		
Photograph Book	1		

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FIGURE 2 -- MANUAL PLAN SPREADSHEET

MANUAL	SPEC REF	Dates	DRAFT		PRELIMINARY		FINAL		COMMENTS
			TO AMTK	FROM AMTK	TO AMTK	FROM AMTK	TO AMTK	FROM AMTK	
Operator Manual – Operator (Engineer)		Due							
		Actual							
Operator Manual – Conductor		Due							
		Actual							
Operator Manual – Food Service		Due							
		Actual							
Service and Inspection Manual		Due							
		Actual							
Fuel Pad Manual		Due							
		Actual							
Running Maintenance Manual		Due							
		Actual							
Heavy Repair/Overhaul Manual		Due							
		Actual							
Illustrated Part Manual		Due							
		Actual							
Drawing Manual		Due							
		Actual							
Test Manual		Due							
		Actual							
Car History Book		Due							
		Actual							
Equipment Plan & Data Book Sheets		Due							
		Actual							
Photograph Book		Due							

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Note: Identify each supplier manual on a separate line; identify supplier in "comment" column. Status as of _____

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FIGURE 3

INDIVIDUAL MANUAL PROGRESS REPORT: MANUAL _____ TYPE

CHAPTER	NO. PAGES	DATES	DRAFT		PRELIMINARY		FINAL		COMMENTS
			TO AMTK	FROM AMTK	TO AMTK	FROM AMTK	TO AMTK	FROM AMTK	
1		Due							
		Actual							
2		Due							
		Actual							
3		Due							
		Actual							
4		Due							
		Actual							
5		Due							
		Actual							
6		Due							
		Actual							
7		Due							
		Actual							
8		Due							
		Actual							
9		Due							
		Actual							
10		Due							
		Actual							

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Status as of _____

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4.5 Manual Availability

The Builder shall develop the manual family for review by AMTRAK during the time between preliminary and final design reviews of the car design.

A draft version of each manual shall be drafted and submitted to AMTRAK for comment and/or approval thirty (30) days following the final design review for the respective system(s).

Since approved manuals are required in advance of putting the first vehicle in service, it is essential that draft versions of these documents be provided in a timely fashion. This will allow appropriate Amtrak review as well as time for the Builder to address any deficiencies noted.

The status of each manual and each chapter of each major manual shall be recorded in a spreadsheet form, in accordance with Figures 2 and 3. This document shall be updated monthly and presented as an attachment to the program meeting minutes.

4.6 Document Progression

Supplier manuals are to be written by the equipment supplier, with thorough review by the Builder engineering department to ensure compliance with his requirements as well as those of this and the vehicle specifications. The manuals shall then be submitted to Amtrak for approval.

The Builder manuals shall be written jointly by the builder engineering and technical writing departments. They shall be thoroughly reviewed to ensure compliance with the requirements of this as well as the vehicle specifications and shall be then submitted to Amtrak for approval.

It is the Builder's responsibility to integrate his and the supplier manuals to ensure every device and all functions of all equipment are adequately described.

Discussion of the manual approach and content with Amtrak Equipment Engineering during development is encouraged to expedite the approval process.

As the builder develops the documents, they shall go through the following internal review process:

1. tech writer develops chapter of the document
2. Builder engineer responsible for that chapter reviews document, whether written internally or by the system supplier, indicating necessary revisions to tech writer
3. tech writer corrects document accordingly, returns to engineer
4. engineer reviews and (assuming he is satisfied) approves draft-level document
5. section submitted to Amtrak for review
6. Amtrak reviews and provides comments to builder
7. builder engineer reviews Amtrak comments, forwarding necessary guidance information to tech writer
8. process repeats within builder organization.

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4.7 Approval Process

Manuals, including both those provided by the Builder as well as those to the Builder by suppliers, shall be submitted for Amtrak approval. If deficiencies are identified, the manuals shall be revised and resubmitted for approval. If, in Amtrak's sole judgment, the manual is still deficient, the revision and resubmittal processes shall be repeated until the requirements are met. Primary points of evaluation include, but are not limited to:

- Safety
- Completeness of subject
- Inclusion of all equipment
- Conformance to standard organization Outline
- Compatibility with Amtrak shops and standard practices
- Suitability for the end user

Normally, the process has three iterations between the builder and Amtrak: draft, preliminary and final. However, should a manual be missing sections of the chapter, those sections are still subject to the 3 pass process. **Amtrak will not accept as final any chapter which contains new sections of material.** Each submittal shall include a sign-off sheet, including the name of the author, the name of the engineer responsible for the review and review date.

Submittals:

Draft Submittal

This is the first iteration from the builder to the customer. It is expected to be > 60% complete.

Preliminary Submittal

This is the second iteration from the builder and is expected to be >95% compete.

Final Submittal

This is the final iteration from the builder and is expected to be >99% complete. As noted above, a manual submitted with new sections of the chapter at this time is **NOT** defined as "final". Should the document not yet be sufficient, or be otherwise inadequate, **as determined solely by Amtrak**, additional iterations will be required before the contractual requirements are met.

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4.8 Revision Process

Should any changes to the vehicles, its components or maintenance requirements occur during the warranty period, manual updates shall be provided by the Builder to update/ revise the manuals accordingly.

4.9 Product Support

The builder shall provide Amtrak in a timely manner with corrections and updates to the maintenance manual as required to keep the manual current with equipment. Service bulletins shall also be provided as may be required by Amtrak.

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5. MANUAL DESCRIPTIONS

The Builder presentations shall consist of all of the material needed to ensure that the following functions are fully covered by the information and instructional data:

Manual Types:

Field Manuals (Used in the field by operating and maintenance personnel.)
These manuals, including #5.1 through 5.6, will see wide distribution in the field.

5.1 Operator Manual Family

These manuals will provide instructions for on-board personnel on how to operate car equipment. While the intent is to keep the manual brief and non-technical, it will describe operation of all controls, and the significance of all indicators normally encountered.

These manuals will describe briefly the operation of each system, its user controls, and what action to take and not take if it does not function as expected. This trouble shooting section will address safety of passengers as well as crew.

5.1.1 Operator Manual-Operator (Engineer) See Figure 7.1
This manual describes equipment that the Operator (engineer) uses to operate the train.

5.1.2 Operator Manual-Conductor See Figure 7.2
This manual describes equipment that the Conductor uses to operate the train.

5.1.3 Operator Manual-Food Service See Figure 7.3
This manual describes equipment that the food service attendant and/ or dining car staff uses on the train.

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5.2 Service and Inspection Manual See Figure 4

This manual will identify requirements for service and inspection of the equipment as well as cleaning instructions for the car cleaning staff. Items included are: water fill, waste drain, brake pad/ shoe wear, etc.

5.3 Fuel Pad Manual See Figure 5

This manual will identify requirements for fueling, sanding, lubricant and coolant level checks and inspection of the engines and traction equipment. It will also include engine starting and stopping, including emergency shutdown.

5.4 Maintenance Manual Family

This set of several loose-leaf binders will include maintenance instructions for all vehicle

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equipment. It will be composed of builder-written material as well as vendor supplied maintenance manuals, written in conformance with Amtrak specification 353. For complicated systems in which several vendors provide portions, such as HVAC, the builder will provide an introduction describing the overall system operation, and then provide the various vendor manuals describing their individual components. Aside from very simple items, such as fittings, catalog cut-sheets are not acceptable as manual information.

The manuals shall contain information required for effectively understanding operation of the system and the entire vehicle, as well as how to and when to perform maintenance and repairs. Detail shall be such that any vehicle component requiring maintenance, replacement or adjustment is included.

The topics should be discussed to the level necessary for an understanding by persons unfamiliar with the vehicle or its equipment, but possessing the basic skills associated with their respective trade and good knowledge of standard railroad practices.

5.4.1 Running Maintenance Manual See Figure 6
This set of manuals identifies the equipment composing a system, theory of operation, controls & indicators and operating procedures. It shall include a maintenance schedule to identify and explain periodic maintenance requirements, such as inspections, lubrication, filter changes and basic tests. It shall also explain adjustments, installation/ removal, trouble shooting procedures as well as repairs that would typically be done in a Running Repair Shop.

5.4.2 Heavy Repair/ Overhaul Manual See Figure 7
This set of manuals identifies major work done to the vehicle and its systems which would be done in a backshop or component overhaul shop. It includes a maintenance schedule to identify and explain periodic long term maintenance requirements, such as wear limits, component changeout and basic tests.

This manual includes items such as detailed overhaul of the entire vehicle as well as system components, such as HVAC units.

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5.5 Illustrated Part Manual See Figure 8

The Parts manual shall contain the information required to effectively locate, identify, and order all replaceable units **down to the lowest repairable level**, including assemblies, sub-assemblies, components, printed circuit boards and parts of the vehicle from the original equipment manufacturer. The manual is intended to provide Amtrak with information to:

- Identify any user-replaceable part
- Identify Amtrak part number for it
- Plan a spare part inventory, including stocking locations

The part manual shall be provided to Amtrak in LinkOne format, in accordance with Appendix A, in addition to the hard-copy and electronic format forms.

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5.6 Drawing Manual See Figure 9

This manual will primarily provide reference material to the maintenance department for maintenance, trouble shooting and repair. The manual will include all schematic (electrical, air brake, auxiliary air, water, waste, HVAC air distribution, fuel, lubricant, as well as wiring, conduit and piping diagrams. It will include device tables/ locators. Schematics shall include those of vendor internal systems.

Engineering Manuals (Used in engineering offices as reference.)

These manuals, including #5.7 through 5.10, will be used primarily in Engineering & Mechanical Department offices as a resource.

5.7 Test Manual See Figure 10 (Also refer to the Amtrak specification for the equipment, or #366, as appropriate).

This manual will include a copy of each of the following:

- Test plan
- Text of each supplier's Acceptance test and a completed test report of each
- Text of each supplier's Qualification Test and Proof of Design test and a
- completed test report of each
- Text of each Builder's Acceptance test and a completed test report of each
- Text of each Builder's Proof of Design test and a completed test report of each
- Certification of the Qualification and Proof of Design test results by the Quality Control Department of the Builder

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5.8 Vehicle History Book See Figure 11

This book, one for each vehicle, will include specified serial numbers, test reports, wheel press reports, etc.

5.9 Equipment Plan and Data Book Sheets See Figure 12

These sheets provide reference primarily to Mechanical Department and Management for vehicle floor plan, undercar plan and major car equipment location. The Builder will complete the blank form, and return it to Equipment Engineering for incorporation into the master book.

5.10 Photograph Book

This book contains a set of mounted color photographs, in accordance with the vehicle specification. Each photograph shall be clearly labeled as to what is shows, as well as be identified with date and negative number identification.

6. DESIGN DETAILS

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6.1 Section Numbering System

Amtrak has adopted a standard functional numbering system that is designed to provide consistent section numbers among the following documents:

- Running maintenance manual
- Heavy repair/ Overhaul manual
- Illustrated Parts manual

For example, section 7.4 is temperature controls, regardless of which of the above documents is referenced. This allows easy cross - reference between documents. Note that the maintenance manual subdivides into smaller sections, since it use requires much more detail.

The numbering system divides the vehicle into 16 major sections:

1. General
2. Carbody
3. Truck
4. Coupler and Draft Gear
5. Brakes
6. Interior
7. Heating Ventilation and Air Conditioning
8. Lighting and Convenience Outlets
9. Communication
10. Electrical
11. Food Service
12. Water and Waste
13. Traction and Controls (complete)
14. Cab and Controls
15. Head End Power Generation
16. Fire Control & Emergency Equipment

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Each section is then subdivided eg.:

7.Heating, Ventilation and Air Conditioning

- 7.1 Description
- 7.2 Air Distribution
- 7.3 Dampers
- 7.4 Temperature Control
- 7.5 Air Conditioning
- 7.6 Exhaust Fans
- 7.7 Heaters
- 7.8 Freeze Protection

Each subsection may be further divided: eg.

7.7 Heaters

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7.7.1 Duct
7.7.2 Floor

The function of the equipment determines the chapter in which it is described in the Running and Heavy Maintenance manuals. For example, the brake components mounted on the trucks are described in “Brakes” rather than “Trucks”.

6.2 Page Numbering System, Headers & Footers

Paragraph numbering
Paragraphs are numbered with the chapter as the first digit(s), followed by the section and subsection: “5.3.1”

Figures and tables
These are numbered with the chapter as the first digit(s), with the items then numbered sequentially.

Page numbering
Pages are numbered with the chapter as the first digit(s), then a dash followed by the page number of the chapter:
“6 – 3”

Each page of the manual will be numbered. Blank pages shall be so indicated either through the use of the work "blank", or by double numbering the preceding page, such as for fold-outs.

Headers
A header will be used on the top of each page, including:
“Amtrak”
Equipment name, such as “Amfleet”
Chapter #, Chapter name, such as “Carbody”

Footers
A footer will be used on the bottom of each page, including:
Manual type, such as “Running Maintenance”
Revision letter and date
Page number as above

Revision indication
When a page is revised, the changed section text shall be identified in the margin, along with the revision letter associated with it, such as “B”. Only the changes from the latest revision will be identified.

6.3 Configuration: 4” x 8 ½” Binder Type Manuals

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The following manuals shall be provided in 4"x 8-1/2" format, in loose-leaf binders:

- Operator's Manual: Operator (engineer)
- Operator's Manual: Conductor
- Operator's Manual: Food Service

Binder

The binder shall be a 6-ring type, with a flexible plastic cover, with silk-screened (or equal) graphics, with colors specified by Amtrak during manual design review. It shall allow for 10% expansion in the number of pages. The binder shall be labeled on the spine and cover with the following information at a minimum:

- "Amtrak"
- Equipment name such as "Amfleet I"
- Vehicle number series
- Name of book: Operator's Manual: Operator, etc.
- Builder

Paper

The manual will be black print on white, 60 pound paper, printed by lithograph offset method. Printing will be on both sides of the paper.

Assembly

Manuals shall be shipped with the binders empty, but packaged with binders and paper for a complete set in the same shipping container. All material shall be collated with colored printer's blank separators used to separate each complete volume of data.

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6.4 Configuration: 8-1/2 x 11" Pamphlet

The following manuals shall be provided in 8-1/2 x 11 format, in

- Service and Inspection
- Fuel Pad

Cover

The cover shall be cardboard, with the paged secured with staples. The graphics and colors will be specified by Amtrak during manual design review. The manuals will be labeled with the following information at a minimum:

- "Amtrak"
- Equipment name such as "Amfleet I"
- Vehicle number series
- Name of book: Service and Inspection Manual, etc.
- Builder

Paper

The manual will be black print on white, 60 pound paper, printed by lithograph offset method. Printing will be on both sides of the paper.

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6.5 Configuration: 8-1/2" x 11" Binder Type Manuals

The following manuals shall be provided in 8-1/2 x 11 format, in loose-leaf binders:

- Running maintenance
- Heavy Repair/ Overhaul
- Illustrated parts
- Test
- Vehicle history
- Photograph

Binder

The binder shall be a 3-ring heavy duty type, with tab-locked rings (so they won't open accidentally). It shall include clear front and spine pockets for display of printed manual designation inserts. The ring shape will be such that the binder can be opened flat, and remain opened to the selected page. Ring spacing shall be 4-1/4 center-to- center.

Binder size shall be 3-1/4" spine or less, and shall allow for 10% expansion in number of pages.

The binder shall be labeled on the spine and cover, with graphic and colors specified by Amtrak during manual design review. The following information shall be included at a minimum:

- "Amtrak"
- Equipment name such as "Amfleet I"
- Vehicle number series
- Name of book: Running Maintenance, etc.
- Volume number and/or chapter numbers
- Builder

Tabs

Manuals shall be subdivided using plastic-edge tabs. The tabs will be labeled with section name and number. The maintenance manuals will be divided into main sections and subsections, using large and small tabs. The test manual will have a tab for each test code.

Paper

The manual will be black print on white 8-1/2 x 11", 100M non-reinforced paper, title pages/ tabs, foldouts on 140M paper. Printing shall be by lithograph offset method. Printing will be on both sides of the paper, except drawings, which will be on one side of the paper only. Paper will be punched with 3 - 3/8" holes on 4-1/4" centers. Suitable hole reinforcement shall be provided to resist page tear out for all fold-out and any schematics. Reinforcement shall be no thicker than an average page.

Assembly

Manuals shall be shipped with the binders empty, but packaged with binders and paper for a complete set in the same shipping container. All material shall be complete with tabs, and collated with colored printer's blank separators used to separate each complete volume of data.

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6.6 Configuration: Drawing Manual

The drawing manual will be supplied on 11 x 17" format, mounted in a heavy plastic cover, with graphics and colors specified by Amtrak during manual design review

Binder

The cover will be a flexible plastic material, with silk-screened graphics (or equal). Pages shall be secured with 3 screws, on 4-1/4" centers, along the 11" edge. It shall allow for 10% expansion in the number of pages.

The binder shall be labeled on the spine and cover with the following information at a minimum:

- "Amtrak"
- Equipment name such as "Amfleet I"
- Vehicle number series
- Name of book: Drawing Manual
- Builder

Paper

The drawings will be black print on white 100M reinforced paper, printing by lithograph offset method. Printing will be an one size of the paper only. Paper will be punched with 3-3/8" holes, on 4-1/4 centers along the 11" edge. Suitable hole reinforcement shall be provided on all pages to resist paper tear-out.

Assembly

The drawing manuals shall be shipped fully assembled.

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6.7 Configuration: Equipment Plan and Data Book Sheets

Data sheets will be 8-1/2 x 11 format originals, punched with 3- 3/8" holes on 4-1/4" centers. Amtrak will arrange for inclusion into existing manual.

7. MANUAL CONTENT AND ORGANIZATION

The general contents of the manuals shall conform to the following standard outlines.

Amtrak will consider alternative formats for approval, such as for "off the shelf" supplier manuals, however the content must meet the all the items identified in the Amtrak outlines.

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Figure 7.1: Organization and Content: Operator Manual-Operator (Engineer)

Forward

- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables

Introduction

- Safety warnings
- "this manual does not supercede …."
- Overview of book
- Equipment arrangement
- Equipment data, salient features
- Brief equipment description:
    - Vehicle
    - Traction system
    - Brake system, including blended & dynamic, as appropriate
    - Compressed air system
    - HEP system
    - Train makeup

General Description of Equipment

Provide a detailed description of each item, switch, indicator, etc, describing function, meaning of indications, etc.:

- Entire cab area
- Cab console, including all controls, indicators, etc
- Other cab control panels
- Engine room/ compartment controls, indicators, etc.

Equipment Operation

Provide a detailed description of how to use the equipment, both at vehicle level and train level:

- Use of throttle
- Starting a train
- Stopping a train, including automatic, dynamic and blended brake modes
- Operation of independent/ parking brake
- Operation of PCS
- Emergency brake applications and recovery
- Penalty brake applications and recovery (each type: alerter, overspeed, ATS, etc.)
- Changing ends:
    - To activate this cab
    - To deactivate this cab

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- Shutting down the engines- normal mode
- Emergency activities, such as shutting down all engines in the train
- Dead-in-tow moves
- Use of cab equipment:
- Alerter
- Vehicle overspeed
- Cab signal
- IITS
- 2-way radio
- Alarms
- HEP system
- Starting / stopping HEP engine
- Setup of HEP configuration (lead, trail, pass-through, wayside, etc.)
- Starting/ stopping HEP
- Starting/ stopping traction engine

Train Makeup and Preparation

- Coupling/ uncoupling
- Applying/ removing jumper cables
- Train makeup
- Preparation for service
- Inspection

Trouble shooting

- Symptoms
- What the symptoms means
- Corrective action trees: this shall include cutout procedures for alerter, overspeed, cab signal, IITS, and any other equipment the operator may be called upon to manipulate following a malfunction, etc.

Emergency Equipment

- Emergency equipment locker
- Fire extinguisher
- Emergency door releases
- Emergency windows

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Figure 7.2: Organization and Content: Operator Manual-Conductor

Forward

- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables

Introduction

- Safety warnings
- "this manual does not supercede …."
- Overview of book
- Equipment arrangement
- Equipment data, salient features
- Brief equipment description:
    - Vehicle
    - Vehicle systems

General Description of Equipment

Provide a detailed description of each item, switch, indicator, etc, describing function, meaning of indications, etc.:

- Side entrance doors
- Wheel chair accessibility
- Body end doors
- HVAC system
- Lighting system
- Communications system
- Electrical system
- HEP and 27 point jumper cables
- Water & Waste system
- Emergency equipment

Equipment Operation

Provide a detailed description of how to use the equipment, both at vehicle level and train level of the same items as identified in General Description of Equipment.

Train Makeup and Preparation

- Coupling/ uncoupling
- Applying/ removing jumper cables
- Train makeup
- Preparation for service
- Inspection
- Water filling procedure
- Water drain procedure

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Trouble shooting

- Symptoms
- What is means
- Corrective action trees

Emergency Equipment

- Emergency equipment locker
- Fire extinguisher
- Emergency door releases
- Emergency windows

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Figure 7.3: Organization and Content: Operator Manual-Food Service

Forward

- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables

Introduction

- Safety warnings
- "this manual does not supercede …."
- Overview of book
- Equipment arrangement
- Equipment data, salient features
- Brief equipment description:
    - Vehicle
    - Food service equipment

General Description of Equipment

Provide a detailed description of each item, switch, indicator, etc, describing function, meaning of indications, etc.:

- Refrigeration system
- Each appliance (OEM manuals are acceptable for standard commercial products)
- Water system

Equipment Operation

Provide a detailed description of how to use the equipment:

- Refrigeration system
- Each appliance (OEM manuals are acceptable for standard commercial products)

Trouble shooting

- Symptoms
- What is means
- Corrective action trees

Emergency Equipment

- Emergency equipment locker
- Fire extinguisher
- Emergency door releases
- Emergency windows

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Figure 7.4: Organization and Content: Service and Inspection Manual

Forward
- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables

Introduction
- Safety warnings
- "this manual does not supercede …."
- Overview of book

Cleaning
- Cleaning general interior surfaces
- Cleaning toilet

Inspection
- Running gear
- Engines, transmissions, gear boxes, etc.
- Brakes
- Trucks
- Etc

Renewal
- Brake pads and shoes
- Filters of all types

Servicing
- Water fill
- Waste drain

Tests

Identify basic functional tests:
- Doors (if trainlined)
- Water
- Waste collection

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Figure 7.5: Organization and Content: Fuel Pad Manual

Forward
- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables

Introduction
- Safety warnings
- Emergency engine stop push buttons
- "this manual does not supercede …."
- Overview of book

Inspection
- Running gear
- Engines, transmissions, gear boxes, etc.
- Brakes
- Trucks
- Air compressor
- Air drier
- Etc

Renewal
- Brake pads and shoes
- Filters of all types:
    - Fuel
    - Oil
    - Air filters
- Topping up of fluids:
    - Coolant
    - Oil
    - Transmission
    - Gear box

Servicing
- Fuel
- Sand

Tests

Identify basic functional tests:
- Traction
- HEP
- Cab controls

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Figure 7.6: Organization and Content: Running Maintenance Manual

Forward (entire manual)

- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables
- List of Procedures

Introduction to Book

- Safety warnings
- "this manual does not supercede …."
- Overview of book

Chapter 1 General

This chapter provides an overview of the vehicle, to familiarize maintenance personnel with the basic equipment, its location and component accessibility. In cases of special importance, reference should be provided to the relevant chapter & section of the manual. This chapter should also include general information, such as torque limits, etc.

Chapters 2-16 (?) Specific System Information

These chapters describe the equipment of a given system/ subsystems. Due to the differing requirements of systems, no one outline will apply to each system, however the following should apply to the extent practical.

Content should be as follows:

1. Chapter Forward

Each chapter shall begin with:

- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables
- List of Procedures
- Safety Warnings

2. Introduction to System

This section should provide an overview of the entire system, describing function, operation and interaction among subsystems. Using the HVAC system as an example:

Functions:

- Ventilation
- Heating fresh air
- Heating to overcome carbody losses
- Air conditioning

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- Freeze protection
- Control of all the above

The section should identify and describe subsystems and components composing the system. Provide ratings as appropriate, such as for HVAC unit, etc. Again, using HVAC as an example:

Ventilation subsystems and components:

- Fresh air intakes
- Fresh air dampers
- Air filters
- HVAC unit blower fan
- Supply air ducts
- Supply air diffusers
- Return air ducts
- Exhaust fans

Component Description

(include photos/illustrations, envelope drawings with dimensions)

- Function
- Size
- Weight
- Mechanical, electrical, etc., connections

Specifications

(reference Amtrak specification number if applicable).

Brief equipment specifications covering performance, function, materials, rating, power consumption by individual rating, motors, heaters, etc., capacity, air and water flow rates.

3. Operation

This section describes how the equipment is controlled and operates in normal operation, from the viewpoint of the user.

3.1 Description of Operation - Controls and Indicators

This section should describe each switch, selector, etc., its function, and what the equipment does in each switch position. Each indicator should be described, and the meaning of the indication explained. Include illustrations of control panels.

3.2 Operating Instructions

Explain how to operate the equipment, including any specific procedures as might be required. For equipment which uses a portable test unit (laptop), such as wheel slide controller, event recorder, etc, operating instructions explaining the features and use of the software for these units shall be provided.

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3.3 Typical Operating Characteristics

This section should describe all normal operating modes of the equipment - say for an air conditioning system, the general series of events the system undergoes as the car interior temperature drops and rises. This description should be reasonably non-technical, but still describe normal characteristics - say battery charger output voltage. Include operating charts, such as temperature chart for temperature control system, typical pressures, timing, etc.

4. Theory of Operation

4.1 Theoretical

Describe technically how the equipment works - for example, the refrigerant cycle in a refrigeration system. For an electronic system, the operating concept, say the controlled phase rectifier battery charger.

4.2 How it's applied here

Describe how the theory of 4.1 is used in the actual system. For electronic equipment, describe the blocks of the circuit.

4.3 Technical Description of System

This section provides system details, such as on a battery charger - typical circuit waveforms, voltage levels at test points, etc.

4.4 Component descriptions

In a complicated system, such as refrigeration, this section would describe each section - evaporator with defrost function, condenser unit, enclosure environmental control, etc.

5. Periodic Maintenance

Amtrak periodic maintenance is generally performed on the following basis, however these intervals are subject to change:

- Trip (every day or two, minor inspections, servicing; primarily a check that all equipment operates)
- 180 (?)Day (car is removed from service for several days and serviced in the shop. A reasonably thorough inspection is made, repairs and adjustments performed.)
- 4 (?)Year Overhaul (medium overhaul)
- 8 (?) Year Overhaul (major overhaul, all mechanical systems removed from car, overhauled or replaced).

5.1 Inspections and Servicing

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The manual should provide sufficient information for Amtrak to set up a schedule for servicing and inspection; including a list of tasks to be performed. Inspection schedules planned for these vehicles should be in the form of tables and include:

- Inspections
- Lubrication and lubricant changes
- Filter changes
- Adjustments
- Basic functional tests

Trip Inspection and Service

Show items requiring inspection, cleaning, re-supplying, replacement (consumables), and testing or checking prior to placing car in service for that trip.

180 Day Inspection and Service

Show items requiring inspection, replacement, testing, lubricating, etc. on a 180 day basis; especially those items of safety which may be required by F.R.A. rules. Specific location for lubrication should be identified on a photograph or illustration. Also include such items as normal operating pressure, current, etc.

4 Year Overhaul

Show items requiring inspection, service and overhaul. (Also refer to section 10 of index).

8 Year Overhaul

Show items requiring inspection, service and overhaul. (Also refer to section 10 of index).

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5.2 Tests

This section should include step-by-step tests as may be required to periodically confirm system performance on a trip, 180 day 4 year and 8 year basis.

5.3 Service Procedures

This section defines step-by-step periodic service procedures - such as lubrication (where, what type, how much), cleaning, etc; requiring explicit instructions.

6. Trouble Shooting

Troubleshooting guides, presented as a fault tree or matrix, shall consist of a listing of the most probable symptoms of degradation and/or failure of the equipment to operate or perform properly. Each symptom shall be accompanied by a number of probable causes, how to check for the cause, and how to repair and re-inspect the repaired equipment.

An important goal of trouble shooting is to allow service personnel to determine the level

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of the defect and whether the vehicle can be repaired "in line", or whether it must be shopped.

- Symptoms
- Defect
- Corrective Action
- Cause of Failure

7. Field Repair Procedures

This section describes adjustments/ calibrations and repairs done to equipment while it is still on the car. As appropriate, the manual shall include warning against special danger, such as spilled battery electrolyte, spring-loaded parts, etc.

The Repair Process shall be described by a step- by-step adjustment/ calibration, disassembly, repair, and/or replacement process. All special requirements for bolt and fastener torques, settings and means of applying lubricants and sealants shall be included. The detail presented shall be sufficient for qualified technicians, supervisors, and inspectors to successfully complete the work. Recommendations, based upon a probable combination of symptoms, shall be included for in-place repairs and/or lubrication and adjustments, removal of subassemblies for bench testing and repair, and/or removal of major systems for disassembly, inspection, repair, reassembly, testing, and replacement.

Information describing maintenance procedures, use of diagnostic equipment, special tools to facilitate disassembly and reassembly, and advice based on the supplier's experience with similar equipment, will be included. The section shall include complete data for setting, tuning, adjusting and operating the equipment.

Each procedure will include:

1. Purpose
2. Special Tools
3. Materials
4. Precautions
5. Preparation
6. Procedure (Disassembly, Replacement of Parts, Reassembly)
7. Adjustments
8. Tests
9. Follow-Up

8. Installation/ Removal

8.1 Installation/ Removal

Description of how to handle and install and remove the equipment, including special precautions for human safety, as well as to prevent equipment damage. Include in here such information as brazing procedures, types of copper tubing, cleaning out procedures,

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etc., as may apply. Installation drawings may be required.

8.2 Installation tests and adjustments

Provide complete procedures for adjusting all components, proper fluid levels, etc., as may be required for initial operation. Tests should include step-by-step procedure to check complete operation of equipment - all features: all controls, all valves, control devices, floats, solenoids, etc. It should also include list of defects to watch for, such as over-under charging of a refrigeration system.

8.3 Initial Operation

This section should include procedure and observations personnel should make to ensure equipment operates properly during and after break-in period. It should also include any adjustments that may be required, and appropriate warnings: "If pressure exceeds 450 PSI, shut unit off immediately", etc.

9. Shop Repair Procedures:

This section is similar to section 8 in style, but describes OFF-car repairs done with the equipment in a shop or lab. This section will include procedures to set/adjust every adjustable device on the system (those not described in 8 above), including every adjustment on each printed circuit board in the system. This section shall include procedures to fully test the operation of each control, switch sensor, etc., of the entire system.

Each procedure will include:

1. Purpose
2. Special Tools
3. Materials
4. Precautions
5. Preparations
6. Procedures (Disassembly, Replacement of Parts, Reassembly)
7. Adjustments
8. Tests
9. Follow-up

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10. Special Tools and Test Equipment

This section describes any special tools, fixtures or instruments required to efficiently test and/or overhaul car systems. Information shall be sufficient for Amtrak to either build or purchase this equipment.

1. Test Fixtures
2. Test Instruments

11. Drawing List and Reference

This section is a list of drawings, both supplier and Amtrak, which provide information

useful to Amtrak maintenance or engineering department.

For example, supplier envelope and part list drawings are necessary, whereas manufacturing drawings are not required, in general.

1. Supplier Drawing List
2. Amtrak Drawing List

12. Factory Repairs and Warranty

This section describes vendor's warranty, service policy and procedures followed to make a warranty claim.

1. Who to Contact
2. How to Ship
3. Documentation
4. Warranty

Chapter 17 (?) Scheduled Maintenance

This last chapter shall include tables of all suggested scheduled maintenance activities, listed both by time and by system:

- Inspections
- Lubrication/ lubricant change
- Filter change
- Adjustments
- Tests

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Figure 7.7: Organization and Content: Heavy Repair/ Overhaul Manual

Forward

- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables
- List of Procedures

Introduction

- Safety warnings
- "this manual does not supercede …."
- Overview of book

Chapter 1 General

This chapter provides an overview of the vehicle, to familiarize maintenance personnel with the basic equipment, its location and component accessibility. In cases of special importance, reference should be provided to the relevant chapter & section of the manual. This chapter should also include general information, such as torque limits, etc.

Chapters 2-16 (?) Specific System Information

These chapters describe the equipment of a given system/ subsystems. Due to the differing requirements of systems, no one outline will apply to each system, however the following should apply to the extent practical.

Content should be as follows:

1. Chapter Forward

Each chapter shall begin with:

- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables
- List of Procedures
- Safety Warnings

2. Theory of Operation

For some equipment, the level of detail provided in the Theory section of Running Maintenance may not be sufficient for overhaul level of work. Where this is the case, provide additional details here.

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3. Overhaul Procedure

This section shall include sufficient information for Amtrak or another outside qualified repair shop to conduct a complete system overhaul, following a major accident, and/or for periodic overhaul. Instructions shall include: welding and torque specifications, special tooling, fixtures, test gear, plating and painting surface finish specification and part wear tolerances.

It shall include disassembly, assembly, and installation procedures necessary for repair of heavy damage and/or long term wear and tear. The instructions shall provide for complete full load system check as well as a check of all equipment devices.

The section shall include procedures for surface cleaning & preparation, priming, surfacing and painting for the carbody and all equipment that is painted or powder coated. A detailed paint schedule showing the equipment to be painted, paint type and manufactures, recommended thickness and other pertinent information shall be included.

Overall, the section will include:

1. Frequency of Overhaul
2. Scope
3. Preparation for Shipment
4. External Preparation and Cleaning
5. Inspection
6. Disassembly
7. Internal Cleaning
8. Part Inspection & wear limits
9. Routine Part Renewal
10. Retrofits/Modification
11. Reassembly
12. Adjustments
13. Tests
14. Preparation for Shipment

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4. Special Tools and Test Equipment
   This section describes any special tools, fixtures or instruments required to efficiently test and/or overhaul car systems. Information shall be sufficient for Amtrak to either build or purchase this equipment.
   1. Test Fixtures
   2. Test Instruments

5. Drawing List and Reference
   This section is a list of drawings, both supplier and Amtrak, which provide information useful to Amtrak maintenance or engineering department.

   For example, supplier envelope and part list drawings are necessary, whereas manufacturing drawings are not required, in general.
   1. Supplier Drawing List
   2. Amtrak Drawing List

6. Factory Repairs and Warranty
   This section describes vendor's warranty, service policy and procedures followed to make a warranty claim.
   1. Who to Contact
   2. How to Ship
   3. Documentation
   4. Warranty

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Figure 7.8: Organization and Content: Illustrated Part Manual

Forward

- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables

Introduction

- Safety warnings
- "this manual does not supercede …."
- Overview of book
- "How to use this manual"
    - scope
    - organization
    - locating equipment in the manual
    - how to use the manual when part number is known
    - how to use the manual when part number is not known
    - common commercial hardware
- Manufacturer names, addresses and telephone numbers
- Abbreviations

Body of manual

- Part identification
  Note: This section shall include **all** the information shown below in "Format"
- Numerical index
- Common commercial hardware

The manual must also identify:

- Consumables:
    - Lamps/ light bulbs
    - Lubricants
    - Anti-seize compounds
    - Fluids
    - Brake pads, shoes
    - Wheel sets,
    - Adhesives
    - Sealants
    - Paints
    - Wire
    - Electrical lugs
    - Brazing alloys
    - Etc.

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- Gages used to check equipment
- Software and instructions for using it for portable test equipment
- Adapter cables for using portable test equipment
- Overhaul/ rebuild kits where available, not merely individual parts.

Format
The following provides details of the required content and format.

Part Identification Illustrations
Illustrations should be provided with sufficient detail to identify all listed parts, including the order of assembly. Phantom line may be used to reference parts that are not part of the illustrated assembly, but need to be shown for clarity. Phantom lines must be used sparingly and should be of light weight so as to avoid "clutter".

Index numbers keyed to the part list and leader lines should be used to locate all listed parts.

Hardware should be exploded only when needed to show detail parts. Where attaching hardware is obvious, on one leader line with stacked index numbers is used.

Subassemblies broken down within their overall assembly should be identified with an index number and note, such as "See Detail A" on the main illustration, with a separate detail showing the additional breakdown.

Part List
This section shall include a compete list of all parts identified on the illustration, in accordance with Part Manual Format shown below. Part numbers for labels and instruction sheets shall be included. (These should include the part number on the label itself, as well.) Casualty parts used only in repairing severely damaged equipment (such as underframe, structural elements, etc.) are not normally stocked and need not be identified.

The cross references provide vital information to the mechanic to easily identify the OEM number on the part, the system vendor's number and the Amtrak number. An example is a plug-in relay, which is typically not identified with the supplier's part number, but only with the OEM's.

The maximum number of parts should not exceed 25 per 8-1/2 x 11" page. To the extent possible, illustrations and the corresponding parts list should be on facing pages of the manual to avoid having to turn the page.

Numerical Index
This index lists in alpha-numeric order all the part numbers in the listing for the chapter. A separate column identifies the applicable figure and index number for the part.

Common Commercial Hardware
This is a list of hardware used through the vehicle, organized by type of fastener and then size.

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Samples of all the above formats should be presented at or before the first meeting discussing part manuals.

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PART MANUAL BASIC FORMAT SHOWING STOCKING LOCATION

Fig. Index	Qty	Description *	Amtrak P/N	Supplier / Builder P/N	OEM & Component P/N	Used On Code	Stocking Location				
							S&I	Minor Running Maint. Shop	Major Running Maint. Shop	Back Shop	Unit Overhaul Shop
1	1	A/C compressor		23x233335	Carrier 06D825				X	X	X
2	2	Unloader		23x234345	Carrier 123543				X	X	X
3	2 pts.	Compressor oil		33x23443z	Shell 02X		X		X	X	X
4	4	Air Filter, 16x20”		13z12345	Harris 1515x		X	X	X	X	
5	2	Marker light lamp		23x98765	GE75R3		X	X	X	X	

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* **Note:** Description of common commercial hardware shall be complete; for example a bolt would be defined with the following characteristics:

- Bolt
- Hex head
- Galvanized steel
- 3/8”
- 16UNC
- 2A
- 1.5” long
- Grade, as required

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Figure 7.9: Organization and Content: Drawing Manual

Drawing content shall conform to Amtrak specification 700.

Forward

- Title page
- Record of Revisions
- Table of Contents
- List of Illustrations
- List of Tables

Introduction

- Overview of book

Schematics

- Electrical Schematic Forward:
    - symbol chart
    - device legends and locators
    - power distribution
    - summer/ winter load chart
    - battery load chart
- Electrical schematics- builder level
- Electrical schematics- supplier level
- Air brake schematic
- Auxiliary air schematic
- Water/ waste schematic
- HVAC air distribution schematic
- Fuel system schematic
- Lubricant system schematic
- Cooling system schematic

Conduit routing & terminal block locations

Wiring diagrams

Piping diagrams

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Figure 7.10: Organization and Content: Test Manual

- Cover sheet
- Table of contents
- Test plan
- Text of each supplier's Acceptance test and a completed test report of each
- Text of each supplier's Qualification Test and Proof of Design test and a
- completed test report of each
- Text of each Builder's Acceptance test and a completed test report of each
- Text of each Builder's Proof of Design test and a completed test report of each
- Certification of the Qualification and Proof of Design test results by the Quality Control Department of the Builder

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Figure 7.11: Organization and Content: Vehicle History Book

- Cover sheet
- Table of contents
- Serial numbers: trucks, engine, gear boxes, etc
- Wheelset pressing reports
- Acceptance test reports
- USPHS certification
- Etc.

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Figure 7.12: Equipment Plan and Data Book Sheets

The builder will provide a completed sheet for each vehicle configuration, in accordance with the Amtrak template.

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Figure 7.13: Photograph Book

- Cover page
- Table of contents
- Photographs

Each photograph will be mounted in a transparent plastic sheet, with a label provided with the photograph clearly identifying the location and what it shows and page number. The photo shall be identified on the back with the date and number of the negative.

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APPENDIX A

AMTRAK ELECTRONIC PARTS AND SERVICE CATALOG SPECIFICATION

The Electronic Parts and Service Book will be Published in LinkOne®. If the Builder does not have LinkOne® Software in-house, it may be necessary to subcontract the work to an Authorized LinkOne® Publisher. Information will be provided about the Distributor Publisher, who is currently contracted to Amtrak for technical support. The Builder is not limited to a sole source situation.

LinkOne® is an international graphical parts book system formerly called Mincom ImageLink. Mincom Inc.'s corporate office is located in Australia, and there is a worldwide network of Distributor Publishers. Mincom's U.S. office is located in Denver, Colorado.

To locate the Electronic Parts Catalog Exchange Standard ("EPCES"), the Builder will be required to log onto the Internet and access the NAPM Rail Industry Forum's WEB Site www.napmrif.org/infostnd/epces/index.html. Compliance with this standard will be required as it applies to the EPCES, Documentation Type Definition ("DTD"), defined terms and allowable graphic standards. Actual Standard Generalized Markup Language ("SGML") tagging will not be required.

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General Information

The LinkOne® Parts Book purchased with the equipment is to include copyright privileges that will authorize Amtrak to update the Parts Book, make changes to it and any disposition of the LinkOne® Parts Book without notification or consent of the Builder.

LinkOne® Parts Books built for Amtrak will reference Builder's Part Numbers, Vendor Part Numbers, - i.e., usually the OEM - Original Equipment Manufacturer Part Numbers (applicable to all Builder purchased components) and Amtrak (AAMPS) Corporate item numbers.

The process for establishing AAMPS numbers will be as follows:

In the early stages of documenting the Parts Book, the Builder will convey applicable catalog part number information to Amtrak utilizing an Amtrak provided Excel Spread Sheet. The data to be provided to Amtrak is to include the Noun Descriptions, the identification of the applicable system on which it is used, the Builder's Part Numbers, and the OEM Part Numbers for all parts purchased by the Builder from another source. Amtrak will use this information to identify existing AAMPS numbers or to create new AAMPS item numbers when none are found to exist.

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Amtrak will respond and supply the Builder with applicable AAMPS numbers within a reasonable turnaround timeframe, normally 5 working days after the Builder has provided complete, accurate data. This procedure should allow the Builder to provide the Publisher of the Source Book Data in a timely manner and expedite Publication of the LinkOne® Parts Book.
The Builder is solely responsible to ensure the accuracy and integrity of its supplied books. It is the responsibility of the Builder to maintain their source books through the complete manufacturing process and until the last Unit in the Contract has been delivered and accepted by Amtrak. The Builder will be obligated to provide Amtrak with updates to their original LinkOne® Parts Book whenever the Builder makes a revision or modification under warranty to the Equipment for the life of the Equipment.

A Preliminary Draft version of the LinkOne® Book must be made available within 60 days of the start of Publication to verify compliance with the Amtrak requirements. Delivery of the Preliminary and Final Versions of the Book are to be made to the Amtrak Catalog Dept. (Catalog Dept. Address and Contact Name will be furnished by Amtrak's Contract Representative upon request). Upon final version acceptance, the Builder will be notified, and the billing invoice is to be submitted for payment.

Delivery of the final version of the LinkOne® books constructed for Amtrak must include both the Target and Source Books. These books will remain the property of Amtrak.

The Builder is also required to deliver a duplicate copy of all source data used to make the LinkOne® books. The data contained on CD(s) is to be delivered to Amtrak's Catalog Department.

Amtrak reserves the right to reject any books that it deems substandard as to quality of content provided by the Builder or if the finished product of the Publisher fails to meet any part of this Specification.

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General Description:

Format and content required in the Equipment Parts Catalog

Front Matter

Cover Page: Graphic of the Equipment Unit
Equipment Name
Equipment Model Number
Contract Information: Contract Number, with information regarding the number of units, Road Numbers, etc.

General Table of Contents, listing:
Front Cover Page
Title Page
Chapter Index

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List of All Vendors
List of the Common Commercial Hardware
List of Abbreviations and Glossary
Any Other Applicable Front Matter

Chapter Index – Listing Individual Chapter Numbers and Titles
List of Vendors: With Corporate Name, Address, Phone Number, E-mail Address, Contact Person and Vendor Code.

List of Common Commercial Hardware:
This should be a key list of all parts not manufactured by the Builder. The list is to be in the Builder's part numbers sequence. It is to include all common Fasteners, Electrical and Plumbing Hardware items and must be identified by:
Either A: The complete physical description required for purchase.
Or B: The OEM Names and OEM part numbers or Mil. Specs.

List of Abbreviations
Any Other Front Matter, if Applicable

Chapters

The Builder will coordinate with Amtrak's Catalog Department when determining the Book Chapter Titles and the order of sequence of Chapters. This Is required in order to assure concurrence with Amtrak's Work Management System ("WMS").

Each chapter should begin with a list of included figures, (illustrations), with titles, in numerical order. The list is to be followed by the first Figure on the list, which will contain one or more illustrations, followed immediately by an associated list of components of the illustration. The equipment shown on the first illustration will be the top-level view of an equipment system or assembly. It will be followed in logical sequence by lower-level views called the "drill down" or NLA, (next lower assembly). The figure usually will include "callout" numbers identifying sub-parts or detail parts of the Assembly. Each "callout" item number will appear on the Parts List on the following page. The Parts List is identified by the Figure number it is associated with, and the parts are identified with the "callout" numbers.

Example: Figure 1-1 may be the first figure in Chapter 1. The associated Parts List may be identified as Fig/Index No. 1-1, and the items on the parts list will follow in numerical order corresponding with the "callout" item numbers shown on the illustration.

Information for the LinkOne® Publisher: Include the following in the Book:

LinkOne® Book Date of Publication:_____ Date of Revision:_____

Below is the manner in which Amtrak prefers the Parts List and column headings to be listed

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in the LinkOne® Book.

Fig./Index (Or similar terminology – i.e., Asm./Ref. No. is acceptable)
Amtrak Item No.
Description
Qty.
U/M
Builders Part No.
Vendor Code
Vendor Part No. (OEM)

Chapter 1 – Car Body							
Fig/Index No. 1-1	**Amtrak Item No.**	**DESCRIPTION**	**QTY.**	**U/M**	**Builders Part No.**	**Vendor Code**	**Vendor Part No.**
1							
2							
3							
4							

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List of Vendors and Vendor Codes

Amtrak established Vendor Codes are to be used in the LinkOne® Book.

In the event any of the Equipment Builder's Vendor Codes are different from Amtrak's and this requirement poses a serious problem, it should be listed as an exception in the Equipment Builders' proposal. Amtrak will attempt to negotiate an acceptable compromise to resolve this issue.

LinkOne® Searches that are required to be available for Amtrak Books

Page Titles
Part Descriptions
Part Numbers
Documents
AAMPS Item Numbers
Vendor Part Numbers
Vendor Codes
Part Number/Description
Vendor Code/Description

Amtrak
Mechanical Department
Bureau of Rolling Stock Engineering

SPECIFICATION

For

Sleeping Car Mattresses

SPECIFICATION No. 364 REV "H"

Issue Date: 4-9-14

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Approved By: Date:

4/15/14 Chief Mechanical Officer

4/15/14 Deputy Chief Mechanical Officer - Engineering

4/14/14 Senior Director - Rolling Stock Engineering

4.9.14 Duncan P Copland

Specification Change Sheet

Revision	Date	Section(s)	Description	Approver
REV A	01-31-1991		Paragraphs 3.1.1 and 3.2.1 added.	
REV B	08-01-1991		Stencil added to foam core, paragraph 5.0.	
REV C	04-01-1992		Indelible ink specified in para. 5.0.	
REV D	12-27-1993		Voided dwg. #A-5400; rev. B dwg. #A-5492.	
REV E	07-24-2002		Added 49 CFR 238, 103 Appendix B. Removed Amtrak Spec 352 ref. Changed cover to box construction.	
REV F	08-16-2011		Added Design considerations information, Revised table of contents	
REV G	05-07-2012		Construction changed to Indura core plus CR Foam	
REV H	04-09-2014		Updated spec to match new spec template and changed mattress construction to polyurethane foam with fireblocker	

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Amtrak
Bureau of Rolling Stock Engineering

Specification for TITLE

Specification No. 364 Rev H

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Amtrak
Bureau of Rolling Stock Engineering

Specification for Sleeping Car mattress

Specification No. 364 Rev H

1.0 Scope

1.1 General

This Specification is intended to be used in conjunction with any associated Amtrak drawings and/or CADD models, the Amtrak Procurement Department purchase orders, and other contractual documents issued to the vendor. It is Amtrak's intention that all components supplied under this Specification, unless improvements are otherwise identified, be functionally interchangeable with those currently in use at Amtrak in terms of form, fit, function, general appearance, durability and operation. Any food service, sanitation or other public health items supplied under this Specification must comply with the applicable requirements of the Food and Drug Administration (FDA) of the US Department of Health and Human Services, and also the National Sanitation Foundation (NSF).

As basic work under this Specification, each item produced must be completely functionally tested, cleaned, sanitized as required, properly packaged for shipment to Amtrak, and have documentation submitted. Amtrak will perform a series of First Article Inspections on the first item produced by a vendor, in order to verify that the process and materials used are in compliance with this Specification and drawings.

The design criteria and constraints that are known to Amtrak have been specified. If other factors require definition after Contract award, the vendor shall be responsible for making those definition requirements known to the Amtrak Contracting Agent in a timely manner for mutual investigation and satisfactory resolution, with any revision approved in writing by the Amtrak Contracting Agent. The vendor shall not be relieved of the overall responsibility of providing an adequate design for the Amtrak service conditions. Wherever possible, this Specification has been developed on the basis of equipment performance required, rather than specific hardware to be provided. Where specific hardware is mentioned, it is for the purpose of providing an example of concepts or designs acceptable to the Amtrak Engineer, in order to allow vendors to employ innovation and advanced technology, where appropriate. Preference, to the extent practicable and economically feasible, will be given for products and services that conserve natural resources, protect the environment and are energy efficient.

Whenever in this Specification an article or material is defined by using a trade name or the name and catalog number of a particular manufacturer or vendor, or a limited description, the term "or approved equal" if not written thereafter shall be implied. Any reference to a particular manufacturer's product, either by trade name or limited description, is only for the purpose of setting a standard of performance, quality, composition, construction or size. The term "or approved equal" means any other manufactured product or article which is equivalent in material, workmanship and service and is as efficient and economical in operation in the opinion of the Amtrak Engineer. Amtrak's written opinion as to whether the proposed alternate is equal

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to the specified items for Amtrak's specified use and purposes shall be final and conclusive. The vendor shall not subcontract the design and manufacturing work under this Specification without the written authorization of the Amtrak Contracting Agent. The vendor shall not patent or copyright any original materials or information created by this procurement which will be submitted to Amtrak.

Any items of material or equipment, which are not fully described or are omitted in this Specification or the accepted vendor Technical Proposal, but are necessary for the completion of the item being supplied, shall be considered a part of the scope of supply. In this Specification, all references to "number of days" shall mean calendar days unless otherwise stated.

Safety shall be of primary importance in the design of any items being supplied. They shall present a safe, hazard-free environment to the extent practical. No sharp edges or corners or pinch points shall occur where any personnel may come into contact with them. Smooth surfaces and avoidance of protrusions shall be used to minimize injury.

1.2 Amtrak Ownership Rights

Unless specifically waived in writing by the Amtrak Contracting Agent, all drawings, bills of materials, catalog lists, mockups, CAD models, documentation and all other engineering and design materials related to this Specification shall become the property of Amtrak, and shall be delivered by the vendor in total as part of the First Article Inspection or other process. If any patented items are used, Amtrak must be granted an unrestricted license to use, copy or otherwise manufacture the item by itself or a third party.

1.3 Vendor's Technical Proposal

As a condition of contract award unless otherwise indicated in the Amtrak Procurement documents, the vendor must submit a written and detailed Technical Proposal to the designated Amtrak Contracting Agent. This Technical Proposal must identify the vendor's interpretation of what it considers to be the scope of Basic Work to be performed, present a complete technical description of the components to be supplied, fully describe the operation and maintenance requirements of the components, include a copy of the vendor's Quality Assurance program, describe any Design Review process, present a step-by-step work plan for construction, include a project schedule by major events starting from the Notice to Proceed, and a Bill of Material of all components to be supplied.

1.4 Exceptions

The vendor shall explicitly identify to the Amtrak Contracting Agent any exceptions being taken to this Specification, referencing the Specification Section number and the exact wording in question. It will otherwise be assumed by Amtrak that the vendor takes no exception to this Specification and is completely compliant with all Specification requirements.

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1.5 Legal Requirements

All items being supplied under this Specification must comply with all applicable Federal government requirements, in particular those identified in 36 CFR Part 1192, Subpart F (ADA Requirements for InterCity Rail Cars), 49 CFR Part 223 (Glazing Standards), 49 CFR Part 229 (Locomotive Safety Standards) and 49 CFR Part 238 (Passenger Equipment Safety Standards), among others. This shall include all design aspects, as well as required submittals for approval. It is mandatory that all required materials used by the vendor for application in passenger cars or the cab interior of passenger service locomotives comply with the flammability and smoke emissions requirements of the latest edition of 49 CFR Parts 238.103 (a)(2) and (b)(2), and the Appendix B requirements (including referenced notes) for the category and function of material so listed. Prior to the First Article Inspection and any delivery of material, the vendor must supply the Amtrak Contracting Agent with a report by a recognized third-party independent testing laboratory certifying that all required materials used comply with the 49 CFR Part 238 Appendix B flammability requirements, if applicable.

Any food service and sanitation items to be supplied shall meet all applicable requirements of the U.S. Public Health Service, including the latest edition of the U.S. Food and Drug Administration Food Code. All commercially available appliances shall be approved by Underwriters' Laboratories (UL) and the National Sanitation Foundation (NSF). All approvals, including approvals from USPHS and FDA, are the responsibility of the vendor and its suppliers, and shall be submitted in writing to the Engineer. Appliances developed specifically for this procurement must be designed and manufactured to UL and NSF guidelines. However, actual certification will not be required.

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1.6 Engineer

The Engineer or Amtrak Engineering, as referenced in this Specification or any drawings, is defined as the Senior Director of the Amtrak Bureau of Rolling Stock Engineering within its Mechanical Department, or its written designee. The vendor may be submitting items for the Engineer's approval as required by the Specification. The vendor shall not interpret this process to mean that the Engineer will function as an arm of the vendor's Project Management or Engineering staff. Submissions shall be structured to show how the vendor is responding to all of the requirements of the Specification, and not on the basis of requiring the Engineer to discover how the vendor is not meeting those requirements. Submissions shall contain sufficient detail to confirm that Specification requirements are being met. However, the vendor shall use judgment as to what level is appropriate and shall communicate with the Engineer when guidance is needed on a case-by-case basis. Submittals requiring the Engineer's approval prior to implementation shall be reviewed and classified by the Engineer within 30 days from the day the submittal is received based on a rate of submittal that is reflective of the pace of an orderly, properly managed program. Priorities will be given to special cases when possible.

1.7 Cost Items

Any individual extra work items regarding the items being supplied shall be handled in accordance with the purchase order and other contractual documents issued to the vendor by the Amtrak Procurement Department. The vendor must contact the Amtrak Contracting Agent,

and not solely the Engineer, regarding all such issues. The vendor agrees that no payment will be made by Amtrak for any additional work outside the basic work scope of the contract documents unless such work is first preapproved in writing by the Amtrak Contracting Agent in accordance with the contract documents.

1.8 Vendor Quality Assurance Program

The vendor is required to have in place a documented Quality Assurance Program that is modeled after an established industry quality standard, such as the ISO, AAR, or other organization. The vendor's facility is required to be equipped with equipment, personnel and management completely sufficient to assemble, inspect and test each item being supplied under this Specification. The vendor shall have suitable equipment to diagnose any failure mode, and perform all adjustments and tests required to confirm proper operation. The vendor's Quality Assurance staff shall be active participants in the assembly, inspection, testing and documentation phases of the work. The vendor is required to submit a copy of its Quality Assurance Program as part of its Technical Proposal, as explained in Section 1.3. While it not a mandatory requirement under this Specification, it is highly desirable that the vendor's quality assurance program be certified under ISO 9001:2000 or an equivalent recognized standard.

Amtrak Quality Assurance personnel may conduct random audits of the vendor's quality assurance program to verify that these Specification requirements are being achieved. The vendor shall fully cooperate in such audits. Specific attention shall be paid to the areas of management responsibility, quality system, contract review, design control, document control (including drawings), purchasing, purchaser-supplied product, product traceability and identification, process control (including procedures, testing and equipment), inspection and testing, measuring and test equipment (including calibration programs), control of nonconforming products (applied controls), corrective and preventative actions, handling, storage, packaging and delivery, quality records, internal quality audits, training, servicing and statistical techniques.

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1.9 Critical to Quality (CTQ) Part Criteria

It is mandatory that the vendor comply with Amtrak procedure PD 3.7.4.02, Critical to Quality (CTQ) Part Criteria, which applies to all products identified by either the Engineer or the designated Amtrak Contracting Agent that Amtrak considers to have aspects identified that are Critical To Quality (CTQ). CTQs shall be Critical to Quality (CTQ) characteristic are defined as "Those characteristics of an item which, if non-conforming, may prevent or seriously affect the unit performance, reliability, producibility, or customer satisfaction of a component." This procedure defines the methodology when qualifying parts or processes to assure that the critical to quality product criteria meet Amtrak requirements by:

- Implementing a rigorous Part/Process qualification to ensure the participation, communications of all related departments and the quality acceptance.
- Support the Quality process by involving the vendor early in the project/design process.
- Assure that the vendor is supplying materials that meet the quality, cost, delivery and reliability requirements.

1.10 Components

The vendor shall use only new parts for all components, unless otherwise specified on the drawings or contract documents. It is Amtrak's desire that all materials, to the greatest extent possible, be of commonly available commercial items and hardware. The vendor shall maintain drawings for each component, and where necessary, patterns, jigs and fixtures, to assure identical manufacture. All elastomers used shall have a design life of 10 years in service unless otherwise approved by the Engineer.

1.11 Conducting Tests

The vendor shall be equipped to fully test the items being supplied in accordance with this Specification and any referenced drawings as part of basic work. All testing apparatus shall be calibrated on a periodic basis as recommended by the apparatus supplier, and the vendor shall maintain documentation of such calibrations.

1.12 Workmanship

All workmanship shall be of high grade and shall conform to the best of manufacturing practices. Skilled, qualified, well motivated personnel, with appropriate experience, training and aptitude shall be utilized to assure high quality of workmanship at all levels. Foremen, supervisors, inspectors, and shop managers shall be well integrated within the project team and be fully experienced and capable in their fields. They shall manage their teams in a competent and professional manner. The vendor is required to have on hand in its facility this Specification, and all other referenced drawings and documents.

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1.13 Documentation Records

The vendor shall maintain an electronic database and/or approved logbook of information regarding all components supplied to Amtrak under this Specification. At a minimum, records shall identify the Amtrak purchase order number, any serial number of the assembly, Amtrak "AAMPS" internal catalog number (if known), copies of any written authorizations by the Amtrak Contracting Agent, inspection and test data, shipping date and shipping location. In addition, it shall include a copy of the flammability and smoke emission laboratory certification report, if required, under 49 CFR Part 238 Appendix B for the components being supplied. The vendor shall include any applicable fire safety analysis and all certifications such as by the U.S. Public Health Service, the U.S. Food and Drug Administration, Underwriters' Laboratories and the National Sanitation Foundation.

1.14 Referenced Documents

The latest revision level of all referenced drawings and documents are to be considered to be the applicable version.

- Amtrak Procedure PD 3.7.3.01, Design Review and Control Procedure

- Amtrak Procedure PD 3.7.4.02, Critical to Quality (CTQ) Part Criteria
- Amtrak Specification 323, Wire and Cable
- Amtrak Specification 328, Materials and Workmanship
- Amtrak Specification 339, Water System
- Amtrak Specification 352, Flammability, Smoke Emissions and Toxicity
- Amtrak Specification 429, Environmental and Operating Conditions
- Amtrak Specification 531, Freeze Protection Systems
- Amtrak Specification 866, CAD Model Standards
- Amtrak Specification 867, Amtrak Drawing Standards for CAD
- Code of Federal Regulations 36 CFR Part 1192; 49 CFR Parts 223, 229 and 238
- ISO 9001:2000, Quality Management Systems - Requirements
- Amtrak drawings and models provided with the bidding and contract documents.

2.0 General Requirements

2.1 Design Considerations

Any components being supplied under this Specification shall be designed and manufactured to perform satisfactorily for a minimum design life of 10 years, unless otherwise specified. To the extent possible, only readily available components, hardware and fasteners shall be used. Any assembly hardware visible to passengers shall be recess mounted stainless steel.

The design and components shall comply with the flammability, smoke emissions and toxicity requirements of Amtrak Specification 352. Any water systems being supplied shall comply with the design requirements of Amtrak Specification 339. All water and waste systems shall have freeze protection systems provided in compliance with Amtrak Specification 531. All wire and cable shall comply with Amtrak Specification 323. All materials and workmanship shall comply with the requirements of Amtrak Specification 328. Components shall be selected for maximum endurance between inspections, and for ease and quickness of inspection. All items of electronic hardware and software proposed by the vendor to control or monitor any safety functions must have a safety program meeting the requirements of 49 CFR Part 238.105 submitted to the Engineer for approval and compliance.

As appropriate, the overheating of apparatus and overall fire safety design shall be addressed by use of thermal cutouts, selection and use of materials meeting flammability, smoke generation and toxicity requirements, and by means of fire detection and suppression. All food service galley systems and auxiliary equipment shall be equipped with overheat sensors and thermal cutouts.

Any items being supplied under this Specification for use either by passengers or train crew staff shall be designed to provide maximum comfort and safety as dictated by ergonomic requirements. All items shall be designed utilizing Universal or Transgenerational design, considering the needs of a broad range of users and citizens. This is particularly critical for the very young and the elderly who, while not considered "disabled" are often less stable or lack strength in situations considered "normal" by manufacturers. Applying these concepts need not complicate or add expense to the component but insure its continued utility and safety over time regardless of the demographics of the service area. Special attention shall be given to

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passengers with reduced visual acuity by providing them with visual cues as required. Floor support surfaces should have high contrast colors in this regard, and high contrast signage and striping patterns shall be provided where necessary, as approved by the Engineer.

All apparatus being supplied which requires inspection or maintenance must be readily accessible and replaceable, and shall be arranged to provide simple, easy access. Special attention shall be given such that opened covers, access doors, etc., provide sufficient room for a maintainer to easily gain access to equipment within lockers or enclosures. Secondary safety latches shall be used for all overhead ceiling covers, and any car exterior enclosure cover. In general, frequency of required service shall determine the degree of equipment accessibility.

For newly designed systems being supplied under this Specification, the vendor shall prepare for Engineer approval a Maintainability Analysis for the components being supplied. The analysis shall be the basis for development of maintenance tasks procedures, methods, and techniques. This analysis shall establish the maintenance concepts to be incorporated in the design, taking into consideration the requirements for safety, reliability, accessibility of apparatus, and the skills available for performing maintenance. Maintainability Analysis shall include all tasks required at each level of maintenance (daily, periodic, annual and overhaul), the task frequency, the time required, required labor resource, skill levels, and the necessary tools and support equipment. The Maintainability Analyses shall be a continuing effort during design and shall provide data for consideration in the review of the design.

2.2 Environmental Conditions

Any components being supplied under this Specification shall be designed to comply with the conditions listed in Amtrak Specification 429, Environmental and Operating Conditions, and must be suitable for use up to 10,000 feet elevation above sea level. They shall also be designed and mounted to have structural integrity and be operationally reliable for the vibration environment at the point of attachment, and shall prevent unacceptable vibration inputs to the attachment structure. The component structure and mounting shall be designed to prevent amplification through component resonance beyond a level twice that of the attachment point. The vibration force output of any rotating component shall not exceed the vibration environment specified for the component.

All carbody mounted equipment shall be designed to withstand continuous vibrations of at least 0.2 g at frequencies up to 100 Hertz in all directions, as well as randomly orientated shock loads of at least 5 g's longitudinally, 3 g's vertically and 3 g's laterally. Truck components located above the primary suspension shall be designed to withstand continuous vibrations of at least 6 g's at frequencies up to 100 Hertz in all directions, as well as randomly orientated shock loads of at least 8 g's. Truck components directly carried on the axles shall withstand continuous vibrations of at least 50 g's up to 100 Hertz in all directions, as well as randomly oriented daily shock loads of at least 200 g's. Vibration resistance shall be verified by analysis, to the satisfaction of the Engineer.

2.3 Interchangeability

All similar parts on each item being supplied and among all other assemblies and their spare parts shall be designed and manufactured to be identical, both as individual parts and as

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subassemblies. All assemblies shall mount to the vehicle without modification. Model numbers for identical components shall be identical. Replaceable components of any such apparatus shall be fully interchangeable, without adjustments to any part being necessary.

2.4 Dimensions

All designs, components, dimensions and fasteners used on the components being supplied under this Specification, unless otherwise stated in the bidding and contract documents, shall be of United States inch-standards. Due to potential compatibility issues with existing Amtrak rolling stock, any components and fasteners using metric dimensions shall not be supplied unless approved in writing by the Engineer.

The vendor shall provide English dimensioning for its drawings and other communications which are generated. Fractional measurements shall be expressed as a decimal value. Drawings prepared by the vendor shall be made using third angle projections. First angle projection shall be allowed provided all views are labeled, including the front, top, bottom and side views. Dimensional tolerancing shall be appropriately applied for the part being manufactured.

2.5 Cleaning and Maintenance

All components being supplied under this Specification shall be easy to clean and maintain. They shall not require maintenance or adjustments at internals of less than four years, unless approved in writing by the Engineer. Pockets where dirt and debris can collect shall be minimized; those that exist shall be made easy to clean with standard vacuum cleaner equipment. Light fixtures shall be fully gasketed, including diffuser covers, to prevent dirt entry into the fixtures. Where possible, components requiring maintenance or replacement at overhaul shall be replaceable as individual units. The design shall ensure that items that require repair and or service are easily accessed, removed and replaced and that this is possible with the use of standard hand tools. Variations of fastener thread size, thread length and head style shall be minimized to ease overhaul and regular maintenance. The number of fasteners shall be kept to a minimum. All paints, coatings and corrosion protection shall meet the requirements of Amtrak Specification 328.

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2.6 Interference and Transient Suppression

All electrical components and wiring being supplied shall be carefully planned and selected to avoid electrical interference in the operation of train crew and maintenance department portable radios, public address and any other frequency sensitive systems. Likewise, these components shall be immune to the EMI/RFI effects of electrical interference from Amtrak's electrically and diesel-electrically propelled trainsets, passenger cars and locomotives. The vendor shall include the use of shielded cables, chokes, filters, and capacitors, as required by good design standards, to avoid possible interference with these systems. Adequate voltage transient suppression shall be provided for the protection of circuitry involving semiconductor devices. Low voltage circuits shall be capable of withstanding 1.5 joules, unless otherwise approved by the Engineer.

Apparatus creating EMI emissions shall be designed to contain these emissions within their

package area. Suppressors shall be incorporated across inductive devices to minimize switching transients. All suppression devices shall be selected on the basis of their ability to absorb the amount of energy available in the connected circuit, for the number of cycles of operation expected in service, without requiring replacement prior to scheduled overhaul. All magnet valves and relay/contactor coils shall have free-wheeling diode or metal-oxide varistor voltage spike suppression, or other suppression means, except where this results in deterioration of performance. Coil suppression devices shall be located physically on or as close as possible to the coil it protects (preferably directly at the coil terminal). Wherever possible, the suppression of transients shall be at the source.

3.0 Specific Requirement

This specification addresses the design, performance, and acceptance criteria for bedding mattresses used in Amtrak passenger rail sleeping cars. All mattresses furnished under this specification shall provide maximum passenger comfort as dictated by ergonomic requirements.

The foam cushion material shall be flexible cellular foam with fire barrier fabric and a cotton ticking cover, or equal, in as much as it meets or exceeds the resistance qualities for flame, smoke, heat release, toxic chemical emissions, and physical properties

The cushion foam under normal passenger service use will have no deterioration of the mattress core over four years from the date of manufacture and during this period the permanent set will not exceed 20%. (Permanent set is defined as the reduction of foam thickness, at any point, as a result of normal use.)

If failure occurs in the first and second year, the manufacturer will replace mattress assembly at no charge to AMTRAK. The third year AMTRAK will pay 50% of the current foam insert cost. The fourth year AMTRAK will pay 75% of the current foam insert cost. This warranty will apply directly to the prime construction of the complete assembly or, if bought separately, apply to the foam manufacture

3.1 DESIGN CONSIDERATIONS

Mattress Core and Mattress Ticking Fire Performance Properties
All mattress components shall comply with the Federal Regulation 49 CFR 283.103, Appendix B, in addition to all detailed criteria stated in Section 4.0. Fire performance properties required of the cushioning by 49 CFR 238.103, Appendix B, shall be obtained after testing to Dynamic Fatigue Testing required in Section 4.2.

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3.2 SYSTEM COMPONENTS

3.2.1 Mattress Core

The mattress core is to be an open cell flexible resilient foam cushioning conforming to the following criteria.

Test Identification	*Test Description*	*Test Pass/fail Criteria*
ASTM D3574 test B, Sample size 15"X15"x4".	Indented Force Deflection IFD	25% IFD =41-49 Support factor =2.1min
ASTM D1055, Oven aged (ASTM D573} for 70 hrs. at 212 degrees F Compression load defection change at 25% deflection	Accelerated Aging test	10% max.
ASTM D3574 test D	Compression set at 50% deflection	5% max
ASTM D1055	Flex Fatigue	Thickness loss = 5% max IFD change = 25% max
ASTM D3574, Test E	Tensile Strength	IFD<35, TLN = 40 max IFD>35, TLN = 30 max
ASTM D3574, Test F	Tear Resistance	0.57 lbs./inch min.
ASTM D3574, Test H	Resilience	50% min.
ASTM D3574, Test I_2 , procedure B (20,000 cycles)	Dynamic fatigue	IFD<35, TLN=40 max IFD>35, TLN=30 max
ASTM 3574, test A	Density	2.5 min.
ASTM D 3675, test shall be performed as an	Radiant Panel, Flexible Cellular	Is < 25

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assembly with fire barrier fabric applied over the cushioning foam.	Materials	
ASTM E1537, test shall be conducted with fire barrier fabric but without ticking cover.	Upholstered Furniture Flammability Test	Is , 25
ASTM E662, test shall performed as an assembly with fire barrier applied over the cushioning foam	NBS Smoke Chamber	Ds @ 1.5mins<100 (worst mode) Ds @ 4mins < 175 (worst mode)

3.3 Mattress Core Properties

The I.F.D. value above shall be used unless agreed upon in writing by Amtrak engineering of a variation needed for comfort due to variation in thickness of the mattress insert.

3.4 Mattress Cover

The ticking fabric shall be 6.5 Ounce per square yard minimum Government Standard ACA cotton ticking in accordance to Federal Specifications CCC-C-436E, Type II, Class 2- not preshrunk, blue stripe color..

The ticking materials shall be sewn in such a manner as to present neat appearance without wrinkles, loose ends or tabs that might be used to pull the material loose while installed in the bunk. The cover will have separate top bottom, side piece and closure flap. The sides and leading edge of the closure flap shall be hemmed in conjunction with hook fastener. The exposed edges of the sidepieces and bottom panel shall be hemmed. Located 1/2" from the exposed edge of the bottom panel, one inch wide loop shall be sewn in across the width to accommodate a hook to loop closure seam.

All upholstery seams shall be constructed per ASTM D-6193, Standard Practice for Stitches and Seams, stitch Type 301, Fabric seams are 3/8" at 6-8 stitches per inch,

All perimeters edges of the ticking fabric shall be serged Class 500, 6 stitches per inch minimum per ASTM D-6193.

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3.5 Mattress Cover Properties

Ticking material shall be fire retardant and comply with the following:

Test	Method	Requirement
Vertical Burn Test	F.A.R. 25.853(a) 14 CFR 25, Appendix F, Part I (a) (1) (i) (60 second test)	Flame Time ≤ 10 seconds Burn Length ≤ 6 inches
Smoke Generation	ASTM E662 (flaming and nonflaming	D_s (4.0) ≤ 200
Break Strength	ASTM D751	Warp: 136 minimum Fill: 65 minimum
Trapezoid Tear Strength	ASTM D1117	Warp: 25 minimum Fill: 35 minimum

3.6 Mattress Holding Loop

When specified on the purchase order or on drawings accompanying the purchase order, mattresses shall be provided with a holding loop. The loop shall be made of the same ticking material described in paragraph 4.3.

3.7 Identification

Each mattress shall have a label sewn on the outside of the mattress cover complying with applicable state and federal regulations and giving the following information in indelible ink:

a. Manufacturers name and part number
b. Date of manufacture
c. Size of mattress
d. Amtrak's name and AMMS number

Additionally, the manufacturers name and date of manufacture shall be indelibly stamped in one-inch lettering on the top or bottom surface of one end of each foam core.

4.0 Packaging and Shipment

For all components produced, following all assembly the vendor is required to perform and fully document a complete verification test and evaluation of each component being supplied, prior to shipment to Amtrak. The results of this final testing shall be recorded in the documentation record. When successfully completed, the vendor may be directed by the Engineer to apply a

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permanent Engineer-approved identification label in an inconspicuous agreed-upon area, which shall include the name and location of the vendor, any serial number used by the vendor, any Amtrak "AAMPS" internal catalog number, and the date of manufacture.

All packaging and shipping requirements shall be performed by the vendor. It is required that the vendor properly prepare all components being supplied under this Specification for shipment to Amtrak so that they are ready to install following unpacking.

The vendor shall package the components, unless otherwise instructed by the Amtrak Contracting Agent, to be suitable for continuous storage prior to unpacking in unheated (subfreezing), dusty indoor storage conditions. Fabric and soft goods shall be individually wrapped in clear plastic for protection against water exposure. Components shall be appropriately packaged for their weight and size. Special efforts must be used to protect unusually fragile or plastic items from damage during shipping and handling. Large and bulky items shall be secured to a shipping skid or other commercial shipping media suitable to allow the use of fork lift trucks for handling.

The shipping package shall have an identification label. This label shall include the vendor's name and address, purchase order number, date released for shipment, Amtrak "AAMPS" internal catalog number, and any component assembly serial number. This information shall also appear in the vendor's invoice, and be included in the documentation record.

The vendor shall retain a copy of the shipping documentation record, and shall make three copies for Amtrak. One copy shall be included within the shipping container for the assembly, one copy shall be sent to the Amtrak Contracting Agent (or as otherwise designated in the purchase order), and the third copy shall be sent to the attention of the Amtrak Quality Assurance inspector in care of the Amtrak "ship to" address.

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5.0 Product Support

5.1 Program Schedule

If required by the contract documents, any vendor-produced Program Schedule shall include all program milestones, design reviews, production schedule, delivery schedule, and any other pertinent information that will assist with tracking program progress. Any requested changes to the Program Schedule must be presented to the Amtrak Contracting Agent for review and approval.

5.2 First Article Inspections

To verify that any components being supplied under this Specification meet all Specification and drawing requirements, and are truly interchangeable with existing components, Amtrak will conduct a series of two (initial and as-installed) First Article Inspections (FAI) on the first complete assembly manufactured by a vendor, prior to allowing unrestricted manufacturing work to start. It is the intention of the FAI process that every function and feature of the items being supplied under this Specification be fully exercised and tested for proper operation under all

normal, abnormal and fault conditions, both in the vendor's workshop and as applied on the vehicle.

The initial FAI shall consist of a pre-shipment inspection and testing of a prototype assembly at the vendor's facility. This shall be an active test, and the vendor shall provide all mounting fixtures, electrical and pneumatic power, etc, as required to fully functionally exercise all components and features. A complete range of operating voltages, currents, pressures, loads, etc. shall be applied to simulate both normal and abnormal conditions, and the response of the components to these conditions.

Once this FAI is successfully completed at the vendor's facility, the vendor shall ship the same assembly to the Amtrak maintenance facility identified by the Amtrak Bidding and Contract Documents or the Engineer, where Amtrak will install the assembly onto an Amtrak vehicle. A second "as-installed" FAI shall then be performed to verify proper operation of the assembly in the "as-installed" configuration. This shall in particular verify all component interface conditions with the vehicle.

Each FAI shall have Amtrak Engineering and/or Quality Assurance personnel as well as the vendor in attendance. They shall include, but not be limited to, a mechanical and electrical inspection to determine compliance with the specifications and the drawings, complete testing of the functionality of the component, demonstration of maintainability and troubleshooting, and verification of proper operation and complete compatibility/interoperability when installed on a vehicle. Approval by the Engineer following successful completion of the FAI process, as communicated through the Amtrak Contracting Agent, shall constitute final system approval.

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5.3 Delivery of All CAD Models and Drawings

Following the successful completion of the First Article Inspections, and as a precondition to permit production delivery of material to commence, the vendor must supply to the Amtrak Bureau of Rolling Stock Engineering, via the Amtrak Contracting Agent, an electronic set of every fully-developed CAD model and dimensioned drawing and Bill of Material which may have been created for every individual part used for the manufacture of all items being supplied under this Specification. All models and drawings shall comply with Amtrak Specifications 866 and 867. Refer to Section 5.4 for additional details. Any later modifications as a result of warranty or other actions must include the affected models and drawings being revised as necessary and resubmitted to Amtrak.

5.4 Production Changes Require Engineer Approval

Once final system approval is granted by the Engineer and production has commenced, the vendor is forbidden to make any changes in the design, material or configuration of the items being supplied, unless approved in writing by the Amtrak Contracting Agent as per Amtrak Procedure PD 3.7.3.01, Design Review and Control Procedure. This shall include any modifications required as a result of warranty actions, so as to provide complete documentation.

5.5 Spare Parts List

The vendor shall supply to the Engineer, via the Amtrak Contracting Officer, a Microsoft Excel spreadsheet list in Engineer approved format of any spare or consumable parts which are recommended to be stocked by Amtrak for maintenance of the components being supplied. Such lists shall contain for each item an item number, the spare part name (in noun, adjective format), the name of the Original Equipment Manufacturer (OEM), the OEM part number, approximate cost for each item, and recommended stocking quantity. The vendor shall also supply any revisions in this data up to the conclusion of the warranty period.

5.6 CAD Models, Drawings, Manuals and Parts Lists

All CAD models and drawings prepared by the vendor under this Specification shall be in full compliance with Amtrak Specification 866, CAD Model Standards and Amtrak Specification 867, Amtrak Drawing Standards for CAD. All CAD models and drawings shall be in Engineer-approved formats, and shall include a complete set of all "as-built" drawings of every part, component and assembly used for all items being supplied to Amtrak of all levels, not only the top assembly level. All CAD models shall identify all materials, surface finish and fasteners. Each drawing shall include a complete Bill of Material, providing quantities, original component manufacturer name and part number of the actual supplier of the part. Every part on the Bill of Material must be fully identified regarding its characteristics including material, plating, finishing, heat treatment, secondary operations, etc. Amtrak drawing formats and number series shall be used as agreed upon with the Engineer. The drawing package shall also include drawings of every special tool, jig or fixture required to install, maintain or overhaul the assembly, and if referenced in any of the maintenance manuals. The final CAD models shall be delivered as 3 sets of DVDs or CDs in SolidWorks 2004 or above. The as-built drawings shall be delivered as 3 sets of DVDs or CDs of all drawings in electronic format in SolidWorks 2004 or above (DXF and AutoCAD 2000 format files shall be accepted only with prior approval of the Engineer) along with 3 sets of CDs of all drawings in Adobe Acrobat read-only PDF file format. The vendor shall also supply any revisions in this data up to the conclusion of the warranty period.

One set of software (including any diagnostic tester software) used for any microprocessor system being supplied under this Specification shall be included with each assembly, with an additional complete set on CDs or DVDs to be provided to the Engineer via the Amtrak Contracting Agent. Amtrak shall be identified as the license holder for any commercial software used. Complete operations, programming, and diagnostic tester documentation shall be provided to the Engineer, including procedures for Amtrak to revise all user-changeable software settings. The vendor shall also supply any revisions in this data up to the conclusion of the warranty period.

The vendor shall also submit in electronic format to the Amtrak Bureau of Rolling Stock Engineering, via the Amtrak Contracting Agent, a complete set of all documentation including the operating manual, maintenance manual, and parts list. All documentation data must be compatible with Microsoft Office 2000 or newer applications. The parts list shall identify all individual parts used (in noun, adjective format) in the items being supplied under this Specification, and must include the original equipment manufacturer (OEM) name and part number; use of an intermediate supplier or distributor's name or part number is not acceptable. The parts list shall indicate quantities for each item within each assembly, use exploded isometric-view parts diagrams if possible, use separate pages for parts diagrams and tabular data if possible, and be sufficiently complete to permit Amtrak to order individual replacement spare parts direct from the actual parts manufacturer. The maintenance manual shall include

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complete information from installation, through troubleshooting, repair and complete overhaul. The manuals shall include maintenance and parts information for every special tool, jig, fixture or diagnostic test equipment used to repair or overhaul the assembly. The vendor shall also supply in electronic format all other manuals and other support documentation it has available for the components being supplied under this Specification. All documentation data must be delivered as 3 sets of CDs in Adobe Acrobat read-only PDF file format, distilled in Acrobat 5.0 or higher and in addition 3 sets of CDs in its original Microsoft Office applications format, for internal use by Amtrak for future revision of the data. The vendor shall also supply any revisions in this data up to the conclusion of the warranty period.

All PDF files (other than drawings) shall be distilled from the authoring documents, resulting in PDF documents that can be indexed and searched. All authoring electronic data files making up the manuals shall be delivered formatted such as to not cause pagination errors during the PDF distillation process. The PDF file produced from the distillation process shall match any published version of the authoring document. All files shall be editable by Amtrak for future document maintenance. All columnar data found within word processing files shall be presented in a table format. Any fonts used on the creation of authoring and/or PDF files shall be embedded and not restricted for use. PDF documents with definable chapters, sections and/or subsections shall be linked to their individual locations with bookmarks internal to the file in the fashion of a hierarchical format such as a Table of Contents. Creation of PDF files from scanned images only, resulting in non-searchable or non-indexable documents, will be restricted to only those allowed by the Engineer. Scanned information in the form of document attachments may be allowed to be imported into an existing PDF file that is searchable and capable of indexing, if the information is supplemental to context to the file and not the primary means of communicating the subject's information. If documents are scanned, careful attention will be taken to not allow misalignment of the pages. Opening options in the PDF file format should be set to show bookmarks and page, with magnification at "Set Width" and "Continuous Page" settings. Distillation settings shall be "E Book" or "Print", with DPI settings set to produce quality printing from a desktop printer without overly increasing the size of the file.

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5.7 Training

If required by the Bidding and Contract Documents, following the successful conclusion of the First Article Inspection, the vendor shall provide complete on-site training at the Amtrak maintenance location identified in the Bidding and Contract Documents. The training shall highlight both the operation, maintenance and calibration procedures for the components being supplied. This shall include a minimum of 8 hours of classroom time and "hands-on" training, to be scheduled as mutually agreed between the vendor and the Engineer. The training program shall be presented in written format and shall include the written manuals that are provided for operation and maintenance.

5.8 Failure Analysis

A Failure Analysis to determine the cause and frequency of defects occurring during the warranty shall be performed by the vendor and submitted to the Engineer and the Amtrak Contracting Agent for concurrence. Such analysis shall be performed and reported within 30 days from the date of each failure.

6.0 Source Inspection

6.1 Purpose

Amtrak will perform periodic source inspection of vendor materials and components being supplied. The following is intended to be used as an outline defining activities and responsibilities of the vendor performing the source inspections.

6.2 Professionalism

All inspections, test observations, and other activities performed in the fulfillment of the contract are to be conducted in a professional and ethical manner. The vendor is representing Amtrak in the performance of the contract and therefore must remain courteous, conscientious and professional under all circumstances arising from performance of the contract.

6.3 Scope of Work

Amtrak has implemented a multi-faceted supplier management program of which source inspection is an integral part. Amtrak identifies vendors and materials/components through various methods which will be subject to source inspection. By performing source inspections, Amtrak expects to benefit by use of vendor facilities, measuring and testing equipment to verify materials/components, through rejecting noncompliant materials/components before shipment and receipt by Amtrak, presence of Amtrak representative periodically to ensure continuing good performance, and assist to communicate Amtrak intentions and interpretations of specifications and resolve issues. The vendor will conduct inspection or verify through observation, product compliance with drawings, specifications, standards or Amtrak contract documents and report findings of said inspections to Amtrak.

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6.4 Services

6.4.1 Scheduling Inspections

The vendor shall conduct observations and verifications on Amtrak identified materials and components produced by the vendors for Amtrak. Inspections must be scheduled to coincide with final inspection of said materials/components due for shipment to Amtrak. The vendor may use random sampling where large quantities of material are subject to shipment and note sampling method in associated reports. The vendor must perform all dimensional and operational inspections in accordance with the Quality Plan prior to source inspection, and make all inspection records available for review by the Amtrak source inspector, with focus on CTQ items.

6.4.2 Dimensional Inspection

The vendor must witness and verify conformance with dimensional characteristics per drawings identified in the Amtrak contract documents. The vendor must witness and verify conformance with regulatory standards and requirements including material certification as cited in specification or other reference documents identified in Amtrak contract documents.

6.4.3 Operational Inspection

The vendor must witness and verify conformance with operational tests as cited in specifications, operators manual or other reference documents identified in Amtrak contract documents.

6.4.4 Inspection Reports

The vendor must provide a report documenting the vendor source inspection and the inspection results. The report must include the name of the vendor, the date of the inspection, the material or component name, Amtrak (AAMPS) ID number(s) for items inspected, the quantities of each item inspected the inspection results, and the actions taken where nonconforming materials/components are found. Reports should reference appropriate drawings, specifications, standards, requirements, or Amtrak contract document as appropriate.

6.5 Qualification of Personnel

It is the responsibility of the vendor to provide personnel with adequate training and experience to perform all the activities of the source inspections described above. Personnel must also conduct their activities with professionalism.

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AMTRAK

SPECIFICATION

DESCRIBING

ENVIRONMENTAL AND OPERATING CONDITIONS

DOCUMENT NUMBER: 429

ORIGINAL ISSUE DATE: 12/07/ 1984

REVISION: B REV. DATE: 6/20/2000

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ABSTRACT:
This specification describes the environment the car electrical and electromechanical equipment will experience in Amtrak operation.

KEY WORDS: Environment, temperature

PREPARED BY: R. F. Bruss **DATE:** 12/07/1984

APPROVED BY: C. J. Engelhardt **DATE:** 12/07/1984

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REVISION HISTORY

Revision	Description of Change	Date	Approved
--	Original release	12/07/84	CJE
A	Added sections 2.1j & k, 3.1.5, 3.1.6, 3.2.3, 3.2.4; "under pressure from sprays" to 2.1.h; carbody shock numbers were 6,4,10 respectively	11/27/89	RFB
B	2.1 "exterior" was "undercar"; 2.1: 9200 was 8000 feet; 3.2.1: was 3,3,6g	6/20/2000	RFB

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1.0 **SCOPE**

1.1 Purpose

This specification describes the environment the car electrical and electromechanical equipment will experience in Amtrak operation.

1.2 Intent

If a conflict exists between this specification and the primary procurement specification in which it is referenced, that specification shall rule.

2.0 **GENERAL**

Electrical and electromechanical equipment, its components and associated interconnecting wiring shall be designed to withstand the vehicle shock, vibration, environmental, temperature, and humidity extremes to be expected under operating conditions.

2.1 General Environmental Considerations

The exterior car environment is severe, and care must be taken to protect against the following factors:

a) Heavy rain, driven by wind, or water from a hose
b) Hail, ice, and powdered snow
c) Blown sand, dust, ballast, and rocks
d) Vehicle velocity to 125 mph
e) Wind gust velocity to 90 mph
f) Salt (sea spray or from roads during winter months)
g) Impact from road debris
h) Car washing chemicals and wash rack operation under pressure from sprays
i) Maximum operating altitude of approximately 9200 feet above sea level.
j) Oily film, from diesel locomotive exhaust
k) Electrically conductive dust, primarily from wheel, brake and rail wear.

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3.0 **Operating Conditions**

3.1 Normal Operating Environment

The normal operating environment is those conditions the car equipment can experience during typical daily operation. These are conditions the equipment must be expected to encounter continuously for extended periods of time (rather than occasional transient conditions) without suffering from degradation of performance.

3.1.1 Truck

Vibrational Acceleration Extremes

The truck-mounted equipment will encounter the following vibrational acceleration levels which

have been measured on the unsprung mass (side frame) of rail vehicle trucks with wheel flats moving at 120 miles per hour:

Truck Acceleration Parameter	Measured "G" levels (Peak-To-Peak)	Frequency (Hertz)
Vertical	100	60 to 70
Lateral	100	380 Hz

3.1.2 Carbody Exterior

Vibrational Acceleration Extremes

The carbody-mounted equipment will encounter the following vibrational acceleration levels which have been measured in the sprung mass (car body) of rail vehicles moving at 120 miles per hour:

Car Acceleration Parameter	Measured "G" levels (Peak-To-Peak)	Frequency (Hertz)
Vertical	0.40 to 0.60	12 to 15
Lateral	0.20 to 0.40	1.5 to 2.0

Temperature

During the operation, the equipment will be subjected to the following temperature variations outside the vehicle.

The equipment must be functional at any temperature between:
-40 and +150°F for "vital" equipment; -20 and +130°F for "non vital" equipment. Vital/non vital is defined in the basic system specification.

Humidity

The exterior relative humidity for the undercar equipment will vary from 0 to 100%.

3.1.3 Carbody Interior

Temperature

During operation, the equipment will be subjected to the temperature variations within the vehicle.

Typically, the interior temperature ranges from +40 to +90°F. However, the system must be

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functional at any temperature between:

-40 and +150°F for "vital" equipment -20 and +110°F for "non-vital" equipment

Humidity
During layover, the interior relative humidity will range from 5 to 100%. During normal operation, the interior relative humidity will range from 20 to 90 percent.

3.1.4 Electrical

AC
Normal operation of the car AC electrical system conforms to NEMA standards of +\-10% nominal voltage and +\-5% nominal frequency. Standard voltages include: 480, 240, 208/120, 120, and 28 all at 60Hz.

AC Power Interruption
During normal operation of the car, 480 volt power, and all derived voltages (240, 208/120, 120 and 28) are often interrupted as follows:

Momentary (0 to 10 seconds typical), such as those caused by pantograph bounce on an Electric Locomotive.

Short Term (up to 1/2 hour typical), such as those experienced in locomotive changes or at adding cars to a train enroute.

Long Term (several hours to several days), such as those experienced in yard switching, train spotting and yard storage and service.

DC
Normal operation of the car DC electrical systems is:

Nominal (when train is on Head End Power (HEP) 72 VDC + 8, -16, ripple less than 2V P-P, (harmonics of 60 Hz).

Battery operation (when train is NOT ON HEP): 64VDC +\-8.

There may be momentary loss of power during transition from HEP to battery, or battery to HEP operation.

3.1.5 Pneumatic
Depending upon equipment, cars are equipped with 1 or 2 pneumatic sources, Main Reservoir and Auxiliary. Compressed air is supplied either from a locomotive or stationary compressor and is supplied to the train via a combination of rubber hoses and steel pipe, with in-car distribution

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via copper tubing. Compressors are rotary or reciprocating. Air is often wet, especially in yard operation. Air may also carry some compressor oil.

Main Reservoir Line Air:

Coupled to a Locomotive
When coupled to road locomotive, main reservoir air line pressure ranges from 130 to 140 PSIG. This pressure is normally maintained once the locomotive(s) is coupled to the train; but will experience the following outages; at which time pressure will drop abruptly to zero:

Short Term - (Up to 1/2 hour typical) such as those experienced in locomotive changes or at adding cars to a train enroute.

Coupled to Yard or Station Air - When coupled to either stationary air source, air line pressure ranges from 80-90 PSIG. This pressure is normally maintained once the cars are coupled to the air source, but will experience the following outages at which time pressure will drop abruptly to zero:

Short Term - (up to 1/2 hour typical) such as those experienced in switching moves or adding cars to the consist.

Long Term - (several hours to several days), such as those experienced in yard switching, train spotting, yard storage and service.

Auxiliary Air :
Auxiliary air is an air source derived from main reservoir air. A small air reservoir is charged through a governor valve, which cuts off the air source feeding the reservoir if incoming pressure is less than about 80 PSIG. Because of the reservoir, auxiliary air pressure does not drop abruptly to zero upon loss of train air, but rather drops slowly over a period of several hours.

Coupled To A Locomotive - When coupled to a road locomotive, car auxiliary air pressure ranges from 80 to 140 PSIG. This pressure is normally maintained once the locomotive(s) is coupled to the train. However, main reservoir air feeding the auxiliary air system is interrupted as described above in Main Reservoir Line Air, thus pressure will slowly drop.

Coupled to Yard or Station Air - When coupled to either stationary air source, auxiliary air pressure ranges from 80-90 PSIG. This pressure is normally maintained once cars are coupled to the air source. However, main reservoir air feeding the auxiliary air system is interrupted as described above in Main Reservoir Line Air, thus pressure will slowly drop.

3.1.6 Water
Depending upon equipment, cars are equipped with 1 of 2 water sources: gravity or pressurized.

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Tanks are refilled at the origin of the trip, and at intermediate points on lengthy overnight trips.

Gravity
Water is supplied from an overhead tank by gravity. Typical head is 4 feet. Water is not always available:

- If car runs out of water from excessive demand
- In subfreezing weather, temperature sensitive automatic drain valves must drain car water system if car heat is not available.

Pressurized
Water is supplied from an undercar tank through the use of auxiliary compressed air, which pressurizes the water tank directly. Nominal water pressure is regulated 20 - 25 PSIG, but will slowly drop to zero if main reservoir air pressure is not available to the car. (See section 3.1.5 above, Auxiliary Air).
Car water is not always available:

- If car is out of water from excessive demand.
- In subfreezing weather, temperature sensitive automatic drain valves will drain car water system if car heat is not available.
- If car water tanks are being refilled.

In the first case, car water system will have normal pressure of 20-25 PSIG, but it will be air pressure. In the second case, car will have low pressure, if any while in the 3rd case, car will have neither water, nor pressure. Accordingly, equipment which requires no-water protection must sense the presence of water, not pressure.

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3.2 Survive Environment
The "survive" environment is the conditions car equipment will experience occasionally. Generally, these are conditions equipment must be expected to encounter continuously for extended periods of time, without change or degradation. While equipment may be under power during these extreme conditions, operations specifications need not be met.

3.2.1 Carbody

Shock:

Vertical	4g
Lateral	4g
Longitudinal	8g

Temperature - Interior and Exterior
The car experiences severe temperatures during storage and operation. Equipment must be designed to withstand without damage, the following temperature extremes. These temperatures

are attained only occasionally: -40 to +150°F. Normal temperature range: -20 to +130°F.

3.2.2 Electrical

AC

Equipment shall not be damaged from sustained undervoltage condition.

Equipment shall not be damaged from reverse phase rotation (when applicable)

DC

Equipment shall sustain no damage from sustained low voltage conditions, 0-56VDC.

Equipment shall be reverse-polarity protected.

3.2.3 Pneumatic

Equipment must not sustain damage from short or long term operation at subnormal air pressure.

3.2.4 Water

Equipment must not sustain damage from short or long term operation at subnormal water pressure, nor partial nor complete loss of water supply.

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AMTRAK

SPECIFICATION

FOR

480, 240, 208, 120 VAC

AND

72 VDC

SWITCHBOARD PANELS

SPECIFICATION NO. 498

DRAFT

APPROVED	DATE	REVISION	DATE
Richard F Bruss	3/2/90	A	6/30/89
C J Engelhardt	3/6/90		

ISSUED: MARCH 6, 1990

ORIGINATOR
R. F. Bruss

ENGRE.125

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SPECIFICATION NO. 66-498 CHANGE SHEET

REVISION LEVEL	DATE	PAGE	DESCRIPTION
		TITLE	New spec. #
A	6/30/89	4	Added wire labeling paragraph 3.8, 3.9 was 3.8, 3.10 was 3.9
		5	Rewrote paragraph 4.2.
		6	Added approved circuit breaker list.
		10	Updated spec. numbers
		1,2	Added Vendor Responsibility Sec. 1.4; Location was 1.4.
		8	Added section 4.8

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1.0 SCOPE

1.1 Purpose

The specification defines the requirement for 480, 240, 208, 120, 28, 3 Phase VAC, and 72 VDC switch board panels to be used on Amtrak railroad passenger cars.

1.2 General

This specification is subordinate to the General Vendor Requirements Specification No. 327, which shall take precedence unless specifically excepted in this specification.

1.3 Function

The switchboards provide power distribution and circuit protection for various car loads. In addition, they may include minor switching functions.

1.4 Supplier Responsibility

The General Vendor Requirements Specification 10-327 defines the supplier responsibility in the following areas:

a. System Approach
b. Program Planning
c. System Development
d. Construction and Workmanship
e. Nameplates
f. Testing
g. Acceptance Testing
h. Product Support
i. Detailed Documentation Requirements

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2.0 GENERAL

2.1 Equipment Configuration

Switch boards include the following configurations:

Name	Voltages	Phasing	Function
480 VAC	480 VAC	3Ø 3Wire	Main power distribution
	240 VAC	3Ø 3Wire	
	*72 VDC	1Ø	
Lighting	240 VAC	3Ø 3Wire	Lighting, small-load
	120 VAC	3Ø 3Wire	power distribution
	28 VAC	3Ø 3Wire	
	*72 VDC	1Ø	
Food Service	208/120 VAC	3Ø 4Wire	Food service (kitchen) power distribution
Operating Cab	*72 VDC	1Ø	Operating cab throttle and locomotive control power distribution

*Nominal - may range from 80 to zero volts.

2.2 Location

Unless otherwise specified, switch boards are located within the car interior. The 480 VAC, Lighting and Food Service switch boards are located within electrical closets, while the Operating Cab panel is exposed in the Vehicle Cab, near the operator.

2.3 General Arrangement

The general arrangement of the switchboards will conform to attached Amtrak drawings. The switch boards will have the following arrangements:

480 VAC, Lighting, Food Service	Operating Cab
Rigid back plate	Rigid front panel
Circuit breakers (back mounted)	Circuit breakers (front mounted)
Bus bars	Wiring
Wiring	
Hinged/removable front cover	

Panels are generally mounted on Uni-struts, using mounting holes through the rear of the panel. Cab operating switch boards generally are surface mounted.

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2.4 Shipping

Switch boards shall be packaged to protect against damage during shipment and storage prior to use. The shipping label shall include the following information as a minimum:

(a) Part name
(b) Manufacturer name
(c) Type/catalog/part number
(d) Serial number
(e) Manufacture date
(f) AMMS number (Amtrak part number)
(g) Warning and safety precautions for shipping and storage (this side up, do not stack, etc.)
(h) Preparation for delivery shall assure arrival at the designation without degradation of hardware and performance.

3.0 DESIGN CONSIDERATIONS

The switch board panel design must include the following goals:

(a) Safety
(b) Reliability
(c) Maintainability
(d) Availability
(e) Interchangeability

3.1 Environment

The railroad environment is severe and imposes considerable demands on the panels. Refer to Amtrak specification 429 Environmental Operating Conditions for details.

Panel design shall be such that it is stiff enough to not flex, rattle, nor drum during car operation. Wiring and bus bars shall be constructed to prevent "working" which would lead to eventual electrical or mechanical failure.

3.2 Normal Operation

Circuit breakers on the Lighting, Food Service, and Operating Cab switch boards are occasionally used as switches, though they are generally left on at all times. The 480 switch board circuit breakers are rarely used as switches.

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3.3 Component Mounting

The design of the 480, Lighting and Food Service switch boards is to be such that all components are front serviceable. All parts shall be removable without access to the rear side of the panel, or panel removal. Only severe damage to the switch board shall require its removal from the car. (Design of the Operating Cab switch board requires access to both front and back for servicing.) All circuit breakers shall be arranged so that the handles move vertically, with the "on" position up.

3.4 Protection Against Accidental Contact

Circuit breakers panels shall have a "Dead Front" construction to provide protection against accidental contact with live conductors.

3.5 Wiring Access

Circuit breakers will be mounted in parallel rows, alternating with bus bars and raceways. Spacing between these components shall be such that all internal and external connection points are readily accessible. The design shall also insure that adequate space is provided to prevent any wiring from being crushed by mechanical components, being sharply bent, or located adjacent to surfaces where vibrations could create failure due to insulation abrasion. Adequate clearance shall also be provided between all exposed electrical contacts and terminals and adjacent conductive components and surfaces. Protective edging shall be used as required to protect against wire abrasion.

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3.6 Circuit Breaker to Bus Connection

These connections shall be designed to allow any circuit breaker in any panel position to be connected to any bus bar phase by simply changing the jumper connections. No bus bar modifications are allowed. This is to provide ease in reassigning circuit breaker phasing, should future car loads change.

3.7 Wire Terminations

All internal and external wire connections will be through the use of crimp-on, ring-tongue electrical lugs per Amtrak Specification No. 359. All circuit breakers, bus bars, and all other terminals must accept this type of connection. Panel design shall be such that lugs are not bent nor strained when installed, and wiring is given generous bend radii. Certified crimp tools will be used on all crimp connections.

The position of the phase wires on circuit breakers, etc., will be:

A, B, C, N with A on the top or left
-, + with + on top or right

3.8 Wire Labeling

All vendor installed wiring shall be identified with wire names through the use of sleeve-type wire tags, such as Raychem TMS system. This shall conform to Amtrak Specification No. 319.

3.9 Fault Conditions

The switch board, circuit breakers, bus bars, and accessories must be designed to withstand, without damage, a worst case fault when fed from the following sources:

Main Circuit Breaker	Power Source
480 VAC Main	Locomotive power - 1600 amp continuous
	Yard power - utility transformer feeding entire yard
240 VAC Main	Dry type delta connected transformer, total capacity 45 KVA
208/120 VAC Main	Dry type WYE connected transformer, total capacity 30 to 75 KVA
120 VAC Main	Dry type delta connected transformer, total capacity 30 KVA
28 VAC Main	Dry type delta connected transformer, total capacity 3 KVA
72 VDC Battery	Battery, capacity as stated, typically 80 to 175 amp hr

3.10 Codes and Standards

Switch boards must meet applicable grounding requirements of the National Electrical Code, and applicable NEMA standards.

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4.0 COMPONENTS

4.1 Back Plate

The back plate shall be of heavy gauge steel, sufficient to produce a rigid panel assembly.

Components mounted onto the panel will be attached with screws going into tapped holes (or nutserts) in the back plate. Mounting holes shall be accurately drilled into the back plate to prevent misalignment between components and mounting holes. This will require a drill jig, numerical control machine, etc.

4.2 Cover

The cover shall be of heavy gauge steel or aluminum, of sufficient gauge to avoid rattles and drumming when the car is in motion.

The 480 VAC, lighting and food service panels will be equipped with removable covers, secured with capture sliding-type fasteners, DINCO Gray Co.'s #3 large. The operating cab panel will be secured to the cab structure through the use of a continuous hinge with captive pin. The panel will be held closed through the use of machine screws screwing into the cab structure.

4.3 Bus Bars

Bus bars may be open type, or encapsulated. They will be drilled and tapped on circuit breaker pole centers the entire length of the branch circuit area. They will be aligned to provide fast, easy means of fastening circuit devices to the panel in one-pole increments. This will allow a simple screw driver application for circuit changes. Bus bar system design shall be such that all phase combinations be available at each circuit breaker site.

4.4 Circuit Breakers

Circuit breakers chosen shall be shock resistant, trip free, magnetic/thermal detection, suitable for railroad use with Amtrak approval (see below). Breakers are equipped with toggle operators marked "on" - "off". Minimum interrupt ratings shall be sufficient to handle maximum fault current anticipated in a breaker circuit.

All circuit breakers used on the 480 VAC panel will be screw mounted to the back plate.

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Circuit breakers used on the Lighting and Food Service panels will be snap-in as much as possible.

Circuit breakers used on the Operating Cab panel will be front mounted with screws.

The circuit breakers used must accept ring-tongue, crimp-type lugs, and may be either stud type or pan-head screw into swaged nut or keeper-nut configuration.

Compression connections which a set screw is tightened to squeeze a wire inserted into the terminal are not acceptable.

All circuit breakers will be labeled with the following information:

a. Manufacture
b. Manufacture part number
c. Current rating
d. Voltage rating
e. Interrupting capacity
f. Time delay curve name
g. Date of manufacture

The following circuit breakers are approved for use; other manufacturers and models are subject to Amtrak approval.

480 VAC
Westinghouse EHD
Westinghouse FDB

240 VAC
Westinghouse QC-H

208/120 VAC
Westinghouse QC-H

120 VAC
Westinghouse QC-H

72 VDC Main Battery Circuit Breaker
Westinghouse EHD

72 VDC (Lighting Switch Board)
Westinghouse QCHW

72 VDC (Operating Cab)
Heinemann AM

4.5 Paint

The panel and cover shall be painted inside and outside as indicated on the attached Amtrak drawings.

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4.6 Labels

The panel shall be permanently labeled as follows:

Interior

1. All Circuit breakers (such that when front cover is removed to expose wiring, breakers are identified).

2. Bus bars:
   - Voltage
   - Name of each phase
   - Warnings, as appropriate (e.g., Danger 480 Volts)

3. Vendor nameplate:
   - Vendor name
   - Vendor part number
   - Date of manufacture
   - Serial Number

Labels are not to be attached by adhesives.

Exterior

1. All exposed devices shall be labeled, including circuit breakers, receptacles, switches, etc. The labels are to be colored engraved plastic laminate, track mounted. Labels are to be secured from sliding on the track through the use of small machine screws at each end of the track. This will allow ease in future label changes as may be required. Labels are to be color coded as follows (also refer to Amtrak drawing):

Voltage	Label Material	Lettering
480 VAC	Red	White
240 VAC	Yellow	White
208 VAC	Green	White
120 VAC	Orange	White
28 VAC	Black	White
72 VDC	Gray	Black

"Danger high voltage" - type warning labels should be applied as needed.

Additional instruction labels may be required - refer to attached Amtrak drawings for details.

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4.7 Wiring

Internal panel wiring shall be stranded wire, as per Amtrak specification 323 "High Performance Wire and Cable".

Wiring will be terminated using crimp-type pre-insulated ring-tongue lugs, per Amtrak specification 359. Wiring shall be adequately secured in position. All wires shall be labeled on both ends using heat-shrink tubing type labels, per Amtrak Specification No. 319.

4.8 120VAC Receptacle

A 20 amp 120 VAC duplex receptacle shall be incorporated as part of the lighting switchboard.

5.0 Testing

5.1 Qualification Test (one sample each type)

A qualification test plan (QTP) shall be submitted for Amtrak approval in a timely fashion prior to the manufacturer's intent to perform the tests.

The qualification test is an engineering proof-of-design test, and will be run on one sample of each panel configurations.

All vibration testing is to be performed in accordance with MIL-STD-202 Vibration test Method 204, test condition D, with the equipment powered.

The QTP shall, as a minimum, demonstrate the following:

1. Panel temperature rise test
2. High potential test (2 X circuit voltage + , 1000V for 1 minute)

Amtrak reserves the right to request additional tests as may be required.

5.2 Acceptance Test

An acceptance test plan (ATP) shall be submitted for Amtrak approval at the same time the qualification test plan is submitted.

The acceptance test is a quality control test used to ensure all panels produced are built consistently and operate properly.

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The ATP shall, as a minimum, include the following:

1. Mechanical inspection
2. High potential test (2 X circuit voltage + 1,000V for 1 minute)

6.0 SYSTEM APPROVAL

6.1 General

Each circuit breaker panel shall be subject to Amtrak approval. All major components shall be submitted for Amtrak approval.

6.2 Design Reviews

Design reviews shall be held at times mutually agreed upon between Amtrak and the manufacturer of the panel; such reviews are intended to convey design concepts not readily shown on equipment drawings.

6.3 Documentation

For system approval, the manufacturer of the panel shall submit, as a minimum, the following drawings and documents :

1. Component (assembly) interface drawings, showing:

   a. Outline and mounting dimensions
   b. Weight and center of gravity
   c. Electrical connections
   d. Bill of materials

2. Qualification test plan

3. Acceptance test plan

6.4 First Article Inspection

Prior to the delivery of the first production panel, each type shall be subject to a first article inspection. Such inspection shall include, but not be limited to:

a. A mechanical inspection to determine compliance with the specification and approved drawings.

b. The performance of an acceptance test.

c. The performance of the qualification test. (It is permissible to have the vibration testing previously performed at an independent testing laboratory, the results being available at the first article inspection.) Successful completion of the first article inspection shall consitute final system approval.

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7.0 PRODUCT SUPPORT

7.1 Drawings

All assembly, subassembly, and arrangement drawings shall include a complete bill of material and parts list on the field of the drawing describing all items, including vendor's parts, which form a part of the assembly. Amtrak shall reserve the right to review and approve all drawings prior to construction of a prototype system.

Amtrak shall be supplied, upon completion of the system design, with one set of first generation (not DIAZO) 35 mm film (mounted in accordance with Amtrak specification No. 199) of all assembly drawings, diagrams, schematics, etc., and service manuals.

7.2 Maintenance Manual

The equipment supplier shall provide a maintenance manual in accordance with Amtrak specification No. 353. Manual draft shall be presented for Amtrak approval.

7.3 Photographs

A set of photographs shall be supplied showing the following features of each panel type:

a. Cover
b. Panel with cover removed
c. Bus bar assembly and jumpers to circuit breakers
d. Other salient features of panel

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8.0 APPLICABLE DOCUMENTS

The following shall be considered part of this specification:

Amtrak Specification No.	Name
199	Micro Film
319	Wire, Contactor/Relay Identification
323	High Performance Wire and Cable
327	System and Components Vendor Responsibility
328	Materials and Workmanship
353	Vendor Maintenance Manual
359	Solderless Wire Termination
429	Environmental Operating Conditions

U. L. circuit breakers test requirements.

NEMA Standard AB-1-1975

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Next Generation Equipment Committee NGEC 305

AMTRAK

SPECIFICATION

FOR

480, 240, 208, AND 120 VAC

72VDC

RELAY AND CONTACTOR PANEL

SPECIFICATION NO. 528

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ISSUED: 11/17/1989

(signature page follows)

This specification has been adopted by the Passenger Rail Improvement and Investment Act (PRIIA) Next Generation Equipment Committee (NGEC) for use in its vehicle specifications. If changes to this document are made, please contact the PRIIA Revision Control Coordinator (RCC) so that the NGEC can evaluate changing its version for use in vehicle specifications. The RCC's contact information can be found on the AASHTO web site http://www.highspeed-rail.org/Pages/default.aspx, then follow the link to documents and the Document Management Process procedure.

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AMTRAK

SPECIFICATION

FOR

480,240,208, AND 120VAC

72VDC

RELAY AND CONTACTOR PANEL

~~SPECIFICATION NO.~~ 528

DRAFT

~~Approved~~	~~Date~~	~~Revision~~	~~Date~~

ORIGINATOR

ISSUED: November 17, 1989 ~~R. F. BRUSS~~

SPECIFICATION NO. 528

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Appendix

A. Typical Contactor Panel Instruction Label

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1.0 SCOPE

1.1 Purpose

This specification defines the requirements for 480, 240, 208 VAC and 72VDC relay and contactor panels to be used on Amtrak railroad passenger cars.

1.2 General

This specification is subordinate to the General Vendor Requirement Specification No. 327, which shall take precedence unless specifically excepted in this specification.

1.3 FUNCTION

These panels provide control logic, timing and power switching for various car systems, such as, but not limited to:

A. Auxiliary relay panel (load shed, emergency light, loop relays, etc.)
B. HVAC contactor panel
C. Auxiliary Contactor Panel
    1. Freeze protection
    2. Exhaust fan
    3. Water heater
D. Waste collection contactor panel (except lounge & diner)
E. Refrigeration contactor panel (lounge & diner only)

1.4 Supplier Responsibility

The General Vendor Requirements Specification No. 327 defines the supplier responsibility in the following areas:

a. System Approach
b. Program Planning
c. System Development
d. Construction and Workmanship
e. Nameplates
f. Testing
g. Acceptance Testing
h. Product Support
i. Detailed Documentation Requirements

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2.0 GENERAL

2.1 Equipment Configuration

Panels include, but are not limited to, the following configurations:

NAMES	POWER VOLTAGES	CONTROL VOLTAGE		FUNCTION
A. Auxiliary Relay Panel	* 72 VDC	*72VDC	o	Load Shed Relay
	* 72 VDC	*72VDC	o	Loop relays & diodes (including conductor signal)
	* 72 VDC	120 VAC 10Φ	o	Emergency light relay and associated timer(s)
	* Nominal - may range from 80 to zero volts.			
B. HVAC Contactor Panel	480 VAC, 30Φ	120 VAC 10Φ	o	Blower fan control and Overload Protection
	480 VAC, 30Φ	120 VAC 10Φ	o	A/C Compressor and Condenser Fan control, logic and overload protection
	240 and/or 480 VAC 30Φ	120 VAC 10Φ	o	Floor heat control
	480 VAC 30Φ	120 VAC 10Φ	o	Duct Heat control
C. Auxiliary Contactor Panel				
Freeze Protection	120 VAC 30Φ	120 VAC 10Φ	o	Water Tank Heat Control
	120 VAC 30Φ	120 VAC 10Φ	o	Water Pipe Heat Control
	120 VAC 30Φ	120 VAC 10Φ	o	Water drain heat Control
	120 VAC 30Φ	120 VAC 10Φ	o	Door track, pocket,etc. Heat Control
Exhaust Fan	120 VAC 30Φ	120 VAC 10Φ	o	Exhaust Fan Control and overload protection
Water Heater	480 VAC 30Φ	120 VAC 10Φ	o	Water heater control
D. Waste Contactor Panel	480 VAC 30Φ	120 VAC 10Φ	o	Waste treatment macerator Collection and pump control, logic and overload protection
	120 VAC 30Φ	120 VAC 10Φ	o	Freeze protection
E. Refrigeration Contactor	208 VAC 30Φ	120 VAC 10Φ	o	Refrigeration compressor control and overload

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Panel					protection.
	208 VAC 30Φ		120 VAC 10Φ	o	Condenser Environmental heat control and time delay.
	208 VAC 30Φ		120 VAC 10Φ	o	Diner kitchen exhaust fan control and overload protection.

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2.2 ~~LOCATION~~

Unless otherwise specified, panels are wall-mounted within the car interior as follows:

Item A: switch or electric locker
Items B-D: electric locker
Item E: food service switch locker

2.3 ~~General Arrangement~~

The general arrangement of the relay and contactor panels will be:

A)	Auxiliary Relay Panel	o Rigid back panel o Open construction o Front-mounted components
B)	HVAC Contactor Panel	o Rigid back panel
C)	Auxiliary Contactor Panel	o Removable transparent front panel, secured to standoffs with sliding captive fasteners.
D)	Waste Collection Contactor Panel	o Open construction
E)	Refrigeration Contactor Panel	o Front-mounted components

Panels are generally mounted on Uni-struts, using mounting holes through the rear of the panel.

2.4 ~~Shipping~~

Contactor and Relay Panels shall be packaged to protect against damage during shipment and storage prior to use. The shipping label shall include the following information as a minimum:

(a) Part name
(b) Manufacturer name
(c) Type/catalog/part number
(d) Serial number
(e) Manufacture date
(f) AMMS number (Amtrak part number)
(g) Warning and safety precautions for shipping and storage (this side up, do not stack, etc.)

Preparation for delivery shall assure arrival at the destination without degradation of hardware and performance.

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3.0 DESIGN CONSIDERATIONS

The relay/contactor panel design must consider the following goals:

(a) Safety
(b) Reliability
(c) Maintainability
(d) Availability
(e) Interchangeability

3.1 Environment

The railroad environment is severe and imposes considerable demands on the panels. Refer to Amtrak specification 429 Environmental Operating Conditions for details.

Panel design shall be such that it is stiff enough to not flex, rattle, nor drum during car operation nor be damaged in handling. Wiring and cover mounting, in particular, shall be constructed to prevent "working" which would lead to eventual electrical or mechanical failure.

3.2 Normal Operation

In normal car operation ON-BOARD crew (car attendants, conductors, etc.) do not require access to the relay and contactor panels. If car equipment malfunctions, however, the above crew members may require access to these panels to reset overloads, etc. Accordingly, panels require protection against accidental contact with live electrical connections.

Protection shall still provide access to reset overloads, etc., through the use of appropriate holes, etc. labeled with function and reset instructions.

In repair shops, maintenance personnel may temporarily remove protective covers for servicing equipment.

3.3 Component Mounting

Design of the relay and contactor panels is to be such that all components are front serviceable. All parts shall be removable without access to the rear side of the panel, or panel removal from the wall. Only severe damage to the panel shall require its removal from the car. Component mounting shall be as follows:

A. Contactors, motor starters, overload relays:
Machine screws into back plate
B. Overload Relays:

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Machine screws into back plate

C. Relays:
Socket mount, secured to socket with clips ~~not~~ wire bail.
D. Relay sockets:
Machine screws into back plate - track mounting is ~~not~~ acceptable.
E. Circuit Boards
Machine screws into back plate; electrical connections to board via terminal strip; edge connector is not acceptable.
F. Terminal strips:
Machine screws into back plate; track-mounted terminals are not acceptable.

Component mounting shall be such that ~~any~~ component may be removed independently without disturbing any other component, except for wiring.

3.4 ~~Protection Against Accidental Contact~~

Contactor panels shall have a "Dead Front" construction to provide protection against accidental contact with live conductors. Also see Section 3.2 and 4.2.

3.5 ~~Wiring Access~~

Relays, contactors and other devices shall be mounted in parallel rows. Spacing between these components shall be such that all internal and external connection points are readily accessible.

The design shall also insure that adequate space is provided to prevent any wiring from being crushed by mechanical components, being sharply bent, or located adjacent to surfaces where vibrations or device operation could create failure due to insulation abrasion. Adequate clearance shall also be provided between all exposed electrical contacts and terminals and adjacent conductive components and surfaces. Protective edging shall be used as required to protect against wire abrasion.

3.6 ~~Wiring and Terminations~~

Control wiring from the car to the contactor or relay panel will terminate on terminal block(s) on the panel.

Generally, power circuit wiring will go directly to the contactor on the panel, rather than to terminal blocks. Exception to this is in situations where power circuit splits to many separate loads, such as in some freeze protection circuits. In these situations, the circuits will fan out at the terminal block, where several adjacent terminals can be ganged together.

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All internal and external wire connections will be through the use of crimp-on, ring-tongue electrical lugs per Amtrak Specification #359. Certified crimp tools will be used on all crimped connections. All contactors, starters and relays and all other terminals must accept this type of connection. Exceptions to this rule include:

- Heinemann Hydraulic Overload Relays
- Modular Time Delay Relays.

In both cases, "Faston" terminations are acceptable, but only to wiring internal to the panel. External car wiring connecting to the panel will not use "Faston" connections. Panel design shall be such that lugs are not bent nor strained when installed, and wiring is given generous bend radii.

Compression type terminals, in which a set screw moves down to clamp a wire, whether using a saddle or not, are not acceptable.

The position of the phase wires on contactors, starters, etc., will be:

A, B, C, N with A on the top or left; -, + with + on top or right Generally, power relay and contactor power feed will be from the top row of terminals vertically, or near the back panel horizontally.

3.7 Fault Conditions

The relay and contactor panels must be designed to withstand, without damage, a worst case fault when fed from the following sources through car circuit breakers, etc.:

Main Circuit Breaker	Power Source
480 VAC Main	Locomotive power - 1600 amp continuous
	Yard power - utility transformer, feeding entire yard
240 VAC Main	Dry type delta connected transformer, total capacity 45 KVA
208/120 VAC Main	Dry type WYE connected transformer, total capacity 30 to 75 KVA
120 VAC Main	Dry type delta connected trans- former, total capacity 30 KVA

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28 VAC Main	Dry type delta connected transformer, total capacity 3 KVA
72 VDC Battery	Battery, capacity as stated, typically 80 to 175 amp hr.

3.8 Common Return

All circuit branches shall be arranged such that any relay, contactor, solenoid or other load has one side of the device connected directly to the return circuit of the system; switching on both feed and return sides of the circuit is not acceptable.

3.9 Codes and Standards

Panels must meet applicable grounding requirements of the National Electrical Code, and applicable NEMA standards. Likewise, all electrical components i.e., relays, contactors, resistors, diodes, heaters, etc., will meet NEMA requirements.

4.0 COMPONENTS

4.1 Back Plate

The back plate shall be of heavy gauge steel, sufficient to produce a rigid panel assembly. The panel shall be painted as follows:

Prime with 1 coat Federal Spec #TT-P-664A

Approved Suppliers:
Magnus Chemical Co. XK-185
Duralac Chemical Corp. L4392
J. Landau 14128

Paint with 1 coat White Glyptal GE # 8746

The panel shall be provided with 4 or 6 mounting holes, located along the edges (none in the center). Clearance shall be provided around each mounting hole to use a heavy-wall socket wrench, driving a hex head bolt, without disturbing panel components or wiring. Components mounted onto the panel will be attached with screws going into nut-serts in the back plate. Mounting holes shall be accurately drilled into the back plate to prevent misalignment between components and mounting holes. This will require a drill jig, numerical control machine, etc.

4.2 COVER

The cover shall be of a heavy gauge transparent polycarbonate, of

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sufficient gauge to avoid rattles and drumming while the car is in motion. The cover shall be secured to the back panel standoffs with captive sliding - type fasteners, such as Dinco Gray Co.'s #3 large.

When the panel is equipped with overloads, the cover shall contain holes which allow manual reset of the overload relays without removing the cover. For a specific type of panel, all covers shall be interchangeable.

4.3 Contactors/Motor Starters

All contactors and motor starters will be domestic industrial grade, NEMA standard, conservatively rated. IEC Rated components are not acceptable. Coil voltage will be Nominal 120VAC, or 72 VDC (for battery loads only refer to Battery Charger/Low Voltage Power Supply Specification #64-312 for details). Contactors will be screw mounted to the backplate. If reversing or multiple speed motor starters are used, the two contactors shall be both mechanically and electrically interlocked, the later using auxiliary contact sets on the contactors. Multiple speed starters shall use 5-3 contact arrangement.

Minimum contactor/starter size shall be:

Motor starter	NEMA 0
Contactor	NEMA 1
A/C Compressor starter	NEMA 2

A suppression device such as MOV, will be used across the coil of each contactor, mounted on the contactor coil. AC coils will use devices with 150VAC continuous rating. DC coils will use devices with 90 volt or higher continuous rating.

Approved Contactors/Motor Starters

AC	GE	CR305 and CR306 family
	Allen Bradley	500/509 family
	Westinghouse	A200/A201 family
	Cutler Hammer	CN15/AN16 family
DC	Refer to battery charger/low voltage power supply specification, 312.	

4.4 Overload Relays

Overload relays will be industrial grade, NEMA standard, conservatively rated. IEC Rated components are not acceptable. Overloads will be screw mounted either to the backplate, or the motor starter mounting plate.

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Overload relays may be either hydraulic, or bi metallic thermal, with manual reset, except for A/C compressor, which will be hydraulic.

Thermal overloads, if adjustable, must have a very limited adjustment range, +\-10% maximum. The setting shall be made, then permanently sealed - a drop of paint is not sufficient.

Approved Overload Relays

- Thermal-type: same as contactors (motor starters above)
- Hydraulic: Heinemann SILIC-O-NETIC

4.5 Relays and Sockets

All relays will be domestic industrial grade components, conservatively rated for the intended service. Except for the larger relays, as outlined below, all relays will be enclosed, plug-in type, mounted in surface mount sockets. A suppression device, such as a MOV, will be mounted across the coil of each relay, mounted at the relay socket, or, on larger devices, on the coil terminals. AC coils will use devices with 150VAC continuous rating, DC coils will use devices with 90 Volt or higher continuous rating. Within a given panel, all plug-in relays will be the same type. Relays will be held securely in their sockets with suitable captive socket clips, not bail wires, etc.

Relay pockets will use screw-type terminals for all electrical connections.

Function	Approved Relay Type	Contacts	Coil Voltage
General purpose control	*Potter Brumfield KUP	10A, 3PDT	120 VAC 48 VDC
Loop Relay	Struthers Dunn 8DXX183	4P-NO	64 VDC
Emergency Light Relay	*Struthers Dunn 8AXA159	1P-NO 1P-NC	120 VAC
Emergency Light Relay	*Vapor 36530117-04	3PDT	74 VDC

* Or Amtrak Approved Equal

4.6 Timing Relays

Timing relays will be domestic industrial grade components,

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conservately rated for the intended service. Refer to specification 429 for electrical environment. Timers may take the form of Agastat, surface-mount modular, or plug-in (octal base). The first two relay types will be panel mounted, whereas the latter will use a surface mount socket.

The plug-in type relay will be held securely in its socket with suitable socket clips, or a clamp which is permanently secured to the back plate, ie., cannot be lost. Timer relay coils shall generally operate on 120VAC.

A suppression device, such as a MOV, will be mounted across the coil of mechanical type timing relays, mounted at the relay itself, or its socket. AC timers will use devices with 150VAC continuous rating, where as DC coils will use devices with 90 volt or higher continuous rating.

Solid state timers shall be protected in two ways:

- Spike protection for power source
- Input protection against false triggering (Solid state timers generally have a high input impedance, and can be subject to false triggering from leakage voltage in car wiring - capacitive, inductive or resistive. One means to overcome this is to shunt the input with a resistor.)

Modular timers must be supplied with timing preset - either with internal resistor, or soldered - on resistor. Loose item resistors, etc. are not acceptable.

Agastat or similar timers will have time setting locked, such as through the use of a glob of RTV, not paint.

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Approved Timing Relays

Manufacturer	
Agastat 7000 family	electromechanical
Agastat	modular
Agastat	hybrid, plug in
SSAC	modular

The use of other types of timer is subject to specific Amtrak approval.

4.7 Printed circuit boards

Printed circuit boards shall be designed to minimize the chance of miswiring. All terminals shall be clearly labelled, and oriented in such a way that a board can be replaced without requiring a drawing to reconnect the wiring correctly. Circuit

boards shall be conformal (or equivalent) coated, both sides, and be labeled as to:

Vendor name
Vendor part number
Manufacturer date
Amtrak AMMS number
Serial number

4.8 Terminal Blocks

Panel terminal blocks will be rigid phenolic, double row screw type blocks, such as Kulka 602 series. Track-mounted, modular type are not acceptable.

4.9 Wiring

Internal panel wiring shall be stranded wire, as per Amtrak Specification No. 323 "High Performance Wire and Cable.

Wiring will be terminated using crimp-type pre-insulated ring-tongue lugs, per Amtrak specification 359. Wiring shall be adequately secured in position, using ty-wraps, screw-down cable clamps, etc. Cable clamps secured to the panel by an adhesive are not acceptable for this purpose. All wires Shall be labeled on both ends using using heat-shrink tubing type labels, per Amtrak Specification No. 319. Wires 4" or less in length need only 1 label.

4.10 Labels

The panel shall be permanently labeled as follows:

Backplate

1. Devices

The back plate itself is to be permanently labeled with labels located so they can still be easily read with the panel fully wired. All devices shall be labeled; refer to Specification No. 359 for naming procedure.

Device	Example
Contactor	DHC1
Motor Starter	BFC
Overload Relay	OL1
Overload Relay Heater Values	2.06A
Relay	PDR
Timer and delay	TDR1, 10 SEC DOD
Terminal Block	TB1

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Terminal Numbers	1,2,3
Wire Names	LSL0/1A
Circuit Breaker	CB1
Fuse and Value	FU1, 5A

2. ~~Vendor nameplate~~:

Vendor name
Vendor part number
Date of manufacture
Amtrak AMMS number
Serial number

3. ~~Label materials~~:

- Silk screened paint
- Engraved plastic, mounted with screws or rivets, ~~not~~ adhesive.

4. ~~Cover~~

The panel cover shall permanently labeled as follows:

1. ~~Panel name~~ eg. HVAC contactor panel
2. ~~Overload reset~~ identification and reset instructions (if panel has manual reset overloads) See appendix A.
3. ~~Warning labels~~ as appropriate: Danger High Voltage-480 Volts
4. ~~Label materials~~
   Stick - on metal film

5.0 ~~TESTING~~

5.1 ~~Qualification Test~~ (one sample each type)

A qualification test plan (QTP) shall be submitted for Amtrak approval in a timely fashion prior to the manufacturer's intent to perform the tests.

The qualification test is an engineering proof-of-design test, and will be run on one sample of each panel configuration. All vibration testing is to be performed in accordance with MIL-STD-202 Vibration test Method 204, test condition D, with the equipment powered.

The QTP shall, as a minimum, demonstrate the following:

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1. Proper operation of panel logic (as appropriate).
2. High Potential test (2 x circuit voltage + 1,000V for one (1) minute)

Amtrak reserves the right to request additional tests as may be required.

5.2 Acceptance Tests

An Acceptance Test Plan (ATP) shall be submitted for Amtrak approval at the same time the qualification test plan is submitted.

The acceptance test is a quality control test used to ensure all panels produced are built consistently and operate properly.

The ATP shall, as a minimum include the following:

1. Mechanical inspection
2. High potential test (2 x circuit voltage +1,000v for one (1) minute)
3. Wiring checkout (continuity)

6.0 SYSTEM APPROVAL

6.1 General

Each contactor or relay panel type shall be subject to Amtrak approval. All major components shall be submitted for Amtrak approval.

6.2 Design Reviews

Design reviews shall be held at times mutually agreed upon between Amtrak and the manufacturer of the panel; such reviews are intended to convey design concepts not readily shown on equipment drawings.

6.3 Documentation

For system approval, the manufacturer of the panel shall submit, as a minimum, the following drawings and documents:

1. Component (assembly) interface drawings, showing:
   a. Outline and mounting dimensions
   b. Weight and center gravity
   c. Electrical connections

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d. Bill of materials

2. Component cut sheets

3. Qualification test plan

4. Acceptance test plan

6.4 First Article Inspection

Prior to the delivery of the first production panel, each type shall be subject to a first article inspection. Such inspection shall include but not be limited to:

a. A mechanical inspection to determine compliance with the specification and approved drawings.

b. The performance of an acceptance test.

c. The performance of the qualification test. (It is permissible to have the vibration, testing previously performed at an independent testing laboratory, the results being available at the first article inspection.) Successful completion of the first article inspection shall constitute final panel approval.

7.0 PRODUCT SUPPORT

7.1 Drawings

All assembly, subassembly, and arrangement drawings shall include a complete bill of material and parts list on the field of the drawing describing all items, including vendor's parts, which form a part of the assembly. Amtrak shall reserve the right to review and approve all drawings prior to construction of a prototype system.

Amtrak shall be supplied, upon completion of the system design, with one set for first generation (not DIAZO) 35 mm file (mounted in accordance with Amtrak specification 199 of all assembly drawings, diagrams, schematics, etc.

7.2 Maintenance Manual

The equipment supplier shall provide a maintenance manual in accordance with Amtrak Specification Nos. 353 and 354. Manual draft shall be presented for Amtrak approval.

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7.3 Photographs

A set of photographs shall be supplied showing the following features of each panel type:

a. Cover
b. Panel with cover removed
c. Other salient features of panel

8.0 APPLICABLE DOCUMENTS

The following shall be considered part of this specification:

Amtrak Specification No.	Name
199	Microfilm
312	Low Voltage Power Supply/Battery Charger
319	Wire, Terminal, Terminal Block Contactor/ Relay and Connector Identification
323	High Performance Wire and Cable
327	System and Components Vendor Responsibility
328	Materials and Workmanship
353	Vendor's Manual Data
359	Solderless Wire Termination
429	Environmental Operating Conditions
354	Carbuilder Maintenance Manual
317	Waste Collection System
311	HVAC System

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Appendix A
Typical Contactor Panel Instruction Label

Toilet System Contactor Panel
Instructions For Resetting Tripped Overload Relays

Toilet Pump/Grinders(Macerators) are each equipped with Manual Reset Overload Relays, which may occasionally trip (usually from toilet blockage).

If the Overload Relay trips, the corresponding toilet will not flush.

A. To reset an Overload Relay:

1) Ensure toilet is clear, and no one is servicing unit.
2) Locate reset pushbutton labeled... "Overload Reset" on this panel. Adjacent will be a hole with an Actuator behind it.
3) Push Actuator to reset, if it was tripped, it will click.
4) Check both Overload Relays.

B. Cycle toilet to ensure it now operates.

C. Do not repeat procedure A more than 3 times or equipment damage may result.

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AMTRAK
Mechanical Department
Bureau of Rolling Stock Equipment

SPECIFICATION

For

Replacement Truck Springs

SPECIFICATION No. 563

Revision 7

Issue Date: May 24, 2018

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APPROVED 5/31/18 DATE

5/31/18 VP/Chief Mechanical Officer

5/31/18 AVP/Deputy Chief Mechanical Officer

Michael R Burshtin 5/24/18 Director – Systems Engineering and Specifications

Michael L Burshtin 5/24/18 Originator
Michael L. Burshtin

SPECIFICATION CHANGE SHEET

REVISION	DATE	DESCRIPTION	PAGE	APPROVER
1	6/1/10	Rewritten into current specification template, without change to technical data.	All	T. Moree
2	8/2/10	AAR M-112 was AAR M-115	2 & 4	T. Moree
3	8/2/10	AAR M-112 reference deleted. Added paint spec. for Surfliner springs	2 & 4 7	T. Moree
4	4/20/11	Added additional constraints on coil spacing, tapered ends termination, hardness, test measurement, and drawing requirement.	5	T. Moree
5	12/6/11	Removed "as required by the original manufacturer"	5	T. Moree
6	9/9/15	Clarified testing & record-keeping req'ts Updated tolerance & material req'ts Updated marking & shipping req'ts Rewritten into current specification template, without change to technical data except as noted.	4 & 7 5 7 All	M. LaPosta
7	5/24/18	Reformatted Cover page, deleted 1.2-Vendor Certification and renumbered Section 1, revised 1.4-Proposal requirements, revised 1.8-Vendor Quality Policy, corrected 2.3 end finish ASTM reference, revised 2.6-Finishing with additional powder coat supplier.	See Sections	M. L. Burshtin

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Amtrak

Bureau of Rolling Stock Equipment

Specification for Replacement Truck Springs

Specification No. 563
Revision 7

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Amtrak

Bureau of Rolling Stock Equipment

Specification for Replacement Truck Springs

Specification No. 563
Revision 7

1.0 Scope

1.1 General

This specification and any attached Amtrak drawings set forth the minimum requirements for materials, workmanship, inspection and testing of for helical steel springs used on various Amtrak passenger car trucks. This Specification is intended to be used in conjunction with any associated Amtrak drawings and/or CADD models, the Amtrak Procurement Department purchase orders, and other contractual documents issued to the vendor. It is Amtrak's intention that all components supplied under this Specification, unless improvements are otherwise identified, be functionally interchangeable with those currently in use at Amtrak in terms of form, fit, function, general appearance, durability and operation.

As basic work under this Specification, each item produced must be completely functionally tested, properly packaged for shipment to Amtrak, and have documentation submitted. Amtrak will perform a First Article Inspection on the first item of each type produced by a vendor, in order to verify that the process and materials used are in compliance with this Specification and drawings.

The design criteria and constraints that are known to Amtrak have been specified. If other factors require definition after Contract award, the vendor shall be responsible for making those definition requirements known to the Amtrak Contracting Agent in a timely manner for mutual investigation and satisfactory resolution, with any revision approved in writing by the Amtrak Contracting Agent. The vendor shall not be relieved of the overall responsibility of providing an adequate design for the Amtrak service conditions.

Whenever in this Specification an article or material is defined by using a trade name or the name and catalog number of a particular manufacturer or vendor, or a limited description, the term "or approved equal" if not written thereafter shall be implied. Any reference to a particular manufacturer's product, either by trade name or limited description, is only for the purpose of setting a standard of performance, quality, composition, construction or size. The term "or approved equal" means any other manufactured product or article which is equivalent in material, workmanship and service and is as efficient and economical in operation in the opinion of the Amtrak Engineer. Amtrak's written opinion as to whether the proposed alternate is equal to the specified items for Amtrak's specified use and purposes shall be final and conclusive. The vendor shall not subcontract the design and manufacturing work under this Specification without the written authorization of the Amtrak Contracting Agent. The vendor shall not patent or copyright any original materials or information created by this procurement which will be submitted to Amtrak.

Any items of material or equipment, which are not fully described or are omitted in this Specification or the accepted vendor Technical Proposal, but are necessary for the completion of the item being supplied, shall be considered a part of the scope of supply. In this Specification, all references to "number of days" shall mean calendar days unless otherwise stated.

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1.2 Standards

It is mandatory that all springs supplied by the vendor under this Specification must comply with the referenced requirements of the latest revision of the Association of American Railroads (AAR) Manual of Standards and Recommended Practices. The vendor shall provide special attention to compliance with AAR Standard M-114.

1.3 Amtrak Ownership Rights

Unless specifically waived in writing by the Amtrak Contracting Agent, all drawings, bills of materials, catalog lists, mockups, CAD models, documentation and all other engineering and design materials related to this Specification shall become the property of Amtrak, and shall be delivered by the vendor in total as part of the First Article Inspection or other process. If any patented items are used, Amtrak must be granted an unrestricted license to use, copy or otherwise manufacture the item by itself or a third party.

1.4 Vendor's Technical Proposal

As a condition of contract award unless otherwise indicated in the Amtrak Procurement documents, the vendor must submit a written and detailed Technical Proposal to the designated Amtrak Contracting Agent. This Technical Proposal must identify the vendor's interpretation of what it considers to be the scope of Basic Work to be performed, present a complete technical description of the components to be supplied, include a copy of the vendor's Quality Assurance program, describe any Design Review process, describe the product testing, present a step-by-step work plan for construction, include a project schedule by major events starting from the Notice to Proceed, and a Bill of Material of all components to be supplied.

1.5 Exceptions

The vendor shall explicitly identify to the Amtrak Contracting Agent any exceptions being taken to this Specification, referencing the Specification Section number and the exact wording in question. It will otherwise be assumed by Amtrak that the vendor takes no exception to this Specification and is completely compliant with all Specification requirements.

1.6 Engineer

The Engineer or Amtrak Engineering, as referenced in this Specification or any drawings, is defined as the Director of the Amtrak Bureau of Rolling Stock Equipment within its Mechanical Department, or its written designee. The vendor may be submitting items for the Engineer's approval as required by the Specification. The vendor shall not interpret this process to mean that the Engineer will function as an arm of the vendor's Project Management or Engineering staff. Submissions shall be structured to show how the vendor is responding to all of the requirements of the Specification, and not on the basis of requiring the Engineer to discover how the vendor is not meeting those requirements. Submissions shall contain sufficient detail to confirm that Specification requirements are being met. Submittals requiring the Engineer's approval prior to implementation shall be reviewed and classified by the Engineer within 30 days from the day the submittal is received based on a rate of submittal that is reflective of the pace of an orderly, properly managed program. Priorities will be given to special cases when possible.

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1.7 Cost Items

Any individual extra work items regarding the items being supplied shall be handled in accordance with the purchase order and other contractual documents issued to the vendor by the Amtrak Procurement Department. The vendor must contact the Amtrak Contracting Agent, and not solely the Engineer, regarding all such issues. The vendor agrees that no payment will be made by Amtrak for any additional work outside the basic work scope of the contract documents unless such work is first preapproved in writing by the Amtrak Contracting Agent in accordance with the contract documents.

1.8 Vendor Quality Policy

The vendor is required to have in place a documented Quality Assurance Program that is modeled after an established industry quality standard, such as the ISO, AAR, or other organization. The vendor's shop is required to be equipped with equipment, personnel and management completely sufficient to manufacture and inspect each spring being supplied under this Specification. The shop shall have suitable equipment to diagnose any failure mode and to perform all adjustments and tests required to confirm proper manufacture. The vendor's Quality Assurance staff shall be active participants in the production, inspection, testing, and documentation phases of the work. The vendor is required to submit a copy of its Quality Assurance Program as part of its Technical Proposal. While it not a mandatory requirement under this Specification, it is highly desirable that the vendor's quality assurance program be certified under ISO 9001:2000 or an equivalent recognized standard.

Amtrak Quality Assurance personnel may conduct random audits of the vendor's quality assurance program to verify that these Specification requirements are being achieved. In addition, Amtrak may choose to inspect springs prior to shipment or upon receipt at any of its maintenance facilities. The vendor shall fully cooperate in such audits.

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1.9 Conducting Tests

The vendor shall be equipped to fully perform all inspections and tests required in accordance with this Specification and any referenced Association of American Railroads standards as part of basic work. All testing apparatus shall be calibrated on a periodic basis as recommended either by its supplier, or by the vendor's quality system requirements.

1.10 Documentation Records

The vendor shall provide a complete record of all inspections for each spring assembly produced, as well as maintain a logbook of information regarding all springs manufactured by it for Amtrak. The records format must be reviewed and approved by the Engineer to ensure all required information is captured. As a minimum, records shall identify the Amtrak purchase order number, material certifications, all component serial numbers, copies of any written authorizations by the Amtrak Contracting Agent, inspection and test data, shipping date and shipping location. This documentation must be retained by the vendor for a minimum period of five years.

1.11 Dimensions

The vendor shall provide English dimensioning for its documentation, drawings and other communications which are generated. All springs supplied under this Specification shall be of United States inch-standards, unless otherwise approved in writing by the Engineer.

1.12 Referenced Documents

The latest revision level of all referenced drawings and documents are to be considered to be the applicable version.

- Amtrak drawings and models provided with the bidding and contract documents.
- Association of American Railroads (AAR) Manual of Standards and Recommended Practices Specification M-114, Specification for Helical Springs, Heat Treated Steel
- ASTM A 125, Specification for Steel Springs, Helical Springs, Heat Treated Steel
- ASTM A 689, Specification for Carbon and Alloy Steel Bars and Springs

2.0 General Requirements

2.1 Design Considerations

Unless otherwise instructed by this Specification or any provided Amtrak drawing, the vendor shall design, manufacture and test all springs in accordance with both the latest revision of AAR Specification M-114, Specification for Helical Springs, and the latest revision of ASTM Specification A 125, Specification for Steel Springs. This shall include both the ASTM specification mandatory requirements and the following supplementary requirement sections: S2 Magnetic Particle Inspection, S3 Shotpeening, S4 and S5 Protective Finishes, and S7 Special Loads Requirement.

2.2 Load Stress Requirements

For each spring type, the calculated uncorrected stress, when loaded to 133 percent of the sprung weight at the gross rail load identified by the Engineer, shall not exceed 90,000 psi for carbon steel or 103,500 psi for alloy steel.

2.3 Material and Manufacturing

All springs shall be made from alloy steel bars conforming to the latest revision of ASTM Specification A 689, and shall have a chemical composition in accordance with the latest revision of ASTM Specification A 304 or as noted on any Amtrak drawing supplied for this procurement.

The spring material for all outer coil springs shall be centerless ground or turned and polished (springs for "Heritage" fleet equipment as identified by the Engineer in writing are exempt from this requirement). Any deviation from this requirement must be issued in writing by the Engineer.

The maximum hardness shall not exceed 477 Brinell number. The minimum hardness must be 388 Brinell number.

Both ends of each spring shall be squared and ground (3/4 bearing) or forged tapered as required by ASTM Specification A 125 Section 4.4.1. The grinding process should avoid excessive heat input so as to prevent any undesirable transformation (such as un-tempering) of the material's mechanical properties. Perpendicularity and squareness of ground spring ends shall be in accordance with ASTM Specification A 125 Sections 4.4.2 and 4.4.3, unless otherwise identified on any Amtrak drawing referenced in the procurement.

Ends of 2" (approx.) rod diameter springs shall maintain a 1/2" minimum thickness with a taper.

Termination of the tapered ends of each outer coil spring shall be 180 degrees ± 45 degrees apart from each other (see Figure 1).

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Spacing between each coil shall be equally distant to the maximum extent possible (see Figure 2).

Amtrak requires the suppliers to provide drawings of each spring supplied. The drawings should be complete showing all details including coil spacing and end terminations with tolerances. The drawings will need to be submitted for Amtrak approval at least 2 weeks before the FAI.

Any deviation from the above requirements must be with the written approval of the Engineer.

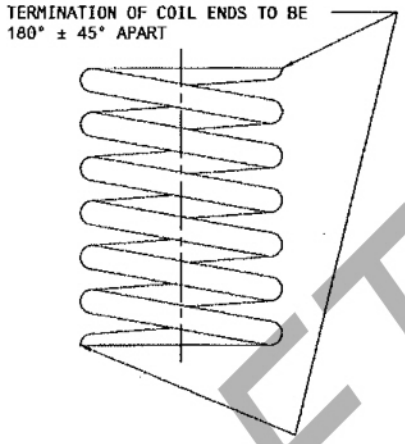

Figure 1: Coil Terminal Locations

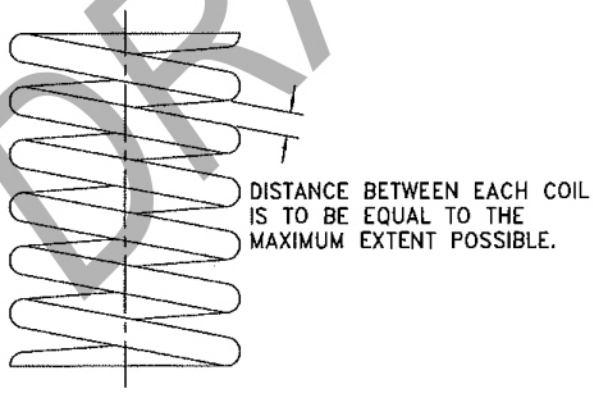

Figure 2: Coil Spacing

2.4 Magnetic Particle Inspection

A **wet** magnetic particle inspection must be performed on each individual spring, including the ground ends, in accordance with methods addressed in ASTM A 125 Supplementary Requirement Section S2. The maximum seam or surface defect on the body of the spring shall not exceed 3 percent of the bar diameter. No surface defects are allowed on the ground ends.

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2.5 Shotpeening

Shotpeening, including the ground ends, must be performed on each individual spring in accordance with ASTM A 125 Supplementary Requirements Section S3. The ground ends of the spring shall be shotpeened after grinding. The minimum intensity for shotpeening shall be 0.006C for springs with a bar diameter of 1" and under, 0.008C minimum intensity for springs with a bar diameter of over 1" to and including 1.5", and 0.010C minimum for springs with a bar diameter larger than 1.5", with 90 percent visual coverage as measured on an Almen C strip.

2.6 Finishing

Each spring shall be finished following manufacturing in accordance with the additional finishing requirements of ASTM A 125 Supplementary Requirement Sections S4 and S5. The springs shall be coated with either:

- one coat of high gloss coat of black powder (Mirror Black PRSF 10306, PPG Envirocron PCT90128, or approved equal);
- or two coats of Williams-Hayward Black Dip Primer (No. 62-12075);
- or coated with red oxide primer and Seibert Powder Coatings Silver Metallic Polyester TGIC #PTM 1384;
- or similar paint (upon approval by Amtrak) for corrosion protection.

2.7 Special Load and Inspection Requirements

Test sample inspections shall be performed in accordance with ASTM A-125 Supplementary Requirements Section S7. For each type of spring being supplied in the Purchase Order, either 10 percent or 10 springs, whichever is greater, are to be inspected and tested to the light load and other parameters listed below. Spring sets are to be tested as a set. The test results and the mill certifications are to be maintained as a part of the Documentation Records described in Section 1.11. A copy must also be provided to the Amtrak Contracting Agent and the Amtrak Senior Quality Assurance Analyst at time of shipment. The inspection report must include, at a minimum, the results of the following inspections or tests in accordance with ASTM A 125, Paragraphs S7.1 and S7.2:

A. Outside Diameter
B. Bar Diameter
C. Free Height
D. * Load and Load Height (under the light or AWO car weight load)
E. * Solid Height.

For the load test in section D, apply the light or AWO car weight load to the spring and then measure the height of the spring.

* Indicates the two parameters that are specified. The remaining parameters will be considered reference.

2.8 Marking Requirements

Each spring and spring set being supplied shall be marked in accordance with AAR Specification M-114, Section 5.0. In addition, each spring and spring set shall be identified with its Amtrak "AAMPS" internal catalog part number.

The Amtrak spring AAMPS part number shall be stamped on each spring. The number stamped shall consist, at a minimum, of the last five (5) digits of the Amtrak part number.

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Springs comprising a nested set shall be firmly wired together for shipping. A metal tag with the word "set", the Amtrak AAMPS part number for the set, and the manufacturer's name shall be attached. Any individual springs shall have a metal tag with the Amtrak AAMPS part number for the spring and the manufacturer's name attached. All individual and nested spring set metal tags shall be positioned for ease of reading.

3.0 Packaging and Shipment

For all components produced, following all assembly the vendor is required to perform and fully document a complete verification test and evaluation of each component being supplied, prior to shipment to Amtrak. The results of this final testing shall be recorded in the documentation record.

All packaging and shipping requirements shall be performed by the vendor. It is required that the vendor properly prepare all components being supplied under this Specification for shipment to Amtrak so that they are ready to install following unpacking.

The vendor shall package the components, unless otherwise instructed by the Amtrak Contracting Agent, to be suitable for continuous storage prior to unpacking in outdoor storage conditions. Components shall be appropriately packaged for their weight and size. Large and bulky items shall be secured to a shipping skid or other commercial shipping media suitable to allow the use of fork lift trucks for handling.

The shipping package shall have an identification label. This label shall include the vendor's name and address, purchase order number, date released for shipment, Amtrak "AAMPS" internal catalog number, and any component assembly serial number. This information shall also appear in the vendor's invoice, and be included in the documentation record.

The vendor shall retain a copy of the shipping documentation record, and shall make three copies for Amtrak. One copy shall be included within the shipping container for the assembly, one copy shall be sent to the Amtrak Contracting Agent (or as otherwise designated in the purchase order), and the third copy shall be sent to the attention of the Amtrak Quality Assurance inspector in care of the Amtrak "ship to" address.

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4.0 Product Support

4.1 Program Schedule

If required by the contract documents, any vendor-produced Program Schedule shall include all program milestones, design reviews, production schedule, delivery schedule, and any other pertinent information that will assist with tracking program progress. Any requested changes to the Program Schedule must be presented to the Amtrak Contracting Agent for review and approval.

4.2 First Article Inspection

To verify that components being supplied under this Specification meet all Specification and drawing requirements, and are truly interchangeable with existing components, Amtrak will conduct a First Article Inspection (FAI) on the first spring of each type manufactured by a vendor, prior to allowing unrestricted manufacturing work to start. It is the intention of the FAI process that every function and feature of the items being supplied under this Specification be fully exercised and tested for proper operation under all normal, abnormal and fault conditions in the

vendor's workshop. The FAI shall include testing of all spring dimensions, loads, capacity, spring rate, etc. as well as verification of compliance with all specification requirements and drawings. The FAI shall have Amtrak Engineering and/or Quality Assurance personnel as well as the vendor in attendance. Approval by the Engineer following successful completion of the FAI process, as communicated through the Amtrak Contracting Agent, shall constitute final system approval.

Following the successful completion of the First Article Inspections, and as a precondition to permit production delivery of material to commence, the vendor must supply to the Amtrak Bureau of Rolling Stock Equipment, via the Amtrak Contracting Agent, an electronic set of the dimensioned drawings and Bill of Material which may have been created for every individual spring of all items being supplied under this Specification. Any later modifications as a result of warranty or other actions must include the affected drawings being revised as necessary and resubmitted to Amtrak.

4.3 Failure Analysis

A Failure Analysis to determine the cause and frequency of defects occurring during the warranty shall be performed by the vendor and submitted to the Engineer and the Amtrak Contracting Agent for concurrence. Such analysis shall be performed and reported within 30 days from the date of each failure.

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26-FOI-00415 00000006232 "UNCLASSIFIED" 4/30/2026

Next Generation Equipment Committee NGEC 305

SPECIFICATION

FOR

DISPOSABLE AIR CONDITIONING AIR FILTERS

FOR

USE ON

AMTRAK PASSENGER CARS

SPECIFICATION NO. 685

DRAFT

ORIGINATOR: Tammy Krause

APPROVED: Tammy Krause 5/16/2003

(signature page follows)

This specification has been adopted by the Passenger Rail Improvement and Investment Act (PRIIA) Next Generation Equipment Committee (NGEC) for use in its vehicle specifications. If changes to this document are made, please contact the PRIIA Revision Control Coordinator (RCC) so that the NGEC can evaluate changing its version for use in vehicle specifications. The RCC's contact information can be found on the AASHTO web site http://www.highspeed-rail.org/Pages/default.aspx, then follow the link to documents and the Document Management Process procedure.

SPECIFICATION FOR DISPOSABLE AIR CONDITIONING AIR FILTERS FOR USE ON AMTRAK PASSENGER CARS

SPECIFICATION # 685

DRAFT

APPROVED	DATE	REVISION	DATE
Tammy Krause	05/16/03		

ORIGINATOR

T. L. KRAUSE

26-FOI-00415 00000006232 "UNCLASSIFIED" 4/30/2026

SPECIFICATION # 685 CHANGE SHEET

REVISION LEVEL	DATE	PAGE	DESCRIPTION

DRAFT

1.0 SCOPE

This specification is a derivative of Specification # 545, dated 3/25/91, and establishes the materials and performance requirements for air conditioning filters utilized on the air conditioning system for Amtrak's passenger cars.

2. 0 APPLICABLE DOCUMENTS

ASHRAE Standard 52.2-1999 and Standard 52.1-1999 (latest revision) titled "Method of testing air cleaning devices used in general ventilation for removing particulate matter."

Underwriter's Laboratories Standard 900.

3.0 FILTER REQUIREMENTS

3.1 Filter Construction

The air filters shall be a 2" deep disposable type. Each filter shall consist of a synthetic media incorporating an electrical charge; a welded wire or expanded metal media support grid; and a high wet-strength beverage board frame. The filter shall be rated by Underwriters Laboratories as Class 2 (two).

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3.1.1 Filter Media

Filter media shall be comprised of multi-layered synthetic fibers with an electrostatic charge. The media shall be formed in a pleat design and laminated to the support grid. It shall be listed by Underwriters Laboratories as Class 2 (two).

When tested in accordance with ASHRAE standard 52.2-1999, the filter shall have a minimum efficiency reporting value (MERV) of 8 (eight).

3.1.2 Media Support Grid

The media support grid shall be of welded wire or expanded metal construction with an effective open area of not less than 96%. The support grid shall be treated for corrosion resistance. The completed grid shall be further coated with rust inhibiting adhesive prior to being laminated to the filter media. The media support grid shall be formed in such a manner that it creates a pleat design. The support grid shall be laminated to the filter media to eliminate the possibility of media oscillation and media pull-away.

3.1.3 Enclosing Frame

The enclosing frame shall be constructed of a rigid, heavy-duty, high wet-strength beverage board, with diagonal support members bonded to the air entering and air exit side of each pleats, to ensure pleat stability. Corners shall be interlocked and reinforced for durability, structural rigidity and ease of installation. The inside periphery of the enclosing frame shall be bonded to the filter pack.

3.1.4 Alternate Filters

Alternate filter constructions must be approved by Amtrak Engineering Department.

3.2 Physical Characteristics

Thickness of Media	0.14 inches (avg.)
Number of Pleats per Linear Foot (Note: Pleats to be parallel to the short direction and evenly spaced)	15 (min)
Total Media Area (TMA) Where TMA is defined as: Nom. thk (usually 1 3/4") x (length of shortest side) x (2) x (# of Pleats in Filter)	30 sq. ft. (min.)

Alternate physical characteristics must be approved by Amtrak Engineering Department.

3.3 Ashrae Standard 52 - (Latest Revision) Tests

3.3.1 Test Parameters

The filter shall be tested at the following test parameters:

Nominal Filter Size	24" x 24" x 2" Standard Capacity approx 3.1 sq. ft media area per l sq. ft. face area.
Test Air Flow Rate	2000 CFM
Dust Feeding Rate	2.0 gm/MCF

3.3.2 Performance Characteristics

The filter shall have the following performance characteristics using the test parameters listed in Section 3.5.1.

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Initial Resistance	0.26 in w.g. (max.)
Initial Atmospheric Dust Spot Efficiency	19.0% (min.)
Average Atmospheric Dust Spot Efficiency	30.0% (min.)
Average Synthetic Dust Weight Arrestance	92.0% (min.)
ASHRAE Dust Holding capacity at 1.0 in. w.g.	90 grams (min.)

3.4 Filters Marking

The exterior of the enclosing frame of each filter shall be identified with the following information:

a. Manufacturer's name and part or model number.
b. Arrows identifying air flow direction.
c. Locate on edge of filter box a date and installation location.
d. Underwriters Laboratories, Inc. flammability classification.

3.5 Field Testing

3.5.1 Compliance to ASHRAE Standard

Supplier to submit an independent laboratory test report using standards set forth under ASHRAE Standard 52 (latest revision) prior to testing. Such report shall be less than one year of age and in accordance with Section 3.3. Test Filter must conform to all requirements of this specification.

3.5.2 Amtrak Field Test

Supplier to submit minimum of 18 sample test filters for evaluation and field testing by Amtrak and Vendor. Amtrak reserves the right to request additional filters or filters of different dimensions for field testing.

Filters are to be qualified by a 60-day service test on Amtrak equipment. The filter is to experience a maximum change in resistance of 0.8 in. of water, where the maximum change in resistance is equal to the resistance at 60 days minus the initial resistance at installation.

eg. Max. Change Resist = (Resist. at 60 days) - Initial Resist.)

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3.6 Dimension of Filters

The dimensions of the air filters are as follows:

CAR TYPE	FILTER SIZE	AMMS NUMBER
Amfleet 1	16” x 20” x 2”	26-075-30008
Amfleet 2	16” x 20” x 2”	26-075-30008
Heritage	16” x 20” x 2”	26-075-30008
Horizon	16” x 20” x 2”	26-075-30008
Santa Fe Parlor	16” x 20” x 2”	26-075-30008
Superliner 1	32” x 40” x 2”	22-090-00451
Superliner 2	32” x 40” x 2”	22-090-00451
Viewliner	16” x 16” x 2”	24-090-24090
Surfliner	14” x 20” x 2”	24-222-00011

4.0 QUALITY CONTROL PROVISIONS

The Contractor shall provide a certificate of compliance in accordance with the requirements (Section 3) of this specification.

The vendor is responsible for inspecting all materials furnished in accordance with the requirements of this specification. Acceptance by the Amtrak of materials furnished by the Vendor, is subject to inspection verification and approval or disapproval by Amtrak.

5.0 PREPARATIONS AND DELIVERY

The Vendor’s package shall be of a cardboard construction and have label attached to it, stating the quantity and dimensions of the air conditioning filters within. Deliveries shall be made to the place designated by Amtrak.

6.0 NOTES

This section is not applicable to this specification.

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26-FOI-00415 00000006233 "UNCLASSIFIED" 4/30/2026

Next Generation Equipment Committee NGEC 305

SPECIFICATION

FOR

VALVE AND EXTERIOR EQUIPMENT IDENTIFICATION

TAGS & LABELS AND OPERATING INSTRUCTIONS

FOR USE ON

AMTRAK PASSENGER CARS

SPECIFICATION NO. 696

REVISION A: May 29, 2003

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(signature page follows)

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26-FOI-00415 00000006233 "UNCLASSIFIED" 4/30/2026

SPECIFICATION

FOR

VALVE AND EXTERIOR EQUIPMENT IDENTIFICATION TAGS & LABELS AND OPERATING INSTRUCTIONS

FOR USE ON

AMTRAK PASSENGER VEHICLES

SPECIFICATION NO. 696

REV. A

Abstract: This document defines the requirements for valve and exterior equipment identification tags & labels and associated operating instructions for use on new and existing passenger vehicles.

Key Words: equipment label
label
operating instruction
instruction
tag

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Approved	Title	Date
Richard F Bruss	Act Sen. Director	Jan 31, 2002

Originator: Richard F. Bruss

RECORD OF REVISIONS

Revision	Date	Change
–	1/31/02	Original Release
A	5/29/03	Added colors for section 6.1

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1. OVERVIEW

1.1. SCOPE

This document defines the requirements for valve and exterior equipment identification tags & labels and associated operating instructions for use on new and existing passenger vehicles. This document does not supercede any additional requirements of the vehicle specification.

1.2. PURPOSE

The purpose is to provide clear, consistent labeling requirements for both tags and labels as well as identifying where they are required.

2. REFERENCES

2.1. ASSOCIATED AMTRAK SPECIFICATIONS

- Spec 697 National Onboard Signage Manual
- Spec. # 498: 480, 240, 208, 120 Vac and 72Vdc Switchboard Panels
- Spec. #528: 480, 240, 208, 120 Vac and 72Vdc Relay and Contactor Panels

2.2. OTHER REFERENCES

None

3. DEFINITIONS

None

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4. GENERAL REQUIREMENTS

4.1. GENERAL

All devices, systems and subsystems shall be identified using a methods approved by Amtrak. The labels, their marking and securement method shall be designed to survive the life of the vehicle.
Labels and/or tags shall be applied to identify exterior car equipment as well as the function and position of all valves, pressure switches, test ports and other devices on the vehicle interior and exterior.

The adequacy of identification as well as the labels/tags employed and their location shall be subject to Amtrak approval.

A drawing shall be provided by the builder which identifies all tags and labels used on the vehicle, both interior and exterior. This will include not only the label/tag and its properties, but also the location of each.

4.2. TAGS

Tags shall be of color-coded laminated plastic, secured to the device or near it with a permanent attachment, such as a tie-wrap or wire. Tags shall be approximately .75 inch by 3.0 inch, with text centered.

4.3. LABELS

Labels shall be either deeply stamped or etched metal plates or self-adhesive types, with a permanent adhesive. Contrast shall be used to make the labels easy to read in reduced light, such as at night. Refer to Spec 697: National Onboard Signage Manual for details of signs.

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5. PASSENGER COACHES

The following label and operating instructions apply to coaches.

5.1. TAGS

Functions shall be color-coded as follows:

System	Tag color	Text color
Potable water	blue	white
Toilet flush water	green	white
Water drain	white	black
Waste	brown	white
Auxiliary air	yellow	black
Air Brake	green	white

5.2. EXTERIOR SERVICE LABEL AND TAG REQUIREMENTS

The following equipment, at a minimum, shall be identified on the car exterior:

Tags:

Tags shall be applied to the following, at a minimum:

Brake cylinder cutout (at each truck)
Main reservoir cutout for Decelostat valve (at each truck, if used)
Main reservoir (pipe at ends of car)
Brake pipe (at ends of car)

Labels:

Battery (box)
Potable water fill
Water fill valve positions: "Water" and "Fill"
Dump valve (waste tank)
Brake cylinder cutout
Brake indicator (applied)
Jacking pad
Circuit breaker panel undercar

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Any undercar equipment which includes switches, circuit breakers, relays, contactors and/ or other similar devices
Instruction plate for connecting car-to-car jumper cables
Danger 480 volt warning at 480v jumpers and receptacles and any other high voltage enclosures
Communication and MU receptacle labels (if 27 point, on the lid, per APTA RP-E-019-99)

Emergency labels:

- Emergency door release
- Emergency window instructions
- Body end door cutout switch/ valve

5.3. INTERIOR LABEL AND TAG REQUIREMENTS

The following valves, switches, etc. shall, at a minimum, be labeled whether within the carbody interior, equipment room(s) or undercar within an enclosure:

Tags:

Main water supply
Water supply to each sink, toilet, water cooler, food service appliance, etc.
Water drain of each sink, toilet, appliance or water system
Water pressure regulator, including function and set point
Main auxiliary air supply
Auxiliary air supply to each toilet or other device
Auxiliary air pressure regulator, including function and set point
Other air-operated equipment, such as doors or dampers
Main waste system line valve
Waste system line valves to each toilet
Air brake valves
Thermostats/ temperature sensors

On operator's cabs:
Horn cutout
Bell cutout
Windshield wiper cutout

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Alerter, overspeed and ATS cutout
Dead-in-tow valve

5.4. OVERALL INTERIOR LABELING

A label shall be applied at a central place, such as in the electric locker, which shows the location of all water, waste and air valves on the car.

In addition, in locations were valves within the car interior is not obvious, locator labels shall be included to help crew to locate them. For example, water shutoff valves located beneath the sink they serve do not normally require a locator label, but if the valve was located inside a trash locker, it would require a label.

A label shall be provided which explains the "Dead in Tow" procedure to be followed to set up the brake system to operate when MR is not available. The text of the procedure shall be developed with the input of Amtrak.

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6. LOCOMOTIVES/ POWER CARS

The following label and operating instructions apply to locomotives/ power cars.

6.1. TAGS

Functions shall be color-coded as follows: (per AAR RP-512)

System	Tag color	Text color
Fuel	red	white
Engine coolant	blue	white
Engine oil	yellow	black
Engine drain	tbd	tbd
Sump drain	tbd	tbd
Waste drain	tbd	tbd
Air brake	green	white

6.2. EXTERIOR SERVICE LABEL AND TAG REQUIREMENTS

The following equipment, at a minimum, shall be identified on the vehicle exterior:

Tags:

Tags shall be applied to the following, at a minimum:

Brake cylinder cutout (at each truck)
Main reservoir (pipe at ends of vehicle)
Brake pipe (at ends of vehicle)
Application/ release (pipe at ends of vehicle)
Actuation (pipe at ends of vehicle)
Main auxiliary air cutout
Sump drain(s)

Labels:

Battery (box)
Dump valve (toilet waste)
Brake indicator (unless tread brakes)
Jacking pad
Emergency fuel shut off
Any undercar equipment which includes switches, circuit breakers, relays, contactors and/ or other similar devices
Danger 480 volt warning at 480v jumpers and receptacles and any other high voltage enclosures
Communication and MU receptacle labels (on lid, per APTA RP-E-019-99)

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6.3. INTERIOR LABEL AND TAG REQUIREMENTS

The following valves, switches, etc. shall, at a minimum, be labeled whether within the carbody interior, equipment space or undercar:

Tags:

Power plant:
Fuel
Engine coolant fill
Engine coolant drain
Engine oil drain
HEP engine coolant fill

HEP engine coolant drain
HEP engine oil drain
Engine sensors: timing, pressure, temperature, etc.

Auxiliary air:
Horn
Bell
Windshield wipers
Dampers
Sand

General:
Air compressor cutout

Cab:
Alerter/ Overspeed and ATS cutout (color coded Yellow, White and Red, respectively)
Dead-in-tow valve

6.4. OVERALL INTERIOR LABELING

A label shall be applied at a central place, such as in the high voltage locker, which shows the location of all water, fuel and air valves, etc. on the vehicle.

In addition, in locations were valves within the vehicle interior is not obvious, locator labels shall be included to help crew to locate them. For example, air cocks located inside a cabinet would require a label.

A label shall be provided which explains the "Dead in Tow" procedure to be followed to set up the brake system to operate when Main Reservoir is not available. The text of the procedure shall be developed with the input of Amtrak.

Labels shall be provided which explain:
– fuel compartmentization controls
– how to add coolant, including system depressurization.
– how to cutin/ cutout the air compressor
– how to check engine oil level, including idle speed required

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Next Generation Equipment Committee NGEC 305

AMTRAK

SPECIFICATION

FOR

NATIONAL ON-BOARD SIGNAGE MANUAL

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SPECIFICATION NO. 697

REVISION A: August 6, 2001

(signature page follows)

This specification has been adopted by the Passenger Rail Improvement and Investment Act (PRIIA) Next Generation Equipment Committee (NGEC) for use in its vehicle specifications. If changes to this document are made, please contact the PRIIA Revision Control Coordinator (RCC) so that the NGEC can evaluate changing its version for use in vehicle specifications. The RCC's contact information can be found on the AASHTO web site http://www.highspeed-rail.org/Pages/default.aspx, then follow the link to documents and the Document Management Process procedure.

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Amtrak®

SPECIFICATIONS
FOR

National On-Board Signage Manual

SPECIFICATION NO.
697

REVISION: DATE: **August 6, 2001**

ABSTRACT: This signage manual and the accompanying equipment specific manuals, define the On-Board Signage for use on Amtrak passenger vehicles, locomotives and freight equipment incorporating the new corporate identity. Equipment specific sub-manuals are included for each vehicle type with interior and exterior application drawings, as well as exterior locomotive, freight and non-revenue decal manuals.

Key words: signage, sign, decal, graphic, application

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APPROVED	DATE	
_____	_____	Corporate Service Center VP & CMO
_____	_____	General Manager Standards and Compliance
Richard F Burns	1/31/02	Acting Sr. Director, Equipment Engineering
_____	_____	Director, Equipment Engineering

Originator: C. Poulouin

Amtrak Corporate Equipment Engineering and Mechanical Department

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This document is very large, showing the entire sign catalog. The manual will be made available to the successful carbuilder at design review.

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Amtrak

Mechanical Department
Bureau of Rolling Stock Engineering

SPECIFICATION FOR FLAMMABILITY, SMOKE EMISSIONS AND TOXICITY FOR USE ON RAILWAY PASSENGER CARS AND LOCOMOTIVE CABS

Document Number: 352

Original Issue Date: 01/29/1990
Current Revision Date: 01/27/2010

Abstract:
This specification establishes testing methods and evaluation criteria for smoke generation, flammability and toxicity of materials used in locomotive cab and passenger car interiors and passenger car exteriors.

Key Words: smoke, flame, toxicity, flammability

Original prepared by: George Lobstein **Date:** 1989

Approved by: C.J. Engelhardt **Date:** 1/29/1990

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APPROVED	DATE	
	3/14/10	Chief Mechanical Officer
	3/12/10	Deputy Chief Mechanical Officer - Engineering
	3/12/10	Senior Director - Rolling Stock Engineering
	2.12.10	Director - Systems Engineering
	1-27-2010	Originator J. Blair Slaughter

SPECIFICATION CHANGE SHEET

Revision	Section	Description	Date	Approver
A	p. 5	.60 watts/square centimeter was 1.5	4/29/91	D. Karan
B	p. 2	Added section 2.2	03/12/03	D. Karan
	p. 1	Added reference to FRA 238 Removed specific requirements covered in FRA 238		
	p. 5	Changed section 3.10 from Exterior Plastic Components and boxes to “Exterior Shell”		
C	p. 6	Revised toxicity section to use The Boeing BSS-7239 and added the Requirement of testing for HF,NO_2, Typical industry practice Updated title page format		J. B. Slaughter
	p.1	Updated title page format		
D	2.0	Revised section 2.0 for clarity from as written below: All materials tested must be evaluated in their base form and in a compound form as it is intended to be supplied as a finished product.	8/19/2005	J. B. Slaughter
E	p.1, 2	Updated title page to include revised sign-off schedule. Revised Specification Change Sheet format.		J. B. Slaughter

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1.0 SCOPE

1.1 Purpose

This specification provides parameters and/or test methods for determining properties of materials exposed to thermal degradation.

1.2 Areas of Concern

The following material properties will be determined: Flammability, Smoke Emission and Acute Inhalation Toxicity.

2.0 GENERAL

This specification is issued to govern testing of all flammable materials used in a railcar. All materials tested must be evaluated in their base form unless otherwise specified by Amtrak, required by Federal Regulation or approved by Amtrak's Bureau of Rolling Stock Engineering. A compound form will be considered for testing in lieu of individual base forms if the compound form improves the flammability, smoke or toxicity of a single assembly. A compound form requiring approval by Amtrak for use will be accessed for its overall appropriateness, not just the compound's improved smoke, flame and toxicity performance. Tests conducted on a compound form must be conducted on a production sample.
An example of a compound form is the Kevlar encapsulated foam seat cushion. The foam / Kevlar assembly is considered a compound part and is tested only as an assembly. Seat cushion covers are tested based on the individual parts. An upholstered seat cushion assembly is not an approved compound for testing because individual covers from one manufacturer may be placed on another manufacturer's foam / Kevlar assembly.

The data from each individual test method will not be used independently in evaluating the fire safety of a material since additional factors must be considered for a given situation. These additional factors include, but shall not be limited to: the quantity of material present, its configuration, the proximity to other combustibles, the volume of the compartment(s) to which the combustion products may spread, the ventilation conditions, the ignition and combustion properties of the material(s) present, the presence of ignition sources, the presence of fire protection systems and vehicle occupancy. Therefore data from all tests will be combined with other information to develop a fire hazard assessment, which will be used to select materials on the basis of function, safety and cost.

2.1 FRA Requirements

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49 CFR Part 238 Passenger Safety Standards shall govern smoke and flammability testing for interior components of railroad passenger cars and locomotive cabs. No exceptions beyond those allowed by Part 238 will be considered.

2.2 Documentation

2.2.1 Individual Tests

Independent certified laboratories shall conduct individual Tests. In-house testing will not be considered for initial approval. Test results from certified laboratories shall be provided to Amtrak each component covered by this document and FRA Part 238.

2.2.2 Multiple Tests

When assemblies, modules or whole vehicles require multiple products to be tested and approved, results of the testing shall be provided to Amtrak in a three ring binder properly labeled for its contents.

2.2.3 Fire Safety Analysis

This section applies only to whole vehicle manufacturers and suppliers of large assemblies such as room modules.
A Fire Safety Analysis shall be provided for the vehicle or major assembly in accordance with 49 CFR Part 238 Subpart B, 238.103.

3.0 TESTS FOR FLAMMABILITY AND SMOKE EMISSIONS

This specification and all associated tests relates to all combustible materials used in an intercity rail passenger system. Relative test number factors will be utilized in the final hazard analysis.

3.1 Cushions, Mattresses

Seat cushions, mattress materials, foam padded armrests & pads.

3.1.1 Flammability

Materials shall be tested in accordance with CFR 49 part 238.

3.1.2 Smoke Emissions

Materials shall be tested in accordance with CFR 49 part 238.

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3.2 Panels, Partitions and Frames

Walls, panels and ceiling panels, shelves, tables, partitions, windscreens, seat frames, seat shrouds, mattress frames, toilet seats and to toilet shrouds.

3.2.1 Flammability

Materials shall be tested in accordance with CFR 49 part 238.

3.2.2 Smoke Emissions

Materials shall be tested in accordance with CFR 49 part 238.

3.3 HVAC Ducting

HVAC ducting (both rigid and flexible) where nonmetallic.

3.3.1 Flammability

Materials shall be tested in accordance with CFR 49 part 238.

3.3.2 Smoke Emissions

Materials shall be tested in accordance with CFR 49 part 238.

3.4 Windows & Light Diffusers

All window assemblies, light diffusers and lenses.

3.4.1 Flammability

Materials shall be tested in accordance with CFR 49 part 238.

3.4.2 Smoke Emissions

Materials shall be tested in accordance with CFR 49 part 238.

3.5 Upholstery & Fabric Finishes

All seat upholstery, fabric finishes, draperies, curtains, mattress ticking, and covers.

3.5.1 Flammability

Materials shall be tested in accordance with CFR 49 part 238.

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3.5.2 Smoke Emissions

Materials shall be tested in accordance with CFR 49 part 238

3.6 Flooring

Structural flooring, floor panels.

3.6.1 Flammability

Materials shall be tested in accordance with CFR 49 part 238 Flooring shall be capable of withstanding the requirements of ASTM-E-119 when exposed for 15 minutes at up to 1400EF (760EC) on the material underside.

This test is designed to simulate resistance to penetration from under car fires. Perforation of floor in the form of ducts, conduits, shall be designed so as not to act as passageways for fire and smoke.

3.7 Floor Covering

To include carpet, padding, rubber flooring or other floor finishes.

3.7.1 Flammability

Materials shall be tested in accordance with CFR 49 part 238

3.7.2 Smoke Emissions

Materials shall be tested in accordance with CFR 49 part 238

3.8 Insulation

Acoustical and thermal insulation.

3.8.1 Flammability

Materials shall be tested in accordance with CFR 49 part 238

3.8.2 Smoke Emissions

Materials shall be tested in accordance with CFR 49 part 238

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3.9 Elastomers

Window gaskets, door housings, diaphragms, matting, gaskets.

3.9.1 Flammability

Materials shall be tested in accordance with CFR 49 part 238

3.9.2 Smoke Emissions

Materials shall be tested in accordance with CFR 49 part 238

3.10 Exterior Shell
End caps, roof housings, non-metallic shrouding, non-metal flexible conduit, battery cases, shields, covers, and exterior boxes.

3.10.1 Flammability

Materials shall be capable of passing ASTM-E-162, radiant panel test with a flame propagation index (Is) not to exceed 35. Additional qualifications are as follows:

a) There shall be no flaming running or dripping.

b) If components are supplied as laminate construction or composites, they shall be tested as complete assemblies as actually installed.

3.10.2 Smoke Emissions

Materials shall be capable of passing ASTM-E-662, specific optical density of smoke generated by solid materials with an optical smoke density index (Ds) not to exceed 100 after 90 seconds or 200 after 4 minutes. Additional qualifications are as follows:

a) See qualifications as stated in 3.10.1 a), b).

b) Maximum limits for smoke emissions shall be measured in either flaming or nonflaming modes, whichever mode produces the most smoke.

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3.11 Electrical Wire Insulation

Refer to Amtrak Specification No. 323.

4.0 TOXICITY

All materials tested under paragraph 3.0 shall also be tested to determine inhalation toxicity using Boeing Specification Support Standard BSS-7239.

Parts per million (PPM) shall be gathered for the following gasses:

Carbon Monoxide	(CO)
Hydrogen Fluoride	(HF)
Nitrogen Dioxide	(NO_2)
Hydrogen Chloride	(HCL)
Hydrogen Cyanide	(HCN)
Sulfur Dioxide	(SO_2)

Test reports shall include the specific method used to collect data where multiple methods are described in BSS-7239.

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AMTRAK
SPECIFICATION

for

SLEEPING CAR DELUXE BEDROOM
OCCASIONAL SEAT

SPECIFICATION No. 720

Initial Issue

Issue Date: August 6, 2004

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APPROVED	DATE	
Paul L Stutt	8/9/04	Senior Director - Rolling Stock Engineering
Michael R Burnette	8/6/04	Director - Field and Systems Engineering
Michael R Burnette	8/6/04	Originator

SPECIFICATION CHANGE SHEET

REVISION	DATE	DESCRIPTION	PAGE	APPROVER

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AMTRAK
Bureau of Rolling Stock Engineering

Technical Specification for Sleeping Car Deluxe Bedroom Occasional Seat

SECTION 1: INTRODUCTION

A. General

This document defines the requirements for the design and supply of a replacement single passenger Occasional Seat for use in the deluxe bedrooms of Amtrak's Superliner I, Superliner II and Viewliner sleeping cars. The current Occasional Seat is a free standing single passenger seat. When not in use the seat may be folded flat and stored under the sleeper seat. The current seat is awkward to assemble and could possibly injure someone during this operation. As the seat is free standing it may become a loose object in the event of sudden deceleration.

There are five occasional seats required for each of the 59 Superliner I and 46 Superliner II regular sleeping cars, with three of the seats being right-handed and two seats being left-handed when mounted to the car sidewall. There are ten occasional seats required for each of the 5 Superliner II deluxe sleeping cars, with five of the seats being right-handed and five seats being left-handed when mounted to the car sidewall. There are three occasional seats required for each of the 51 Viewliner regular sleeping cars, with two of the seats being right-handed and one seat being left-handed when mounted to the car sidewall.

This Specification described a replacement for the present Occasional Seat which includes a permanent mounting to the car structure, to prevent injury from a loose seat during an accident. This replacement seat shall be of a universal design, able to be used in both Superliner and Viewliner sleeping cars, and easily convertible in the field using common hand tools when required from a left hand to a right hand mounting to the sleeping room sidewall. A Design Review approach involving both the Engineer and the Contractor shall be used to design the prototype seat, which shall undergo Type Tests prior to production to verify the design. All production seats shall undergo Routine Tests.

The design criteria and constraints that are known to Amtrak have been specified. Further definition and clarification are anticipated during negotiation. If other factors require definition after Contract award, the Contractor shall be responsible for making those definition requirements known to Amtrak in a timely manner for mutual investigation and satisfactory resolution. The Contractor shall not be relieved of the overall responsibility of providing an adequate design for the Amtrak service conditions.

Wherever possible, this Technical Specification has been developed on the basis of car performance required, rather than specific hardware to be provided. Where specific

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hardware is mentioned, it is for the purpose of providing an example of concepts or designs acceptable to the Engineer. This approach will allow Proposers to employ innovation and advanced technology where appropriate.

Any items of material or equipment, which are not fully described or are omitted in this Specification or the accepted Technical Proposal, but are necessary for the completion of the seats, shall be considered a part of the scope of supply. In this Specification all references to "number of days" shall mean calendar days unless otherwise stated.

Safety shall be of primary importance in the design of the seat. The seat shall present a safe, hazard-free environment to passengers and the operating and maintenance personnel to the extent practical. Use of the seat shall be easy and safe. No sharp edges or corners or pinch points shall occur where passengers, crew, or maintenance personnel may come into contact with them. Adequate handholds shall be provided where necessary. Smooth surfaces and avoidance of protrusions shall be used to minimize passenger injury in the event of a collision.

B. Engineer

The Engineer, as stated in this Technical Specification, is defined as the Senior Director of the Amtrak Bureau of Rolling Stock Engineering within its Mechanical Department, or its written designee.

During the course of the project the Contractor will be submitting items for the Engineer's approval as required by the Contract and Technical Specifications. The Contractor shall not interpret this process to mean that the Engineer will function as an arm of the Contractor's Project Management or Engineering staff. Submissions shall be structured to show how the Contractor is responding to the requirements of the specifications, and not on the basis of requiring the Engineer to discover how the Contractor is not meeting those requirements. All material being submitted shall have been reviewed by qualified Contractor personnel and judged to be suitable for submission prior to doing so, and this shall be so stated in the letter of transmission or on the document, particularly as regards material passed through from subcontractors. Test results shall receive Contractor staff review and signature prior to submission. Submissions found to be deficient with regard to any of the above shall be immediately returned without review to the Contractor.

Submissions shall contain sufficient detail to confirm that specification requirements are being met. However, the Contractor shall use judgment as to what level is appropriate and shall communicate with the Engineer when guidance is needed on a case-by-case basis. Documents with levels of detail and information considered to be beyond what is needed or is time-effective to confirm compliance shall be given cursory review by the Engineer and considered as background information and shall not receive formal approval. Individual submissions shall not contain material from multiple subsystems or subcontractors and such submissions will be returned without review to the Contractor.

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Submittals requiring the Engineer's approval prior to implementation shall be reviewed and classified by the Engineer within 30 days from the day the submittal is received based on a rate of submittal that is reflective of the pace of an orderly, properly managed program. Priorities will be given to special cases when possible. However, the Contractor shall consider the 30 days criteria and the time requirements involved for mailing when scheduling submittals. The days used by the Engineer in Design Review meetings or in travel to or from such meetings shall not be included in the 30 days figure. Delays caused by the Engineer's failure to review and approve drawings or schedules in a timely fashion as listed above shall be treated as an excusable delay, provided that the Contractor can demonstrate to the satisfaction of the Engineer that actual production delays have been caused by the Engineer and there is no other concurrent cause for delay.

C. Interchangeability

All similar parts on each seat, and among all other seats and their spare parts, shall designed and manufactured to be identical, both as individual parts and as subassemblies. Model numbers for identical components shall be identical. Replaceable components of any such apparatus shall be fully interchangeable, without adjustments to any part being necessary. Specific approval shall be obtained from the Engineer during Design Review for each part whose replacement may require an adjustment, and such approval may be granted only where it can be shown to be absolutely necessary.

D. Inch-Standard

The Proposer is advised that the existing sleeping cars used by Amtrak are entirely composed of inch-standard components and fasteners. All designs, components, dimensions and fasteners used on the new seats shall be of United States inch-standards.

E. Design Life

The seats shall be designed and manufactured to perform satisfactorily for a minimum design life of 16 years, except for the seat cushions which shall have a minimum design life of 8 years, and the fabric upholstery which shall have a minimum design life of 4 years, prior to replacement. Each car will receive an annual inspection, and a four year light overhaul cycle.

F. Dimensions

The Contractor shall provide English dimensioning for its drawings and other communications which are generated. Fractional measurements shall be expressed as a decimal value, and unless otherwise noted and approved drawings shall be made using third angle projections. First angle projection shall be allowed provided all views are labeled, including the front, top, bottom and side views.

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SECTION 2: DESIGN

A. General

The seats shall be designed and manufactured to provide maximum passenger comfort as defined as the absence of discomfort while maintaining the natural curves of the spine with safety, strength, durability and ease of maintenance as primary considerations. The seats shall reflect high quality, comfort and appearance standards. Resistance to wear and ease of cleaning shall be important considerations. The aesthetic and functional aspects of the seat shall be addressed through the use of industrial design to create a comfortable and inviting environment. When in use the seat shall not vibrate (natural frequency of the seat assembly shall be greater than 10 Hz if possible). The use of the seat shall be straightforward and easy for the user to understand).

The seats shall be designed to provide maximum passenger comfort and safety as dictated by ergonomic requirements. The seat, and all options, shall be designed to comfortably accommodate the 2.5th percentile female to 97.5th percentile male of current United States adult general population anthropometric data. Specifics may be found in "Humanscale 1/2/3, 4/5/6, 7/8/9" (3 volumes), by Different, Tilley, Harman and Bardagjy of Henry Dreyfuss Associates (published by MIT Press, Cambridge, MA), or Engineer approved equal sources of current general (not military) population data.

Special attention shall be given to passengers with reduced visual acuity by providing them with visual cues as required and identified during the Design Review effort. Floor support surfaces should have high contrast colors in this regard, and high contrast signage and striping patterns shall be provided for the seat when folded, as approved by the Engineer, recognizing that the seat will typically be folded during the overnight hours.

Where possible, components requiring maintenance or those that have a high frequency of passenger use shall be replaceable as individual units. The entire seat assembly shall comply with the flammability, smoke emissions and toxicity requirements of Amtrak Specification 352.

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B. Application

Amtrak deluxe sleeping car bedrooms have a folding partition between pairs of rooms to allow a large party of passengers to have use of two rooms "en suite". When this partition door is opened, the occasional seat must be able to be easily stored against the side wall in order to not obstruct the partition opening, and require no heavy lifting greater than generally 30 pounds. The mechanism to hold the seat in its stowed position must not unfold during motion. It is anticipated that the passenger will store and deploy the seat as needed during their journey.

The seat shall be attached to the car structure and the design shall allow for the simplest possible installation procedure. It is preferred that the seat assembly be mounted to the car sidewall structural posts, otherwise it may be mounted to the car floor structure. The

mounting system shall be approved by the Engineer. All mounting provisions shall be designed to prevent the accumulation of dirt, debris, and infestation by rodents. The room floor carpeting shall be removable without the need to remove the seat mounting structure.

C. Features

The seat assembly shall include the following features:

- Universal design to permit one assembly to be mounted either left or right hand
- Sidewall or approved floor mount (stainless steel hardware to be included)
- Primary suspension system
- Fixed backrest
- Outer armrests

It is intended that seat assembly be of a universal application design, such that the seat could be easily changed in the field using only hand tools to remove and reapply fasteners, from the left hand to the right hand configuration, or vice versa. All required mounting holes, tapping plates, etc. for both configurations shall be included in each seat, regardless of originally-delivered configuration. The ability to change configurations must be demonstrated by the Contractor during Design Review.

D. Frame

The seat frame shall be fabricated from square and tubular painted carbon steel or approved equal, and AISI number 3 finished stainless steel where exposed to passengers. It shall be robustly constructed for long life with minimal maintenance. All frames shall have their tube ends sealed to prevent the entry of vermin. The sidewall attachments shall be designed to discourage the accumulation of dust or debris, and shall not interfere with heater enclosures or other equipment. All welding shall meet AWS standards, and all welders and weld procedures used shall be certified to applicable AWS standards. Seat frame welding shall be done in appropriately designed and constructed weld fixtures which shall insure dimensional consistency of all frames**.** The seat frame components shall be so designed and fabricated that when cleaned or exposed to liquids, no accumulation will occur. All tube assemblies shall have their lowest points drilled for draining when the seat is in a normal sitting position. Seat assemblies shall be installed to allow ready access to baseboard heater elements and other similar items.

E. Cushions and Upholstery

The seat bottom and backrest cushions shall conform to the requirements of Amtrak Specification 665 "Specification for Seat Cushioning Assemblies", incorporated herein by reference. Seat cushion construction shall employ high resilient flexible foam completely covered and sealed with a fire barrier as described in Amtrak Specification 665, paragraph 2.2.3. The cushion material shall be capable of passing the cushion life test described in Section 6.2 of the American Public Transportation Association

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Specification SS-C&S-016-99, Revision 1, "Standard for Row-to-Row Seating in Commuter Rail Cars". Alternative cushion assemblies may be submitted to the Engineer for approval provided they meet all requirements as detailed in this specification.

All surfaces, including the bottom of the seat bottom cushion, shall be attractively finished. The upholstery used to cover the seat bottom cushion and the surfaces exposed to passenger view of the backrest cushion shall be the current Amtrak-approved "Blue Triangle" upholstery. Currently-approved Amtrak suppliers for this upholstery are LaFrance style 381 090D 3194-75, "Blue Triangles", and Lantal Textiles style 92-3194 075, "Blue Triangles". Any surfaces of the bottom and backrest cushion assemblies exposed to passenger view when the seat assembly is stored shall be suitably and attractively covered with either upholstery, or a shroud manufactured from compression molded fiberglass reinforced plastic (FRP), thermoformed Royalite R61 or approved equal thermoplastic, or other approved and equally durable material. The minimum inside radius of all shroud corners shall be 0.375 inch. All exposed edges shall be smoothly finished and form an aesthetic smooth interface with the seat cushions. The color shall be homogeneous throughout. All FRP shall be covered with DuPont Tedlar composite laminate, or approved equal, during the compression molding process to provide a colored graffiti resistant surface. The FRP color shall match the color utilized in the Tedlar composite laminate. The shroud shall be attached to and be fully supported by the seat frame in a tamperproof manner using appropriate fasteners, without stress risers at attachment points. The shroud shall closely match the shape of the support frame to prevent any buckling or poor fitting when assembled, and prevent cracking while in service. It shall not be possible for a passenger to pull the shroud away from the support frame. The design and colors of the cushions and upholstery shall be approved by the Engineer.

The latest technological advances shall be considered to provide maximum comfort, durability and minimize cleaning and maintenance requirements. The attachment of all cushion types to the seat structure shall be reliable over the life of the seat and cushion. In addition, the attachment shall be designed to allow maintenance staff to easily and reliably attach and detach the cushions for maintenance, preferably without the use of tools. It shall be possible to remove and replace these two cushions, by one person, in 5 minutes.

F. Cleaning and Maintenance

The complete seat assembly shall be easy to clean and maintain. It shall not require maintenance, adjustments or lubrication at internals of less than four years. To the extent possible, only readily available components, hardware and fasteners shall be used. Any assembly hardware visible to passengers shall be flush mounted stainless steel. There shall not be any sharp or exposed edges in the entire seat assembly which could cause injury to passengers or workmen, or snag passenger's clothing. Pockets where dirt and debris can collect shall be minimized; those that exist shall be easy to clean with standard vacuum cleaner equipment.

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Design of the seat shall ensure that items that require repair and or service are easily accessed, removed and replaced and that this is possible with the use of standard hand tools. It shall be possible to readily repair or replace any item on the seat, except the frame, with the seat installed in the car.

G. Overhaul

The seat design shall ensure that when used in daily revenue service, it shall not require overhaul (nor look shabby) in less than:

- Upholstery - 4 years
- Foam Cushion - 8 years
- Rest of seat - 16 years

The modular design of the seat shall allow the easy addition or deletion of options in the seat overhaul shop.

The seat attachment to the car shall ensure that a seat can be removed and a new seat installed in its place, using specified tools, in 10 minutes with a two-man team. This shall be demonstrated by a test during Design Review. The seat, complete with all options, shall be designed to allow it to be overhauled in 1.5 hours in an appropriately equipped seat shop. This shall include the following:

- Disassembly
- Inspection
- Cleaning
- Renewal of worn and defective parts
- Reassembly
- Adjustments
- Testing

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The seat frame design shall include provisions for lifting from a central point with overhead conveying devices such that the seat remains balanced and upright. This will facilitate handling during overhaul. A special device may be provided that is used on the overhaul line, which affixes to the seat and allows single point lifting.

All wear points such as pivots, slides and bearing surfaces shall be renewable at overhaul by means of inserts. Such inserts shall not require complex pressing procedures, but shall be retained by simple fastening devices. Variations of thread size, thread length and head style of fasteners shall be minimized to ease overhaul and regular maintenance. The number of fasteners shall be kept to a minimum. For example if a cover plate requires 2 or 4 screws, a retaining clip or tab and a single screw is preferable. Frequently accessed fasteners shall be self-retained in the removable part.

For overhaul, all disposable parts shall be marked with recycling codes identifying the material content. This particularly applies to composites and plastics. Readily

identifiable metal components need not be marked. At the end of its useful life, a seat shall be completely recyclable except for cushions and small wear components. The Contractor shall supply a recycling plan for the seat for approval during Design Review.

H. Standards

The following drawings and documents form a part of the specification to the extent herein specified:

Flammability, Smoke Emissions and Toxicity	Amtrak Spec. 352
Vendor Maintenance Manual	Amtrak Spec. 353
Seat Cushioning Assemblies	Amtrak Spec. 665
Passenger Coach Seat	Amtrak Spec. 683-A
Environmental and Operating Conditions	Amtrak Spec. 429
Code of Federal Regulations	49 CFR Part 238.233
Standard for Row-to-Row Seating in Commuter Rail Cars	APTA SS-C&S-016-99, rev1

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SECTION 3: TESTS

A. General

The Contractor shall be responsible for a comprehensive series of tests to be performed to verify both the suitability of design, and the workmanship of each seat. The Contractor is also responsible to fulfill all requirements called for by the Federal Railroad Administration (FRA) of the United States Department of Transportation for testing passenger equipment which has not been used in revenue service, for submission by the Engineer to the FRA. Whenever test requirements overlap, the more comprehensive shall govern. The Contractor shall perform all tests under Engineer observation, and the FRA may also observe such tests. All contractual tests shall be conducted in accordance with Engineer approved test procedures. Testing activity scheduled and/or conducted before test procedure approval will be at the Contractor's risk.

The Contractor is required to perform all tests as specified herein. The Contractor and its subcontractors may, at their option, perform additional testing as they deem necessary as part of their quality assurance program. All costs associated with any of the tests performed are to be borne by the Contractor. In the event of a failure to meet the Technical Specification requirements in any test, necessary corrections shall be made by the Contractor at its expense, and the failed test shall be rerun in its entirety at the Contractor's expense. If further corrections or modifications affecting the item under test are instituted, the Contractor shall perform a complete retest at its expense to demonstrate compliance with the Technical Specification requirements. The Contractor shall give at least ten working days notice to the Engineer prior to the start of any test referred to herein, not counting Federal holidays.

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B. Test Plans

The Contractor shall submit to the Engineer for approval a Master Test Plan covering all tests and adjustments listed in or otherwise required by this Technical Specification. The Master Test Plan shall be submitted to the Engineer for review and approval no later than 60 calendar days after the Notice to Proceed.

The Contractor shall prepare a detailed Test Procedure for each test described herein, and for any other tests conducted by the Contractor in connection with its own quality assurance program. Each test shall be a separately controlled document and identified by its own number, title and revision. All revisions shall be submitted to the Engineer for approval. A history of test revisions and changes shall be maintained and recorded within the test document. All tests must be written in an instructional form describing the full activity of each test step. All special tools and/or equipment to be used must be specified within the test document. All calibrated test equipment shall be verified as part of the test plans to be within calibration dates. A data collection form shall be used with each procedure and shall be fully identified.

Each individual test shall be accompanied by a separate test results sheet. Each step of the test requiring a specified result or measurement shall be included and identified by the

paragraph number referenced in the test document. Areas shall be provided for recording actual values produced during the test where needed. In addition, acceptance criteria and associated tolerances shall also be shown in parenthesis near the space available for recording the actual value. Each test sheet shall be identified by the associated test number and revision. Areas shall also be allocated for the date, component serial numbers (as applicable), test equipment serial numbers, verification of test equipment calibration, test status (accept/reject) and signature areas for the test technician, Contractor QC and the Engineer.

Each detailed Test Procedure shall be submitted to the Engineer for review far enough in advance of the planned test date to allow the Engineer at least 15 working days to initially review and comment on, or approve the procedure, and still have sufficient time to allow the Contractor to modify a rejected procedure and resubmit to the Engineer, to have approval a minimum of 3 working days prior to any testing covered by the procedure. The Engineer will, at its option, witness all tests.

Within 30 days upon the completion of each test, the Contractor shall submit a written report of each test, including copies of all test data, to the Engineer for approval. In every case, the report shall include a description of the test, all raw data collected in the test, and a summary of the results in a form that can be directly compared to the Technical Specification without further calculations. A test shall not be considered as completed until the Engineer (and the FRA, as required) has approved its final written test report. The approval of the Engineer does not in any way relieve the Contractor of responsibility for the adequacy of the Test Program within the scope of this Technical Specification.

C. Type Tests

Type (proof of design) tests shall be performed to verify that the proper materials were used and that the equipment meets the stated design requirements. These seat qualification tests, including static, dynamic, anti-rotation and component tests, shall be conducted on a production seat assembly. The test seat shall be mounted to a structure for testing that simulates actual car construction. The seat assembly tested shall be a fully assembled seat incorporating all featured referenced in this specification.

Seat testing shall be conducted per the procedures outlined in American Public Transportation Association (APTA) Specification SS-C&S-016-99, revision 1, Sections 5 and 6. The pass-fail criteria listed in the APTA specification shall apply. Test plans, test procedures and test reports shall be in compliance with Section 8 of the APTA Specification. Tests shall also be performed as specified in Amtrak Specification 665 on cushions and cushion materials.

A series of tests conducted in accordance with Section 8 of the APTA Specification shall be conducted to verify compliance with the following design requirements:

- Third-party Flammability, Smoke Emissions and Toxicity test data (section 2-A)
- Universal (left and right hand) seat application (section 2-C)

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- Cushion renewal time (section 2-E)
- Seat replacement time (section 2-G)
- Seat overhaul time (section 2-G)

D. Routine Tests

The Contractor's Quality Control department shall perform a complete inspection of every seat produced to verify compliance with all design, workmanship and specification items.

E. Test Reports

The Contractor shall provide test reports from authorized labs and statement(s) of compliance with all laws, rules or regulations currently in effect in the United States and Canada as applied by the AAR, USDOT, Canadian Ministry of Transport, APTA and/or Amtrak applicable to any assembly, part, material and process. These test reports and statements of compliance shall be provided in a binder labeled as to its contents. Electronic PDF files shall also be provided on CD.

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SECTION 4: PERFORMANCE OF THE WORK

A. Design Review

The Design Review Program is a design development and approval program which shall begin with a Conceptual Design Phase and progress through a Preliminary Design Phase and a Final Design Phase.

The Design Review Program shall include, but not be limited to, Engineer review and approval of all the design concept and arrangement drawings of the seat, all the engineering and production detail drawings, performance and design calculations, configuration drawings and design details, clearance diagrams, mock-ups, stress analysis reports, tests, and publication preparation. Design Review activities shall also include review and approval of substitute or equal materials not dealt with in the pre-proposal period, and review and approval of the Contractor's test program and Quality Assurance program as well as all other Contractor management programs. Design Review activities shall continue throughout the entire pre-production period, with each succeeding stage presenting greater amounts of detail and reflecting the progress of the designs. In addition to his own designs, the Contractor shall submit the design of all components being purchased by him for review and discussion at the Design Review sessions. In all submissions and at all sessions the Contractor and supplier presentations shall be organized so as to show exactly how the design meets each specific requirement of the Technical Specification. Amtrak shall be granted by the Contractor full delivery and ownership rights of all drawings, documentation, parts information, test data, etc. associated with this Program.

B. Conceptual Design Phase

The Contractor shall provide the following for Engineer approval in accordance with the delivery schedule:

- Develop component layouts to verify the initial design;
- Produce soft mock-ups to verify the volume, basic ergonomic requirements and maintenance requirements;
- Produce three-dimensional renderings to convey the primary appearance of the seat; and
- Prepare control drawings of the seat structure and interface control drawings.

C. Preliminary Design Phase

Following written approval of the appropriateness of the design by the Engineer, the Contractor shall provide the following for Engineer approval in accordance with the delivery schedule:

- Develop top assembly drawings of the major components of the seat;

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- Verify designs with modification of the soft mock-up from Section 4-B;
- Prepare preliminary Stress Analysis;
- Review drawings with the Engineer for approval; and
- Generate color renderings in a three dimensional computer generated format, to reflect the approved design.

D. Final Design Phase

Following written approval of the Preliminary Design Phase by the Engineer, the Contractor shall provide the following for Engineer approval in accordance with the delivery schedule:

- Develop detailed engineering drawings for the manufacture, production and installation of the seat;
- Complete the Stress Analysis;
- Develop the Bills of Material; and
- Prepare one car set of seats for installation in a standard Superliner sleeping car.

Prior to the completion of the Final Design Phase, the Contractor shall supply to the Engineer a complete Bill of Material and a set of all seat component drawings and overall assembly drawing. This must be accomplished a minimum of 30 days prior to the initial shipment of any material, in order for the Engineer to have Amtrak internal part numbers ("AAMPS numbers") created for each part. The Engineer will promptly forward these AAMPS numbers to the Contractor, who must include this data in the nameplate labels for the seat components.

E. Stress Analysis

In order to verify that the strength of the seat design and its attachments to the carbody complies with the seating requirements of the FRA in 49 CFR Part 238 and APTA, a complete stress analysis of the seat design and its carbody attachments shall be performed by the Contractor. This may be performed by manual or computerized calculations of stress, or by using an advanced computer-driven finite element analysis such as Nastran, Ansys, Strudl, Algor or approved equal. The stress analysis shall show the calculated stresses, allowable stresses and margins of safety for all elements at all specified loading conditions, and shall comply with all FRA and APTA requirements and recommendations.

During Design Review the finite element model to be used by the Contractor shall be submitted to the Engineer for approval. The element grid, all assumptions, and all input data, such as loads, section properties, material properties, etc., shall be included as part of the preliminary submittal, and again as part of the complete analyses. Prior to the start of manufacture, the Contractor shall submit his complete stress analysis report to the Engineer for approval. A typical stress analysis of any structural element shall consist of a sketch of the element, a statement of the specified applied loadings, a listing of the

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material of which the element is to be made and its thickness, an identification of critical sections, the calculated stresses at these sections and the corresponding calculated factor of safety. A complete copy of the finite element analysis shall be included with the analysis, with each page numbered and data clearly identified on each page using terms defined in the analysis.

The Engineer reserves the right to require submittal of relevant detailed stress analysis calculations prior to his approval of production structural drawings if in his opinion the structural adequacy of the proposed construction is questionable.

F. Installation Support

The Contractor shall develop a detailed installation instruction package showing steps and sequence of installing the seat into a car. Prior to the shipment of the first seat, the Contractor shall also supply the Engineer with 12 installation templates, to act as a guide for the drilling and tapping of the carbody structure required to install the seat. Drawings for this template shall be included in the as-delivered drawing package and the maintenance manuals. The Contractor shall provides a minimum of three days of Field Engineer support at the Amtrak Beech Grove, IN shop during the initial production installation of the seat in each of the three sleeping car types (Superliner I, Superliner II and Viewliner cars), as scheduled by the Engineer.

G. Program Schedule

The Contractor shall provide a program schedule that includes all program milestones, design reviews, delivery schedule for prototypes and any other pertinent information.

H. First Article Inspection

The Contractor's Quality Assurance program shall include a procedure for conducting a First Article Inspection (FAI) of the first production article considered to be complete by the manufacturer and reflecting the approved baseline drawings. This shall be performed by the Engineer at the Contractor's facility prior to shipment. Successful completion of all type tests is a prerequisite for conducting the FAI. The Engineer shall be given notice of an upcoming FAI at least two weeks before its schedule date. Successful conduct of the FAI shall precede any shipment of material.

The FAI shall be performed using the approved baseline drawings in conjunction with the Technical Specification reflecting specific requirements of the subject along with any special tools and/or equipment needed to verify the design requirements, configuration and operation (if applicable) of the item being inspected. All technical data required for maintenance manual and or parts catalogs shall be submitted as initial drafts prior to the full acceptance of the FAI. The initial drafts shall contain enough information to adequately maintain the equipment during the initial production delivery.

Prior to the scheduling of an FAI, the Contractor shall submit to the Engineer the following:

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- Samples of related color and materials for each of the supplied products;
- A complete drawing package with all approved drawings defining the supplied product;
- An outline or list of specific items and equipment to be reviewed;
- Structural analysis reports of seat to carbody mounting, and product design integrity (as required), as it applies to the crashworthiness requirements; and
- Flammability and smoke emissions test results as required by 49 CFR Part 238 and also Amtrak Specification 352 for all supplied parts and assemblies, certifying material compliance.

I. Review Drawings

During each of the three phases (Conceptual Design, Preliminary Design and Final Design) of the Design Review program, the Contractor shall submit to the Engineer three printed copies of all drawings for review and approval. All drawings submitted to the Engineer for review shall be high quality blue or black-line prints with sharp lines and white backgrounds. Individual sheets with a maximum size of 3 feet 8 inches wide by 2 feet 10 inches high shall be used, unless otherwise approved by the Engineer.

J. As-Built Drawings

Prior to the shipment of the last seat assembly, the Contractor shall deliver to the Engineer, using Engineer-approved formats, a complete set of "as-built" drawings of every part, component and assembly used for the complete seat assembly. Each drawing shall include a complete Bill of Material, providing original component manufacturer name and part number of the actual supplier of the part. Amtrak drawing formats and number series shall be used as agreed upon with the Engineer. The drawing package shall also include drawings of every special tool, jig or fixture required to install, maintain or overhaul the seats, and if referenced in any of the maintenance manuals.

The as-built drawings shall be delivered in the following formats:

- 3 bound sets of all drawings in 11 inch by 17 inch format;
- 2 bound sets of all drawings in full drawing size;
- 3 sets of CDs of all drawings in electronic format in DXF, AutoCAD 2000 and Solidworks 2004 or above, including installation fixture drawings; and
- 3 sets of CDs of all drawings in electronic format in Adobe read-only PDF files, including installation fixture drawings.

K. Maintenance and Spare Parts Manuals

Prior to the shipment of the last seat assembly, the Contractor shall deliver to the Engineer, using Engineer-approved formats, a complete set of maintenance and spare

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parts manuals, in accordance with Amtrak Specification 353, revision A, "Vendor Maintenance Manuals".

L. Production

The Contractor shall deliver each seat completely assembled and ready for installation into a car. All small assembly hardware items shall be packaged in relation to the stage or assembly in which they are to be used. All parts must be packed with each seat and will be checked by Amtrak prior to shipping or upon delivery to Amtrak, at Amtrak's discretion.

Each seat assembly shall be individually packed in a shipping container, which shall be plainly marked with the name and address of the manufacturer, identification of the seat and if left or right hand configuration, manufacturer's part number and the Amtrak AAMPS part number. Each seat assembly shall include a package of all stainless steel seat mounting hardware required to install the seat to the carbody, and a set of installation instructions which provide dimensional information for drilling and tapping the carbody structure for mounting. All components will be shipped in secure packaging and palletized when appropriate. The Contractor will confirm the appropriate container and pallet sizes with the Amtrak Material Control department at the Beech Grove, IN shop prior to shipping the first seat.

Each seat shall be serial numbered and permanently marked in a location that is not in normal passenger view but viewable in a service area. The serial number "plate" shall include the Amtrak AAMPS number, serial number, manufacturer's name and model number, and the date of manufacture, and shall be embedded in or otherwise permanently affixed to the seat frame.

M. Exceptions

Amtrak at its sole discretion, and upon written request, may waive delivery of particular items if the Deliverable is covered in conjunction with another Deliverable.

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AMTRAK
SPECIFICATION

For

Interior

Paints and Coatings

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SPECIFICATION No. 742

Revision 1

Issue Date: Feb 20, 2008

APPROVED	DATE	
	11 March 08	Chief Mechanical Officer
	3/6/08	Deputy Chief Mechanical Officer
	2/22/08	Senior Director - Rolling Stock Engineering
	2/21/08	Director - Systems Engineering
	2/20/08	Originator

Originator: Gil Bailey

SPECIFICATION CHANGE SHEET

REVISION	DATE	DESCRIPTION	PAGE	APPROVER
0	4/8/05	Initial issue	- -	G. Bailey
1	2/20/08	Revision 1. Removes Scope of Work items from Specification. Otherwise, NO changes.	TOC, 1,2,4,5 App. A, B, C	G. Bailey

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Amtrak

Bureau of Rolling Stock Engineering

Specification for Paints and Coatings

Specification No. 742
Revision 1

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Amtrak

Bureau of Rolling Stock Engineering

Specification for Paints and Coatings

Specification No. 742
Revision 1

1.0 Scope

1.1 Purpose

This Specification covers only Paints and Coatings applied to interior surfaces of certain Amtrak passenger cars. All Paints and Coatings referred to herein shall comply with the requirements of CFR 49 Part 238. It is required that prior to the start of any work, the Contractor must supply the Amtrak Procurement officer with a report by a recognized independent testing laboratory certifying that all materials supplied by the Contractor comply with the 49 CFR Part 238 Appendix B requirements.

1.2 Exceptions

The Contractor shall explicitly identify to the Amtrak Procurement officer any exceptions being taken to this Specification, referencing the Specification paragraph and exact wording in question.

1.3 Surfaces

Surfaces to be painted or coated shall include, but not be limited to: AISI Series 300 stainless steel, fiberglass, Melamine, Di-Noc and Schneller vinyls, anodized aluminum and Plymetal with previously applied factory paint. Fasteners used to retain removable panels must not be painted. Rubber or elastomers shall not be painted or coated EXCEPT as specifically designated in the particular Scope of Work.

1.4 Locations

Areas to be painted or coated and all associated colors shall be as identified in Amtrak's 'Interior Color Scheme' book for the specific equipment and Scope of Work documents.

1.5 Color

Colors shall match Amtrak's Frosty White, Navy Legacy, Nebular and Wilsonart Midnight Melange Surface 9091-ML color standards. Sufficiency of match shall be determined by Amtrak's Industrial Design Department, Bureau of Rolling Stock Engineering, Mechanical Department, whose decision is final. Contractor must submit samples for Approval before commencing work.

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1.6 Quality

Paints and Coatings must be applied in a competent, workmanlike manner. There shall be no defects such as: pinholes, peeling, craters, sags, runs, lumps, evidence of pigment segregation or improper mixing, thin or tacky areas, overspray, solvent burn or alligatoring. Contractor shall correct any such defects at its expense. Amtrak's Q/A department shall determine compliance.

1.7 Touch-Up

Contractor shall perform any touch-up work as necessary at its expense. Contractor shall furnish touch-up kits to Amtrak for field repair.

1.8 Color Match

In so far as possible, Contractor shall maintain color consistency between batches of paints and areas on the car. Paints from different batches shall be applied in separated locations to minimize the visual impact of any color variation. Manufacturer, batch or run numbers of all materials and dates of application shall be recorded.

1.9 Masking

Adjacent surfaces must be masked as necessary. Paint lines must be sharp, without bleed. Fasteners used to retain removable panels shall be masked.

1.10 Clear Coating

All painted surfaces shall be Clear Coated. Clear Coating may be required on other surfaces as specified in the 'Interior Color Scheme ' book and Scope of Work documents.

1.11 Primers

Primers and Clear Coats shall be compatible with paints and substrates. They may not cause any undesirable reaction or degradation.

1.12 Clear Coats

Clear Coats shall resist abrasion and graffiti removing compounds.

1.13 Disposal of Waste

Contractor shall comply with all Amtrak, Local, State and Federal Regulations regarding disposal of waste materials.

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1.14 Repair of Surfaces

Amtrak shall repair all surfaces before presentation to the Contractor. Contractor shall repair only minor defects such as scratches and small dents.

1.15 Environment

Paints and Coatings shall be applied in accordance with manufacturer's recommended range of temperature and humidity. All materials shall air dry. Contractor shall ensure proper conditions for storage of materials.

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2.0 Surface Preparation

All Materials: All dirt and grease must be removed. Any residue from adhesives, polishes, waxes and like materials must be removed chemically. Surface shall be sufficiently 'scuffed' to promote adhesion of primer as necessary. Immediately prior to application of any coat, surface must be cleaned.

Stainless steel: All surfaces shall be 'scuffed' with 80 grit sanding material.

Anodized aluminum: Anodizing must be thoroughly abraded by aggressive sanding with 60 Grit paper, followed by 80 Grit. The surface must be cleaned again to remove all dirt and sanding residues prior to application of primer (etching type recommended). Primer must be applied IMMEDIATELY after final cleaning.

Melamine: Light 'scuffing' recommended.

Fiberglass: Clean. 'Scuff' to break gloss if necessary.

Di-Noc and Schneller: Clean with compatible solvent. Solvent must not degrade bond between vinyl and substrate.

Plymetal with Factory Applied Paint: Contractor shall determine compatibility of primers and paints by spot testing.

Contractor shall be responsible for all surface preparation.

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3.0 Technical Requirements

Contractor shall furnish all MSDS.

All paints, primers and coatings shall be free of lead, cadmium and arsenic.

All Compliance testing required by this Part shall be conducted by an Amtrak approved laboratory. All test results shall be submitted for approval to Amtrak's Bureau of Rolling Stock Engineering, Mechanical Department. Submittals must be certified and on the testing laboratory's letterhead.

Paints and Coatings may consist of multiple parts and/or multiple applications.

Film thicknesses must conform to manufacturer's and Amtrak specifications for the application. Contractor shall furnish written documentation that its procedures and application methods produce compliant films. Documentation shall include thicknesses (in mils) of individual layers as well as the finished coating.

Testing must be performed on appropriately coated test plates. EXCEPT: Compatibility testing shall be performed on scrap material.

Contractor shall bear all costs of testing.

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4.0 Standards

4.1 Hardness

Final application must comply with ASTM D-3363, and withstand being scratched with a 2H drawing pencil.

4.2 Adhesion

Final application must comply with ASTM D2197 > 6 Kg, ASTM D-3359 Minimum Rating 5A.

4.3 Flammability and Smoke Emissions

Final application must comply with the requirements of Appendix B of 49 CFR Part 238, as well as ASTM E162 with an Is not to exceed 35 with no flaming running or dripping materials. Smoke emissions shall comply with ASTM E662 with a Ds (1.4) not to exceed 100 and a Ds (4.0) not to exceed 200.

4.4 Solvent Resistance (Clear Coat)

Clear Coat material shall comply with ASTM D4752. No mar with 300 methyl ethyl ketone double rubs.

4.5 Gloss

Clear Coat material shall comply with ASTM D523, 60 Degree angle > 90 Gloss. Loss < 10%. Color loss ASTM D2244 <1.1

4.6 VOC

VOC's shall not exceed local Permitted values.

4.7 Warranty

Warranty shall be provided as per terms of Amtrak Procurement documents.

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Amtrak

Mechanical Department
Bureau of Rolling Stock Engineering

SPECIFICATION

for

General Requirements for Wheels

SPECIFICATION No. 771

Revision 1

Issue Date: September 20, 2007

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APPROVED	DATE	
	18 Oct. 07	Chief Mechanical Officer
	10/5/07	Senior Director - Rolling Stock Engineering
	10/3/2007	Director - Systems Engineering
		Originator

Originator: Roy Moyer

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SPECIFICATION CHANGE SHEET

Revision	Section	Description	Date	Approver
1	2.2, 2.3, 2.5, 2.6, 2.7, 2.8, 4.0	Clarified design approval process, revised profile, clarified wheel unbalance and eccentricity, clarified magnetic particle inspection rim face, revised tread profile inspection process, revised wheel marking, clarified shipping coating of loose wheels, clarified warranty support.	9-20-2007	Roy Moyer

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Amtrak
Bureau of Rolling Stock Engineering

Specification for
General Requirements for Wheels

Specification No. 771
Revision 1

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Amtrak
Bureau of Rolling Stock Engineering

Specification for
General Requirements for Wheels

Specification No. 771
Revision 1

1.0 Scope

1.1 Purpose

This Specification defines the vendor general requirements applicable for the design and supply of replacement wheels for use on Amtrak-maintained locomotives and passenger cars. This Specification is to be used in conjunction with the Amtrak Procurement Department contract documents, purchase orders, other contractual documents, and various Amtrak drawings which provide specific dimensional details for the several sizes and types of wheels used.

It is mandatory that the wheels supplied under this Specification be of a low stress design, manufactured from wrought steel, and fully comply with the referenced standards identified in the latest revision of the Association of American Railroads (AAR) Manual of Standards and Recommended Practices Specification M-107/208 for multiple-wear wrought steel wheels.

Amtrak will define the basic outline dimensions for various types of wheels on drawings associated with this Specification and/or the contract documents. It is the vendor's responsibility to fully design the complete wheel, including the wheel plate, in accordance with this Specification. As basic work under this Specification each item produced must be properly packaged for shipment to Amtrak and documentation submitted.

The design criteria and constraints that are known to Amtrak have been specified. If other factors require definition after Contract award, the vendor shall be responsible for making those definition requirements known to Amtrak in a timely manner for mutual investigation and satisfactory resolution. The vendor shall not be relieved of the overall responsibility of providing an adequate design for the Amtrak service conditions.

Whenever in this Specification an item is defined by using a trade name or the name and catalog number of a particular manufacturer or vendor, or a limited description, the term “or approved equal” if not written thereafter shall be implied. Any reference to a particular manufacturer’s product either by trade name or limited description is only for the purpose of setting a standard of performance, quality, composition, construction or size. The term “or approved equal” means any other manufactured product or article, which is equivalent in material, workmanship and service and is as efficient and economical in operation in the opinion of the Amtrak Engineer. Amtrak’s opinion as to whether the proposed alternate is equal to the specified items for Amtrak’s specified use and purposes shall be final and conclusive.

1.2 Vendor AAR Certification

It is mandatory that the proposed vendor must be qualified as a manufacturer of wrought wheels for use in Association of American Railroads (AAR) interchange service, in accordance with Appendix B of the AAR Manual of Standards and Recommended Practices Specification M-

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107/208 for multiple-wear wrought steel wheels. The vendor must maintain its AAR qualification for the duration of the contract term.

1.3 Exceptions

The vendor shall explicitly identify to the Amtrak Procurement officer any exceptions being taken to this Specification, referencing the Specification paragraph and exact wording in question.

1.4 Engineer

The Engineer, as referenced in this Specification, is defined as the Senior Director of the Amtrak Bureau of Rolling Stock Engineering within its Mechanical Department, or its written designee. During the course of the project the vendor may be submitting items for the Engineer's approval as required by the Contract and Specification. The vendor shall not interpret this process to mean that the Engineer will function as an arm of the vendor's Project Management or Engineering staff. Submissions shall be structured to show how the vendor is responding to the requirements of the Specification, and not on the basis of requiring the Engineer to discover how the vendor is not meeting those requirements. Submittals requiring the Engineer's approval prior to implementation shall be reviewed and classified by the Engineer within 30 days from the day the submittal is received. Submittal rates shall be reflective of the pace for an orderly and properly managed program. Priorities will be given to special cases when possible. Delays caused by the Engineer's failure to review and approve drawings or schedules in a timely fashion as listed above shall be treated as an excusable delay, provided that the vendor can demonstrate to the satisfaction of the Amtrak Procurement officer that actual production delays have been caused by the Engineer and there is no other concurrent cause for delay.

1.5 Cost Items

Any individual extra work items regarding supply of the wheels shall be handled in accordance with the contract and purchase order documents issued to the vendor by the Amtrak Procurement Department. The vendor must contact the Amtrak Procurement officer regarding all such issues. The vendor agrees that no payment will be made by Amtrak for any additional work outside the basic work scope of the contract documents unless such work is first reviewed and approved in writing by both the Engineer and the Amtrak Procurement officer.

1.6 Vendor Quality Policy

It is mandatory under this Specification that the vendor have an established Quality policy system meeting the requirements of the Association of American Railroads (AAR) Manual of Standards and Recommended Practices Specification M-1003 and Appendix B of its Specification M-107/208. The vendor's shop is required to be equipped with equipment, personnel and management completely sufficient to manufacture, inspect, and test each wheel being supplied under this Specification. The shop shall have suitable equipment to diagnose any failure mode and to perform all adjustments and tests required to confirm proper manufacture. The vendor's Quality Assurance staff shall be active participants in the production, inspection, testing, and documentation phases of the work, and shall also promptly assist Amtrak in the analysis of any wheel failing in service. The vendor must maintain all Association of American Railroads wheel manufacturer certifications for the entire duration of its contract period with Amtrak. Both the Engineer and the Amtrak Procurement officer shall be immediately notified in writing by the vendor if there is any notification issued to the vendor by the AAR of any exceptions to its certifications or its wheel manufacturing process. Amtrak

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Quality Assurance personnel may conduct random audits of the vendor's quality assurance program to verify that these Specification requirements are being achieved. In addition, Amtrak may choose to inspect wheels prior to shipment or upon receipt at any of its maintenance facilities. The vendor shall fully cooperate in such audits.

1.7 Conducting Tests

The vendor shall be equipped to fully perform all tests required in accordance with this Specification and any referenced Association of American Railroads (AAR) standard as part of basic work. All testing apparatus shall be calibrated on a periodic basis as recommended by its original manufacturer, any AAR standards, or the vendor's quality system requirements.

1.8 Workmanship

All workmanship shall be of high grade and shall conform to the best of manufacturing practices. Skilled, qualified, well motivated personnel with appropriate experience, training, and aptitude shall be utilized to assure high quality of workmanship at all levels. Foremen, supervisors, inspectors, and shop managers shall be well integrated within the project team and be fully experienced and capable in their fields. They shall manage their teams in a competent and professional manner. The vendor is required to have on hand in his facility for reference this Specification, all referenced Amtrak drawings, and all referenced current Association of American Railroads (AAR) standards and wheel gauges.

1.9 Documentation Records

The vendor shall maintain a logbook of information regarding all wheels manufactured by it for Amtrak. As a minimum, records shall identify the Amtrak purchase order number, wheel heat numbers, material certifications, wheel serial number, copies of any written authorizations by the Amtrak Procurement officer, inspection and test data, shipping date and shipping location. This documentation must be retained by the vendor for a minimum period of five years.

1.10 Dimensions

The vendor shall provide inch-standard dimensioning for its drawings and other communications which are generated. All drawings shall be made using third angle projections and shall be in English. First angle projection shall be allowed provided all views are labeled, including the front, top, bottom and side views.

2.0 General Requirements

2.1 Scope

This Specification covers the general requirements for the supply of wheels to Amtrak. Associated with use of this Specification will be various Amtrak wheel drawings issued by the Amtrak Procurement officer which provide specific wheel geometry dimensional details for the various classes of wheels used by Amtrak.

The vendor shall supply a heat treated (rim quenched and tempered), multiple-wear, wrought steel wheel of a low-stress design suitable for use on passenger locomotives and cars operating in both Federal Railroad Administration (FRA) Tier I and Tier II revenue service. The wheel

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shall be in full compliance with the latest revision of the Association of American Railroads (AAR) Manual of Standards and Recommended Practices Specification M-107/208 for multiple-wear wrought steel wheels.

Permissible variations in wheel dimensions not otherwise shown by tolerances either in this Specification, the Amtrak-referenced drawings, or in AAR Specification M-107/208, shall be in accordance with Section 8.0 of Appendix B of AAR Specification M-107/208.

2.2 Design

2.2.1 General

Unless otherwise identified on the Amtrak referenced drawing for a specific wheel type, the wheel supplied shall be of Class B carbon steel multiple-wear wrought steel wheel. Brinell hardness shall comply with Association of American Railroads (AAR) Specification M-107/208 requirements.

2.2.2 Qualification of Low Stress Wheel Design

It is mandatory that every low stress wheel design being supplied by a vendor to Amtrak must be fully approved by the Engineer prior to being considered for use. The vendor must prequalify its low stress wheel design using an analytical design review process based upon the general principles of AAR Manual of Standards and Recommended Practices Standard S-660 as would be appropriate for passenger car wheels in Amtrak high speed service conditions. The analysis method, criteria, acceptable results, and personnel used to conduct the analysis shall be approved by the Engineer. As a minimum, the vendor shall supply for each low stress wheel design a complete set of analysis documentation as identified in AAR Standard S-660, along with a completely dimensioned drawing of the proposed low stress wheel. The Engineer will review this submission for acceptability and inform the vendor if the proposed low stress wheel design is considered approved. Once an analytical procedure has been approved by the Engineer for a wheel design, it shall be the responsibility of the vendor to immediately inform Amtrak if it deviates from the conditions under which the design was qualified, and the vendor must then resubmit the wheel design for requalification. Amtrak will keep this vendor information confidential, but requires that it be available for its qualification and inspection processes.

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2.3 Wheel Profile

The wheel profile, including manufacturing tolerances, shall comply with the latest revision of Amtrak drawing 62-00106, Wheel Tread Profile, unless otherwise identified by the Engineer. It is Amtrak's desire that the vendor attempt to manufacture the wheel flange to the maximum width permitted by manufacturing tolerances.

2.4 Manufacture

The vendor is advised that the wheels to be supplied under this Specification will be used in high speed passenger service. The vendor shall give particular attention to providing the highest quality material and manufacturing process to provide a high quality finished product. Process improvements such as extended duration inert gas stirring of the heat shall be used to achieve these results. Careful attention shall be given to the composition of the raw materials and steel scrap used to create a heat to avoid contamination of material properties. Sufficient

discard shall be made to insure the quality of the finished product. A ladle analysis shall be made of each heat, and this information shall be traceable in the vendor documentation to the individual serial number of each wheel. Temperatures shall be carefully controlled during the entire manufacturing process to prevent the development of internal defects.

2.5 Finishing

All mill scale shall be removed from the entire wheel. The wheel shall be shot peened with Society of Automotive Engineers (SAE) No. 550 or larger hardened steel as specified in SAE Specification J827. The minimum peening time shall be sufficient to ensure that full coverage is attained on the Almen C strip as defined in SAE Recommended Practices J443, Alternate Procedure, or Military Specification MIL-S-13165 C, paragraph 6.11.

Each wheel, unless otherwise identified on the Amtrak drawing, shall be completely machined all over, in addition to the machining requirements of Association of American Railroads (AAR) Specification M-107/208. It is Amtrak's intention that this complete machining process provide wheel balancing, and that separate wheel balancing is not required. If the Amtrak purchasing and contract documents do not require a wheel to be completely machined all over, the maximum wheel unbalance must not exceed 0.6 pound at the outside diameter of the rim.

All wheels intended for AEM-7 electric locomotives must have machining of the mounting surfaces for cheek-mounted disc brakes and hub machining for oil-assisted removal performed in accordance with Amtrak drawing D-08-1311, latest revision.

The machined surface finish on the wheel shall not exceed the following requirements:

- 500 micro inches for the wheel hub;
- 350 micro inches for the tread, flange and rim faces; and
- 250 micro inches for the inner diameter of the rims, web, and outer diameter of the hub.

No steps, grooves or "black spots" are permitted. The eccentricity between the wheel hub rough bore and the wheel tread measured in the plane of the taping line shall not exceed 0.030 inch, unless otherwise indicated on the Amtrak drawings or agreed to by the Engineer. If the bidding and contract documents call for the wheels to be supplied finish bored, the inner face of the wheel hub must be square with the centerline of the finished wheel bore within 0.002 inch total indicated runout (TIR).

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2.6 Inspection

Following machining, each wheel shall be ultrasonically inspected to Association of American Railroads (AAR) Specification M-107/208. Each wheel shipped to any Amtrak facility must be ultrasonically tested at 25 percent of the amplitude response associated with a 0.125 inch flat bottom hole. The wheel shall be inspected axially from either the front or back rim face and radially from the tread surface with an instrument that incorporates a pulse echo receiver with an operating frequency of 2 to 5 MHz. Manufacturers shall ensure optimum volumetric coverage for the test method and manufacturing process. Optimization of coverage is verified by using supplemental reference standard holes in different areas of the rim. Scanning speed shall permit detection of reference standards at calibration level. Any wheel with a flaw indication equal to or larger than 25 percent of the reference standard at the estimated discontinuity depth shall be cause for rejection. Any indication from discontinuity giving a loss of back reflection equal to or greater than the reference standard during axial scanning shall be

cause for rejection. Ultrasonic indications that result from wheel geometry or spurious electrical signals shall not be valid for rejection. Final disposition of rejectable wheels may be determined by manual testing of questionable areas. Any wheel subject to manual testing must have a level II operator verify that the wheel is compliant with all AAR Specification M-107/208 requirements and the above criteria before shipment to Amtrak.

In addition, each wheel shall be subjected to wet fluorescent magnetic particle inspection to AAR Specification M-107/208, with the requirement that the rim faces, hub and bore shall also be inspected in addition to the wheel plate identified in Section 18.5.2 of the AAR Specification.

The tread profile of each wheel must be successfully verified by the vendor using inspection methods agreed to by the Engineer.

2.7 Marking

Each wheel shall have its identification markings either hot or cold stamped on the hub face identified on the Amtrak drawings or as identified by the Engineer, consisting of the manufacturer's serial number, date of manufacture, manufacturer's identification, class of heat treatment and design designation. All wheels must be marked for class using letters L, A, B, or C as appropriate. Stamping shall be applied in accordance with Section 17.1 and Figure B.5 of Association of American Railroads (AAR) Specification M-107/208.

In addition, each wheel shall have the following information paint stenciled in minimum 1 inch high letters using durable paint:

- the identification "Amtrak" on the inside wheel plate in white paint;
- the wheel design designation on the inside wheel plate in white paint;
- the tape size on the wheel tread in white paint; and
- the identification "H.B. M.T." followed by month and date on the wheel tread in yellow paint, to indicate that the wheel hub and bore has undergone wet fluorescent magnetic particle final inspection.

2.8 Shipping

Wheels shall be supplied to Amtrak in pairs with the same tape size to the locations specified in the bidding and contract documents. Prior to shipment, the vendor shall install plastic plugs in any threaded holes, and shall then apply to each wheel, including loose wheels, a heavy uniform coating of an Association of American Railroads (AAR) approved lead-free rust preventative which complies with AAR Specification S-727. Wheels shall be appropriately packaged for their weight and size within a shipping skid or other commercial shipping media suitable to allow the use of fork lift trucks for handling. Where identified in the Amtrak purchasing and contract documents, wheels may be shipped loose to certain Amtrak locations. The vendor shall apply an identification label on the shipping package. This label shall include the vendor's name and address, telephone number, purchase order number, date released for shipment, and the Amtrak "AAMPS" (internal catalog) number for the wheel as identified by the Amtrak Procurement officer. This information shall also appear in the vendor's invoice, and be included in the vendor's documentation record.

The vendor shall retain a copy for 5 years of the shipping documentation record, and shall make three copies for Amtrak. One copy shall be included with the wheel shipment, one copy shall be sent to the Amtrak Procurement officer (or as otherwise designated in the purchase order), and

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the third copy shall be mailed to the attention of the Amtrak Quality Assurance inspector in care of the Amtrak "ship to" address.

3.0 Drawings

Prior to the start of manufacturing, and as a precondition to permit production delivery of material to commence, the vendor shall supply to the Amtrak Bureau of Rolling Stock Engineering, via the Amtrak Procurement officer, an electronic version of the fully dimensioned drawing for every wheel type being supplied under this Specification. All drawings shall be made using third angle projections, shall provide inch-standard dimensioning, and shall be in English. First angle projection shall be allowed provided all views are labeled, including the front, top, bottom and side views. All wheel dimensions, including the wheel profile, shall be completely provided on only one drawing, which may be in multiple sheets, without the need for Amtrak to refer to other referenced drawings. The vendor shall also include any other vendor drawings or documentation referenced on its drawing for such manufacturing items or standards such as tolerancing, etc. Amtrak will keep details of the wheel designs proprietary, if requested by the vendor, but reserves the right to reproduce the drawings as required for its internal use such as for receiving inspections. Drawings shall be in Engineer-approved formats, using Amtrak drawing formats and number series if possible, as agreed upon with the Engineer. The drawings shall be delivered to Amtrak as 3 sets of CDs of all drawings in electronic format in either DXF, AutoCAD 2000, Solidworks 2004, or newer release; and 3 sets of CDs of all drawings in electronic format in Adobe read-only PDF files.

4.0 Warranty

Warranty shall be provided as per the terms of the Amtrak Procurement documents. The supplying wheel manufacturer shall fully support Amtrak in the event of any wheel failure while their wheel is in revenue service, and shall promptly perform a failure analysis of each failed wheel identified by Amtrak.

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RAILROAD FRICTION PRODUCTS CORPORATION
DYNAMOMETER TEST REPORT
DTR-06-0012

COBRA® Disc Pads
D-715 FRICTION MATERIAL

AMTRAK SPECIFICATION 80-276 Revision E
for
Amfleet & Superliner Car Brake Equipment

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RAILROAD FRICTION PRODUCTS CORPORATION
LAURINBURG, NORTH CAROLINA

Document No.

DTR-06-0012 REV 00

October 2006

From: Kahr, Joe
Sent: Tuesday, November 07, 2006 5:11 PM
To: Charles Florian (FloriaC@amtrak.com)
Cc: Slater, William; Baek, Mike; Petzoldt, Martin
Subject: COBRA® Disc Brake Pads

Attachments: DTR-06-0012 Rev 00 Report.pdf
Chuck,

The enclosed report DTR-06-0012 Revision 00 summarizes results of dynamometer tests of a new COBRA® Disc Brake Pad material according to the Amtrak Specification No. 80-276, Revision E. A comparison of pad wear results (in cubic centimeters worn for the various sections of the Amtrak Specification) for this material, designated D-715, in comparison to current test results for the previous standard COBRA D-527 Material are as follows:

DISC PAD MATERIAL	PROCEDURE A Stop Tests (cm^3)	PROCEDURE B Slowdown Tests (cm^3)	PROCEDURE C NEC Schedule Tests (cm^3)	PROCEDURE D Grade Tests (cm^3)
D-527	76.4	29.5	297.1	113.5
D-715	51.8	6.6	102.3	28.7

Based on the above comparisons and attached dynamometer data, and on similar relative results when compared to current tests of the Bremskerl 2050 material used by Amtrak, we believe the D-715 material will provide improved performance on Amtrak Superliner and Amfleet Cars.

It is RFPC's proposal to provide sufficient samples to allow service testing of the D-715 material. We will look forward to your review of the attached data, and directions regarding the next actions for arrangement of field evaluations. In making this request, we recognize that a relatively short period is available for the field evaluation before the next contract bid for Amtrak disc pads. As a result, please be assured that we will assist in any way possible to expedite submittal of the necessary sample quantities of brake pads and to facilitate the evaluation process.

Very Truly,

Joseph C. Kahr

Manager - Product Engineering & International Projects
Railroad Friction Products Corporation
Phone 910 844 9716
Fax 910 844 9733

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RAILROAD FRICTION PRODUCTS CORPORATION
DYNAMOMETER TEST REPORT

COBRA® Disc Pads
D-715 FRICTION MATERIAL

AMTRAK SPECIFICATION 80-276 Revision E
for
Amfleet & Superliner Car Brake Equipment

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SYMBOLS AND UNITS

Symbol	Definition	Units
EWL	Equivalent Wheel Load	Pounds
V_1	Initial Velocity	mph
V_2	Instantaneous Velocity after buildup to first peak brake cylinder pressure	mph
V_f	Final Velocity	mph
NSF	Net Shoe Force Applied to Disc Rotor	Pounds
t	Total stop time	Second
t_2	Stop time beginning after buildup to first peak brake cylinder pressure	Second
^{o}Fi	Initial Disc Friction Surface Temperature	Fahrenheit
^{o}Fx	Max Disc Friction Surface Temperature	Fahrenheit
^{o}Ff	Final Disc Friction Surface Temperature	Fahrenheit
μ T	Friction calculated over total stop	Unitless
μ 2	Friction calculated after buildup to first peak brake cylinder pressure	Unitless
S	Stop Distance	Feet
S_2	Stop Distance beginning after buildup to first peak brake cylinder pressure	Feet
V/T	Average deceleration for entire stop.	mphps

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Material: COBRA D-715
AMTRAK 80-276 Specification Test
Procedure A (Stop Tests) and Procedure B (Slowdowns)

Average Friction versus Brake Application Number
Shoe Code: D376A-D
Test Number: 3195
October 11, 2006

	STOP	VELOCITY (mph)		NSF	STOP TIME (sec)		DISTANCE (feet)		TEMPERATURE (°F)			COF		V/T	Max. Noise
	NO.	V_1	V_2	(lbs)	T_1	T_2	S_1	S_2	$°F_I$	$°F_X$	$°F_T$	μ_T	μ_2	(mph/s)	dB
	1	80	79.2	7633	48.9	47.1	3028	2810	103	254	254	0.292	0.313	1.63	65
	2	60	59.5	7643	35.8	34.0	1684	1527	150	277	277	0.291	0.320	1.67	53
	3	100	99.5	7623	63.3	61.6	4660	4402	149	450	450	0.300	0.316	1.57	57
	4	40	39.5	7655	25.5	23.7	815	711	150	224	224	0.261	0.297	1.56	55
Full	5	120	119.3	7617	86.9	85.1	7504	7182	149	580	565	0.270	0.282	1.38	54
Service	6	80	79.5	7629	46.4	44.6	2907	2701	149	276	275	0.303	0.326	1.72	52
	7	60	59.5	7641	33.6	31.8	1597	1443	150	257	257	0.305	0.336	1.76	55
	8	100	99.3	7622	62.3	60.4	4585	4317	149	415	414	0.304	0.322	1.60	49
	9	40	39.5	7655	24.3	22.6	785	682	149	230	230	0.268	0.307	1.63	58
	10	120	119.3	7617	85.4	83.6	7365	7045	147	596	574	0.275	0.287	1.40	48
	11	80	79.1	10349	37.1	35.3	2321	2106	149	269	268	0.277	0.303	2.15	50
	12	60	59.1	10367	25.8	23.9	1247	1086	149	265	265	0.261	0.319	2.32	55
	13	100	98.9	10337	50.1	48.2	3653	3385	149	457	457	0.276	0.296	1.99	50
	14	40	39.1	10394	19.7	17.9	640	533	150	227	227	0.238	0.282	1.96	57
Emergency	15	120	119.0	10324	67.4	65.6	5871	5551	146	610	609	0.251	0.264	1.78	49
Service	16	60	79.1	10349	35.5	33.7	2258	2044	149	336	336	0.283	0.311	2.25	53
	17	60	59.0	10371	24.6	22.7	1198	1037	149	280	279	0.286	0.327	2.38	55
	18	100	98.9	10338	47.1	45.3	3436	3166	149	488	488	0.291	0.314	2.12	53
	19	40	39.1	10394	19.7	17.9	638	532	149	227	226	0.239	0.283	1.97	57
	20	120	118.9	10325	67.4	65.5	5838	5514	147	629	626	0.251	0.265	1.78	59
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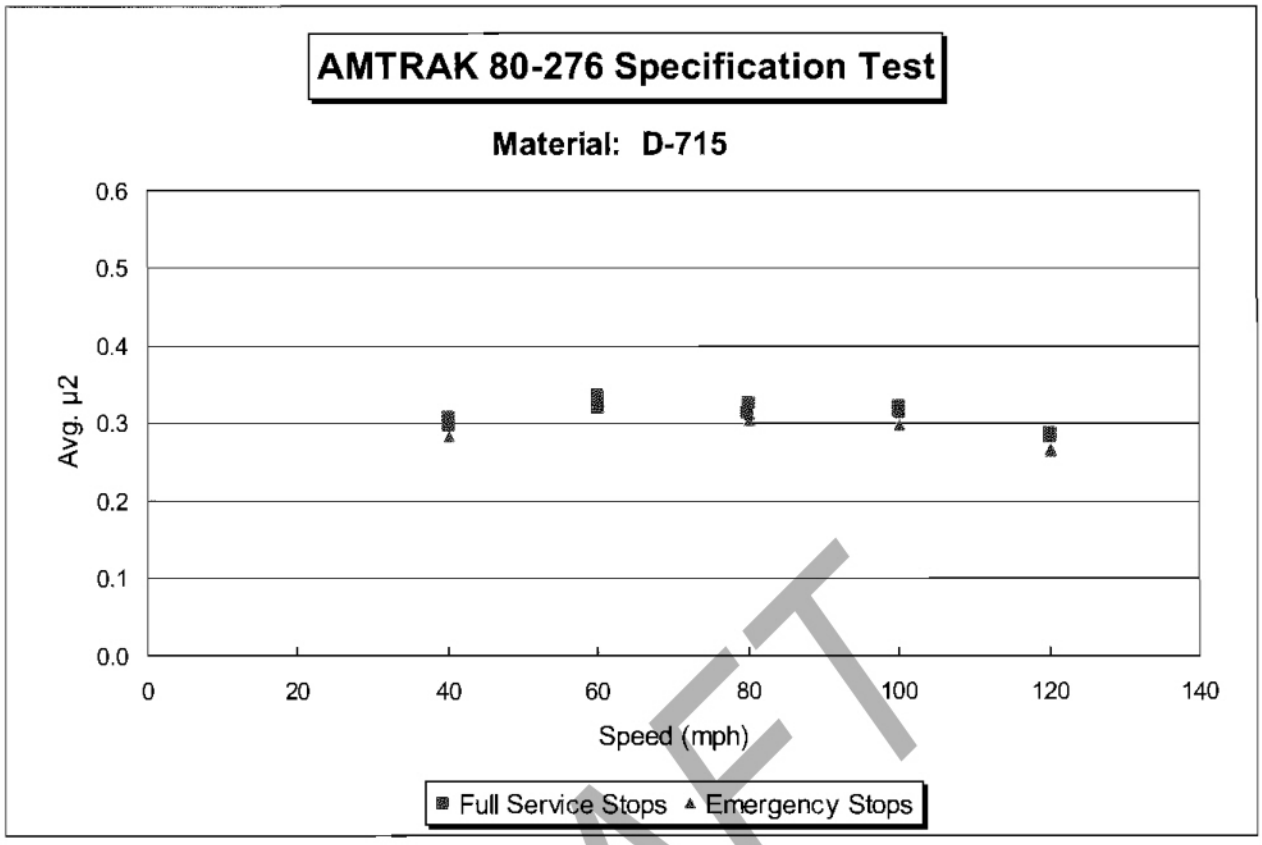
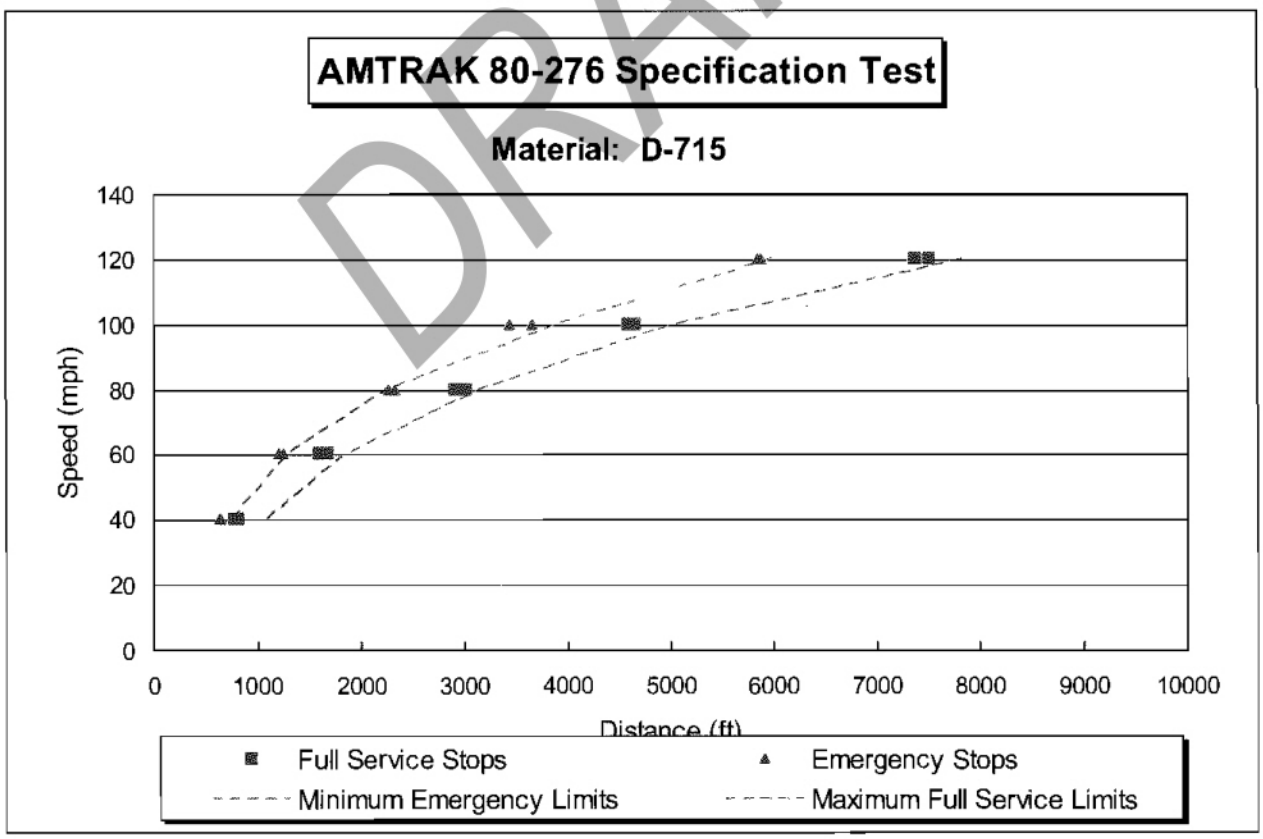
	7	90	89.4	7745	11.2	9.5	1274	1043	128	268	269	0.224	0.271	2.70	53
	8	90	89.1	7757	10.8	9.0	1227	989	148	289	291	0.230	0.283	2.80	54
	9	90	89.1	7762	10.6	8.8	1204	966	162	306	307	0.235	0.290	2.86	50
	10	90	89.1	7761	10.5	8.7	1197	959	170	325	326	0.236	0.291	2.87	51
	11	90	89.1	7767	10.4	8.6	1186	948	178	329	330	0.238	0.295	2.91	47
	12	90	89.2	7762	10.5	8.7	1192	955	179	338	339	0.238	0.294	2.89	51

DRAFT

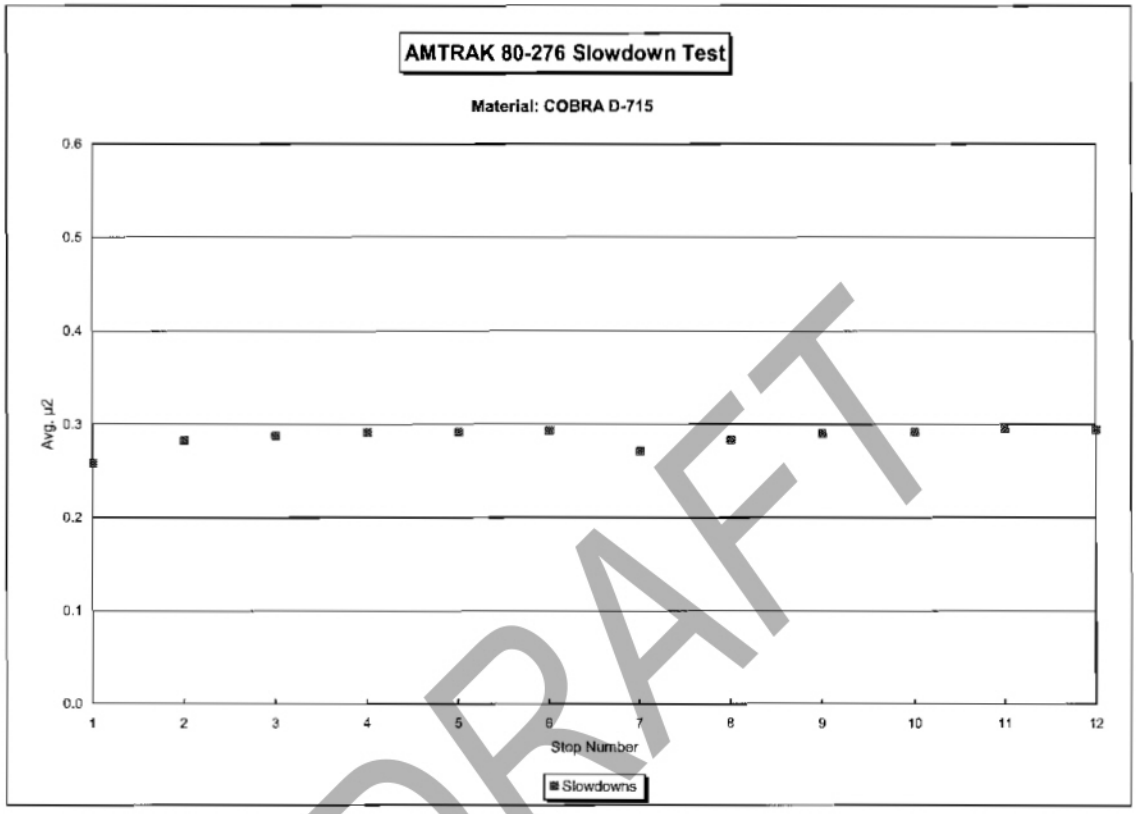

AMTRAK 80-276 Specification Test
Material: D-715
Avg. μ2
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
20
40
60
80
100
120
140
Speed (mph)
Full Service Stops
Emergency Stops


AMTRAK 80-276 Specification Test
Material: D-715
Speed (mph)
140
120
100
80
60
40
20
0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Distance (ft)
Full Service Stops
Emergency Stops
Minimum Emergency Limits
Maximum Full Service Limits

DRAFT

Material: COBRA D-715
AMTRAK 80-276 Specification Test
Procedure B (Slowdowns)

Average Friction versus Brake Application Number
Shoe Code: D376A-D
Test Number: 3195
October 11, 2006



DRAFT

Pad Wear Results: Procedure A (Stops) and Procedure B (Slowdowns)
Material: COBRA D-715
Shoe Code: D376A-D

Specific Gravity (g/cm³)
2.480

Application	Initial Weight GRAMS	Final Weight GRAMS	WEAR GRAMS	WEAR CM³
Full Service and Emergency Stops	13582.3	13453.9	128.4	51.8
Slowdowns	13453.9	13436.7	17.2	6.9

Material: COBRA D-715
AMTRAK 80-276 Specification Test
Procedure C (NEC Schedule Simulation)
Shoe Code: D376A-D
Test Number: 3195
October 11, 2006

STOP	VELOCITY (mph)			NSF	STOP TIME (sec)		DISTANCE (feet)		TEMPERATURE (°F)			COF		V/T	Max. Noise
NO.	V_i	V_2	V_f	(lbs)	T_1	T_2	S_1	S_2	$°F_i$	$°F_x$	$°F_f$	μ_T	μ_2	(mph/s)	dB
1	60	58.8	50	7692	9.6	6.4	796	517	109	160	160	0.183	0.257	1.06	55
2	124	122.4	105	7653	15.2	12.0	2584	2001	110	336	337	0.228	0.280	1.24	50
3	105	103.4	100	7958	5.2	2.0	787	304	232	262	264	0.128	0.262	0.95	56
4	105	103.2	45	7616	43.0	39.7	4718	4222	199	594	590	0.268	0.293	1.40	55
5	45	43.6	35	7690	9.6	6.4	582	373	345	389	390	0.174	0.248	1.02	50
6	125	123.2	65	7614	46.9	43.6	6507	5919	184	614	814	0.247	0.266	1.28	52
7	125	123.4	105	7650	15.9	12.8	2702	2115	188	498	499	0.231	0.282	1.26	38
8	125	123.4	90	7626	27.8	24.6	4399	3807	248	607	608	0.241	0.270	1.26	56
9	100	98.4	90	7707	8.8	5.6	1243	774	304	369	370	0.193	0.279	1.13	41
10	125	123.5	0	7608	97.6	94.4	9122	8539	101	433	433	0.243	0.256	1.28	65
11	125	123.4	90	7629	25.8	22.6	4141	3554	112	493	494	0.251	0.284	1.35	54
12	125	123.4	70	7617	38.5	35.3	5530	4953	149	607	607	0.272	0.298	1.43	57
13	70	69.0	50	7667	15.9	12.7	1431	1108	464	572	572	0.226	0.285	1.26	51
14	124	122.4	40	7609	72.3	69.2	8529	7953	277	647	629	0.230	0.242	1.16	58
15	75	73.7	30	7619	38.2	35.0	2986	2635	356	464	464	0.222	0.246	1.18	53
16	30	28.9	0	7625	27.5	24.3	661	521	305	368	368	0.184	0.223	1.09	58
17	125	123.4	90	7627	26.5	23.3	4219	3642	196	446	446	0.249	0.280	1.32	80
18	125	123.3	110	7672	11.8	8.7	2063	1487	220	387	388	0.224	0.292	1.26	37
19	110	108.2	105	7949	5.0	1.8	798	284	283	297	296	0.134	0.269	0.98	37
20	125	123.3	105	7654	14.2	11.0	2428	1852	166	381	382	0.253	0.316	1.40	36
21	125	123.1	100	7647	17.1	13.9	2859	2272	190	466	467	0.267	0.322	1.45	53
22	100	98.2	90	7717	8.0	4.8	1130	670	315	404	405	0.208	0.311	1.24	42
23	126	123.8	40	7610	65.6	62.4	7813	7223	251	664	632	0.258	0.274	1.31	56
24	40	38.9	0	7617	38.8	35.6	1189	1002	473	559	559	0.187	0.214	1.03	56
25	126	124.1	105	7648	16.0	12.8	2733	2153	311	513	514	0.238	0.288	1.29	50
26	125	123.6	100	7639	20.3	17.1	3393	2813	103	344	344	0.227	0.265	1.23	56
27	100	98.5	85	7686	11.7	8.6	1615	1156	216	327	328	0.226	0.299	1.27	44
28	125	123.3	105	7654	14.6	11.4	2487	1911	179	432	433	0.249	0.308	1.37	67
29	125	123.3	100	7646	17.4	14.2	2909	2331	159	483	484	0.262	0.315	1.44	62
30	126	124.0	100	7644	17.7	14.5	2965	2385	252	591	591	0.268	0.320	1.45	58
31	125	123.5	50	7614	48.5	45.3	6369	5787	133	605	605	0.290	0.314	1.55	56
32	70	68.2	45	7649	16.9	13.8	1469	1147	305	446	447	0.263	0.322	1.47	51
33	45	43.4	15	7635	23.1	20.0	1059	852	301	391	391	0.232	0.276	1.29	52
34	15	13.5	0	7671	12.5	9.3	158	90	277	305	305	0.172	0.267	1.19	53
35	125	123.4	110	7669	12.7	9.5	2217	1637	96	198	197	0.212	0.269	1.17	45
36	110	108.4	0	7610	71.9	68.8	5835	5327	164	548	536	0.292	0.315	1.53	94
37	109	107.5	100	7727	7.8	4.6	1210	705	282	383	384	0.198	0.300	1.16	74
38	125	123.2	95	7639	20.5	17.3	3346	2766	209	572	572	0.271	0.316	1.46	54
39	95	93.3	40	7620	36.9	33.7	3690	3253	331	646	639	0.281	0.312	1.49	51
40	40	38.8	15	7644	21.9	18.7	914	732	495	552	552	0.203	0.247	1.14	53
41	15	13.7	0	7650	15.0	11.8	186	118	336	377	377	0.154	0.218	1.00	55

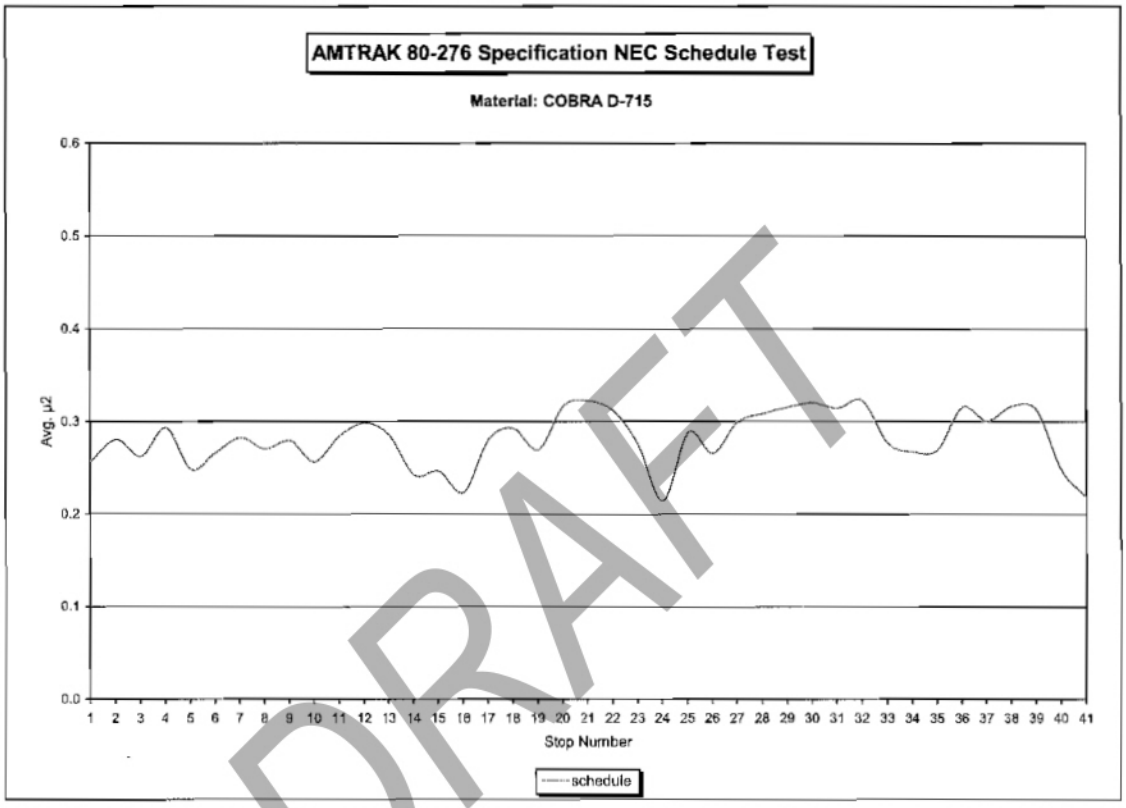
AVERAGE OF MAX ROTOR TEMPERATURE: 457
MAX INDIVIDUAL READING: 664

AVERAGE V/T 1.26
min 0.95
max 1.55

DRAFT

Material: COBRA D-715
AMTRAK 80-276 Specification Test
Procedure C (NEC Schedule Simulation)

Average Friction versus Brake Application Number
Shoe Code: D376A-D
Test Number: 3195
October 11, 2006



DRAFT

Pad Wear Results: Procedure C (NEC Simulation)
Material: COBRA D-715
Shoe Code: D376A-D

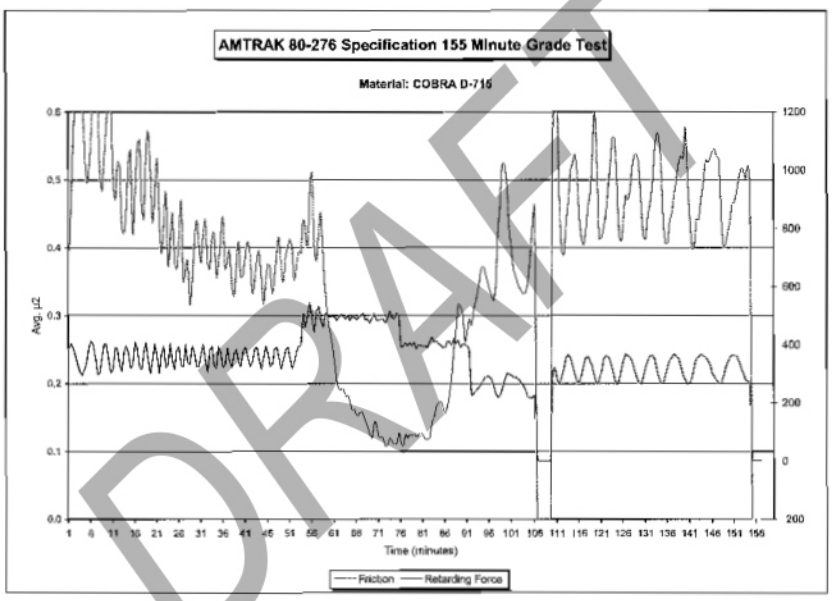
Specific Gravity (g/cm³)
2.480

Application	Initial Weight GRAMS	Final Weight GRAMS	WEAR GRAMS	WEAR CM³
NEC Schedule	13436.7	13182.9	253.8	102.3

Material: COBRA D-715
AMTRAK 80-276 Specification Test
Procedure D (Grade Test)

Shoe Code: D376A-D
Test Number: 3197

TEST PARAMETERS			TEST RESULTS				
Grade Segment	Duration In Minutes	Target Retarding Force lb	Average Retarding Force lb	Average Friction	Minimum Friction	Beginning Temperature °F	Final Temperature °F
1	55	360	361	0.439	0.289	101	440
2	22	500	492	0.225	0.108	440	521
3	16	400	380	0.177	0.107	521	467
4	15	260	261	0.379	0.286	467	297
5	3	0	0			297	282
6	45	320	317	0.485	0.389	282	375



DRAFT

Pad Wear Results: Procedure D (Grades)
Material: COBRA D-715
Shoe Code: D376A-D

Specific Gravity (g/cm³)
2.480

Application	Initial Weight GRAMS	Final Weight GRAMS	WEAR GRAMS	WEAR CM³
Procedure D Grades	13136.7	13065.6	71.1	28.7

Railroad Friction Products Corporation
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Phone ● 910-844-9700
Fax ● 910-844-9740

Registered Firm
ISO 9001:2000
AAR M-1003

September 1, 2006

Mr. Charles J. Florian
Air Brake Engineer – Rolling Stock Engineering
National Mechanical Hqtrs – HSR Engr, Rm 219
Amtrak –Wilmington Shop
4001 Vandever Avenue
Wilmington, DE 19802

Subject: **COBRA® DISC BRAKE PADS – QUALIFICATION PROCESS**

DRAFT

Thank you for reviewing with us by phone on Thursday August 24, 2006 the plans for testing our COBRA brake pads. We understand the Qualifications Process consists of three portions and is summarized as follows.

1. Dynamometer Test: Current Amtrak dynamometer test Specification 80-276 will be used for dynamometer evaluation. Performance Criteria is based on COBRA D-527 and Bremskerl 2050 dynamometer results as approximate upper and lower limits for braking performance. Performance should be closer to, but not exceed upper limit represented by the Bremskerl product.

2. Field Test for Brake Pad Wear and rotor condition: Six (6) Amfleet 1 vehicles fully equipped with new rotors and new test brake pads (Requiring 48 caliper sets of COBRA brake pads) are to be operated in multiple train sets in random revenue service for 92 days. Interim inspections conducted at bi-weekly intervals are planned to monitor brake pad and rotor wear and a final inspection is to occur when the test vehicles reaches 92 days of service. The pass/fail Criteria is that the brake pads should remain in service for the full test period of 92 days, unless unusual vehicle conditions or operating circumstances occur.

   After review of the field test plan we recommend the test include a provision for applying at least one caliper set of control pads of the existing pad type to each test vehicle. This may assist in confirming normal vehicle operation.

   We also request that all pads are removed and retained for joint AMTRAK and RFPC inspection at the completion of the test period.

   To facilitate the interim inspection process, RFPC is interested to participate in as many of the interim inspections as possible and will provide a suggested data sheet and test log electronic file.

3. Vehicle Braking Performance: A train consisting of (4) Amfleet 1 vehicles (requiring 32 caliper sets of COBRA brake pads) and (1) AEM-7 locomotive is to be used to perform and record Full Service brake applications at various speeds up to 125 mph. Pass/fail criteria per Amtrak requirements. These test vehicles are not required to have new brake rotors.

   The same train consist may be used to perform brake rate tests using the existing brake pads as a performance baseline or for comparison.

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We would appreciate your review and comments on the qualification process and criteria as described above. As discussed in our phone call, RFPC is currently in the process of determining the best available new material for the Amtrak Disc Pads, and will provide preliminary dynamometer information as soon as possible. Please be assured that RFPC will assist in any way possible during the field test activity, and that Amtrak Representatives are welcome to witness the dynamometer qualification test portion of the program.

Very Truly,

Martin A. Petzoldt

Martin A. Petzoldt
Railroad Friction Products Corporation
Senior Project Engineer
Phone 910 844-9781
Fax 910 844-8281

DRAFT

VEHICLE MASTER LOG SHEET

Amfleet 1 Type Vehicles: Test to start from Bear Shop on vehicles equipped with new Brake Rotors.

Cobra Test Brake Pads installed on Both A and B-Trucks per alternate sheet A, B, or C

The test Pass/Fail requirements: Test brake pads remain in service for the full test period of 92 days, unless unusual vehicle conditions or operating circumstances occur.

	Vehicle No.	Start of Test	Target 92 Day PM Date	Actual inspection Date	Pass/Fail
1					
2					
3					
4					
5					
6					

DRAFT

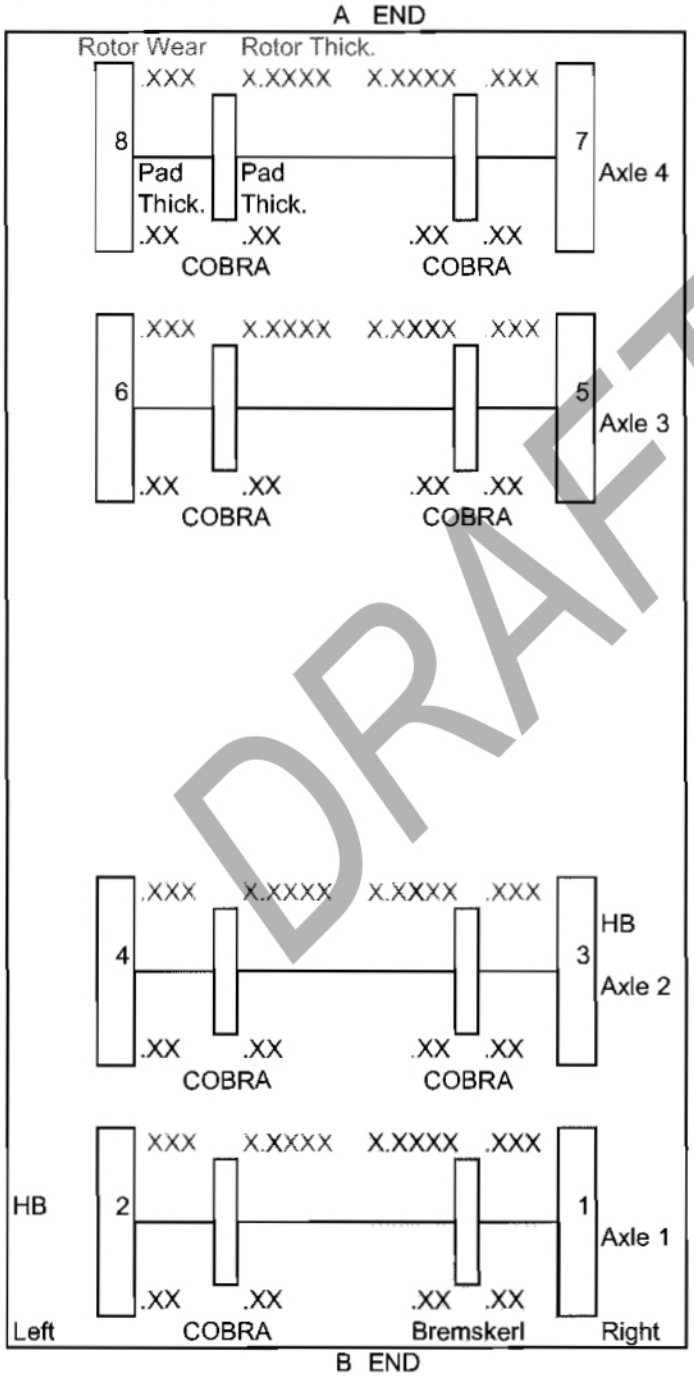
Individual Vehicle Data Sheet A

Inspection Date: M/D/YY

Inspection Loc'n & Days in Service
LOCATION:
SERVICE DAYS:

A Truck Cobra Pads
B Truck 3 rotors Cobra Pads
Start of Test: M/D/YY

Amfleet 1 Vehicle No. XXXXX



COMMENTS:

Control Caliper With Bremskerl Pads Installed

DRAFT

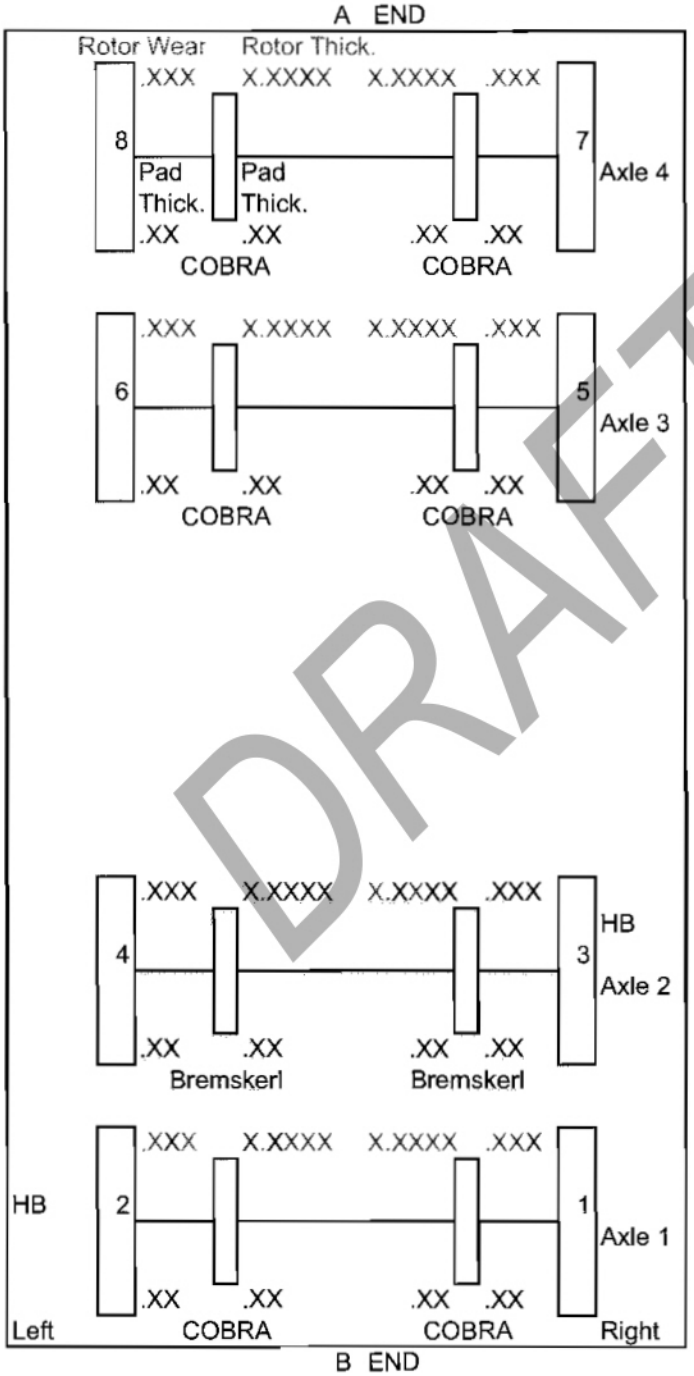
Individual Vehicle Data Sheet B

Inspection Date: M/D/YY

Inspection Loc'n & Days in Service
LOCATION:
SERVICE DAYS:

A Truck Cobra Pads
B Truck Cobra and Bremskerl Pads
Start of Test: M/D/YY

Amfleet 1 Vehicle No. XXXXX



COMMENTS:

Control Axle With Bremskerl Pads Installed

DRAFT

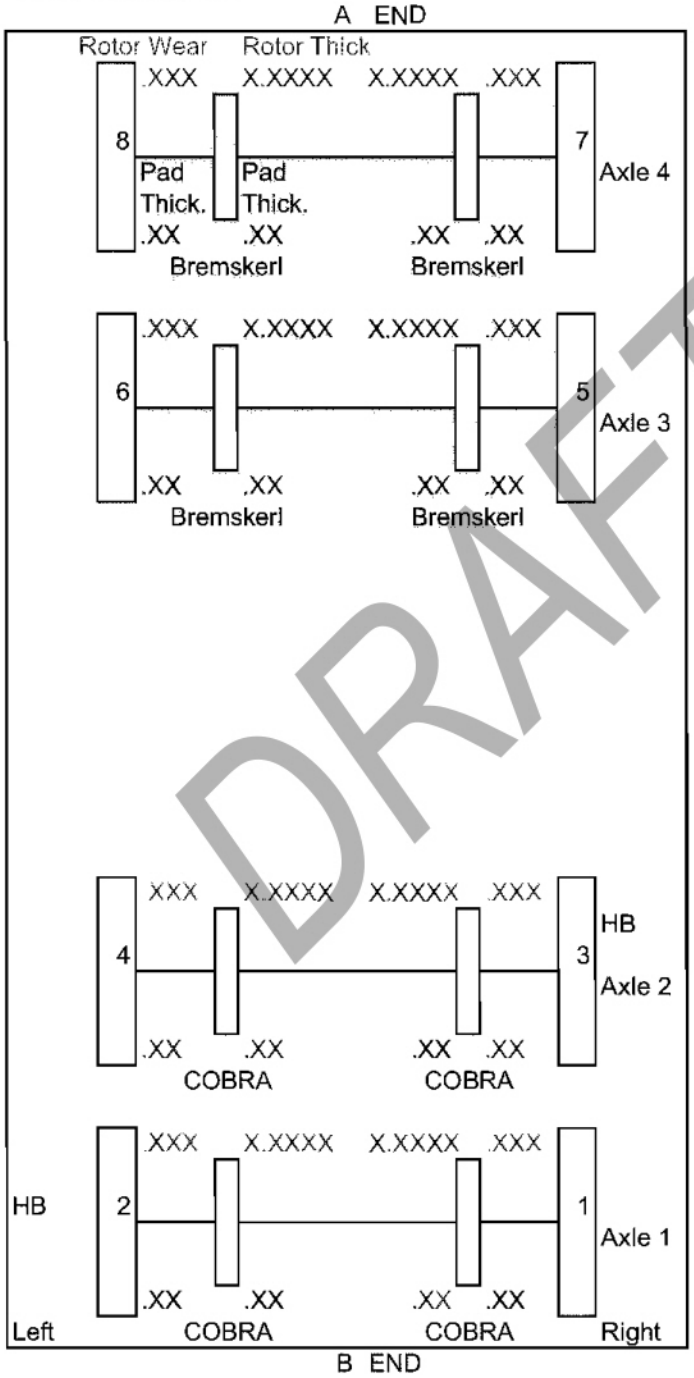
Individual Vehicle Data Sheet C

Inspection Date: M/D/YY

Inspection Loc'n & Days in Service
LOCATION:
SERVICE DAYS:

A Truck Bremskerl Pads
B Truck Cobra Pads
Start of Test: M/D/YY

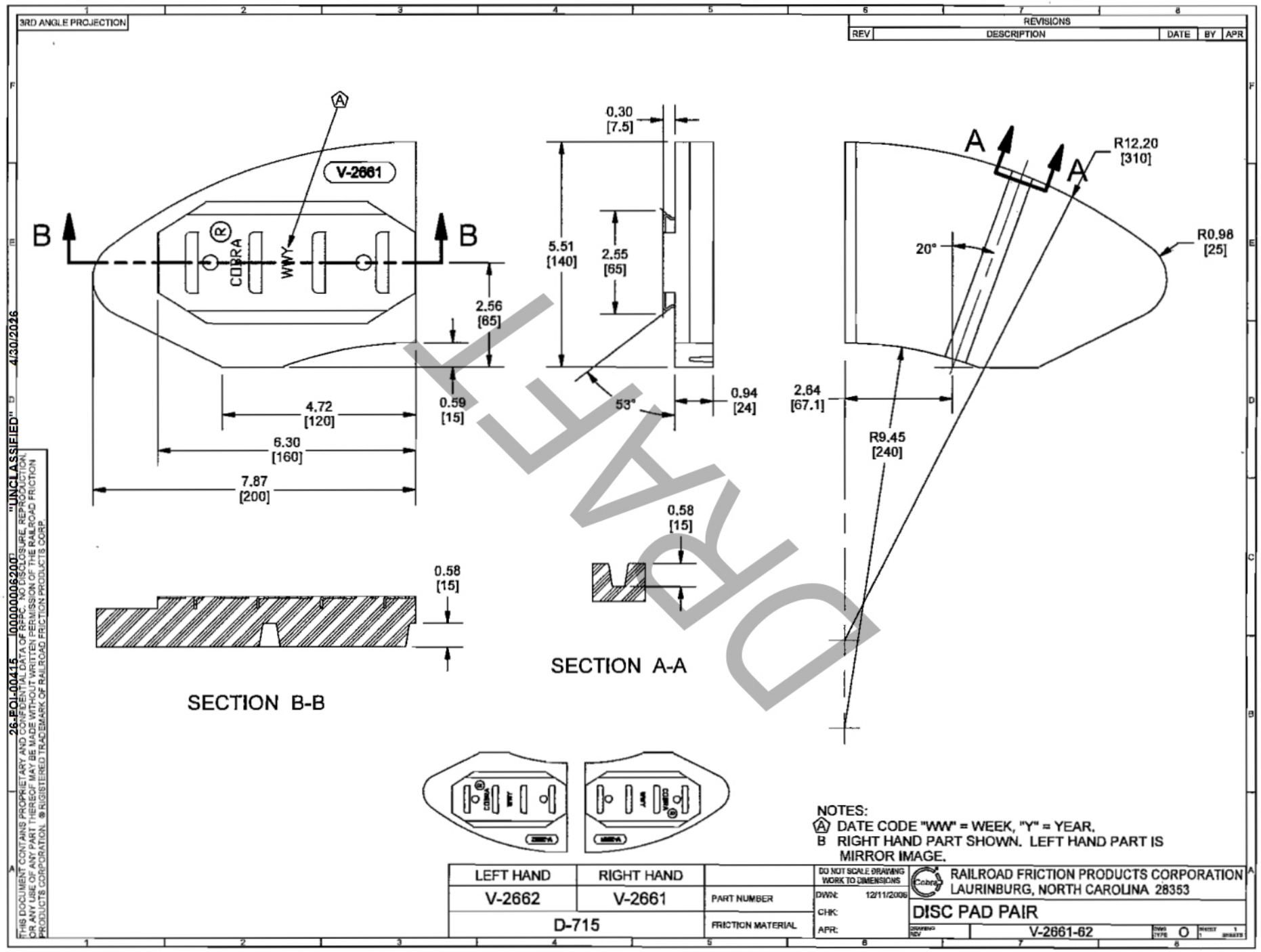
Amfleet 1 Vehicle No. XXXXX



Control Truck With Bremskerl Pads Installed

COMMENTS:

DRAFT


3RD ANGLE PROJECTION
REVISIONS
REV
DESCRIPTION
DATE
BY
APR
V-2661
B
B
A
COBRA
WW
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2.56
[65]
0.59
[15]
4.72
[120]
6.30
[160]
7.87
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0.30
[7.5]
5.51
[140]
2.55
[65]
53°
0.94
[24]
0.58
[15]
SECTION B-B
SECTION A-A
A
A
R12.20
[310]
R0.98
[25]
20°
2.64
[67.1]
R9.45
[240]
NOTES:
A DATE CODE "WW" = WEEK, "Y" = YEAR.
B RIGHT HAND PART SHOWN. LEFT HAND PART IS MIRROR IMAGE.
LEFT HAND
RIGHT HAND
V-2662
V-2661
PART NUMBER
D-715
FRICTION MATERIAL
DO NOT SCALE DRAWING
WORK TO DIMENSIONS
DWN: 12/11/2006
CHK:
APR:
RAILROAD FRICTION PRODUCTS CORPORATION
LAURINBURG, NORTH CAROLINA 28353
DISC PAD PAIR
V-2661-62
DWG TYPE O
4/30/2026
"UNCLASSIFIED"
26-FOI-00415 0000000062007
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DRAFT

Lin, Ted

From: Florian, Chuck
Sent: Monday, December 11, 2006 6:56 PM
To: Steets, Paul
Cc: Burshtin, Michael; Gagarin, Greg; Fedora, Jon; Florian, Chuck; Ferguson, Paul; Lin, Ted; Truitt, Ron; Fenley, James
Subject: Accepted: Updated: WABTEC-RFP-Cobra/RFP Presentation on Brake Shoes

Attachments: COBRAR Disc Brake Pads

12 ~ 1:30 PM

Agenda
1. New Brake Pad Material
2. Dynamometer results
3. Superliner Brake Disc testing

COBRAR Disc Brake Pads

Preparation Notes from C Florian
Attached for reference is the 11/7/06 Cobra Dynamometer test report for the new COBRA D-715 material that Rwy Friction Products Corp/WABTEC are proposing for Amtrak to put into the qualification evaluation & test procedure.

Wabtec also plans a Dynamometer test of their 'new' design Superliner Disc (based on the 'new' Amfleet design, for the week of 12/18/06 - Amtrak is invited - but must choose which pad material to use for the test -

Considered materials include the:

- old D-527, no longer used,
- newer D-702 as used for the Amfleet Disc Dyno test 12/19-20/06 before Amtrak field tests showed wear less than expected.
- -newest D-715 - not yet tested in any form by Amtrak - just now being proposed by RFPC and
- -Bremskerl material, the current approved and contract supplier.

Also, WABTEC International now owns European based Becorite. They are the brake pad supplier (to Knorr) for the ACELA TS and HHP-8 Loco equipment. Becorite have some materials that meet some new UIC standards requiring more uniform performance in wet-to -dry and across temperature ranges as well as noise and wear life. We will want to learn how RFPC will incorporate those qualities into their offering to Amtrak.

Amtrak also needs to update our old dynamometer Spec 80-267, Rev E to more accurately represent the equipment, operating conditions and test technology currently active and available.

DRAFT

Amtrak
Mechanical Department
Bureau of Rolling Stock Engineering

Specification

for

Passenger Car Wheelsets

SPECIFICATION No. 907

Initial Issue

Issue Date: October 10, 2008

DRAFT

APPROVED	DATE	
Vincent A. Mesia	24 Oct '08	Chief Mechanical Officer
Dale F. Cryglhardt		Deputy Chief Mechanical Officer - Engineering
Paul G. Stutz	10/21/2008	Senior Director - Rolling Stock Engineering
Michael L. Burshtin	10/17/2008	Director - Systems Engineering
Roy Moyer/MLB	10/17/2008	Originator

Originator: Roy Moyer

26-FOI-00415 00000006201 "UNCLASSIFIED" 4/30/2026

SPECIFICATION CHANGE SHEET

Revision	Section	Description	Date	Approver

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26-FOI-00415 00000006201 "UNCLASSIFIED" 4/30/2026

Amtrak

Bureau of Rolling Stock Engineering

Specification for Passenger Car Wheelsets
Specification No. 907

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Appendix A - Amtrak Drawings for Passenger Car Wheelset Assemblies
Appendix B - Wheel Tabulation Chart

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26-FOI-00415 00000006201 "UNCLASSIFIED" 4/30/2026

Amtrak

Bureau of Rolling Stock Engineering

Specification for Passenger Car Wheelsets
Specification No. 907

1.0 Scope

1.1 Purpose

This Specification defines the vendor general requirements applicable for the repair, replacement or overhaul of mounted wheelsets for use on Amtrak-maintained or operated passenger cars, including Amfleet I, Amfleet II, Heritage, Horizon, Superliner I, Superliner II, Surfliner and Viewliner car fleets. This Specification is to be used in conjunction with the Amtrak Procurement Department contract documents, purchase orders, other contractual documents, and various Amtrak drawings. All work performed and components used in this Specification must comply with the requirements of the Association of American Railroads (AAR) commodity Group B.

The design criteria and constraints that are known to Amtrak have been specified. If other factors require definition after Contract award, the vendor shall be responsible for making those definition requirements known to Amtrak in a timely manner for mutual investigation and satisfactory resolution. The vendor shall not be relieved of the overall responsibility of providing an adequate product for the service conditions.

Whenever in this Specification an article or material is defined by using a trade name or the name and catalog number of a particular manufacturer or vendor, or a limited description, the term “or approved equal” if not written thereafter shall be implied. Any reference to a particular manufacturer’s product either by trade name or limited description is only for the purpose of setting a standard of performance, quality, composition, construction or size. The term “or approved equal” means any other manufactured product or article, which is equivalent in material, workmanship and service and is as efficient and economical in operation in the opinion of the Amtrak Engineer. Amtrak’s opinion as to whether the proposed alternate is equal to the specified items for Amtrak’s specified use and purposes shall be final and conclusive. In this Specification all references to "number of days" shall mean calendar days. The vendor shall not patent or copyright any original materials or information created by this procurement which will be submitted to Amtrak.

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1.2 Amtrak Ownership Rights

Unless specifically waived in writing by the Amtrak Procurement officer, all drawings, bills of materials, catalog lists, mockups, CAD models, documentation and all other engineering and design materials related to this Specification shall become the property of Amtrak, and shall be delivered by the vendor in total as part of the First Article Inspection or other process. If any patented items are used, Amtrak must be granted an unrestricted license to use, copy or otherwise manufacture the item by itself or a third party.

1.3 Vendor's Technical Proposal

As a condition of contract award unless otherwise indicated in the Amtrak Procurement

documents, the vendor must submit a written and detailed Technical Proposal to the designated Amtrak Procurement officer. This Technical Proposal must identify the vendor's interpretation of what it considers to be the scope of Basic Work to be performed, present a complete technical description of the components to be supplied, fully describe the work procedure to be used, include a copy of the vendor's Quality Assurance program and all AAR certifications, include a project schedule by major events starting from the Notice to Proceed, and include a Bill of Material of all components to be supplied by wheelset type.

1.4 Scope of Work

This Specification shall be used to define the technical requirements for the supply of passenger car wheelsets to Amtrak, as defined by the Amtrak Purchase Order and as directed by the Amtrak Procurement officer. This scope shall include the supply of wheelsets using all new components, the repair/recondition and return of existing wheelsets using new or fully reconditioned subcomponents, or solely the reprofiling of an existing wheelset. All wheels, either new, requalified or reprofiled, shall be supplied to the Amtrak standard wheel tread profile per the latest revision of Amtrak drawing 062-00106.

Unless otherwise directed by the Amtrak Procurement officer, a wheelset reaching the end of its economic life (i.e., wheel thickness near condemning limit) shall be remanufactured by the vendor using new wheels, a requalified existing axle, requalified brake discs, and either new or fully reconditioned bearings as further detailed in Section 2.

On occasion as defined in the Amtrak Purchase Order, Amtrak may also require service under this Specification for a wheelset with more than 50 percent remaining rim thickness. In such a situation, the vendor shall prepare a written estimate to the Amtrak Procurement officer regarding the cost to reprofile the wheels to the Amtrak standard per the latest revision of Amtrak drawing 062-00106, and to requalify the existing axle, brake discs and wheel bearings for continued use. The Amtrak Procurement officer shall then authorize in writing if such components shall be reused, or if new or reconditioned components are to be used (in accordance with the latest revision of the Association of American Railroads (AAR) Manual of Standards and Recommended Practices, Standards S-659 and S-723). In every case, the wheel bearings must be requalified for continued use. The reporting methods to Amtrak and the costing methods shall be in accordance with the Amtrak purchase order and other contract documents.

1.5 Vendor Certification

It is mandatory that the vendor performing the wheelset assembly work under this Specification, as well as all suppliers of components, must be an Association of American Railroads certified company holding a valid M-1003 certification. The vendor’s and supplier's certifications must be current for the time period that the work is being performed. As part of its Technical Proposal, the vendor shall identify all of the major component suppliers being used, to permit Amtrak to verify this certification requirement. The vendor must have valid certifications and status codes for each specific work process involved with the mounting of wheel and axle sets, including new, second hand and reprofiled wheels. The Amtrak Procurement officer and the Engineer shall be immediately notified by the vendor if there is any notification issued to the vendor or its suppliers by the Association of American Railroads of any exceptions to its certifications or its wheel shop process.

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1.6 Standards

It is mandatory that all wheelsets supplied by the vendor under this Specification, including its components and all assembly services, must comply with the referenced requirements of the latest revision of the Association of American Railroads (AAR) Manual of Standards and Recommended Practices, Section G, Parts I and II - Wheel and Axle Manual. The vendor shall provide special attention to compliance with AAR Standards M-101, M-107/M-208, RP-631, RP-632, RP-633, RP-634, S-659, S-723 and S-727.

1.7 Exceptions

The vendor shall explicitly identify to the Amtrak Procurement officer any exceptions being taken to this Specification, referencing the Specification paragraph and exact wording in question.

1.8 Engineer

The Engineer, as referenced in this Specification, is defined as the Senior Director of the Amtrak Bureau of Rolling Stock Engineering within its Mechanical Department, or its written designee. During the course of the project the vendor may be submitting items for the Engineer's approval as required by the Contract and Specification. The vendor shall not interpret this process to mean that the Engineer will function as an arm of the vendor's Project Management or Engineering staff. Submissions shall be structured to show how the vendor is responding to the requirements of the Specification, and not on the basis of requiring the Engineer to discover how the vendor is not meeting those requirements. Submittals requiring the Engineer's approval prior to implementation shall be reviewed and classified by the Engineer within 30 days from the day the submittal is received. Delays caused by the Engineer's failure to review and approve drawings or schedules in a timely fashion as listed above shall be treated as an excusable delay, provided that the vendor can demonstrate to the satisfaction of the Amtrak Procurement officer that actual production delays have been caused by the Engineer and there is no other concurrent cause for delay.

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1.9 Cost Items

Any individual extra work items regarding supply of the wheelsets shall be handled in accordance with the contract and purchase order documents issued to the vendor by the Amtrak Procurement Department. The vendor must contact the Amtrak Procurement officer regarding all such issues. The vendor agrees that no payment will be made by Amtrak for any additional work outside the basic work scope of the contract documents unless such work is first preapproved in writing by the Amtrak Procurement officer in accordance with the contract documents.

1.10 Vendor Quality Policy

It is mandatory under this Specification that the vendor and its suppliers have established and maintain a Quality Policy System meeting the requirements of the Association of American Railroads Manual of Standards and Recommended Practices Specification M-1003 and also Section G, Part II - Wheel and Axle Manual. The vendor's shop is required to be equipped with equipment, personnel and management completely sufficient to assemble and inspect each wheelset being supplied under this Specification. The shop shall have suitable equipment to diagnose any failure mode and to perform all adjustments and tests required to confirm proper manufacture. The vendor's Quality Assurance staff shall be active participants in the

production, inspection, testing, and documentation phases of the work. The vendor and its component suppliers must maintain all Association of American Railroads wheel shop certifications for the entire duration of its contract period with Amtrak. The Amtrak Procurement officer and Engineer shall be immediately notified by the vendor if there is any notification issued to the vendor by the Association of American Railroads of any exceptions to its certifications or its wheel shop process. Amtrak Quality Assurance personnel may conduct random audits of the vendor's quality assurance program to verify that these Specification requirements are being achieved. In addition, Amtrak may choose to inspect wheelsets prior to shipment or upon receipt at any of its maintenance facilities. The vendor shall fully cooperate in such audits.

All measuring and test equipment used in the vendor's and suppliers' wheel, axle and roller bearing shops shall be traceable to a national standard. When no national standard exists, the original equipment manufacturer's standards shall be used for calibration.

1.11 Critical to Quality (CTQ) Part Criteria

It is mandatory that the vendor comply with Amtrak procedure PD 3.7.4.02, Critical to Quality (CTQ) Part Criteria, which applies to all components of the wheelsets. Critical to Quality (CTQ) characteristics are defined as "Those characteristics of an item which, if non-conforming, may prevent or seriously affect the unit performance, reliability, producibility, or customer satisfaction of a component." This procedure defines the methodology when qualifying parts or processes to assure that the critical to quality product criteria meet Amtrak requirements by:

- Implementing a rigorous Part/Process qualification to ensure the participation, communications of all related departments and the quality acceptance.
- Support the Quality process by involving the vendor early in the project/design process.
- Assure that the vendor is supplying materials that meet the quality, cost, delivery and reliability requirements.

1.12 Conducting Tests

The vendor and its suppliers shall be equipped to fully perform all inspections and tests required in accordance with this Specification and any referenced Association of American Railroads standards as part of basic work. All torque wrenches, press tonnage recording equipment and pressure gauges, testing apparatus, etc. shall be calibrated on a periodic basis as recommended either by its supplier, by Association of American Railroads standards, or by the vendor's quality system requirements.

1.13 Workmanship

All workmanship shall be of high grade and shall conform to the best of wheel shop practices. Skilled, qualified, well motivated personnel with appropriate experience, training, and aptitude shall be utilized to assure high quality of workmanship at all levels. Foremen, supervisors, inspectors, and shop managers shall be well integrated within the project team and be fully experienced and capable in their fields. They shall manage their teams in a competent and professional manner. The vendor is required to have on hand in his facility for reference this Specification, all referenced Amtrak drawings, and all referenced Association of American Railroads standards and wheel gauges.

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1.14 Documentation Records

The vendor shall provide a complete Wheelset Inspection Record (using an Engineer-approved form) for each wheelset produced, as well as maintain a logbook of documentation. As a minimum, records shall identify the Amtrak purchase order number, component documentation (such as wheel heat numbers), material certifications, all component serial numbers, copies of any written authorizations by the Amtrak Procurement officer, inspection and test data, assembly documentation (such as press tonnage records), shipping date and shipping location. This documentation must be retained by the vendor for a minimum period of five years.

1.15 Dimensions

The vendor shall provide English dimensioning for its documentation, drawings and other communications which are generated. All wheelsets supplied under this Specification shall be of United States inch-standards, unless otherwise approved in writing by the Engineer.

1.16 Use of Approved Components Required

It is mandatory that the vendor use only Amtrak approved components in the assembly of any wheelsets under this Specification. Any replacement wheel bearing parts must be new or reconditioned parts supplied by the Timken Company, and in all cases the wheel bearings must be equipped with new hydrodynamic labyrinth (HDL) seals. As information, a tabulation of Amtrak approved components is given in Appendix A. These components are identified by the Amtrak "AAMPS" internal catalog number. The vendor may obtain supplier details for these AAMPS number items from the Amtrak Procurement officer.

1.17 Referenced Documents

- Association of American Railroads (AAR) Manual of Standards and Recommended Practices
- Refer to Appendix A and B for a tabulation of Amtrak drawings and wheelset dimensions.

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2.0 General Requirements

2.1 Process

All wheelsets supplied to Amtrak must meet the following criteria. Under this Specification, the vender shall provide either (A) repaired, (B) reconditioned or (C) complete new wheelsets.

Wheelsets supplied to Amtrak shall consist of the following components listed below (note that end caps are not used on Amfleet I and Amfleet II wheelsets), and be rebuilt as furnished from Amtrak unless otherwise identified by the Amtrak Procurement officer.

1. Axle
2. Wheels
3. Brake discs (if applicable)
4. End caps with center plastic plug
5. New locking plates
6. Journal bearings
7. Fitted backing rings
8. New end cap bolts

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Wheelset components marked 'D' (Derail) shall be inspected and reconditioned, if acceptable, per the latest issue of the Field Manual of the AAR Interchanges Rules, APTA specification SS-I&M-015-00, and the AAR Manual of Standards and Recommended Practices, Section G-II.

It is mandatory that all wheels be of wrought steel, and not of cast construction. Unless otherwise approved, all wheels shall be of Class B multiple-wear design, with a tread profile in compliance with the latest revision of Amtrak drawing 062-00106. All brake discs shall be inspected and installed in compliance with Amtrak Standard Maintenance Procedure (SMP) 03610. All brake discs bolted to the wheel shall be installed using new locking plates and bolts.

All journal bearings shall be either new, or reconditioned in accordance with all Timken Company procedures, Amtrak Specification No. 900 entitled Purchase of New or Reconditioned Roller Bearings, and in all cases shall be equipped with new hydrodynamic labyrinth (HDL) seals. The end cap shall be either new or reconditioned. New seals, plugs, cap screws and locking plates shall be used.

All axles shall be Grade F in accordance with AAR specification M-101. The Engineer shall be furnished a certification of the chemical composition and physical properties for every new axle. Any axle being reused must be requalified in accordance with the latest edition of AAR Specification M-101 Appendix A, and also AAR Standard S-659 rules 1.1 through 1.2.8.2. All axles shall be inspected and finished in accordance with Amtrak Standard Maintenance Procedure (SMP) 49408. In all cases, each axle must be wet fluorescent magnetic particle inspected for its entire length and found completely free of defects before assembly.

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2.2 Definitions

Accepted Material - When roller bearing/wheel and axle components are inspected during incoming or in-process inspection and found acceptable they shall be identified by applying a suitable status indicator (Refer Table 1 - Status Indicator).

Rejected Material - When material is rejected in the roller bearing/wheel and axle reconditioning cycle, it must be segregated immediately from the acceptable material. There are three (3) types of rejected material. Rejected material shall be handled as follows:

Scrap material - material that is known to be scrap or physically marked scrap (S), shall be put in a bin, container or racks designated for scrap material or placed in an area that is designated for scrap material only.

Rework material - material that is not acceptable to continue in the bearing, wheel and axle reconditioning cycle is to be physically marked Rework (RWK) and set aside in containers, shelves or areas designated to be sent out for rework. Material in this category is to be accumulated until such time as it is sent to an AAR certified roller bearing/wheel and axle re-manufacturer.

New material - new or reconditioned material that is rejected shall be physically marked and set aside for the Corporate Quality Control Department or authorized personnel to handle with the supplier. Nonconformance material shall be documented (Reference QA Forms Manuals and Nonconformance Control and Quality Program Improvement Instructions).

Additionally, nonconformance AAR approved material items shall be reported to the AAR as specified in AAR Manual, Section J, M1003, Figure 7.1 and 7.1-II, AAR Material Rejection Report/Response and Amtrak Problem Tracking Field Reports NRPC Form 2925 (reference QA Forms and Section 2.18, Non-Conformance Control and Quality Program Improvement).

Component	Markings	Description
Wheel Sets		
	T	Turn
	S	Scrap
	HOLD	Hold for Inspection
	R&R	Remove and Replace
	D	Derailed
	RWK	Rework
	OK OFF	Hold Wheel for Inspection - Remount
Disc		
	OK OFF	Hold Disc for Inspection - Remount
	CRACKED	Apply Orange Paint
Axle		
	S	Scrap
	HOLD	Hold for Inspection
	R&R	Remove and Replace
	D	Derailed
	OK OFF	Hold Wheel for Inspection - Remount
	RWK	Rework

Table 1 - Status Indicators

Any wheel assembly involved in a major derailment must be tagged or marked (DERAIL or "D") and placed in an area to indicate status. Wheel assemblies that have been derailed shall be handled in accordance with APTA specification SS-I&M-015-00 and the AAR Field Manual inspection procedures for derailed wheel sets.

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2.3 Inbound Inspection

All wheels, axles, discs and bearings that enter the wheel shop shall be inspected for defects. Refer to Rule 2.8 of the AAR Manual of Standards and Recommended Practices, Section G, Part II for types and identification of defects. Each inbound wheel shall be inspected using a steel wheel gauge to determine if the wheel is acceptable for machining or needs to be rejected. A passenger car wheel may be reprofiled if the tread thickness remains 1.5 inch and above after machining. Refer to Rule 1.5 for additional details. Visually inspect wheel for flat spots, spalls, cracks, etc.

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Visually inspect each disc brake for cracks, chip off, etc. Refer to Amtrak Standard Maintenance Procedure (SMP) 03610 - Maintenance Instructions on Brake Discs for detailed inspection procedures. Visual inspection of the hub and spokes shall be conducted more closely. Visually inspect the chamfer on the outside diameter of the disc brake. A chamfer that is significant is considered acceptable. If the chamfer is almost absent, then the disc is rejected. Markings shall be identified by applying a suitable a status indicator (Refer to Table 1 - Status Indicator).



Rotate the roller bearing by hand. The bearing should rotate freely without any internal obstruction or any noise.

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Any wheel or axle with a defect that cannot be removed by machining must be scrapped. Scrap wheelsets shall be marked with a status indicator “S” (scrap). Wheelsets that can be reprofiled shall be marked with a status indicator “T” (turn). Refer to Table 1 for a list of status indicators that shall be used. Wheelsets that need only wheels to be reprofiled shall be moved into the wheel lathe queue. Wheelsets that have scrap components (marked ‘S’) or have been involved in a derailment (marked ‘D’) shall be moved into the dismount press queue.

2.4 Wheelset Demounting

Record the serial number of the axle, wheels, journal bearings and brake discs. Demount the wheelset components. Both the journal and dust guard combinations of the axle must be protected during the entire demounting operation to prevent any nicking or scratching of the journal surfaces. A suitable method must be used to prevent upset ends and high spots on the wheel bearing journals. The outer diameter of the journal and dust guard protector must not be less than 0.025 inch under the axle wheel seat minimum diameter. The inner bore shall be recessed to assure protection of the dust guard, and shall be sufficiently long to cover the entire bore.

If the reuse of the axle has been authorized by the Amtrak Procurement officer, clean the axle to bare metal, including the gear, journal bearing and wheel seats. Inspect the axle for the following defects: water etching in the bearing fillet area, nicks, gouges, or deep scratches less than 0.125 inch deep as measured from the original body contour. All such defects must be removed to create a smooth contour and blended into the contour of the axle body, with a minimum radius of 2.0 inch. The surface roughness of all such repairs shall not exceed 90 Ra. A maximum of 25 such repairs will be permitted in each axle. Material removal must be performed such that all marks are aligned with the length of the axle. Operations must not produce discoloration at any time during the process. No high spots or depression greater than 0.0625 inch on any part of a journal bearing surface is permitted.

Axle bodies may be machined, provided that surface defects can be removed without violating

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minimum dimensions or specifications. The surface roughness of the machined body shall not exceed 125 Ra. Check for bent axle or other condemnable damage, and reject all nonconforming axles. Any reused axle must be wet fluorescent magnetic particle inspected for its entire length and found completely free of defects before remounting.

2.5 Axle Lathe Work Station

The following rules and practices outline the procedures to be followed for the reconditioning of all Amtrak axles. They are to be used in conjunction with the recommendations of the OEM, Amtrak, and Association of American Railroads Rules and Practices.

Axles must be reconditioned in compliance with AAR Manual, Section G, Part II, latest revision. Axles that are not covered in the AAR Manual should be inspected according to the Original Equipment Manufacturers and Amtrak specifications and procedures. All scrap and reworked axles must be segregated and marked in accordance with Table 1 - Status Indicators. Unmounted secondhand axles and any mounted axles involved in a major derailment must be checked per Rule 1.2.2, AAR Manual of Standards and Recommended Practices, Section G, Part II. Axles must be checked for bent condition with roller bearings removed. This check, including tolerances, must be the same as specified in Rule 1.2.2 of the AAR Manual of Standards and Recommended Practices, Section G, Part II, or as specified by the Original Equipment Manufacturer (OEM).

Wheel seats of secondhand axles need to be turned prior to mounting, provided they meet the specifications of Rule 1.1.2 of the AAR Manual of Standards and Recommended Practices, Section G, Part II.

At the beginning of each shift, an axle wheel seat must be checked from each lathe in service, at not less than three (3) points in its length and on two different diameters at each of these points to ensure rotundity per Rule 1.1.7 of the AAR Manual of Standards and Recommended Practices, Section G, Part II.

Centering holes must be wiped clean before placing the axle in the lathe in order that journals and wheel seats are not eccentric and grit will not cut the lathe centers. Using the center gauge, inspect the angle of the axle centering hole. Centering holes in the ends of axles must form an angle of 60° and be in accordance with Figure 4.8 of the AAR Manual of Standards and Recommendations, Section G, Part II. Any burrs around the centers must be removed.

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Incoming axles that need to be reconditioned shall be mounted securely between the lathe spindles. Remove rust, oil, dirt and paint from the axle using a suitable cleaning agent. Surface defects such as nicks, gouges or deep scratches less than 0.125 inch deep, as measured from the original body contour, must be removed to a smooth contour and blended into the contour of the axle body, with a minimum radius of 2 inches.

Using temperature compensating dial snap gauges measure the bearing seat diameter. Rotate the snap gauge around the journal diameter at least 180° within the bearing seat locations to obtain maximum and minimum journal diameters. The average diameter of each bearing seat must be within the specific axle type's tolerance limits. Refer to Wheelset Tabulation for shop limits.



Using the outside diameter micrometer, measure the wheel and disc seat diameter at three different locations along the longitudinal axis of the axle. Refer to Wheelset Tabulation for shop limits.

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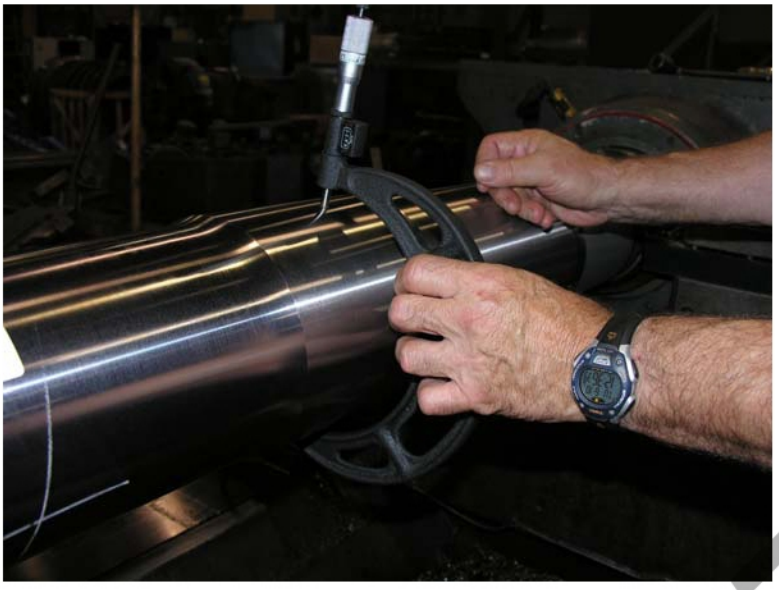
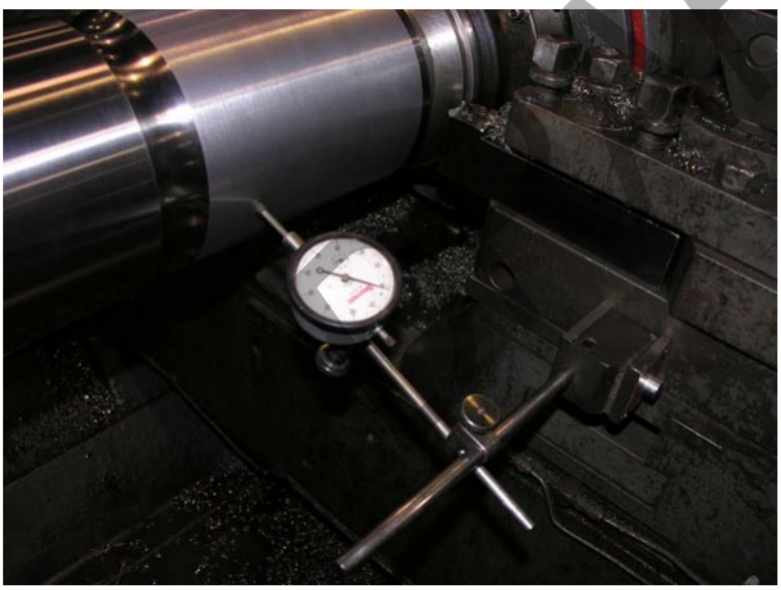


Record the wheel seat values obtained by attaching a magnetic base dial indicator to the tool rest, and set it up to record readings about 0.25 inch to 0.5 inch from the end of the journal. Plunger of indicator should be located at the longitudinal centerline of the axle.



Crank the lathe tool rest in till the indicator plunger comes in contact with the axle. Set the dial indicator to zero at this point. Rotate the axle, noting the total amount of indicator runout to the bearing journal. At the end of each revolution, the dial will return to zero if it has been set up properly. Maximum runout of 0.010 inch total indicator reading is acceptable.

The maximum allowable runout for bearing journals, when mounted between centers, is 0.015 inch total dial indicator. When runout exceeds 0.015 inch on the bearing journal, the bearing journals must be turned or axle ends recentered to bring the runout into tolerance.

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Compare the obtained data against the shop allowable values, tolerances and limits for each corresponding axle type. Refer to Wheelset Tabulation in Appendix A for shop limits.

Using the journal fillet gauge, inspect the fillet radius to ensure proper fit and proper seating of the backing ring on the axle fillet. If a 0.005 inch fillet gauge can be inserted more than 0.375 inch down from the dust guard seat at all points around the periphery, the axle fillet must be corrected. Axle journal length should also be in compliance with Amtrak drawings.



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2.6 Magnaflux

The following rules and practices apply to the Magnaflux process for surface crack detection of axles. These rules outline the procedures to be followed for inspecting axles for surface discontinuities not visible to the eye, such as inclusions, seams and cracks, by the magnetic particle method. They are to be used in conjunction with Magnaflux Corporation recommendations and the Association of American Railroads Manual of Recommend Practices, Section G, Standard M-101, latest revision. All Magnaflux operating procedures shall be in accordance with the Magnaflux Corporation specifications and instructions. A pie gauge test shall be performed and recorded at the start of every shift.

All personnel performing the inspections, at a minimum, shall be qualified and certified by the vendor as a Level I MPI inspector, with Level II MPI inspector oversight under the requirements of the American Society for Nondestructive Testing (ASNT) Personnel Qualification SNT-TC-1A, Recommended Practice and Supplement Magnetic Particle Inspection.

Thoroughly clean out the agitator pipe, the tank and the strainer, and prepare the bath with Magnaglo-14AM for newly mixed bath and daily thereafter, per Magnaflux Corporation's recommended limits and procedure. Axles that need to be inspected by the magnetic particle method shall be mounted between the spindles on the Magnaflux unit.



Remove all rust, oil, dirt and paint from the axle using a suitable cleaning agent.



Visually inspect the axle for scars, pits and other surface defects. Blend and remove any surface defects on the axle, to the extent possible, by using the grinding tool before commencing with the magnetic particle inspection.

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To begin magnetizing the axle, turn the lever on the control panel to 'MAG'. Move one of the coils from the end of the axle slowly towards the center of the axle and simultaneously spray Magnaglo-14AM using the spray gun.



Repeat the above process with the other coil. Use the Ultraviolet/Black Light Filter in the absence of any ambient or artificial light, and carefully inspect the magnetized axle for cracks, seams and other discontinuities. Any crack that cuts across the magnetic field attracts the magnetic particles to form an indication and reveals defects.

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Each surface crack detected shall be blended and removed using the grinding tool. Magnetic particle inspection shall be repeated as per the Magnaflux recommended work procedure to ensure that the surface cracks detected during the magnetic particle inspection have been successfully removed during the grinding operation.

At the end of inspection the axle must be demagnetized by passing a demagnetizing current through the coils. Move each coil towards the center of the axle in 6 inch increments. Wait for the demagnetizing current reading to reach zero before moving the coil further down the axle. Using a Gauss meter, ensure that the axle has been completely demagnetized. The Gauss meter reading should be 3 gauss or less. When completed, apply an internal follower adhesive sticker on each axle end.



A Pie Gauge test must be documented and recorded at the start of every shift. The depth of setting must be performed and recorded daily. To perform the pie gauge test, magnetize the axle by turning the lever on the control panel to 'MAG'. Place the Pie Gauge on the axle with

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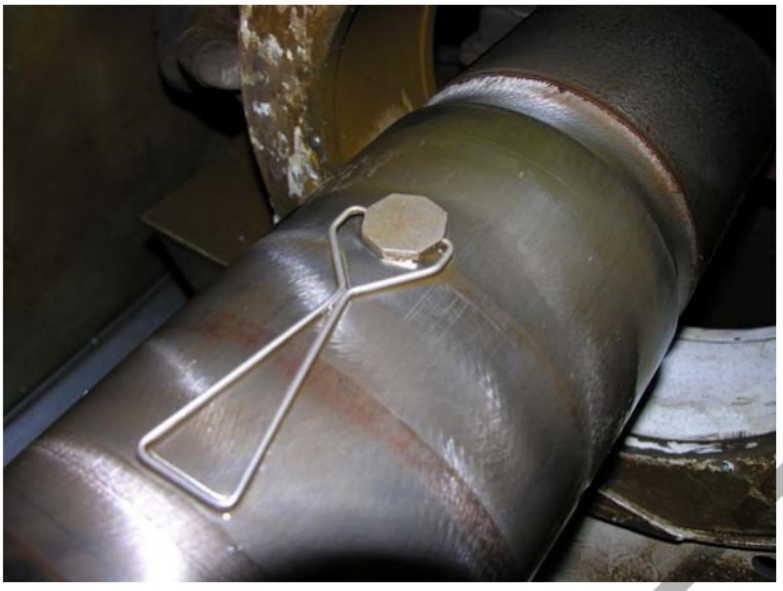
the smooth surface facing up. The pie gage must sit as flat as possible against the axle and be in full contact with the parent metal.



Move one of the coils from the end of the axle slowly towards the center of the axle and simultaneously spray Magnaglo-14AM using the spray gun. Repeat the above process with the other coil. In the absence of any ambient or artificial light, use the Ultraviolet/Black Light Filter and carefully inspect the pie gauge. The magnetic field will attract magnetic particles to the flat surface of the gauge to form a segmented pie design. This indicates that the magnetic fields are working correctly and that the axle has been fully magnetized.



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2.7 Assembly

Each wheelset shall be assembled in full compliance with the requirements of latest revision of the Association of American Railroads (AAR) Manual of Standards and Recommended

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Practices, Section G, Parts I and II, Wheel and Axle Manual. All wheel mounting presses must be equipped with a periodically calibrated dial pressure gauge and a pressure recording gauge. These gauges must be used for every mounting operation and agree within plus or minus 2 percent. The dial gauge must be recalibrated against a dead weight tester or an accurate master gauge at least once every six months of service. Documentation of the brake disc, wheel and journal bearing press tonnage charts must be retained as part of the wheelset documentation record. A wheelset inspection record shall be completed for each wheelset.

Verify that the dimensions of all wheel hub bores and axle wheel seats are suitable to achieve the necessary interference fit and resulting mounting tonnage. Prior to wheel mounting, apply an Association of American Railroads approved mounting compound using standard wheel shop practices. Wheels shall be mounted using an application tonnage of 100 to 170 tons, with a back to back reading of 53-3/16 to 53-3/8 inches, which shall be recorded by instrumentation for each wheelset produced. The use of white lead for wheelset assembly is expressly prohibited. Apply torque seal to the heads of all fasteners after torquing.

In preparation for journal bearing installation, coat the relief groove on both sides of the axle bearing seats, and an area 4 inch inboard of each bearing location, with an Engineer-approved rust preventative compound (Chromac 420, Tectyl 506 EH WD, or approved equal). Coat the entire bearing seat of the axle with either mineral or Caster oil prior to mounting. Appropriate journal bearing locking plates will be applied with at least two locking tabs secured against each end cap screw per AAR MSRP Section G-II requirements.

Upon completion of all assembly and inspection work, stamp the locking plate with the month/year and the shop code, in accordance with Association of American Railroads procedures.

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2.8 Wheel Mounting Press

Both wheels must be the same tape size, and have a tread profile in compliance with Amtrak Drawing No. 062-00106. Check for bent axle or other condemnable damage, and reject all nonconforming axles. Insure that all wheelset components and material is stored together under identical temperature conditions for a minimum of 24 hours to achieve a common internal temperature, prior to taking any interference fit measurements or performing any assembly. Measure and record all assembly interference fit measurements of the wheelset components. Machine the wheel bores sufficient to produce the required interference fit. All measurements must be documented on an Engineer-approved Wheelset Inspection Record form.

The following rules and practices apply to the Wheel Mounting Press operation. These rules outline the procedure to be followed for the mounting of wheels, brake disc, bearings, end caps, and speed sensors. Note that these procedures are only generic descriptions of the process. Refer to the Wheelset Assembly Drawings to determine the wheelset configuration and the Wheelset Tabulation Chart for tonnage requirements for each wheelset type.

Seats and bores of brake discs, roller bearings and wheels shall be cleaned using Quilsol or equal to remove rust, grit, chips and grease. Both the seat and the bore must be cleaned as necessary with an AAR and Amtrak approved mounting lubricant. Apply Castor Oil or Molykote, as required, on the bore of the brake disc and axle disc seat using a brush before commencing with pressing the disc brakes onto the axle.

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Hoist and position both brake discs onto the axle at the same time.



Place the pressing collar in between the brake disc and the hydraulic press in order to transfer the load and not damage the discs by direct loading.

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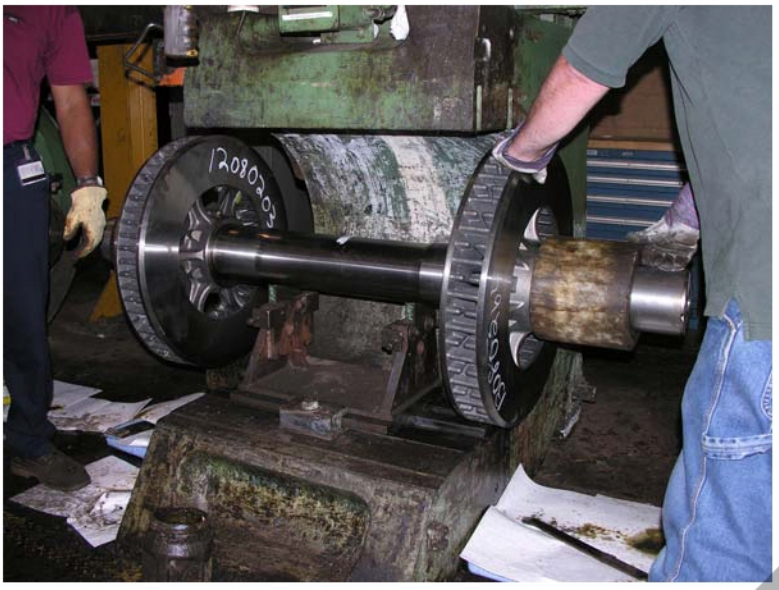

Refer to the mounting press recording procedure. Press the brake disc until the Disc Gauge reaches the center line of the axle which is marked with a white reference line.



Apply a pre-heated (to 250°F) speed sensor gear on the axle. Apply Molykote to lubricate the bore of each journal bearing and axle bearing seat before commencing with the mounting the wheels onto the axle. Refer to Rule 1.8.2.6 of the AAR Manual of Standards and Recommended Practices, Section G, Part II for more information.

2.9 Boring Mill

The following rules and practices are to be followed for boring of wheels, used in conjunction with the Association of American Railroads Manual of Standards and Recommended Practices, Section G, Part II.

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Using the outside micrometer, measure and record the wheel seat diameter of the axle associated with the wheel to be bored.



Center the wheel between the chuck to prevent eccentricity. It is necessary to align the wheel properly in position on the mill with regard to concentricity and to plane. The tread of the wheel must be clean in order to permit concentric chucking and boring. Wheels having new tread and flange contours will normally be aligned automatically with contact of the jaws. Worn wheels should be aligned from the back face of the rim by means of shims under the contact points of the jaws. Wheels that have the front face of the rim machined should be aligned by means of hard steel blocks of equal height resting on the cleaned surface of the table, and supporting the front face of the rim of the wheel. This alignment should be checked to ensure the required accuracy of the finished bore.

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Enter the wheel seat diameter measured on the axle into the CNC program if the boring machine is so equipped, to limit the bore diameter. Initiate the boring cycle.



Use an inside micrometer to measure and record the inside diameter of the wheel. The measured diameter should match the diameter that was programmed into the CNC boring machine.



Using a grinding tool, remove all sharp edges of the bore on the back hub of the wheel.



Using the Pocket Surf, check the surface finish on the wheel bore. The surface finish shall be compatible with the axle surface finish. Refer to the AAR Manual of Standards and recommended Practices, Section G, Part II for acceptable surface finish values.

Using an all-surface white marker, write the bore size and wheel series number on the wheel as shown below.



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2.10 Wheel Lathe

The following rules and practices apply to the wheel lathe operation. These procedures outline the steps to be followed for the reconditioning of wheels. They are to be used in conjunction with the OEM Recommendations and the Association of American Railroads Rules and Practices.

Inbound wheels that are marked Turn (T) for reconditioning shall be moved into the wheel lathe work area.



Remove the plastic cap from the axle centering hole on the outside of roller bearing end cap.



Using the Back-to-Back gauge, measure and record the distance between the wheels before machining.

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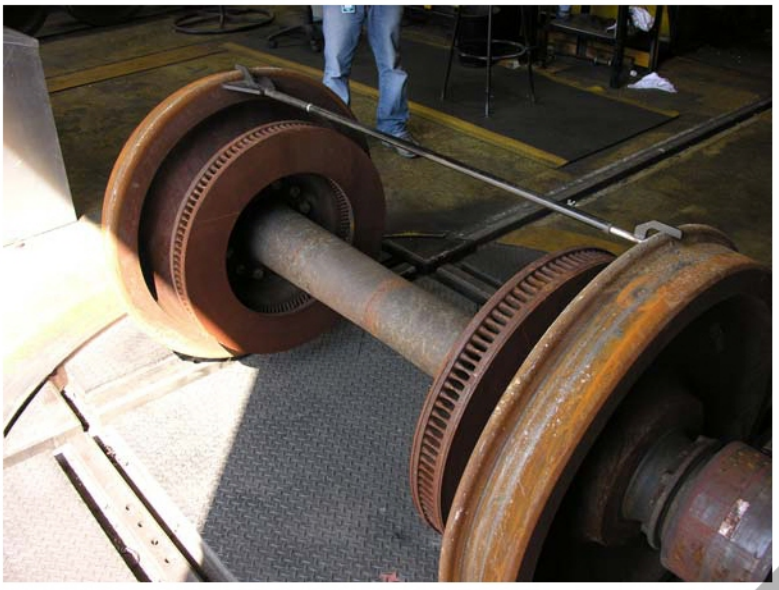

Compare the current wheel profile against the required wheel profile and determine the depth of cut. Refer to Rule 2.4 of the AAR Manual of Standards and Recommended Practices, Section G, Part II to determine the wheel defect and the necessary amount of service metal to remove to restore wheels to proper contour. All wheels must be reprofiled to the Amtrak standard per the latest revision of Amtrak drawing 062-00106.

Enter the minimum depth of cut parameter in the CNC program if the wheel lathe is so equipped. Closely monitor the machining process so as to be ready to activate the Emergency Stop button if required.



When machining is complete, measure the wheel using the steel wheel gauge at three (3) unique points. Witness groove, if present, in the flange indicates that service metal has not been wasted. The witness groove must not be more than 3/64 inch deep. Refer to Figure 4.47 of the AAR Manual of Standards and Recommended Practices, Section G, Part II.

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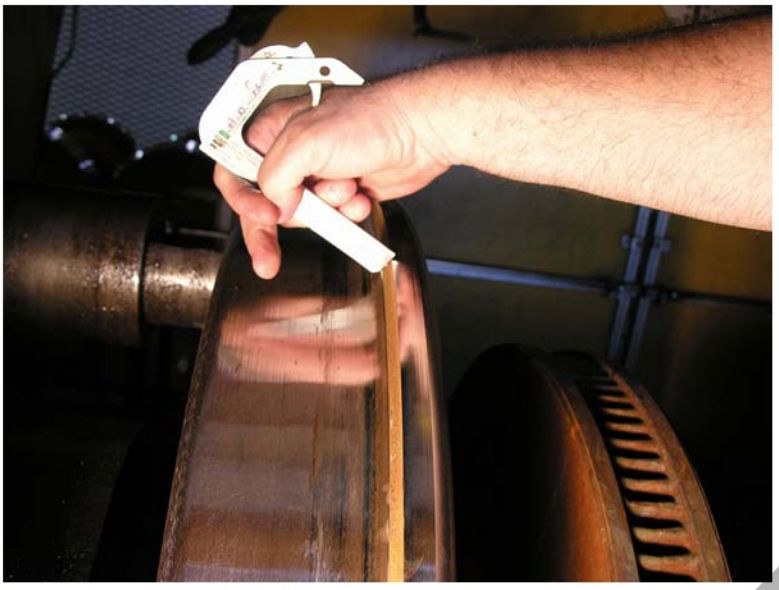
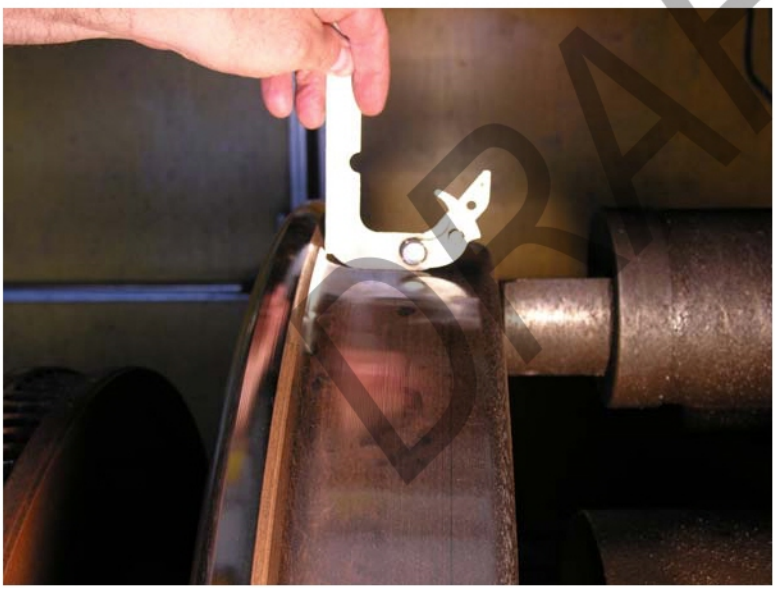


Using the steel wheel gauge, measure the height of witness groove at three (3) unique points. Refer to Figure 4.48 of AAR Manual of Standards and Recommended Practices, Section G, Part II.



Using the profile gauge, measure the profile of each retrued wheel at three (3) unique points. If there is any mismatch between the profile gauge and the profile of the wheel, the wheel shall be remachined with a new depth of cut.

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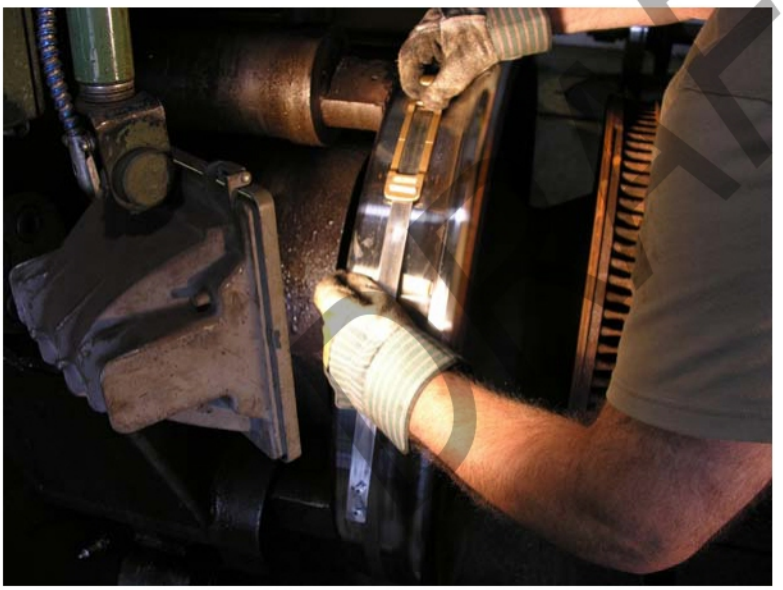
Using the wheel tape gauge, measure and record the diameter of each retrued wheel. Both wheels in a wheelset must be within 1 tape size of each other.



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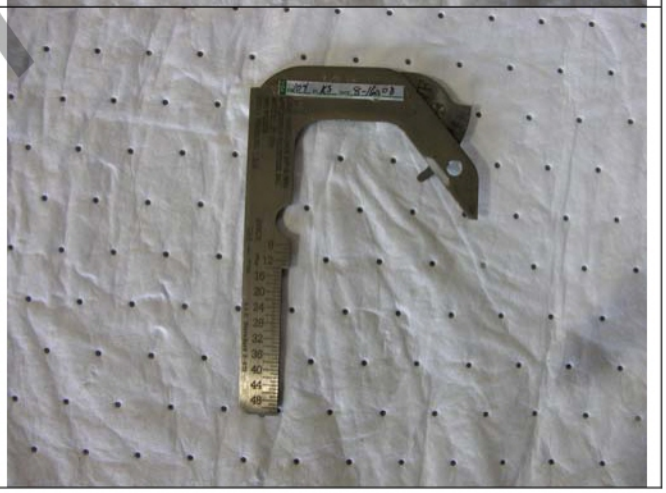
GAUGE	AAMPS NUMBER	
1 in 20 Taper – Contour Gauge	062796-25	
1 in 40 Taper – Contour Gauge	W659	
Steel wheel gauge	N/A	

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Back-to-Back Gauge	N/A	
Wheel Tape Gauge	NA	

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3.0 Packaging and Shipment

Wheelsets shall be securely attached to suitable shipping pallets or other Engineer-approved packaging. All wheelset items susceptible to corrosion during shipping or any exterior storage prior to Amtrak installation shall be protected by coating with an Engineer-approved rust preventative compound and protective wrappings. To prevent chaffing or nicking of the axle, a cushioned protective wrapping material (such as heavy duck or approved equal) shall be applied to the axle in any area where it would be contacted by lifting or shipment securement devices.

The vendor shall apply an identification label on the finished wheelset assembly. This label shall include the vendor's name and address, purchase order number, date released for shipment, and the Amtrak "AAMPS" (internal catalog) number for the wheelset. This information shall also appear in the vendor's invoice, and be included in the vendor's documentation record.

The vendor shall retain a copy for 5 years of the Wheelset Inspection Record and the shipping documentation, and shall make three copies for Amtrak. One copy shall be included with the wheelset shipment, one copy shall be sent to the Amtrak Procurement officer (or as otherwise designated in the purchase order), and the third copy shall be mailed to the attention of the

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Amtrak Quality Assurance inspector in care of the Amtrak "ship to" address.

4.0 Product Support

4.1 Program Schedule

If required by the contract documents, any vendor-produced Program Schedule shall include all program milestones, design reviews, production schedule, delivery schedule, and any other pertinent information that will assist with tracking program progress. Any requested changes to the Program Schedule must be presented to the Amtrak Procurement officer for review and approval.

4.2 First Article Inspection

To verify that the wheelsets being supplied under this Specification meets all Specification and drawing requirements, Amtrak will conduct a First Article Inspection (FAI) on the first complete inside bearing and outside bearing type of wheelset produced by the vendor, prior to allowing unrestricted manufacturing work to start. Each FAI shall follow the complete wheelset manufacturing process, from inbound inspection to the final assembly. Each FAI shall have Amtrak Engineering and Quality Assurance personnel as well as the vendor in attendance. Approval by the Engineer following successful completion of the FAI process, as communicated through the Amtrak Procurement officer, shall constitute final system approval.

4.3 Production Changes Require Engineer Approval

Once final system approval is granted by the Engineer and production has commenced, the vendor is forbidden to make any changes in the wheelset manufacturing or assembly process, unless approved in writing by the Amtrak Procurement officer as per Amtrak Procedure PD 3.7.3.01, Design Review and Control Procedure. This shall include any modifications required as a result of warranty actions, so as to provide complete documentation.

4.4 Failure Analysis

A Failure Analysis to determine the cause of any wheelset defect occurring during the warranty shall be performed by the vendor and submitted to the Engineer and the Amtrak Procurement officer for concurrence. Such analysis shall be performed and reported within 30 days from the date of each failure.

5.0 Source Inspection

5.1 Purpose

Amtrak will perform periodic source inspection of vendor materials and components being supplied. The following is intended to be used as an outline defining activities and responsibilities of the vendor performing the source inspections.

5.2 Professionalism

All inspections, test observations, and other activities performed in the fulfillment of the contract

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are to be conducted in a professional and ethical manner. The vendor is representing Amtrak in the performance of the contract and therefore must remain courteous, conscientious and professional under all circumstances arising from performance of the contract.

5.3 Scope of Work

Amtrak has implemented a multi-faceted supplier management program of which source inspection is an integral part. Amtrak identifies vendors and materials/components through various methods which will be subject to source inspection. By performing source inspections, Amtrak expects to benefit by use of vendor facilities, measuring and testing equipment to verify materials/components, through rejecting noncompliant materials/components before shipment and receipt by Amtrak, presence of Amtrak representative periodically to ensure continuing good performance, and assist to communicate Amtrak intentions and interpretations of specifications and resolve issues. The vendor will conduct inspection or verify through observation, product compliance with drawings, specifications, standards or Amtrak contract documents and report findings of said inspections to Amtrak.

5.4 Services

5.4.1 Scheduling Inspections

The vendor shall conduct observations and verifications on Amtrak identified materials and components produced by the vendors for Amtrak. Inspections must be scheduled to coincide with final inspection of said materials/components due for shipment to Amtrak. The vendor may use random sampling where large quantities of material are subject to shipment and note sampling method in associated reports. The vendor must perform all dimensional and operational inspections in accordance with the Quality Plan prior to source inspection, and make all inspection records available for review by the Amtrak source inspector, with focus on CTQ items.

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5.4.2 Dimensional Inspection

The vendor must witness and verify conformance with dimensional characteristics per drawings identified in the Amtrak contract documents. The vendor must witness and verify conformance with regulatory standards and requirements including material certification as cited in specification or other reference documents identified in Amtrak contract documents.

5.4.3 Operational Inspection

The vendor must witness and verify conformance with operational tests as cited in specifications, operators manual or other reference documents identified in Amtrak contract documents.

5.4.4 Inspection Reports

The vendor must provide a report documenting the vendor source inspection and the inspection results. The report must include the name of the vendor, the date of the inspection, the material or component name, Amtrak (AAMPS) ID number(s) for items inspected, the quantities of each item inspected, the inspection results, and the actions taken where nonconforming materials/components are found. Reports should reference appropriate drawings, specifications, standards, requirements, or Amtrak contract document as appropriate.

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5.5 Qualification of Personnel

It is the responsibility of the vendor to provide personnel with adequate training and experience to perform all the activities of the source inspections described above. Personnel must also conduct their activities with professionalism.

6.0 Warranty

Warranty shall be provided as per the terms of the Amtrak Procurement documents.

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Appendix A

Amtrak Drawings for Passenger Car Wheelset Assemblies

Listed within Appendix A are the following assembly drawings

- Axle Tabulation drawings
  - Amfleet (Amtrak Drawing No. A-62-00502, Wilmington Reference Drawing C-62-0014)
  - F40PH/GP40 (Amtrak Drawing No. A-62-0064)
  - BTR (Amtrak Drawing No. A-62-0053)
  - Road Railer/Freight (Amtrak Drawing No. A-62-0077)
  - Freight (Amtrak Drawing No. A-62-0056)

- Amfleet Wheel and Axle Assembly Tabulation Display (Amtrak Drawing No. C-62-0050, Wilmington Reference Drawing C-20-1165)

- Amfleet Axle, Wheel & Bearing Assembly (Amtrak Drawing No. C-20-1165)

- 9115 Axle, Wheel, and Journal Bearing Tabulation Display (Amtrak Drawing No. C-62-0059, Wilmington Reference Drawing C-62-0069)

- 9115 Axle, Wheel, and Bearing Assembly (Amtrak Drawing No. C-62-0069)

- 9123 Axle, Wheel, and Journal Bearing Tabulation Display (Amtrak Drawing No. #C-62-0059, Wilmington Reference Drawing C-62-0068)

- 9123 Axle, Wheel, and Bearing Tabulation Assembly (Amtrak Drawing No. C-62-0068)

- 9183 Axle, Wheel, and Journal Bearing Tabulation Display (Amtrak Drawing No. C-62-0060, Wilmington Reference Drawing C-62-0072)

- 9183 Axle, Wheel, & Bearing Tabulation Assembly (Amtrak Drawing No. C-62-0072)

- Viewliner/Horizon Wheel, Axle, and Journal Bearing Assembly Tabulation Display (Amtrak Drawing No. C-62-0062, Wilmington Reference Drawing C-62-0067)

- Viewliner/Horizon Axle, Wheel, and Bearing Assembly (Amtrak Drawing No. C-62-0067)

- Superliner/Capitoliner Axle, Wheel, & Journal Bearing Tabulation Display (Amtrak Drawing No. C-62-0061, Wilmington Reference Drawing C-62-0070)

- Superliner/Capitoliner Axle, Wheel, and Bearing Tabulation Assembly (Amtrak Drawing No. C-62-0070)

- Wheel Tread Profile (Amtrak Drawing No. D-062-00106)

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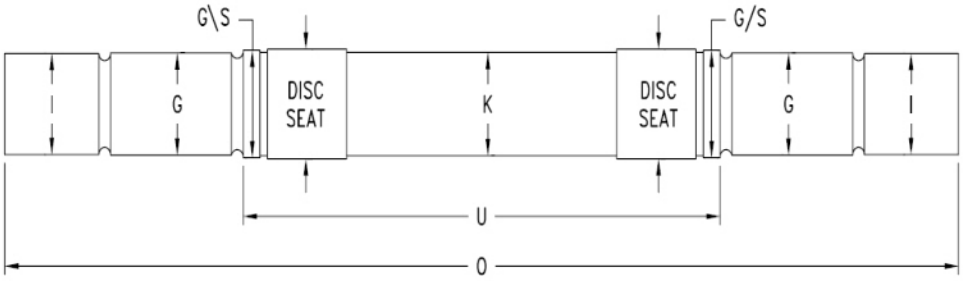

AMFLEET AXLE TABULATION DISPLAY

(PASSENGER CAR)

———	DESCRIPTION	NEW DIMENSIONS	SHOP LIMITS
I	WHEEL SEAT DIAMETER STANDARD	6.135 6.125	5.875
I	WHEEL SEAT DIAMETER OVERSIZED	6.151 6.163	5.875
G	JOURNAL BEARING DIAMETER	6.1915 6.1905	———
G/S	GEAR SEAT DIAMETER	6.502 6.500	———
DISC SEAT	DISC SEAT	6.6260 6.6240	———
K	AXLE BODY DIAMETER	6.25 $^{+0.015}_{-0.015}$	———
U	JOURNAL FILLET TO FILLET	35.50 $^{+0.015}_{-0.015}$	———
O	AXLE LENGTH	71.00 $^{+0.032}_{-0.046}$	———

WHEEL ASSEMBLY COMPONENTS

DESCRIPTION	AMM'S NUMBER
AXLE STANDARD	29-454-00504
AXLE OVERSIZED	29-015-01514
WHEEL	29-454-02307
GEAR	22-946-03518
JOURNAL BEARING	29-879-01657

MECHANICAL SERVICES

Amtrak N.E.C.

National Railroad Passenger Corporation
4001 Vandever Avenue, Wilmington Delaware, 19802

TITLE: AMFLEET AXLE TABULATION DISPLAY

DRAWING NUMBER	REV.	WILMINGTON REFERENCE DRAWING
A 62-00502		C 62-0014

DRAWN	Approved	DATE	SHT. 2 OF 2
SPS		1/14/98	

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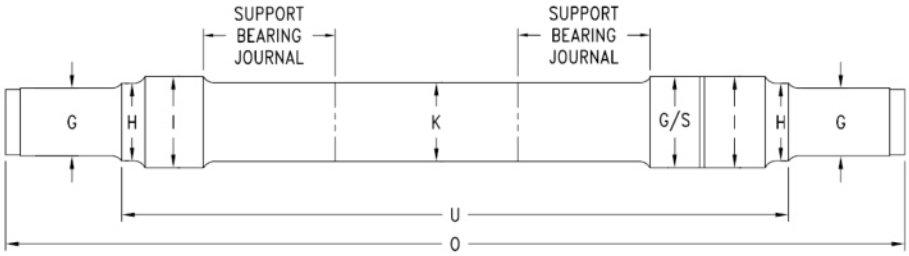

F40PH/GP40 AXLE TABULATION DISPLAY

(6 7/8, CLASS GG)

WILMINGTON REFERENCE DWG. # B 04-0044			
———	DESCRIPTION	NEW DIMENSIONS	SHOP LIMITS
G	JOURNAL BEARING DIAMETER	6.8792 6.8777	———
H	DUST GUARD DIAMETER	7.875 7.870	7.869
I	WHEEL SEAT DIAMETER STANDARD	9.230±.001	9.125 MIN
K	JOURNAL DIAMETER (SUPPORT BRG.)	$8.000^{+.002}_{-.004}$ (12.5 LG)	———
2	JOURNAL DIAMETER (AFTER FIRST TURN)	———	7.969 7.954
	JOURNAL DIAMETER (AFTER SECOND TURN)	———	7.938 7.923
G/S	GEAR SEAT DIAMETER	$9.250^{+.001}_{-.000}$	———
U	JOURNAL FILLET TO FILLET	$67.50^{+.010}_{-.010}$	———
O	AXLE LENGTH	$91.00^{+.003}_{-.003}$	90 15/16

NOTE: 1. MAXIMUM JOURNAL "BENT CONDITION": .010
2 REFERENCE AMTRAK'S STANDARD MAINTENANCE PROCEDURE #49408 & EMD MAINTENANCE INSTRUCTION #1518 FOR SUPPORT BEARING FINISH.

WHEEL ASSEMBLY COMPONENTS

DESCRIPTION	AMM'S NUMBER
AXLE STANDARD	29-523-01301
WHEEL- 40" CLASS B	29-412-01508
GEAR (57T)	26-520-11775
SUPPORT BEARING (S/N)	19-522-01672
SUPPORT BEARING (1st)	23-523-00778
SUPPORT BEARING (2nd)	23-523-00786
JOURNAL BEARING (6 7/8 x 12)	29-879-01658

THESE DRAWINGS ARE FOR AMTRAK'S WHEEL SHOP QUALITY ASSURANCE PURPOSES AND ARE NOT TO BE USED AS ENGINEERING DRAWINGS.

MECHANICAL SERVICES
Amtrak N.E.C.
National Railroad Passenger Corporation
4001 Vandever Avenue, Wilmington Delaware, 19802

TITLE F40PH/GP40 AXLE TABULATION DISPLAY (6 7/8, CLASS GG)

DRAWING NUMBER A 62-0064 REV.

DRAWN SPS | Approved JWP For Issue | DATE 3/31/98 | SHT 2 OF 3

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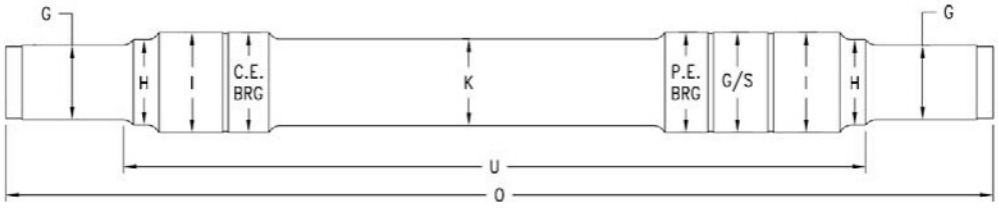

BTR AXLE TABULATION DISPLAY

(6 7/8 CLASS GG F40-PH LOCOMOTIVE)

WILMINGTON REFERENCE DWG. # C 62-0039			
———	DESCRIPTION	NEW DIMENSIONS	SHOP LIMITS
G	JOURNAL BEARING DIAMETER	6.879 $^{+0.0002}_{-0.0013}$	———
H	DUST GUARD DIAMETER	7.875 $^{+0.000}_{-0.005}$	7.869
I	WHEEL SEAT DIAMETER	9.230 $^{+0.001}_{-0.001}$	9.105
C.E. BRG.	COMMUTATOR END SUPPORT BEARING DIA.	9.251 $^{+0.001}_{-0.000}$	———
K	AXLE BODY DIAMETER	8.00	———
P.E. BRG.	PINION END SUPPORT BEARING DIA.	9.270 $^{+0.001}_{-0.000}$	———
G/S	GEAR SEAT DIAMETER	9.250 $^{+0.0015}_{-0.0000}$	———
U	JOURNAL FILLET TO FILLET	67.500 $^{+0.010}_{-0.010}$	———
O	AXLE LENGTH	91.00 $^{+0.03}_{-0.03}$	———

NOTE: MAXIMUM JOURNAL "BENT CONDITION": .010

WHEEL ASSEMBLY COMPONENTS

DESCRIPTION	AMM'S NUMBER
AXLE	26-521-51049
WHEEL-40" CLASS B	29-412-01508
GEAR (57 T)	29-523-01512
GEAR (56 T)	???
BEARING ASS'Y (C.E.)	26-521-51161
BEARING ASS'Y (P.E.)	26-521-51030
JOURNAL BEARING	29-879-01658

THESE DRAWINGS ARE FOR AMTRAK'S WHEEL SHOP QUALITY ASSURANCE PURPOSES AND ARE NOT TO BE USED AS ENGINEERING DRAWINGS.

MECHANICAL SERVICES

Amtrak N.E.C.

National Railroad Passenger Corporation
4001 Vandever Avenue, Wilmington Delaware, 19802

TITLE: BTR AXLE TABULATION DISPLAY (6 7/8, CLASS GG)

DRAWING NUMBER: A 62-0053 REV.

DRAWN: SPS | Approved: JMP | DATE: 3/14/98 | SHT 3 OF 3

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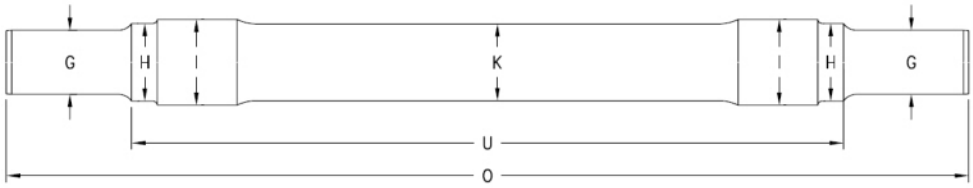

ROAD RAILERS/FREIGHT AXLE TABULATION DISPLAY

(6 x 11, CLASS E)

WILMINGTON REFERENCE DWG:		AAR MANUAL OF STANDARDS SECTION G PART 2 FIG. 4.3	
———	DESCRIPTION	NEW DIMENSIONS	SHOP LIMITS
G	JOURNAL BEARING DIAMETER	5.6915 5.6905	———
H	DUST GUARD DIAMETER	7.032 7.030	7.026
I	WHEEL SEAT DIAMETER STANDARD	8.25±.015	7.875 MIN
K	AXLE BODY DIAMETER	6.440	6.310 MIN
U	JOURNAL FILLET TO FILLET	66 1/8±1/16	66.00
O	AXLE LENGTH	88±1/16	87.94

NOTE: MAXIMUM JOURNAL "BENT CONDITION": .010

WHEEL ASSEMBLY COMPONENTS

DESCRIPTION	AMM'S NUMBER
AXLE STANDARD	29-441-01502
WHEEL 33 CLASS A (USED ON ROAD RAILERS)	29-345-31269
WHEEL CJ-36 CLASS B (USED ON FREIGHT 6")	29-865-36619

THESE DRAWINGS ARE FOR AMTRAK'S WHEEL SHOP QUALITY ASSURANCE PURPOSES AND ARE NOT TO BE USED AS ENGINEERING DRAWINGS.

MECHANICAL SERVICES
Amtrak N.E.C.
National Railroad Passenger Corporation
4001 Vandever Avenue, Wilmington Delaware, 19802

TITLE	ROAD RAILERS/FREIGHT 6" AXLE TABULATION DISPLAY (6 x 11, CLASS E)	
DRAWING NUMBER	A 62 – 0077	REV.
DRAWN: SPS	Approved: JWP For Value	DATE: 3/18/98
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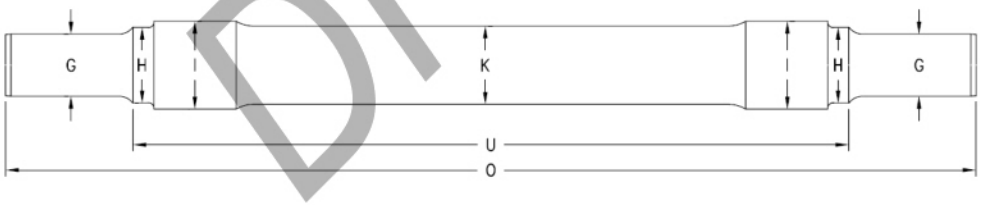


FREIGHT AXLE TABULATION DISPLAY

(6 1/2 x 12, CLASS F)

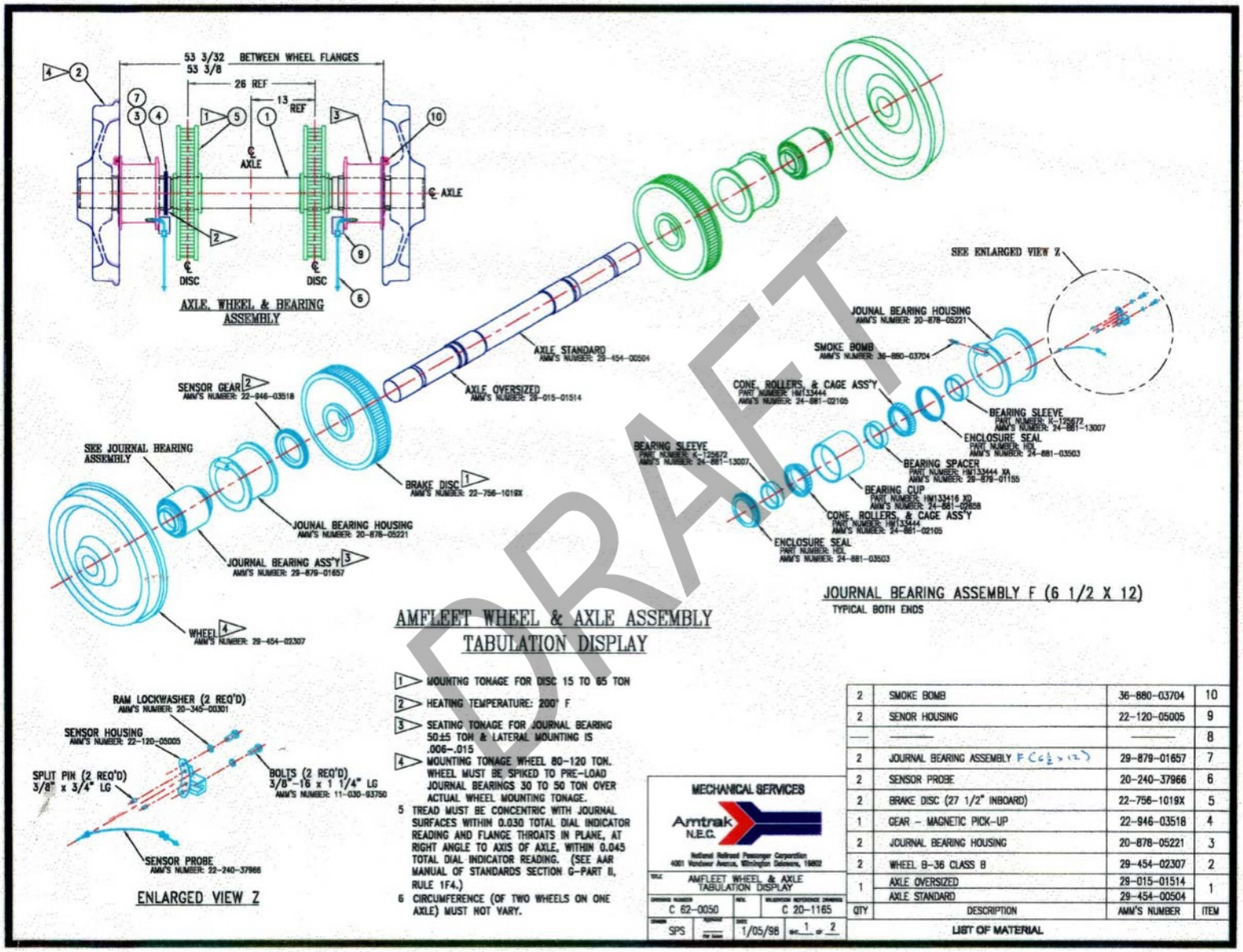
WILMINGTON REFERENCE DWG:		AAR MANUAL OF STANDARDS SECTION G-PART 2 FIG. 4.3	
———	DESCRIPTION	NEW DIMENSIONS	SHOP LIMITS
G	JOURNAL BEARING DIAMETER	6.1915 6.1905	———
H	DUST GUARD DIAMETER	7.532 7.530	7.529
I	WHEEL SEAT DIAMETER STANDARD	8.750±.015	7 7/8
K	AXLE BODY DIAMETER	7 3/8	6 3/4
U	JOURNAL FILLET TO FILLET	66 1/8±1/16	66 MIN
O	AXLE LENGTH	89 5/8±1/16	———

WHEEL ASSEMBLY COMPONENTS

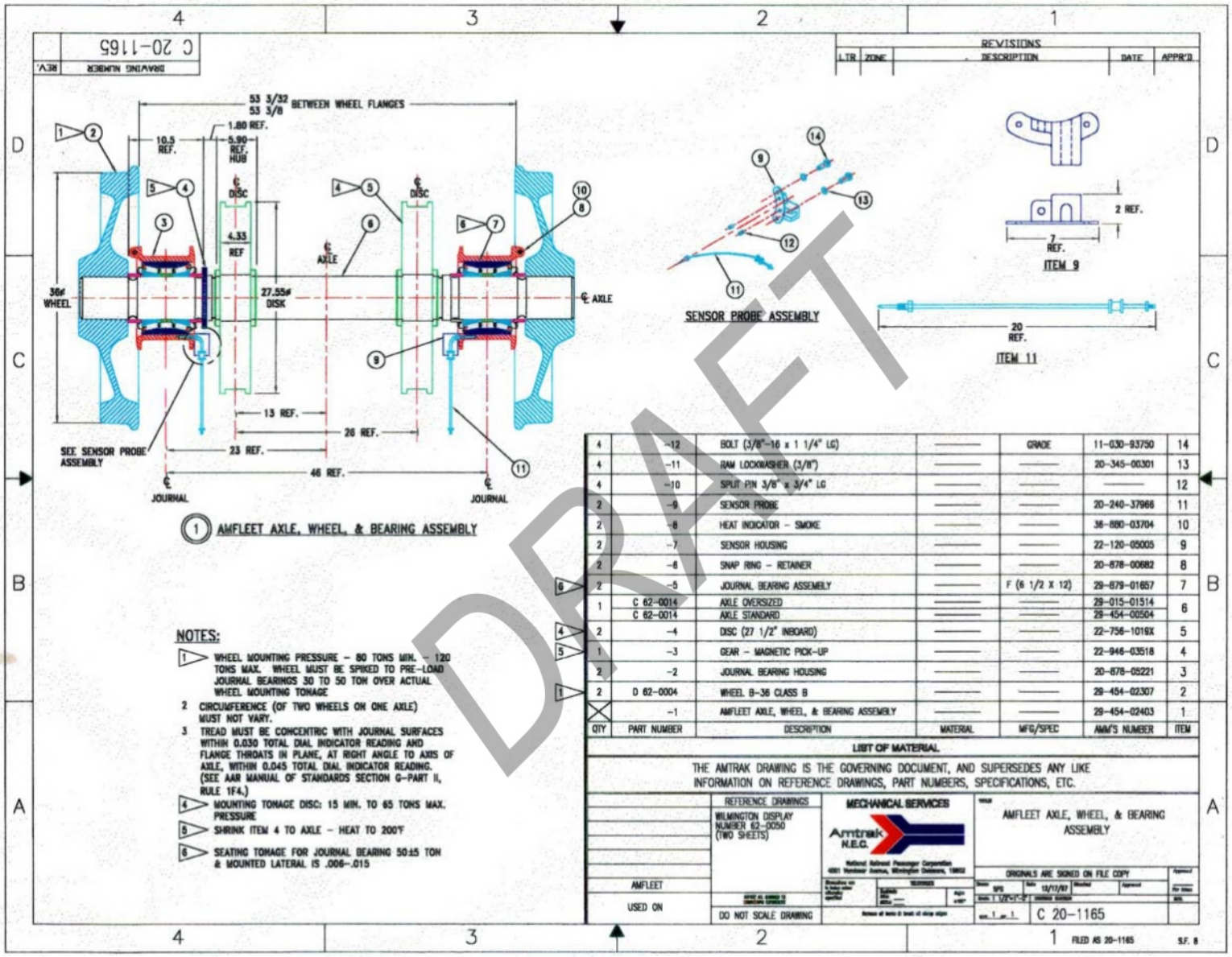
DESCRIPTION	AMM'S NUMBER
AXLE STANDARD	
WHEEL CJ-36 CLASS B	
JOURNAL BEARING	

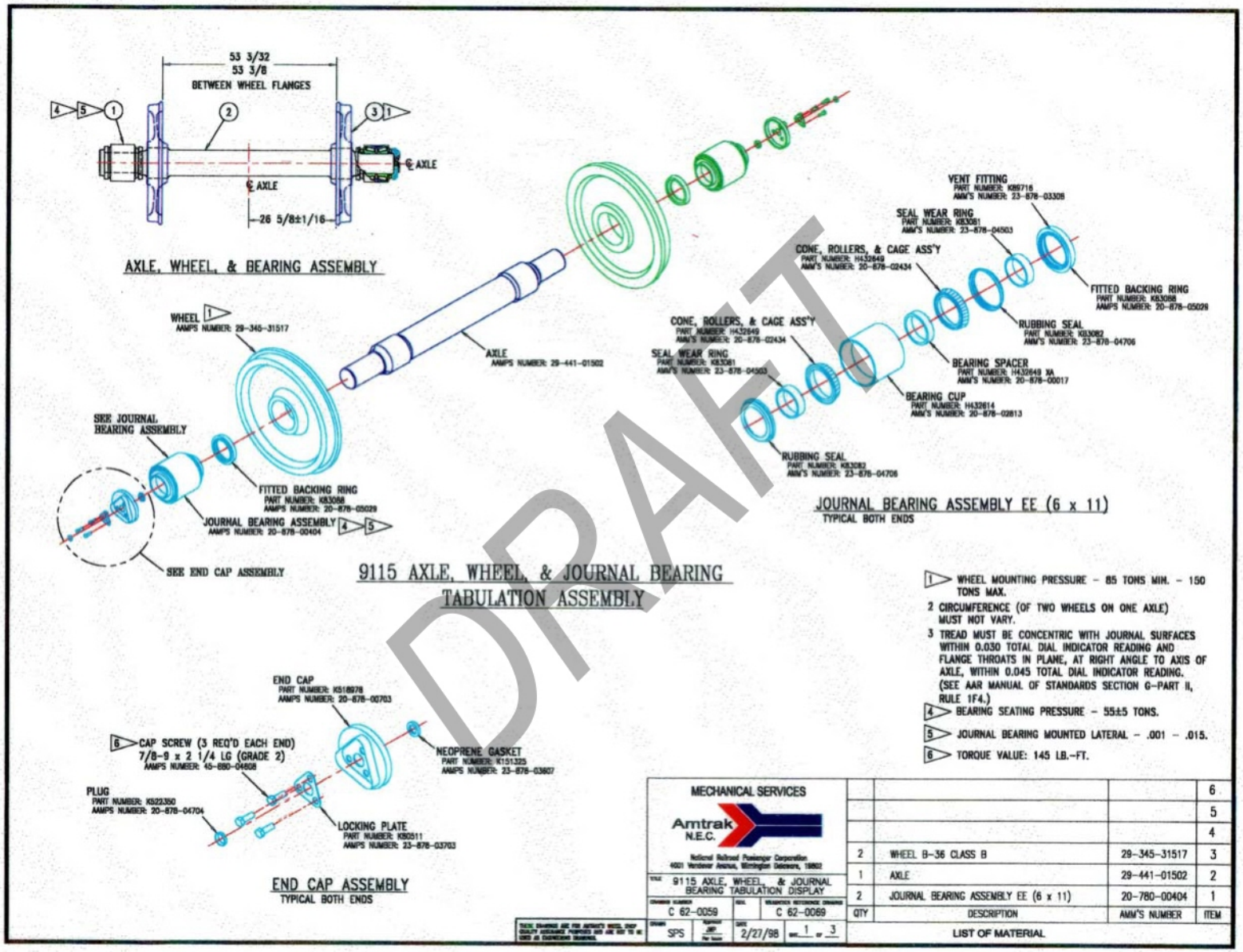
MECHANICAL SERVICES
Amtrak N.E.C.
National Railroad Passenger Corporation
4001 Vandever Avenue, Wilmington Delaware, 19802

TITLE	FREIGHT AXLE TABULATION DISPLAY (6 1/2 x 12, CLASS F)	
DRAWING NUMBER: A 62-0056	REV.	WILMINGTON REFERENCE DRAWING: AS NOTED
DRAWN: SPS	Approved: ——— For Value	DATE: 2/4/98
SHT. 2 OF 2		

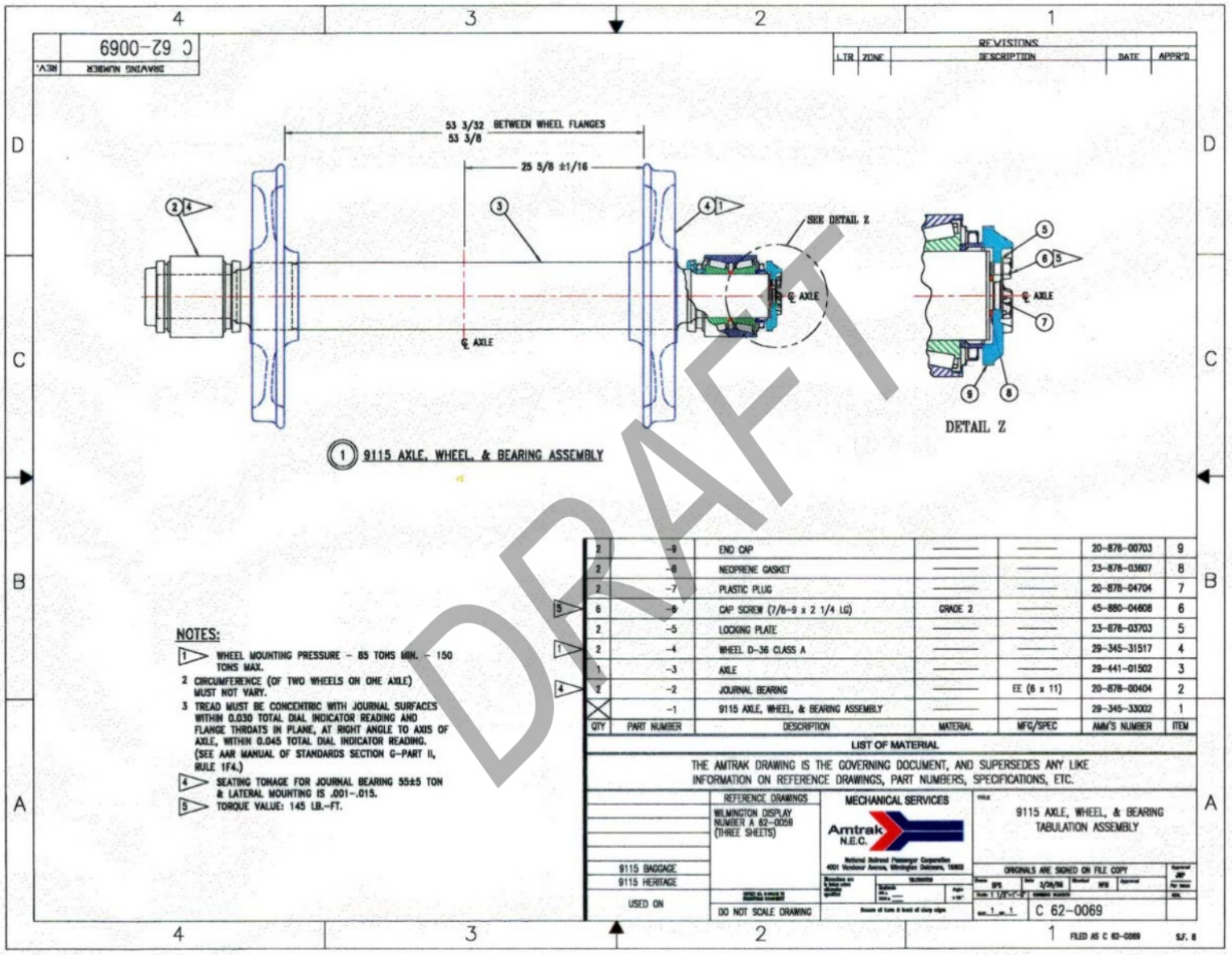

53 3/32 BETWEEN WHEEL FLANGES
53 3/8
26 REF
13 REF
℄ AXLE
℄ DISC
AXLE, WHEEL & BEARING ASSEMBLY
AXLE STANDARD
AXLE OVERSIZED
SENSOR GEAR
BRAKE DISC
SEE JOURNAL BEARING ASSEMBLY
JOURNAL BEARING HOUSING
JOURNAL BEARING ASS'Y
WHEEL
SEE ENLARGED VIEW Z
SMOKE BOMB
CONE, ROLLERS, & CAGE ASS'Y
BEARING SLEEVE
ENCLOSURE SEAL
BEARING SPACER
BEARING CUP
JOURNAL BEARING ASSEMBLY F (6 1/2 X 12)
TYPICAL BOTH ENDS
AMFLEET WHEEL & AXLE ASSEMBLY TABULATION DISPLAY
1 MOUNTING TONAGE FOR DISC 15 TO 65 TON
2 HEATING TEMPERATURE: 200° F
3 SEATING TONAGE FOR JOURNAL BEARING 50±5 TON & LATERAL MOUNTING IS .006-.015
4 MOUNTING TONAGE WHEEL 80-120 TON. WHEEL MUST BE SPIKED TO PRE-LOAD JOURNAL BEARINGS 30 TO 50 TON OVER ACTUAL WHEEL MOUNTING TONAGE.
5 TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
6 CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
RAM LOCKWASHER (2 REQ'D)
SENSOR HOUSING
SPLIT PIN (2 REQ'D) 3/8" x 3/4" LG
BOLTS (2 REQ'D) 3/8"-16 x 1 1/4" LG
SENSOR PROBE
ENLARGED VIEW Z
MECHANICAL SERVICES
Amtrak N.E.C.
AMFLEET WHEEL & AXLE TABULATION DISPLAY
C 62-0050
C 20-1165
SPS
1/05/98
SHT. 1 OF 2
2 SMOKE BOMB 36-880-03704 10
2 SENOR HOUSING 22-120-05005 9
— — — 8
2 JOURNAL BEARING ASSEMBLY F (6½ x 12) 29-879-01657 7
2 SENSOR PROBE 20-240-37966 6
2 BRAKE DISC (27 1/2" INBOARD) 22-756-1019X 5
1 GEAR - MAGNETIC PICK-UP 22-946-03518 4
2 JOURNAL BEARING HOUSING 20-878-05221 3
2 WHEEL B-36 CLASS B 29-454-02307 2
1 AXLE OVERSIZED 29-015-01514 1
AXLE STANDARD 29-454-00504
QTY DESCRIPTION AMM'S NUMBER ITEM
LIST OF MATERIAL

DRAFT

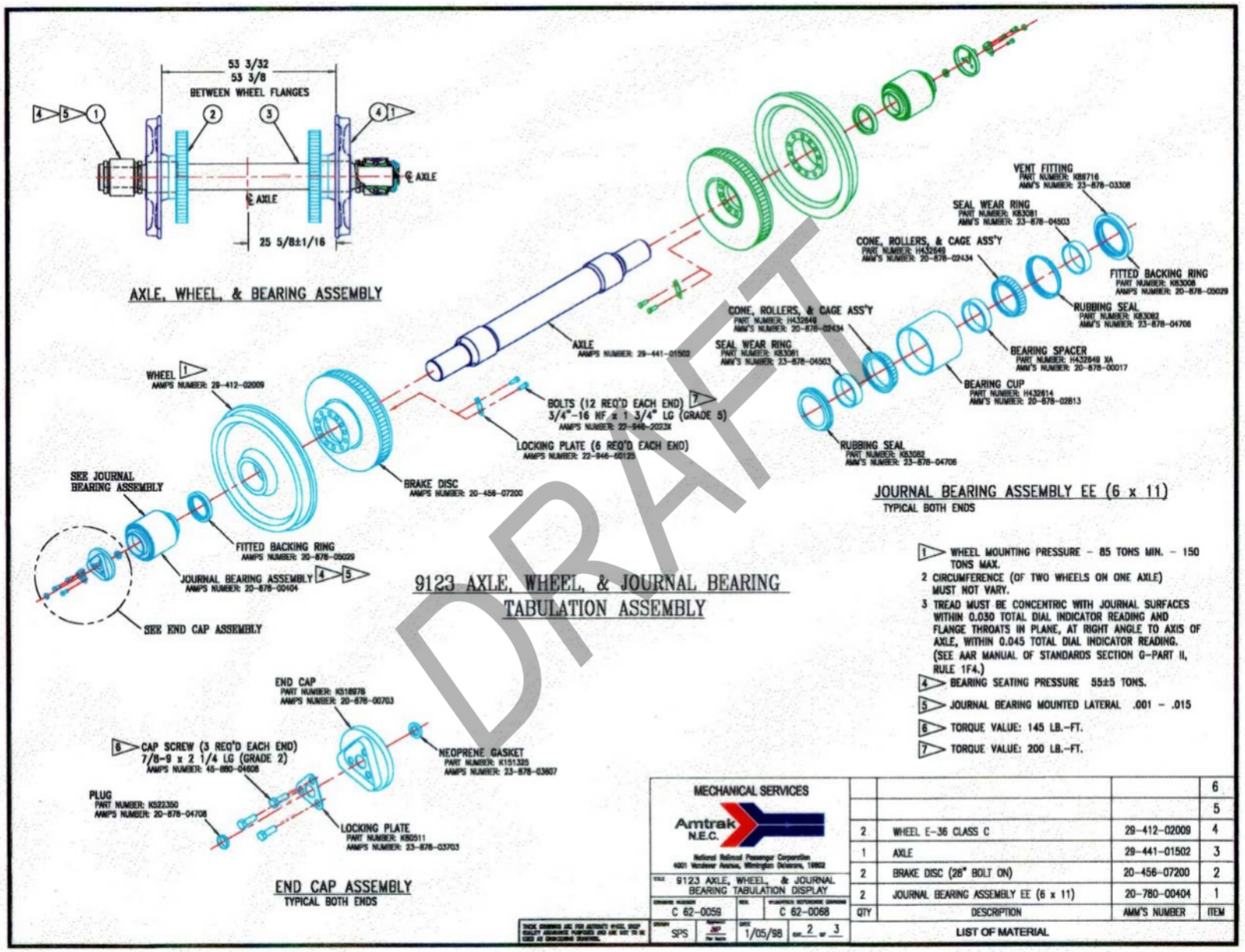

C 20-1165
DRAWING NUMBER
REV.
REVISIONS
LTR ZONE DESCRIPTION DATE APPR'D
53 3/32
53 3/8 BETWEEN WHEEL FLANGES
1.88 REF.
10.5 REF.
5.90 REF. HUB
4.33 REF
36ø WHEEL
27.55ø DISK
℄ AXLE
13 REF.
20 REF.
23 REF.
46 REF.
SEE SENSOR PROBE ASSEMBLY
JOURNAL
JOURNAL
SENSOR PROBE ASSEMBLY
2 REF.
7 REF.
ITEM 9
20 REF.
ITEM 11
1 AMFLEET AXLE, WHEEL, & BEARING ASSEMBLY
NOTES:
1 WHEEL MOUNTING PRESSURE - 80 TONS MIN. - 120 TONS MAX. WHEEL MUST BE SPIKED TO PRE-LOAD JOURNAL BEARINGS 30 TO 50 TON OVER ACTUAL WHEEL MOUNTING TONAGE
2 CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
3 TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
4 MOUNTING TONAGE DISC: 15 MIN. TO 65 TONS MAX. PRESSURE
5 SHRINK ITEM 4 TO AXLE - HEAT TO 200°F
6 SEATING TONAGE FOR JOURNAL BEARING 50±5 TON & MOUNTED LATERAL IS .006-.015
4 -12 BOLT (3/8"-16 x 1 1/4" LG) GRADE 11-030-93750 14
4 -11 RAM LOCKWASHER (3/8") 20-345-00301 13
4 -10 SPLIT PIN 3/8" x 3/4" LG 12
2 -9 SENSOR PROBE 20-240-37966 11
2 -8 HEAT INDICATOR - SMOKE 36-880-03704 10
2 -7 SENSOR HOUSING 22-120-05005 9
2 -6 SNAP RING - RETAINER 20-878-00682 8
6 2 -5 JOURNAL BEARING ASSEMBLY F (6 1/2 X 12) 29-879-01657 7
1 C 62-0014 AXLE OVERSIZED 29-015-01514 6
C 62-0014 AXLE STANDARD 29-454-00504
4 2 -4 DISC (27 1/2" INBOARD) 22-756-1019X 5
5 1 -3 GEAR - MAGNETIC PICK-UP 22-946-03518 4
2 -2 JOURNAL BEARING HOUSING 20-878-05221 3
1 2 D 62-0004 WHEEL B-36 CLASS B 29-454-02307 2
-1 AMFLEET AXLE, WHEEL, & BEARING ASSEMBLY 29-454-02403 1
QTY PART NUMBER DESCRIPTION MATERIAL MFG/SPEC AAR'S NUMBER ITEM
LIST OF MATERIAL
THE AMTRAK DRAWING IS THE GOVERNING DOCUMENT, AND SUPERSEDES ANY LIKE INFORMATION ON REFERENCE DRAWINGS, PART NUMBERS, SPECIFICATIONS, ETC.
REFERENCE DRAWINGS
WILMINGTON DISPLAY NUMBER 62-0050 (TWO SHEETS)
AMFLEET
USED ON
DO NOT SCALE DRAWING
MECHANICAL SERVICES
Amtrak N.E.C.
AMFLEET AXLE, WHEEL, & BEARING ASSEMBLY
ORIGINALS ARE SIGNED ON FILE COPY
C 20-1165
FILED AS 20-1165
DRAFT

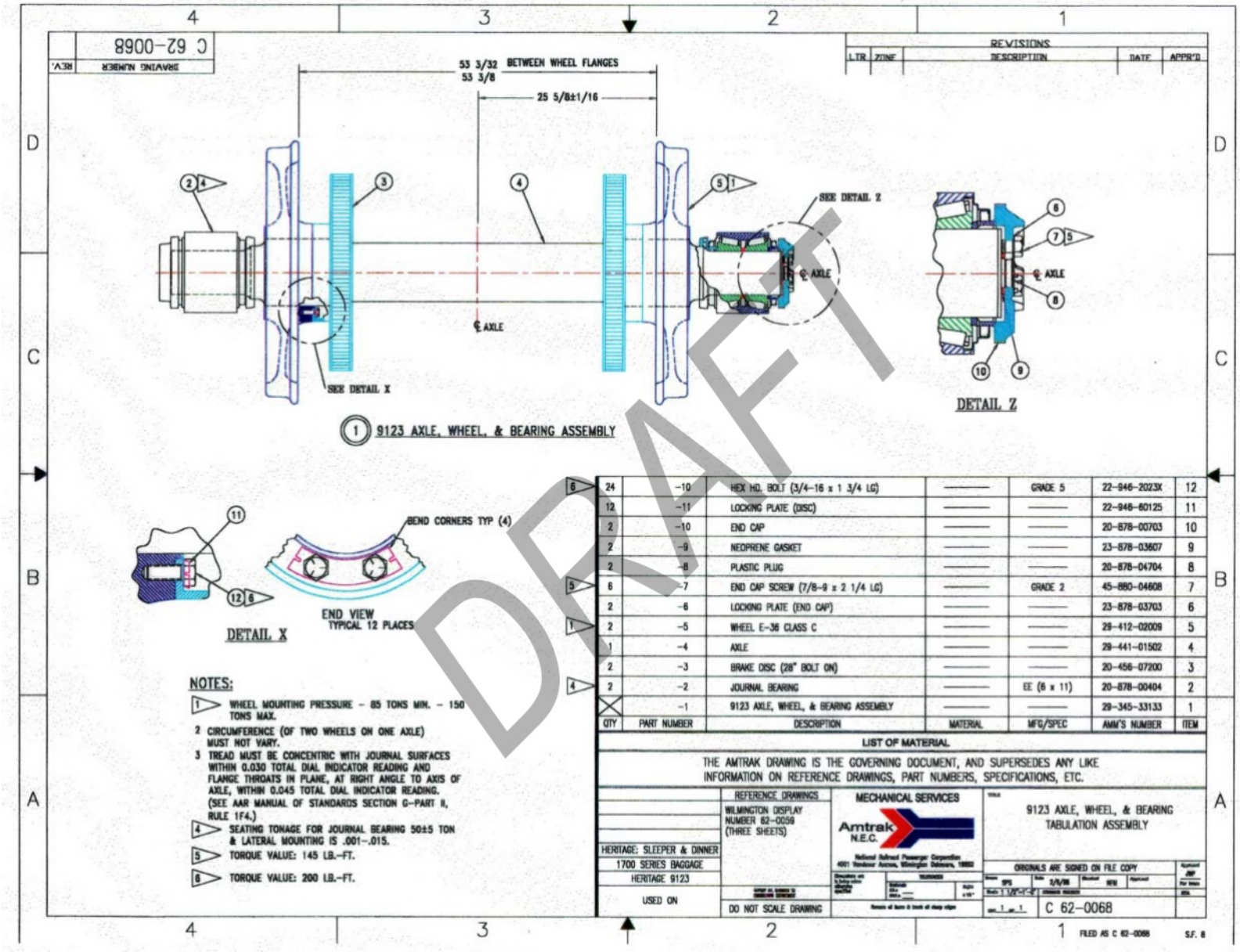

53 3/32
53 3/8
BETWEEN WHEEL FLANGES
℄ AXLE
℄ AXLE
26 5/8±1/16
AXLE, WHEEL, & BEARING ASSEMBLY
WHEEL 1
AMMS NUMBER: 29-345-31517
AXLE
AMMS NUMBER: 29-441-01502
SEE JOURNAL BEARING ASSEMBLY
FITTED BACKING RING
PART NUMBER: K83088
AMMS NUMBER: 20-878-05029
JOURNAL BEARING ASSEMBLY 4 5
AMMS NUMBER: 20-878-00404
SEE END CAP ASSEMBLY
VENT FITTING
PART NUMBER: K85716
AMM'S NUMBER: 23-878-03306
SEAL WEAR RING
PART NUMBER: K83081
AMM'S NUMBER: 23-878-04503
CONE, ROLLERS, & CAGE ASS'Y
PART NUMBER: HA32649
AMM'S NUMBER: 20-878-02434
FITTED BACKING RING
PART NUMBER: K83088
AMMS NUMBER: 20-878-05029
RUBBING SEAL
PART NUMBER: K83082
AMM'S NUMBER: 23-878-04706
CONE, ROLLERS, & CAGE ASS'Y
PART NUMBER: HA32649
AMM'S NUMBER: 20-878-02434
SEAL WEAR RING
PART NUMBER: K83081
AMM'S NUMBER: 23-878-04503
BEARING SPACER
PART NUMBER: HA32649 XA
AMM'S NUMBER: 20-878-00017
BEARING CUP
PART NUMBER: HA32614
AMM'S NUMBER: 20-878-02813
RUBBING SEAL
PART NUMBER: K83082
AMM'S NUMBER: 23-878-04706
JOURNAL BEARING ASSEMBLY EE (6 x 11)
TYPICAL BOTH ENDS
9115 AXLE, WHEEL, & JOURNAL BEARING TABULATION ASSEMBLY
END CAP
PART NUMBER: K516978
AMMS NUMBER: 20-878-00703
6 CAP SCREW (3 REQ'D EACH END)
7/8-9 x 2 1/4 LG (GRADE 2)
AMMS NUMBER: 45-880-04608
NEOPRENE GASKET
PART NUMBER: K151325
AMMS NUMBER: 23-878-03607
PLUG
PART NUMBER: K522350
AMMS NUMBER: 20-878-04704
LOCKING PLATE
PART NUMBER: K80511
AMMS NUMBER: 23-878-03703
END CAP ASSEMBLY
TYPICAL BOTH ENDS
1 WHEEL MOUNTING PRESSURE - 85 TONS MIN. - 150 TONS MAX.
2 CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
3 TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
4 BEARING SEATING PRESSURE - 55±5 TONS.
5 JOURNAL BEARING MOUNTED LATERAL - .001 - .015.
6 TORQUE VALUE: 145 LB.-FT.
MECHANICAL SERVICES
Amtrak
N.E.C.
9115 AXLE, WHEEL, & JOURNAL BEARING TABULATION DISPLAY
C 62-0059
C 62-0069
SPS
2/27/98
2 WHEEL B-36 CLASS B 29-345-31517 3
1 AXLE 29-441-01502 2
2 JOURNAL BEARING ASSEMBLY EE (6 x 11) 20-780-00404 1
QTY DESCRIPTION AMM'S NUMBER ITEM
LIST OF MATERIAL

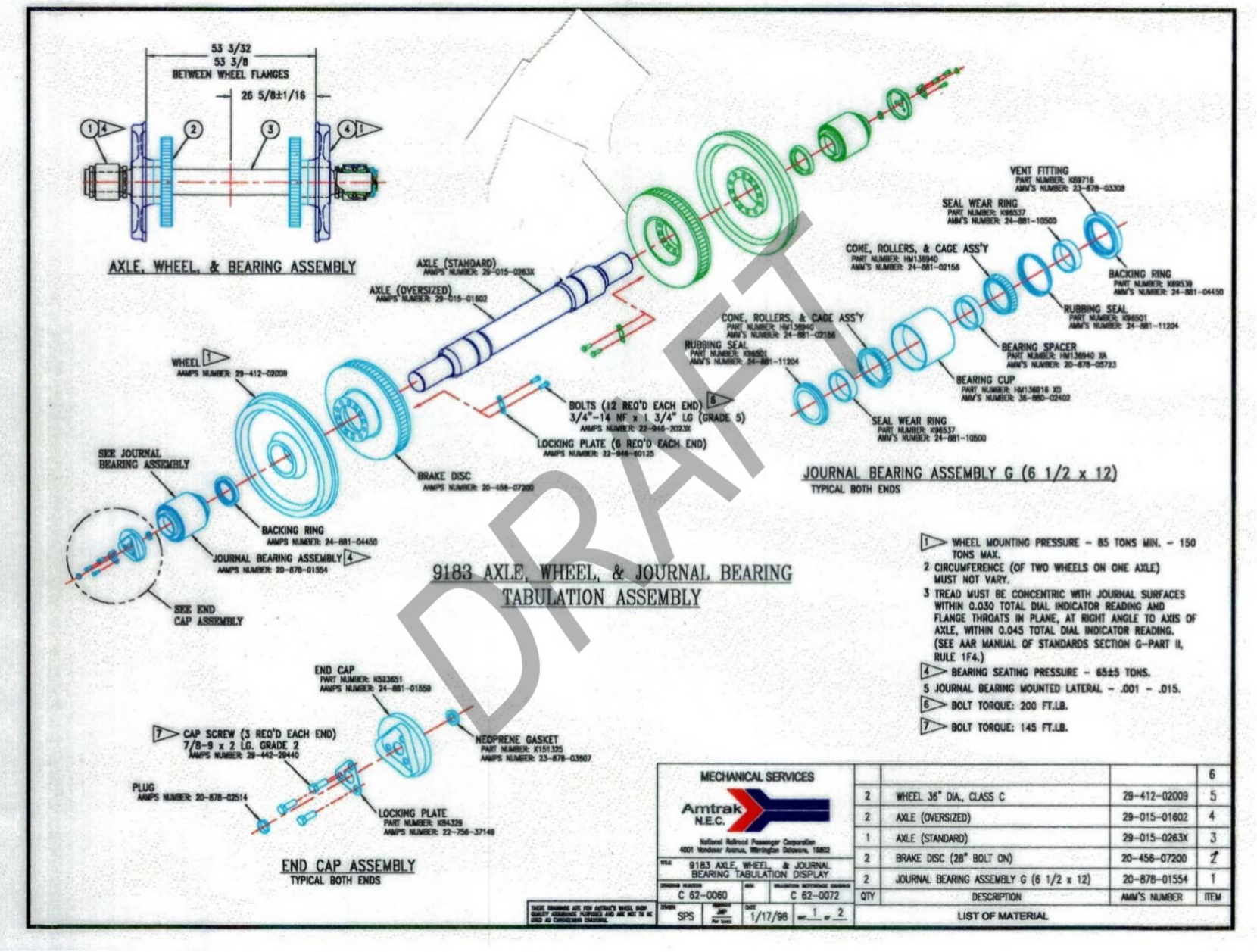
DRAFT

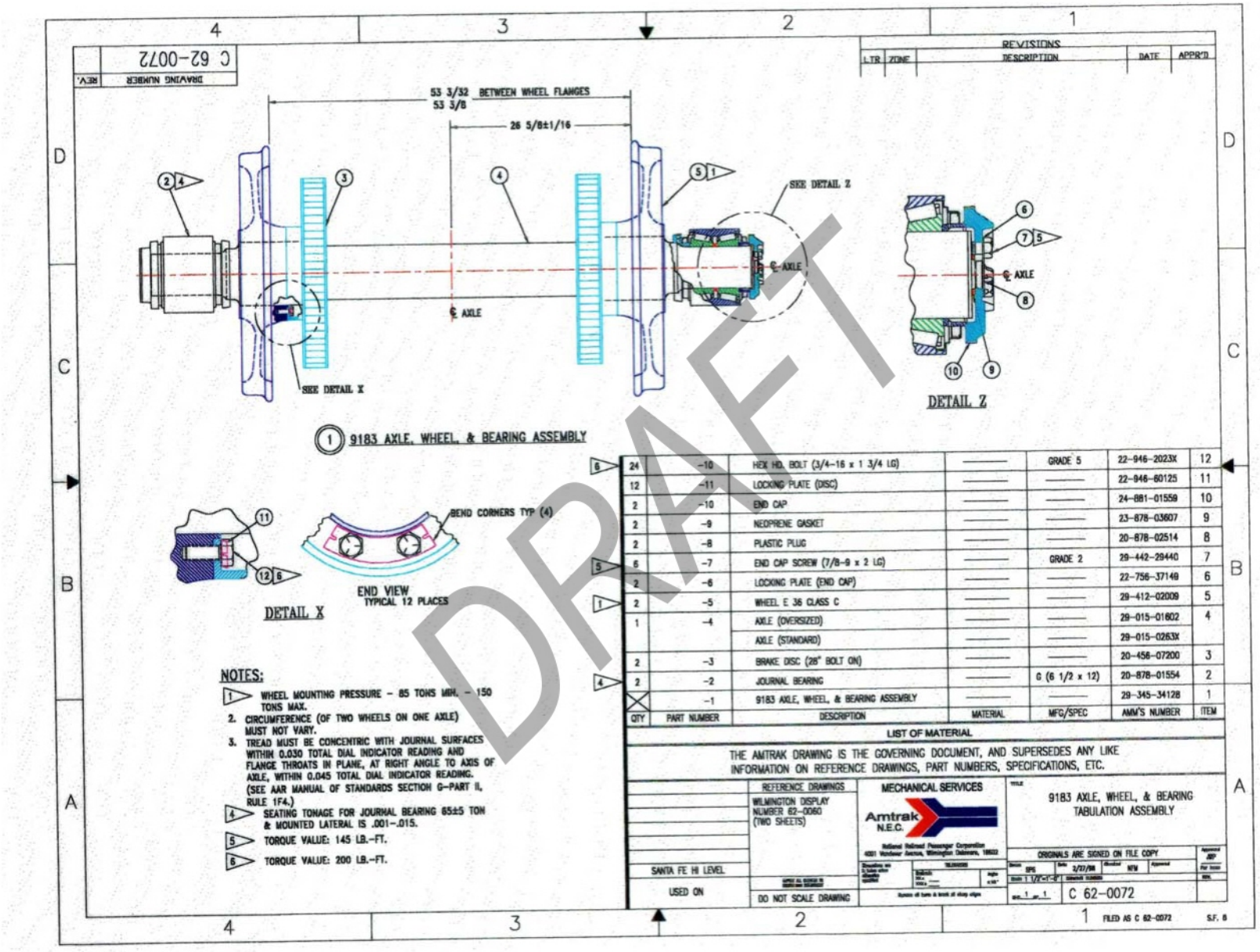

DRAWING NUMBER
C 62-0069
REVISIONS
LTR ZONE DESCRIPTION DATE APPR'D
53 3/32 BETWEEN WHEEL FLANGES
53 3/8
25 5/8 ±1/16
SEE DETAIL Z
℄ AXLE
℄ AXLE
DETAIL Z
1 9115 AXLE, WHEEL, & BEARING ASSEMBLY
NOTES:
1 WHEEL MOUNTING PRESSURE – 85 TONS MIN. – 150 TONS MAX.
2 CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
3 TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
4 SEATING TONAGE FOR JOURNAL BEARING 55±5 TON & LATERAL MOUNTING IS .001-.015.
5 TORQUE VALUE: 145 LB.-FT.
2 -9 END CAP — — 20-878-00703 9
2 -8 NEOPRENE GASKET — — 23-878-03607 8
2 -7 PLASTIC PLUG — — 20-878-04704 7
5 6 -6 CAP SCREW (7/8-9 x 2 1/4 LG) GRADE 2 — 45-880-04608 6
2 -5 LOCKING PLATE — — 23-878-03703 5
1 2 -4 WHEEL D-36 CLASS A — — 29-345-31517 4
1 -3 AXLE — — 29-441-01502 3
4 2 -2 JOURNAL BEARING — EE (6 x 11) 20-878-00404 2
-1 9115 AXLE, WHEEL, & BEARING ASSEMBLY — — 29-345-33002 1
QTY PART NUMBER DESCRIPTION MATERIAL MFG/SPEC AAR'S NUMBER ITEM
LIST OF MATERIAL
THE AMTRAK DRAWING IS THE GOVERNING DOCUMENT, AND SUPERSEDES ANY LIKE INFORMATION ON REFERENCE DRAWINGS, PART NUMBERS, SPECIFICATIONS, ETC.
REFERENCE DRAWINGS
WILMINGTON DISPLAY NUMBER A 62-0059 (THREE SHEETS)
9115 BAGGAGE
9115 HERITAGE
USED ON
DO NOT SCALE DRAWING
MECHANICAL SERVICES
Amtrak N.E.C.
9115 AXLE, WHEEL, & BEARING TABULATION ASSEMBLY
ORIGINALS ARE SIGNED ON FILE COPY
C 62-0069
FILED AS C 62-0069
SZ. B

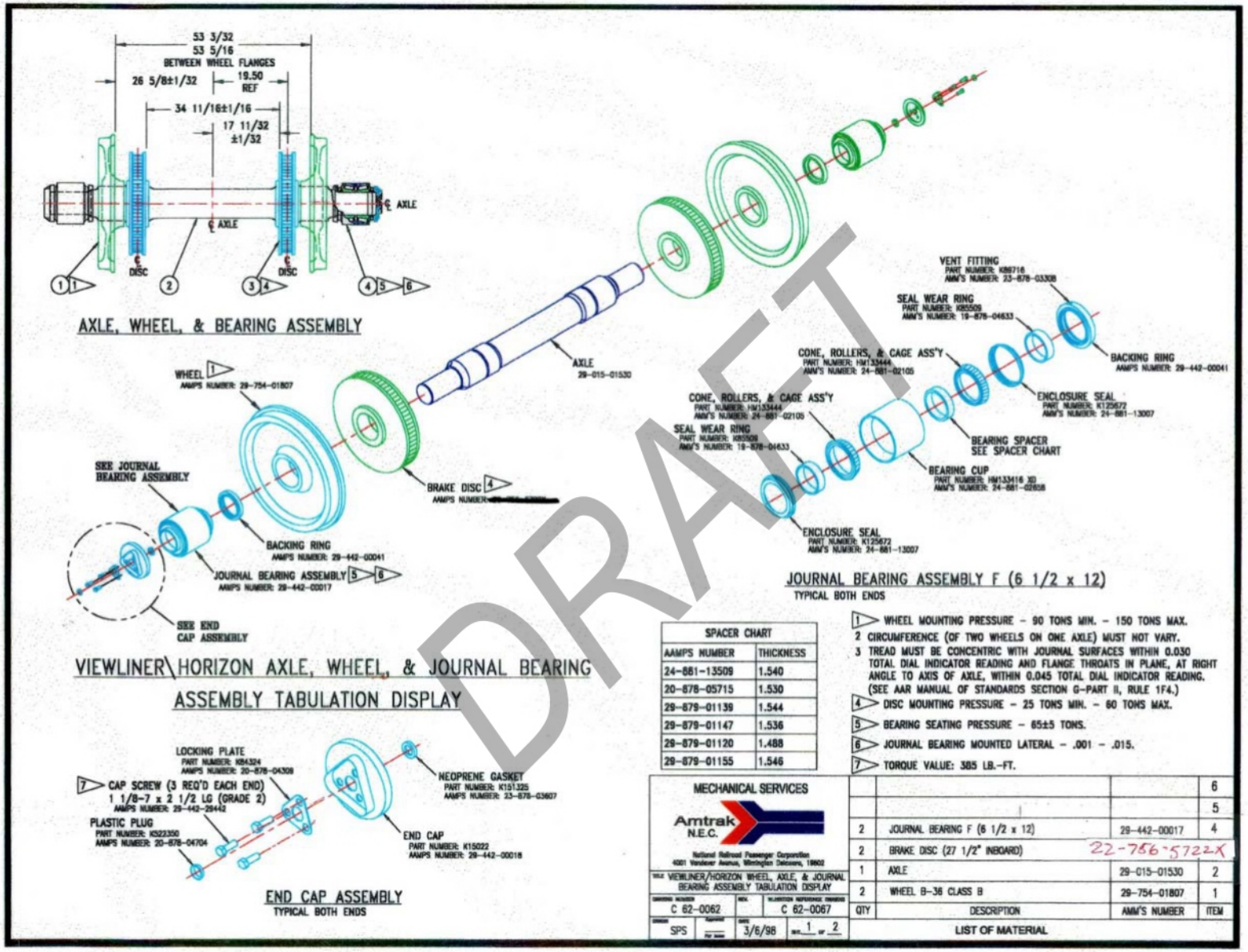
DRAFT


53 3/32
53 3/8
BETWEEN WHEEL FLANGES
℄ AXLE
℄ AXLE
25 5/8±1/16
AXLE, WHEEL, & BEARING ASSEMBLY
WHEEL 1
AAMS NUMBER: 29-412-02009
AXLE
AAMS NUMBER: 29-441-01502
BOLTS (12 REQ'D EACH END) 7
3/4"-16 NF x 1 3/4" LG (GRADE 5)
AAMS NUMBER: 22-946-20235
LOCKING PLATE (6 REQ'D EACH END)
AAMS NUMBER: 22-946-60125
BRAKE DISC
AAMS NUMBER: 20-456-07200
SEE JOURNAL BEARING ASSEMBLY
FITTED BACKING RING
AAMS NUMBER: 20-878-05029
JOURNAL BEARING ASSEMBLY 4 5
AAMS NUMBER: 20-878-00404
SEE END CAP ASSEMBLY
VENT FITTING
PART NUMBER: KB6716
AAM'S NUMBER: 23-878-03308
SEAL WEAR RING
PART NUMBER: KB3081
AAM'S NUMBER: 23-878-04503
CONE, ROLLERS, & CAGE ASS'Y
PART NUMBER: HA32648
AAM'S NUMBER: 20-878-02434
FITTED BACKING RING
PART NUMBER: KB3008
AAMS NUMBER: 20-878-05029
RUBBING SEAL
PART NUMBER: KB3082
AAM'S NUMBER: 23-878-04706
CONE, ROLLERS, & CAGE ASS'Y
PART NUMBER: HA32648
AAM'S NUMBER: 20-878-02434
SEAL WEAR RING
PART NUMBER: KB3081
AAM'S NUMBER: 23-878-04503
BEARING SPACER
PART NUMBER: HA32648 XA
AAM'S NUMBER: 20-878-00017
BEARING CUP
PART NUMBER: HA32614
AAM'S NUMBER: 20-878-02813
RUBBING SEAL
PART NUMBER: KB3082
AAM'S NUMBER: 23-878-04706
JOURNAL BEARING ASSEMBLY EE (6 x 11)
TYPICAL BOTH ENDS
9123 AXLE, WHEEL, & JOURNAL BEARING TABULATION ASSEMBLY
1 WHEEL MOUNTING PRESSURE - 85 TONS MIN. - 150 TONS MAX.
2 CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
3 TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
4 BEARING SEATING PRESSURE 55±5 TONS.
5 JOURNAL BEARING MOUNTED LATERAL .001 - .015
6 TORQUE VALUE: 145 LB.-FT.
7 TORQUE VALUE: 200 LB.-FT.
END CAP
PART NUMBER: K518978
AAMS NUMBER: 20-878-00703
6 CAP SCREW (3 REQ'D EACH END)
7/8-9 x 2 1/4 LG (GRADE 2)
AAMS NUMBER: 45-890-04608
NEOPRENE GASKET
PART NUMBER: K151328
AAMS NUMBER: 23-878-03607
PLUG
PART NUMBER: KS22350
AAMS NUMBER: 20-878-04708
LOCKING PLATE
PART NUMBER: K50511
AAMS NUMBER: 23-878-03703
END CAP ASSEMBLY
TYPICAL BOTH ENDS
MECHANICAL SERVICES
Amtrak
N.E.C.
National Railroad Passenger Corporation
4001 Wendover Avenue, Wilmington Delaware, 19802
9123 AXLE, WHEEL, & JOURNAL BEARING TABULATION DISPLAY
C 62-0059
C 62-0068
SPS
1/05/98
2 of 3
6
5
2 WHEEL E-36 CLASS C 29-412-02009 4
1 AXLE 29-441-01502 3
2 BRAKE DISC (28" BOLT ON) 20-456-07200 2
2 JOURNAL BEARING ASSEMBLY EE (6 x 11) 20-780-00404 1
QTY DESCRIPTION AAM'S NUMBER ITEM
LIST OF MATERIAL
DRAFT

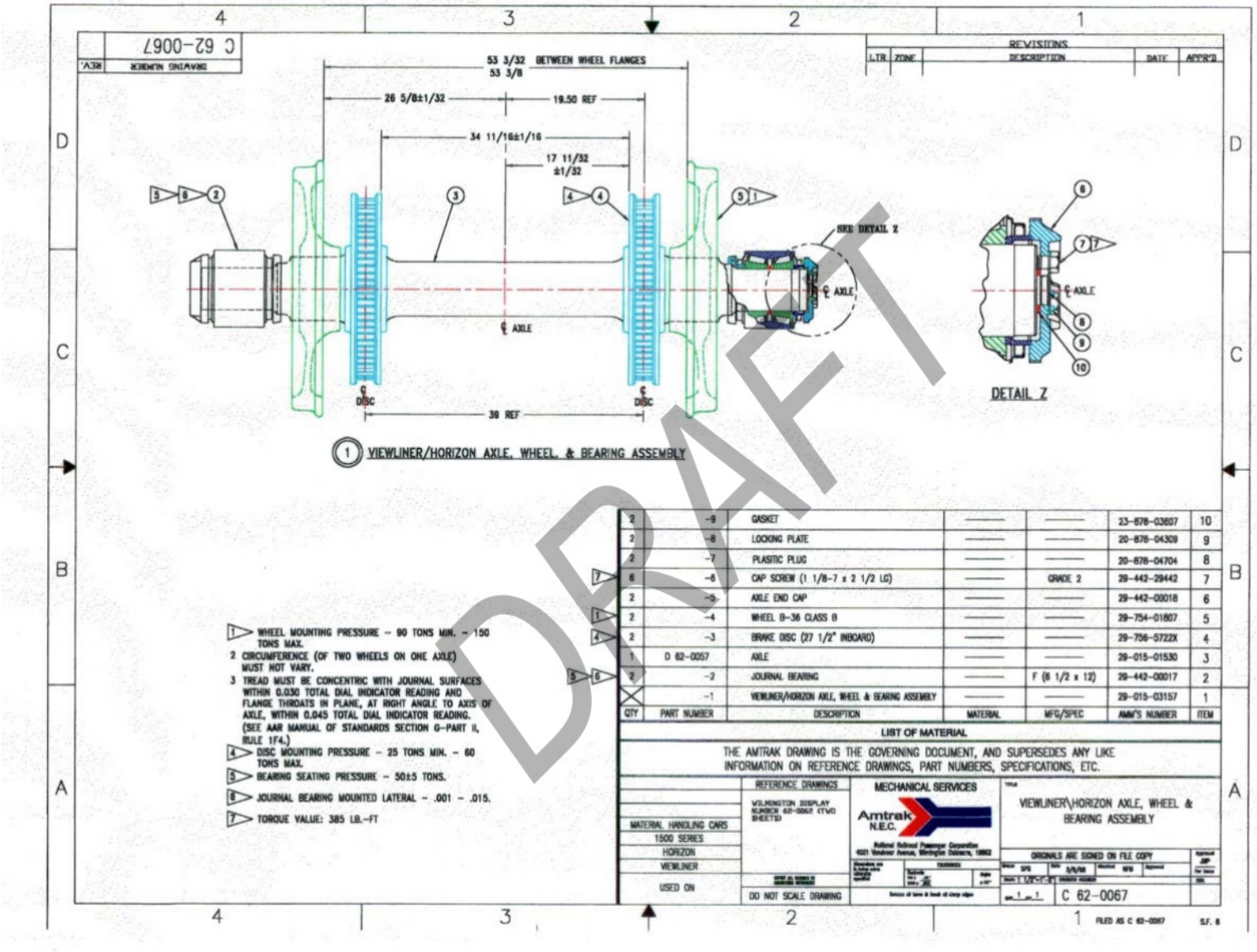

C 62-0068
REVISIONS
LTR ZONE DESCRIPTION DATE APPR'D
53 3/32
53 3/8 BETWEEN WHEEL FLANGES
25 5/8±1/16
SEE DETAIL X
SEE DETAIL Z
℄ AXLE
1 9123 AXLE, WHEEL, & BEARING ASSEMBLY
DETAIL Z
DETAIL X
BEND CORNERS TYP (4)
END VIEW
TYPICAL 12 PLACES
NOTES:
1 WHEEL MOUNTING PRESSURE - 85 TONS MIN. - 150 TONS MAX.
2 CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
3 TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
4 SEATING TONAGE FOR JOURNAL BEARING 50±5 TON & LATERAL MOUNTING IS .001-.015.
5 TORQUE VALUE: 145 LB.-FT.
6 TORQUE VALUE: 200 LB.-FT.
QTY PART NUMBER DESCRIPTION MATERIAL MFG/SPEC AAR'S NUMBER ITEM
24 -10 HEX HD. BOLT (3/4-16 x 1 3/4 LG) GRADE 5 22-946-2023X 12
12 -11 LOCKING PLATE (DISC) 22-946-60125 11
2 -10 END CAP 20-878-00703 10
2 -9 NEOPRENE GASKET 23-878-03607 9
2 -8 PLASTIC PLUG 20-878-04704 8
6 -7 END CAP SCREW (7/8-9 x 2 1/4 LG) GRADE 2 45-880-04608 7
2 -6 LOCKING PLATE (END CAP) 23-878-03703 6
2 -5 WHEEL E-36 CLASS C 29-412-02009 5
1 -4 AXLE 29-441-01502 4
2 -3 BRAKE DISC (28" BOLT ON) 20-456-07200 3
2 -2 JOURNAL BEARING EE (6 x 11) 20-878-00404 2
-1 9123 AXLE, WHEEL, & BEARING ASSEMBLY 29-345-33133 1
LIST OF MATERIAL
THE AMTRAK DRAWING IS THE GOVERNING DOCUMENT, AND SUPERSEDES ANY LIKE INFORMATION ON REFERENCE DRAWINGS, PART NUMBERS, SPECIFICATIONS, ETC.
REFERENCE DRAWINGS
WILMINGTON DISPLAY NUMBER 62-0059 (THREE SHEETS)
HERITAGE: SLEEPER & DINNER
1700 SERIES BAGGAGE
HERITAGE 9123
USED ON
DO NOT SCALE DRAWING
MECHANICAL SERVICES
Amtrak N.E.C.
9123 AXLE, WHEEL, & BEARING TABULATION ASSEMBLY
ORIGINALS ARE SIGNED ON FILE COPY
C 62-0068
FILED AS C 62-0068
DRAFT

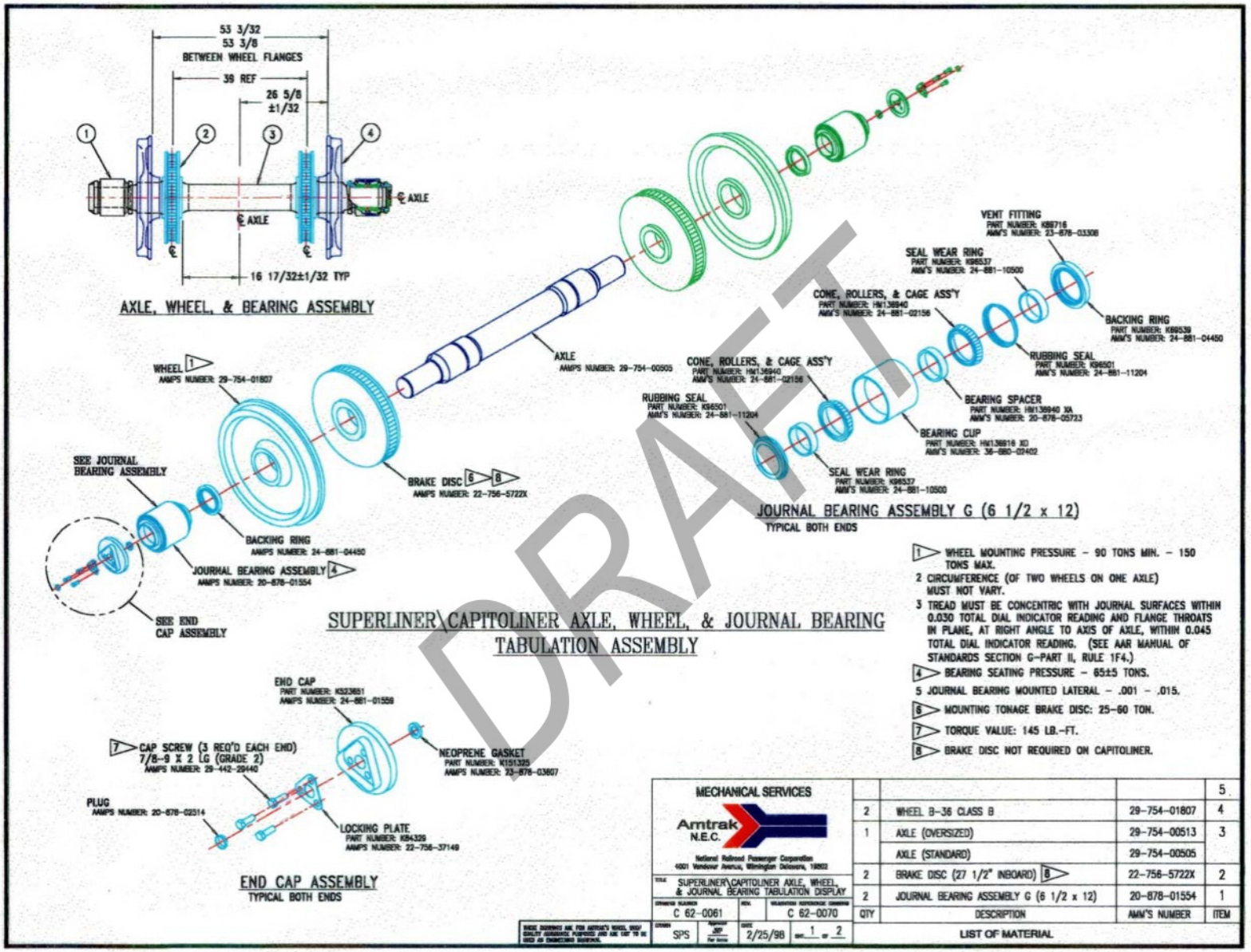

53 3/32
53 3/8
BETWEEN WHEEL FLANGES
26 5/8±1/16
AXLE, WHEEL, & BEARING ASSEMBLY
AXLE (STANDARD)
AAMPS NUMBER: 29-015-0263X
AXLE (OVERSIZED)
AAMPS NUMBER: 29-015-01602
WHEEL
AAMPS NUMBER: 29-412-02009
BOLTS (12 REQ'D EACH END)
3/4"-14 NF x 1 3/4" LG (GRADE 5)
AAMPS NUMBER: 22-946-2023X
LOCKING PLATE (6 REQ'D EACH END)
AAMPS NUMBER: 22-946-60125
BRAKE DISC
AAMPS NUMBER: 20-456-07200
SEE JOURNAL BEARING ASSEMBLY
BACKING RING
AAMPS NUMBER: 24-881-04450
JOURNAL BEARING ASSEMBLY
AAMPS NUMBER: 20-878-01554
SEE END CAP ASSEMBLY
9183 AXLE, WHEEL, & JOURNAL BEARING TABULATION ASSEMBLY
VENT FITTING
PART NUMBER: K69716
AMM'S NUMBER: 23-878-03308
SEAL WEAR RING
PART NUMBER: K96537
AMM'S NUMBER: 24-881-10500
CONE, ROLLERS, & CAGE ASS'Y
PART NUMBER: HM136940
AMM'S NUMBER: 24-881-02156
BACKING RING
PART NUMBER: K69539
AMM'S NUMBER: 24-881-04450
RUBBING SEAL
PART NUMBER: K96501
AMM'S NUMBER: 24-881-11204
CONE, ROLLERS, & CAGE ASS'Y
PART NUMBER: HM136940
AMM'S NUMBER: 24-881-02156
RUBBING SEAL
PART NUMBER: K96501
AMM'S NUMBER: 24-881-11204
BEARING SPACER
PART NUMBER: HM136940 XA
AMM'S NUMBER: 20-878-05723
BEARING CUP
PART NUMBER: HM136916 XD
AMM'S NUMBER: 36-880-02402
SEAL WEAR RING
PART NUMBER: K96537
AMM'S NUMBER: 24-881-10500
JOURNAL BEARING ASSEMBLY G (6 1/2 x 12)
TYPICAL BOTH ENDS
1 WHEEL MOUNTING PRESSURE - 85 TONS MIN. - 150 TONS MAX.
2 CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
3 TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
4 BEARING SEATING PRESSURE - 65±5 TONS.
5 JOURNAL BEARING MOUNTED LATERAL - .001 - .015.
6 BOLT TORQUE: 200 FT.LB.
7 BOLT TORQUE: 145 FT.LB.
END CAP
PART NUMBER: K523651
AAMPS NUMBER: 24-881-01559
CAP SCREW (3 REQ'D EACH END)
7/8-9 x 2 LG. GRADE 2
AAMPS NUMBER: 29-442-29440
NEOPRENE GASKET
PART NUMBER: K151325
AAMPS NUMBER: 23-878-03607
PLUG
AAMPS NUMBER: 20-878-02514
LOCKING PLATE
PART NUMBER: K84329
AAMPS NUMBER: 22-756-37149
END CAP ASSEMBLY
TYPICAL BOTH ENDS
MECHANICAL SERVICES
Amtrak N.E.C.
National Railroad Passenger Corporation
4001 Vandover Avenue, Wilmington Delaware, 19802
9183 AXLE, WHEEL, & JOURNAL BEARING TABULATION DISPLAY
C 62-0060
C 62-0072
SPS
1/17/98
1 of 2
6
2 WHEEL 36" DIA., CLASS C 29-412-02009 5
2 AXLE (OVERSIZED) 29-015-01602 4
1 AXLE (STANDARD) 29-015-0263X 3
2 BRAKE DISC (28" BOLT ON) 20-456-07200 2
2 JOURNAL BEARING ASSEMBLY G (6 1/2 x 12) 20-878-01554 1
QTY DESCRIPTION AMM'S NUMBER ITEM
LIST OF MATERIAL
DRAFT

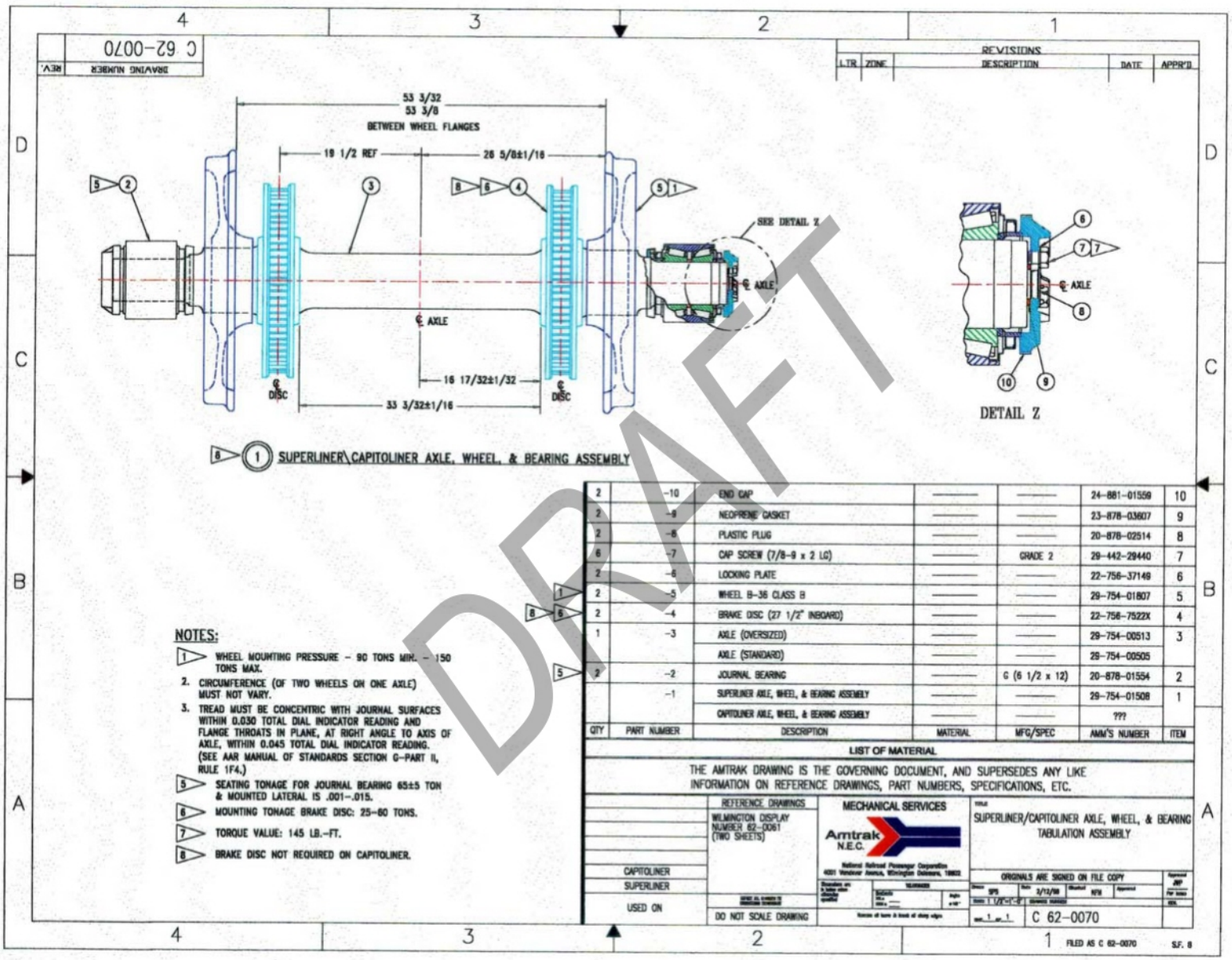

DRAWING NUMBER C 62-0072
REV.
REVISIONS
LTR ZONE DESCRIPTION DATE APPR'D
53 3/32 BETWEEN WHEEL FLANGES
53 3/8
28 5/8±1/16
SEE DETAIL Z
℄ AXLE
SEE DETAIL X
DETAIL Z
1 9183 AXLE, WHEEL, & BEARING ASSEMBLY
BEND CORNERS TYP (4)
END VIEW
TYPICAL 12 PLACES
DETAIL X
NOTES:
1. WHEEL MOUNTING PRESSURE - 85 TONS MIN. - 150 TONS MAX.
2. CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
3. TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
4. SEATING TONAGE FOR JOURNAL BEARING 65±5 TON & MOUNTED LATERAL IS .001-.015.
5. TORQUE VALUE: 145 LB.-FT.
6. TORQUE VALUE: 200 LB.-FT.
QTY PART NUMBER DESCRIPTION MATERIAL MFG/SPEC AAR'S NUMBER ITEM
24 -10 HEX HD. BOLT (3/4-16 x 1 3/4 LG) GRADE 5 22-946-2023X 12
12 -11 LOCKING PLATE (DISC) 22-946-60125 11
2 -10 END CAP 24-881-01559 10
2 -9 NEOPRENE GASKET 23-878-03607 9
2 -8 PLASTIC PLUG 20-878-02514 8
6 -7 END CAP SCREW (7/8-9 x 2 LG) GRADE 2 29-442-29440 7
2 -6 LOCKING PLATE (END CAP) 22-756-37149 6
2 -5 WHEEL E 36 CLASS C 29-412-02009 5
1 -4 AXLE (OVERSIZED) 29-015-01602 4
AXLE (STANDARD) 29-015-0263X
2 -3 BRAKE DISC (28" BOLT ON) 20-456-07200 3
2 -2 JOURNAL BEARING G (6 1/2 x 12) 20-878-01554 2
-1 9183 AXLE, WHEEL, & BEARING ASSEMBLY 29-345-34128 1
LIST OF MATERIAL
THE AMTRAK DRAWING IS THE GOVERNING DOCUMENT, AND SUPERSEDES ANY LIKE INFORMATION ON REFERENCE DRAWINGS, PART NUMBERS, SPECIFICATIONS, ETC.
REFERENCE DRAWINGS
WILMINGTON DISPLAY NUMBER 62-0060 (TWO SHEETS)
MECHANICAL SERVICES
Amtrak N.E.C.
9183 AXLE, WHEEL, & BEARING TABULATION ASSEMBLY
ORIGINALS ARE SIGNED ON FILE COPY
SANTA FE HI LEVEL
USED ON
DO NOT SCALE DRAWING
C 62-0072
FILED AS C 62-0072
DRAFT

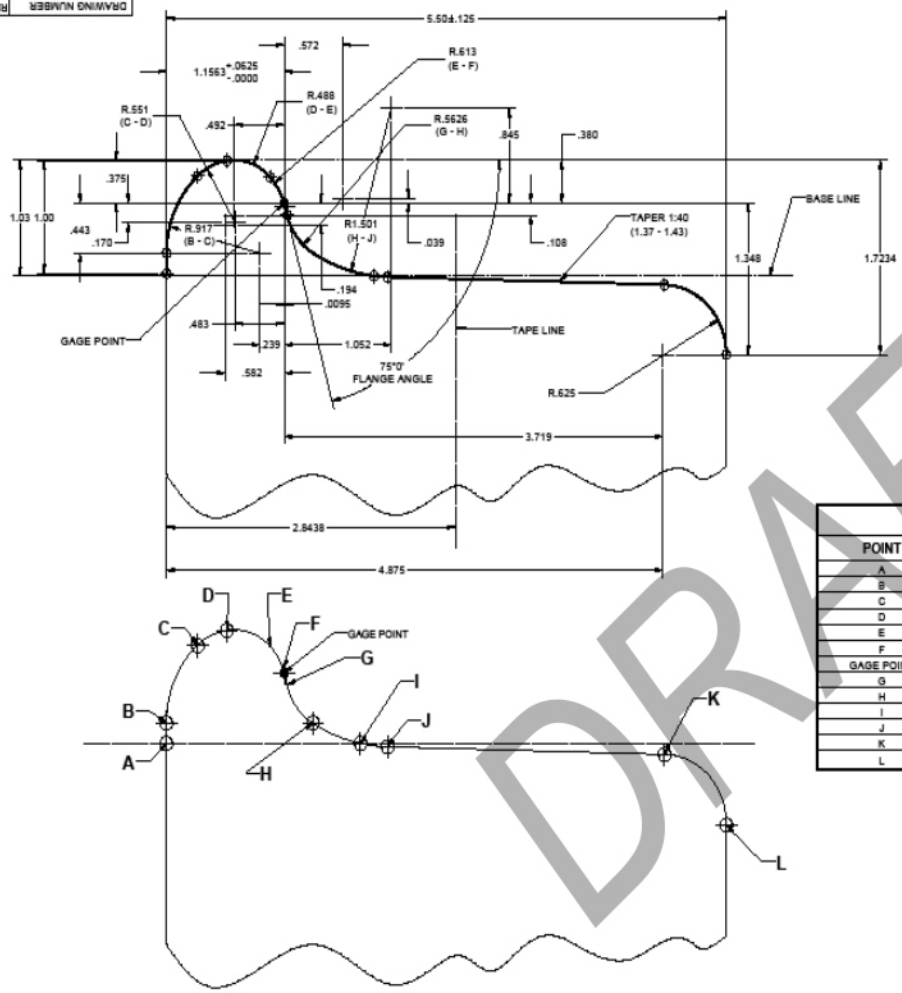

53 3/32
53 5/16
BETWEEN WHEEL FLANGES
26 5/8±1/32
19.50 REF
34 11/16±1/16
17 11/32 ±1/32
℄ AXLE
℄ DISC
AXLE, WHEEL, & BEARING ASSEMBLY
WHEEL 1
AAMPS NUMBER: 29-754-01807
AXLE
29-015-01530
SEE JOURNAL BEARING ASSEMBLY
BRAKE DISC 4
BACKING RING
AAMPS NUMBER: 29-442-00041
JOURNAL BEARING ASSEMBLY 5 6
AAMPS NUMBER: 29-442-00017
SEE END CAP ASSEMBLY
VENT FITTING
SEAL WEAR RING
CONE, ROLLERS, & CAGE ASS'Y
BACKING RING
ENCLOSURE SEAL
BEARING SPACER
SEE SPACER CHART
BEARING CUP
JOURNAL BEARING ASSEMBLY F (6 1/2 x 12)
TYPICAL BOTH ENDS
VIEWLINER\HORIZON AXLE, WHEEL, & JOURNAL BEARING
ASSEMBLY TABULATION DISPLAY
LOCKING PLATE
PART NUMBER: K84324
AAMPS NUMBER: 20-678-04308
7 CAP SCREW (3 REQ'D EACH END)
1 1/8-7 x 2 1/2 LG (GRADE 2)
AAMPS NUMBER: 29-442-29442
PLASTIC PLUG
PART NUMBER: K523350
AAMPS NUMBER: 20-678-04704
NEOPRENE GASKET
PART NUMBER: K151325
AAMPS NUMBER: 33-678-03607
END CAP
PART NUMBER: K15022
AAMPS NUMBER: 29-442-00018
END CAP ASSEMBLY
TYPICAL BOTH ENDS
SPACER CHART
AAMPS NUMBER | THICKNESS
24-681-13509 | 1.540
20-678-05715 | 1.530
29-879-01139 | 1.544
29-879-01147 | 1.536
29-879-01120 | 1.488
29-879-01155 | 1.546
1 WHEEL MOUNTING PRESSURE - 90 TONS MIN. - 150 TONS MAX.
2 CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
3 TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
4 DISC MOUNTING PRESSURE - 25 TONS MIN. - 60 TONS MAX.
5 BEARING SEATING PRESSURE - 65±5 TONS.
6 JOURNAL BEARING MOUNTED LATERAL - .001 - .015.
7 TORQUE VALUE: 385 LB.-FT.
MECHANICAL SERVICES
Amtrak N.E.C.
National Railroad Passenger Corporation
4001 Vendacor Avenue, Washington Delaware, 19802
VIEWLINER/HORIZON WHEEL, AXLE, & JOURNAL BEARING ASSEMBLY TABULATION DISPLAY
C 62-0062
C 62-0067
SPS
3/6/98
1 OF 2
QTY | DESCRIPTION | AMM'S NUMBER | ITEM
2 | JOURNAL BEARING F (6 1/2 x 12) | 29-442-00017 | 4
2 | BRAKE DISC (27 1/2" INBOARD) | 22-756-5722X
1 | AXLE | 29-015-01530 | 2
2 | WHEEL B-36 CLASS B | 29-754-01807 | 1
LIST OF MATERIAL

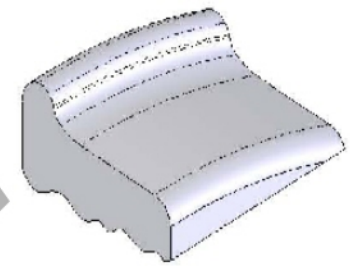
DRAFT


C 62-0067
REVISIONS
LTR ZONE DESCRIPTION DATE APPR'D
53 3/32 BETWEEN WHEEL FLANGES
53 3/8
26 5/8±1/32
19.50 REF
34 11/16±1/16
17 11/32
±1/32
SEE DETAIL Z
℄ AXLE
℄ DISC
30 REF
DETAIL Z
1 VIEWLINER/HORIZON AXLE, WHEEL, & BEARING ASSEMBLY
1 WHEEL MOUNTING PRESSURE - 90 TONS MIN. - 150 TONS MAX.
2 CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
3 TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
4 DISC MOUNTING PRESSURE - 25 TONS MIN. - 60 TONS MAX.
5 BEARING SEATING PRESSURE - 50±5 TONS.
6 JOURNAL BEARING MOUNTED LATERAL - .001 - .015.
7 TORQUE VALUE: 385 LB.-FT
2 -9 GASKET 23-878-03607 10
2 -8 LOCKING PLATE 20-878-04309 9
2 -7 PLASTIC PLUG 20-878-04704 8
6 -6 CAP SCREW (1 1/8-7 x 2 1/2 LG) GRADE 2 29-442-29442 7
2 -5 AXLE END CAP 29-442-00018 6
2 -4 WHEEL B-36 CLASS B 29-754-01807 5
2 -3 BRAKE DISC (27 1/2" INBOARD) 29-756-5722X 4
1 D 62-0057 AXLE 29-015-01530 3
2 -2 JOURNAL BEARING F (6 1/2 x 12) 29-442-00017 2
-1 VIEWLINER/HORIZON AXLE, WHEEL & BEARING ASSEMBLY 29-015-03157 1
QTY PART NUMBER DESCRIPTION MATERIAL MFG/SPEC AAR'S NUMBER ITEM
LIST OF MATERIAL
THE AMTRAK DRAWING IS THE GOVERNING DOCUMENT, AND SUPERSEDES ANY LIKE INFORMATION ON REFERENCE DRAWINGS, PART NUMBERS, SPECIFICATIONS, ETC.
REFERENCE DRAWINGS
WILMINGTON DISPLAY NUMBER 62-0062 (TWO SHEETS)
MATERIAL HANDLING CARS
1500 SERIES
HORIZON
VIEWLINER
USED ON
DO NOT SCALE DRAWING
MECHANICAL SERVICES
Amtrak N.E.C.
VIEWLINER\HORIZON AXLE, WHEEL & BEARING ASSEMBLY
ORIGINALS ARE SIGNED ON FILE COPY
C 62-0067
FILED AS C 62-0067
DRAFT


53 3/32
53 3/8
BETWEEN WHEEL FLANGES
39 REF
26 5/8
±1/32
16 17/32±1/32 TYP
AXLE
AXLE
AXLE, WHEEL, & BEARING ASSEMBLY
WHEEL 1
AAMPS NUMBER: 29-754-01807
AXLE
AAMPS NUMBER: 29-754-00505
BRAKE DISC 6 8
AAMPS NUMBER: 22-756-5722X
SEE JOURNAL BEARING ASSEMBLY
BACKING RING
AAMPS NUMBER: 24-881-04450
JOURNAL BEARING ASSEMBLY 4
AAMPS NUMBER: 20-878-01554
SEE END CAP ASSEMBLY
VENT FITTING
PART NUMBER: K86716
AAM'S NUMBER: 23-878-03308
SEAL WEAR RING
PART NUMBER: K96537
AAM'S NUMBER: 24-881-10500
CONE, ROLLERS, & CAGE ASS'Y
PART NUMBER: HM136940
AAM'S NUMBER: 24-881-02156
BACKING RING
PART NUMBER: K86539
AAM'S NUMBER: 24-881-04450
RUBBING SEAL
PART NUMBER: K96501
AAM'S NUMBER: 24-881-11204
CONE, ROLLERS, & CAGE ASS'Y
PART NUMBER: HM136940
AAM'S NUMBER: 24-881-02156
RUBBING SEAL
PART NUMBER: K96501
AAM'S NUMBER: 24-881-11204
BEARING SPACER
PART NUMBER: HM136940 XA
AAM'S NUMBER: 20-878-05723
BEARING CUP
PART NUMBER: HM136816 XD
AAM'S NUMBER: 36-680-02402
SEAL WEAR RING
PART NUMBER: K96537
AAM'S NUMBER: 24-881-10500
JOURNAL BEARING ASSEMBLY G (6 1/2 x 12)
TYPICAL BOTH ENDS
SUPERLINER\CAPITOLINER AXLE, WHEEL, & JOURNAL BEARING TABULATION ASSEMBLY
1 WHEEL MOUNTING PRESSURE - 90 TONS MIN. - 150 TONS MAX.
2 CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
3 TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
4 BEARING SEATING PRESSURE - 65±5 TONS.
5 JOURNAL BEARING MOUNTED LATERAL - .001 - .015.
6 MOUNTING TONAGE BRAKE DISC: 25-60 TON.
7 TORQUE VALUE: 145 LB.-FT.
8 BRAKE DISC NOT REQUIRED ON CAPITOLINER.
END CAP
PART NUMBER: K323651
AAMPS NUMBER: 24-881-01556
7 CAP SCREW (3 REQ'D EACH END) 7/8-9 X 2 LG (GRADE 2)
AAMPS NUMBER: 29-442-29440
NEOPRENE GASKET
PART NUMBER: K151325
AAMPS NUMBER: 23-878-03607
PLUG
AAMPS NUMBER: 20-878-02514
LOCKING PLATE
PART NUMBER: K84329
AAMPS NUMBER: 22-756-37149
END CAP ASSEMBLY
TYPICAL BOTH ENDS
MECHANICAL SERVICES
Amtrak
N.E.C.
National Railroad Passenger Corporation
4001 Vandover Avenue, Wilmington Delaware, 19802
SUPERLINER\CAPITOLINER AXLE, WHEEL, & JOURNAL BEARING TABULATION DISPLAY
C 62-0061
C 62-0070
SPS
2/25/98
sht 1 of 2
QTY
DESCRIPTION
AAM'S NUMBER
ITEM
LIST OF MATERIAL
2 WHEEL B-36 CLASS B 29-754-01807 4
1 AXLE (OVERSIZED) 29-754-00513 3
AXLE (STANDARD) 29-754-00505
2 BRAKE DISC (27 1/2" INBOARD) 6 22-756-5722X 2
2 JOURNAL BEARING ASSEMBLY G (6 1/2 x 12) 20-878-01554 1
5
4
3
2
1
DRAFT


DRAWING NUMBER
C 62-0070
REV.
REVISIONS
LTR ZONE DESCRIPTION DATE APPR'D
53 3/32
53 3/8
BETWEEN WHEEL FLANGES
19 1/2 REF
26 5/8±1/16
16 17/32±1/32
33 3/32±1/16
℄ DISC
℄ AXLE
SEE DETAIL Z
DETAIL Z
8 1 SUPERLINER\CAPITOLINER AXLE, WHEEL, & BEARING ASSEMBLY
NOTES:
1. WHEEL MOUNTING PRESSURE - 90 TONS MIN. - 150 TONS MAX.
2. CIRCUMFERENCE (OF TWO WHEELS ON ONE AXLE) MUST NOT VARY.
3. TREAD MUST BE CONCENTRIC WITH JOURNAL SURFACES WITHIN 0.030 TOTAL DIAL INDICATOR READING AND FLANGE THROATS IN PLANE, AT RIGHT ANGLE TO AXIS OF AXLE, WITHIN 0.045 TOTAL DIAL INDICATOR READING. (SEE AAR MANUAL OF STANDARDS SECTION G-PART II, RULE 1F4.)
5 SEATING TONAGE FOR JOURNAL BEARING 65±5 TON & MOUNTED LATERAL IS .001-.015.
6 MOUNTING TONAGE BRAKE DISC: 25-60 TONS.
7 TORQUE VALUE: 145 LB.-FT.
8 BRAKE DISC NOT REQUIRED ON CAPITOLINER.
LIST OF MATERIAL
QTY PART NUMBER DESCRIPTION MATERIAL MFG/SPEC AAR'S NUMBER ITEM
2 -10 END CAP 24-881-01559 10
2 -9 NEOPRENE GASKET 23-878-03607 9
2 -8 PLASTIC PLUG 20-878-02514 8
6 -7 CAP SCREW (7/8-9 x 2 LG) GRADE 2 29-442-29440 7
2 -6 LOCKING PLATE 22-756-37149 6
1 2 -5 WHEEL B-36 CLASS B 29-754-01807 5
8 6 2 -4 BRAKE DISC (27 1/2" INBOARD) 22-756-7522X 4
1 -3 AXLE (OVERSIZED) 29-754-00513 3
AXLE (STANDARD) 29-754-00505
5 2 -2 JOURNAL BEARING G (6 1/2 x 12) 20-878-01554 2
-1 SUPERLINER AXLE, WHEEL, & BEARING ASSEMBLY 29-754-01508 1
CAPITOLINER AXLE, WHEEL, & BEARING ASSEMBLY ???
THE AMTRAK DRAWING IS THE GOVERNING DOCUMENT, AND SUPERSEDES ANY LIKE INFORMATION ON REFERENCE DRAWINGS, PART NUMBERS, SPECIFICATIONS, ETC.
REFERENCE DRAWINGS
WILMINGTON DISPLAY NUMBER 62-0061 (TWO SHEETS)
CAPITOLINER
SUPERLINER
USED ON
DO NOT SCALE DRAWING
MECHANICAL SERVICES
Amtrak N.E.C.
SUPERLINER/CAPITOLINER AXLE, WHEEL, & BEARING TABULATION ASSEMBLY
ORIGINALS ARE SIGNED ON FILE COPY
C 62-0070
FILED AS C 62-0070
S.F. 8
DRAFT





ISOMETRIC VIEW

NODE COORDINATES		
POINT	X	Y
A	-1.1563	-0.6250
B	-1.1563	-0.4434
C	-0.8501	0.2407
D	-0.5625	0.3750
E	-0.1403	0.2301
F	-0.0084	0.0312
GAGE POINT	0.0000	0.0000
G	0.0286	-0.1069
H	0.2840	-0.4445
I	0.7485	-0.6250
J	1.0148	-0.6556
K	3.7344	-0.7236
L	4.3437	-1.3483

SEGMENT DETAILS			
SEGMENT	RADIUS / LINE	'X' CENTER	'Y' CENTER
A - B	LINE 90°		
B - C	R .917	-0.239	-0.443
C - D	R .551	-0.483	-0.170
D - E	R .488	-0.492	-0.108
E - F	R .613	-0.623	-0.233
F - G	LINE 75°		
G - H	R .5626	0.572	0.039
H - I -J	R 1.501	1.052	0.845
J - K	LINE 1:40		
K - L	R .625	3.719	-1.348
BEYOND L	LINE 90°		

BASED UPON APTA 240 WHEEL PROFILE WITH 75 DEGREE FLANGE ANGLE
(APTA SS-M-015-06), USING TANGENT ARCS.

DRAFT

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPR'D
-	-	-	-	-

LIST OF MATERIALS

REFERENCE DRAWINGS

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering

TITLE: WHEEL TREAD PROFILE

ORIGINALS ARE SIGNED ON FILE COPY

M. BURSHTIN

PROJECT 2060 | D 062-00105 | WHEELS | REPORT ALL DRAWING TO ENGINEERING DEPARTMENT | TOLERANCES

PROGRAM | NEXT ASS'Y | USED ON | DO NOT SCALE DRAWING

D 062-00106

D 062-00106

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THE AMTRAK DRAWING IS THE GOVERNING DOCUMENT, AND SUPERSEDES ANY LIKE INFORMATION ON REFERENCE DRAWINGS, PART NUMBERS, SPECIFICATIONS, ETC.

Appendix B
Wheel Tabulation Chart

WILMINGTON MAINTENANCE FACILITY/WHEEL SHOP
WHEEL TABULATION CHART

TYPE	NOMINAL WHEEL SEAT	BEARINGS	BRAKE DISC	BULL GEAR	WHEELS	BACK TO BACK
BTR	9 1/4	6 7/8 X 12 CLASS: GG OUTBOARD TONNAGE: 65 ± 5 LAT: .001 - .015 END CAP BOLTS 7/8-9 X 2 (GRD 5)	N/A	TONNAGE 55 - 125	DESIGN: 40" CLASS: B TONNAGE: 95 - 150	53 3/16 TO 53 5/16
U-TUBE	9 15/16	6 7/8 X 12 CLASS: GG OUTBOARD TONNAGE: 65 ± 5 LAT: .001-.015 END CAP BOLTS 7/8-9 X 2 (GRD 5)	N/A	TONNAGE 60 - 120	DESIGN: 40" CLASS: B TONNAGE: 100 - 170	53 3/16 TO 53 5/16
CAPITOLINER	8 3/4	6 ½ X 12 CLASS: G OUTBOARD TONNAGE: 65 ± 5 LAT: .001 - .015 END CAP BOLTS 7/8-9 X 2 (GRD 2)	N/A	N/A	DESIGN: MOD. B – 36 CLASS: B TONNAGE: 90 – 150	53 3/32 TO 53 3/8
RD. RAILERS	8 1/4	6 X 11 CLASS: E OUTBOARD TONNAGE: 50 ± 5 LAT: .001 - .015 END CAP BOLTS 1-8 X 2 ¼ (GRD 2)	N/A	N/A	DESIGN: 33 CLASS: B TONNAGE: 85 - 150	53 TO 53 3/32
FREIGHT 5 1/2	7 9/16	5 1/2 X 10 CLASS: D OUTBOARD TONNAGE: 50 ± 5 LAT: .001 - .015 END CAP BOLTS 7/8-9 X 2 (GRD 2)	N/A	N/A	DESIGN: P-33 CLASS: B (NARROW FLANGE) TONNAGE: 85 - 150	53 3/32 TO 53 5/16
FREIGHT 6"	8 1/4	6 X 11 CLASS: E OUTBOARD TONNAGE: 50 ± 5 LAT: .001 - .015 END CAP BOLTS 1-8 X 2 1/4 (GRD 2)	N/A	N/A	DESIGN: CJ-36 CLASS: B (NARROW FLANGE) TONNAGE: 85 - 150	53 3/32 TO 53 5/16
FREIGHT 6 1/2	8 3/4	6 ½ X 12 CLASS: F OUTBOARD TONNAGE: 50 ± 5 LAT: .001 - .015 END CAP BOLTS 11/8-7X 2 1/2 (GRD 2)	N/A	N/A	DESIGN: CJ –36 CLASS: B (NARROW FLANGE) TONNAGE: 90 - 160	53 3/32 TO 53 5/16
TURBO DRV.	8 3/4	SKF 140MM OUTBOARD	N/A	N/A	DESIGN: 34"--EURO-DES. CLASS: A TONNAGE: 85 - 150	53 3/32 TO 53 5/16
TURBO IDLER	8 1/4	SKF 140MM OUTBOARD	1—23" INBOARD	N/A	DESIGN: 34"-- EURO-DES CLASS: A TONNAGE: 85 - 150	53 3/32 TO 53 5/16
				REVISION: D DATE: 4/1/2002	APPR. BY:	

DRAFT

The Capitoliner, Road Railer, and Turbo Driver/Idler are no longer in Amtrak's inventory.

WILMINGTON MAINTENANCE FACILITY/WHEEL SHOP
WHEEL TABULATION CHART

TYPE	NOMINAL WHEEL SEAT	BEARINGS	BRAKE DISC	BULL GEAR	WHEELS	BACK TO BACK
AMFLEET	6 1/8	6 ½ X 12 CLASS: F INBOARD TONNAGE 50 ± 5 LATERAL: .006 - .015	2- INBOARD 27 1/2" TONNAGE: 15-65	N/A	DESIGN: B-36 CLASS: B TONNAGE: 75-120 SPIKE: 30-50	53 3/32 TO 53 3/8
HEP 9115	8 1/4	6 X 11 CLASS: EE OUTBOARD TONNAGE: 55 ± 5 LAT: .001-.015 END CAP BOLT 7/8-9 X 2 1/4 (GRD 2)	N/A	N/A	DESIGN: D- 36 CLASS: A TONNAGE: 85-150	53 3/32 TO 53 3/8
HEP 9123	8 1/4	6 X 11 CLASS: EE OUTBOARD TONNAGE: 55 ± 5 LAT: .001 - .015 END CAP BOLT 7/8-9 X 2 1/4 (GRD 2)	2-BOLT ON 26" BOLT ¾ X 16 NF. (GRD 5) BOLT TORQUE: 200 FT. LB.	N/A	DESIGN: E – 36 CLASS: C TONNAGE: 85 - 150	53 3/32 TO 53 3/8
HEP 9114	7 9/16	5 1/2 X 10 CLASS: D OUTBOARD TONNAGE: 50 ± 5 LAT: .001 - .015 END CAP BOLT 7/8-9 X 2 (GRD 2)	N/A	N/A	DESIGN: C – 33 CLASS: A TONNAGE: 85 - 150	53 3/32 TO 53 3/8
HEP 9183	8 1/4	6 1/2 X 12 CLASS: G OUTBOARD TONNAGE: 65 ± 5 LAT: .001 - .015 END CAP BOLT 7/8-9 X 2 (GRD 2)	2 – BOLT ON 28" BOLT ¾ X 16 NF. . (GRD 5) BOLT TORQUE: 200 FT. LB.	N/A	DESIGN: E 36 CLASS: C TONNAGE: 85 - 150	53 3/32 TO 53 3/8
AEM-7	9 7/8	SKF 170 MM OUTBOARD OR M-CLASS 7X9 TONNAGE 65 ± 5 END CAP BOLT 1-8 UNC X 2 ¾ (GRD 5)	2-INBOARD - 2-OUTBOARD BOLT ON TORQUE: 200 FT. LB.	1 - 85 TOOTH HELICAL GEAR	DESIGN: 51" CLASS: B TONNAGE: 100 - 170	53 3/16 TO 53 5/16
E – 60	9 7/8	6 ½ X 12 CLASS: GG OUTBOARD TONNAGE: 65 ± 5 LAT: .001 - .015 END CAP BOLT 7/8-9 X 2 (GRD 5)	N/A	1 – 74 TOOTH TONNAGE: 60-120	DESIGN: 40" CLASS: B TONNAGE: 100 - 170	53 3/16 TO 53 5/16
F – 40	9 1/4	6 ½ OR 6 7/8 X 12: GG OUTBOARD TONNAGE: 55 ± 5 - LATERAL: .001-.015 END CAP BOLT 7/8-9 X 2 (GRD 5)	N/A	1 – 57 / 62 TOOTH TONNAGE: 55 - 125	DESIGN: 40" CLASS B TONNAGE: 95 - 150	53 3/16 TO 53 5/16
SWITCHER	9 1/4	6 ½ X 12 CLASS: F OUTBOARD TONNAGE: 50 ± 5 LAT: .001-.015 END CAP BOLT 1 1/8-7 X 2 ½ (GRD 2)	N/A	1 – 62 TOOTH TONNAGE: 55 - 125	DESIGN: 40" CLASS B TONNAGE: 95 - 150	53 3/16 TO 53 5/16
HORIZON	8 3/4	6 ½ X 12 CLASS: F OUTBOARD TONNAGE: 50 ± 5 LAT: .001 - .015 END CAP BOLT 1 1/8-7 X 2 ½ (GRD 2)	2– INBOARD 27 ½" TONNAGE: 25 - 60	N/A	DESIGN: MOD. B – 36 CLASS B TONNAGE: 90 - 150	53 3/32 TO 53 3/8
SUPERLINER	8 3/4	6 ½ X 12 CLASS: G OUTBOARD TONNAGE: 65 ± 5 LAT: .001 - .015 END CAP BOLT 7/8-9 X 2 (GRD 2)	2– INBOARD 27 ½" TONNAGE: 25 - 60	N/A	DESIGN: MOD. B – 36 CLASS B TONNAGE: 90 - 150	53 3/32 TO 53 3/8

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Next Generation Equipment Committee NGEC 305

OPERATIONAL & ENVIORNMENTAL

CONDITIONS FOR

PRIIA

ROLLING STOCK

DRAFT

SPECIFICATION NO. 963

ISSUE DATE: August 19, 2010

APPROVED: Sept. 30, 2010

(signature page follows)

This specification has been adopted by the Passenger Rail Improvement and Investment Act (PRIIA) Next Generation Equipment Committee (NGEC) for use in its vehicle specifications. If changes to this document are made, please contact the PRIIA Revision Control Coordinator (RCC) so that the NGEC can evaluate changing its version for use in vehicle specifications. The RCC's contact information can be found on the AASHTO web site http://www.highspeed-rail.org/Pages/default.aspx, then follow the link to documents and the Document Management Process procedure.

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Amtrak

Mechanical Department

Bureau of Rolling Stock Engineering

Operational & Environmental Conditions for PRIIA Bi-Level Rail Rolling Stock

AMTRAK SPECIFICATION No. 963

Issue Date: August 19, 2010

DRAFT

Approved Date

9/30/10 Chief Mechanical Officer

9/20/10 Deputy Chief Mechanical Officer - Engineering

8/20/10 Senior Director – Rolling Stock Engineering

8/19/10 Originator

Originator: Tammy Lee Krause

26-FOI-00415 0000006202 UNCLASSIFIED 4/30/2026

Specification Change Sheet

Revision	Date	Section(s)	Description	Originator

DRAFT

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1.0 Overview

This specification identifies the operational and environmental conditions in which all rail rolling stock and associated components must function without failure, degradation of component performance or condition, or reduced factor of safety. This specification applies to all aspects, features and parts of rail vehicles, including all exterior and interior components.

Rolling stock and associated components shall comply with this specification regardless of whether the vehicle or component is in normal operating service, in layover at a rail facility, or unpowered for storage or shipment.

These requirements shall apply under all possible combinations of conditions as described herein.

2.0 Regulations, Standards, Specifications and Drawings

APTA

SS-M-011-99: *Standard for Compressed Air Quality for Passenger Locomotive and Car Equipment*

RP-E-017-99: *Recommended Practice for 27-Point Control and Communication Trainlines for Locomotives and Locomotive-Hauled Equipment*

Amtrak

Drawing B-066-00050, revision A: *Bi-Level Clearance*

FRA

49CFR 231.31: *Drawbars for Freight Cars; Standard Height*

BNSF

Plate 2509, Sheet 3: *Passenger Platform*

Metrolink Station Design Manual

Accessible Station Platform Design Standard

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3.0 Scope

This specification applies to all Department-owned rail rolling stock, and all associated components, materials, machinery, equipment and supplies.

Specific provisions in rail equipment procurement or remanufacture contracts may require or permit vehicle, component or material performance that differs from those performance requirements set forth herein. In the case of a differing performance requirement, the requirement identified in the specific equipment contract shall supersede that requirement in this specification. Only the requirement that is specified differently shall be superseded. All other requirements shall apply.

4.0 Abbreviations and Acronyms

AAR: Association of American Railroads

APTA: American Public Transportation Association

AREMA: American Railway Engineering and Maintenance-of-Way Association

ATOR: Above Top of Rail

AW0: Actual weight of an empty car, ready for revenue service, with no crew or passengers aboard

AW2: Calculated weight of a car with normal full load defined as seated load plus one standee per 3 square feet of clear floor space

BNSF: Burlington Northern Santa Fe Railway (BNSF Railway)

CFR: Code of Federal Regulations

FRA: Federal Railroad Administration

mphps: miles per hour per second

mphpsps: miles per hour per second per second

5.0 General Requirements

Under the operational and environmental conditions identified in this specification:

- Materials shall not shrink or expand beyond their manufacturing tolerances, become brittle or soft such that they fail to perform their intended function, warp or lose original shape, or discolor or haze.
- Fasteners shall not loosen or tighten outside their specified torque range.
- System and component performance shall not degrade beyond specified limits.
- Paint, decals and elastomeric materials such as rubber shall not fade, crack, peel or delaminate.
- Liquids shall not harden, freeze or evaporate such that they cause damage to components, pipes, tanks or hoses. All liquids inside closed components shall either be equipped with freeze protection or shall be designed to accommodate freezing and expansion without damage to components, parts or performance.
- Components shall not rattle, shake, squeak, vibrate, flex beyond specified limits, hum or whistle, drum or oilcan, abrade against adjacent surfaces, distort or loosen.
- Vehicle or component performance shall not change beyond specified limits due to changes in passenger load, volume or quantity of operational supplies (such as fuel, water or sand) or shifting of passengers and supplies from one area or level of the vehicle to another.
- All vehicles and components shall maintain adequate clearance to wayside structures in compliance with specified clearance standards under all operational and environmental conditions at all applicable speeds.
- Unsafe conditions shall not be created for passengers, crew, maintenance personnel or others due to environmental or operational conditions relating to the design, performance or operation of rail rolling stock and associated components.

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6.0 Operational Requirements

6.1 Speed

6.1.1 Design Maximum (mph)

All rolling stock shall be designed for revenue operation at all speeds up to 125 mph, unless otherwise specified.

6.1.2 Certification Maximum (mph)

All rolling stock shall be delivered ready for revenue operation at all speeds up to 90 mph without requiring additional testing or documentation, unless otherwise specified.

6.2 Track

6.2.1 FRA Class of Track

The rolling stock shall be designed for revenue operation on all classes of track from FRA Class 1 to Class 7.

Track quality shall be the minimally compliant for each class of track, per FRA regulations and AREMA standards.

6.2.2 Track Gauge

All equipment shall operate on standard gauge track. Standard gauge is 56.5 in.

6.2.3 Grade

All rolling stock shall be capable of operation on track with a gradient of up to 5%. Pneumatic and mechanical braking systems shall be capable of stopping moving equipment, and retaining stationary equipment, on all ascending or descending grades up to 5% in either the forward or rearward direction.

6.2.4 Curvature, Horizontal

All rolling stock shall be capable of negotiating a 250 ft radius (23 degree) horizontal curve, coupled to other equipment, without damage to any portion of the trucks and suspension, coupler, draft gear, air and electrical connections, carbody, diaphragm or track.

6.2.5 Curvature, Vertical

All rolling stock shall be capable of negotiating a 1000 ft radius vertical curve (concave or convex), coupled to other equipment, without damage to any portion of the trucks and suspension, coupler, draft gear, air and electrical connections, carbody, diaphragm or track.

6.2.6 Superelevation

Rolling stock shall be stable (no greater than 50% wheel unloading) at all design speeds, including while stationary, on superelevated curves up to 7 in. above level.

6.2.7 Cant Deficiency

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Rolling stock shall be capable of operation at maximum authorized track speed on curves with a cant deficiency of up to 5 in, per the requirements of 49CFR 213.329.

6.2.8 Operation on Adjacent Tracks

Rolling stock shall be capable of safely passing other trains that are operating at maximum authorized track speed in either direction on adjacent tracks with 12 ft centers.

6.2.9 Operation through Crossovers

All rolling stock shall be capable of negotiating a number 8 crossover between two tracks with centers 12 ft apart, coupled to other equipment, without damage.

6.3 Compatibility with Station Platforms

6.3.1 Height Above Top of Rail

Revenue passenger cars shall be compatible for loading and unloading of passengers and supplies while adjacent to platforms that range from top of tie (8 in. below top of rail) to 18 in. ATOR. Platforms may be located on tangent or curved track, with or without superelevation.

6.3.2 Distance from Track Centerline

Station platform edges may be as far as 64 in. from center of track.

6.3.3 Accessible Mini-High Platforms

Some stations are equipped with mini-high level accessible platforms for use with an equipment-based bridge plate. These accessible platforms are located 21 in. ATOR and 95 in. from centerline of track. See Figure 2.

Rolling stock utilizing non-powered bridge plates or ramps for accessibility must interface with these platforms in accordance with ADA requirements.

6.3.4 Reference Documents – Station Platform Standards

1. Figure 1: BNSF Plan 2509, Sheet 3, *Passenger Platform.*
2. Figure 2: Metrolink *Accessible Station Platform Design Standard.*

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7.0 Equipment Standards

7.1 Electrical

7.1.1 HEP - Voltage, Cycle, and Phase

All rolling stock shall operate on head-end power system with the following characteristics:

- Voltage: 480 VAC nominal (tolerance range from 408 to 528 VAC)
- Frequency: 60 Hz nominal (tolerance range from 56 to 64 Hz)
- 3-phase
- Pin assignments for HEP supply and control circuits are shown in Table 1.

7.1.2 Communication Trainline Pin Assignments

The Department standard for Communication trainline pin assignment is shown in Table 2.

7.1.3 MU (locomotive control) Trainline Pin Assignments

The Department standard for MU (locomotive control) trainline pin assignment is shown in Table 3.

7.1.4 Trainline Cable and Receptacle Standards

Car-to-car and car-to-locomotive trainlines shall conform to APTA RP-E-017-99, *Recommended Practice for 27-Point Control and Communication Trainlines for Locomotives and Locomotive-Hauled Equipment.*

Trainlines and receptacles shall be located on the end plate of passenger rail cars in accordance with APTA RP-E-017-99 figure 2, the "Intercity Car" configuration and in the dimensional locations shown in APTA RP-E-017-99 figure 4A.

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7.2 Locomotive Air Supply

7.2.1 Brake Pipe - Operating Pressure

Maximum brake pipe air pressure is 110 psig (full release).

7.2.2 Main Reservoir - Operating Pressure range

Maximum main reservoir air pressure in normal operation is 140 psig.

Minimum main reservoir air pressure in normal operation is 80 psig.

7.2.3 Air Quality Standard

Air will be delivered from the locomotive compressed air supply in accordance with APTA Standard SS-M-011-99, *Standard for Compressed Air Quality for Passenger Locomotive and Car Equipment.*

7.3 Carbody Dimensions

Carbody dimensions shall be designed and measured with the rail vehicle at load condition AW0, unless otherwise specified.

7.3.1 Static and Dynamic Clearance

All rolling stock shall comply with the static dimensional and dynamic envelope clearances specified on Amtrak Bi-Level Clearance drawing B-066-00050, revision A, under all load conditions AW0 through AW2.

7.3.2 End Door Pass-Through/Floor Height

7.3.2.1 For bi-level rail passenger cars

- Upper floor height and floor height at the end door passageway shall be 104.5 in. ATOR (+/- 0.5 in.).
- The height of the lower floor and threshold for side entry doors shall be 18 in. ATOR (+/- 0.5 in.).

7.3.2.2 For single-level rail passenger cars

Floor height and end door passageway height shall be 51 in. ATOR (+/- 0.5 in.).

7.3.3 Coupler Height

Coupler height shall be in conformance with 49CFR 231.31.

Coupler height shall be maintained at a nominal 34.5 in. ATOR, measured at the center of the coupler knuckle when car is uncoupled.

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7.4 Braking Performance

7.4.1 Full Service Brake Rate

Trains consisting of five cars at load condition AW2, and one locomotive shall have a minimum full service braking rate of 1.35 mphps at 125 mph increasing to and maintaining an average of 2.0 mphps at speeds of 70 mph or less. The instantaneous full service deceleration rate shall not exceed 2.75 mphps nor be less than 1.25 mphps. Locomotive dynamic or blended braking shall not be used to calculate brake rates.

7.4.2 Emergency Brake Rate

The emergency brake rate shall not be less than 2.5 mphps at speeds below 70 mph.

7.4.3 Jerk Rate

The maximum jerk rate (change in the rate of deceleration) during initial service brake application shall be limited to 1.5 mphpsps under all normal braking conditions. There shall be no jerk rate limit for emergency brake applications.

7.5 Standard Amtrak Coach Key

All locks, latches and access control devices that are capable of locking shall be designed for use with a standard Amtrak coach key. This key shall be compliant or equivalent with the following references:

- Amtrak drawing B-144, rev B
- Amtrak AMMS part number 24-601-07430
- J L. Howard style 2555

8.0 Environmental Conditions

All rail rolling stock, and associated components, shall be designed to be fully operational under the following environmental conditions, in all possible combinations of conditions, without failure, degradation of component functionality, condition, installation or maintainability. This requirement applies to all equipment:

- While under normal operating conditions in revenue service (normal).
- While in layover with wayside or head end power (layover).
- While in storage or transit with no internal or external power source (dead).

8.1 Ambient Exterior Conditions

8.1.1 General Atmospheric Conditions

All rail rolling stock, and associated components, shall be fully operational in the presence or absence of the following conditions:

- Strong direct sunlight
- Heavy rain, driven by wind
- High temperatures outside and inside the equipment
- Freezing conditions, including buildup of snow and ice
- Blown sand, dust, pollen, leaves and aerial debris
- Airborne salt from sea spray or snowmelt
- Wind gusts up to 90 mph

8.1.2 Chemical and Electrical Contaminants

- Oily exhaust from diesel locomotives
- Cleaning agents and lubricants
- Ferrous dust from rail, wheel and brake shoe wear

8.1.3 Vehicle Washing Facilities

- Acid and alkaline wash water composition
- High-pressure rinse spray and rotating brushes
- Specific technical characteristics of vehicle wash facilities are shown in Table 4.

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8.2 Specific Atmospheric Conditions

All rail rolling stock, and associated components, shall be fully operational in the presence or absence of the following specific environmental conditions:

8.2.1 Temperature

- Outside ambient temperatures may range from -35°F to 150°F.
- Equipment may experience an ambient outside temperature change of up to 70°F (from cool to hot, or from hot to cool) in a 6-hour period while in service.
- The ambient temperature inside an unpowered rail vehicle may range from -35°F to 150°F.

8.2.2 Humidity

- Ambient atmospheric humidity ranges from 5% to 100%.
- Atmospheric moisture in coastal areas contains salt.

8.2.3 Precipitation

- Potential precipitation types include rain, hail, snow, ice and freezing rain.
- Peak precipitation may be as high as 6 in. of rainfall per hour.

8.2.4 Wind

- Wind speeds may range from still air to sustained gusts up to 90 mph.
- Wind direction is independent of train direction.
- Wind speed may be combined with train speed to create relative headwinds in excess of 200mph.

8.2.5 Elevation

Equipment must be fully functional at all elevations and barometric pressures from 200 ft below mean sea level to 9200 ft above mean sea level.

8.2.6 Dust, Dirt, Debris, etc.

- All rail equipment must be capable of normal operation in an environment with a high degree of wind-blown dust, such as the San Joaquin Valley. This dust may be found throughout the vehicle, including the interior.
- The dust in the San Joaquin Valley is composed of fine silica sand, silt, salt compounds (calcite, halite, gypsum), and ferrous iron dust from rails, wheels and brake shoes. This dust is highly corrosive, hard, and abrasive, and easily accumulates on surfaces coated with water, grease, oil, or other lubricants. It is also attracted to magnetic objects such as motors.

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8.3 Vibration and Shock

8.3.1 Vibrational Acceleration Extremes – Trucks

Truck-mounted equipment shall be designed and manufactured to withstand long-term exposure to the following vibrational acceleration levels:

Truck Acceleration Parameter	Measured "G" Levels	Frequency (Hz)
Vertical	100	60 to 70
Lateral	100	380

8.3.2 Vibrational Acceleration Extremes – Carbody

Carbody-mounted equipment shall be designed and manufactured to withstand long-term exposure to the following vibrational acceleration levels:

Carbody Acceleration Parameter	Measured "G" Levels	Frequency (Hz)
Vertical	100	12 to 15
Lateral	100	1.5 to 2.0

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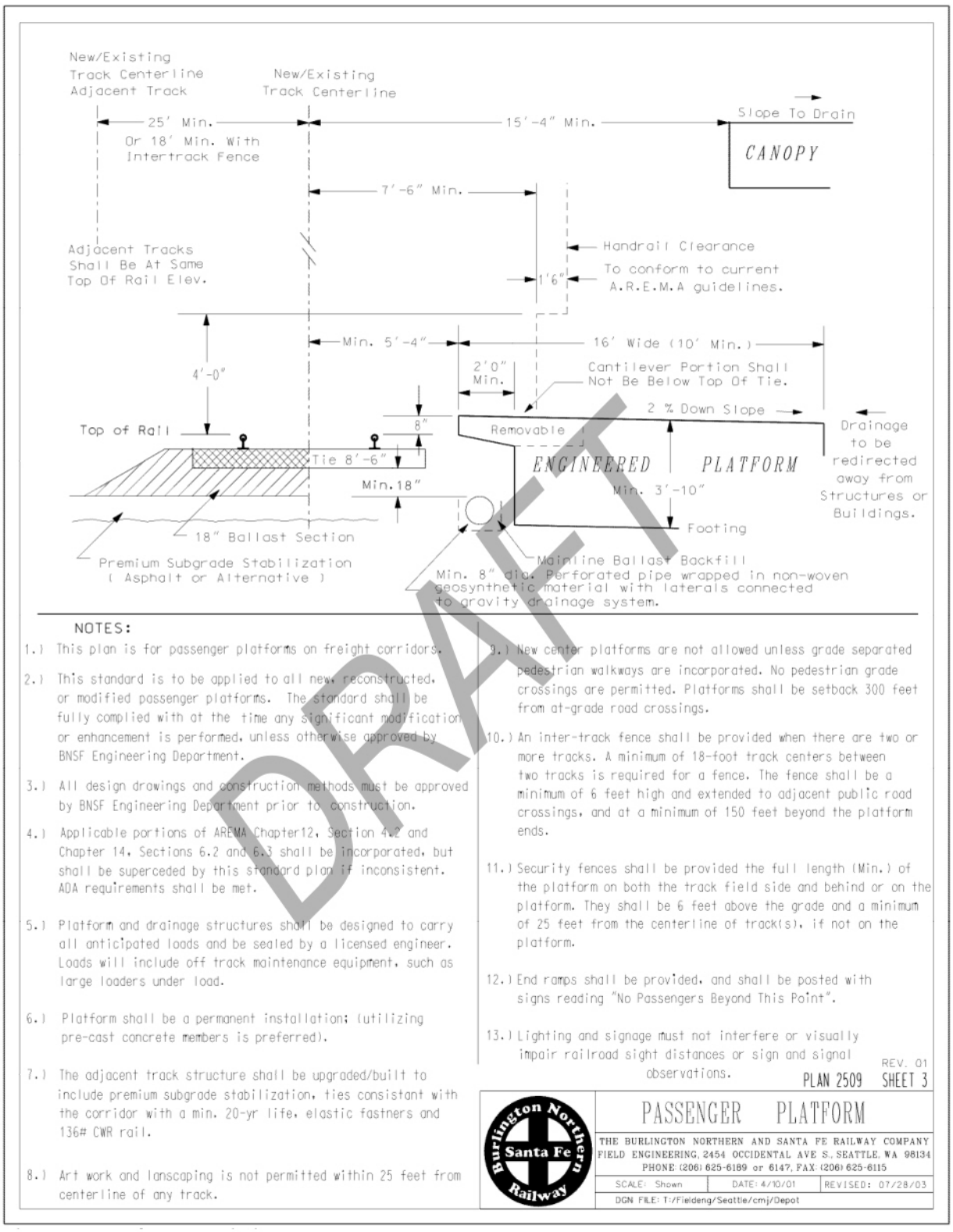
Figure 1: BNSF Plan 2509, Sheet 3, *Passenger Platform*



NOTES:

1.) This plan is for passenger platforms on freight corridors.

2.) This standard is to be applied to all new, reconstructed, or modified passenger platforms. The standard shall be fully complied with at the time any significant modification or enhancement is performed, unless otherwise approved by BNSF Engineering Department.

3.) All design drawings and construction methods must be approved by BNSF Engineering Department prior to construction.

4.) Applicable portions of AREMA Chapter12, Section 4.2 and Chapter 14, Sections 6.2 and 6.3 shall be incorporated, but shall be superceded by this standard plan if inconsistent. ADA requirements shall be met.

5.) Platform and drainage structures shall be designed to carry all anticipated loads and be sealed by a licensed engineer. Loads will include off track maintenance equipment, such as large loaders under load.

6.) Platform shall be a permanent installation; (utilizing pre-cast concrete members is preferred).

7.) The adjacent track structure shall be upgraded/built to include premium subgrade stabilization, ties consistant with the corridor with a min. 20-yr life, elastic fastners and 136# CWR rail.

8.) Art work and lanscaping is not permitted within 25 feet from centerline of any track.

9.) New center platforms are not allowed unless grade separated pedestrian walkways are incorporated. No pedestrian grade crossings are permitted. Platforms shall be setback 300 feet from at-grade road crossings.

10.) An inter-track fence shall be provided when there are two or more tracks. A minimum of 18-foot track centers between two tracks is required for a fence. The fence shall be a minimum of 6 feet high and extended to adjacent public road crossings, and at a minimum of 150 feet beyond the platform ends.

11.) Security fences shall be provided the full length (Min.) of the platform on both the track field side and behind or on the platform. They shall be 6 feet above the grade and a minimum of 25 feet from the centerline of track(s), if not on the platform.

12.) End ramps shall be provided, and shall be posted with signs reading "No Passengers Beyond This Point".

13.) Lighting and signage must not interfere or visually impair railroad sight distances or sign and signal observations.

REV. 01
PLAN 2509 SHEET 3

Burlington Northern Santa Fe Railway

PASSENGER PLATFORM

THE BURLINGTON NORTHERN AND SANTA FE RAILWAY COMPANY
FIELD ENGINEERING, 2454 OCCIDENTAL AVE S., SEATTLE, WA 98134
PHONE (206) 625-6189 or 6147, FAX (206) 625-6115

SCALE: Shown	DATE: 4/10/01	REVISED: 07/28/03
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Figure 2: *Metrolink Accessible Station Platform Design Standard*

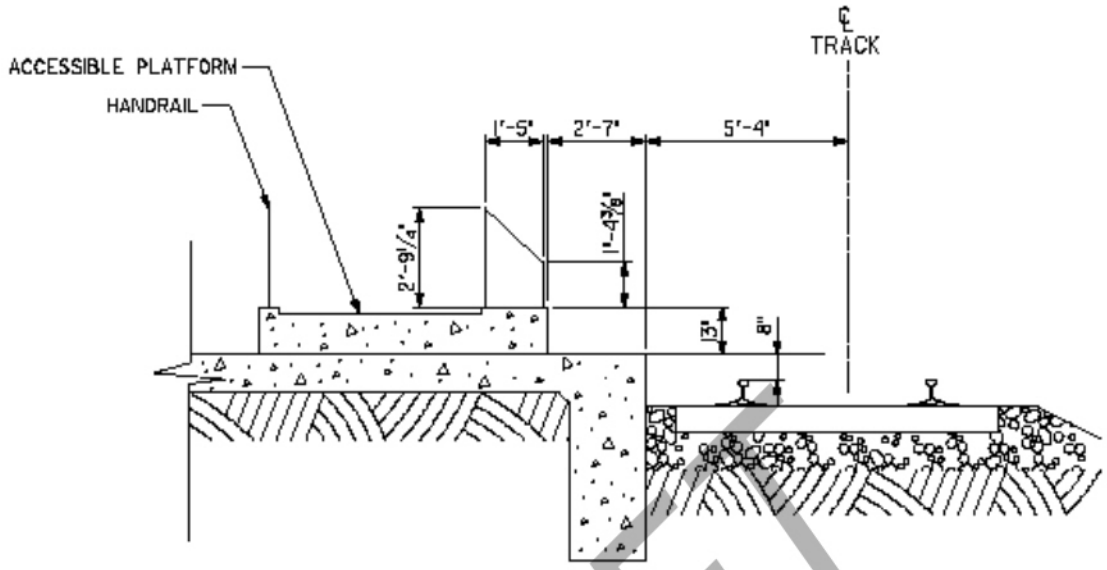

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Table 1: Pin Assignments for HEP Supply and Control Circuits

Pin #	Description	Wire Tag
HEP Power Circuit:		
1	480vac Phase 1	TLA
2	480vac Phase 2	TLB
3	480vac Phase 3	TLC
HEP Control Circuit:		
1	Trainline Continuity Control	TLF
2	Carbody Ground	TLG
3	Trainline Continuity Control	TLS

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Table 2: Communication Trainline Pin Assignments

Pin	California Department of Transportation Standard (for information only)	Amtrak Standard	APTA Standard (for information only)
1	Shield (Common)	Shield	Shield (Common)
2	Battery Negative	Battery Negative	Battery Negative
3	Reserved for digital trainline/passenger information	PA/Tape Music #1 (black)	PA/Tape Music #1 (black)
4	Reserved for digital trainline/passenger information	PA/Tape Music #1 (white)	PA/Tape Music #1 (white)
5	Intercom (black)/analog with digital overlay	Intercom (black)	Intercom (black)
6	Intercom (white)/analog with digital overlay	Intercom (white)	Intercom (white)
7	PA Control (black)/analog with digital overlay	PA Control (black)	PA Control (black)
8	PA Control (white)/analog with digital overlay	PA Control (white)	PA Control (white)
9	Reserved for digital trainline/passenger information	Passenger Info (black)	Music-3 (radio)(black)
10	Reserved for digital trainline/passenger information	Passenger Info (white)	Music-3 (radio)(white)
11	Brake Application (not used)	Brake Application (spare-reserved for future use)	Brake Application
12	Brake Release (not used)	Brake Release (spare-reserved for future use)	Brake Release
13	Brake Negative (not used)	Brake Negative (spare-reserved for future use)	Brake Negative
14	Open Doors - Right Hand Side	Open Doors R.H.	Open Doors R.H.
15	Open Doors - Left Hand Side	Open Doors L.H.	Open Doors L.H.
16	Close Doors - Right Hand Side	Close Doors R.H.	Close Doors R.H.
17	Close Doors - Left Hand Side	Close Doors L.H.	Close Doors L.H.
18	Door Closed Light	Door Closed Light	Door Closed Light
19	Brake Released Light	Brake Released Light	Brake Released Light
20	Brake Applied Light	Brake Applied Light	Brake Applied Light
21	Hot Journal Light (not used)	Hot Journal Light	Hot Journal Light
22	Conductor's Signal	Conductor's Signal	Conductor's Signal
23	Door Close Light	Conductor's Door Closed Light	Door Close Lt
24	Reserved for digital trainline/passenger information	Tape Music #2 (black) (spare)	Tape Music #2 (black)
25	Reserved for digital trainline/passenger information	Tape Music #2 (white) (spare)	Tape Music #2 (white)
26	Conductor's Door Light Feed	Conductor's Door Light Feed	Conductor's Door Light Feed
27	Attendant Call	Attendant Call System (not active)	Attendant Call
shielded pairs:	3&4, 5&6, 7&8, 9&10, 24&25	3&4, 5&6, 7&8, 9&10, 24&25	3&4, 5&6, 7&8, 9&10, 24&25
Source:		Amtrak dwg A-63-7676-1 (under revision)	APTA Std RP-E-017-99

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Table 3: MU (Locomotive Control) Trainline Pin Assignments

Pin	California Department of Transportation Standard (for information only)	Amtrak Standard	APTA Standard (for information only)
1	Spare	Spare	Spare (reserved for cruise control)
2	Alarm Bell	Alarm Bell	Alarm Bell
3	Engine Speed Solenoid "DV"	D Throttle	D Throttle
4	Control Negative	Control Negative	Control Negative
5	Emergency Sand	Emergency Sand	Emergency Sand
6	Generator Field	Generator Field	Generator Field
7	Engine Speed Solenoid "CV"	C Throttle	C Throttle
8	Forward	Forward	Forward
9	Reverse	Reverse	Reverse
10	Wheel Slip Indicator	Wheel Slip	Wheel Slip
11	Spare	Spare	Spare
12	Engine Speed Solenoid "BV"	B Throttle	B Throttle
13	Control Positive	Control Positive	Control Positive
14	Spare	Spare	Spare
15	Engine Speed Solenoid "AV"	A Throttle	A Throttle
16	Engine Run	Engine Run	Engine Run
17	Dynamic Brake Setup	Dynamic Brake Setup	Dynamic Brake Setup
18	Remote Load Meter Line 1	Remote Loadmeter	Remote Loadmeter
19	Remote Load Meter Line 2	Remote Loadmeter	Remote Loadmeter
20	Dynamic Brake Warning	Dynamic Brake Warning	Dynamic Brake Warning
21	Dynamic Brake Start	Dynamic Brake Start	Dynamic Brake Start
22	Spare	Spare	Spare
23	Manual Sanding	Manual Sanding	Manual Sanding
24	Dynamic Brake Excitation	Dynamic Brake Excitation	Dynamic Brake Excitation
25	Spare	Spare	MU Headlight
26	Remote Fault Reset	Remote Fault Reset	Remote Fault Reset

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27	Brake Emergency	Brake Emergency	Brake Emergency

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Table 4: Characteristics of Vehicle Wash Facility

Car Wash Characteristic	Oakland Maintenance Facility
High Pressure Rinse	
Water pressure at nozzle	300 psi
Spray nozzle flow rating	1.6 gpm
Angle of spray nozzle	65 degrees
Spray nozzle - angle relative to car side	90 degrees
Spray nozzle distance from car side	24 in.
Acid Rinse	
Chemical type	Acid Liquid Cleaner
pH before dilution	1.6 - 1.8
Dilution range	1:5 - 1:30
Duration on carshell	up to 30 seconds
pH after dilution	
Alkaline Rinse	
Chemical type	Alkaline Liquid Cleaner
pH before dilution	10.5
Dilution range	1:5 - 1:30
Duration on carshell	up to 30 seconds
pH after dilution	
Brushes	
Material	European Bristle
Overlap against car side	4 in.
Rotation rate	100 RPM

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* End of Specification *

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AMTRAK
Mechanical Department
Rolling Stock Equipment

SPECIFICATION

For

Seat Cushion Assemblies

DRAFT

SPECIFICATION No. 665

Revision E

Issue Date: 05/05/2020

APPROVED 5-6-20 **DATE**

DocuSigned by: Charles King DAB2378A05BE4D2...	5/6/2020	VP/Chief Mechanical Officer
DocuSigned by: George Hull 60B85C5072C24EF...	5/6/2020	AVP/Deputy Chief Mechanical Officer
DocuSigned by: Steven Curley BC0B0FB9E9B6423...	5/6/2020	Director System Engineering & Specifications
DocuSigned by: Duncan Copland 92A1900DE432497...	5/6/2020	Senior Manager – Industrial Design
DocuSigned by: Seth Geist B0ABF301F2C7479...	5/6/2020	Originator

REVISION	DATE	PAGE	DESCRIPTION
A	Sept. 7, 1999	10 &11	ASTM D3674 test I_2 Procedure B was A (8000 cycles). ASTM E662 Ds @ 1.5 min. was 25.
B	June 29, 2000	8, 9, 10, 12, 12, 13, 14	Misc changes relative to compliance with 49CFR 238.103. Seam construction further defined.
C	Aug, 22, 2016	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	Many changes to correct errors as well as further define material specifications. Also added FAI and Change Management sections.
D	April 6, 2017	6, 11, 12	Changes to fire blocker construction, lamination and stitching method
E	May 5, 2020	Section 2.2.4	Added Synthetic Leather and testing to materials

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1.0 SCOPE

1.1 Purpose of Specification.

The purpose of this specification and related engineering drawings is to state the minimum technical criteria for the design, material selection, and construction of seat cushion assemblies and components acceptable for application into Amtrak owned and/or operated rail passenger vehicles.

1.2 Workmanship

The manufactured quality of all cushioning products and assemblies shall meet or exceed applicable Federal Standards and applicable industry standards and recommended practices in addition to those defined in this specification. All product suppliers, fabricators, and assemblers shall demonstrate their ability to manufacture products of the highest quality by providing, at the request of Amtrak, a copy of their Quality Assurance program in writing or provide proof of certification of ISO 9001:2008 or an equal industry wide quality assurance program.

1.3 Testing Requirements

1.3.1 Material Physical Properties

Manufacturer must submit a formal material specification showing material meets the criteria identified in this specification

1.3.2 Material Fire Safety Properties

Seat cushion assembly shall meet the criteria specified in Amtrak specification 352. A formal test report, signed by an independent testing laboratory technician and supervisor, identifying the manufacturer, product name or part number with all reportable data shall be forwarded to Amtrak prior to approval for use. All non-metallic parts must be tested. These tests must be performed by an independent testing facility certified to ISO 9001 or equal.

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2.0 GENERAL

2.1 Description

Seat cushion assemblies described herein shall be manufactured for installation as coach seat bottom and back, sleeper seat/mattress bottom/back assemblies, sleeper headrest assemblies, armrest and leg rest assemblies single lounge bottom and back, diner booth bottom and back, and lounge bottom and back cushions to include:

- o Cushioning foam
- o Fire barrier fabric (if so designated)
- o Upholstery fabric or approved equal
- o Attachment straps and hardware
- o Hook and Loop attachment tape
- o Zippers

o Labels

Cushion assemblies may be purchased complete with cushioning foam and upholstery covers or as component sub-assemblies of cushioning foam with fire barrier fabric, fire resistant cushioning foam without barrier fabric, or upholstery covers complete with attachments and hardware.

2.2 Materials

The cover shall be constructed from the materials shown in appropriate Amtrak drawing. Material A will be used in the main center panel. Material B will be used in the bolsters, side boxing and aft visible areas. Non-visible areas of the cover may be constructed from nylon pack cloth. Covers must be designed to dress easily (zipper recommended) and such that the main seat surfaces are tight and wrinkle free. All A and B fabric surfaces must be laminated using a ¼" dax foam and a jersey backing material.

Lamination:

All visible surfaces must be made from a tri-laminate panels. The laminate is a heat set polymer web adhesive (Min 0.9 OZ/SQ YD) that allows the fabric to bend and breathe easily. The durability of the laminate is a key performance requirement for Amtrak and each vendor submitting a bid must be able to demonstrate that they have at least two years of experience in manufacturing laminated textile panels, they have a quality control systems to ensure repeatable performance, and their lamination panels have been tested under jounce and squirm conditions to 100,000 cycles with no visible delamination, puckering, crack marks, bubbles, or blisters. Tests must be conducted to Daimler Chrysler Test Specification PF-10254 Change A, S6.4 Jounce and Squirm or approved equivalent. Additionally, the laminate must meet the 12 second vertical burn flammability requirements of 14 CRF 25.853(a) Appendix F, Part I(1)(a)(ii) as defined in FRA 238.103 appendix B.

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Alternate materials may be suggested but must be submitted to Amtrak Industrial Design for prior approval.

2.2.1 Woven Fabric

Woven fabrics used for seat upholstery shall be made of woven, transportation grade fabrics of a 90% wool and 10% nylon blend with a minimum weight of 12 ounces per square yard. The maximum fabric shrinkage shall be no greater than 2% in either the warp or fill direction. All woven fabrics shall be back-coated with a latex or equivalent coating material to prevent/reduce linear distortion. Alternative fabric construction and materials will be considered, however approval for their use is subject to Amtrak's Industrial Design Group review and written approval. The following testing criteria shall apply to woven fabrics:

Test Identification	*Test Description*	*Test Pass/Fail Criteria*
ASTM D-4966 (12KPA)	Abrasion Resistance Martindale	20,000 cycles min – no breaks
ASTM D-4034	Yarn Slippage	Warp/Fill – 25lbf. min
ASTM D-2262	Tear Strength (Tongue)	Warp/Fill - 6 lbf. min.
ASTM D 3597	Breaking Strength	Warp/Fill – 50lbf. min
ASTM D 3597	Color Fastness	Water-Class 4 min. Solvent – Class 4 min. Crocking – Class 4 min. Light – Class 4 min.

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2.2 Materials

2.2.2 Vinyl Fabric

Fabric-backed vinyl fabrics used for seat upholstery shall be made of woven, transportation grade fabric-backed vinyl with a weight of 22 ounces per square yard min. Alternative fabric construction and materials will be considered, however approval for their use is subject to Amtrak's Industrial Design Group review and written approval. The following testing criteria shall apply to vinyl fabrics:

Test Identification	*Test Description*	*Test Pass/Fail Criteria*
ASTM D-5034	Tensile Strength	Warp - 65 lbf. min. Fill -60 lbf. min.
ASTM D-2261	Tear Strength (Tongue)	Warp - 10 lbf. min. Fill - 12 lbf. min.
ASTM D-1117	Shear Strength (Trapezoid)	Warp - 29 lbf. Fill - 29 lbf.
ASTM D-1117	Martindale Abrasion Test	250,000 double rubs with #8 cotton duck. – no wear through

2.2.3 Leather

Aniline dyed leather with a light texture.

Test Identification	*Test Identification*	*Test Pass/Fail Criteria*
ASTM d-3884	Abrasion	300 cycles, 500g H-18 wheels. No wear through
	Colorfastness	72 hr. exposure to UV light. 4 or better on the AATCC grey scale for color change.
ASTM D-4705	Tear Strength	12 lbf. min.

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2.2.4 Synthetic Leather

Lantal XP is the Amtrak approved synthetic leather. Alternative synthetic leathers and materials will be considered, however approval for their use is subject to Amtrak's Industrial Design Group review and written approval. The following testing criteria shall apply to synthetic leathers:

Test Identification	*Test Description*	*Test Pass/Fail Criteria*
ASTM D-2261	Abrasion Resistance (500g, H-18 Wheel)	>1000
ASTM D2209	Tensile Strength	>3194 psi Warp/Weft Average.
ASTM D-5034	Breaking Force	>195 lbf Warp/Weft Average
AATCC 16	Light Fastness	Class 5
AATCC 8	Color Fast Crocking	Dry/Wet Grade 5

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2.2.5 Fire Barrier Fabric (when employed)

Approved fire barrier fabrics are Tex Tech Industries TTI 8174 and Dupont Nomex 17253. Alternative fire barrier materials will be considered. Approval is contingent upon submittal of the following tests to Amtrak's Industrial Design group for review and written approval.

Test Identification	*Test Description*	*Test Pass/Fail Criteria*
ASTM D3884 (CS-10 wheel, 1000 gm wt.)	Abrasion Resistance	150 cycles @ 50% wear through
ASTM D2261	Tear Resistance	15 lbf (in both the warp and fill directions)
FTMS 191A Method 5122	Burst/Puncture Resistance	200 lbf

2.2.6 Cushioning Foam

2.2.6.1 Foam with Fire Barrier Cover

Cushioning foam employed in applications with fire barrier fabrics shall be high quality transportation grade flexible cellular resilient foam conforming to the following criteria:

Test Identification	*Test Description*	*Test Pass/Fail Criteria*
ASTM D3574, test B_1 (Sample size, 15" x 15" x 4")	Indented Force Deflection	Back Cushion Foam 25% IFD = 31 - 39 Bottom Cushion Foam 25% IFD = 41 - 49 Support Factor = 2.1 min.
ASTM D3574 test D	Compression Set at 50% deflection	10% max.
ASTM D3574, test E	Tensile Strength	IFD < 35TLN = 15 lbs/in^2 min. min. IFD > 35TLN = 15 lbs/in^2 min.
ASTM D3574, test F	Tear Resistance	2 lbs/inch min.
ASTM D3574, test H	Resilience	40 % min.
ASTM D3574, test A	Density	2.5 lbs/ft^3 min.

Cushion foam assemblies may be molded, or fabricated from buns or slab stock. Adhesives used to bond foam cut from slab stock must be fire resistant.

2.2.6.2 Cushioning Foam without Fire barrier Cover

Cushioning foam employed in applications without fire barrier covers shall be high quality transportation grade flexible cellular resilient foam conforming to the following criteria:

Test Identification	*Test Description*	*Test Pass/Fail Criteria*
ASTM D3574, test B_1 (Sample size, 15" x 15" x 4")	Indented Force Deflection	Back Cushion Foam 25% IFD = 31-39 Bottom Cushion Foam 25% IFD = 41-49
ASTM D3574 test D	Compression Set at 50% deflection	10% max.
ASTM D3574, test E	Tensile Strength	IFD <35, TLN = 12 lbs/in^2 min. IFD > 35, TLN = 12 lbs/in^2 min.
ASTM D3574, test F	Tear Resistance	2 lbs/inch min.

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ASTM D3574, test H	Resilience	40 % min.
ASTM D3574, test A	Density	2.5 lbs/ft^3 min.

Cushion foam assemblies may be molded, or fabricated from buns or slab stock. Adhesives used to bond foam cut from slab stock must be fire resistant.

2.2.7 400D Nylon Packcloth

400D Nylon Packcloth fabric supplied by Associated Textile Mills may be employed as part of the upholstery covers on the cushion bottoms and backs in areas which are not exposed. No nylon fabric shall be exposed to view after the cushion is applied to the seat frame. Alternative materials and suppliers may be considered but will require the review and written approval of Amtrak's Industrial Design Group.

Test Identification	*Test Description*	*Test Pass/Fail Criteria*
ASTM D-5034	Breaking Strength	Warp -355 lbs. min. Fill - 275 lbs. min.

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2.2.8 Snaps

Snap attachment, where employed, shall be nickel plated brass eyelet and bottom. Nominal size is 1/4.

2.2.9 Zippers

Zippers used to close upholstery covers shall be nominally 5/8" black chain with black slider and large pull tab. Zipper shall be metal.

2.2.10 Hook and Loop

1-1/2" wide Loop attachment tape shall be applied to cushion backs, and bottoms where required. All Hook and Loop attachment tape shall be applied by stitching defined in paragraph 3.1.

The color of the 1-1/2" wide Loop attachment tape on the backs of the backrest and bottom cushions may be selected by discretion of the manufacturer. The color of the 3/4" wide Hook tape attached to the coach seat headrests shall be as defined on applicable Amtrak drawings. Amtrak shall be consulted for advisement of color of all Hook or Loop tape applications which have not been specified on document drawings or applicable Amtrak specifications.

Aplix is an approved supplier for smoke, flame and toxicity approved Hook and Loop tape.

2.2.11 Nylon Straps – Astrup is an approved supplier.

Attachment straps shall be 3/4" wide woven nylon tape.

2.2.12 Eyelet

Eyelets where used shall be brass with plain washer face, .315" inside diameter, Astrup code 233221-1 or equal

2.2.13 Thread

All thread employed to attach fabrics, zippers, straps, and hook & loop shall be Nylbond nylon thread #69 (or equal). The thread color shall either compliment or contrast the finish upholstery fabric. Samples of finished upholstery seams shall be forwarded to Amtrak for approval of thread color.

Serging thread shall be spun 50/3 spun polyester thread (or equal).

All thread employed in the construction of the fire barrier cover shall be 100 percent DuPont Kevlar # 69.

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3.0 CONSTRUCTION

3.1 Stitching and Seaming

All upholstery seams shall be constructed per Federal Standard 751a, general seam type SS, stitch type 301.

Back tacks are required at the beginning and end of every stitch run and must be a minimum of 3 stitches.

Seams not requiring a decorative top stich will have a 3/8” hem and be type SSa.

Seams requiring a decorative topstitch will have a 3/8” hem with a 3/16” top stitch and be type LSq.

See latest revision of approved Amtrak drawing for locations requiring top stitch and the side of the seam on which the top stitch is visible.

When the Amtrak cushion design requires horizontal bars on both the back and bottom covers. The aesthetic appearance of these features is critical and as such, these features must be tooled and sewn in an automated systems. Marking and hand sewing is not acceptable. Vendors submitting bids

must demonstrate to Amtrak their computerized sewing system to ensure these lines are consistent and repeatable.

3.1.1 Woven to woven fabric joints

All finish cover upholstery seams shall be constructed employing Type SSa-1 seams with one row of flat stitching and one row of top stitching, 6 stitches per inch min.

3.1.2 Zipper Attachment

All zippers shall be attached with a Type SSa-1 seam, a single row of stitching, 6 stitches per inch min. Ends must be “locked”.

3.1.3 Hook and Loop@ Attachment Seam

All Hook and Loop attachment seams shall be seam type SSa-1, single row of stitching, 6 stitches per inch min. Stitching thread shall be Nylbond #69. Nylon thread (or equal). Color to match fabric.

3.1.4 Fire Barrier Cover Construction

Method A: All fire barrier cover attachment seams on seat cushion assemblies shall be lock stitched, single row of stitching, 7 stitches per inch min. Stitching thread shall be 100 percent Kevlar, #69. Final joint (joint remaining after cushioning foam is inserted into cover) may be bonded rather than stitched providing a flap with a 2" minimum overlap is employed. Approved fire barrier fabrics for method A are Tex Tech Industries TTI 8174 and Dupont Nomex 17253.

Method B: Foam must be fully encapsulated in protective fire-blocking material, TexTech 7725R or equivalent. Fire-blocking must be firmly affixed to foam through adhesive process with water based eco-friendly adhesive such as Simalfa 321FR or equivalent such that all seams overlap a minimum of 1” and there are no puckers or wrinkles greater than ¼” high. All puckers or wrinkles in fire-blocking must be such that they will lay flat and not be visible once the fire-blocked assembly is dressed. To protect the fireblock and ensure the longevity of the fire-blocked assembly, a ballistic nylon (420 denier nylon pack cloth or equivalent) wear strip must be adhered inside the aft insert channel that engages with the seat plate. Any sewing on the fireblock must be accomplished using an approved Kevlar thread.

Alternate materials may be suggested but must be submitted to Amtrak Engineering for prior approval.

Alternative construction will be considered, for cushions other than seat bottoms, but will require Amtrak’s Industrial Design Group review and written approval.

3.2 Serging

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All perimeters of fabric that fray must be serged per Federal Standard Number 751a, stitch type 504, 5 stitches per inch minimum using spun 50/3 spun polyester thread or equal.

3.3 Size - Tolerances

Overall finished size and dimensional tolerance for all cushions shall be as identified on the respective engineering drawing for each cushion type where available. Where no engineering drawings exist, or where dimensional tolerancing is not shown the following shall apply:

Length = +1/2", -0"
Width = + 3/8", -0"
Height = +1/4", - 1/8"

The above tolerancing shall be viewed as relative to the engineering drawings where applicable or the FAI (First Article Inspection) model where drawings are not available.

4.0 LABELLING

4.1 Upholstery Cover

All finished upholstery covers shall include an identification label. The label shall be constructed of Tyvek fabric paper and shall be sized to include the following information in 3/16" high lettering:

Amtrak - (Part description, i.e. back or Bottom)
SAP XX-XXX-XXXXX
Mfg. By XXXXXX
Mfg. P/N XXXX
Mfg. Date MO-DY-YR

The label shall be attached to the upholstery cover with stitching on two opposite sides of the label and shall be located on the under side near the nose of the bottom cushion and on the backside near the bottom of the back cushion. Labels shall be attached on the outside of the upholstery covers and readable without removing the cushion assembly from the seat. Label must be able to tolerate washing and still have legible text after washing.

4.2 Cushioning Foam Assembly

Cushioning foam and cushioning foam assemblies with a fire barrier cover shall be identified with the manufacturers name and date of manufacture (Calendar Quarter-YR or MO-YR) stenciled in 1" high lettering on the foam or fire barrier cover directly beneath the upholstery zipper.

5.0 WARRANTY

5.1 Upholstery Cover

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All upholstery assemblies shall be warrantied for a period of two years against defects in material, workmanship and premature wear.

5.2 Cushioning Foam Assembly

5.2.2 Foam

All cushioning foam employed shall be warrantied for a period of 8 years from date of manufacture. The foam material under normal passenger service use shall exhibit no deterioration of the foam and during this period shall exhibit no loss of height in excess of 25 percent of its original height and the resilience as measured per ASTM D3574 test H shall not be less than 40 percent.

If failure occurs in the first through fourth years the manufacturer will replace cushions and refit the existing upholstery and fire barrier covers at no charge to Amtrak. The fifth and sixth year Amtrak will pay 50 percent of the foam replacement cost and 50 percent of the upholstery and fire barrier cover refit cost. The seventh and eighth year Amtrak will pay 75 percent of the foam replacement cost and 75 percent of the upholstery and fire barrier cover refit cost.

This warranty shall apply directly to the manufacturer of complete cushion assemblies.

6.0 DOCUMENTATION

Amtrak requires the manufacturer to supply a detailed parts list for each cushion assembly. This is required as part of the product approval process.

7.0 SUPPLIER QUALIFICATION and PRODUCT APPROVAL

In addition to meeting the Vendor Qualification requirements established by the Amtrak Materials Management Service Center the supplier shall demonstrate his ability to:

1. Manufacture products which are compliant with this and all relevant technical requirements of Amtrak.
2. Manufacture products which are of consistently high quality.
3. Manufacture products in the production quantities required by Amtrak.
4. Select materials which are compliant with all Amtrak specifications and FRA (Federal Railroad Association) standards.

As demonstration of his ability to do all of the above, the manufacturer shall provide the following evidence:

1. Manufacture and deliver to Amtrak one coach seat bottom and matching backrest cushion. Cushions shall be manufactured to the criteria depicted on an approved Amtrak drawing.

2. Forward to Amtrak duplicate copies of the manufacturers Quality Assurance Plan/Manual and the quality assurance organization chart. Amtrak will perform a Quality Assurance audit to qualify the supplier initially and further, reserves the right to perform similar such

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audits as deemed necessary by Amtrak at periodic intervals. Additionally, prior to manufacture of a product, one Aas manufactured@ sample of each product shall be forwarded to the Amtrak Quality Assurance group who will perform a First Article Inspection (FAI) and grant product approval status of each manufactured product.

3. Forward a written report to Amtrak identifying and quantifying all of the equipment used to process, manufacture, and ship the subject products.
   This report shall include the quantity of manufacturing and administrative personnel and quantify the facility space employed in the manufacture, inventory of all related materials and products.

4. Forward copies of all test reports and material specifications identified in paragraph 1.3 Testing Requirements@ to Amtrak.

8.0 FIRST ARTICLE INSPECTION (FAI)

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An FAI shall be required for all manufactured materials for New Parts, New Suppliers, New Tooling, or New Process. These categories are defined as follows:

- New Part: First shipment of newly released product or change to a released part resulting in a P/N and/or drawing / Spec revision change.
- New Supplier: When changing to a different supplier or adding a supplier as an alternate source for released parts.
- New Tooling: When hard tooling originally qualified is changed due to wear, damage, or change to part design.
- New Process: When the supplier makes a major change to their manufacturing process.

NOTE: OEM Supplier components purchased as “factory off the shelf” would normally be outside the scope of this procedure. A repeat of all or selected portions of the First Article Inspection may be required under the following conditions.

a) The original FAI results/report were disapproved
b) Design changes to, or software changes in the product or system
c) Changes in the production process or to any of the associated processes including changes in facilities, tooling or test equipment.
d) Changes in materials or parts and /or suppliers of parts, materials, components or acquired software used in the products or systems delivered
e) Establishment of new or movement of product lines
f) Production inactivity of more than 1 year
g) After a critical tool or piece of equipment has been refurbished, moved, modified or replaced

Timely availability of an FAI plan is essential to ensure that the appropriate level of Amtrak technical expertise is available for the FAI and that the individuals have sufficient prior information to inspect the Equipment. The supplier shall provide the following information to Amtrak at least 5 working days before a scheduled FAI:

1. A complete list of Equipment to be inspected as well as a bill of material. Identify each completed assembly along with the configuration in which it is to be presented.
2. A copy of the technical Specification for the Equipment and the Subcontractor's scope of supply.
3. A report by a recognized independent testing laboratory certifying that all materials used in the equipment comply with the 49 CFR Part 238 Appendix B requirements, as applicable.
4. An Amtrak approved Inspection & Acceptance Test Procedure and an Amtrak approved Qualification Test Procedure to which the equipment will be inspected. A fit, form and functional test shall be required as part of the FAI.
5. All manufacturing variations of specified materials that vary in color, texture, pattern, etc., shall be presented, for approval by Amtrak, at FAI. Samples of acceptable variation extremes will be retained for reference in future inspections.
6. Should any of the above documents be incomplete or otherwise unacceptable to Amtrak, this shall be grounds to delay the FAI until they are made right. The burden of any delay shall be with the Supplier.
7. The FAI sample shall be retained by the equipment manufacturer at a minimum 90 days after the warranty expiration date on the last produced piece. This FAI sample needs to be clearly identified as such with manufacturing date on the label.

9.0 CHANGE MANAGEMENT

Amtrak requires its Suppliers to inform Amtrak of any Product or Process changes that they would like to implement. Formal acceptance by Amtrak is mandatory before this change request can be considered as approved.
Process modifications include but are not limited to:

- Relocation of the production site (manufacturing transfer),
- Production process,
- Tools change,
- Material change,
- Subcontractors change.

Configuration management of the Product is the Supplier’s responsibility.
Any change with an impact on Amtrak and/or the Contract requirements must be reviewed and approved by Amtrak prior to implementation.

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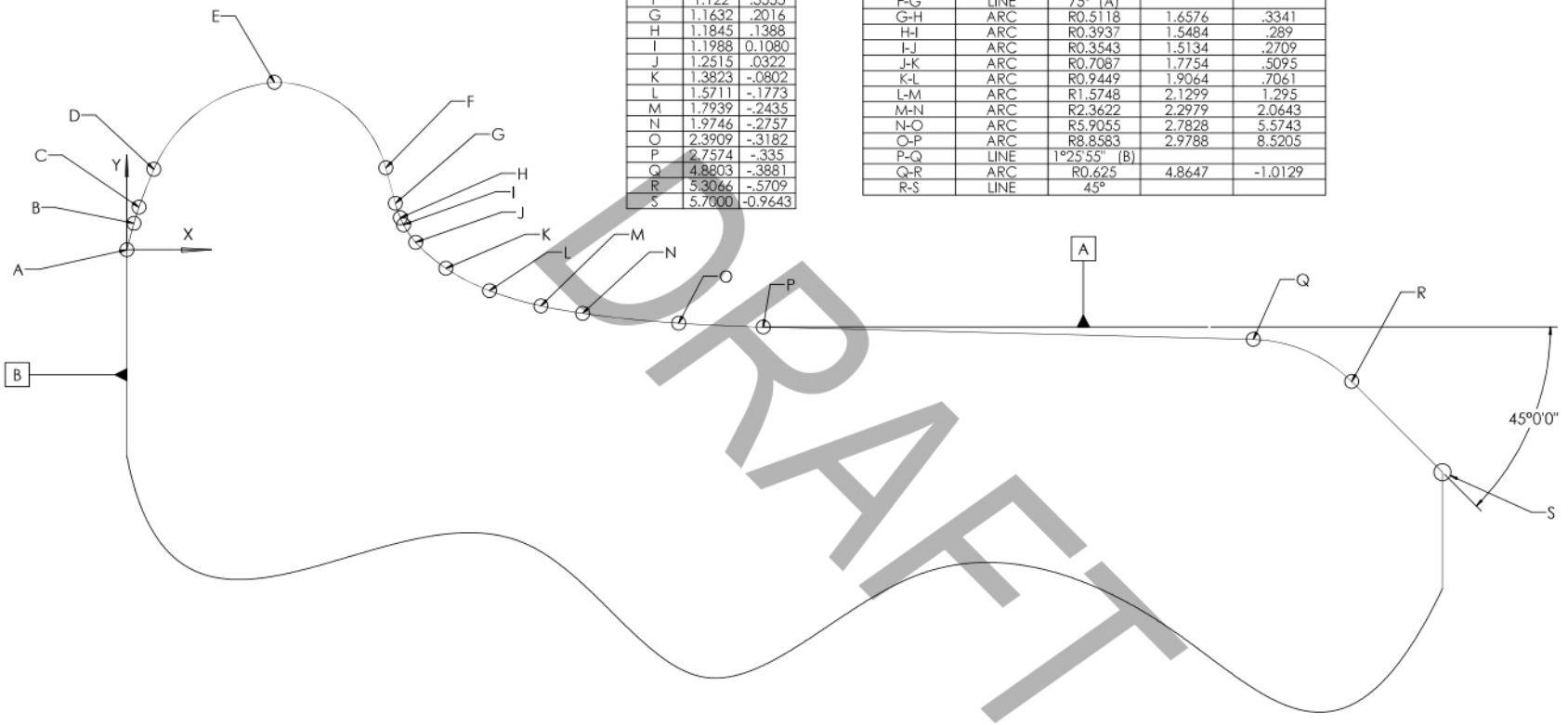
DRAWING NUMBER	REV
062-00106	D

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	D	changed note 2 updated title	2/20/2015	

NODE COORDINATES		
	X	Y
A	0.0	0.0
B	.0308	.1148
C	.0527	.1850
D	.1169	.3492
E	.639	.7261
F	1.122	.3555
G	1.1632	.2016
H	1.1845	.1388
I	1.1988	0.1080
J	1.2515	.0322
K	1.3823	-.0802
L	1.5711	-.1773
M	1.7939	-.2435
N	1.9746	-.2757
O	2.3909	-.3182
P	2.7574	-.335
Q	4.8803	-.3881
R	5.3066	-.5709
S	5.7000	-0.9643

SEGMENT DETAILS				
SEGMENT	ARC / LINE	RADIUS	X CENTER	Y CENTER
A-B	LINE	15° (A)		
B-C	ARC	R0.9063	.9062	-.1197
C-D	ARC	R2.9647	2.8447	-.8118
D-E	ARC	R0.625	.6915	.1033
E-F	ARC	R0.500	.639	.2261
F-G	LINE	75° (A)		
G-H	ARC	R0.5118	1.6576	.3341
H-I	ARC	R0.3937	1.5484	.289
I-J	ARC	R0.3543	1.5134	.2709
J-K	ARC	R0.7087	1.7754	.5095
K-L	ARC	R0.9449	1.9064	.7061
L-M	ARC	R1.5748	2.1299	1.295
M-N	ARC	R2.3622	2.2979	2.0643
N-O	ARC	R5.9055	2.7828	5.5743
O-P	ARC	R8.8583	2.9788	8.5205
P-Q	LINE	1°25'55" (B)		
Q-R	ARC	R0.625	4.8647	-1.0129
R-S	LINE	45°		



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26-FOI-00415 0000006193 "UNCLASSIFIED" 4/30/2026

1 Amtrak NRCC / APTA 340 wheel tread profile provides 75 +/- 2.5 degrees of flange angle, similar to APTA 340 wheel profile.

2 Amtrak NRCC / APTA340 Wheel Profile is based on Amtrak drawing of "AMTK-NRCC Wheel Profile" dated 02/10/02. Wheel acceptance gage (W846-1) or wheel contour gage (W846), made by Winchester industries, can be used to check the wheel tread profile (Amtrak SAP numbers 5000005041 and 5000005040 respectively)

*NRCC- National Research Council of Canada

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THE AMTRAK DRAWING IS THE GOVERNING DOCUMENT, AND SUPERSEDES ANY LIKE INFORMATION ON REFERENCE DRAWINGS, PART NUMBERS, SPECIFICATIONS, ETC.

NOTES:
1. ASSEMBLY MUST CONFORM TO THE APPLICABLE REQUIREMENTS SET FORTH IN THE LASTEST REVISION OF AMTRAK SPEC. 854 GENERAL SPEC. FOR VEHICLE DESIGN/BUILD COMPONENTS, AS THEY RELATE TO LABELING, WORKMANSHIP, MATERIALS AND TOLERANCES.
2. DIMENSIONS MARKED WITH THE INSPECTION SYMBOL ( ) ARE TO BE USED FOR THE FIRST ARTICLE INSPECTION. ALL OTHER DIMENSIONS ARE FOR MANUFACTURE OR ARE FOR REFERENCE ONLY.
3. PAINTING & SURFACE PREPARATION TO BE ACCORDING TO LATEST REVISION OF AMTRAK SPEC 328, SECTION 15.0 - COATINGS AND APPLICATIONS

Wheel Tread Profile	000-00000	EQUIPMENT
PROGRAM	NEXT ASS'Y	USED ON

REFERENCE DRAWINGS

ORIGINALS ARE SIGNED ON FILE COPY

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

DO NOT SCALE DRAWING

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Railroad Passenger Corporation
4501 Vanderwal Ave, Washington DC 19801

TOLERANCES
Dimensions are in inches unless otherwise specified
Decimals xx ± .03 xxx ± .010
Angles ± 1/2°
Remove all burrs & break sharp edges.

TITLE
AMTRAK NRCC / APTA 340 WHEEL TREAD PROFILE

ORIGINALS ARE SIGNED ON FILE COPY

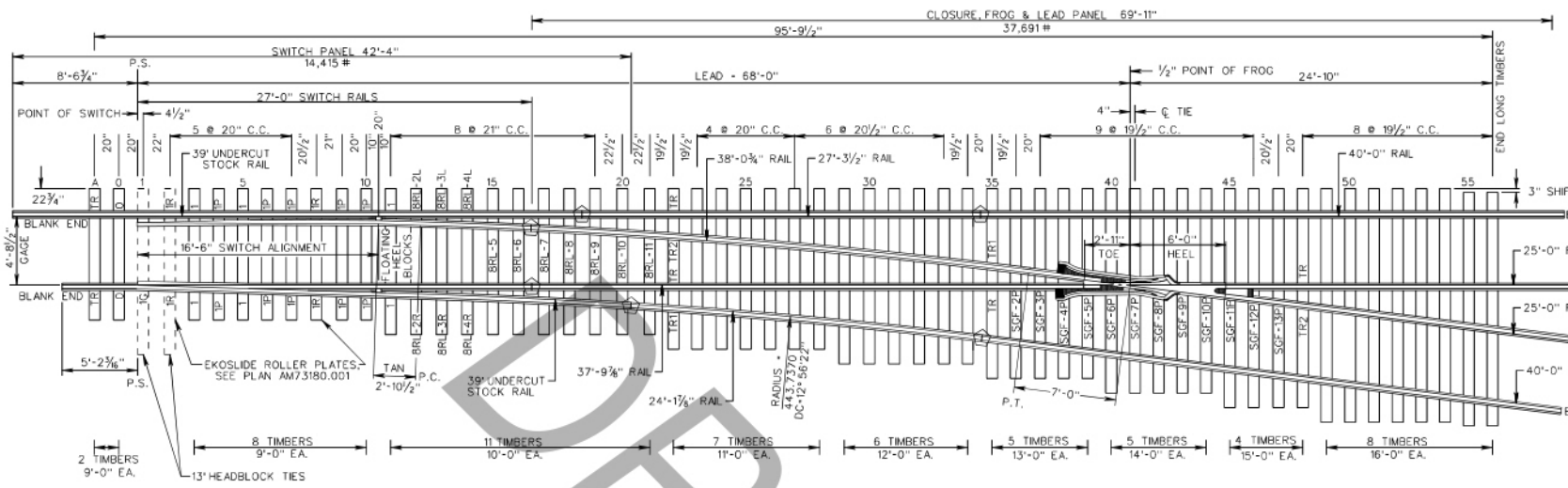
Drawn By	Checked By	ENG Approval	Final Approval
B. PRICE	G.MARZILI	T. LIN	M. BURSHTIN
Date 1/23/2014	Date 10/3/2014	Date 1/23/2015	Date

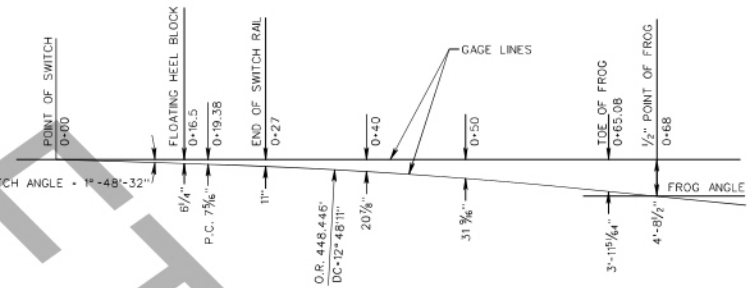
Scale 4:1

DRAWING NUMBER 062-00106

REV. D

SHT. 1 OF 1



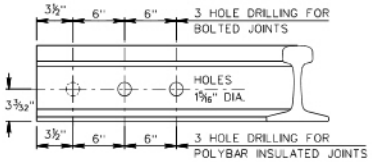


OFFSETS FOR NO. 8 R.H. TURNOUT

LEGEND:

(1) INDICATES BOLTED JOINT BAR (⅛" OPENING)

⊠ INDICATES INSULATED GAGE PLATE



YARD AREMA END DRILLING (136RE)

NOTES:

1. ALL RAILS TO BE FURNISHED HEAD HARDENED.
2. 39'-0" STOCK RAILS TO BE UNDERCUT AS PER PLAN 73180.001.
3. FOR SWITCH DETAILS, SEE PLAN 73180.001.
4. GAGE PLATE NO. 1G AS PER PLAN 73501.002.
5. SWITCH PLATES NO. 0, 1, 1R, 1P, TR, TR-1, TR-2 AS PER PLAN 73501.001.
6. TURNOUT PLATES NO. 10-2 THRU 10-11 AS PER PLAN 72219.002.
7. VERTICAL INSULATED SWITCH RODS AND ADJUSTABLE ROCKER CLIPS AS PER PLAN 73518.001.
8. SGM FROG AS PER PLAN 74159.
9. FLOATING HEEL BLOCK AS PER PLAN 73620.001.
10. ALL BOLT HOLES TO BE CHAMFERED ⅛" x 45°.
11. SWITCHES AND FROGS SHALL HAVE A.R.E.M.A. TOLERANCES, CLOSURE RAIL TOLERANCE SHALL BE ± 7/16" FOR RAIL LENGTHS 39'-0" AND UNDER, ± ⅜" FOR OVER 39'-0".
12. ALL BOLTED JOINT BARS MUST CLEAR TIE PLATES BY 2" MINIMUM, TIES MAY BE SHIFTED WHERE NECESSARY.
13. SWITCH PANEL FURNISHED ASSEMBLED: REMAINDER OF TIES PRE-PLATED AND BUNDLED IN GROUPS OF FOUR.

DRAFT

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OFFICE OF THE CHIEF ENGINEER OF TRACK

Phila., PA Date: December 04, 2024 Approved:

No.	Revisions	Date	By
-	-	-	-
06	REV. FIELD WELDED JOINT TO BOLTED JOINT BAR	12-04-24	GAH
05	REVISED NOTE 8, GENERAL REVISION	04-25-24	DRS
04	GENERAL REVISION	06-08-18	KJW
C	REVISED TO INCLUDE EKOSLIDE ROLLERS	05-05-15	KJW
B	REVISED DESIGN TO 136RE WITH SGM FROG	03-20-15	KJW

STANDARD TRACK PLAN

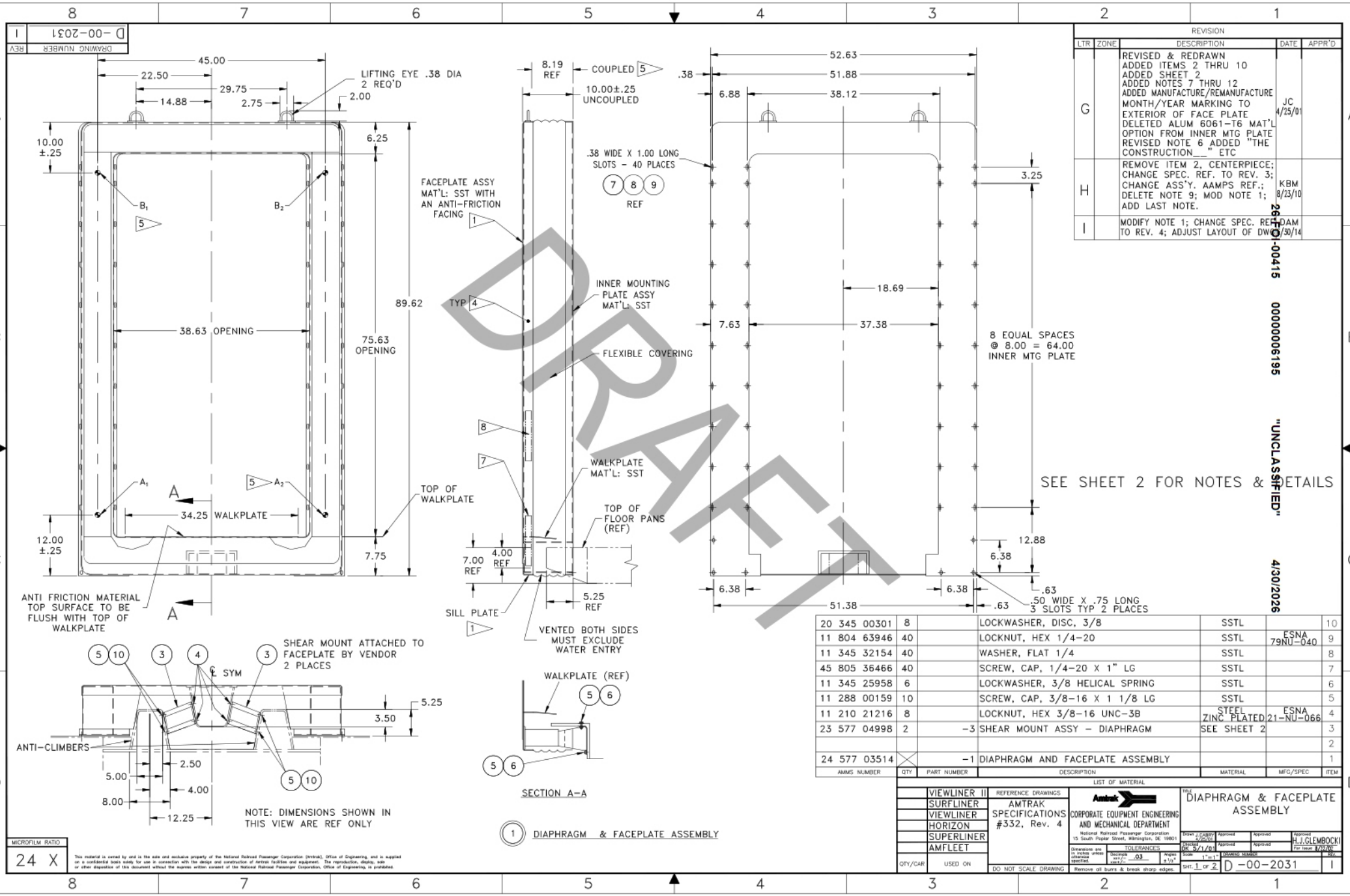
NO. 8 WELDED TURNOUT, SGM FROG

TIMBER & RAIL LAYOUT

136RE RAIL

Designed: Amtrak | Drawn: GAH | Checked: IVE | Date: 12-09-24 | Dwg. No. 73195.001.05

26-FCI-00416 0000006194 "UNCLASSIFIED" 4/30/2026



REVISION				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
G		REVISED & REDRAWN ADDED ITEMS 2 THRU 10 ADDED SHEET 2 ADDED NOTES 7 THRU 12 ADDED MANUFACTURE/REMANUFACTURE MONTH/YEAR MARKING TO EXTERIOR OF FACE PLATE DELETED ALUM 6061-T6 MAT'L OPTION FROM INNER MTG PLATE REVISED NOTE 6 ADDED "THE CONSTRUCTION__" ETC	JC 4/25/01	
H		REMOVE ITEM 2, CENTERPIECE; CHANGE SPEC. REF. TO REV. 3; CHANGE ASS'Y. AAMPS REF.; DELETE NOTE 9; MOD NOTE 1; ADD LAST NOTE.	KBM 8/23/10	
I		MODIFY NOTE 1; CHANGE SPEC. REF. TO REV. 4; ADJUST LAYOUT OF DWG.	DAM 4/30/14	

AMMS NUMBER	QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	ITEM
20 345 00301	8		LOCKWASHER, DISC, 3/8	SSTL		10
11 804 63946	40		LOCKNUT, HEX 1/4-20	SSTL	ESNA 79NU-040	9
11 345 32154	40		WASHER, FLAT 1/4	SSTL		8
45 805 36466	40		SCREW, CAP, 1/4-20 X 1" LG	SSTL		7
11 345 25958	6		LOCKWASHER, 3/8 HELICAL SPRING	SSTL		6
11 288 00159	10		SCREW, CAP, 3/8-16 X 1 1/8 LG	SSTL		5
11 210 21216	8		LOCKNUT, HEX 3/8-16 UNC-3B	STEEL ZINC PLATED	ESNA 21-NU-066	4
23 577 04998	2	-3	SHEAR MOUNT ASSY - DIAPHRAGM	SEE SHEET 2		3
						2
24 577 03514	X	-1	DIAPHRAGM AND FACEPLATE ASSEMBLY			1

LIST OF MATERIAL

REFERENCE DRAWINGS: AMTRAK SPECIFICATIONS #332, Rev. 4

QTY/CAR	USED ON
	VIEWLINER II
	SURFLINER
	VIEWLINER
	HORIZON
	SUPERLINER
	AMFLEET

DO NOT SCALE DRAWING

Amtrak
CORPORATE EQUIPMENT ENGINEERING AND MECHANICAL DEPARTMENT
National Railroad Passenger Corporation
15 South Poplar Street, Wilmington, DE 19801

TOLERANCES: Dimensions are in inches unless otherwise specified. Decimals .xx +/- .03, .xxx +/- ____. Angles ±1/4°. Remove all burrs & break sharp edges.

TITLE: DIAPHRAGM & FACEPLATE ASSEMBLY

Drawn J. CASEY 4/26/01 | Approved | Approved | Approved H.J.GLEMBOCKI
Checked DK 5/1/01 | Approved | Approved | For Issue 8/22/02

Scale 1"=1" | DRAWING NUMBER D-00-2031 | REV I | SHT 1 OF 2

MICROFILM RATIO 24 X

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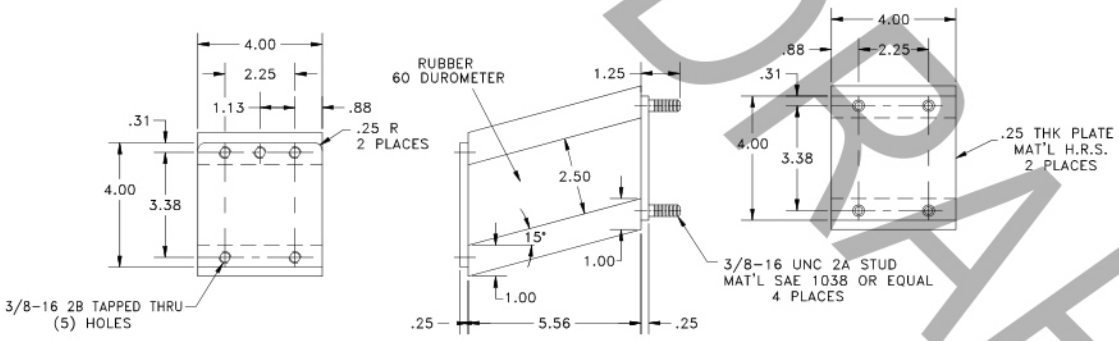
DRAWING NUMBER	REV
D -00-2031	1

REVISION				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
		SEE SHEET 1		



3 SHEAR MOUNT ASSY – DIAPHRAGM

NOTES

1. FACEPLATE ASSY TOLERANCES & FINISH:
   FACEPLATE ASSY MUST BE FLAT WITHIN 0.10" TOTAL WHEN CHECKED ON A SURFACE PLATE.
   FOR THE ANTI-FRICTION PLATES:
   ROUGHNESS: 125 MU IN (MICRO INCHES) MAX.
   WAVINESS: .002" IN 2"
   STRAIGHTNESS: .060" MAX DEFLECTION ACROSS MAX. HEIGHT.
   .015" MAX DEFLECTION ACROSS MAX. WIDTH.
2. ALL RELIEF CUTS TO BE WELDED 100 PERCENT PENETRATION.
3. WELD AREAS TO BE FLUSH ON BOTH SIDES – GRIND IF NECESSARY. 100 PERCENT PENETRATION IS REQUIRED.
4. FINISH: U.S.S. #3 (100 GRIT) ON ALL EXPOSED SURFACES.
5. MAXIMUM ALLOWABLE FORCES AS MEASURED AT POINTS A & B WHEN COMPRESSED TO 8.38 ±.25 DIMENSION ARE:
   - $A_1 + A_2$ = 800 LB – 1050 LB
   - $B_1 + B_2$ = 200 LB – 300 LB
6. THE CONSTRUCTION OF THE DIAPHRAGM SHALL PRECLUDE THE ENTRY OF WATER AND DIRT INTO THE DIAPHRAGM & PASSAGEWAY, AS WELL AS INTO THE ASSEMBLY ITSELF.
7. MANUFACTURE DATE (MONTH/YEAR), VENDOR I.D., PART NUMBER & SERIAL NUMBER AND AMTRAK PART NO. 24 457 00709 TO BE STAMPED ON THE FLANGE OF THE FACEPLATE WHERE INDICATED, IN 1/4" HIGH NUMERALS.
8. WHEN REMANUFACTURED VENDOR TAG TO BE APPLIED WHERE INDICATED (NOT TO DISTURB ORIGINAL LABEL).
   THE PERMANENT LABEL WILL INCLUDE:
   SHOP NAME
   LOCATION
   TYPE OF REPAIR: REPAIR OR OVERHAUL
   DATE OF REPAIR (DAY, MONTH, YEAR)
9. ENVIRONMENTAL NOTE:
   SEE AMTRAK SPEC. 429 PARTS 1, 2, 3.1, 3.1.2 (VITAL), 3.2 & 3.2.1.
10. ALL DISSIMILAR METAL JOINTS SHALL USE SUITABLE TECHNOLOGIES TO PREVENT CORROSION.
11. ALL MATERIALS USED MUST MEET AMTRAK SPECIFICATION #352 LATEST REVISION.
12. SEE OEM DRAWINGS FOR ASSEMBLY DETAILS

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4/30/2026

QTY/CAR	USED ON
	VIEWLINER II
	SURFLINER
	VIEWLINER
	HORIZON
	SUPERLINER
	AMFLEET

REFERENCE DRAWINGS
AMTRAK SPECIFICATIONS #332, Rev. 4

DO NOT SCALE DRAWING

Amtrak
CORPORATE EQUIPMENT ENGINEERING AND MECHANICAL DEPARTMENT
National Railroad Passenger Corporation
15 South Poplar Street, Wilmington, DE 19801

TOLERANCES
Dimensions are in inches unless otherwise specified. Decimals xx+/- .03, xxx+/- . Angles ±1/4°
Remove all burrs & break sharp edges.

DIAPHRAGM & FACEPLATE ASSEMBLY

Drawn J.CASEY 4/26/01 | Approved | Approved | Approved H.J.GLEMBOCKI
Checked DK 5/1/01 | Approved | Approved | For Issue R727707
Scale 1"=1" | DRAWING NUMBER D -00-2031 | REV 1
SHT 2 OF 2

MICROFILM RATIO
24 X

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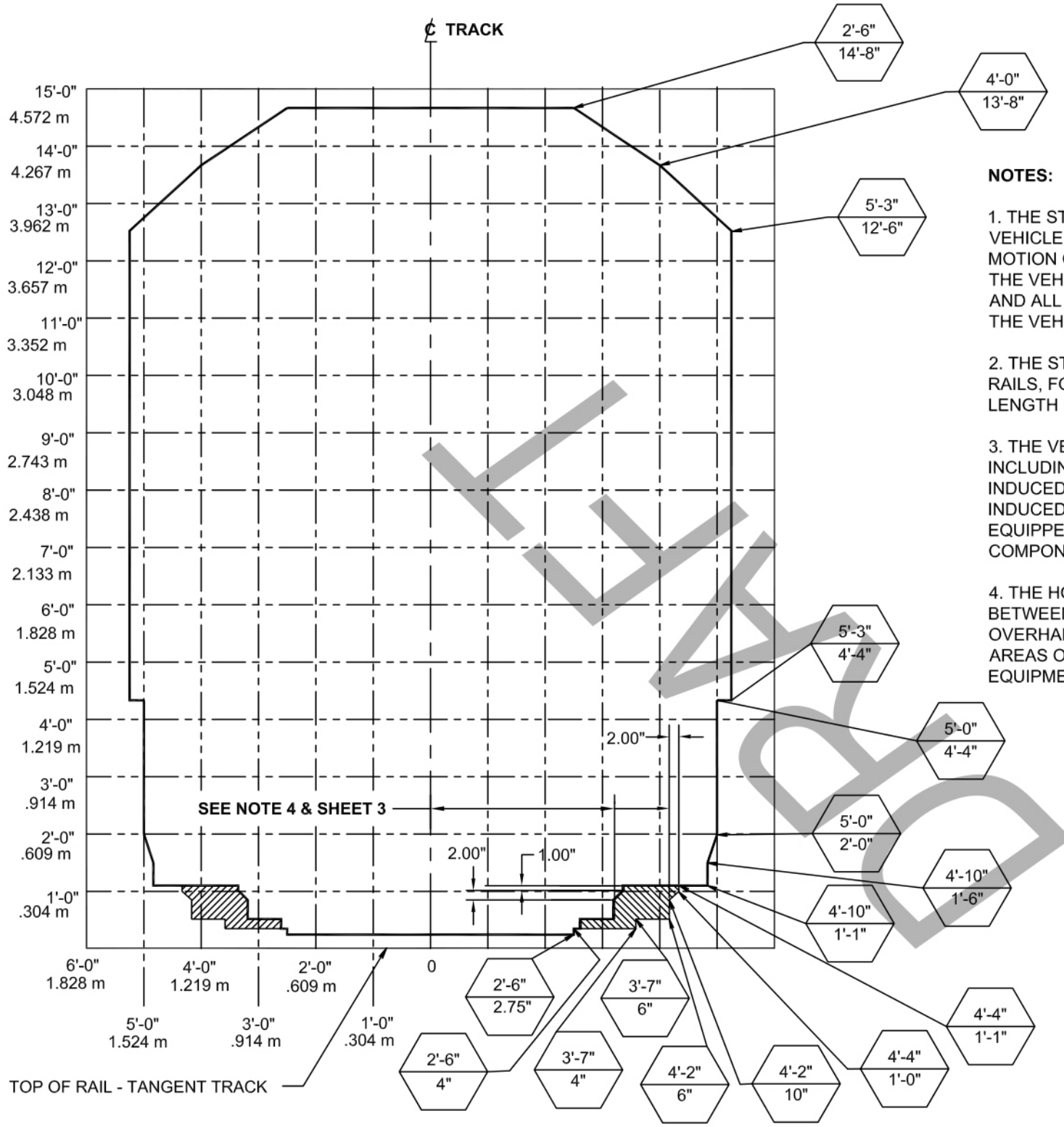
REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
D	-	REVISED & REDRAWN	01/29/05	MLB
E		CHANGED LATERIAL & VERTICAL DIMENSIONS ON SHEETS 2 & 3	03/15/06	MLB

DRAWING NUMBER D 05-1355 REV. E



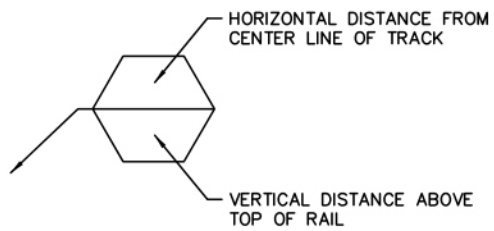
NOTES:

1. THE STATIC OUTLINE (SHEET 1) REPRESENTS THE MAXIMUM STATIC DIMENSIONS OF THE VEHICLE. THE DYNAMIC OUTLINE (SHEET 2) REPRESENTS THE MAXIMUM DYNAMIC RANGE OF MOTION OF THE VEHICLE, AND IS NOT TO BE USED AS THE STATIC CONSTRUCTION OUTLINE OF THE VEHICLE. PROVIDED THE VEHICLE MEETS THE REQUIREMENTS OF THE DYNAMIC OUTLINE AND ALL NOTES, THE STATIC OUTLINE MAY BE USED AS THE STATIC CONSTRUCTION OUTLINE OF THE VEHICLE.

2. THE STATIC OUTLINE AND DYNAMIC OUTLINE IS REFERENCED TO THE PLANE OF THE TOP OF RAILS, FOR TRACK WITH AND WITHOUT SUPERELEVATION, FOR A VEHICLE HAVING A MAXIMUM LENGTH OF 85'-0", AND A TRUCK CENTER DISTANCE OF 59'-6".

3. THE VEHICLE MUST REMAIN WITHIN THE DYNAMIC OUTLINE UNDER ALL CONDITIONS, INCLUDING LATERAL AND VERTICAL MOVEMENT OF THE VEHICLE ON ITS SUSPENSION, ROLL INDUCED BY UP TO 6" SUPERELEVATION (WITH THE VEHICLE STOPPED OR IN MOTION), ROLL INDUCED BY THE DESIGN CANT DEFICIENCY, RANGE OF MOTION OF THE TILT SYSTEM (IF SO EQUIPPED), NORMAL WEAR, VARIATIONS OF LOAD, FAILURE OF ANY SINGLE SUSPENSION COMPONENT, AND ANY COMBINATION OF THESE CONDITIONS.

4. THE HORIZONAL DISTANCE FROM CENTER LINE OF TRACK, FOR VERTICAL DISTANCES BETWEEN 2.75" AND 1'-1" ABOVE TOP OF RAIL, MUST ALLOW FOR THE INSIDE AND OUTSIDE OVERHANG OF THE VEHICLE ON A 12°-30' CURVE, AS SHOWN ON SHEET 3 AND THE SHADED AREAS OF THE STATIC OUTLINE AND THE DYNAMIC OUTLINE. ALL VEHICLE STRUCTURE, EQUIPMENT, AND APPLIANCES, MUST REMAIN WITHIN THIS OUTLINE UNDER ALL CONDITIONS.



STATIC OUTLINE

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QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

REFERENCE DRAWINGS: AM70070A

AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Railroad Passenger Corporation
4001 Vandever Ave. Wilmington DE 19802

TITLE: CLEARANCE DIAGRAM

Drawn	Date	Approved	Approved
J. A. CAMPBELL	01/29/05	M. L. BURSHTIN	M. TROSINO
Checked	Date	Approved	For Issue
B. F. HOFFMAN	01/31/05		

STANDARD TRACK PLAN | PROGRAM | NEXT ASS'Y | USED ON

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

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Scale: SCALE | SHT. 1 OF 3 | DRAWING NUMBER: D 05-1355 | REV. E

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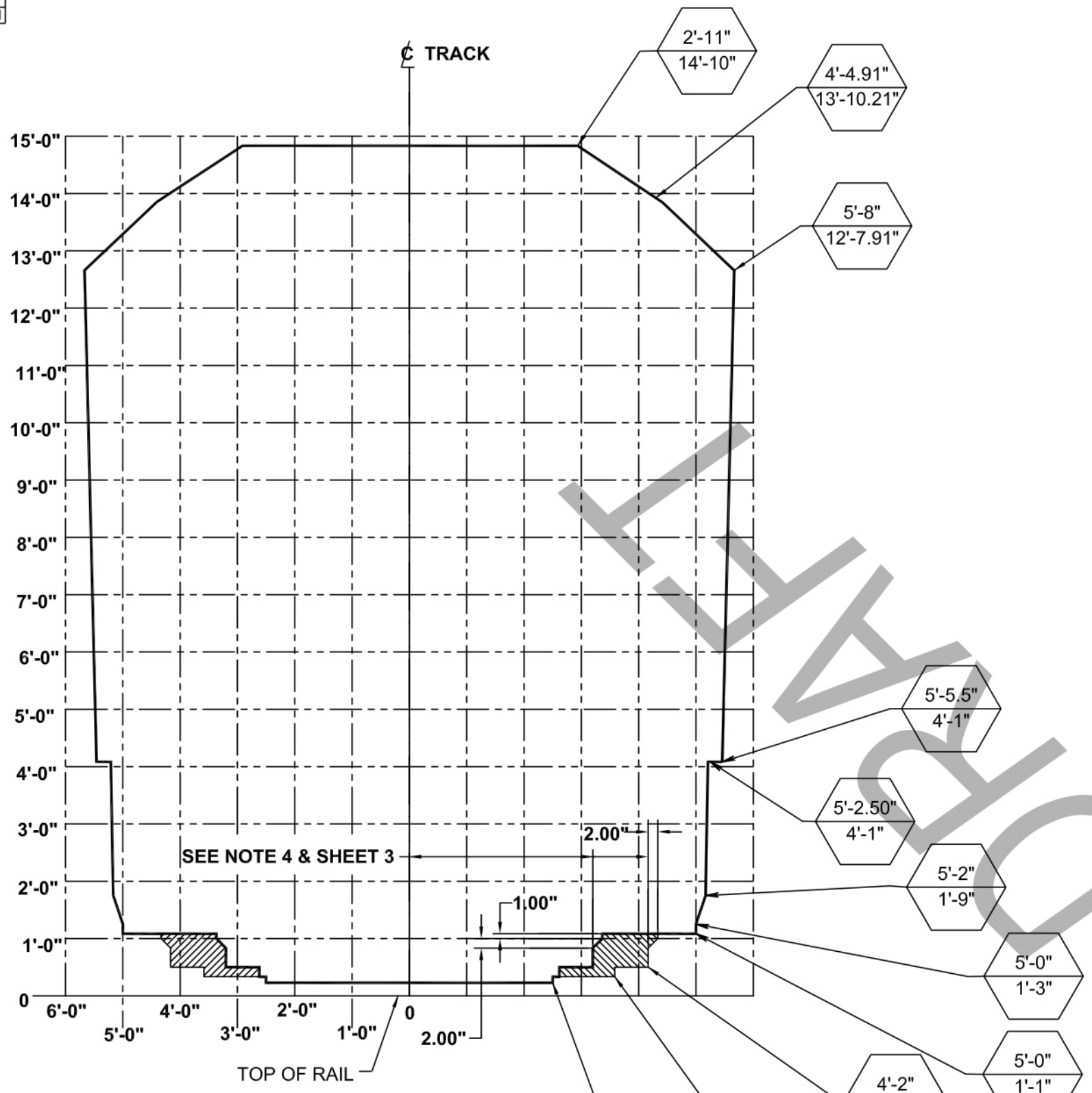
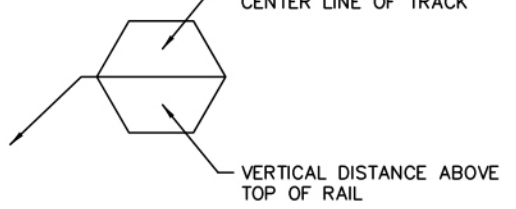
DRAWING NUMBER	REV.
D 05-1355	D

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
D	-	SEE SHEET 1	01/29/05	M.L.B.





DYNAMIC OUTLINE

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QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	AMM'S NUMBER	ITEM
						1

LIST OF MATERIAL

STANDARD TRACK PLAN	
PROGRAM	

REFERENCE DRAWINGS: AM70070A

NEXT ASS'Y | USED ON | DO NOT SCALE DRAWING

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AMTRAK
Mechanical Department
Bureau of Rolling Stock Engineering
National Railroad Passenger Corporation
4001 Vandever Ave. Wilmington DE 19802

TITLE: CLEARANCE DIAGRAM

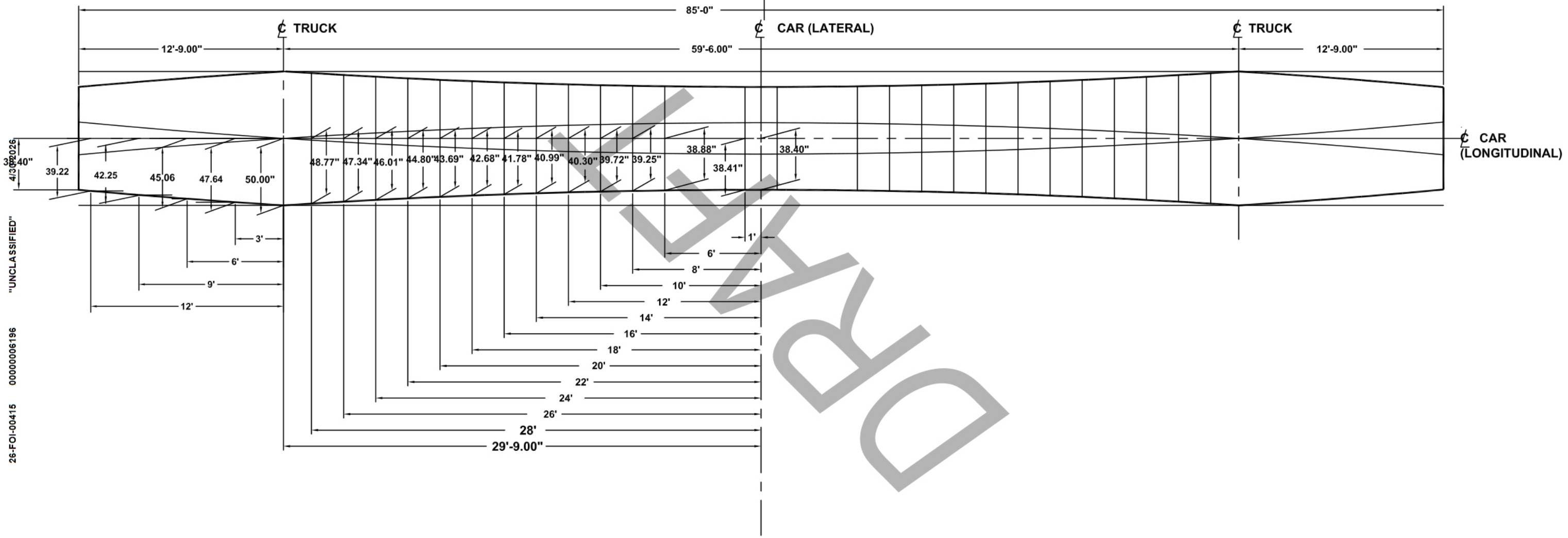
Drawn	Date	Approved	Approved
J. A. CAMPBELL	01/29/05	M. L. BURSHTIN	M. TROSINO
Checked B F HOFFMAN	Date 01/31/05	Approved	For Issue

Scale SCALE | SHT. 2 OF 3 | DRAWING NUMBER D 05-1355 | REV. D

FILED AS 05-1355_rd_s1-3

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
D	-	SEE SHEET 1	01/29/05	M.L.B.

REV.	DRAWING NUMBER
D	D 05-1355



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TANGENT OFFSETS

FOR 85'-0" CAR WITH 59'-6" TRUCK CENTERS

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						1

LIST OF MATERIAL

STANDARD TRACK PLAN			
PROGRAM	NEXT ASS'Y	USED ON	

REFERENCE DRAWINGS: AM70070A

REPORT ALL CHANGES TO ENGINEERING DEPARTMENT

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AMTRAK

Mechanical Department
Bureau of Rolling Stock Engineering
National Railroad Passenger Corporation
4001 Vandever Ave. Wilmington DE 19802

TOLERANCES: Dimensions are in inches unless otherwise specified. Decimals xx ± .03, xxx ± .010. Angles ± 1/2°. Remove all burrs & break sharp edges.

TITLE: CLEARANCE DIAGRAM

Drawn	Date	Approved	Approved
J. CAMPBELL	01/29/05	M. L. BURSHTIN	M. TROSINO
Checked	Date	Approved	For Issue
B F HOFFMAN	01/31/05		

Scale: SCALE — SHT. 3 OF 3 — DRAWING NUMBER: D 05-1355 — REV.: D

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AMTRAK®

Long Distance
Product Features

Issued March 2026

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

CONTENTS

COACH AREAS

1. Standard Coach
2. Premium Accessible Coach
3. Accessible Positions

SLEEPER BEDROOMS

4. Roomette
5. SoloSuite
6. Standard Bedroom
7. Accessible Bedroom

FOOD & BEVERAGE

8. Cafe Counter
9. Diner & Cafe Features
10. Lounge Features

TOILETS & SHOWERS

11. Accessible Toilet Room
12. Standard Toilet Room
13. Shower & Changing Room

COMMON USE AREAS

14. Entrance Areas
15. Interior Structures
16. Hallways

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Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas

Amtrak® Long Distance Product Features

Coach Areas

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Coach Areas

Sleeper Bedrooms

Food & Beverage

Toilets & Showers

Common Use Areas

Amtrak® Long Distance Product Features

01 | Coach

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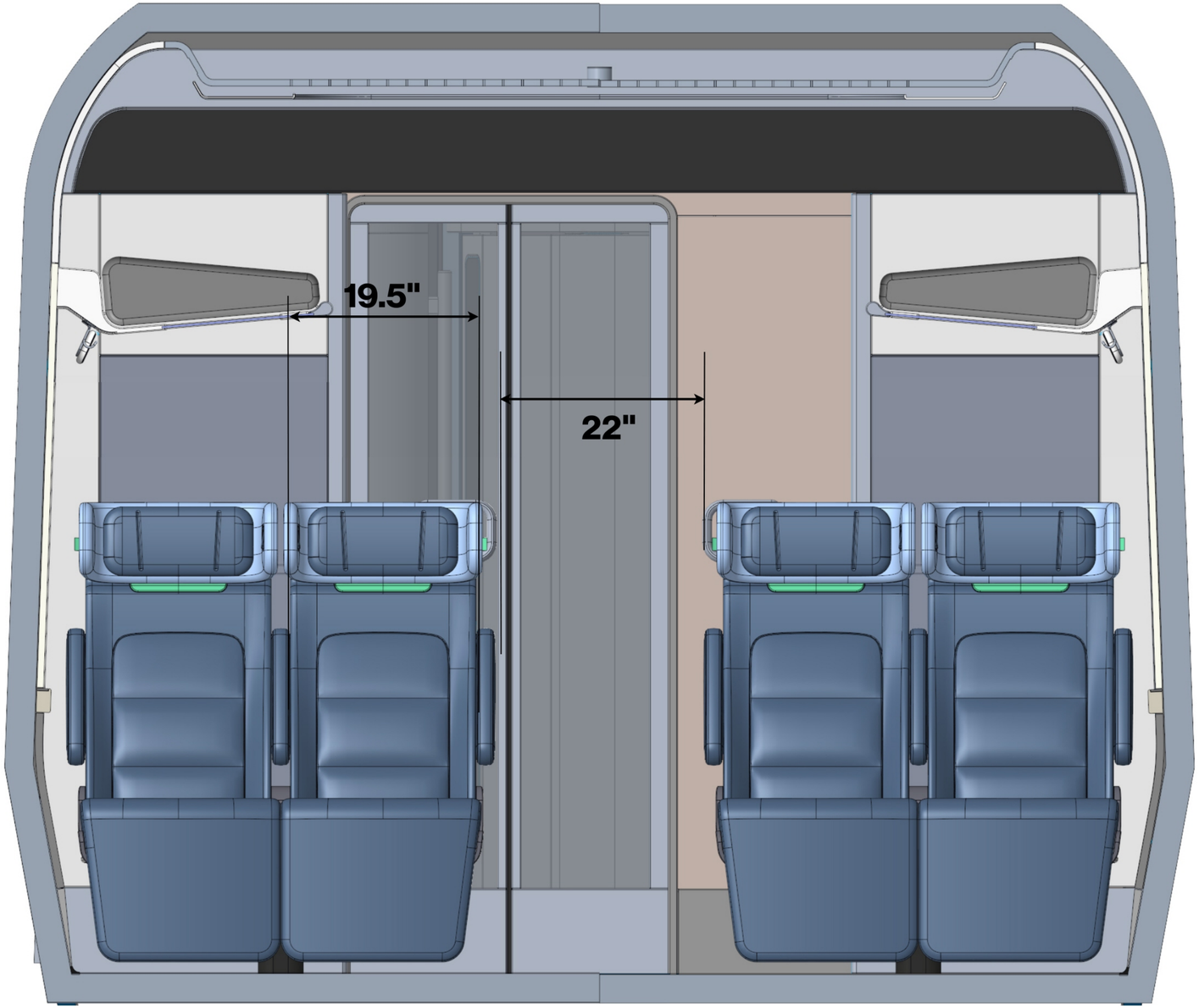
Coach Seat | General



The Coach Seat

The coach seat is designed to work as pairs with four seats across the width of the train. The seat should be optimized for both day and night time operations.

Features should be included that aid a better night's sleep or support passengers on longer journeys by maximizing comfort and available passenger space.

The minimum width of the seat between armrests should be 19.5” when arranged with a minimum aisle dimension of 22”.

A single seat option may also be required in smaller numbers to accommodate transfer seats and fulfill requirements around accessible paths in our accessible coach car.

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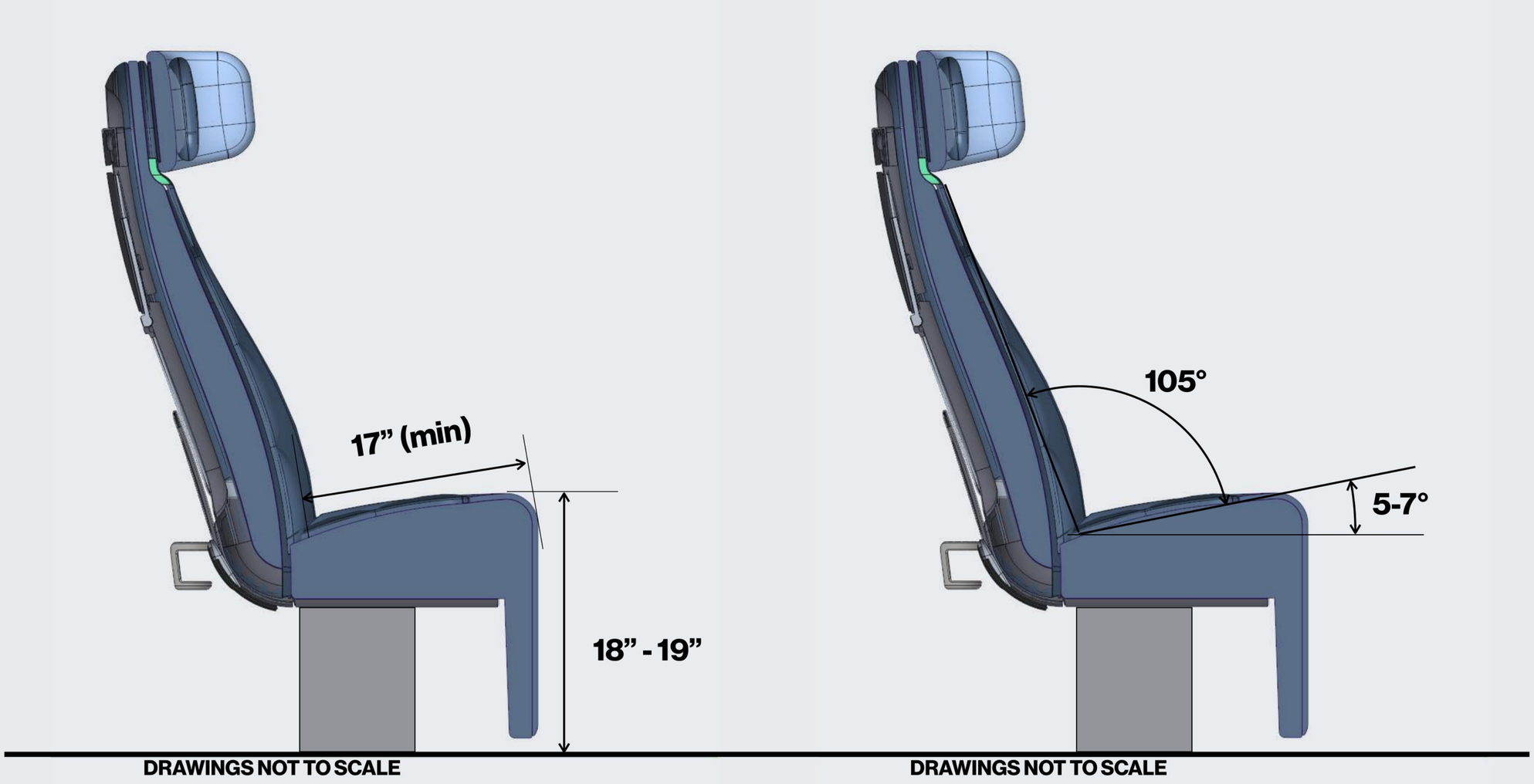
Coach Seat | General

Seat Dimensions
All seat dimensions, cushion density/shore hardness will be subject to mockup review, a detailed human factors study and approval by Amtrak.



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Coach Seat | Features

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Coach Seat | Features

Headrest Pillow
Headrest pillow should be adjustable in height for a range of people sizes. It should have adjustable wings that fold outwards to adjust the width of the headrest.

Privacy Wing
Privacy wing on the seats should provide good separation between passengers at head level.

Seat Comfort
Seat cushions are contoured to aid seat comfort. Detailing will be evaluated and judged carefully during the design review process and will be subject to Amtrak approval.



Hand Grab
Every aisle seat should have a compliant accessible grab for better access along the aisle.

Reading Light
Positioned so as not to disturb neighbors during night time hours. Passengers should be able to adjust the lighting angle to cast light over the shoulder. Light intensity should have three settings.

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Coach Seat | Features



20° Recline
The seat should have a minimum seat recline angle of 20 degrees.

Seat Controls
Seat controls for recline and leg rest should be located within easy reach of a customer. It should be possible to control the seat back recline and the calf rest independently.

Folding Armrests
2” wide armrest with a soft wrap around the top for comfort, and a hard-wearing bottom wrap and side cap for durability.

Seat Recline Mech
Seat recline mechanism should allow the seat pan to slide forwards so as not to burden the full recline onto the passenger behind.

Calf Rest Pad
Calf-rests tilt up for optimal leg support and comfort. The calf rest should be integral to the seat pan to avoid seat pinch.

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Coach Seat | Features



Clean, Tidy Seat Back
The back of the seat should be designed to have an integrated appearance.

Flexible Pocket
A stowage pocket should be provided on the back of the seat.

Central Foot Pedestal
A central seat pedestal should be positioned to maximize foot clearance.

On-seat Power
Two USB ports should be provided on the back of each of the seats.

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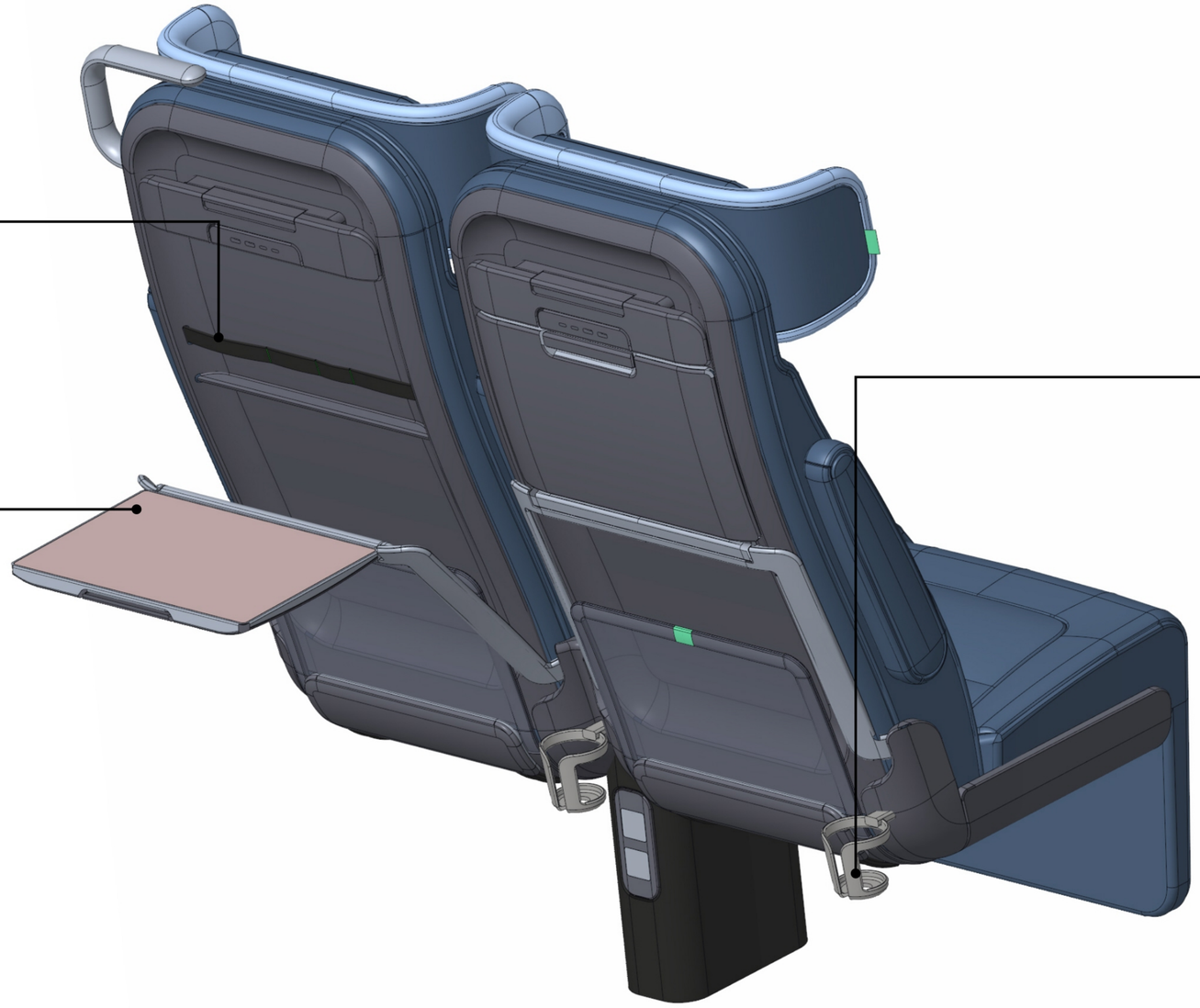
Coach Seat | Features

Stowage Lectern
Behind the fold down table a lectern edge and elastic restraint band suitable to allow customers to simply stow smart phones and other personal items behind table.

Fold out Table
A fold out table should have an independent pivot point so that its resting position will not be impacted by the recline of the seat in front.



Cup Holders
A metal cup holder should be positioned on the back of the seat. Cup holders should be placed in positions outside of knee and leg clearance and free from the movement of the seat.

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Coach Seat | Features

Device Holder
A fold out lectern edge with clip should allow the secure mounting of passengers' personal devices. The angle should be set so it is usable in both recline and upright positions.

Folding Table Extension
The table should be able to extend forwards telescopically. The usable surface should allow people to use a 15” laptop even when seat is fully reclined.

Fold-out Footrest
A fold-out adjustable footrest should be provided. There should be three set positions and the footrest should have a degree of angle adjustment.

Power Socket
Two power sockets should be located on the seat pedestal.



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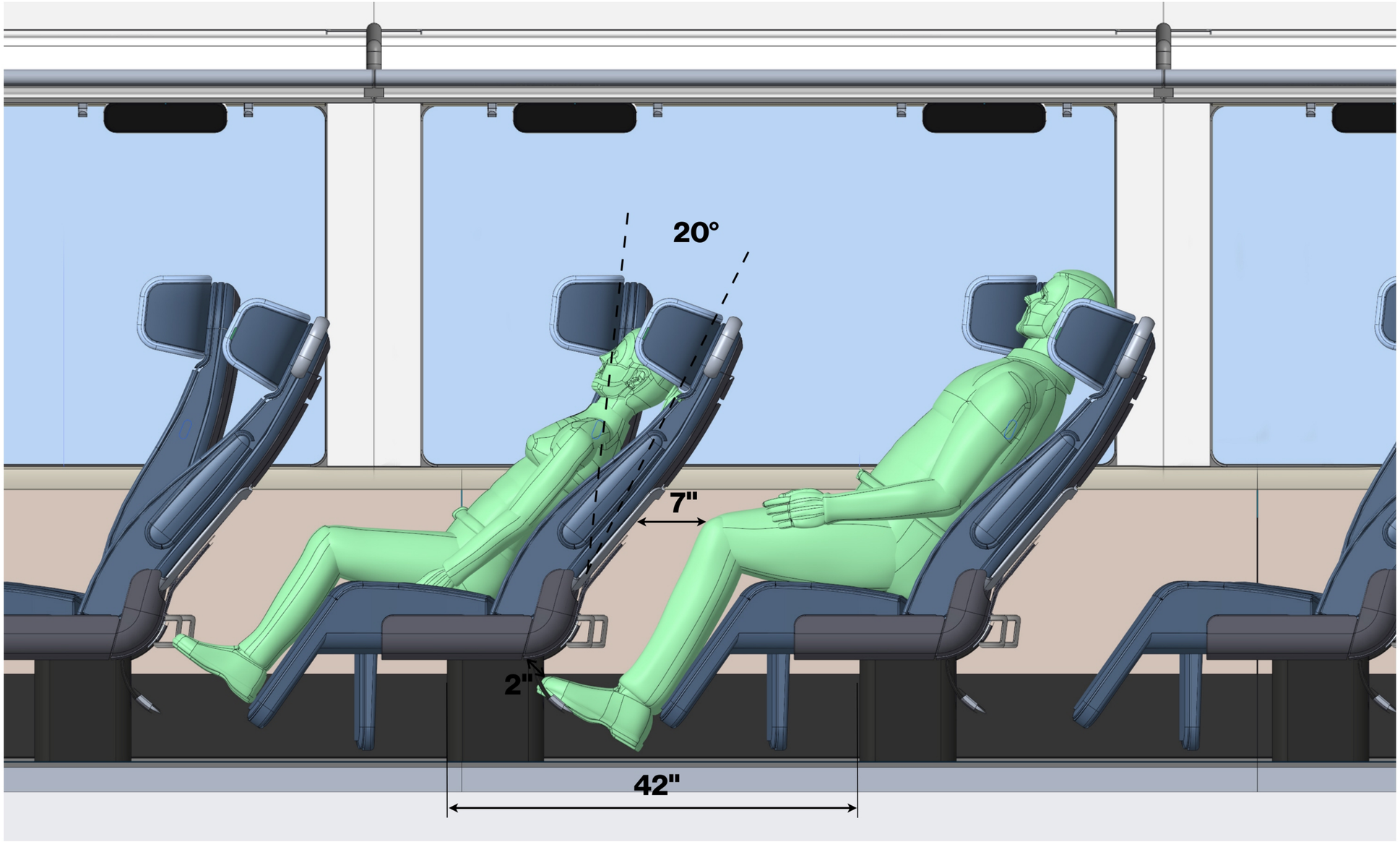
Coach Seat | Features

Seat Dimensions
All seat dimensions, cushion density/ shore hardness will be subject to mockup review and approval by Amtrak.

Knee Clearance
Seats set at a 42” pitch must provide at least 7” knee clearance and at least 2” of feet clearance for a 95th percentile male in the seat's worst case scenario - i.e. when both seats are reclined.



5th Percentile Female **95th Percentile Male**

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Coach Areas

Sleeper Bedrooms

Food & Beverage

Toilets & Showers

Common Use Areas

02 | Premium Coach

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Premium Coach Seat | General



The Premium Coach Seat

The Premium Coach seat is designed as an elevated coach product. The seat can be arranged 2x1 across a 32” accessible aisle. The seat should be optimized for both day and night time operations.

All features should be optimized to provide a better night's sleep, maximizing comfort and the available space to support passengers on longer journeys.

The minimum width of the seat between armrests should be 22” when arranged with a 32” aisle.

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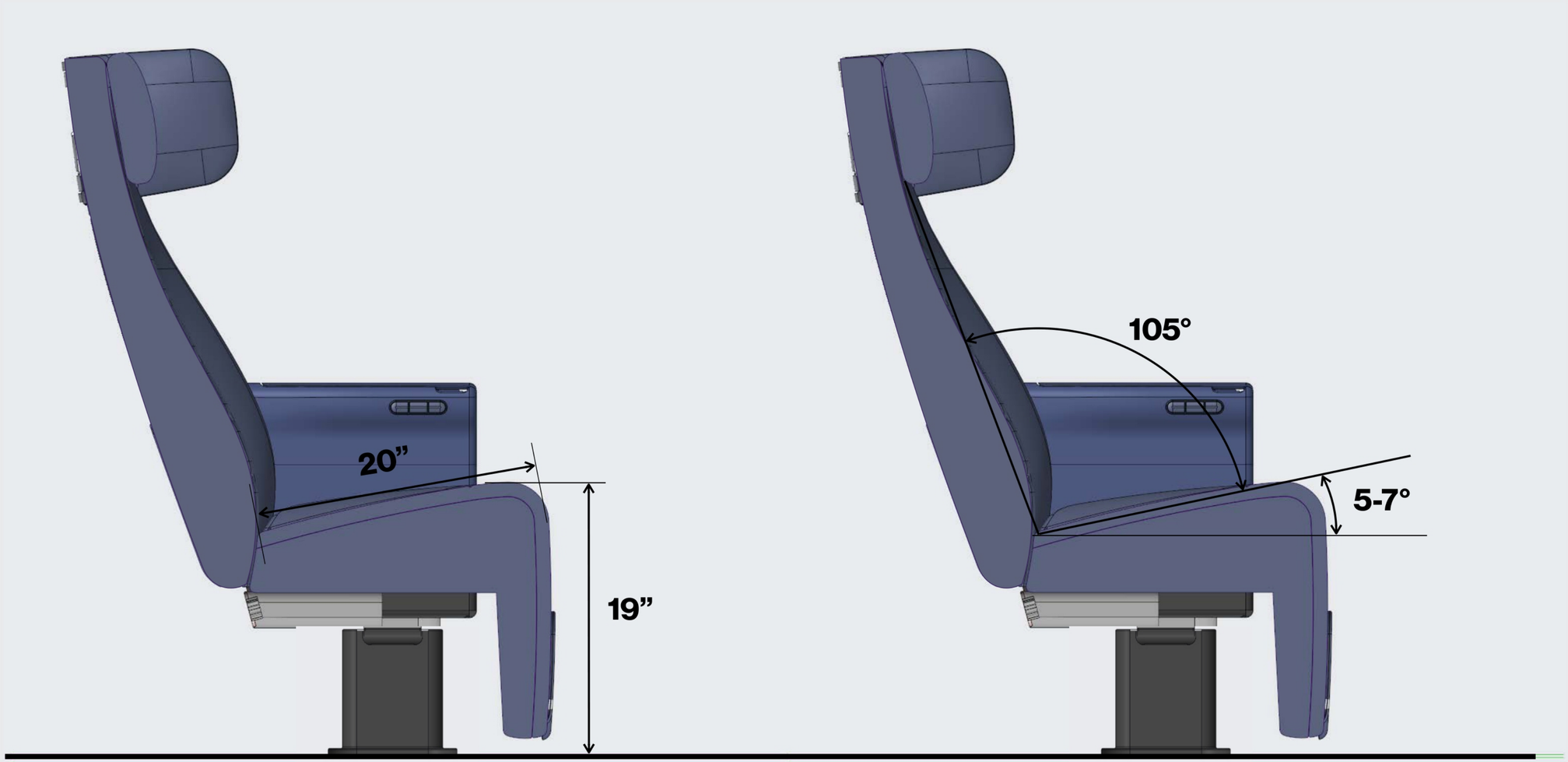
Premium Coach Seat | General

Seat Dimensions
All seat dimensions, cushion density/ shore hardness will be subject to mockup review and approval by Amtrak.



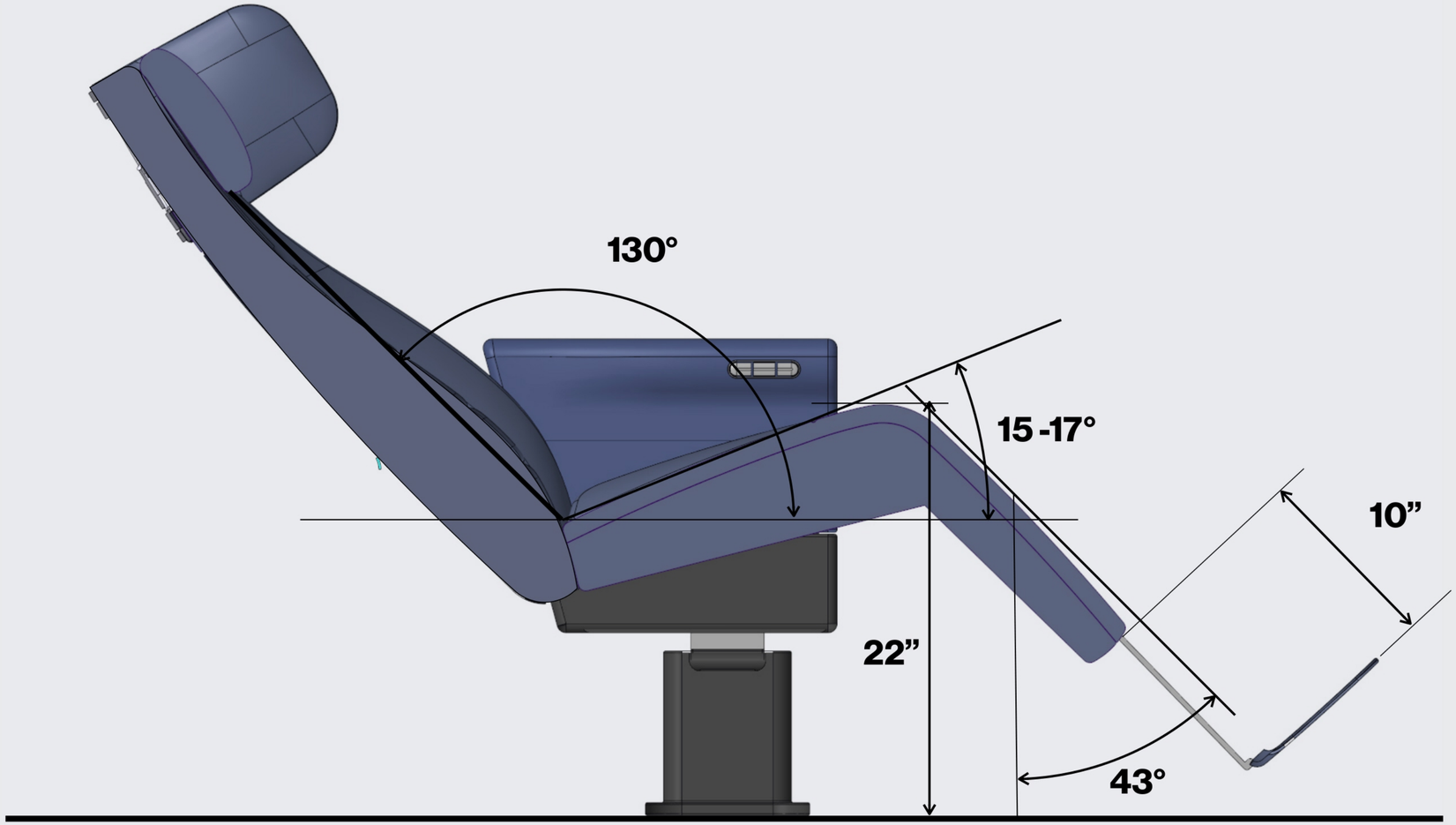
DRAWINGS NOT TO SCALE

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Premium Coach Seat | General

Lazy Z
The Premium Coach Seat has a 25° recline. Importantly the seat pan should also change angle with the recline by 10° lifting the knees upwards to create a cradle position. An adjustable calf rest angle of 43° supports the legs while a flip out foot rest with a telescopic movement of 10” supports the feet.

The seat should be optimized to maximize foot and leg clearance at a 48” pitch.



DRAWINGS NOT TO SCALE

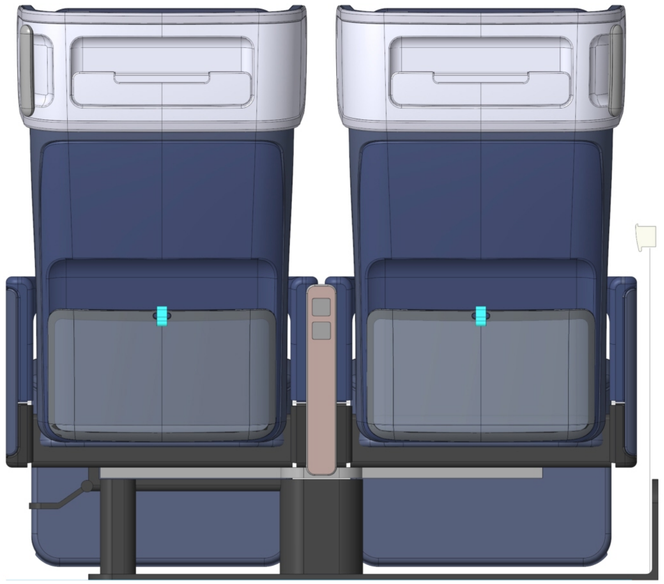
26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Premium Coach Seat | General

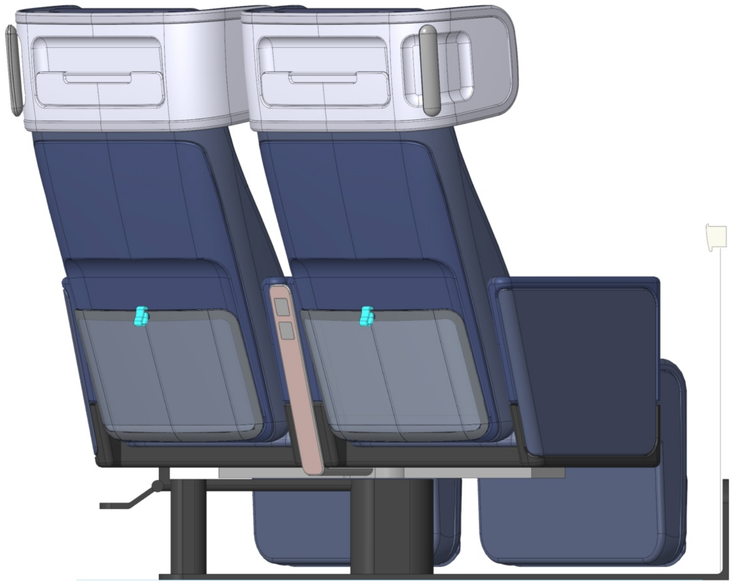
Rotating Seat Mechanism
The seat should rotate with the seat pan moving past the side wall when the seat is fully upright. The pivot location should be positioned in such a way to maximize the width of the seat and provide an optimized arrangement of the seats in both directions.

Rotating Seat Pedestal
The pedestal size and position should be designed to maximize foot space and space for small bags under the seat. The design under the seat should be free from protrusions and snag points and be easy to clean around the pedestal

Release Pedal
A foot release pedal should unlock the seat ready for rotation.



0° Rotation



45° Rotation



180° Rotation

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Premium Coach Seat | Features

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Premium Coach Seat | Features

Privacy Wing
Wide privacy wing should offer good separation between passengers at head level.

Headrest Pillow
Headrest pillow should be adjustable in height for a range of people sizes and have adjustable wings that fold outwards to adjust the width of the headrest.

Seat Controls
Seat controls for recline and leg rest should be located within easy reach of a customer It should be possible to control the seat back recline and the calf rest independently.



Reading Light
Positioned so as not to disturb seat neighbor during night time hours. Passengers should be able to adjust the lighting angle. Light intensity should have three settings.

USB ports
On seat USB ports to charge mobile devices should be in the armrest of each seat.

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Premium Coach Seat | Features



Cup Holders
A fold out metal cup holder on each seat should be deployed from the central console.

Fold Out Table
An airline style bi-fold table should deploy from central console. The usable surface should allow people to use at least a 15” laptop. The table should also be able to track forward and back when deployed.

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Premium Coach Seat | Features

Seat Comfort
Seat cushions are contoured to aid seat comfort.



Lazy Z
The seat must achieve a Lazy Z position.

Rotating Seat Pedal

Seat Mechanism
Seat mechanism should be easy to use by people of all abilities.

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Premium Coach Seat | Features



Calf Rest Pad
Calf rest must be independently controlled from the Lazy Z recline.

Foot rest
Each seat has fold out, telescopic foot rest to increase seat comfort.

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Premium Coach Seat | Features



Slide Down Armrest
The aisle armrest must move to provide an unobstructed approach to the seat pan so a person using a wheelchair can complete a successful side transfer.

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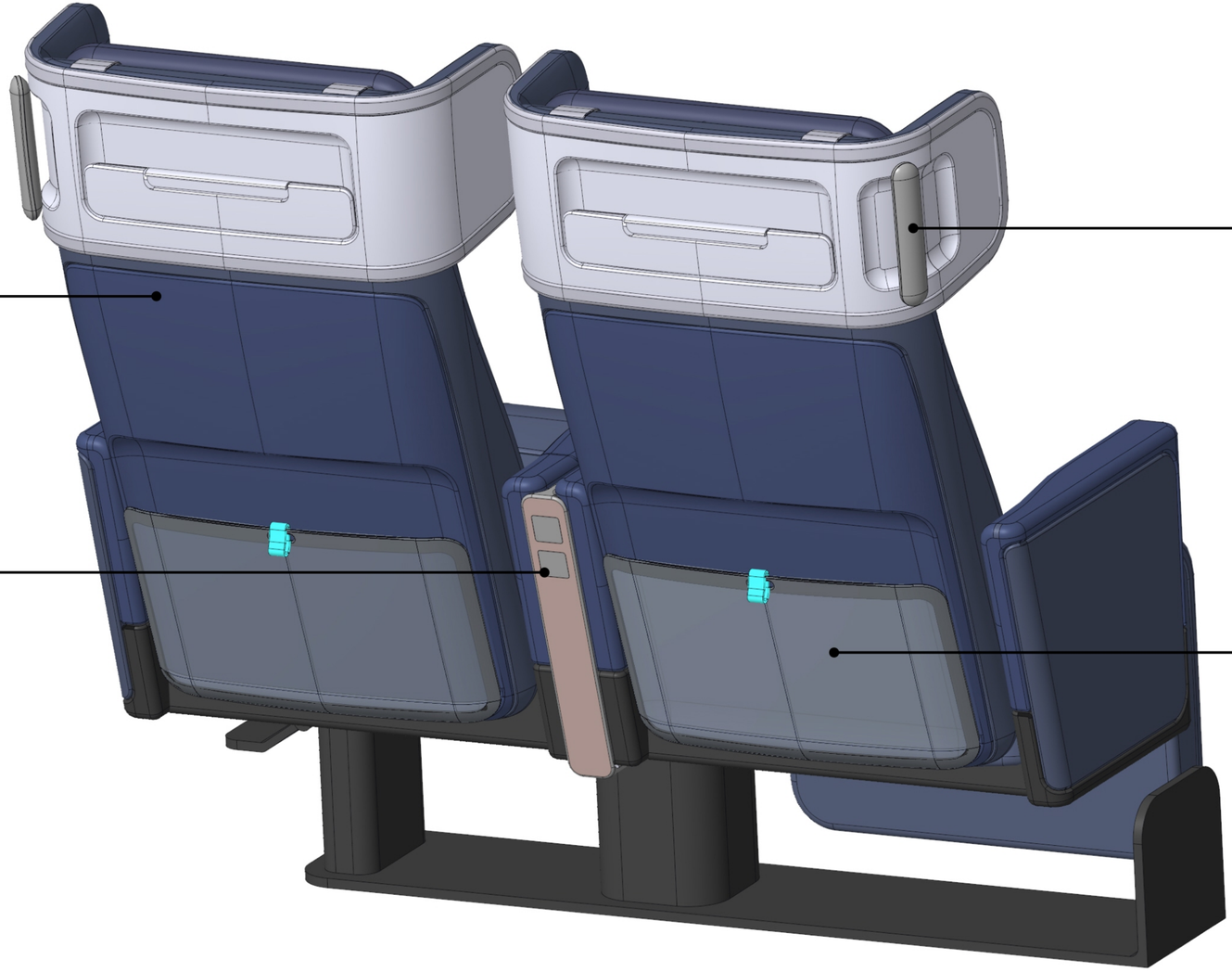
Premium Coach Seat | Features



Clean, Tidy Seat Back
The back of the seat should be designed to have an integrated appearance.

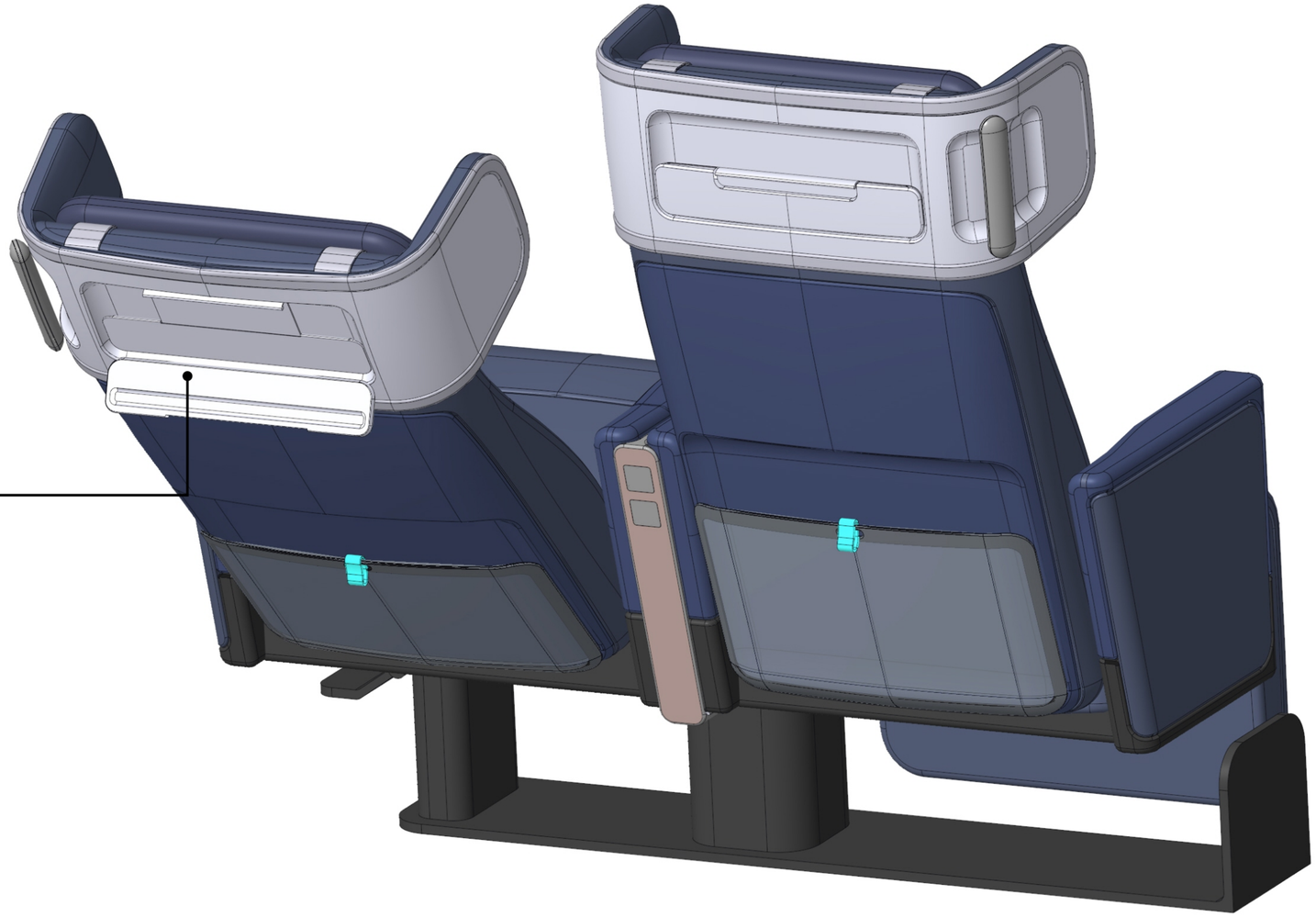
Power Socket
Two power sockets should be located on the seat pedestal.

Hand Grab
Seats should have a compliant accessible grab on both sides of the seat pair and on both sides of the single seat for better access along the aisle regardless of the seat rotation condition.

Flexible Pocket
A stowage pocket should be provided on the back of the seat.

Premium Coach Seat | Features

Device Holder
A fold out lectern edge with clip should allow the secure mounting of passengers' personal devices. The angle should be set so it is usable in both recline and upright positions.



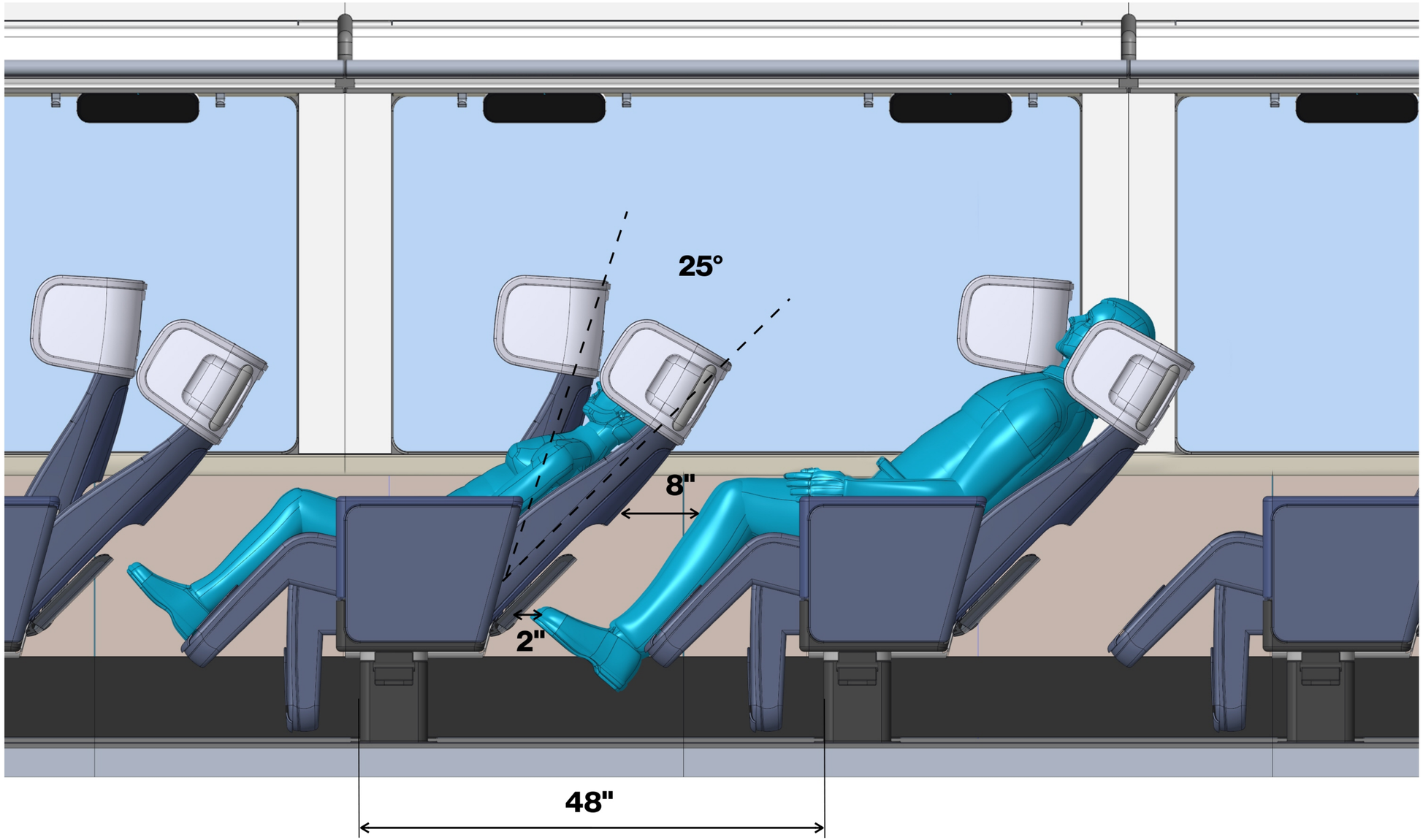
26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Premium Coach Seat | Features

Seat Dimensions
All seat dimensions, cushion density/ shore hardness will be subject to mockup review and approval by Amtrak.

Knee Clearance
Seats set at a 48” pitch must provide at least 8” knee clearance for a 95th percentile male in the seat's worst case scenario - i.e. when both seats are reclined.

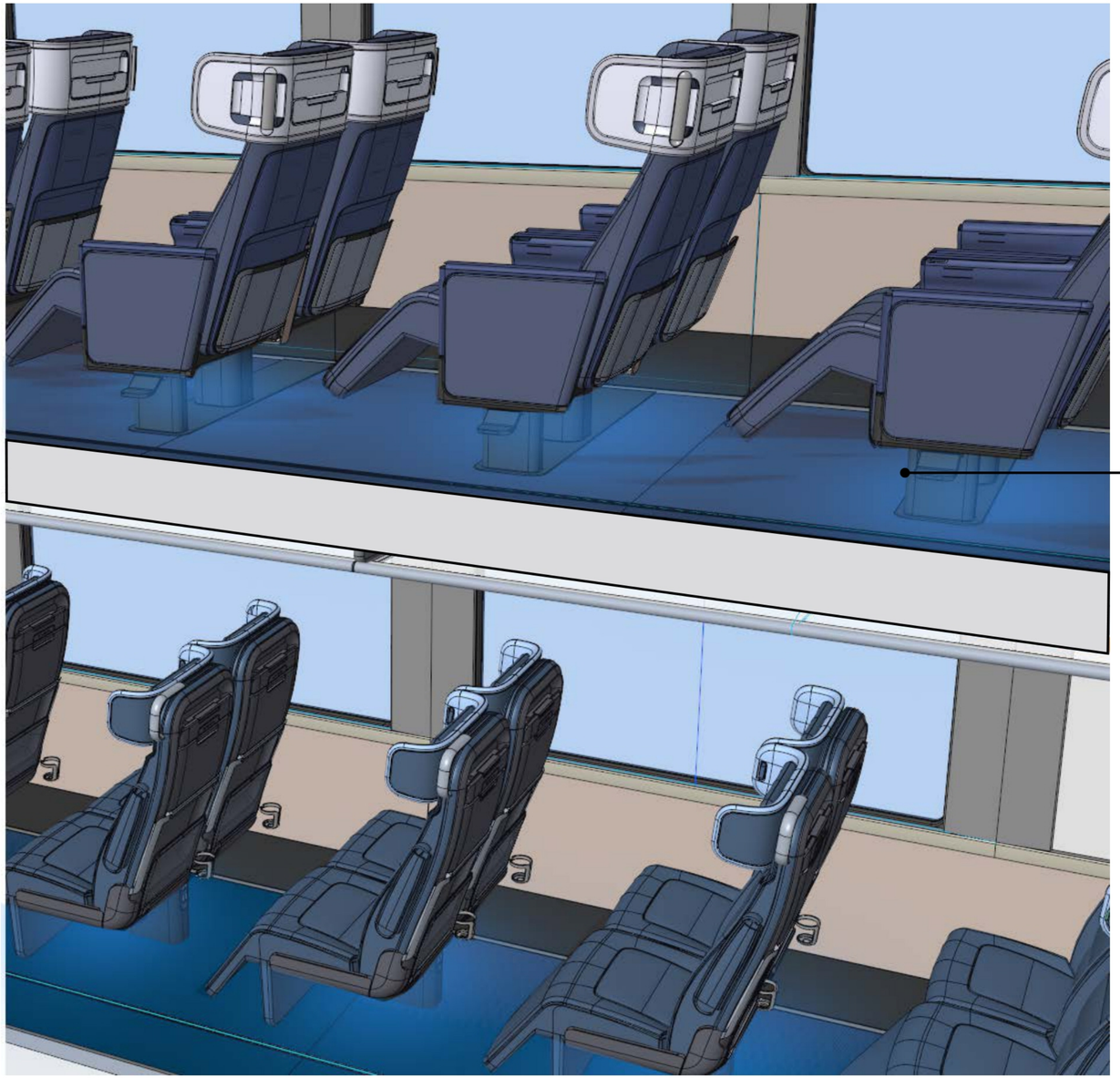
Feet Clearance
Seats set at a 48” pitch must provide at least 2” of feet clearance for a 95” percentile male with the footrest and seat at its most reclined and most extended condition .



Coach & Premium Coach | Lighting

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Coach and Premium Coach | Lighting



Under Seat Lighting
Indirect wash lighting under each seat or seat pair washes pools of light under and around seat. Spread of light to be approved by Amtrak.

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Coach Areas

Sleeper Bedrooms

Food & Beverage

Toilets & Showers

Common Use Areas

03 | Accessible Positions

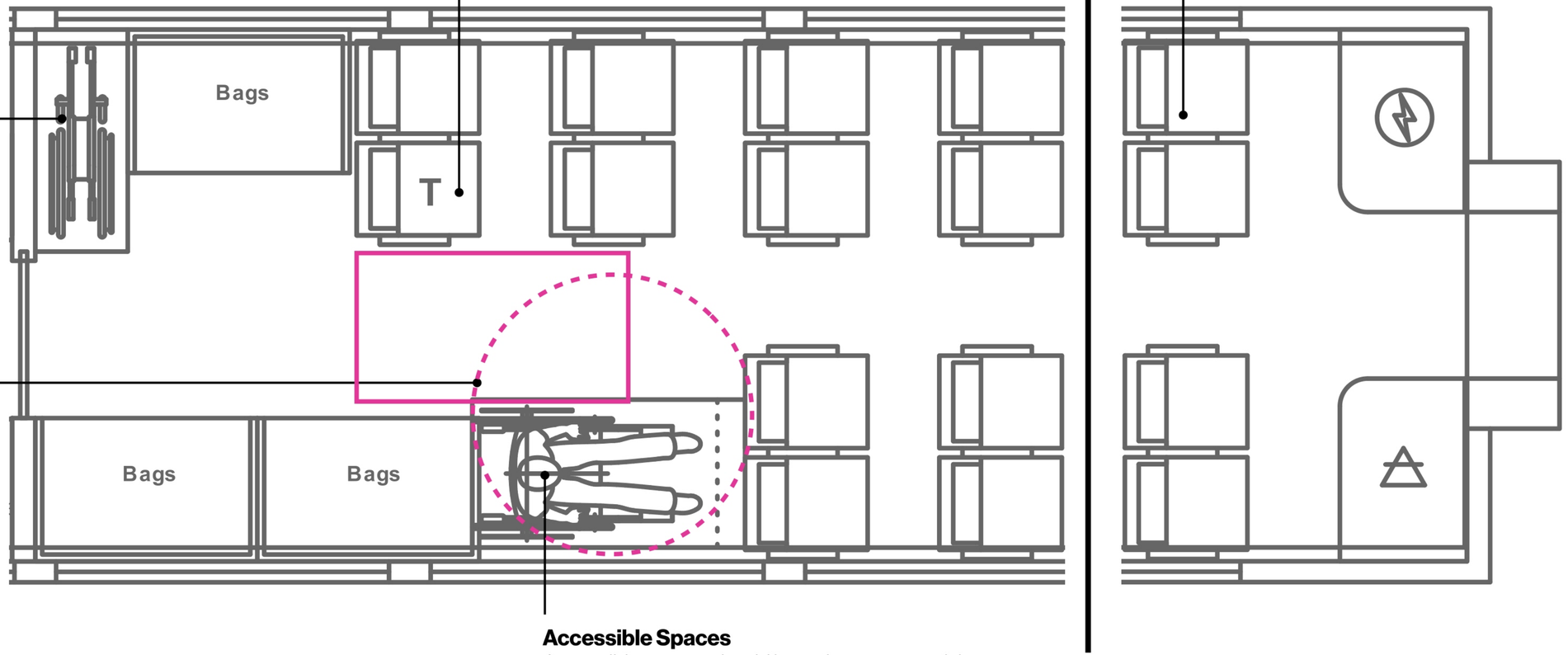
26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Coach and Premium Coach | General

Accessibility
All accessible spaces, turning circles and transfer seats will be subject to mockup review, user testing and approval by Amtrak.

Transfer Seats
Transfer seats shall have an RVAAC Accessible space allowance so people who choose to transfer from their wheelchairs to a seat have free and easy access to complete this maneuver.

First Row Seating
First row seating should have the same provisions and features as all other seats, including at seat power, stowage pockets, tables and footrests. In the case of rotating seats these shall be provisions at both ends of the cars so features are accessible in both seating orientations.



Folded Wheeled Mobility Device Storage

60” Turning Circles
60” turning circles should be provided at each accessible space per ADA and RVAAC guidelines.

Accessible Spaces
Accessible spaces should have the same provisions and features as all other seats, including at seat power, stowage pockets and tables. Accessible spaces should be protected in the case of rotating seats. A short partition should be provided that gives an option for wheelchair restraints. Accessible spaces should allow passengers to have a choice in direction of travel.

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas

Sleeper Bedrooms

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Coach Areas

Sleeper Bedrooms

Food & Beverage

Toilets & Showers

Common Use Areas

Amtrak® Long Distance Product Features

04 | Roomette

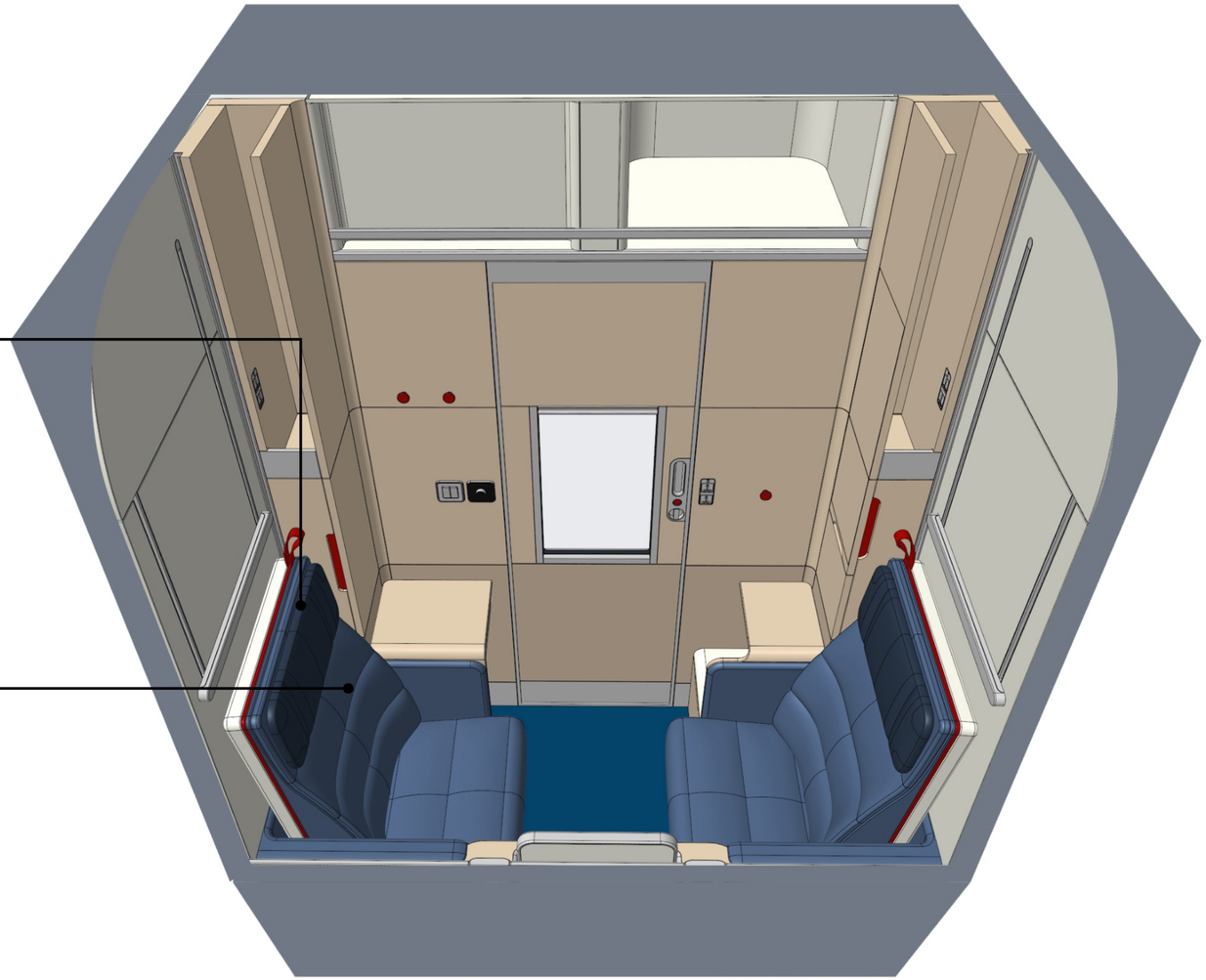
26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Roomette | Features

Roomette | Features

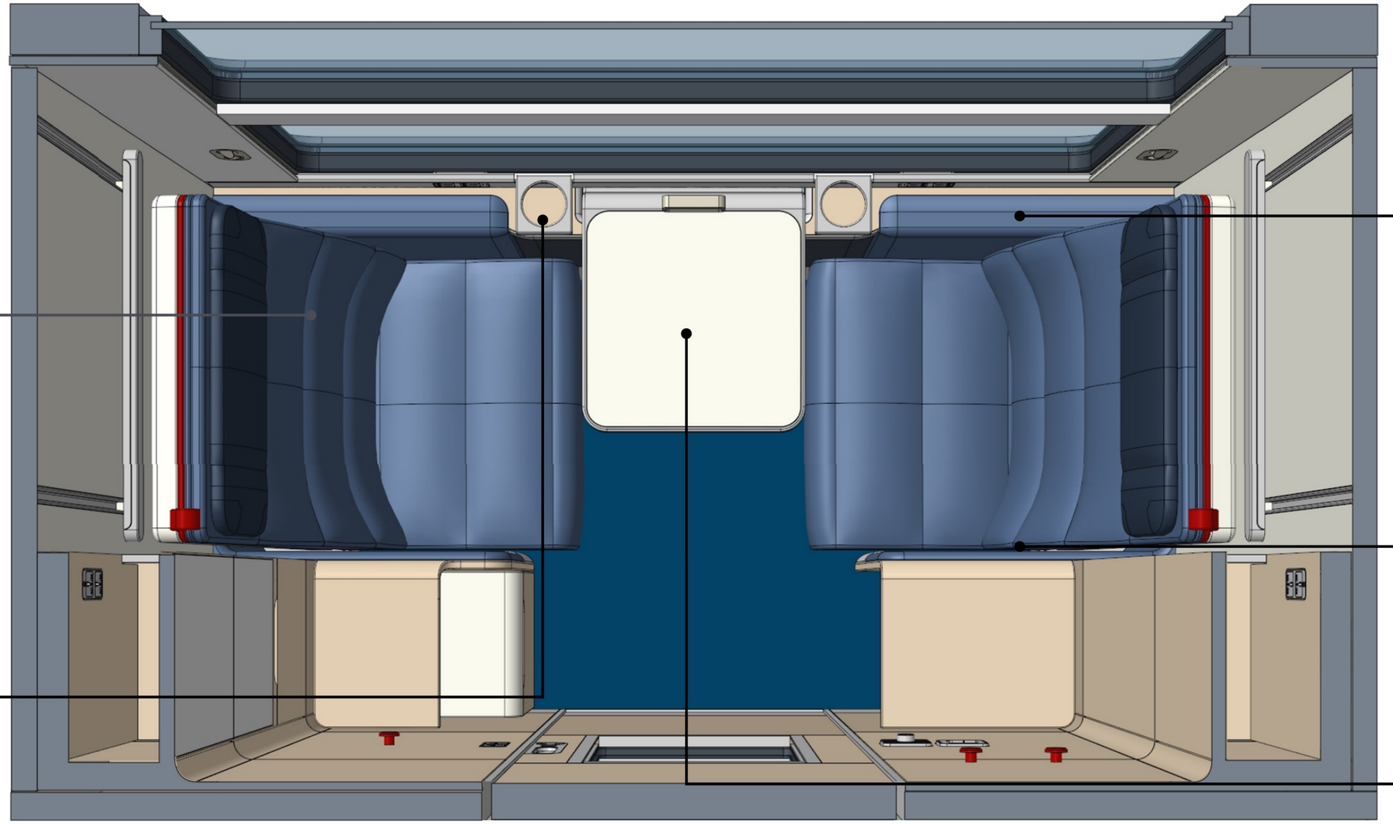
Seat Headrests
Seat headrest should be adjustable in height for a range of people sizes and have adjustable wings that fold outwards to adjust the width of the headrest.

Seat Comfort
Seat cushions should be contoured to aid seat comfort.



26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Roomette | Features



Seat Dimensions
A minimum seat width between inside surfaces of armrests should be a minimum of 26”.

Cup Holders
One for each passenger, located so people can use and access the cupholders from a seated position. Cup holders should be able fold away when not.

Armrest
A full and cushioned armrest of 3.5” should be provided on the window side. The armrest should be of a suitable length for a seated passenger to rest their forearm on the cushioned section.

Seat side pad
A soft seat side pad is required on the inside side of the seat to balance the seat and allow some cushioning to the inside edge to soften joining panel work

Fold out Table
Single leaf table deployed from side wall. The table height should provide good knee clearance for seated people with a height off the finished floor between 27” and 29”. The table should be easy to deploy and stow with an intuitive handle.

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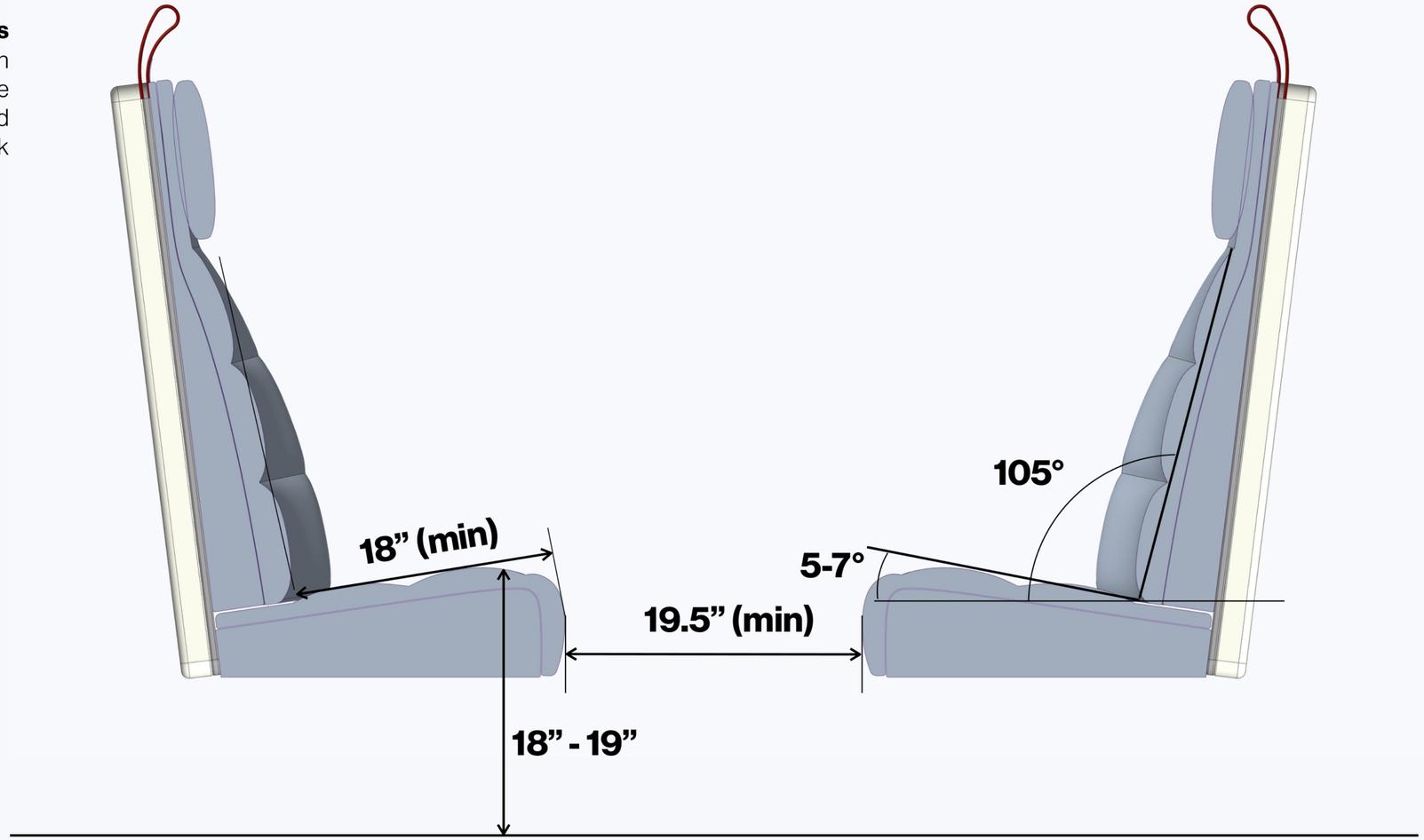
Roomette | Features

Seat Dimensions
All seat dimensions, cushion density/ shore hardness will be subject to mockup review and approval by Amtrak



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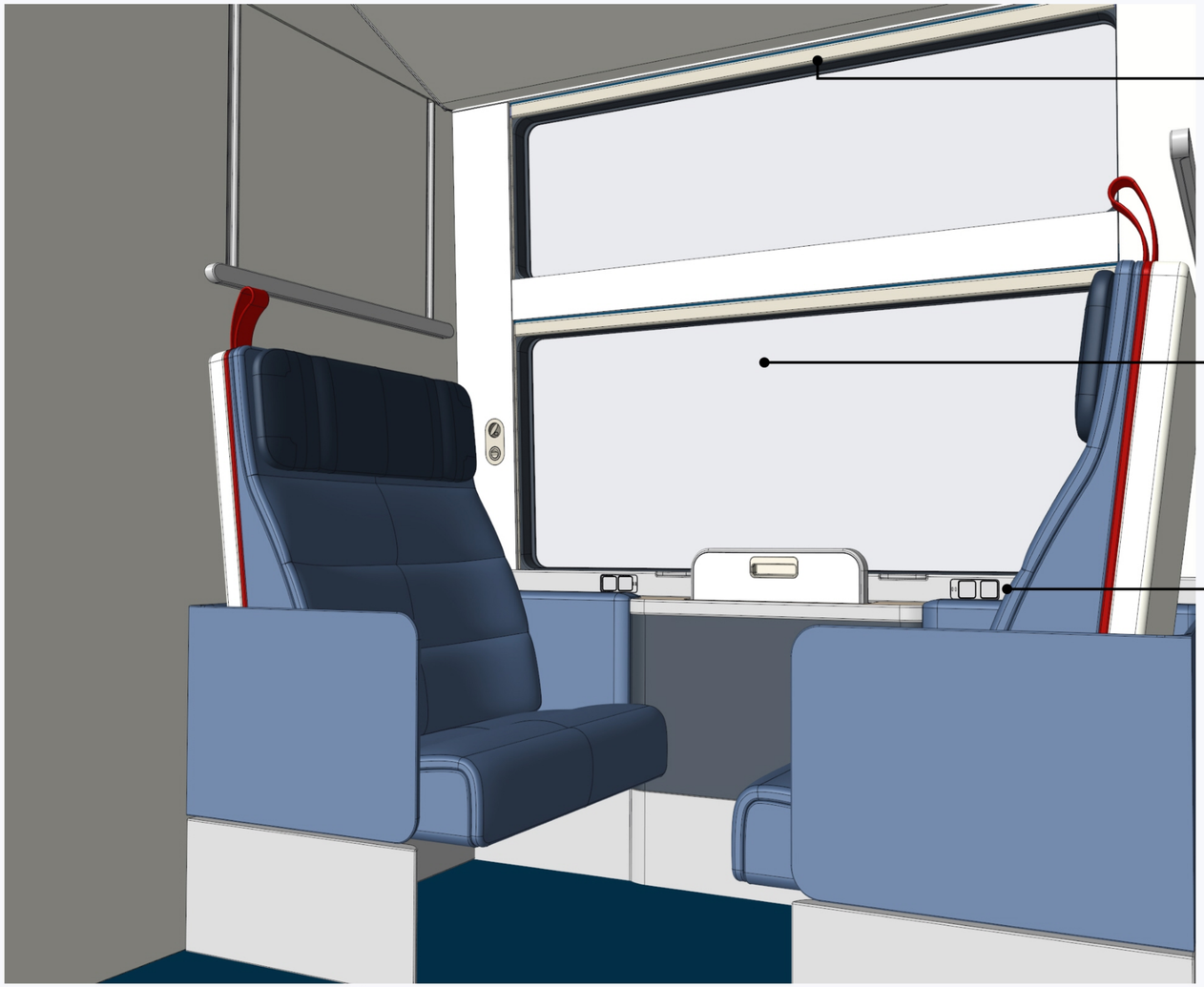
Roomette | Features

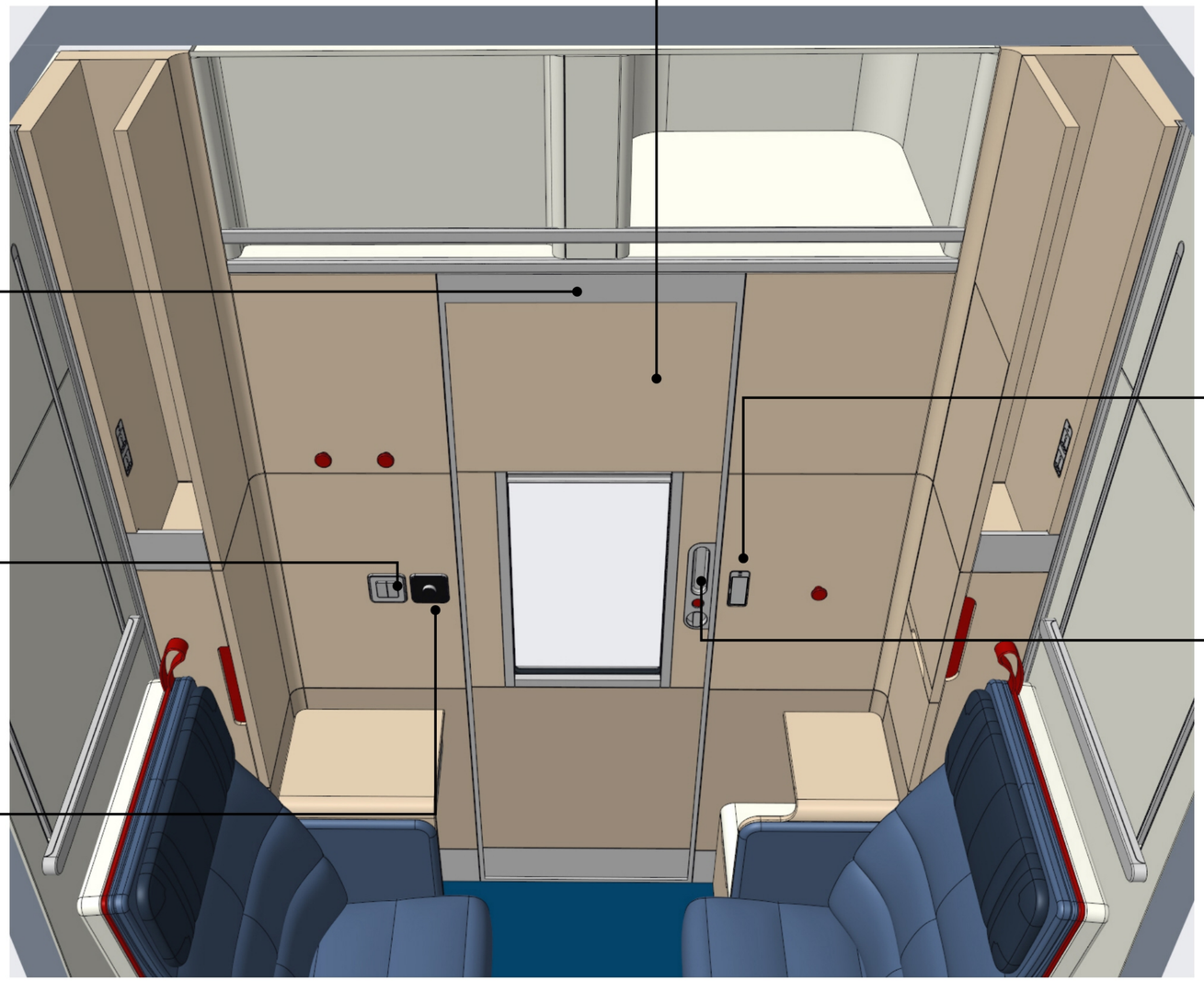


Blinds
A single pull-down blind system shall be provided per window, capable of delivering both daytime solar/glare control and full blackout performance.

Window and Window Mask
Window and window mask should be central to the room and overall window size maximized.

At Seat Power
Two power sockets and two USB sockets should be provided to each seated location. The position should be above the armrest height and in easy reach of people while seated.

Roomette | Features



Door Window and Blind
Door window should be central to door and come equipped with an integrated blinds

Door
Door free from rattle, smooth sliding operation.

Power Outlets
Two power sockets and two USB sockets positioned on outer wall in close proximity to vanity area

Master Light Switch
Master Light switches to be positioned near door. A second master switch should be safely accessible by a person lying in the top bunk

Door Handle and Lock
Door handles should be positioned to slide door easily open and closed. An accessible manual lock should be included with an indicator to show lock condition.

Temperature Control

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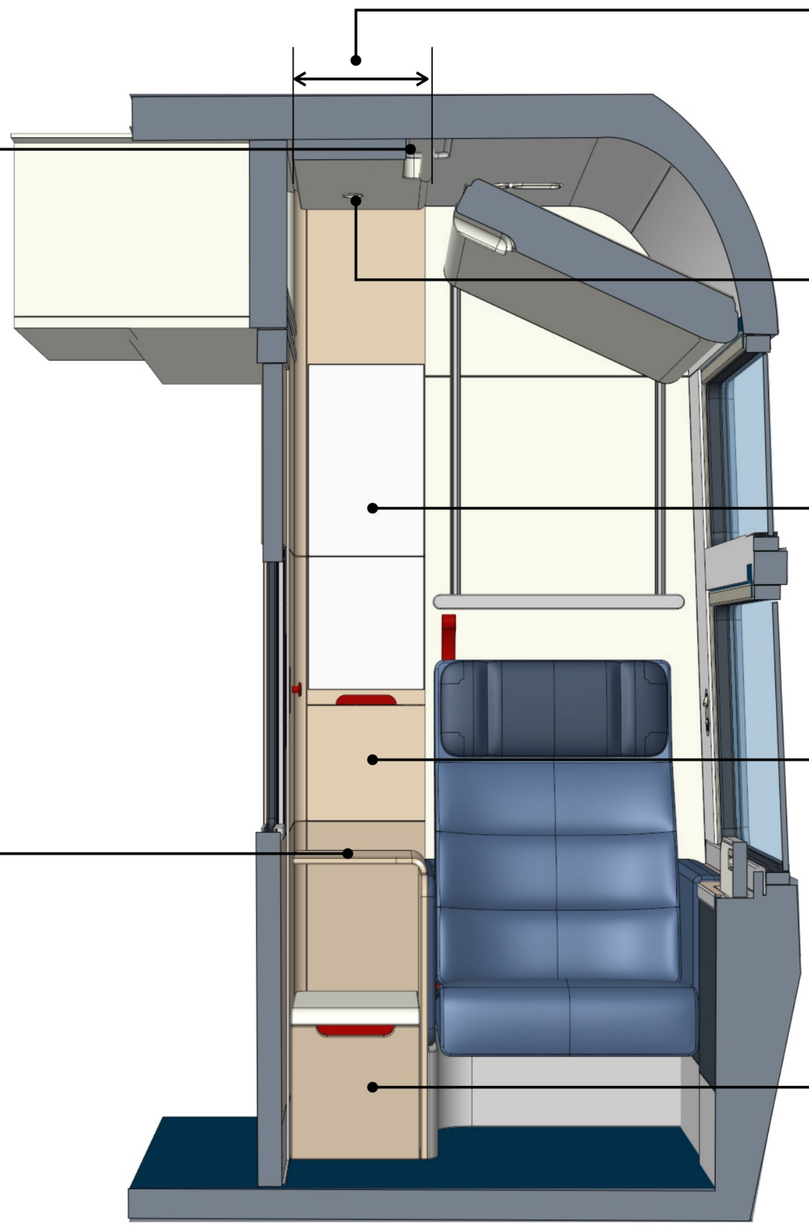
Roomette | Features

Handrails and Grabs
Suitable handholds shall be provided to assist people transiting to the bunk when deployed. .

Steps
At least two integrated steps should be built into the area beside the seat to allow people to safely transit to the upper bunk. Step surfaces shall be free from trip hazards and have an anti-slip finish to the tread surfaces. Steps shall be designed in such a way that the seat cushions, armrests or any soft furnishings are protected and clear of tread surfaces.



Minimum clear way
A free clear channel of at least 14” should be provided. Key dimensions and access to the upper bunk will be subject to mockup testing and Amtrak approval.

HVAC
HVAC control in the room should have a feature that allows passengers to adjust the direction of airflow away from their sleeping positions.

Mirror
The mirror on the front of the vanity unit should be suitable for people to see their reflection while standing.

Fold Out Sink

Trash Bin

Roomette | Storage

Roomette | Storage

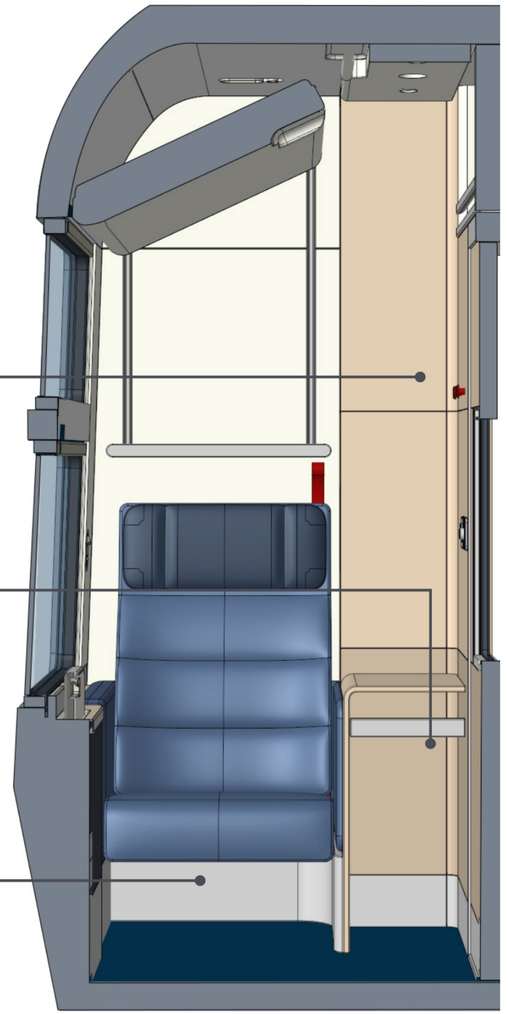


Cabinet
Shelved cabinet with retaining bars for clothes and personal items.

Vanity Cabinet
Shelved cabinet for toiletries, hand towels and face cloths (2 of each Amtrak's standard towels supplied). Space required for integrated tissue dispenser.

Carry On Stowage Area
Maximize area beside seat for small carry on luggage. Area should be protected from seat area so luggage can be stored discreetly out of the way.

Under Seat Stowage
Space under the both seats should remain free for carry on luggage. No seat mechanism or structure should preclude the ability to store large carry on bags.

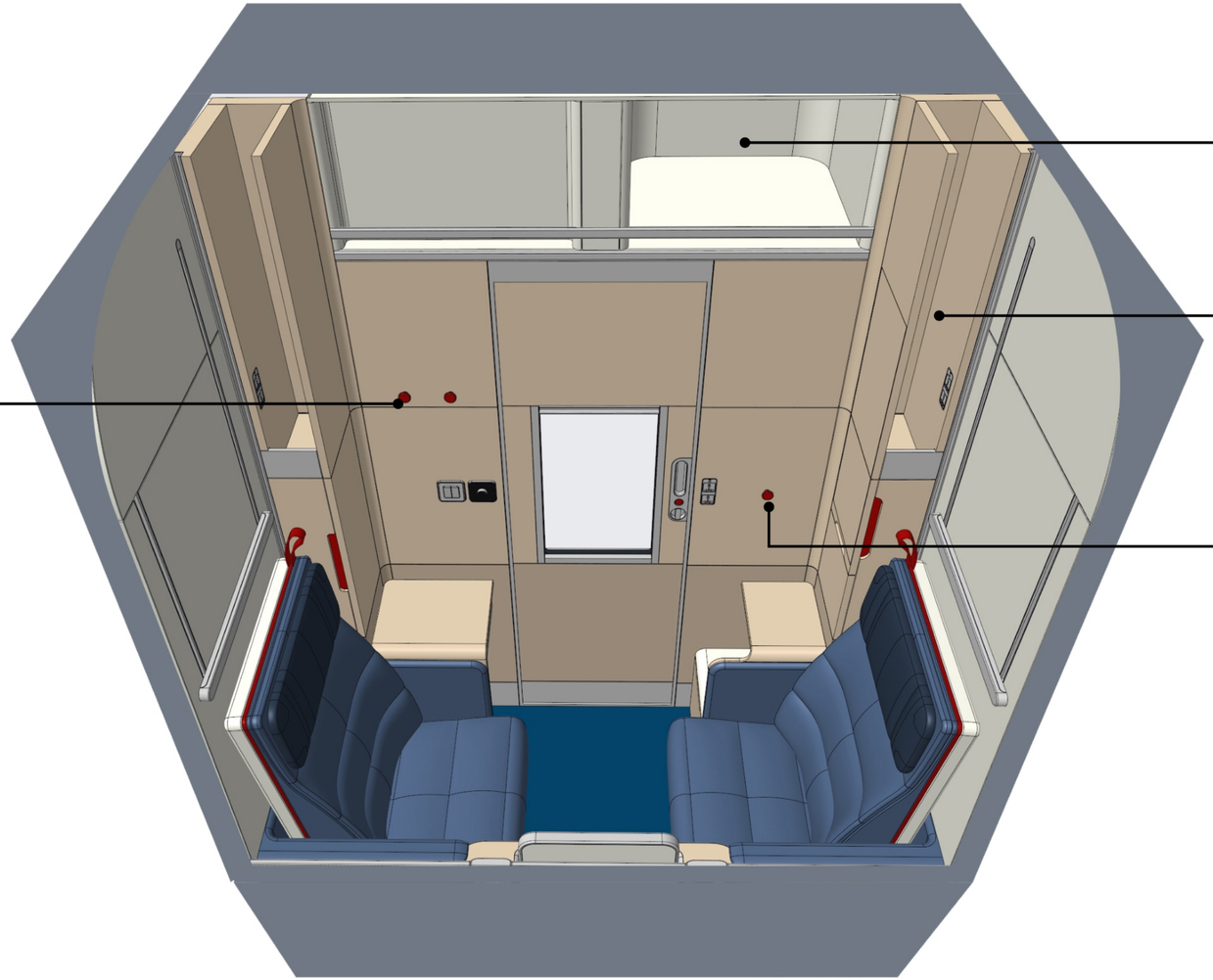


LH Side

RH Side

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Roomette | Storage



Upper Storage
High level storage for carry on luggage

Cubbies
Cubbies shall provide storage for personal items at both berth heights

Vanity Hook
Provision should be made to allow for wash bags or towels to be hung by the sink and vanity unit.

Hanging Space
At least two coat hooks should be provided on the inner wall, suitable to hang clothes or provide the function of an open wardrobe

Roomette | Seat to Bed Conversions

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Roomette | Seat to Bed Conversions



Lower Berth Deployment
A simple unlatch mechanism is required to convert the seats into a lower bed/berth. This should be positioned in a place that is easy for people to use and designed in a way so that people can understand its purpose.

Upper Bunk
Bunk should be stored horizontally at an optimized height in the room. Bunk should not preclude any part of the window when stowed.

Upper Bunk Deployment
A simple and easy to use handle, latch and lock mechanism should be within easy reach from a standing position. Successful locking should be visually indicated and safety measures should be put in place to prevent accidental deployment and prevent misuse.

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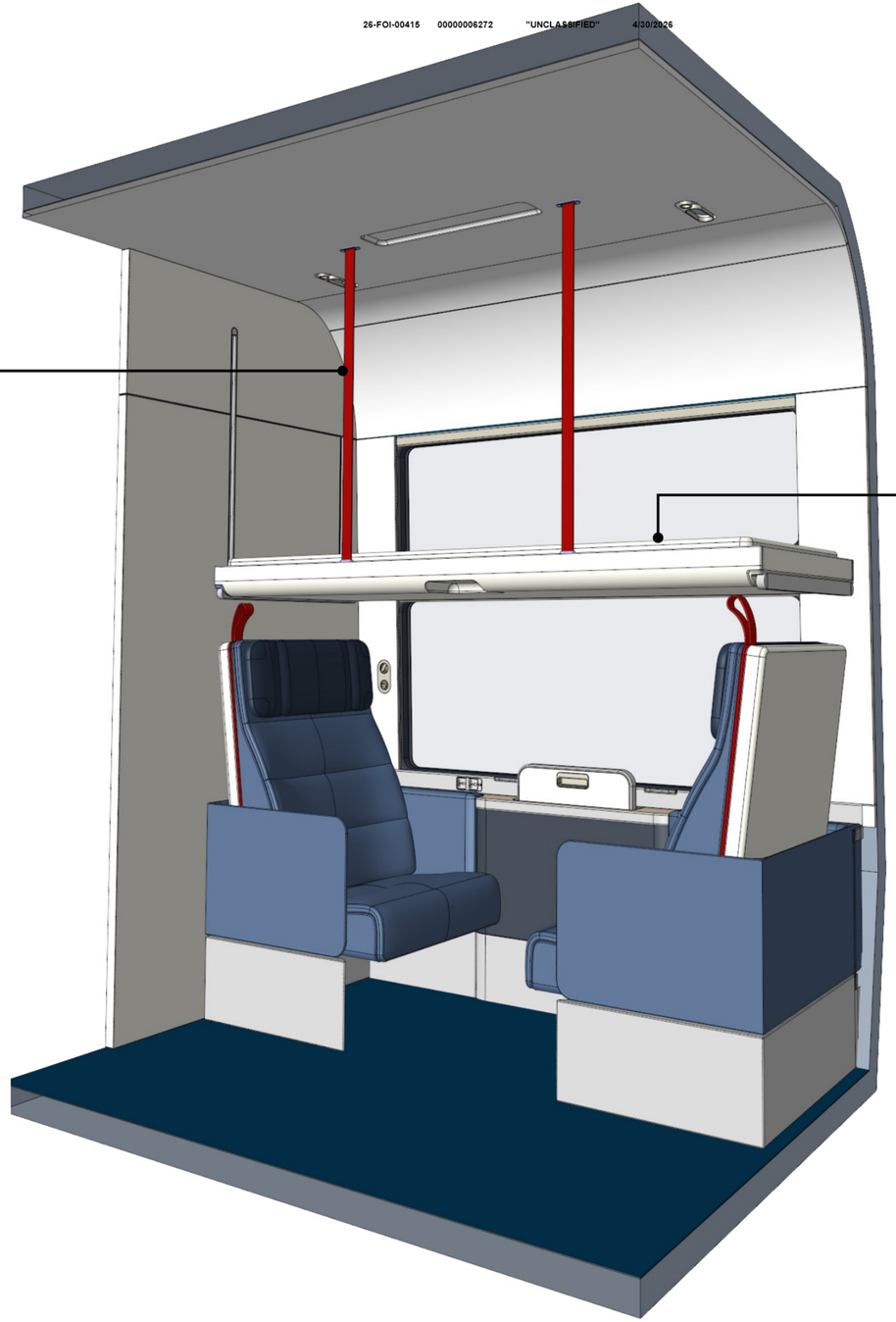
Roomette | Seat to Bed Conversions

Bunk Retaining Straps
Retaining straps are required to prevent people from rolling out of the bunk . These should retract into the ceiling and be easily pulled down and click into place using an automatic locking retractor belt system (similar to a car seat belt system).



Bunk Height
The seated area below the bunk should still be usable by seated passengers when the upper bunk is deployed.

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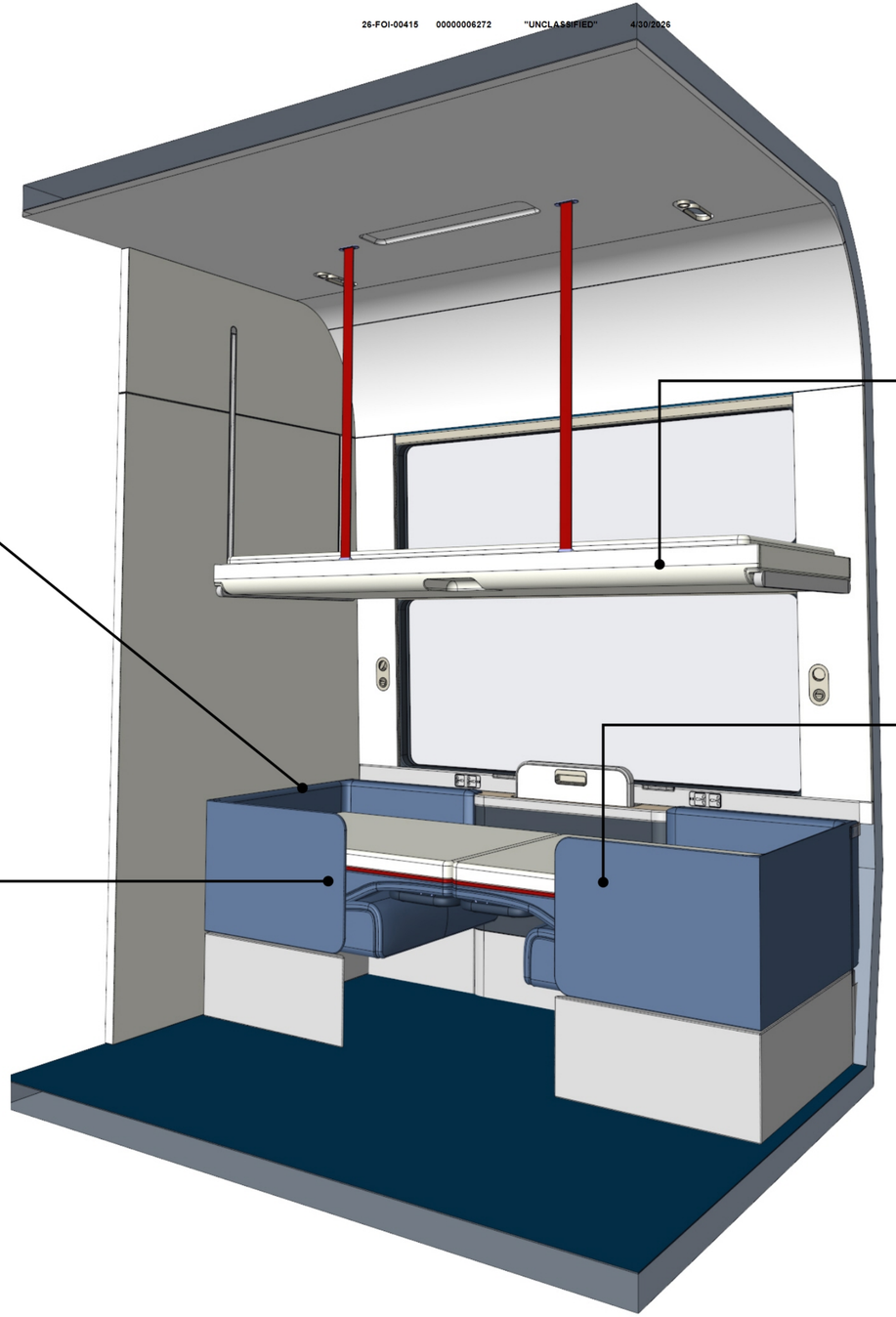
Roomette | Seat to Bed Conversions



Head Board
The armrest and seat side pad should continue and connect to form a thin soft headboard around the back of the seat when the bed for the lower berth is down.

Lower Berth
Conversion of seats to bed should result in an entirely flat bed surface. The mattress surface should be integral to the seat . A single seam between the bed surface is acceptable with a single thin topper to finish the bed surface.

Bunk Dimensions
Minimum width 27" x Minimum length 77”

Lower Berth Dimensions
Minimum width 27" x Minimum length 77”

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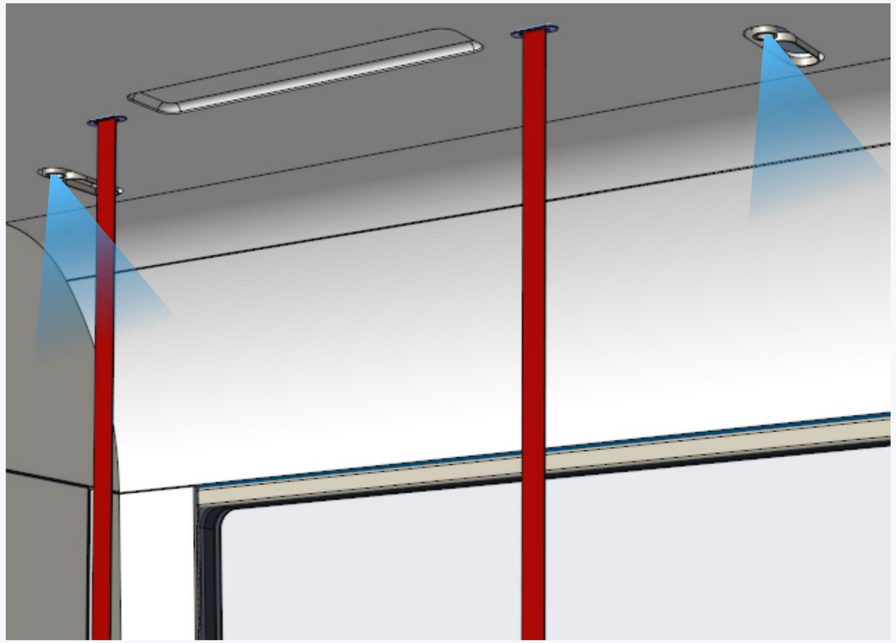
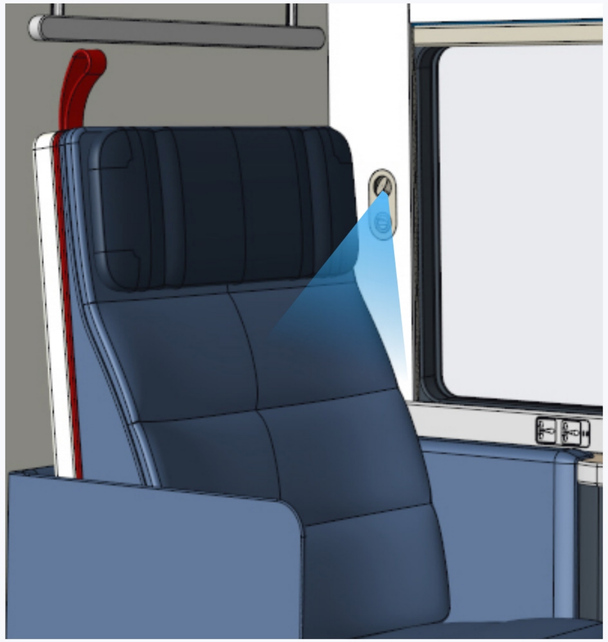
Roomette | Lighting

Roomette | Lighting



Upper Reading Lights
Reading lights should be provided embedded in ceiling above the bunk. These should be mini panel lights. 2 lights in total located at each end of the bed. Light switches should be located next to the reading light.



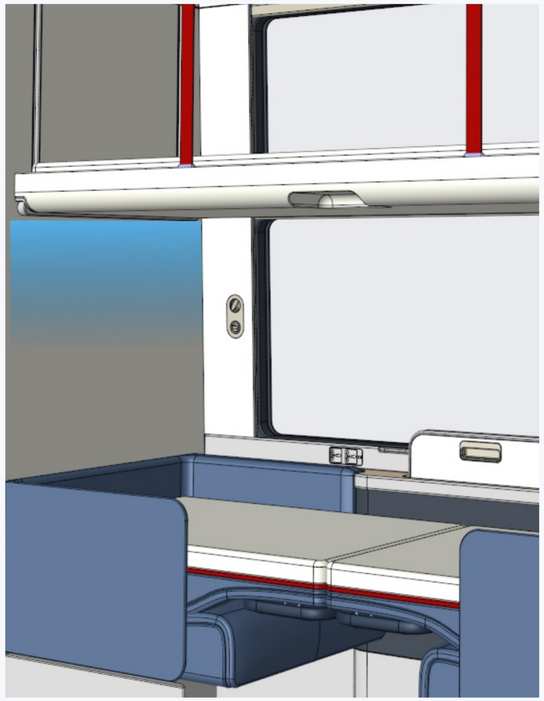
Lower Reading Lights
Reading lights should be provided at each seated location. People should be able to adjust the direction position of the light over their lap and in a suitable way to read a book at night. Switches should be located near or on the light.



LED light panel light
LED light panels or panel spot lights lights provide ceiling master lights.

*See lighting spec for detailed definition

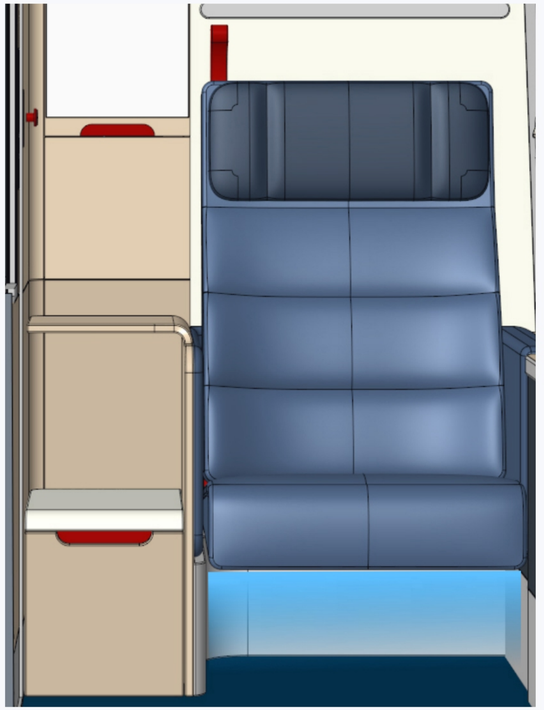
Roomette | Lighting



Back Wall Wash Light
Bunk support runner washes indirect light down the end walls on both sides of the room.



Back Wall Wash Light
Bunk support runner washes indirect light up across the end walls on both sides of the room.



Under Seat Light
Under seat light should be indirect and spill light out across the floor.



Step Light
Indirect light provides wash light over the steps.

*See lighting spec for detailed definition

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

- Coach Areas
- **Sleeper Bedrooms**
- Food & Beverage
- Toilets & Showers
- Common Use Areas

Amtrak® Long Distance Product Features

05 | SoloSuite

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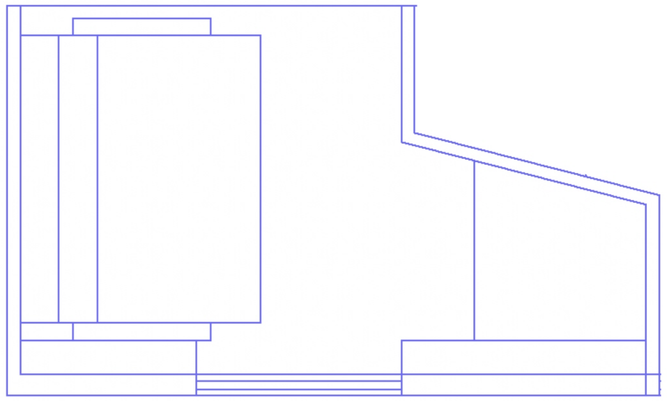
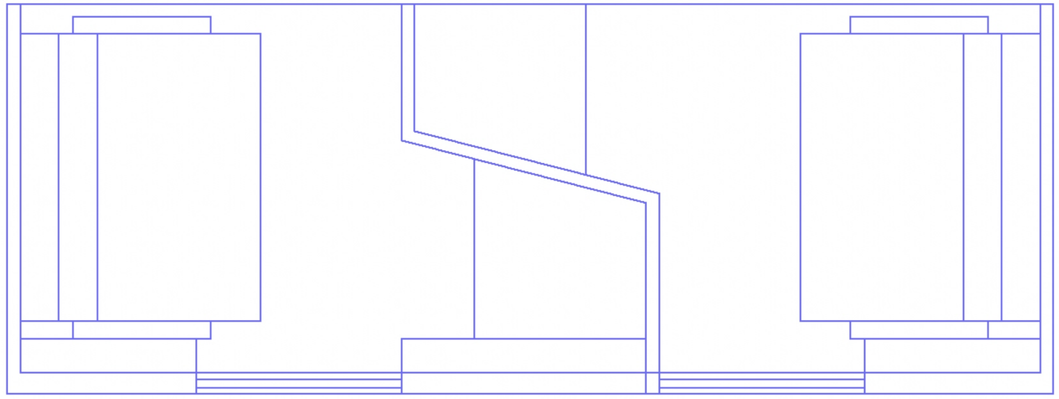


Solo SoloSuite



Twin SoloSuite

SoloSuite

SoloSuite is a room designed and optimized for a single occupant. SoloSuite rooms can combined with a mirrored version of the room to create a larger twin room for two.

***The following diagrams illustrate two SoloSuite rooms as a facing pair.**

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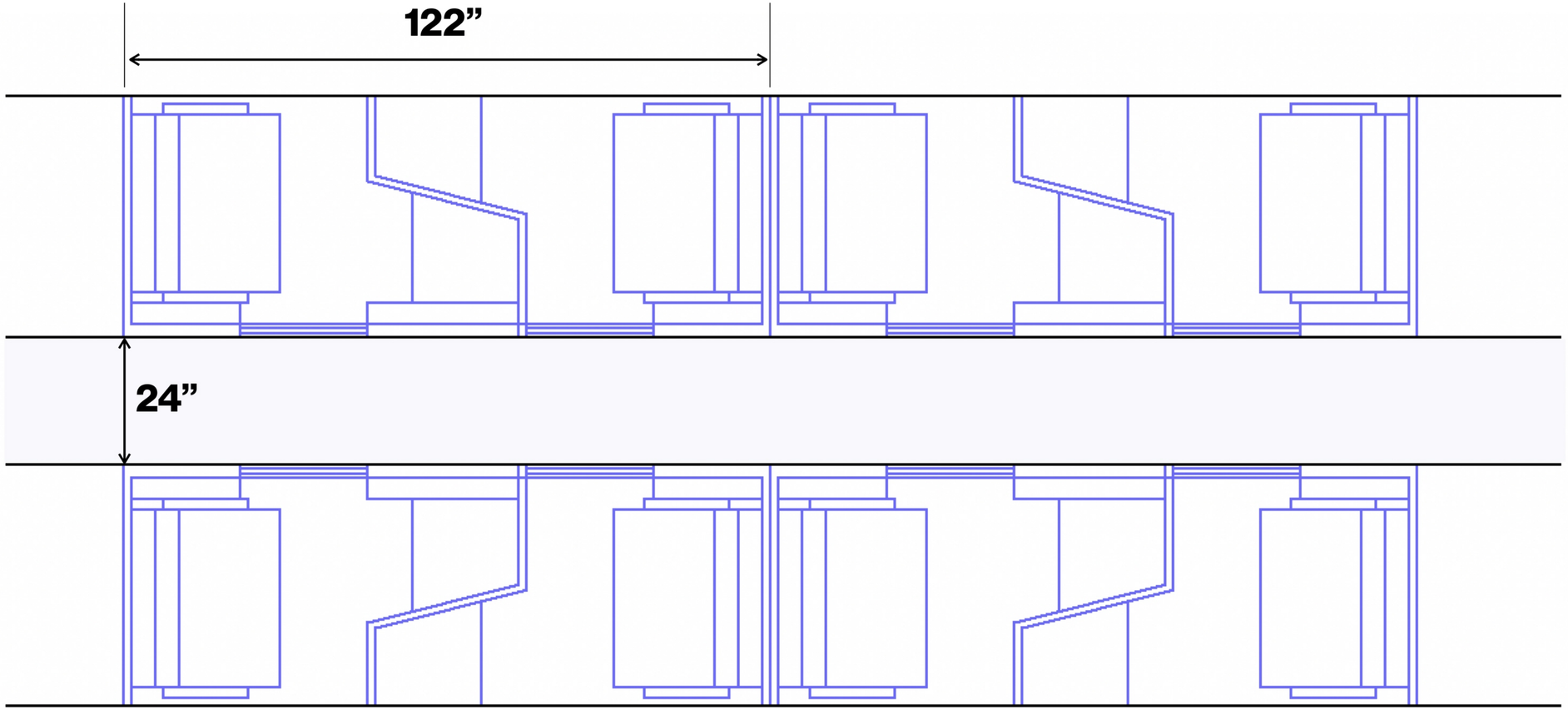
SoloSuite

SoloSuite rooms should be optimized for a central 24” aisle. Two SoloSuite modules combined (or facing pair) should be designed to a minimum length of 122”.



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Solo Suite | Features

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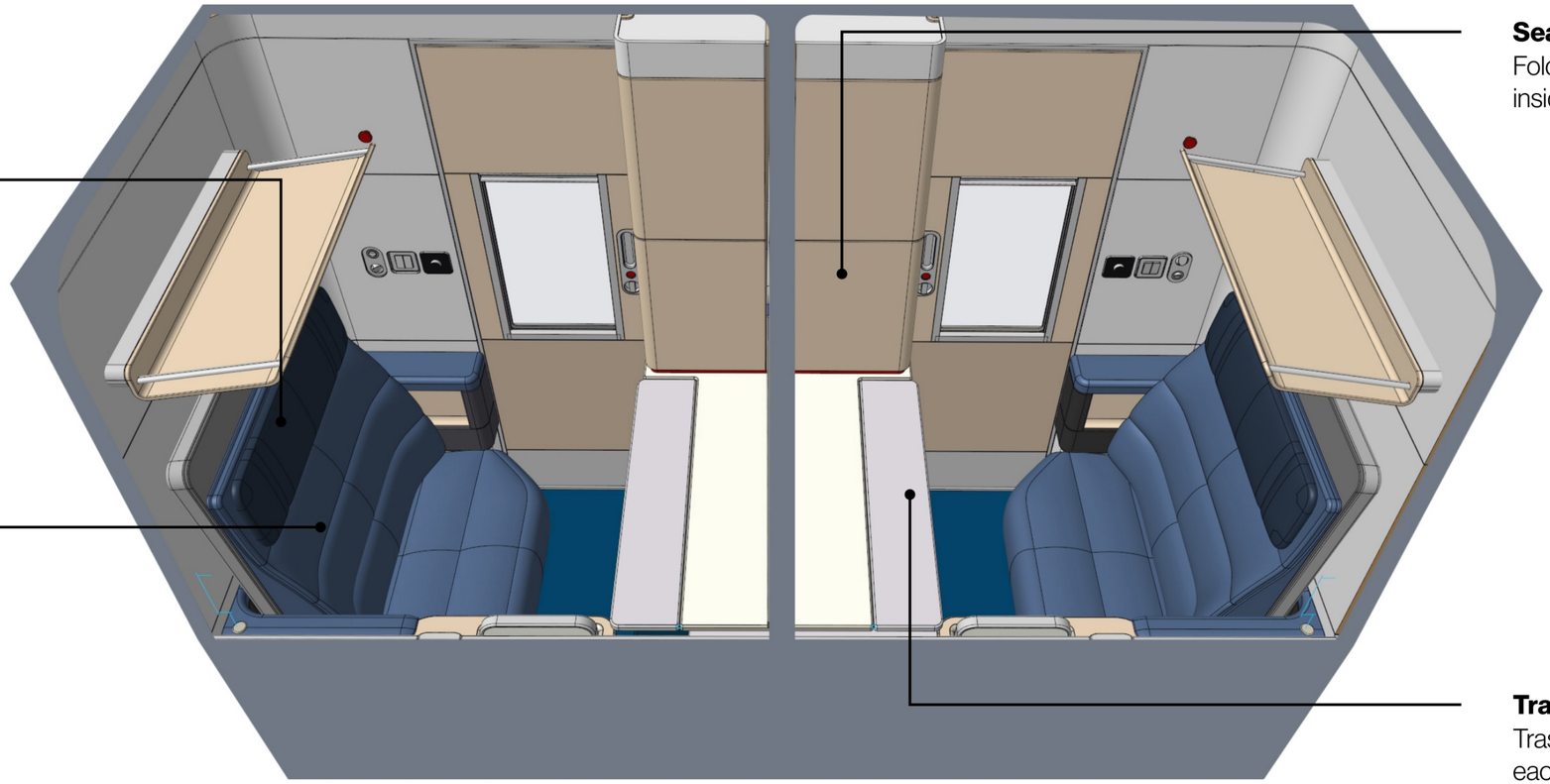
Solo Suite | Features

Seat Headrests
Seat headrest should be adjustable in height for a range of people sizes and have adjustable wings that fold outwards to adjust the width of the headrest.

Seat Comfort
Seat cushions should be contoured to aid seat comfort.



Seat Fold Out Sink
Fold out sinks shall be provided inside vanity cabinets

Trash
Trash bins shall be provided in each room located under central console.

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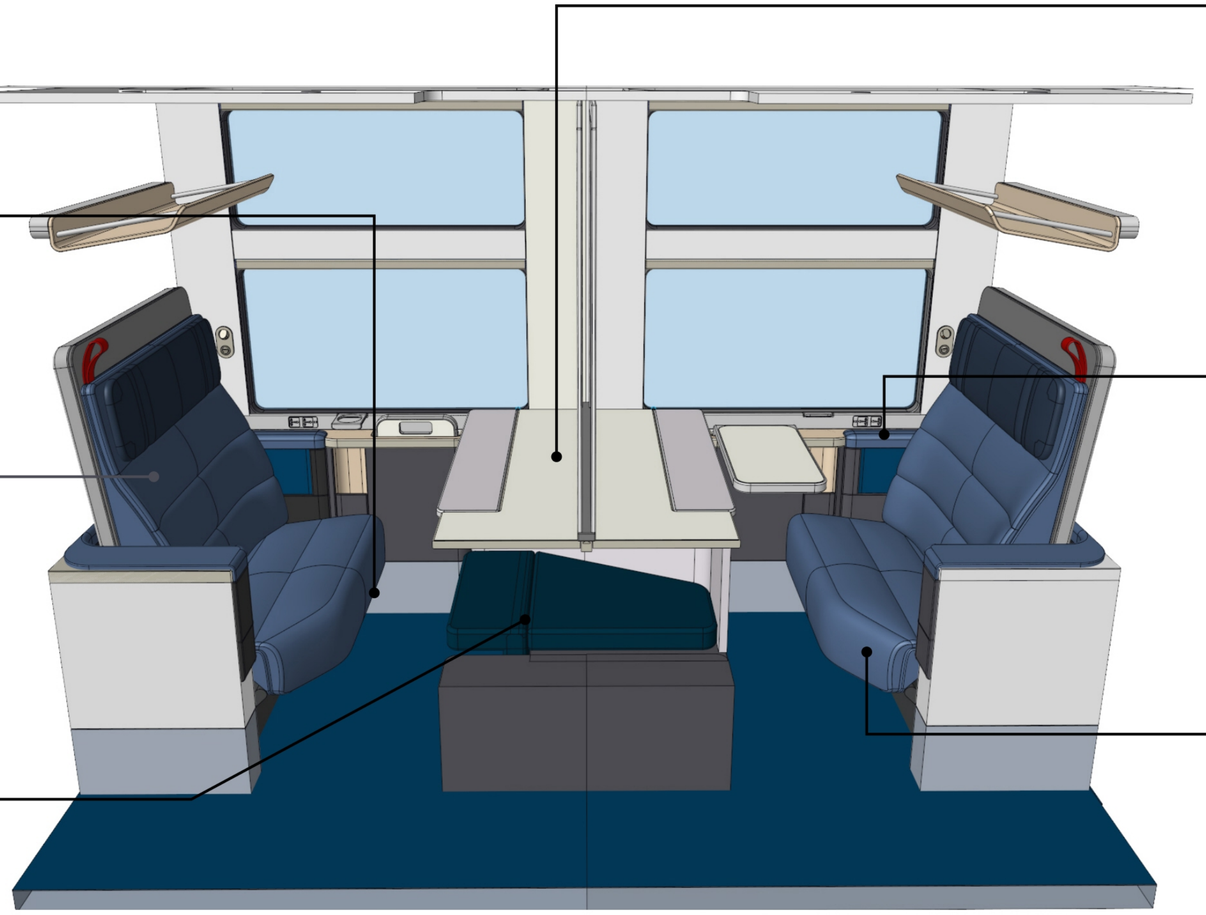
Solo Suite | Features

Seat Tracking
Seat should track forward so customers can utilize the large central table. The result will provide some recline for the seat.

Seat Dimensions
A minimum seat width between inside surfaces of armrests should be a minimum of 34". It should be possible to invite a companion into the room and comfortably sit side by side on the same seat.

Ottoman
A fixed ottoman should be provided inside a foot-box. A foldable portion of the ottoman should fold up to complete the bed surface and down to provide some standing space when the main part of the bed is deployed.



Central Console
A fixed central console houses foot-boxes for the facing SoloSuite pairs. Careful balance between each pair should be considered to maximize living accommodation for each of the passengers.

Armrest
A full and cushioned armrest of 3.5" should be provided on both sides of the seat. The armrest should be of a suitable length for a seated passenger to rest their forearm on the cushioned section.

Seat pan shape
The seat pan should be profiled to maintain ingress and egress clearance. This is a high wearing area of the seat surfaces and this area should be suitably designed to be durable and free from snagging or entrapment.

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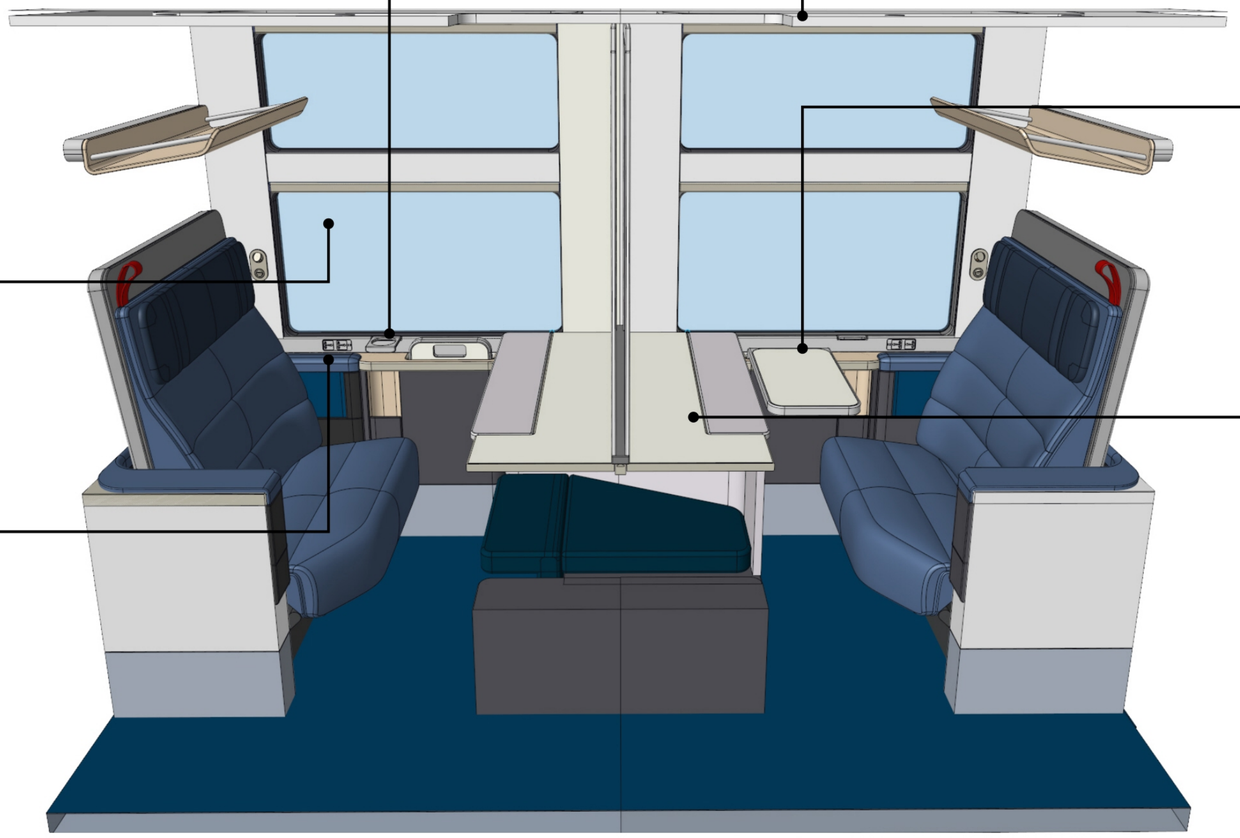
Solo Suite | Features

Cup Holders
Each room should have one cup holder located so people can use and access the cupholders from a seated position. They should fold away when not in use.

Window and Window Mask
Window and window mask should be central to the room and overall window size maximized.

At Seat Power
Two power sockets and two USB sockets should be provided to each seated location. The position should be above the armrest height and in easy reach of people while seated.



Blinds
A single pull-down blind system shall be provided per window, capable of delivering both daytime solar/glare control and full blackout performance.

Fold out Table
Single leaf table deployed from side wall. The table height should provide good knee clearance for seated people with a height off the finished floor between 27” and 29”. The table should be easy to deploy and stow with an intuitive handle.

Ottoman Table
The ottoman table should be large enough for face to face dining. When the seat is tracked forward. It should incorporate a folding leaf to create extra knee and turnover space for sleeping passengers. The leaf must not interfere with divider mechanism when folded.

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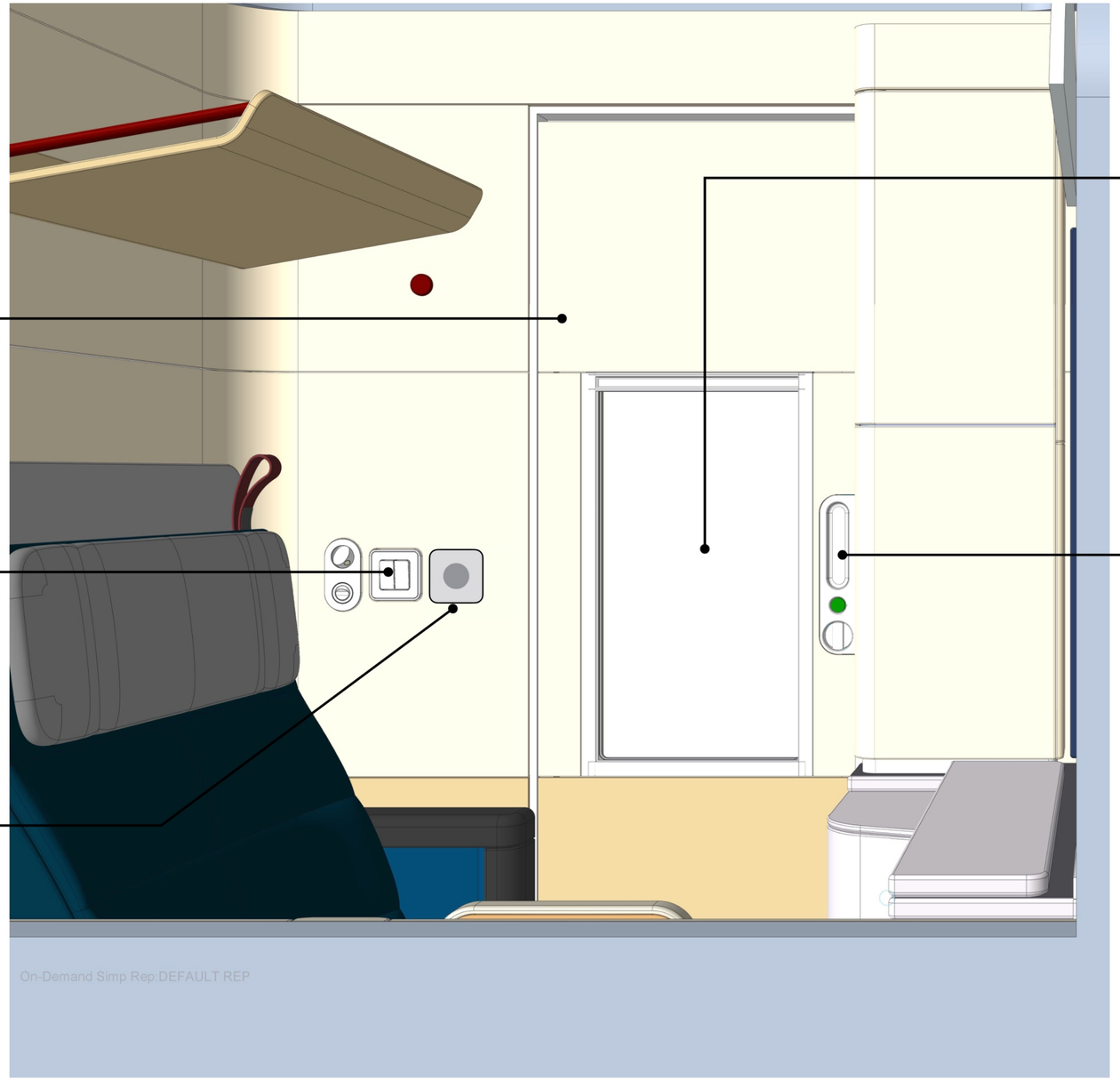
Solo Suite | Features



Door
Door free from rattle, smooth sliding operation.

Master Light Switch
Master light switches to be positioned near door. A second master switch should be safely accessible by a person lying in the top bunk.

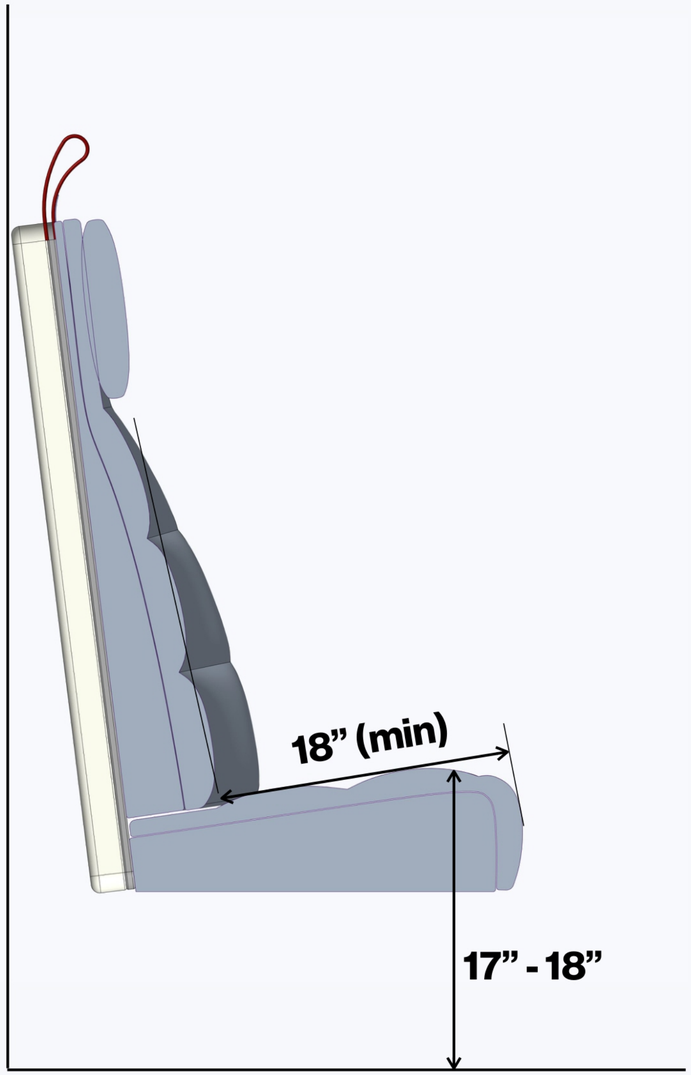
Temperature Control

Door Window and Blind
Door window should be central to door and come equipped with an integrated blind.

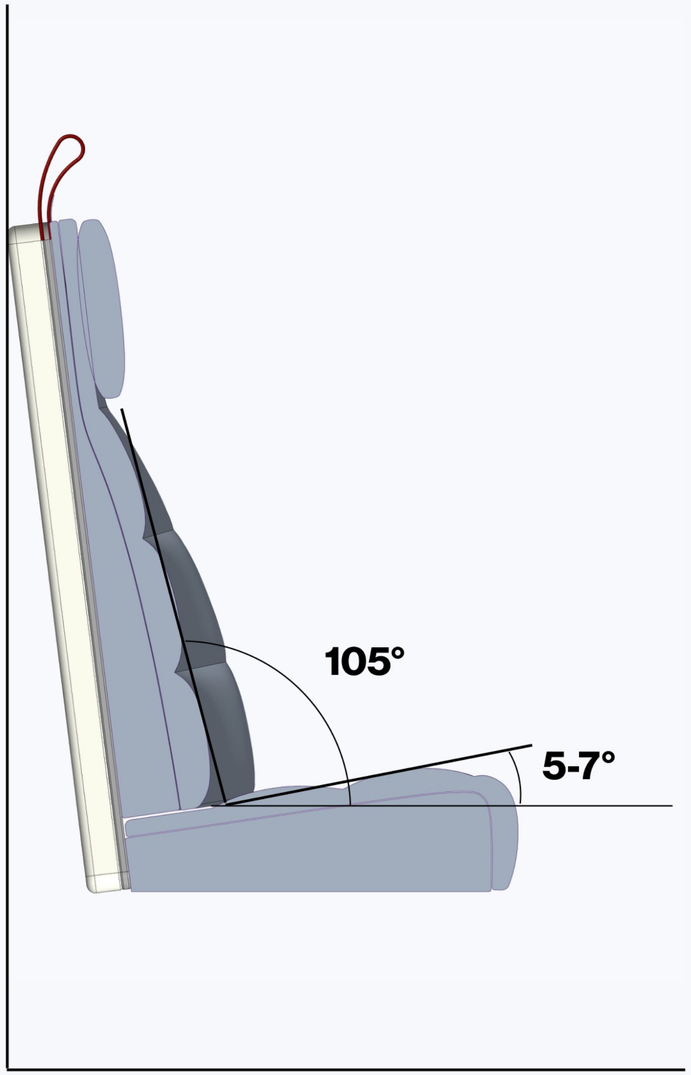
Door Handle and Lock
Door handles should be positioned to slide door easily open and closed. An accessible manual lock should be included with an indicator to show lock condition.

Solo Suite | Features

Seat Dimensions
All seat dimensions, cushion density/ shore hardness will be subject to mockup review and approval by Amtrak

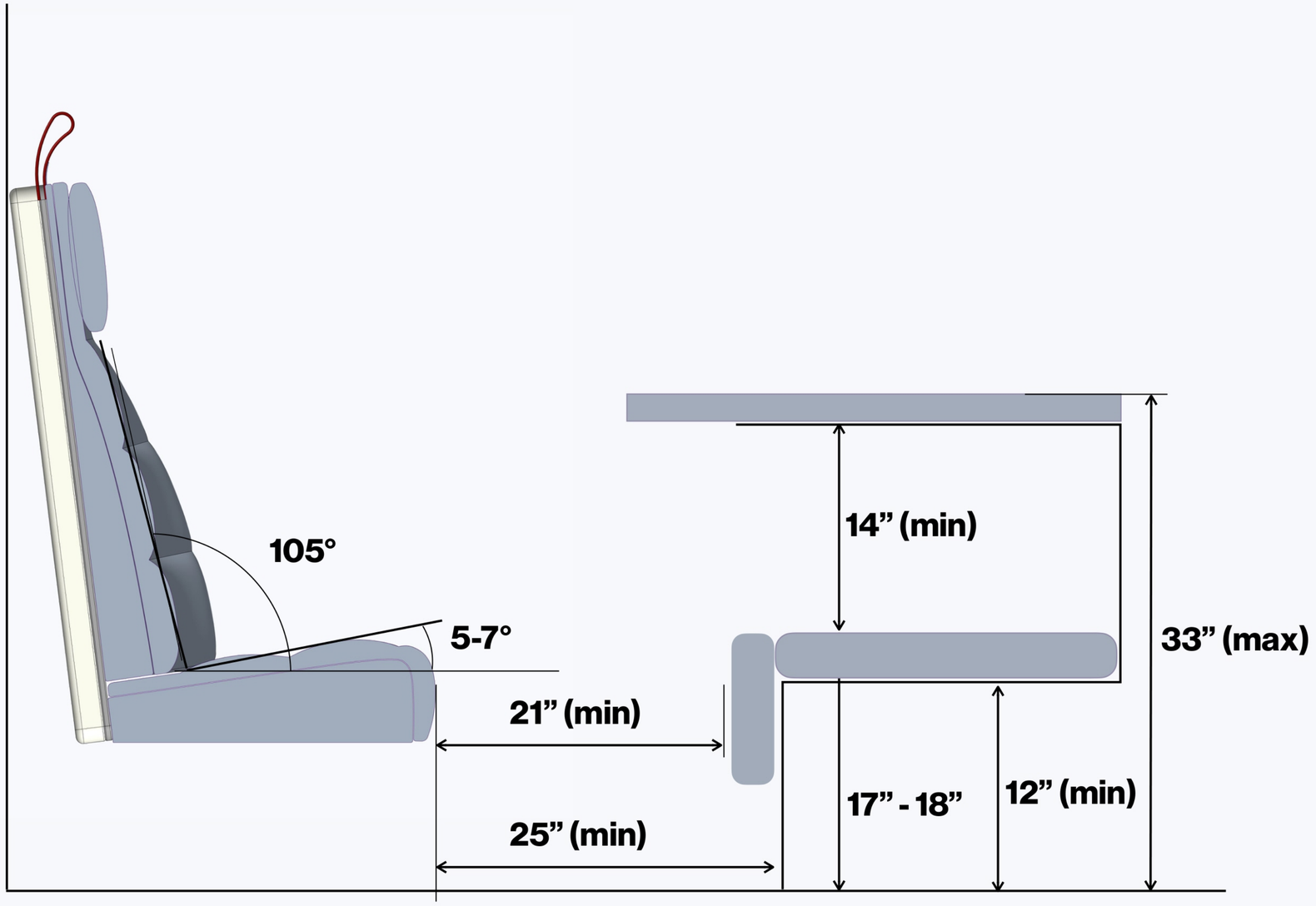


DRAWINGS NOT TO SCALE



DRAWINGS NOT TO SCALE

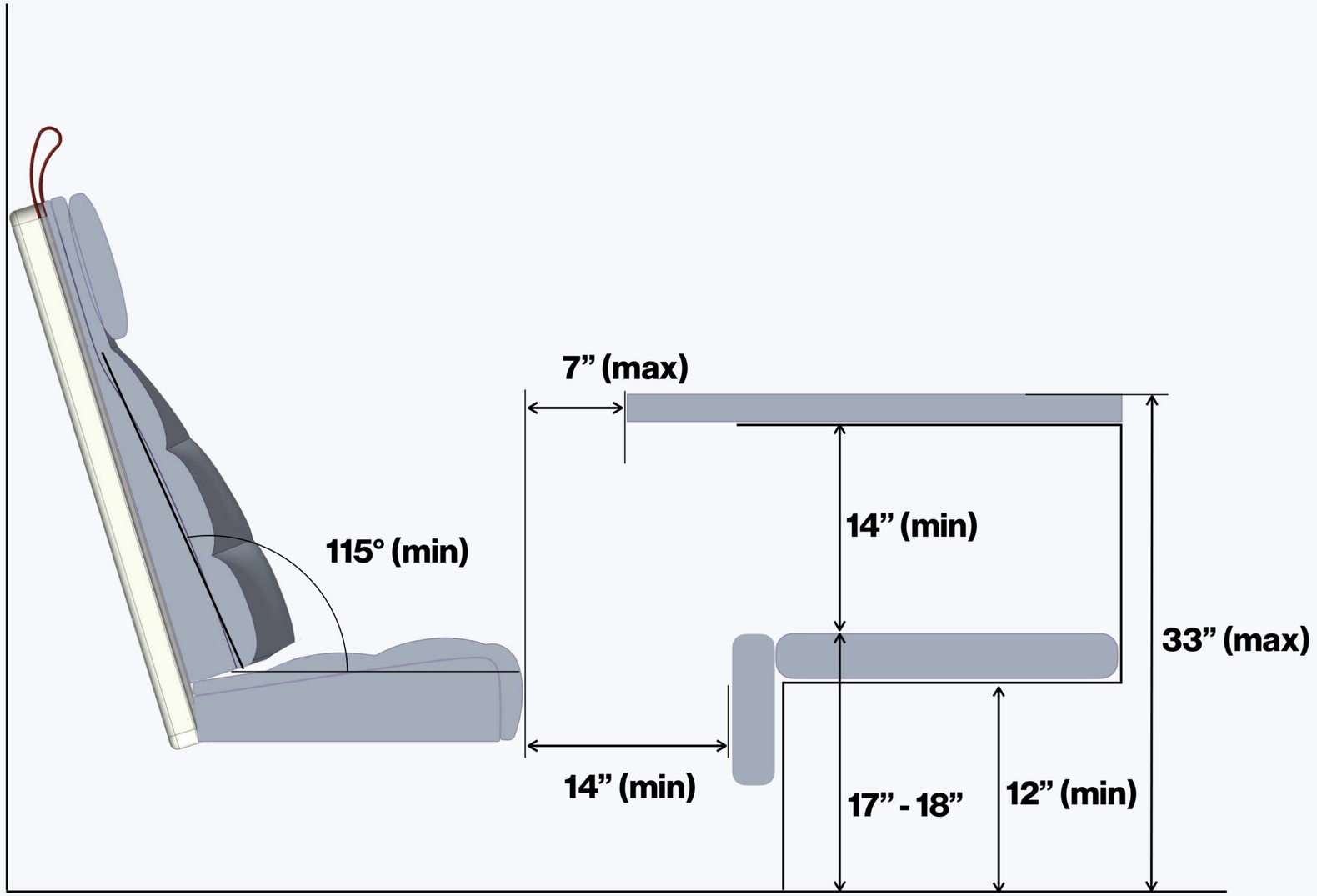
Solo Suite | Features



DRAWINGS NOT TO SCALE

Solo Suite | Features

Seat Tracking
Seat should track forward so customers can utilize the large central table and create some recline in the seat.



DRAWINGS NOT TO SCALE

Solo Suite | Storage

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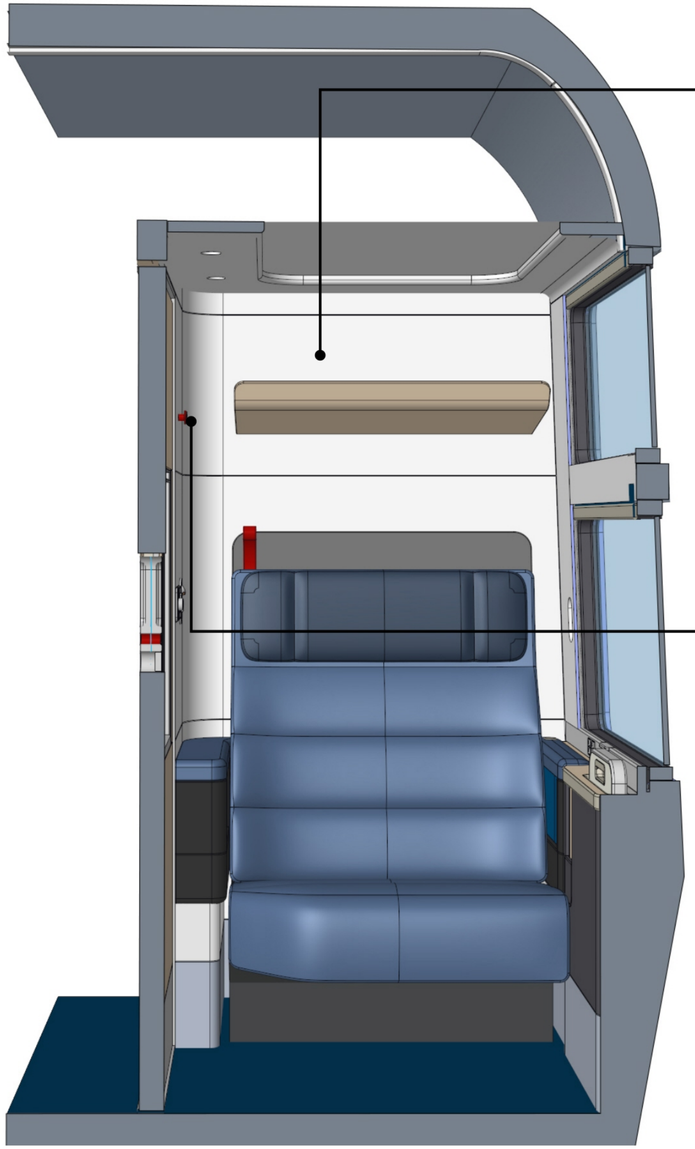
Solo Suite | Storage



Seat Side

Luggage Rack

Luggage rack for clothes and/or small carry on luggage. The rack should be design to prevent luggage falling off in typical railroad conditions i.e. with lip or retention strap.

Vanity Cabinet

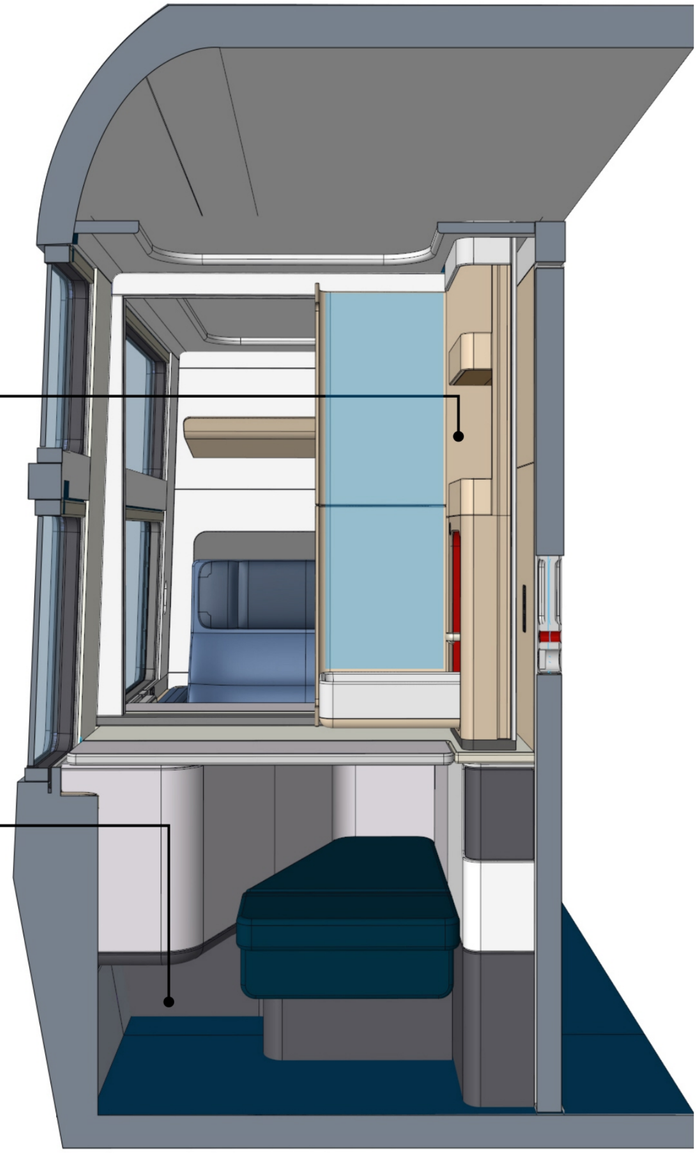
Shelved cabinet for toiletries, hand towels and face cloths and bath towel storage and integrated tissue dispenser. Mirror and towel shall be included.

Hanging Space

At least one coat hook should be provided on the inner wall, suitable to hang clothes or provide the function of an open wardrobe.

Ottoman Stowage

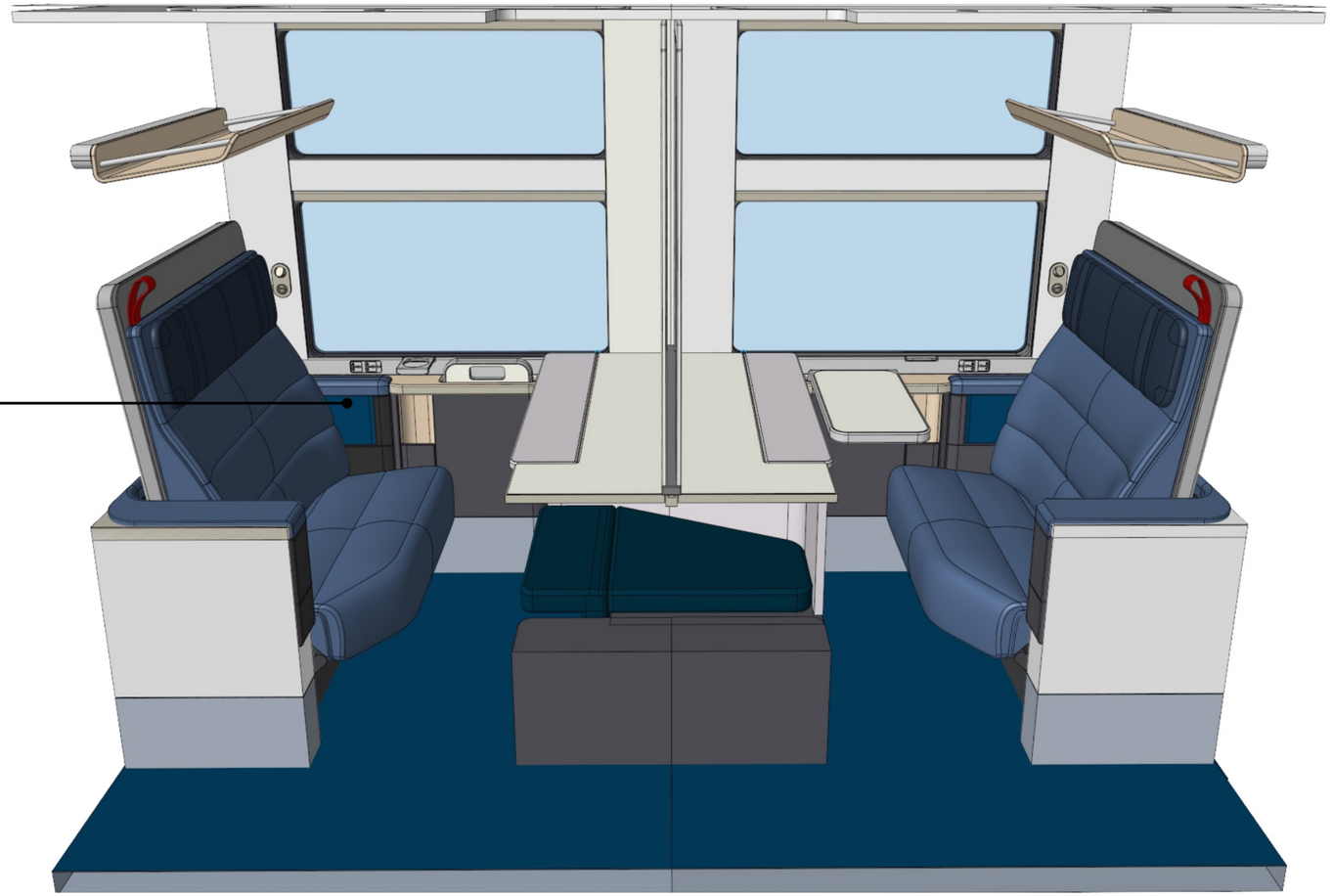
Space under the opposite passenger's ottoman should remain free for carry on luggage. The carry on luggage shouldn't encroach into the door space.



Ottoman Side

Solo Suite | Storage

Armrest storage
Available space on each side of the seat shall be provide storage for personal items and water bottles.



Solo Suite | Seat to Bed Conversions

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Solo Suite | Seat to Bed Conversions

Ottoman Table
Table leaf fold up to create knee space.

Headboard
The armrest and seat side pad should continue and connect to form a thin soft headboard around the back of the seat when the bed for the lower berth is down.

Bed
Conversion of seat to bed should result in an entirely flat bed surface. The mattress surface should be integral to the seat. Seams between the bed surface and ottoman are acceptable if finished with a single thin topper. There should be no movement in the bed structure when fully loaded when the bed is deployed.

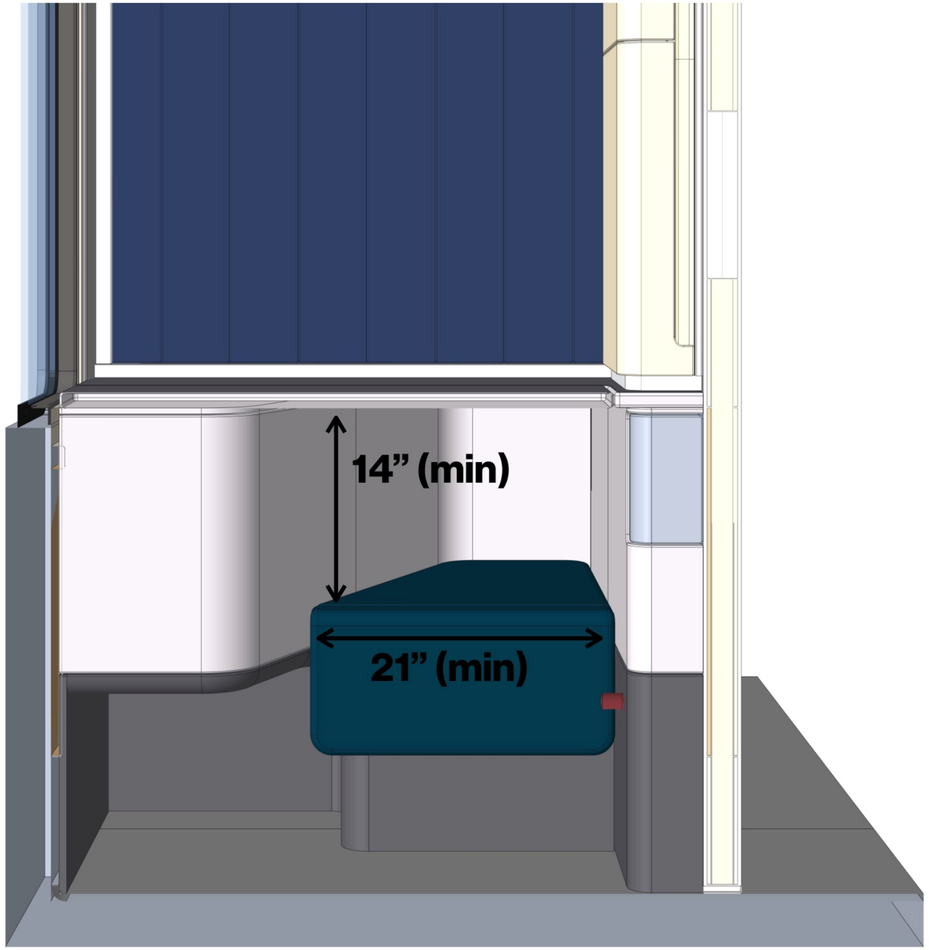
Folding Ottoman Pad
A folding ottoman pad should complete the seat surface between bed and ottoman. The pad should be independently operated. Care should be taken in the design and activation to avoid accidental entrapment or mitigate injury through misuse.



Bed Deployment
A simple unlatch mechanism is required to convert the seats into a lower bed/berth. This should be positioned in a place that is easy for people to use and designed in a way so that people can understand its purpose. The latch should be free from jamming and free from any finger trap hazards.

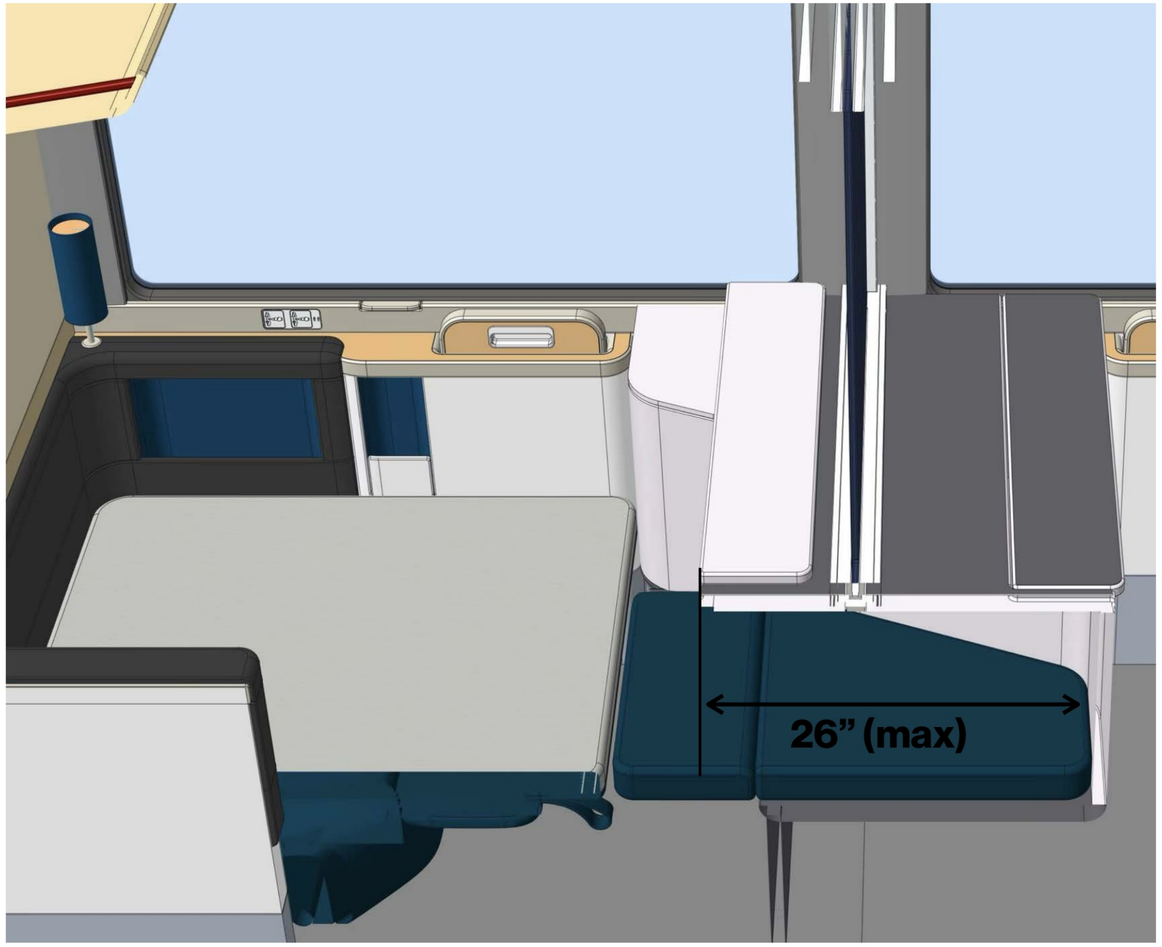
Standing space
The folding ottoman pad and ottoman table leaf should create a space large enough for passenger to stand and deploy and stow the bed while in the room with the door closed.

Solo Suite | Seat to Bed Conversions



Foot-box threshold

There should be a minimum of 14” between the top of the ottoman/bed surface and the underside of the foot-box/table surface. There should be a minimum of 22” between the two sidewalls at the threshold of the foot-box.



Foot-box depth

The foot-box should be a maximum of 24” deep when the ottoman pad table is folded up.

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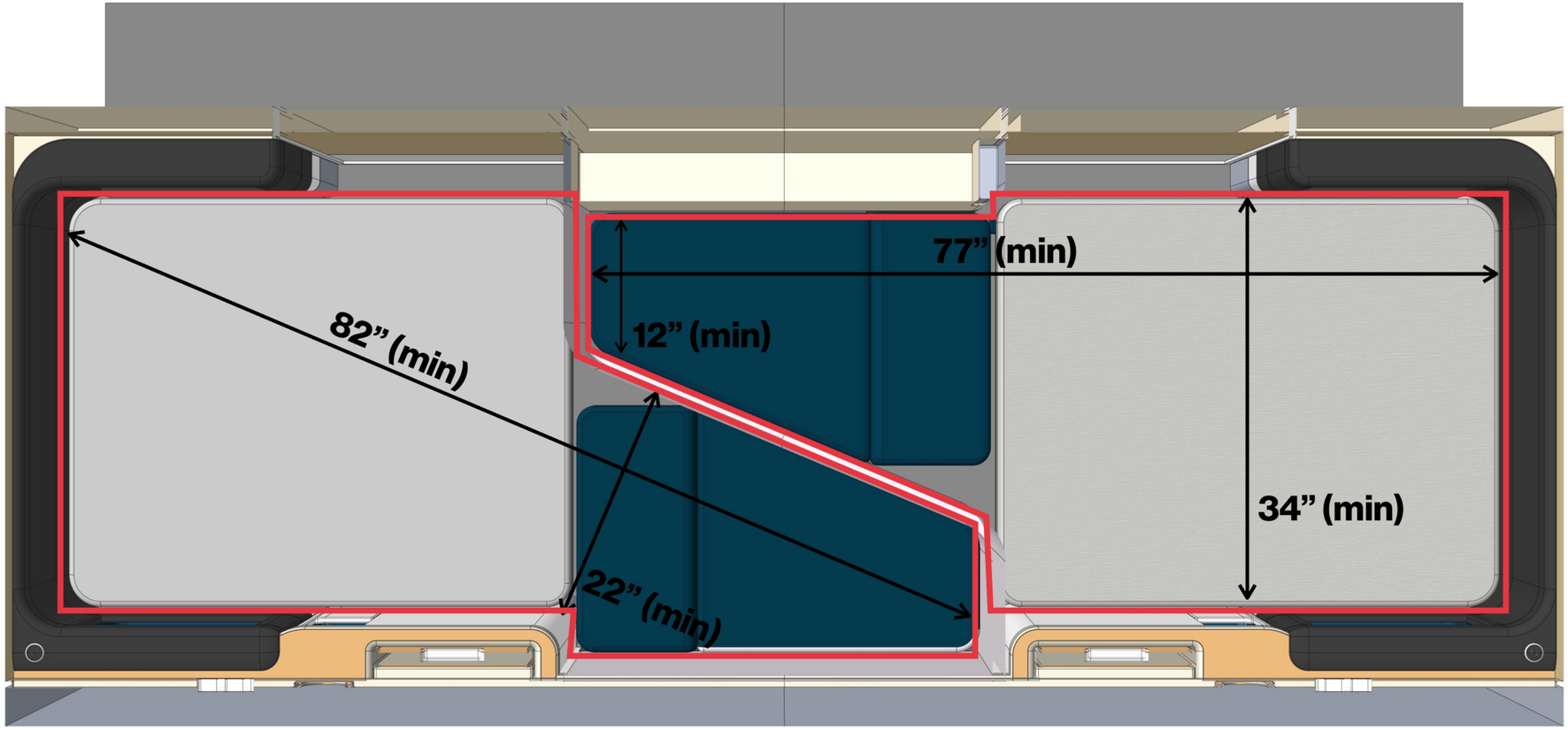
Solo Suite | Seat to Bed Conversions



Bed dimensions

There should be a minimum of 82” between the two opposite corners to account for the tapering bed shape.
There should be a minimum of 22” between the inside surface of the foot-box and any sidewall structure.
Dimensions and usability will be subject to Amtrak approval.

Bed dimensions cont.

There should be a minimum of 77” bed length.
There should be a minimum of 34” bed width.
Dimensions and usability will be subject to Amtrak approval.

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Solo Suite | Connecting Rooms

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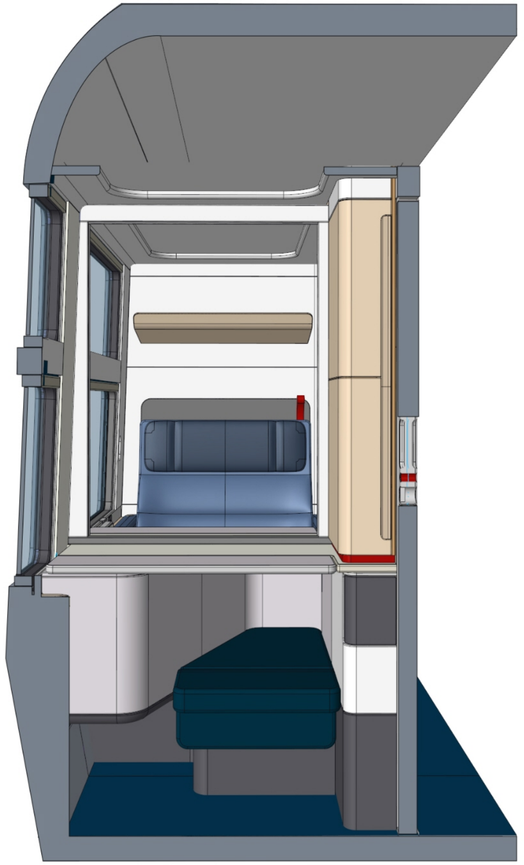
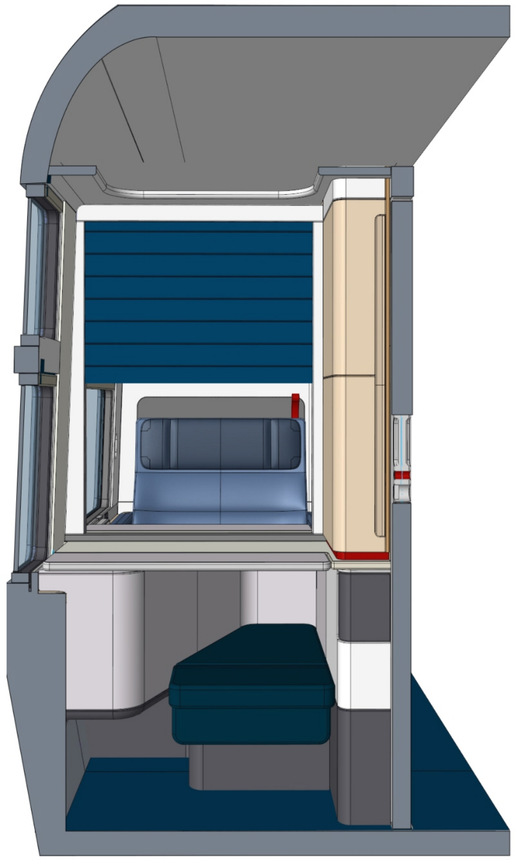
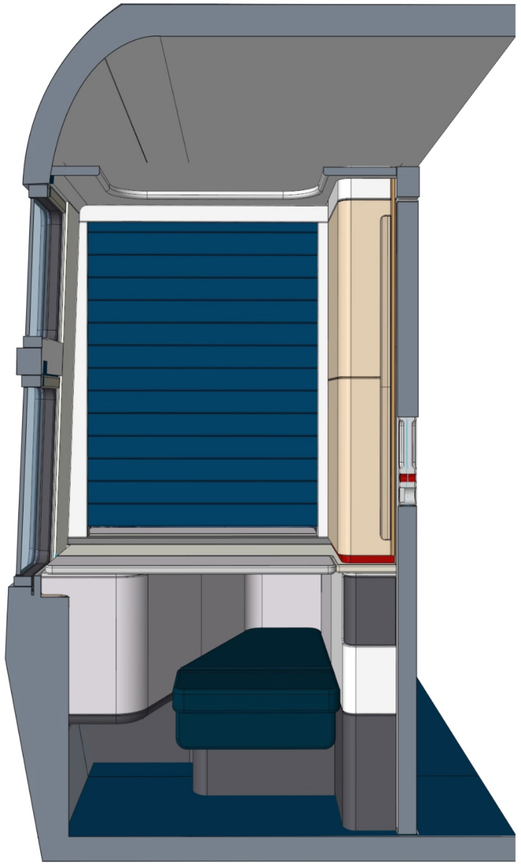
Solo Suite | Connecting Rooms



Open (Stowed)
The divider must stow away neatly into a pocket, wall or ceiling and not protrude into the room. When stowed the divider must be free from rattle and movement and be securely retained in its stowed position. The opening should be maximized and be a minimum of 35” x 35”. The stowed divider must not prevent the use of any other of the room's features or obscure the window or skylight.



Deployed
As the divider is deployed it must be done with a smooth and gliding motion, with little or no noise. The deployment of the divider should be easy to use and be able to be operated safely by passengers independently.

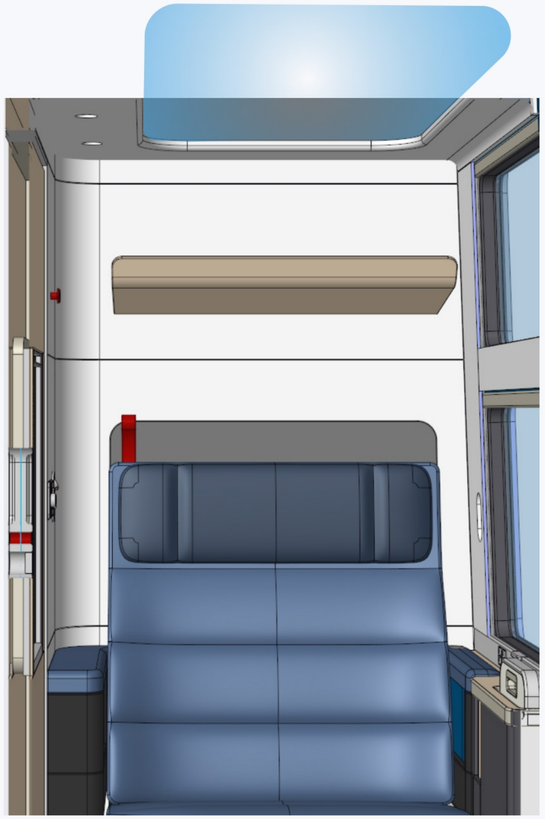


Closed
When divider is in its closed position it must provide good sound insulation to the adjoining room, no less than that of a normal module wall. The divider must be securely locked in place with a visual indicator on both sides of the room to show that it is locked. A solution must be found to prevent one passenger opening the divider without the other's permission, such as a double latch.

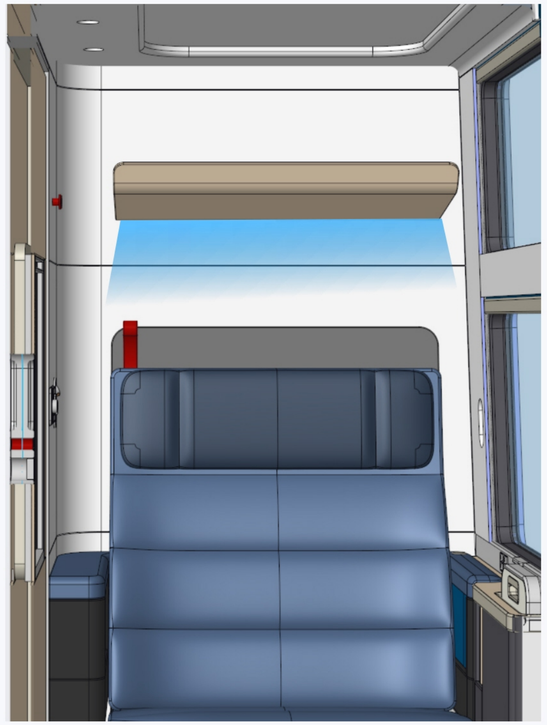
When closed the divider must be free from rattle and movement and be securely locked in place along all edges. There should be no light spill from the adjoining room.

Solo Suite | Lighting

Solo Suite | Lighting



Master Ceiling Light
Central light well acts as master ceiling light.



Rack Wash Lights
Indirect wash light running across the width of the room behind the luggage rack

*See lighting spec for detailed definition

Solo Suite | Lighting



Lower Reading Lights

Reading lights should be provided at the seated location. People should be able to adjust the direction and position the light over their lap and in a suitable way to read a book at night. Switches should be located near or on the light.



Under Ottoman Light

Indirect light provides additional light well inside luggage stowage area.



Foot-box light

Indirect light provides additional light well inside the foot-box.

*See lighting spec for detailed definition

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Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas
Crew Areas

06 | Club Bedroom

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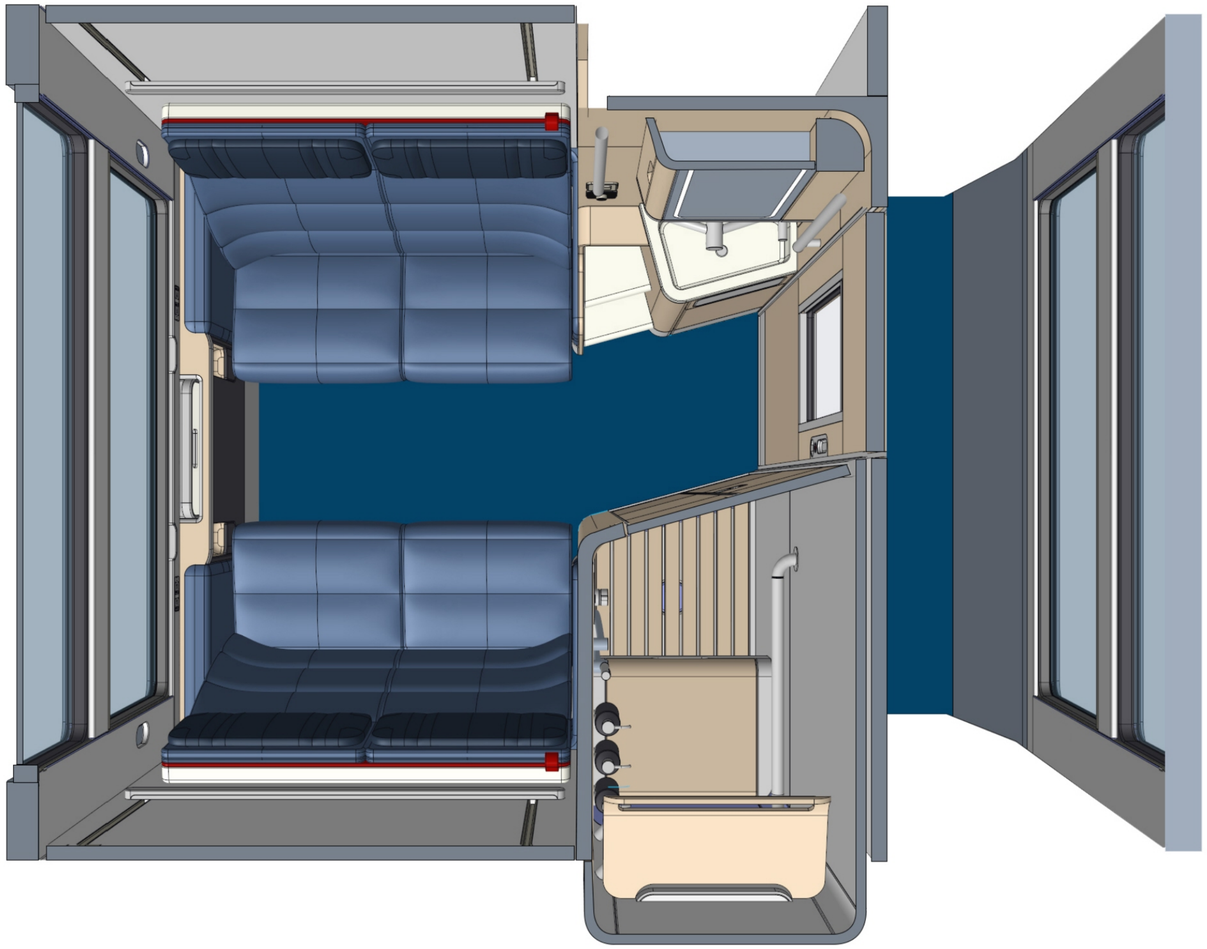
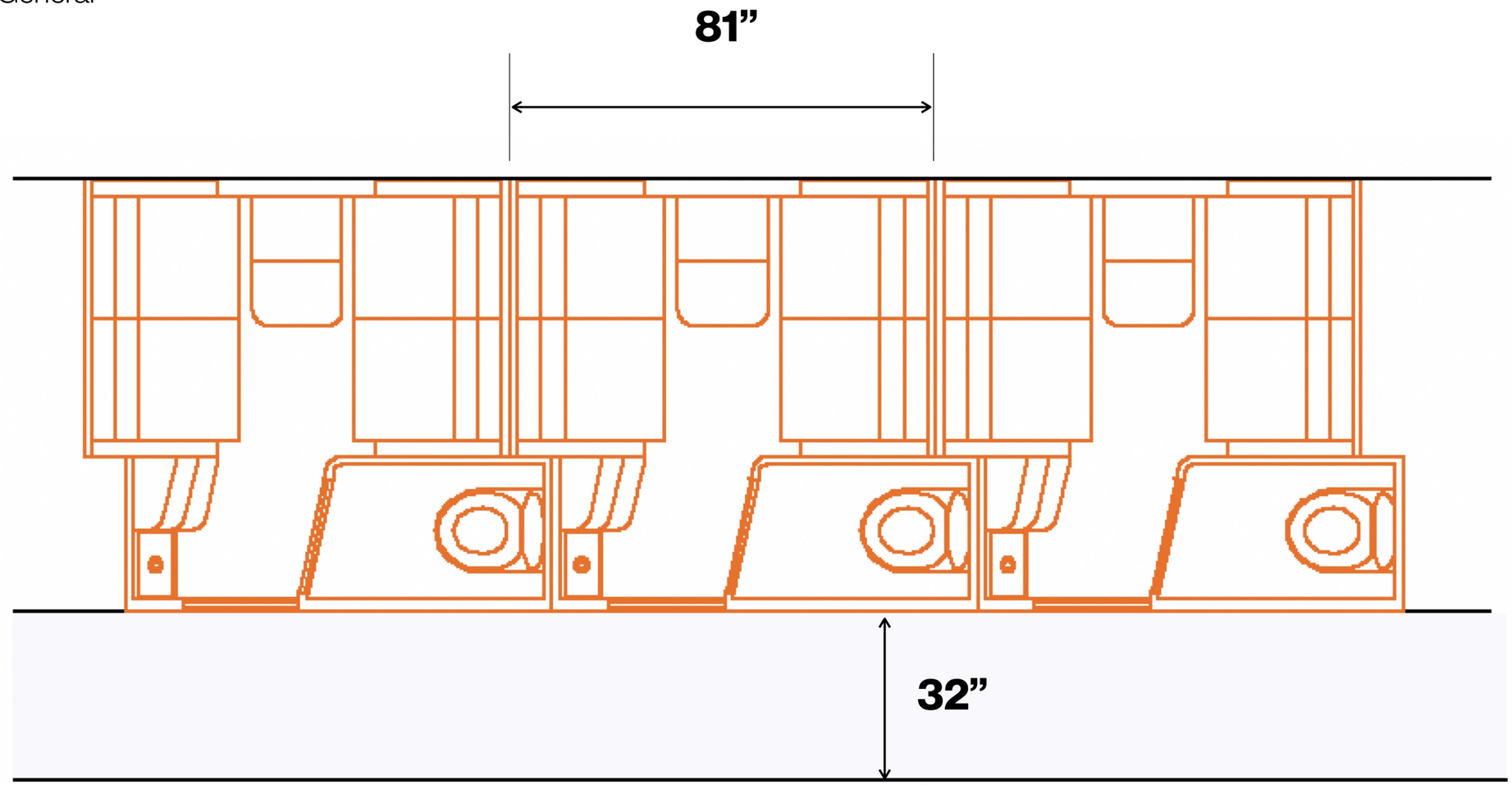
Club Bedroom | General



The Club Bedroom

The Club Bedroom should be designed to be a great bedroom for two but also suitable for four people to sit and sleep together. The room should work alongside a 32” accessible aisle. The room comes equipped with a vanity sink and an ensuite toilet and shower.

Club Bedroom | General



Modules
Modules are 81” in length. Rooms are pitched at 81”. The toilets are offset allowing central access to the bedroom.

Aisle Requirements
Works in combination with a 32” accessible aisle

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Club Bedroom | Features

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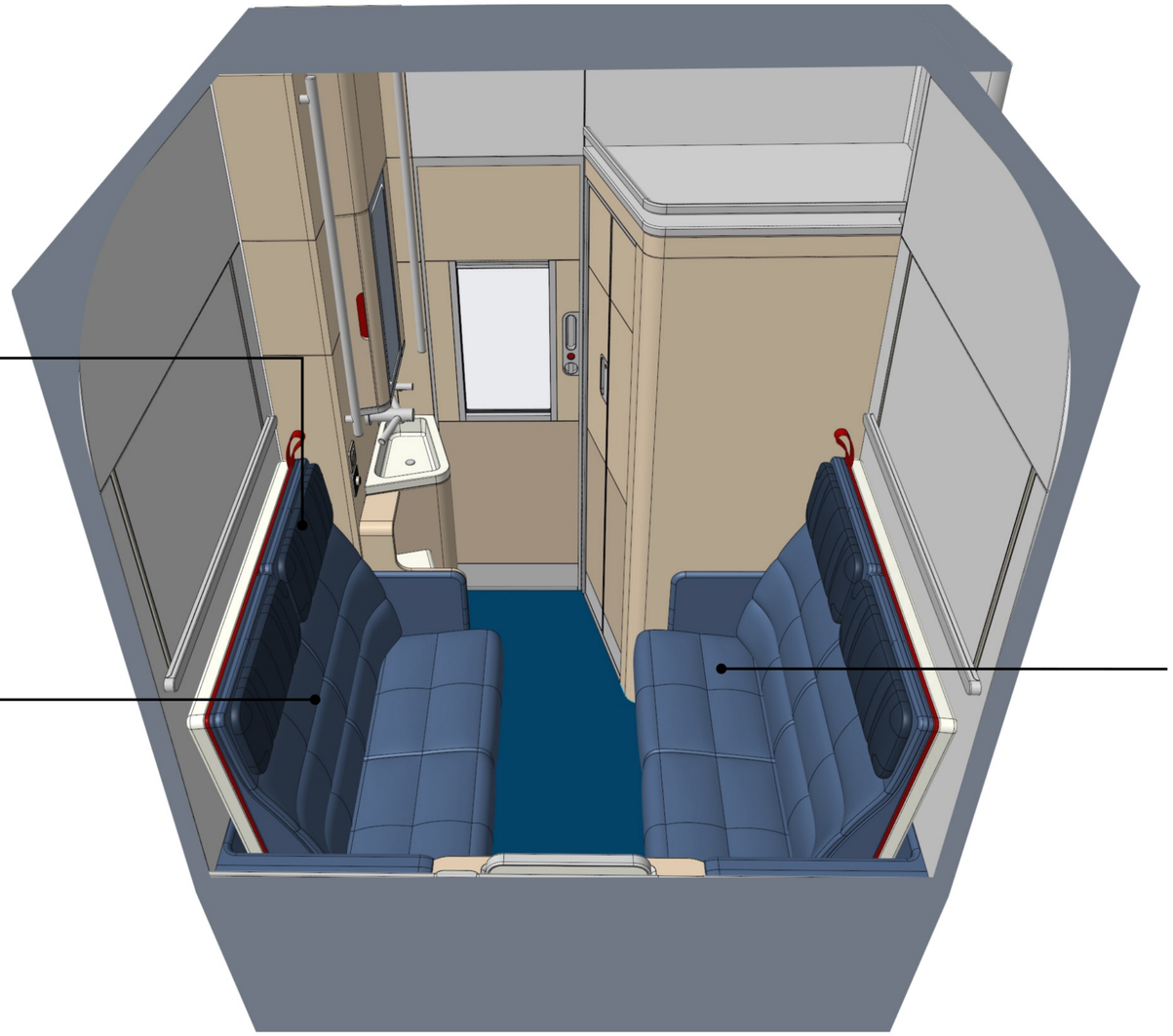
Club Bedroom | Features

Seat Headrests
Seat headrests should be adjustable in height for a range of people sizes. There should be four headrests in total. They should have adjustable wings that fold outwards to adjust the width of the headrest .

Seat Comfort
Seat cushions should be contoured to aid seat comfort.



Seats
The Club Bedroom should have four comfortable seats which should also act as two wide couches so people can spread out.

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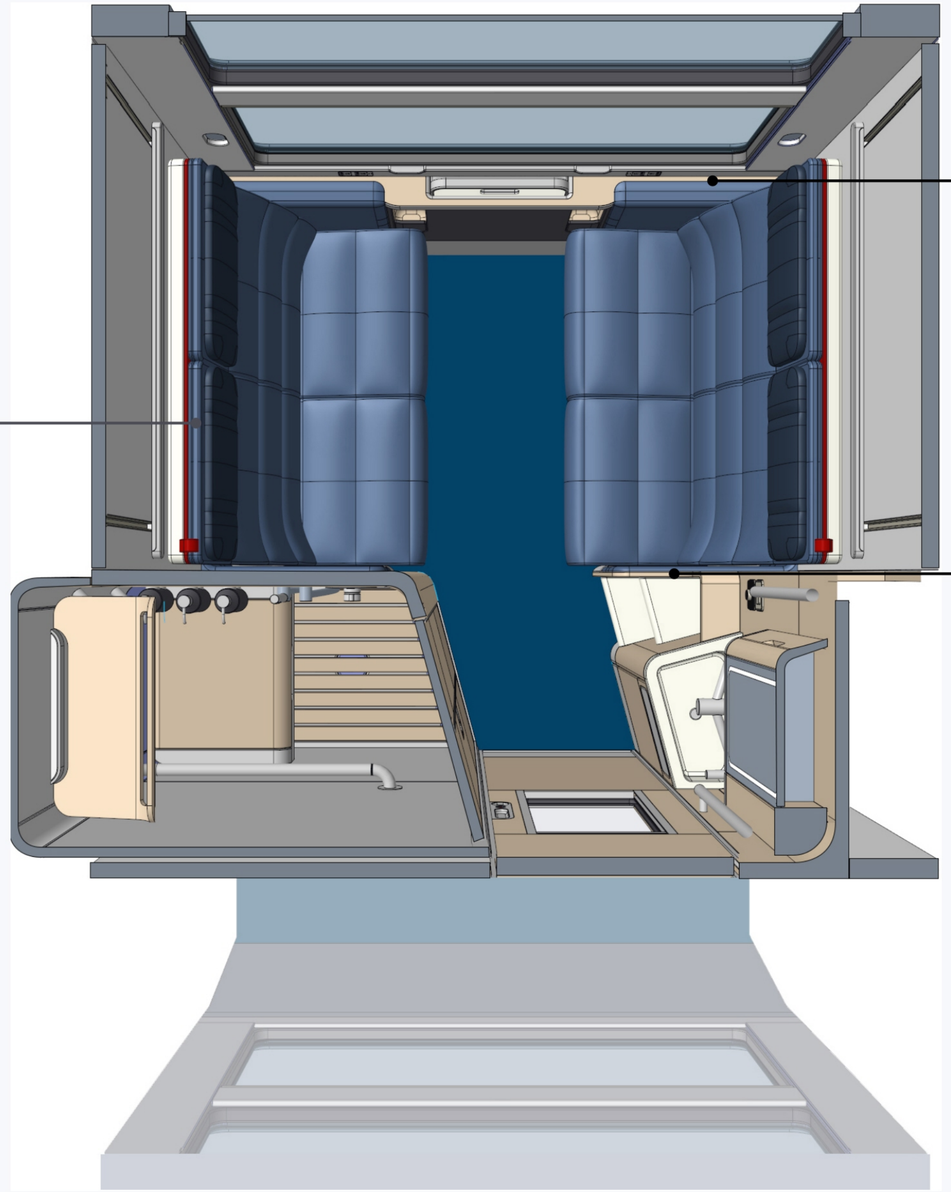
Club Bedroom | Features

Seat Dimensions
A minimum seat width between inside surfaces of armrests should be a minimum of 48”.

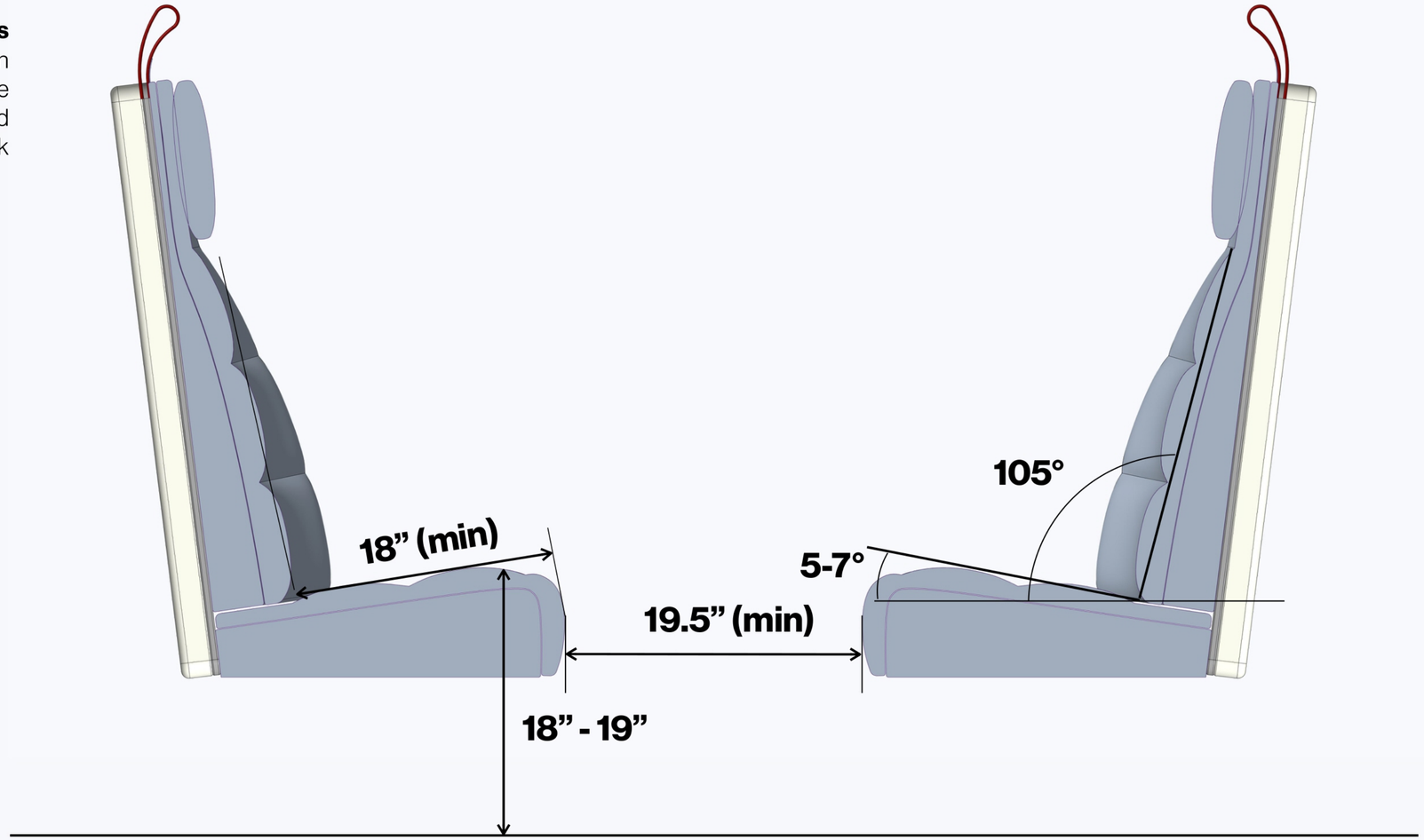


Armrest
A full and cushioned armrest of 3.5” should be provided on the window side.

Seat side pad
A soft seat side pad is required on the inside side of the seat to balance the look of the seat and allow some cushioning to the inside edge of the seat and to soften the joining panel work.

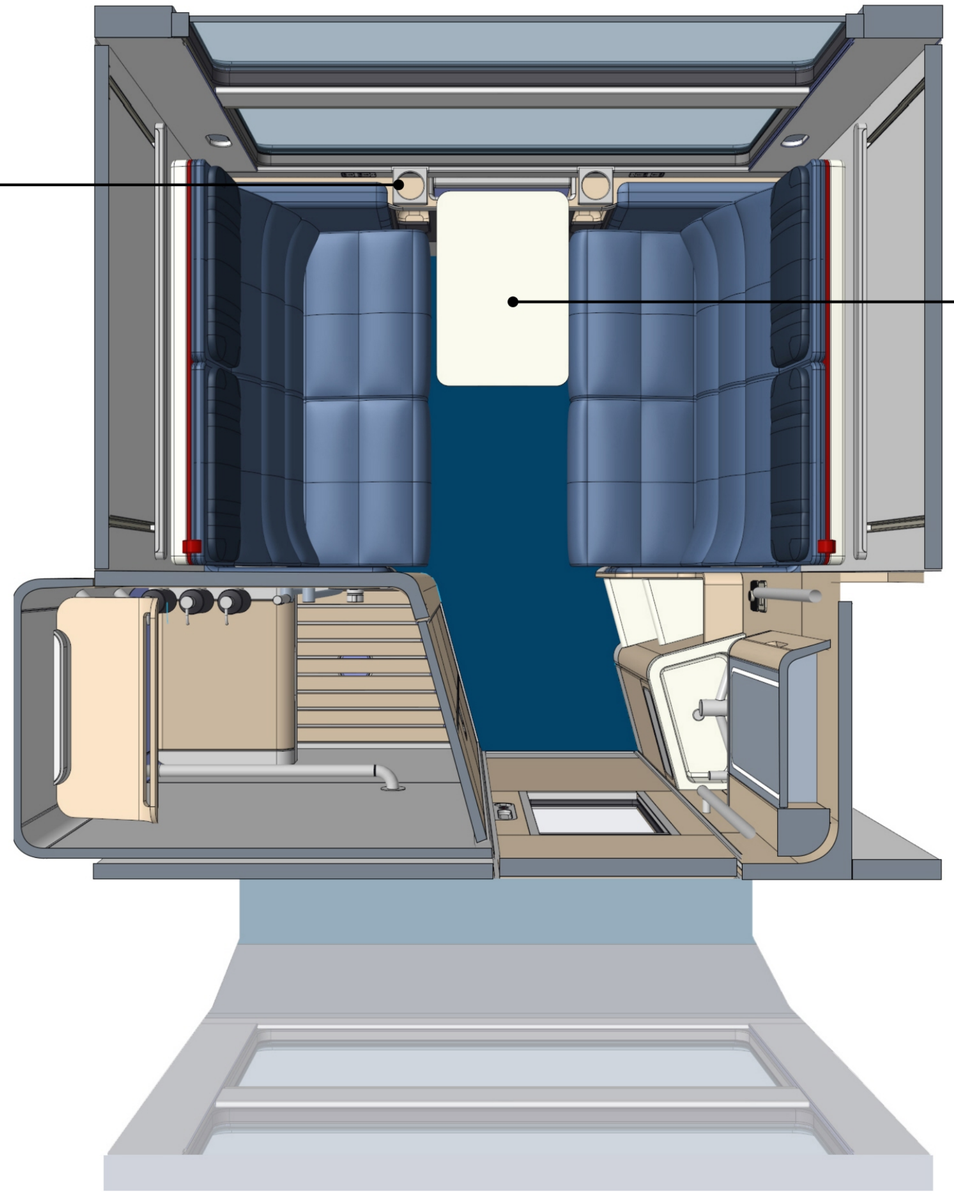
Club Bedroom | Features

Seat Dimensions
All seat dimensions, cushion density/ shore hardness will be subject to mockup review and approval by Amtrak



Club Bedroom | Features

Cup Holders
One for each side for the room located so people can use and access the cupholders from a seated position by the window. They should fold away when not in use.



Fold out Table
A single leaf table deployed from side wall should be supplied. The table height should provide good knee clearance for seated people with a height off the finished floor between 27” and 29”. The table should be easy to deploy and stow with an intuitive handle.

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Club Bedroom | Features



Blinds
A single pull-down blind system shall be provided per window, capable of delivering both daytime solar/glare control and full blackout performance.

Window and Window Mask
Window and window mask should be central to the room and overall window size maximized.

At Seat Power
Two power sockets and Two USB sockets should be provided at each seated location by the window.

Cubbies
Cubbies shall be built into available space for stowage of personal items.

Club Bedroom | Features

Power Outlets
Two power sockets and two USB sockets shall be positioned the by the vanity area.

Master Light Switch
Master light switches to be positioned near door.. A second master switch sets a preset condition in the toilet/shower room. A second bank of master switches should be safely accessible by a person in the top bunk.

Temperature Control

Trash
A trash bin should be provided below the sink. Access to the bin should be provided via a swing door. The bin should be watertight in case of a spill to prevent any water escapement.



RH Side



LH Side

Power Outlets
Two power sockets and two USB positioned by the open wardrobe within easy access of seated passengers.

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Club Bedroom | Features

Automatic Water Faucet
Water is automatically dispensed when hands are placed under the faucet. A physical element should be visible so it is clear where water is dispensed from. Water pressure, water flow should not create any water splash or spill outside of the sink area.

Automatic Hand Drier
An automatically triggered hand dryer should be included under the vanity unit. This can be part of the faucet or supplied separately. A physical element should be visible so it is clear how to use the dryer. The dryer should use high velocity air and HEPA filters similar to a Dyson Airblade. The air dryer should not blow water out of the sink.

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Soap Dispenser
An automatic soap dispenser should be included above the sink area. A physical element should be present to indicate how and where the soap will dispense.

Sink
The sink should have a marine edge so any water spill is captured in the sink area. A splash back behind the sink should protect the surrounding areas from water splashed onto the back wall from the sink area. An area on the side of the sink should be reserved for a refillable hand lotion bottle fixed to the side wall.

Club Bedroom | Features



Door Window and Blind
Door window should be central to door and come equipped with an integrated black out blind.

Door Handle and Lock
Door handles should be positioned to slide door easily open and closed. An accessible manual lock should be included with an indicator to show lock condition.

Door
Door free from rattle, smooth sliding operation.

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Club Bedroom | Storage

Club Bedroom | Storage



RH Side

Vanity Cabinet

Shelved cabinet for toiletries, hand towels and face cloths (4 of each Amtrak's standard towels supplied). Space required for integrated tissue dispenser. Internal light activated as cabinet is opened. Mirror fronted.

Under Seat Stowage

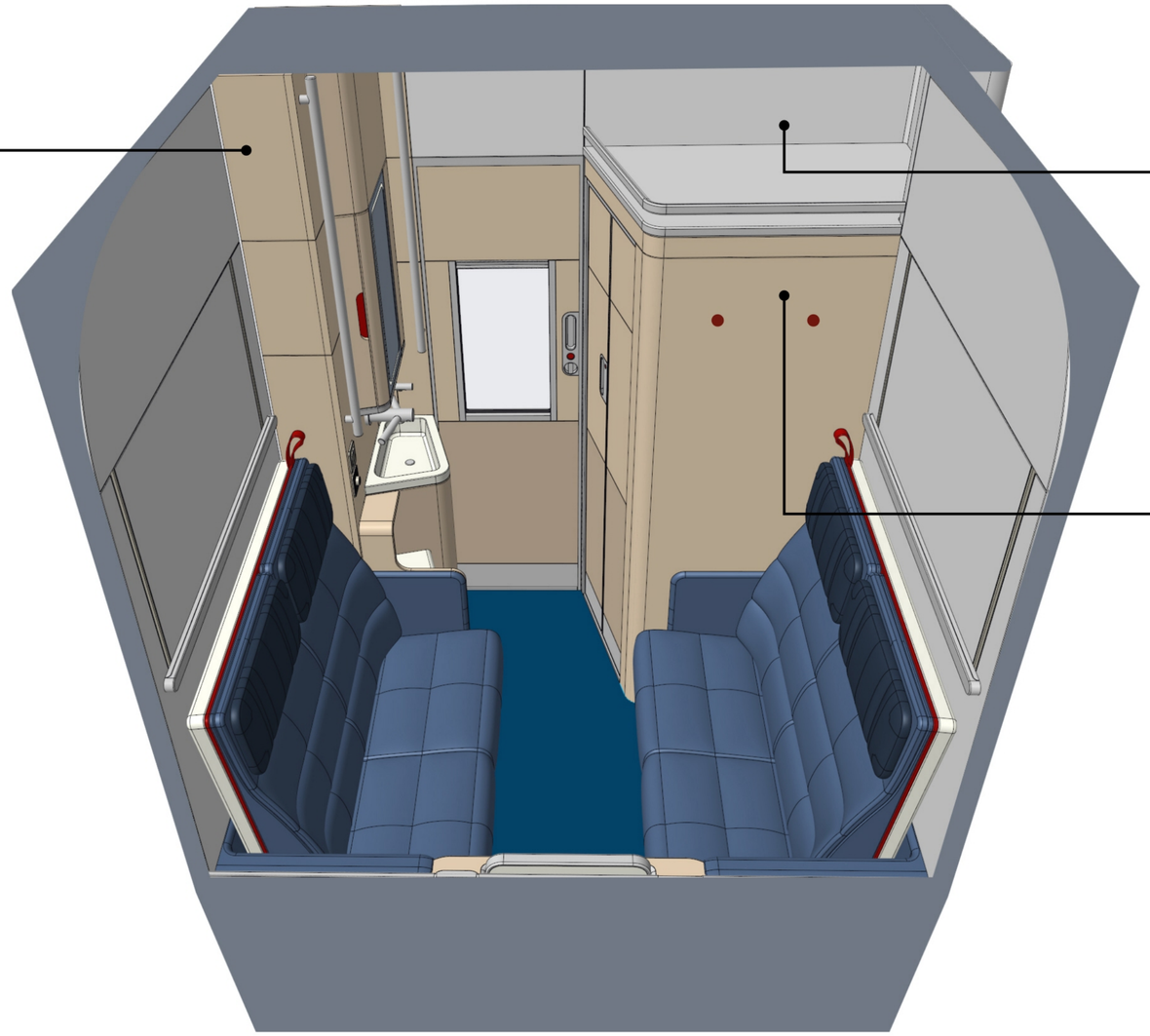
Space under the both seats should remain free for up to four pieces of carry on luggage. No seat mechanism or structure should preclude the ability to store large carry on bags.



LH Side

Club Bedroom | Storage

Upper Cubbies
Cubbies shall be provide storage for personal items where possible at upper bunk level.



Upper Storage
Upper storage shall be provided for carry on cases above the aisle or bathroom.

Open Wardrobe
At least two coat hooks should be provided within an open wardrobe. The space should be large enough to hang clothes on coat hangers.

Club Bedroom | Seat to Bed Conversions

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Club Bedroom | Seat to Bed Conversions

Lower Berth Deployment
A simple unlatch mechanism is required to convert the seats into a lower bed/berth. This should be positioned in a place that is easy for people to use and designed in a way so that people can understand its purpose.



Upper Bunk
Bunk should be stored horizontally in the room. Bunk should not preclude any part of the window when stowed. The bunk's stored height should be optimized in both seated and standing positions.

Upper Bunk Deployment
A simple and easy to use handle, latch and lock mechanism should be within easy reach from a standing position. Successful locking should be visually indicated and safety measures should be put in place to prevent accidental deployment and prevent misuse.

The bunk deployment should be free from jamming and racking and should lower slowly and in a controlled manner. Considerations should be made for assisted movement or counter balances to assist people moving the bunk down and back up into the stowed position.

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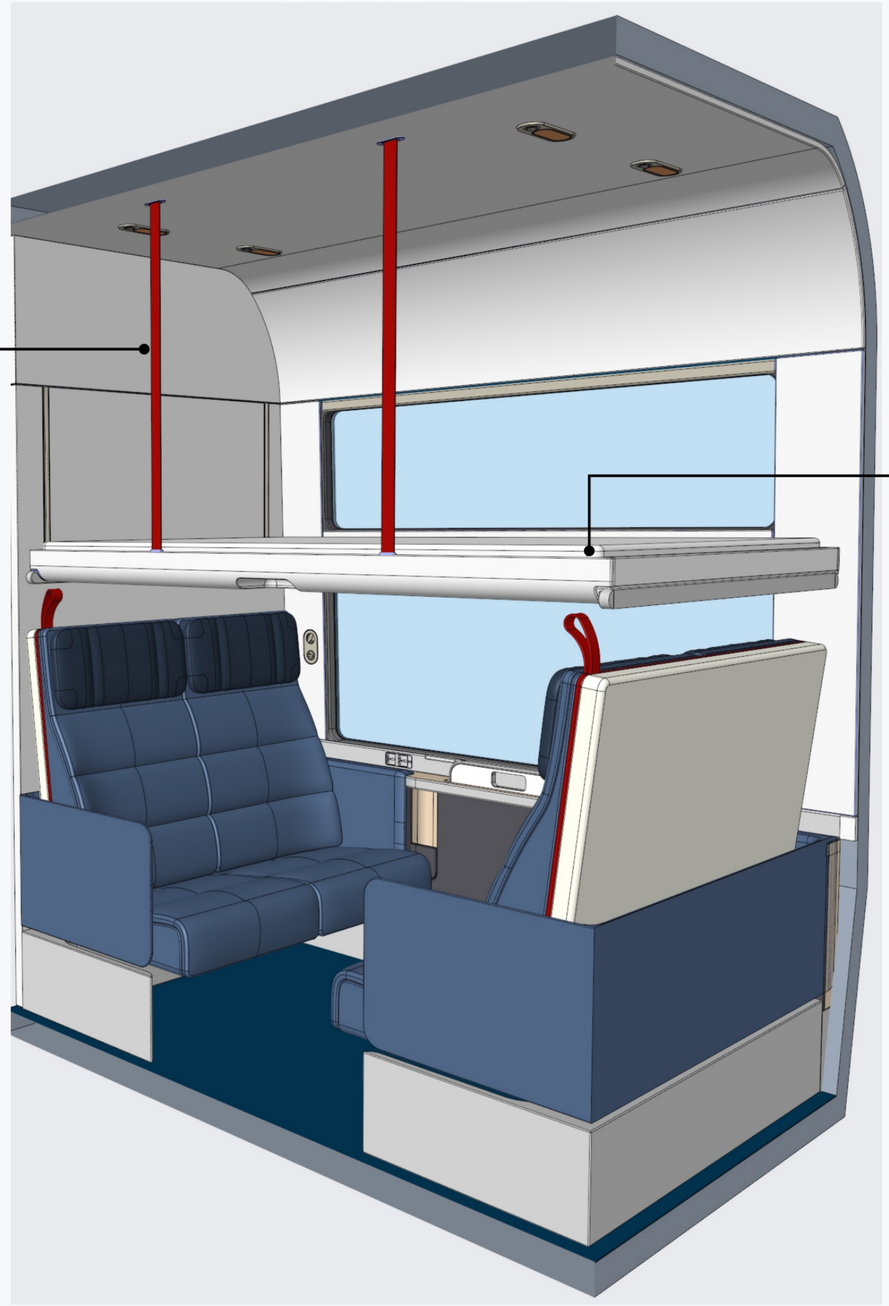
Club Bedroom | Seat to Bed Conversions

Bunk Retaining Straps
Retaining straps are required to prevent people from rolling out of the bunk . These should retract into the ceiling and be easily pulled down and click into place using an automatic locking retractor belt system (similar to a car seat belt system).



Bunk Height
The bunk height when deployed will be evaluated and judged carefully during the design review process .

The seated area below the bunk should still be usable by seated passengers when the upper bunk is deployed, the area should still be well lit and tables and other amenities should not be restricted by a deployed bunk.

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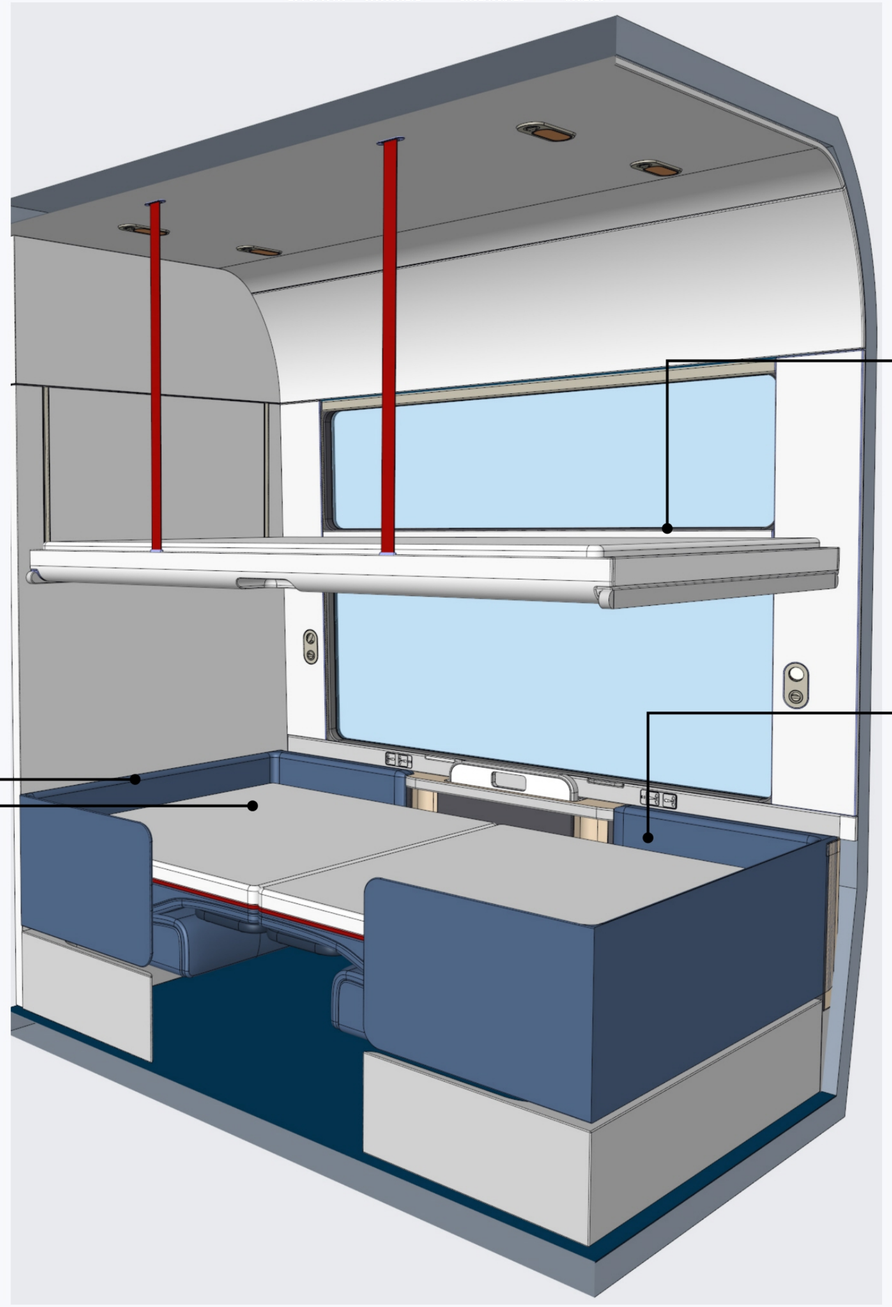
Club Bedroom | Seat to Bed Conversions

Head Board
The armrest and seat side pad should continue and connect to form a thin soft headboard around the back of the seat when the bed for the lower berth is down.

Lower Berth
Conversion of seats to bed should result in an entirely flat bed surface. The mattress surface should be integral to the seat . A single seam between the bed surface is acceptable with a single thin topper to finish the bed surface.



Bunk Dimensions
Should be maximized to the available width with a minimum width 44” x minimum length of 77”.

Lower Berth Dimensions
Should be maximized to the available width with a minimum width 48” x minimum length 77”.

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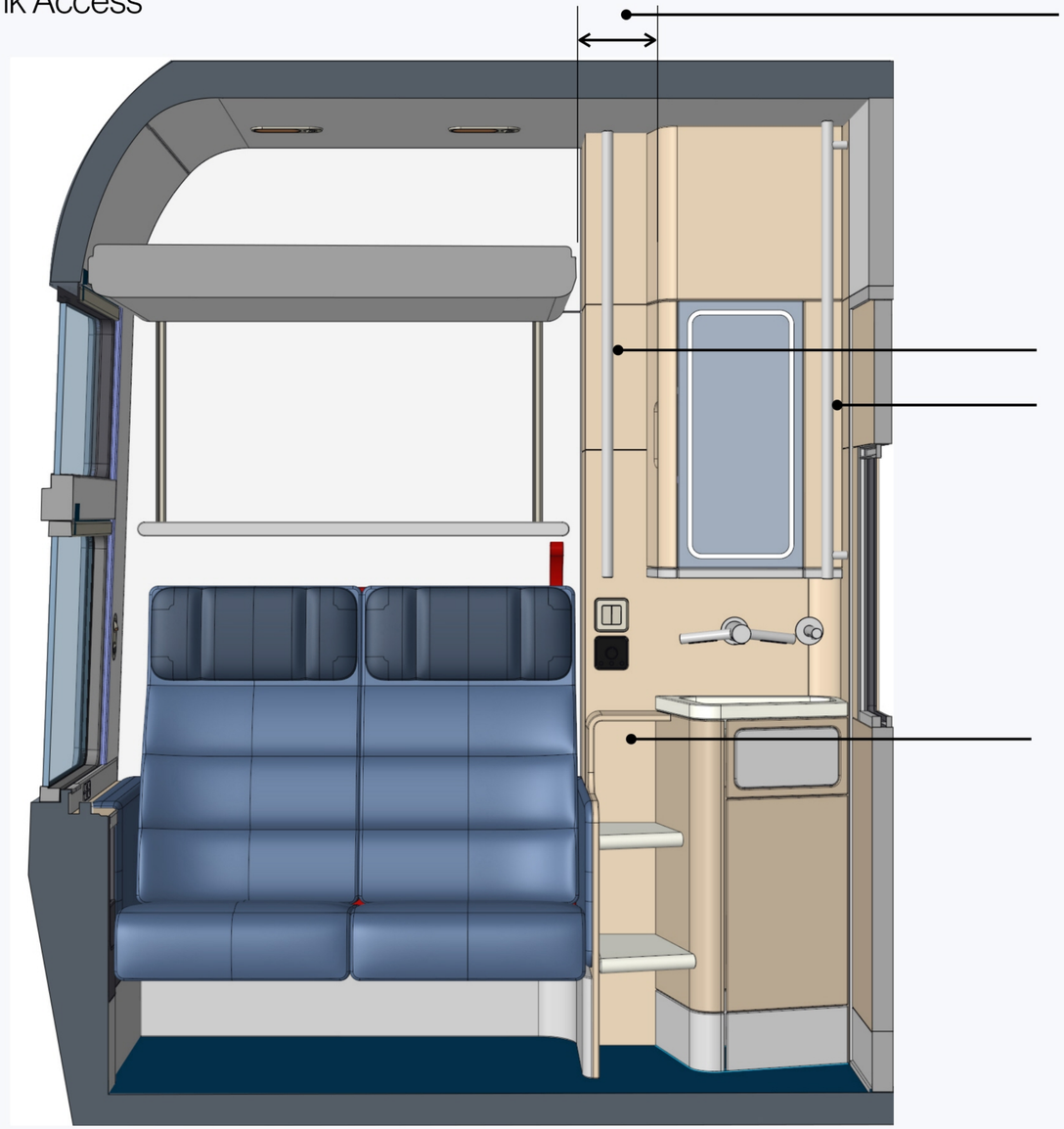
Club Bedroom | Upper Bunk Access



Minimum Clear Way
A free clear channel should be provided. Key dimensions and access to the upper bunk will be subject to mockup testing and Amtrak approval.

Handrails and Grabs
Suitable handholds shall be provided to assist people transitioning to the bunk. These should be positioned on both sides of the bunk. Additional handholds may be required to assist people climbing down safely from the bunk, positioned closer to the door of the room.

Steps
At least three integrated steps should be built into the area beside the seat to allow people to safely transition to and from the upper bunk. Step width should be at least 15” wide. Step surfaces shall be free from trip hazards and have an anti-slip finish to the tread surfaces. Steps shall be designed in such a way that the seat cushions, armrests, any soft furnishings are protected and clear of tread surfaces. Design of the steps should discourage people from using the sink surfaces as steps. Step design and access to upper bunk will be subject to mockup testing and the approval of Amtrak.

Club Bedroom | Lighting

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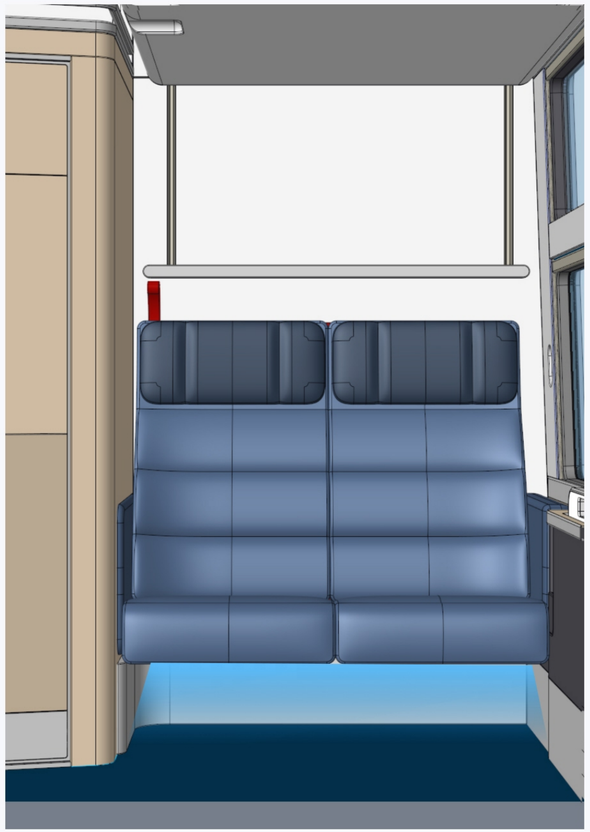
Club Bedroom | Lighting



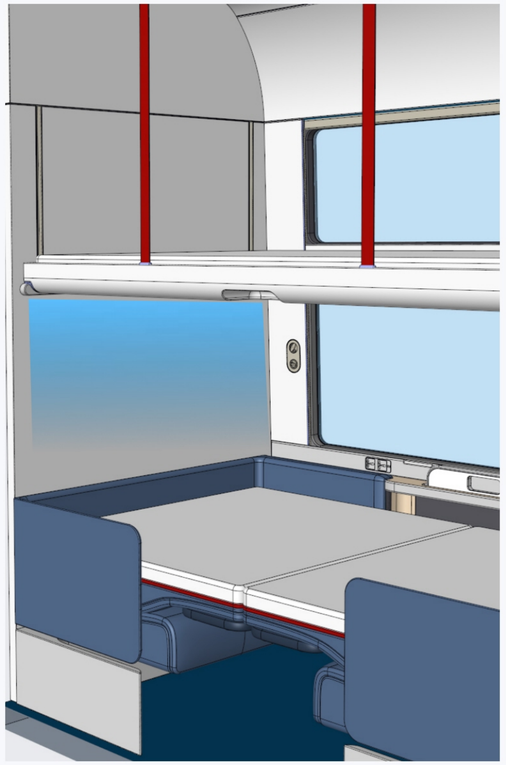
Lobby Lights
Panel lighting provides master ceiling light to the lobby and vanity area.



Under Seat Light
Under seat light should be indirect and spill light out across the floor.

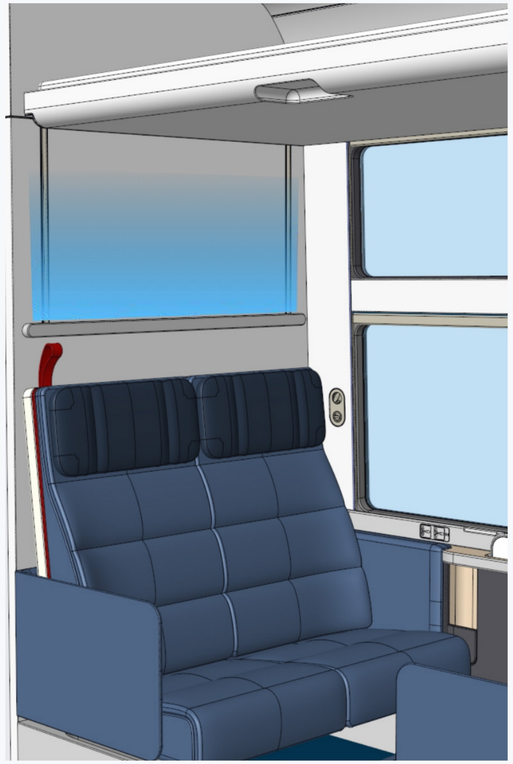
*See lighting spec for detailed definition

Club Bedroom | Lighting



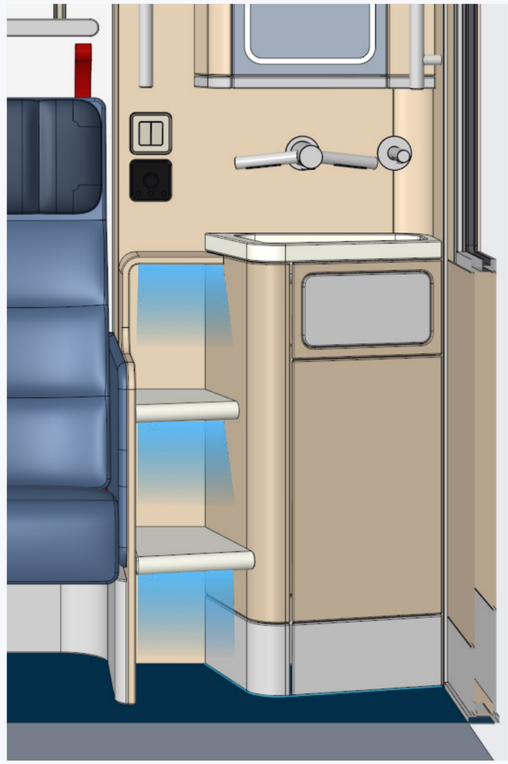
Back Wall Wash Light

Bunk support runner washes indirect light down the end walls on both sides of the room.



Back Wall Wash Light

Bunk support runner washes indirect light up across the end walls on both sides of the room.



Step Lights

Indirect light provides wash light over each of the steps.

*See lighting spec for detailed definition

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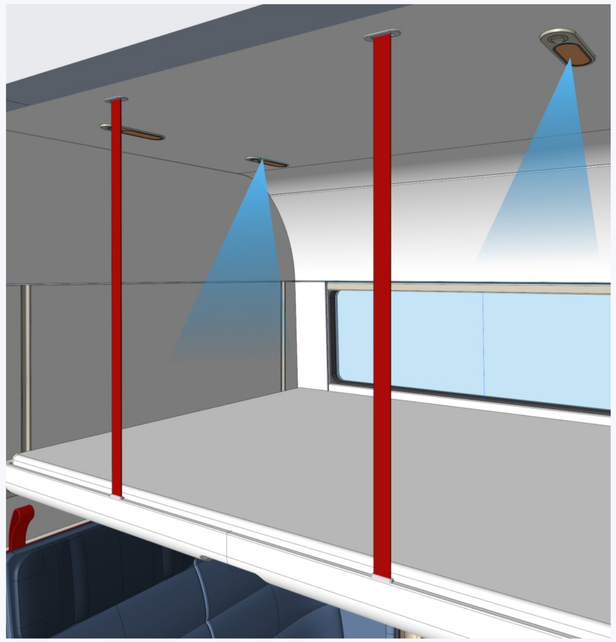
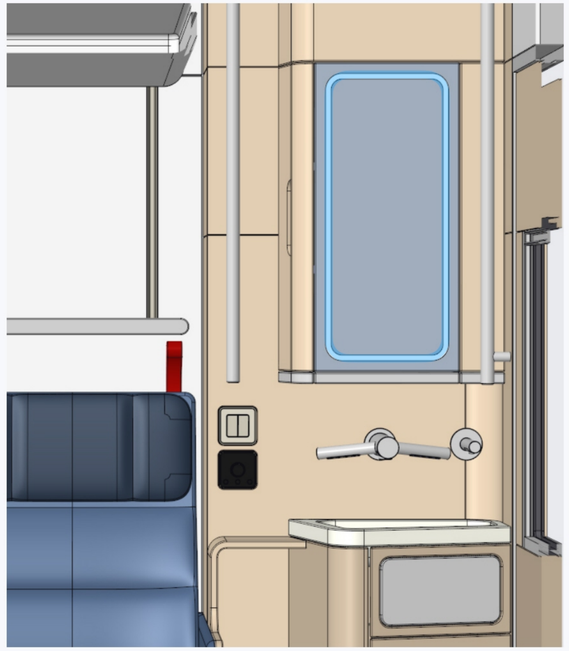
Club Bedroom | Lighting



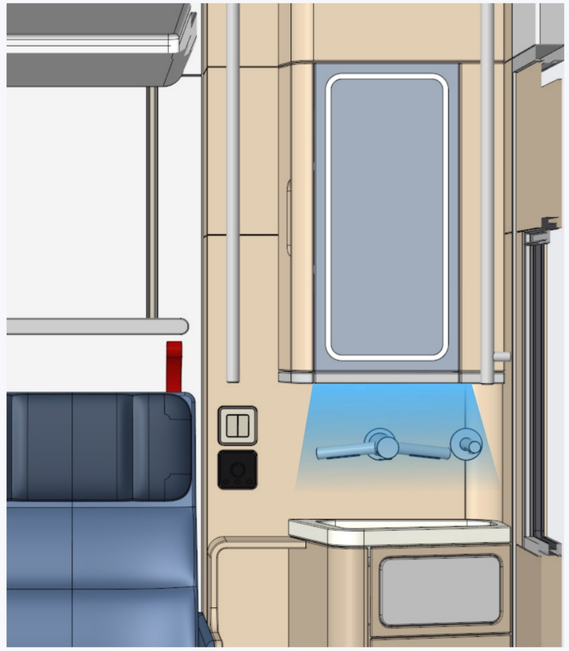
Upper Reading Lights
Reading lights should be provided, embedded in the ceiling above the bunk. These should be mini panel lights. 2 lights in total located at each end of the bed. Light switches should be located next to the reading light.



Lower Reading Lights
Reading lights should be provided at each seated location. People should be able to adjust the direction, position the light over their lap to be able to read a book at night. Switches should be located near or on the light.



Mirror Light
The vanity mirror is illuminated with a back light or similar.



Vanity Light
The vanity surface is illuminated with an indirect lighting.

*See lighting spec for detailed definition

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Club Bedroom | Toilet & Shower

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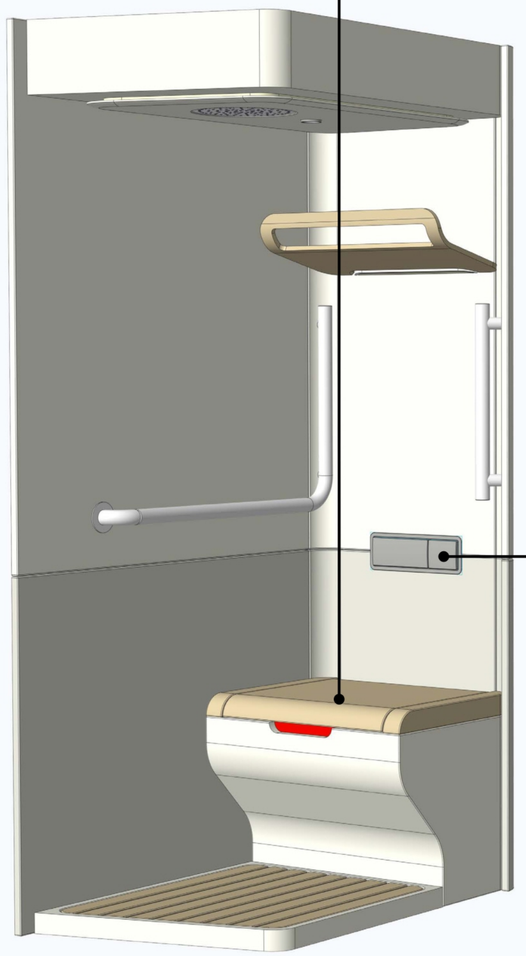
Club Bedroom | Bathroom Features



LH Side

Toilet

The toilet is covered by a lid that covers the toilet seat and also acts as a shower seat.

While the bathroom is being used as a shower the lid should disguise the toilet seat forming a bench across the width of the room. The form of the toilet is undercut at the bottom to maximize standing space in the shower area. The design of the toilet, access and lid design will be subject to testing and ergonomic review during mockup stages and subject to the approval of Amtrak.

A separate more standard toilet seat and toilet lid may be required with the shower seat acting as an additional layer with the sole purpose of hiding the toilet and providing a shower seat.

Toilet seat, seat lid and shower seat should all have soft close mechanisms.

Toilet Flush

A two button push flush is located on the back wall providing standard and eco flush.

Toilet Paper Storage

The toilet paper should be stored in the wall of the bathroom with a waterproof cover to protect it from getting wet with shower water.



RH Side

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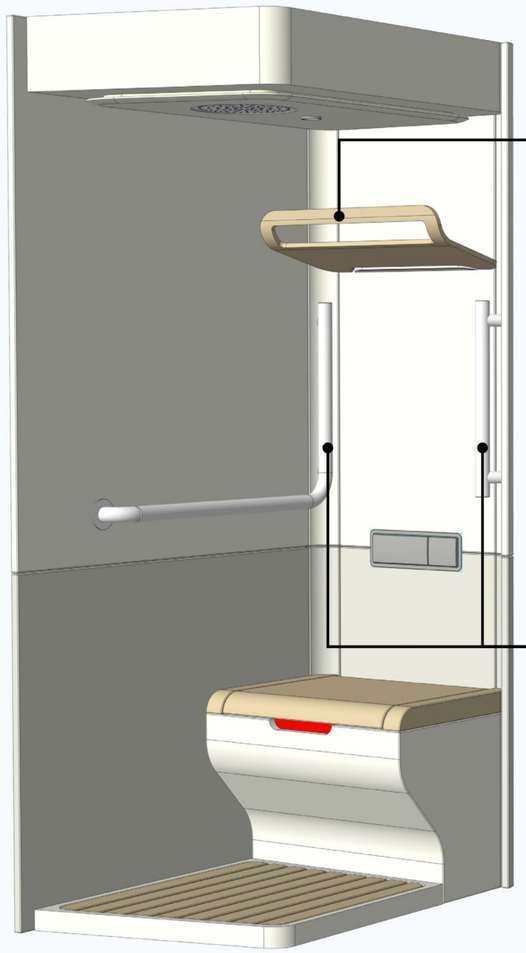
Club Bedroom | Bathroom Features



LH Side

Towel Storage

A shelf on the back wall of the bathroom of a suitable size to store a minimum of 4 Amtrak bath towels. The shelf and towels are to be placed high and out of the direction of any shower water when the shower is in use.

Dispensing Bottles

3 refillable Amtrak bottles dispensing shampoo, conditioner and body lotion. Bottles should be fixed to the wall and easily refilled or replaced by Amtrak staff.

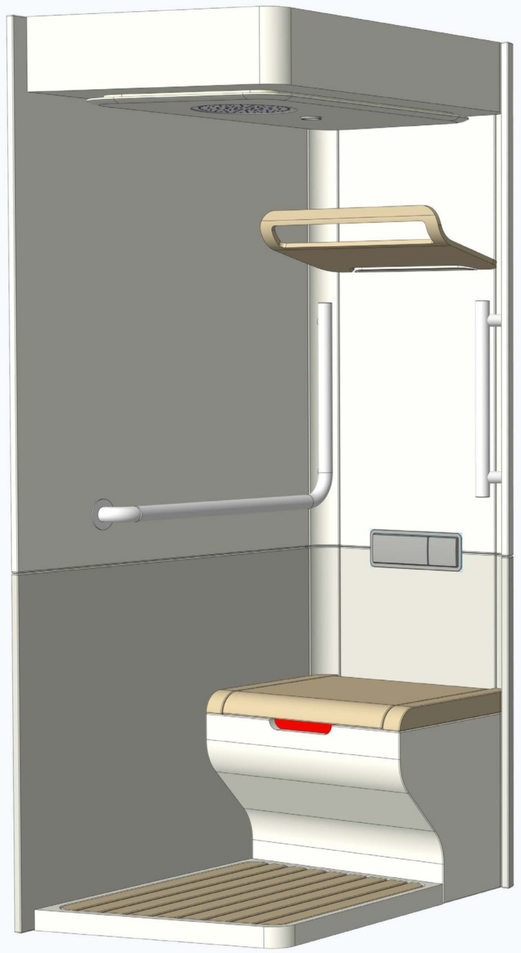
Grab Handles

Suitable grab rails should be positioned to aid people while standing in the bathroom for both showering and for use of the toilet. Locations and sizes will be subject to mockup testing and Amtrak approval.



RH Side

Club Bedroom | Bathroom Features



LH Side

Rain Shower

A rain shower in the ceiling provides a shower above head height. Rain shower should be seamlessly integrated into the ceiling in order to maximize head room in the bathroom.

Hand Shower

A second hand shower is located with a slimline design handset. A hose clip should be included to prevent the hose from rattling while the train is in transit.

Shower Control

Shower controls are located on the bathroom wall close to the door. The shower control should prevent any accidental activation when using the toilet.

Drainage

The toilet floor has a built in shower tray with a raised lip. A slatted platform finishes flush with the top of the tray to allow the shower water to drain out underneath and prevent the floor remaining wet after use as a shower. The shower tray should be designed to prevent water from escaping into the main area of the room.



RH Side

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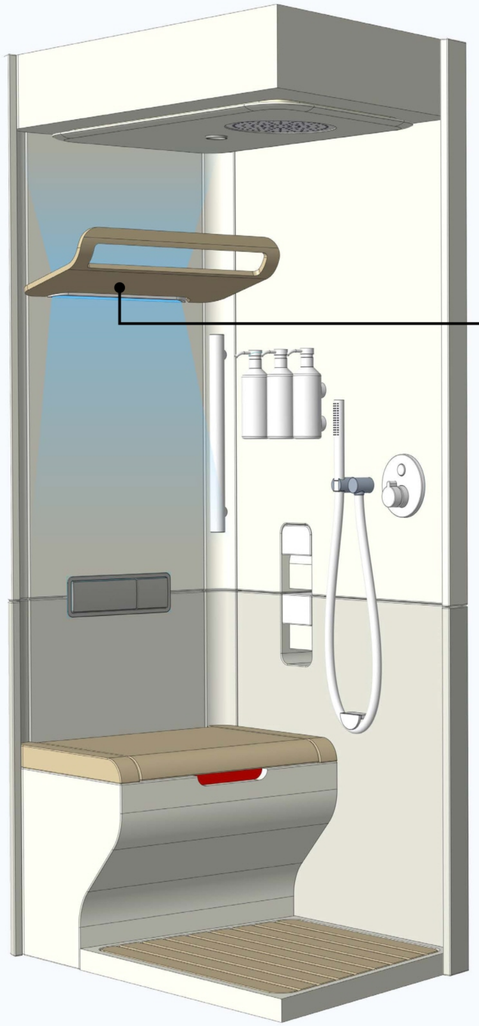
Club Bedroom | Bathroom Lighting



LH Side

Back Wall Wash Light

Shelf runner washes indirect light upwards and underneath the towel shelf.

LED light panel spot

Small circular LED light panels act as spot lights - frame to be color matched.



RH Side

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Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas

07 | Accessible Bedroom

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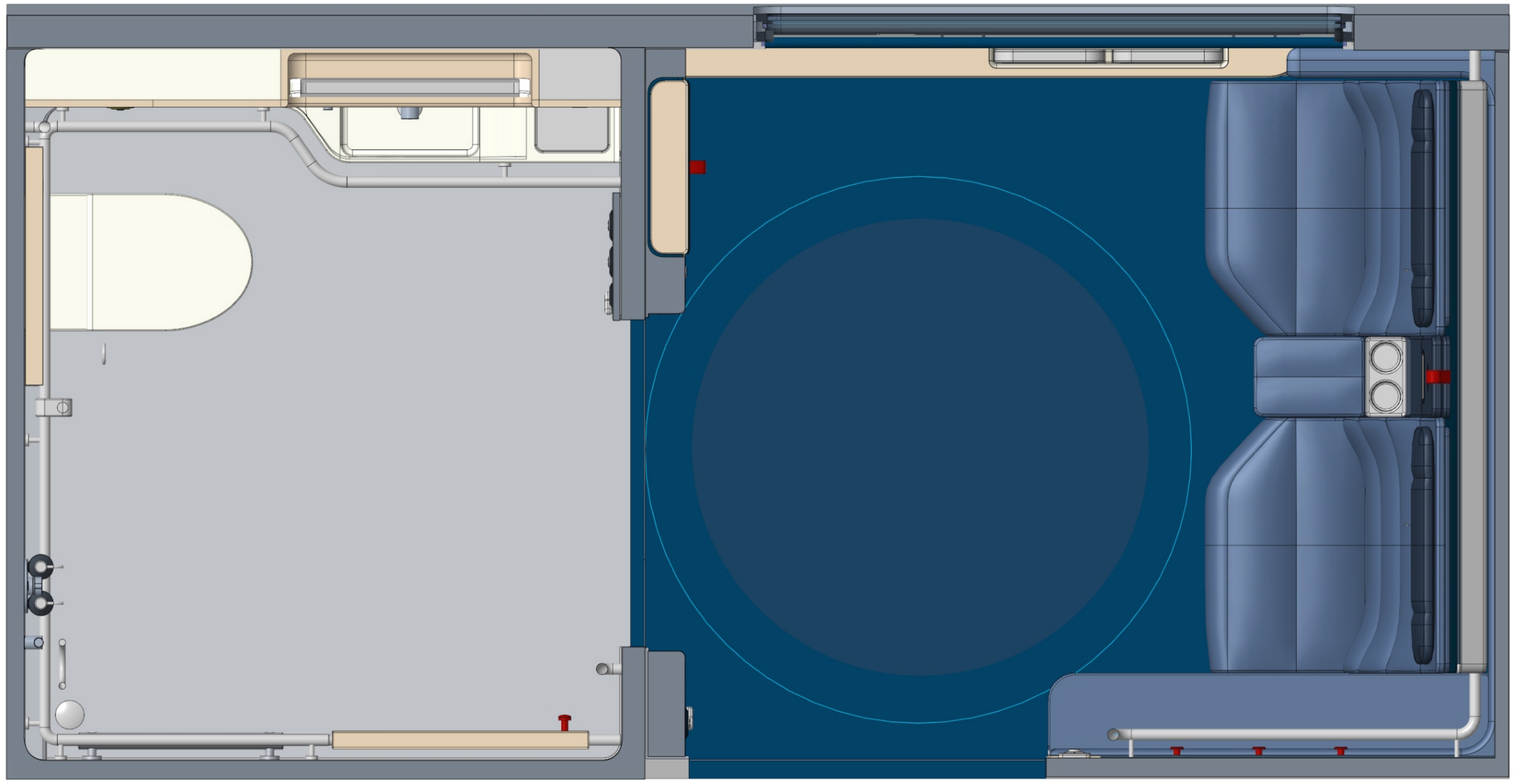

Accessible Bedroom

The Accessible Bedroom is a fully accessible room for three. The room has a double lower berth and a single upper bunk.

The accessible space is based on the RVACC recommendations to accommodate larger mobility devices. The ability to turn around in the room is facilitated by a clear 60” turning circle.

The room has an ensuite bathroom that is also fully accessible with a lockable door separating it from the living space.

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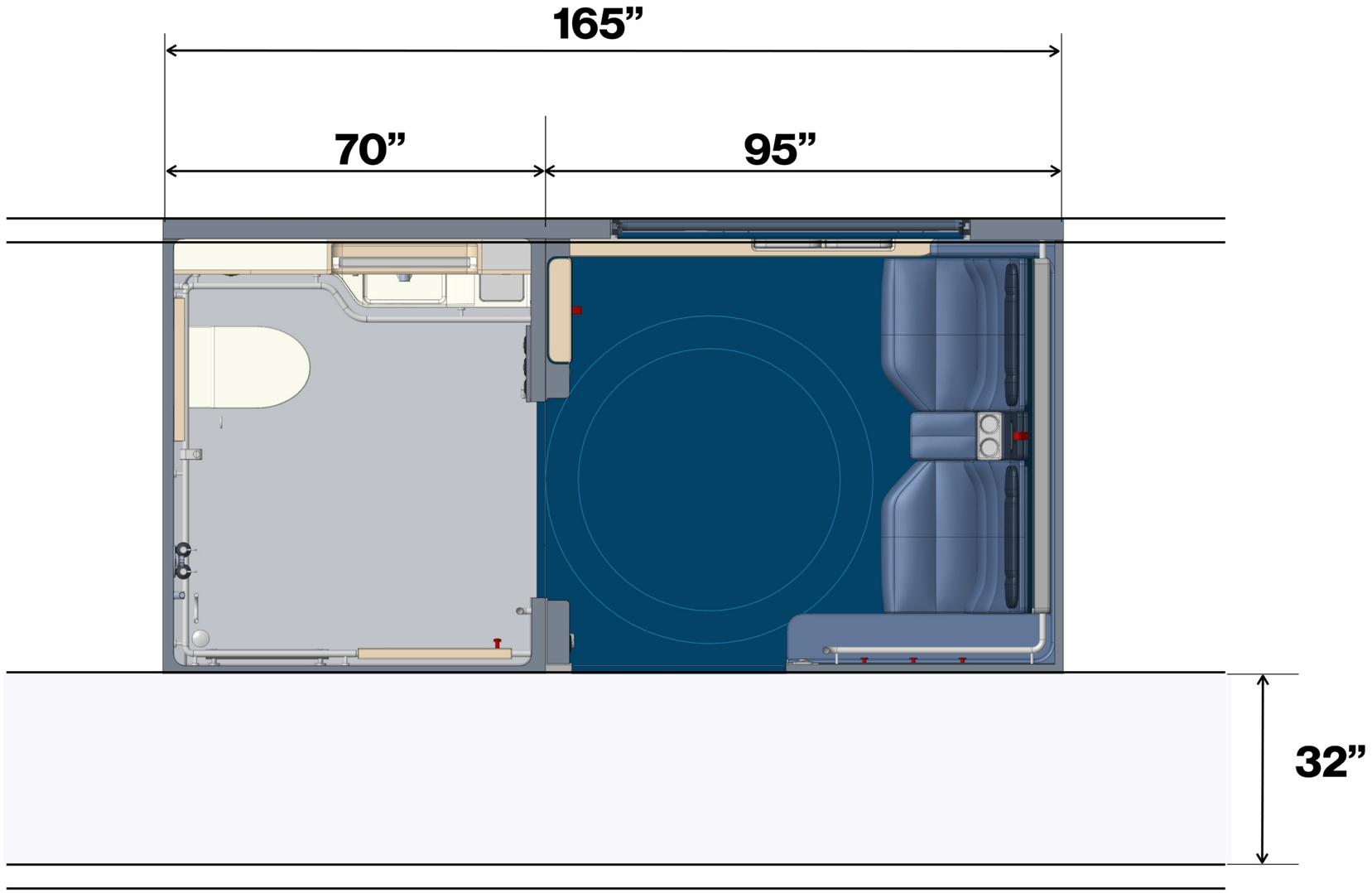
Accessible Bedroom | General



Accessible Bedroom

The Accessible Bedroom should be a maximum of 165” long and designed for a 32” side aisle.

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Accessible Bedroom | Accessibility

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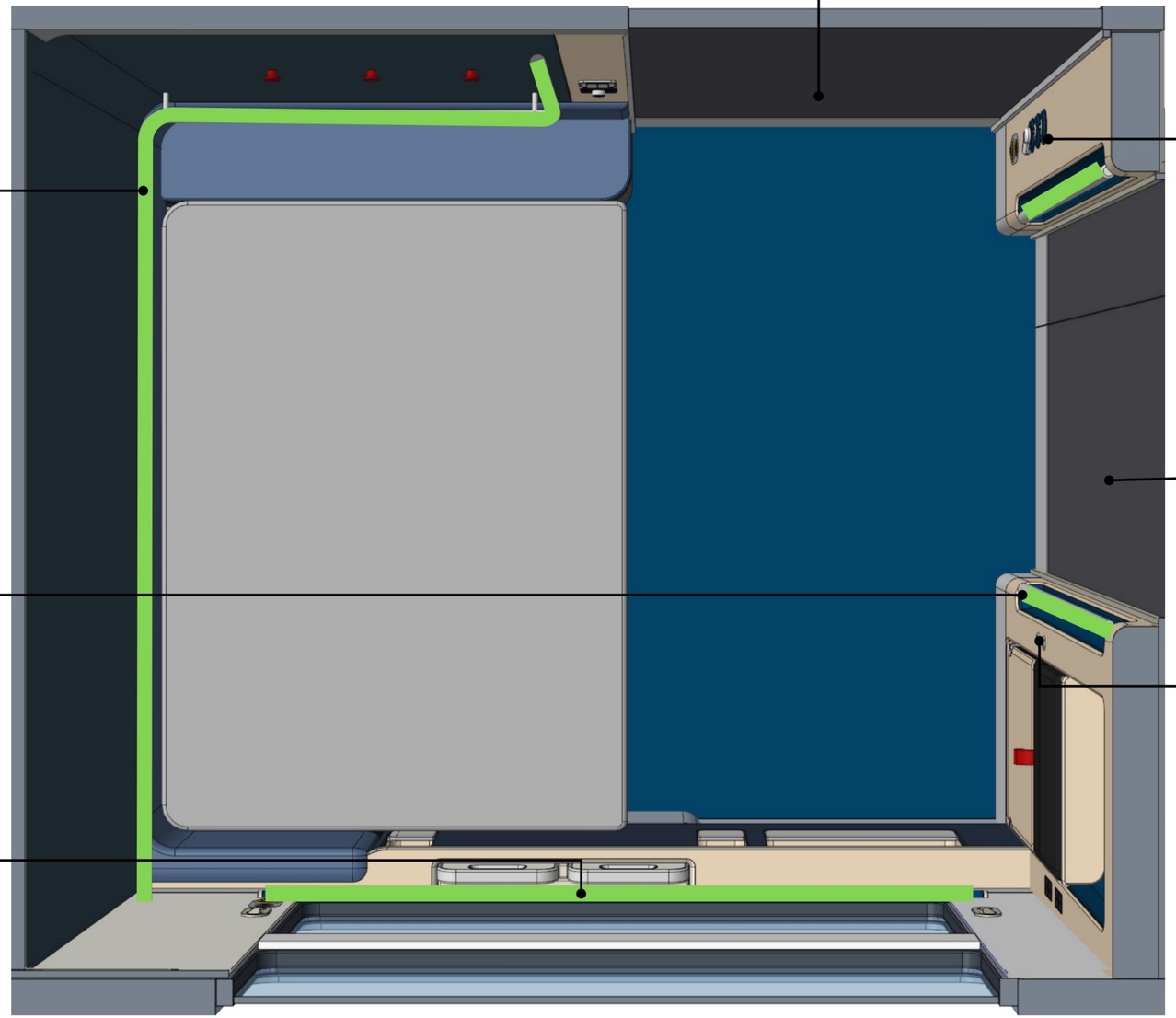
Accessible Bedroom | Accessibility



39” Room Door
Access to the room will be subject to review and mockup user testing. Room doors should be an automatic sliding door.

Room Door controls
The controls for the room door must be ADA compliant in position, size and configuration. The buttons should be easy and intuitive to use. An accessible manual lock should be included with an indicator to show lock condition. The buttons should have visual and haptic feedback.

36” Bathroom Door
The Bathroom door should be an automatic sliding door. The door should be positioned to create space for a T maneuver when the door is open and the bed is deployed.

Bathroom Door Controls
The controls for the bathroom door must be ADA compliant in position, size and configuration. The buttons should be easy and intuitive to use. The buttons should have visual and haptic feedback. The controls should be positioned away from the main room controls to prevent confusion. Dimensions, position and usability will be subject to Amtrak approval.

Horizontal Handrail
ADA compliant horizontal handrails positioned adjacent to the aisle side seat to assist transfer into the seat and bed. The handrail should be positioned to maximize the space between the bed and the bottom of the handrail.

Vertical Handrail
ADA compliant vertical handrails positioned either side of the bathroom door to aid transit around the room and into the bathroom.

Horizontal Handrail
ADA compliant horizontal handrails positioned adjacent to the window side seat and accessible space. The handrail should be a minimum compliant distance (33”) above the finished floor to reduce impact on the window views. The handrail should not impede the use of the table and cupholders positioned on the sidewall.

***The position of all Accessible interaction points, turning spaces and clearances will be subject to review, mockups, and user testing**

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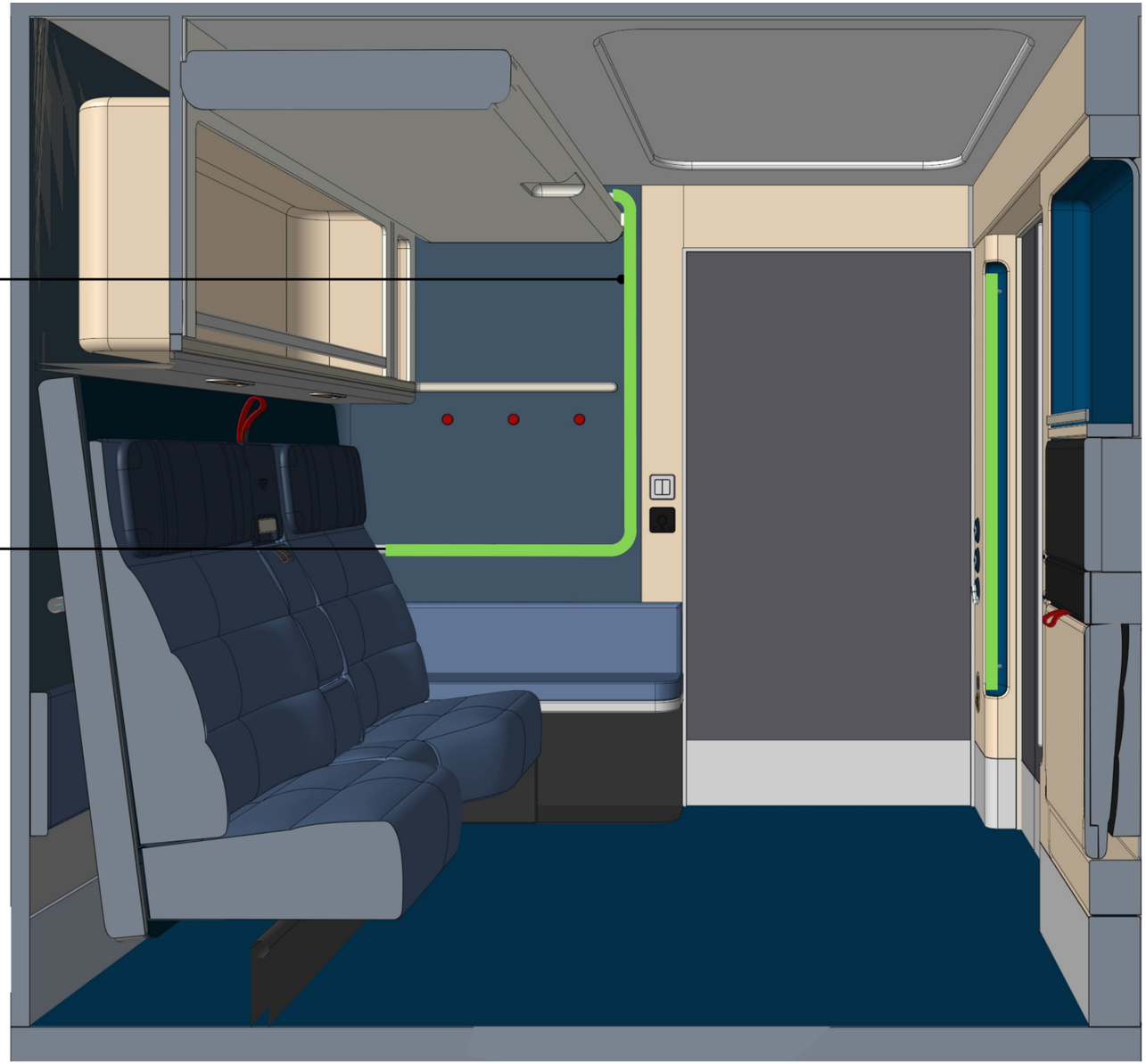
Accessible Bedroom | Accessibility

Vertical Handrail
ADA compliant vertical handrails positioned on should aid bunk access.

Horizontal Handrail
ADA compliant horizontal handrails should be usable at the threshold of the room and assist people who wish to transfer from a wheelchair.



***The position of all Accessible interaction points, turning spaces and clearances will be subject to review, mockups, and user testing**

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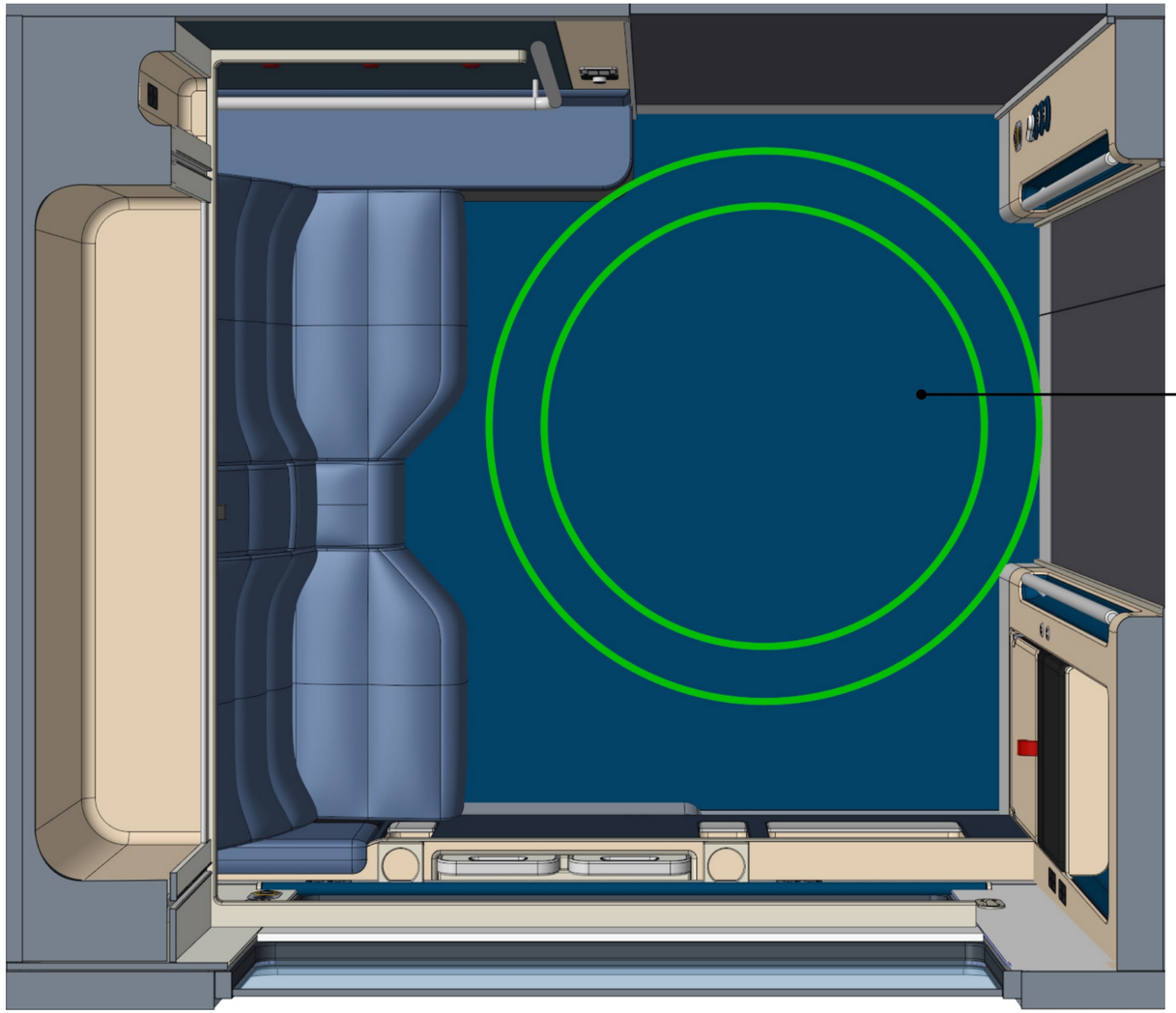
Accessible Bedroom | Accessibility



60” Turning Circle
A clear 60" turning circle should be provided inside the room when the seats are in an upright position.

***The position of all Accessible interaction points, turning spaces and clearances will be subject to review, mockups, and user testing**

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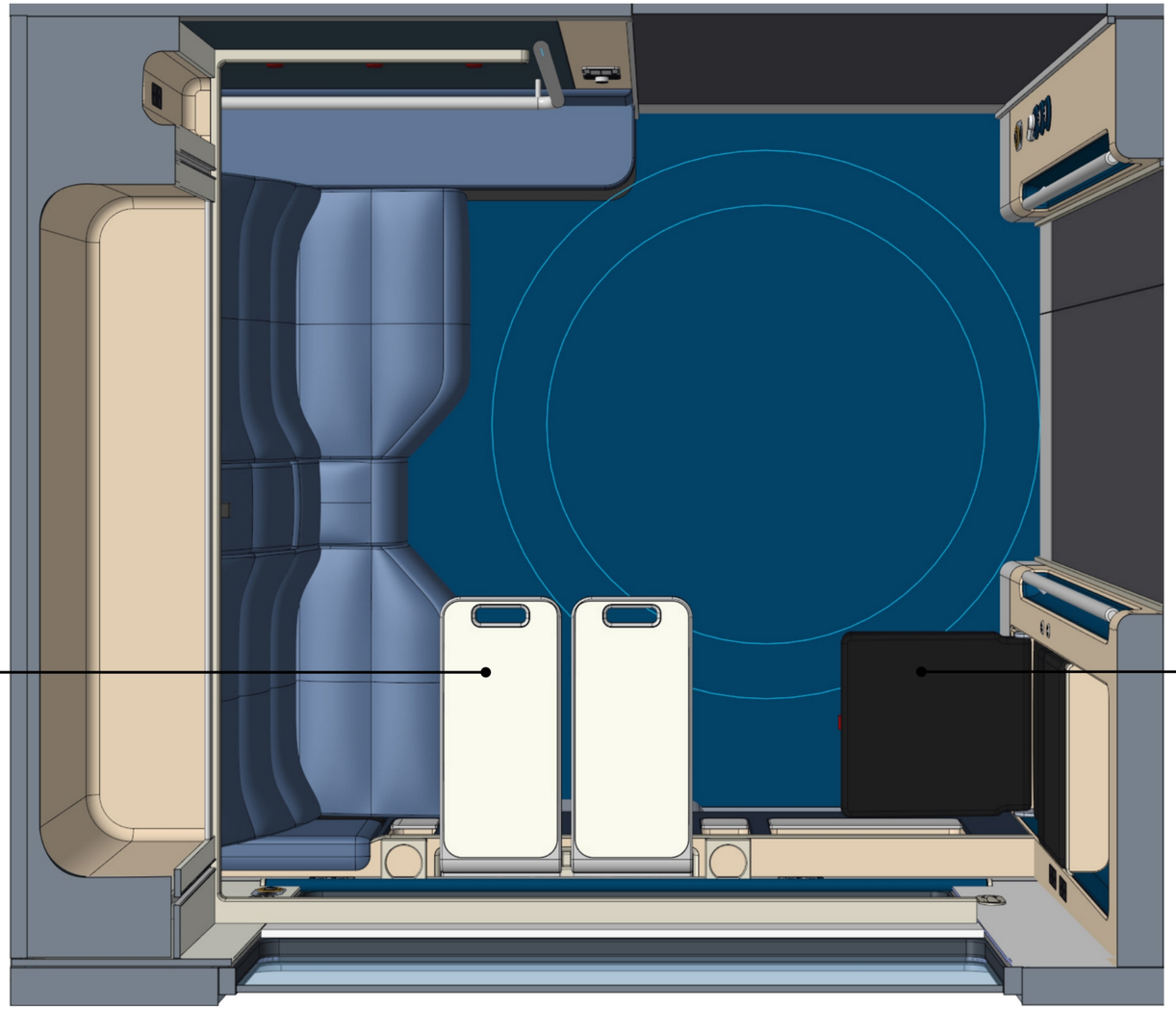
Accessible Bedroom | Accessibility

Fold Out Table Clearance
The 60” turning circle should be clear when fold out table is deployed.



Tip-up Seat Clearance
The 60” turning circle should be clear when the tip-up seat is deployed.

***The position of all Accessible interaction points, turning spaces and clearances will be subject to review, mockups, and user testing**

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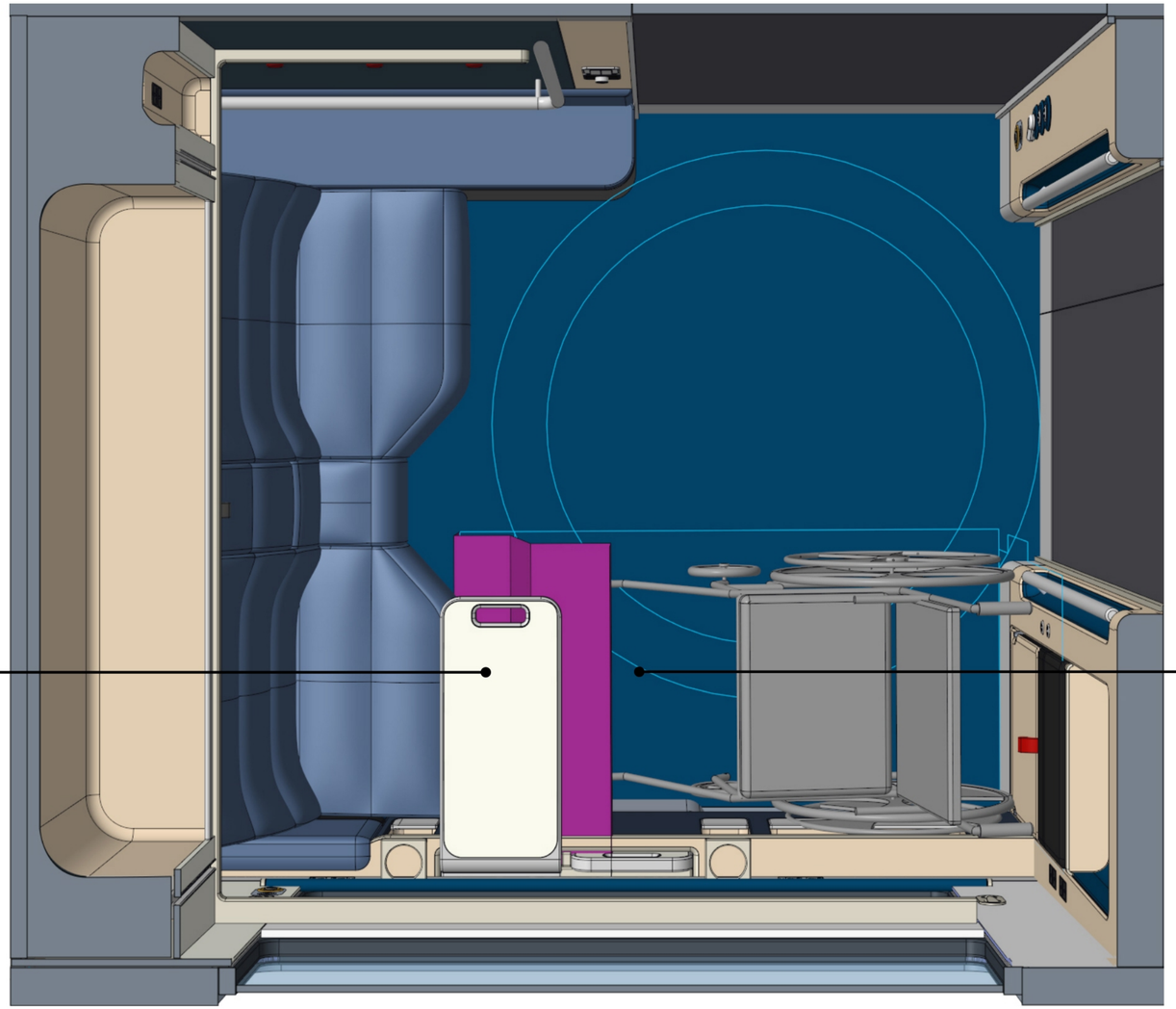
Accessible Bedroom | Accessibility

Fold Out Table
Fold out table should be positioned so when deployed it is clear of an RVAAC accessible space and an ADA accessible space.



RVAAC Accessible Space
A clear accessible space of 59” x 32” should be provided inside the room when the seats are in an upright position.

***The position of all Accessible interaction points, turning spaces and clearances will be subject to review, mockups, and user testing**

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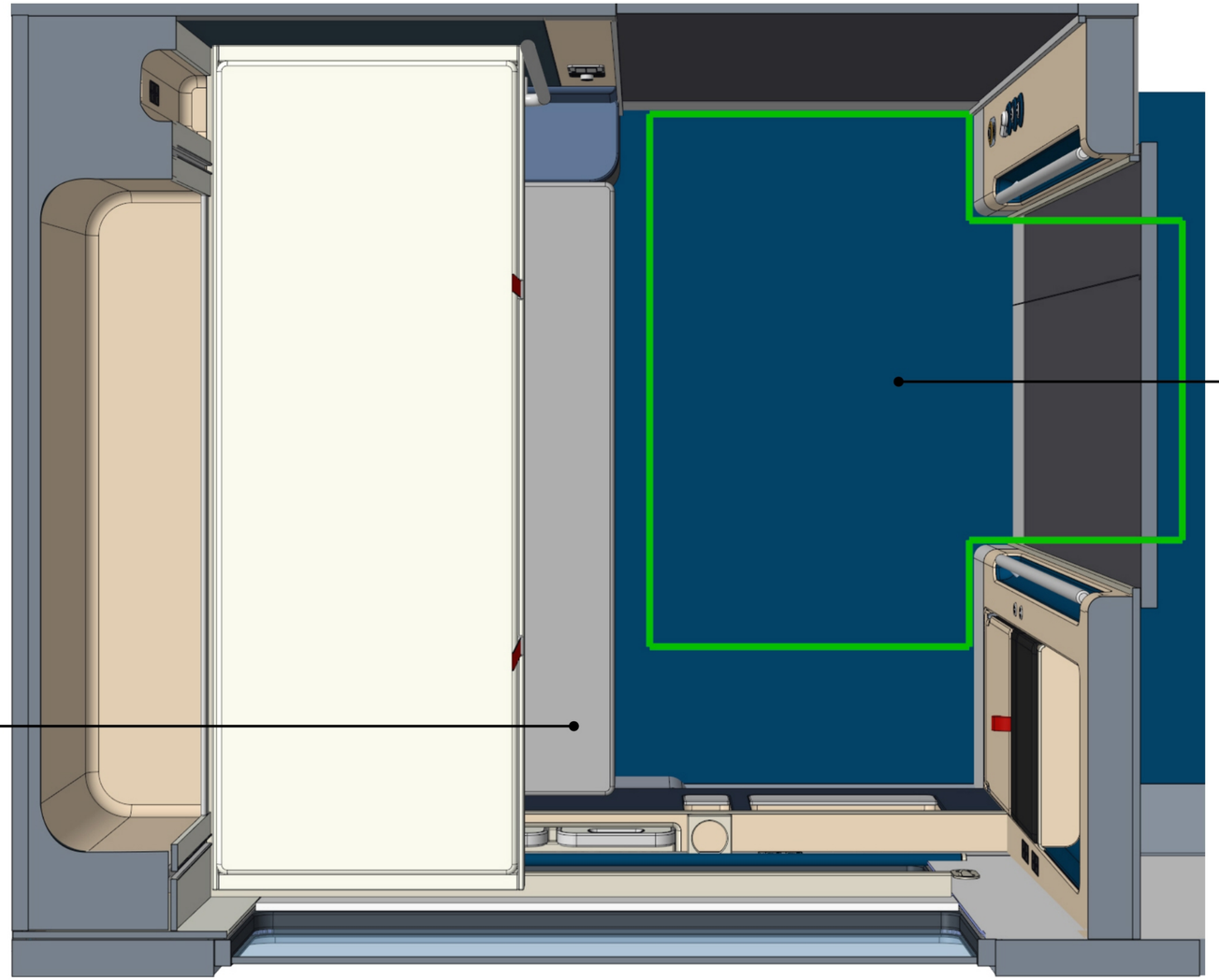
Accessible Bedroom | Accessibility



Ladder Clearance
The turning area should be clear when the bunk ladder is attached on the window side.

Turning Space
Space should be provided with a 60” turning circle or ADA approved T-maneuver when the lower berth is deployed.

***The position of all Accessible interaction points, turning spaces and clearances will be subject to review, mockups, and user testing**

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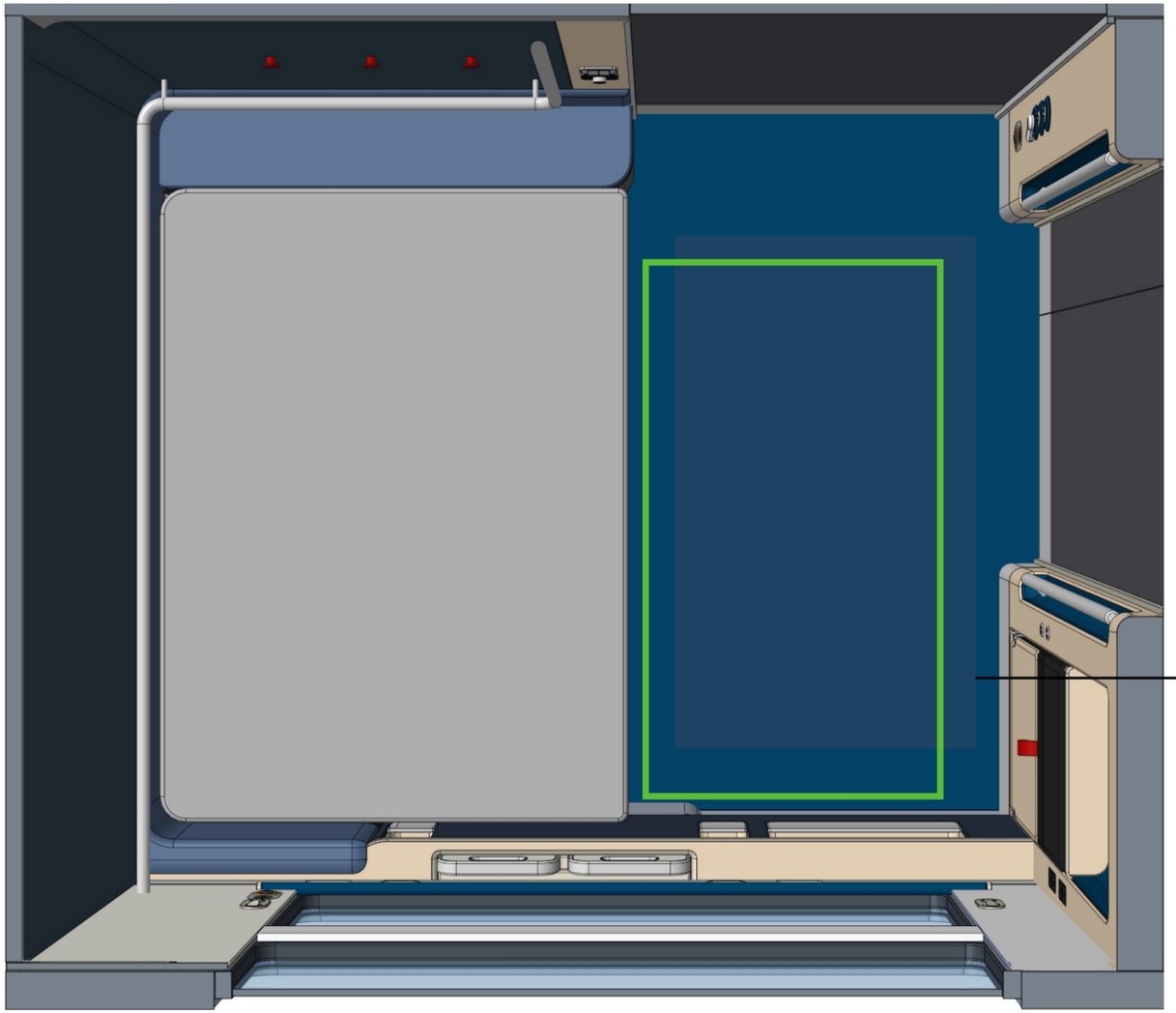
Accessible Bedroom | Accessibility



RVAAC Accessible Space
An RVACC accessible space of 59” x 32” should be provided for storing a wheelchair beside the bed.

***The position of all Accessible interaction points, turning spaces and clearances will be subject to review, mockups, and user testing**

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Accessible Bedroom | Features

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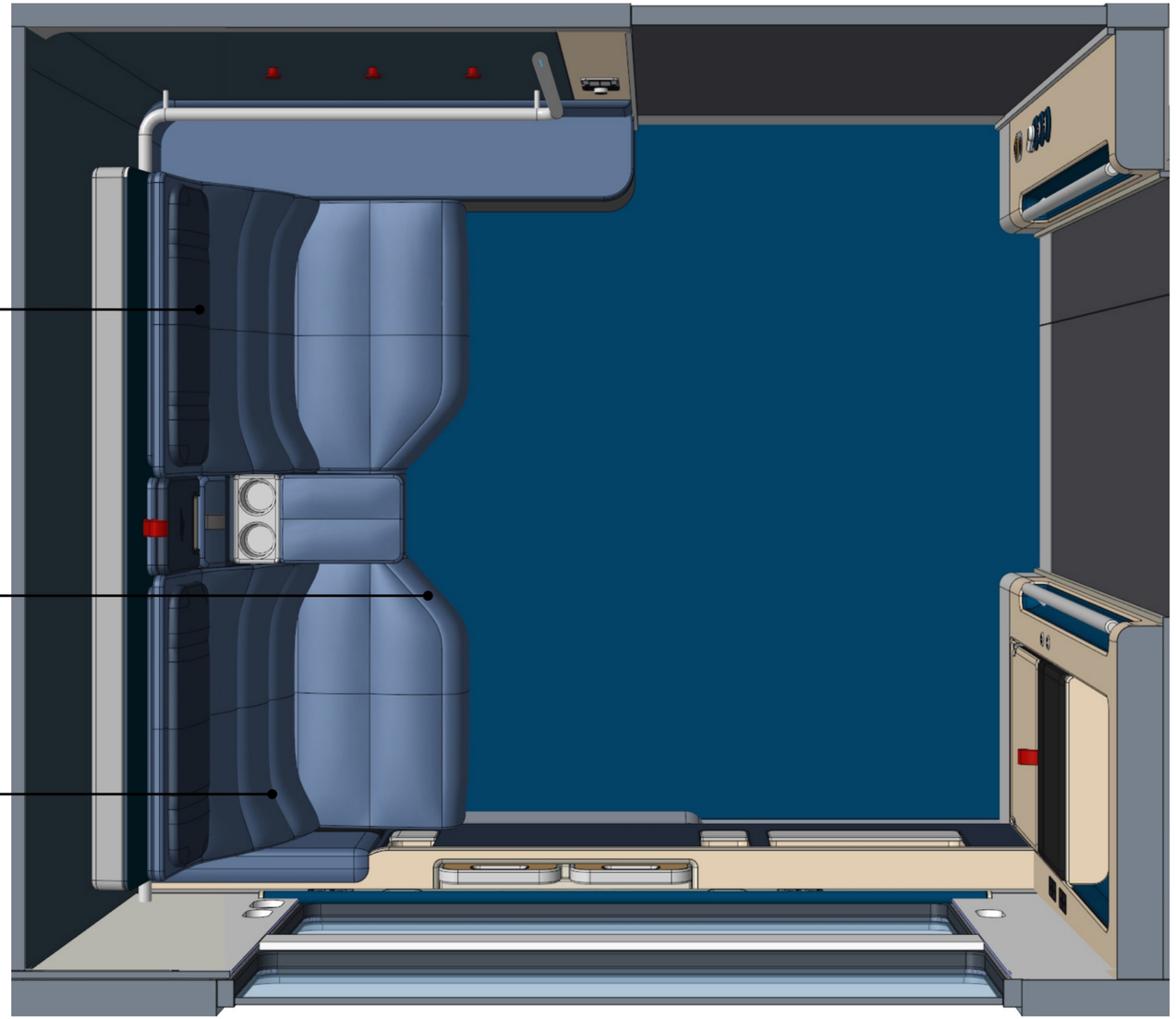
Accessible Bedroom | Features

Seat Headrests
Seat headrest should be adjustable in height for a range of people sizes and have adjustable wings that fold outwards to adjust the width of the headrest .

Seat Shape
The seat shape should be optimized to maximize clear floor area, aid wheelchair transfer, and facilitate an accessible, self-sufficient bed deployment.

Seat Comfort
Seat cushions should be contoured to aid seat comfort.



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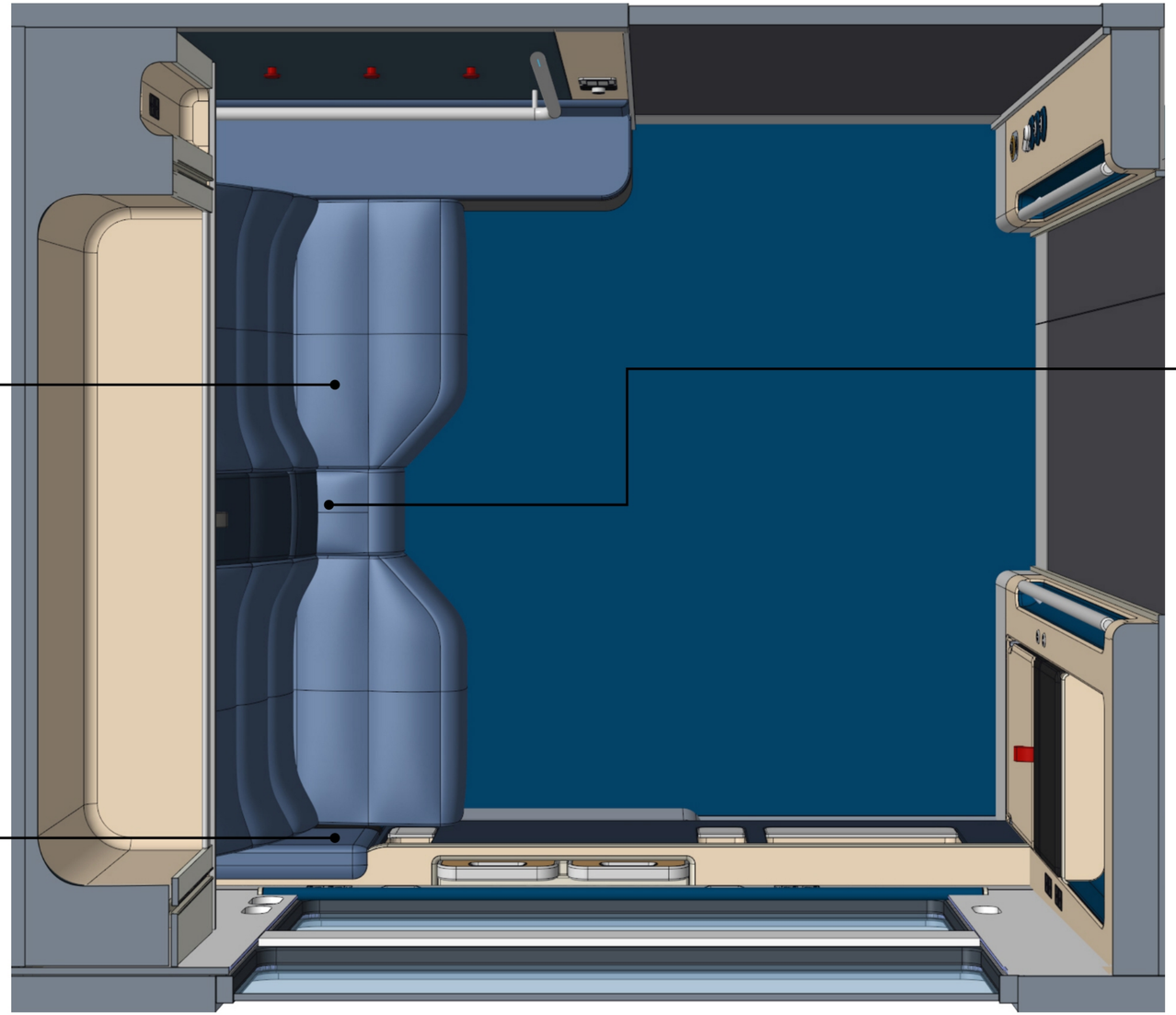
Accessible Bedroom | Features

Seat Dimensions
Each seat should have a minimum width of 28" between the inside armrests and the central armrest.

Armrest
A full and cushioned armrest of 3.5" should be provided on the windows side. The armrest should be of a suitable length for a seated passenger to rest their forearm on the cushioned section.



Center Armrest
A full and cushioned armrest should be provided between the two seats. The armrest should have provision for two cup holders.

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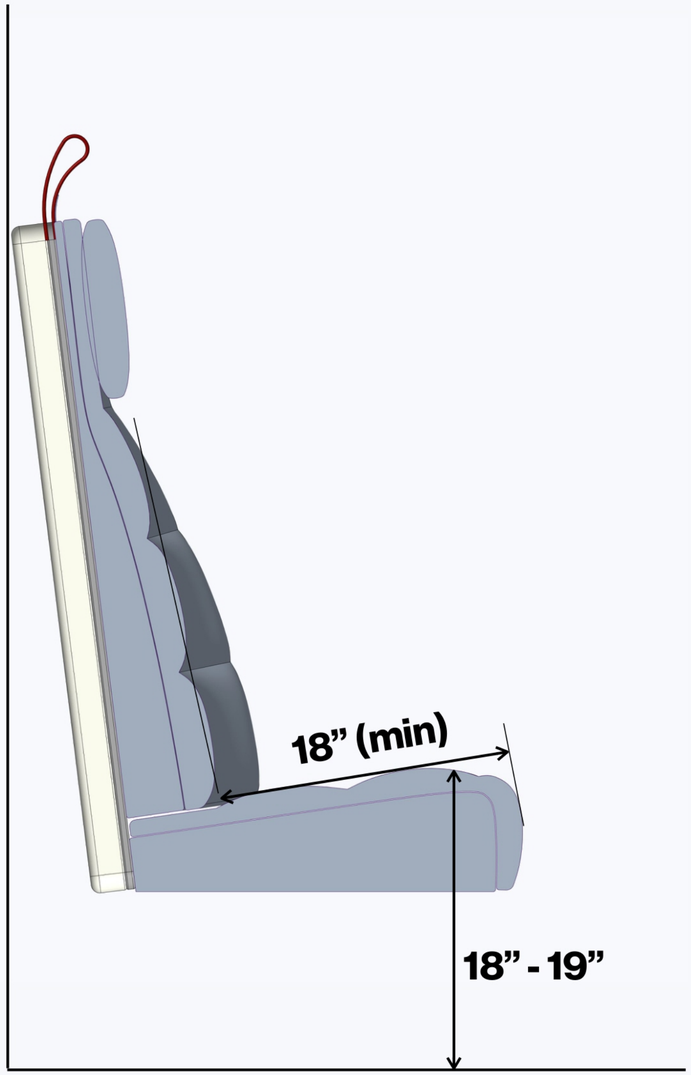
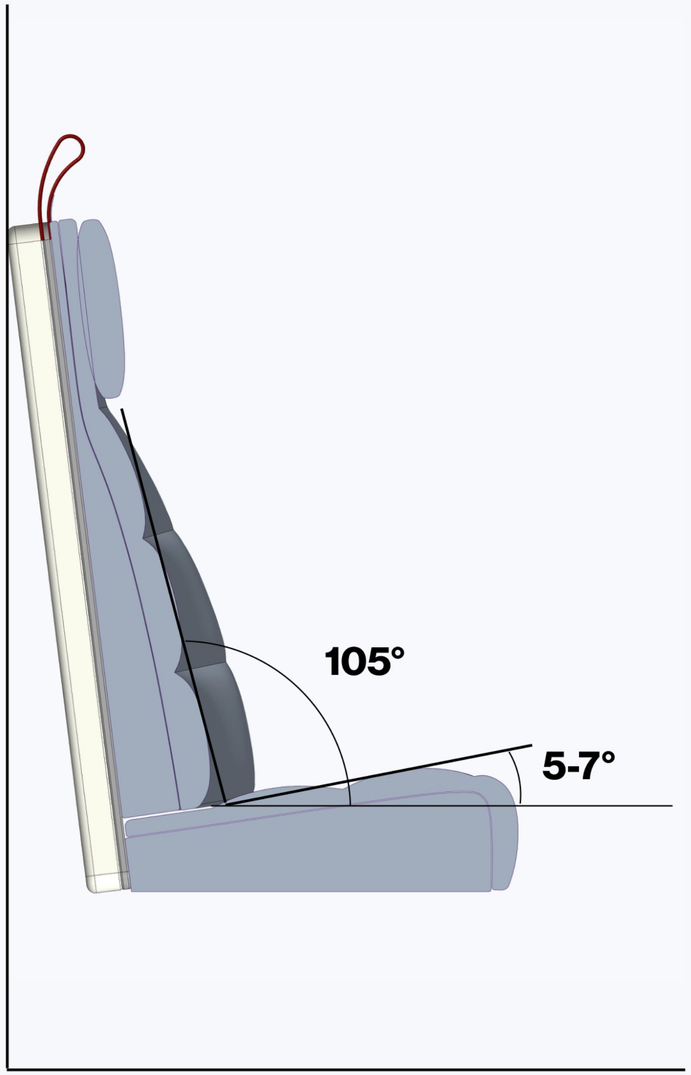
Accessible Bedroom | Features

Seat Dimensions
All seat dimensions, cushion density/shore hardness will be subject to mockup review and approval by Amtrak.



DRAWINGS NOT TO SCALE



DRAWINGS NOT TO SCALE

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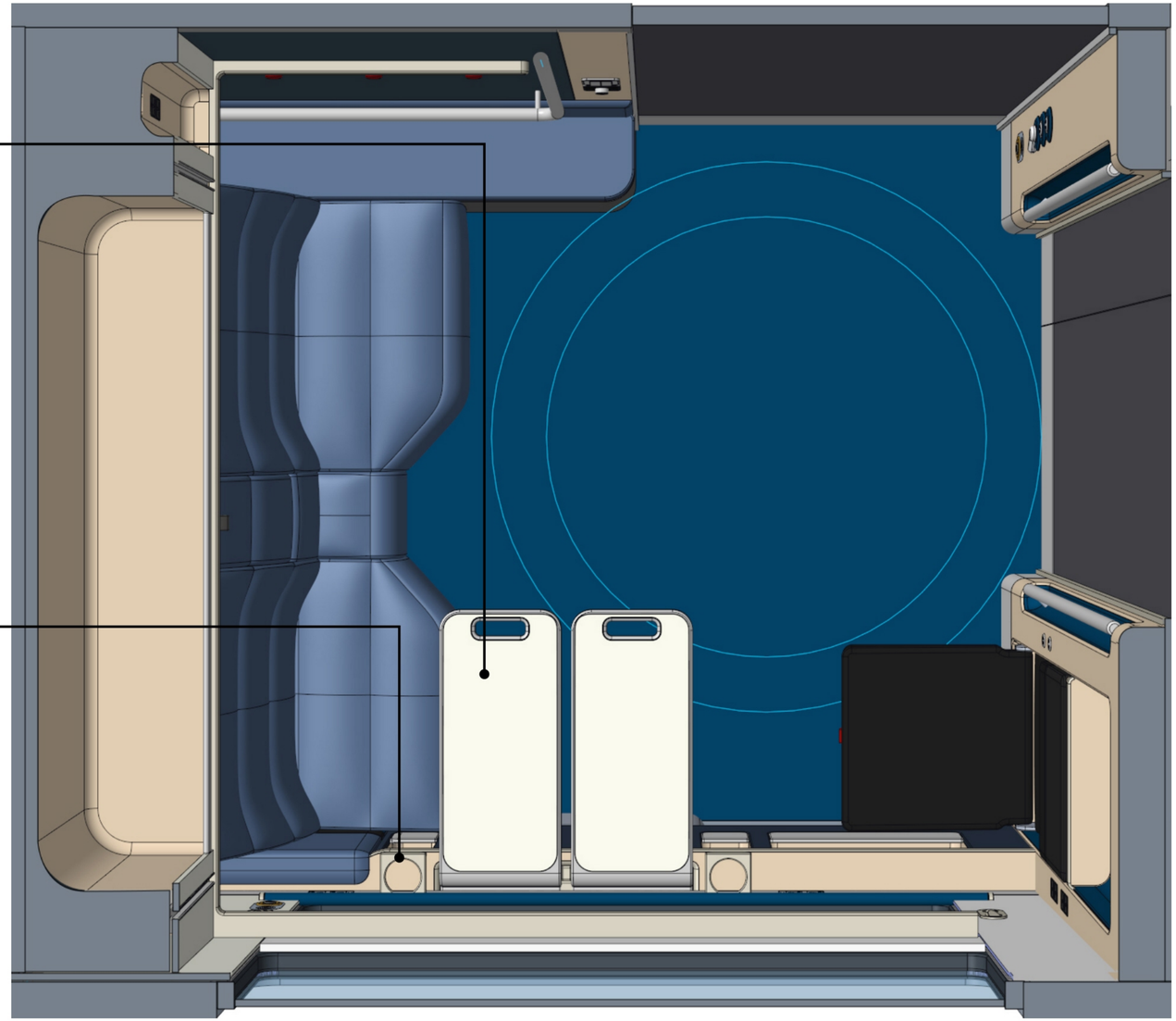
Accessible Bedroom | Features

Fold Out Tables
Fold out table should be provide clearance for mobility devices of different sizes while also providing a good table surface for a person sat in the fold out seat.

Cup Holders
Two cupholders located so people can use and access the cupholders from a seated position and can fold away when not in use.



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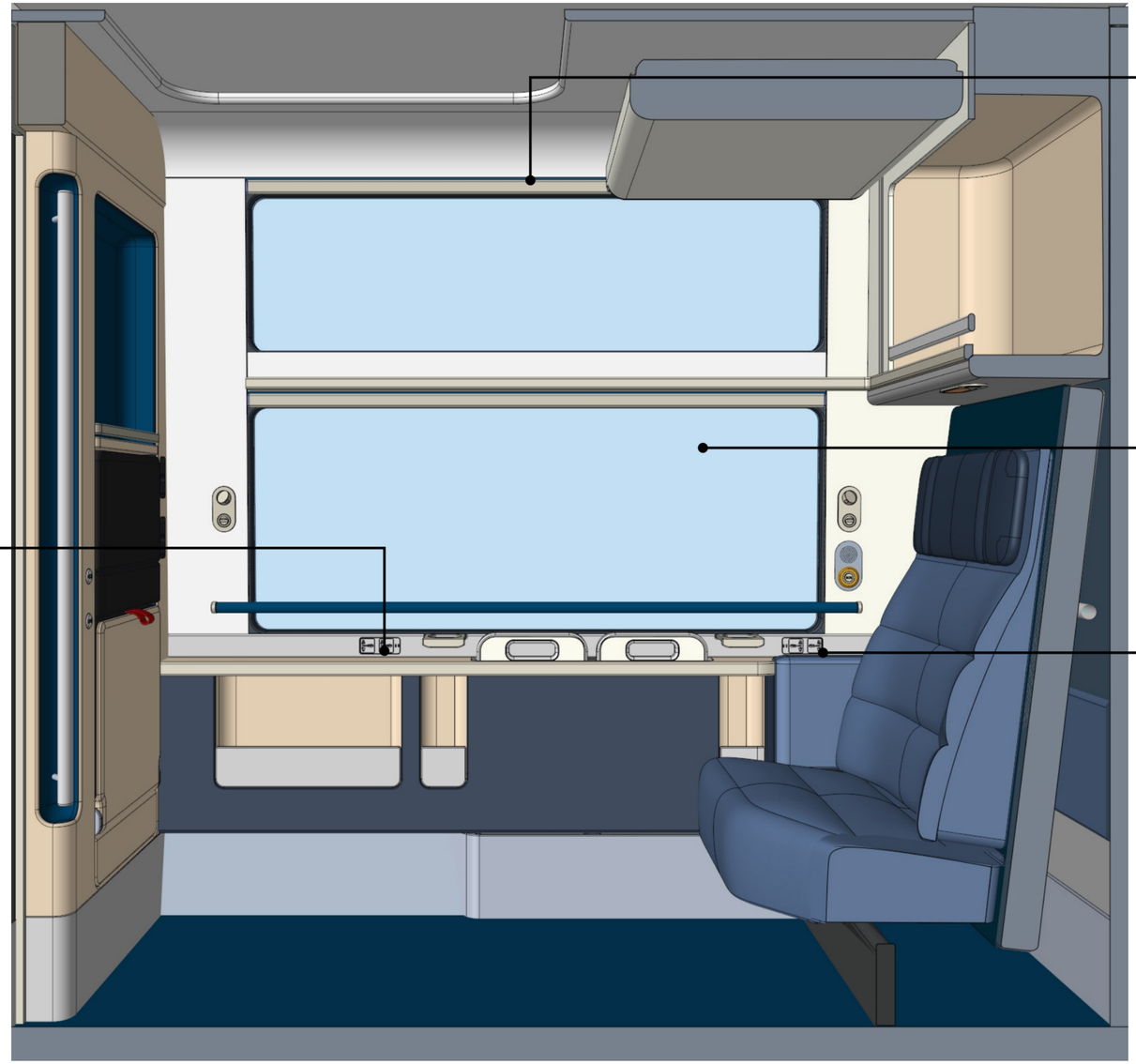
Accessible Bedroom | Features



Blinds
A single pull-down blind system shall be provided per window, capable of delivering both daytime solar/glare control and full blackout performance.

Window and Window Mask
Window and window mask should be positioned so each seated position has clear views with the overall window size maximized.

At Seat Power
Two power sockets and two USB sockets should be provided to each seated location. The position should be above the armrest height and in easy reach of people while seated.

Accessible Seat Power
Two power sockets and two USB sockets should be provided near the accessible space suitable for charging an electric wheelchair. The position should comply with ADA and be clear and intuitive to use.

Accessible Bedroom | Features

Bunk Power Outlet
Two power sockets and two USB ports shall be accessible from the top bunk when the bunk is deployed.

Lower Berth Power Outlet
Two power sockets and two USB ports positioned in the lower cubby. The outlet should be ADA compliant reach when passengers are seated and accessible from the lower berth when the bed is deployed.



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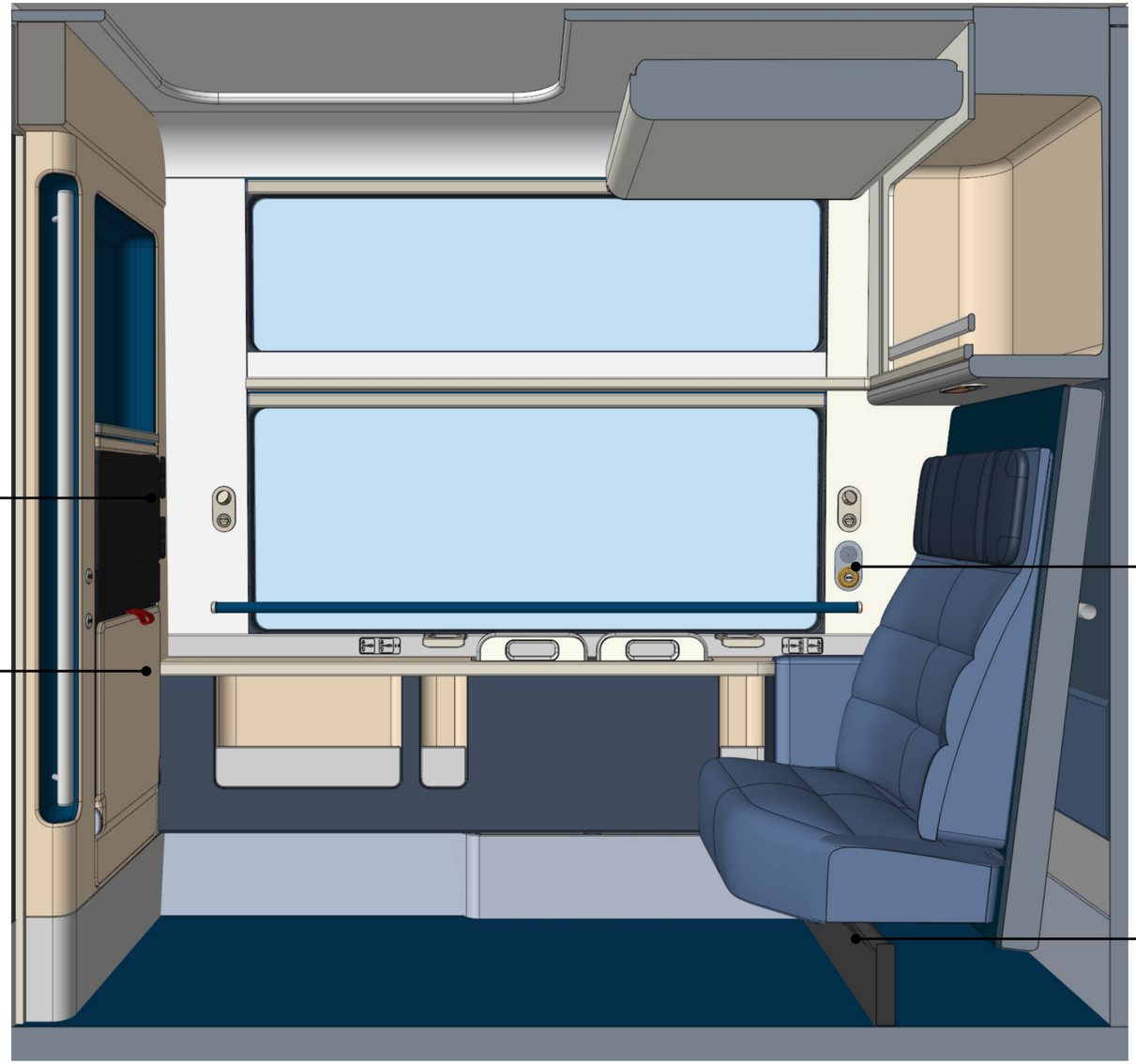
Accessible Bedroom | Features

Tip-up Seat
Tip up seat should fold up flush with the side wall to provide a clear and unobstructed space for wheelchairs. Spaces when folded should be durable and suitable to back a wheelchair against. When deployed the seat should reveal a soft cushioned seat back and headrest so when deployed should have similar comfort levels as the other seats in the room. The seat should be positioned to have good access to the fold out table with a minimum seat width of 21" and minimum seat pan depth of 19".



Call for Aid
Provision for call for aid by seat - locations for all call for aids are subject for review and in compliance with ADA regulations detailed in technical specification.

Under Seat Clearance
Space under the seat can be used to provide clearance for wheelchair.

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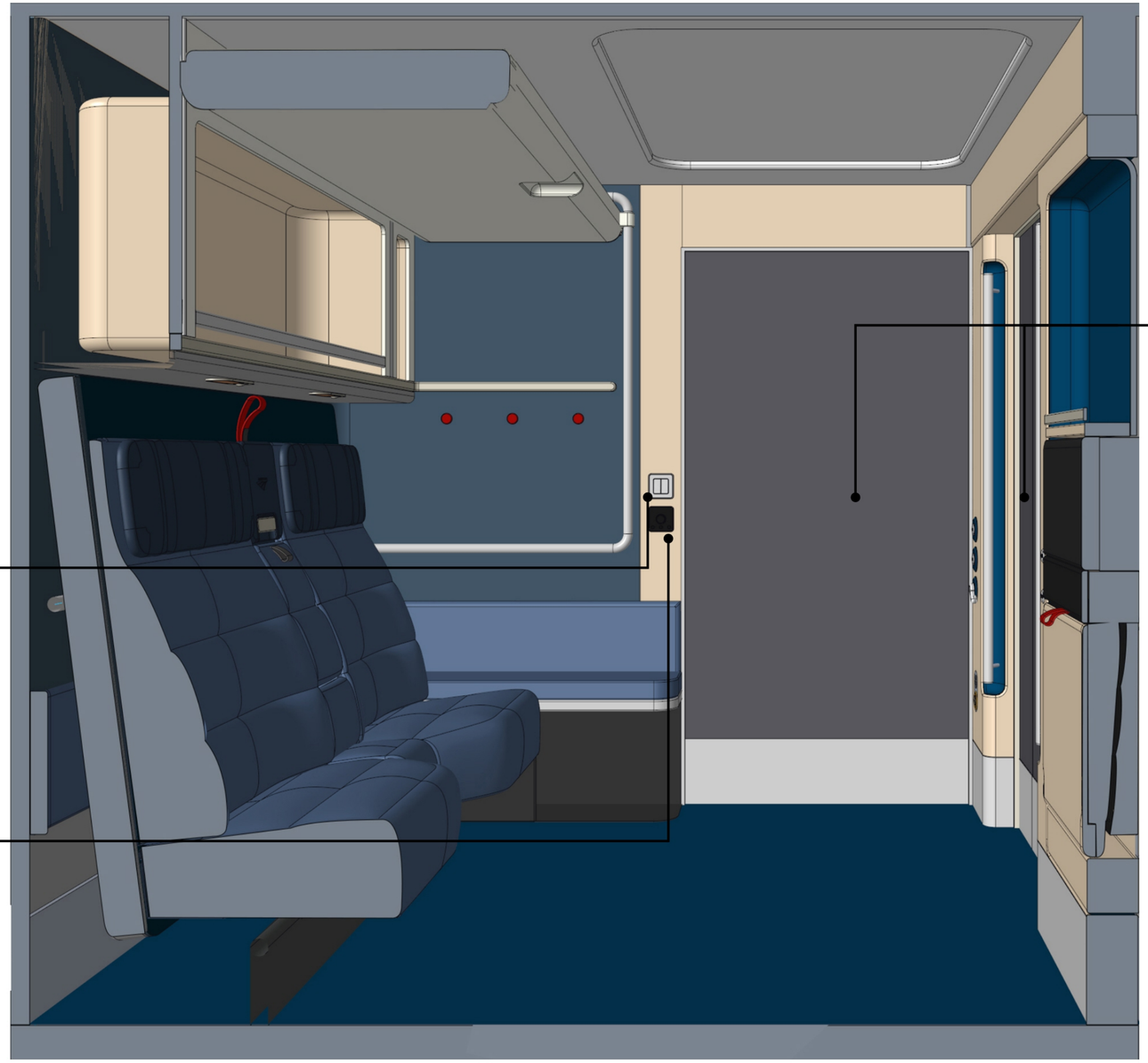
Accessible Bedroom | Features



Doors
Door free from rattle, smooth sliding operation.

Master Light Switch
Master light switches to be positioned near the door. A second master switch should be safely accessible by a person lying in the bed. The position of light switches should be ADA compliant.

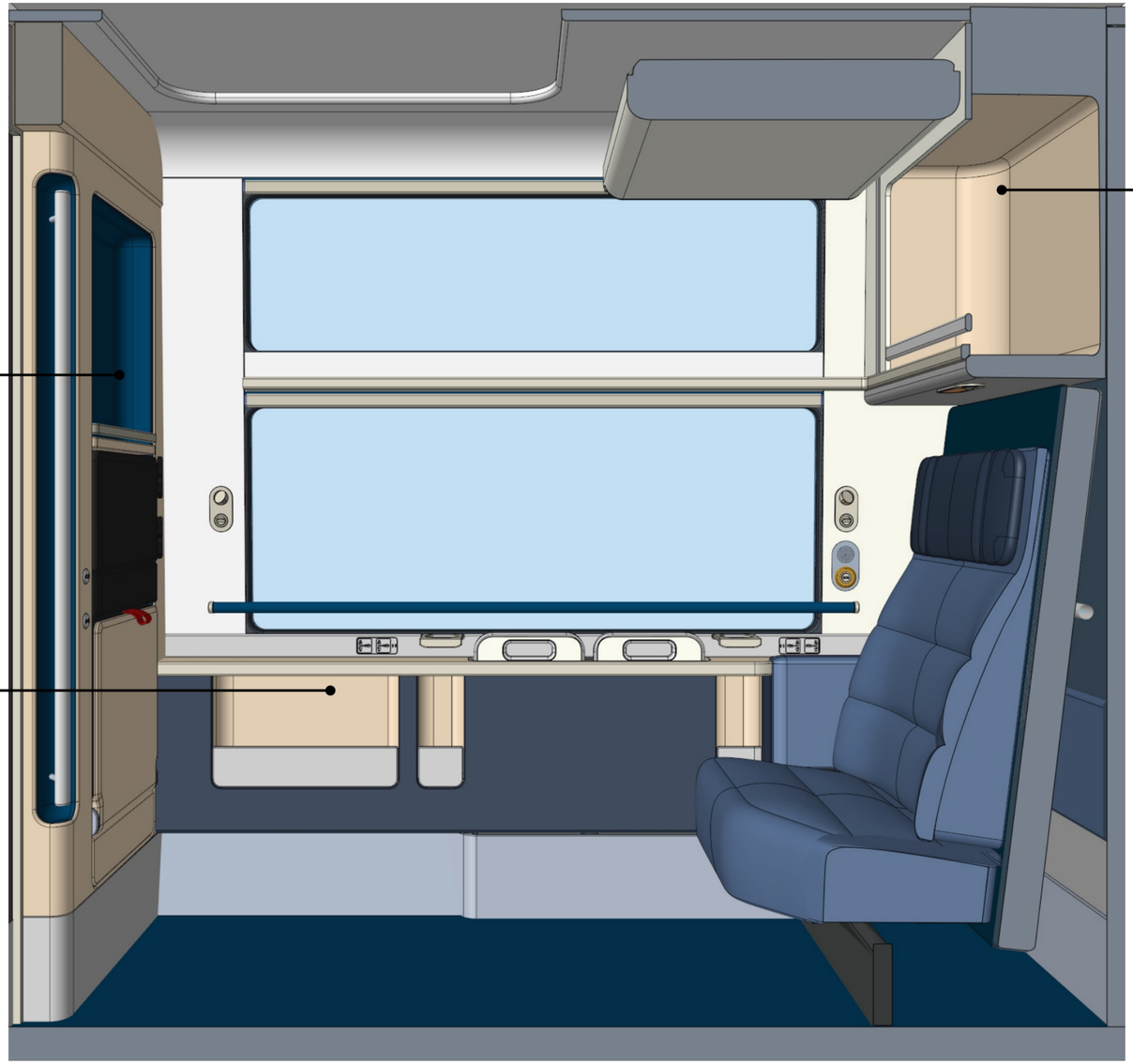
Temperature Control

Accessible Bedroom | Storage

Accessible Bedroom | Storage

Upper Cubbies
Upper Cubbies shall be provided for personal items.

Cubbies
Sidewall cubbies adjacent to the accessible space and seat shall be provided for storage for personal items.



Upper Storage
Upper Storage shall be provided for carry on baggage.

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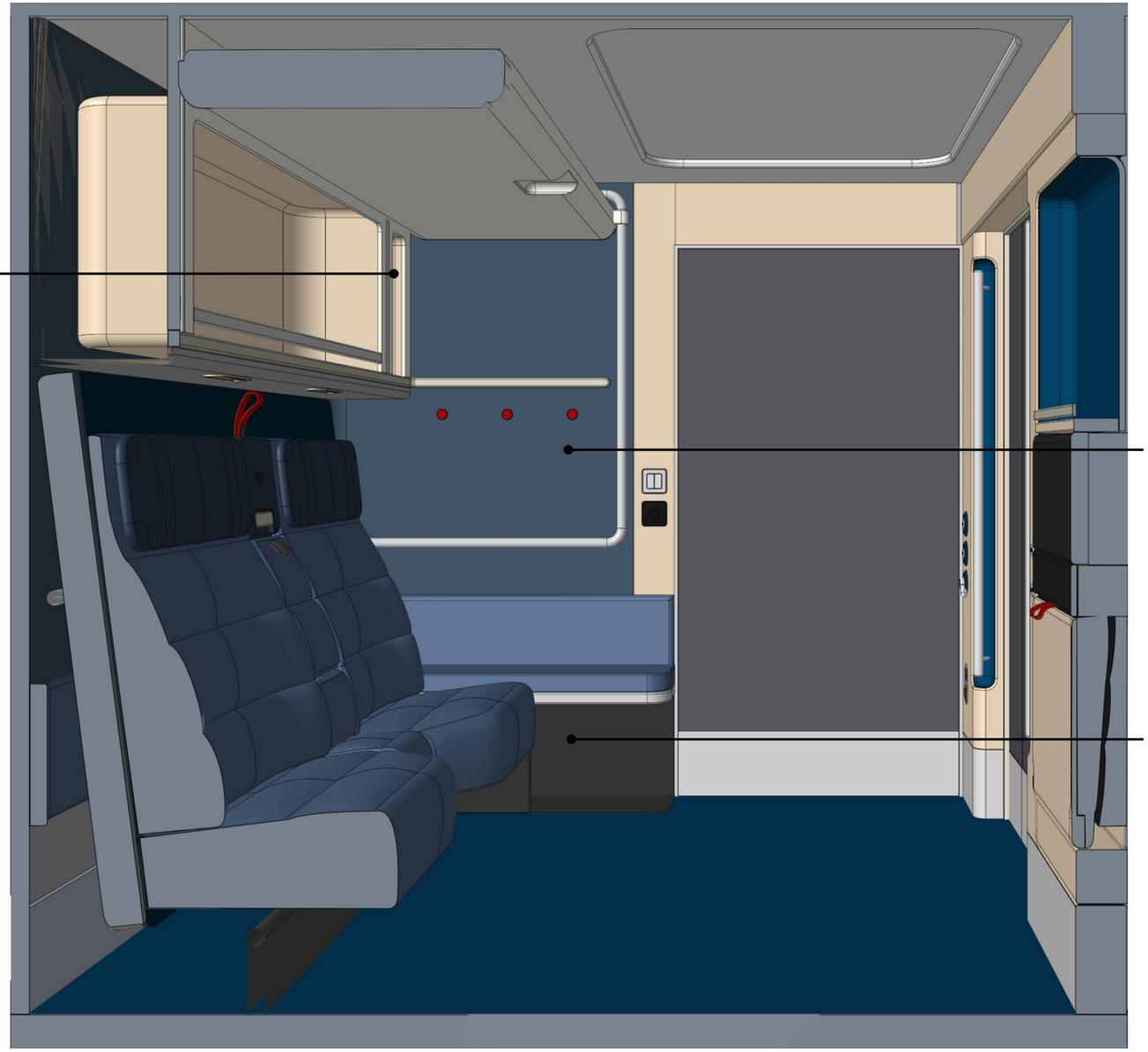
Accessible Bedroom | Storage

Bunk Cubby
Bunk cubbies provide storage for personal items. Usable when bunk is stored and also provides storage for upper bunk when bunk is deployed.



Hanging Space
At least two coat hooks should be provided on the inner wall, suitable to hang clothes or provide the function of an open wardrobe. The lower hook should be accessible for a person using a wheelchair at a maximum of 48” from the finish floor.

Lower Storage
Storage for carry on baggage shall be provide at an accessible lower level beside or under the seating area.

Accessible Bedroom | Seat to Bed Conversions

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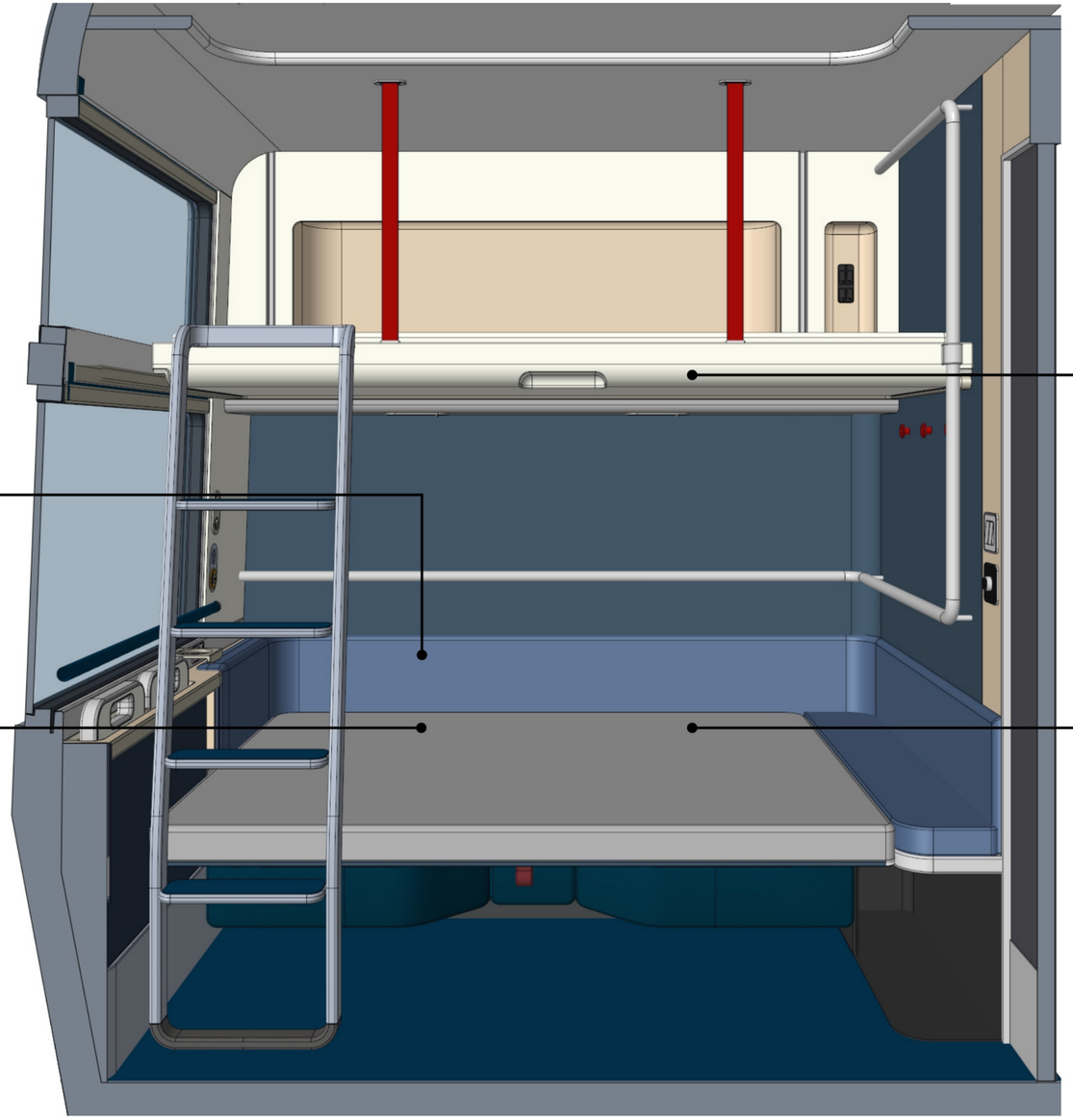
Accessible Bedroom | Seat to Bed Conversions



Bed Headboard
The armrest and ottoman side pad should continue and connect to form a thin soft wrap around the bed.

Lower Berth
Conversion of seat to bed should result in an entirely flat bed surface. The mattress surface should be integral to the seat. A single seam between the bed surface and the Ottoman is acceptable. A single thin topper will finish the bed surface.

Bunk Dimensions
Minimum width 28” x Minimum length 76”.

Lower Berth Dimensions
Minimum width 48” x minimum length 73” when combined with the Ottoman.

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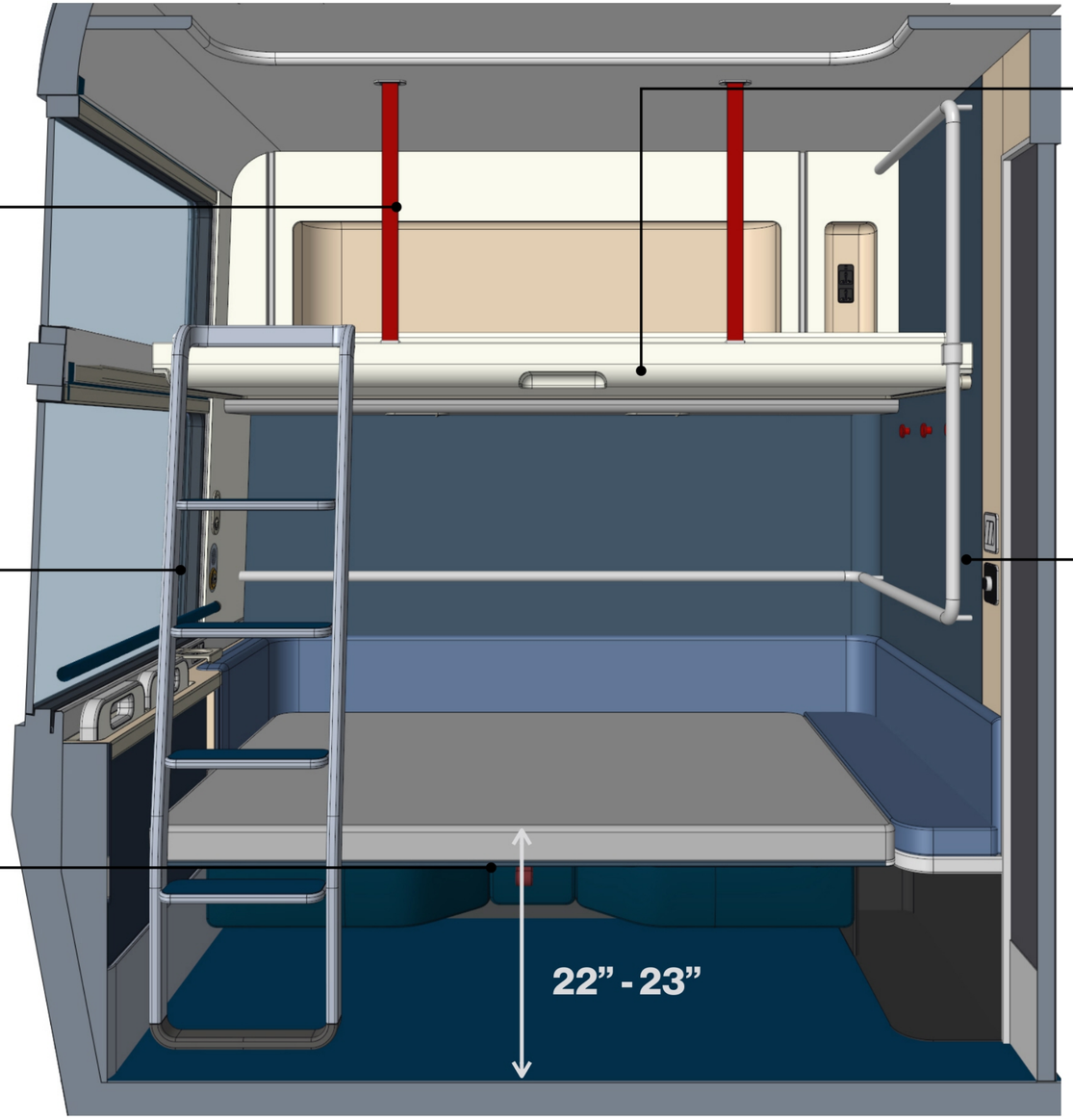
Accessible Bedroom | Seat to Bed Conversions

Bunk Retaining Straps
Retaining straps are required to prevent people from rolling out of the bunk. These should retract into the ceiling and be easily pulled down and click into place using an automatic locking retractor belt system (similar to a car seat belt system).

Ladder Dimensions
The ladder dimensions should comply with the relevant standard.

Deployed bed height
The deployed bed height shall be between 22” and 23”



Bunk Height
The bunk height when deployed will be evaluated and judged carefully during the design review process.

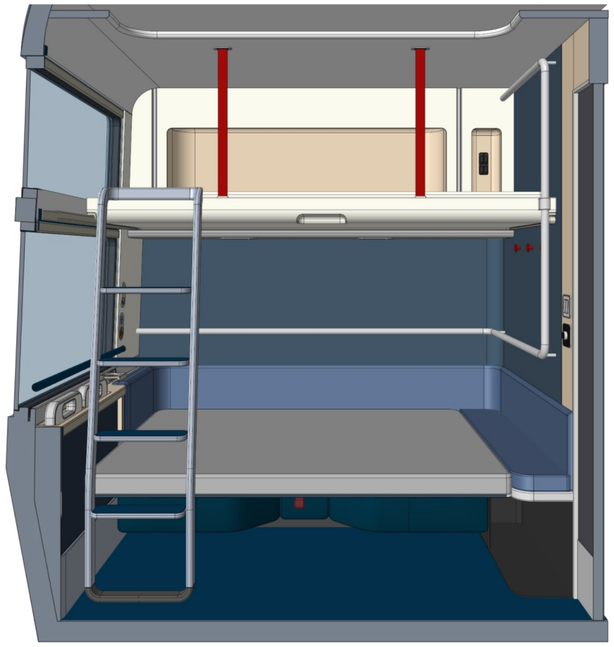
The seated area below the bunk should still be usable by seated passengers when the upper bunk is deployed. The area should still be well lit and tables and other amenities should not be restricted by a deployed bunk bed.

Handrails and Grabs
Suitable handholds shall be provided to assist people transitioning on both sides to the bunk. Additional handholds may be required to assist people climbing down safely from the bunk.

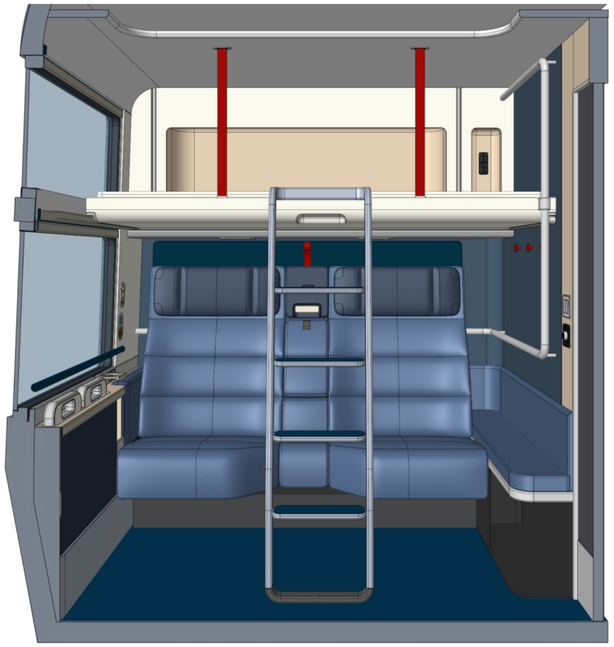
Accessible Bedroom | Seat to Bed Conversions

Ladder

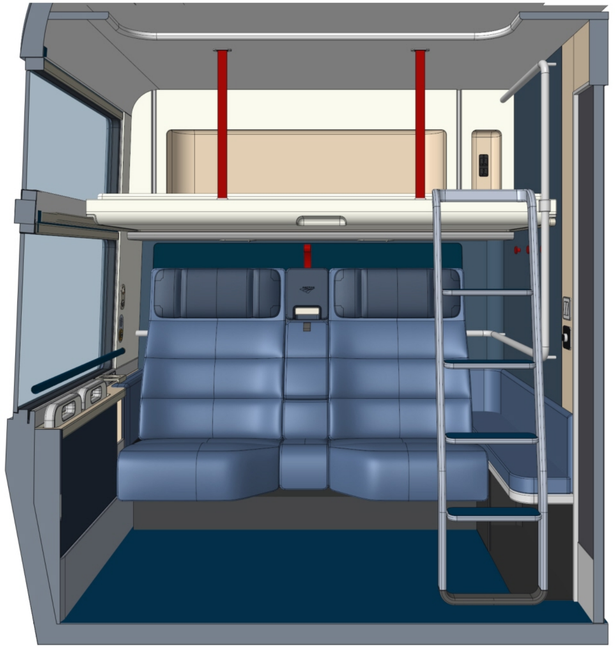
The ladder is stored in the bunk. It should be durable and lightweight. It should not have any sharp corners or edges. It must be intuitive to use and locate. The fixation method should be robust and easy to lock and unlock. Successful locking should be visually indicated and safety measures should be put in place to prevent accidental unlatching and prevent misuse. The ladder should be usable in multiple positions based on user specific needs and preference. Each step should clearly contrast the floor and It should also have integrated battery powered lights for safe use during low level light conditions.



Ladder position 1
Maintains a 60” turning circle on the floor.



Ladder position 2
Bunk down and a passenger in both seats.



Ladder position 3
Accessible space clear and one seat occupied.

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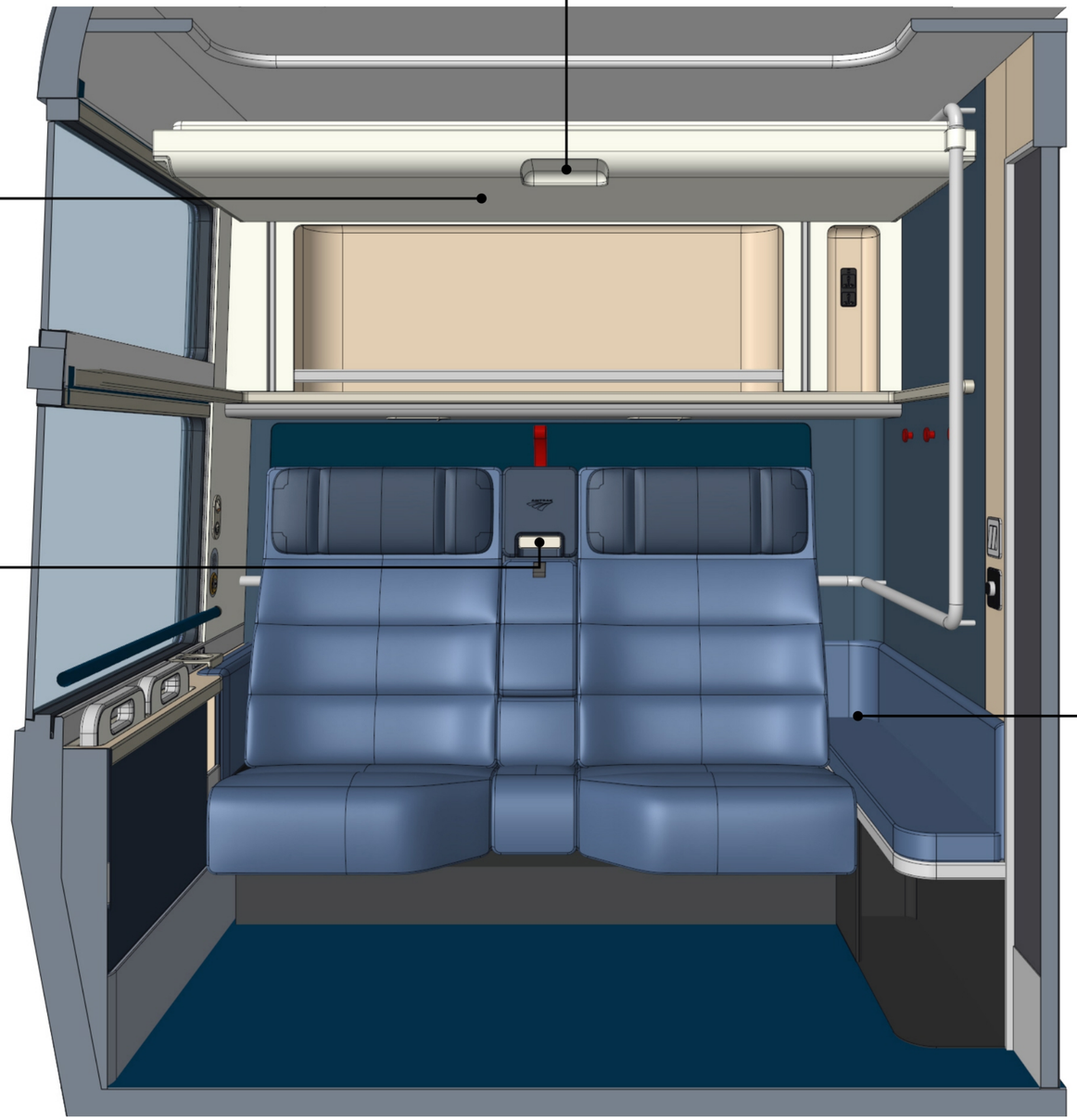
Accessible Bedroom | Seat to Bed Conversions

Upper Bunk
Bunk should be stored horizontally at the maximum height in the room. Bunk should not preclude any part of the window when stowed. The bunk's stored height should be maximized so head clearance is maximized in both seated and standing positions.

Lower Berth Deployment
A simple unlatch mechanism is required to convert the seats into a lower bed/berth. This should be positioned in a place that is easy for people to use and designed in a way so that people can understand its purpose. The position should be ADA compliant and within reach of a person using a wheelchair. Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. There should be an assisted mechanism making it easy for passengers of any ability to self-sufficiently and safely deploy and store the bed.



Upper Bunk Deployment
A simple and easy to use handle, latch and lock mechanism should be within easy reach from a standing position. Successful locking should be visually indicated and safety measures should be put in place to prevent accidental deployment and prevent misuse.

The bunk deployment should be free from jamming and racking and should lower slowly and in a controlled manner. Considerations should be made for assisted movement or counter balances to assist people moving the bunk down and back up into the stowed position.

Ottoman
An ottoman can be provided by the side of the seats to form part of the bed surface. The top surface can be used as additional storage during the day. Carry on stowage can be stored under the ottoman.

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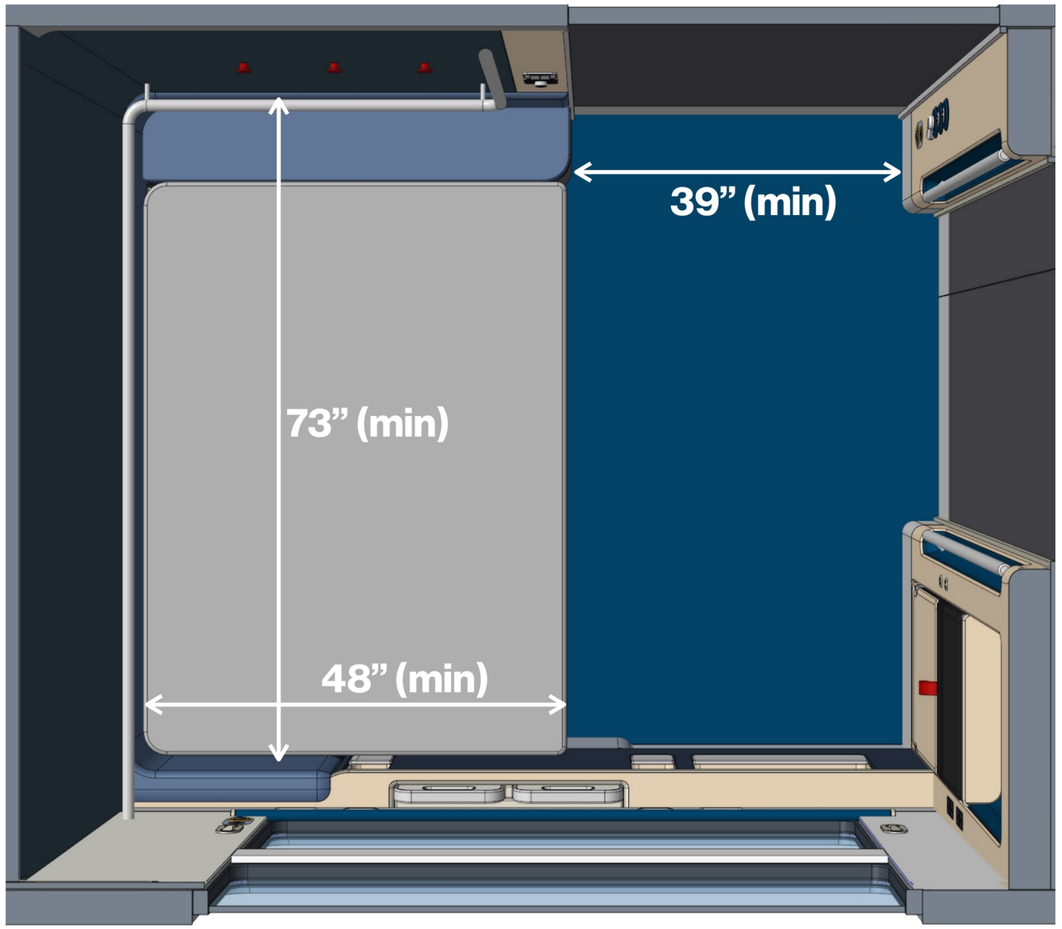
Accessible Bedroom | Seat to Bed Conversions

Bed Dimensions
All bed dimensions, mattress densities will be subject to mockup review and approval by Amtrak.



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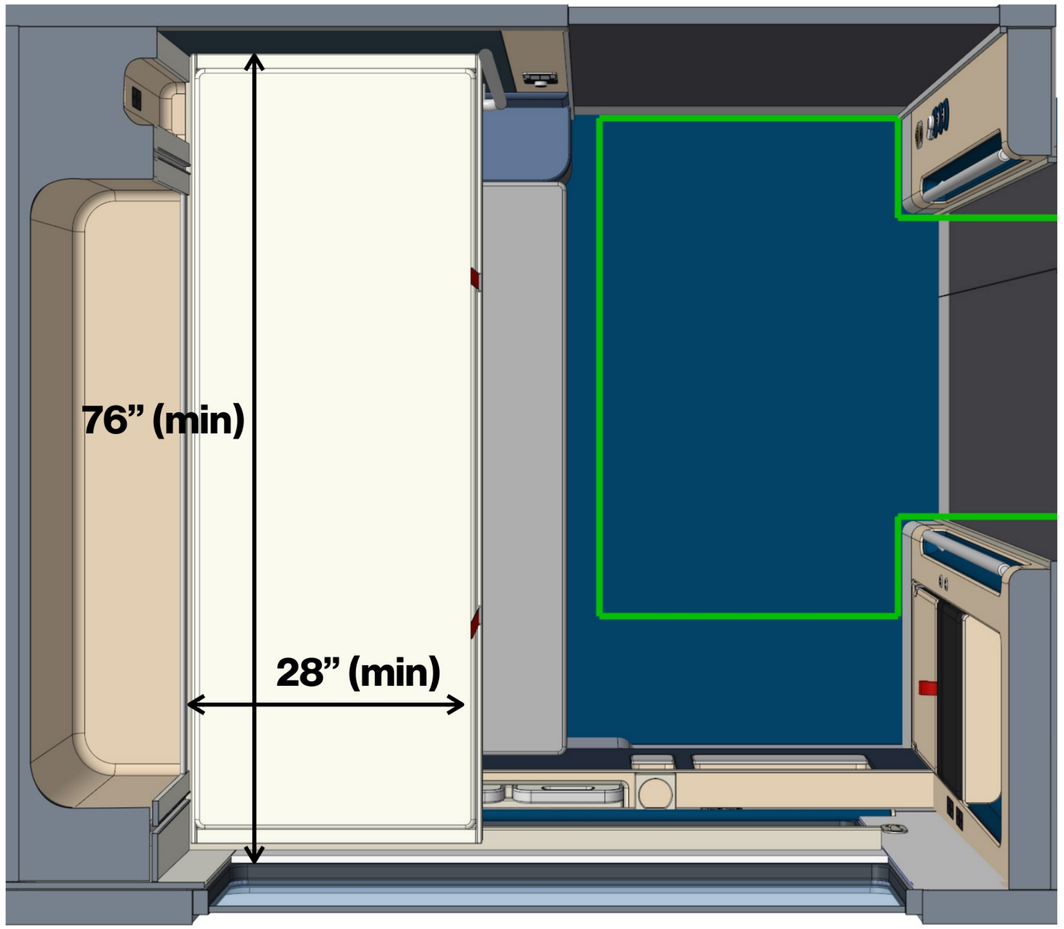
Accessible Bedroom | Seat to Bed Conversions

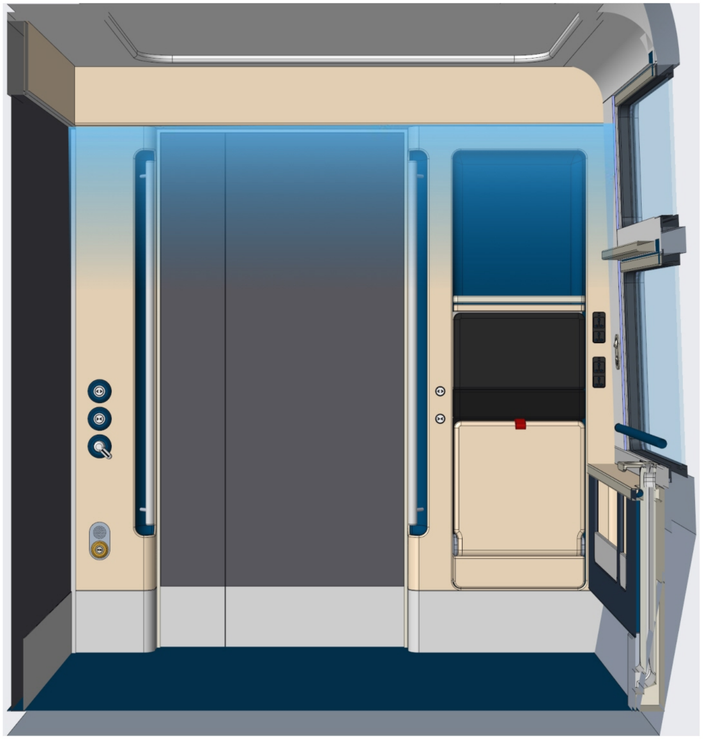
Bed Dimensions
All bed dimensions, mattress densities will be subject to mockup review and approval by Amtrak.



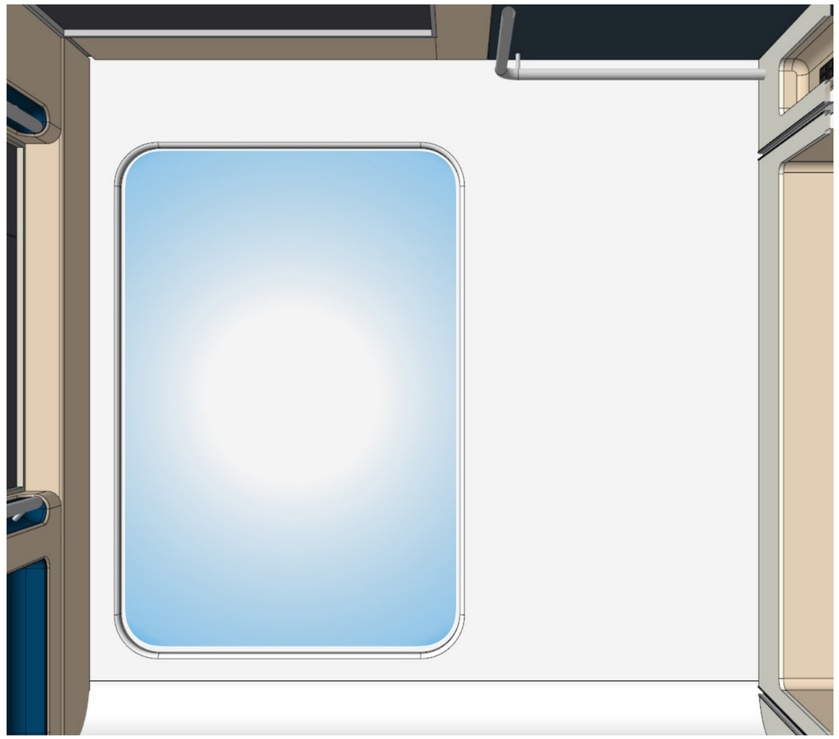
Accessible Bedroom | Lighting

Accessible Bedroom | Lighting





Wall Wash Light
Indirect wash light running down both sides of room.



Ceiling Pool Light
Ring pool lighting in the ceiling provides indirect wash light in the centre of the room.

*See lighting spec for detailed definition.

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Accessible Bedroom | Lighting



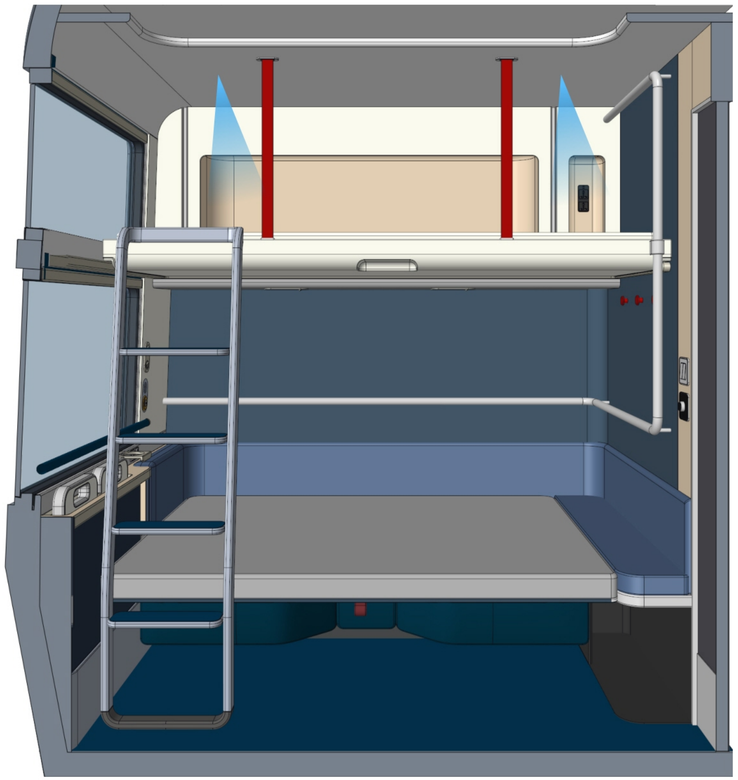
Under Seat Light

Under seat light should be indirect and spill light out across the floor.



Reading Lights

Reading lights should be provided at each seated location, including the fold out seat. People should be able to adjust the direction and position the light over their lap and in a suitable place to read a book at night. Switches should be located near or on the light.



Bunk Reading Light

Reading lights should be provided, embedded in the ceiling above the bunk. Two lights in total located at each end of the bed. Light switches should be located next to the reading light.

*See lighting spec for detailed definition.

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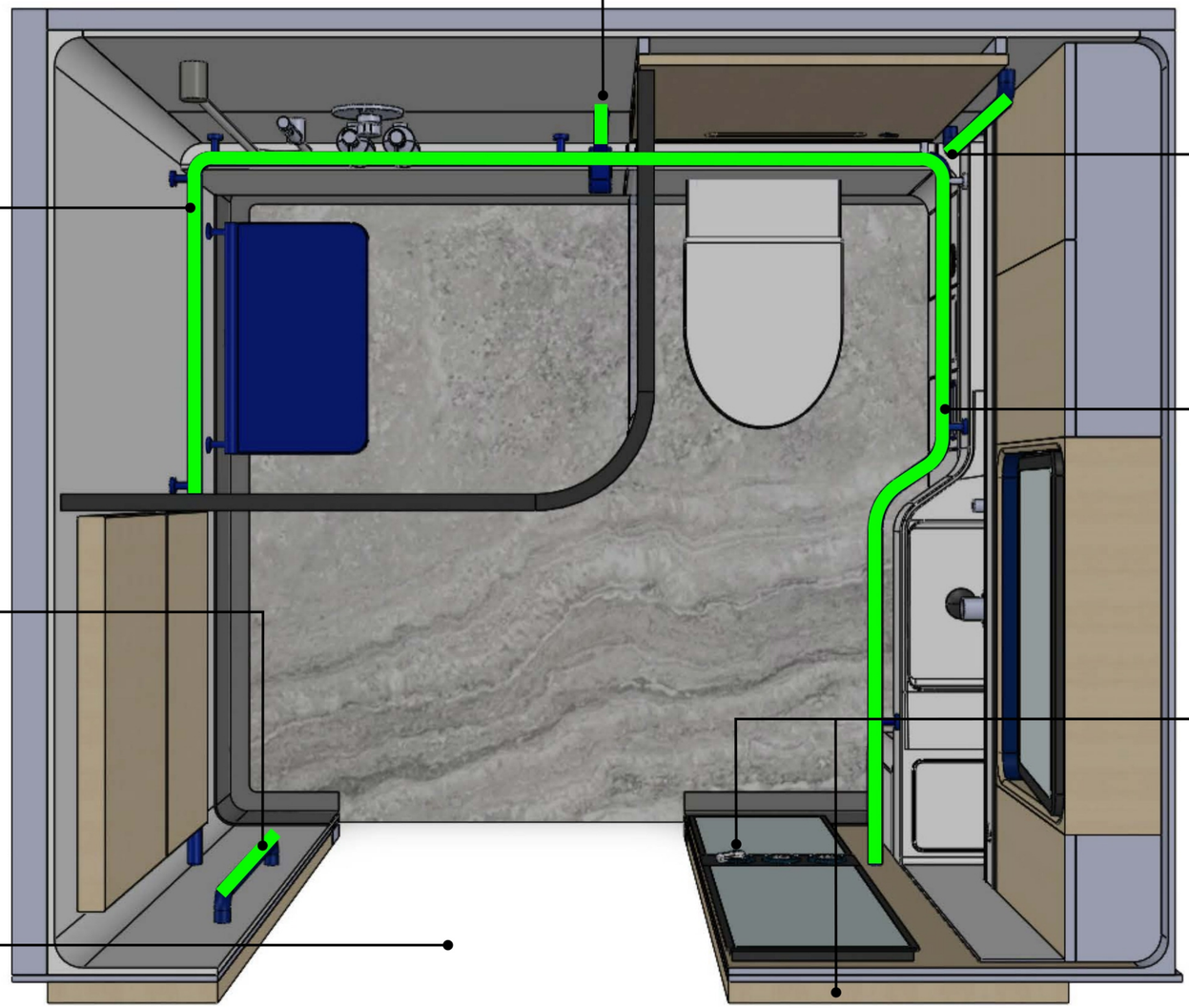
Accessible Bedroom Toilet | Accessibility

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Accessible Bedroom Toilet | Accessibility



Fold Down Handrail
The fold down handrail can be used to aid transfer on to the shower seat and on to the toilet. When stored in the vertical position it should not protrude from the sidewall more than 3” to keep side transfer space clear for the toilet.

Vertical Handrail 2
ADA compliant vertical handrails positioned in front of the toilet.

Shower Handrail
ADA compliant horizontal handrails positioned in the shower area. The handrail should be a compliant height and length.

Toilet + Sink Handrail
ADA compliant horizontal handrails positioned in the toilet and sink area. The handrail should be a compliant height and length. The handrails should be one continuous loop where possible.

Vertical Handrail 1
ADA compliant vertical handrails positioned adjacent to the bathroom door. It can also be used by baby changing table.

Toilet Door Controls
The controls for the bathroom door must be ADA compliant in position, size and configuration. The buttons should be easy and intuitive to use. An accessible manual lock should be included with an indicator to show lock condition. The buttons should have visual and haptic feedback.

36” Toilet Door
The toilet door should be an automatic sliding door, this can be achieved with two leaves. The door is positioned to create space for a T maneuver when the door is open and the bed is deployed.

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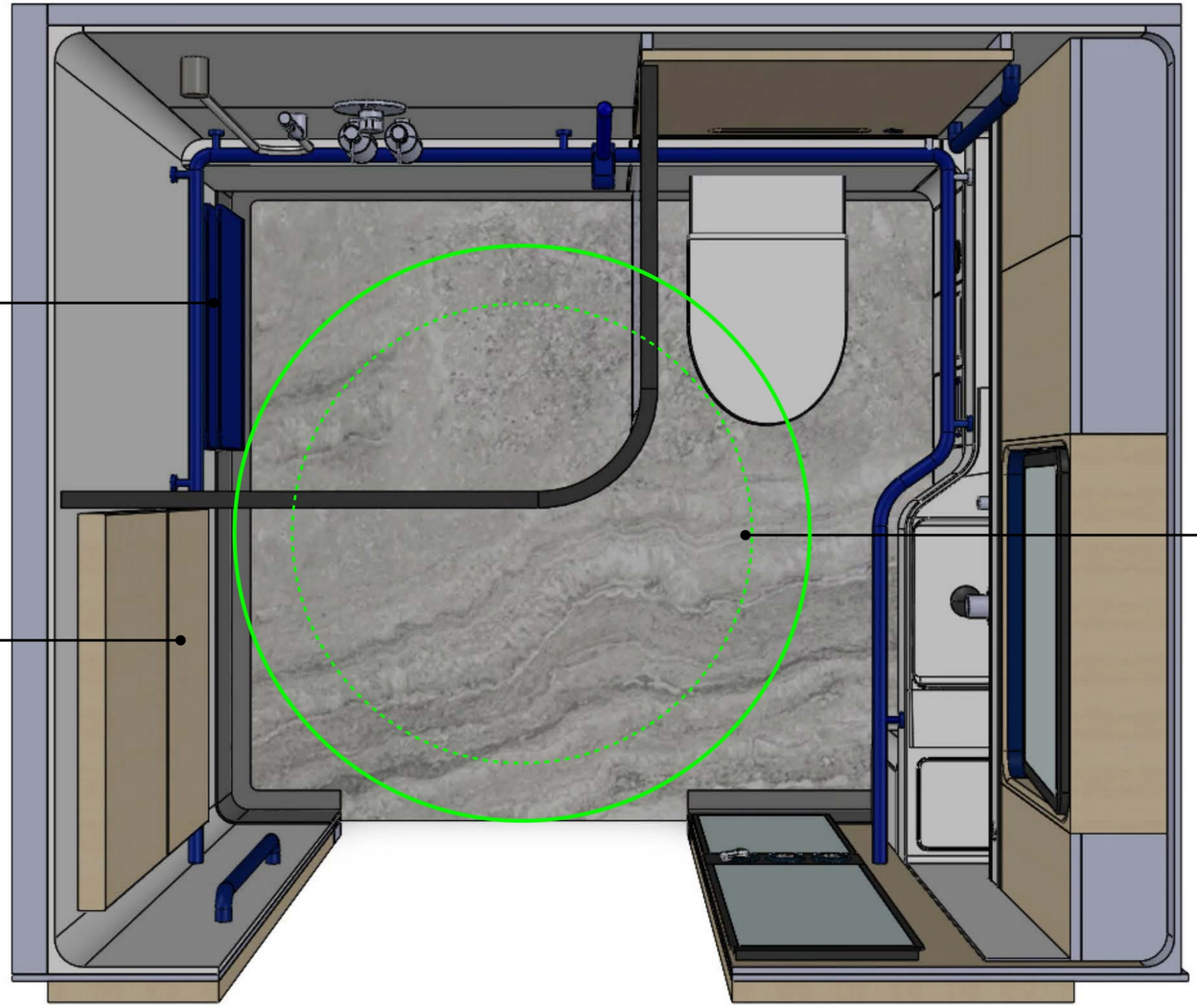
Accessible Bedroom Toilet | Accessibility

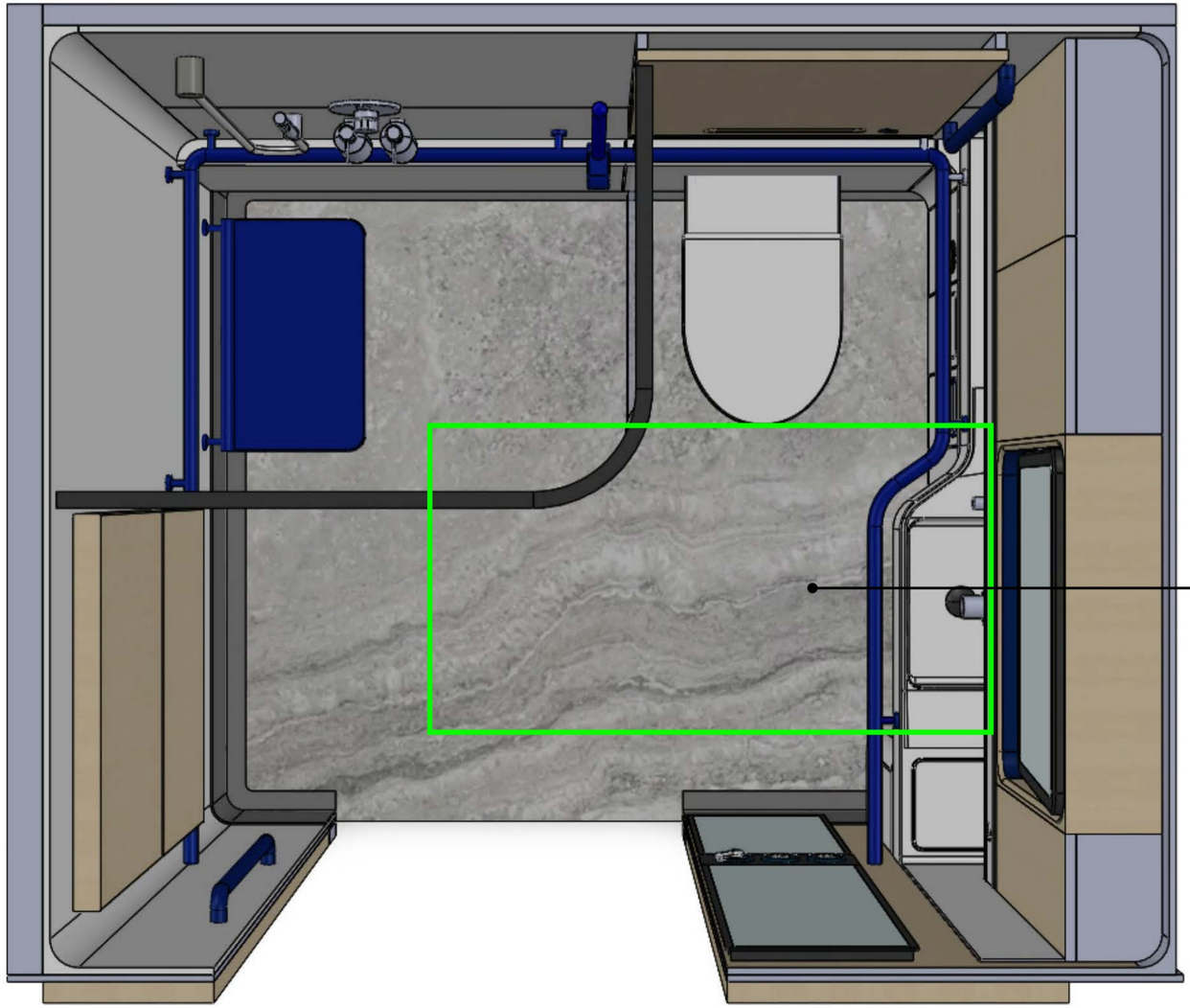
Shower Seat
Shower seat when folded up should be clear of the 60" turning circle.

Baby Changing Table
Baby changing table when stored should clear of the 60" turning circle.



60" Turning Circle
A turning circle should be provided in the Toilet when the door is closed. It is acceptable that a portion of the turning circle at four height can be overlapped in compliance with ADA guidelines.

Accessible Bedroom Toilet | Accessibility



RVAAC Accessible Space 1

There should be clearance directly in front of the sink and vanity unit for an RVAAC accessible space of 59” x 32”. The sink overhang should comply with ADA and RVAAC guidance. Dimensions and usability will be subject to mock-up testing and Amtrak approval.

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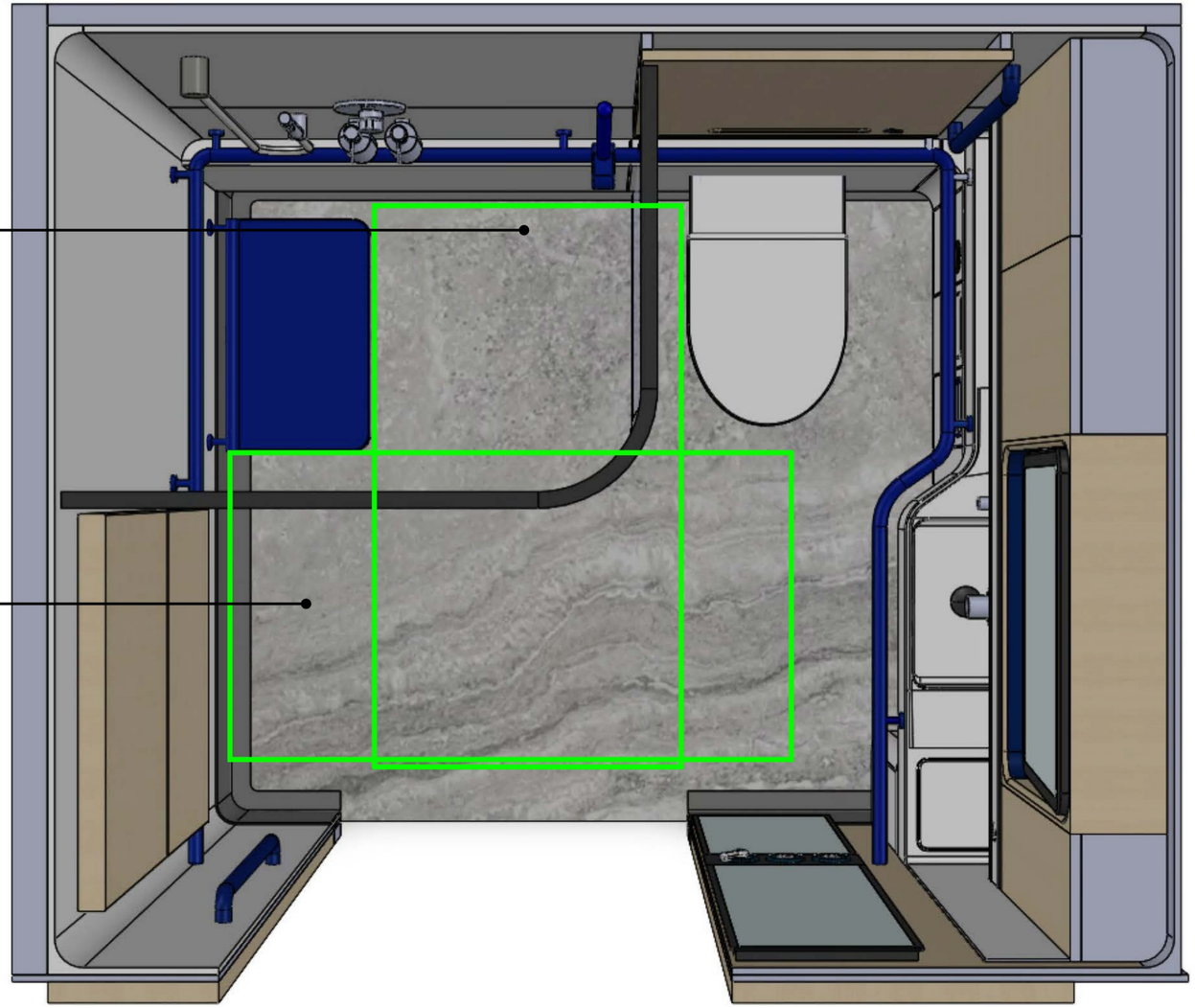
Accessible Bedroom Toilet | Accessibility

RVAAC Accessible Space 2
There should be clearance between the toilet and shower seat when folded down for an RVAAC accessible space of 59" x 32". This position should be suitable for side transfer to the toilet and the shower seat.

RVAAC Accessible Space 3
There should be clearance between the shower seat when folded down and the door sidewall for an RVAAC accessible space of 59" x 32'. This position should be suitable for side transfer the shower seats and access for the baby changer.



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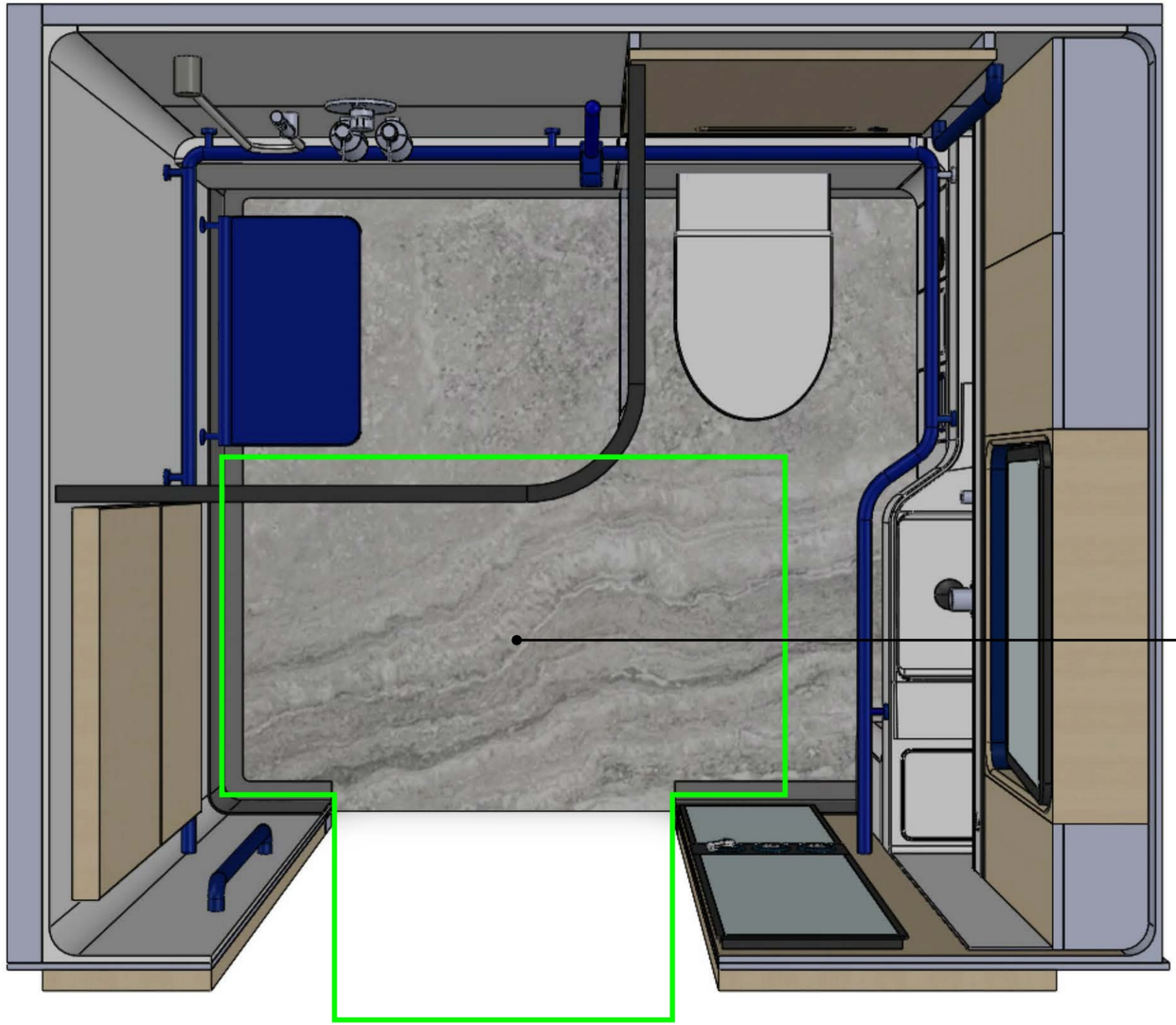
Accessible Bedroom Toilet | Accessibility



ADA T- maneuver Space
When the shower seat is folded down, there should be clearance for a T-maneuver through the bathroom door.

Accessible Bedroom Toilet | Room Features

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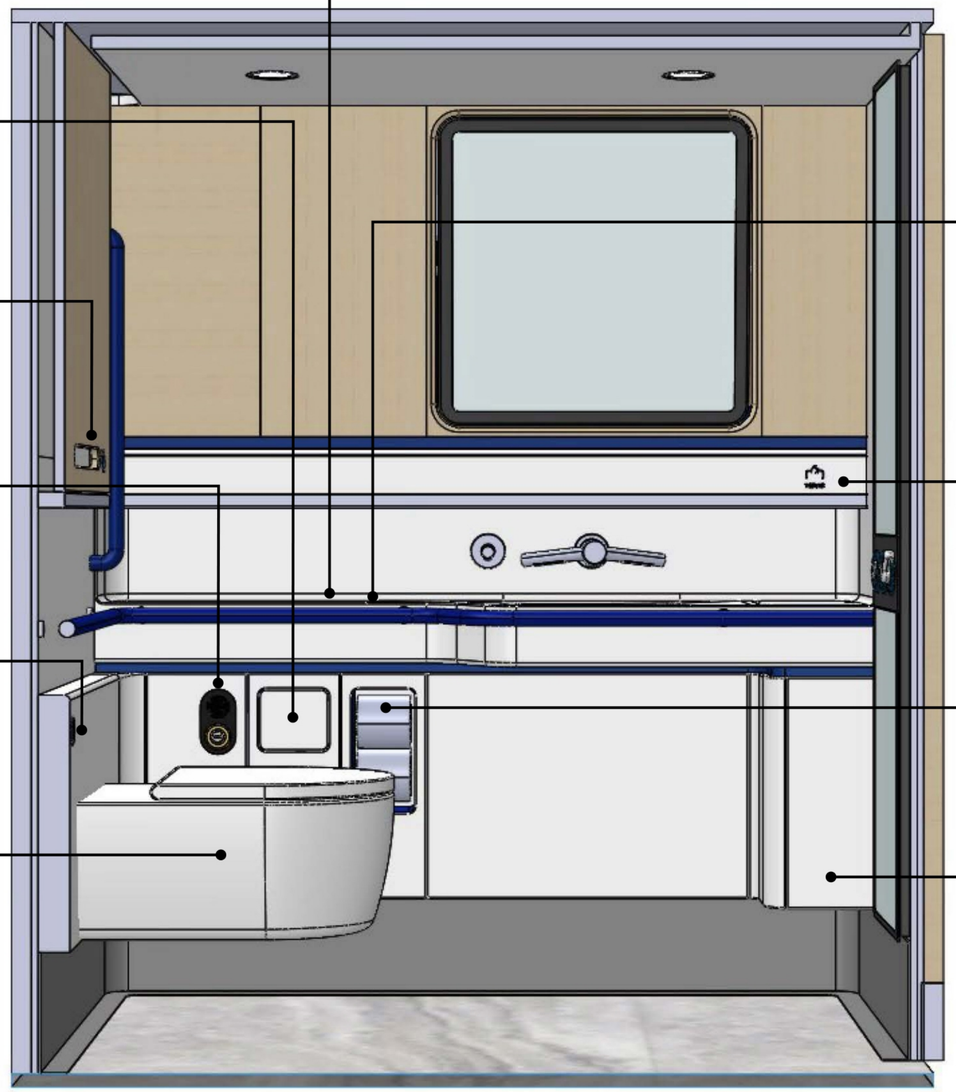
Accessible Bedroom Toilet | Amenities and Features



Sanitary Waste
A sanitary bin with modesty flap is provided to the right of the toilet. Position and function should comply with ADA.

Toilet Seat Cover Dispenser
A dispenser for paper toilet seat covers should be located by the toilet. Position and function should comply with ADA regulations.

Call for Aid Button
There should be a call for aid button adjacent to the toilet. Position and function should comply with ADA.

Toilet Flush
A two button touch-less flush is located on the back wall providing standard and eco flush. Position and function should comply with ADA.

Toilet
The toilet has a seat and a cover. The form of the toilet is undercut at the bottom to maximize wheelchair clearance. Toilet seat and seat lid should all have soft close mechanisms.

Sharps Bin
Provision for a sharps bin should be provided within the room.

Sink Surface
Sink surface should be large enough to store a wash bag and toiletry items and aid the safe and clean disposal of a colostomy bag . Marine edge should run along entire length and a draining surface angled towards sink.

Tissue Dispenser
Tissue dispenser should be positioned near the trash and sink.

Toilet Paper Storage
The toilet paper should be stored in the wall of the bathroom.

Trash
A trash bin is provided to the right of the sink. The volume should be 14 gallons minimum. Position and function should comply with ADA. The opening to the trash should be a minimum of 8” x 10”.

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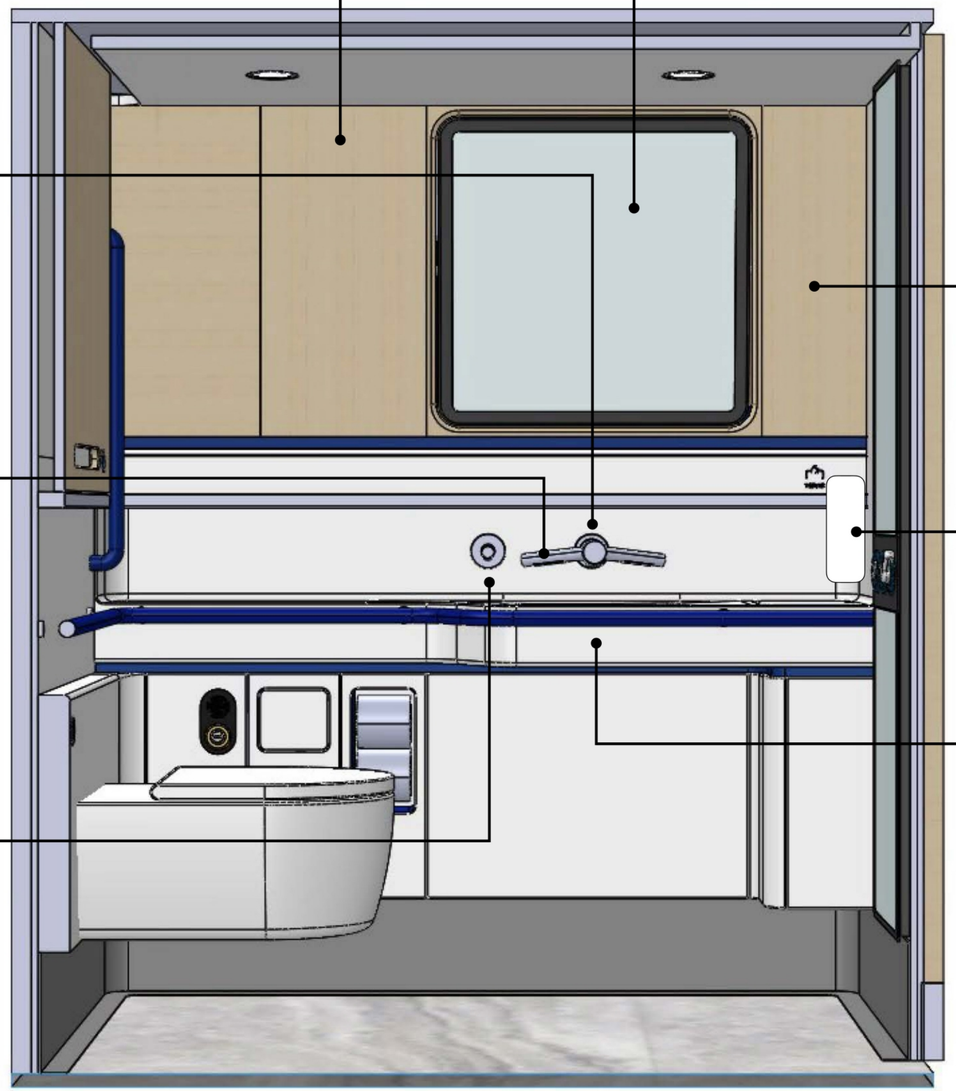
Accessible Bedroom Toilet | Amenities and Features

Crew Cabinet
Cabinet storage is provided for crew to store cleaning and bathroom servicing items.

Automatic Water Faucet
Water is automatically dispensed when hands are placed under the faucet. A physical element should be visible so it is clear where water is dispensed from. Temperature of water should be controllable. Water pressure, water flow should not create any water splash or spill outside of the sink area.

Automatic Hand Drier
An automatically triggered hand dryer should be included under the vanity unit. This can be part of the faucet or supplied separately. A physical element should be visible so it is clear how to use the dryer. The dryer should use high velocity air and HEPA filters similar to a Dyson Airblade. The air dryer should not blow water out of the sink.

Soap Dispenser
An automatic soap dispenser should be included above the sink area. A physical element should be present to indicate how and where the soap will dispense.



Vanity Mirror
A large mirror is positioned in front of the sink. The bottom edge of the reflective surface should be a maximum of 40” above the finish floor. If this is not possible, the mirror should be angled to allow wheelchair passengers to use it.

Passenger Cabinet
A cabinet to the right of the mirror should be provided for passengers to store personal toiletry items. The position of the lower portion of this cabinet should comply with ADA reach rules.

Hand Lotion Bottle
An area on the side of the sink should be reserved for a refillable hand lotion bottle fixed to the side wall.

Sink
The sink should have a marine edge so any water spill is captured in the sink area. A splash back behind the sink should protect the surrounding areas from water splashed onto the back wall from the sink area. The sink should be accessible while sat on the toilet.

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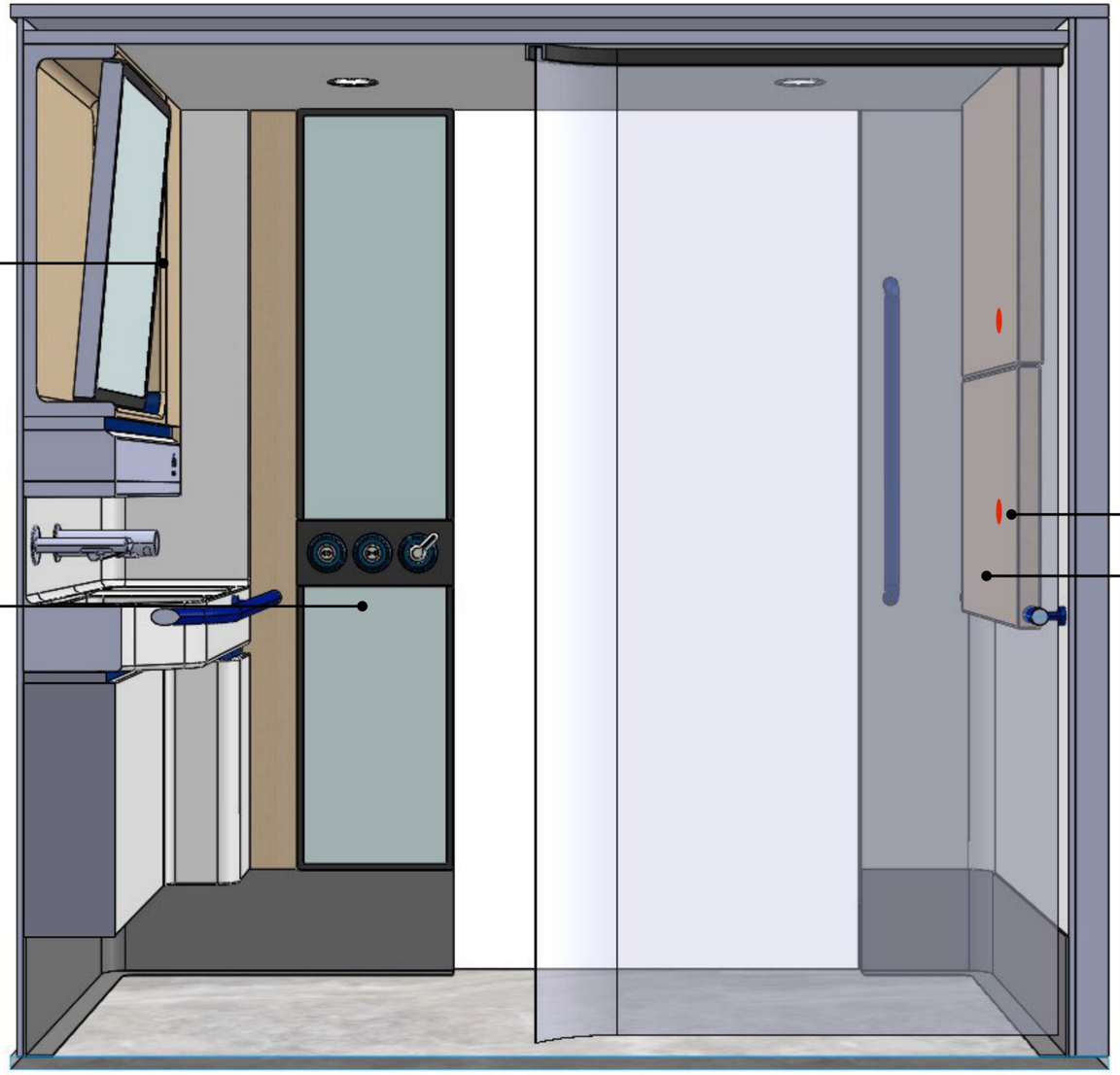
Accessible Bedroom Toilet | Amenities and Features

Towel Storage
A cabinet, surface or hooks should be provided to store bath towels, face cloths and hand towels (2 of each standard Amtrak towels). These should be located in a position accessible for a person using a wheelchair

Full Length Mirror
A full length mirror should be provided in addition to the sink mirror. The bottom edge of the reflective surface should be a maximum of 40” above the finish floor.



Towel Hooks
At least two towel hooks should be provided. One hook must be within the reach range of a person using a wheelchair at a maximum height of 45”.

Fold Down Baby Changing
A baby changing table should be provided with an RVAAC compliant clear space in front of it. The changing table should be easy to deploy and stow with an intuitive handle. The mechanism should be durable, free from jamming and racking. The design should meet abuse loads. It should have a soft opening mechanism. Position and function should comply with ADA.

Accessible Bedroom Toilet | Amenities and Features

Drainage

The floor in the shower area should be designed to minimize water spreading to other parts of the room with a drainage angle directing water towards a covered drain in the corner of the room. The floor must also allow wheelchair passengers complete freedom to turn and maneuver in the room with floor levels compliant with ADA regulations .



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Accessible Bedroom Toilet | Amenities and Features



Rain Shower
A rain shower in the ceiling provides a shower above head height. Rain shower should be seamlessly integrated into the ceiling in order to maximize head room in the bathroom.

Shower Control
An on/off button and temperature control are located on the bathroom wall close to the door. The shower control should prevent any accidental activation when using the toilet. Dimensions, position and function should comply with ADA.

Hand Shower
A second hand shower is located with a slimline design handset. A hose clip should be included to prevent the hose from rattling while the train is in transit. Dimensions, position and function should comply with ADA.

Shower Seat
A fold down shower seat should be provided. Dimensions, position and function should comply with ADA.

Fold Down Grab
The fold down handrail should be provided to aid transfer on to the shower seat and on to the toilet seat. When stored in the vertical position it should not protrude from the sidewall more than 3” to keep side transfer space clear for the toilet. Dimensions, position and function should comply with ADA.

Shower Curtain
A shower curtain should be provided to control water spread in the room while the shower is on. It should also provide a modesty screen for users. The curtain should be easy to deploy and stow with an intuitive handle.

Dispensing Bottles
3 refillable Amtrak bottles dispensing shampoo, conditioner and body lotion. Bottles should be fixed to the wall and easily refilled or replaced by Amtrak staff. Dimensions, position and function should comply with ADA.

Accessible Bedroom Toilet | Lighting

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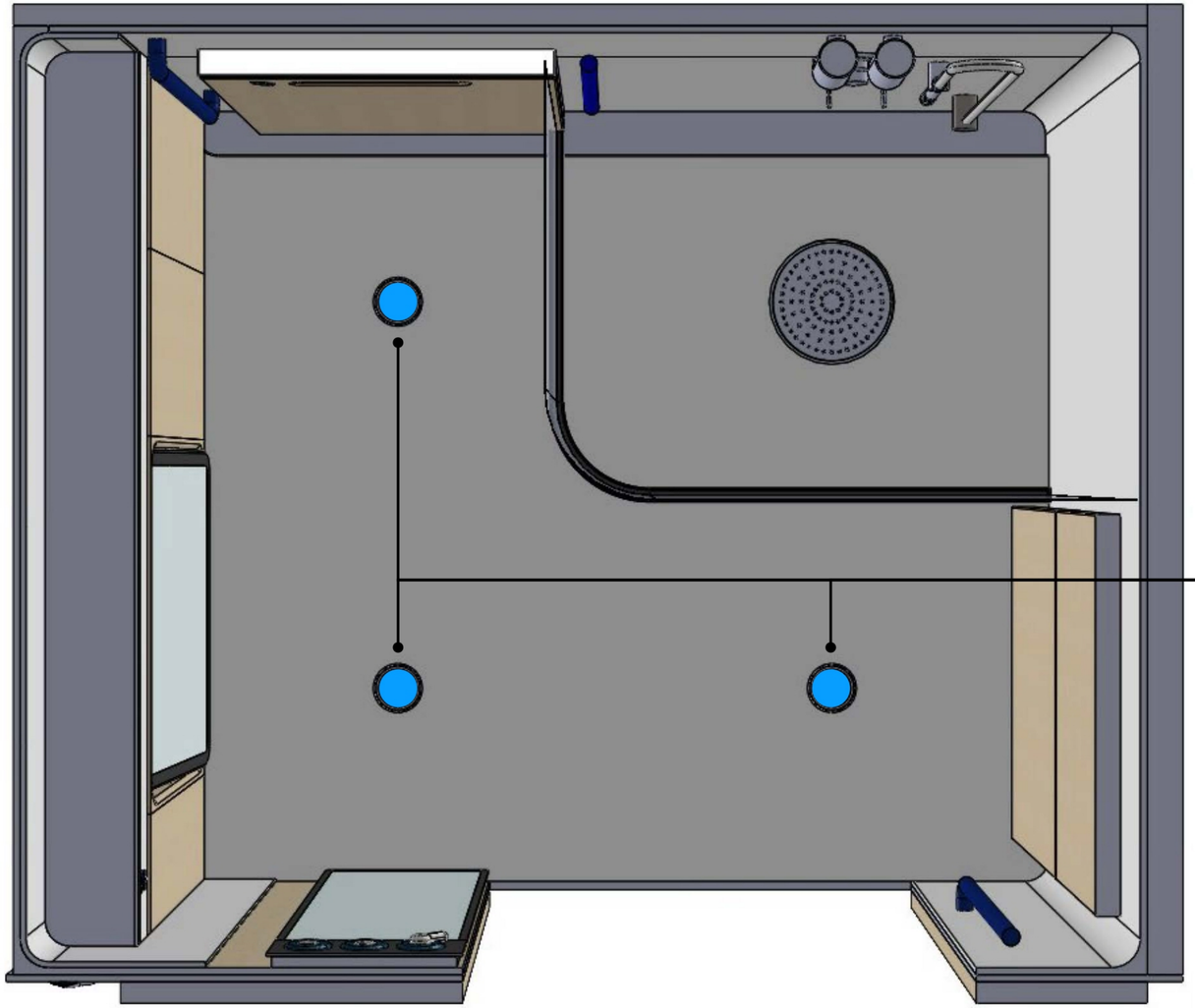
Accessible Bedroom Toilet | Lighting



LED light panel spot

Small circular LED light panels act as spot lights - frame to be color matched. Activated only when door is locked from the inside. Position, number and style to be approved by Amtrak.

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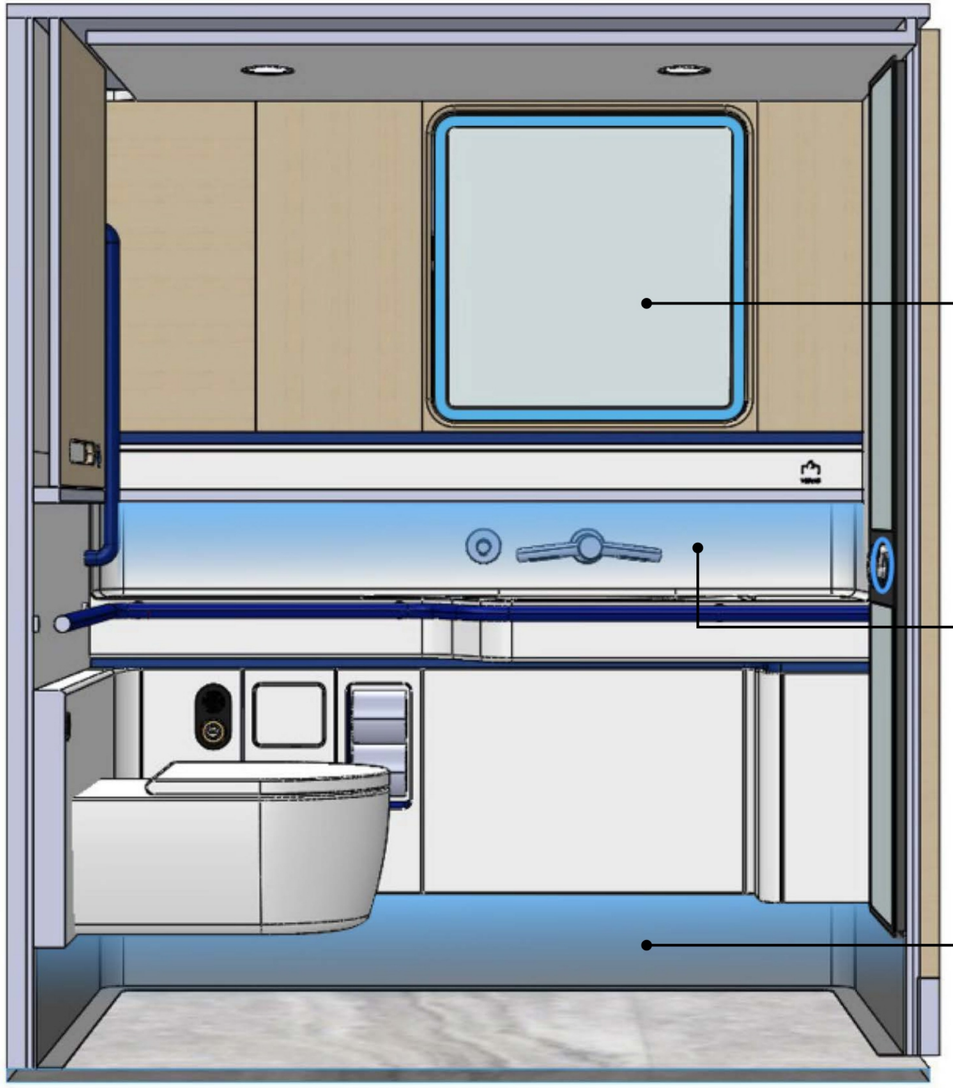
Accessible Bedroom Toilet | Lighting



LED Illuminated Mirror

The vanity mirror is illuminated with an LED strip around the border. Activated with a switch located near or on the mirror.

Vanity Wash Light

The cabinet washes indirect light on to the sink surface. Activated only when door is locked from the inside.

Floor Wash Light

Lower sidewall panels wash indirect light on to the floor. Activated by the master control switch.

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Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas

Food & Beverage

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Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas
Crew Areas

08 | Cafe Counter

Cafe Counter | Features

Display Cabinets
Maximize available space for additional display items menus and Amtrak literature

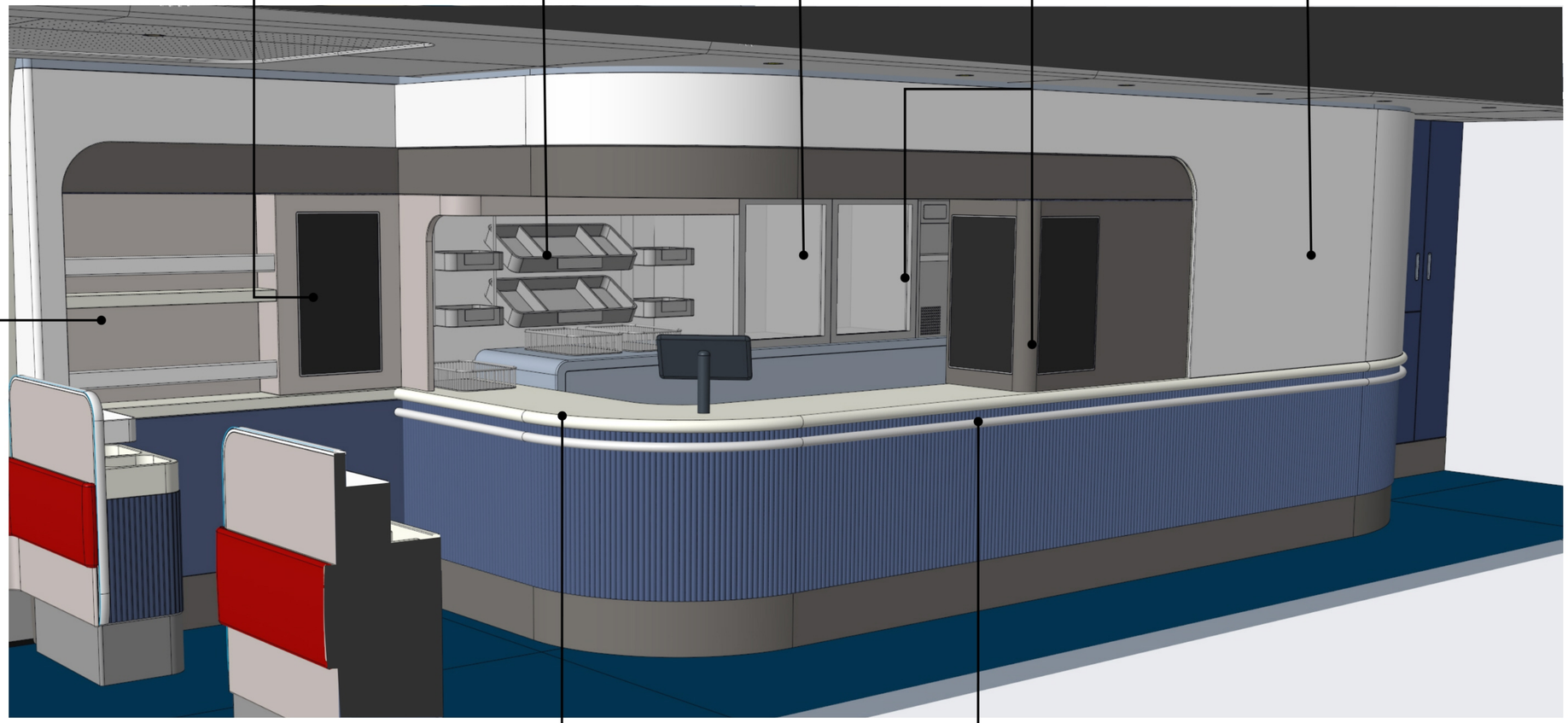
Digital Menus
Position at point of purchase

Dry Display Area
Premium finishes

Cold Display Fridges

Digital Menus
Aisle side and front side

Branding Area
Area reserved for branding



Open Accessible Counter
Accessible counter height over entire length

Handholds
Accessible handhold across entire length of Cafe wall

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Cafe Counter | Features

Condiment Stations
Condiment stations to provide space for napkins, condiments and serving items, Shelf to rest a drink or snack. Trash bins maximized in lower area



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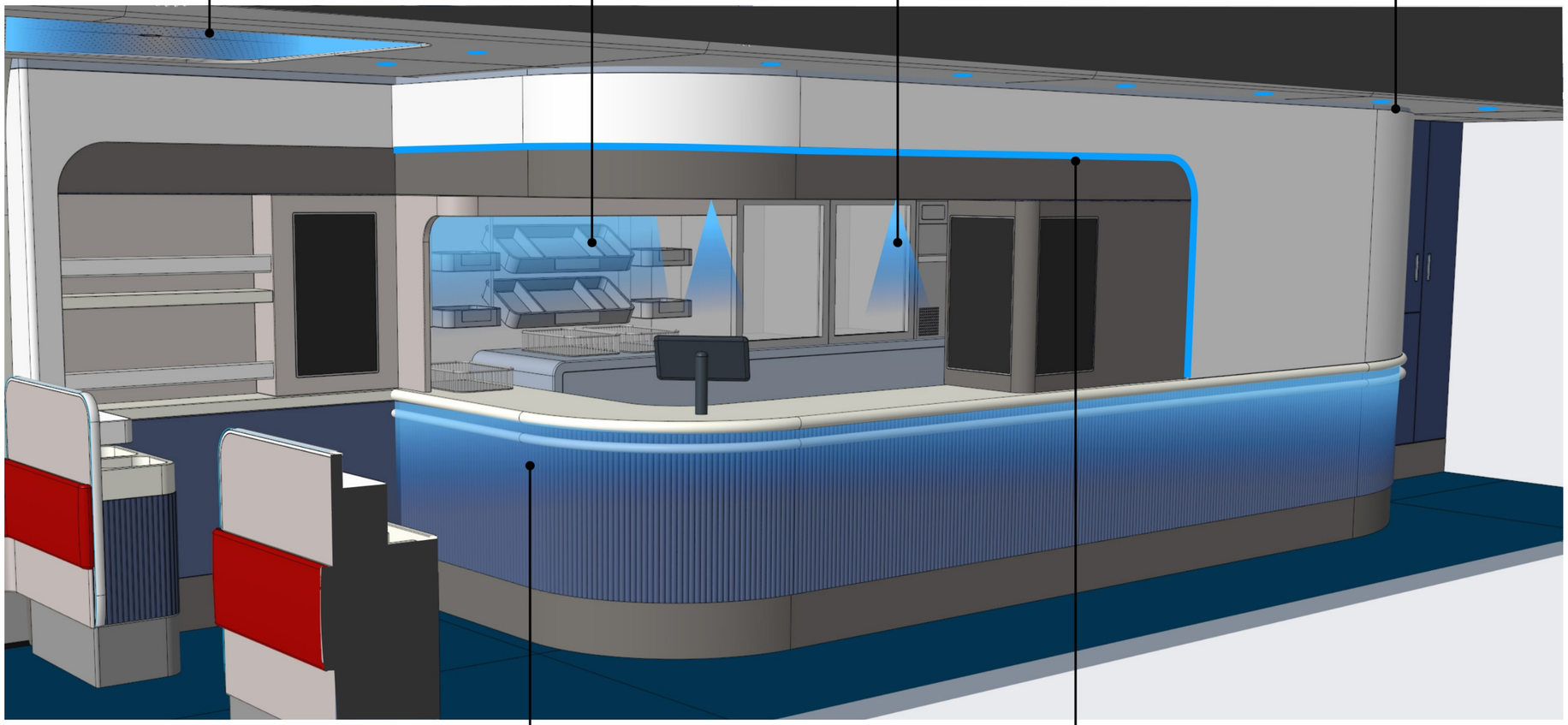
Cafe Counter | Lighting

Ceiling Wash lights
Ceiling wash lights identical to with coach areas

Display lighting
Lighting to highlight display items

Counter spot lights
Down lights to illuminate counter and counter display

Panel Spot Lights
Spot lights provide downlighting along aisle and at cafe counter



Counter Wash Lights
Indirect light to wash down entire front edge of the Cafe counter

Feature Light
Feature or pendant light

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Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas

09 | Diner & Cafe Features

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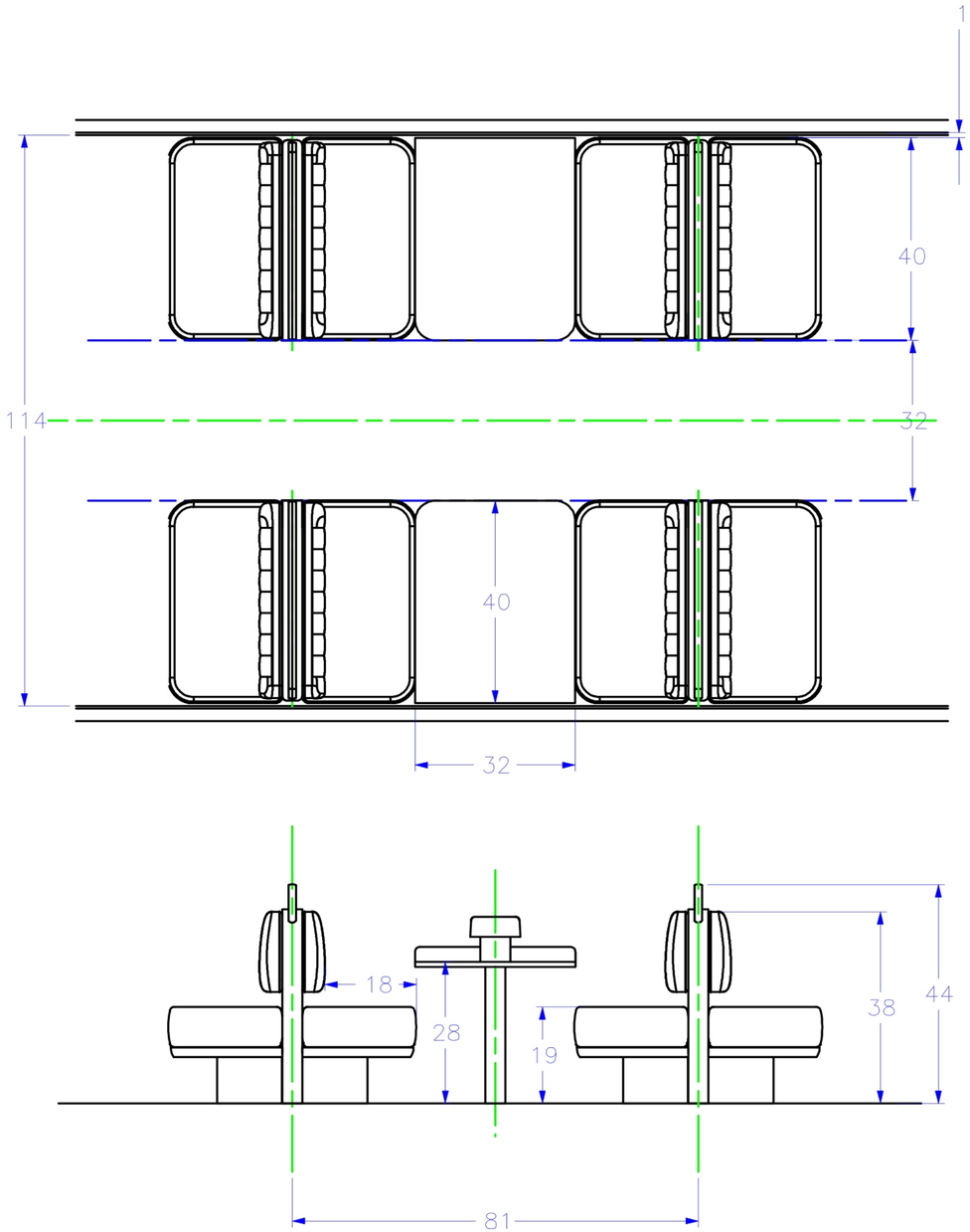
Diner & Cafe | Seating Features



Seat Dimensions

Seat width shall be maximized with a minimum acceptable dimension of 40” wide for a seat suitable for two passengers.

To achieve a 32” accessible path between diner seats, the side wall detail/clearance will need to be minimized and tolerances will need to be tightly controlled. Seat pan height shall be between 18” and 19” with a seat pan depth of no less than 18”. Seat back height from finished floor should be a minimum of 38” with a higher divider no lower than 44”.

All seat dimensions, cushion density/ shore hardness will be subject to mock-up review, testing and approval by Amtrak.

Table Dimensions

A minimum usable table width of 32” shall be provided. Access in and out of the seat should be evaluated carefully. A tapered leading edge may be required to aid access to the seat. Top of table surface should be between 27” and 28” while also allowing 3” clearances in height for the legs of a 95 percentile male. Table leg location shall be positioned as to not provide a knee clash for passengers.

All table dimensions will be subject to mock-up review, testing and approval by Amtrak.

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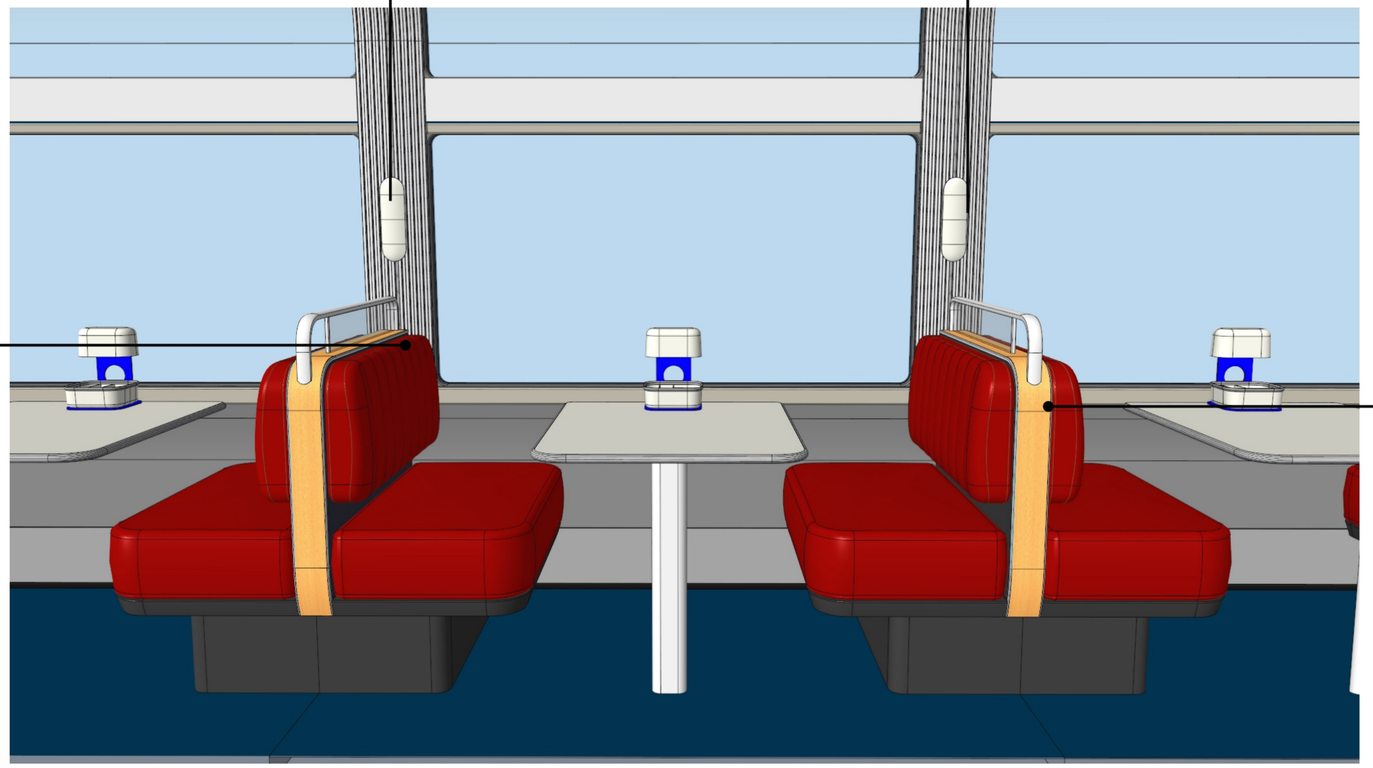
Diner & Cafe | Seating Features

Window Alignment
The center of the table should be central to the window with the center of the diner module in alignment with the window pillar repeating at an 81" pitch.



Seat Comfort
Ergonomics, back support, seat back and seat pan pillowing, cushioning and seat trim and detailing will be evaluated and judged carefully during the design review process and will be subject to Amtrak approval.

Seat Stowage
Booth seats should be designed with trunk type stowage in the base. The intention here is to provide extra stowage for crew only access to store emergency supplies. The access and design of the trunk stowage should not negatively impact the comforter the aesthetic of the seat.

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Diner & Cafe | Seating Features

Handholds
Compliant handhold should be provided on the aisle side of every booth seat.

Table Surface
A high quality table surface should have a protective edge trim detail. Split lines should be managed to a high tolerance and sealed to create a flush finish and prevent any potential dirt build up in edges.

Pedestal
Seat pedestals should be seamless with the floor, with no dirt traps or protruding edges to support easy cleaning routines. Pedestals should be undercut from the seat base to provide a floating seat aesthetic.

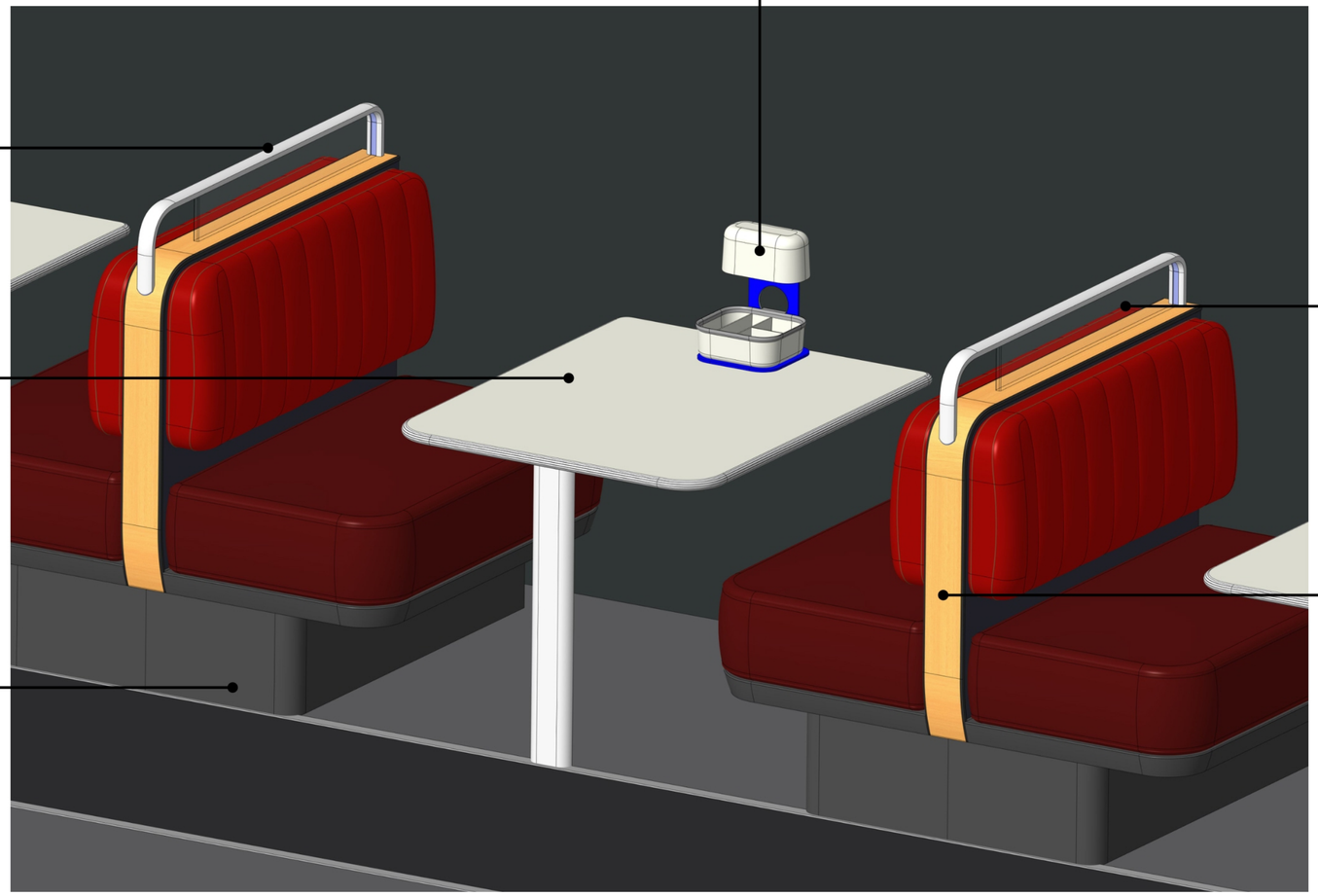

Table Lamp
A table lamp shall be provided at every table in the Diner against the side wall. An integrated condiment basket or rail shall be provided on the base of the lamp suitable to store a varied arrangement of condiments to be defined during PDR.

Privacy Divider
A glazed privacy divider should be provided between back to back seats. Divider frame should be integrated with the handholds.

Hardwearing Quality
Seat structure should be finished with high quality, hard wearing laminates and veneers. The form of the seats can be simple providing that the design is delivered using premium materials. Laminate edges should be protected with delicate trim details.

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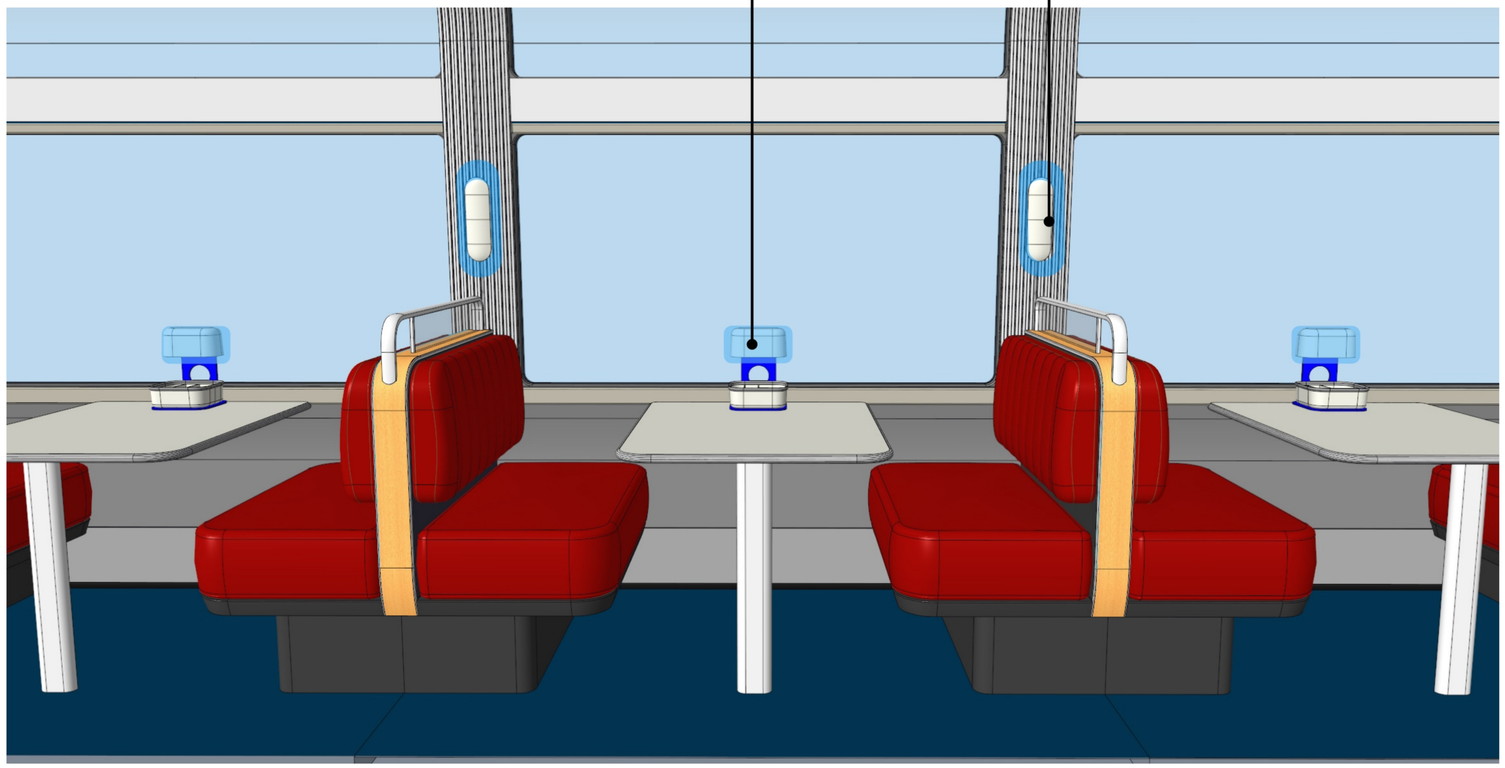
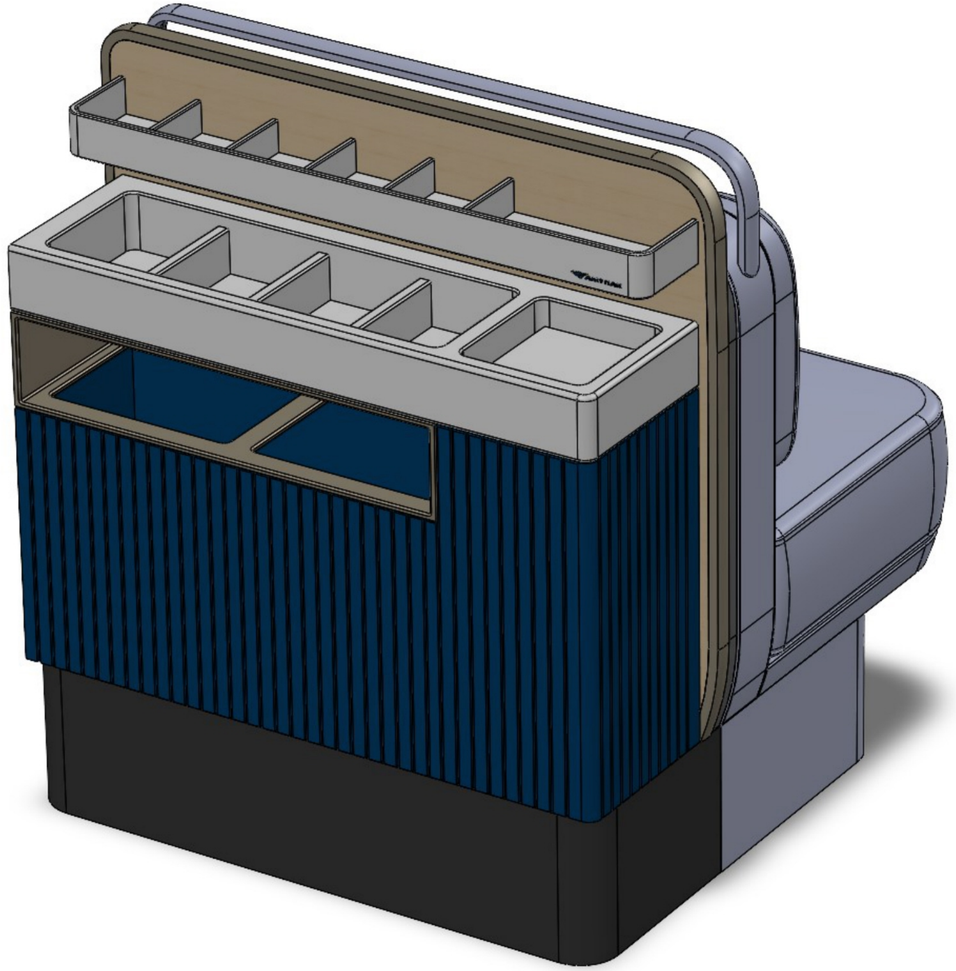
Diner & Cafe | Lighting

Table Booth Lamp
At each table position in the Diner a table lamp shall be provided. The lamp is intended to be a premium design feature that contributes to the overall lighting levels of the space. .

Wall Lamp
On each window pillar in Cafe, Diner and Lounge areas a wall lamp shall be provided that casts indirect light onto the pillar. The lamp is intended to be a premium design feature that contributes to the overall lighting levels of the space.



Diner | Service Station



Service Station

A service station should be provided within the Diner. The purpose of this station is to assist crew with performing an efficient food service. Crew will use the station to replenish the tables so should be designed to store provisions needed for table settings including cutlery, napkins (standard and small beverage) menus and items to support coffee service. It should have open storage and closed storage and may also require a trash bin.

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Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas

10 | Lounge Features

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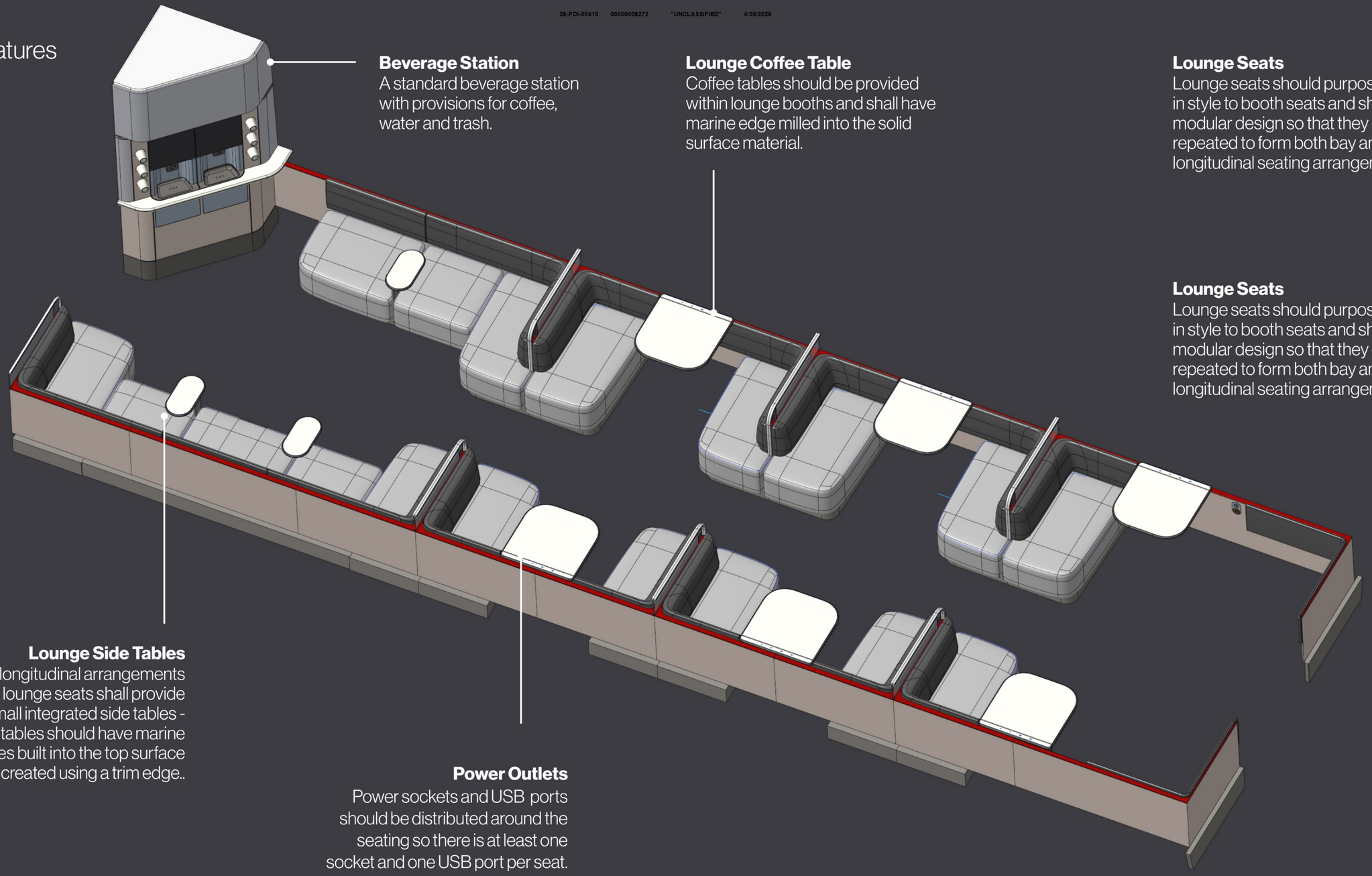
Lounge | Features



Beverage Station
A standard beverage station with provisions for coffee, water and trash.

Lounge Coffee Table
Coffee tables should be provided within lounge booths and shall have marine edge milled into the solid surface material.

Lounge Seats
Lounge seats should purposefully differ in style to booth seats and should utilize modular design so that they can be repeated to form both bay and longitudinal seating arrangements.

Lounge Seats
Lounge seats should purposefully differ in style to booth seats and should utilize modular design so that they can be repeated to form both bay and longitudinal seating arrangements.

Lounge Side Tables
Any longitudinal arrangements of lounge seats shall provide small integrated side tables - side tables should have marine edges built into the top surface or created using a trim edge..

Power Outlets
Power sockets and USB ports should be distributed around the seating so there is at least one socket and one USB port per seat.

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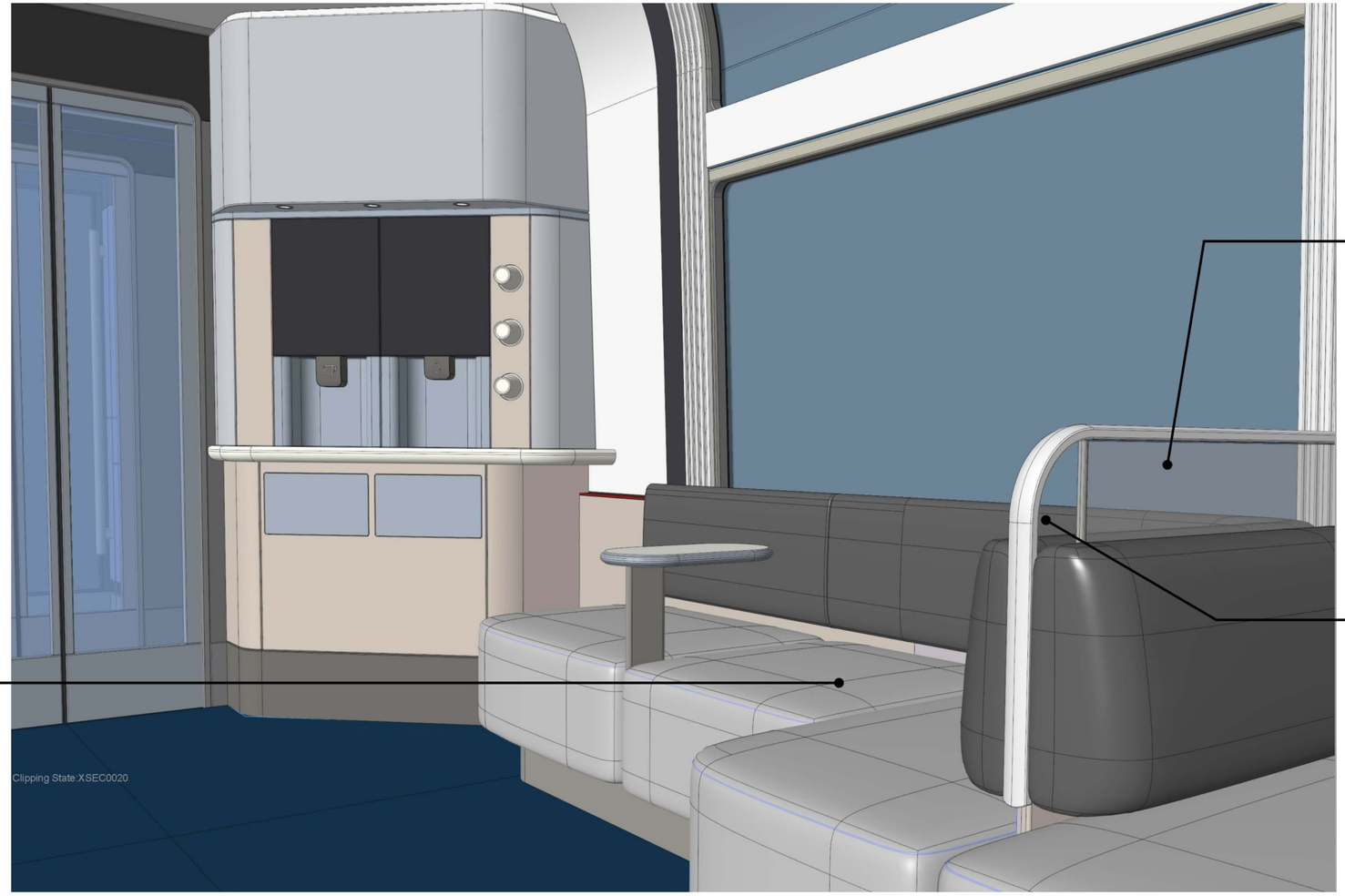
Lounge | Features

Seating Dimensions
Lounge seats should have a minimum seat pan depth of 20” and a minimum seat width of 20”. Seat pan height should be a minimum of 18”.

Seat Comfort
Ergonomics, back support, seat back and seat pan pillowing, cushioning and seat trim and detailing will be evaluated and judged carefully during the design review process and will be subject to Amtrak approval.



Lounge Privacy Dividers
Privacy dividers should be included where seating is back-to-back. The height of the divider shall be low enough not to obstruct view out of the windows, yet high enough to provide some level of privacy for seated passengers.

Grab Handles
Purposeful and compliant handholds integrated with the divider should
be located on entry and exit points to lounge booths.

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Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas

Toilets & Showers

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas

11 | Accessible Toilet Room

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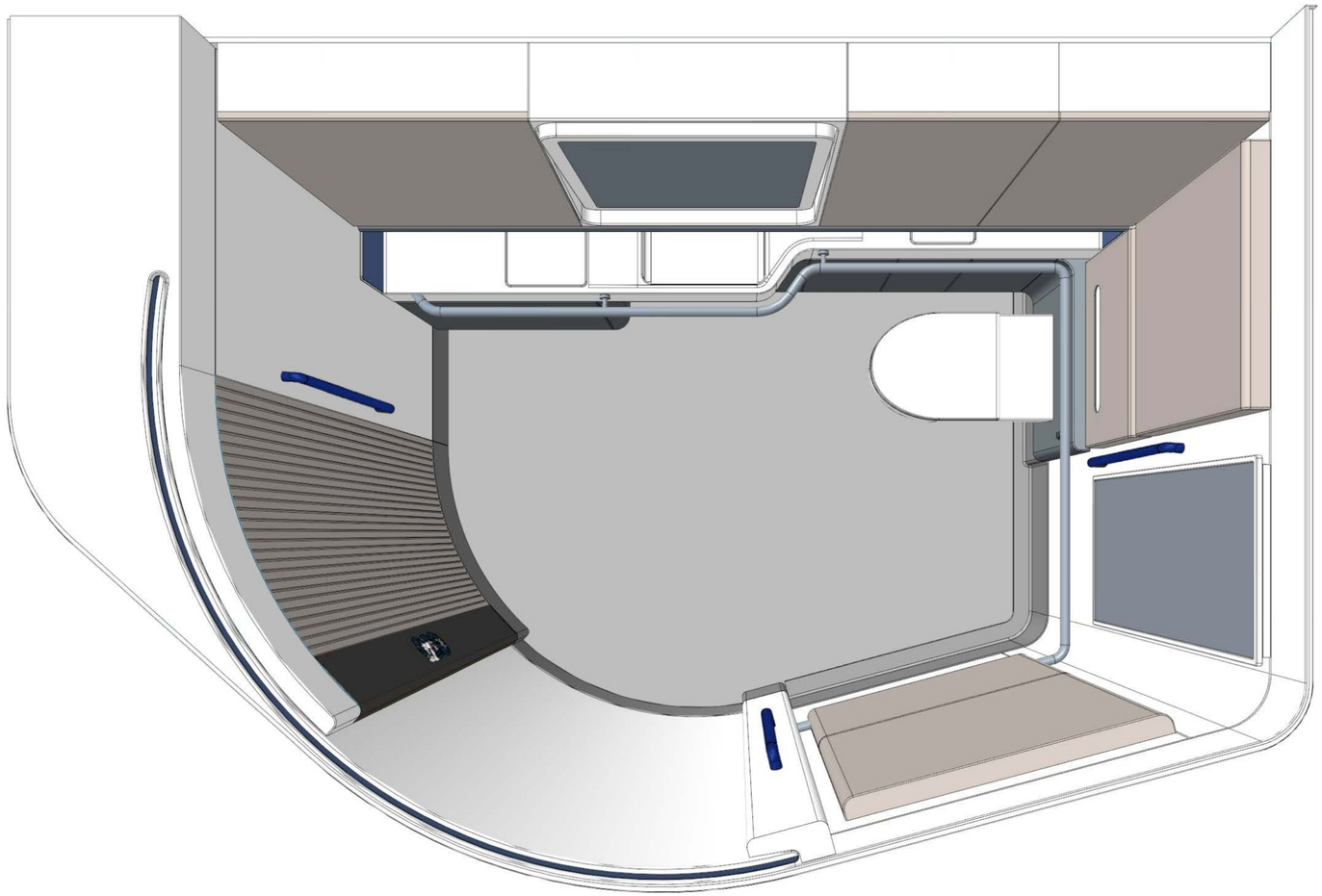
ATR | General

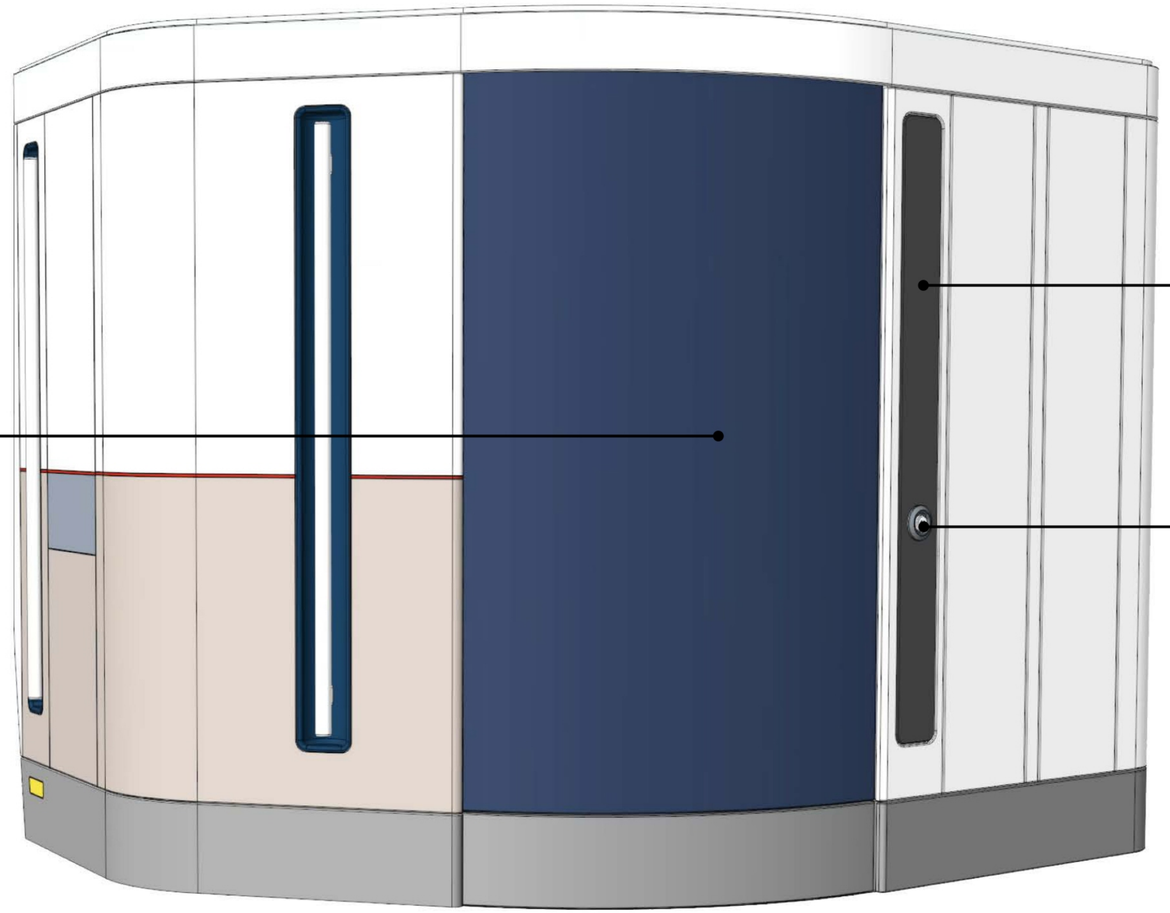


The Accessible Toilet Room

The ATR is ADA compliant but also taking on the RVAAC enhanced accessibility recommendations for restrooms.

Design will be subject to mockup, user testing and Amtrak approval.

ATR | Amenities and Features



Branding and Information Panel
A space should be reserved for signage and branding.

Occupied Light
A clear signal to show if the toilet is occupied/available or out of service should be provided.

Room Door Controls
The controls for the bathroom door must be ADA compliant in position, size and configuration. The buttons should be easy and intuitive to use. The buttons should have visual and haptic feedback for occupied, out of service and available.

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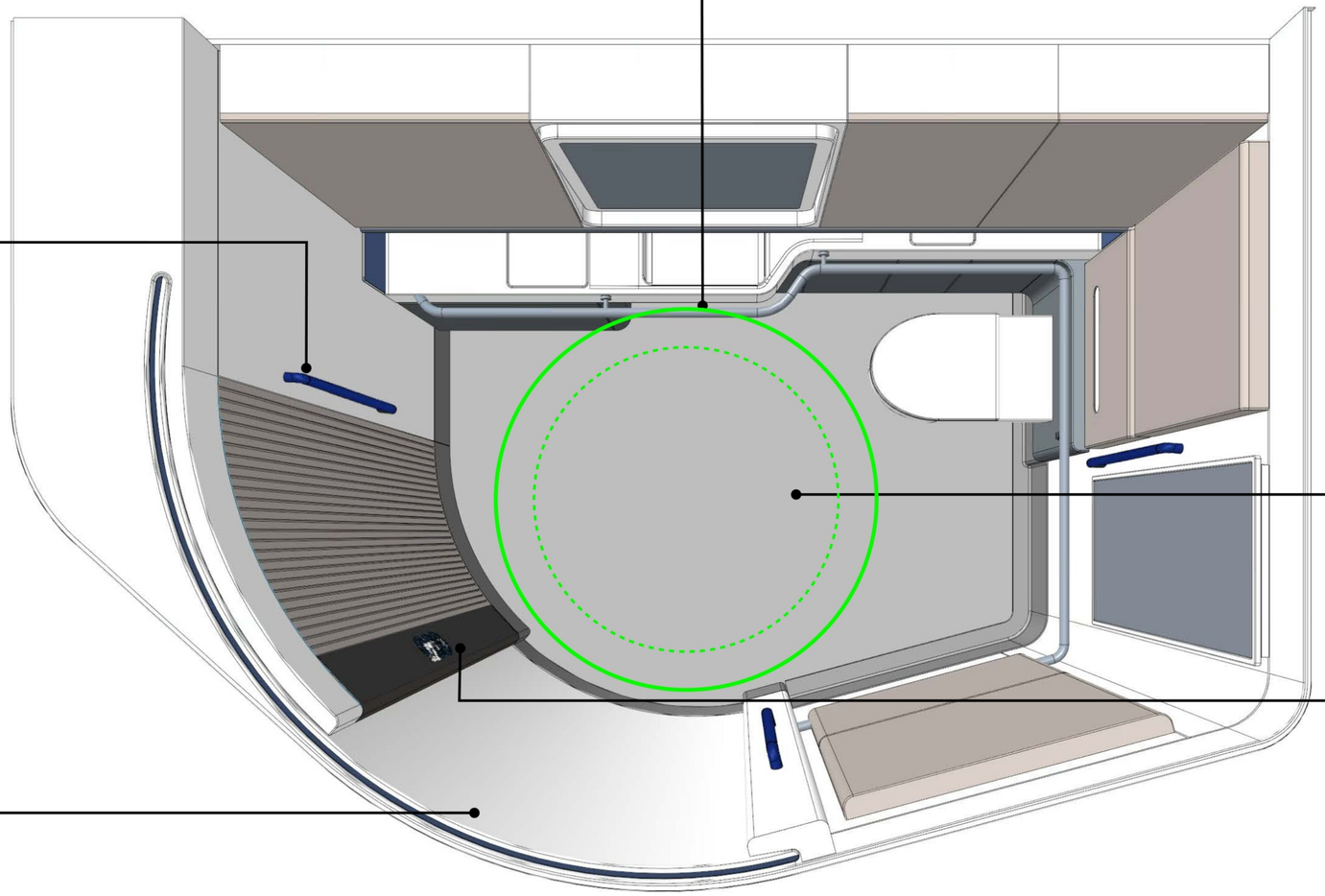
ATR | Accessibility

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

ATR | Accessibility



Toilet + Sink Handrail
ADA compliant horizontal handrails positioned in the toilet and sink area. The handrail should be a compliant height and length. The handrails should be one continuous loop where possible.

Vertical Handrails
ADA compliant vertical handrails shall be provided and will be subject to review during mockup stages.

60” Turning Circle
A 60” turning circle should be provided inside the toilet with the door closed.

Room Door Controls
The controls for the bathroom door must be ADA compliant in position, size and configuration. The buttons should be easy and intuitive to use. An accessible manual lock should be included with an indicator to show lock condition. The buttons should have visual and haptic feedback.

44” Toilet Door
The toilet door should be an automatic sliding door and should have a minimum clear opening of 44”.

***The position of all accessible interaction points, turning spaces and clearances will be subject to review, mockups, and user testing.**

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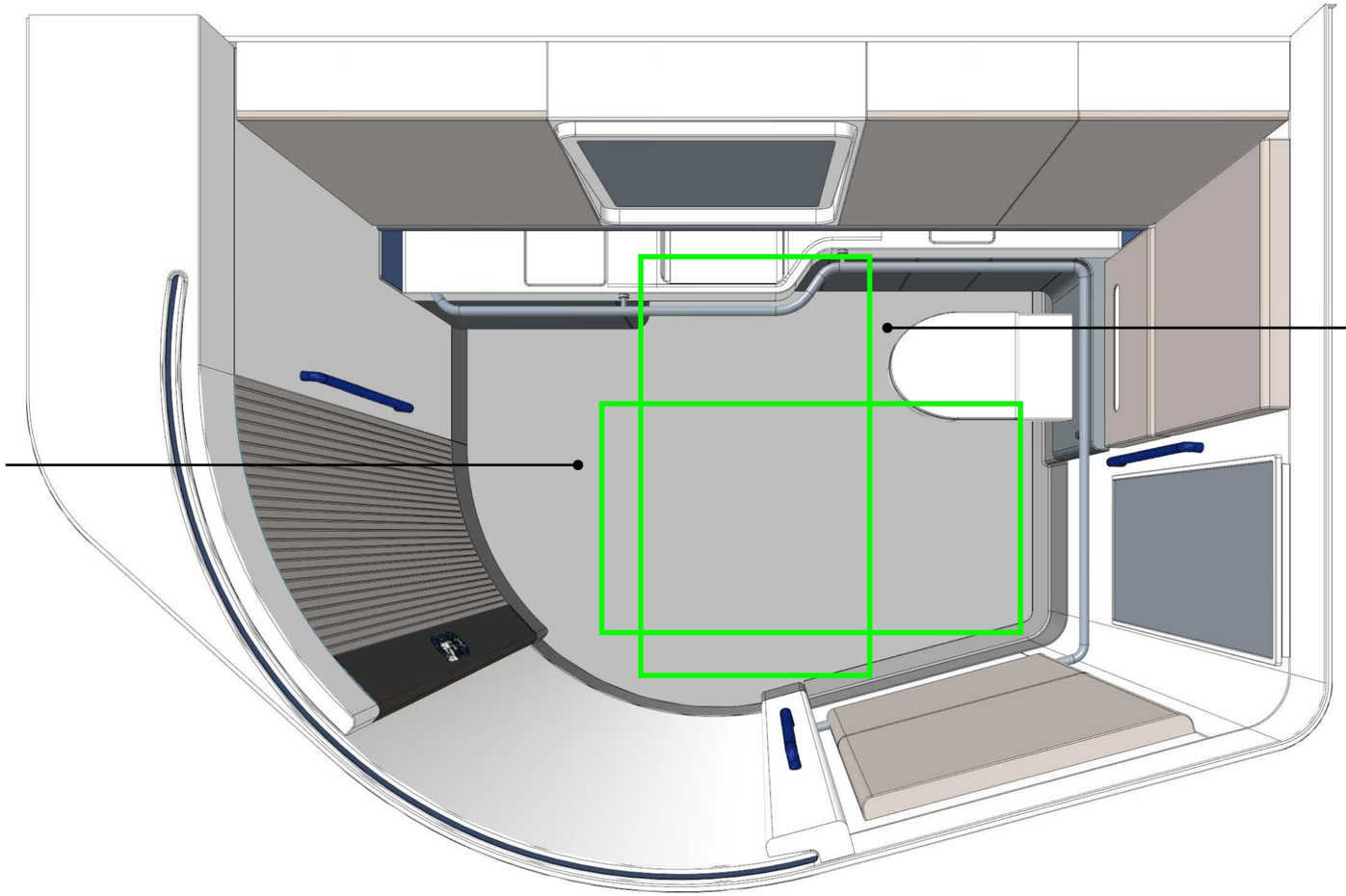
ATR | Accessibility

RVAAC Accessible Space 2
There should be clearance adjacent to the toilet for an RVAAC accessible space of 59” x 32”. Space should be in a suitable place to aid transfer to the toilet .



RVAAC Accessible Space 1
There should be clearance directly in front of the sink to fit an RVAAC accessible space of 59” x 32”. Access to the sink should comply with ADA and RVAAC clearances.

***The position of all accessible interaction points, turning spaces and clearances will be subject to review, mockups, and user testing.**

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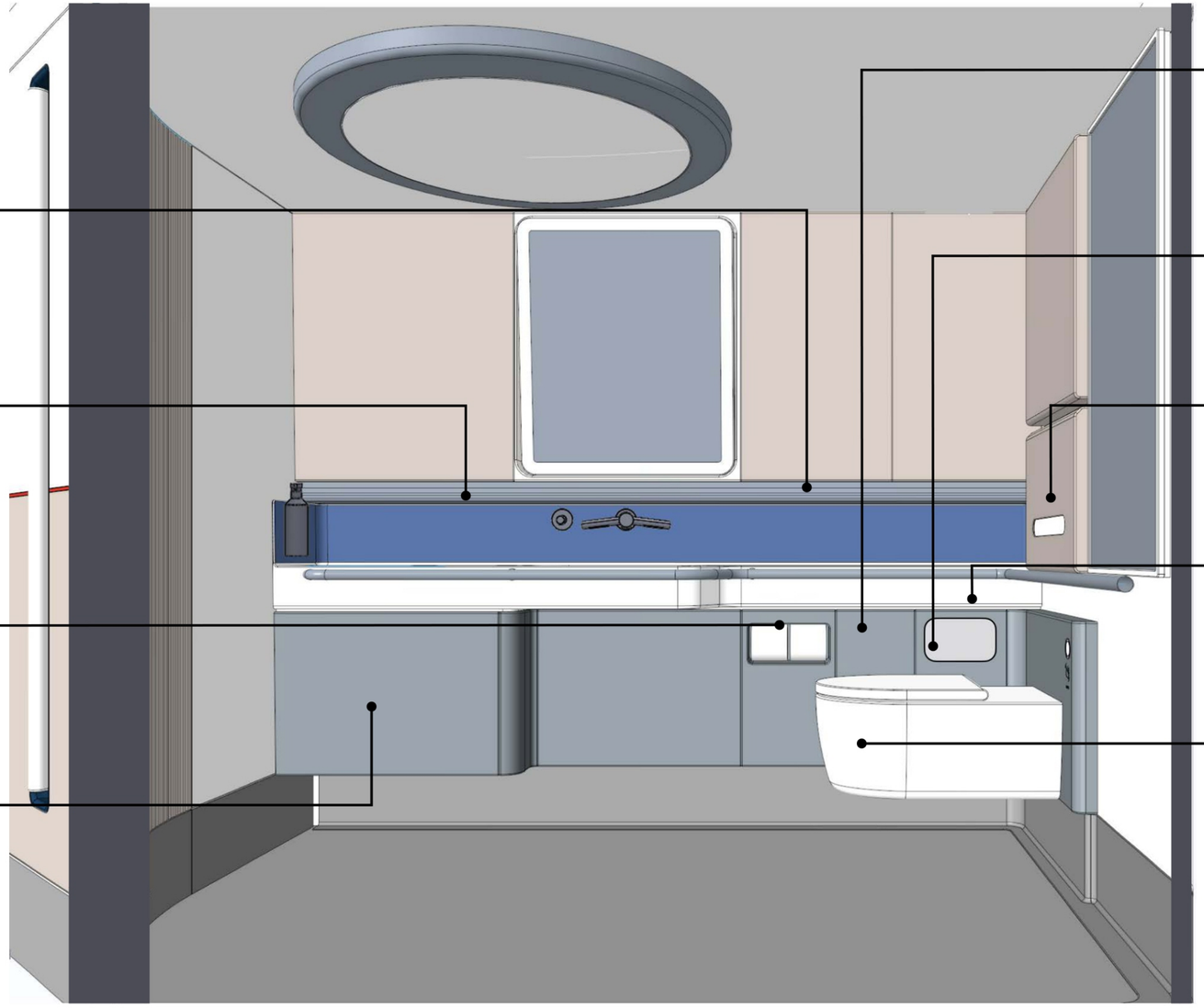
ATR | Amenities and Features



Paper Tissue Dispenser
A paper tissue dispenser should be positioned near the trash and sink. Position and function should comply with ADA.

Paper Towel Dispenser
A paper towel dispenser should be positioned near the trash and sink. Position and function should comply with ADA.

Toilet Paper Storage
The toilet paper should be stored in the wall of the bathroom. Position and function should comply with ADA.

Trash
A trash bin is provided to the right of the sink. The volume should be 16 gallons minimum. Position and function should comply with ADA. There opening to the trash should have a push flap or similar and be a minimum of 10” x 10”.

Sanitary Waste
A sanitary bin with modesty flap is provided to the right of the toilet. Position and function should comply with ADA.

Call for Aid Button
There should be a call for aid button adjacent to the toilet. Position and function should comply with ADA.

Toilet Seat Cover Dispenser
A dispenser for paper toilet seat covers should be located by the toilet. Position and function should comply with ADA.

Toilet Flush
A two button push / touch-less flush is located on the back wall providing standard and eco flush. Position and function should comply with ADA.

Toilet
The toilet has a seat and a lid. The form of the toilet should be floating or undercut at the bottom to maximize wheelchair clearance. The design of the toilet, access and lid design will be subject to testing and ergonomic review during mockup stages and subject to the approval of Amtrak. Toilet seat and seat lid should all have soft close mechanisms.

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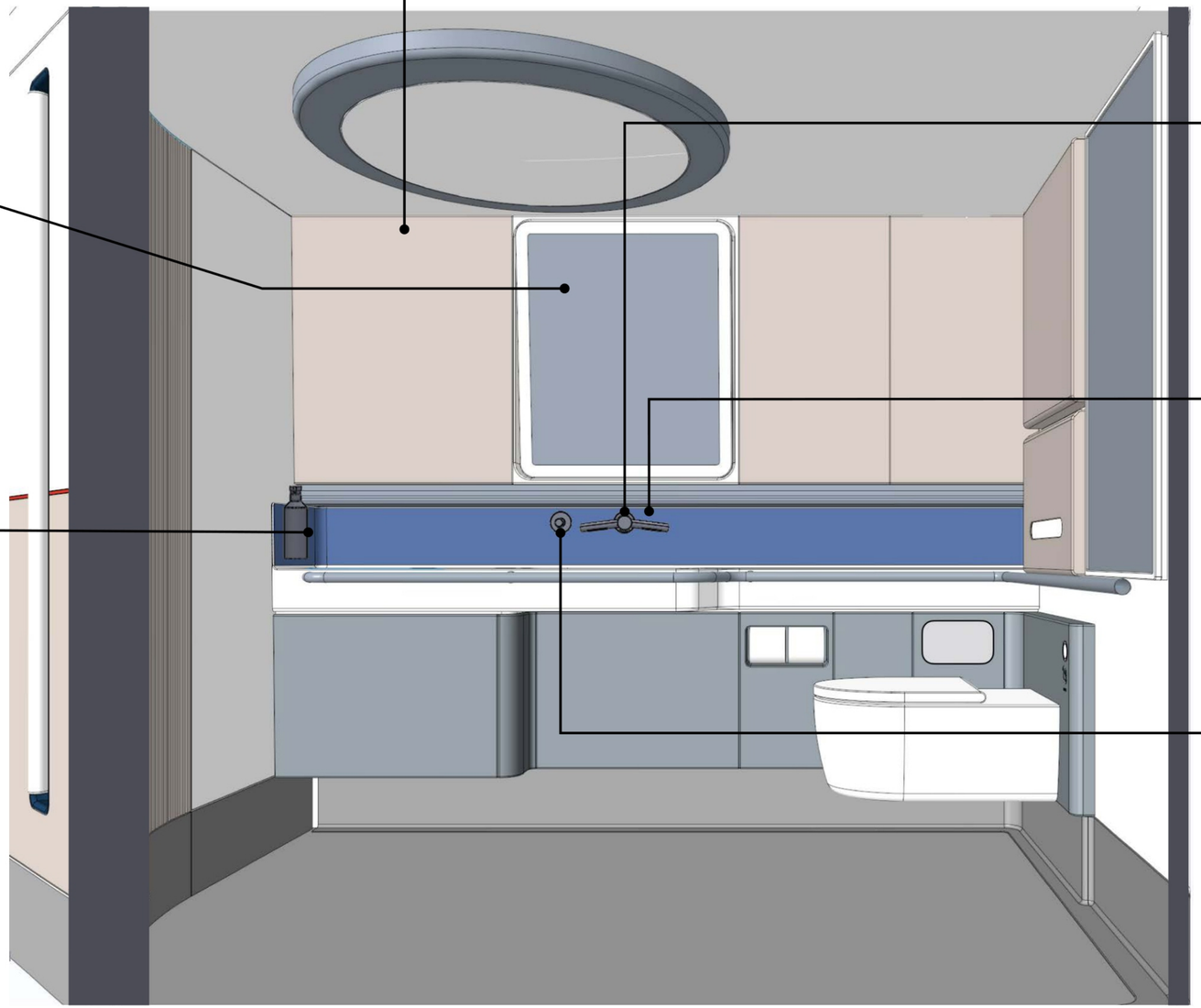
ATR | Amenities and Features

Vanity Mirror
A large mirror is positioned in front of the sink. The bottom edge of the reflective surface should be a maximum of 40" above the finish floor. If this is not possible, the mirror should be angled with an accessible lever to allow wheelchair passengers to use. Dimensions, position and usability will be subject to Amtrak approval.

Hand Lotion Bottle
An area on the side of the sink should be reserved for a refillable hand lotion bottle fixed to the side wall.



Crew Cabinet
Cabinet storage should be provided for crew to store cleaning and bathroom provisions.

Automatic Water Faucet
Water is automatically dispensed when hands are placed under the faucet. A physical element should be visible so it is clear where water is dispensed from. Temperature of water should be controllable. Water pressure, water flow should not create any water splash or spill outside of the sink area.

Automatic Hand Dryer
An automatically triggered hand dryer should be included under the vanity unit. This can be part of the faucet or supplied separately. A physical element should be visible so it is clear how to use the dryer. The dryer should use high velocity air and HEPA filters similar to a Dyson Airblade. The air dryer should not blow water out of the sink.

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Soap Dispenser
An automatic soap dispenser should be included above the sink area. A physical element should be present to indicate how and where the soap will dispense.

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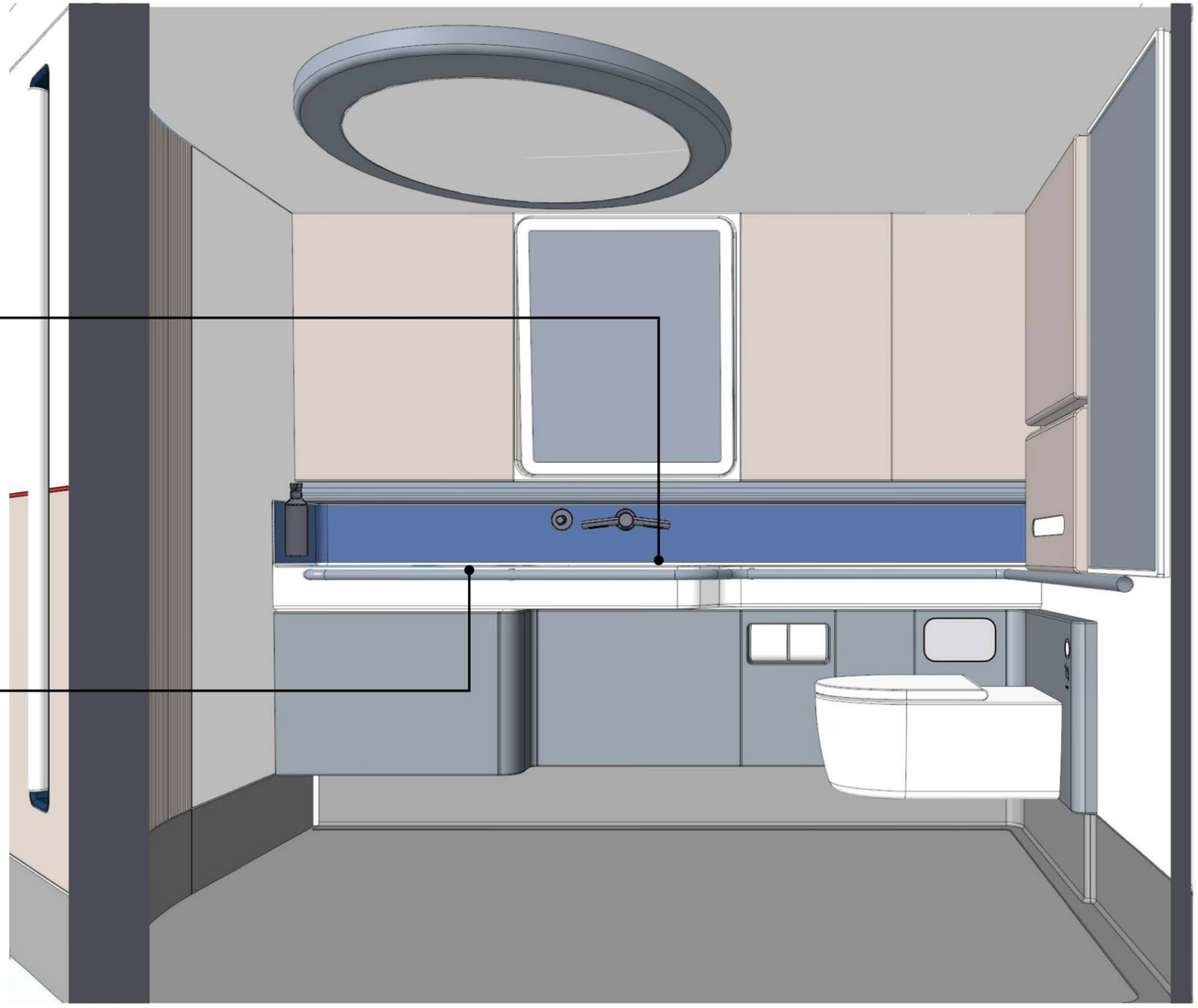
ATR | Amenities and Features

Sharps Bin
Provision for a sharps bin should be provided within the room. The size and position and means of removal of sharps should be agreed and instructed by Amtrak.

Sink Surface
Sink surface should be large enough to store a wash bag and toiletry items and aid the safe and clean disposal of a colostomy bag. Marine edge should run along entire length and a draining surface angled towards sink.

Sink
The sink should be accessible while sat on the toilet. There should be an RVAAC compliant clearance underneath the sink to allow wheelchair passengers to fully access the sink and amenities.



Intercom
A speaker should be provided in the toilet, passengers should be able to control notifications via the in room screen.

Extraction Fan
A filtered exhaust fan in the bathroom suitable to remove excess moisture, odors, and stale air.

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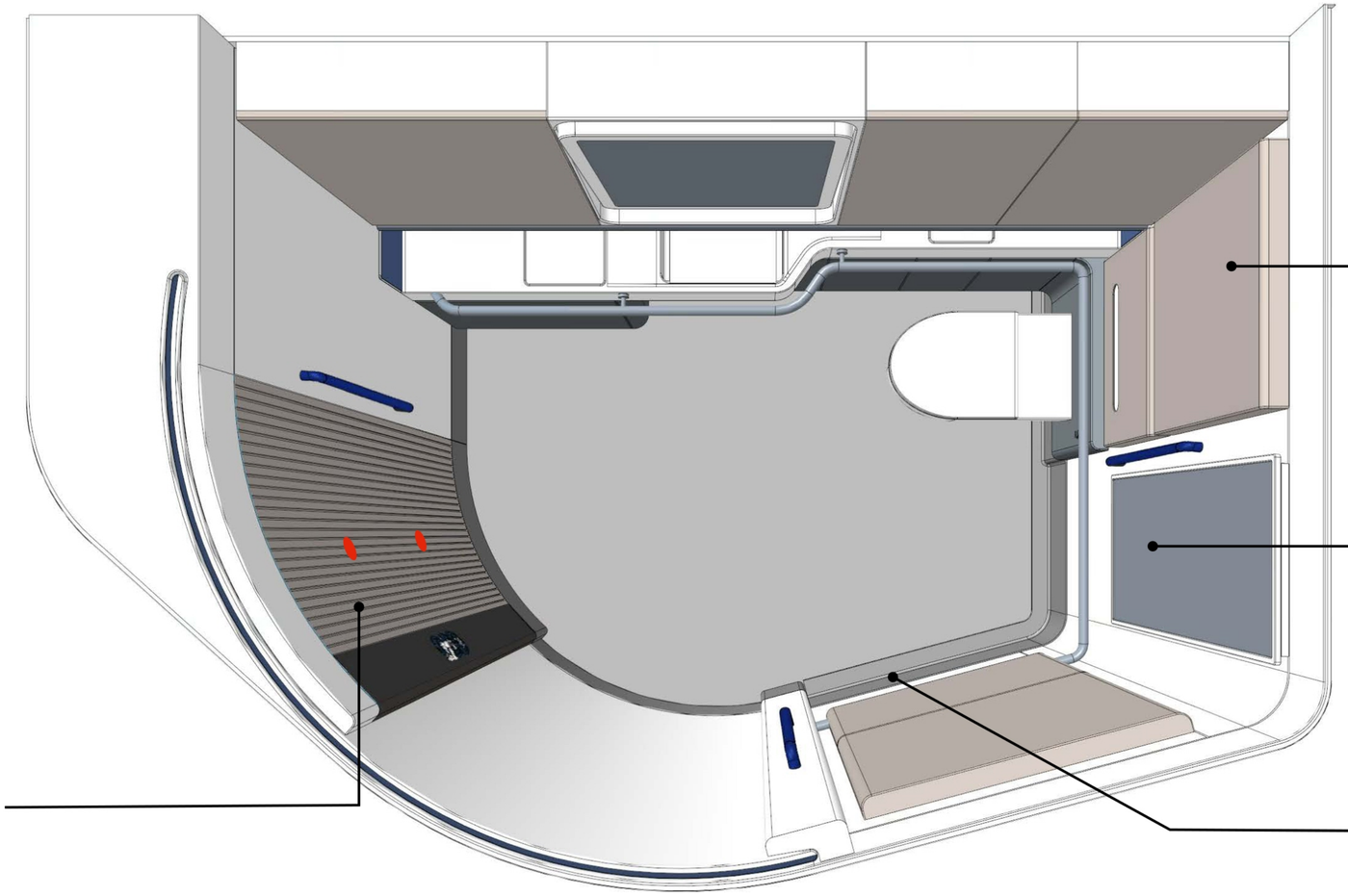
ATR | Amenities and Features



Fold Down Baby Changing
A baby changing table should be provided with an RVAAC compliant clear space in front of it. The changing table should be easy to deploy and stow with an intuitive handle. It should have a soft opening mechanism. Position and function should comply with ADA.

Full Length Mirror
A full length mirror should be provided in addition to the sink mirror. The bottom edge of the reflective surface should be a maximum of 40" above the finish floor.

Coat Hooks
At least two coat hooks should be provided. One hook must be within the reach range of a person using a wheelchair at a maximum height of 45".

Soft Corners
The bathroom should have soft corners to aid cleaning and maintenance. The profile should not affect any clearance required for accessible space or turning spaces.

ATR | Lighting

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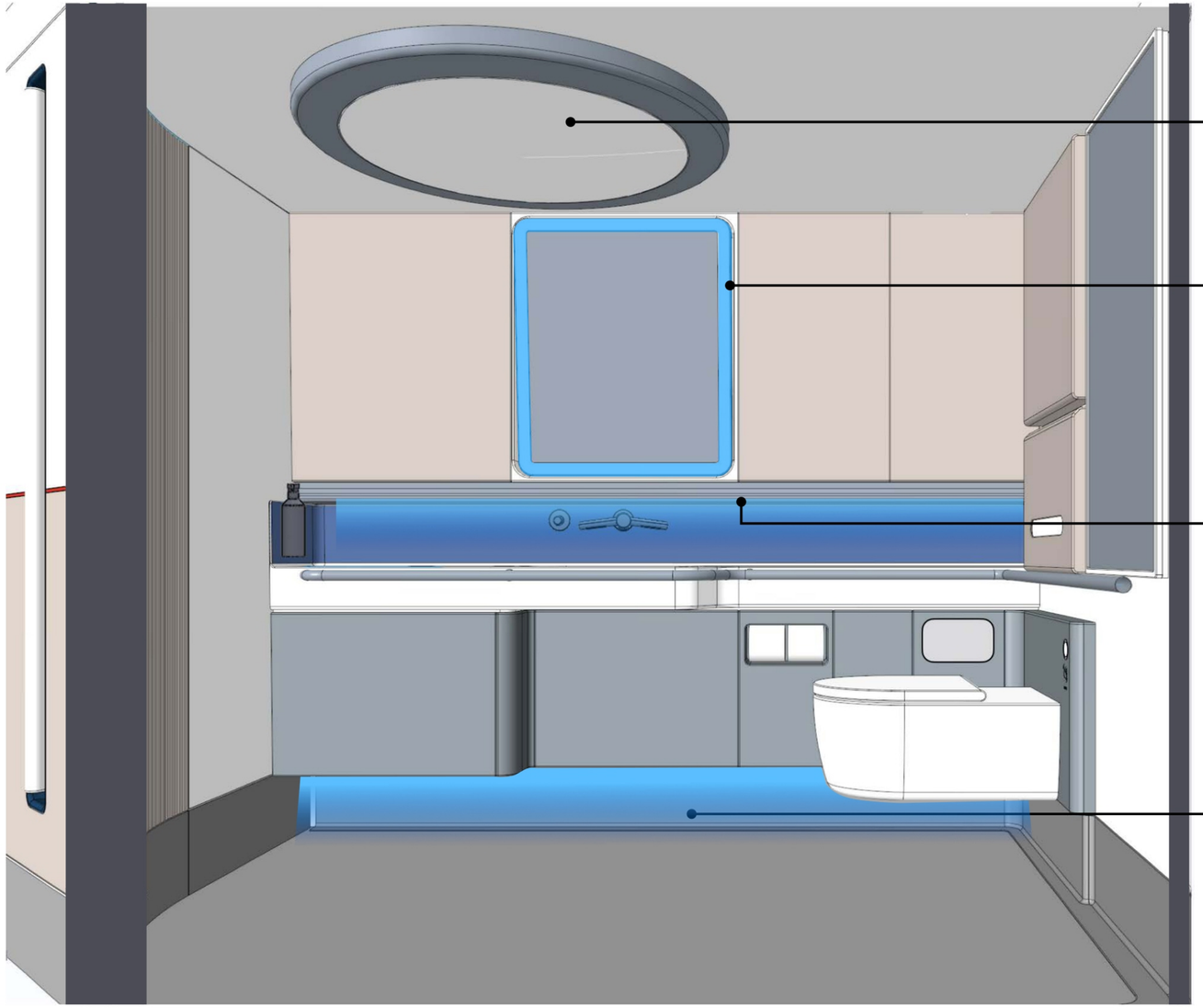
ATR | Lighting



Ceiling Light Panel
A large circular LED panel light in the ceiling provides the main source of light for the room.

LED Illuminated Mirror
The vanity mirror is illuminated with an LED strip around the border. Activated when the door is locked from the inside.

Vanity Wash Light
The cabinet washes indirect mood light on to the sink surface. Activated only when door is locked from the inside.

Floor Wash Light
Lower sidewall panels wash indirect mood light on to the floor. Activated only when door is locked from the inside.

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12 | Standard Toilet Room

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026



The Standard Toilet Room

The Standard Toilet Room is a compact space packed full of customer features.

The module is used in both coach and sleeper cars. A slightly differently CMF is applied to each of these spaces to denote the two different classes of travel.

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STR | Room Features

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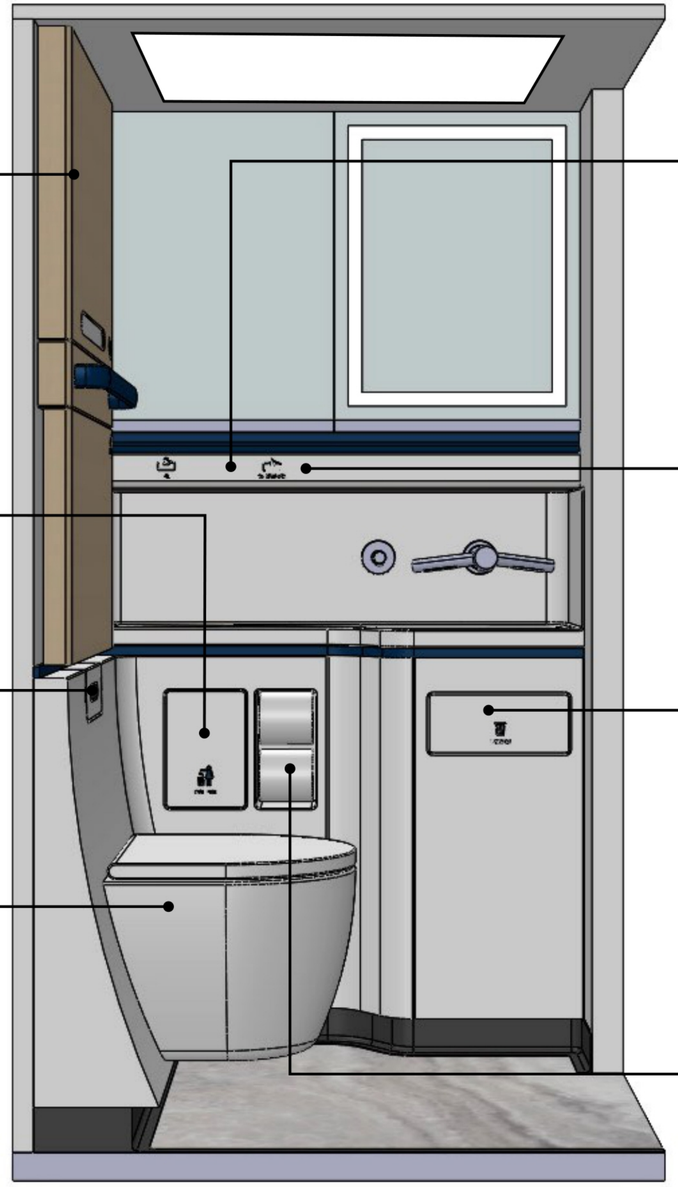
STR | Amenities and Features

Toilet Seat Cover Dispenser
A dispenser for paper toilet seat covers should be located above the toilet.

Sanitary Waste
A sanitary bin with modesty flap should be provided next to the toilet. Minimum volume of 7 Gal .

Toilet Flush
A two button push / touch-less flush is located on the back wall providing standard and eco flush.

Toilet
The toilet has a seat and a lid. The area under the toilet should be easy to clean. Toilet seat and seat lid should all have soft close mechanisms.



Paper Tissue Dispenser
A paper tissue dispenser should be positioned near the trash and sink.

Paper Towel Dispenser
A paper towel dispenser should be positioned near the trash and sink.

Trash
A trash bin is provided by the sink

Toilet Paper Storage
The toilet paper should be stored in the wall of the bathroom and should be protected from spills from the sink.

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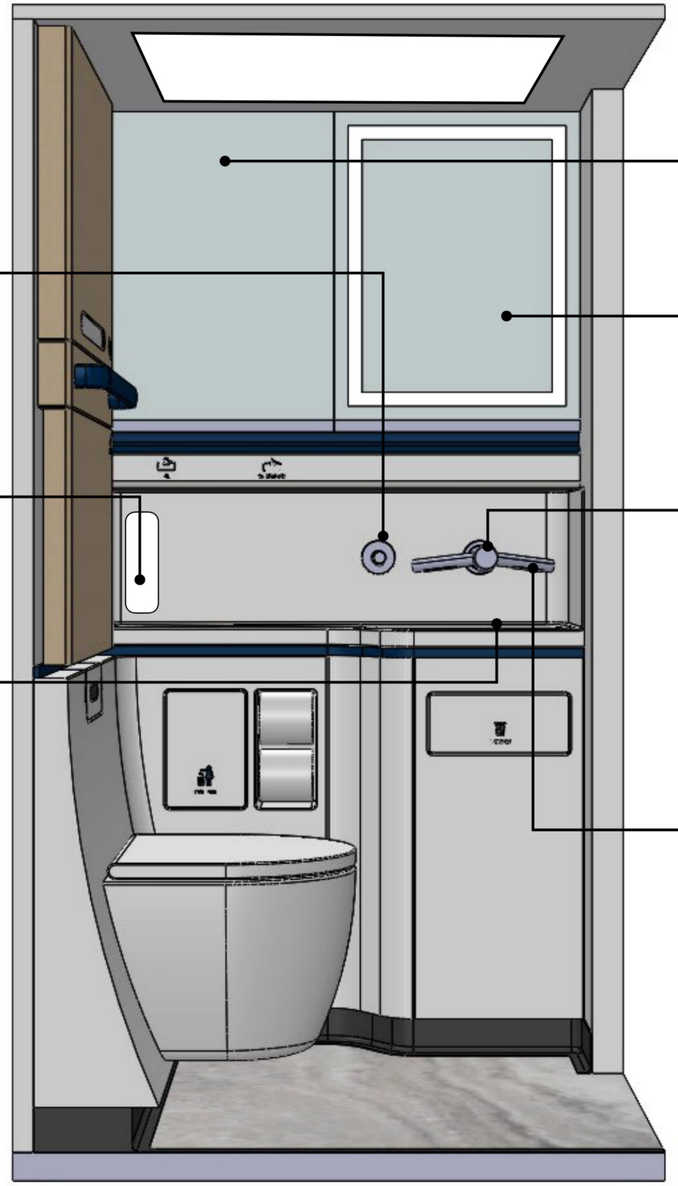
STR | Amenities and Features



Soap Dispenser
An automatic soap dispenser should be included above the sink area. A physical element should be present to indicate how and where the soap will dispense.

Hand Lotion Bottle
An area on the side of the sink should be reserved for a refillable hand lotion bottle fixed to the side wall.

Sink
The sink should have a marine edge so any water spill is captured in the sink area. A splash back behind the sink should protect the surrounding areas from water splashed onto the back wall from the sink area.

Crew Cabinet
Cabinet storage should be provided for crew to store cleaning and bathroom provisions.

Vanity Mirror
A large mirror is positioned in front of the sink. Dimensions, position and usability will be subject to Amtrak approval.

Automatic Water Faucet
Water is automatically dispensed when hands are placed under the faucet. A physical element should be visible so it is clear where water is dispensed from. Temperature of water should be controllable. Water pressure, and water flow should not create any water splash or spill outside of the sink area.

Automatic Hand Dryer
An automatically triggered hand dryer should be included under the vanity unit. This can be part of the faucet or supplied separately. A physical element should be visible so it is clear how to use the dryer. The dryer should use high velocity air and HEPA filters similar to a Dyson Airblade. The air dryer should not blow water out of the sink.

STR | Amenities and Features

Intercom
A speaker should be provided in the toilet, passengers should be able to control notifications via the in room screen.

Coat Hooks
At least two coat hooks should be provided.

Fold Down Baby Changing
A baby changing table. The changing table should be easy to deploy and stow with an intuitive handle. The mechanism should be durable, free from jamming and racking. The design should meet abuse loads. It should have a soft opening mechanism.



Extraction Fan
A filtered exhaust fan in the bathroom suitable to remove excess moisture, odors, and stale air.

Sink Surface
Sink surface should be large enough to store a wash bag and toiletry items and aid the safe and clean disposal of a colostomy bag. Marine edge should run along entire length and a draining surface angled towards sink.

Soft Corners
The bathroom should have soft corners to aid cleaning and maintenance.

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STR | Amenities and Features

Handholds
Compliant handholds should be provided within the toilet. At least one should be provided behind the toilet and one on the side wall.



22” Toilet Door
The Toilet door can be sliding door or bifold door (much like an aircraft toilet door) - rattle free and free from racking or jamming. An internal lock with lock status indicator with accessible locks handle design. Emergency external unlock with crew key.

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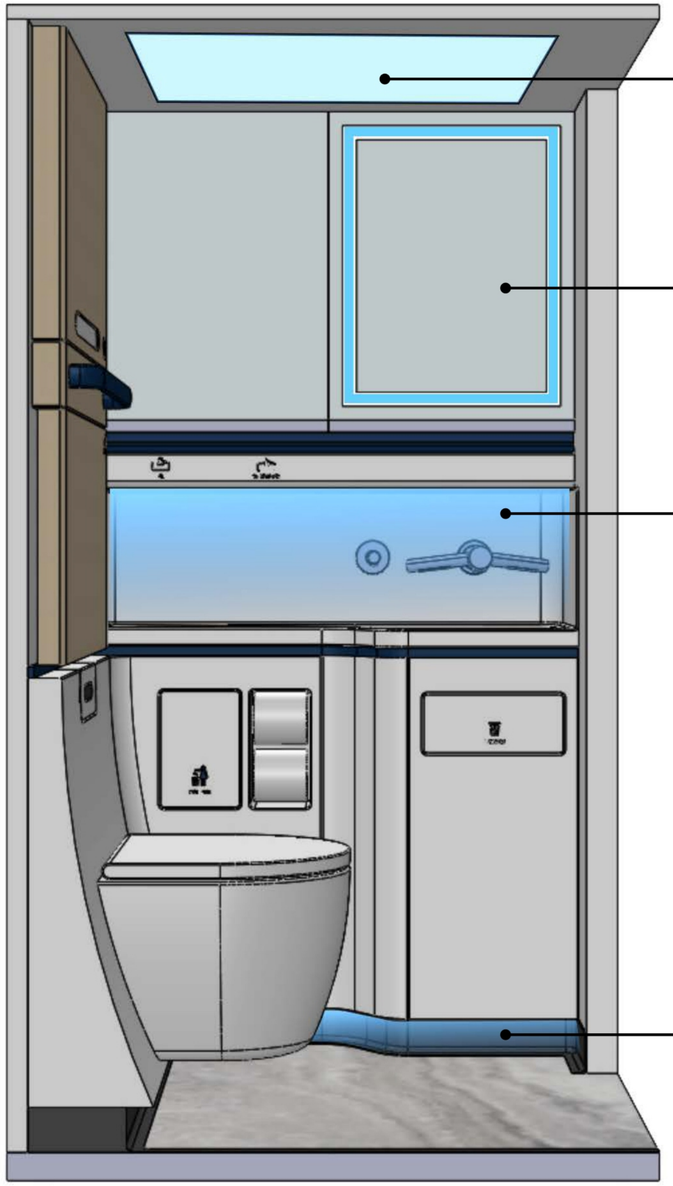
STR | Lighting

26-FOI-00415 00000006272 "UNCLASSIFIED" 4/30/2026

STR | Lighting



Ceiling Light Panel
A large rectangular LED panel in the ceiling provides the main source of light for the room.

LED Illuminated Mirror
The vanity mirror is illuminated with an LED strip around the border. Activated when the door is locked from the inside.

Vanity Wash Light
The cabinet washes indirect mood light on to the sink surface. Activated only when door is locked from the inside.

Floor Wash Light
Lower sidewall panels wash indirect mood light on to the floor. Activated only when door is locked from the inside.

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Coach Areas
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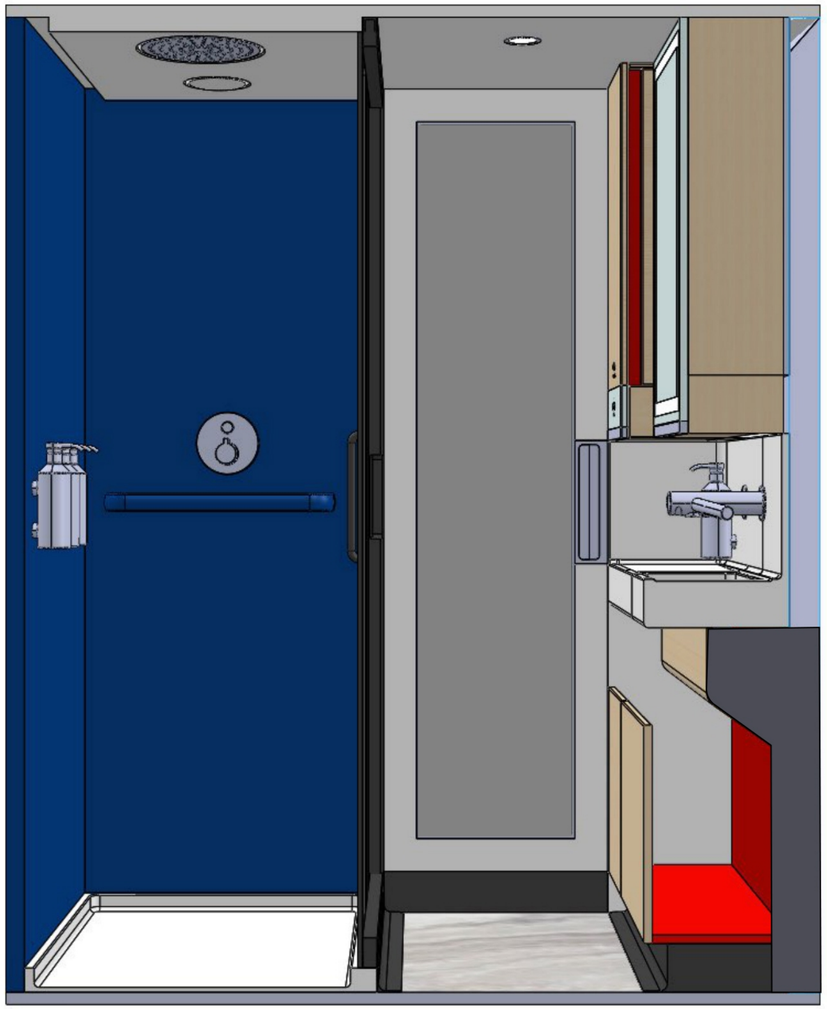
Toilets & Showers
Common Use Areas

13 | Shower & Changing Room

Shower & Changing Room | General



The Shower & Changing Room Room

The Shower & Changing Room designed for sleeper cars only.

The room provides a large shower, a changing area and a vanity area, with towel storage and a towel bin.

Shower & Changing Room | Room Features

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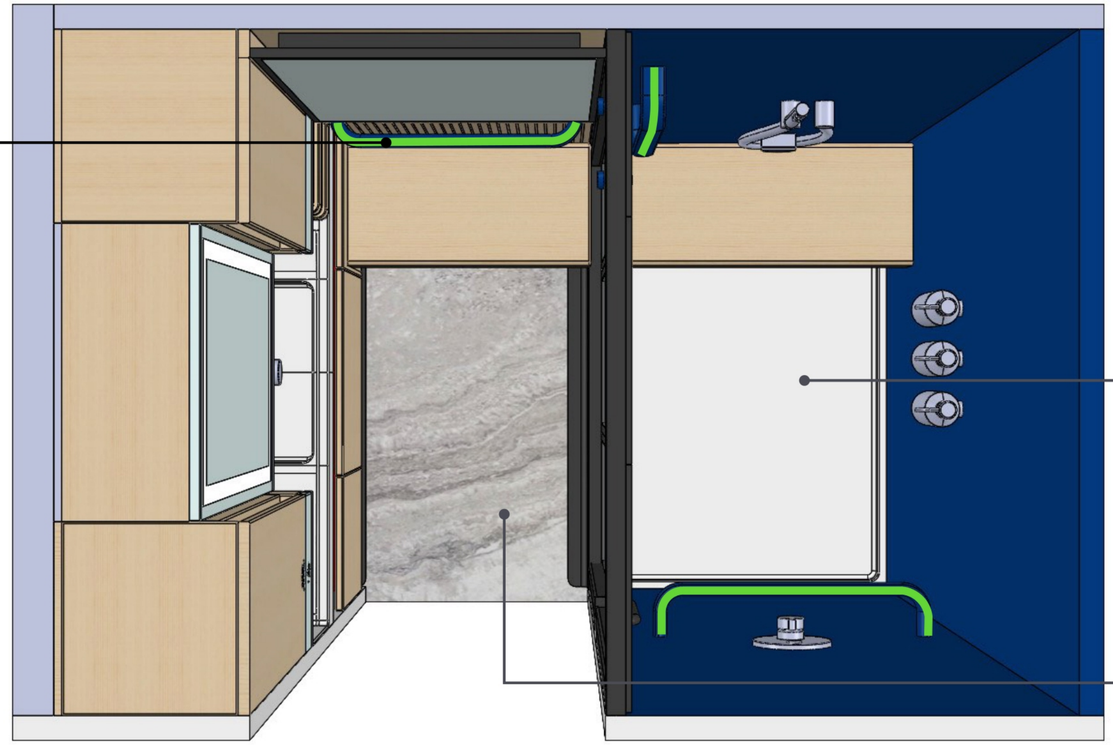
Shower & Changing Room | Amenities and Features

Handholds
Suitable handholds should be positioned to aid people while standing in the shower and the changing area . The sizes will be subject to mockup testing and Amtrak approval.



Shower Tray
The shower tray should be a minimum of 27” x 40” and be fully sealed and easy to clean.

Changing Area
The standing changing area in front of the changing bench should be a minimum of 24” x 30”

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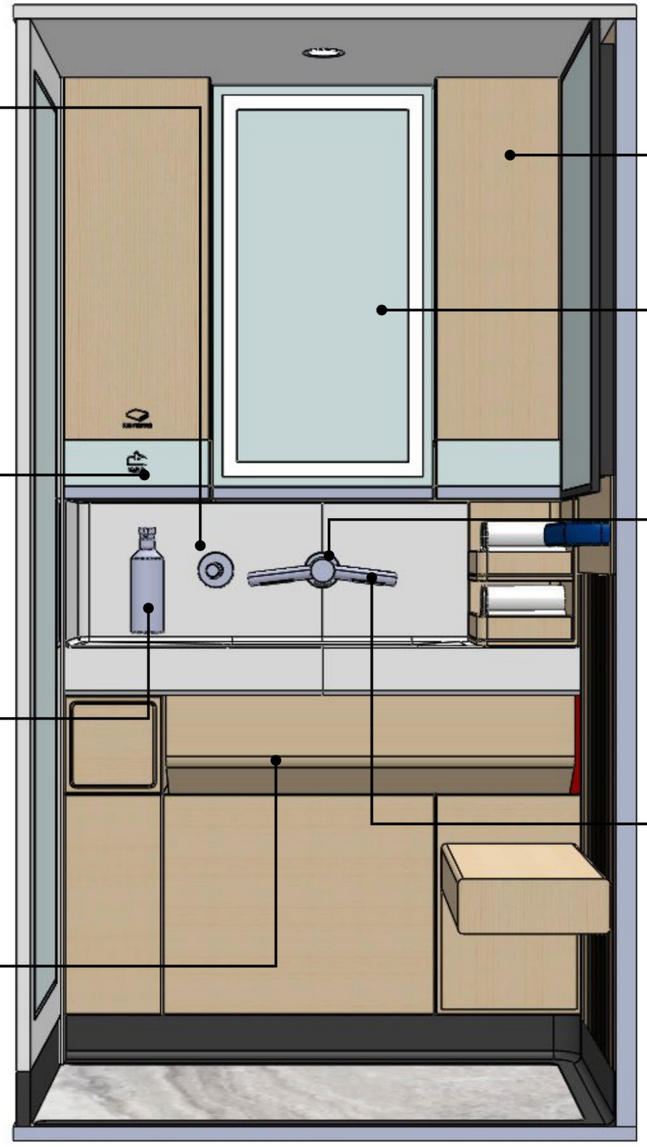
Shower & Changing Room | Amenities and Features



Soap Dispenser
An automatic soap dispenser should be included above the sink area. A physical element should be present to indicate how and where the soap will dispense.

Paper Tissue Dispenser
A paper tissue dispenser should be positioned near the trash and sink.

Hand Lotion Bottle
An area on the side of the sink should be reserved for a refillable hand lotion bottle fixed to the side wall.

Towel Bin
The space under the sink should be maximized for storing used towels with a minimum volume of 30 Gal. The bin should be lined, prevent water ingress and build up of mould.

Crew Cabinet
Cabinet storage should be provided for crew to store cleaning and bathroom provisions.

Vanity Mirror
A mirror is positioned in front of the sink of 18” wide and x 33” in height. The volume behind is reserved for hand dryer and soap equipment .

Automatic Water Faucet
Water is automatically dispensed when hands are placed under the faucet. A physical element should be visible so it is clear where water is dispensed from. Temperature of water should be controllable. Water pressure, water flow should not create any water splash or spill outside of the sink area.

Automatic Hand Dryer
An automatically triggered hand dryer should be included under the vanity unit. This can be part of the faucet or supplied separately. A physical element should be visible so it is clear how to use the dryer. The dryer should use high velocity air and HEPA filters similar to a Dyson Airblade. The air dryer should not blow water out of the sink.

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Shower & Changing Room | Amenities and Features



Bath Towel Cabinet
A cabinet for storing a minimum of 15 clean Amtrak bath towels

Braille Strip
A Braille strip should be provided along the underside of the vanity unit to call out key functions of the vanity area - water, air, tissues, towels etc

Sink Surface
Sink surface should be large enough to store a wash bag and toiletry items . Marine edge should run along entire length with a draining surface angled towards sink.

Hand Towel and Wash Cloth
Space should be provided on the vanity unit to stack hand towels and wash cloths.

Changing Bench
A cantilevered bench should be provided in the changing area with space kept free under the seat for a bag. The bench should have a minimum depth of 11.5” running the full width of the changing area

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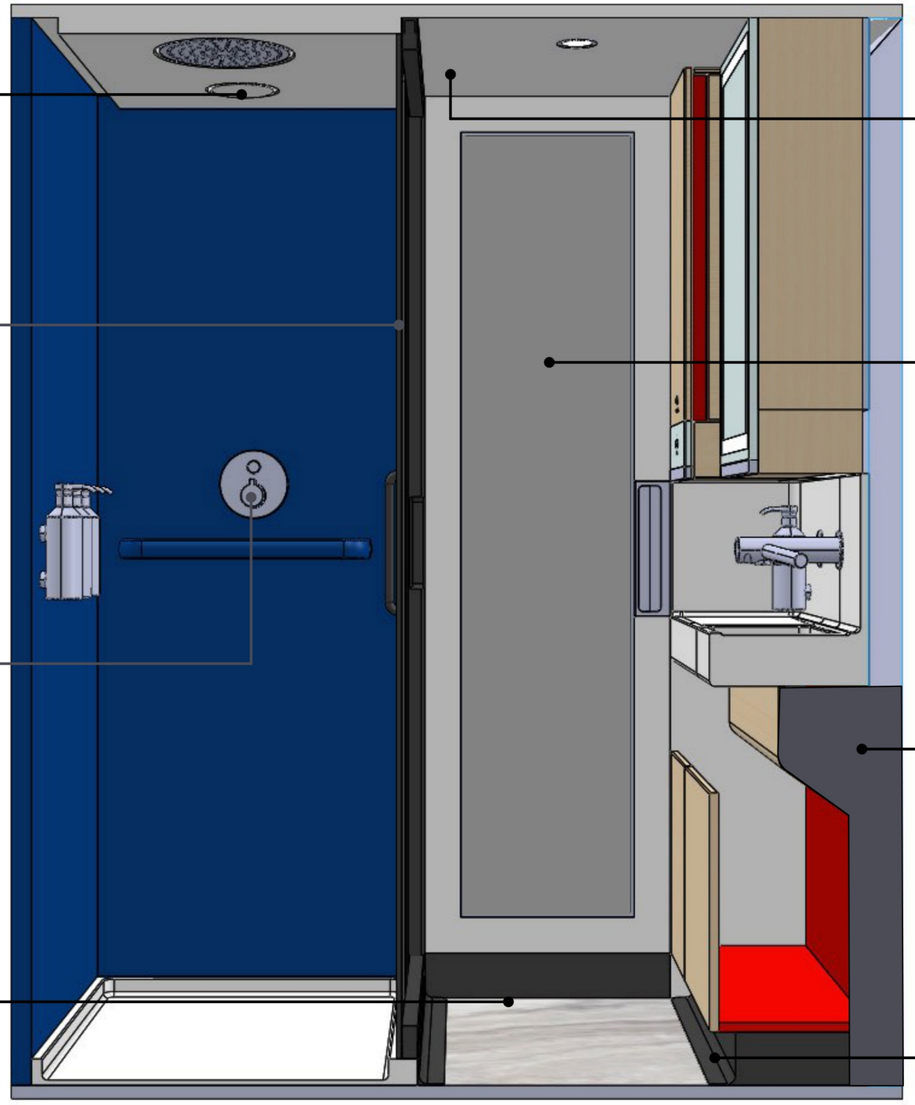
Shower & Changing Room | Amenities and Features



Extraction Fan
A filtered exhaust fan in the bathroom suitable to remove excess moisture, odors, and stale air.

Shower Hooks
Hooks should be provided inside the shower for hanging wash cloths or wash bags .

Shower Control
An on/off button and temperature control are located on the bathroom wall close to the shower door entrance. The shower control should prevent any accidental activation.

Floor
The changing area floor should be sealed with a raised edge to prevent water escapement under the door while at the same time not presenting a trip hazard.

Intercom
A speaker should be provided in the shower room.

Shower Room Door
Should be a sliding door and a minimum width of 22”.

Under Sink Cover
Sink pipe work and waste should be covered with a panel that is accessible for maintenance behind the towel bin.

Soft Corners
The bathroom should have soft corners to aid cleaning and maintenance.

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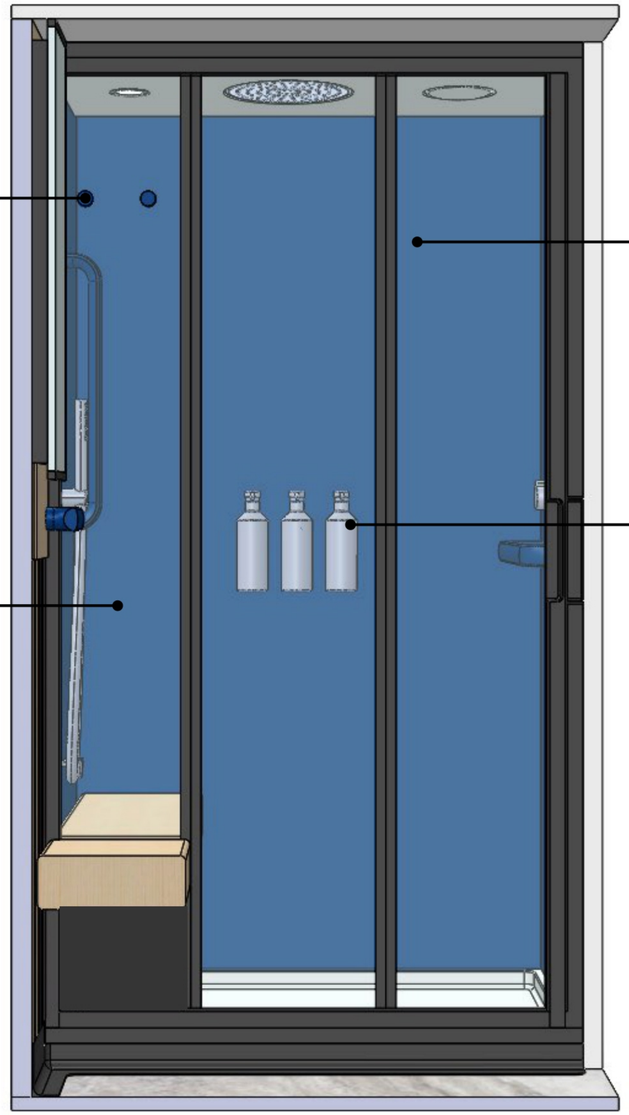
Shower & Changing Room | Amenities and Features

Coat Hooks
Coat hooks should be provided close to the shower door inside the changing area and protected from shower splash for hanging clothes and towels.

Fixed Glazed Panel
A fixed glaze panel should be used to keep the shower space open and bright. The lower portion can be solid to provide structure for the cantilever benches.



Shower Door
The door should open inwards as a bifold door, similar to an airline toilet door. The door should be sealed to prevent shower water escaping into the internal living space of the room, even when water is sprayed directly onto the back surface of the door.

Dispensing Bottles
3 refillable Amtrak bottles dispensing shampoo, conditioner and body lotion. Bottles should be fixed to the wall and easily refilled or replaced by Amtrak staff.

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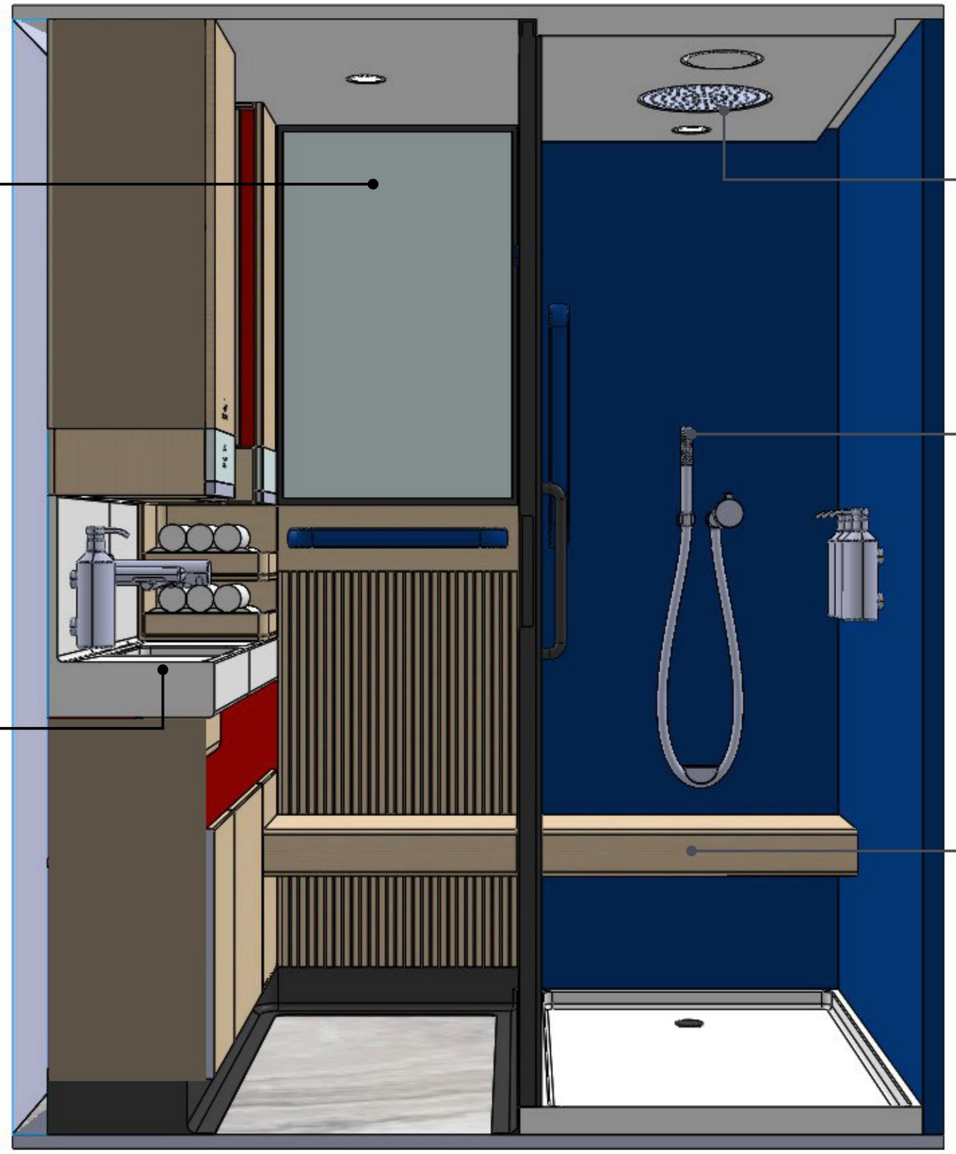
Shower & Changing Room | Amenities and Features



Mirror
A second mirror should be provided in the changing area

Sink
The sink should have a marine edge so any water spill is captured in the sink area. A splash back behind the sink should protect the surrounding areas from water splashed onto the back wall from the sink area.

Rain Shower
A rain shower in the ceiling provides a shower above head height. Rain shower should be seamlessly integrated into the ceiling in order to maximize head room in the bathroom.

Hand Shower
A second hand shower is located with a slimline design handset. A hose clip should be included to prevent the hose from rattling while the train is in transit.

Shower Seat
A fixed cantilevered shower seat should be provided inside the shower with an anti slip finish with a minimum depth of 11.5” running the full width of the shower enclosure.

Shower & Changing Room | Lighting

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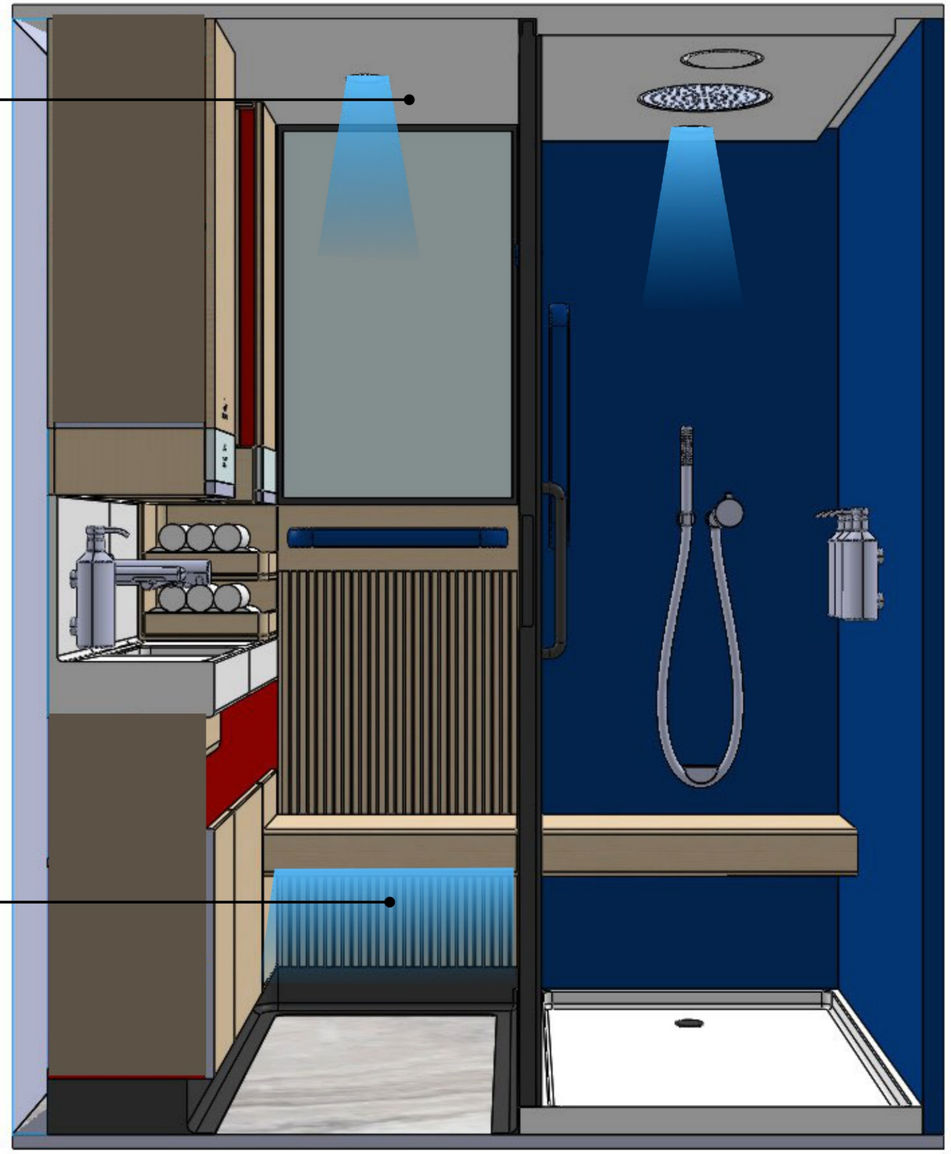
Shower & Changing Room | Lighting

LED light panel spots
Small circular LED light panels act as spot lights to provide the master lighting conditions for this room - frame to be color matched. At least one in the changing area and at least one in the shower enclosure.

Bench Wash Light
Indirect mood light on to the floor from the underside of the bench. Activated only when the door is locked from the inside.



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Shower & Changing Room | Lighting



LED Illuminated Mirror
The vanity mirror is illuminated with an LED strip around the border. Activated when the door is locked from the inside.

Splash Back Wash Light
The cabinet washes indirect mood light on to the sink surface. Activated only when the door is locked from the inside.

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Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas

Common Use Areas

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Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas

14 | Entrance Area

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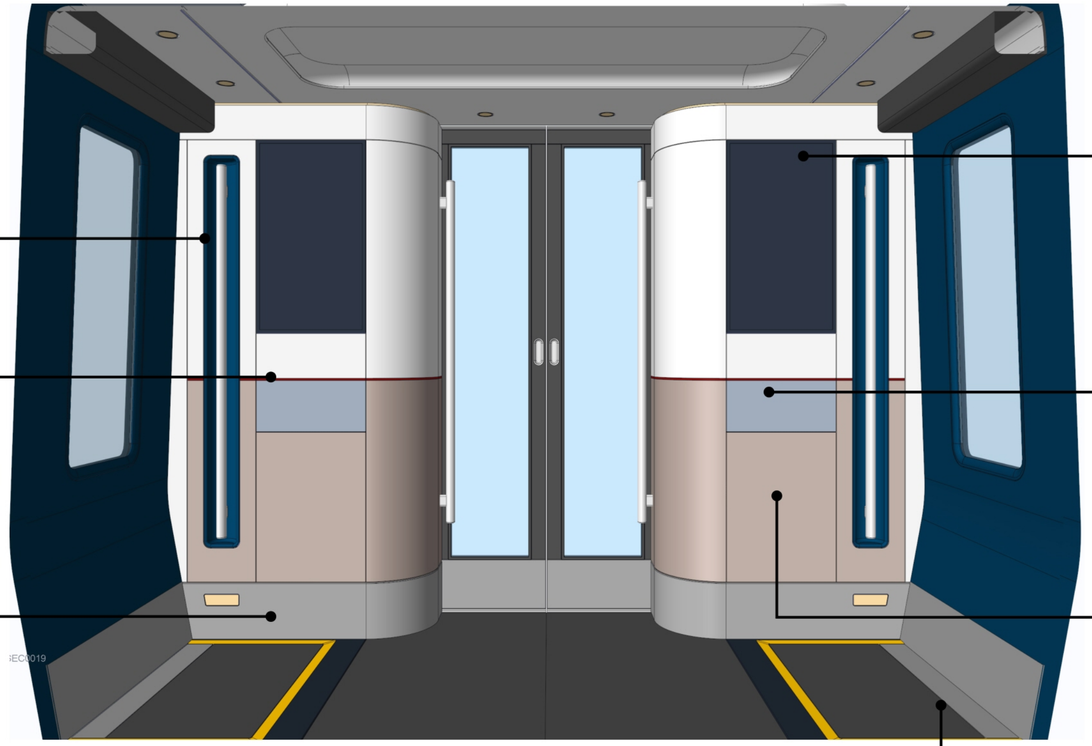
Entrance Area | Interior Architecture

Handholds
Compliant handholds should be supplied on both sides of each door, at key access point along aisles and on both sides of elevators.

Tide line
There should be a horizontal tide line incorporated into the panel work. The edging between upper and lower panel acts as class identifier.

Kick-strips
Stainless steel kick strips at 9” high.



Door Threshold
Should have a slip-free surface and a contrasting floor color to the main vestibule flooring to mark the threshold.

Passenger Information Screens
Display screens should be supplied on both sides of the door.

Trash Bin
Trash bins on both sides vestibule with stainless steel push flaps. Easy access water tight bin liner for quick cleaning routines and maintenance.

Panel Work
Vestibule monuments should be designed to have well fitted clean panel with a high tolerance build to manage split lines and cabinet edging. There should be no protruding equipment, snag point or dirt traps. All equipment cabinets should be accessible under a crew key with discreet locks.

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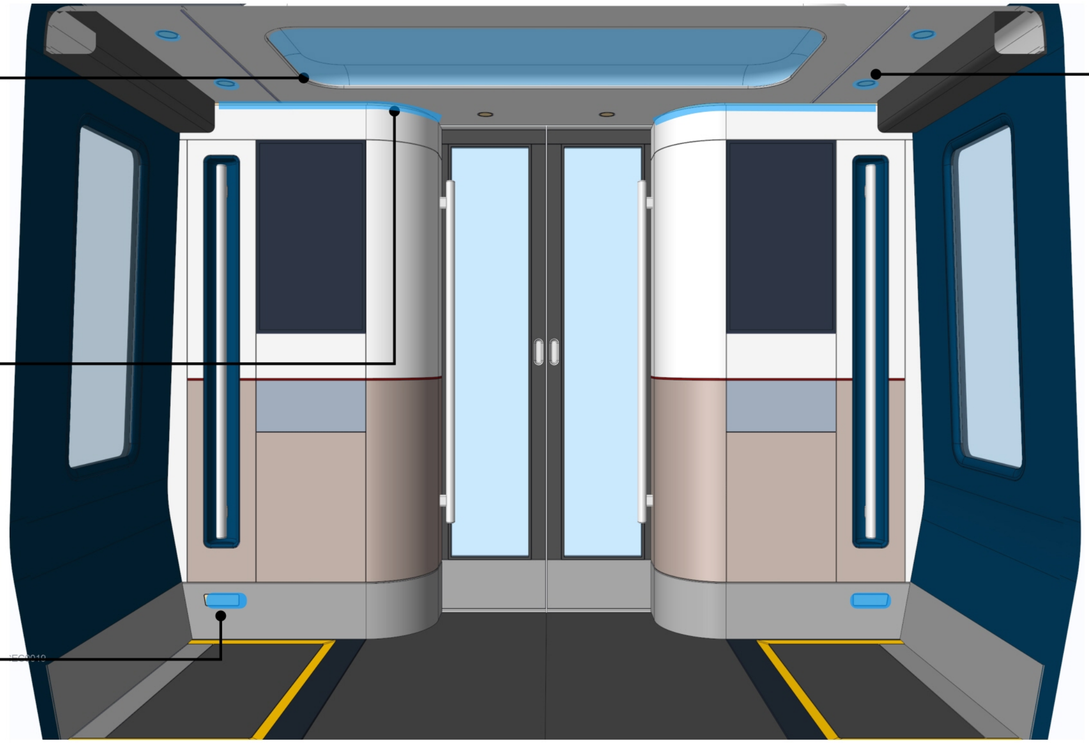
Entrance Area | Lighting

Ceiling Pool Light
Central lighting well in the ceiling provides indirect mood wash light in the centre of the vestibule.

Module Wash Lights
Indirect strip lights wash light onto the ceiling from the top of the vestibule monuments..

Step Lights
Step lights should illuminate interior threshold during boarding sequences.



LED Panel Spot Lights
Spot light over door, elevators and along aisles. Size position and number will be subject to Amtrak approval.

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Coach Areas
Sleeper Bedrooms
Food & Beverage
Toilets & Showers
Common Use Areas

15 | Interior Structure

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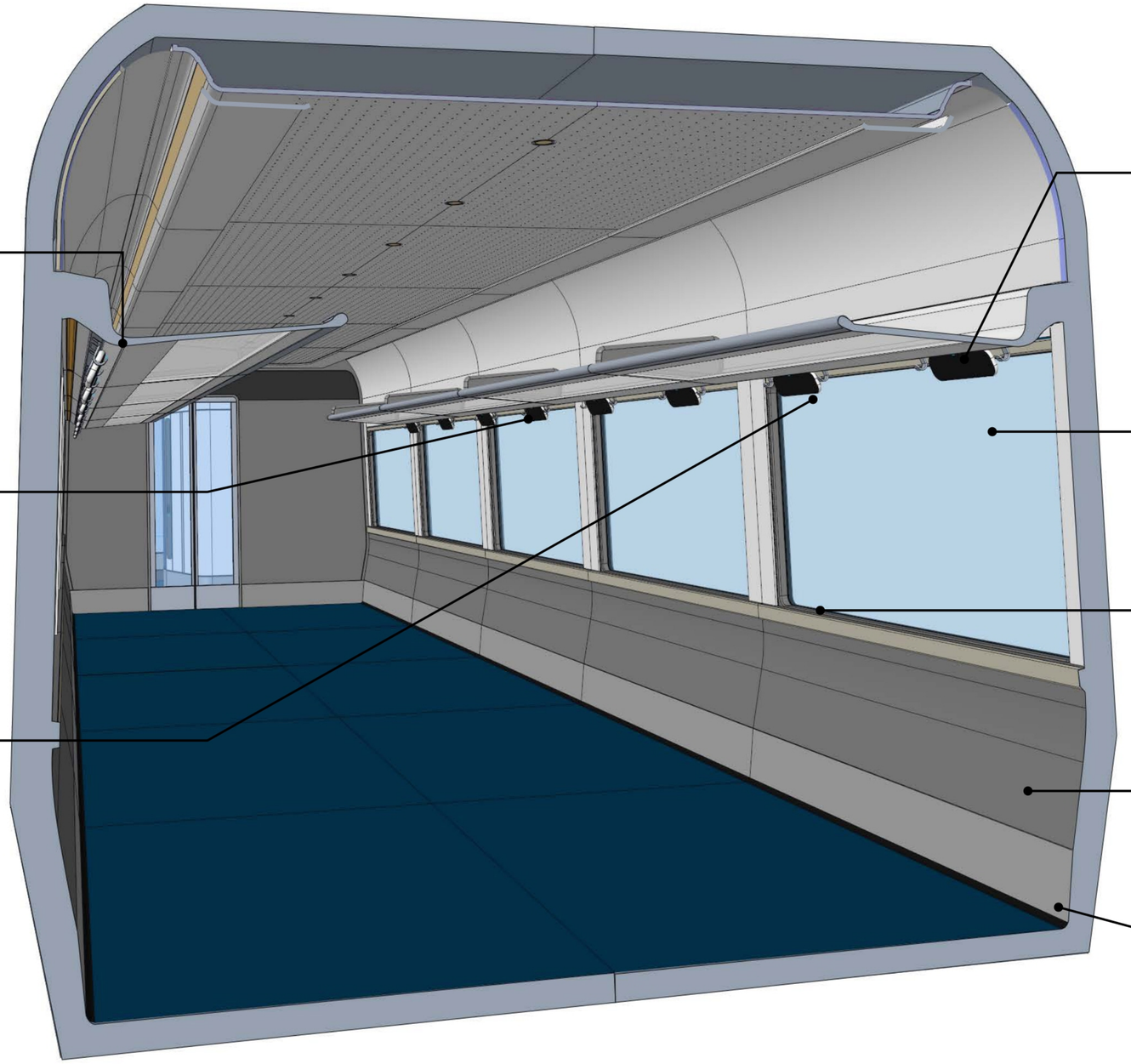
Interior Structures | Coach



Luggage Shelf
Luggage shelf should be built in modules that align with window placements. Split lines and module length should be consistent and to visually match the window module splits.

Reservation Screens
Passenger information displays, should be integrated with the rack design. The position of the seat reservation module should be designed so they can easily be moved in case seat pitch or density is modified in the future.

Coat Hooks
Coat hooks should be provided for each seated location, integrated with the luggage shelf Hooks should be easy to move if seat positions or set pitch is changed in the future.

***Rotating Seats**
In the case of rotating seats, seat reservation systems, at seat power and coat hooks, locations will need to work in both seat orientations.

Blinds
A single pull-down blind system shall be provided per window, capable of delivering both daytime solar/glare control and full blackout performance. Blinds should cover the entirety of the window.

Windows
Window size should be maximized with an equal pitch. Window mask should minimize or mask glass corners to create an architectural aesthetic.

Window Pillars
Window pillar width should be minimized. The pillar trim should continue over the side ceiling to create an arched aesthetic.

Lower Side Wall Panel
A lower side wall panel provides a horizontal tideline and material split

Kick-strips
Stainless steel kick strips at 9” high.

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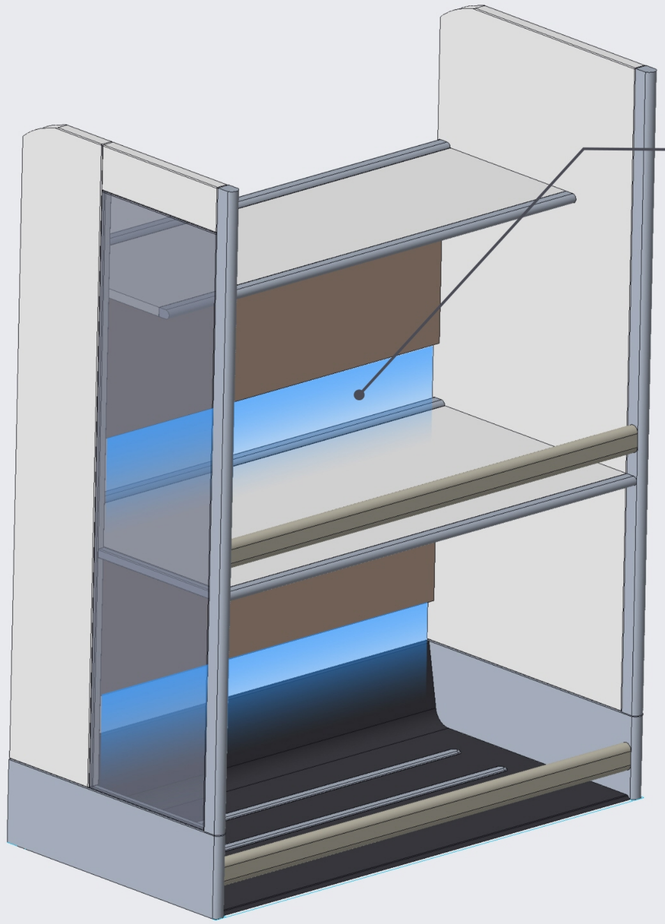
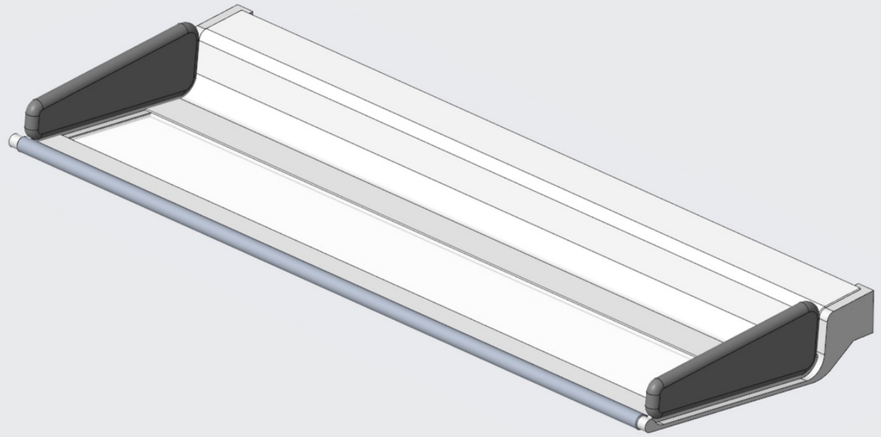


Shelf Lighting
Luggage towers shall have shelf lighting integrated within the tower.

Luggage Tower
Luggage towers shall be constructed as a modular system allowing various tower lengths. Glass side panels shall be provided to allow passengers to view their luggage



Luggage Shelf
Overhead luggage racks shall be modular and constructed using extruded aluminum to allow different length segments. Rack modules and split lines shall align with window placements and visually correspond with the window module divisions. Coat hooks shall be provided for each seated location and integrated within the luggage rack assembly.

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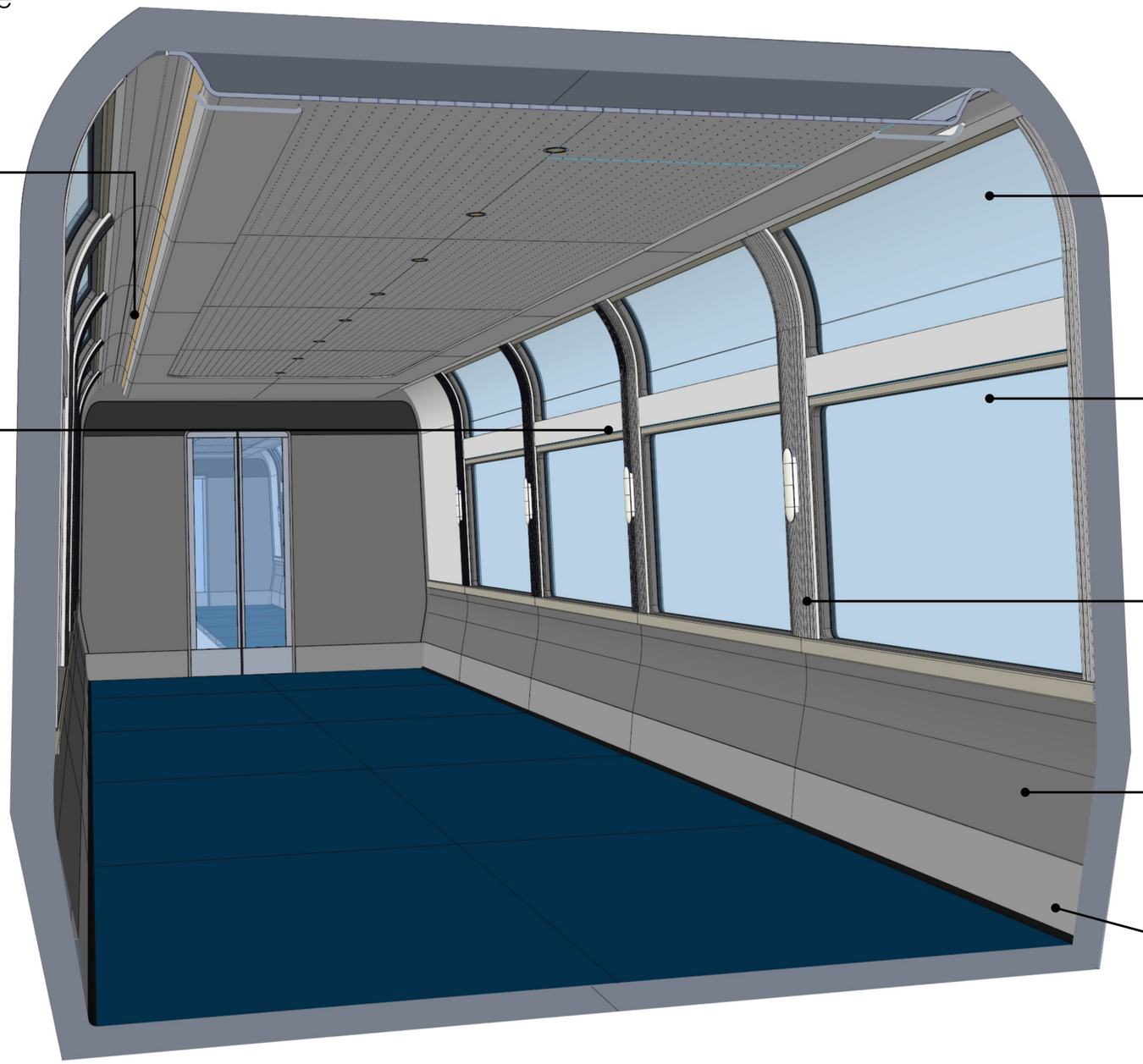
Interior Structures | Cafe, Diner, Lounge

Blinds
A single pull-down blind system shall be provided per window, capable of delivering both daytime solar/glare control and full blackout performance. Blinds should cover the entirety of the window. Skylight blinds to be crew controlled

Blind Pelmet
Blinds shall be stored in a pelmet so that they can easily be accessed for maintenance. to be crew controlled



Skylights
Options provided for Skylights in Cafe,

Windows
Window size should be maximized with an equal pitch. Window mask should minimize or mask glass corners to create an architectural aesthetic.

Window Pillars
Window pillar width should be minimized. The pillar trim should continue over the side ceiling to create an arched aesthetic.

Lower Side Wall Panel
A lower side wall panel provides a horizontal tideline and material split

Kick-strips
Stainless steel kick strips at 9” high.

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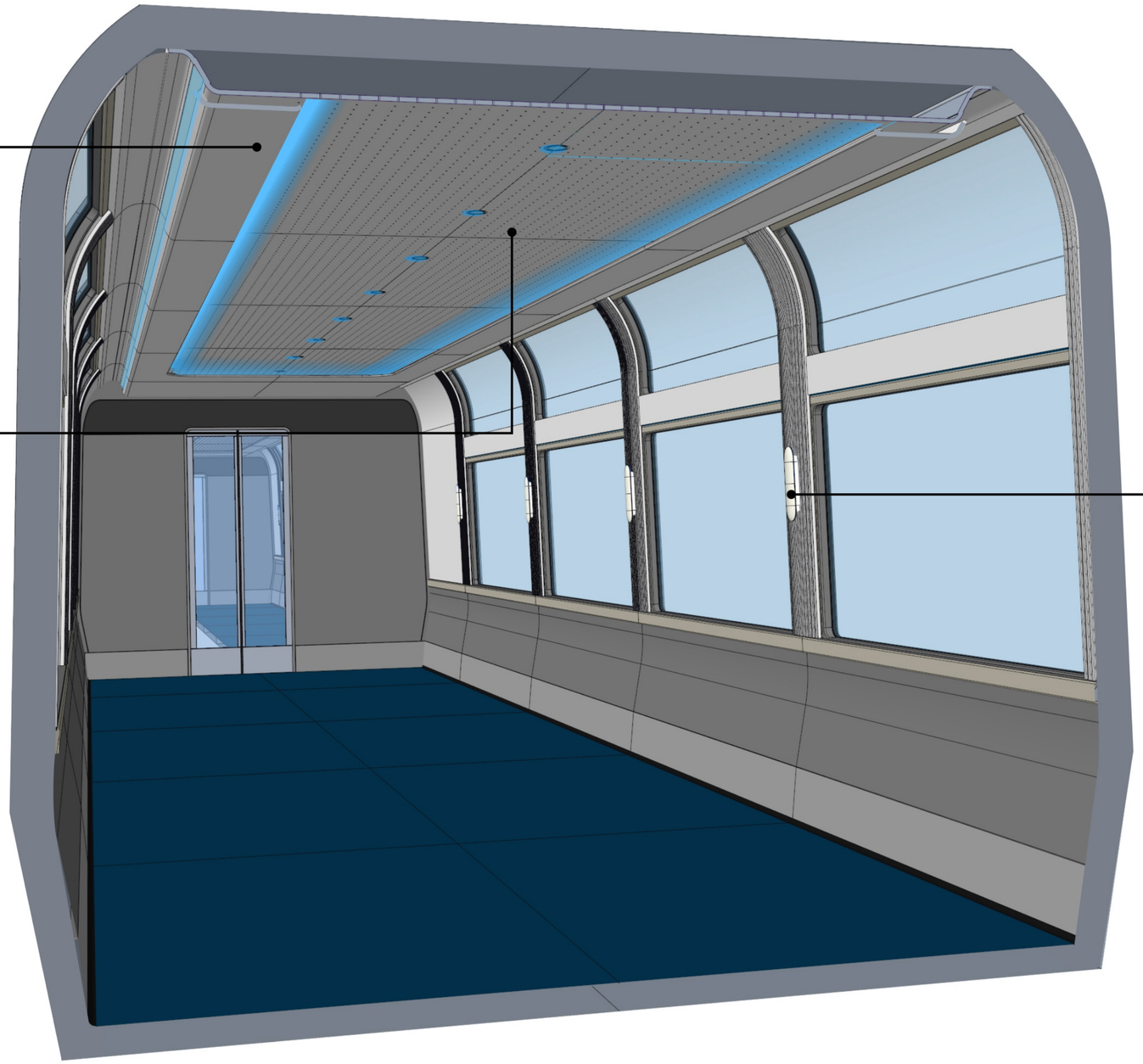
Interior Structures | Lighting

Ceiling Lighting
Ceiling lighting should be consistent across all car types . Wash lighting from both sides of the lighting gondola lights central panel and side ceiling.

Spot Lighting
LED panel spot lights. Downlighting spots light the aisle.



Wall Lights
Additional wall lights shall be provided in Cafe, Diner and Lounge areas

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Amtrak® Long Distance Product Features

16 | Hallways

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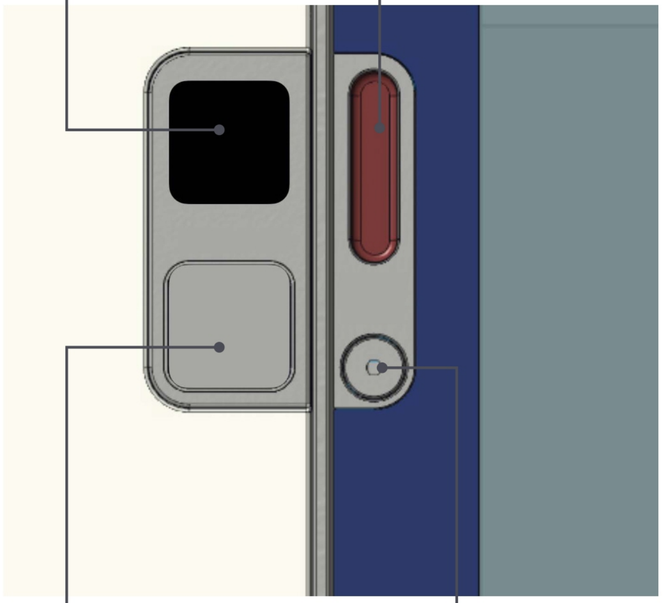
Hallways | Room Doors

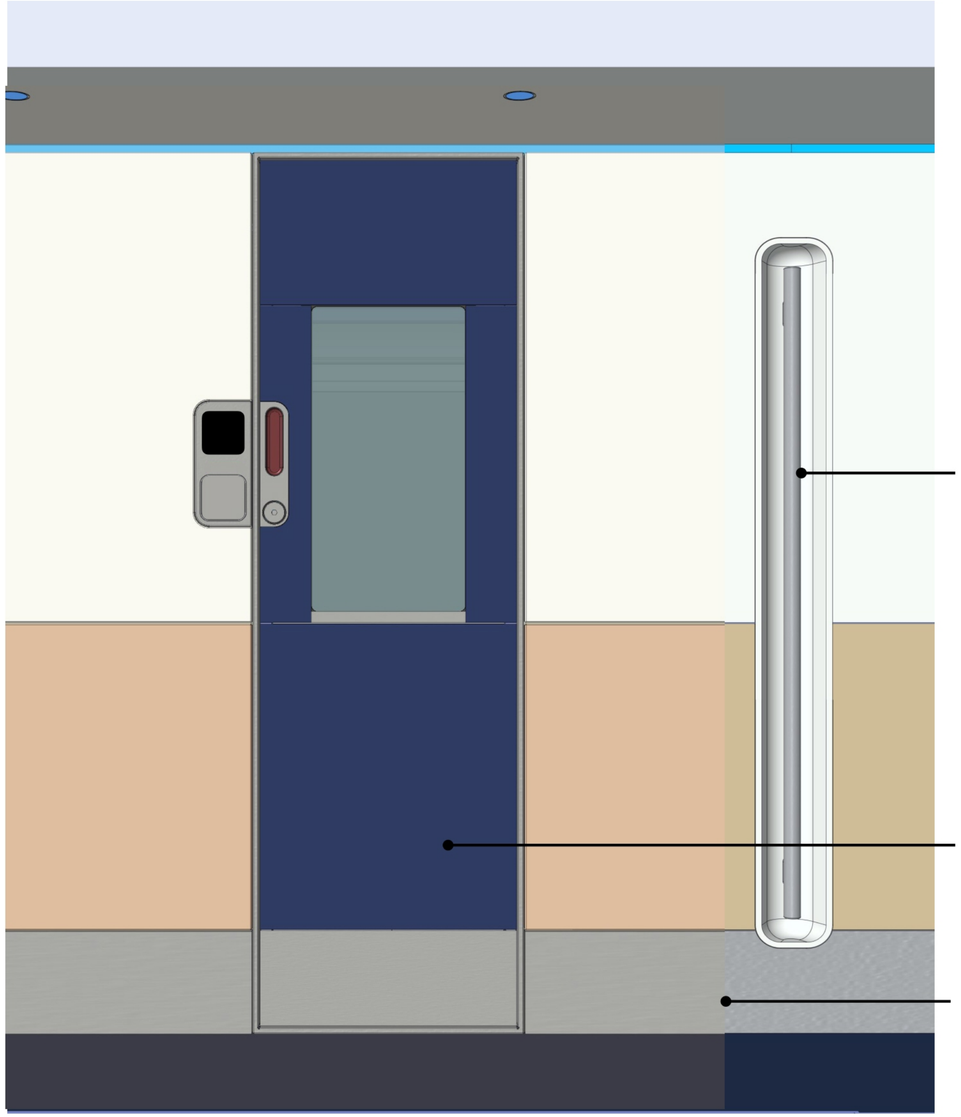
Room Badge
Room numbering, room state signaling.

Handle
Accessible grip with called out contrasting color in class signifier



Keyless Entry
Technology defined elsewhere. Modular approach to panel so tech can be updated and swapped in the future.

Manual Override
External manual lock override with crew key.



Handholds
Hallways should provide handholds either at junction between bedroom modules or along the side wall.

Doors
Sliding doors should be called out in a separate color in line with CMF attachment.

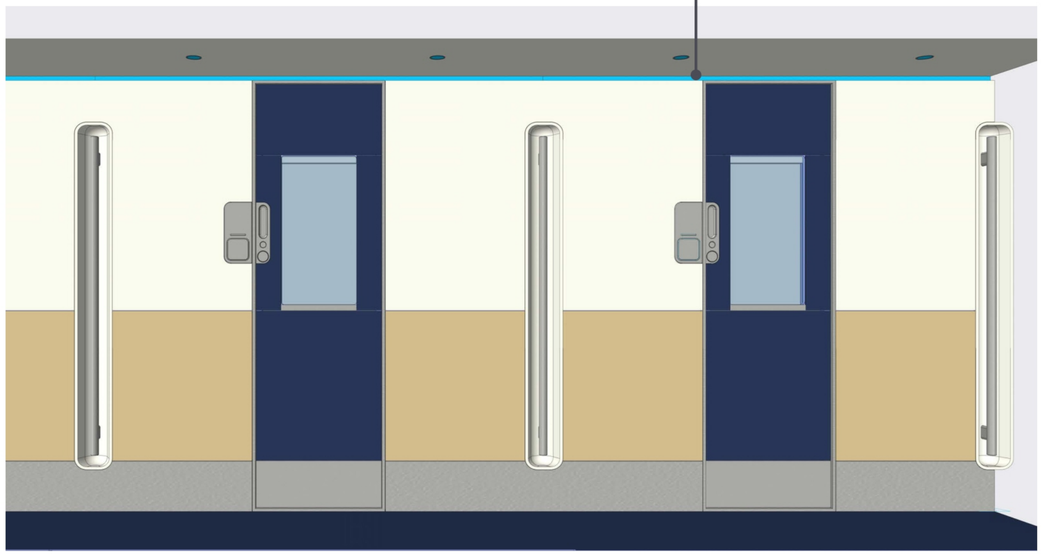
Kick-strips
Stainless steel kick strips at 9” on both sides of the aisle and across bottom top the door.

Hallways | Lighting

Panel Spot lights
Spot lights provides downlighting



Module Wash Lights
Indirect strip lights wash light onto the ceiling from the top of bedroom monuments..



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AMTRAK®

Thank you.

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AMTRAK®

Long Distance
Color Material Finish

Issued March 2026

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CMF Schedule

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CMF **STRATEGY**

The proposed material palette on the following page is indicative and intended to communicate the breadth, variety, and quality of applications expected across the new vehicles. While final colors and finishes will be developed and refined through the design process, the current palette sets out the ambition in terms of material diversity, durability, and overall customer experience.

Suppliers will be expected to accommodate this range through rounds of sampling and refinement to support performance, compliance, and aesthetic cohesion, as well as to align with iterative feedback and approvals from the Amtrak team.

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COLOR PALETTE

SOFT MATERIALS

Synthetic Leather or similar

PRIMARY | **Main Upholstery**



SECONDARY | **Highlight Upholstory / Class Identifier Palette**



Woven Fabric

PRIMARY | **Lounge + Diner Upholstery**



Polyester / Polyamide

PRIMARY | **Blinds + Lamp shades**



Polyester Yarn

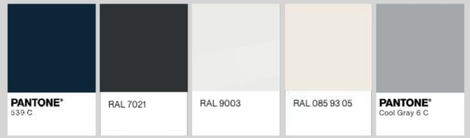
SECONDARY | **Stitch details**



HARD MATERIALS

HPL / Powder coated / Moulded polymer

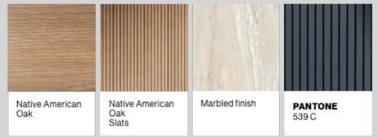
PRIMARY | **Main Hard Surfaces (Matched Colors)**



SECONDARY | **Highlight Hard Surfaces**

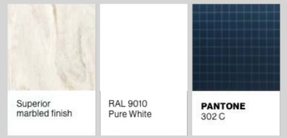


PRIMARY | **Feature Laminates**



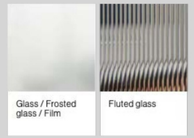
Solid Surface/ Feature Polymers

FEATURE | **Counter Tops/ Sinks / Splash Backs**



Glass

PRIMARY | **Dividers/ Racks /Stacks / Shower screens**



Metal

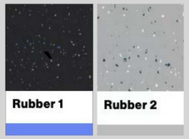
PRIMARY | **Brushed Stainless Steel / Anodized**



FLOORING

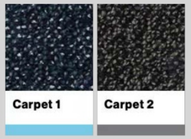
Anti-slip Rubber Floor

PRIMARY | **Vestibules, Restrooms, Food Service**



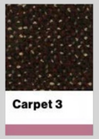
High Traffic Carpet

PRIMARY | **Coach, Food Service**



Low Traffic Carpet

PRIMARY | **Bedrooms**



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SOFT MATERIALS

	Material	Technology/Construction	Texture/ Pattern	Finish	Color	Coach Areas	Sleeper Bedrooms	Food Service Areas	Toilets & Showers	Common Use Areas
1	**Synthetic Leather**	Primary | Upholstery	Various Textures / Patterns (e.g. Soft organic, Top Grain, etc)	Matte	PMS 7699 C	Coach				
					PMS Cool Gray 9 C	Coach				
					PMS 2159c					
					PMS 202 C			Diner		
					PMS 539C	Premium Coach				
					PMS Warm Gray 9c			Lounge		
		Secondary | Class Signifiers	Various Textures / Patterns (e.g. Soft organic, Top Grain, etc)	Matte	PMS 3405 C	Coach				
					PMS 306 C	Premium Coach				
					PMS 483 C					
2	**Woven fabric**	92% wool 8% nylon Weight 500 +/- 5% gsm	As per sample	-	Base : PMS 7620 C Accent 1: Cool Gray 11 C			Diner		
					Base: Warm Gray 9 C Accent 1: Cool Gray 11 C			Lounge		
3	**Polyester Yarn**	3 ply	Various Patterns (Double top stitch + Single stitch line)	Various Finishes (Matte, Silky luster, etc)	PMS 7620 C					
					PMS 539C					
					PMS Cool Gray 9 C					
4	**Polyester / Polyamide**	Solid knitted construction medium light transmittance or Aluminum-backed	Blackout backing TBD	Matte	PMS Cool Gray 9 C		Door Blind			
					PMS 539C		Window Blind			

HARD MATERIALS

	Material	Technology/Construction	Texture/ Pattern	Finish	Color	Coach Areas	Sleeper Bedrooms	Food Service Areas	Toilets & Showers	Common Use Areas
1	**Stainless Steel / Aluminum**	Stainless Steel	Various (e.g. Brushed , Smooth , VDi 39)	-	Natural					
		Anodized Aluminum	Various (e.g. Satin, Smooth , VDi 39)	Metallic	PMS 10353 C					
		Primary | Powder Coated or similar	Various Textures / Patterns (e.g. Smooth , VDi 39, etc)	Various Finishes (Matte, Satin, Gloss, Metallic, etc)	RAL 085 93 05 (Matched Color)					
					RAL 9003 (Matched Color)					
					RAL 7021 (Matched Color)					
					PMS 539 C (Matched Color)					
		Secondary | Powder Coated or similar	Various (e.g. Satin, Smooth , VDi 39)	Various Finishes (Matte, Satin, Metallic, etc)	PMS 2728 C					
					PMS 483 C (Matched Color)					
2	**High Pressure Laminate (HPL) or similar**	Feature laminate	Wood Grain	Matte	Native American Oak					
			Marbled finish, naturally veined, varying intensity		***Refer to sample**					
			Ribbed / Slatted pattern achieved through pressing or texturing.	Various Finishes (Matte, Satin, etc)	Native American Oak.					
					PMS 539 C					
		Solid Colour Laminates	Various Textures / Patterns (e.g. Smooth , Brushed, Sandblasted, VDi 39, etc)	Various Finishes (Matte, Satin, Gloss, Metallic, etc)	PMS 483 C (Matched Color)					
					PMS 539 C (Matched Color)					
					PMS Cool Gray 6 C (Matched Color)					
					RAL 9003 (Matched Color)					
					RAL 085 93 05 (Matched Color)					
					RAL 7021 (Matched Color)					
3	**Moulded polymer or similar**	Solid Colour Polymers	Various Textures / Patterns (e.g. Smooth , Brushed, Sandblasted, VDi 39, etc)	Various Finishes (Matte, Satin, Gloss, Metallic, etc)	PMS 483 C (Matched Color)					
					PMS 539 C (Matched Color)					
					PMS Cool Gray 6 C (Matched Color)					
					RAL 9003 (Matched Color)					
					RAL 085 93 05 (Matched Color)					
					RAL 7021 (Matched Color)	Premium Coach				
4	**Solid Surface / Feature Polymer**	Not prescribed	Smooth	Matte	Pure White					
			Superior marbled finish, naturally veined.	Matte	***Refer to sample**					
			Small tile pattern	Semi Gloss	PMS 302 C					
5	**Glass**	Flat	Various (clear, Frosted, Tint, Film, etc)	-	Transparent					
		Fluted glass	Pattern should blur space between each booth	-						

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FLOORING

	Material	Technology/Construction	Texture/ Pattern	Finish	Color	Coach Areas	Sleeper bedrooms	Food & Beverage	Toilets & Showers	Common Use Areas
1	**High Traffic Carpet 1**	4 Threads. Woven with loop pile, square weaving, 100% Nylon, Low pile for optimum durability and resistance	See sample reference	80% matte 20% luster	Base color: PMS 539 C Accent 1: PMS Cool Gray 1 C Accent 2: PMS Cool Gray 9 C Accent 3: PMS 7699 C					
2	**High Traffic Carpet 2**				Base color: PMS Black 7 C Accent 1: PMS Cool Gray 1 C Accent 2: PMS Warm Gray 9 C Accent 3: PMS Cool Gray 11 C					
3	**Low Traffic Carpet 3**	Not prescribed			Base color: PMS 483 C Accent 1: RAL 9003 Accent 2: RAL 070 85 10 Accent 3: RAL 7021					
4	**Anti-slip Rubber Floor 1**	synthetic rubber made of a colored compound, mixed with multi-colored speckles of the same material which provides excellent anti-slip properties. Anti slip caping to pass R11 standard	Terrazzo like pattern	Fast curing, two component water based Polyurethane top coat for extra abrasion and chemical resistance	Base Color: NCS S8502-B Blue Accent: S6030-R90B Beige Accent: S0502-Y50R Grey Accent: S5502-Y					
5	**Anti-slip Rubber Floor 2**				Base Color: NCS S2002-B Blue Accent: S6030-R90B Beige Accent: S0502-Y50R Dark Accent: S5502Y					

High Traffic Carpet



Carpet 1

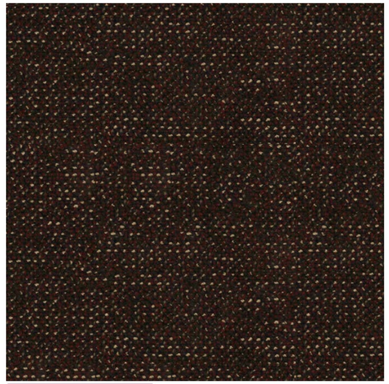
Base color: PMS 539 C
Accent 1: PMS Cool Gray 1 C
Accent 2: PMS Cool Gray 9 C
Accent 3: PMS 7699 C



Carpet 2

Base color: PMS Black 7 C
Accent 1: PMS Cool Gray 1 C
Accent 2: PMS Warm Gray 9 C
Accent 3: PMS Cool Gray 11 C

Low Traffic Carpet



Carpet 3

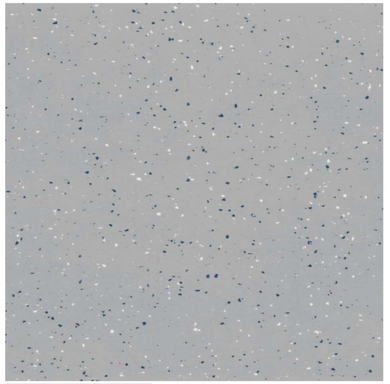
Base color: PMS 483 C
Accent 1: RAL 9003
Accent 2: RAL 070 85 10
Accent 3: RAL 7021

Anti-slip Rubber Floor



Rubber 1

Base Color: NCS S8502-B
Blue Accent: S6030-R90B
Beige Accent: S0502-Y50R
Grey Accent: S5502-Y



Rubber 2

Base Color: NCS S2002-B
Blue Accent: S6030-R90B
Beige Accent: S0502-Y50R
Dark Accent: S5502Y

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FLOORING

High Traffic Carpet



Carpet 1

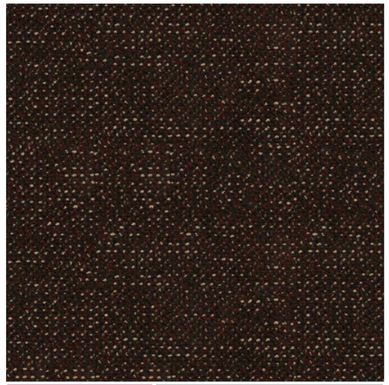
Base color: PMS 539 C
Accent 1: PMS Cool Gray 1 C
Accent 2: PMS Cool Gray 9 C
Accent 3: PMS 7699 C



Carpet 2

Base color: PMS Black 7 C
Accent 1: PMS Cool Gray 1 C
Accent 2: PMS Warm Gray 9 C
Accent 3: PMS Cool Gray 11 C

Low Traffic Carpet



Carpet 3

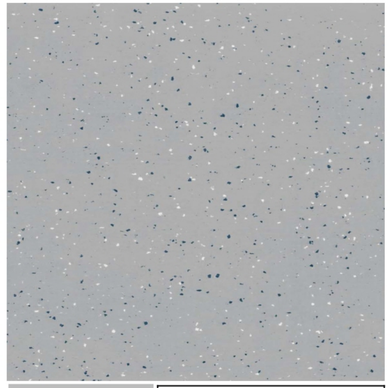
Base color: PMS 483 C
Accent 1: RAL 9003
Accent 2: RAL 070 85 10
Accent 3: RAL 7021

Anti-slip Rubber Floor



Rubber 1

Base Color: NCS S8502-B
Blue Accent: S6030-R90B
Beige Accent: S0502-Y50R
Grey Accent: S5502-Y



Rubber 2

Base Color: NCS S2002-B
Blue Accent: S6030-R90B
Beige Accent: S0502-Y50R
Dark Accent: S5502Y

Location		Flooring Type
Standard Coach	Aisle	High Traffic Carpet 1
	Under Seats	High Traffic Carpet 1
	Entrance Areas	Anti-Slip Rubber Floor 1
Premium Accessible Coach	Aisle	High Traffic Carpet 1
	Under Seats	High Traffic Carpet 1
	Entrance Areas	Anti-Slip Rubber Floor 1
Café	Aisle	Anti-Slip Rubber Floor 1
	Under Seats (booths)	Anti-Slip Rubber Floor 1
	Entrance Areas	Anti-Slip Rubber Floor 1
	Behind counter	Anti-Slip Rubber Floor 2
	Queuing area	Anti-Slip Rubber Floor 2
Diner	Aisle by Galley	Anti-Slip Rubber Floor 1
	Seated Area	High Traffic Carpet 2
	Kitchen	Anti-Slip Rubber Floor 2
Diner / Lounge	Entrance Areas	Anti-Slip Rubber Floor 1
	Seated Area	High Traffic Carpet 2
Sleeper Cars	Entrance Areas	Anti-Slip Rubber Floor 1
	Aisle/Hallway	High Traffic Carpet 2
	Inside Bedooms	Low Traffic Carpet 3
	Bedroom Restrooms	Anti-Slip Rubber Floor 2
Communal Restrooms	ATR & STR & Shower	Anti-Slip Rubber Floor 2
Utility Car (Option)	Entrance Areas	Anti-Slip Rubber Floor 1
	Aisle/Hallway	High Traffic Carpet 2
	Common Area	Anti-Slip Rubber Floor 1
	Checked Bag Storage	Anti-Slip Rubber Floor 2
High Capacity Coach (Option)	Aisle	High Traffic Carpet 1
	Under Seats	High Traffic Carpet 1
	Entrance Areas	Anti-Slip Rubber Floor 1

FLOORING MAP

COACH CARS

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High Traffic Carpet



Carpet 1

Base color: PMS 539 C
Accent 1: PMS Cool Gray 1 C
Accent 2: PMS Cool Gray 9 C
Accent 3: PMS 7699 C

Carpet 2

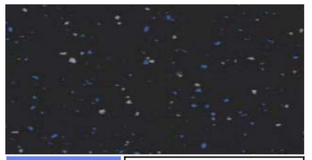
Base color: PMS Black 7 C
Accent 1: PMS Cool Gray 1 C
Accent 2: PMS Warm Gray 9 C
Accent 3: PMS Cool Gray 11 C

Low Traffic Carpet

Carpet 3

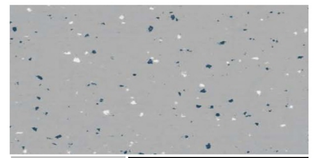
Base color: PMS 483 C
Accent 1: RAL 9003
Accent 2: RAL 070 85 10
Accent 3: RAL 7021

Anti-slip Rubber Floor



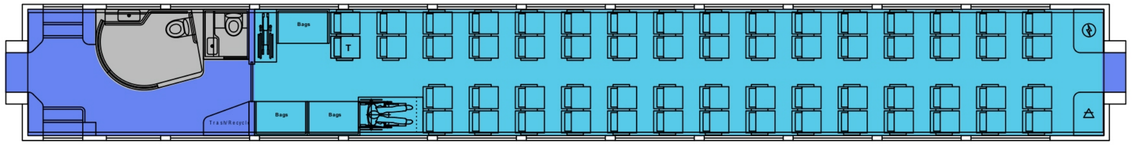
Rubber 1

Base Color: NCS S8502-B
Blue Accent: S6030-R90B
Beige Accent: S0502-Y50R
Grey Accent: S5502-Y

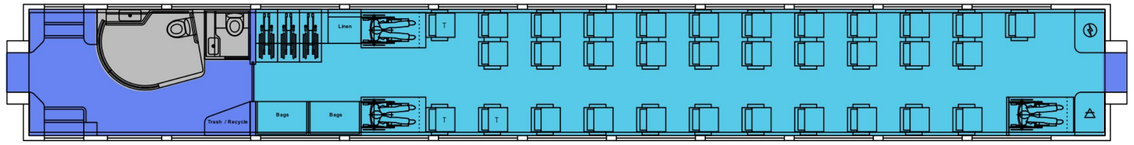


Rubber 2

Base Color: NCS S2002-B
Blue Accent: S6030-R90B
Beige Accent: S0502-Y50R
Dark Accent: S5502Y

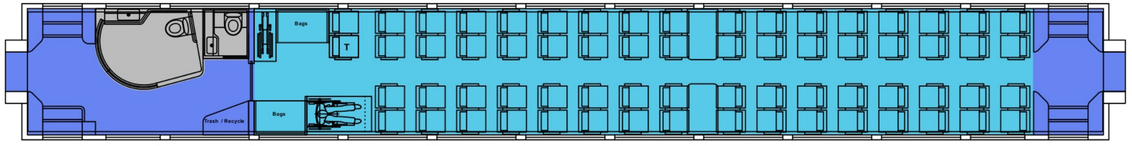


STANDARD COACH (42" pitch) - 60 C / 1 MOB



PREMIUM ACCESSIBLE COACH (48" pitch) - 33 PC / 3 MOB

Option Car



HICH CAPACITY COACH (37" pitch) - 66 C / 1 MOB *2x DOORS

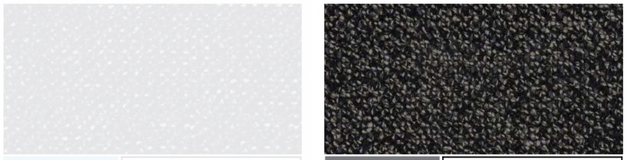
CX VISION | **CMF SCHEDULE**

FLOORING MAP

NON-REVENUE CARS

26-FOI-0[illegible] "[illegible]SSIFIED" 4/30/2026

High Traffic Carpet



Carpet 1

Base color: PMS 539 C
Accent 1: PMS Cool Gray 1 C
Accent 2: PMS Cool Gray 9 C
Accent 3: PMS 7699 C

Carpet 2

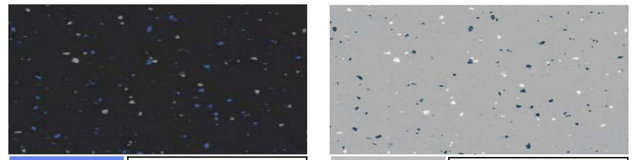
Base color: PMS Black 7 C
Accent 1: PMS Cool Gray 1 C
Accent 2: PMS Warm Gray 9 C
Accent 3: PMS Cool Gray 11 C

Low Traffic Carpet

Carpet 3

Base color: PMS 483 C
Accent 1: RAL 9003
Accent 2: RAL 070 8510
Accent 3: RAL 7021

Anti-slip Rubber Floor

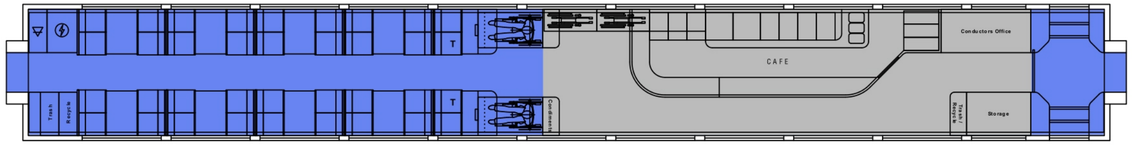


Rubber 1

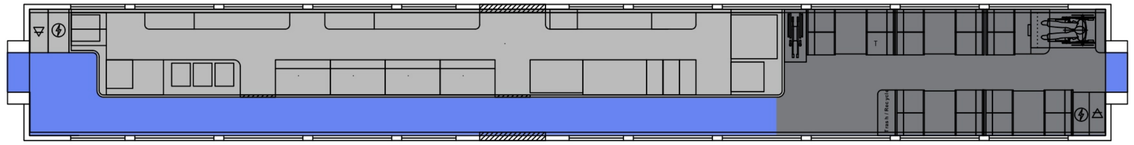
Base Color: NCS S8502-B
Blue Accent: S6030-R90B
Beige Accent: S0502-Y50R
Grey Accent: S5502-Y

Rubber 2

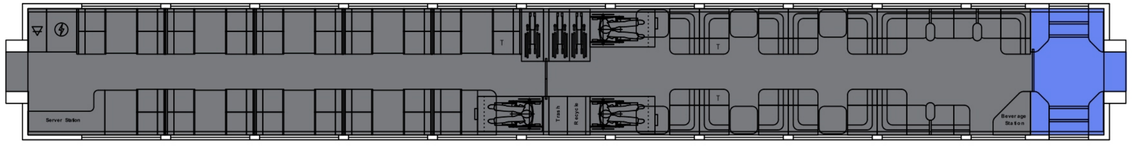
Base Color: NCS S2002-B
Blue Accent: S6030-R90B
Beige Accent: S0502-Y50R
Dark Accent: S5502Y



CAFE - 36 Cafe / 2 MOB



DINER - 18 Diner / 1 MOB



DINER / LOUNGE - 36 Diner / 1 MOB + 30 Lounge / 2 MOB

FLOORING MAP

SLEEPER CARS

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High Traffic Carpet

Carpet 1
Base color: PMS 539 C
Accent 1: PMS Cool Gray 1 C
Accent 2: PMS Cool Gray 9 C
Accent 3: PMS 7699 C

Carpet 2
Base color: PMS Black 7 C
Accent 1: PMS Cool Gray 1 C
Accent 2: PMS Warm Gray 9 C
Accent 3: PMS Cool Gray 11 C

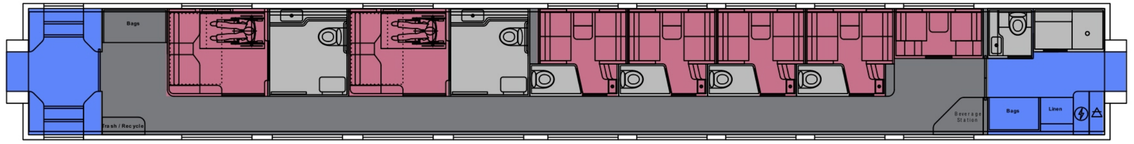
Low Traffic Carpet

Carpet 3
Base color: PMS 483 C
Accent 1: RAL 9003
Accent 2: RAL 070 85 10
Accent 3: RAL 7021

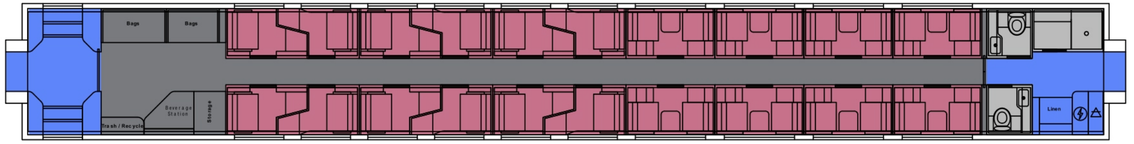
Anti-slip Rubber Floor

Rubber 1
Base Color: NCS S8502-B
Blue Accent: S6030-R90B
Beige Accent: S0502-Y50R
Grey Accent: S5502-Y

Rubber 2
Base Color: NCS S2002-B
Blue Accent: S6030-R90B
Beige Accent: S0502-Y50R
Dark Accent: S5502Y

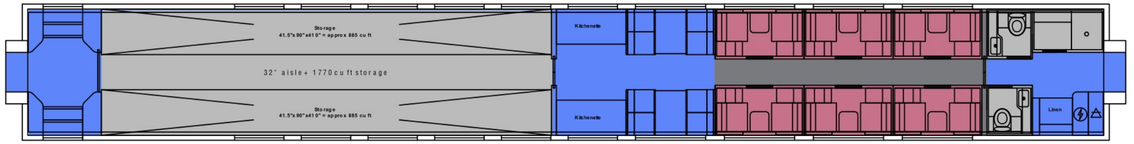


ACCESSIBLE SLEEPER - 2 ACCESS.BR / 4 BR / 1 Crew



STANDARD SLEEPER - 12 S / 7 R / 1 Crew

Option Car



UTILITY CAR - 6 R (Crew) + 8 seats + Minimum of 1,600 cu ft

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STANDARD COACH SEAT





PREMIUM ACCESSIBLE COACH SEAT

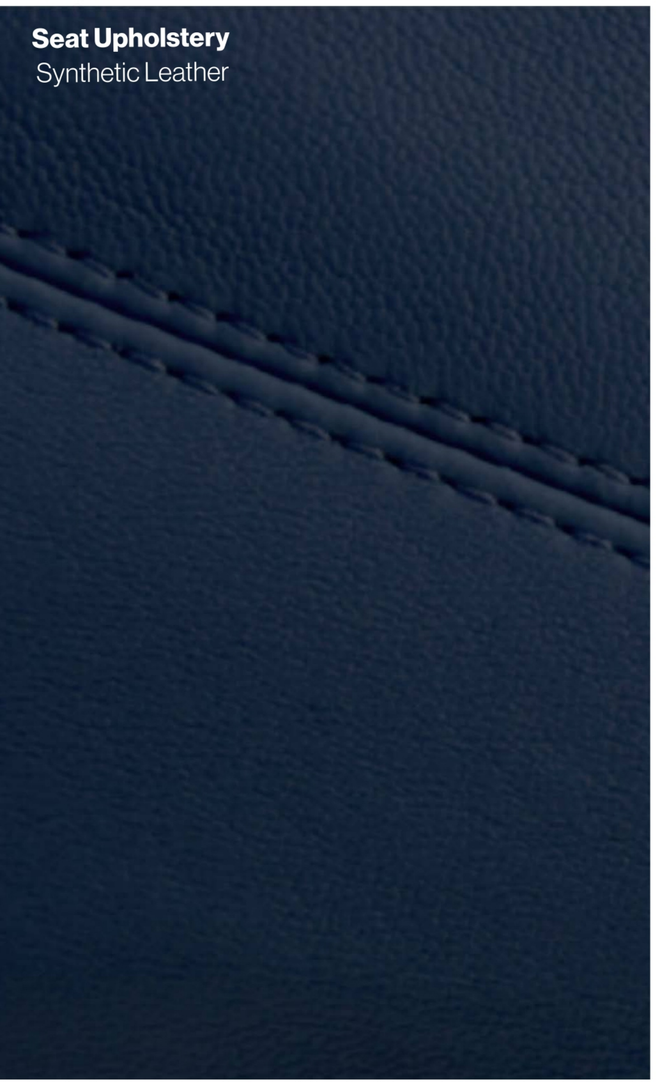




SPECIFIC | PREMIUM ACCESSIBLE COACH SEAT

Identifier
Synthetic Leather

Seat Upholstery
Synthetic Leather



Headrest Strap
Synthetic leather

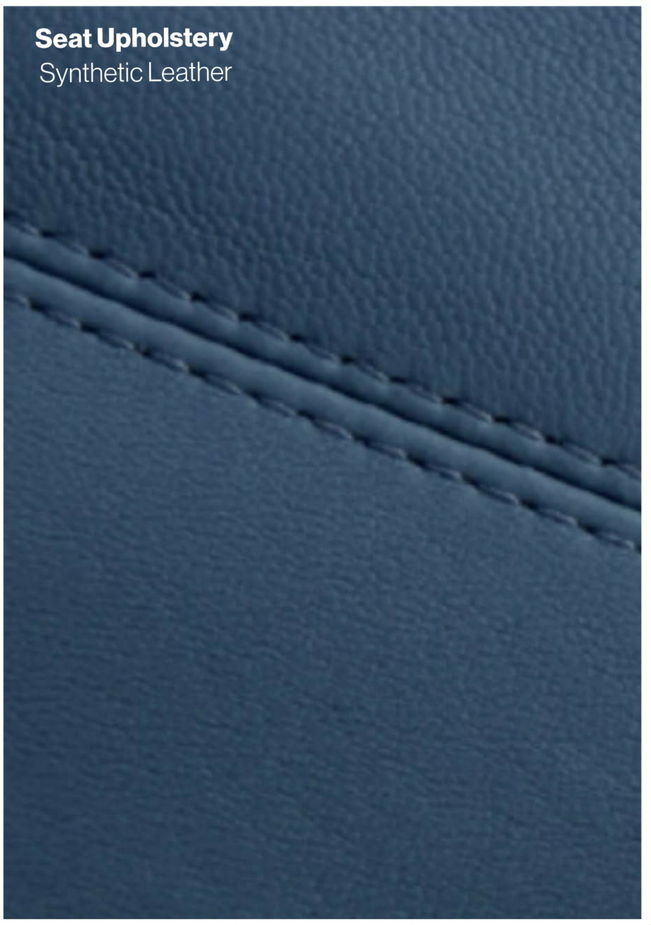
Seat Back Housing
Recycled thermoformed plastic

Privacy Wing back panel
Recycled Thermoplastic

SPECIFIC | STANDARD COACH SEAT

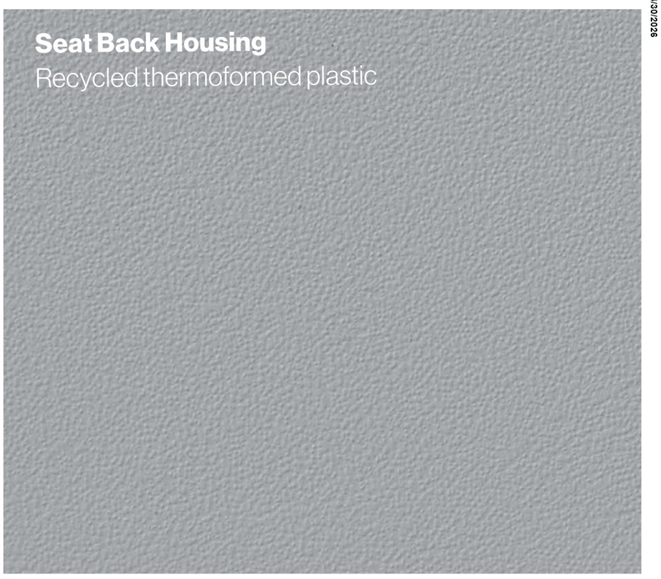
Identifier
Synthetic Leather

Seat Upholstery
Synthetic Leather



Headrest
Synthetic leather

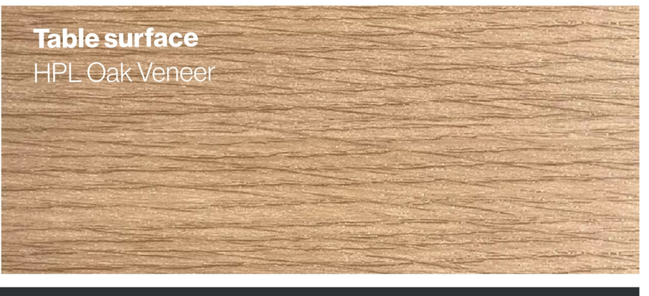
Seat Back Housing
Recycled thermoformed plastic



COMMON | COACH + PREMIUM SEAT

Metal trims
Fossil free Steel

Table surface
HPL Oak Veneer



Seat Pedestal
Powder coating

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0000006235
"UNCLASSIFIED"
4/30/2025

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COACH INTERIOR STRUCTURE | FLOOR, SIDEWALLS, CEILING, BULKHEADS , PARTITION DOOR BULKHEADS, PARTITION LIFT BULKHEADS, LUGGAGE RACK + STACK

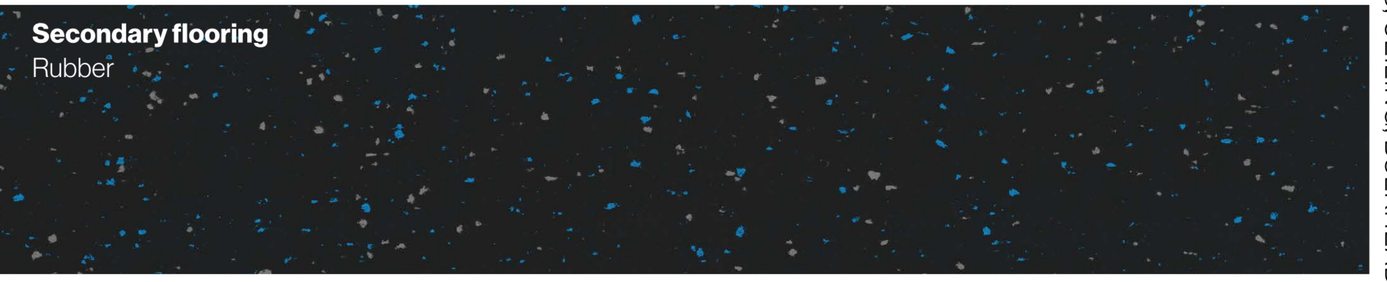




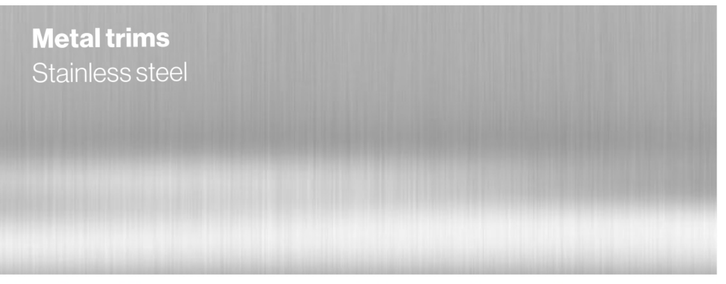




Primary flooring
Woven Carpet



Secondary flooring
Rubber

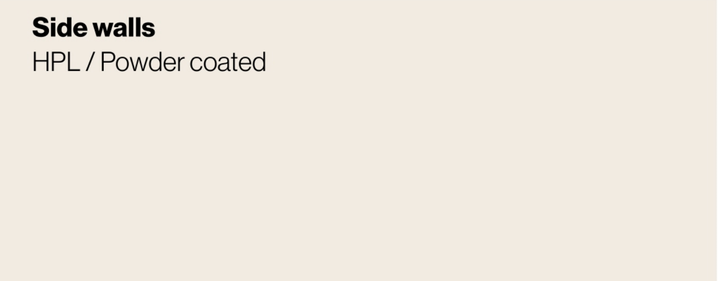


Metal trims
Stainless steel



Racks + Stacks
Glass + Film

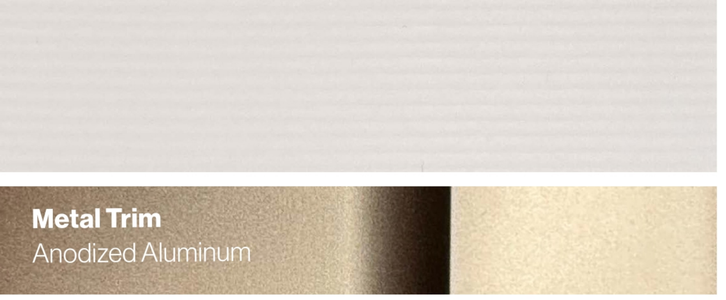
Side walls
HPL / Powder coated



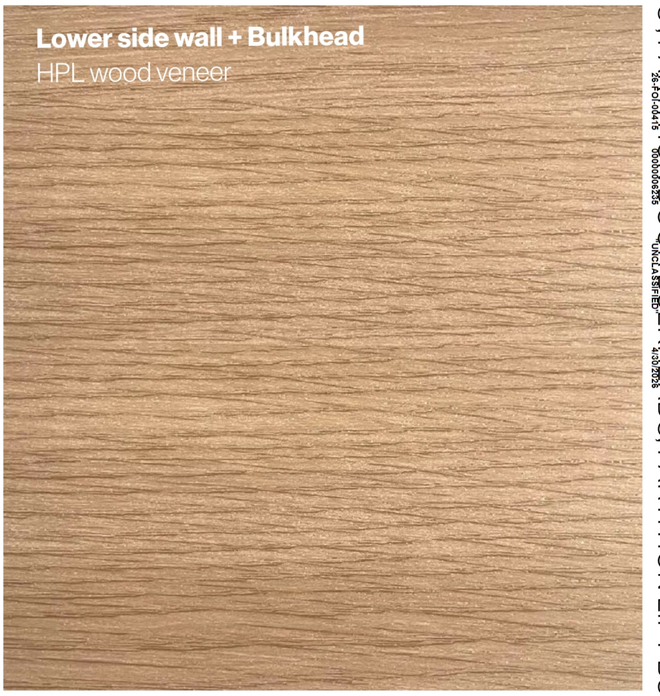
Side wall pillars
Moulded Polymer + film



Metal Trim
Anodized Aluminum



Bulkhead trim
Backed Glass



Lower side wall + Bulkhead
HPL wood veneer

Ceiling panels
HPL / Powder coated

26-FOI-00416 0000006825 UNCLASSIFIED 4/30/2026

ROOMETTE / CLUB BEDROOM / ACCESSIBLE BEDROOM / SOLOSUITE

26-FOI-00415 00000006235 "UNCLASSIFIED" 4/30/2026













COMMON | **ROOMETTE / CLUB BEDROOM / ACCESSIBLE BEDROOM / SOLO SUITE**

26-FOI-00415 00000006235 "UNCLASSIFIED" 4/30/2026



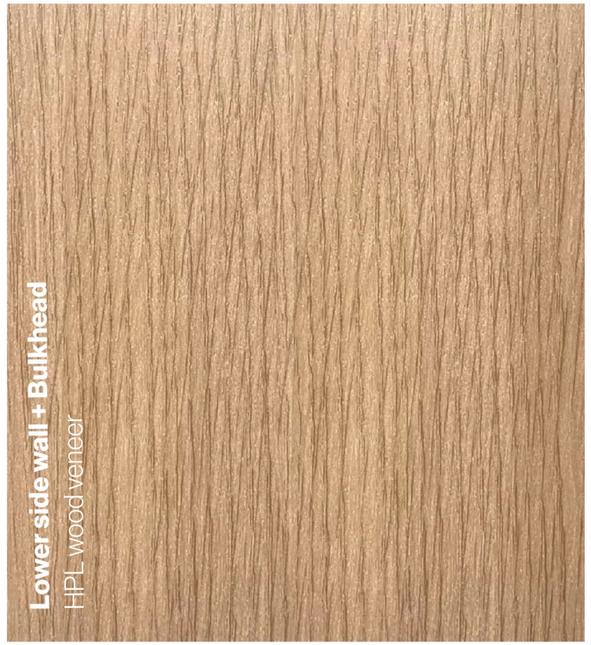
Identifier
Synthetic Leather



Seat Upholstery
Synthetic Leather



Headrest
Synthetic leather



Lower side wall + Bulkhead
HPL wood veneer



Highlight / Cupboard
HPL



Wall surface
Ribbed HPL



Door Blind
Polyamide



Steps
Rubber



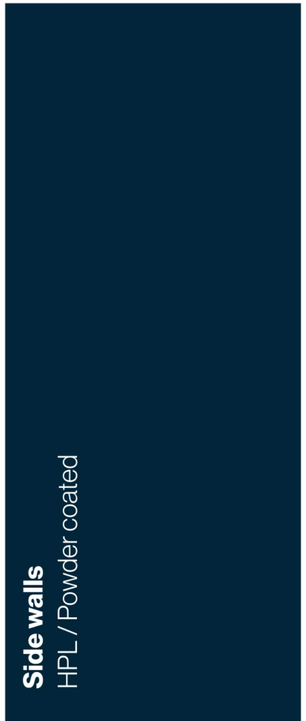
Flooring
Woven Carpet



Metal trims
Stainless steel



Table surface
HPL / Solid Surface



Side walls
HPL / Powder coated

Ceiling panels
HPL / Powder coated



Metal Trim
Anodized Aluminum

Sink + Surround
Solid Surface

CAFE + DINER SEAT / LOUNGE SEAT

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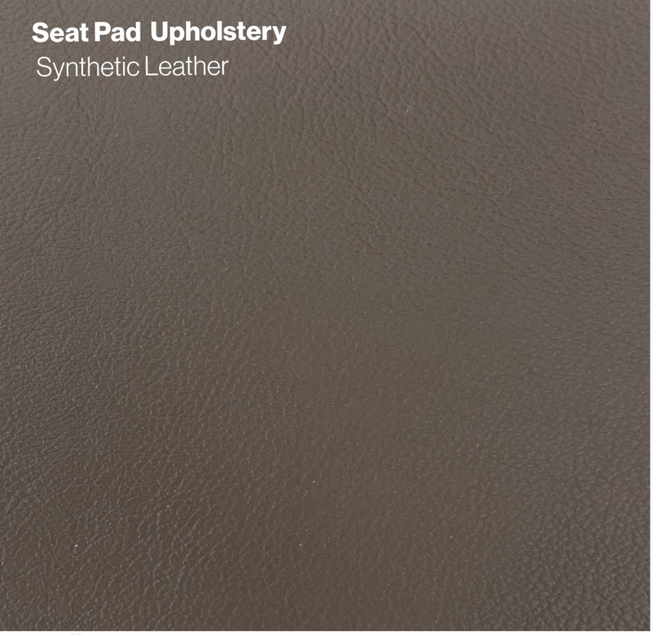
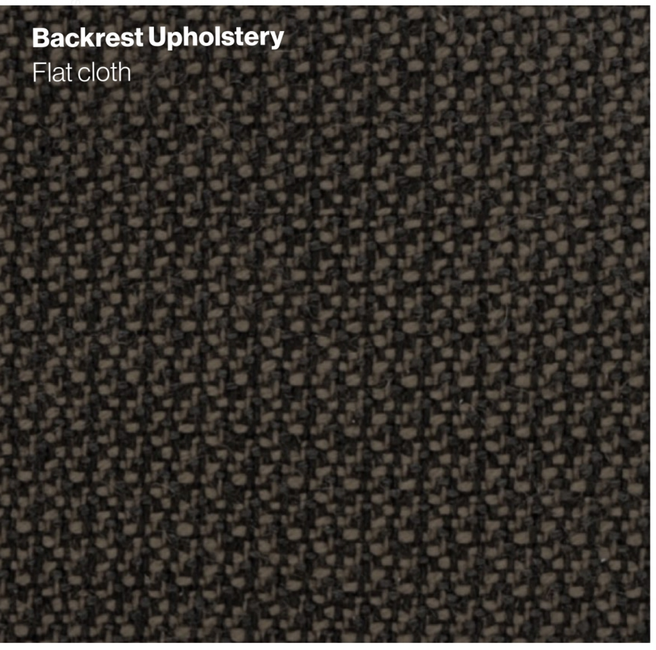
SPECIFIC | LOUNGE SEAT

Seat Pad Upholstery
Synthetic Leather



Backrest Upholstery
Flat cloth

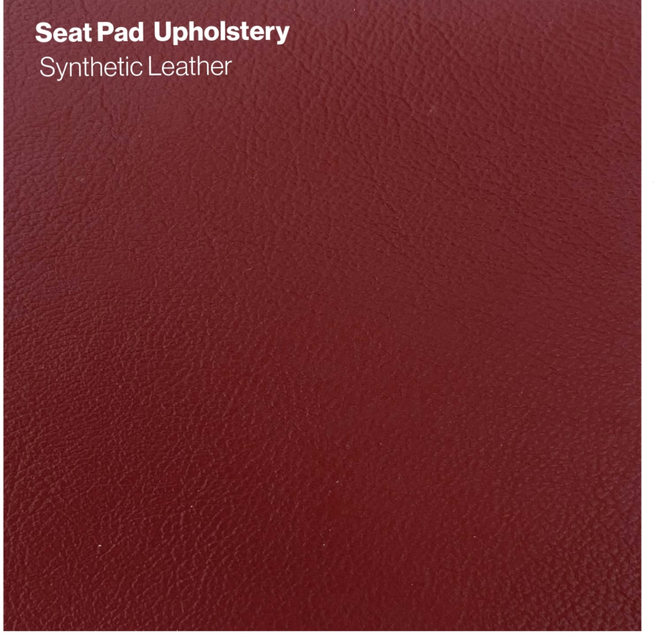


Wall Lamp
Anodized Aluminum



SPECIFIC | CAFE + DINER SEAT

Seat Pad Upholstery
Synthetic Leather



Backrest Upholstery
Flat cloth

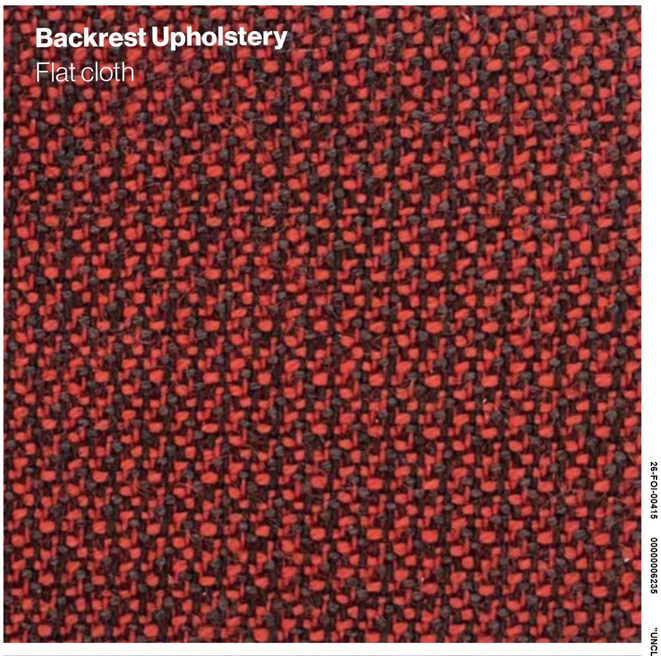


Table Lamp
Anodized Aluminum



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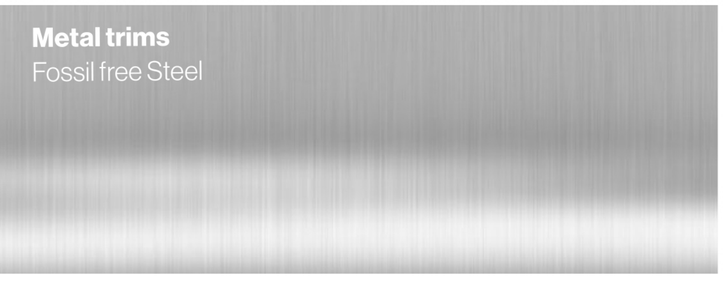
COMMON | CAFE + DINER SEAT / LOUNGE SEAT

Metal trims
Fossil free Steel



Structure
HPL Oak Veneer



Dividers
Fluted glass



Table surface
HPL / Solid Surface



Booth Pedestal
Powder coating

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COACH CAFE + DINER + LOUNGE STRUCTURE



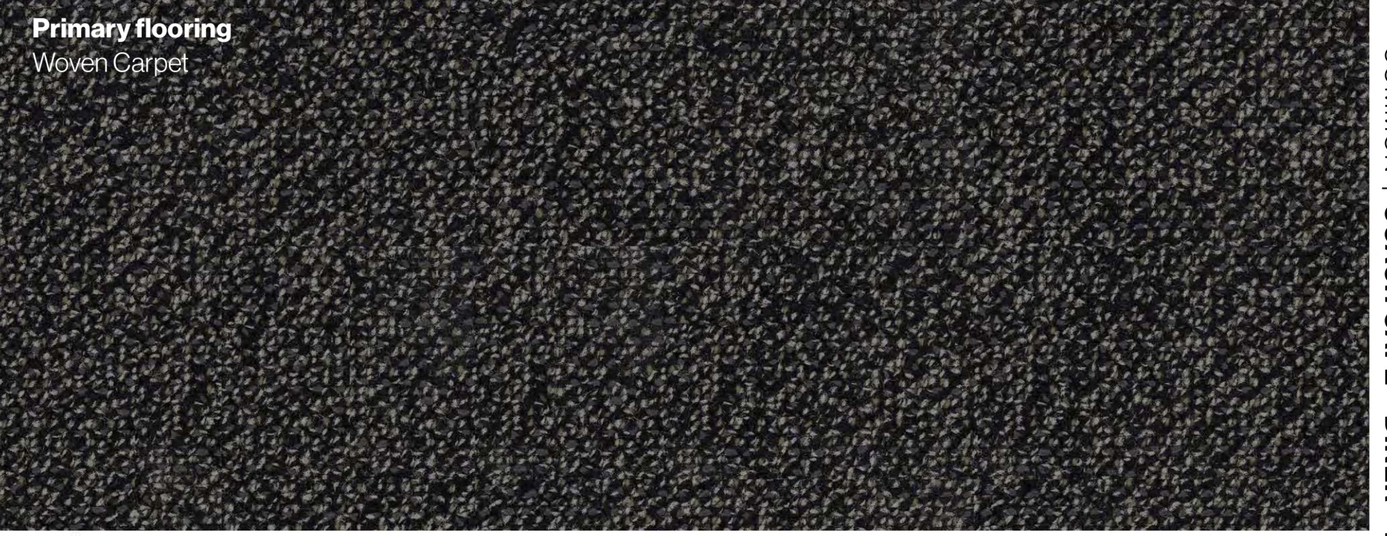


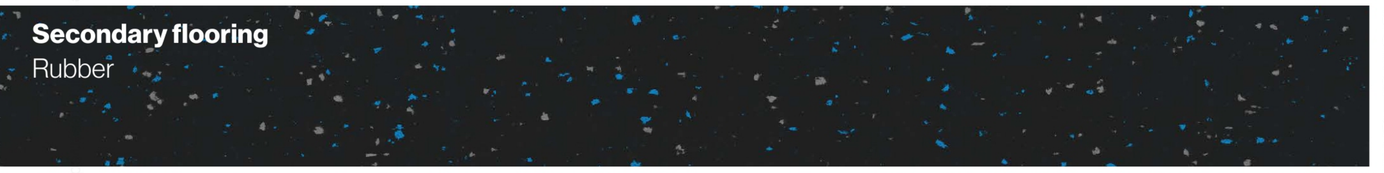
CAFE

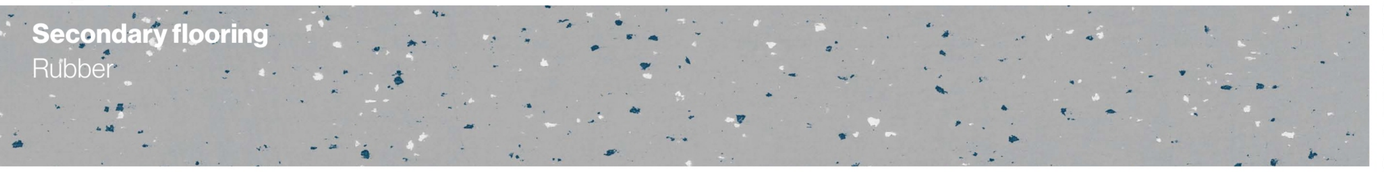


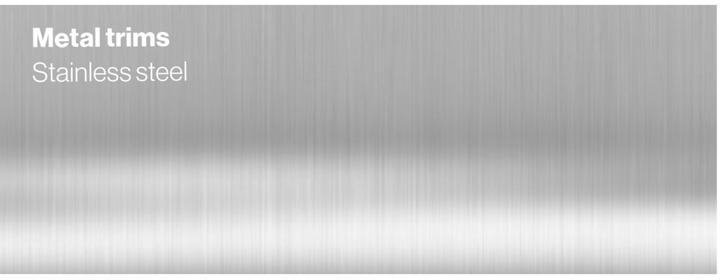


COMMON | **COACH CAFE + DINER + LOUNGE STRUCTURE / CAFE**







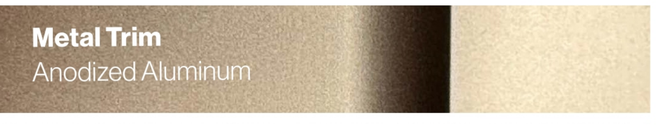


Ceiling panels
HPL / Powder coated

Side walls
HPL / Powder coated

SPECIFIC | **COACH CAFE + DINER + LOUNGE STRUCTURE**



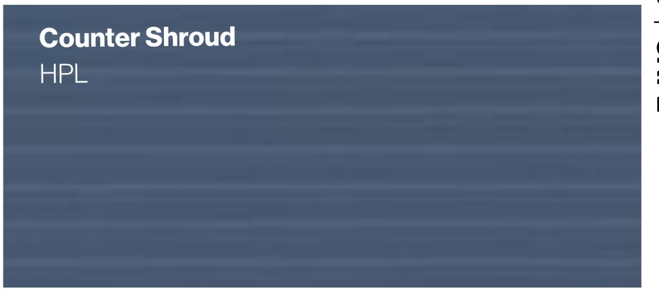


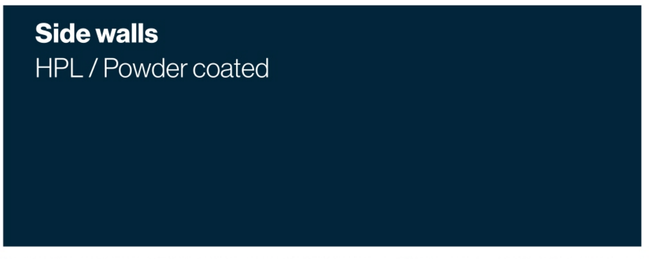
Side wall pillars
Moulded Polymer + film

Blind
Polyamide

SPECIFIC | **CAFE**









Miscellaneous
HPL / Powder coated

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UNIFIED TOILET & SHOWER

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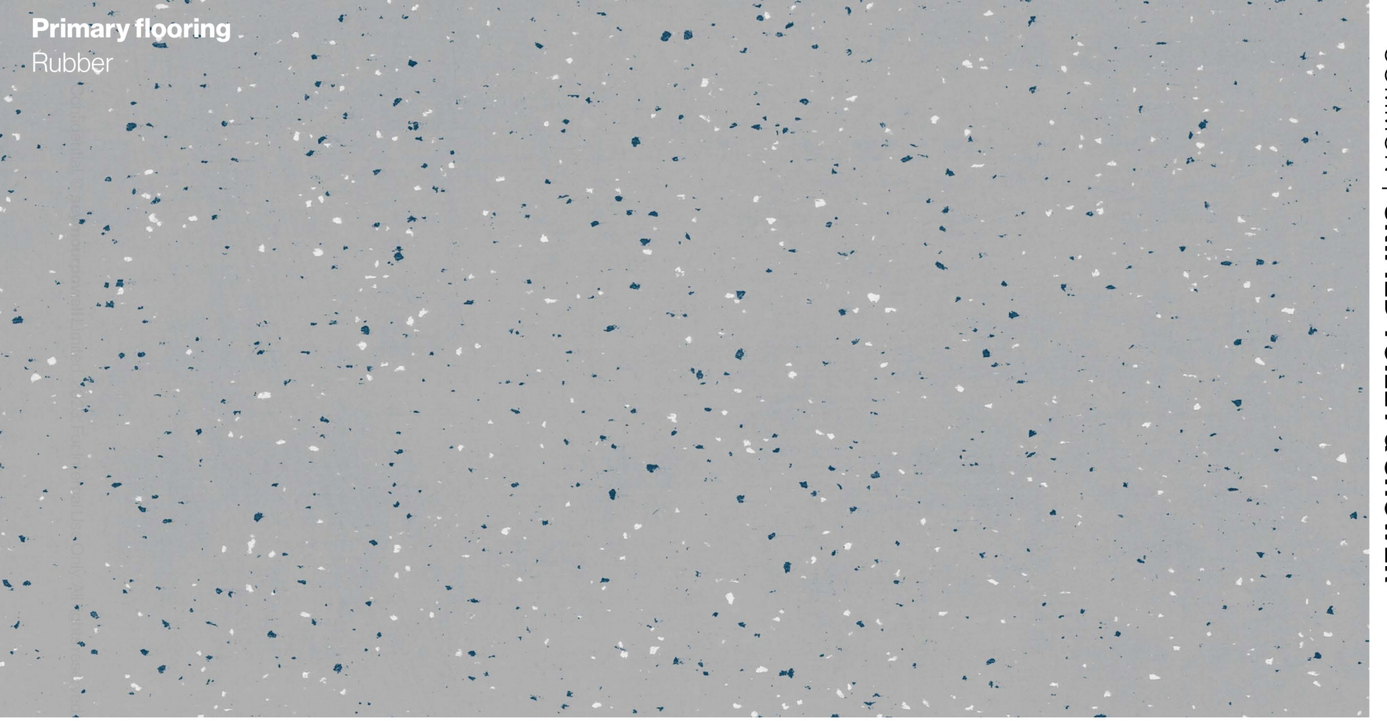
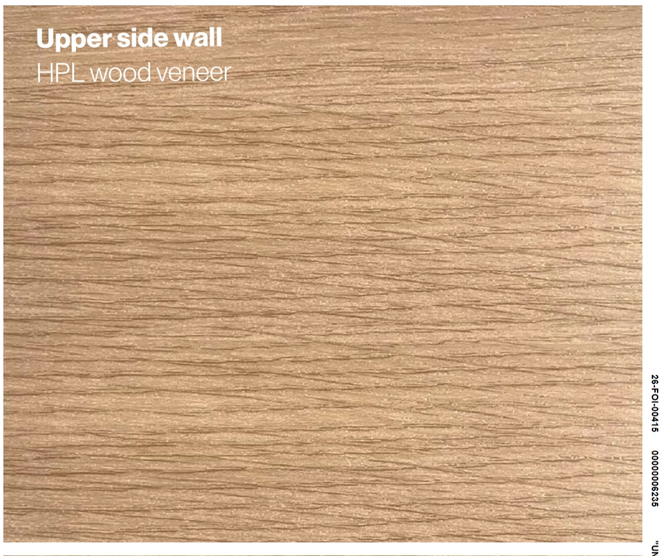
Primary flooring
Rubber



Grab rails + Metal trims
Stainless steel

Upper side wall
HPL wood veneer



Entrance door + Side walls
HPL / Powder coated

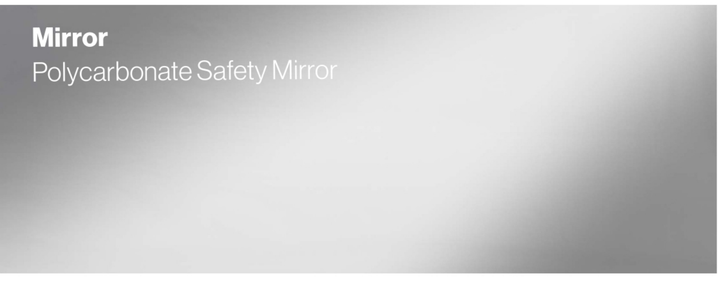
Wall surface
Ribbed HPL



Lower side wall
Moulded polymer

Ceiling panels
HPL / Powder coated

Mirror
Polycarbonate Safety Mirror



Sink + Vanity
Solid Surface

Back splash
Moulded polymer or solid surface



Vanity trims
Powder coated or similar

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UNIFIED COMMON USE AREAS

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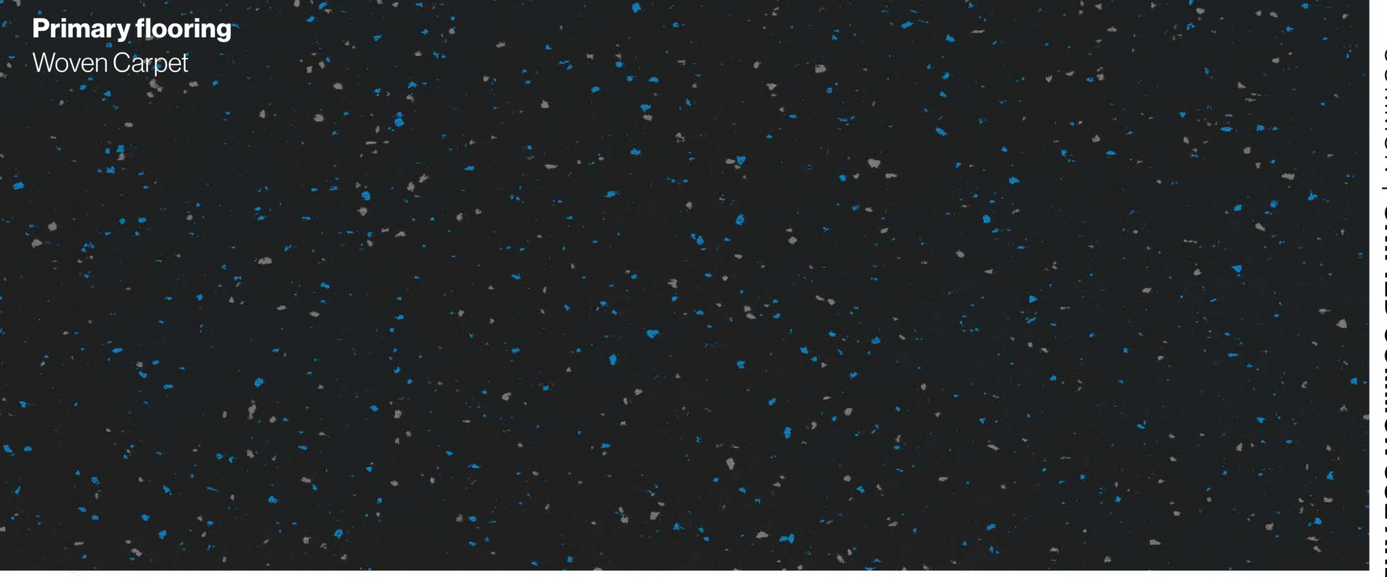


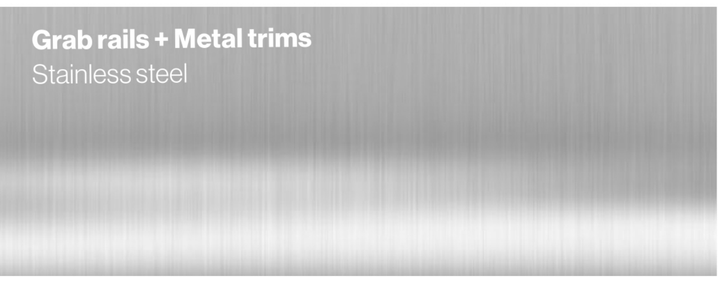
Primary flooring
Woven Carpet



Staircase flooring
Rubber

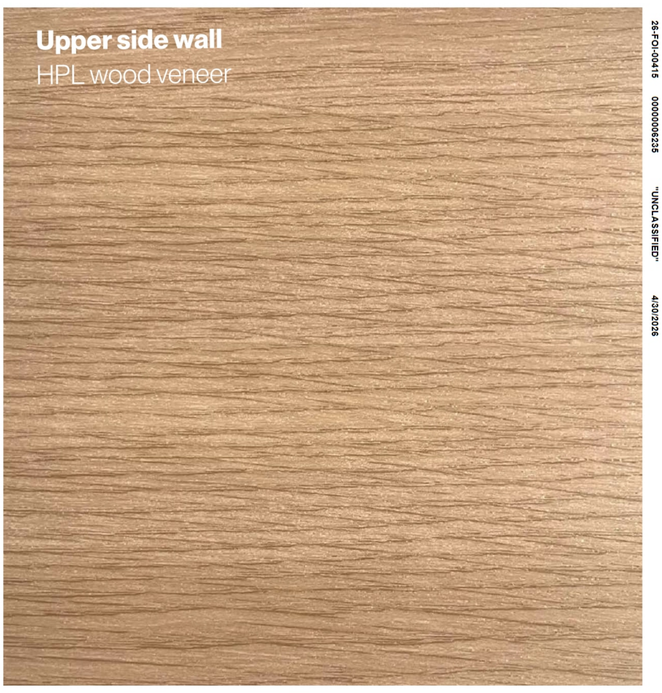


Sleeper flooring
Rubber



Grab rails + Metal trims
Stainless steel

Side walls
HPL / Powder coated



Upper side wall
HPL wood veneer

Ceiling panels
HPL / Powder coated

Door
Powder coated or similar



Wall surface
Ribbed HPL

Vending Counter
Solid Surface

Highlight Trim
HPL / Powder coated

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AMTRAK®

Thank you.

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AMTRAK®

Long Distance
CX Vision - Part 1

Issued March 2026

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THE OPPORTUNITY

Amtrak has a strong legacy as the proud national rail carrier with a mission to connect people across America.

Designing the future of Amtrak's Long Distance trains is a once in a generation opportunity to transform the service into an accessible, sustainable and futureproofed experience that will last another 50 years. This document sets out the Customer Experience Vision for life onboard our future trains.



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THE LONG DISTANCE EXPERIENCE

To ride on a long distance Amtrak train is to have an experience like no other.



As we traverse diverse landscapes, our service is designed to cater to passengers of varied abilities and backgrounds. Embracing the eclectic nature woven into the fabric of America, the long distance service unites communities, turning each journey into a seamless and enriching experience.



The Amtrak Long Distance Train experience is earthly and grounded with customers traveling through the landscape, not above it. Passengers are able to see America in ways that they have never seen before.



Amtrak's crew are the heroes and heroines of our service. They do a fantastic job of providing a high standard of customer service and support the passenger at every step of their journey.



Our unique service demands distinctive spaces. On extended routes, our diners and cafes deliver culinary excellence. In our observation cars, panoramic views become more than just scenery—they become opportunities to connect with fellow travelers, transforming every moment into a destination in itself.

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OUR PEOPLE

At Amtrak, our commitment to excellence extends beyond the tracks; it's woven into the fabric of our culture and the hearts of our people. To embark on a journey with us is to embrace the unique tapestry of experiences and needs that define our onboard crew, the dedicated individuals who ensure the seamless operation of our long-distance services.

Understanding our people goes beyond a surface-level exploration—it's about immersing oneself in their daily lives, gaining insight into the challenges and triumphs they encounter on their journeys. We invite those who work with us to delve into the distinct needs of our staff, forging a connection that goes beyond professional collaboration.

This journey of understanding extends to our engineering team, where comprehension of operational intricacies, maintenance requirements and the collaborative efforts of cleaning crews is paramount. To truly contribute to the Amtrak legacy, a comprehensive grasp of these facets is essential.

Our brand is more than a logo; it's a promise, a commitment to delivering exceptional experiences. Those who collaborate with us must engage with our branding, product development, and design teams to ensure that every touchpoint resonates with the core values that define Amtrak.

Inclusivity is at the heart of our services, and our Accessibility Office stands as a testament to this commitment. Collaborators are encouraged to comprehend and address the diverse needs of all travelers, irrespective of their abilities. By working closely with our Accessibility Office, a more inclusive and accessible future for rail travel can be forged.

Finally, innovation propels us forward. Those working with Amtrak must navigate the intricate processes of testing and validation. From user testing to focus groups, utilizing mockups, and embracing cutting-edge technology like collaborative virtual reality—innovation is the vehicle through which we drive progress.

In essence, to work with Amtrak is to embark on a journey of understanding, collaboration, and innovation—a commitment to shaping the future of rail travel by embracing the richness of our people, the heart and soul of Amtrak. Welcome aboard.













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Prologue

Design DNA

Example Layouts

Product Vision

Design DNA

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DESIGN DNA

Amtrak's Long Distance design DNA has been created to inspire outstanding developments as we design the future long distance rail fleet.

The Design DNA brings to life how the Amtrak long-distance brand personality can be translated into a distinctive rail experience. It is created from a deep understanding of our passenger and crew's needs across the varied products we'll offer onboard. This will create a higher level of emotional engagement between our passengers, crew and our brand.

What is DNA Model?
A Design DNA is a tool that embodies a clear, unequivocal understanding of a brand and how it is expressed through design.

How does the model work?
In the very centre of the DNA model is the Heart. This is the central creative idea that inspires every expression of the brand and captures the distinctive magic of the Amtrak long distance experience. It expresses the feeling that we want our passengers and crew to have whenever they ride our long-distance trains.

Supporting the Heart are four key Values that add direction and colour to how the long distance brand should behave. They are inextricably linked to one another, but can be dialed up or dialed down depending upon their relevance to any design elements onboard the train. Think of them as four individual notes that together create a perfect harmony... it is possible to amplify one of the notes to make a point, but not without the other two in the background to create the harmony.



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HEART

FEELING FREEDOM

Feeling Freedom fills the Heart of our Design DNA.

Our long-distance trains offer all Americans a rare opportunity to escape the burdens of daily life. To be free to explore without the constraints of time. To choose a journey that supports the environment. To be yourself and make new friends.

Whether for a few days revelling in the vast glory of the shifting American landscape, or for a few hours... of simply kicking back and relaxing... Amtrak long distance trains' design empowers people to discover our Land of Liberty on their own terms.



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AMERICAN ICONIC

American Iconic celebrates the Amtrak Long Distance Trains as a destination wholly in themselves.

It inspires us to imbue our vehicles with the optimistic spirit of American design; creating enduring meaning and value so that the memories made on board last a lifetime. It reminds us of the history of the rails we ride and challenges us to question the archetypes of the past, so that we pioneer better long-distance experiences for the future.

American Iconic asks us to make good design available to all, by exploring the notions of ease and comfort. It encourages us to focus on the essential, so that each part is necessary and contributing to the whole. It challenges us to be brave, to shoot for an iconicity that can inspire a new generation to choose ‘the best way to travel’.



HOME TO ALL

Amtrak long distance trains provide common ground. We create empathetic interiors that allow all Americans, no matter their ability, to ride with equal dignity and grace.

Our long distance trains create dynamic communities. To support these communities we consider the social function of our spaces, allowing privacy and peace where it’s needed - and conviviality where it is desired.

This approach encourages the serendipitous moments of connection that add joy to our on board experience. Whether passengers or crew, all are supported by our desire to travel with comfort and ease. Come on in!

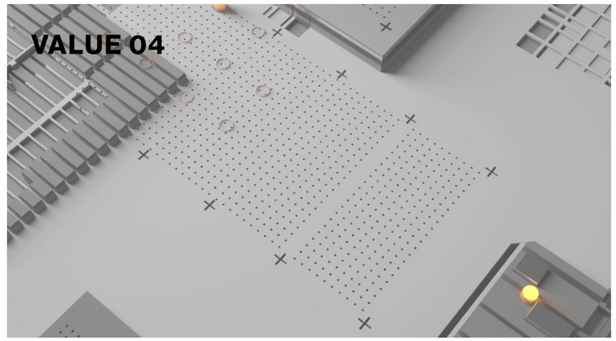


WILDERNESS WITHIN

Whether it’s a private view from a roomette or a shared experience from coach, our Long Distance trains offer passengers a seat at one of the greatest shows on earth; the American landscape.

Wilderness Within reflects the awe that is kindled when seeing the American landscape gently slip by from dawn through to dusk. We find beauty in both the remarkable and the mundane moments, in the outskirts of cities and the rhythms of small town life. In the vastness of the Plains and the expansive Pacific Coast. In the low lying shadows of canyons and high treelined mountains.

We honour these landscapes by echoing their beauty onboard, and cherish them by taking a sustainable approach to design that ensures we do our bit to preserve and protect it for tomorrow.



READY FOR TOMORROW

Ready for Tomorrow represents our commitment to face the difficulties of tomorrow with grit and grace.

No matter the freezing lows of winter or the scorching highs of summer, we anticipate tomorrow so we can move forward with unwavering purpose.

Solid, safe and reassuring in challenging times, we build resilience into our rolling stock through adaptability. Designing our trains around pragmatic, robust and coherent systems that can be evolved over time.

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Prologue

Design DNA

Example Layouts

Product Vision

Example Layouts

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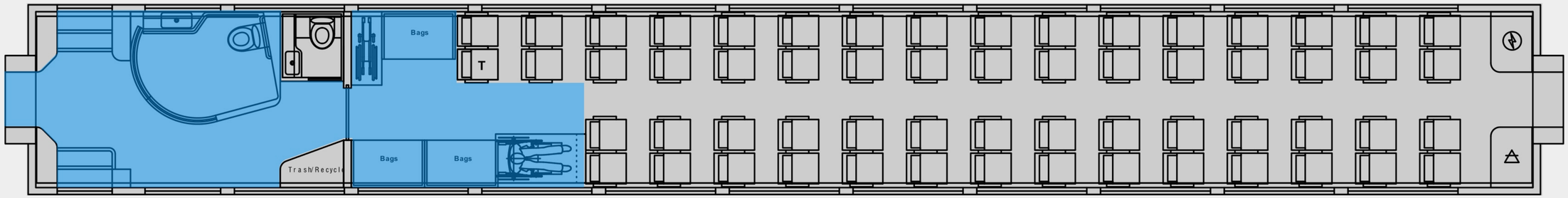
STANDARD COACH



STANDARD COACH

60 High Capacity Coach Seats @ 42” pitch
1 Mobility Position
1 Accessible Restroom
1 Standard Restroom
Loading doors at one end

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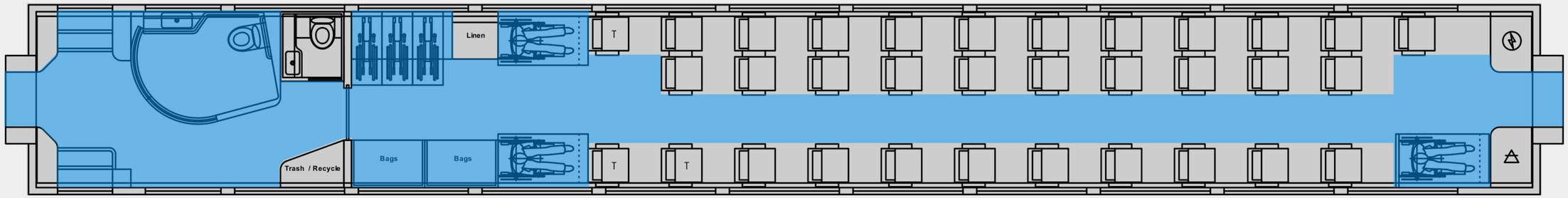
PREMIUM ACCESSIBLE COACH



PREMIUM ACCESSIBLE COACH

33 High Capacity Coach Seats @ 48” pitch
3 Mobility Position
1 Accessible Restroom
1 Standard Restroom
Loading doors at one end

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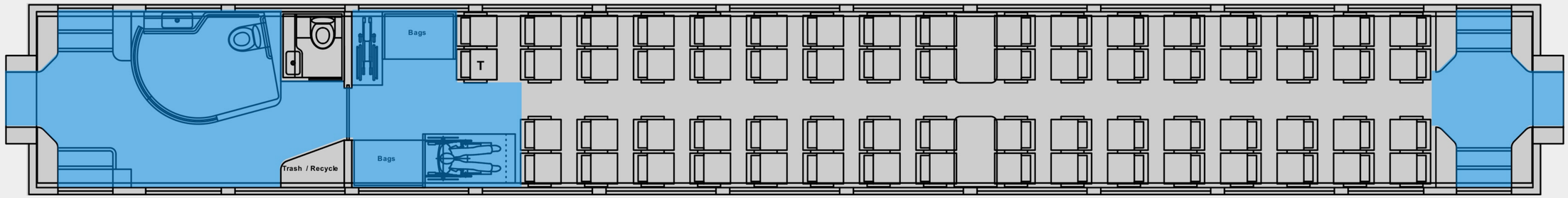
HIGH CAPACITY COACH

*OPTION



HIGH CAPACITY COACH COACH

66 High Capacity Coach Seats @ 37” pitch
1 Mobility Position
1 Accessible Restroom
1 Standard Restroom
Loading doors at each end

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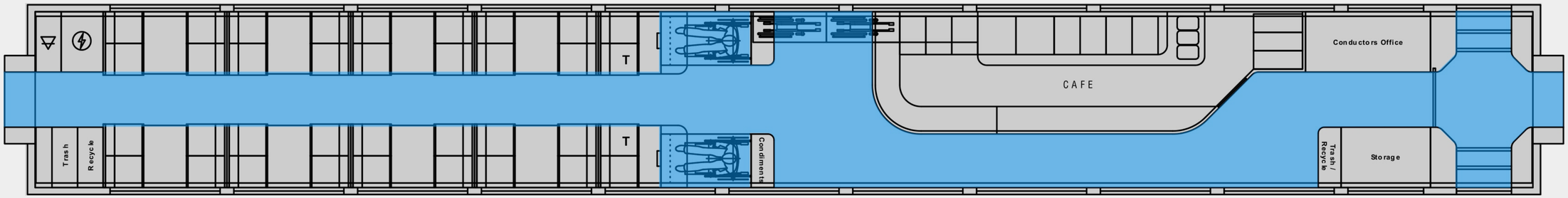
CAFÉ



CAFÉ

36 Café Seats
2 Mobility Position
1 Conductors Office
Loading doors at one end

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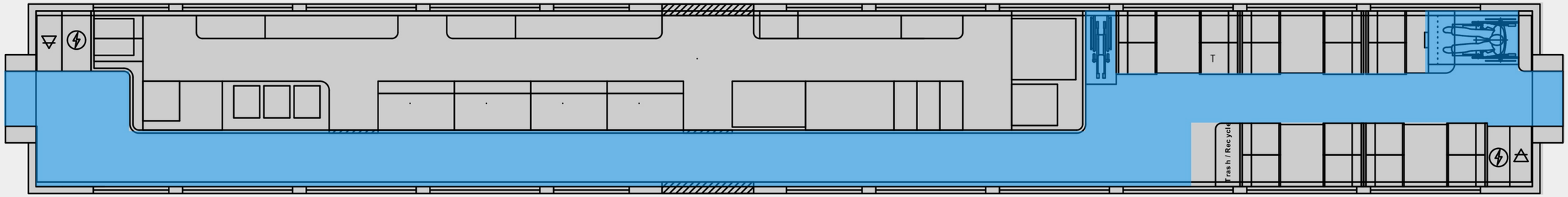
DINER



DINER

18 Diner Seats
1 Mobility Position
Central loading doors

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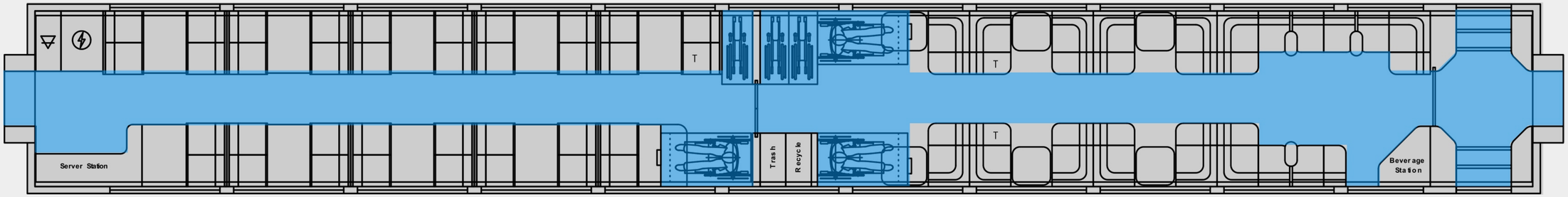
DINER / LOUNGE



DINER / LOUNGE

36 Diner Seats
1 Diner Mobility Position
1 Server Station

30 Lounge Seats
2 Lounge Mobility Position
Loading doors at one end

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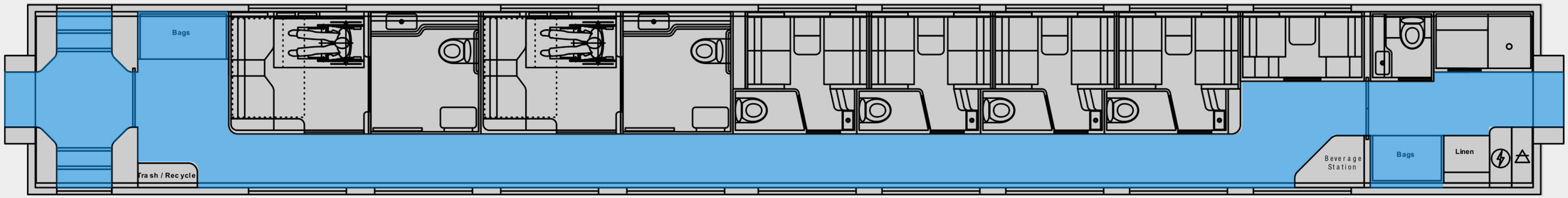
ACCESSIBLE SLEEPER



ACCESSIBLE SLEEPER

2 Accessible Bedrooms
4 Standard Bedrooms
1 Crew Bedroom
1 Standard Restroom
1 Communal Shower
Loading doors at one end

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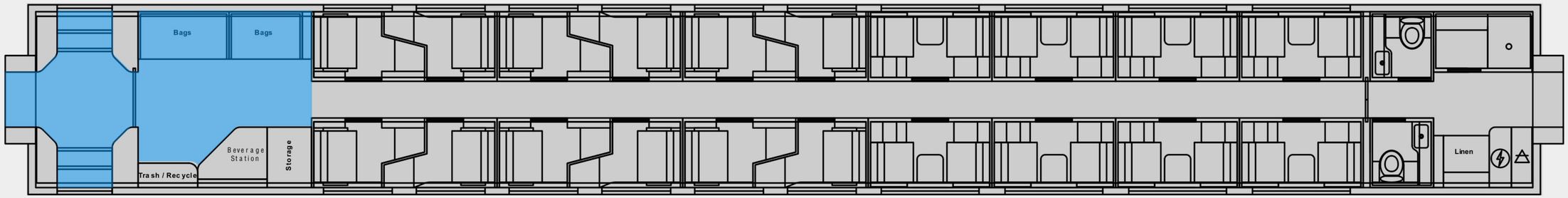
STANDARD SLEEPER



STANDARD SLEEPER

12 Solo Suites
7 Roomettes
1 Crew Bedroom
2 Standard Restroom
1 Communal Shower
Loading doors at one end

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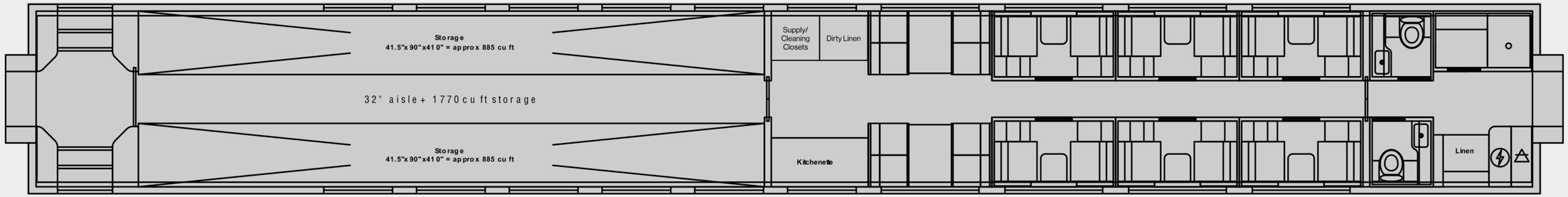
UTILITY CAR

*OPTION



UTILITY CAR

6 Crew Bedroom
2 Standard Restroom
1 Communal Shower
8 Café Seats
Loading doors at one end

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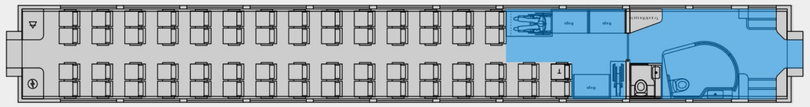
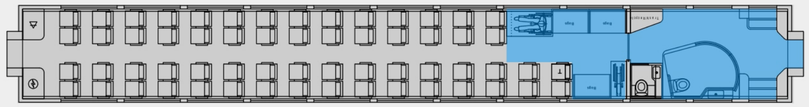
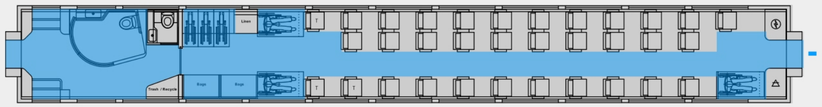
EXAMPLE CONSIST



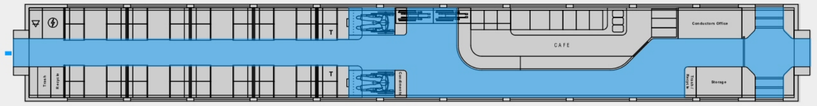
STANDARD COACH (42" pitch) - 60 C / 1 MOB



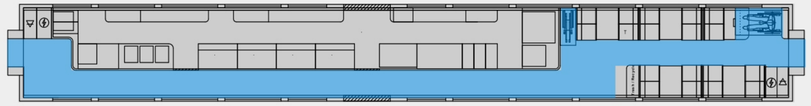
STANDARD COACH (42" pitch) - 60 C / 1 MOB



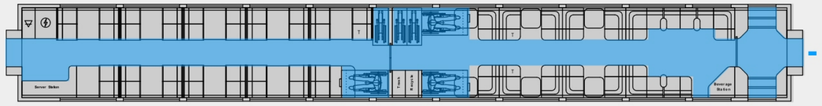
PREMIUM ACCESSIBLE COACH (48" pitch) - 33 PC / 3 MOB



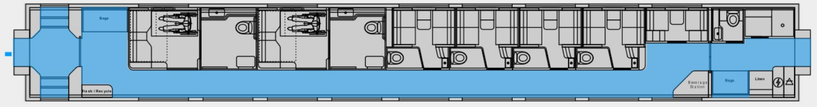
CAFE - 36 Cafe / 2 MOB



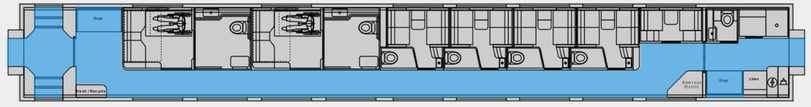
DINER - 18 Diner / 1 MOB



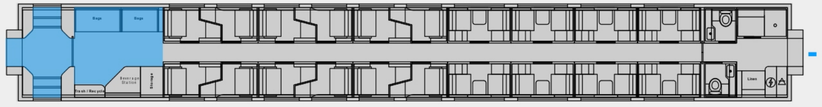
DINER / LOUNGE - 36 Diner / 1 MOB + 30 Lounge / 2 MOB



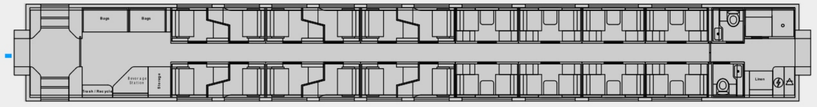
ACCESSIBLE SLEEPER - 2 ACCESS.BR / 4 BR / 1 Crew



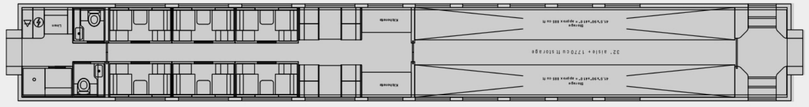
ACCESSIBLE SLEEPER - 2 ACCESS.BR / 4 BR / 1 Crew



STANDARD SLEEPER - 12 S / 7 R / 1 Crew



STANDARD SLEEPER - 12 S / 7 R / 1 Crew



UTILITY CAR - 6 R (Crew) + 8 seats + Minimum of 1,600 cu ft

Accessible path in accordance with equivalent facilitation

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AMTRAK®

Thank you.

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AMTRAK®

Long Distance
CX Vision - Part 2

Issued March 2026

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Prologue

Design DNA

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Product Vision

Product Vision

Amtrak® Long Distance CX Vision

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AMTRAK

ACCESSIBLE PATH

A warm welcome for all

Our new train design prioritizes accessibility. An accessible path runs from coach through the Cafe, Diner and Lounge to Private Rooms.



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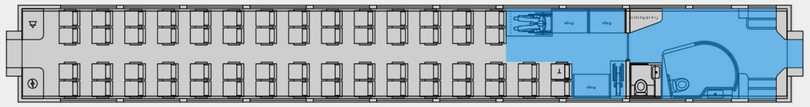
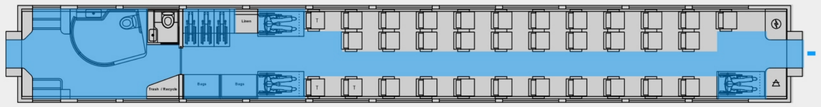
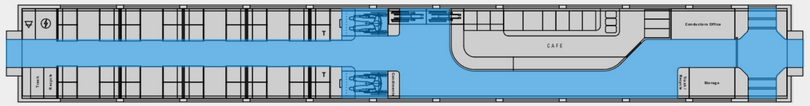
ACCESSIBLE PATH



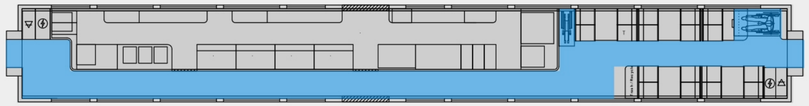
STANDARD COACH (42" pitch) - 60 C / 1 MOB



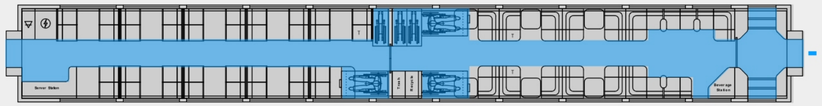
PREMIUM ACCESSIBLE COACH (48" pitch) - 33 PC / 3 MOB



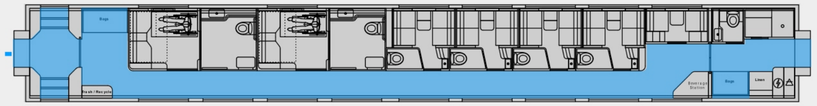
CAFE - 36 Cafe / 2 MOB



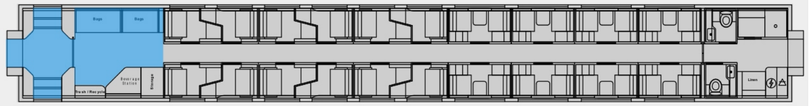
DINER - 18 Diner / 1 MOB



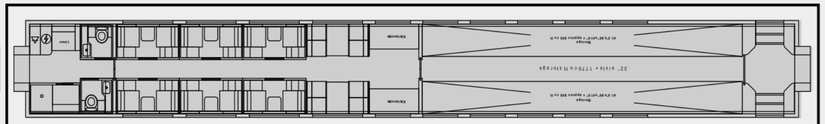
DINER / LOUNGE - 36 Diner / 1 MOB + 30 Lounge / 2 MOB



ACCESSIBLE SLEEPER - 2 ACCESS.BR / 4 BR / 1 Crew



STANDARD SLEEPER - 12 S / 7 R / 1 Crew

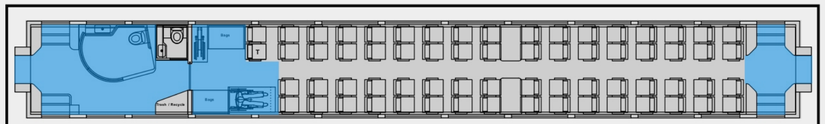


UTILITY CAR - 6 R (Crew) + 8 seats + Minimum of 1,600 cu ft

Option Car

ACCESSIBLE CORE

The accessible core offers an accessible path at 32” wide that allows passengers who use wheelchairs to move freely between each car.



HICH CAPACITY COACH (37" pitch) - 66 C / 1 MOB *2x DOORS

Option Car

Accessible path in accordance with equivalent facilitation

ENTRANCE WAYS

Our new trains extend a warm welcome to all passengers. Handholds are strategically placed to enhance stability as passengers move through the car and access their accommodations. The interior design is crafted to feel more like a hotel lobby, featuring a central light, wood finishes, and an open layout.



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SEAMLESS ACCESS

The vestibule is designed as an open and intuitive space. Soft corners and carefully crafted architecture guide natural passenger movement, supporting safe and efficient flow even at busy times. Seamless surfaces maintain visual clarity and simplify cleaning and maintenance. Carefully selected colors and materials introduce gentle contrast to enhance openness and aid navigation for visually impaired passengers. Vertical and horizontal handrails are integrated throughout, providing reassurance, accessibility, and support from the moment passengers step on board.



SLEEPER
HALLWAYS

Sleeper hallways are bright and open, with simple way-finding and clear room numbering. Each sleeper car also features a well-appointed beverage station offering coffee and fresh water.





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TRAVEL
EASE

Amtrak's commitment to thoughtful baggage handling ensures your bags are well cared for throughout the journey. Baggage towers, checked baggage cars, and convenient overhead shelves allow passengers to travel knowing their belongings are safely stored and easily accessible.



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AMTRAK

COACH

The Heart of Our Journey

Our coach passengers are the heart of Amtrak's long-distance service. They are the driving force behind our mission to connect people across America. Their choice to ride with us fuels the journey that brings our nation closer together. We understand the importance of offering an affordable travel option while ensuring that our coach customers feel valued and appreciated.

The interior should be thoughtfully designed to reflect the significance of this market and should echo the value we place on their experience.



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OPTIMIZED FOR SLEEP

Experience the ultimate sleep-friendly coach seat: plush cushions, tailored ergonomics, a recline optimized for rest, privacy wings, an adjustable headrest pillow, and a leg rest for added comfort. Designed to help passengers sleep well and wake refreshed.



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VISUALLY RESTFUL

Seats and surrounding architecture are designed to provide maximum functionality and convenience without visual clutter. By balancing integrated features with a purity of form, the space feels calm, visually restful, and comfortable for passengers. Elegance and convenience are thoughtfully combined throughout.



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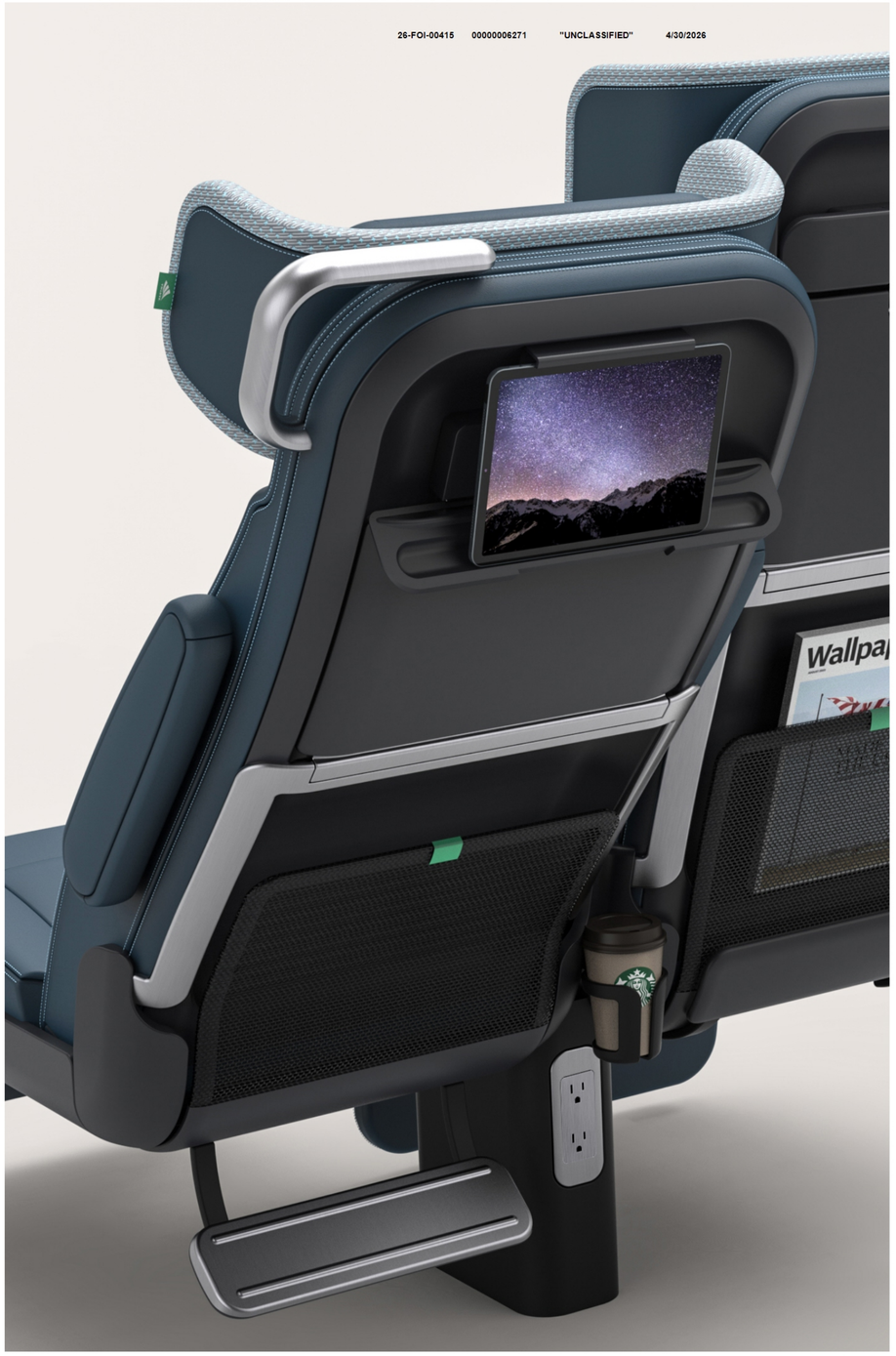
FULLY EQUIPPED

Comfy seats with tables for your laptop, device holders, cup holders for your favorite beverages, a fully adjustable seat for relaxation, power sockets to keep your devices charged, and personal lighting for the perfect ambiance. Everything you need for a comfortable and effortless journey.







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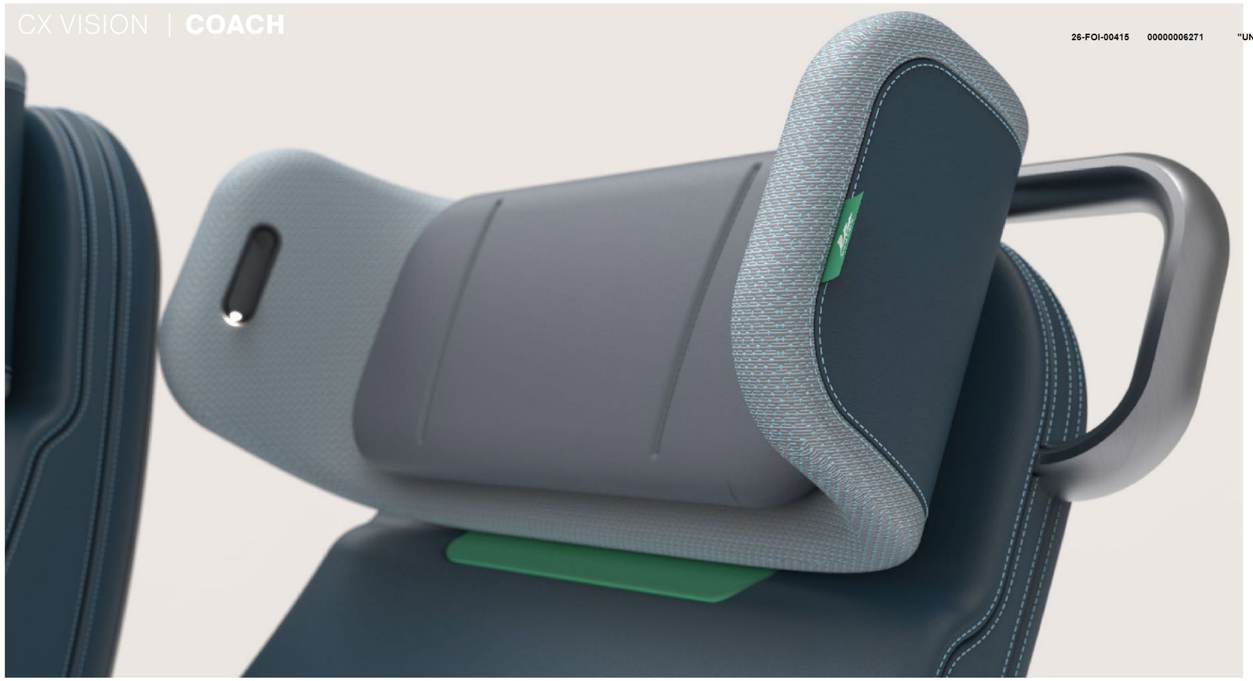



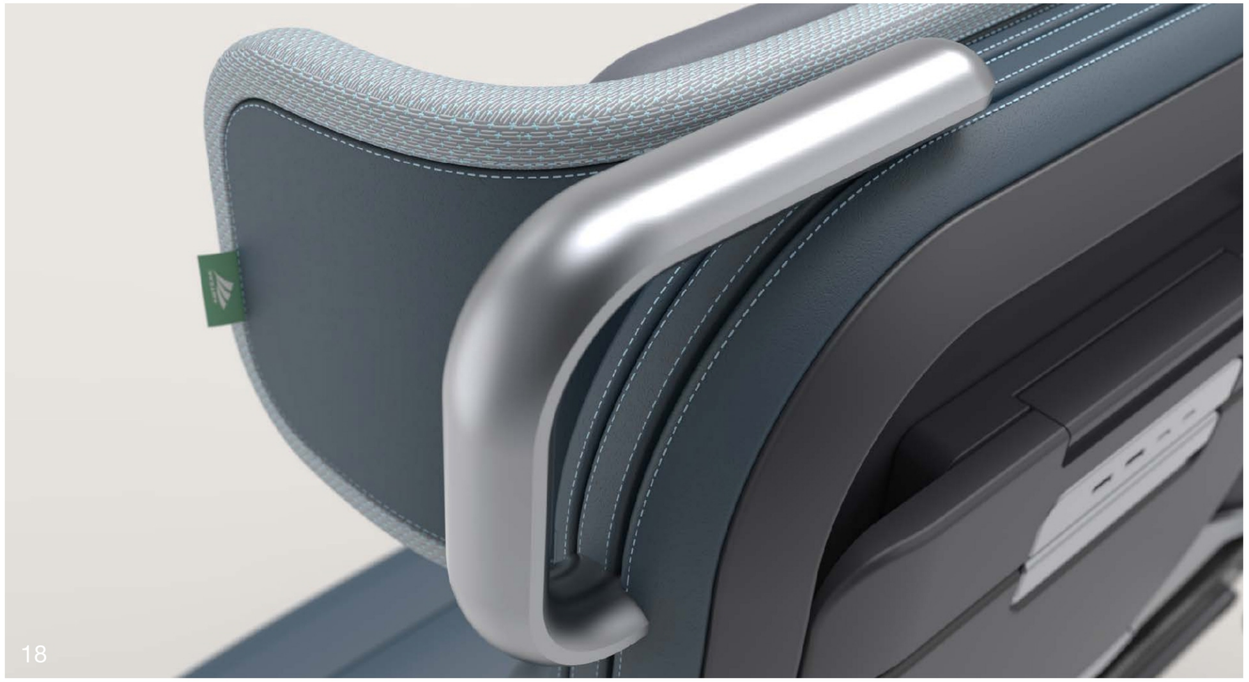



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AMTRAK

PREMIUM COACH

Elevating the Long-Distance Coach Experience

In response to the demand for elevated comfort on our long-distance trains, we proudly introduce 'Premium Coach.' Our customers are at the forefront of a new era in Amtrak's long-distance service. 'Premium Coach' represents an exciting step forward, designed to elevate our passengers' journey with spacious, larger seats, more space, fantastic views, and enhanced privacy. With 'Premium Coach,' our customers can expect the same fantastic features as in our standard coach, but with the added luxury of enhanced seating and increased space. Together, we embark on this journey, redefining long-distance travel with 'Premium Coach'.



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TRANQUIL SPACE

Premium Coach features a generous seat pitch that increases legroom and personal space. The 2 × 1 seating configuration allows for wider seats and a more comfortable passenger experience. Large headrest wings add privacy and support.





CRADLE COMFORT

Premium Coach seats recline to the renowned “Lazy Z” position, designed to enhance comfort. This ergonomic recline supports a more relaxed sitting and sleeping posture, making long journeys more comfortable for passengers.


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FULLY EQUIPPED

The Premium Coach seat offers a high level of personalization, with an adjustable center console table and “Lazy Z” recline providing fully customizable seating positions. Practical features include a device holder, cup holders, USB, and power outlets for added comfort and convenience.



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THE LAZY Z

The “Lazy Z” position is designed to enhance comfort during long periods of sitting. In this position, the seat reclines to support the upper body while raising the knees, reducing pressure on the lower back and undersides of the legs. The result is a more ergonomic and comfortable posture for extended travel.

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AMTRAK

ROOMETTE

Setting the New Standard for a Classic Format

Introducing our revamped Roomettes for the new generation of long-distance travel. These classic accommodations have received a modern makeover, seamlessly blending the timeless comfort of leather seats with a contemporary aesthetic. As you step inside, you'll discover a private space designed for relaxation and rest, complete with the familiar format you know and love. Our upgraded Roomettes redefine the art of travel, providing an elevated experience that marries classic charm with a fresh, sophisticated style.



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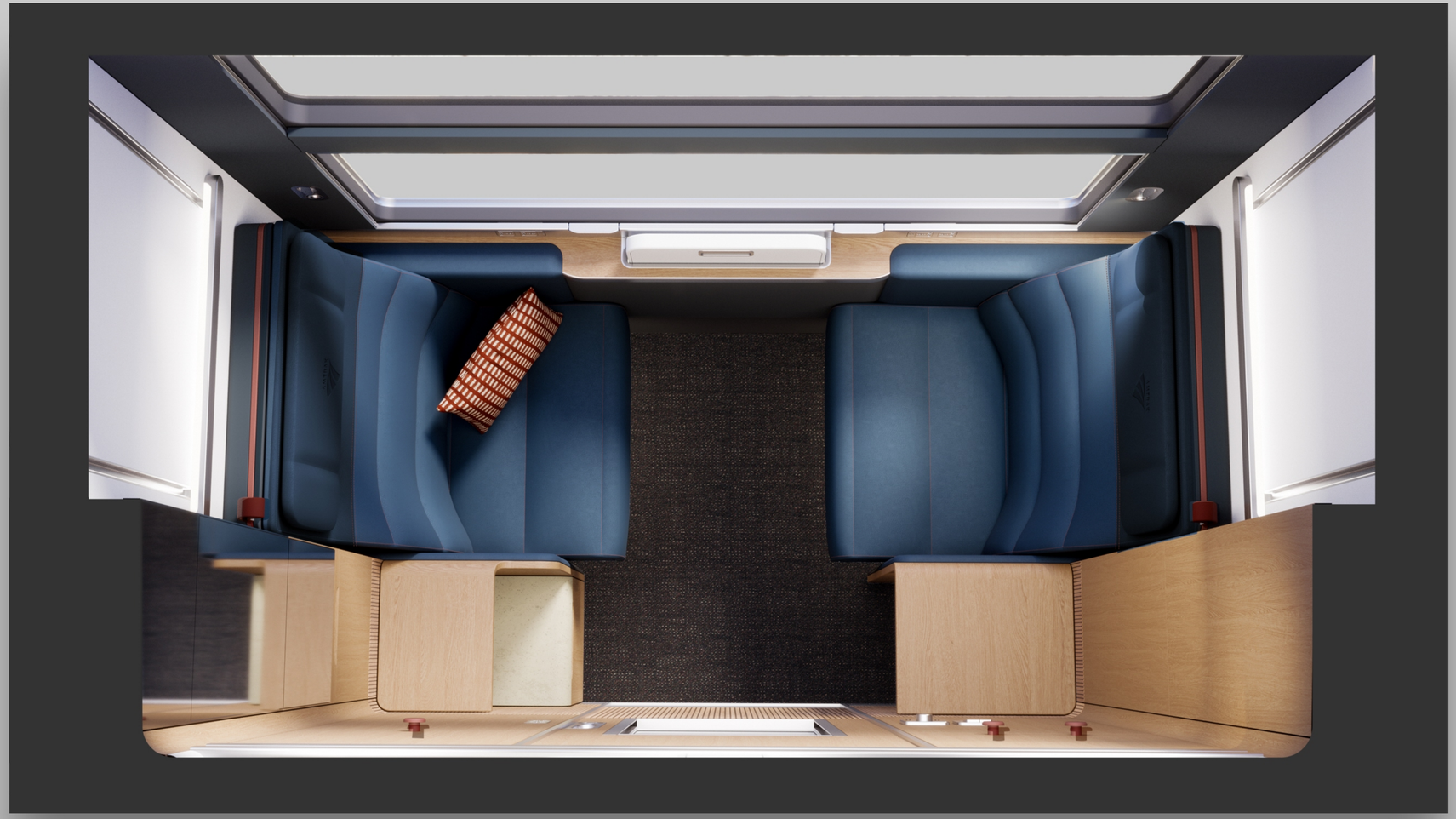

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HOME FROM HOME

Each space is designed to feel like a true home away from home. A carefully curated palette of inviting, high-quality materials such as wood, metal, and leather creates a warm and approachable tactility. Lighting is thoughtfully balanced to support both function and ambiance, resulting in environments that feel comfortable and enriching for passengers.





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BETTER BEDS

The seats are ergonomically designed with a contoured form, side bolsters, lumbar support, and adjustable headrests, optimized for daytime comfort. When converted to a lower berth, they form a fully flat surface for a restful night's sleep. The intuitive conversion allows passengers to easily switch between seating and sleeping configurations. Slide-down upper bunks provide additional accommodation for sharing and families.



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IN ROOM STORAGE

Storage is thoughtfully integrated throughout the rooms, with discreet cabinets keeping the space uncluttered. Dedicated locations for carry-on luggage, including convenient storage beneath the seat, ensure belongings remain easily accessible while maintaining a calm, organised environment.





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AMTRAK

CLUB BEDROOM

Versatility in a New, Spacious Format

The Club Bedroom is a groundbreaking addition to our accommodation options.

This innovative format provides ample room for two passengers but with the added flexibility to comfortably sleep a family of four. With four seats that convert into a double bed and an additional slide down double bunk, the Club Bedroom ensures a restful journey for our customers seeking that little extra space and versatility.

Complete with an en-suite bathroom, vanity sink, and ample storage, this spacious bedroom represents the next level of travel comfort.



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CONVIVIAL SPACE

The Club Bedroom features two face-to-face sofas, creating a comfortable space for relaxation, conversation, or seating up to four passengers. With a double lower berth and a double upper bunk, it provides generous sleeping arrangements for two or a cosy option for families.



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FEELING COMFORT

Enjoy exceptional comfort with wide seats, carefully designed with ergonomic precision and enhanced by plush cushioning for a supportive, contoured fit. Soft leather upholstery provides a refined finish that elevates the travel experience. Additional features include an extra-large table, multiple power outlets for personal devices, and convenient cup and bottle holders.



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BETTER BATHROOMS

Our bedrooms feature well-appointed vanity areas, and the Club Bedroom includes a modern en-suite shower and toilet. Vanity units are equipped with mirrors, storage cabinets, and fresh towels. The bathrooms offer modern conveniences such as a large rain shower, separate shower handset, touch-less flush, and complimentary shower gel, shampoo, conditioner, and lotion.





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IN ROOM STORAGE

Storage is thoughtfully integrated throughout the room, making intelligent use of vertical height and otherwise unused spaces. Open storage cubbies built into sidewalls and corners provide convenient places for smaller personal items. Dedicated locations for carry-on luggage, including storage above the bathroom and beneath the seat, ensure belongings remain easily accessible.



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AMTRAK

SOLOSUITE

Where Solo Comfort Meets Shared Adventures

Introducing 'SoloSuite,' our versatile accommodation designed to cater to the unique needs of solo travelers, with the flexibility to accommodate two passengers when desired. 'SoloSuite' offers a comfortable solo retreat with a spacious single bed and all the amenities and conveniences you'd expect from our bedrooms. For those seeking the companionship of a fellow traveler, ‘SoloSuite' can be transformed into a premium twin room, ideal for sharing.

With ‘SoloSuite,' passengers can enjoy the flexibility to choose between privacy and conviviality, ensuring a tailored travel experience.



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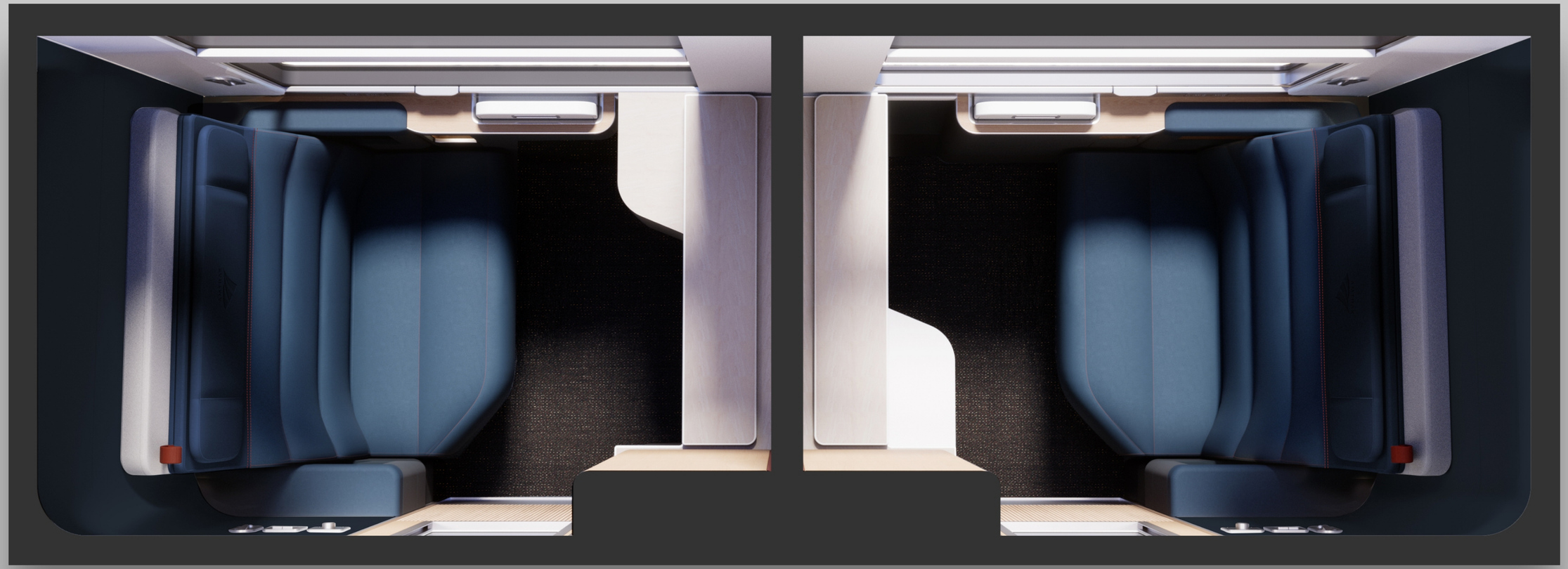

VISTA VIEWS

The bedrooms are centred around large windows that frame the passing landscape and bring the outside world into the room. The architecture and layout are designed to celebrate these views, keeping them at the heart of the experience. When desired, blinds can be deployed to soften daylight or provide complete privacy.



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FLEXIBLE FORMAT

The room features a spacious seat and bed, with the layout centred on the experience of a single passenger. The design opens up the room's vertical space, creating a bright, airy atmosphere while allowing additional storage above. Dual windows further enhance the sense of light and openness. A central divider can open to connect two Solo Rooms, creating a distinctive suite with a spacious central table for shared activities or meals.





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AMTRAK

ACCESSIBLE BEDROOM

Comfort without Boundaries

Introducing the 'Accessible Bedroom', a fully inclusive accommodation designed to cater to passengers with diverse mobility needs. This spacious room features two beds, including a lower accessible double berth and an upper bunk, ensuring that everyone can enjoy a comfortable journey. In addition to all the standard amenities, the 'Accessible Bedroom' boasts an en suite accessible bathroom, providing convenience and comfort.

The room offers ample space for passengers who use wheelchairs to easily navigate and access all features, making it a welcoming and inclusive option for a diverse range of travellers.

A room meticulously designed with our passengers' needs in mind, ensuring that mobility and comfort are equally prioritized, resulting in an inclusive and welcoming space.



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ELEVATED ACCESS

Our accessible room features wide sliding doors with audio and tactile controls for ease of use. Strategically placed handrails and a carefully planned layout maximise accessibility, providing turning space for people who use wheelchairs and ample room for seat and bed transfers. Lighting and blinds are fully accessible, while carefully selected flooring and finishes enhance visibility, creating a safe, functional, and user-friendly environment.



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BETTER BEDS

The beds have been carefully designed for flexibility and ease of use. The upper single berth provides comfort and safe access, with a flexible ladder and integrated handrails to support passengers climbing in and out. The lower double berth offers a spacious, accessible sleeping space that can be used in either orientation, with handrails on three sides and well-placed lighting to ensure confidence and comfort. Together, the arrangement balances accessibility, convenience, and a restful journey.



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BESPOKE SOLUTIONS

Our accessible room is designed with flexibility in mind, offering various configurations to meet different needs. A dedicated accessible space by the window ensures passengers who use wheelchairs can enjoy scenic views comfortably. The inclusion of a fold-out seat with an integrated backrest adapts the space to different accessibility requirements, catering to the diverse needs of our passengers and ensuring a space that is suitable for everyone.

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AMTRAK

DINER

Traditional Dining, Timeless Delights

Continuing the tradition of Amtrak dining cars, our new long-distance trains offer the classic format with contemporary flair. Step aboard to savor freshly prepared meals against the backdrop of breathtaking scenery. In our dining cars, you'll embrace a communal spirit, sharing tables and stories with fellow travelers, making every journey unforgettable. As part of Amtrak's tradition, we provide a unique dining experience that enhances the magic of long-distance travel, turning your meal into a memorable voyage.



ACCESSIBLE FOR ALL

In the Diner, accessibility is paramount, allowing everyone to relax and enjoy its comforts. An accessible pathway, designed to accommodate passengers who use wheelchairs, extends throughout the entire diner car. Handholds on every booth provide stability for passengers as they navigate the car. Handrails seamlessly transition into the glass dividers which enhance the sense of security and privacy.



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CURATED AMBIANCE

Curated lighting and skylight blinds are used to curate an ambiance that transforms throughout the day, creating an inviting, calm, and sophisticated atmosphere during daylight hours and transitioning seamlessly into an intimate, sumptuously cozy setting in the evening. A captivating and adaptable dining experience designed to kindle feelings of romance and indulgence as passengers dine with us. Our signature table and wall lamps add a touch of restaurant-like charm, ensuring a delightful dining experience tailored to your every need. We are committed to crafting memorable moments during every meal in our Diner car.

A TOUCH OF CLASS

Our dining cars are more than places to enjoy a great meal; they are a destination space that lives at the heart of the journey. The design of the diner on our new long-distance trains respects the heritage of these spaces with refined elegance, evoking a warm and inviting ambiance. Red booth seating symbolizing a first-class service and fostering a sense of warmth and connection. Bold blue accents in the table lamps add a contemporary touch, creating a timeless yet captivating atmosphere. Confident textural lines on seats, dividers, and window pillars break up the space, accentuate the height, and add a sense of grandeur to the interior architecture.



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CRAFTED MATERIALS

In our Diner, simplicity in form and construction allows us to prioritize premium materials and exceptional build quality. Our solid surface tables feature refined marble finishes, complemented by booth seating wrapped in rich wood veneers. These thoughtful choices not only enhance the ambiance but also ensure durability and comfort, reflecting our dedication to an elevated and dependable dining experience.



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DESIGNED FOR SERVICE

The Diner is designed to support efficient, premium at-seat service. A wide aisle allows crew to move easily through the car, while strategically placed service stations provide storage for cutlery, condiments, table service items, and waste. This allows crew to serve passengers smoothly and efficiently without unnecessary trips to the galley.





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AMTRAK

LOUNGE

Where Tradition Meets Inclusivity

Inspired by Amtrak's iconic observation and lounge cars, the new long-distance trains introduce a modern lounge designed for passengers to connect, relax, and enjoy the journey. Expansive windows frame panoramic views, while the fully accessible layout creates an inclusive space for everyone. A beverage station provides a natural place to pause and socialize. The lounge continues the legacy of memorable journeys, bringing passengers together and celebrating the experience of travel.



THE SOCIAL HUB

The lounge offers a variety of seating settings designed to support different ways of using the space. Booth seating, long sofas, and open lounge areas allow passengers to choose between privacy and social interaction, while integrated power, coffee tables, and clear accessible pathways support comfort and convenience. The result is a welcoming, flexible environment where passengers can relax, connect, and enjoy the journey



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HERO THE VIEW

In the lounge car, the view takes center stage. Expansive windows and skylights frame panoramic vistas of the American landscape, filling the space with natural light and a strong connection to the journey outside. The architecture and interior layout are carefully arranged to keep sightlines open, ensuring passengers can enjoy the scenery from every seat.



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A WELCOMING RETREAT

The lounge car is designed to transform throughout the journey. Natural light, adjustable blinds, and carefully balanced lighting shift the atmosphere from bright and open by day to warm and relaxed in the evening, creating a comfortable space to unwind, connect, or simply enjoy the view.

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CAFE

Savor the Journey

The Cafe is more than just a place to purchase refreshments; it's a destination for passengers to explore and unwind during their Amtrak long-distance journey.

Its welcoming, accessible counter, bold geometric design, and patterned wall finishes create a contemporary coffeehouse aesthetic.

Striking feature lights set the ambiance, while digital menu screens offer up-to-date information.

The thoughtful design ensures an attractive and passenger-friendly experience while maintaining an efficient space for the crew to work.



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CAFE
COUNTER

The café features a spacious open counter at an accessible height, creating a welcoming and passenger-friendly point of service. The counter is intentionally kept clear of equipment to support future food service options such as grab-and-go. Digital menu screens, positioned at queuing and point-of-purchase locations, connect to live data to provide up-to-date menus, promotions, and passenger information.



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OPTIZIMED OPERATION

The back-of-house design follows a forward-thinking, modular approach that allows equipment to be upgraded or reconfigured as service models evolve. Equipment is arranged to support efficient and safe staff operation.

Areas closest to passengers are designed with a premium aesthetic to support point-of-purchase sales. Visual merchandising and food displays are carefully positioned to highlight fresh, appetizing options.



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EQUITABLE EXPERIENCE

The seating in the Cafe has been thoughtfully designed with premium finishes, mirroring the quality and comfort found in the Diner while also providing a fully accessible space. This means our coach customers can experience the same levels of luxury and relaxation while enjoying their journey without exceeding their budget.





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TOILETS & SHOWERS

Ensuring Refreshing Comfort for Your Journey

A range of thoughtfully designed restrooms and showers have been designed on board to ensure that every passenger's needs are met with comfort and convenience. Our commitment to passenger satisfaction is reflected in the carefully curated design of each facility, ensuring a refreshing and comfortable experience throughout your journey.



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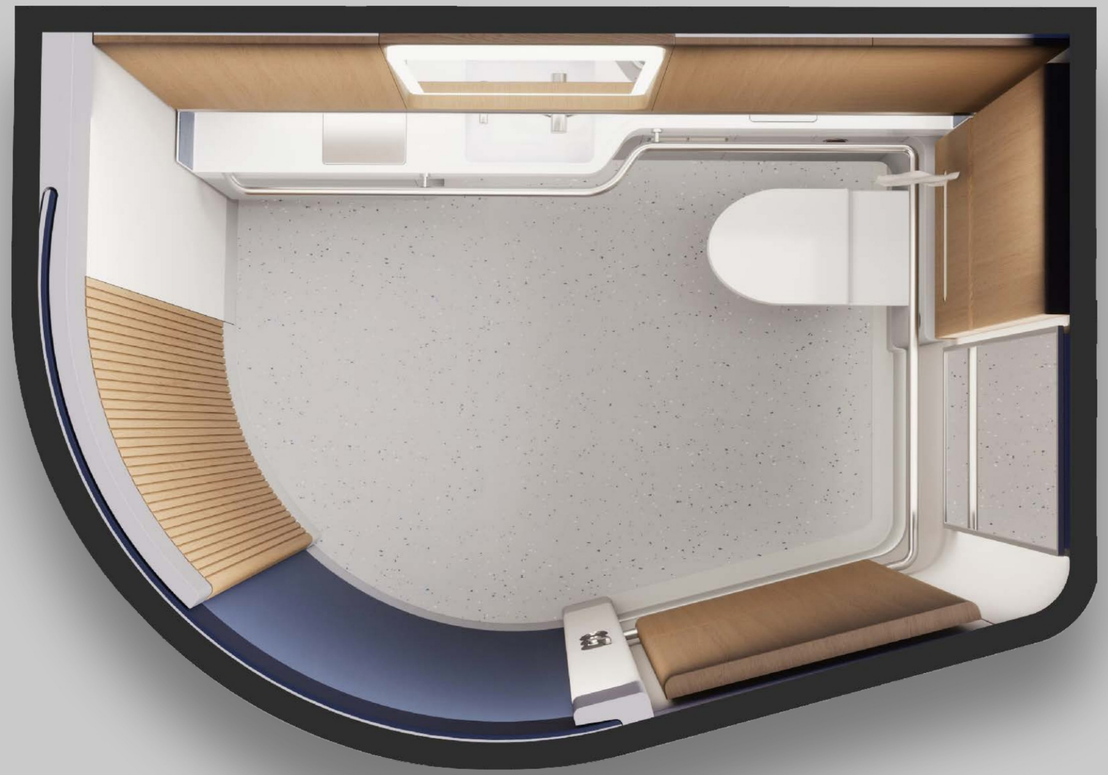
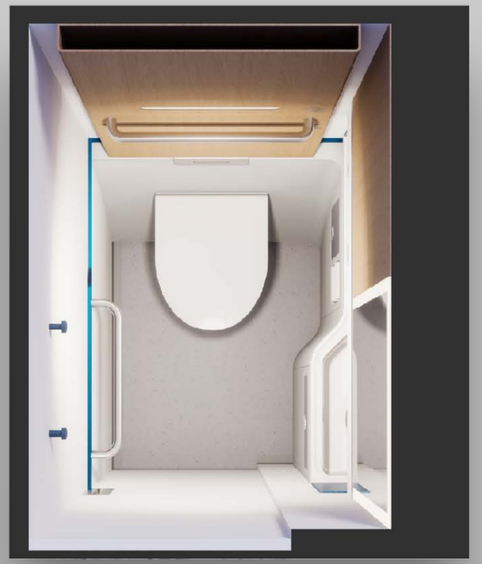
Accessible Toilet Room



Shower & Changing Room



Standard Toilet Room



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ACCESSIBLE TOILET ROOM

Our Accessible Toilet Room, optimized for people who use wheelchairs and for our customers with diverse accessibility needs, offers a spacious and inclusive experience.



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STANDARD TOILET ROOM

Our Standard Toilet Room facilities provide a modern bathroom look and feel, featuring a toilet, sink and vanity area, compact yet stylish.



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SHOWER & CHANGING ROOM

First class customers can indulge in our shower and changing room, boasting a beautifully appointed shower accompanied by a vanity area and a dedicated changing space.



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AMTRAK

CREW QUARTERS

Where the Heartbeat of Amtrak Resides.

Recognizing the pivotal role our crew plays in ensuring a seamless travel experience, we've crafted crew car that is purpose-built for the extended periods our crew spends on our trains. Our new trains will boast a crew rest area equipped with crew lockers, seating and a kitchenette, creating a space specifically designed to prioritize their well-being.

At Amtrak, we value our crew, and our Crew Quarters reflect our commitment to their satisfaction and overall quality of life on the rails.



CREW REST

A designated crew rest area will provide a space for socializing, fostering camaraderie among staff, while a small private kitchen allows them to prepare meals and unwind during well-deserved breaks.



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AMTRAK®

Thank you.

Amtrak Universal Single Level Fleet Replacement

Technical Support, Spares and Supplies Agreement (TSSSA)

G. Statement of Work

Revision 1

TSSSA SOW Change Sheet

Revision	Date	Section(s)	Description	Approver
0	7/11/2025	-	-	M.L. Kraft
1	3/26/2026	G.2 G.6 G.9 G.11	Failure Type Definitions Rotable Material Predictive Maintenance/Monitoring Enroute Depots Train Rider Coverage Reliability Tracking Performance Guarantees	M.L. Kraft

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G.1 Overview

a). This statement of work details the scope of services to be provided by the Contractor under the Technical Support and Spares Supply Agreement ("TSSSA").

b). The TSSSA includes Technical Support for all maintenance activities as well as materials management and supply, including but not limited to procurement, inventory planning, delivery, and quality assurance.

c). The TSSSA requires the Contractor to support Amtrak's implementation of the Maintenance Plan provided as part of the provision of the Universal Single Level Equipment.

d). The Contractor shall have dedicated TSSSA personnel in attendance at all design reviews to provide input from a maintainability and reliability perspective.

e). A Responsibility Matrix is provided in Appendix A summarizing the breakdown of responsibilities between Amtrak and Contractor with respect to TSSSA and maintenance tasks. Additional responsibilities may be listed throughout the Statement of Work and TSSSA.

G.2 Definitions

a). General

i). Capitalized terms used in this Statement of Work without definition shall have the meaning ascribed to them in this section or in the General Provisions in Exhibit A-1.

ii). Certain additional capitalized terms may be defined elsewhere in the TSSSA Contract or Equipment Contract documents.

iii). Capitalized terms that are defined in the TSSSA Contract and/or Equipment Contract documents shall have their plain meaning or usage unless the context indicates otherwise.

iv). Unless the context otherwise requires, the singular shall include the plural, and the masculine gender shall include the feminine and neuter genders and vice versa.

v). Definitions are as follows:

(1) **"Active Equipment"** shall mean a Car, or Spare for which Amtrak has issued either a Certificate of Acceptance or Conditional Acceptance under the terms of the Equipment Contract and made available for Revenue Service, and that is not Inactive Equipment.

(2) "**Amtrak Depot**" or "**Depot**" shall mean an Amtrak facility where maintenance is performed, and Material is provided, as shown in Section G.10.

(3) "**Amtrak Enroute Depot**" shall mean an Amtrak site or host facility where inspection, Turn-around Service and cleaning takes place and where consumable and regularly consumed Materials are stocked.

(4) "**Amtrak Terminal Depot**" shall mean an Amtrak maintenance site or facility where inspection, Scheduled and Unscheduled Maintenance, heavy repair, and Material stocking takes place.

(5) "**Annual Maintenance Schedule**" shall mean that portion of the Life-Cycle Maintenance Schedule that represents all maintenance activities by Car, Depot and date that are intended to be conducted on the Equipment for the applicable calendar year as noted in Section G.6.

(6) "**Annual Service Payment**" shall mean the amount paid or payable to the Contractor under the TSSSA in a one (1) year period.

(7) "**Bad-order Awaiting Material**" or "**BAM**" shall mean the Equipment status condition used in Amtrak's enterprise asset management system to describe the occurrence when, due to lack of Material, work cannot be completed or progressed. "**Car**" or "**Cars**" shall mean the railroad passenger Cars to be provided by the Contractor pursuant to the Equipment Contract.

(8) "**Car Held for Material**" or "**CHFM**" has that meaning ascribed to it in Section G.11

(9) "**Component Overhaul**" shall mean the inspection, cleaning, servicing, and application of new parts or remanufactured parts where deemed appropriate to Material to bring it to a new or like new state for use on the Equipment.

(10) "**Consumable Material**" shall mean consumable or expendable items of Material, as identified by part number and description by Contractor and agreed to by Amtrak.

(11) "**Contract**" or "**Equipment Contract**" means the entire agreement between Amtrak and the Contractor for the manufacture and supply of new Cars, Spare Vehicles, and other related supplies.

(12) "**Contractor**" means the individual, entity, or authorized representative of same, identified as such in the Contract.

(13) "**Data**" shall include the records of all Equipment maintenance activities but not limited to:

(a) Car status by date, location, mileage, hours, cycles, or condition as recorded by Car monitoring devices;

(b) Material requests where the time periods for the Material requests and receipts are to be measured to evaluate CHFM;

(c) Failures evaluated under Failure – Type I, Failure – Type II, Failure – Type III, and Failure Type IV;

(d) Other information that may be required to monitor, enhance, or improve the performance of the Equipment, the TSSSA Contract, and/or the Equipment Contract.

(14) "**Degradation of Capabilities**" shall mean when a system or component operates or functions below its design criteria.

(15) **"Equipment"** means any physical device that is part of the Car or Spare Vehicle and/or is the object of maintenance actions. Equipment may also refer to one or more of the Cars and/or Spare Vehicles.

(16) "**Equipment Specification**" shall mean the Amtrak Universal Single Level Fleet Replacement Technical Specification #1139 for the Cars.

(17) "**Excluded Matter Damage**" means, other than due to normal wear and tear, any damage to or breakage of a Car, Equipment, Spare, Material or other Supplies, which is principally caused by:

(a) the occurrence of a Force Majeure Event;

(b) improper use;

(c) vandalism, collision or accidental damage while the Equipment is not under the control of Contractor, or any of its Subcontractors, suppliers, employees, agents or representatives acting in such capacity, other than:

(i) any such event for which Contractor or any of its Subcontractors, suppliers, employees, agents, representatives or any entity or individual acting on Contractor's behalf is directly responsible; or

(ii) where such event has not been repaired by Contractor pursuant to an obligation it has to so repair the damage caused by such event under this Agreement or the Equipment Contract, including without limitation, pursuant to a Change Order;

(d) the negligence or willful misconduct of Amtrak; or the Failure of Amtrak to maintain the Equipment in accordance with the agreed upon Maintenance Plan.

(18) **"Failure"** means that the Equipment or a unit thereof, a component, or other supplies, instructions, Technical Support, software, or any service supplied by Contractor or Contractor Party under the Contract or the TSSSA did not comply with the requirements or specifications or violated any applicable law, did not perform as designed or its intended purpose or the use to which it was put, or if a service, was improperly delayed or omitted, in all such cases, whether in consequence of faulty

design, faulty Materials, poor workmanship, improper handling, security, storage or installation, negligence, willful misconduct or strict liability, or other errors or omissions or for any other reason attributable to the Contractor.

(19) **"Failure – Type I"** shall mean a Failure that results in either one of below:

(a) A Car being Unfit for Revenue Service within one (1) hour of the scheduled departure due to but not limited to a trainline failure resulting in loss of train line communications or power transmission resulting in Amtrak making modifications to a scheduled consist to operate the train in Revenue Service, or a Car causing an en-route delay of the Revenue Service train more than sixty (60) minutes at a scheduled departure or arrival at any scheduled station, or a failure requiring a Car to be removed from the train consist en-route.

(b) A loss of fifty percent (50%) or more of food service in any of the food service cars due to equipment failure that results in a loss of food storage, refrigeration, cooking, increased meal prep times and/or food delivery, etc.

(c) The loss of the water and/or waste system in a Car during Revenue Service and/or the loss of any restroom in a Car during Revenue Service.

(d) The loss of one (1) HVAC unit in a Car during Revenue Service.

(e) The loss of 50% of any one passenger amenity in any Car type (i.e. convenience outlets, etc.). A list of all amenities will be determined prior to Contract Award.

(f) The failure of the Passenger Emergency Intercom (PEI) or Public Address/Intercom (PAIC) system in any Car.

If vehicle options are exercised, this failure type will be updated and revised to reflect the unique components associated with those cars.

(20) **"Failure – Type II"** shall mean a Failure that results in:

(a) A Car being Unfit for Revenue Service within four (4) hours of the scheduled departure due to but not limited to a trainline failure resulting in loss of train line communications or power transmission resulting in Amtrak needing to make modifications to a scheduled consist, or a Car causing an en-route delay of the Revenue Service train of less than sixty (60) minutes but more than fifteen (15) minutes of a scheduled departure or arrival at any scheduled station.

(b) The failure or impacted operation of any door that adversely affects boarding and/or alighting, passenger comfort and/or any passenger or crew accommodations.

(c) The loss of any passenger amenity including but not limited to, lighting, seating, etc. that affects ten percent (10%) or more of the seating capacity in that given Car.

(d) The loss of wayfinding capabilities in a Car during Revenue Service, i.e., any passenger information screen.

(e) The loss of connectivity in a Car during Revenue Service due to a defect or failure of Contractor supplied Material. The Contractor won't be held responsible for the following interruptions due to failures out of its control (I.E. network provider Failure, network coverage, weather, geographic factors, tunnels) but must provide evidence of the failure when out of their control.

If vehicle options are exercised, the Failure type will be updated and revised to reflect the unique components associated with those cars.

(21) **"Failure – Type III"** shall mean a Failure that results in an actual repair time that exceeds one-half (0.5) labor hour and does not meet the criteria of a Type I or a Type II Failure. Type III Failures constitute Unscheduled Maintenance and can typically be repaired without causing delay to the scheduled departure or arrival of a Car or requiring the movement of the Car to a repair track or facility. I.E. cabinet latch, drawer slide, display screen not fully illuminated, loose trim, etc. not causing a safety issue.

(a) If component design has redundancy built-in, and the component still performs as intended no performance guarantee shall be assessed. The failed component shall be repaired during the next maintenance event.

(22) "Failure - Type IV" shall mean any Failure that leads to a train being annulled or unable to be placed in Revenue Service.

(23) "**Fleet**" means all Cars and Spare Vehicles ordered under the Contract, including all options for additional Cars or Spare Vehicles exercised.

(24) "**Fleet Modification Program**" or "**FMP**" shall mean the corrective action requested by Amtrak to address a fleet defect and shall have that meaning ascribed to it in Section G.15.

(25) "**Fragmented Continuous Maintenance**" shall mean a maintenance and inspection approach utilizing shorter regularly scheduled intervals to perform all maintenance requirements. These maintenance activities shall be a comprehensive set of all maintenance requirements including but not limited to those normally captured under preventive, predictive,

life-cycle or condition-based maintenance, mileage based, time based, or regulatory requirements.

(26) "**Inactive Equipment**" shall mean a Car, or Spare that Amtrak has removed from coverage under the TSSSA Contract in accordance with Section G.4. and not reinstated in accordance with Section G.4.

(27) "**Job Analysis**" shall mean the detailed examination of the tasks that make up a job or work, the conditions under which the job is to be performed, standard labor hours it takes to perform the job, and what the job requires in terms of knowledge, skills and training of an employee. In addition, the Job Analysis defines what procedures, Materials, tools and infrastructure are required to perform the job or work.

(28) "**Life-cycle Maintenance Schedule**" shall mean the mutually agreed upon baseline schedule described in Section G.4. for maintenance activities including component or system overhaul events required to maintain the Equipment to Contractor's specifications over the design life of the Equipment. This schedule shall be included as part of the Maintenance Plan.

(29) "**Line Replaceable Unit**" or "**LRU**" shall mean an essential support item which is removed and replaced at the field level or operating location to quickly return the Car or Spare Vehicle to an operationally ready condition.

(30) "**Line Replaceable Unit List**" or "**LRU List**" shall mean that list described in Section G.10.

(31) "**Maintenance Plan**" shall mean the comprehensive plan which includes all activities, schedules, and documentation recommended by Contractor and/or required by regulatory agencies or Amtrak to maintain, inspect, and restore the Cars and/or Spare Vehicles and to maintain intended design function over the design life of the Equipment.

(a) The Maintenance Plan shall be a detailed documented process describing all Scheduled Maintenance and corrective maintenance activities that are required for the Equipment throughout its life.

(b) It shall include, among other things, the Annual Maintenance Schedule and the Life-Cycle Maintenance Schedule. It shall be reviewed and approved on an annual basis against the performance of the Equipment.

(32) **"Material"** shall mean spare parts, supplies, Equipment, components, Material for Minor Debris Damage, and Consumable Material for use on the Car and/or Spare Vehicles supplied by Contractor, excluding special tools, test equipment or fixtures.

(33) **"Measurement Period"** shall mean the one hundred eighty-three (183) days period commencing on the date that Amtrak issues a Certificate of Conditional Acceptance to Contractor for the first Car and subsequent one hundred eighty-three (183) days period thereafter until the end of the TSSSA Contract term. Amtrak may elect to reestablish the start of the Measurement Period to align with the start of Amtrak' s fiscal year. If after the end of the last full Measurement Period there is less than one hundred eighty-three (183) days remaining until the end of the TSSSA Contract term, the Measurement Period shall be however much time remains under the TSSSA Contract.

(34) "**Minor Debris Damage**" shall mean damage to a unit of Equipment as a result of striking debris along the railway. This damage is mild in that repairs can be made relatively quickly with simple tools. Materials, including but not limited to: ladders, grab irons, angle cocks, gangways, diaphragms, light assemblies, windows, hoses, cables, display screens and other exterior components which are susceptible to Minor Debris Damage.

(35) "**Mobilization Plan**" shall have the meaning ascribed to it in Section G.4. of this TSSSA Statement of Work.

(36) **"Modification**" means any variation, modification or addition to the Equipment Contract.

(37) "**Non-Rotable Material**" shall mean Material that is expendable after use because it is not economically viable to rebuild or overhaul the item.

(38) "**Original Equipment Manufacturer**" or "**OEM**" shall mean a company that produces parts and equipment that may be marketed by another manufacturer.

(39) "**Passenger Amenity**" shall mean a feature or service provided to enhance the comfort, convenience, and overall experience of passengers while they are traveling. These amenities include things like comfortable seating, sleeping facilities, Wi-Fi, refreshments and entertainment options.

(40) "**Performance Guarantee**" shall have that meaning ascribed to it in Section G.11.

(41) "**Performance Incentive**" shall have that meaning ascribed to it in Section G.11.

(42) "**Project Manager**" shall mean the individual assigned by Contractor to supervise Contractor's Work hereunder and serve as Amtrak's point of contact for the resolution of issues.

(43) "**Quality Gates**" shall mean a collection of completion criteria and testing standards representing the satisfactory execution of a Scheduled or Unscheduled Maintenance activity.

(44) "**Reusable Shipping Container**" shall mean the containers that are used to issue Rotatable Material to Amtrak.

(45) "**Revenue Service**" means the time when a unit of Equipment is available to the general public and there is a reasonable expectation of carrying passengers that either directly pay fares, are subsidized by public policy, or provide payment through some contractual arrangement. Equipment operated in fare free service are considered in Revenue Service.

(46) "**Rotable Materia**l" shall mean Material that can be rebuilt, remanufactured or overhauled and restored to a fully serviceable condition (same form, fit and function). Rotable materials will include high cost / long lead time items typically associated with Capital Spares (i.e.: complete truck assemblies, gangway assemblies, couplers, etc.) and shall be pre-positioned at geographic locations to support Amtrak service and maintenance needs. Rotable Material stocking levels shall be submitted to Amtrak for review and approval, and shall include levels to address unplanned maintenance events, such as defects, accidents/damage, etc.

(47) "**Scheduled Maintenance**" shall mean the preventive or predictive maintenance required by Amtrak, the Equipment Contractor, or the Code of Federal Regulations (CFR). Scheduled Maintenance can also describe the corrective repairs or inspections for deteriorating conditions identified from diagnostic data and predictive analytics, provided they are identified no less than 48 hours prior to the need for maintenance. The Scheduled Maintenance activities are listed in the Maintenance Plan.

(48) "**Scheduled Trip**" shall mean a scheduled train trip from start to finish.

(49) "**Service Price**" shall mean dollars paid monthly to Contractor for the work performed under this Statement of Work.

(50) "**Spare Vehicle**" means either a Vehicle purchased under the Equipment Contract as a spare or a Vehicle purchased under the Contract but not in operation.

(51) "TSSSA" shall mean Technical Support and Spares Supply Agreement or means the agreement entered into between Amtrak and Contractor for the provision of technical support and spares.

(52) "**TSSSA Contract**" shall mean Contract No. TBD for the technical support and spares supply for the Equipment between Amtrak and Contractor dated as of TBD.

(53) "**Technical Support**" shall mean the provision of those services set forth in Section G.9 and any other activities agreed to by Amtrak and Contractor.

(54) "**Transition Period**" shall mean the timeframe one hundred and eighty (180) days prior to the termination of the TSSSA Contract, where the Contractor will be responsible for turning over all of the necessary information, Materials, technical guidance and assistance to ensure that Amtrak's ability to effectively manage and ensure service operation of the Fleet is not negatively impacted.

(55) "**Turnaround Service**" shall mean the calendar day inspections, Scheduled Maintenance, resolution of minor repairs, and cleaning designed to support the Car for the duration of travel.

(56) "**Unfit for Revenue Service**" shall mean a Car is unable to operate from the terminal depot and/or deliver the level of Revenue Service for which it was designed.

(57) "**Unscheduled Maintenance**" shall mean those unpredictable maintenance requirements or activities that were not previously planned or programmed, but require prompt attention and must be added to, integrated with or substituted for previously scheduled workloads. This includes, but is not limited to, maintenance that restores operability to the Equipment that is performed after a Failure, defect or problem emerges in Equipment.

(58) **"Vehicle"** means the same as Car.

(59) **"Warranty Period"** shall have the meaning ascribed to it in the General Provisions in Exhibit A-1.

(60) **"Work Instructions"** shall mean step by step instructions on how each maintenance activity or work is to be completed as noted in Section G.6. Each Work Instruction shall be contained in a single comprehensive document, subject to Amtrak approval.

(61) **"Work Management System"** or "**WMS"** shall mean the Amtrak enterprise asset management (EAM) system to create, track, document, and archive Work Orders and Work Order Templates for the Amtrak Fleet. In the event Amtrak intends to change its work management system, Amtrak shall provide notice to Contractor and provide the appropriate training to Contractor personnel. The term shall be used interchangeably with enterprise asset management system.

(62) **"Work Order"** shall mean one or more work request(s) initiated with a completed EAM Jobplan that has/have been launched through the Enterprise Asset Management system as noted in Section G.6.

(63) **"Work Order Template"** shall mean a EAM Jobplan that, once filled in and completed with all the required Job Analysis outputs such as maintenance scope, safety hazards and mitigations, tools, bill of Material including part numbers, labor requirements, WBS Elements (if and when provided by Amtrak), and Work Instructions for the completion of an maintenance activity or combination of maintenance

activities, allows the creation of an executable Work Order as noted in Section G.6.

G.3 Coordination with Equipment Contract

a). The Management Teams for the Equipment and the TSSSA contracts shall both be overseen by a single Fleet Director.

b). The Fleet Director shall be maintained through the delivery of the final piece of equipment on the base Equipment contract.

c). The Fleet Director shall attend, at a minimum, all monthly status meetings.

d). The Equipment and TSSSA Teams shall present to Amtrak as a single entity with conflicting priorities between the groups never impacting the progress of the program as a whole.

e). The Fleet Director shall ensure that both teams are working cohesively optimizing system reliability and transitioning to TSSSA technical services.

i). The Fleet Director shall ensure TSSSA Technical staff are in attendance at Design Review meetings to ensure long-term maintenance concerns are considered.

ii). The Fleet Director shall ensure that the TSSSA technical services personnel have extensive experience gained through the production of the Equipment Contract.

G.4 Mobilization

a). Mobilization Activities

i). Within one (1) year after NTP of the TSSSA Contract, the Contractor and Amtrak shall hold a kick-off meeting to discuss the expectations of the Mobilization plan and mobilization process in general.

ii). Three (3) years prior to the scheduled Conditional Acceptance of the first car, Contractor shall develop and submit a Preliminary Mobilization Plan per Section G.4. for review and approval by Amtrak**. [CDRL G-01]**

iii). No less than two (2) years prior to the scheduled Conditional Acceptance of the first Car, Contractor and Amtrak shall hold an Interim mobilization meeting. **[CDRL G-02]**

(1) Thirty (30) days prior to the interim mobilization meeting, the Contractor shall develop and submit to Amtrak an agenda and a recommended list of participants for both parties. **[CDRL G-03]**

(2) At that time, the Contractor shall also submit any documentation expected to be reviewed at the meeting.

iv). One (1) year prior to the scheduled Conditional Acceptance of the first Car being delivered to Amtrak, Contractor shall submit the Maintenance Plan required by Section G.4. **[CDRL G-04]**

v). Thirty (30) days prior to the scheduled delivery of the first Car to Amtrak, Contractor shall stock all Amtrak Terminal Depot warehouse sites and Enroute Depot locations with sufficient Material needed to support the agreed upon Maintenance Plan. **[CDRL G-05]**

vi). Unless otherwise agreed to by Amtrak, Contractor shall staff all sites as shown in Section G.10 and Figure G-1 prior to delivery of the first Car.

vii). Contractor is required to make seamless transition to TSSSA coverage and provide staffing levels as described in Section G.5.

b). Mobilization Plan

i). The Mobilization Plan shall be a single, comprehensive, cohesive document which details the path from NTP to initiation of TSSSA services.

ii). The Mobilization Plan shall include all the assumptions made by the Contractor for its development.

iii). The Mobilization Plan shall be submitted to Amtrak in three phases:

(1) Three (3) years prior to the scheduled Conditional Acceptance of the first car, the Contractor shall submit a Preliminary Mobilization Plan. **[CDRL G-01]**

(a) The plan shall include the Contractor's assumptions and plan to progress from that point until the initiation of service.

(b) The plan shall include all steps, working groups and activities projected to achieve TSSSA mobilization.

(c) After the submission of the Preliminary Mobilization Plan, the Contractor and Amtrak shall initiate meetings and working sessions to collaboratively help the Contractor to progress Mobilization and refine the plan.

(2) No later than two (2) years prior to the scheduled Conditional Acceptance of the first Car, the Contractor shall resubmit an interim Mobilization Plan **[CDRL G-02]** that includes progress towards the initiation of services.

(a) The Interim Mobilization Plan shall include additional detail with regard to staffing levels, training schedules, Material quantities and procurement status, LRU lists and the Maintenance Plan.

(b) The Interim Mobilization Plan shall include a detailed training schedule and regimen that outlines how the Contractor intends to develop the technical support team. This training plan shall

include, at a minimum, the training courses, hours for each course, internal shadowing with the production floor, and review of all FMI. The training plan needs to include hands on training with similar products provided by the Contractor.

(3) No later than one (1) year prior to the scheduled Conditional Acceptance of the first Car, the Contractor shall resubmit the Final Mobilization Plan **[CDRL G-06]** which would include details of LRU and Material stocking quantities, the comprehensive Maintenance Plan, detailed training scheduled and all other maintenance information necessary to initiate service.

iv). The Mobilization Plan shall include all information required by the Contractor from Amtrak and the meetings and schedule to obtain that information.

v). The Mobilization Plan shall present a roadmap of the assumptions made and processes necessary to prepare for the development and completion of all that is required for the delivery of TSSSA services.

vi). The Mobilization Plan shall include, at a minimum, the following elements:

(1) A descriptive plan which presents and details the process for the mobilization of personnel, processes, procedures, Material and equipment necessary for the provision of TSSSA services.

(2) A comprehensive schedule including milestones, decision points, working sessions, meetings, procurements, design reviews, hiring, training and testing of systems and processes.

(3) The schedule shall be a chronological representation of all the required activities detailed in the balance of the Mobilization Plan.

(4) The Mobilization Plan shall include the discussion on how the Contractor shall address and/or implement the following elements and criteria as they impact the initiation of TSSSA services.

(5) Depot Site Visits – A presentation of when the Contractor would like to schedule a visit(s) to each of the Maintenance Depots applicable to this contract. The plan should also include what the Contractor would like to see and who should be made available during those visits.

(6) Car delivery – A presentation of the impact of the Car delivery schedule on the mobilization of the TSSSA services including:

(a) Monitoring the delivery schedule by the TSSSA Team.

(b) Addressing changes to the delivery schedule in the TSSSA mobilization schedule.

(c) Assumptions made which tie the delivery schedule to key activities in TSSSA mobilization.

(7) Car Deployment Plan – A presentation of the plan to support the implementation and deployment of the equipment, especially for each Car and at each Depot.

(8) TSSSA Staffing Plan – The plan for the mobilization of staffing to support the TSSSA services.

(a) The Staffing Plan shall detail the strategic process which shall enable the Contractor to understand and engage the number and types of employees necessary to provide the TSSSA services.

(b) The staffing plan shall include:

(i) Recruiting

(ii) Training

(iii) Scheduling

(9) Training Plan – shall include all requirements for training both Contractor personnel and Amtrak employees. The training plan will outline the process for regular updates and assessments that are intended to define when, where and who should be getting training.

(10) Materials – The plan for the identification, procurement and availability of Materials required to support the TSSSA services.

(11) Communication Plan – The plan to develop and implement the communication processes and procedures necessary to meet the relevant requirements of the TSSSA contract.

(12) Data management systems deployment – The plan to develop and implement the servers and software that will support the remote monitoring of the safety critical components and alert Amtrak.

(a) In addition to presenting the technical and functional description of the various components that make up the system, it shall detail the planned process to achieve full operation to support the deployment of the pilot equipment.

(13) Maintenance Plan – Details the plan for the development of the maintenance plan to ensure its completion and implementation on a schedule to support Car deployment.

(a) The Maintenance plan shall include all task plans and related documentation needed for all Scheduled and Unscheduled Maintenance.

(14) Maintenance/Reliability/Availability tracking – Details the approach on how the Contractor will track equipment reliability, availability, and maintainability targets, as required by the TSSSA contract. The plan will

also include the process to have those mechanisms in place and operation in support of the deployment of the equipment.

(15) Diagnostic & remote maintenance monitoring – Details the approach on how the Contractor will perform diagnostics and remote monitoring as required by the TSSSA contract. The plan will also include to process planned to have those alert mechanisms when it's out of tolerance by segregating the alerts and data/predictive analysis plan on fixing equipment.

(a) This plan will outline the methods and resources that will be deployed by the Contractor to incorporate progressive proactive means for identifying when maintenance should be planned to eliminate line of road Failures.

(16) Warehousing and logistic arrangements shall include the plan to develop and implement the following activities and processes:

(a) Material handling processes (requests, receipts, deliveries)

(b) Material Quarantine

(c) Storage Procedures

(d) Tracking Procedures

(i) Identification of hazardous material and handling procedures

(e) Material Management shall also include the following information:

(i) Material inventory list

(ii) A list of Rotable Material

(iii) A list of Reusable Shipping Containers that are expected to be returned

(iv) Space required for Material and personnel at each site.

(17) Data and information sharing interfaces and processes – Shall detail the planned information sharing as well as the plan to develop, test and implement all required interfaces prior to the deployment of the equipment.

(a) Integrations to provide the visibility, trackability, liability and accountability of inventory to both Amtrak and Contractor of what has been stocked, received, requested and consumed. Maintenance of the asset will be handled in Amtrak EAM system by Amtrak/Contractor Technician

(18) Life-cycle Maintenance Schedule, to be updated sixty (60) days prior to the agreed upon date for the delivery of the first production unit of each Car type and then updated annually as part of the Maintenance Plan.

c). Document Control

i). Amtrak shall use its Document Management System (DMS) as the documentation control system for the TSSSA program.

(1) While the Contractor may opt to use its own document control system internally, it shall use the DMS when submitting documents and contract letters to Amtrak and shall adhere to the processes inherent to that system.

(2) During the course of the TSSSA program, Amtrak will have the right to transition to a different documentation management program.

ii). The Contractor shall be responsible for the development of the following TSSSA documents. These documents shall be submitted to Amtrak for review and acceptance. The documents shall be reviewed, revised and resubmitted to Amtrak at least annually.

(1) Maintenance Plan

(2) Repair/Maintenance Procedures

(3) Work Instructions or task plans

(4) Illustrated Parts Catalog

(5) Communication and TSSSA Process Plan

(6) TSSSA Staffing Plan

(a) Three (3) years prior to the scheduled Conditional Acceptance of the first car, the Contractor shall develop and submit to Amtrak a list of defined roles, responsibilities, and reporting structures (organization chart) for the Team Leads and team personnel required for the TSSSA. **[CDRL G-07]**

(i) This list shall be subsequently incorporated into the Contractor's Staffing Plan.

(ii) The Contractor's Team Leads shall develop the Mobilization Plan and schedule to detail and present the goals and milestones necessary through the mobilization process.

(iii) Requested changes to Contractor's TSSSA leads and key staff must be submitted to Amtrak for review and approval. Amtrak, at its sole discretion, may reject proposed key staff.

d). Mobilization Status Review

i). Contractor shall develop and submit to Amtrak for review and acceptance, a written progress report at least monthly. **[CDRL G-08]**

(1) The written report shall describe the activities and progress since the last report, schedule adherence, risks and mitigations, challenges and upcoming major activities.

(2) The monthly report shall be accompanied by a current version of the TSSSA mobilization schedule.

e). Management of Cars and Spare Vehicles

i). Removal of Cars and Spare Vehicles

(1) Within three hundred sixty-five (365) days of execution of the TSSSA Contract, Amtrak and Contractor shall meet to discuss and develop a process for removing and reinstating Equipment that includes terms which are consistent with the TSSSA Contract and this scope of work.

(2) Upon written notice to Contractor, Amtrak may, at its sole discretion, reduce the number of Active Equipment for which the Contractor is obligated to perform the Work under this TSSSA Contract.

(a) Amtrak shall notify the Contractor by written notice specifying the Car(s) or Spare Vehicle(s) affected.

(b) Cars or Spare Vehicles shall only be considered removed from active status if the duration of inactive is at least thirty (30) consecutive days and inactive status shall last as long as determined by the Contracting Official, in his or her sole discretion.

(c) Upon removal of a Car or Spare Vehicle, Contractor shall not be required to perform any of the services covered under this TSSSA Contract, nor shall Contractor be subject to any associated Performance Guarantees or Incentives under this TSSSA Contract, with respect to such Inactive Equipment while it is removed.

(d) Amtrak shall have no further obligation to pay for the services covered under this TSSSA Contract with respect to such Inactive Equipment while it is removed from the first day of the Equipment being removed, which may have occurred up to sixty (60) days preceding the notice.

(e) For any Car or Spare Vehicle removed from service, the Scheduled Maintenance interval(s) shall be adjusted in accordance with the time removed from service.

(f) The associated Annual Maintenance Schedule and Life-Cycle Maintenance Schedule shall be updated accordingly as part of the Maintenance Plan.

(g) At no time is the Contractor permitted to remove any part, component or system from any Inactive Equipment, without the written permission of the COTR. Any item removed will be tracked by the Contractor in the Amtrak System of record and shall be replaced with a new part, component or system as soon as practicable.

ii). Reinstatement of Cars or Spare Vehicles

(1) Amtrak shall have the right, at its sole discretion, to reinstate Inactive Equipment removed from service by giving written notice to the Contractor.

(2) Upon reentry into service, the Contractor shall re-initiate the Work required under this TSSSA Contract on the affected Equipment

(3) The Car shall again be considered Active Equipment.

(4) Prior to the re-initiation of work performed under this TSSSA Contract for any Car or Spare Vehicle previously removed from service, the Contractor and Amtrak shall conduct a joint inspection solely for the purpose of determining the Equipment's state of repair.

(5) If Scheduled Maintenance events are required, then the Parties shall adjust the schedule for Scheduled Maintenance events to add such Cars or Spare Vehicles previously removed from service and shall schedule such events accordingly.

(6) Material for any such events shall be covered under the TSSSA Contract.

(a) If the joint inspection determines that additional Materials are required due to improper adherence by Amtrak to the Contractor's storage guidelines and conditions as included in the accepted maintenance manuals, Amtrak will cover the cost of the Material, and the schedule shall be adjusted accordingly. Contractor's storage guidelines and conditions shall be submitted during design review for Amtrak review and approval.

(7) In addition, upon reinstatement of a Car or Spare Vehicle, the Parties shall meet to discuss whether any changes to the Annual Maintenance Schedule are appropriate.

(8) As directed by Amtrak, Contractor shall make any applicable modifications and submit a revised Annual Maintenance Schedule to Amtrak.

(9) Upon re-instatement of the Car or Spare Vehicle, Contractor shall be eligible to receive a one-time cost adjustment to cover needs for Scheduled Maintenance for such reinstated Car or Spare Vehicle.

(10) Within thirty (30) days of such reinstatement or as otherwise agreed to by Amtrak, Contractor shall submit its claim for a one- time cost adjustment with such supporting documentation as may be requested by Amtrak.

(11) Amtrak shall review Contractor's claim and make a determination as soon as practical.

(12) Amtrak shall pay the agreed upon one-time adjustment in accordance with the payment terms in the TSSSA Contract.

(13) If the parties are unable to agree to the one-time adjustment, it shall be considered a dispute and resolved in accordance with the Claims and Disputes provision of the terms and conditions of the TSSSA Contract.

G.5 Project Management and Staffing

a). Organizational Structure

i). Contractor shall provide a dedicated TSSSA Project Management Team to manage the TSSSA.

ii). Key Personnel shall be designated in accordance with Article 10 of the General Provisions in Exhibit A-1, Contractor Key Personnel, of the General Provisions of the TSSSA Contract.

iii). The Project Management Team shall be fully staffed and trained during mobilization to perform the functions described in this section.

iv). Responsibilities will include:

(1) Coordinating all logistics;

(2) Providing management for all aspects of the TSSSA;

(3) Quality assurance and management of all quality requirements;

(4) Management and deployment of engineering and Technical Support; and

(5) Oversight of Materials management.

b). Contractor Personnel and Personnel Change Requests

i). Contractor shall employ competent and qualified personnel that meet the minimum requirements outlined in the TSSSA Contract and satisfy Contractor's obligations set forth herein.

ii). Contractor shall staff its Technical Support team with qualified personnel that includes specialized engineering and maintenance experts having design experience of the Car as well as a strong maintenance background. All Contractor Technical Support personnel shall be qualified through the technical training plan that as outlined in this document.

iii). The Contractor shall develop its staffing plan to achieve a continuity of personnel from the Car design, production and testing phases of the project through Technical Support to be provided under the TSSSA.

iv). All personnel identified by the Contractor in the TSSSA Program Management and Staffing Plan shall work full time (at least 40-hours/week) and be fully dedicated to this TSSSA Contract.

(1) For example, Contractor may need to extend work schedule to continue supporting an Unscheduled Maintenance event.

v). Staff hourly schedules and relief days shall be flexible to meet the operational needs of Amtrak. The staffing plan and schedule will be updated as necessary and shared with Amtrak no less than monthly.

vi). Contractor shall ensure that all Contractor personnel work in a collaborative and professional manner with Amtrak staff.

vii). As set forth in the General Provisions of the TSSSA Contract, Amtrak has the right to require Contractor to replace any employee, including Key Personnel.

c). TSSSA Program Management and Staffing Plan

i). Three (3) years prior to the scheduled Conditional Acceptance of the first car and as part of the Mobilization Plan, the Contractor shall submit a detailed TSSSA Program Management and Staffing Plan to Amtrak for its review and approval. **[CDRL G-09]**

(1) All Terminal depots are staffed 24/7.

ii). This plan shall demonstrate sufficient staffing and management for the management and delivery of TSSSA services including operations, Material Management, quality, engineering, and technical support.

(1) During performance of the TSSSA, Contractor shall ensure that each of these areas have dedicated personnel to adequately manage and supervise the assigned Contractor personnel.

iii). Contractor’s Program Management and Staffing Plan shall be developed based on the Amtrak Terminal Depots and Enroute Depots defined in this Statement of Work.

iv). The specific staffing levels for each location will be determined after the number of Cars at each location has been finalized (i.e., at the time of Notice to Proceed).

d). Technical Support

i). The Contractor will supply support technicians as outlined in Section G.5. These technicians will offer on-site support at each of Amtrak's Terminal Depots, as specified in Section G.10 and in accordance with the TSSSA Scope of Work.

ii). These on-site support technicians will support Amtrak maintenance employees in developing their skills in fault finding and fault rectification and conduct fault finding on complex faults.

iii). During the Mobilization Phase and through the initial Car acceptance, the on-going training for Amtrak maintenance staff will primarily be delivered through the on-site support technicians who will be at the disposal of Amtrak to investigate any Car Failures, incidents and accidents, including derailments, anywhere on the Amtrak system.

iv). The Contractor shall also provide around the clock, uninterrupted Technical Support coverage at Amtrak's CNOC Help Desk and remotely to all Amtrak Enroute Depots as detailed in Section G.10.

e). Material Management

i). Under this TSSSA, the Contractor is responsible for Material Management.

ii). The Contractor shall use Material and maintenance projections developed as part of the Car design and testing process to plan Material needs.

iii). The Contractor will fulfill these Material needs by finding and qualifying sources for existing or replacement Materials as necessary and procuring Materials from these suppliers.

(1) Planning and stocking shall be based on the resource availability and demand.

iv). Contractor will arrange for Materials to be shipped to and from suppliers as necessary for use and repair or overhaul and will coordinate with Amtrak the different warehouse locations for the project.

v). The Contractor will arrange to ship Material to the Amtrak managed Amtrak Terminal Depot warehouse space allocated at each site in addition to any required off-site Contractor managed sites.

vi). Amtrak Enroute Depot Materials shall be located in storage containers at each site or Amtrak approved alternative. The Contractor shall be responsible for managing, maintaining and all costs associated with the storage containers

(1) En-route depots typically have select shifts when personnel are present on site that correspond with train arrival/departure at each location. The Contractor will be responsible for material logistics and will work with Amtrak's material control when necessary.

vii). Contractor will coordinate with Amtrak and manage all aspects of Material Management and report to the Project Manager.

viii). The Materials group will consist of dedicated resources.

ix). Any Material repairs and overhauls that will not be performed by suppliers will be performed by Contractor at a Contractor's off-site location, unless otherwise approved by Amtrak.

x). The Contractor's Materials Management responsibilities shall include:

(1) Provide daily written reports to Amtrak describing any Material issues affecting Scheduled or Unscheduled Maintenance.

(2) Provide monthly written reports to Amtrak summarizing the performance statistics (e.g. on time delivery), showing trends and driving improvement actions.

(3) Manage the forecast and execution of the Material supply process and to interface with Contractor's organization.

(4) Ensure Material kits are in stock at the Amtrak warehouses and ready to disperse to Amtrak maintenance technicians as required.

(5) Manage and adjust Material inventory and stocking locations based on the analysis of service Failures and on-board diagnostic and monitoring systems for Scheduled and Unscheduled Maintenance.

(6) Manage and control the availability of Materials between Contractor's warehouse and the identified Amtrak Terminal Depots and Enroute Depots.

(7) Interface with supplier quality assurance and manage warranty activities.

(8) Investigation into root cause analysis for all component Failures not within 5% of the end of their scheduled replacement.

(a) Root cause analysis reports shall be completed and submitted to Amtrak within 60 days of the Failure.

(9) Any other report as determined by Amtrak as necessary to ensure delivery of the TSSSA.

(10) Creation of Amtrak part numbers for all Material within Amtrak's SAP system.

xi). Warehousing and Materials Handling

(1) Contractor's personnel assigned for Materials handling at each Amtrak Terminal Depot will coordinate with Amtrak to manage the flow of Materials in/out of Amtrak managed warehouse.

(2) Incoming Materials will be received by Amtrak at the Amtrak Terminal Depots and moved by Amtrak to storage locations based on size, shape, immediacy of need, and any special storage requirements.

(3) As Work Order requests come in or Contractor identifies need for Material from the planners, software, or technicians, Contractor's warehousing and Materials handling personnel will create maintenance kits as required for each day's maintenance tasks and coordinate with Amtrak to draw the necessary Material from the Amtrak warehouse or from Contractor maintained off-site storage.

xii). The Contractor's Maintenance Planning Personnel will be responsible for all maintenance planning activities which shall include the following:

(1) Conduct the initial screening of incoming incidents and Work Orders

(2) Identify scope and analysis of required level of planning

(3) Create Work Orders based on Scheduled and Unscheduled Maintenance

(4) Identify specific safety hazards that may be encountered in the performance of the proposed work

(5) Estimate required hours of work for Work Order tasks

(6) Determine work duration and skills required to perform the tasks

(7) Determine and incorporate QA/QC requirements on jobs

(8) Review work procedures and make recommendations where required

(9) Determine and communicate to stores department the Material required to perform the work, as well as delivery time and location

(10) Coordinate and set priorities with the Amtrak team(s) placing emphasis on obtaining the input of the operations personnel in the setting of priorities

(11) Ensure all Work Orders and maintenance log items are closed properly when work is finished. The maintenance planner shall be the first line of support for the Consolidated National Operations Center (CNOC) Mechanical desk

xiii). Scheduled Heavy Repair

(1) Scheduled heavy repair refers to the Contractor's unit exchange and component exchange of spare or replacement Material as defined in the Maintenance Plan.

(2) Under the unit exchange and component exchange process, Material may be exchanged with a new or rebuilt Material, while the removed

Material is either overhauled/repaired off of the Equipment or sent back to a supplier for refurbishment or replacement.

(3) It is expected that the majority of the Fragmented Continuous Maintenance Activities are developed to be performed within the anticipated eight (8) hours of maintenance touch time that the Cars will see.

(a) Any exceptions must be clearly detailed within the Maintenance Plan and included in the schedules for the Annual Maintenance Schedule and the Life-Cycle Maintenance Schedule.

(4) For planning purposes, eight (8) hours of touch time at an Amtrak Terminal Depot shall be made available for maintenance on a jointly agreed upon periodicity.

(a) Any Scheduled Maintenance activities that require a Car to be set out longer than eight (8) hours shall be clearly identified by the Contractor and incorporated into the Annual Maintenance Schedule and Life-Cycle Maintenance Schedule as part of the Maintenance Plan.

(b) Amtrak shall attempt to allow for 8-12 hours of touch time for maintenance and planning purposes, however, for the intent of this contract only 3.5-8 hours should be planned for maintenance work depending on the deployment of the equipment.

(5) Contractor’s personnel are responsible for coordinating with Amtrak prior to the scheduled heavy repair work on the Equipment and Materials, as well as working with suppliers to perform system and component repairs and overhauls that cannot be performed by the Contractor on site.

(6) Spares/Components shall be tracked by position and serial number. All locations for all parts shall be identified by the Contractor. The subcomponent should provide any structure that may have an impact on the replacement of any part.

(7) Contractor’s personnel will coordinate with Amtrak and work with Contractor’s engineering and technical support personnel to manage the on- and off-train scheduled heavy repair work required by the Maintenance Plan.

(8) The Contractor will manage external Material repair and overhaul work, including work performed off-site at Contractor’s supplier’s site. In conjunction with the engineering team, Contractor will review supplier technical specifications, repair times, and monitor quality of performance.

(9) In anticipation of the scheduled heavy repair work, Contractor will identify specific location(s) subject to Amtrak approval and assign a

specific team dedicated to scheduled heavy repair activities and to design, industrialize, and perform the scheduled heavy repair work.

G.6 Maintenance Information Management

a). Contractor's Maintenance Information Management

i). Contractor will advise Amtrak about the Maintenance Plan and that will be set in Amtrak's EAM for the frequency of Scheduled Maintenance.

ii). Contractor shall utilize Amtrak's EAM system while ensuring a detailed method of managing all relevant maintenance information is available. The method and additional system that is employed may include an integrated database which is synchronized and interfaced with Amtrak's own system Amtrak's EAM will be used to record all maintenance activities, Material movements and any updates to existing documentation.

iii). The Maintenance information management shall include all aspects of the Maintenance Plans and information that comes in from technicians, inspection, monitoring, diagnostic system, and Fragmented Continuous Maintenance work.

iv). Contractor will provide access to the web-based portal for all data, KPI's and reliability reports along with Failures.

v). All documentation produced and used by Contractor throughout the project will be in the American English language.

vi). All information technology firmware and in some cases versions of the software to be tracked by the Contractor, and data shall fully comply with Amtrak Universal Single Level Fleet Replacement Technical Specification #1139.

vii). Contractor shall ensure that the maintenance information includes the following:

(1) The necessary information to monitor and report on the reliability and maintainability of all parts of the Equipment

(2) Work performed by part number, individual serialized part number, and child and parent pointers to facilitate detailed root cause analysis

(3) Updates to technical documentation and an archival system that allows for the retrieval of information.

(4) Detail sufficient to allow planners to monitor and plan maintenance activities and verify that maintenance policies are applied. This includes organization definition, activity planning, work distribution, activity prioritization, finished task recording, and workflow management.

(5) Amtrak and the Contractor shall have access to technical data related to the maintenance of the Equipment through Amtrak's EAM system.

Facilitate the operation of the Work Management System, including interfaces with field tablets.

(6) Monitor the current and long-term health of on-board digital systems and digital control systems via on-board monitoring through a link with Contractor's diagnostic and monitoring database, and a data repository of condition-based monitoring results

(7) Based on the severity of the event, to be defined by Amtrak, faults should be sent to Amtrak's EAM system for further analysis and technician to troubleshoot through data lake.

(8) Obtain a high level of economic performance through optimization of economic flows and capital mobilization (i.e., sourcing, orders and delivery, logistics and storage levels)

(9) Provide consolidated information regarding the maintenance activity through required performances follow-up and production reporting

(10) Include secure back-up storage for all data and documentation

(11) Interface with Contractor's diagnostic and monitoring system(s) to enable the gathering and recording of data for analysis. Both raw and curated data to handle the data analysis and predictive analysis shall be provided.

(12) Predictive models must be sent to Amtrak data lake to support data analysis on Amtrak agreed upon intervals and integration formats.

b). Maintenance Management

i). Contractor shall update the Maintenance Plan using Amtrak's EAM system.

ii). Work Order execution by Amtrak will occur in Amtrak's enterprise asset management platform which will provide workers with a consistent user interface to simplify training and avoid complexity with multiple sets of technology in each shop.

iii). Contractor will utilize a Fragmented Continuous Maintenance approach and real- time monitoring devices on the Cars to provide information to its own developed system.

(1) Contractor shall use real-time data gathered through remote diagnostics and monitoring to anticipate and predict the maintenance needs, ensuring that the required maintenance support is accomplished quickly and effectively. The intent is also to provide the useful life of the asset along with any reliable measurements of diagnostics.

iv). For some components and systems where the continuous, running monitoring of diagnostic and monitoring systems is not practical, other methods will be used to support the Fragmented Continuous Maintenance.

(1) This may include performing regular testing before, during, and after the anticipated Failure date of a component.

(2) This regular testing detects components that are at risk of failing prematurely and prevents costly components from being replaced or overhauled too early or too late in their individual life cycles, thereby optimizing both performance and availability of the Cars.

c). Implementation

i). The maintenance, operation, and Materials personnel will utilize the Amtrak approved Material information system and work management system utilizing its data to provide the following service deliverables:

(1) Scheduled Maintenance including Fragmented Continuous Maintenance and spares supply for guaranteed performance of the system

(2) Unscheduled Maintenance and spares supply to rectify any Failures

(3) Scheduled heavy repair services using a Fragmented Continuous Maintenance approach to manage traditional overhaul requirements while reducing the need for long Vehicle down-time preventive maintenance.

ii). Detailed feedback from all Failures especially in service will be recorded in Contractor's information system to analyze the Failure occurrence, determine root causes, and prevent repeated Failures. Updated to the LRU lists may be necessary during this analysis.

(1) In the event of a major incidents and Failures, the Contractor shall be required to perform detailed inquiries and develop and submit written reports.

(a) Details of the report contents to be mutually agreed during mobilization.

(b) This feedback will additionally be provided to Amtrak in approved electronic formats.

iii). As maintenance work is scheduled or performed, relevant information about the work performed will be recorded in Amtrak's EAM system and moved via electronic interface to Contractor's system.

iv). Corrective actions shall be documented beginning with the issuance of a Work Order but can also be submitted by Contractor Help Desk personnel.

(1) The data entry and reporting shall not conflict with Amtrak's enterprise asset management system.

(2) Amtrak's enterprise asset management system shall be considered the master system of record.

d). Maintenance Planning

i). Contractor shall work collaboratively with Amtrak's planners to ensure that both Scheduled and Unscheduled Maintenance activities are forecasted in a way to optimize maintenance and increase reliability and availability without affecting scheduled Revenue Service.

(1) Maintenance planning shall optimize Equipment availability within the limits of staff and resource constraints.

(2) Additional details pertaining to Fragmented Continuous Maintenance activities are detailed in Section G.6.

ii). Contractor's Fragmented Continuous Maintenance schedule, which may include mileage or time- based maintenance activities, shall be coordinated with Amtrak.

iii). Individual Car diagrams/schedules shall be optimized to level-load the maintenance requirements of the overall Fleet while ensuring that the scheduled Amtrak Revenue Service is met.

e). Maintenance Plan

i). The Contractor shall develop and submit to Amtrak for review and approval a comprehensive Maintenance Plan. **[part of CDRL G-04]**

ii). The Maintenance Plan shall be updated and submitted annually for review and approval.

iii). The Maintenance Plan shall include all activities, schedules, and documentation required by Contractor, regulatory agencies and Amtrak to maintain, inspect, and restore the Equipment to maintain intended design function over the design life of the Equipment.

iv). The Maintenance Plan shall be a detailed documented process describing all Scheduled Maintenance activities that are required for the Equipment throughout its life and must be reviewed and approved on an annual basis against the performance of the Equipment.

v). The Maintenance Plan shall include the frequency and duration of each activity required and provide a scheduling tool to demonstrate how the Equipment will be maintained throughout the life of the project.

vi). The list of activities shall be considered an all-encompassing and complete list of every inspection, testing, and maintenance requirement.

vii). The Maintenance Plan must incorporate all regulatory inspections, Amtrak procedures, Amtrak Mechanical Bulletins and guidance from Contractor, related to the reliability and safety of the Equipment.

viii). The Maintenance Plan shall include the submittal of the Life-Cycle Maintenance Schedule and Annual Maintenance Schedule(s) per Section G.4.

ix). The Maintenance Plan shall fulfill all requirements of 49 CFR 238.107.

x). The Maintenance Plan development and updates are to be the responsibility of Contractor and are subject to approval by Amtrak.

xi). The Maintenance Plan shall include:

(1) All Material/systems identified for a duration of twenty (20) years or the life of the TSSSA Contract, whichever is longer.

(2) Logistic efforts to ensure the Material is available to schedule as jointly agreed upon.

(3) Investment in and management of spares pool required to support the Fragmented Continuous Maintenance approach and the Life-Cycle Maintenance and Annual Maintenance Schedules.

(4) Coordination with suppliers, engineering and regulatory authorities to research and support continuous efforts at extending the maintenance periods without compromising safety or reliability.

(5) Joint determination of quality expectations, controls, inspections or tests to apply to equipment before Contractor acceptance back into Material pool.

(6) An agreeable re-commissioning process at the conclusion of the TSSSA Contract to ensure state of good repair.

(7) Detailed description of Inspection procedure, intervals and criteria.

(8) Detailed test procedures and intervals

(9) Scheduled preventive maintenance intervals

(10) Detailed maintenance procedures

(11) Detailed description of special testing equipment or measuring devices required to perform inspections and tests. Calibration of these devices shall be the responsibility of the Contractor.

xii). For the purposes of planning, the Contractor shall include in the Maintenance Plan and all submittals of maintenance schedules any anticipated changes in Amtrak labor requirements exceeding ten percent (10%).

(1) Contractor shall notify Amtrak of these changes no less than one hundred eighty (180) days prior to the anticipated start date.

(2) For the purposes of level-loading labor and Material supply, the Contractor shall make every attempt to minimize extreme variations in maintenance activity.

xiii). Fragmented Continuous Maintenance

(1) The Contractor shall support Amtrak's Fragmented Continuous Maintenance philosophy for the Cars.

(2) The Contractor's Maintenance Plan shall address the intervals and requirements to support the Fragmented Continuous Maintenance of the Cars, Spare Vehicles, systems, and Materials throughout the design life of the Equipment.

(3) Three and a half (3.5) hours for NEC Operation and Eight (8) hours for Long Distance operation of touch time at an Amtrak Terminal Depot shall be made available for maintenance on a jointly agreed upon periodicity. Any Scheduled Maintenance activities that require a Car to be set out longer shall be clearly identified by the Contractor and incorporated into the Annual Maintenance Schedule and Life-Cycle Maintenance Schedule as part of the Maintenance Plan.

(4) The majority of the Fragmented Continuous Maintenance Activities shall be developed to be performed within the anticipated three and a half (3.5) hours for NEC Operation and eight (8) hours for Long Distance operation of maintenance touch time that the Car will see.

(a) Any exceptions must be clearly detailed within the Maintenance Plan.

(5) It is the intention for both parties to optimize, expand, and extend the maintenance intervals in order to maximize availability, yet not impact the overall Car performance or reliability.

(a) The Contractor shall employ the use of diagnostic monitoring and predictive maintenance analysis, discussions, agreements and appropriate field test analysis to ensure changes to maintenance practices are appropriate and taking the associated risks into account.

(b) Amtrak is open to the concept of sharing documented cost savings that can be realized over the course of the TSSSA as defined in Section G.14.

xiv). Life Cycle Maintenance Schedule

(1) Contractor shall develop and submit to Amtrak for review and approval a Life-cycle Maintenance Schedule **[CDRL G-10]** listing of all Fragmented Continuous Maintenance activities including component or system overhaul events required to maintain the Equipment to Contractor's specifications.

(a) The Life-cycle Maintenance Schedule shall list the maintenance support requirements, maintenance activity, note whether it is a regulatory requirement, the maintenance interval in years which is the frequency or periodicity of when the maintenance activity should occur, the amount of Material or kits (maintenance activities), the number of the times the maintenance activity should be performed, for the life of the Equipment, maintenance activity task time, specialized tooling, and facility requirements (i.e. crane, drop table).

(2) The Life-cycle Maintenance Schedule shall address the time period from the delivery of the first Car to the end of the design life of the Equipment.

xv). Annual Maintenance Schedule **[CDRL G-11]**

(1) The Annual Maintenance Schedule represents the schedule of the maintenance activities that, barring unforeseen circumstances, will actually be conducted on the Equipment for the applicable calendar year as a subset of the Maintenance Plan activities.

(2) The initial Annual Maintenance Schedule shall be developed and submitted to Amtrak as part of the Maintenance Plan.

(3) At least ninety (90) days prior to the end of each Amtrak fiscal year or as otherwise agreed to by Amtrak, the Contractor shall provide the 12-month look-ahead schedule which includes all Scheduled Maintenance, inspection, and overhaul activities for the subsequent calendar year by Equipment, depot and date along with required purchase order requests.

(4) This Annual Maintenance Schedule shall be included as part of the Maintenance Plan.

xvi). Annual Maintenance Schedule Change Proposal

(1) Contractor or Amtrak may propose schedule changes which improve performance, reduce maintenance, and/or minimize out of service time.

(a) These changes shall be considered pursuant to Section G.14.

(b) It is possible that during the course of performing Unscheduled Maintenance, Material on Equipment that is scheduled for an upcoming maintenance activity may be replaced.

(i) The parties shall meet and discuss whether the maintenance activity still needs to take place given the recent replacement under the TSSSA Contract.

(ii) To the extent the parties do not agree, the parties shall utilize the communication process set forth in Section G.13.

xvii). Work Orders/Job plans

(1) Contractor shall develop a Work Order Template for each maintenance activity which will be launched through Amtrak's Enterprise Asset Management system to create Work Orders. The Job plan shall include, at a minimum, the following types of information:

(a) Description

(b) Safety Hazards and Mitigations

(c) Detailed Work Instructions

(d) Labor Requirements

(e) Planned Material

(f) Planned Tools

(g) Measurements (if needed to be recorded by technician)

(h) Maintenance Activity Periodicity

(i) Quality Gates

(2) A sample Work Order Template has been provided in Appendix C; however, it should be viewed as reference only.

xviii). Work Instructions

(1) Contractor shall be responsible for delivering single, independent, Work Instructions for Amtrak to validate.

(a) These Work Instructions should be delivered to Amtrak in an electronic format via a standard interface.

(b) A sample Work Instruction has been provided in Appendix D.

(2) Each regularly scheduled maintenance activity in Contractor’s Maintenance Plan shall have an associated detailed Work Instruction, which shall be subject to Amtrak review and approval.

(a) Each Work Instruction shall be contained in a single comprehensive document and shall include associated drawings, schematics, and a bill of materials that may be required in execution of the work.

(b) For clarity, the Contractor shall not simply provide cross references to other documents or section thereof. The text of the reference should be included in the Work Instruction.

(c) Amtrak is responsible for executing the work, including trouble shooting for corrective interventions.

(d) Contractor will station skilled on-site support technicians at each maintenance Depot to support the Amtrak staff.

(e) Contractor support may include physical assistance with technical repairs.

(f) Amtrak will remove and replace Material.

f). Work Order Entry to Enterprise Asset Management System

i). Amtrak considers the creation and entry into the enterprise asset management system of Work Orders for maintenance activities critical to the success of this TSSSA Contract.

ii). Contractor shall submit all Work Order Templates **[CDRL G-12]** to Amtrak.

(1) The Contractor and Amtrak will validate the Work Order Templates, and any necessary changes will be made at that time.

(2) After obtaining Amtrak approval, Contractor shall create Work Orders in Amtrak's EAM.

(3) Amtrak shall provide the proper accounting WBS Elements for each Work Order.

iii). Up-to-date and correct Work Orders are of vital importance to Amtrak's operations, as out-of-date or incorrect Work Orders can result in additional labor costs, backlog of maintenance tasks, and unnecessary operational challenges.

(1) The Contractor shall use due diligence and best efforts to ensure that all Work Orders are updated, revised, or corrected as appropriate or as the need arises.

(2) If Contractor fails to update, revise, or correct a Work Order(s), Contractor shall notify Amtrak in writing as soon as possible. Contractor shall then exercise best efforts to promptly update, revise, or correct the Work Order so that the Work Order can be completed as scheduled or as soon thereafter as reasonably possible.

g). Work Order Execution

i). Once the Work Order is generated, Contractor shall assist Amtrak in identifying the Material required for the task and issuing a Material request to the warehouse. Amtrak will pull the necessary Material from stock, if available, and issue the Material to Amtrak for resolution of the maintenance task.

h). Remote Diagnostics and Predictive Analytics

i). In order to provide predictive analysis to enable scheduling necessary maintenance activities and avoiding potential Unscheduled Maintenance

work, Contractor will implement a plan for gathering and interpreting remote diagnostic information from the Equipment.

(1) The plan shall include monitoring of all equipment that reports to the Central Diagnostics Unit, i.e. batteries, HVAC, refrigeration, water & waste, lighting etc.

ii). The Equipment will have all diagnostics reported out to a centralized database and will be available for viewing remotely as well as provided in an approved electronic interface to Amtrak's back-office system in near real time.

(1) This information will allow the maintainers and engineers to receive real time information from the Equipment in service.

iii). Contractor shall provide details of its remote diagnostic and monitoring system and capabilities to Amtrak for its review and approval as part of the design review process for the Equipment.

(1) The system shall also allow the Help Desk representatives to assist the on-board crew in recovering a defective Car, and to also facilitate the planning of Unscheduled Maintenance to eliminate surprises during daily inspections or other Scheduled Maintenance.

iv). The diagnostic data from the Equipment will be remotely shared with Amtrak in near real time through an agreed-upon interface, at no cost between Amtrak and Contractor.

(1) The system will be used to parse the Contractor data that is shared with Amtrak into useful information in making decisions or recommendations about maintenance, utilization, and troubleshooting.

(2) All information generated from the Equipment as well as any derived data from the system will be freely shared with Amtrak.

(3) The Contractor shall develop a summary report of all faults and Failures on a trend analysis basis and the resulting recommended predictive maintenance for the fleet.

(a) Report shall be submitted to Amtrak on a monthly basis and discussed at the monthly meeting.

(4) The Contractor shall provide a dedicated resource to evaluate diagnostic data.

v). The predictive software system must be capable of precise pattern recognition and statistical confidence levels that will be used to assess risks and identify early-onset conditions that are either abnormal or precursors to Failure.

(1) When a Failure occurs, Contractor's system must generate a Failure signature that is immediately shared and compared with other fleets of the same type to prevent similar instances from occurring.

(2) The system must be continuously monitored and updated by Contractor to detect the onset of Failures by utilizing feedback and recommendations from industry experts, analyzing Work Orders for trends, or performing advanced analytics.

vi). When predicting potential Failures, the indication will require the leading indicators, data values, and an accurate time to Failure to allow operating personnel sufficient time to mitigate the issue(s) in advance.

(1) If a potential Failure or undesired condition exists that requires corrective attention, an Amtrak Work Order shall be generated and shall incorporate a severity code such as “Critical: Immediate Repair” or “Abnormal: Address Next Scheduled Shopping.”

(2) The predictive system must have a comprehensive set of views and dashboards that present real time health monitoring information and runtime statistics.

(3) If any signature patterns have been created and verified, the system will allow the pattern to be monitored “live” and compared to historical data as well as other beneficial diagnostics mutually agreed to by the parties.

(4) Contractor’s predictive system and health monitoring shall identify signature patterns and detect repeated signature patterns for analysis, provide predictive Failure trends, and allow potential design improvements to improve reliability.

vii). The comprehensive diagnostic exchange must allow for both Contractor and Amtrak hardware and software expansion.

i). Data Collection

i). Contractor shall be responsible for collecting storing and sharing all Equipment related fault reporting, diagnostics, maintenance records, and technical documentation relating to maintenance activities.

ii). Through review and manipulation of the captured data, Contractor’s engineers will use the information to drive the continuous improvement activities required in Maintenance Plan.

(1) Key outputs of this activity are used to support continuous reliability growth activities and to refine the Maintenance Plan.

(2) The data collected by Contractor shall define and record the configuration of the Cars, Spare Vehicle(s), sub-systems and components.

iii). At Amtrak's discretion the technical documentation will be housed in Amtrak's distributed document management system, or an Amtrak approved Contractor server and will be populated with relevant technical support information that is generated for the life of the Equipment Contract.

(1) This information will be updated or supplemented by any new technical support information that is developed during the execution of the TSSSA Contract.

(2) As new information is produced by Contractor or its subcontractors, Contractor will upload the information to the technical documentation and notify Amtrak of the change. All additions or changes to the technical documentation will be recorded.

iv). An index of all technical documentation will be developed in the form of an electronic catalog. This catalog will be delivered to Amtrak and updated as needed. Each element of information will be cross-referenced or hyperlinked to the technical documentation.

v). Contractor will establish a standard interface with Amtrak to access the technical documentation. Amtrak will have access to the technical information related to the maintenance of the Equipment. At the termination of the TSSSA Contract, the updated technical documentation will be delivered to Amtrak.

G.7 Point of Sale Support (Option)

a). If Amtrak exercises the option for the Contractor to provide a POS system as part of the Equipment contract, the Contractor shall also be responsible for supporting the on-board Point of Sale system for Food Service.

b). The Contractor shall support hardware and software both on-board the rolling stock and wayside (back-office).

c). During Mobilization, the Contractor shall coordinate with Amtrak the routing of POS sales to Amtrak accounts.

d). The system shall also support real time inventory management of on-board food service items.

i). Shortages shall be announced to on-board crew as well as transmitted wayside for mitigation by Amtrak Food and Beverage Services.

(1) Details of the wayside messaging shall be clarified during mobilization.

e). The Contractor shall provide monthly electronic reports detailing all on-board POS purchases.

i). These reports shall be searchable by all relevant criteria to all Amtrak to fine tune its food and beverage service.

G.8 Wi-Fi Service Support (Option)

a). If Amtrak exercises the option for the Contractor to provide an on-board passenger Wi-Fi system as part of the Equipment contract, the Contractor shall also be responsible for supporting the on-board equipment providing that service.

b). The Contractor shall support on-board hardware and software.

c). The system shall support train to wayside connectivity throughout Amtrak's service area and would be expected to incorporate at least cellular and satellite connectivity.

d). At 3-year intervals, the Contractor shall evaluate the available Wi-Fi, cellular and satellite technologies and shall develop and submit to Amtrak a proposal to upgrade the on-board equipment.

e). Connectivity outages shall be announced to on-board crew as well as transmitted wayside for mitigation the Contractor.

f). The Contractor shall provide monthly electronic reports detailing cellular, satellite and Wi-Fi.

G.9 Technical Support Services

a). Technical Support

i). Contractor shall provide Technical Support at Amtrak Terminal Depots as described in Section G.10.

(1) Until and unless Amtrak modifies the maintenance capabilities and capacities, Technical Support at Amtrak Enroute Depot shall be provided by unrestricted 24/7 telephone and e-mail communications.

ii). Contractor shall provide support to handle technical issues related to the Equipment. This includes, but is not limited to, the following:

(1) Assisting Amtrak in performing inspections, maintenance and repairs;

(2) Tutoring Amtrak employees on the proper maintenance procedures;

(3) Providing support in analyzing symptoms, troubleshooting, and diagnosing problems;

(4) Assisting in helping to identify Material, including the level of LRU that requires replacement;

(5) Assisting in the documentation of reported problems and remedies. (This ensures the proper Equipment data logging and issue tracking in the proper systems and applications.);

(6) Using major or complex repairs as opportunities for impromptu hands-on demonstration;

(7) Providing technical Help Desk support at CNOC, including support of Cars experiencing en-route defects or Failures;

(8) Providing technical expertise to support investigations, performance monitoring, obsolescence management, and Fleet improvement programs;

(9) Assist Amtrak in the coordination of Equipment Fleet management and planning;

(10) Providing Technical Support to investigate and resolve systemic Fleet problems;

(11) Maintaining and providing version control for applications of FMPs, Material and software to Equipment and Material supply;

(12) Generating, validating and maintaining all required maintenance work instructions/procedures in accordance with OEM specifications;

(13) Provide on-site support technicians to assist Amtrak in fault finding and to generate key performance indicators and Failure analysis to support continuous improvement;

(14) Providing reviews, updates and recommendations to maintenance practices and maintenance work instructions/procedures;

(15) Analyzing data logs and events and providing software updates as required;

(16) Upon completion of work, communicate with Amtrak's personnel regarding ideas and procedures that will make future work more efficient;

(17) Assist with the further development of troubleshooting procedures and documentation as required by Amtrak;

(18) Assisting in helping to identify Material called out in the repair manuals and assigning missing part numbers;

(19) Creating and tracking of reliability Fleet performance report with data provided by Amtrak and by Contractor;

(20) Identifying common or repeated maintenance errors and including information on these errors in the training of Amtrak's Trainers; and

(21) Performing, and providing equipment or tooling for, specialized inspections, screening or scanning of Car or systems as required by Contractor, such as ultrasonic testing (UT).

iii). Contractor shall provide pricing option for train rider coverage support on each long distance train for a monthly or annual basis. Train riders shall be well versed in all car systems, maintenance, troubleshooting, and repair.

Train riders shall address in-service Failures reported, implement repairs and corrective actions when possible, and provide detailed diagnostic or maintenance work order requests for open Failures. Experienced engineers/technicians from local depot or Contractor locations may additionally be requested to provide short-term train rider coverage at Contractor direction or within 24-hours of Amtrak's request.

iv). In addition, Contractor shall be required to revise and maintain an up-to-date Operator's Manual as required in the Technical Specification and originally provided under the fleet procurement.

(1) The Operator's Manual shall contain Car troubleshooting procedures and steps for recovery of train operations when a fault or Failure has occurred.

(2) The Operator's Manual shall be continuously updated and reviewed bi-annually with Amtrak over the life of the TSSSA Contract **[CDRL G-13]**.

b). Help Desk Representatives & Monitoring and Diagnostics Technicians

i). Contractor shall implement a decision procedure for deploying on-call Contractor Technical Support personnel as follows:

(1) When a call for support comes in, Contractor's help desk representative will attempt to work through the problem with Amtrak.

(2) If that is not possible, the help desk representative will, in conjunction with the caller, Amtrak, and established protocols, determine if the affected Car can continue the route, with or without certain limitations or adjustments.

(3) If the Car can finish the route, the Car will continue its route, and the help desk representative will alert Amtrak and Contractor's Fleet and maintenance planners to the problem on the particular Car.

ii). If it is determined that the Car cannot finish the route, the passengers on the Car will detrain.

(1) Amtrak will decide whether a spare Car will be required to be deployed to the location or if the Car will be set out of revenue service.

(2) Then, the help desk representative and Amtrak will determine whether the Car can move, possibly with certain adjustments. Amtrak will make the final decision.

(3) If the Car can move, Amtrak will move it to the nearest agreed Amtrak facility for maintenance.

(4) If Contractor's technical support is needed, the on-call Technical Support person assigned to the facility for that time will be dispatched to the necessary location for support.

(5) If the Car cannot move and Contractor's technical support is needed, the help desk representative will contact an on-call support technician assigned to the nearest site will be dispatched to head to the stalled Car to provide technical support.

iii). Contractor's help desk representatives will be located at Amtrak's CNOC site and will coordinate directly with Contractor's TSSSA Project Manager.

(1) Contractor's assigned help desk representatives will provide backup to the Project Manager in case of absence.

(2) Contractor's help desk representative will also be the single point of contact for Amtrak managers, supervisors or employees seeking advice or assistance or reporting train defects or Material issues by telephone, e-mail and/or other electronic communications.

(3) Their location at Amtrak's CNOC site allows direct interaction with Amtrak controllers communicating with train crews.

(4) The help desk representative will record and log issues, create Work Orders, and communicate with Contractor's TSSSA Project Manager or appropriate Contractor personnel on Material issues.

iv). In addition to the Help Desk tasks, Contractor's representative will monitor the outputs from the Equipment's monitoring and diagnostic system tools and respond to fault messages and values approaching critical thresholds.

(1) Contractor's representatives and technicians assigned to the CNOC Help Desk shall have access to the remote diagnostic data repository and will provide inputs for Contractor's systems engineers to carry out Failure trend analysis per sub-system and create the necessary reports for Contractor's and Amtrak's engineering groups.

v). Help desk representatives will review monitoring and diagnostic data and feedback from Amtrak on the health status of the Equipment. When an event with potential or immediate impact to Revenue Service occurs, Contractor representative will provide a recommendation to Contractor's Project Manager and to Amtrak if the issue requires:

(1) Immediate attention and the Car should be removed from service as quickly as possible and a corrective maintenance action scheduled,

(2) Urgent attention and the Unscheduled Maintenance action should be scheduled at the next appropriate occasion, or

(3) Investigation/attention at the next appropriate Scheduled Maintenance interval.

vi). In general, the role of the help desk is to facilitate availability of the Fleet, by organizing Scheduled and Unscheduled Maintenance activities and giving support to engineers or on-board crew in the case of a service-affecting Failure.

(1) Contact regarding service-affecting Failures between the help desk and engineers/crew will be always subject to authorization by the Amtrak Fleet Manager.

(2) The final decision about actions to be undertaken during service will remain Amtrak's, assuming in particular that safety-related instructions in case of degraded mode are covered by Contractor's manuals, and do not require a call to the support desk.

c). Central Functions

i). In addition to the Contractor's back office administrative support, it is expected that Contractor shall have off-site support personnel who are dedicated solely to the performance of the TSSSA Contract.

ii). These functions may include project management, commercial management, product management, quality management, as well as engineering support from Contractor's design engineers and procurement.

iii). These functions may be supported by personnel located at various Contractor locations.

iv). Periodically, Contractor may be required to have these personnel on site to support the TSSSA Contract.

v). Contractor shall assign resources to:

(1) Lead purchasing activities (Material identification, supplier selection, quotation analysis, TSSSA Contract negotiation) for Material requirements;

(2) Identify potential areas of risk or opportunity;

(3) Ensure negotiation with suppliers and subcontractors takes into account life cycle cost and new build purchasing power and future Material prices;

(4) Negotiate and enter into the appropriate supplier agreements based on the TSSSA Contract;

(5) Manage the supplier base and review ways with the supplier to improve performance levels (quality of products, delivery times and lead times, cost, reliability); and

(6) Assist the Contractor's quality manager to establish supplier approval ratings, supplier auditing, monitoring supplier performance and recommend improvement actions.

(7) Monitor, track, and report on system and car reliability including MDBF calculations.

d). Obsolescence Management

i). If Material or software is no longer supported by the manufacturer or licensor and, the performance or availability of the Equipment will be negatively impacted by the Failure of the manufacturer or licensor to support the Material or software, Contractor shall develop a suitable succession plan, subject to Amtrak approval, and develop a suitable replacement for the impacted Material or software.

(1) Contractor is responsible for the design, development and replacement of any obsolete Material or software to ensure the contractual performance of the Fleet.

(a) Any redesign or replacement of any obsolete Material or software which results in a change to special tools or diagnostic equipment shall also be the responsibility of the Contractor.

(2) The cost will be covered by the Contractor as part of the TSSSA Contract throughout the TSSSA Contract term.

(3) The vendor would be expected to work with Amtrak to find a suitable process and electronic interfaces to ensure Amtrak's Product Lifecycle Management ("PLM") tool is used to track and record changes to ensure Amtrak has an accurate record of changes to specifications related to the Equipment.

ii). The obsolescence management process consists of all steps required to manage the manufacturing of discontinued discrete components, manufacturing of discontinued complete systems or sub-systems, Material, and Software.

iii). Obsolescence Management Activities

(1) Continuous observation and surveying of the market and Materials;

(2) Periodic reporting to the maintenance team and Amtrak (as the owner of the Fleet);

(3) Mitigating the impact of obsolescence by proposing appropriate solutions or actions; and

(4) Evaluating and implementing the technical and economic solutions to handle obsolescence.

iv). For every specific case of obsolescence, typically various options will be available to manage it.

(1) Contractor will undertake all measures to mitigate the negative effects of obsolescence for Material and software until the end of the TSSSA Contract term.

(2) Specifically, Contractor agrees to issue formal reporting to Amtrak no less than fifteen (15) days after receiving notice of obsolescence and

additional reporting no less than seven (7) days after mitigating solutions have been determined.

(3) In addition, Contractor shall issue formal reporting consisting of a report status of all identified obsolete or potentially obsolete Materials and software with mitigating solutions and their respective status of action during annual review meetings.

v). Those situations impacting long-term Material availability, i.e., beyond the years covered under this TSSSA Contract will be brought to Amtrak's attention for its consideration.

(1) In those cases where Amtrak agrees to implement actions with impact beyond the current TSSSA Contract, those services will be performed under a separate agreement.

G.10 Material Supply Services

a). Material Supply

i). In addition to the other obligations specified herein, subject to the Specific Exclusions set forth in Section G.12, within the timeframes set forth herein, Contractor shall supply to Amtrak all Material, required for Scheduled Maintenance, turnaround service, and Unscheduled Maintenance.

(1) Sufficient quantities of Rotable Material, including but not limited to Axle sets, shall be included in the Material to be supplied by the Contractor.

(2) Contractor shall also supply to Amtrak all Material required to repair Minor Debris Damage to the Cars or Spare Vehicles. Contractor is also responsible for stocking all Material required to repair Excluded Matter Damage for accessible replacement by Amtrak.

(3) If Contractor fails to provide Material by the prescribed delivery times identified in the TSSSA, Contractor shall be subject to Performance Guarantees as set forth in Section G.11.

ii). A Material Supply diagram is provided in Appendix B for reference.

iii). Material supplied by Amtrak shall not be part of the TSSSA requirements.

(1) Amtrak supplied Material will be identified during the kickoff process.

b). Line Replaceable Unit (LRU)

i). Material to be supplied by Contractor under the TSSSA Contract shall be identified and replaced at the mutually agreed-upon designated LRU, unless otherwise approved by Amtrak.

(1) As an example, if an assembly has an internal computer board that fails, but the LRU is the assembly, the whole assembly will be exchanged, not the computer board.

(2) The LRU list shall be defined and approved by Amtrak during design reviews and finalized prior to delivery of the first Car. The tracking of serialized LRU's shall be identified on this list.

(3) Annual meetings shall be performed for the review of the LRU list by the parties and modified as mutually agreed.

(a) This may include alterations to the LRU level as well as additions or subtractions from the LRU list.

(b) If the parties do not agree on subsequent adjustments to the LRU list, those LRUs that are not agreed to shall revert to the prior LRU level.

c). Excluded Matter Damage

i). Contractor is responsible for purchasing, stocking, and supplying to Amtrak all Material required to address Excluded Matter Damage.

(1) For the avoidance of doubt, Contractor shall be responsible for stocking all Material required due to Excluded Matter Damage regardless of the cause, including, but not limited to, accident or vandalism.

(2) Except as otherwise set forth herein, Contractor shall deliver Material for Excluded Matter Damage to Amtrak within 48 hours of Amtrak's request for the Material. The Contractor can submit for Amtrak approval additional delivery times depending on the size of the shipment. Requests will be considered on a case-by-case basis.

ii). If Contractor provides Material to Amtrak and Contractor believes or asserts that Amtrak's request is due to Excluded Matter Damage, Contractor shall, within five (5) days of receiving Amtrak's request, provide Amtrak in writing with evidence, to Amtrak's reasonable satisfaction, that Amtrak's request is due to Excluded Matter Damage.

(1) If Amtrak concurs with Contractor's assertion, the cost of the Material provided due to Excluded Matter Damage shall be chargeable to Amtrak at rates to be agreed upon by the parties, which shall take into consideration and not exceed the mark-ups for Excluded Matter Damage Material in the pricing schedule at Exhibit I-2 submitted by Contractor and accepted by Amtrak and the payment and pricing provisions of the TSSSA Contract

iii). If after receipt of such evidence, Amtrak does not agree with Contractor and no agreement can be reached on whether Amtrak's request for such Material is a result of Excluded Matter Damage, the dispute shall be resolved in accordance with the Claims and Disputes provision of the terms and conditions of the TSSSA Contract.

(1) If the Dispute is resolved in Contractor's favor, the cost of the Material provided due to Excluded Matter Damage shall be chargeable to Amtrak at the rates described above.

(2) Notwithstanding any such dispute, Contractor shall deliver the requested Material to Amtrak within the timeframes set forth herein and any delayed deliveries may result in the assessment of Performance Guarantees.

iv). Contractor shall invoice Amtrak for any payments due under this provision in accordance with the payment provisions of the General Provisions in Exhibit A-1. Contractor and Amtrak will agree on a formal process for addressing those instances where Contractor asserts that Amtrak requested Material due to Excluded Matter Damage.

d). Amtrak Labor

i). All maintenance work performed on Amtrak property shall be performed by Amtrak with Amtrak labor. Amtrak shall retain responsibility for its labor, i.e. the management, recruitment, discipline, availability, work assignment, and training of its workforce. Except as otherwise specified herein, Contractor's role is limited to providing Technical Support services and Material Supply Services.

e). Depot Levels

Figure G-1: Depot Levels

Terminal Depots	Washington DC
	New Orleans, LA
	Chicago, IL (All Locations)
	Hialeah, FL
	New York, NY
	Boston, MA
	Seattle, WA
	Oakland, CA
	Los Angeles, CA
	Sanford, FL (Auto Train)
	Lorton, VA (Auto Train)

Enroute Depots	St. Louis, MO (Option)
	Kansas City, MO (Option)
	Minot, ND
	Denver, CO
	Albuquerque, NM
	Portland, OR
	San Antonio, TX
	Spokane, WA
	Savannah, GA
	Albany, NY

f). Material Kits

i). Contractor shall develop kits of Materials to be issued and used for all Scheduled Maintenance activities over the life of the equipment while under contact.

(1) The Materials kits will be reviewed and updated on a continual basis.

(2) The Material kits of Material shall be developed and stocked for normal repair activities such as windshield replacement, compressor overhaul, etc.

(3) Kits shall be subject to the Performance Guarantees. Kits and maintenance activity frequency shall be approved by Amtrak.

ii). Scheduled Maintenance Material kits shall be available fifteen (15) days prior to scheduled maintenance activity date.

g). Amtrak's Rights in Event of Untimely Delivery of Material

i). In the event that Contractor fails to deliver Material within the time periods set forth in the TSSSA Contract, Amtrak shall have the right to correct the defective Material or to obtain replacement Material from another source so as to minimize the potential impact on its train operations without any risk to warranty.

(1) The performance of such right by Amtrak shall not relieve Contractor of its obligations to deliver replacement Material in a timely manner and to continue to pay the Performance Guarantees as provided herein until replacement Material is delivered. Any replacement Material obtained or installed by Amtrak under the terms of this section shall be covered under the same warranty or TSSSA coverage of this TSSSA Contract if the Material is provided from the OEM or is demonstrated by Amtrak to be form, fit, and functionally equivalent to the OEM Material.

ii). In the event replacement Material cannot be provided by Contractor in a reasonable timeframe, the cost of the replacement Material shall be deducted from the monthly invoice as part of the reconciliation process described in Section G.11.

h). Aesthetic Material Replacement

i). Contractor shall identify, subject to Amtrak approval, the recommended replacement life for soft good items or aesthetic Materials subject to wear and degradation such as carpets, seat coverings, windows, interior panels, low-level exit path marking, decals, etc. Contractor is responsible for purchasing, stocking, and supplying to Amtrak all Material required to address Aesthetic Material Replacement.

(1) Any interior or exterior painted surfaces shall fall under the requirements of this Statement of Work. Contractor's Maintenance Plan will account for the periodic replacement or refurbishment of such

Material as an ongoing refresh effort to coincide with the life expectancy defined by Contractor or as deemed necessary by Amtrak inspection personnel following an agreement on inspection standards.

(2) Replacement materials shall include, but not be limited to, walk-off carpets utilized in high traffic areas and manageable car sections that can be quickly and easily removed and replaced. The replaced carpets will be taken off-vehicle and thoroughly cleaned and renewed for a rotating pool or replaced if their condition warrants. At a minimum, all walk-off carpets shall be replaced every 6-months and incorporated into the normal maintenance schedule. The interval may change pending the season and routes the cars operate on. Contractor shall review and propose a replacement plan.

(3) These inspection standards shall be agreed upon during Mobilization.

(4) Premature degradation of these Materials shall be cause for Amtrak to require Contractor to re-establish the replacement periodicity to ensure that timely refresh efforts of the affected Materials adequately address Amtrak's concerns.

(5) Two (2) years prior to the scheduled Conditional Acceptance of the first Car and during mobilization, the Contractor shall develop and submit to Amtrak for review and approval a Book of Wear and Appearance Standards **[CDRL G-14]** which details the periodic and condition-based triggers for soft- good items or aesthetic Material replacement.

(a) The Book of Wear and Appearance Standards shall include the triggers for replacement as well as the time allowed to complete the replacement.

ii). The Book of Wear and Appearance Standards shall include, but not be limited to:

(1) Carpets

(2) Seat coverings and cushions

(3) Windows and window shades

(4) Seat tray tables

(5) Workstation Tables

(6) Interior panels

(7) Low-level exit path marking

(8) Signs and decals

(9) Restrooms

iii). Periodic replacement shall indicate the mandatory time-based replacement of applicable components and shall not exceed the expected service life.

(1) Each component or Material in the Book of Wear and Appearance Standards shall have an associated time-based replacement trigger.

(2) The following are mandatory changeout periods unless an extended service life can be demonstrated to Amtrak. The acceptance of an extended service life shall be solely at Amtrak's discretion.

(a) Carpets – maximum ten (10) years

(i) Aisle carpets/heavy traffic areas – maximum four (4) years

(ii) Walk-off carpets – maximum six (6) months interval can vary based on season and car route contractor to review and provide proposal.

(b) Seat coverings – maximum five (5) years

(c) Seat cushions - maximum ten (10) years

(d) Windows – maximum seven (7) years

(e) Window shades – maximum five (5) years

(f) Interior panels – maximum fifteen (15) years

(g) Signs and decals – maximum two (2) years

iv). Condition-based triggers for replacement shall include any and all aspects which unsatisfactorily impact the usefulness or aesthetic appeal of a component.

(1) Each trigger shall be presented with a distinct range that will be used to indicate if a component is suitable for continued service or must be replaced.

(2) Condition-based triggers shall include, but not be limited to, the following as well as similar indicators of component degradation.

(a) Unsightly stains which cannot be cleaned

(b) Perceptible odor from age, mildew, etc.

(c) Significant color or pattern loss or fading

(d) Fabric or carpet matting, ripples or wrinkles

(e) Rips or tears

(f) Scratches

(g) Water damage

(h) Loss of support (e.g. seat cushions, bedding)

(i) Clouding (e.g. windows)

v). Initial Depot stocking strategy, recommended replacement interval, and proposed inspection standards shall be provided to Amtrak no later than one hundred eighty (180) days before delivery of the first Car and shall be reviewed biannually with Amtrak over the life of the TSSSA Contract.

(1) Material shall be primarily stocked at all Amtrak Terminal Depots and small amounts of regularly consumed Material shall be stocked at Amtrak Enroute Depots along with Consumable Material.

i). Material Delivery and Distribution

i). Within two (2) hours of the time Amtrak notifies Contractor of the need for Material at an Amtrak Terminal Depot (either by an Amtrak enterprise asset management system generated request or some other agreed method, i.e.: e-mail), Contractor shall make the requested Material available at the Amtrak Terminal Depot store for Amtrak pick-up or Contractor shall deliver the Material to Amtrak at the applicable Amtrak Terminal Depot store.

(1) Except as set forth in Section G.12, if Contractor fails to deliver Material to Amtrak Terminal Depot store by the two (2) hour delivery deadline, Contractor shall be subject to the Performance Guarantees set forth in Section G.11.

ii). Within twenty-four (24) hours of the time Amtrak notifies Contractor of the need for Material at an Amtrak Enroute Depot, (either by an Amtrak enterprise asset management system generated request or some other agreed method, i.e.: e-mail), Contractor shall deliver the Material to Amtrak at the applicable Amtrak Enroute Depot or make it available for pick-up at the applicable Amtrak Enroute Depot.

(1) Except as set forth in Section G.12, if Contractor fails to deliver Material to the Amtrak Enroute Depot store by the twenty-four (24) hour delivery deadline, Contractor shall be subject to the Performance Guarantees set forth in Section G.11.

(2) Costs associated with movement of Material between Amtrak Terminal and Enroute Depots under performance of the TSSSA Contract shall be the responsibility of Contractor.

j). Material Handling by Amtrak

i). While Material is on Amtrak property, if requested by Contractor, Amtrak shall perform Material handling. Such Amtrak labor shall be provided at no charge to Contractor.

k). Contractor's Material Storage

i). Contractor's Material will be stored at either the Amtrak Terminal Depots or at any other Contractor's managed locations, as per Contractor's material strategy in line with expected consumption demand.

(1) In addition, Contractor's Material will be stored at the commissioning location of the Cars.

(2) Once commissioning is completed, Contractor shall relocate all Contractor's Material to the Amtrak sites unless otherwise agreed to by Amtrak.

ii). The Amtrak Enroute Depot shall all be considered unstaffed for the purpose of Material handling and are not considered warehouses in Amtrak's Materials management system.

(1) The only personnel located at these sites shall be maintenance of equipment personnel. Contractor shall propose methods for managing, tracking, receiving, and storing the Material required at an Amtrak Enroute Depot, subject to Amtrak approval.

l). Material Maintenance

i). Contractor shall be responsible for any required or OEM recommended maintenance during the storage period.

(1) This shall include, but not be limited to, turning rotating equipment, greasing, corrosion protection, etc.

m). Contractor's Material Storage Locations

i). Amtrak shall provide Contractor Space to use at the Amtrak facilities as available.

Figure G-2: Amtrak Terminal Depots, Contractor Available Space

Terminal Depots	Contractor Available Space (Sq. Ft.)
Washington, DC	1000
New Orleans, LA	1000
Chicago, IL	1000
Hialeah, FL	1000
New York, NY	1000
Boston, MA	1000
Seattle, WA	1000
Oakland, CA	1000
Los Angeles, CA	1000
Sanford, FL (Option)	1000
Lorton, VA (Option)	0

ii). As Amtrak may be able to provide more space, the Contractor shall approach Amtrak before obtaining additional space externally. It remains the Contractor's responsibility to plan and arrange for additional warehouse space as needed in proximity to the depots to be able to fulfill its obligations under this contract.

iii). In addition, Contractor shall specify the additional onsite storage space requirements necessary for equipment associated with the OESS, including any details on restrictions for storage of any equipment and any storage needs beyond the available space listed in Figure G-2.

n). Contractor Access

i). Amtrak will provide access and use of the sites and facilities to Contractor as listed above in Figure G-2.

(1) Contractor may use Amtrak's facilities and sites at no cost. Contractor shall be permitted to use agreed upon areas or sites for Material storage.

(2) If additional space is required by Contractor, such space shall be secured by Contractor at Contractor's expense and at no cost to Amtrak.

(3) General infrastructure or equipment such as cranes, as well as special tools or fixtures designed for the Cars, will be available for use by Contractor in support of the TSSSA Contract unless otherwise mutually agreed.

(4) Upon Contractor's reasonable request, such Amtrak-owned assets and infrastructure will be operated by Amtrak employees. Contractor-owned assets and infrastructure will be operated by Contractor's employees.

(5) Amtrak may allow Contractor to use Amtrak owned special tools and jigs for use by Contractor's employees.

ii). Amtrak may consider allowing qualified and trained Contractor representatives to operate Amtrak-owned assets in the event no Amtrak resource is readily available. Under such terms, Contractor shall be responsible for any damages or liability.

o). System Interfaces

i). Contractor will be expected to integrate with Amtrak's material management and warehouse software such that Amtrak's enterprise asset management system would have visibility to inventory levels being maintained by Contractor.

p). Amtrak Depot Stocking Inventory

i). Material inventory levels will be based on the type and frequency of maintenance occurring at each Amtrak Depot.

(1) The inventory levels will be closely monitored as the Fleet is deployed to ensure Material delivery requirements are maintained and adapted to the Maintenance Plan and that items identified as aesthetic Materials are stocked in accordance with usage and lead time.

(2) Contractor is solely responsible for establishing inventory levels to meet the demand of the Maintenance Plan in order to meet the Performance Guarantees.

ii). Amtrak Terminal Depots, and non-Amtrak sites where required, shall be the primary stocking locations for most of the Material required for Equipment maintenance.

iii). Amtrak Enroute Depots are intended to be stocked with basic Material for Turnaround Service, such as brake shoes, filters, lights, and other regularly required supplies but not limited to the above Material if Contractor specifies other Material needed.

(1) In addition, a small quantity of the Material commonly subject to debris damage as well as the items identified in aesthetic Materials shall be made available for servicing at Amtrak Enroute Depots.

iv). Contractor shall provide the initial depot stocking strategy to Amtrak no later than one hundred eighty (180) days before delivery of the first Car and it shall be reviewed bi-annually with Amtrak over the life of the TSSSA Contract.

q). Physical Inventory

i). Amtrak may conduct a cycle count program of all Material maintained on Amtrak property to ensure that the inventory count is accurate, identify any lost or missing Material, and ensure that there are no Material discrepancies.

(1) This physical inventory frequency may be subject to change based on shrinkage and the quality of record keeping. In the event changes in inventory process are mutually agreed upon, both parties agree to update the relevant documents to reflect the processes in effect.

ii). Amtrak may direct Contractor to perform an annual review of slow-moving Material maintained on Amtrak property to adjust allocation of space.

(1) Slow moving Material shall be located to alternate warehousing locations or back to supplier.

r). Notice of Receipts, Issues and Returns

i). Notice of receipts, issues and returns will occur real time via material management system interface or e-mail to Contractor.

s). Amtrak Depots and Site Coverage

i). Contractor shall provide on-site support staff at the Amtrak Depots identified in Section G.10 Figure G-1; and at Amtrak's CNOC facility in Wilmington, DE.

ii). Contractor shall provide 24/7 manned support at Amtrak's CNOC facility and for all Amtrak Terminal Depots and 24/7 remote support for all Amtrak Enroute Depots via telephone or e-mail subject to Amtrak approval.

t). Return and Disposal of Material

i). Non-Rotable Material

(1) Once Non-Rotable Material is removed from the Equipment, Amtrak may dispose of it as it sees fit.

(a) Notwithstanding the foregoing, if Contractor requests the return of Non-Rotable Material removed from the Equipment, Amtrak shall endeavor to return the Material as reasonably requested.

(b) The Contractor shall be responsible for any transportation costs and for the proper disposal of the returned Non-Rotable Material.

(2) If Amtrak or Contractor determines that Material, other than Rotable Material, removed from the Equipment is faulty or suspect, Contractor shall have the cause of the issue diagnosed including associated Failure timelines and report to Amtrak on the findings and/or resolution of faulty or suspect Material removed.

ii). Rotable Material

(1) Within fourteen (14) days of the date of issuance of an item of Rotable Material, Amtrak shall plan to return the core of the Rotable Material, which is being removed from the Equipment and being replaced by the newly issued Material, to Contractor at one of Amtrak's Terminal Depots identified. If the core is not returned within fourteen (14) days of issuance of Rotable material, Contractor shall inform Amtrak in writing. If Amtrak has not returned the core within fourteen (14) days after such written notice, such core shall be categorized as overdue and Amtrak shall pay Contractor the amount associated with such core. Contractor shall pick up the core of the Rotable Material within Seven (7) days after Amtrak makes such core available for pickup at one of the Terminal Depots.

(2) Amtrak can facilitate shipping the Rotable Material for Contractor at Contractor's expense, but Contractor shall be responsible for preparation of all shipping documentation including obtaining any necessary Return Material Authorization (RMA) numbers.

(a) On the last day of each month, Contractor shall issue to Amtrak an invoice for all unreturned cores of Rotable Material that became overdue during the month.

(b) If and when the core is returned by Amtrak to Contractor, any amounts paid for the core will be credited back to Amtrak by Contractor.

(3) Biannually, at a minimum, the list of Rotable Material shall be reviewed by the parties and modified or adjusted, as mutually agreed.

(a) This may include additions or subtractions from the list of Rotable Material or changes to the scope of work for repair of any Material.

(b) If the parties do not agree on a modification to the list of Rotable Material, such modification shall not be made.

(4) The Contractor shall be responsible for tracking all Rotable Material's serial numbers from Amtrak to return to Amtrak's inventory.

G.11 Performance Guarantees and Performance Incentives

a). Availability

i). Car Held for Material (CHFM) shall be defined as:

(1) A Car Held for Material (CHFM) shall be defined as a Car or Spare Vehicle in BAM status that Amtrak has delivered to the designated Amtrak Depot or for which:

(a) Amtrak has notified Contractor of the need for Material (either by an Amtrak enterprise asset management system generated request or another agreed-upon method, i.e., e-mail) and

(b) after notification as described above, maintenance activities pertaining to said Material cannot be performed on the Car because Contractor has failed to deliver the Material to Amtrak at the Depot where the Car or Spare Vehicle is located, within the following period following such notification:

(i) two (2) hours to Amtrak Terminal Depots

(ii) twenty-four (24) hours to Amtrak Enroute Depots.

(2) Alternatively, a Car or Spare Vehicle in BAM status is set out enroute and:

(a) Amtrak has notified Contractor of the need for Material (either by an Amtrak enterprise asset management system generated request or another agreed-upon method, i.e., e- mail) and

(b) After notification as described above, maintenance activities pertaining to said Material cannot be performed on the Car or Spare Vehicle because Contractor has failed to deliver the Material to Amtrak designated Depot, within the following period following such notification"

(i) two (2) hours to Amtrak Terminal Depot

(ii) twenty-four (24) hours to Amtrak Enroute Depot.

(3) As a CHFM occurrence usually causes a negative impact to Amtrak's operations, Amtrak and Contractor have agreed to the Performance Guarantees set forth in Section G.11 and the General Provisions in Exhibit A-1.

(a) In the event of a CHFM as described above occur, Contractor shall pay Performance Guarantees to Amtrak.

(b) Performance Incentives are not applicable when CHFM occurs. Therefore, Contractor may not earn, and Amtrak shall not pay, Performance Incentives associated with CHFM.

(c) CHFM Performance Guarantees shall be in effect upon the first car Conditional Acceptance.

(4) Amtrak may request Material to rescue Cars or Spare Vehicles set out from service along its routes.

(a) Consumption will be reflected in an Amtrak-designated Amtrak Terminal Depot for the purpose of Material planning and guarantees.

(b) Material shall be moved by Amtrak to the location of the Car or Spare Vehicle.

(5) Amtrak shall use all reasonable efforts to move any Car or Spare Vehicle which requires work to an appropriate Amtrak Terminal Depot or Enroute Depot within one (1) day.

(a) Any additional time required to move such Car or Spare Vehicle to a maintenance facility shall not be deemed as "Out-of-Service" time.

(6) It is agreed that any time required to make such warranty repair or field modification work on any Car or Spare Vehicle shall be deemed "Out-of- Service" time.

(7) Spare Vehicles which are held for Material are not available for revenue service and shall be subject to CHFM Performance Guarantees amount in accordance with Section G.11.

b). Car Held For Material (CHFM) Performance Guarantees

(1) If the total of actual CHFM hours exceeds the requirements of delivering Material within two (2) hours at an Amtrak Terminal Depots or within twenty-four (24) hours at the affected Amtrak Enroute Depots, the difference will be multiplied by $100 per each hour.

(a) After the CHFM exceeds forty- eight (48)-hours beyond the Material delivery requirement, the guaranteed amount shall be assessed at $1,500 for each additional day until the Material is delivered and the CHFM has been resolved. Once the Material is available at the applicable Amtrak Depot, the Car or Spare Vehicle shall be released from CHFM status.

(b) If a CHFM is deemed operational by Amtrak, the Car will return to service. However, a performance guarantee of $150 per 24-hour period will be applied until the necessary Material is delivered to Amtrak.

(c) A Car shall remain in CHFM status for the purpose of Performance Guarantee calculations as long as the Materials have not been delivered, even if Amtrak has rectified the Failure using alternative sources to maintain continuous revenue operations.

(2) Cumulative CHFM Performance Guarantees incurred during each Measurement Period shall be invoiced as per Section G.11.

(3) The CHFM Performance Guarantee amounts set forth in this section shall be assessed independently of the Failure related Performance Guarantee amounts set forth elsewhere in this section and are effective upon the first car Conditional Acceptance.

(4) The amounts set forth in the above paragraph are subject to escalation as per pricing schedule in Exhibit J-2.

(5) In any calendar year, Contractor shall not be obligated to pay Amtrak Performance Guarantees that exceed twenty percent (20%) of the Annual Service Payment as that term is defined in the TSSSA General Provisions.

c). Reliability

i). Contractor understands that Amtrak shall suffer damages in the event of the Failure of Material. Contractor shall ensure that it provides reliable Material during the TSSSA Contract term. The parties agree to the following Performance Guarantee of reliability:

ii). Reliability Target

(1) The Contractor shall meet the Mean Distance Between Service Failure (MDBSF) and Mean Distance Between Component Failure (MDBCF) as defined in the equipment Technical Specification #1139. In the event that the MDBSF and MDBCF requirements of the Technical

Specification are not met, corrective actions shall be taken during the reliability demonstration testing. The parties agree that any Failure may only be allocated to one of the four (4) types of Failures as follows:

(a) Failure Type I.

(b) Failure Type II.

(c) Failure Type III.

(d) Failure Type IV.

(2) Amtrak has established the Failure rates per Measurement Period set forth in Figure G-3.

(3) The respective quantity of Failures per Measurement Period stated in Figure G-3 shall mean that the quantity of those Failures shall be neutral (no Performance Guarantees or Performance Incentives either party).

Figure G-3: Reliability Target – Allowable Failures within a Measurement Period

	Failure Type I	Failure Type II	Failure Type III	Failure Type IV
Failures per Car	0	1	1	0

(4) The performance guarantee will be applied once for each Failure occurrence; however, if another separate Failure occurs on the same Car, it would be treated independently of the first Failure.

(5) If a Failure meets the criteria for multiple Failure types, the more severe Failure (resulting in highest performance guarantee) type shall be applied. Any Failure of Equipment, system, Material, or other supplies, instructions, Technical Support, software, or services shall be considered independent of any other distinct Failure, unless proven to be related.

(6) Contractor is responsible for any secondary or subsequent Failure if a failed Car or Spare Vehicle is required to be moved to an Amtrak Depot for repairs.

(7) Amtrak and the Contractor will jointly work together, but the Contractor shall be responsible for disproving any Failure type identified on a Car.

iii). Conditions

(1) Typically, a Failure caused during a Scheduled Trip shall be corrected prior to the next Scheduled Trip by Amtrak or onboard train rider.

(2) Notwithstanding the foregoing, Amtrak shall have the right to use the Car or Spare Vehicle for a Scheduled Trip.

(a) In the event that Amtrak decides to run a Car or Spare Vehicle with a Failure:

(i) Contractor shall not be assessed additional Performance Guarantees tied to repeat of the same Failure beyond the original Failure until the original Failure has been repaired, so long as the Material is readily available, and

(ii) further or additional Failure(s) caused by running the Car or Spare Vehicle without correcting or repairing the original Failure shall not result in the recording of additional Failures under Section G.11

(b) The reliability Performance Guarantees and Incentives shall become effective at the expiration of the Three-Year Warranty period of each Car or Spare Vehicle.

(i) Reference General Provision Section 12 of the Equipment Contract General Provisions in Exhibit A-1 for applicable Liquidated Damages in effect during the Three-Year Warranty Period.

(c) If a Car was not in Revenue Service for a continuous period exceeding seven (7) days during the Measurement Period due to Material unavailability by the Contractor, the reliability targets (Allowable Failures within a Measurement Period) shall be prorated by days in service.

d). Reliability Performance Guarantees and Performance Incentives

i). Calculation of Performance Guarantees and Performance Incentives

(1) Once the parties have agreed on the Data, the parties shall calculate the reliability metrics on each car for the given Measurement Period. The parties shall compare the target value as defined in Figure G-3 – Reliability Target Value Table to the actual Failure Rate for each Car

(a) The target value less the actual Failure multiplied by the USD $ amounts listed below for each type of Failure is the guarantee. If there are no Failures in excess of the target values defined in Figure G-3, Amtrak shall pay an incentive of $2,000.

(2) The sum of the amounts for each of the Failure Types above the target values shall be the calculated Performance Guarantees, and if there are no failures above any of the target values then Performance Incentives shall be calculated for each car.

(a) Failure – Type I the amount of $ 29,960.

(b) Failure – Type II the amount of $5,992.

(c) Failure – Type III the amount of $322.

(d) Failure – Type IV the amount of $60,000

(e) No Failures above the target values in Figure G-3 – the incentive amount of $2,000. Incentives will only be paid if there are no total failures above the target values in Figure G-3 for the performance period.

(3) The Performance Guarantee and Incentives amounts set forth in this section shall be assessed independently of the CHFM Performance Guarantee amounts set forth in elsewhere in this section.

(a) Any proration shall affect reliability targets in that Measurement Period only and shall be handled on a Car-by-Car basis.

(4) The amounts set forth in this section are subject to escalation as per pricing schedule in Exhibit J-2.

(5) In any calendar year, Contractor shall not be obligated to pay Amtrak Performance Guarantees that exceed twenty percent (20%) of the Annual Service Payment as that term is defined in the TSSSA General Provisions.

(6) In any calendar year, Amtrak shall not be obligated to pay the Contractor Performance Incentives that exceed five percent (5%) of the Annual Service Payment as that term is defined in the TSSSA General Provisions.

e). Performance Guarantees and Performance Incentives – Payment and Credits

(1) Amtrak and Contractor shall use the following process to calculate Performance Guarantees and Performance Incentives associated with the availability and the reliability targets as set out in this Chapter and settle the payments and credits resulting from this process.

(2) Within ten (10) days after each Measurement Period, Contractor shall compile the Equipment recorded Data and provide it to Amtrak. The parties shall review the data together not later than ten (10) days after provision of this Data and will reconcile any differences that may exist between Contractor's Data and any corresponding Data that Amtrak may possess. After such reconciliation, such Data will be deemed accepted by the parties. Any difference between Contractor's Data and Amtrak's Data that cannot be reconciled in accordance with this Section, shall be resolved in accordance with the Claims and Disputes section of the General Provisions Exhibit A-1.

(3) The agreed-upon Data of each Measurement Period shall be listed in a reconciliation table. This reconciliation table shall include all measures that result in Performance Guarantees and/or Performance Incentives as well as the sums for the balancing of availability and reliability. This may subsequently lead to setoffs on a one-for-one basis.

(4) The net Performance Guarantee or Performance Incentives from the Measurement Period documented on the reconciliation table shall be dispensed as follows:

(5) If a balance is owed to Amtrak, Contractor shall credit the following month's invoice. The credit shall be presented on the invoice as a separate line item.

(6) If a balance is owed to Contractor, Contractor shall invoice Amtrak with the amount due. Amtrak shall pay such invoice in accordance with the General Provisions in Exhibit A-1.

(7) Any other set-off against Performance Guarantees or Performance Incentives owed to a party shall be allowed only if the parties have agreed to such set-off.

(8) At the end of the TSSSA Contract term or upon TSSSA Contract termination after the last set-off has been made by the parties, if the remaining balance is negative, that amount shall be paid to Amtrak by Contractor or Amtrak, in its sole discretion, may elect to deduct such amount from any payment due to Contractor under the TSSSA Contract. If the amount is positive, that amount shall be paid to Contractor by Amtrak.

ii). Annual Reconciliation

(1) Amtrak and the Contractor shall hold a reconciliation meeting annually at the end of the second Measurement Period of that year to review the accumulated Failures, total Performance Guarantees or Incentives, and to establish the Annual Service Payment for the following year.

(2) If necessary, the Annual Service Payment shall be adjusted to reflect any changes between the forecasted amount and any net changes resulting from approved change orders, Fragmented Continuous Maintenance and scheduled heavy repair events, or other impacts.

(3) In the event the accumulated Performance Guarantees or Incentives exceed their respective limits, any Performance Guarantees or Incentives for that year shall be reconciled with the Annual Service Payment.

(4) Annual Material Inventory Listing and Review

(a) Additionally, the Contractor shall provide an annual inventory listing with all Materials at each of the supported Amtrak Terminal Depots and Enroute Depots.

(b) The Material inventory listing shall indicate all Materials intended to be stocked at each location and their annual usage rate.

(c) Amtrak and Contractor shall perform a review of the planned stocking levels along with the annual usage rate or Failure history for specific Materials to determine if any adjustments are warranted.

G.12 Exclusions

a). Exclusion from the Assessment of Performance Guarantees and Performance Incentives Associated with the Availability of Material

i). The exclusions for the assessment of Performances Guarantees for availability are expressly set forth below. For the avoidance of doubt, Performance Guarantees for reliability are not subject to these exclusions.

ii). Force Majeure Events

(1) Subject to Contractor meeting the requirements of Article 28 of the General Provisions in Exhibit A-1, during the period of a Force Majeure Event affecting Contractor, Contractor shall not be assessed Performance Guarantees for availability due to its inability to provide certain Material.

iii). Major Wreck Repair Events

(1) In the case where Contractor has been requested to supply Material for a major wreck repair, which could place Contractor at risk of not supplying Material to meet contractually obligated Material needs, Contractor shall inform Amtrak of this potential so that Amtrak can decide how to proceed with the supply of such Material.

(a) If Contractor is instructed to proceed with the supply of such Material, both parties agree that in the event of a subsequent demand causing available stock to become depleted within normal lead times, the event will not be included in the calculation of the Performance Guarantees.

(b) If, however, the Material is not replaced within the published lead times and Contractor has a need for the Material to fulfill its obligations under the TSSSA Contract, Performance Guarantees will be assessed.

iv). Material Consumption for Cars Not Covered under the TSSSA Contract

(1) If applicable, Material supplied by Contractor for the repair of other Cars in Amtrak use shall not be subject to Performance Guarantees for availability.

b). Specific Exclusions from the Service Price

i). Repair of Wrecks, Accidents or Damage

(1) In the event of damage other that Minor Debris Damage resulting from a wreck or accident, within twenty (20) days of Amtrak's request or a later date as agreed to by Amtrak, Contractor shall render its support by analyzing the damage and inform Amtrak of the extent of the damage and the estimated costs of repair.

(a) The quotation for repairing this damage shall include relevant documentation on the analysis of the damage (for example, brief report with image), the time required for the repair, and the estimated prices of Material along with any Contractor markups for Material.

(b) The quotation shall be sent to Amtrak in writing. Contractor shall work with Amtrak to provide a mutually acceptable offer.

(c) In the event where significant engineering time and costs are incurred in the establishment of the estimate for repair, or if support for the repair process shall require technical support from Contractor, this will also be quantified, and agreement obtained from Amtrak before proceeding with final quotation.

ii). Upon receipt of a purchase order from Amtrak, Contractor will initiate support and begin making repairs. Support shall include all functions of the TSSSA Contract along with:

(1) Detailed bills of material for damage repair;

(2) Specification of repair tooling;

(3) Material ordering and planning;

(4) Creation or supply of repair procedures and standards;

(5) On-site technical support during repair; and

(6) Quality assurance support.

iii). At no point shall Contractor invoice Amtrak for services provided by personnel assigned to and funded by this TSSSA Contract.

iv). Third Party Repairs

(1) In all cases, if Amtrak chooses a third party instead of Contractor to perform or support any repairs, or if Amtrak chooses not to implement suggested repairs, Contractor reserves the right to either inspect such repairs at completion or assess the complete impact on the operation and determine if they meet Contractor's standards. Contractor shall have no liability with respect to the repairs performed by Third Parties.

(a) If Amtrak retains a third party to repair damage to a component, spare, or item on the Equipment, that if supplied by Contractor, would be considered Material under the TSSSA Contract, such component, spare, or item shall be deemed Material once removed from the Equipment and Contractor's obligations with respect to Material shall apply.

(b) Both parties shall mutually agree on how to reinstate the Equipment under the TSSSA Contract so that the operating condition of the Equipment meets the standard of original manufacture (wear and tear excepted).

v). Aesthetic Upgrades

(1) Throughout the life of the TSSSA Contract, to remain consistent with market trends and the desires of its internal stakeholders and partners, Amtrak may elect, in its sole discretion, to make aesthetic upgrades in addition to ongoing aesthetic material replacements, including, but not limited to, color schemes, interior Materials, or interior layouts within the Cars and Spare Vehicles.

(a) In the event Amtrak decides to pursue upgrades to any of the Cars and/or Spare Vehicles, Contractor shall lend its support by partnering with the Amtrak designers to develop Material replacement programs to facilitate the upgrades. Contractor shall develop an initial quote to support the upgrades and shall send all supporting documentation, including the quote, to Amtrak in writing. Contractor shall work with Amtrak to provide a mutually acceptable offer.

(2) Contractor shall initiate support for the upgrade under the terms of this TSSSA Contract upon receiving a purchase order from Amtrak. Support shall include all functions of the TSSSA Contract along with:

(a) Detailed bills of material;

(b) Specification of tooling;

(c) Material ordering and planning;

(d) Creation or supply of procedures and standards;

(e) On-site technical support; and

(f) Quality assurance support.

(3) At no point shall Contractor invoice Amtrak for services provided by personnel assigned to and funded by this TSSSA Contract.

vi). Excluded Consumable Material

(1) The following Materials are defined in this TSSSA Contract as excluded from Consumable Material:

(a) Tissues, soaps, water and cleaning liquids for the water and waste system;

(b) Crew kits;

(c) Water bottles;

G.13 Training and Documentation

a). Documentation Maintenance

i). Contractor shall be responsible for maintaining the documentation required by the Equipment Contract under Chapter 23 of the Equipment Specification throughout the life of the TSSSA Contract.

ii). Contractor shall issue updates to the printed manuals every three (3) months. Distribution of updates will be the responsibility of Amtrak.

iii). Every six (6) month period, unless otherwise approved by Amtrak, a complete reissue of the electronic documents with all current updates will be provided by Contractor.

iv). Electronic technical manuals as specified in Chapter 23 of the Equipment Specification shall be updated by Contractor in real time.

b). Contractor's Training

i). During the manufacturing of the Equipment, the personnel responsible for managing each of the Terminal Depots shall be required to participate in the production build and testing process for each Car type. This will ensure that the Contractor will provide experienced personnel to the Terminal Depots prior to the Equipment arriving.

ii). Contractor shall develop a new employee training program for Amtrak review. Records shall be maintained at each Terminal Depot for Amtrak review to ensure all personnel have been properly trained.

c). Amtrak Training

i). Annually, Contractor shall be responsible for providing training classes or holding training classes at each Terminal Depot during all shifts at no additional cost to Amtrak, beyond the "Train the Trainer" sessions approved during the development of the initial training plan. Contractor shall support the training of Amtrak employees by:

(1) Working together with on-the-job training for Amtrak personnel in a continuous manner.

(2) Participating in conjunction with Amtrak in an annual review of the training materials for the Equipment.

(3) Training during the TSSSA contract shall include “best in class” continuous improvement training presented by the Contractor once per year at each Terminal Depot during all shifts.

(a) Continuous improvement training, developed and presented by the Contractor, shall incorporate all maintenance activities that will improve the reliability of the Equipment.

d). Contractor’s Material Documentation Role

i). In addition to other Documentation obligations that may occur elsewhere in the Statement of Work, Contractor shall perform the following:

(1) Providing training materials necessary for “Train the Trainer” sessions and for Amtrak to establish and hold ongoing maintenance training.

(2) Material part number establishment.

(a) Material identification to be updated as revisions take place or Material replacement occurs due to obsolescence or alternative sourcing of Materials that have been accepted by Amtrak as meeting the approved level of performance and function as the original Material being replaced.

(i) This includes issuing of newly defined LRU in case of lower level of Material replacement being agreed upon or in the event of new Material numbers.

(b) In performing the work, Contractor shall only provide Material of the same or similar standards, functionality, features and quality as the original equipment manufactured Material provided under the TSSSA Contract, except where Contractor seeks and is granted Amtrak approval, which shall not be unreasonably withheld.

(c) If Contractor wishes to change the supplier of any Material (a “Proposed Supplier Change”), Contractor shall notify Amtrak in writing of the Proposed Supplier Change including the new supplier’s name and Contractor’s, suppliers’ part numbers, and any of the information reasonably requested by Amtrak.

(3) Notification to Amtrak if the bill of material for any Material, assembly, or LRU requires updating due to proposed changes by a manufacturer to any components or subcomponents within an assembly.

(a) Changes shall include, but not be limited to, changes to Material manufacturer, technical specifications, Materials, geometry, functionality, country of origin, or method of manufacture.

(4) Contractor is also responsible for updating affected documentation such as serialized Material lists, bills of Materials, drawings, schematics, training documentation, and manuals.

(5) Contractor shall notify Amtrak of LRU revision changes for updates to Amtrak parts catalog.

(6) Notification to Amtrak when Contractor observes that the documentation used by Amtrak technicians does not reflect a current and correct status.

ii). Contractor to provide Documentation Oversight Plan to ensure current and correct documentation.

e). Communications Plan – Communications and Meetings

i). Communication Plan

(1) Daily meetings will be held between Amtrak and Contractor at each site location to cover local logistics, shop moves, Equipment repair status, and other activities.

(a) Contractor shall participate in operations meetings and conference calls as required, but no less than outlined in Figure G-4 below, at dates and times agreed to by the parties.

(b) The designated Contractor's representatives and Amtrak's representatives shall communicate regularly outside of these designated meeting to ensure the success of the operation and relationship.

Figure G-4: Meetings

Frequency	Discussion
Daily Meeting	1. Review Availability/Out-of-Service Units 2. Review Failures and Cause(s) of Failures 3. Collect Issues/Concerns
Weekly Meeting / Conference Call	1. Collect Metrics 2. Joint Review of Metrics 3. Facilitate TSSSA Contract 4. Document Disputes 5. Collect Issues/Concerns 6. Resolve Disputes Issues/Concerns 7. Review Work Order Accuracy
Monthly Meeting	1. Resolve Disputes 2. Resolve Issues/ Concerns 3. Finalize Monthly Metrics for Settlement 4. Discuss Equipment performance 5. Review FMPs 6. Review Purchase order requests 7. Review of Metrics 8. Contractual Review 9. Diagnostics/Predictive Analysis Review 10. Staffing Review 11. Continuous Improvement Review 12. Contractor Recommendations Training 13. Partnership Topics 14. Obsolescence Management 15. Untimely Delivery of Material
Biannual and Annual Meetings	1. Resolve Contractual Issues 2. Review Action Items 3. Forecast Annual Service Payment for Following Year 4. Reconcile Annual Annual Service Payment 5. Review Material Usage, Stocking Levels, and Inventory Value Review Performance Metrics 6. Review Reliability Targets and Trends
Continuous Improvement Meeting	1. Review Job Analysis 2. Review Performance Against Baseline 3. Review Contractor Proposals Evaluate Business Case Proposals

(a) Once both parties have mutually resolved open issues that may include, but not be limited to, performance metrics, requisition status, core status or Performance Guarantees or Performance Incentives, it is understood that the issue is closed.

(b) However, should Contractor wish to dispute any of the issues, or if Contractor believes that specific claims are excluded, then Contractor shall have the burden of proof to justify the exclusion.

(c) The descriptions of the following meetings are intended to identify and discuss issues at various levels within the organizations, with the intent to resolve open issues at the lowest possible level.

(2) Contractor's costs for attending meetings described in this section and Figure G-4 are already included in the basic monthly compensation.

ii). Weekly Meetings

(1) Among other things, the intent for the weekly meetings is for the local Amtrak and Contractor representatives to coordinate activities and attempt to resolve any issues that have been raised over the previous week.

(2) Issues that are unresolved and that have been escalated from the daily meetings shall be discussed during the weekly meeting with the intent for both parties to mutually agree to a resolution.

(3) Discussion topics would include TSSSA Contract performance metrics, Amtrak enterprise asset management system Work Order accuracy, and any issues that the parties have not agreed to.

(4) Should any specific issue or issues not be resolved during the weekly meeting, they will be documented for discussion and resolution during the monthly meeting.

(5) Open items from previous weekly meetings will be tracked for resolution.

iii). Monthly Meetings

(1) Among other things, the intent for the monthly meeting is for both parties to resolve contractual issues and review action items in a face-to-face setting.

(2) The expectation is that an agenda will be mutually developed and that both parties will complete regular action items as may be required.

(3) The monthly meeting will also be an opportunity to discuss any related engineering issues, modifications, FMPs, or topics as either party may require, as well as review of Data and calculation of the performance metrics.

(4) The parties agree to mutually resolve any open issues that have been documented as part of the weekly meetings.

iv). Biannual and Annual Meetings

(1) The intent for the biannual and annual meetings called out in this TSSSA Contract is for both parties to resolve contractual issues and review action items in a face-to-face setting.

(a) The expectation is that an agenda will be mutually developed and that both parties will complete regular action items as may be required.

(b) The biannual and annual meetings will also be an opportunity to discuss any related engineering issues, Material issues, maintenance issues, modifications, FMPs, or topics as either party may require, as well as review of Data and calculation of the performance metrics.

(c) The parties agree to mutually resolve any open issues that have been documented as part of the monthly meetings.

v). Other Meetings

(1) Daily meetings will be held between Amtrak and Contractor at each site location to cover local logistics, shop moves, Car repair status, and other activities.

(2) The parties shall recognize that the need for other meetings requiring participation by Contractor's personnel will arise from time to time.

(3) The parties agree to cooperate in making available the appropriate personnel to attend those meetings, upon being given reasonable notice by Amtrak.

f). Operating Reports

i). As reasonably required by Amtrak, Contractor shall supply reports in support of the ongoing TSSSA Contract deliverables.

ii). Contractor to provide four (4) times a year an estimate of the value of Material that fulfills the requirements of Section 1.3.

G.14 Continuous Improvement

a). Purpose of Continuous Improvement

i). The overall objective of having an ongoing focus on continuous improvement and reducing the amount of time required to maintain the Equipment will be one of the primary goals pursued by the maintenance planners.

ii). This will be a repetitive cycle of comparing maintenance plans against actual time taken, suggesting improvements or changes to maintenance processes or methods.

iii). In the event where processes or tasks change, Contractor will work closely with Amtrak labor management, quality assurance and the training department to implement recommended changes.

iv). Amtrak seeks opportunities to improve maintenance, both in the ability to predict and plan for maintenance and the actual maintenance performed on the Equipment.

(1) Through the use of diagnostic monitoring and analytical tools, efficiencies may be gained through software applications and diagnostic data to predict Failures before they occur or provide early indication when maintenance should be scheduled in order to avoid reacting to Unscheduled Maintenance.

(2) Early indication and identification by the Contractor are essential to helping drive the continuous improvement philosophy.

(3) To the extent that the Contractor is able to effectively predict maintenance needs and prevent an Unscheduled Maintenance event, Amtrak will consider corrective actions recommended as a result of Contractors' predictive analysis to be a Scheduled Maintenance event for those actions identified by the Contractor provided the Contractor provides Amtrak with notice of the preventive maintenance action at least 48 hours prior to the need for maintenance.

(4) Maintenance activity efficiencies can be gained through improvements to the rate for successful first-time repairs, repair time spent waiting for Material, troubleshooting or fault-finding time, repair or replacement process, alternative repair location(s), or training in maintenance and operations, among others.

v). In collaboration, Amtrak and Contractor share the objective of minimizing the out-of-service time, improving performance, maximizing efficiencies of the maintenance and operations of the Equipment, improving predictive analytics, and extending the periodicities between maintenance activities.

(1) This will entail thorough research, diagnostic monitoring and predictive analysis, discussions, agreements and appropriate field test analysis to ensure changes to maintenance practices are appropriate taking the associated risks into account.

(2) Amtrak is open to the concept of sharing of documented cost savings or adjustments to TSSSA Contract Performance Guarantees and Incentives that can be realized over the course of the TSSSA.

b). Continuous Improvement Team

i). The parties agree to jointly participate in the team make-up as described in Table 4.

c). Setting Standards and Processes Around Continuous Improvement

i). The Continuous Improvement Team shall meet and jointly determine:

(1) As an initial task:

(a) Contractor shall develop the Job Analysis which will include the resources, number of hours, Material, procedures, tooling and related documents required for Scheduled and Unscheduled Maintenance activities requiring Amtrak labor of more than one-quarter (0.25) labor hour.

(b) This Job Analysis will become baseline and will need to be shop floor validated prior to approval.

(2) Specific Contractor deliverables.

(a) Contractor to submit first draft of the Job Analysis at the end of the first Car's Three-Year Warranty Period.

(b) Contractor to have all applicable Job Analyses approved and in place within twenty-four (24) months after the end of the first Car's Three-Year Warranty Period.

ii). On an on-going basis:

(1) In preparation for the continuous improvement meeting, on an annual basis, a benchmark analysis utilizing Contractor's global experience of maintenance for comparison with the Amtrak actuals shall be provided by Contractor as a deliverable.

(2) For any proposed continuous improvement, Contractor will create a business case that justifies the improvement and submit to Amtrak for review and approval.

(3) If Amtrak approves the business case the parties will mutually agree to cost and benefit sharing.

G.15 Fleet Modification Program

a). Failure Rate

i). If the Failure of a particular item of Material exceeds ten percent (10%) of the installed quantity in the Fleet in any given twelve (12) month period, with the unit of Material being at the LRU level at which the part is replaced or transacted, if requested by Amtrak, Contractor will institute a Fleet Modification Program (FMP) to address the identified Fleet defect.

ii). Excluded from the calculation of the ten percent (10%) are Failures of LRUs that would not have failed if an agreed-upon Fleet Modification Program had been implemented. The burden of proof rests upon Contractor.

b). Fleet Modification Program Plan

i). Within thirty (30) days of Amtrak's request for a Fleet Modification Program (FMP), Contractor shall provide a written, detailed Fleet Modification Program Plan for the Fleet Modification Program addressing the Fleet defect for Amtrak's approval.

(1) The Fleet Modification Program Plan shall include Contractor's schedule for delivering the FMP required Materials, suggested standard hours for installation, which shall be agreed to by the parties, and installation schedule.

(2) Amtrak shall provide its then current labor costs, management fee and overhead rate, adjusted annually, for the given Fleet Modification Program period.

(3) Such Fleet Modification Program Plan shall have as its goal to bring the Fleet to optimal operating condition in as short a timeframe as possible with the least amount of financial and other impact to Amtrak.

(4) Within sixty (60) days of receipt of the Fleet Modification Program Plan, Amtrak shall notify Contractor in writing whether it approves of such plan.

(5) If after fifteen (15) days Amtrak has not responded, Contractor shall provide written notice to Amtrak that the Fleet Modification Program will be accepted as submitted unless otherwise notified within five (5) business days from such written notice.

(6) If Amtrak notifies the Contractor in writing that it does not approve of the Fleet Modification Program Plan, Contractor shall revise the proposed Fleet Modification Program Plan until approved by Amtrak, whose approval shall not be unreasonably withheld.

(7) Upon approval, the Fleet Modification Program shall be implemented promptly in accordance with a mutually agreed upon schedule.

ii). Contractor shall provide all required Material, instructions and technical support along with reimbursement for Amtrak labor required to carry out the Fleet Modification Program.

(1) The reimbursement of Amtrak labor shall be monthly unless otherwise agreed to by the parties.

iii). If Material for the Equipment's scheduled Fleet Modification Program is not available on the agreed-upon date per the Fleet Modification Program Plan, the Equipment shall then be considered in CHFM status.

G.16 CDRLs

CDRL	Description	Due
CDRL G-01	Preliminary Mobilization Plan	3 years prior to the scheduled Conditional Acceptance of the first Car.
CDRL G-02	Interim Mobilization Plan	2 years prior to the scheduled Conditional Acceptance of the first Car.
CDRL G-03	An agenda and a recommended list of participants for both parties.	30 days prior to kick-off meeting.
CDRL G-04	The Contractor shall develop and submit to Amtrak for review and approval a comprehensive Maintenance Plan	1 year prior to the scheduled Conditional Acceptance of the first Car.
CDRL G-05	Contractor shall stock all Amtrak Terminal Depot warehouse sites and Enroute Depot locations with sufficient Material needed to support the agreed upon Maintenance Plan.	30 days prior to Delivery of first Car.
CDRL G-06	Final Mobilization Plan including the details of Material quantities, the comprehensive Maintenance Plan, the Life Cycle Maintenance Schedule, detailed training scheduled and all other maintenance information necessary to initiate service	1 year prior to the scheduled Conditional Acceptance of the first Car.
CDRL G-07	A list of defined roles, responsibilities, and reporting structures for the Team Leads and key team personnel	3 years prior to the scheduled Conditional Acceptance of the first Car.
CDRL G-08	Monthly mobilization progress report	Monthly after kickoff
CDRL G-09	TSSSA Program Management and Staffing Plan	3 years prior to the scheduled Conditional Acceptance of the first Car.
CDRL G-10	Contractor shall develop and submit to Amtrak for review and approval a Life-cycle Maintenance Schedule listing of all Fragmented Continuous Maintenance activities	1 year prior to the scheduled Conditional Acceptance of the first Car.
CDRL G-11	Annual Maintenance Schedule	1 year prior to the scheduled Conditional

		Acceptance of the first Car.
CDRL G-12	Work Order Templates	1 year prior to the scheduled Conditional Acceptance of the first Car
CDRL G-13	Operator's Manual	Bi-Annually
CDRL G-14	Book of Wear and Appearance Standards	2 years prior to the scheduled Conditional Acceptance of the first Car

Appendix A:

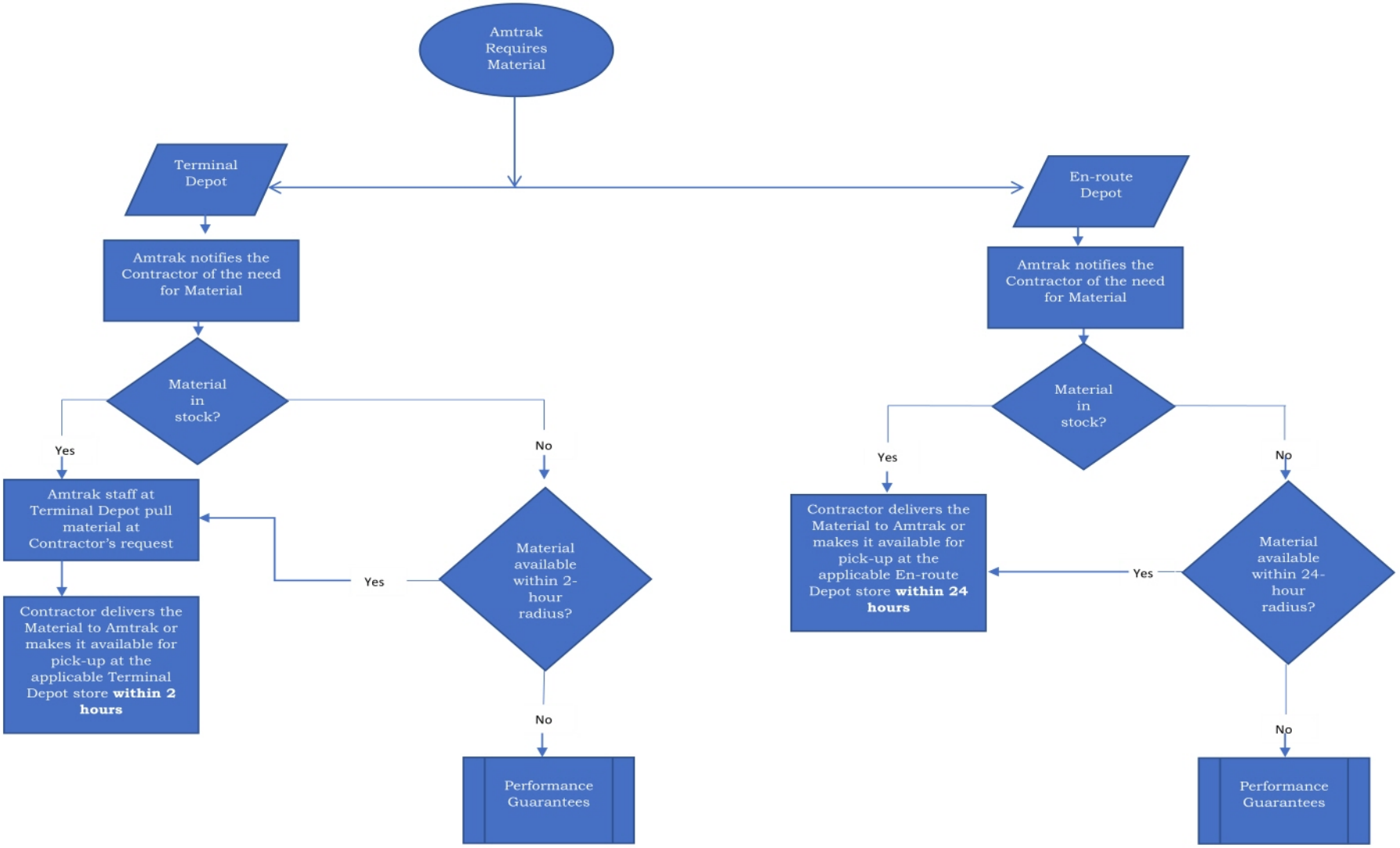
Responsibility Matrix

Ref.	Activity	TSSSA Responsibility
	Management	
1	Amtrak maintenance staff	Amtrak
2	Implementation of the Maintenance Plan	Amtrak
3	Management of Contractor's Technical Support staff	Contractor
4	Management of warranty claims and associated activity	Contractor
	Direct Labor	
5	Scheduled Maintenance labor	Amtrak
6	Unscheduled Maintenance	Amtrak
7	Labor for component replacement	Amtrak
8	Labor for any repair or overhaul activities to be carried out outside of the Depot	Contractor
9	Labor for inspection, repair, cleaning, and train preparation	Amtrak
	Materials	
10	Provide Scheduled Maintenance Material	Contractor
11	Provide Unscheduled Maintenance Material	Contractor
12	Provide All Consumable Spares & Lubricants (oils, grease, etc.) required for the maintenance and operation of the long-distance fleet covered by this contract.	Contractor
13	Provide Spares for Special Tools delivered by the Contractor	Contractor
14	Provide Rotable Materials	Contractor
15	Provide all Materials for Aesthetic Material replacement (reference G.10.h)	Contractor
16	Material Control at Terminal Depots (Shipping/Receiving/Warehouse/Material Distribution to Mechanical)	Amtrak
17	Material Management (Procurement/Planning)	Contractor
18	Transportation of all Material	Contractor
19	Supply Chain Management	Contractor
20	Cost of Material for Excluded Matter Damage	Amtrak
	Technical Support Services	
21	Management of incident investigation and recovery	Amtrak & Contractor
22	Provide technical support to incident investigation and recovery	Contractor
23	Technical support to investigate and resolve systemic fleet problems	Contractor
24	Technical support to Help Desk (CNOC)	Contractor
25	Supply and updating of maintenance documentation/instructions	Contractor
26	Performance engineering, including performance analysis and trending	Amtrak & Contractor
27	Updating of drawings, documentation, Technical Library	Contractor
28	Configuration control of all Cars	Contractor
297	RAMS and improvement processes and events	Contractor
	Training	
30	Initial training of train the trainer staff	Contractor
31	On-going training of training staff	Contractor
32	On-going training of maintenance staff	Contractor
	General	

Ref.	Activity	TSSSA Responsibility
33	Repainting – minor and Major damage e.g. ballast	Amtrak & Contractor
34	Maintenance services for the Wi-Fi System	Amtrak & Contractor
35	Crash/accident/misuse repairs while under control of Contractor	Contractor
36	Failed Car recovery	Amtrak
37	Vehicle movement planning	Amtrak
	Amtrak Maintenance Facility Equipment	
38	Provide access to facilities and equipment on site	Amtrak
39	Provide Special Tools and test equipment for Cars	Contractor
40	Calibration of Special Tools & test equipment	Contractor
	Digital Technology	
41	Maintenance and support of DT systems – general	Contractor
42	Provide an integrated maintenance information management system	Contractor
	Miscellaneous	
43	Provide office space on site for Contractor's staff	Amtrak
44	Vehicle (Car History Book) records updating	Contractor
45	Equipment movements at Amtrak Depots	Amtrak
46	Equipment storage at Amtrak Depots	Amtrak

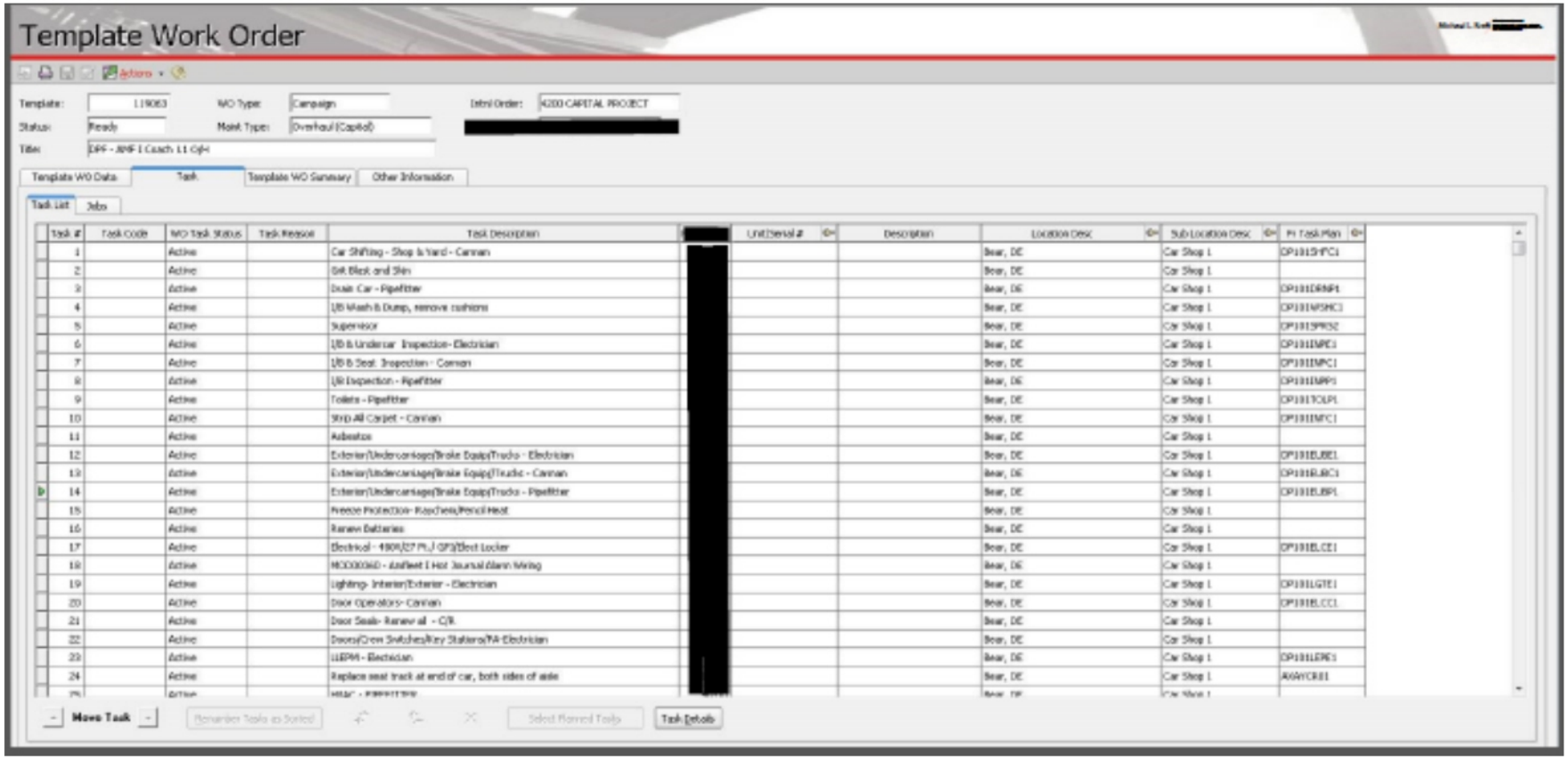
Appendix B:

Material Supply


Amtrak Requires Material
Terminal Depot
En-route Depot
Amtrak notifies the Contractor of the need for Material
Amtrak notifies the Contractor of the need for Material
Material in stock?
Material in stock?
Yes
No
Yes
No
Amtrak staff at Terminal Depot pull material at Contractor's request
Material available within 2-hour radius?
Contractor delivers the Material to Amtrak or makes it available for pick-up at the applicable En-route Depot store **within 24 hours**
Material available within 24-hour radius?
Yes
Yes
Contractor delivers the Material to Amtrak or makes it available for pick-up at the applicable Terminal Depot store **within 2 hours**
No
No
Performance Guarantees
Performance Guarantees

Appendix C:

Sample Work Order


Template Work Order
Actions
Template:
WO Type:
Campaign
Intrnl Order:
4200 CAPITAL PROJECT
Status:
Ready
Maint Type:
Overhaul (Capital)
Title:
Template WO Data
Task
Template WO Summary
Other Information
Task List
Jobs
Task #
Task Code
WO Task Status
Task Reason
Task Description
Unit/Serial #
Description
Location Desc
Sub Location Desc
PI Task Plan
Move Task
Renumber Tasks as Sorted
Select Planned Tasks
Task Details

Appendix D:

Sample Work Instruction

	AMTRAK TRADE SECRET - CONFIDENTIAL AND PROPRIETARY INFORMATION	
Work Instruction #	**Title**	LDSL 975 to 957 Filter Upgrade
MOD00379		
Revision	**Date**	**# of Pages**
2.2		11
Equipment	**Type**	
LDSL	ALL	
# Personnel	**Estimated Task Duration**	**Total Man Hours**
3	8	24

1. PURPOSE

The purpose of this work instruction is to outline the step-by-step procedure to upgrade the Graham-White 975 Filter with Manual Drain Valve to the Graham-White 957 Coalescing Filter with Auto-Stop Drain Valve and Heater on LDSL cars.

2. SCOPE

This work instruction outlines the step-by-step procedure to upgrade the Graham-White 975 Filter with Manual Drain Valve to the Graham-White 957 Coalescing Filter with Auto-Stop Drain Valve and Heater on LDSL cars.

3. HISTORY

None.

4. SAFETY PRECAUTIONS

WARNING

WEAR PERSONAL PROTECTIVE EQUIPMENT AT ALL TIMES WHILE CONDUCTING THIS PROCEDURE.

WARNING

PRIOR TO COMMENCING THIS PROCEDURE, COMPLY WITH ALL CODE OF FEDERAL REGULATIONS, TITLE 49, CHAPTER II, PART 218, REQUIREMENTS AND APPLY AMTRAK'S BLUE SIGNAL PROTECTION.

WARNING

TO PREVENT PERSONAL INJURY WHEN USING COMPRESSED AIR, OBSERVE ALL AMTRAK AND GOVERNMENT REGULATIONS. COMPRESSED AIR USED FOR CLEANING SHALL NOT EXCEED A PRESSURE OF 30 PSI. DO NOT USE COMPRESSED AIR TO BLOW DIRT FROM YOUR BODY OR CLOTHING.

5. REQUIRED PARTS, TOOLS AND REFERENCES

Description	SAP#	Photo	Quantity
FILTER, COALESCING, WITH ASDV INSTALL KIT	50 000 04663		1
ASSEMBLY, PIPE, BRANCH, MAIN RESERVOIR TRAINLINE TO MAIN RESERVOIR FILTER ASSEMBLY	50 000 10343		1
PLATE, MOUNTING, FOR 2 POLE AMPHENOL PANEL MOUNT RECEPTACLE	50 000 07117		1
ASSEMBLY, BRACKET, FOR MAIN RESERVOIR FILTER UPGRADE ON LDSL CARS	50 000 07018		1
LABEL, CIRCUIT BREAKER, TOP ROW, LDSL, BRAKE INDICATOR LIGHTS, LOOP RELAY, WHEEL SLIDE CONTROLLER, DC CEILING LIGHTS DOOR AND DIAPHRAGM LIGHTS, MARKER LIGHTS, MAIN RESERVOIR FILTER VALVE AND HEATER	50 000 10344		1
BRACKET, ANGLE SUPPORT, PILOT CONTROLLER	50 000 10265		1
BLOCK, TERMINAL, 4 CONTACT 1600V, 30A, 12-14AWG	24 030 0817X		1
CONNECTOR, CONDUIT 0.500" STRAIGHT STRAIN RELIEF, LIQUID TIGHT	25 871 01378		1
GASKET, LIQUID TIGHT SEALING RING, CONDUIT SIZE 1/2"	26 568 06173		1
WIRE, ELE 16 AWG 19/.0117 600 V	25 613 02008		30 FT
TERMINAL, 16-14 AWG, RING TONGUE, NO.8 STUD, NYLON INSULATION (.150 MAX)	25 999 30122		12
ELBOW, 90DEG SWIVEL, 1" MALE X 1" FEMALE JIC SWIVEL, 37DEG FLARE	50 000 07047		1
ELBOW, PIPE TO PIPE, 90DEG 0.37 BRASS 3/8"FPT X 3/8"MPT	42 805 20868		1
ELBOW, PIPE TO PIPE, 90DEG 0.25 BRASS BRASS 1/4"FPT X 1/4"MPT	42 801 00132		1

AMTRAK TRADE SECRET - CONFIDENTIAL AND PROPRIETARY INFORMATION

Description	SAP#	Photo	Quantity
TORQUE SEAL, ORANGE	47 651 00000		AS NEEDED
TAPE, SEALANT PIPE THREADS 0.750"WD 3/4 WD X 520" ROLL	47 285 00719		AS NEEDED
3/4" Unibit	45 312 00003 or equivalent		AS NEEDED
WRENCH, TORQUE,30-150 FT LBS, 1/2" DRIVE	26 555 90008		AS NEEDED
Electric or Cordless Drill			AS NEEDED

5.1. REFERENCE

5.1.1. CAF Drawing E.33.65.598

5.1.2. Amtrak Drawing 0016310

5.1.3. Amtrak Drawing 0016705

5.1.4. Amtrak Drawing 0051760

5.1.5. Amtrak Drawing 0051500

6. PROCEDURE

6.1. PIPING

6.1.1. Remove all air supply from the car.

6.1.2. Remove all necessary shrouds to access the Graham-White 975 Filter Assembly and respective piping.

6.1.3. Drain all air from the Main Reservoir and other supply tanks.

6.1.4. Loosen the three sleeve nuts of the input and output piping. Then loosen and remove the four bolts for the two 1" flanges on each side of the filter. Set both flanges and hardware aside for reuse.

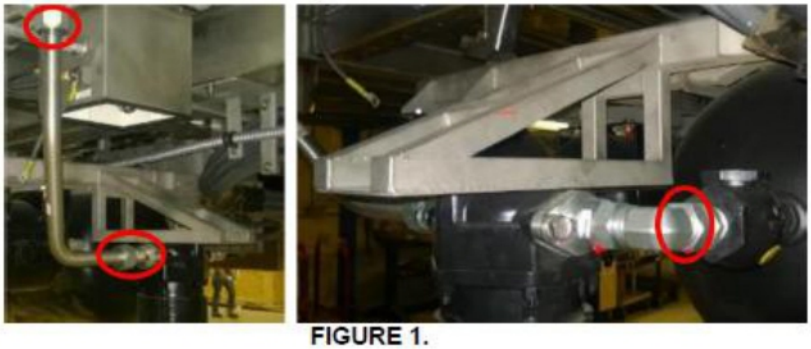


FIGURE 1.

AMTRAK TRADE SECRET - CONFIDENTIAL AND PROPRIETARY INFORMATION

6.1.5. Loosen and remove the two bolts at the top of the filter and remove the filter assembly. Set aside.

6.1.6. Plug the input and output piping using plastic pipe plugs to prevent any debris from getting into the air brake system.

6.1.7. Using a cutting wheel, remove the triangular shaped support bracket from the large support frame. Grind the surface smooth to prepare for welding.

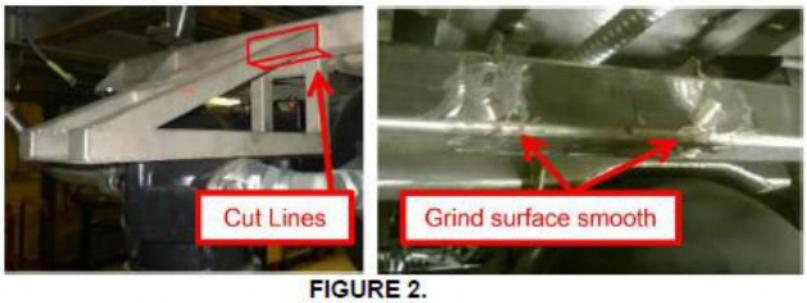


FIGURE 2.

6.1.8. Install 1" Swivel 90° Elbow (42 427 02708) to the 1" output flange removed earlier.

6.1.9. Attach the flange and elbow to the existing 1" Elbow before the 1" Check Valve and attach the 975 filter assembly removed earlier to the 1" Flange. NOTE: This is for fit up only. The 1" gasket is not required and the bolts only need to be hand tight.



FIGURE 3.

6.1.10. Attach the new main reservoir pipe assembly (50 000 10343) to the 1" input flange removed earlier. Bolt the flange to the input side of the 975 Filter and hand tighten.

6.1.11. Tighten the upper sleeve nut of the new main reservoir pipe assembly. Then begin tightening all hardware, sleeve nuts and fittings to get a dry fit of the piping.

6.1.12. Attach the new support bracket assembly (50 000 07018) to the 975 Filter using the same two bolts removed earlier in step 7.5. Slide the support bracket so that it is tight up against the main support frame.

6.1.13. Tack weld the new support bracket to the frame and then remove all of the piping, filter, flanges and elbows.

6.1.14. Finish welding the new support bracket per Amtrak's welding procedures.

6.1.15. Install the new 957 Filter with ASDV from the Graham White installation kit (50 000 04663) to the support bracket using the two ½" bolts in the top of the filter.

6.1.16. Attach the new main reservoir pipe assembly (50 000 10343) and hand tighten the bolts of the flange to the input side of the filter. Also hand tighten the sleeve nut at the opposite end of the pipe. **NOTE: Use the original 1" Flange gaskets.**

6.1.17. Attach the output side of the filter to the flange and hand tighten the bolts.

6.1.18. Tighten both flanges and all fittings first. Then tighten the two ½" bolts on top of the filter. Torque all ½" bolts to 78 ft-lbs.

6.1.19. Weld Pilot Controller Support Bracket to the main air brake support frame located 8 inches from the edge shown below.

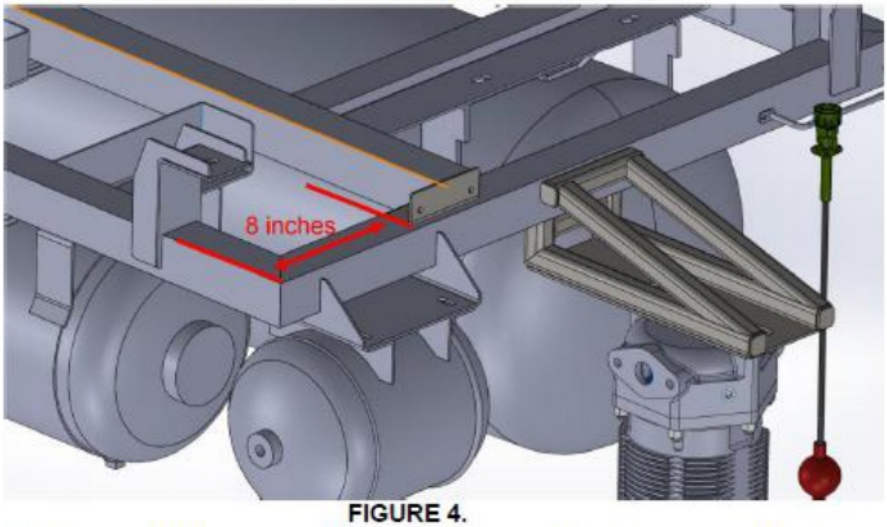


FIGURE 4.

6.1.20. Install the Pilot Controller in the Graham White installation kit to the side of the support bracket using the supplied hardware in the kit.

6.1.21. Install the stainless steel braided hoses and fittings (items 7, 8, 9, 10, 11, 12 and 13 in the diagram below) supplied in the Graham-White installation kit to the respective connection points of the pilot controller and filter assembly.

AMTRAK TRADE SECRET - CONFIDENTIAL AND PROPRIETARY INFORMATION

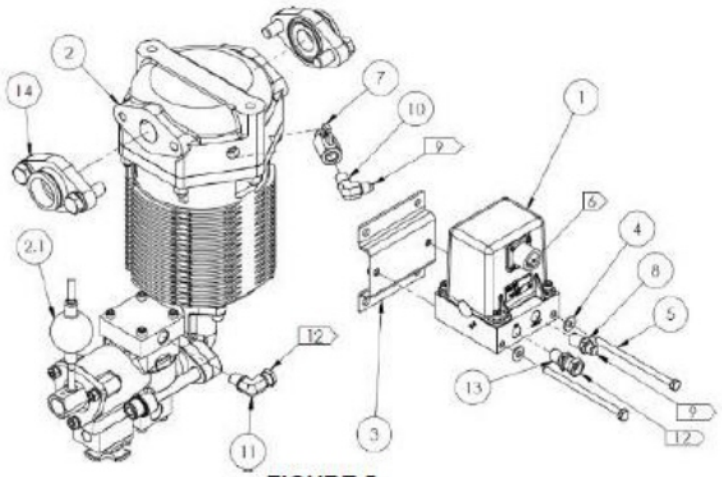


FIGURE 5.

6.1.22. Install a 3/8" NPT brass 90° elbow (42 805 20868) to the exhaust port of the ASDV and tighten so the elbow exhaust is facing towards the rail.

6.1.23. Install a ¼" brass street elbow (42 801 00132) to the other exhaust port of the ASDV and tighten so the elbow exhaust is facing towards the rail.

6.2. ELECTRICAL

6.2.1. Remove the cover from Pullbox #2 located above the filter assembly.

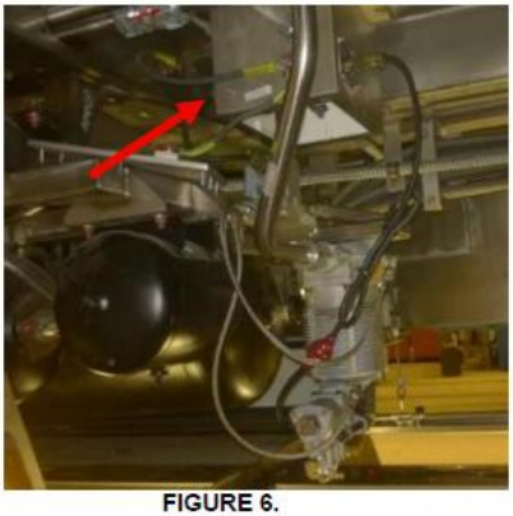


FIGURE 6.

6.2.2. Unwrap the bundle of wires in the pullbox and locate wires labeled U-SR649/PB2_SPARE and U-SR650/PB2_SPARE.

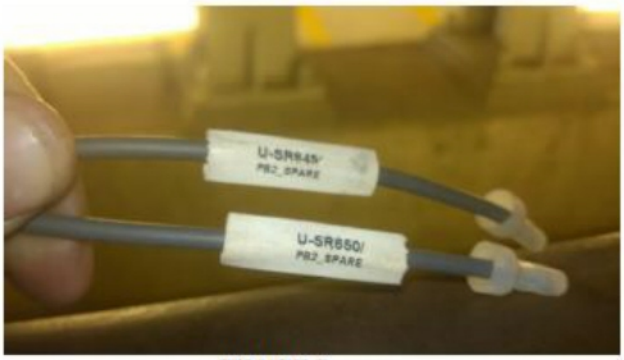


FIGURE 7.

6.2.3. Neatly wrap the wires not being used and secure them in the top of the pullbox using zip ties.

6.2.4. Install 4 point terminal block (24 030 0817X) to the inside wall of pullbox #2 using four (4) #10-32 x 1" machine screws and locknuts.



FIGURE 8.

6.2.5. Drill a ½" hole in the side of Pullbox #2 and install ½" strain relief connector (25 871 01378) and sealing ring (26 568 06173) to the pullbox.

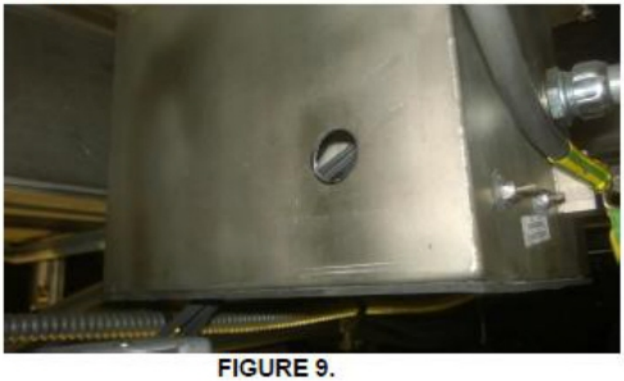


FIGURE 9.

6.2.6. Drill a 2" hole in the opposite side of Pullbox #2 and install the Amphenol mounting plate (50 000 07117) to the pullbox using ¼"-20 x 1" bolts and locknuts. Use sealant to prevent moisture intrusion.

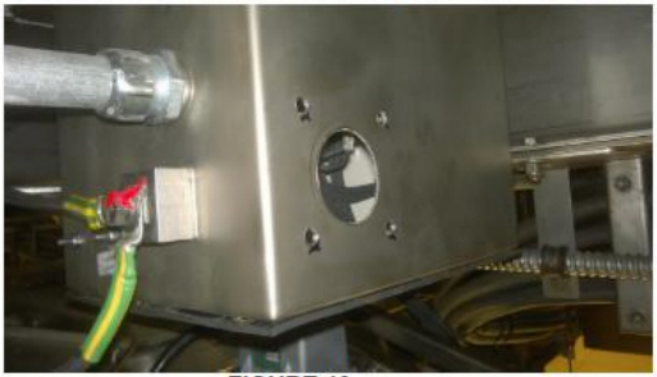


FIGURE 10.

6.2.7. Install the 2-pole Amphenol plug supplied in the Graham-White installation kit to the mounting plate using the supplied hardware.



FIGURE 11.

6.2.8. Remove cover of the Pilot Controller by removing the 4 cap screws. (This will require cutting the Tamper Evident Labels)

6.2.9. 7.32 Locate the Time Delay switch on the circuit board and use a small Phillips head screwdriver to adjust the Time Delay switch to Setting 4 (60-Minute Interval).

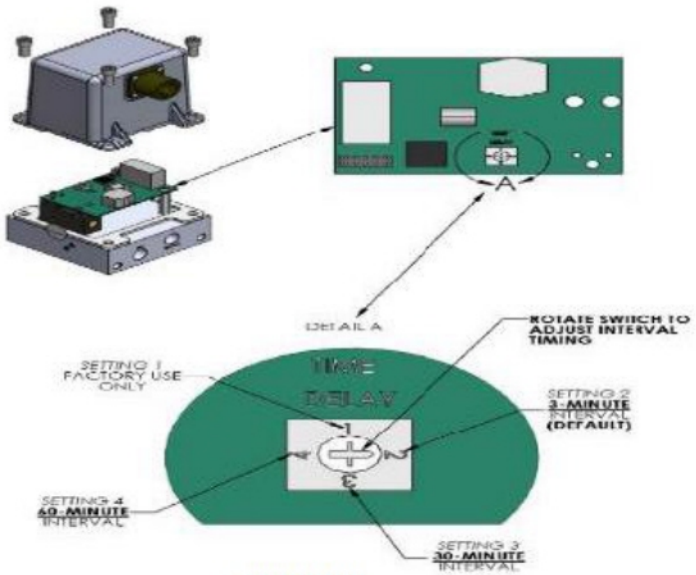


FIGURE 12.

6.2.10. Replace the Pilot Controller Cover using the same 4 cap screws.

6.2.11. Connect all wiring to the new terminal block per schematic below using ten ring terminals (25 999 30122).

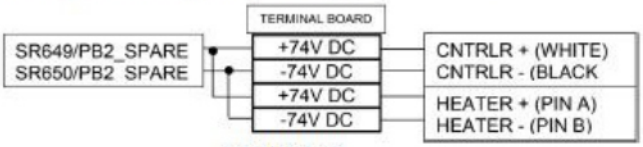


FIGURE 13.

6.2.12. Connect the pilot controller and heater cables to their respective Amphenol plugs.

6.2.13. Remove the front and back cover of the circuit breaker panel located in the electric locker.

6.2.14. Locate wires labeled U-SR649/PB2_SPARE and U-SR650/PB2_SPARE in the bundle of spare wires on the back of the circuit breaker panel.



FIGURE 14.

AMTRAK TRADE SECRET - CONFIDENTIAL AND PROPRIETARY INFORMATION

6.2.15. Wrap the wires not being used and secure them back to their original location.

6.2.16. Terminate U-SR649/PB2_SPARE on terminal ELCT6.12_9 using ring terminal (25 999 30122) and terminate U-SR650/PB2_SPARE on terminal ELCT6.12_10 using ring terminal (25 999 30122).

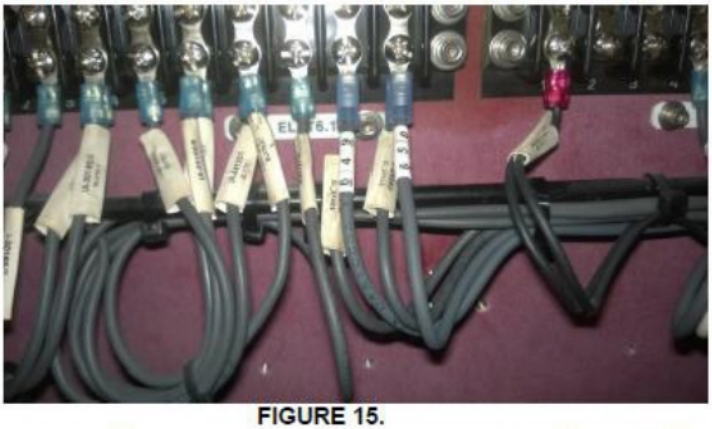


FIGURE 15.

6.2.17. Locate the spare 74VDC 10A 2P circuit breaker at the top of the circuit breaker panel. Connect the breaker to ELCT6.12_9 and ELCT6.12_10 using 16 AWG wire (25 613 02008) and four ring terminals (25 999 30122). Connect wire 649 to the positive side of the circuit breaker and 650 to the negative. Label new wires 649/+ and 650/-.

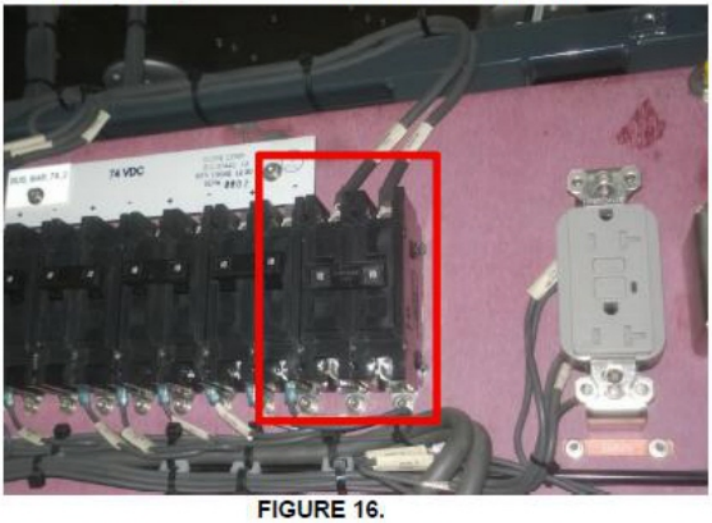


FIGURE 16.

6.2.18. Secure all new wiring using zip ties.

6.3. TESTING

6.3.1. Connect the car to Main Reservoir supply air and allow the brake system to charge for 10 minutes.

6.3.2. Check all pipe fittings for Main Reservoir leakage. Ensure the mini ball valve at the top of the new filter is open.

6.3.3. Turn the circuit breaker on and ensure the drain valve exhausts.

6.3.4. Apply torque stripe (47 651 00000) to all hardware and fittings.



FIGURE 17.

6.3.5. Reinstall all covers and access covers, install new circuit breaker label (50 000 10344) to the panel.

7. RECORD KEEPING

Document repairs to the equipment in WMS (Work Management System) and all appropriate MAP forms.

NOTE

Return the removed Air Filter Assembly (23 582 21413) to Material control as a core.

EXHIBIT G-1

TABLE 1 OF AMTRAK UNIVERSAL SINGLE LEVEL REPLACEMENT TSSSA STATEMENT OF WORK

Amtrak Depots

TABLE 1 - Space Assigned to Contractor:			
Terminal Depots			
Facility Locations	**Washington, DC** **New Orleans, LA** **Chicago, IL** **Hialeah, FL** **New York City, NY** **Boston, MA** **Seattle, WA** **Oakland, CA** **Los Angeles, CA** **Sanford, FL (Auto Train Option)** **Lorton, VA (Auto Train Option)**		
Material Requirements	Specific Location **TBD**	Material Storage by Amtrak	CONTRACTOR resources required - **TBD**
Office Space	Appropriate desk space to accommodate Contractor's personnel assigned to Depot. (integrated with Amtrak personnel)	Desk space for minimum of 2	Technical Support Engineer
Enroute Depots			
Facility Locations	**Minot, ND** **Denver, CO** **Albuquerque, NM** **Portland, OR** **San Antonio, TX** **Spokane, WA** **Savannah, GA** **Albany, NY** **St Louis, MO (Option)** **Kansas City, MO (Option)**		

Material Requirements	Specific Location **TBD**	Material Storage by Amtrak	CONTRACTOR resources required - **TBD**
Staff Support	Staff Support As-Required		Technical Support provided 24/7 by telephone and e-mail
Facility	**Wilmington DE CNOC**		
Office Space	Appropriate desk space to accommodate Contractor's personnel assigned to Depot. (integrated with Amtrak personnel)	Desk space for 2	Reliability team and maintenance planning

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EXHIBIT H

QUESTION/EXCEPTION WORKSHEET

Offeror's Name: _____

Question/ Exception Number	Submission Date	Indicate Specific Solicitation Documentation Letter Designation listed in the Instructions to Offerors	Document Section Number	Excerpt from Sections in Question	Offeror's Requested Language Change or Modification-if applicable.	Explanation of Offeror's Change or Modification Request-if applicable.	Question

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EXHIBIT I-1

PROPOSAL FORM

NATIONAL RAILROAD PASSENGER CORPORATION
PROCUREMENT AND LOGISTICS DEPARTMENT
2955 MARKET STREET
PHILADELPHIA, PA 19104
PROJECT: UNIVERSAL SINGLE LEVEL FLEET REPLACEMENT PROGRAM
ATTENTION: GINA PITCHERELLA, PROCUREMENT SENIOR MANAGER

DATE OF RFP: 3/31/2026 Rev 0
RFP NO.: DOC5509033158
ELECTRONIC CLOSE DATE: 9/30/2026

Having thoroughly examined the Solicitation Documents as set forth in last section of the Instructions to Offerors and familiarized itself with the requirements contained therein, Offeror does hereby: (1) accept all of the terms and conditions of the Solicitation Documents (as may be modified by Amtrak by issuance of an amendment prior to the Close Date); and (2) tender a Financial Proposal for the following: Single Level Fleet Replacement – Equipment in accordance with Contract documents. Offeror's Total Firm Fixed Price for said Supplies/Services is in the amount of _____dollars ($_____).

Please refer to Exhibit I-2-Pricing Schedule which includes Options.

Offeror shall provide all supervision, labor, materials, tools, supplies, insurance, bonds or guarantees, permits, equipment transportation, overhead, profit, and any applicable duties or tariffs and any other items necessary to accomplish the Work, as set forth in the Solicitation Documents.

If awarded a contract, the Offeror agrees to complete the work within the agreed upon Delivery Schedule.

Offeror hereby acknowledges receipt of the following Amendments and certifies that its Price Proposal includes any and all price changes resulting from such Amendments:

Amendment Number	Date

This Proposal is firm for 365 calendar days after the Electronic Close Date.

IMPORTANT NOTICE: This Proposal Form, along with the Pricing Schedule and all other Solicitation Documents identified with an asterisk under the last section of the Instructions to Offerors, must be received by Amtrak prior to 2:00 P.M. (Eastern Time) on the Electronic Close Date specified above.

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REQUEST FOR PROPOSAL ("RFP") – EXHIBIT I-1
UNIVERSAL SINGLE LEVEL FLEET REPLACEMENT PROGRAM – EQUIPMENT
NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)
1 Massachusetts Ave NW, Washington DC 20001

THE UNDERSIGNED CERTIFIES THAT, TO THE BEST OF HIS/HER KNOWLEDGE, THE INFORMATION STATED HEREIN AND PROVIDED HEREWITH IS TRUE, ACCURATE, CURRENT AND COMPLETE AS OF THE DATE OF THIS PROPOSAL.

Offeror's Name and Address:

_____

Printed or Typed Name of Person Signing Below:

_____

Title of Person Signing Below:

_____

Authorized Signature of Offeror:

_____

Telephone: _____

Date: _____

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REFER TO SPECIFICATIONS FOR DETAILS ON CARS, AMENITY OPTIONS, CAR OPTIONS, CAR TYPE OPTIONS

Exhibit I-2

Base Order - FIRM FIXED PRICING

Amtrak Universal Single Level Fleet Replacement - Equipment

Item No.	Description				
1	**NON-RECURRING COSTS**[1]	**Lump Sum Price**			
	Performance Security				
	Insurance				
	Engineering Equipment Design				
	Three-year Warranty				
	Other				
	Sub-Total	$ -			
2	**RECURRING COSTS**[2]	**The Base Order Requires Delivery of 836 Cars Composed of the Car Types that Meet Amtrak Specifications**			
	List of Car Types in the Base	**Quantity Of Cars**	**Price Per Car**	**Price for Base Order**	
	Car Type "Standard Coach"	186		0	
	Car Type "Accessible Coach"	102		0	
	Car Type "Café"	76		0	
	Car Type "Diner"	69		0	
	Car Type "Diner Lounge"	69		0	
	Car Type "Accessible Sleeper"	177		0	
	Car Type "Standard Sleeper"	157		0	
	Total Calculations	836		$ -	
2a	**RECURRING PRICES FOR CARS**	**The Base Order Requires Delivery of 836 Cars Composed of the Car Types that Meet Amtrak Specifications**			
	Transportation of Cars[3]	**Price Per Car/Batch**	**# of Cars in Base Order**	**Total Price**	
	Transportation from Fabrication Facility to New Orleans, LA		836	$ -	
	Transportation from Fabrication Facility to Hialeah, FL		836	$ -	
	Transportation from Fabrication Facility to Bear, DE		836	$ -	
2b	**RECURRING COSTS**	**Lump Sum Price Per Car**	**# of Cars in Base Order**	**Total Price**	
	Other - Please explain		836	$ -	

Yellow Cells are calculations. Please do not modify.

Notes:

[1]Non-Recurring Base Costs: All Design and Engineering, Type and Qualification Testing and Inspection on Pilot Cars, Bench Test Equipment and Special Tools, Spare Parts and All One Time Incidentals such as Manuals and Training and Performance Bond.

[2]Recurring Base Costs: Vehicle Manufacture & Assembly, Production Unit Testing and Inspection, Shipping and Delivery, Warranty Support and All Repeating Incidentals.

[3]If Amtrak elects to transport the Equipment, the Transportation costs will be removed.

Delivery Schedule of Cars shall be as prescribed in Exhibit V; Contractor to describe any alternate options as Cost-Saving Ideas

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REFER TO SPECIFICATIONS FOR DETAILS ON CARS, AMENITY OPTIONS, CAR OPTIONS, CAR TYPE OPTIONS

Exhibit I-2
Car Type Options
Amtrak Universal Single Level Fleet Replacement - Equipment

Item No.	Description			
1	**Option Car Type: High Capacity Coach Car**	**Quantity**	**Price Per Car in Each Tranche**	**Order Date Deadline**
1a	High Capacity Coach Car	1-25	$	
1b	High Capacity Coach Car	26-50	$	
1c	High Capacity Coach Car	51-75	$	
1d	High Capacity Coach Car	76-100	$	
1e	High Capacity Coach Car	101-150	$	
1f	High Capacity Coach Car	151-200	$	
1g	High Capacity Coach Car	200+	$	
2	**Option Car Type: Utility Car**	**Quantity**	**Price Per Car in Each Tranche**	**Order Date Deadline**
2a	Utility Car	1-25	$	
2b	Utility Car	26-50	$	
2c	Utility Car	51-75	$	
2d	Utility Car	76-100	$	
2e	Utility Car	101-150	$	
2f	Utility Car	151-200	$	
2g	Utility Car	200+	$	
3	**Option Car Type: Cab Car**	**Quantity**	**Price Per Car in Each Tranche**	**Order Date Deadline**
3a	Cab Car	1-25	$	
3b	Cab Car	26-50	$	
3c	Cab Car	51-75	$	
3d	Cab Car	76-100	$	
3e	Cab Car	101-150	$	
3f	Cab Car	151-200	$	
3g	Cab Car	200+	$	
4	**Option Car Type: Dome-Like or Panoramic Viewing Car**	**Quantity**	**Price Per Car in Each Tranche**	**Order Date Deadline**
4a	Dome-Like or Panoramic Viewing Car	1-25	$	
4b	Dome-Like or Panoramic Viewing Car	26-50	$	
4c	Dome-Like or Panoramic Viewing Car	51-75	$	
4d	Dome-Like or Panoramic Viewing Car	76-100	$	
4e	Dome-Like or Panoramic Viewing Car	101-150	$	
4f	Dome-Like or Panoramic Viewing Car	151-200	$	
4g	Dome-Like or Panoramic Viewing Car	200+	$	
5	**Option - Base Car Type: Standard Coach Car**	**Quantity**	**Price Per Car in Each Tranche**	**Order Date Deadline**
5a	Standard Coach Car	1-25	$	
5b	Standard Coach Car	26-50	$	
5c	Standard Coach Car	51-75	$	
5d	Standard Coach Car	76-100	$	
5e	Standard Coach Car	101-150	$	
5f	Standard Coach Car	151-200	$	
5g	Standard Coach Car	200+	$	
6	**Option - Base Car Type: Accessible Coach Car**	**Quantity**	**Price Per Car in Each Tranche**	**Order Date Deadline**
6a	Accessible Coach Car	1-25	$	
6b	Accessible Coach Car	26-50	$	
6c	Accessible Coach Car	51-75	$	
6d	Accessible Coach Car	76-100	$	
6e	Accessible Coach Car	101-150	$	
6f	Accessible Coach Car	151-200	$	
6g	Accessible Coach Car	200+	$	
7	**Option - Base Car Type: Café Car**	**Quantity**	**Price Per Car in Each Tranche**	**Order Date Deadline**
7a	Café Car	1-25	$	
7b	Café Car	26-50	$	
7c	Café Car	51-75	$	
7d	Café Car	76-100	$	

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7e	Café Car	101-150	$	
7f	Café Car	151-200	$	
7g	Café Car	200+	$	
8	**Option - Base Car Type: Diner Car**	**Quantity**	**Price Per Car in Each Tranche**	**Order Date Deadline**
8a	Diner Car	1-25	$	
8b	Diner Car	26-50	$	
8c	Diner Car	51-75	$	
8d	Diner Car	76-100	$	
8e	Diner Car	101-150	$	
8f	Diner Car	151-200	$	
8g	Diner Car	200+	$	
9	**Option - Base Car Type: Diner Lounge Car**	**Quantity**	**Price Per Car in Each Tranche**	**Order Date Deadline**
9a	Diner Lounge Car	1-25	$	
9b	Diner Lounge Car	26-50	$	
9c	Diner Lounge Car	51-75	$	
9d	Diner Lounge Car	76-100	$	
9e	Diner Lounge Car	101-150	$	
9f	Diner Lounge Car	151-200	$	
9g	Diner Lounge Car	200+	$	
10	**Option - Base Car Type: Accesible Sleeper Car**	**Quantity**	**Price Per Car in Each Tranche**	**Order Date Deadline**
10a	Accessible Sleeper Car	1-25	$	
10b	Accessible Sleeper Car	26-50	$	
10c	Accessible Sleeper Car	51-75	$	
10d	Accessible Sleeper Car	76-100	$	
10e	Accessible Sleeper Car	101-150	$	
10f	Accessible Sleeper Car	151-200	$	
10g	Accessible Sleeper Car	200+	$	
11	**Option - Base Car Type: Standard Sleeper Car**	**Quantity**	**Price Per Car in Each Tranche**	**Order Date Deadline**
11a	Standard Sleeper Car	1-25	$	
11b	Standard Sleeper Car	26-50	$	
11c	Standard Sleeper Car	51-75	$	
11d	Standard Sleeper Car	76-100	$	
11e	Standard Sleeper Car	101-150	$	
11f	Standard Sleeper Car	151-200	$	
11g	Standard Sleeper Car	200+	$	

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REFER TO SPECIFICATIONS FOR DETAILS ON AMENITY OPTIONS

Exhibit I-2
Amenity Options
Amtrak Universal Single Level Fleet Replacement - Equipment

Item No.	Description	Refer to specification document for guidance on which car types that require the option		
1	Full-Scale Completed Car Mock-ups	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Standard Coach Car	1		
Car Type - Base	Accessible Coach Car	1		
Car Type - Base	Café Car	1		
Car Type - Base	Diner Car	1		
Car Type - Base	Diner Lounge Car	1		
Car Type - Base	Accessible Sleeper Car	1		
Car Type - Base	Standard Sleeper Car	1		
Car Type - Option	High Capacity Coach Car	1		
Car Type - Option	Utility Car	1		
Car Type - Option	Cab Car	1		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
2	Wheeled Mobility Device Lift	Quantity of Cars	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Option	Utility Car			
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
3	Diner/Lounge Car, Diner and Cafe - Skylight Windows, Blinds and Valence	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
4	Interchangeable Coupler Design	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	High Capacity Coach Car	-		
Car Type - Option	Utility Car	-		
Car Type - Option	Cab Car	-		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
5	Seat Reservation System	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	High Capacity Coach Car	-		
Car Type - Option	Utility Car	-		
Car Type - Option	Cab Car	-		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
6	Standard Coach Under Seat Indirect Wash Light	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Standard Coach Car	186		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		

Yellow Cells are calculations. Please do not modify.

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7	Standard Coach and Premium Accessible Coach - Manual Seat Rotation	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
8	Café Car - Coach Seating	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Café Car	76		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
9	Drinking Water Stations	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	High Capacity Coach Car	-		
Car Type - Option	Cab Car	-		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
10	Manual Side Loading Doors	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	Utility Car	-		
Car Type - Option	Cab Car	-		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
11	Video Surveillance System (VSS/NVR)	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	High Capacity Coach Car	-		
Car Type - Option	Utility Car	-		
Car Type - Option	Cab Car	-		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
12	Bluetooth LE Auracast Broadcast	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	High Capacity Coach Car	-		
Car Type - Option	Utility Car	-		
Car Type - Option	Cab Car	-		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
13	Exterior Display Sign (Digital)	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	High Capacity Coach Car	-		
Car Type - Option	Utility Car	-		
Car Type - Option	Cab Car	-		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
14	PC Based Network Simulator Software Package	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
15	Emergency Backup Operation	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	High Capacity Coach Car	-		
Car Type - Option	Cab Car	-		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
16	Fire Suppression System	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	Cab Car	-		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
17	POS System	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Item No.	Description	Refer to specification document for guidance on which car types that require the option		
18	On-Board Ozone Treatment System	Quantity of Cars (in the base order)	Incremental Price of Each Car Type	Total Incremental Price of Base Order

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Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	High Capacity Coach Car	-		
Car Type - Option	Utility Car	-		
Car Type - Option	Cab Car	-		
Item No.	**Description**	**Refer to specification document for guidance on which car types that require the option**		
19	**Emergency Waste System Operation**	**Quantity of Cars (in the base order)**	**Incremental Price of Each Car Type**	**Total Incremental Price of Base Order**
Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	High Capacity Coach Car	-		
Car Type - Option	Utility Car	-		
Car Type - Option	Cab Car	-		
Item No.	**Description**	**Refer to specification document for guidance on which car types that require the option**		
20	**OTIS Wayside Customer Experience Simulation Lab**	**Quantity of Cars (in the base order)**	**Incremental Price of Each Car Type**	**Total Incremental Price of Base Order**
Item No.	**Description**	**Refer to specification document for guidance on which car types that require the option**		
21	**Additional Accessible Seating Locations (per location)**	**Quantity of Cars (in the base order)**	**Incremental Price of Each Car Type**	**Total Incremental Price of Base Order**
Car Type - Base	Café Car	76		
Car Type - Option	High Capacity Coach Car	-		
Item No.	**Description**	**Refer to specification document for guidance on which car types that require the option**		
22	**Up to 4 RVAAC Seating Locations**	**Quantity of Cars (in the base order)**	**Incremental Price of Each Car Type**	**Total Incremental Price of Base Order**
Car Type - Base	Café Car	76		
Car Type - Option	High Capacity Coach Car	-		
Item No.	**Description**	**Refer to specification document for guidance on which car types that require the option**		
24	**Lactation Room**	**Quantity of Cars (in the base order)**	**Incremental Price of Each Car Type**	**Total Incremental Price of Base Order**
Item No.	**Description**	**Refer to specification document for guidance on which car types that require the option**		
25	**Passenger Seating Area**	**Quantity of Cars (in the base order)**	**Incremental Price of Each Car Type**	**Total Incremental Price of Base Order**
Car Type - Option	Cab Car			
Item No.	**Description**	**Refer to specification document for guidance on which car types that require the option**		
26	**Passenger/Baggage Area**	**Quantity of Cars (in the base order)**	**Incremental Price of Each Car Type**	**Total Incremental Price of Base Order**
Car Type - Option	Cab Car			
Item No.	**Description**	**Refer to specification document for guidance on which car types that require the option**		
27	**Passenger Wi-Fi System**	**Quantity of Cars (in the base order)**	**Incremental Price of Each Car Type**	**Total Incremental Price of Base Order**
Car Type - Base	Standard Coach Car	186		
Car Type - Base	Accessible Coach Car	102		
Car Type - Base	Café Car	76		
Car Type - Base	Diner Car	69		
Car Type - Base	Diner Lounge Car	69		
Car Type - Base	Accessible Sleeper Car	177		
Car Type - Base	Standard Sleeper Car	157		
Car Type - Option	High Capacity Coach Car	-		
Car Type - Option	Utility Car	-		
Car Type - Option	Cab Car	-		
Item No.	**Description**	**Refer to specification document for guidance on which car types that require the option**		
28	**Flip-Down (Jump) Seats in Accessible Seating Locations (per Seat)**	**Quantity of Cars (in the base order)**	**Incremental Price of Each Car Type**	**Total Incremental Price of Base Order**

REQUEST FOR PROPOSAL ("RFP") - EXHIBIT I-2
UNIVERSAL SINGLE LEVEL FLEET REPLACEMENT PROGRAM - EQUIPMENT
NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)
1 Massachusetts Ave NW, Washington DC 20001

Discount related to early payment by Amtrak

Early Payment Discount:	
Example:	4% 15 Net 90

Cost reduction ideas

Please provide at least your top 5 ideas for reducing total cost. We welcome additional ideas for cost reduction beyond your top 5.

Idea 1	
Idea 2	
Idea 3	
Idea 4	
Idea 5	
Idea 6	
Idea 7	
Idea 8	
Idea 9	
Idea 10	

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EXHIBIT J-1

PROPOSAL FORM – TSSSA

NATIONAL RAILRAD PASSENGER CORPORATION
PROCUREMENT AND LOGISTICS DEPARTMENT
2955 MARKET STREET
PHILADELPHIA, PA 19104
PROJECT: UNIVERSAL SINGLE LEVEL FLEET REPLACEMENT PROGRAM
ATTENTION: GINA PITCHERELLA, PROCUREMENT SENIOR MANAGER

DATE OF RFP: 3/31/2026 Rev 0
RFP NO.: DOC5509033158
ELECTRONIC CLOSE DATE: 9/30/2026

Having thoroughly examined the Solicitation Documents as set forth in the last section of the Instructions to Offerors and familiarized itself with the requirements contained therein, Offeror does hereby: (1) accept all of the terms and conditions of the Solicitation Documents (as may be modified by Amtrak by issuance of an amendment prior to the Close Date); and (2) tender a Financial Proposal for the following Supplies and services: Single Level Fleet Replacement – Technical Support and Spares Supply Agreement in accordance with Contract documents. Offeror's Total Not to Exceed Price for said Services is in the amount of _____dollars ($_____).

Please refer to Exhibit J-2 Pricing Schedule – Single Level Fleet – TSSSA which includes Options.

Offeror shall provide all supervision, labor, materials, tools, supplies, insurance, bonds or guarantees, permits, equipment transportation, overhead, profit, and any applicable duties or tariffs and any other items necessary to accomplish the Work, as set forth in the Solicitation Documents.

If awarded a contract, the Offeror agrees to complete the work within the agreed upon Period of Performance.

Offeror hereby acknowledges receipt of the following Amendments and certifies that its Price Proposal includes any and all price changes resulting from such Amendments:

Amendment Number	Date

This Proposal is firm for 365 calendar days after the Electronic Close Date.

IMPORTANT NOTICE: This Proposal Form, along with the Pricing Schedule and all other Solicitation Documents identified with an asterisk under the last section of the Instructions to Offerors, must be received by Amtrak prior to 2:00 P.M. (Eastern Time) on the Electronic Close Date specified above.

THE UNDERSIGNED CERTIFIES THAT, TO THE BEST OF HIS/HER KNOWLEDGE,

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REQUEST FOR PROPOSAL ("RFP") – EXHIBIT J-1
UNIVERSAL SINGLE LEVEL FLEET REPLACEMENT PROGRAM – TECHNICAL SUPPORT, SPARES, AND SUPPLIES AGREEMENT (TSSSA)

NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)
1 Massachusetts Ave NW, Washington DC 20001

THE INFORMATION STATED HEREIN AND PROVIDED HEREWITH IS TRUE, ACCURATE, CURRENT AND COMPLETE AS OF THE DATE OF THIS PROPOSAL.

Offeror's Name and Address:

_____

Printed or Typed Name of Person Signing Below:

_____

Title of Person Signing Below:

_____

Authorized Signature of Offeror:

_____

Telephone: _____

Date: _____

Exhibit J-2 TSSSA Pricing Schedule

NOTES

All TSSSA pricing (USD) shall be based on the year 2029, subject to escalation from January 1, 2030 as per Table 6A
TSSSA pricing shall include all work as described in Exhibit G-TSSSA SOW.
All Contractors should price each table accordingly and supply a TSSSA cost for all years 1 -20, including any assumptions. These costs are to be all inclusive with OH and Profit.
Payment within 90 days from invoice date
Definition: Monthly Material Service Fee: Fixed monthly material fee per Active Equipment, subject to escalation, covering all materials as per Scope of Work, excluding the materials required for overhaul
Definition: Monthly Support Service Fee: Fixed monthly technical support fee for the fleet, subject to escalation, as per Scope of Work
Excluded Matter Damage (EMD) Materials. The Contractor shall be responsible for procuring and maintaining adequate stock of materials required for Excluded Matter Damage ("EMD Materials"). Amtrak shall be responsible for the cost of EMD Materials upon delivery to Amtrak, when such materials are requested by Amtrak. EMD Materials shall be invoiced to Amtrak on an open-book, cost-plus basis, consisting of the actual price paid by the Contractor to the subsupplier, plus a surcharge of twenty percent (20%). The surcharge shall cover freight, storage, handling, overhead, and profit
These cells contain formulas and shall not be modified
These cells are to be filled out by the Contractor

Car Types and quantities

Abbreviation	Car type	Base Quantities
SCC	Standard Coach Car	186
ACC	Accessible Coach Car	102
CAC	Café Car	76
DIC	Diner Car	69
DLC	Diner Lounge Car	69
ASC	Accessible Sleeper Car	177
SSC	Standard Sleeper Car	157
HCC	High Capacity Coach Car	- (option car type)
UTC	Utility Car	- (option car type)
CBC	Cab Car	- (option car type)
Total		836

List of Depots

Depot Name	Location	Category	Phase
	Washington DC	Terminal	Phase 1
	New Orleans, LA	Terminal	Phase 1
	Chicago, IL	Terminal	Phase 1
	Hialeah, FL	Terminal	Phase 1
	New York, NY	Terminal	Phase 1
	Boston, MA	Terminal	Phase 1
	Seattle, WA	Terminal	Phase 2
	Oakland, CA	Terminal	Phase 2
	Los Angeles, CA	Terminal	Phase 2
	Sanford, FL	Terminal - Option	
	Lorton, VA	Terminal - Option	
	St. Louis, MO	En Route - Option	
	Kansas City, MO	En Route - Option	
	Minot, ND	En Route	

	Denver, CO	En Route	
	Albuquerque, NM	En Route	
	Portland, OR	En Route	
	San Antonio, TX	En Route	
	Spokane, WA	En Route	
	Savannah, GA	En Route	
	Albany, NY	En Route	

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Exhibit J-2 TSSSA Pricing Schedule

Table 1A - Mobilization Payments

Mobilization Payment Milestones	Payment Value
20% after kick-off meeting and submission and approval of CDRL G-01 (Preliminary Mobilization Plan), CDRL G-07 and CDLR G-08	$ 20.00
15% after submission and approval of final mobilization plan and all other CDRLs required as per SoW prior to Conditional Acceptance for the first car - Phase 1 (East - Café and Coach cars)	$ 15.00
15% after completion of material stocking at Amtrak's Terminal Depots as per targeted stock levels - Phase 1 (East - Café and Coach cars)	$ 15.00
15% after submission and approval of final mobilization plan and all other CDRLs required as per SoW prior to Conditional Acceptance for the first car - Phase 2 (West all cars)	$ 15.00
15% after completion of material stocking at Amtrak's Terminal Depots as per targeted stock levels - Phase 2 (West all cars)	$ 15.00
10% after submission and approval of final mobilization plan and all other CDRLs required as per SoW prior to Conditional Acceptance for the first car - Phase 3 (East - Sleepers/Diners)	$ 10.00
10% after completion of material stocking at Amtrak's Terminal Depots as per targeted stock levels - Phase 3 (East Sleepers/Diners)	$ 10.00
Total Mobilization Price (to be input by Contractor)	$ 100.00

Notes:

• Payment milestones to be invoiced after having completed the milestone (the COTR has received a invoice request by the Contractor and the COTR has approved such request)

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Exhibit J-2 TSSSA Pricing Schedule

Table 2A – TSSSA-Individual Car Pricing During Warranty Period (Years 1-3)

Pricing should be on a per Month Basis throughout the Term

Car Type Description	Monthly Material Service Fee per active car
Standard Coach Car	
Accessible Coach Car	
Café Car	
Diner Car	
Diner Lounge Car	
Accessible Sleeper Car	
Standard Sleeper Car	
Option - High Capacity Coach Car - order quantity up to 25	
Option - High Capacity Coach Car - order quantity up to 75	
Option - High Capacity Coach Car - order quantity over 75	
Option - Utility Car - order quantity up to 25	
Option - Utility Car - order quantity up to 75	
Option - Utility Car - order quantity over 75	
Option - Cab Car - order quantity up to 25	
Option - Cab Car - order quantity up to 75	
Option - Cab Car - order quantity over 75	

Notes:

• Monthly Material Service Fee to be invoiced in the first week of the following month, for the services performed in the previous month

• The invoice amount shall include only Active Equipment as reported by Amtrak. If a car is removed from Active status during the month, the material service fee will be invoiced on a pro rata basis according to the number of days the car was active that month

• In the first week of each month, the CO will share the list of all Active Equipment in and outside of Warranty with the total Material Service Fee amount to be invoiced for the previous month. The Contractor shall invoice accordingly only after having received this information from the CO.

• Service fee shall apply for all cars as per base quantities as well for any additional (optional) cars ordered under the new-built contract

Exhibit J-2 TSSSA Pricing Schedule

Table 2B – TSSSA-Individual Car Pricing Post Warranty Period (Years 4-20)

Pricing should be on a per Month Basis throughout the Term

Car Type Description	Monthly Material Service Fee per active car
Standard Coach Car	
Accessible Coach Car	
Café Car	
Diner Car	
Diner Lounge Car	
Accessible Sleeper Car	
Standard Sleeper Car	
Option - High Capacity Coach Car - order quantity up to 25	
Option - High Capacity Coach Car - order quantity up to 75	
Option - High Capacity Coach Car - order quantity over 75	
Option - Utility Car - order quantity up to 25	
Option - Utility Car - order quantity up to 75	
Option - Utility Car - order quantity over 75	
Option - Cab Car - order quantity up to 25	
Option - Cab Car - order quantity up to 75	
Option - Cab Car - order quantity over 75	

Notes:

• Monthly material service fee to be invoiced in the first week of each month for the previous month

• The invoice amount shall include only Active Equipment as reported by Amtrak. If a car is removed from Active status during the month, the material service fee will be invoiced on a pro rata basis according to the number of days the car was

• In the first week of each month, the CO will share the list of all Active Equipment in and outside of Warranty with the total Material Service Fee amount to be invoiced for the previous month. The Contractor shall invoice accordingly only after having received this information from the CO.

• Service fee shall apply for all cars as per base quantities as well for any additional (optional) cars ordered under the new-

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Exhibit J-2 TSSSA Pricing Schedule
Table 3A-Technical Support (Years 1-20)

Milestones	Details	Monthly Support Service Fee
CNOC Wilmington, from Phase 1 onwards		
Terminal Depots, from Phase 1 onwards		
Terminal Depots, from Phase 1+2 onwards		
Terminal Depots, from Phase 1+2+3 onwards	final Support Service Fee after full mobilization	

Notes

- Monthly service support fee to be invoiced in the first week of the following month
- to be invoiced per phase from start date of the respective phase (start date = first car to be conditionally accepted in this phase), capturing the Depots mobilized at each start date
- The quoted monthly support service fee covers the entire fleet based on the base quantities, as well as any additional optional cars ordered under the new-build contract

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Exhibit J-2 TSSSA Pricing Schedule

Table 4A - Exhaustive List of all Overhaul activities (= scheduled maintenance activities with a frequency greater than one (1) year as described in the Maintenance Plans) - Years 1-20

In case of additional activities, an increase of quantities per activity or increase of frequency per activity as compared to below chart, the Contractor shall bear all such additional costs.

					Car Type (please mark as "x" if applicable)											
Subsytem	**Overhaul activity**	**Duration Between Events**	**Unit for event duration**	**# activities Per Car**	**SCC**	**ACC**	**CAC**	**DIC**	**DLC**	**ASC**	**SSC**	**HCC**	**CBC**	**UTC**	**Unit Price per OH activity (include all parts and labor)**	**Price for Each Event per car**
Brakes	Example Maintenance Event Name	18	months	2											$ 2.00	$ 4.00
																$ -
																$ -
																$ -
																$ -
																$ -
																$ -
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Subsytem	Overhaul activity	Duration Between Events	Unit for event duration	# activities Per Car	SCC	ACC	CAC	DIC	DLC	ASC	SSC	HCC	CBC	UTC	Unit Price per OH activity (include all parts and labor)	Price for Each Event per car
																$ -
																$ -
																$ -
																$ -
																$ -
																$ -
																$ -
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																$ -
																$ -

Notes:

• to be invoiced upon delivery to Depot in line with latest overhaul schedule

x

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Exhibit J-2 TSSSA Pricing Schedule
Table 5A – Amenity Options

Description	Additional monthly TSSSA Material Service Fee per car	Additional monthly TSSSA Support Service Fee fleet (if any) - covering all depots and CNOC
Wheeled Mobility Device Lift		
Option - Utility Car		
Diner/Lounge Car, Diner and Cafe - Skylight Windows, Blinds and Valence		
Café Car		
Diner Car		
Diner Lounge Car		
Interchangeable Coupler Design		
Standard Coach Car		
Accessible Coach Car		
Café Car		
Diner Car		
Diner Lounge Car		
Accessible Sleeper Car		
Standard Sleeper Car		
Option - High Capacity Coach Car		
Option - Utility Car		
Option - Cab Car		
Seat Reservation System		
Standard Coach Car		
Accessible Coach Car		
Café Car		
Diner Car		
Diner Lounge Car		
Accessible Sleeper Car		
Standard Sleeper Car		
Option - High Capacity Coach Car		
Option - Utility Car		
Option - Cab Car		
Standard Coach Under Seat Indirect Wash Light		
Standard Coach Car		
Standard Coach and Premium Accessible Coach - Manual Seat Rotation		
Standard Coach Car		
Accessible Coach Car		
Café Car - Coach Seating		
Café Car		
Drinking Water Stations		
Standard Coach Car		
Accessible Coach Car		
Café Car		
Diner Car		
Diner Lounge Car		
Accessible Sleeper Car		
Standard Sleeper Car		
Option - High Capacity Coach Car		
Option - Cab Car		
Manual Side Loading Doors		
Standard Coach Car		
Accessible Coach Car		
Café Car		
Diner Car		
Diner Lounge Car		
Accessible Sleeper Car		
Standard Sleeper Car		
Option - Utility Car		
Option - Cab Car		
Video Surveillance System (VSS/NVR)		

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Description	Additional monthly TSSSA Material Service Fee per car	Additional monthly TSSSA Support Service Fee fleet (if any) - covering all depots and CNOC
Standard Coach Car		
Accessible Coach Car		
Café Car		
Diner Car		
Diner Lounge Car		
Accessible Sleeper Car		
Standard Sleeper Car		
Option - High Capacity Coach Car		
Option - Utility Car		
Option - Cab Car		
Bluetooth LE Auracast Broadcast		
Standard Coach Car		
Accessible Coach Car		
Café Car		
Diner Car		
Diner Lounge Car		
Accessible Sleeper Car		
Standard Sleeper Car		
Option - High Capacity Coach Car		
Option - Utility Car		
Option - Cab Car		
Exterior Display Sign (Digital)		
Standard Coach Car		
Accessible Coach Car		
Café Car		
Diner Car		
Diner Lounge Car		
Accessible Sleeper Car		
Standard Sleeper Car		
Option - High Capacity Coach Car		
Option - Utility Car		
Option - Cab Car		
Emergency Backup Operation		
Standard Coach Car		
Accessible Coach Car		
Café Car		
Diner Car		
Diner Lounge Car		
Accessible Sleeper Car		
Standard Sleeper Car		
Option - High Capacity Coach Car		
Option - Cab Car		
Fire Suppression System		
Café Car		
Diner Car		
Diner Lounge Car		
Accessible Sleeper Car		
Standard Sleeper Car		
Option - High Capacity Coach Car		
Option - Cab Car		
POS System		
Café Car		
Diner Car		
Diner Lounge Car		
On-Board Ozone Treatment System		
Standard Coach Car		
Accessible Coach Car		
Café Car		
Diner Car		
Diner Lounge Car		
Accessible Sleeper Car		

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Description	Additional monthly TSSSA Material Service Fee per car	Additional monthly TSSSA Support Service Fee fleet (if any) - covering all depots and CNOC
Standard Sleeper Car		
Option - High Capacity Coach Car		
Option - Utility Car		
Option - Cab Car		
Additional Accessible Seating Locations (per location)		
Café Car		
Option - High Capacity Coach Car		
Up to 4 RVAAC Seating Locations		
Café Car		
Option - High Capacity Coach Car		
Lactation Room		
Car type: tbd		
Passenger Seating Area		
Option - Cab Car		
Passenger/Baggage Area		
Option - Cab Car		
Passenger Wi-Fi System		
Standard Coach Car		
Accessible Coach Car		
Café Car		
Diner Car		
Diner Lounge Car		
Accessible Sleeper Car		
Standard Sleeper Car		
Option - High Capacity Coach Car		
Option - Utility Car		
Option - Cab Car		

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Exhibit J-2 TSSSA Pricing Schedule

Table 5B – Scope Options

Option 1 - Terminal depot full Warehouse Management

Description	Additional monthly TSSSA Support Service Fee for the complete fleet	Comments / Assumptions
Terminal Depot Warehouse Management by Contractor - Phase 1 (East)		
Terminal Depot Warehouse Management by Contractor - Phase 1-3 (all Depots)		

* Contractor to be fully responsible for material management at all Depots, from receiving materials, GR, storage, picking, handing over to Shop.

Option 2 - Train rider support

Train rider en route to address in-service failures reported, implement repairs and corrective actions when possible, and provide detailed diagnostic or maintenance work order requests for open failures. Reference SoW G9			Comments / Assumptions
Train Type	Fixed Monthly charge for full time well versed train rider	Fixed Monthly charge for full time well versed train rider if 12 consecutive months requested	
Any long distance route / train			

Option 3 - Additional Terminal Depots

Description	Additional Monthly Support Service Fee	Comments / Assumptions
Sanford, FL		
Lorton, VA		

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Exhibit J-2 TSSSA Pricing Schedule

Table 5C – option years (every five(5) years) from 21-40

If Amtrak elects to extend the period of performance in five (5) year increments, Amtrak will determine if/how the pricing and scope will be adjusted through a Change Order Process.

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Exhibit J-2 TSSSA Pricing Schedule

Table 6A - ESCALATION FOR TECHNICAL SUPPORT, SPARES AND SUPPLIES AGREEMENT ("TSSSA")

Pricing firm until December 2029. For years 2030 onward, an escalation factor shall be applied as per below formulars.
TSSSA Costing shall be based on below mechanism proposed by Amtrak, not on optional alternatives proposed by Contractor (if any)

Cost Element	Name of Index	Source	Data Series Name	URL	How will this index be used in escalation calculation?
Monthly Material Service Fee and Overhaul materials	Producer Price Index by Commodity: Transportation Equipment: Railroad Equipment	US Bureau of Labor Statistics	(WPU144) "wpu"	https://data.bls.gov/pdq/SurveyOutputServlet	Xn(material) = Xo (material) * (wpu Q4 n-1 / wpu Q4 n-2) Xo (material) = Initial material service fee offered by Contractor, 2029 baseline Xn(material) = Escalated new material service fee for year n Thereafter each subsequent year, Xn-amount will become the new Xo-amount. wpu Q4 is the arithmetic average of WPU144 index for the months of October, November, December
Support Service Fee	Total compensation for Private industry workers in Nonunion, service-providing industries	US Bureau of Labor Statistics	CIU201S0000000520I "ciu"	https://data.bls.gov/dataViewer/view/timeseries/CIU201S0000000520I	Yn(labor) = Yo (labor) * (ciu Q4 n-1 / ciu Q4 n-2) Yo (labor) = Initial support service fee offered by Contractor, 2029 baseline. Yn(labor) = Escalated new support service fee for year n Thereafter each subsequent year, Yn-amount will become the new Yo-amount ciu Q4 is the arithmetic average of WPU144 index for the months of October/November/December
Performance Guarantees and Incentives as per G11 of SoW	Total compensation for Private industry workers in Nonunion, service-providing industries	US Bureau of Labor Statistics	CIU201S0000000520I "ciu"	https://data.bls.gov/dataViewer/view/timeseries/CIU201S0000000520I	Zn(perf) = Zo (perf) * (ciu Q4 n-1 / ciu Q4 n-2) Zo (perf) = guarantee/incentive amount as per SoW, 2029 baseline. Zn(perf) = Escalated new guarantee/incentive amount for year n Thereafter each subsequent year, Zn-amount will become the new Zo-amount ciu Q4 is the arithmetic average of WPU144 index for the months of October/November/December

Option: Alternative proposal by Contractor (if any)

Cost Element	Name of Index	Source	Data Series Name	URL	How will this index be used in escalation calculation?
Monthly Material Service Fee and Overhaul materials					
Support Service Fee					
Performance Guarantees and Incentives as per G11 of SoW					

Cost impact on Monthly Material Service Fee and Overhaul materials if alternative proposed by Contractor is applied:

Cost impact on Monthly Support Service Fee if alternative proposed by Contractor is applied:

Notes

• In the first month of each calender year, starting January 2030, parties shall determine the new prices as per above formulars by applying the published quarter 4 arithemetic average of wpu/ciu index of previous year (Qn-1) and the published quarter 4 arithemetic average of wpu/ciu index of the year before previous year (Qn-2)) to the formulars. Contractor to invoice new prices beginning of each February for the services rendered in January onwards. For the sake of clarity, prices might increase in case of inflation or decrease in case of deflation.

• The yearly price increase / decrease shall be capped at +/- 10% maximum

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Table 6A - ESCALATION FOR TECHNICAL SUPPORT, SPARES AND SUPPLIES AGREEMENT ("TSSSA")

• Any annual price escalation specified in the Price Sheet shall not apply to any period of delay in project milestones or delivery in the execution of either the new-built contract or the TSSSA contract. If the aggregated delay exceeds twelve (12) months, the escalation shall be paused for one (1) year. For every additional twelve (12) months of aggregated delay (e.g., twenty-four (24) months, thirty-six (36) months), an additional one (1) year of escalation shall be paused.

• If the "wpu" or "ciu" index published by the U.S. Bureau of Labor Statistics is discontinued, substantially altered, or no longer available, the parties shall promptly meet and agree on a substitute index that most closely reflects the same economic conditions and cost trends as WPU144.

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Exhibit J-2 TSSSA Pricing Schedule

Table 7A – Cost reduction ideas

Discount related to early payment by Amtrak

Early Payment Discount:	
Example:	4% 15 Net 90

Cost reduction ideas

Please provide at least your top 5 ideas for reducing total cost. We welcome additional ideas for cost reduction beyond your top 5.

	Description (if it refers to a cost reduction idea proposed in the Rolling Stock proposal, please indicate)	**reduction monthly material service fee per car**	**reduction total monthly support service fee from Phase 3 onwards**
Idea 1			
Idea 2			
Idea 3			
Idea 4			
Idea 5			
Idea 6			
Idea 7			
Idea 8			
Idea 9			
Idea 10			

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SUBJECT	CLASSIFICATION	DATE APPROVED	P/I NUMBER
Background Check	Human Resources	November 4, 2020	7.39.3

1.0 POLICY

Safety is Amtrak's highest priority. To protect its employees, customers, finances, data, property and other assets, Amtrak requires a Background Check of every Prospective Employee and certain Contractors, prior to commencing work for Amtrak.

2.0 RESPONSIBILITY

The Executive Vice President, Chief Human Resources Officer is responsible for the administration and interpretation of this policy. Exceptions to this policy are discouraged; however, if a manager believes an exception is warranted, a request should be forwarded to HRCompliance@amtrak.com for possible consideration by the Executive Vice President, Chief Human Resources Officer, in consultation with the department's Executive Vice President, Amtrak Police Department (APD), Law, Finance or other departments as appropriate.

3.0 PURPOSE

This policy establishes standards for conducting Background Checks.

4.0 SCOPE

This policy applies to all departments which engage or seek to engage outside firms or individuals to perform work for or on behalf of Amtrak, except the APD which is subject to applicable APD policies.

5.0 DEFINITIONS

For purposes of this policy, the following definitions apply:

5.1 Background Check. An investigation, review and evaluation of the background of a Prospective Employee, Contractor or current employee. A Background Check shall include the following:

- A review of relevant criminal history databases;
- Social Security number verification;
- A review of relevant databases to determine the individual's eligibility to work in the United States;
- Prior employment verification and references;
- Education, licensure or certification verification; and
- Credit checks when job-related and consistent with business necessity.

5.2 Contractor. An Independent Contractor or Temporary Contractor as defined in the Independent and Temporary Contractor Services policy, P/I 7.13, or a Professional Services contractor as defined in the Consultant Services policy, P/I 1.6.

5.3 Prospective Employee. A candidate for employment who accepts a conditional offer of employment.

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6.0 BACKGROUND CHECK REQUIREMENTS (PROSPECTIVE EMPLOYEE)

A Background Check will be required of each Prospective Employee within six (6) months prior to commencing work for, or on behalf of, Amtrak.

7.0 BACKGROUND CHECK REQUIREMENTS (CONTRACTOR)

A Background Check will be required of each Contractor within six (6) months prior to commencing work for, or on behalf of, Amtrak when the work performed or expected to be performed entails or is expected to entail either:

7.1 Access to Facilities / Infrastructure. Unsupervised physical access to facilities owned or operated by Amtrak (e.g., individuals who receive an Amtrak identification badge and / or security key card) or access to Amtrak infrastructure, including but not limited to administrative rights access to Amtrak IT infrastructure and systems; or

7.2 Access to Other Information. Access to any of the following types of Amtrak information:

- Protected Critical Infrastructure Information (PCII) and Sensitive Security Information (SSI);
- Vulnerability assessments;
- Security risk assessments;
- Threat assessments;
- Corporate Security Plan information;
- Tactical and operational plans prepared by or for the Mobile Team and its partners, including but not limited to deployment schedules and baggage screening schedules;
- Security Procedures and Alert Plans prepared by or for Amtrak;
- Deployment Schedules and Resource Loading regarding Mobile Team operations;
- Security Capital Plan documents;
- Information regarding security remediation plans, solutions and priorities;
- Control Systems and related technical information, including but not limited to Positive Train Control, SCADA infrastructure and Dispatch Systems and related controls;
- Emergency and / or disaster recovery plans;
- Business continuity and recovery plans;
- Emergency response procedures; or
- Credit card information, including but not limited to PCI data.

7.3 Access Exemptions. Individuals having access to the information listed in Sections 7.1 and 7.2 above solely in connection with anticipated or actual litigation or in response to a subpoena or other legal process, and individuals whose work is not expected to involve access as described in Sections 7.1 and 7.2 above, are exempted from this policy.

8.0 CURRENT EMPLOYEE

Upon request by the department's Executive Vice President and in consultation with the Law Department and APD, the Executive Vice President, Chief Human Resources Officer (or that

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individual's designee) shall have the authority to require background checks on current employees where there is a safety or security necessity, or where there are heightened security risks. Amtrak reserves the right to take disciplinary action, up to and including termination, based on the results of a Background Check of a current employee.

9.0 CRIMINAL CONVICTION NOTIFICATION

In accordance with the Disclosure of Criminal Convictions policy, P/I 7.57, employees and Contractors are required to report any conviction received while working for Amtrak within seventy-two (72) hours of the conviction.

10.0 CREDIT CHECK

For a limited number of positions that may require significant financial responsibility, a Background Check may include a credit check. Human Resources, in consultation with the affected Amtrak department, shall determine whether, due to the work to be performed, a Background Check should include a credit history check.

11.0 DRUG AND ALCOHOL RECORDS

Pursuant to the Drug and Alcohol-Free Workplace Program Guidelines and Procedures, for all Prospective Employees and current employees who seek to begin Department of Transportation-regulated service, a Background Check will include a review of information from prior employers detailing the employee's or Prospective Employee's drug and alcohol testing records.

12.0 REPEAT BACKGROUND CHECK

The Executive Vice President, Chief Human Resources Officer and a department's Executive Vice President (or their designees) shall have authority to require periodic re-investigations in the form of repeat Background Checks in circumstances where there is a law enforcement, safety or security necessity.

13.0 ADMINISTRATION

13.1 The Human Resources department is responsible for the following:

13.1.1 Ensuring Background Checks are conducted on every Prospective Employee and Independent Contractor in accordance with this policy and Amtrak's Background Check Guidelines.

13.1.2 Maintaining Background Check investigation reports in accordance with Amtrak's record retention policies.

13.2 For contracts negotiated by the Procurement department (except for contracts to procure Temporary Contractors, as they are defined in the Independent and Temporary Contractor Services policy, P/I 7.13), the Procurement department is responsible for the following:

13.2.1 Ensuring that firms or entities complete a Contractor Staffing Resource Background Check Certification form, NRPC 3524, affirming compliance with

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this policy and Background Check Guidelines including the requirement to conduct a Background Check on every Professional Services contractor within six (6) months prior to the individual commencing work for or on behalf of Amtrak.

13.2.2 Providing the firm or entity a copy of this policy and the Background Check Guidelines.

13.2.3 Ensuring the appropriate contractual provisions reflecting the requirements of this policy are incorporated into agreements between Amtrak and the firm or entity.

13.3 For contracts negotiated by individual departments outside the Procurement process and when acquiring Temporary Contractors, the department is responsible for the following:

13.3.1 Ensuring that firms or entities (including a Staffing Agency) complete a Contractor Staffing Resource Background Check Certification form, NRPC 3524, affirming compliance with this policy and Background Check Guidelines including the requirement to conduct a Background Check on every Professional Services contractor or Temporary Contractor within six (6) months prior to the Professional Services contractor or Temporary Contractor commencing work for or on behalf of Amtrak.

13.3.2 Providing the firm or entity (including a Staffing Agency) a copy of this policy and the Background Check Guidelines.

13.3.3 Ensuring the appropriate contractual provisions reflecting the requirements of this policy are incorporated into agreements between Amtrak and the firm or entity.

14.0 FURTHER CHECKS

Nothing in this policy shall be interpreted to restrict or broaden Amtrak's ability to conduct or require more in-depth background investigations of employees, Prospective Employees, Independent Contractors, Professional Services contractors or Temporary Contractors who perform security-sensitive duties and to make disqualification decisions based on the results of such additional background investigations.

15.0 POST-DISQUALIFICATION

If an individual has been disqualified for an employment or Contractor position based upon the Background Check and pursuant to this policy and / or the Background Check Guidelines, such position may not be filled, except on a temporary basis, until either: (a) the time for submitting an appeal or waiver request has expired; or (b) the appeal or request for a waiver has been resolved. This provision does not apply to individuals who are rejected or terminated for failing to provide complete and accurate information during the application process.

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16.0 CONFIDENTIALITY

Background Check reports are confidential and to be disseminated only to the extent permitted by law and reasonably necessary for Amtrak to meet its legitimate business needs.

17.0 AUDIT

Human Resources shall conduct periodic audits to ensure compliance with this policy.

18.0 NON-COMPLIANCE

Failure to comply with this policy and the Background Check Guidelines poses an unacceptable risk to Amtrak and may result in disciplinary action.

19.0 RELATED POLICIES

- Background Check Guidelines
- Drug and Alcohol-Free Workplace Program, APIM 7.3
- Recruitment, Hiring and Reassignment, APIM 7.7
- Independent and Temporary Contractor Services, APIM 7.13
- Disclosure of Criminal Convictions, APIM 7.57

For additional questions, contact the HR Employee Resource Center at (888) 694-7372.

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EXHIBIT M-1
BUY AMERICA REQUIREMENTS

UNIVERSAL SINGLE LEVEL FLEET REPLACEMENT EQUIPMENT
DOMESTIC PREFERENCE REQUIREMENTS/AMTRAK BUY AMERICAN ACT

As noted in the instructions to offerors, this request for proposal (RFP) and the resulting Supplies contracts will be subject to Amtrak's domestic preference requirements found at 49 U.S.C. § 24305(f) (the "Amtrak Buy American Act"), the domestic preference requirements of the Build America, Buy America Act (BABA) § 70914, Pub. L. No. 117-58, div. G, tit. IX, subtit. A, 135 Stat. 429, 1298 (2021), as implemented by OMB, USDOT, and FRA and 2 C.F.R. §200.32. The technical support supplies agreement (TSSSA) will be subject to these Amtrak Buy American Act, as well. The applicable Buy American provision is also set forth in the Supplementary General Provisions for Nonconstruction Contracts.

I. Amtrak Buy American Act Requirements

A. The Amtrak Buy American requirements of this RFP are comprised of two parts:

Part I – Domestic Preference/Buy American Certification and Waiver Processes: Offeror must complete the Domestic Preference/Buy American Act Certification forms to indicate that the proposed Equipment will undergo final assembly in the U.S. and that more than fifty-five percent (55%) of the cost of all components will be manufactured in the U.S. or indicate that a waiver(s) will be required and sufficient documentation to process the waiver(s) is submitted with that Certificate indicating non- compliance. (See Domestic Preference/Buy American Act Certifications).

Part II – Buy American Pre-Award, Ongoing, and Post-Delivery Audits: The Buy American process for this procurement and the resulting contracts will include both pre-award and post-delivery audits. Amtrak, the FRA, and/or its representative(s) will also provide ongoing oversight of the awardee's Buy American compliance during the Equipment's design and manufacture.

B. Certification Requirements

Each Offeror shall submit the Buy America Certifications with its Supplies Technical Proposal. Supplies Technical Proposals not accompanied by properly completed Buy America Certifications may be rejected as nonresponsive.

The Offeror is bound by the certifications submitted with its Proposal and is not permitted to change its certifications after submission of the Proposal. In no event may Offeror change its certification, after contract award.

Where the Offeror certifies in its Proposal that it will comply with the Buy American requirements and later determines that it cannot, the Offeror shall not be eligible for a waiver of those requirements, unless FRA determines that circumstances completely beyond the Offeror's control exist making compliance impossible (e.g., where the intended supplier for a particular component goes out of business and no other supplier exists). No price adjustments will be allowed under these circumstances.

Offeror certifications and requests to correct certifications are subject to FRA/Amtrak audit, and the Offeror/Contractor and its suppliers agree that by submitting a proposal to supply a component or by

submitting a Proposal to supply the Equipment to provide all required information to support any such audit(s)the following Buy America documentation must be included as part of the Supplies Technical Proposal submission:

1. Completed and signed Buy American Certificates;
2. Completed and signed Buy American Component Supplier Certification Forms (Exhibit M-3), one for each domestic component supplier whose component will be calculated to demonstrate that more than fifty-five (55) percent of the cost of all components is domestic; and
3. Any Buy American Waiver Requests and justifications (see below for detailed requirements regarding application for waivers).

II. Amtrak Buy American Act -- Overview

The Amtrak Buy American Act requires Amtrak to purchase only those items that are "manufactured in the United States substantially from domestic components.
The statute does not define what it means to be "substantially" domestic, however, Amtrak and the FRA have interpreted this to mean that more than fifty-five (55) percent of the cost of all components must be domestic and the end product must be manufactured in the United States.

Amtrak has additional Buy America requirements for the steel and iron used to manufacture the following types of primarily steel and iron manufactured goods or end products:

- Railcar systems and components, including items such as steel car shells, wheels, couplers, trucks, axles, piping, battery boxes, enclosures, mounting racks, and grab irons.
- Structural construction materials, including items such as steel or iron beams and columns, and bridge trusses.
- Steel track work used in track projects, including items such as running rail, contact rail, switch rails, and turnouts.

The additional requirements for steel and iron are that all steel and iron manufacturing processes must have taken place in the United States, except any metallurgical processes involving refinement of steel additives. In other words, Amtrak requires all manufacturing process from the ***initial melting stage*** through the application of coatings take place in the United States. The initial melting stage in the production of steel occurs when iron feedstock (e.g., iron ore, pig iron, reduced iron) or scrap steel is melted to produce steel. Depending on the production process used, the initial melting stage commonly may occur in a blast furnace, a basic oxygen furnace, or an electric arc furnace. The iron feedstock, scrap steel, or other inputs at this stage may be non-domestic. Products from steel that was melted and cast outside the U.S., and only reheated to below its melting point or cold worked in the United States, do not meet this standard.

(Note: if an Offeror has achieved the 55% requirement of the Amtrak Buy American Act, it is acceptable for Offeror to utilize steel from nondomestic sources on components that are confirmed as foreign and not included in the calculation of the 55%.)

Amtrak encourages maximizing domestic materials wherever possible.

A. (1) Definitions. As used herein--

Component means any article, material, or supply, whether manufactured or unmanufactured, that is directly incorporated into the end product at the final assembly location. Amtrak has

included at Representative List of Trainset Components at Exhibit M-4 to the RFP. The items on the list are presumed to be components, but in determining whether an item is a component, the definition here shall prevail.

Cost of components means--

(a) For components purchased by Contractor, the acquisition cost, including transportation costs to the place of incorporation into the end product (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(b) For components manufactured by Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the end product.

Domestic end product means--

(a) An unmanufactured end product mined or produced in the United States; or

(b) An end product manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 55 percent of the cost of all its components.

End product means any vehicle, structure, product, article, material, supply, or system, which directly incorporates constituent components at the final assembly location, that is acquired for public use under a federally-funded third-party contract, and which is ready to provide its intended end function or use without any further manufacturing or assembly change(s).

Foreign end product means an end product other than a domestic end product.

Subcomponent means any article, material, or supply, whether manufactured or unmanufactured, that is one step removed from a component in the manufacturing process and that is incorporated directly into a component.

United States means the fifty (50) States, the District of Columbia, and outlying areas.

B. The Amtrak Buy American requirement has two elements as follows:

(1) Final assembly of the Equipment must occur in the United States (no waivers will be granted to this requirement), and
(2) More than fifty-five (55) percent of the cost of the components of each rail car or vehicle must be domestic (manufactured in the U.S.). (see Exhibit M-4, Representative List of Trainset Components for Purposes of Amtrak 49 USC 24305(f) .

In the case of the manufacture of a new rail car, final assembly would typically include, ***as a minimum***, the following operations: installation and interconnection of propulsion control equipment, propulsion cooling equipment, brake equipment, energy sources for auxiliaries and controls, heating and air conditioning, communications equipment, motors, wheels and axles, suspensions and frames; the inspection and verification of all installation and interconnection work; and the in-plant testing of the stationary product to verify all functions.

A **Proposal** will be deemed compliant with the Amtrak Buy American Act requirements in this RFP under the following circumstances:

The Proposal indicates final assembly of the Equipment will occur in the U.S. and **EITHER**:

(1) More than fifty-five (55) percent of the cost of the Components will be domestic (manufactured in the U.S.) and the Offeror submits a Certificate indicating compliance (Exhibit M-2) and a form documenting the U.S. location of each components' manufacture; **OR**

(2) More than fifty-five (55) percent of the cost of the Trainset Components cannot be manufactured in the U.S. and the Offeror submits a Buy American Act Certificate indicating non-compliance (Exhibit M-2) and a form, documenting the components that will be manufactured in the U.S. and for components that cannot be manufactured in the U.S. submits documentation sufficient to process and support a waiver from the Amtrak Buy American Act requirements (see 49 U.S.C. § 24305 (f).

All certifications are subject to audits.

C. Non-Compliance Certification and Waiver Process

As set forth above, final assembly of the Equipment must occur in the U.S. No waiver of this requirement will be granted and a Proposal containing such a request for waiver will be rejected as nonresponsive.

A waiver from the Amtrak Buy American Act regarding the requirement that more than fifty-five (55) percent of the cost of the Trainset components must be of U.S. origin may be granted if the FRA determines one of the following to be true:

(1) Applying the requirement would be inconsistent with the public interest;
(2) The required component(s) are not produced in the U.S. in a sufficient and reasonably available amount or are not of a satisfactory quality;
(3) Including the required component(s) would cause the rolling stock or power train equipment to not be bought and delivered in the U.S. within a reasonable time; and/or
(4) imposing the requirements will unreasonably increase the cost of the Trainset or other end products.

(See 49 U.S.C. § 24305(f)(4)).

D. Waiver Process

Offeror shall submit, as part of its Supplies Technical Proposal, any waiver request(s) together with its Buy America(n) Act Certificate indicating non-compliance.

At minimum and where applicable, the Offeror's waiver request shall include the following information for each component:

(1) Identification and description of the Equipment proposed under this project;
(2) Identification of the Component(s), including the cost, country of origin, and the name of the supplier or sub-supplier, not meeting the applicable Amtrak Buy American Act requirement;
(3) Description of the process used to find U.S. suppliers of component(s) for which a waiver is being requested;
(4) Description of a process demonstrating a commitment to finding and/or developing U.S. suppliers in future procurements;
(5) Cost differential(s) to secure domestic component(s) as compared with nondomestic component(s);
(6) Issues with quality or quantity of compliant component(s);
(7) Issues with timely delivery of compliant component(s);
(8) Citation to the specific 49 U.S.C. § 24305(f)(4) waiver category(ies) under which the waiver is sought;
(9) Justification supporting the application of the waiver category(ies) cited to the extent not already answered by the above; and
(10) Any other information that offeror can provide that might influence the waiver decision such as:

a. Whether offeror can source the initial quantity of the component non-domestically and then the remainder in the U.S.;
b. Whether manufacturing in the U.S. can occur over time. Please provide details on when and where;
c. The number of jobs offeror would add in the U.S.; and
d. Whether this would create a second domestic supplier moving forward.

The Offeror must provide clear justification for each separate component for which a waiver is being requested. Offeror should also provide a statement detailing the percentage of domestic content by cost and quantity of components.

The FRA will review the waiver documentation provided by Amtrak. The FRA in consultation with Amtrak will identify any deficiencies with the waiver request(s). Waiver documentation review by the FRA does not guarantee the waiver request will be granted; instead its purpose is only to determine that sufficient information has or has not been submitted and to make a determination. If request deficiencies are identified, the deficiencies may be discussed with the Offerors during one on one interviews, which shall be held only in the event they are determined by Amtrak to be needed.

Contract award can be made only to Offerors that have certified Buy American compliance (either by certification that the Offeror can meet assembly and the applicable component percentage (more than 55 percent of the cost of all components) requirements or by certification that the Offeror can meet assembly requirements but not the applicable component percentage requirements and the Offeror has submitted a complete waiver request(s)). Contract award will not occur before the FRA has reached a final decision on any waivers. Offeror certifications, waiver request(s) and justifications are subject to FRA/Amtrak audit, and the Offeror/Contractor and its suppliers agree that by submitting a proposal to supply a component or by submitting the Proposal to supply the Equipment to provide all required information to support any such audit(s).

III. Buy America(n) Pre-Award, Ongoing, and Post-Delivery Audits

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The Buy America(n) process for this procurement will include pre-award and post-delivery audits. In addition, throughout design and manufacture of the Equipment, Amtrak or their representative(s) will provide ongoing oversight of selected Offeror's Buy American compliance.

The presumptive awardee/Contractor must agree (and get agreement from its suppliers and/or proposed suppliers) to provide to Amtrak or its representatives all relevant documents, including Buy American certifications, waiver requests and justifications, bills of lading or other shipping documents, and any other documents verifying the final assembly location and origin of manufacture for included components. The presumptive awardee/Contractor must also agree (and get agreement from its suppliers and/or proposed suppliers) to give access to manufacturing plants and assembly locations to allow Amtrak or their representatives to complete audits. Information obtained during all audits will be kept confidential to the extent allowed by Federal and State laws.

Pre-award Audit: The pre-award audit will be conducted before Amtrak enters into a formal contract with the presumptive awardee. The pre-award audit may include, at Amtrak's discretion, an inspection of the facility where final assembly is to occur, an inspection of documentation provided by the presumptive awardee detailing the assembly activities that will occur at this facility, procurement documentation, and an inspection of all Buy America(n) Certification Forms and Supplemental Documents provided by suppliers for all included components and site visits to selected component manufacturing plants to verify the assertions made in those certifications. All Buy American Certification Forms submitted by component suppliers shall be signed and dated by the responsible official having knowledge of the origin of manufacture for the particular component(s). Unsigned forms will be rejected. The pre-award audit will take place during the evaluation process or some other time frame as indicated by Amtrak, but prior to Contract Award.

Post-delivery Audit: The post-delivery audit of the first serial production of the Equipment will be completed by Amtrak and/or their representatives before the final acceptance by Amtrak. Amtrak will not accept Equipment if the post-delivery audit cannot be completed to verify the Contractor's compliance with the Buy American requirements.

EXHIBIT M-2

DOMESTIC PREFERENCE/BUY AMERICA(N) ACT CERTIFICATIONS

Bidder/Offeror must complete one of the certifications below indicating whether it can meet the requirements of 49 U.S.C. § 24305(f) and the domestic preference requirements of the Build America, Buy America Act (BABA) § 70914, Pub. L. No. 117-58, div. G, tit. IX, subtitle. A, 135 Stat. 429, 1298 (2021), as implemented by OMB, USDOT, and FRA.

Certificate of Compliance with Domestic Preference/Buy America(n) Requirements
The bidder or offeror hereby certifies that it will comply with the requirements of 49 U.S.C. § 24305(f), and the domestic preference requirements of the BABA, as implemented by OMB, USDOT, and FRA.

Date _____

Signature of Authorized Representative _____

Company _____

Printed Name _____

Title of Authorized Representative _____

REQUEST FOR PROPOSAL ("RFP") – EXHIBIT M-2
UNIVERSAL SINGLE LEVEL FLEET REPLACEMENT PROGRAM
NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)
1 Massachusetts Ave NW, Washington DC 20001

Certificate of Non-Compliance with Domestic Preference/Buy America Buy America(n) Requirements

The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. § 24305(f), and the domestic preference requirements of the BABA, as implemented by OMB, USDOT, and FRA, but it may qualify for an exception to the requirement pursuant to 49 U.S.C. § 24305(f), and the domestic preference requirements of the BABA, as implemented by OMB, USDOT, and FRA.

Date _____

Signature of Authorized Representative _____

Company _____

Printed Name _____

Title of Authorized Representative _____

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EXHIBIT M-3

DOMESTIC PREFERENCE/AMTRAK BUY AMERICA(N) COMPONENT SUPPLIER CERTIFICATION FORM

Offerors' Company Name _____

Component Supplier Company Name and Address:

_____

_____

Component to be Supplied: _____

_____

The above-named supplier hereby certifies that the Components being supplied hereunder are manufactured in the United States in accordance with Amtrak's Domestic Buy Preference Requirements found at 49 USC § 24305 (f) and the and the domestic preference requirements of the Build America, Buy America Act (BABA) § 70914, Pub. L. No. 117-58, div. G, tit. IX, subtitle. A, 135 Stat. 429, 1298 (2021), as implemented by OMB, USDOT, and FRA.

Authorizing Signature:_____ Date: _____

Name: _____ Title: _____

Phone: _____Email: _____

REQUEST FOR PROPOSAL ("RFP") – EXHIBIT M-3
UNIVERSAL SINGLE LEVEL FLEET REPLACEMENT PROGRAM
NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)
1 Massachusetts Ave NW, Washington DC 20001

The above-named supplier hereby certifies that the Components being supplied hereunder are NOT manufactured in the United States in accordance with Amtrak's Domestic Buy Preference Requirements found at 49 USC § 24305 (f) and the and the domestic preference requirements of the Build America, Buy America Act (BABA) § 70914, Pub. L. No. 117-58, div. G, tit. IX, subtitle. A, 135 Stat. 429, 1298 (2021), as implemented by OMB, USDOT, and FRA.

Authorizing Signature:_____ Date: _____

Name: _____ Title: _____

Phone: _____Email: _____

Exhibit M-4 Representative List of Car Components

No.	Component
	STRUCTURE AND EXTERIOR/INTERIOR
1	Vehicle Body
1.1	Shell structure/frame - end, floor, roof, side
1.2	Integrated cab/CEM structure
2	Vehicle Fitting Out
2.1a	Windows - door
2.1b	Windows - side
2.1c	Windows - end (windscreens)
2.2	Floor substructures
2.3	Floor coverings and carpeting
2.4	Thresholds
2.5	Interior paneling
2.6	Glass partitions
2.7	Obstacle deflectors
2.8	Exterior appurtenances - skirts, handrails
2.9	Vehicle paintwork
2.10	Sound and thermal insulations
	INTERIOR APPOINTMENTS
3	Interior Appointments
3.1	Interior appointments (e.g. interior fittings, fabric furnishings, etc.)
3.2	Interior appurtenances - handles, stanchions
3.3a	Seats - passengers (regular and fold-down)
3.3b	Seats - driver
3.4	Tables
3.5	Restroom fresh water tanks
3.6	Toilets
3.7	Restroom retention tanks
3.8	Luggage racks and partitions
3.9	Suitcase racks
3.10	Bicycle/surf board racks
3.11	Food storage equipment
3.12	Galleys
	BOGIES AND SUSPENSIONS
4	Running Gear
4.1	Bogie frames (where applicable) , mounts for propulsion system, suspension system supports, safety add-ons
4.2	Wheelset (incl. bearings, axles, wheels)
4.3	Suspension systems (primary, secondary, and emergency support)
4.3	Dampers
4.5	Tilting systems/technologies
4.6	Wheelset guides
4.7	Stabilizers
	TRACTION/ELECTRICAL EQUIPMENT
5	Power System/Drive Unit
5.1	Traction Converter (incl. converter, inverter, rectifier, chopper)

5.2	Transformers
5.3	Traction motors
5.4	Pantographs
5.5	Lightning arrestor
5.6a	Gearbox
5.6b	Gears
5.7	Traction-brake resistors
5.8	Switchgears and associated components
5.9	Batteries and other storage devices
TRAIN OPERATION CONTROLS	
6	Control Apparatus for Train Operation
6.1	Power supply controls/on-board computers
6.2	Traction Control Unit
6.3	Brake Control Unit
6.4	Train control devices
6.5	Wheel slip and slide protection - speed sensors
6.6	System data acquisition/fault storage devices - measurement and logging devices
AUXILIARY EQUIPMENT	
7	Auxiliary Operating Equipment
7.1	Auxiliary converter/transformer
7.2	Battery charger
7.3	Onboard supply system - outlets
7.4	Traction converter cooling unit
7.5	Traction motor blower
TRAIN CONTROL AND MONITORING SYSTEM AND SAFETY DEVICES	
8	Monitoring and Safety Devices
8.1	Diagnostics equipment (incl. brake and speed indicators)
8.2	Event recorders
8.3	Smoke detectors
8.4	Fire extinguishers, fire detection and suppression system
8.5	Automatic Train Control system (incl. ATO)
8.6	Positive Train Control system
8.7	Driver's vigilance and deadman systems
8.8	Horns and warning bells
8.9	Data transmission devices
8.10	Communication equipment - train radio
8.11	Exterior and interior cameras
8.12	Windscreen cleaning facilities
LIGHTING SYSTEM	
9	Lighting
9.1	Exterior lighting equipment - flashing lights, auxiliary lights, headlights, marker lights, etc.
9.2	Interior lighting equipment - console lighting, driver's cab lighting, emergency lighting, instrument lighting, equipment room lighting, passenger cabin lighting, reading lights, etc.
HVAC SYSTEM	
10	Air Conditioning
10.1	Air conditioning unit (incl. ventilation, condensers, filtering system, heat exchangers, controllers, regulators, pressure protection elements)
10.2	Air intakes and outlets

10.3	Compressors
10.4	Heaters
10.5	Air distribution elements - ducts, pumps, pipes
	ANCILLARY EQUIPMENT
11	Ancillary Operating Equipment
11.1	Sanding equipment
11.2	Lubricating equipment
	DOOR SYSTEM
12	Doors, Entrances
12.1	Passenger door panels
12.2	Cab door panels
12.3	Exterior door actuators
12.4	Exterior door controls
12.5	Interior door panels
12.6	Interior door actuators
12.7	Interior door controls
12.8	Ladders
	COMMUNICATION SYSTEM
13	Information Facilities
13.1	Passenger information system - digital displays
13.2	Passenger information system - signage
13.3	Train/car number indicators
13.4	Radio system
13.5	Video system
13.6	Advertising
13.7	PA/IC systems, telecommunications
	PNEUMATIC/HYDRAULIC EQUIPMENT
14	Pneumatic/Hydraulic Equipment
14.1	Air compressors
14.2	Air dryers/water collectors
14.3	Air reservoirs
14.4	Compressed air hoses
14.5	Release devices
14.6	Piping
	BRAKE SYSTEM
15	Brake
15.1	Disc brake equipment
15.2	Tread brake equipment/tread cleaners
15.3	Eddy current brake equipment
15.4	Brake valves
15.5	Parking brake units
15.6	Hoses and connectors
15.7	Fittings and couplings
15.8	Brake mechanics
	COUPLER SYSTEM
16	Vehicle Linkage Devices
16.1	Automatic coupler (incl. signal, power, air, electric couplings)
16.2	Intercar coupler

16.3	Towing gear - coupler adapters
16.4	Gangway/gangway facilities
	ENCLOSURES
17	Carrier Systems, Enclosures
17.1	Battery boxes
17.2	Distribution boxes
17.3	Traction Converter Box
17.4	Auxiliary Converter Unit Box
17.5	Underfloor Box for eletric equipment
17.6	Traction Converter Cooling Unit Rack
17.7	Brake System Rack
17.8	Pressure Air Reservoir Rack
17.9	Traction Motor Housing
17.10	HVAC Exhaust Air Blower Rack
17.11	Steel or Aluminium Equipment Cabinets
17.12	Non-Steel or Non-Aluminium Equipment Cabinets
17.13	Control and display units
18	Electrical Wiring
18.1	Wiring and Assembly of Electrical Cabinets
18.2	Wiring and Assembly of Drivers Desk
18.3	Wiring and Assembly of Car Control Panel
18.4	Wiring and Assembly of Under Floor Equipment Containers
18.5	Cable ducts, pipes, flexible tubes

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Exhibit M-4 Representative List of Car Components

No.	Component
	STRUCTURE AND EXTERIOR/INTERIOR
1	Vehicle Body
1.1	Shell structure/frame - end, floor, roof, side
1.2	Integrated cab/CEM structure
2	Vehicle Fitting Out
2.1a	Windows - door
2.1b	Windows - side
2.1c	Windows - end (windscreens)
2.2	Floor substructures
2.3	Floor coverings and carpeting
2.4	Thresholds
2.5	Interior paneling
2.6	Glass partitions
2.7	Obstacle deflectors
2.8	Exterior appurtenances - skirts, handrails
2.9	Vehicle paintwork
2.10	Sound and thermal insulations
	INTERIOR APPOINTMENTS
3	Interior Appointments
3.1	Interior appointments (e.g. interior fittings, fabric furnishings, etc.)
3.2	Interior appurtenances - handles, stanchions
3.3a	Seats - passengers (regular and fold-down)
3.3b	Seats - driver
3.4	Tables
3.5	Restroom fresh water tanks
3.6	Toilets
3.7	Restroom retention tanks
3.8	Luggage racks and partitions
3.9	Suitcase racks
3.10	Bicycle/surf board racks
3.11	Food storage equipment
3.12	Galleys
	BOGIES AND SUSPENSIONS
4	Running Gear
4.1	Bogie frames (where applicable) , mounts for propulsion system, suspension system supports, safety add-ons
4.2	Wheelset (incl. bearings, axles, wheels)
4.3	Suspension systems (primary, secondary, and emergency support)
4.3	Dampers
4.5	Tilting systems/technologies
4.6	Wheelset guides
4.7	Stabilizers
	TRACTION/ELECTRICAL EQUIPMENT
5	Power System/Drive Unit
5.1	Traction Converter (incl. converter, inverter, rectifier, chopper)
5.2	Transformers
5.3	Traction motors
5.4	Pantographs
5.5	Lightning arrestor
5.6a	Gearbox
5.6b	Gears

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5.7	Traction-brake resistors
5.8	Switchgears and associated components
5.9	Batteries and other storage devices
	TRAIN OPERATION CONTROLS
6	Control Apparatus for Train Operation
6.1	Power supply controls/on-board computers
6.2	Traction Control Unit
6.3	Brake Control Unit
6.4	Train control devices
6.5	Wheel slip and slide protection - speed sensors
6.6	System data acquisition/fault storage devices - measurement and logging devices
	AUXILIARY EQUIPMENT
7	Auxiliary Operating Equipment
7.1	Auxiliary converter/transformer
7.2	Battery charger
7.3	Onboard supply system - outlets
7.4	Traction converter cooling unit
7.5	Traction motor blower
	TRAIN CONTROL AND MONITORING SYSTEM AND SAFETY DEVICES
8	Monitoring and Safety Devices
8.1	Diagnostics equipment (incl. brake and speed indicators)
8.2	Event recorders
8.3	Smoke detectors
8.4	Fire extinguishers, fire detection and suppression system
8.5	Automatic Train Control system (incl. ATO)
8.6	Positive Train Control system
8.7	Driver's vigilance and deadman systems
8.8	Horns and warning bells
8.9	Data transmission devices
8.10	Communication equipment - train radio
8.11	Exterior and interior cameras
8.12	Windscreen cleaning facilities
	LIGHTING SYSTEM
9	Lighting
9.1	Exterior lighting equipment - flashing lights, auxiliary lights, headlights, marker lights, etc.
9.2	Interior lighting equipment - console lighting, driver's cab lighting, emergency lighting, instrument lighting, equipment room lighting, passenger cabin lighting, reading lights, etc.
	HVAC SYSTEM
10	Air Conditioning
10.1	Air conditioning unit (incl. ventilation, condensers, filtering system, heat exchangers, controllers, regulators, pressure protection elements)
10.2	Air intakes and outlets
10.3	Compressors
10.4	Heaters
10.5	Air distribution elements - ducts, pumps, pipes
	ANCILLARY EQUIPMENT
11	Ancillary Operating Equipment
11.1	Sanding equipment
11.2	Lubricating equipment
	DOOR SYSTEM
12	Doors, Entrances
12.1	Passenger door panels
12.2	Cab door panels

12.3	Exterior door actuators
12.4	Exterior door controls
12.5	Interior door panels
12.6	Interior door actuators
12.7	Interior door controls
12.8	Ladders
	COMMUNICATION SYSTEM
13	Information Facilities
13.1	Passenger information system - digital displays
13.2	Passenger information system - signage
13.3	Train/car number indicators
13.4	Radio system
13.5	Video system
13.6	Advertising
13.7	PA/IC systems, telecommunications
	PNEUMATIC/HYDRAULIC EQUIPMENT
14	Pneumatic/Hydraulic Equipment
14.1	Air compressors
14.2	Air dryers/water collectors
14.3	Air reservoirs
14.4	Compressed air hoses
14.5	Release devices
14.6	Piping
	BRAKE SYSTEM
15	Brake
15.1	Disc brake equipment
15.2	Tread brake equipment/tread cleaners
15.3	Eddy current brake equipment
15.4	Brake valves
15.5	Parking brake units
15.6	Hoses and connectors
15.7	Fittings and couplings
15.8	Brake mechanics
	COUPLER SYSTEM
16	Vehicle Linkage Devices
16.1	Automatic coupler (incl. signal, power, air, electric couplings)
16.2	Intercar coupler
16.3	Towing gear - coupler adapters
16.4	Gangway/gangway facilities
	ENCLOSURES
17	Carrier Systems, Enclosures
17.1	Battery boxes
17.2	Distribution boxes
17.3	Traction Converter Box
17.4	Auxiliary Converter Unit Box
17.5	Underfloor Box for eletric equipment
17.6	Traction Converter Cooling Unit Rack
17.7	Brake System Rack
17.8	Pressure Air Reservoir Rack
17.9	Traction Motor Housing
17.10	HVAC Exhaust Air Blower Rack
17.11	Steel or Aluminium Equipment Cabinets
17.12	Non-Steel or Non-Aluminium Equipment Cabinets

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17.13	Control and display units
18	Electrical Wiring
18.1	Wiring and Assembly of Electrical Cabinets
18.2	Wiring and Assembly of Drivers Desk
18.3	Wiring and Assembly of Car Control Panel
18.4	Wiring and Assembly of Under Floor Equipment Containers
18.5	Cable ducts, pipes, flexible tubes

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EXHIBIT N

PARENT GUARANTY

THIS PARENT GUARANTY ("Guaranty"), dated as of _____ __, 2026, is made by _____, a corporation organized under the laws of the State of _____, ("Guarantor"), in favor National Railroad Passenger Corporation, a corporation organized under the laws of the District of Columbia, United States ("Amtrak").

WHEREAS, _____*[enter name of Guarantor's subsidiary – Primary Obligor]*_____, a _*[enter State of incorporation]*_____ corporation ("Primary Obligor"), is a subsidiary of Guarantor; and

WHEREAS, the Primary Obligor executed and delivered Contract *[enter contract number*_____dated _____, titled _____ which contain or evidence obligations in favor of Amtrak (together with all amendments, extensions, renewals, replacements, consolidations and replacements, and all related documents, agreements, and instruments now or in the future related to or in respect of the foregoing, are hereafter referred to as the "Contract" and all obligations, liabilities and indebtedness of Primary Obligor to Amtrak now or hereafter arising out of or under the Contract, are hereafter referred to as the "Contract Obligations"); and

WHEREAS, Guarantor may derive substantial direct and indirect benefit from the transactions and/or consideration resulting from the Contract Obligations and Amtrak requires this Guaranty be executed and delivered by Primary Obligor as set forth in the Contract.

NOW, THEREFORE, in consideration of the mutual promises and agreements contained herein, the parties agree as follows:

1. Guaranty. Guarantor hereby unconditionally and irrevocably guarantees, in accordance with the terms of this Guaranty, to Amtrak, and its successors and assigns, the full and prompt payment and performance when due of the Contract Obligations and all the indebtedness, liabilities and other obligations of the Primary Obligor to Amtrak pursuant to the Contract. The foregoing indebtedness, liabilities and other obligations of the Primary Obligor, and all other indebtedness, liabilities and obligations to be paid or performed by Guarantor in connection with this Guaranty (including any and all amounts due under Section 11 hereof), shall hereinafter be collectively referred to as the "Obligations." In the event of default, non-payment or other non-compliance by the Primary Obligor in performance of any of the Contract Obligations and the expiration without cure of any applicable cure period in accordance with the Contract, Guarantor shall, within five (5) business days of receipt of written demand from Amtrak, pay or perform such Contract Obligations.

2. Payment. All payments by Guarantor to Amtrak shall be made in United States Dollars. This Guaranty and Guarantor's liability with respect to the Obligations shall remain in full force and effect without regard to and shall not be impaired or affected by (a) any insolvency, bankruptcy, reorganization, assignment for the benefit of creditors or other insolvency proceeding of the Primary Obligor, (b) any merger or change of structure of the Primary Obligor or Guarantor, and (c) any amendment, extension or modification of the Contract or Contract Obligations.

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3. Consents. Guarantor hereby consents and agrees that, without notice to or further assent from Guarantor: (i) the time, manner, place or terms of any payment or performance of the Contract Obligations may be extended or changed, including by an increase or decrease in the interest rate on any Obligation or any fee or other amount payable under the Contract Obligations, by a modification or renewal of the Contract Obligations agreed to by Primary Obligor and Amtrak; (ii) the time for Primary Obligor's performance of or compliance with any term, covenant or agreement on its part to be performed or observed under the Contract Obligations may be extended, or such performance or compliance waived, or failure in or departure from such performance or compliance consented to, all in such manner and upon such terms as Amtrak may deem proper; (iii) Amtrak may discharge or release, in whole or in part, any other guarantor or any other person or entity ("Person") liable for the payment and performance of all or any part of the Obligations, and may permit or consent to any such action or any result of such action, nor shall Amtrak be liable to Guarantor for any failure to collect or enforce payment of the Obligations; (iv) Amtrak may request and accept other guaranties of the Obligations and may, from time to time, in whole or in part, surrender, release, subordinate, modify, waive, rescind, compromise or extend any such guaranty and may permit or consent to any such action or the result of any such action; (v) Amtrak may exercise, or waive or otherwise refrain from exercising, any other right, remedy, power or privilege granted by the Contract Obligations, or otherwise available to Amtrak, with respect to the Obligations and any collateral therefor, even if the exercise of such right, remedy, power or privilege affects or eliminates any right of subrogation or any other right of Guarantor against Primary Obligor, and (vi) Amtrak may pursue relief under other security provided by Primary Obligor or any other Person, at any time to secure the Obligations, and may, from time to time, in whole or in part, exchange, surrender, release, waive, rescind, modify, extend, or compromise such security all as Amtrak may deem advisable, and all without impairing, abridging, releasing or affecting this Guaranty; provided, however, that in no event shall Amtrak receive duplicate recovery under this Guaranty for the same Contract Obligations for which any recovery or payment has already been received or made from any collateral, bond, letter of credit or other security, with respect to the Contract Obligations.

4. Waivers. (a) Guarantor waives and agrees not to assert: (i) any right to require Amtrak to proceed against Primary Obligor any other guarantor or any other Person, to proceed against or exhaust any letter of credit, bonds, collateral or other security held for the Obligations (except to the extent required by applicable law), to give notice of or institute any public or private sale, foreclosure, or other disposition of any collateral or security for the Obligations, including, without limitation, to comply with provisions of the Uniform Commercial Code ("UCC") applicable to the Obligations, the Contract Obligations, or transactions contemplated by them, or any equivalent provision of any other applicable law in connection with the sale, foreclosure, or other disposition of any collateral or to pursue any other right, remedy, power or privilege of Amtrak whatsoever; (ii) any defense arising by reason of any lack of corporate or other authority or any other defense of Primary Obligor, Guarantor or any other Person; (iii) any defense to the enforcement of this Guaranty or any rights of Amtrak created or granted hereby or to the recovery by Amtrak against Primary Obligor or any other Person liable therefor of any deficiency after a judicial or nonjudicial foreclosure or sale, even though such a foreclosure or sale may destroy or impair the subrogation rights of Guarantor or the right of Guarantor to proceed against Primary Obligor or any other obligor of the Obligations for reimbursement; (b) Guarantor waives any and all notice of the acceptance of this Guaranty, and any and all notice of the creation, modification, or accrual of the Obligations, or the reliance by Amtrak upon this Guaranty, or the exercise of any right, power or privilege hereunder. The Obligations shall conclusively be deemed to have been created, contracted, incurred and permitted to exist in reliance upon this Guaranty. Guarantor waives promptness, diligence, presentment, protest, demand for payment, notice of default, dishonor or nonpayment and all other notices to or upon Primary Obligor, Guarantor or any other Person with

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respect to the Obligations. (c) Upon the occurrence and during the continuance of any Default (as hereinafter defined), a separate action or actions may be brought against Guarantor, whether or not Primary Obligor or any such other guarantor is joined therein or a separate action or actions are brought against Primary Obligor or any such other guarantor. (d) Guarantor shall not have any right to require Amtrak to obtain or disclose any information with respect to (i) the financial condition or character of Primary Obligor or the ability of Primary Obligor to pay and perform the Obligations; or (ii) the existence or nonexistence of any other guaranties of all or any part of the Obligations. For the avoidance of doubt, Guarantor shall be entitled to all defenses, limitations and exclusions available to the Primary Obligor under the Contract.

5. Corporate Interest. The Guarantor hereby unconditionally and irrevocably declares and warrants to Amtrak, and its successors, transferees, and assigns that its obligations pursuant to this Guaranty do not include any obligation which if incurred would constitute a violation to its corporate interest.

6. Continuing Guaranty. Guarantor agrees that this Guaranty is a continuing guaranty relating to any Obligations, including Obligations which may exist continuously or which may arise from time to time, and Guarantor expressly acknowledges that this Guaranty shall remain in full force and effect notwithstanding that there may be periods in which no Obligations exist. This Guaranty shall continue to be effective or shall be reinstated and revived, as the case may be, if, for any reason, any payment of the Obligations by or on behalf of Primary Obligor shall be rescinded or must otherwise be restored by Amtrak, whether as a result of proceedings in bankruptcy or reorganization or otherwise. To the extent any payment is rescinded or restored, the Obligations shall be revived in full force and effect without reduction or discharge for such payment.

7. Payments. Guarantor hereby agrees, in furtherance of the foregoing provisions of this Guaranty that any payments made with respect to a Default hereunder (defined below) shall include interest which, but for the filing of a petition in bankruptcy with respect to Primary Obligor, would have accrued on such Obligations, whether or not a claim is allowed against Primary Obligor for such interest in any such bankruptcy proceeding. All payments made by Guarantor hereunder may be applied in such order as Amtrak shall elect. As used herein, "Default" means any of the following: (a) Primary Obligor shall fail to pay when due or perform any of the Contract Obligations, in accordance with the terms of the Contract; (b) Guarantor shall fail in any material respect to perform or observe any term, covenant or agreement contained in this Guaranty on its part to be performed or observed; or (c) (i) Primary Obligor or Guarantor shall admit in writing its inability to, or shall fail generally or be generally unable to, pay its debts as they become due, or shall make a general assignment for the benefit of creditors, or shall file a voluntary petition in bankruptcy or a petition or answer seeking reorganization, to effect a plan or other arrangement with creditors or any other relief under the Bankruptcy Code or under any other state or federal law relating to bankruptcy or reorganization granting relief to debtors, whether now or hereafter in effect (collectively, "Bankruptcy Laws"), (ii) Primary Obligor or Guarantor shall be adjudicated a bankrupt, or shall make an assignment for the benefit of creditors, or shall apply for or consent to the appointment of any custodian, receiver or trustee for all or any substantial part of Primary Obligor's or Guarantor's property, or shall take any action to authorize any of the actions set forth above in this clause, or (iii) an involuntary petition seeking any of the relief specified in this clause shall be filed against Primary Obligor or Guarantor, or any order for relief shall be entered against Primary Obligor or Guarantor in any involuntary proceeding under any Bankruptcy Laws.

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8. Notices. All notices and other communications provided for hereunder shall, unless otherwise stated herein, be in writing (including by facsimile) and shall be mailed, sent via facsimile or delivered by hand (i) if to Amtrak, to the following address:

National Railroad Passenger Corporation (Amtrak)
Law Department
1 Massachusetts Ave., NW
Washington, D.C. 20001

and (ii) if to Guarantor, at or to its address or facsimile number set forth below its name on the signature page hereof, or at or to such other address or facsimile number as such party shall have designated in a written notice to the other party. All such notices and communications shall be effective upon receipt.

9. No Waiver. No failure on the part of Amtrak to exercise, and no delay in exercising, any right, remedy, power or privilege hereunder shall operate as a waiver thereof, nor shall any single or partial exercise of any such right, remedy, power or privilege preclude any additional exercise thereof or the exercise of any other right, remedy, power or privilege, provided that recovery from such exercise of rights is without duplication of any other recovery obtained from rights exercised under the Contract, or any collateral, bond, letter of credit or other guaranty, with respect to the Contract Obligations.

10. Costs and Expenses. Guarantor agrees to pay all costs and expenses of Amtrak and fees and disbursements of counsel reasonably expended and justified in connection with the good faith enforcement or attempted enforcement, or preservation of any rights under this Guaranty, necessitated by Guarantor's failure to comply with its Obligations hereunder.

11. Guarantor Defenses. Except as provided in the prior paragraph, (a) unless the Primary Obligor has been discharged or otherwise excused from payment or performance of its obligations secured by this Guaranty pursuant to a bankruptcy, insolvency, reorganization, receivership or similar proceedings, the Guarantor shall not, under this Guaranty or any of its provisions, have any greater obligations or liability than the Primary Obligor under the Contract, and (b) the limitations and exclusions of obligations and liability of the Primary Obligor included in the Contract shall equally limit and exclude liability and obligations of the Guarantor under this Guaranty, (c) the Guarantor's cumulative liability hereunder shall be limited to the Contract Amount, which upon the effective date hereof is $[ ], and (d) in the event of any claim under this Guaranty, the Guarantor shall be entitled to assert any defense, set-off or counterclaim that the Primary Obligor could assert had such claim been made directly against the Primary Obligor under the Contract arising out of Amtrak's failure to perform or breach of the Contract. For avoidance of doubt, these defenses, setoffs and counterclaims do not include (i) defenses arising from the insolvency, reorganization, or bankruptcy of the Primary Obligor and (ii) defenses previously asserted by the Primary Obligor against such claims to the extent such defenses have been finally resolved in Amtrak's favor either by the parties or by a court of last resort or by arbitration conducted pursuant to the Contract.

12. Binding Effect; Entire Agreement; Amendments. This Guaranty shall be binding upon Guarantor and its successors and assigns, and inure to the benefit of and be enforceable by Amtrak and its successors, transferees and assigns, as permitted under the terms of the Contract; provided that Guarantor shall not have the right to assign or transfer its rights and obligations hereunder without the prior written consent of Amtrak. This Guaranty constitutes the entire

agreement of Guarantor with respect to the matters set forth herein and supersedes any prior agreements, commitments, discussions and understandings, oral or written, with respect thereto. There are no conditions to the full effectiveness of this Guaranty. This Guaranty may not be amended except by a writing signed by Guarantor and Amtrak. No waiver of any rights of Amtrak under any provision of this Guaranty or consent to any departure by Guarantor therefrom shall be effective unless in writing and signed by Amtrak. Any such amendment, waiver or consent shall be effective only in the specific instance and for the specific purpose for which given.

13. Severability. Whenever possible, each provision of the Guaranty shall be interpreted in such manner as to be effective and valid under all applicable laws and regulations. If, however, any provision of this Guaranty shall be prohibited by or invalid under any such law or regulation, it shall be deemed modified to conform to the minimum requirements of such law or regulation, or, if for any reason it is not deemed so modified, it shall be ineffective and invalid only to the extent of such prohibition or invalidity without affecting the remaining provisions of this Guaranty.

14. Governing Law. This Guaranty shall be governed by, and construed in accordance with, the law of the District of Columbia, United States.

15. Arbitration. Any dispute, controversy or claim between Guarantor and Amtrak arising out of or relating to this Guaranty, including the formation, interpretation, breach or termination thereof, and including whether the claims asserted are arbitrable, will be referred to and finally determined by arbitration in accordance with the JAMS International Arbitration Rules. The Tribunal will consist of three arbitrators, each (and not just the chair) chosen in accordance with JAMS International Arbitration Rule 7.5 (or any successor rule to that rule). The Chair of the arbitration panel should be an attorney with at least 20 years of active litigation experience or be a retired judge. The place of arbitration will be Washington, D.C. The language to be used in the arbitral proceedings will be English. Judgment upon the award rendered by the arbitrator(s) may be entered in any court having jurisdiction thereof. The arbitral award will be deemed final and definitive, binding the parties, which expressly waive any appealing procedure. Notwithstanding, each party reserves the right to access the competent courts with the purpose of (i) assuring the arbitration, (ii) obtaining provisional remedy for the protection of rights before the arbitration is initiated, and (iii) enforcing any decision of the arbitration panel, including, without limitation, the arbitral award. The arbitration award may be enforced in any country having jurisdiction over a party or the parties.

16. Consent to Jurisdiction. If for any reason notwithstanding the arbitration provisions of this Guaranty, resort to courts for judicial relief is necessary or appropriate, (a) Guarantor consents to the jurisdiction and venue of the United States District Court for the District of Columbia in any suit, action or proceeding brought by Amtrak against Guarantor in connection with or arising from this Guaranty, and (b) Guarantor further agrees that any suit, action or proceeding brought by Guarantor against Amtrak in connection with this Guaranty shall be brought solely in the United States District Court for the District of Columbia. Once a final judgment, order or award is issued in arbitration (or if for any reason arbitration is not utilized, by any court) in favor of Amtrak, the judgment, order or award may be enforced by Amtrak in any court of competent jurisdiction, including those of England.

17. Waiver of Jury Trial. ***The parties knowingly, voluntarily and with advice of counsel, waive trial by jury in an action or proceeding arising out of this Guaranty or the underlying transactions or Obligations contemplated or covered by it.***

[Next page – Signature page]

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IN WITNESS WHEREOF, Guarantor has executed and delivered this Guaranty by its duly authorized officer, as of the date first above written.

GUARANTOR

_____

By: _____

Print Name:

Title:

Address:

Attn: _____

Fax: _____

E-Mail Address:

ACCEPTED AND AGREED BY:
NATIONAL RAILROAD PASSENGER CORPORATION
FOR ITSELF AND ITS SUCCESSORS, TRANSFEREES AND ASSIGNS

By: _____

Print Name:

Title:

Address:

Attn: _____

Fax: _____

E-Mail Address:

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EXHIBIT P

FINANCIAL CAPABILITY SUBMITTAL REQUIREMENTS

The financial capability of the Offeror will be evaluated as part of the financial proposal. This exhibit provides the submittal requirements from the Offeror for financial capability.

Financial information described below should be packaged separately for each entity with a cover sheet identifying the name of the organization and its role in the Offeror organization (i.e., Offeror, Equity Member, or Guarantor). Offerors shall identify any information, which it believes is entitled confidential by placing the word "confidential" on each page as described.

1. Financial Statements and Credit Ratings

Financial statements for the Offeror, each Equity Member of Offeror, and each Guarantor for the three most recent completed fiscal years must be provided to demonstrate financial capability of the Offeror. If the entity has been in existence for less than 3 fiscal years, Offeror should expressly state that such entity has been in existence for less than 3 fiscal years and shall provide financial statements for the number of fiscal years it has been in existence.

Financial statement information must include:

1.1. Opinion Letter (Auditor's Report), required for those financial statements that are audited

1.2. Balance Sheet

1.3. Income Statement

1.4. Statement of Changes in Cash Flow

1.5. Footnotes, required for those financial statements that are audited.

In addition, financial statements must meet the following requirements:

1.6. GAAP - Financial statements must be prepared in accordance with U.S. Generally Accepted Accounting Principles ("U.S. GAAP") or International Financial Reporting Standards ("IFRS"). If financial statements are prepared in accordance with principles other than U.S. GAAP or IFRS, a letter must be provided from a certified public accountant discussing the areas of the financial statements that would be affected by a conversion to U.S. GAAP or IFRS. A restatement of the financial information in accordance with U.S. GAAP or IFRS is not required.

1.7. U.S. Dollars - Financial statements must be provided in U.S. dollars, if available. If financial statements are not available in U.S. dollars, the Offeror must include summaries of the Income Statements and Balance Sheets for the applicable time- periods converted to U.S. dollars by a certified public accountant.

1.8. Audited – Fiscal year-end financial statements must be audited by an independent party qualified to render audit opinions (e.g. a certified public accountant). If audited financials are not available for an entity, the Proposal shall include unaudited financial statements for such entity, certified as true, correct, and accurate by the chief executive officer, chief financial officer, treasurer, or similar position of the entity.

1.9. English - Financial statement information must be prepared in English. If audited financial statements are prepared in a language other than English, translations of all financial statement information must be provided with the original financial statement information.

1.10. Newly Formed Entity - If the Offeror is a newly formed entity and does not have independent financial statements, financial statements for the Equity Members shall be provided (and the Offeror shall expressly state that the Offeror is a newly formed entity and does not have independent financial statements).

1.11. Guarantee - Financial statements of each Guarantor must be provided to demonstrate financial capability of the Offeror. The Offeror shall note that Amtrak may, in its discretion and based upon the review of the information provided, specify that another acceptable Guarantor is required.

1.12. SEC Filings - If the Offeror or any other entity for whom financial information is submitted hereby files reports with the Securities and Exchange Commission, then such financial statements shall be provided through a copy of their annual report on Form 10K or Form 20F. For all subsequent quarters, provide a copy of any report filed on Form 10Q, Form 8-K, or Form K-6, which has been filed since the latest filed 10K or 20F.

1.13. Notes and Disclosures – Notes and disclosures to the financial statements shall address any material changes in financial condition as described herein and report any off- balance sheet liabilities.

1.14. Credit Ratings - If available, credit ratings and credit rating reports must be supplied for each Offeror, Equity Member, and Guarantor that submits financial statements with its Proposal. If credit ratings do not exist for any Offeror, Equity Member, or Guarantor that has submitted financial statements with its Proposal, then the Proposal must include a statement specifying that no credit ratings exist for that entity.

2. Material Changes in Financial Condition

Information regarding any Material Changes in Financial Condition for Offeror, each Equity Member, and Guarantor for the past 3 years and anticipated for the next reporting period must be provided with the Proposal. Financial statements dated more than 12 months prior to the Close Date shall include a letter from the affected entity's chief financial officer or treasurer or an independent auditor's statement disclosing any Material Change that has occurred or is pending since the date of the financial statements.

If no Material Change has occurred and none is pending, the Offeror, Equity Member, or Guarantor, as applicable, shall provide a letter from its chief executive, chief financial officer, treasurer, or similar position so certifying. At the discretion of Amtrak, any

failure to disclose a prior or pending Material Change may result in disqualification from further

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participation in the selection process.

In instances where a Material Change has occurred or is anticipated, the affected entity shall provide a statement describing the following:

2.1. Each Material Change in detail;

2.2. The likelihood that the developments will continue during the period of performance for the Contract; and

2.3. The projected full extent of the changes likely to be experienced in the periods ahead.

Estimates of the impact on revenues, expenses, and the change in equity shall be provided separately for each Material Change as certified by the chief executive, chief financial officer or treasurer or similar position. References to the notes in the financial statements are not sufficient to address the requirement to discuss the impact of Material Changes.

Where a Material Change will have a negative financial impact, the affected entity shall also provide a discussion of measures that would be undertaken to insulate the Project from any recent material changes and those currently in progress or reasonably anticipated in the future. If the financial statements indicate that expenses and losses exceed income in each of the 3 completed fiscal years (even if there has not been a material change), the affected entity shall provide a discussion of measures that will be undertaken to make the entity profitable in the future and an estimate of when the entity will be profitable.

The Offeror must disclose to Amtrak any Material Change that occurs after it has submitted its Proposal. Failure to disclose any Material Change that occurred after submission of its Proposal may result in disqualification, at the sole discretion of Amtrak.

3. Guarantor Letter of Support

The Proposal must include a letter from the chief executive, chief financial officer, treasurer, or similar position of each Guarantor explicitly stating that it will guarantee both the performance and financial obligations of the entity on behalf of which it is providing a guarantee.

The Guarantor's financial information shall be used for purposes of evaluating the affected member's financial capability. Following review of the financial information provided and the letter of support, Amtrak may, in its sole discretion, specify that an additional guarantee will be required in order to demonstrate financial capability.

4. Security

The Offeror shall provide a statement certified by the chief financial officer or treasurer of the Proposer that it will be able to obtain all required performance security as required under Section 6 of Exhibit A-1. The Offeror shall also identify the Qualified Issuer(s) that will provide any performance security under the contract and its rating information.

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5. Off-Balance Sheet Liabilities

A letter from the Chief Financial Officer or treasurer of the entity or the certified public accountant for each entity for which financial information shall be submitted, identifying all off- balance sheet liabilities. References to notes in the financial statements are not sufficient for identifying all off-balance sheet liabilities. If no off-balance sheet liabilities exist, then a letter certified by the Chief Financial Officer or treasurer of the entity shall be provided stating that no off-balance sheet liabilities exist.

6. Financing Sources

While the Offeror is not required to arrange or bring financing to deliver the project, should the Offeror intend to use financing to deliver the project, then the Offeror shall describe their plan for financing the project including:

6.1. Identity of the lenders or investors anticipated to be used;

6.2. Amounts, types and purpose of each financing facility to be used;

6.3. Letters of commitment from the anticipated lenders and/or investors;

6.4. Term sheets for each facility stating the costs, terms, and other assumptions used to calculate financing costs and amounts, and.

6.5. The proposed steps for arranging and closing financing.

7. Major Agreements

The Offeror shall provide the major agreements between the Offeror and its major participants. The major agreements include, but are not limited to, subcontracts, financing agreements, equity agreements, commitment letters, and parent guarantees.

The Offeror shall submit updated agreements to provide sufficient evidence to support the Offeror's ability to deliver the Project according to its Financial Proposal.

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Exhibit Q-1 - Milestone Payment Schedule

Milestone #	Description	Payment % of Total Contract Amount at the time Milestone is met (5% of each payment will be added to reflect Retainage).
	Mobilization	
1	Performance Securities and Insurance submitted by Contractor, Issuance of NTP, completion of Kick-off Meetings and completion of detailed Specification review	1.0%
	Pre-Design Review	
2	Amtrak approval of Project Schedule and Project Management Plan including engineering and production schedules, System Integration Plan and Quality Assurance Program Plan (CDRL 3-01; CDRL 3-02; CDRL 3-05; CDRL 5-01)	1.5%
3	Amtrak approval of Reliability Program Plan and Reliability Prediction Summary Report (CDRL 4-01; CDRL 4-03)	0.5%
4	Amtrak approval of System Safety Program Plan (CDRL 25-01)	0.5%
5	Amtrak approval of Test and Inspection Plan (CDRL 5-15, CDRL 20-02)	0.5%
6	Amtrak approval of Training Plan (CDRL 23-01)	0.5%
7	Amtrak approval of Master Manual Plan (CDRL 23-08)	0.5%
	Design Reviews	
8	Amtrak approval of Preliminary Design Review (CDRL 3-09)	1.0%
9	Amtrak approval of Intermediate Design Review (CDRL 3-18)	1.0%
10	Amtrak approval of Preventative Maintenance Schedule and Mean Time to Repair (CDRL 4-07)	0.5%
11	Amtrak approval of Mock-Ups (CDRL 3-55; CDRL 3-56; CDRL 3-57; CDRL 3-58; CDRL 3-59)	2.0%
12	Amtrak approval of Carbody Structural Report (CDRL 6-17)	0.5%
13	Amtrak approval of Dynamic Simulation Report (CDRL 7-03)	0.5%
14	Amtrak approval of Final Design Review (CDRL 3-34)	3.0%
15	Amtrak approval of LRU List (CDRL 3-54)	0.5%
16	Amtrak approval of all Test Procedures (CDRL 20-03)	1.0%
17	Amtrak approval of Book of Quality (Chapter 5)	0.5%
	FAIs, Production and Testing	
18	Amtrak approval of completion and closeout of Major Sub System FAIs (Refer to Chapter 5.8.b.ii)	4.0%
19	Amtrak approval of FAI of each Car type and Amtrak approval of the closure of all open items (Chapter 5) (prorated by Car type)	4.0%
20	Amtrak approval of draft Manuals (CDRL 23-09)	3.0%
21	Successful completion of user training program (CDRL 23-15)	3.0%
22	Acceptance of Special Tools and BTEs (CDRL 21-01; CDRL 21-02)	1.0%
23	Issuance of Production/Test completion form with closure of all open items with a fully executed pre-shipping inspection report by Amtrak for a Consist to be shipped (prorated by number of cars)	10.0%
24	FDA approval of all Car types and all Cars (CDRL 16-01)	2.0%
	Commissioning and CA	
25	Amtrak approval of all As-Built Drawings and Schematics (CDRL 03-44, CDRL 23-03) (prorated for each car type)	7.5%
26	Successful delivery of all Pilot Cars, and completion of all associated activities and testing including but not limited to, climate test, Pilot Car Reliability Testing, and receipt of FRA and Amtrak approvals for each car type (prorated by car type)	10.0%
27	Conditional Acceptance of Production Cars including closure of all open items (Chapter 22) (prorated by number of cars)	20.0%
	Final Acceptance	
28	Final Acceptance of Production Cars (prorated by number of cars)	8.0%
29	Amtrak approval and delivery of final Manuals	4.0%
30	Amtrak approval of successful completion and acceptance of Fleet Service Reliability Demonstration Test (CDRL 4-04; CDRL 4-05)	3.0%
	Retainage	
31	Final Payment (refer to GPs Article 10)	5.0%

AMTRAK
1 Massachusetts Avenue, NW, Washington, DC 20001
Email roger.harris@amtrak.com Tel 202-906-3961

Roger Harris
President

September 15, 2023

Amit Bose
Administrator
Federal Railroad Administration
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Administrator Bose:

Pursuant to 49 C.F.R. § 37.7(b), National Railroad Passenger Corporation (Amtrak) hereby submits to the Federal Railroad Administration the request for a determination of equivalent facilitation in connection with its Long Distance core accessible trainset concept, which would substitute trainset-based Alternative Design Standards for certain regulatory standards that are specific to individual rail cars.

Attached to this letter are the request for equivalent facilitation and appendices, which include materials used in furtherance of our request for equivalent facilitation.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Roger Harris
President

Enclosures

cc: Calvin Gibson, Office of Civil Rights

Request For Equivalent Facilitation

I. Introduction

As Amtrak develops plans for procuring and deploying new rail equipment for overnight train service on our Long Distance network, we are committed to enhancing and improving the customer experience for customers with disabilities, including customers who use wheeled mobility devices. Many of today's regulatory standards that define accessible rail cars do not provide a truly accessible journey. To ensure that all customers have equal access to the unique experiences offered by our Long Distance services, we are re-imagining what is possible. Community engagement has played and will continue to play a critical role in this process.

In addition, new train designs and technologies offer opportunities to deliver a better and more accessible experience to customers with mobility disabilities. Strict compliance with existing regulations hinder some of these new alternatives.

After providing opportunities for the public to provide feedback, Amtrak is submitting this equivalent facilitation request to the Federal Railroad Administration for approval to use alternative design standards that provide equal or better accessibility. This reflects Amtrak's dedication to fostering an environment where everyone feels welcome, comfortable, and valued throughout their journey.

II. Entity Information

Name: National Railroad Passenger Corporation (Amtrak)
Address: 1 Massachusetts Ave., NW
Washington, DC 20001
Contact: Keren Rabin
Telephone: 202-906-2171

III. Specific Provision of Part 38 Concerning which Amtrak is Seeking Determination of Equivalent Facilitation

As stated above, Amtrak is seeking a determination of "equivalent facilitation" on several regulatory provisions that define standards of accessibility that are specific to individual rail cars (as opposed to entire trainsets). In lieu of strict compliance with the following provisions in 49 CFR Part 38, Amtrak proposes to use the Alternative Design Standards described below in Section IV, which would meet or exceed the level of accessibility or usability of the train, as further described below in Section V.

38.111(a)(1) requires individual single-level rail passenger coaches to have a specific number of accessible spaces, regardless of the number or location of accessible spaces elsewhere on the train. It states:

> (1) Single-level rail passenger coaches and food service cars (other than single-level dining cars) shall comply with §§ 38.113 through 38.123 of this part. Compliance with § 38.125 of this part shall be required only to the extent necessary to meet the requirements of paragraph (d) of this section.

38.111(a)(4) requires individual bi-level lounge cars to be accessible on the lower level and to have accessible restrooms in the car, regardless of the accessibility of the upper level and regardless of the availability of accessible restrooms in other nearby accessible cars. It states:

Bi-level lounge cars shall have doors on the lower level, on each side of the car from which passengers board, complying with § 38.113, a restroom complying with § 38.123, and at least one space complying with § 38.125(d) (2) and (3) to provide table service to a person who wishes to remain in his or her wheelchair and space to fold and store a wheelchair for a person who wishes to transfer to an existing seat.

38.111(a)(5) requires accessible restrooms in each individual single-level coach and food service car, as well as in each individual dining or lounge car if there is a restroom for other passengers, regardless of the availability of accessible restrooms in other nearby accessible cars and regardless of whether the "restroom for other passengers" is on the same floor as the accessible seating locations. It states:

Restrooms, complying with § 38.123 shall be provided in single-level rail passenger coaches and food services cars adjacent to the accessible seating locations required by paragraph (d) of this section. Accessible restrooms are required in dining and lounge cars only if restrooms are provided for other passengers.

38.111(a)(6) requires each individual sleeper car to have accessible accommodations, regardless of the number or location of accessible bedrooms elsewhere on the train. It states:

Sleeper cars shall comply with §§ 38.113 (b) through (d), 38.115 through 38.121, and 38.125 of this part, and have at least one compartment which can be entered and used by a person using a wheelchair or mobility aid and complying with § 38.127 of this part.

38.111(d) requires individual coaches to have a specific number of accessible spaces, regardless of the number or location of accessible spaces elsewhere on the train. It states:

Passenger coaches or food service cars shall have the number of spaces complying with § 38.125(d)(2) of this part and the number of spaces complying with § 38.125(d)(3) of this part, as required by § 37.91 of this title.

38.125(a) requires each individual rail car to have an accessible path from the platform to the accessible seating location, even for cars that are part of fixed trainsets with accessible spaces and accommodations on the upper level, with multiple elevators connected by an accessible path, as proposed in the Alternative Design Standards described herein. It states:

(1) General. All intercity rail cars, other than level entry cars, required to be accessible by §§ 38.111 (a) and (e) of this subpart shall provide a level-change mechanism or boarding device (e.g., lift, ramp or bridge plate) complying with either paragraph (b) or (c) of this section and sufficient clearances to permit a wheelchair or other mobility aid user to reach a seating location complying with paragraph (d) of this section.

(2) Exception. If level-entry boarding, portable or platform lifts, ramps or bridge plates meeting the applicable requirements of this section are provided on station platforms or other stops required to be accessible, or mini-high platforms complying with § 38.113(d) are provided, the car is not required to be equipped with a car-borne device. The access systems or devices used at a station to which section 37.42 applies must permit compliance with that section.

38.125(d)(1) requires individual rail cars to have a specific number of accessible spaces, regardless of the number or location of accessible spaces elsewhere on the train. It states:

Requirements. All intercity rail cars required to be accessible by §§ 38.111 (a) and (e) of this subpart shall provide at least one, but not more than two, mobility aid seating location(s) complying with paragraph (d)(2) of this section; and at least one, but not more than two, seating location(s) complying with paragraph (d)(3) of this section which adjoin or overlap an accessible route with a minimum clear width of 32 inches.

IV. Alternative Means of Compliance

Amtrak proposes to comply with the following Alternative Design Standards as an alternative method of compliance, providing equal or better accessibility and usability of its trainsets, as further described below in Section V.

1. Trainset / Semi-Permanent Coupling

These Alternative Design Standards are based on the concept of an accessible core trainset offering enhanced mobility between cars and access to train amenities and utilizing semi-permanent coupling.

2. Number of Accommodations

a. The number of accessible coach spaces in a trainset will be equal to or greater than the number of coach cars in the trainset.

b. The number of accessible bedrooms in a trainset will be equal to or greater than the number of sleeper cars in the trainset (not including sleeper cars used primarily for crews or other non-revenue purposes).

3. Access to Amenities

All accessible coach spaces and all accessible bedrooms will be located along or within an accessible core area of the trainset, with access to dining, café and lounge cars and similar amenities, via an accessible 32” wide path. If or when accessible coach spaces or accessible bedrooms are located on the lower level of a bi-level car, access to amenities and redundant restrooms on the upper level will be via an accessible elevator, but such access may be more limited than for spaces and bedrooms on the upper level. [1]

4. Priority Positions

a. Accessible sleeper cars will have priority over any non-accessible sleeper cars in terms of proximity to dining, café and lounge cars.

b. Accessible coaches will have priority over any non-accessible coaches in terms of proximity to dining, café and lounge cars.

5. Access to Redundant Restrooms

All accessible spaces will have access to at least two accessible restrooms, via an accessible 32” wide path.

6. Access to Redundant Vertical Access Points

All accessible coach spaces and accessible bedrooms on the upper level of a bi-level train will have access, via an accessible 32” wide path, to at least two accessible elevators to provide access to the platform for boarding and deboarding.

[1] Based on feedback received, this was added to the original Alternative Design Standards that were posted for public comment.

7. Access to Lower Level Options

Bi-level trains will include at least one accessible coach seat and accessible wheelchair space on the lower level and at least one accessible bedroom on the lower level.[2]

V. Demonstration of How Proposed Design Standards Meet or Exceed the Level of Accessibility or Usability of the Train

The ADA regulations listed above require certain accessible accommodations in each individual rail car. For trains that are made up of rail cars that are regularly connected to others and disconnected, having each car be accessible is a practical rule that ensures sufficient access to accessible seating locations and other accommodations. However, while this rule ensures that each railcar is technically accessible, each individual accessible location is "isolated," not connected to other accessible locations, without access to a redundant restroom, and without direct (or often any) access to other parts of the train, such as dining, lounge, café or observation cars.

The Alternative Design Standards proposed herein are for "trainsets," or trains that utilize "semi-permanent coupling." The cars that make up these trainsets are not easily or regularly disconnected from each other, but rather, they are connected in fixed arrangements via connections that are not designed to be easily separated. This type of connection (similar type of connection used by Amtrak on its Acela trainsets) has many benefits, including smoother transitions for passengers traversing from one car to another.

Because of the unique nature of trainsets, Amtrak proposes that they should rightly be considered as a whole and not as the sum of their individual rail car parts. In other words, the accessibility of a trainset should be viewed and considered when it is fully "assembled."

If the Alternative Design Standards listed here are approved, Amtrak can provide a much more accessible and enjoyable train experience for customers with mobility disabilities than what the current regulations provide. The Alternative Design Standards require at least the same number of accessible seats, spaces and rooms as the regulations, so in that regard, they provide the same level of accessibility as the current regulations. In other respects, the Alternative Design Standards provide better accessibility and usability compared to current regulations. Instead of isolated accessible positions, Amtrak will provide a fully accessible core area of the train. The core will have accessible accommodations – for bi-level trains, these will be available on the upper level – connected via an accessible path to multiple seating spaces (allowing a person using a wheelchair to move to other locations within the train) and redundant restrooms (maintaining access to an accessible restroom even if one restroom is in use or out of service), and access to the amenities that are central to Amtrak's Long Distance journeys, such as dining cars, lounge cars, café cars, and the opportunity to take advantage of the expansive windows often provided on the upper level of bi-level train cars to enjoy the scenery. Amtrak can also locate accessible positions in priority locations, closer to the dining and lounge cars, making it easier for customers with mobility disabilities to get to those amenities.

[2] Based on feedback received, this was added to the original Alternative Design Standards that were posted for public comment.

VI. Documentation of Public Participation

a. Consultation with Individuals with Disabilities and Groups Representing Them

Amtrak holds quarterly and ad hoc meetings with representatives of the disability community to continually keep them informed of Amtrak's efforts to provide safe, efficient and comfortable service to all customers, including customers with disabilities, and get their input on accessibility issues. One such meeting was held in June 2023, where Amtrak and disability groups discussed ideas and principles for incorporating greater accessibility into plans for new long distance trains.

On Aug. 2, Amtrak met again with representatives from regional and national disability associations to present and get feedback on its plan to seek a determination of equivalent facilitation and to use the Alternative Design Standards defined herein. At this meeting, Amtrak presented preliminary concept designs based on the Alternative Design Standards. Those present at this meeting expressed overwhelmingly positive reactions to Amtrak's proposal. Organizations with representatives in attendance at this meeting included:

- Access Living
- Federal Railroad Administration
- Disability Rights Education & Defense Fund
- Open Doors Organization
- National Council on Independent Living
- National Disability Rights Network
- National Federation of the Blind
- Paralyzed Veterans of America
- STV Incorporated
- United Spinal Association
- U.S. Access Board
- U.S. Department of Justice
- Wounded Warrior Project

b. National Outreach Efforts to Provide Notice of Equivalent Facilitation, Hearing and Public Comment Opportunity

A comprehensive communications plan was executed to bring awareness to Amtrak's request for public comment on the accessibility of future long distance trains, and in particular, Amtrak's proposed request for equivalent facilitation. This included the development of a dedicated microsite to provide attendees with detailed information about the equivalent facilitation process, as well as the particulars of the equivalent facilitation request. On the site, the public could also submit their feedback and/or register to participate in a public meeting either in person or virtually.

The site's visibility and awareness for the public meeting was enhanced through targeted digital advertising campaigns. A display ad campaign through USAToday.com received 7,277,801 impressions, and a second campaign through TravelDesk received 7,307,485 impressions.

To ensure media awareness and coverage, a media advisory was distributed both via PR Newswire and directly to a targeted list of relevant journalists across the United States and Canada. PR Newswire distribution included delivery of the media advisory to U.S.-based foreign language news outlets. The wire distribution reached a potential audience of 283,230,699. Feature stories about the public meeting and directing people to the microsite were published in Forbes (Unique Views per Month (UVM):

72,897,424), Trains (UVM: 645,330), Progressive Railroading (UVM: 37,216), TravelPulse (UVM: 423,198) and Mobility Management (UVM: 5,156). New Mobility (UVM: 58,113), a membership publication of the United Spinal Association, also shared details of the public meeting on its news site and Facebook, Instagram and Twitter accounts (Reach: 14,309).

Amtrak also reached out directly via email on two different occasions to nineteen organizations representing the disability community, sharing information on the equivalent facilitation process and associated public hearing. Disability organizations that received the hearing information included:

- Access Living
- American Association of People with Disabilities
- American Council of the Blind
- Autistic Self Advocacy Network
- National Association of the Deaf
- Christopher & Diana Reeve Foundation
- Cure Spinal Muscular Atrophy
- Disability Rights Education & Defense Fund
- Disability Rights of PA
- Epilepsy Foundation of America
- National Council on Disability
- National Council on Independent Living
- National Disability Rights Network
- National Federation of the Blind
- National Multiple Sclerosis Society
- Open Doors Organization
- Paralyzed Veterans of America
- The Jewish Federation of North America
- United Spinal Association

The public meeting information was also shared with Amtrak's more than 20,000 employees via the company's weekly online newsletter and through its Employee Resource Group for employees with disabilities.

c. Public Comment

Amtrak received over 200 public comments. Overall, feedback regarding the trainset design proposals is positive. Most commenters look forward to increased accessibility, especially the opportunity for people of all abilities to access all amenities on trains, move about independently while using wheelchairs, and travel with family members. Many travelers with mobility concerns emphasize their preference to travel with Amtrak, as opposed to airlines, and state that this preference would be even greater with the proposed accessibility enhancements.

Many commenters offered suggestions about Amtrak's plans and feedback from their own travel experiences, several of which were repeated throughout submissions. Notably, many recommended improvements to the boarding and deboarding process, with suggestions to offer improved ramp access for those using wheelchairs and for the elderly. Some included questions on Amtrak's plans for evacuating wheelchair users in the event of an emergency. Amtrak agrees that a safe and smooth boarding and deboarding process is critical for all of our customers and has made and will continue to make efforts to improve this experience for customers with mobility disabilities, including the use of car-borne boarding

technologies where feasible. Amtrak also agrees that emergency planning must include sufficient evacuation plans for customers with mobility disabilities, including those who use wheelchairs.

Several comments offered specific accessibility suggestions for Amtrak separate from the design standards proposed as a part of the equivalent facilitation process, including availability of refrigeration for medicines, improved signage for deaf passengers, Braille touchpoints for passengers who are blind and low sinks for wheelchair users. Amtrak appreciates these and all of the thoughtful comments received and will incorporate all such feedback into the design process to the extent feasible.

A small number of comments were negative. These comments mentioned concerns of whether seats would become smaller to accommodate wider aisles, whether these structural changes would be costly to customers and if using semi-permanent trainsets would cause issues of sidelining in the event of accidents or mechanical issues. Amtrak recognizes the importance of comfortable seats for customers, especially those traveling overnight or for long distances, and does not anticipate making seats smaller to accommodate greater accessibility for wheelchair users. With respect to cost and operational issues, Amtrak is and will continue to be focused on these, but based on current information, anticipates that the current approach will not create undue financial or operational concerns.

d. Aug. 30th Public Hearing

Amtrak held a public hearing on August 30, 2023 at the Hyatt Regency Capitol Hill in Washington D.C. and online via Zoom as a forum for members of the public to provide commentary on accessible train travel and the proposed Alternative Design Standards.

Thirty (30) individuals registered to attend the in-person meeting, and nine attended. For the virtual meeting held via Zoom, 136 people registered to attend and 82 logged on to the meeting.

The meeting began with a welcome and safety briefing from Dr. David Handera, Amtrak Vice President, Stations, Facilities, Properties and Accessibility at Amtrak followed by opening remarks regarding Amtrak's continued commitment to accessibility from Amtrak President Roger Harris.

Amtrak Vice President of Product Development and Customer Analytics Fred Gazzolo provided an overview of Amtrak's request for equivalent facilitation, including a review of the Alternative Design Standards and a comparison of a train layout that complies with current regulations against two trainset design concepts that comply with the Alternative Design Standards, providing better accessibility and usability of the train.

Following the presentation, members of the public who were in attendance gave statements. One person provided comment in-person. Five individuals provided comments virtually (four on camera and one via proxy reading of a written comment).

Several commenters (and some who submitted written comments online echoed these points) stated that all cars and all levels in the trainset should be fully accessible, rather than only certain cars or levels. That said, to the extent these commenters addressed the comparison between Amtrak's proposal and the current regulations, they acknowledged that the accessibility provided by the Alternative Design Standards was a marked improvement in providing access to the upper level and all amenities. Moreover, full end-to-end accessibility poses a variety of challenges that make it infeasible, and Amtrak does not believe that it would meaningfully enhance the customer experience beyond what is provided by Amtrak's proposal. Amtrak developed the Alternative Design Standards (as originally shared with the public) without accessible spaces on the lower level of bi-level trains, primarily due to concerns that creating accessible spaces in those areas would provide reduced accessibility and usability compared to the planned spaces.

Nonetheless, based on this feedback, Amtrak revised the Alternative Design Standards it is submitting here to include lower level positions, in both coach and sleeper accommodations, which will provide additional accessible options for customers. However, customers located in lower level positions may not have the same access to amenities and redundant restrooms as those on the upper level. Amtrak will ensure that customers making selections for particular locations are provided clear information about the extent to which these amenities are available to them.

Other commenters shared their views on other accessibility issues, not directly related to the Alternative Design Standards or the equivalent facilitation request. All input and comments were received and noted and will be considered by Amtrak as it continues its planning.

Following the public statements, meeting attendees were reminded that the public comment period would remain open until September 5 in case they had any additional feedback they wanted to provide after the day's presentation. Following the hearing, on August 31, Amtrak shared the slides that had been presented at the hearing with all attendees and notified them that the comment period would be extended to September 8.

VII. Conclusion

The core accessible trainset approach outlined in the Alternative Design Standards would allow Amtrak to design, procure and deliver long distance trainsets that are substantially more accessible and usable for persons with disabilities than what is currently set out in the ADA regulations. An overwhelming majority of those who commented on Amtrak's proposal are in support of it. Some have argued that nothing short of fully end-to-end accessible trains are acceptable, with wheelchair access throughout each level of each car. Amtrak has made some important modifications to its submission in response to these comments. Others, like the Rail Passengers Association, have commended the fact that Amtrak's proposal would yield substantial improvements in accessibility, while also being mindful of the comfort of all passengers and the need to increase capacity. Even those who have argued for full end to end accessibility have not denied (nor can they) that this proposal provides far better accessibility to persons with disabilities than what is provided by the current regulations. Given that this is the applicable standard for equivalent facilitation, Amtrak respectfully asks the FRA to approve this request and make a determination of equivalent facilitation.

VIII. Appendix

a. Equivalent facilitation website content (current version)
b. Spreadsheet with full text of public comments submitted online to Amtrak
c. Slides presented at Aug. 30th meeting
d. Transcript of Aug 30th meeting
e. 9/1/2023 Letter from Rail Passengers Association in support of equivalent facilitation
f. 9/8/2023 Letter from Consortium for Constituents with Disabilities (CCD)
g. 9/15/2023 Amtrak response to CCD

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U.S. Department
of Transportation

**Federal Railroad
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

November 15, 2023

Mr. Roger Harris
President
National Passenger Railroad Corporation
1 Massachusetts Avenue, NW
Washington, DC 20001

Dear Mr. Harris:

On September 15, 2023, the National Railroad Passenger Corporation (Amtrak) requested from the Federal Railroad Administration (FRA) an equivalent facilitation determination for the new single and bi-level long-distance trainsets Amtrak is preparing to procure. In a new design, Amtrak proposes to use a "core accessible" trainset concept in which all accessible spaces and amenities are concentrated within several cars in the center of a trainset rather than locating discrete accessible spaces throughout the train in individual rail passenger cars. The U.S. Department of Transportation (DOT) Americans with Disabilities Act (ADA) regulations at 49 C.F.R. § 38.2 states, "[d]epartures from particular technical and scoping requirements of these guidelines by use of other designs and technologies are permitted where the alternative designs and technologies used will provide substantially equivalent or greater access to and usability of the vehicle." FRA considers requests for equivalent facilitation on a case-by-case basis and determinations are limited to the specific request under consideration. For the reasons set out below, I am granting Amtrak's request.

Current Railcar Requirements

The ADA requires all "new rail passenger cars for use in intercity rail transportation rail cars" to be "readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs."[1] The term "rail passenger car" means, with respect to intercity rail transportation, "single-level and bi-level coach cars, single-level and bi-level dining cars, single-level and bi-level sleeping cars, single-level and bi-level lounge cars, and food service cars."[2]

According to DOT ADA regulations, rail passenger cars "shall be considered to be readily accessible to and usable by individuals with disabilities" if they meet the minimum requirements in 49 C.F.R. parts 37 and 38.[3] Rail passenger cars, including business or first-class passenger

[1] 42 U.S.C. § 12162(a)(2)(A).
[2] 42 U.S.C. § 12161(4).
[3] 49 C.F.R. § 37.7(a).

cars, are required to have "at least one, but not more than two, mobility aid seating location(s)" for passengers who wish to travel seated in their mobility devices and "at least one, but not more than two, seating location(s)" for passengers who opt to transfer to a regular seat and store their devices.[4] Sleeper cars are required to contain at least one accessible sleeper compartment.[5] Neither the ADA nor DOT's regulation on sleeper accommodations limit the number of accessible sleeper compartments that can be in any one car.

There is no ADA or regulatory requirement that the upper level of bi-level cars be accessible to those who cannot navigate stairs. There is also no ADA or regulatory requirement for through car access (except where feasible for single level dining cars) or redundant accessible restrooms. Instead, the current minimum requirement is for a 32" path from the passenger rail car door to the accessible seating or sleeper location(s) and one accessible restroom.[6]

Amtrak's Request

Instead of strict compliance with the above requirements for individual rail cars, Amtrak proposes an alternative design with "trainsets" that would use "semi-permanent coupling" and offer an accessible trainset core in the center of the full trainset. Specifically, Amtrak proposes the following for its new trainset design:

(1) The same or greater number of accessible seats and sleeper compartments as the regulation requires will be available for passengers, except that these spaces would be concentrated in the center or core of each trainset.
(2) Accessible accommodations will be available on the upper level of bi-level trainsets via onboard elevators. At least two elevators will be accessible on every trainset.
(3) An accessible 32" wide path will be provided to multiple seating and sleeper spaces, redundant restrooms, and amenities that are central to Amtrak's long-distance passenger experiences, such as dining cars, lounge cars, café cars, and the expansive windows on the scenic upper level of bi-level train cars.
(4) Accessible seating and sleeper positions will be in priority locations, closer to the dining and lounge cars, making it possible for customers with mobility disabilities to get to those amenities.
(5) Bi-level trainsets will still have at least one lower-level coach seat and sleeper compartment and one available accessible restroom to provide accessibility options for passengers who cannot or prefer not to ride on the upper level. Passengers opting for the lower-level seat or sleeper location would only have access to the upper-level amenities and a redundant restroom when the train is not moving since safe operation of the elevator during train operation has not been established.
(6) Some cars beyond the trainset's core will have no accessible spaces, sleeper compartments, or accessible restrooms.

As required by 49 C.F.R. § 37.7(b)(3), Amtrak conducted significant public outreach on this request, including announcing its plan at its June 2023 standing quarterly meetings with the

[4] 49 C.F.R. § 38.125(d).
[5] 49 C.F.R. § 38.111(a)(6).
[6] 49 C.F.R. §§ 38.113(a)-(b), 38.123(b), and 38.125(d)(1).

disability community; holding a special virtual community meeting on August 2, 2023; conducting national online targeted outreach; and holding a hybrid public meeting on August 30, 2023.

FRA's Determination

Through its public outreach, Amtrak received over 200 public comments. Community feedback for Amtrak's proposal was generally[7] positive, though a few commenters requested full access by a 32" aisle width throughout the trainset. However, full trainset access is not required by the regulations. Amtrak's plan offers more than what is required by the regulations by providing access to the upper level in bi-level trains; access to all amenities such as dining, lounge, and scenic view cars; access to lower-level accessible seating and sleeper space; and redundant restrooms.

Over the years, FRA has received numerous complaints about the old design, which even though technically compliant, isolates passengers who are unable to climb stairs or travel through aisles or cab end doors—for hours or even days on long-distance routes. Thankfully, engineering and operational innovation developed in the years since the ADA regulations were drafted provides an opportunity for more equitable integration. As depicted in the material submitted with Amtrak's request and as described above, FRA finds Amtrak's proposed design provides "substantially equivalent or greater access to and usability of the vehicle."[8] The trainset design provides an integrated transportation experience with greater access for persons with mobility and other[9] disabilities to the amenities of travel, such as the dining and lounge cars, when, under the current regulations, isolated service in individual rail cars is permitted. For these reasons, FRA is granting Amtrak's request for equivalent facilitation.

This approval is limited to the specific trainset procurement described in Amtrak's submission. The equipment must be maintained in the configuration depicted. Under 49 C.F.R. § 37.7(b)(5)-(6), determinations of equivalent facilitation are made on a case-by-case basis "and pertain only to the specific situation" for which the equivalent facilitation is sought. Other passenger rail project sponsors contemplating a similar design would be required to submit a separate request for a determination of equivalent facilitation. Amtrak should seek FRA's advice on whether a new determination would be required for additional future procurements using a similar design.

In addition, 49 C.F.R. § 37.7(b)(6) expressly prohibits entities from making claims that a determination of equivalent facilitation indicates approval or endorsement of any product or method by the Federal Government, the DOT, or its FRA. Any use of this letter as a product endorsement or certification of compliance, or reliance on this letter in marketing materials, is

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[7] Several commenters noted operational concerns, such as issues related to emergency egress from the upper level, Amtrak's choice for trainsets and how equipment breakdowns would be handled, and safety considerations with elevators onboard trains. While these are all important topics, they are not germane to this request since this equivalent facilitation decision only concerns whether the design meets or exceeds the ADA standards. Amtrak remains responsible for demonstrating to FRA that these new trainsets meet operational and safety standards.

[8] 49 C.F.R. § 38.2.

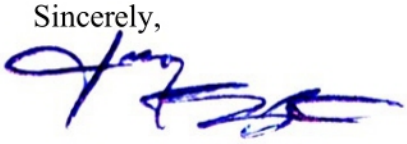
[9] For example, people who are blind or have low vision may benefit from limiting the length of travel in a moving train to access amenities.

therefore unauthorized. No entity other than Amtrak may infer applicability of this determination to its own projects, products, methods, or equipment.

Finally, this determination of equivalent facilitation applies to the design of trainsets and depends upon the specific configuration of those trainsets. Therefore, to remain compliant with this determination, Amtrak must address the operational challenges in using trainsets in long distance service on the National Network so that the trainset configuration approved here can be maintained. Further, this letter does not contemplate the safety of the proposed requirements for the new trainset design. For example, the accessible pathways through the trainsets' articulations must be capable of remaining 32" whether the trainset is being operated on straight or curved track. FRA will perform a comprehensive safety evaluation upon final design. Please continue to work with the FRA Office of Railroad Development on requesting funding for and developing the facilities necessary to maintain and operate this equipment.

Thank you for your continued efforts to improve accessible transportation for all. Please continue to engage with the FRA and the disability community as these trainset designs progress. If you have any questions about this determination, please contact Mr. Calvin Gibson, Director of Civil Rights, at (202) 493-6010, or calvin.gibson@dot.gov.

Sincerely,



Amit Bose
Administrator

EXHIBIT S
Billing Guidelines for Task Services Performed by Amtrak

Amtrak Billing Guidelines

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- Amtrak will issue monthly invoices to Contractor for all hours worked regardless of whether the Task was completed. Such invoice shall list the hours worked, the equipment unit number and the tasks performed. Under no circumstances will Amtrak wait until all units have been completed within an FMI or warranty work before billing the Contractor.

- For Warranty obligations, Contractor shall provide to Amtrak all spare parts and components needed to effectuate the Tasks prior to the start of the Tasks. Contractor understands that Amtrak is not a routine provider of the Tasks contemplated by this agreement and that Amtrak's performance of the same shall not extinguish or diminish Contractor's warranty obligations under the Contract.

- Amtrak shall perform the Tasks within a reasonable timeframe taking into account its business operations, labor agreements, available staffing and other factors. Amtrak's performance shall not affect liquidated damages or performance guarantees payable to Amtrak under the Contract.

- Nothing shall be interpreted to require Amtrak to perform the Tasks without compensation.

- Contractor shall reimburse Amtrak for all costs incurred by Amtrak in connection with the Tasks. Such costs may include, but are not limited to, the following:

➢ **Direct labor and management costs** for all assigned Amtrak employees for actual hours worked while performing Tasks, including but not limited to: any adjustments, allowances and arbitrary hours in accordance with the then-current existing labor agreements; travel costs; overnight accommodations (including boarding and lodging); travel time and mandatory rest time as the result of performing work hereunder; and Amtrak's overhead rates, as set forth in Appendix A hereof ("Overhead/Rate Schedule").

Note: *Amtrak, in its sole discretion, may agree to an alternative billing arrangement where the Tasks are based upon mutually agreed upon estimated hours. If Amtrak agrees to an alternative billing arrangement, the terms and conditions of the arrangement will be agreed to prior to implementation of the arrangement.*

Amtrak Billing Guidelines(con'd)

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- **Costs for any materials and supplies** required for performance of the Tasks that have not been provided by Contractor to Amtrak. Any materials and supplies issued from Amtrak's inventory shall be charged at Amtrak's inventory cost in effect at the time the material or supplies are issued, plus any actual shipping/transportation costs and shipping/ transportation cost additives. Any materials and supplies which are procured by Amtrak, but which are not issued from Amtrak's inventory, shall be charged at Amtrak's actual cost incurred. Material handling and General and Administrative (G&A) overhead rates as set forth in the Overhead/Rate Schedule shall be added to the cost of all materials and supplies.

- **Costs for all third-party contract services** and for any related additional insurance. Costs will be billed at actual cost incurred, plus the G&A overhead rates as set forth in the Overhead/Rate Schedule.

- **Costs for equipment, vehicles, work trains, wire trains, rolling stock** and any other such items which are leased by Amtrak and required for performance of the Tasks shall be charged at the actual cost of the lease, plus the G&A overhead rates as set forth in the Overhead/Rate Schedule.

- **Retroactive wage and benefit costs** (i.e., adjustments made subsequent to performance of the Tasks) which shall be reimbursed based on the actual cost, plus all associated current overhead rates as set forth in the Overhead/Rate Schedule.

- **Any other actual costs**, not listed, necessary to effectively perform the Tasks shall be charged at actual costs, plus Amtrak's overhead rates as set forth in the Overhead/Rate Schedule.

- The overhead rates are computed in accordance with Amtrak's accounting policies and procedures. These rates are updated periodically by Amtrak and will be made available to Contractor, upon request. The applicable billable overhead rates shall be the rates in effect (i) at the time of performance of the Tasks with respect to Tasks performed by Amtrak forces, and (ii) as of the date, Amtrak receives the invoice from its contractors with respect to Tasks performed by Amtrak contractors.

Amtrak Billing Guidelines(con'd)

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- In addition to reimbursement of the costs described above, Contractor shall pay Amtrak a 10% management fee applied to all billable costs and overhead rates.

- Prior to Amtrak performing any FMIs, Contractor shall issue a Purchase Order reflecting the estimated hours needed to complete the FMI and, working with Amtrak's Finance Department, the amount needed for the PO based upon the number of units and the timing of the work.

- Contractor shall pay all undisputed amounts on Amtrak invoices within thirty (30) days of receipt via electronic payment. Failure to pay invoices when due may be considered a breach. If payments are not made by the due date, Amtrak may, at its sole discretion, offset such payments against a future invoice or reduce the amount of retainage returned to cover such payments. Contractor shall pay all amounts stated in invoices in full without set-off or counterclaim unless otherwise agreed to by Amtrak.

- If Contractor objects to any charges identified on a monthly invoice, it shall notify Amtrak of its objection in writing within thirty (30) days of receipt of said invoice. Within thirty (30) days thereafter, Amtrak will provide Contractor with additional documentation and/or explanation as required, to support the accuracy of the charges. If Amtrak finds an adjustment is due, Amtrak will issue a credit memo in the amount of the adjustment. If, after reviewing the additional information provided by Contractor, the billing dispute is still not resolved, the issue shall be resolved in accordance with the Claims and Disputes provision of the Contract.

Appendix A Overhead Rate Schedule Tab 1

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National Railroad Passenger Corporation — EXHIBIT A

Mechanical Shops & Facilities Overhead Rates

Effective January 1, 2022

	Chief Operations Officer Overhead	Mechanical System Overhead	Shop / Facility Overhead	Mechanical Training Overhead	Vacation & Holiday	Force Account Insurance	Fringe Benefits 1/2022 - 9/2022	Total Additive Labor	G&A	Material Handling Additive	Labor Composite	Material Composite
Bear Shop												
Straight Time Labor	4.90%	12.40%	72.60%	2.30%	20.23%	16.00%	50.06%	178.49%	6.61%	9.88%	196.91%	17.15%
Over Time Labor	4.90%	12.40%	72.60%	2.30%	20.23%	16.00%	18.15%	146.58%	6.61%	9.88%	162.89%	17.15%
Wilmington Shop												
Straight Time Labor	4.90%	12.40%	262.72%	2.30%	20.23%	16.00%	50.06%	368.61%	6.61%	9.88%	399.61%	17.15%
Over Time Labor	4.90%	12.40%	262.72%	2.30%	20.23%	16.00%	18.15%	336.70%	6.61%	9.88%	365.59%	17.15%
Beech Grove Shop												
Straight Time Labor	4.90%	12.40%	97.51%	2.30%	20.23%	16.00%	50.06%	203.40%	6.61%	9.88%	223.47%	17.15%
Over Time Labor	4.90%	12.40%	97.51%	2.30%	20.23%	16.00%	18.15%	171.49%	6.61%	9.88%	189.45%	17.15%
High Speed Rail Facilities												
Straight Time Labor	4.90%	12.40%	105.11%	2.30%	20.23%	16.00%	50.06%	211.00%	6.61%	9.88%	231.57%	17.15%
Over Time Labor	4.90%	12.40%	105.11%	2.30%	20.23%	16.00%	18.15%	179.09%	6.61%	9.88%	197.55%	17.15%
Mechanical Terminals (1)												
Straight Time Labor	4.90%	12.40%	85.74%	2.30%	20.23%	16.00%	50.06%	191.63%	6.61%	9.88%	210.92%	17.15%
Over Time Labor	4.90%	12.40%	85.74%	2.30%	20.23%	16.00%	18.15%	159.72%	6.61%	9.88%	176.90%	17.15%
Mechanical System Only												
Straight Time Labor	4.90%	12.40%		2.30%	20.23%	16.00%	50.06%	105.89%	6.61%	9.88%	119.51%	17.15%
Over Time Labor	4.90%	12.40%		2.30%	20.23%	16.00%	18.15%	73.98%	6.61%	9.88%	85.49%	17.15%
Mechanical Exempt Labor												
Straight Time Exempt Labor					17.70%		34.74%	52.44%	6.61%	9.88%	62.52%	17.15%

Note an additional Freight Additive of 4.05% will be applied to all Mechanical material requisitions.

(1) Includes East, Central, and West Mechanical Terminals

Appendix A Overhead Rate Schedule Tab 2

ILLUSTRATIVE OVERHEAD RATE APPLICATION EXAMPLE WITH MECHANICAL TERMINALS RATES

Item	Rate	Amount
Amtrak Exempt Labor		
Direct Charge		$100.00
Vacation & Holiday	17.70%	17.70
Employee Benefits	34.74%	34.74
Sub-Total		152.44
G&A	6.61%	10.08
Composite Exempt Labor Rate		162.52
Management Fee	10.00%	16.25
Total		$ 178.77

Item	Rate	Amount
Amtrak S/T Non-Exempt Labor		
Direct Charge		$100.00
Chief Operations	4.90%	$4.90
Mechanical System	12.40%	$12.40
Shop/Facility	85.74%	$85.74
Mechanical Training	2.30%	$2.30
Vacation & Holiday	20.23%	20.23
Employee Benefits	50.06%	50.06
Force Account Insurance	16.00%	16.00
Sub-Total		$291.63
G&A	6.61%	19.29
Sub-Total		$ 310.92
Management Fee	10.00%	31.09
Total		342.01

Item	Rate	Amount
Amtrak O/T Non-Exempt Labor		
Direct Charge		$100.00
Chief Operations	4.90%	$4.90
Mechanical System	12.40%	$12.40
Shop/Facility	85.74%	$85.74
Mechanical Training	2.30%	$2.30
Vacation & Holiday	20.23%	20.23
Employee Benefits	18.15%	18.15
Force Account Insurance	16.00%	16.00
Sub-Total		$259.72
G&A	6.61%	17.18
Sub-Total		$ 276.90
Management Fee	10.00%	27.69

Item	Rate	Amount
Material (Inventory & Direct Purchase)		
Direct Charge		$100.00
Material Handling	9.88%	9.88
Freight Additive	4.05%	4.05
Sub-Total		113.93
G&A	6.61%	7.54
Sub-Total		121.47
Management Fee	10.00%	12.15
Total		133.61

Appendix A Overhead Rate Schedule Tab 2

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ILLUSTRATIVE OVERHEAD RATE APPLICATION EXAMPLE WITH MECHANICAL TERMINALS RATES

Item	Rate	Amount
Third Party Contract Services/Other Direct Costs		
Direct Charge		$100.00
G&A	6.61%	6.61
Sub-Total		106.61
Management Fee	10.00%	10.66
Total		117.28

MECHANICAL WAGE RATES EFFECTIVE 7/1/2022 (Estimated*)		
Boilermaker	36.21	IC146
Carmen	35.43	C8114
Electrician	35.43	E3100
Mechanic	35.43	DA100
ARSA Foreman	40.94	AB101

* Amtrak is in the process of renegotiating its collective bargaining agreements that will be effective 7/1/2022.

The above wage rates are estimated and could be subject to change.

The above wage rates reflect common mechanical crafts and is not intended to be an all inclusive list of the Amtrak direct wage rates.

EXHIBIT T

AMTRAK SUPPLIER RESPONSIBILITY QUESTIONNAIRE

RESPONSES TO THE QUESTIONS CONTAINED IN THIS QUESTIONNAIRE MUST BE SUBMITTED ON THIS FORM.

The signatory of this Questionnaire guarantees the truth and accuracy of all statements and answers to the questions herein.

Failure to complete and return this questionnaire, the provision of any false statements, or the failure to answer (a) question(s) when required, may render the bid/proposal non-responsive.

Where an explanation is required or needed, please provide the explanation on the form directly or by adding additional pages, as necessary. Submit the completed form and explanations to the contracting official. The contracting official may request additional information based on your responses.

Contractors must submit updated information to the awarding authority if changes have occurred that would render any of the responses inaccurate in any way.

Updates must be submitted to the awarding authority within 30 days of the change(s).

The responses in this Questionnaire will not be made available to the public for review.

REQUEST FOR PROPOSAL ("RFP") – EXHIBIT T
UNIVERSAL SINGLE LEVEL FLEET REPLACEMENT PROGRAM
NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)
1 Massachusetts Ave NW, Washington DC 20001

BIDDER/CONTRACTOR INFORMATION

Business Name:
DUNS Number:
Address:
Phone Number
Point of Contact Person:

TYPE OF SUBMISSION:
The Questionnaire being submitted is:
□ An initial submission of a completed Questionnaire.
□ An update of a prior Questionnaire dated _____/_____/_____.

A. BUSINESS ORGANIZATION/STRUCTURE
Indicate the organizational structure of the company. "Company" includes a sole proprietorship, corporation, joint venture, consortium, association, or any combination thereof.

□ **Corporation:** Date incorporated: _____/_____/_____ State of incorporation: _____
List the corporation's current officers.
President:
Vice President:
Secretary:
Treasurer:
□ Check the box only if the company is a publicly traded corporation.
List those who own 5% or more of the corporation's stocks. Use Attachment A if more space is needed. Publicly traded corporations need not list the owners of 5% or more of the corporation's stocks.

□ **Limited Liability Company:** Date of formation: _____/_____/_____ State of formation: _____
List members who own 5% or more of the company.

□ **Partnership:** Date formed: _____/_____/_____ State of formation: _____
List all partners in the company.

□ **Sole Proprietorship:** Date started: _____/_____/_____
List any company(s) that you have been associated with as an owner, partner, or officer for the last five years. Do not include ownership of stock in a publicly traded company in your response to this question.

□ **Joint Venture:** Date formed: _____/_____/_____
List: (1) each company that is a member of the joint venture and (2) the percentage of ownership the company will have in the joint venture. **Each member of the Joint Venture must complete a separate Questionnaire for the Joint Venture's submission to be considered as responsive.**

B. OWNERSHIP AND NAME CHANGES

Is the company a subsidiary, parent, holding company, or affiliate of another company? □ **Yes** □ **No**

If **Yes**, explain the relationship between the company and the associated companys. Include information about an affiliated company only if one company owns 50% or more of another company, or if an owner, partner or officer of the company holds a similar position in another company.

Have any of the company's owners, partners, or officers operated a similar business in the past five years? □ **Yes** □ **No**

If **Yes**, list the names and addresses of all such businesses, and the person who operated the business. Include information about a similar business only if an owner, partner or officer of the company holds a similar position in another company.

Has the company changed names in the past five years? □ **Yes** □ **No**

If **Yes**, list all prior names, addresses, and the dates they were used. Explain the reason for each name change in the last five years.

Are any of the company's licenses held in the name of a corporation or partnership? □ **Yes** □ **No**

If Yes, the name of the corporation or partnership that actually holds the license.

C. FINANCIAL RESOURCES AND RESPONSIBILITY

Is the company now, or has it ever been at any time in the last five years, the debtor in a bankruptcy case? □ **Yes** □ **No**

Is your company in the process of, or in negotiations toward, being sold? □ **Yes** □ **No**

D. PERFORMANCE HISTORY

How many years has the company been in business? _____ Years.

Has the company ever held any contracts with Amtrak? □ **Yes** □ **No**

If, **Yes,** list all contracts the company has had with Amtrak for the last 10 years. For each contract listed in response to this question, include: (a) contract number; (b) total contract value; (c) starting date; and (d) ending date.

In the past five years, has a governmental or private entity or individual terminated the company's contract prior to completion of the contract? **Yes** □ **No**

In the past five years, has the company used any subcontractor to perform work on a government contract when you knew that the subcontractor had been debarred by a governmental entity?
□ **Yes** □ **No**

In the past five years, has the company been debarred or determined to be a non-responsible bidder or contractor? □ **Yes** □ **No**

E. DISPUTES

In the past five years, has the company been the defendant in court on a matter related to any of the following issues?

(a) Payment to subcontractors? □ **Yes** □ **No**

(b) Work performance on a contract? □ **Yes** □ **No**

(c) Employment-related litigation brought by an employee? □ **Yes** □ **No**

Does the company have any outstanding judgements pending against it? □ **Yes** □ **No**

In the past five years, has the company been assessed liquidated damages on a contract?
□ **Yes** □ **No**

REQUEST FOR PROPOSAL ("RFP") – EXHIBIT T
UNIVERSAL SINGLE LEVEL FLEET REPLACEMENT PROGRAM
NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)
1 Massachusetts Ave NW, Washington DC 20001

F. COMPLIANCE

In the past five years, has the company or any of its owners, partners or officers, ever been investigated, cited, assessed any penalties, or been found to have violated any laws, rules, or regulations enforced or administered, by any federal or state governmental entities? □ **Yes** □ **No**

If a license is required to perform any services provided by the company, in the past five years, has the company, or any person employed by the company, been investigated, cited, assessed any penalties, subject to any disciplinary action by a licensing agency, or found to have violated any licensing laws? □ **Yes** □ **No**

G. BUSINESS INTEGRITY

For questions (a), (b), and (c) below, check **Yes** if the situation applies to the company. For these questions, the term "company" includes any owners, partners, or officers in the company. The term "owner" does not include owners of stock in the company if the company is a publicly traded corporation.

(a) Is a governmental entity or public utility currently investigating the company for making (a) false claim(s) or material misrepresentation(s)? □ **Yes** □ **No**

(b) In the past five years, has a governmental entity or public utility alleged or determined that the company made (a) false claim(s) or material misrepresentation(s)? □ **Yes** □ **No**

(c) In the past five years, has the company been convicted or found liable in a civil suit for, making false claim(s) or material misrepresentation(s) to any governmental entity or public utility?
□ **Yes** □ **No**

In the past five years, has the company or any of its owners or officers been convicted of a crime involving the of a government contract, the awarding of a government contract, the performance of a government contract, or the crime of fraud, theft, embezzlement, perjury, bribery? For this question, the term "owner" does not include those who own stock in a publicly traded corporation. □ **Yes** □ **No**