California Department of Transportation
Division of Rail
Rolling Stock Procurement Branch

Technical Specification
For
The Design, Manufacture and Acceptance of Passenger
Seating for Intercity Rail Cars

Specification 9-101

Revision D.1
April 4, 2008
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1.0 Overview

The objective of this specification is to define the design criteria, as well as the technical characteristics, for the passenger seats to be installed in intercity rail cars owned by the California Department of Transportation (the Department) and operated by Amtrak.

2.0 Regulations, Standards, Specifications and Drawings

APTA

SS-C&S-016-99, Rev. 1: Standard for Row-to-Row Seating in Commuter Rail Cars

ASTM

ASTM D 6193: Standard Practice for Stitches and Seams

California Department of Transportation (Caltrans)

Specification 9-103: Seat Fabric Pattern, Color and Material Specification
Drawing D-9-901: Seat Track Reference Dimensions and Specification

FRA

49CFR Part 238.103: Fire Safety
Appendix B to 49CFR Part 238: Test Methods and Performance Criteria for the Flammability and Smoke Emission Characteristics of Materials Used in Passenger Cars and Locomotive Cabs
49CFR 238.233(a): Interior Fittings and Surfaces

3.0 Scope

The different types of seats to be designed and manufactured in accordance with this specification are those listed below:

1. Two-Passenger Non-Rotating seats (“double seats”)
2. Single-Passenger Non-Rotating seats (“single seats”)

This specification does not apply to the following types of seats:

1. Flip-up seats for use at wheelchair parking locations (“flip-up seats”)
2. Lounge seating in food service or café cars (“lounge seating”)
3. Crew seats in the operating compartment of cab control cars (“cab seats”)

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4.0 Abbreviations and Glossary

APTA: American Public Transportation Association
CFR: Code of Federal Regulations
Department: California Department of Transportation
FRA: Federal Railroad Administration
SIV: Secondary Impact Velocity

5.0 General Conditions

5.1 General Characteristics

This specification shall govern the design and manufacture of row-to-row passenger seats for revenue use on intercity rail passenger cars. Each seat unit shall consist of a frame, pedestal, seat bottom cushion, seat back cushion, armrests, seat back tray table and footrest. The seat back tray table, magazine pocket and footrest shall be designed for use by a passenger seated behind the seat unit. "Double seats" shall have two seat units, divided by a center armrest.

The seats shall comply with all applicable requirements for passenger comfort and safety. The factors regarding ease of maintenance and interchangeability of parts are fundamental requirements. Quantity of different parts should be kept to a minimum.

Seat design and manufacture shall insure snugness between seat elements, thus eliminating rattling or vibration while the train is in motion.

Seats shall be designed to accommodate the safety, comfort and ergonomic needs of passengers over the size range from the 5th percentile female to the 95th percentile male.

5.2 Structural Requirements

The seat shall meet all design, testing and passenger safety requirements of APTA Standard SS-C&S-016-99, Rev. 1, as applicable, except as where noted otherwise within this specification.

The seat assembly, pedestal and mounting system shall meet the attachment strength requirements of APTA Standard SS-C&S-016-99, Rev. 1, as well as the requirements of 49CFR Part 238.233(a).

5.3 Health and Safety Requirements

The seats shall not have sharp or protruding parts or edges or any other potentially harmful elements that may cause passenger injury. There shall be no pinch points or finger hazards during deployment or use of the recline mechanism or tray table.

Combustible components of the seat shall be tested in accordance with 49CFR Part 238.103 and Appendix B to 49CFR Part 238.
The seat frame and all attached parts shall be designed and manufactured to eliminate locations where food particles, trash and debris may collect. The design shall facilitate easy cleaning in accordance with Amtrak standard cleaning procedures.

The upper surfaces on the rear of the seat back or headrest (facing a passenger seated behind the seat unit) shall be individually padded with appropriate-density foam to minimize secondary impact velocity (SIV) injuries, in accordance with applicable APTA standards and FRA regulations.

### 5.4 Dimensions & Weights

Dimensions are in inches (millimeters) unless otherwise noted.

<table>
<thead>
<tr>
<th>Item</th>
<th>Single Passenger Seat</th>
<th>Two Passenger Seat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inches (millimeters)</td>
<td>Inches (millimeters)</td>
</tr>
<tr>
<td>Total height of seat back, including headrest (from floor to top)</td>
<td>Min 43 (1092) to max 47 (1194)</td>
<td>Min 43 (1092) to max 47 (1194)</td>
</tr>
<tr>
<td>Total overall width of seat assembly, max.</td>
<td>25.75 (654)</td>
<td>44.50 (1130)</td>
</tr>
<tr>
<td>Seat bottom height (top of front edge of cushion above floor)</td>
<td>17 to 17.5 (432 to 445)</td>
<td>17 to 17.5 (432 to 445)</td>
</tr>
<tr>
<td>Overall seat depth (from front of cushion to rear of back), max. (when upright and excluding deployed footrest)</td>
<td>27 (686)</td>
<td>27 (686)</td>
</tr>
<tr>
<td>Space between armrests (width of bottom cushion), min.</td>
<td>23 (584)</td>
<td>19 (483)</td>
</tr>
<tr>
<td>Width of outer armrest, max.</td>
<td>2.5 (63)</td>
<td>2.5 (63)</td>
</tr>
<tr>
<td>Width of center armrest, max.</td>
<td>2.5 (63)</td>
<td>2.5 (63)</td>
</tr>
<tr>
<td>Seat bottom depth (front edge of cushion to backrest)</td>
<td>17 (432)</td>
<td>17 (432)</td>
</tr>
<tr>
<td>Max. weight of seat assembly</td>
<td>120 lbs (55 kg)</td>
<td>200 lbs (91 kg)</td>
</tr>
<tr>
<td>Max. weight of any component that must be lifted when the seat is installed into or removed from a rail car</td>
<td>100 lbs (45 kg)</td>
<td>100 lbs (45 kg)</td>
</tr>
<tr>
<td>Seat pitch (for testing purposes)</td>
<td>46 (1168)</td>
<td>46 (1168)</td>
</tr>
</tbody>
</table>

### 6.0 Design Description

#### 6.1 Mounting and Installation

The seat must be able to be mounted in the existing seat mounting system in the Department's fleet of California Cars and Surfliners, as well as being installed in new equipment using an equivalent installation system that will permit use of one design of pedestal for all car types. The seats are mounted in the rail cars using an adjustable floor and wall track, with a pedestal and wall bracket providing the required properties of durability and stability to the entire seat unit. Seat track dimensions and specifications are identified in Department Drawing D-9-901.

The pedestal and wall bracket must be removable from the main seat frame. The pedestal shall be as narrow as structurally feasible. The maximum allowable pedestal width is 2.25".
(57 mm). The lower half of the pedestal shall have an integrated stainless steel surface to prevent cleaning equipment from chipping paint or powder coating off of the pedestal. The stainless steel surface shall have a \#4 brushed finish in the horizontal direction. The side of the pedestal facing the wall shall have an access panel that is removable to access the mounting hardware. Clearance between the underside of the pedestal cross member or seat frame and the floor shall be not less than 5 inches at any point between the pedestal and wall.

The wall bracket must be removable from the main seat frame. The same wall bracket shall be used for all seats, regardless of the direction facing or width of seat.

The seat shall be designed to be mounted in a fixed position and shall not include provision for rotating the seat to face the opposite direction. The seat frame shall be designed so that the same seat may be used on either side of the car, or face either direction, without requiring modification to the seat or seat frame. The seat assembly may use non-symmetrical fiberglass or plastic shrouds for appearance and access for maintenance and cleaning provided that these shrouds are easily removable and installable so that a seat may be deployed in a different location in the car with minimal effort. Seats facing opposite directions on the same side of the car shall be able to use the same pedestal. When installed in a rail car, no part of the seat assembly shall make contact with the interior wall of the car except the wall-mount bracket.

### 6.2 Recline

The seats shall include a recline mechanism. The recline mechanism shall be operated by a positive control system, such as a lever or pushbutton, that is activated by the passenger and will hold the seat in any position between full upright and full recline when released. During recline, the bottom cushion shall slide forward. The lower part of the seat back shall move along with the seat cushion throughout the reclining motion. Reclining the seat back shall not intrude on passengers seated behind the seat. The recline mechanism shall be such that the seat may be placed directly against a bulkhead wall and still have full functional recline capability as any other seat in the car. A decal or label shall be provided that instructs the passenger how to recline the seat.

The seat back when in the most upright position shall measure (at a minimum) 16 degrees when measured from the vertical. The total recline of the seat back should be a minimum of 10 degrees from the upright position (26 degrees from vertical, minimum).

Neither the framework of the seat or any part of the seat unit shall have sharp edges or wear points that can cause damage to any part of the seat unit, including seat fabric or cushions, during the reclining operation. The seat recline mechanism shall not create a pinch hazard during any part of the seat recline range of motion.

### 6.3 Cushions

The seat back and bottom cushions must be easily removable from the seat frame without tools. The seat covers shall also be removable from the cushions without tools to allow for easy removal and replacement using a positive mechanical securement design. All seat parts, including seat cushions, shall be able to withstand deceleration forces in compliance with 49CFR 238.233(a) without coming loose from the seat frame, regardless of recline position or direction of travel.
The cushions should be contoured to provide optimal occupant retention and comfort, incorporating ergonomic design as specified in APTA Standard SS-C&S-016-99, Rev. 1. The cushions shall be covered with fabric as specified in Department Specification 9-103.

The seat back and bottom cushions shall be symmetrical and completely interchangeable between left and right on all double seat units. Seat backs may incorporate an integrated headrest, or use a separate headrest that is mounted to the top of the seat back. If a separate headrest is used, the headrest shall be removable from the seat back without having to remove the seat back from the seat frame.

A strip of hook Velcro 1” wide x 8” long (25 x 204 mm), perimeter stitched, shall be sewn on the top of the seat back cover or headrest to attach an antimacassar.

The seat foam shall be fully encapsulated with a fire barrier material, which shall be sewn with 100% Kevlar 69 lb. thread and should be firmly joined to the cushion foam. An approved fire barrier fabric is 6.4 oz. yd. min. quilted Nomex®/Kevlar® FRQh fabric with Nomex® scrim, DuPont, Merge #17253, Style #4311 or equal. Alternative fire barrier materials will be considered. All fire barrier materials used shall pass the following tests:

<table>
<thead>
<tr>
<th>Test Identification</th>
<th>Test Description</th>
<th>Test Pass/ Fail Criteria</th>
</tr>
</thead>
</table>
| 14 CFR 25.853 Appendix F, Part I (b) (vertical test): | Flammability | Flame time ≤ 10 seconds 10 seconds  
Burn length ≤ 6 inches  
No flame dripping or running |
| ASTM E662          | NBS Smoke Chamber      | Ds @ 1.5 min. ≤ 100 (worst mode)  
Ds @ 4 min. ≤ 200 (worst mode) |
| ASTM D3884         | Abrasion Resistance    | ≥ 150 cycles @ 50% wear through                                                       |
| ASTM D2261         | Tear Resistance        | ≥ 15 lbs  
(in both the warp and fill directions)                                                  |
| FTMS 191A Method 5122 | Burst/ Puncture Resistance | ≥ 200 lbs                                                                               |

Durability of the seat cushions shall be demonstrated as specified in APTA Standard SS-C&S-016-99, Rev. 1.

All finished upholstery covers shall include an identification label. The label shall be constructed of “Tyvek” fabric paper and shall include the upholstery manufacturer, manufacturer’s part number, and date of manufacture in 3/16” high lettering. 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 inside of the upholstery covers and shall not be visible when the cushion is installed on the seat.

### 6.4 Armrests

All armrests shall be no wider than the width shown in section 5.4. Outer armrests shall be interchangeable from one position to another (left to right). Center armrests between seat backs on double seat units shall fold up and recess flush with the seat backs at all angles of recline.
For the purpose of facilitating the action of aiding a passenger into a seat on the train (particularly at a table), the seats shall be equipped with folding armrests at the aisles and between the passenger placements on double seat units.

The armrests shall be durable and comfortable to the passenger. The armrests shall meet the strength requirements of APTA SS-C&S-016-99, Rev 1, Section 5.1.4.

Armrests shall be securely mounted to the seat frame, and shall be removable without requiring the disassembly of the seat in order to replace a damaged armrest.

The armrest structure shall be covered with foam. Foam used on armrests shall be identical to that used on seat cushions. All of the armrests shall have an easily replaceable armrest cover of a material and color as specified in Department Specification 9-103. The design of the armrest shall be such that the foam and cover cannot twist relative to the armrest structure.

### 6.5 Tray Table

Each seat shall have a tray table mounted on the back for use by a passenger seated behind the seat. The tray table shall be designed and tested to be simple, easy to use and safe. The tray table shall be of the fold-down style and not require that any portion of the tray table be pulled up vertically to deploy. The mechanism should be simple and durable, and shall not be spring loaded in any manner. The tray table shall have a lip or raised edge to contain spilled liquids.

The tray table shall be constructed of a material that provides fire safety and crashworthiness as specified in 49CFR Part 238. Deployment or storage of the tray table shall not present any pinch points or reveal any sharp corners, edges or protrusions on the seat frame.

The tray table shall be tested to withstand a static vertical load of 35 lbs (16 kg) without damage or material failure.

The tray table shall be retained in the upright (stored) position by a positive, easy-to-use latch or keeper that will prevent the tray table from unintentionally deploying in the event of an accident.

Each tray table shall rest at a horizontal level when deployed and be stable at that position without requiring any adjustment. The tray table shall remain horizontal when deployed regardless of whether the seat is reclined or not.

The minimum dimensions of the tray table shall be 16” (406 mm) wide by 12.5” (318 mm) deep. The nominal height above the floor for a deployed tray table shall be 24” to 27” (610 to 686 mm).

Each tray table shall include a 3” (75 mm)-diameter indent, no less than 0.375” (10 mm) deep and located in the upper right corner of the tray table when deployed, for a beverage cup/can to minimize risk of it slipping off of the tray table.

An additional cup holder, located elsewhere on the seat, may be incorporated into the seat design so that passengers using the tray table as a work surface may securely store a beverage container in a location not on the tray table. This cupholder must not create an unsafe condition for passengers, nor interfere with the operation of the seat recline mechanism or tray table.
6.6 Footrest
The back of each seat shall have a footrest for passenger use. The footrest shall be able to fold up against the back of the seat. The footrest shall not make a loud noise when being stowed against the seat back or when being deployed. There shall be a spring mechanism for maintaining the footrest in the stowed position until moved by a passenger. The footrest shall meet the load requirements of APTA SS-C&S-016-99, Rev 1, Section 5.1.5.

6.7 Passenger Convenience Step
Each seat frame shall incorporate a passenger convenience step to facilitate a passenger's ability to reach up into overhead luggage storage areas. The top surface of the step shall be between 7 and 12 inches (178 to 305 mm) above the floor, and shall be equipped with an anti-slip surface. The step shall be designed so that it does not present a hazard to passengers walking down the aisle past the seat. It shall not catch or pinch a passenger's foot or present a safety hazard. The step shall be designed to accommodate a minimum 250 lb (117 kg) vertical load. The step may be integral to the seat frame or may be removable for left-to-right interchangeability.

6.8 Seat Back Magazine Pocket
A seat back pocket shall be incorporated into the back of each seat so that its contents may be seen by a passenger seated behind the seat. The seat back pocket shall be easy to remove and install, and be designed to prevent the accumulation of dust and be easily cleaned. The seat back pocket shall be sized appropriately to accommodate a 9” x 12” (230 x 305 mm) magazine or cardstock flier and a tri-fold passenger safety card. The tray table shall not hide the contents of the seat back pocket when stowed, nor shall interfere with the removal or insertion of the material stowed in the seat back pocket.

6.9 Seat Back Passenger Handhold/Wear Pad
Each seat back shall incorporate a durable handhold or wear pad to prevent passengers from discoloring or wearing out the top corners of the seat back when used for stability by passengers while walking through a moving train. The handhold or wear pad may be located on the headrest as an alternative location if the headrest has sufficient width, but must be located as far as possible from the head of a seated passenger. The handhold or wear pad shall be made of resilient material that is easy to clean and presents a complementary color and texture to the seat fabric. Wear pads or handholds shall either be located symmetrically on seat backs to preserve interchangeability, or may incorporate a provision for the removal and installation of the handhold on one corner of a seat back as needed for aisle-side locations. Handholds shall not present a potential point of injury to seated or standing passengers in the event of an accident or sudden deceleration.

6.10 Paint and Coverings
The seat frame and all exposed metallic parts shall be powder coated. Color shall be specified by the Department. Metallic parts that are not exposed shall have a corrosion-resistant protective coating.
Components that are made of polyester or other resin-like material should be dyed or painted to match the color of the seat frame.

**6.11 Plastics and Fiberglass**

The seat structure may incorporate fiberglass or thermoplastic shrouding for aesthetics. fiberglass is not allowed in areas where it may be structurally damaged. Durability of all plastic or fiberglass components must be demonstrated to the Department. The shrouding shall be supported by the frame in critical areas. The shrouding should be easy to remove and install. All plastic and fiberglass components shall incorporate metal sleeves in fastener holes to prevent damage from fasteners.

All fiberglass or plastic parts must be tested for, and be compliant with, all applicable flammability, smoke density and toxic gas emissions standards as specified in 49CFR Part 238.103.

**6.12 Thread, Stitching, Zippers and Seams**

All thread, stitching, seams and zippers used in the construction of the seat cushions shall be in conformance with the following:

1. Eyelets where used shall be brass with plain washer face, .315” inside diameter, Astrup code 233221-1, or approved equivalent.
2. All thread employed to attach fabrics, zippers, straps, and hook & loop shall be “Nylbond” 69 lb. nylon thread, or approved equivalent. The thread color shall either compliment or contrast the finish upholstery fabric. Samples of finished upholstery seams shall be forwarded to the Department for approval of thread color.
3. Serging thread shall be “Daspun” 50/3 spun polyester thread, or approved equivalent.
4. All upholstery seams shall be constructed per ASTM D 6193.
5. All finish cover upholstery seams shall be constructed employing Type SSa-1 seams with one (1) row of flat stitching and one (1) row of top stitching, six (6) stitches per inch minimum.
6. All zippers shall be attached with a Type SSaz-1 seam, a single row of stitching, six (6) stitches per inch minimum. Ends must be locked.
7. All fire barrier cover attachment seams shall be lockstitched, single row of stitching, seven (7) stitches per inch minimum. Stitching thread shall be 100 percent Kevlar, 69lb. Final joint (joint remaining after cushioning form is inserted into cover) may be bonded rather than stitched providing a flap with a 2” minimum overlap.

**7.0 Testing Requirements**

A representative production seat of each design shall be tested in conformance with the testing requirements specified in APTA Standard SS-C&S-016-99, Rev. 1. For testing and simulation of secondary impact velocity (SIV) injuries, seat pitch shall be tested at 46 inches (1168mm) for front-to-back seats. The seat pedestal and mounting hardware shall be simulated using the seat track and hardware components as identified on Department Drawing D-9-901. The pedestal shall not yield or separate from the mounting track during any of the required tests. Securement of the seat track to the carbody shall be the
responsibility of the car manufacturer and shall not be considered as part of the qualification and design testing for the seat frame and pedestal.

Test procedures and results shall be submitted to the Department for review and approval prior to commencement of production of the seats. Submittals shall be made in accordance with section 12 of APTA Standard SS-C&S-016-99, Rev. 1, unless otherwise directed by the Department.

8.0 Documentation and Submittals

Supporting documentation for the seats shall be submitted to the Department for review and approval, and shall include the following at a minimum:

1. Maintenance Manuals (Running and Heavy Maintenance);
2. Illustrated Parts Catalog;
3. Installation drawings and instructions;
4. As-built component and assembly drawings for all seat types;
5. Contact information for all component suppliers;
6. Test results for fire barrier materials as specified in Section 6.3; and

* End of Specification *