Chapter 2

References and Glossary
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2.0 References and Glossary

2.1 Overview

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.

Unless specified otherwise, the Contractor shall comply with the revision of the reference documents in effect at time of Notice to Proceed (NTP).

The Contractor is responsible for ensuring that all applicable regulations, standards and specifications are followed when complying with the requirements of this specification.

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 train set is accepted. The Customer shall determine if the proof of compliance provided is acceptable.

2.2 Supplemental Regulations, Standards, Specifications and Drawings

Regulations, standards, specifications and drawings, which pertain to this specification, are listed below. The following list is furnished as a guide to the Contractor, but shall not be construed as complete. When any of the following are superseded by a later revision that is approved by the issuing entity, the later revision shall apply. Unless specified otherwise, the Contractor shall be responsible for acquiring and maintaining copies of all applicable references from the appropriate source. The Customer shall not be obligated to provide these referenced documents unless specifically stated. The contractor will be responsible for determining if there are newer versions of the referenced specifications/regulations/standards and obtaining them.

2.2.1 Regulations

2.2.1.1 ADA (Americans with Disabilities Act)

49CFR Subtitle A, Figure 4: Intercity Rail Car (with accessible restroom)
49CFR38.101: Lighting

Americans with Disabilities Act of 1990 and regulations promulgated thereafter, including 49CFR27, 37 & 38.

2.2.1.2 DOE (U.S. Department of Energy)

Energy Policy Act (EPAct) of 2005

2.2.1.3 EPA (Environmental Protection Agency)

40CFR82: Protection of Stratospheric Ozone
2.2.1.4 FRA (Federal Railroad Administration)

Title 49, 49CFR Transportation, Section II, Parts 200-299

213: Track Safety Standards
   213.333: Automated Vehicle Inspection Systems
   213.345: Vehicle Qualification Testing
   213.57: Curves; Elevation and Speed Limitations

221: Rear End Marking Device-Passenger, Commuter and Freight Trains

222: Use of Locomotive Horns at Public Highway-Rail Grade Crossings
   222.21: When Must a Locomotive Horn be Used?

223: Safety Glazing Standards—Locomotives, passenger Cars and Cabooses

229: Railroad Locomotive Safety Standards
   229.11: Locomotive Identification
   229.46 through 229.59: Brake System
   229.115: Slip/Slide Alarms
   229.117: Speed Indicators
   229.119: Cabs, Floors and Passageways
   229.121: Cab Noise
   229.123: Pilots, Snowplows, End Plates
   229.125: Headlights and Auxiliary Lights
   229.127: Cab Lights
   229.129: Horn
   229.131: Sanders
   229.133: Interim Locomotive Conspicuity Measures—Auxiliary External Lights
   229.141: Body Structure, MU Locomotives
   229.135: Event Recorder

231: Railroad Safety Appliance Standards

238: Passenger Equipment Safety Standards
   238.103: Fire Safety
   238.111: Pre-revenue Service Acceptance Testing Plan
   238.114: Rescue Access Windows
   238.115: Emergency Lighting
   238.121: Emergency Communication
   238.123: Emergency Roof Access
   238.207: Link Between Coupling Mechanism and Car Body
   238.217: Side Structure
   238.227: Suspension System
   238.231: Brake System
   238.233: Interior Fittings and Surfaces
   238.235: Doors (Emergency Egress)
   238.303: Exterior Calendar Day Mechanical Inspection of Passenger Equipment
   238.307: Periodic Mechanical Inspection of Passenger Cars and Unpowered Vehicles Used in Passenger Trains
2.2.1.5 FTA (Federal Transit Administration)
FTA-IT-90-5001-02.1 of February 2002: Quality Assurance and Quality Control Guidelines

2.2.1.6 USPHS (U.S. Public Health Service)
U. S. Public Health Service Food Code 2005

2.2.2 Standards

2.2.2.1 AAR (Association of American Railroads)
M-101: Axles Carbon Steel, Heat-Treated
M-107/M-208: Wheels, Carbon Steel
M-114: Helical Springs, Heat-Treated Steel
M-201: Steel Castings
M-601: Hose, Wrapped, Air Brake, “End Hose”
M-618: Hose, Air, Wire-Reinforced
RP-585: Wiring and Cable Specification
S-100, Section B: Bushings, Stainless Steel Tube–Coupler Shanks and Yokes
S-400: Brake Equipment-Installation Specifications
S-471: Brake Pipe Restriction Test
S-4200: ECP Cable-based Brake Systems – Performance Specifications
S-4210: ECP Cable-based Brake System Cables, Connectors and Junction Boxes – Performance Specifications

2.2.2.2 Aluminum Association
Aluminum Design Manual

2.2.2.3 ANSI (American National Standards Institute)
C82.2: For Lamp Ballasts– Method of Measurement of Fluorescent Lamp Ballasts
S1.4: Specification for Sound Level Meters
S3.2-2009: Method for Measuring the Intelligibility of Speech over Communication Systems
References and Glossary

2.2.2.4 APTA (American Public Transportation Association)

Manual of Standards and Recommended Practices for Rail Passenger Equipment
RP-C&S-001-98: Recommended Practice for Passenger Equipment Roof Emergency Access
RP-E-002-98: Wiring of Passenger Equipment
RP-E-006-99: Diesel Electric Passenger Locomotive Dynamic Brake Control
RP-E-007-98, Rev 1: Storage Batteries and Battery Compartments
RP-E-009-98: Recommended Practice for Wire Used on Passenger Equipment
RP-E-012-99, Edited 4-1-04: Recommended Practice for Normal Lighting System Design for Passenger Rail Equipment
RP-E-014-99: Recommended Practice for Diesel Electric Passenger Locomotive Blended Brake Control
RP-E-015-99: Head End Power Source Characteristics
RP-E-016-99: Recommended Practice for 480VAC Head End Power System
RP-E-017-99: Recommended Practice for 27-point Control and Communication Trainlines for Locomotives and Locomotive-Hauled Equipment
RP-E-018-99: 480 VAC Head End Power Jumper and Receptacle Hardware
RP-M-001-97: Recommended Practice for Air Connections, Location and Configuration of, for Passenger Cars Equipped with AAR Long Shank Tight Lock or Similar Long Shank Type Couplers
RP-M-001-98: Recommended Practice for Passenger Car Axle Design
RP-M-003-98: Recommended Practice for the Purchase and Acceptance of Type H-Tightlock Couplers
RP-M-009-98: Recommended Practice for New Truck Design
RP-PS-005-00: Fire Safety Analysis of Existing Passenger Rail Equipment
SS-C&S-002-98: Standard for Static Strength Attachment of Major Equipment to the Carbody Structure of Railroad Passenger Equipment
SS-C&S-004-98, Rev 1: Austenitic Stainless Steel for Railroad Passenger Equipment
SS-C&S-006-98, Rev 1: Attachment Strength of Interior Fittings for Passenger Railroad Equipment
SS-C&S-011-99: Standard for Cab Crew Seating Design and Performance
SS-C&S-012-02: Door Systems for New and Rebuilt Passenger Cars
SS-C&S-015-99: Standard for Aluminum and Aluminum Alloys for Passenger Equipment Carbody Construction
SS-C&S-016-99, Rev 1: Row-to-Row Seating in Commuter Rail Cars
SS-E-005-98: Standard for Grounding and Bonding
SS-E-010-98: Standard for the Development of an Electromagnetic Compatibility Plan

SS-M-006-98, Rev. 2: Standard for Parking Brakes for New Passenger Locomotives and Cars

SS-M-007-98: Conductor’s Valve – New Passenger Car and MU Locomotives

SS-M-011-99: Compressed Air Quality for Passenger Locomotive and Car Equipment

SS-M-012-99, Rev 1: Standard for the Manufacture of Wrought Steel Wheels for Passenger Cars and Locomotives

SS-M-014-06: Standard for Wheel Load Equalization of Passenger Railroad Rolling Stock

SS-M-015-06: Standard for Wheel Flange Angle for Passenger Equipment

SS-M-016-06: Standard for Safety Appliances for Rail Passenger Cars

SS-M-017-06: Standard Definition and Measurement of Wheel Tread Taper

SS-M-018-10: Standard for Powered Exterior Side Door System Design for New Passenger Cars


SS-PS-003-98: Standard for Emergency Evacuation Units for Rail Passenger Cars

SS-PS-004-99, Rev. 2: Standard for Low-Location Exit Path Marking

2.2.2.5 ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers)


2.2.2.6 ASME (American Society of Mechanical Engineers)

Boiler and Pressure Vessel Code

2.2.2.7 ASTM (American Society for Testing and Materials)

A6: Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

A488/A488M-07: Standard Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel

A572, A 568, A 588, A 606, A 715, A 710: High Strength Low Alloy Structural Steel

A380-06: Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

A53/A53M-07: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

D3574-95: Seat Cushion Testing Requirements

D4956-07: Standard Specification for Retroreflective Sheeting for Traffic Control

E165-02: Standard Test Method for Liquid Penetrant Examination

E446-98(2004)e1: Standard Reference Radiographs for Steel Castings Up to 2 in. [51 mm] in Thickness

E662-09: Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials

E709-01: Standard Guide for Magnetic Particle Examination
2.2.2.8 AWS (American Welding Society)

AWS Welding Handbook
C7.2: Recommended Practices for Laser Beam Welding, Cutting and Drilling
C7.4/7.4M: Process Specification and Operator for Laser Beam Welding
D1.1/D1.1M: 2008 Structural Welding Code – Steel
D1.2/D1.2M: Structural Welding Code, Aluminum
D1.6/D1.6M: Structural Welding Code, Stainless Steel
D17.2/D17.2M: Specification for Resistance Welding in Aerospace Applications
D17.3/D17.3M: Specification for Friction Stir Welding of Aluminum Alloys for Aerospace Applications

2.2.2.9 Boeing


2.2.2.10 Bombardier

SMP 800-C: Toxic Gas Generation of “Flex 35 Rev. D” Rubber Compound

2.2.2.11 CENELEC (European Committee for Electrotechnical Standardization)

EN 50128: Railway Applications - Communications, Signaling and Processing Systems - Software for Railway Control and Protection Systems

2.2.2.12 CSA (Canadian Standards Association)

C22.2, No. 197-M1983: PVC Insulating Tape

2.2.2.13 European Norms

BS EN 50126: Railway Applications. The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)

2.2.2.14 GSA (General Services Administration)

Federal Standards
QQ-B-654A: Brazing Alloys, Silver
QQ-P-416F: Plating, Cadmium (Electrodeposited) (S/S by SAE-AMS-QQ-P-416)
TT-P-38E: Paint, Aluminum, Ready-mixed
TT-P-664D: Primer Coating, Alkyd, Corrosion-inhibiting, Lead and Chromate Free, Con-
compliant (S/S by SSPC-PAINT25)
2.2.2.15  IEC (International Electrotechnical Commission)

60571: Electronic Equipment used on Rail Vehicles

2.2.2.16  IEEE (Institute of Electrical and Electronics Engineers)

16: Standard for Electrical and Electronic Control Apparatus on Rail Vehicles
1568-2003: Recommended Practice for Electrical Sizing of Nickel-Cadmium Batteries for Rail Passenger Vehicles
P1477: Passenger Information System for Rail Transit Vehicles

2.2.2.17  IFI (Industrial Fasteners Institute)

Inch Fastener Standards, 7th Edition
Metric Fastener Standards, 3rd Edition

2.2.2.18  ISO (International Organization for Standardization)

2631: Mechanical Vibration and Shock – Evaluation of Human Exposure to Whole Body Vibration

2.2.2.19  NFPA (National Fire Protection Association)

10: Standard for Portable Fire Extinguishers
70: National Electric Code
130: Standard for Fixed Guideway Transit and Passenger Rail Systems

2.2.3  Specifications

The Customer will provide copies of the following documents:

2.2.3.1  PRIIA (Passenger Rail Investment and Improvement Act)

305-900: Specification for Composition Brake Shoes and Disc Brake Pads
305-901: Public Address/Intercom System
305-902: Specification for Water Systems for use on Amtrak Passenger Vehicles
305-903: Flammability, Smoke Emissions and Toxicity for use on Railway Passenger Cars and Locomotive Cabs
305-904: Specification for Vendor Maintenance Manuals
305-905: Specification for Builder Operating and Maintenance Manual Family
305-906: 480, 240, 208, and 120 VAC 72VDC Relay and Contactor Panel


References and Glossary

305-907: Disposable Air Filter
305-908: Valve and Exterior Equipment Identification Tags & Labels and Operating Instructions
305-910: Schematic, Wiring and Piping Diagram Drawings
305-911: Replacement of Copper Waste Piping with Non-Metallic Pipe
305-912: Operational and Environmental Conditions for Rail Rolling Stock
305-913: Manufacture and Acceptance of Passenger Seating for Intercity Rail Cars
305-914: Linear Induction Motor Door Controllers
305-915: Plug Doors

2.2.4 Drawings

2.2.4.1 PRIIA

305-800: Single-Level Clearance Drawing
305-801: Bi-Level Clearance Drawing
B-144: Standard Amtrak Coach Key (J.L. Howard Part No. 2555) (Available to contracted builders only)
305-802: Standard Trash Container (Amtrak Part No. 24-045-18737)
305-803: Speed Sensor and Cable Assembly
305-804: Temperature Probe and Connectors
305-805: Axle Single Level Program
305-806: Power Transformers
305-807: Cab/Baggage Car F-end Pilot Assembly (to be available at a later date)
305-808: Emergency Equipment Cabinet Arrangement
305-809: Seat Track Reference Dimensions
305-810: Door System Equipment Location and Nomenclature (to be available at a later date)
305-811: Food Chiller Units

2.2.5 Supplemental Documentation

http://www.volpe.dot.gov/sdd/pubs-crash.html
2.3 Definitions

The definitions and abbreviations defined below are used throughout this technical specification.

Wherever in the Contract Documents terms are used, the definition, intent and meaning shall be interpreted as follows:

**A-End** (of the car) — Defined as the end of the car opposite from the B-end of all cars except the cab/baggage car.

**A/F-End** (of the car) — Defined as the end of the car opposite from the B-end of all car types.

**Accessible** — To be compliant with the applicable standards for accessibility as defined by the Americans with Disabilities Act of 1990 (ADA) as amended.

**Accessible Toilet Room (ATR)** — The larger of the toilet rooms 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.

**Adhesion, Coefficient of** — During rolling contact, the ratio between longitudinal tangential force at the wheel-rail interface and normal force.

**Amtrak** — The National Railroad Passenger Corporation.

**Analysis** — Written report of the systematic examination of the design, performance and condition of parts, components and systems against Contract and Technical Specification requirements.

**Approval** — Review and acceptance, in writing, by the Customer. Customer approval in no way relieves the Contractor of meeting all requirements of the specification.

**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.

**Assembly** — A collection of subassemblies and components typically performing a variety of functions within the context of a larger system.

**Authorize** — To give authority or power to proceed.

**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 (MTBF)/(MTBF+MTTR).

**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 the Customer.

**Baseline Work** — All activities, which shall be performed on the cars in order to comply with the requirements of this Specification.
**References and Glossary**

**B-End** (of the car) — The end of the car where the hand brake is located on all car types.

**Braking, Blended** — In braking, the simultaneous control of dynamic (rheostatic and regenerative) and friction braking, with the effort of each continuously proportioned to achieve the required total braking effort.

**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.

**Buff** — Compressive forces acting longitudinally through the carbody’s primary structure.

**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.

**Calibration** — Comparing the performance of a measuring device of unknown accuracy against one of known accuracy.

**California Car** — Bi-level intercity corridor cars built by Morrison Knudson and Amerail for use on Capitol, San Joaquin and Pacific Surfliner corridor service. Car-to-car pass-through is on the upper level.

**Caltrans** — California Department of Transportation.

**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.

**Car/Cars** — The railroad passenger cars to be provided by the Contractor pursuant to this Contract.

**Carbuilder** — See Contractor.

**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.

**Commissioning** — Activities involved in delivering, adjusting, and testing the cars to demonstrate compliance with Specification requirements and prepare the cars for revenue service.

**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.

**Concept Drawings** — An initial set of drawings showing the general car layout and arrangement.

**Conformed Specification** — These Specifications as revised to include and reflect all approved change orders, variances and waivers implemented throughout the duration of the Contract.
**Contract** — The written agreement as executed between the Customer and the Contractor setting forth the obligations of the Parties, including all authorized changes to this Contract issued subsequent to the execution of the Contract.

**Contract Deliverable Requirements List (CDRL)** — List of documents and other deliverable items that the Contractor is required to deliver to the Customer. CDRL is also used to refer to a specific item on the list.

**Contractor or Carbuilder** — The prime Contractor solely responsible to the Customer for the construction, quality and proper functioning of the complete car and all of its components.

**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 his/her work.

**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.

**Customer** — The organization, agency or party that is acquiring the vehicles from the Contractor through the administration of this specification and associated contract documents.

**Days** — Days shall mean calendar days unless otherwise specified. Business and working days shall be Monday through Friday, exclusive of federally designated Holidays.

**Delivery, Delivered** — The arrival of the completed vehicle at the Customer’s designated facility, ready for commissioning and acceptance testing.

**Defect** — Any instance of non-conformance with a specification for material, appearance, finish, function, performance or manufacture.

**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.

**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 Customer 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 the Customer. The reason for the variance request must be included in the analysis as submitted.

**F-End** (of the Cab car) — The end of the cab/baggage car that is equipped with the locomotive control cab, per the requirements of 49CFR Section 229.11.

**Fail-Safe** — A characteristic of a system which ensures that no malfunction will create a condition that is not known to be safe.
References and Glossary

**Failure** — A condition in which equipment, components or systems do not function as specified, designed or intended.

**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.

**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.

**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.

**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.

**First Article** — The first one of any production component of the base vehicle that is manufactured.

**First Article Inspection (FAI)** — The examination and approval by the Customer 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 and the minimum level of quality.

**Fleet** — All cars furnished under the terms of this Contract.

**Free Travel** — Is defined as 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).

**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.

**Independent Failure** — A failure which is not the result of another failure, either directly or indirectly.

**Indicated** — As used in this Specification, "indicated" shall be understood to mean, "as shown on the Contract Drawings, as described in the Specifications, or as required by other Contract Documents."

**Inspection** — The careful examination, measurement, and testing of the characteristics and performance of materials, components and systems to ensure conformance with Contract requirements.

**Inspection Equipment** — Any tool, gauge, fixture, apparatus, or other device used for inspection purposes.

**Inspector** — The person or firm designated and authorized to perform quality control inspections.
Interface — The points where two or more physical subsystems or systems meet to transfer load, energy or information.

Left-Hand Side — The side of the car on the left, when standing inside the car at the B-end facing the A-end.

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.).

Maintainability — A measure of a car’s ability to be properly maintained taking into account the ease and frequency of maintenance tasks, ability to efficiently use applied labor, and accessibility of equipment to be maintained by the Customer’s maintenance staff.

Material — An all-inclusive term used to denote raw materials, parts, components, assemblies, and equipment used in the finished product.

Mean Time Between Failures (MTBF) — The mean operating time between independent failures, measured in calendar days.

Mean Distance Between Failures (MDBF) — The mean operating mileage between independent failures.

Mean Distance Between Train Delays (MDBTD) — The mean operating mileage between train delays caused by equipment or system failures.

Mileage, Operating — The total distance traveled by the car during scheduled and unscheduled movements.

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.

New — An item, OEM or approved equal, which has not previously seen service in whole or in part.

No-Motion — The vehicle speed at or below the lowest speed detectable by the vehicle control systems. Also known as “zero speed”.

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.

Notice — A written announcement from the Customer.

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.

Original Equipment Manufacturer (OEM) — The original manufacturer of a hardware subsystem, component or completed vehicle.
**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.

**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.

**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.

**Railroad** — Owner(s) of the operating railroad over which the Customer’s trains operate, and/or the property and/or improvements used in connection with such operating railroads, as defined by 49CFR 238.

**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.

**Reliability** — A term used to identify 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%).

**Remanufacture** — To rebuild and recertify to OEM standards for functionality and appearance. Parts that cannot be remanufactured shall be renewed.

**Renew** — To replace with a new equivalent component (regardless of condition of part being renewed).

**Repair** — Correct specific damage to return to original condition or functionality.

**Right-Hand Side** — The side of the car on the right, when standing inside the car at the B-end facing the A-end.

**Safe** — Secure from potential harm, injury, danger or risk; free from danger or risk.

**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.

**Safety Critical** — An action, device or system that is necessary to maintain a safe condition.

**Service** — (as in service use, service braking.) The operation of the cars under normal conditions.

**Services** — Work and incidental material specified in a contract such as inspection, nondestructive examination, calibration, testing, welding, analysis, etc.

**Shipment** — The physical movement of the car from the Contractor’s production facility to the Contractor’s designated acceptance facility or other designated destination.
**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.

**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.

**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.

**Special Tools** — Tools which have been specifically designed or developed for the purpose of repairing, maintaining, diagnosing or installing a particular component or system in a manner which cannot be performed with commercially available, “off-the-shelf” tools.

**Specified or As specified** — As stated in this document or other referenced documents.

**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.

**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.

**Step, Signal** — A signal having a constant value prior to the step and a different constant value immediately thereafter.

**Stop, Emergency** — The stopping of a vehicle or train by an emergency brake application.

**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.

**Subcontractor** — Provider to the Contractor of any services or materials for incorporation into the car design, car construction, spare parts, or other contract deliverable. The Contractor shall be solely responsible for the services or materials provided by the Subcontractor. The words “supplier”, “manufacturer” and “vendor” to have the same meaning.

**Subsystem** — A defined portion of a system.

**Superelevation** — The vertical difference between the top surface of the outside and inside rails of a curve.

**Superliner** — Bi-level Amtrak long distance passenger cars manufactured by either Pullman Standard or Bombardier. Cars have upper-level car-to-car pass-through.

**Surfliner** — Bi-level intercity corridor cars built by Alstom Transportation for Amtrak and Caltrans for use on Capitol, San Joaquin and Pacific Surfliner corridor service. Car-to-car pass-through is on the upper level.

**System** — A combination of hardware, people, and or software systems, in any combination which are integrated to perform a specific operational function.
Tamperproof — Fasteners are designated as tamperproof when they are selected so that they can not be easily loosened with common tools such as screwdrivers or pliers.

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.

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.

Test Plan — A document that defines the plan and schedule for conducting all the tests required on the vehicle.

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.

Test, Production — A series of tests applied to each vehicle to ensure all systems and components perform according to design and specification.

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.

Time, Warm-up — The elapsed time from application of power to an operable device until it is capable of performing its intended function.

Train — Any number of cars coupled to a locomotive and moving as one.

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.

Trainset — A collection of passenger cars which are semi-permanently coupled to create a fixed consist to be used for a particular train application; a trainset car is that portion of the trainset which is located between coupling arrangements.

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.

Unisex Toilet Room (UTR) — The smaller of the two toilet rooms, to be located on the upper level of the passenger rail car, that is not required to be ADA compliant.

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 History Book — A document specific to an individual rail vehicle containing records of technical and parts data pertinent to that individual vehicle.
**Verification** — Examination and testing by the QA Representative to confirm decisions made by those performing the work concerning conformance of material to Contract requirements.

**Vehicle** — Same as car or locomotive.

**Warp, Track** — The vertical distance between a plane defined by any three of four rail head contact points (two on each rail) forming a triangle and the remaining point.

**Weatherproof** — Able to withstand exposure to all weather and environmental conditions without damage or loss of function.

**Weights, Assigned** — The loaded car categories assigned by the Customer as the basis for structural repair design and for subsystem and vehicle testing as indicated. Four weight categories are assigned:

1. **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 café/lounge car.

2. **AW1**: Car at seated load and no standees.
   - Seated Load is defined as all the passenger seats occupied plus one crew member per car.

3. **AW2**: Car at normal full load.
   - Normal Full Load is defined as seated load plus one standee per 3 ft$^2$ of clear floor space.

4. **AW3**: Car at crush load.
   - Crush Load is defined as seated load plus one standee per 1.5 ft$^2$ of clear floor space.

   Each passenger or standee is assumed to weigh an average of 180 pounds.

**Weight, Dry** — The measured axle weight of an empty passenger rail car (measured dry). Fully assembled but with no water or provisions.

**Work (Procurement)** — Where the context will allow, the term "work" shall mean the production of goods and services furnished in accordance with the Contract.

**Zero Speed** — See “No motion”.

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," “the Customer” unless otherwise specifically stated.

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."
2.3.1 Abbreviations

The following is a list of abbreviations in this specification. The list is not intended to be all-inclusive.

- **AAR** Association of American Railroads
- **AC** Alternating Current
- **ADA** Americans with Disabilities Act of 1990 as amended
- **AED** Automated External Defibrillator
- **AEI** Automatic Equipment Identification
- **amp** ampere
- **ANSI** American National Standard Institute
- **APTA** American Public Transportation Association
- **ASHRAE** American Society of Heating, Refrigeration and Air Conditioning Engineers
- **ASME** American Society of Mechanical Engineers
- **ASTM** American Society for Testing and Materials
- **ATOR** Above Top of Rail
- **ATR** Accessible Toilet Room
- **ATS** Automatic Train Stop
- **AWO** Empty vehicle operating weight, Ready-to-Run (Assigned Weight “0” load)
- **AW1** Car at seated load and no standees.
- **AW2** Car at normal full load.
- **AW3** Car at crush load.
- **AWS** American Welding Society
- **BC** Battery Charger
- **BP** Brake Pipe
- **Btu** British Thermal Unit
- **°C** Celsius (degrees)
CAD  Computer-Aided Design
CCJPA  Capitol Corridor Joint Powers Authority
CCTV  Close Circuit TV
CCU  Communication Control Unit
CD  Compact Disk
CDRL  Contract Deliverable Requirements List
CDT  Central Diagnostics Terminal
CEM  Crash Energy Management
CFC  Chlorinated Fluorocarbons
cfm  Cubic Feet per Minute
CFR  Code of Federal Regulations
CO  Central Office
COMM  Communication
COTS  Clean, Oil, Test and Stencil
CPE  Customer Premise Equipment
DAVW  Digital Audio Video Workstation
DB  Dry Bulb
dB  Decibel
dB/sec  Decibels per second
dBA  Decibels (Acoustic)
DC  Direct Current
DCS  Data Communication System
DNTU  Data Network Transport Unit
DR  Design Review
DTE  Diagnostic Test Equipment
DVD  Digital Versatile Disc
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>DVD RW</td>
<td>Digital Versatile Disc - Rewriteable</td>
</tr>
<tr>
<td>EAB</td>
<td>Electronic Air Brake</td>
</tr>
<tr>
<td>ECR</td>
<td>Engineering Change Request</td>
</tr>
<tr>
<td>ECSB</td>
<td>Engineering Change Service Bulletin</td>
</tr>
<tr>
<td>EEPROM</td>
<td>Electrically Erasable Programmable Read Only Memory</td>
</tr>
<tr>
<td>e.g.</td>
<td>exempli gratia (for example)</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic Compatibility</td>
</tr>
<tr>
<td>EMD</td>
<td>Electro Motive Diesel (a locomotive and component manufacturer)</td>
</tr>
<tr>
<td>EMI</td>
<td>Electromagnetic Interference</td>
</tr>
<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>EPROM</td>
<td>Erasable Programmable Read Only Memory</td>
</tr>
<tr>
<td>ER</td>
<td>equalizing reservoir</td>
</tr>
<tr>
<td>etc.</td>
<td>et cetera (and so forth)</td>
</tr>
<tr>
<td>ETMS</td>
<td>Electronic Train Management System</td>
</tr>
<tr>
<td>F</td>
<td>Front (end of locomotive or cab car designator as defined by 49CFR Section 229.11))</td>
</tr>
<tr>
<td>°F</td>
<td>Fahrenheit (degrees)</td>
</tr>
<tr>
<td>FAI</td>
<td>First Article Inspection</td>
</tr>
<tr>
<td>fc</td>
<td>foot-candle</td>
</tr>
<tr>
<td>FDA</td>
<td>U.S. Food &amp; Drug Administration</td>
</tr>
<tr>
<td>FDR</td>
<td>Final Design Review</td>
</tr>
<tr>
<td>FEA</td>
<td>Finite Element Analysis</td>
</tr>
<tr>
<td>FEM</td>
<td>Finite Element Model</td>
</tr>
<tr>
<td>FMECA</td>
<td>Failure Modes and Effects Criticality Analysis</td>
</tr>
<tr>
<td>FMI</td>
<td>Field Modification Instruction</td>
</tr>
<tr>
<td>fpm</td>
<td>feet per minute</td>
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<tr>
<td>FRA</td>
<td>Federal Railroad Administration (U.S. Department of Transportation)</td>
</tr>
</tbody>
</table>
**References and Glossary**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>FRP</td>
<td>Fiberglass Reinforced Plastic</td>
</tr>
<tr>
<td>ft</td>
<td>foot</td>
</tr>
<tr>
<td>ft²</td>
<td>square foot</td>
</tr>
<tr>
<td>ft³</td>
<td>cubic foot</td>
</tr>
<tr>
<td>foot-candle</td>
<td>Foot candle</td>
</tr>
<tr>
<td>FTA</td>
<td>Federal Transit Administration (U.S. Department of Transportation)</td>
</tr>
<tr>
<td>g</td>
<td>Acceleration due to gravity (386.1 inches per second per second)</td>
</tr>
<tr>
<td>gal</td>
<td>gallon</td>
</tr>
<tr>
<td>GB</td>
<td>Gigabyte</td>
</tr>
<tr>
<td>GFCI</td>
<td>Ground Fault Circuit Interrupter</td>
</tr>
<tr>
<td>GHz</td>
<td>gigahertz</td>
</tr>
<tr>
<td>gpm</td>
<td>gallons per minute</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>HDMI</td>
<td>High Definition Multimedia Interface</td>
</tr>
<tr>
<td>HEP</td>
<td>Head End Power</td>
</tr>
<tr>
<td>Hg</td>
<td>Mercury (pressure or vacuum – measured in inches)</td>
</tr>
<tr>
<td>HPPL</td>
<td>High Pressure Photoluminescent</td>
</tr>
<tr>
<td>hr</td>
<td>hour</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilation, &amp; Air Conditioning</td>
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<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>i.e.</td>
<td>id est (that is)</td>
</tr>
<tr>
<td>IC</td>
<td>Intercommunication</td>
</tr>
<tr>
<td>IDR</td>
<td>Intermediate Design Review</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronic Engineers</td>
</tr>
<tr>
<td>in.</td>
<td>inch</td>
</tr>
</tbody>
</table>
\textbf{References and Glossary}

\begin{itemize}
\item \textbf{in}^2 \quad \text{square inch} \\
\item \textbf{IPC} \quad \text{Illustrated Parts Manual} \\
\item \textbf{IPS} \quad \text{Iron Pipe Size} \\
\item \textbf{ISO} \quad \text{International Organization for Standardization} \\
\item \textbf{ISP} \quad \text{Internet Service Provider} \\
\item \textbf{IVDN} \quad \text{Inter-Vehicle Data Network} \\
\item \textbf{IWS} \quad \text{Instrumented Wheelset} \\
\item °\textbf{K} \quad \text{Kelvin (degrees)} \\
\item \textbf{kg} \quad \text{kilogram} \\
\item \textbf{kHz} \quad \text{kilohertz} \\
\item \textbf{km} \quad \text{kilometer} \\
\item \textbf{ksi} \quad 1000 \text{ pounds per square inch (psi)} \\
\item \textbf{kW} \quad \text{kilowatt} \\
\item \textbf{LAHT} \quad \text{Low Alloy High Tensile} \\
\item \textbf{lb} \quad \text{pound} \\
\item \textbf{lbf} \quad \text{pounds of force} \\
\item \textbf{lbs/ft}^2 \quad \text{pounds per square foot} \\
\item \textbf{LCD} \quad \text{Liquid Crystal Display} \\
\item \textbf{LED} \quad \text{Light Emitting Diode} \\
\item \textbf{LLEPM} \quad \text{Low Location Exit Pathway Markings} \\
\item \textbf{lm} \quad \text{lumen} \\
\item \textbf{Log} \quad \text{Inspection and Test Log} \\
\item \textbf{LLRU} \quad \text{Lowest Level Replaceable Unit} \\
\item \textbf{LSA} \quad \text{Lead Service Attendant} \\
\item \textbf{lx} \quad \text{lux} \\
\item \textbf{LVPS} \quad \text{Low Voltage Power Supply}
\end{itemize}
m  meter
mA  milliampere
MAP  Maintenance Analysis Program
MB  Megabyte
Mbps  Megabits Per Second
MDBC  Mean Distance Between Component Failures
MDBF  Mean Distance Between Failures
MDBTD  Mean Distance Between Train Delays
mg/sq. in.  milligrams per square inch
Mhz  Megahertz
MIG  Metal Inert Gas
MIL  Military Specification
min  Minute, minutes
mm  millimeter
MP3  MPEG Audio Layer 3
MPa  Megapascal
mph  miles per hour
mphps  miles per hour per second
mphpsps  miles per hour per second per second
MR  Main Reservoir
MSDS  Material Safety Data Sheet
msec  milliseconds
MTBF  Mean Time Between Failures
MTTR  Mean Time To Repair
MU  Multiple Unit
mV  millivolt
N/A  Not Applicable
NAS  Network Attached Storage
NBS  National Bureau of Standards
NC   Normally Closed
NDE  Non-Destructive Examination
NEMA National Electrical Manufacturers Association
NFL  No Field Lubrication
NFPA National Fire Protection Association
NIC  Network Interface Card
NO   Normally Open
NPT  National Pipe Thread
NSF  National Sanitation Foundation
NTP  Notice-to-Proceed
NTSB National Transportation Safety Board
OCU  Operator Control Unit
ODBC Open Data Base Connectivity
ODK  Operator Display Keypad
OEM  Original Equipment Manufacturer
OSHA Occupational Safety and Health Administration
OTIS Onboard Train Information System
oz   ounce
p/n  part number
PA   Public Address
PA/IC Public Address/Intercom
PC   Personal Computer
PCB  Printed Circuit Board
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>PCMCIA</td>
<td>Personal Computer Memory Card International Association</td>
</tr>
<tr>
<td>PCS</td>
<td>Pneumatic Control Switch</td>
</tr>
<tr>
<td>PDF</td>
<td>Portable Document Format</td>
</tr>
<tr>
<td>PDR</td>
<td>Preliminary Design Review</td>
</tr>
<tr>
<td>PHS</td>
<td>Public Health Service</td>
</tr>
<tr>
<td>PIDS</td>
<td>Passenger Information Display System</td>
</tr>
<tr>
<td>PIS</td>
<td>Passenger Information System</td>
</tr>
<tr>
<td>PISCU</td>
<td>Passenger Information System Control Unit</td>
</tr>
<tr>
<td>PKO</td>
<td>Power Knock/Out</td>
</tr>
<tr>
<td>PM</td>
<td>Preventative Maintenance</td>
</tr>
<tr>
<td>POS</td>
<td>Point-of-Sale</td>
</tr>
<tr>
<td>ppm</td>
<td>parts per million</td>
</tr>
<tr>
<td>pphm</td>
<td>parts per hundred million</td>
</tr>
<tr>
<td>PRIIA</td>
<td>Passenger Rail Investment and Improvement Act</td>
</tr>
<tr>
<td>PROM</td>
<td>Programmable Read-Only Memory</td>
</tr>
<tr>
<td>psi</td>
<td>pounds per square inch</td>
</tr>
<tr>
<td>psig</td>
<td>pounds per square inch (gauge)</td>
</tr>
<tr>
<td>PTC</td>
<td>Positive Train Control</td>
</tr>
<tr>
<td>PTE</td>
<td>Portable Test Equipment</td>
</tr>
<tr>
<td>PTT</td>
<td>Push to Talk</td>
</tr>
<tr>
<td>PTU</td>
<td>Portable Test Unit</td>
</tr>
<tr>
<td>PVC</td>
<td>Polyvinyl Chloride</td>
</tr>
<tr>
<td>QA</td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>RAID</td>
<td>Redundant Array of Independent Disks</td>
</tr>
<tr>
<td>RAM</td>
<td>Random Access Memory</td>
</tr>
<tr>
<td>RFI</td>
<td>Radio Frequency Interference</td>
</tr>
</tbody>
</table>
**RFP** Request for Proposal

**RGB** red green blue

**rms** root mean square

**S&I** Service and Inspection

**SAE** Society of Automotive Engineers

**SCFM** Standard Cubic Feet per Minute

**sec** second

**SIV** Secondary Impact Velocity

**SNR** Signal-to-Noise Ratio

**SQL** Structured Query Language

**SSP** System Safety Plan

**SSS** Sign System Server

**T/L** Trainline

**TB** Terabyte

**TBD** To Be Determined

**TCD** Train Communications Data

**TFT** Thin Film Transistor

**TIG** Tungsten Inert Gas

**TMS** Train Monitoring System

**U.S.** United States

**UL** Underwriter’s Laboratories, Inc.

**UMLER** Universal Machine Language Equipment Register

**USB** Universal Serial Bus

**USDOT** United States Department of Transportation

**USPHS** U.S. Public Health Service of the U.S. Department of Health and Human Services

**USSC** United States Steel Corporation
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>UTR</td>
<td>Unisex Toilet Room</td>
</tr>
<tr>
<td>UV</td>
<td>Ultraviolet</td>
</tr>
<tr>
<td>V</td>
<td>volt</td>
</tr>
<tr>
<td>VAC</td>
<td>Volt Alternating Current</td>
</tr>
<tr>
<td>VDC</td>
<td>Volts Direct Current</td>
</tr>
<tr>
<td>VDSL2</td>
<td>Very High Speed Digital Subscriber Line 2</td>
</tr>
<tr>
<td>W</td>
<td>watt</td>
</tr>
<tr>
<td>W/ft²</td>
<td>watts per square foot</td>
</tr>
<tr>
<td>WB</td>
<td>Wet Bulb</td>
</tr>
<tr>
<td>WiFi</td>
<td>Wireless Fidelity (Wireless Local Area Network protocol, IEEE 802.11b, 802.11g and 802.11n)</td>
</tr>
<tr>
<td>WLAN</td>
<td>Wireless Local Area Network</td>
</tr>
<tr>
<td>WMS</td>
<td>Work Management System</td>
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<tr>
<td>yr</td>
<td>year</td>
</tr>
<tr>
<td>Z</td>
<td>Impedance</td>
</tr>
</tbody>
</table>

* End of Chapter 2 *