Standardized Technical Specification

Bi-Level Passenger Rail Cars
for
Intercity Corridor Service

Chapter 16
Cab and Train Controls

Revision E
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16.0 Cab and Train Controls

16.1 Overview

This chapter describes the design and functionality of the cab area of the cab/baggage car, including locomotive control equipment, instruments and gauges for systems necessary for the safe and efficient operation of the train from the engineer’s cab and ancillary equipment for crew comfort and safety.

16.2 General Requirements

The cab/baggage car shall include a cab control compartment that spans the full width of the upper level of the F-end of the car (opposite end from the B-end). The cab control compartment shall include a desk-type engineer’s console on the right side and desk-type assistant’s work station on the left. The cab control compartment shall provide the engineer with all necessary functions and indications to safely and efficiently control the locomotive, and other train functions, from the cab end of the train through the use of the 27-pin Multiple Unit (MU) and Communication (COMM) trainlines.

The cab shall be configured to permit the cab compartment to be closed off from the passenger seating area when the cab car is at the end of the train, and to permit the engineer’s side and assistant’s side compartments to be closed off separately to provide a passageway to the end frame door so the car may be used as a mid-train coach.

The cab shall be equipped with forward-facing FRA Type I compliant windshields on the right and left end sheets and the end frame door between the collision posts, and FRA Type II compliant drop-sash side windows in the engineer’s and assistant’s compartments.

The operating controls and cab features shall include, but are not limited to those listed in the following paragraphs and shall be in full compliance with all applicable FRA requirements.

16.2.1 Cab Area General Arrangement

Refer to Figure 16-1, Figure 16-2 and Figure 16-3 for the cab area conceptual arrangement. The cab shall be arranged so that the engineer and assistant have easy access to all controls and switches, clear visibility to all indicators and labels, and sufficient view forward and to the sides to safely operate the train and perform all duties as required. Primary train controls and instruments will be ergonomically arranged on a panoramic desk-type console. The interior of the cab shall present a clean, efficient appearance and shall be free of sharp edges, protrusions, pinch points and safety hazards.

The cab arrangement shall allow the cab car to be used as a coach car in any position in a train, with a passageway to the adjacent car seating areas. Cab compartment doors, which can be maintained in either of two positions, will be provided to isolate the cab from the passenger area, allowing configuring the vehicle as a full width cab or creating a passage through the cab area to the end frame door for mid-train use. When the doors are configured for pass-through, the engineer’s and assistant’s sides of the cab are each isolated from the passengers, and from each other.
16.3 Cab Design and Layout

Cab layout will be designed and manufactured so that all devices and equipment are integrated (built-in and flush mounted) into the console, walls, ceiling and floors to give an integrated appearance. Ergonomics, safety, maintainability and commonality with other bi-level equipment as specified shall be major considerations in cab design. The design shall group controls and instruments for function, maintenance and ease of cleaning. Electrical and control enclosures shall be designed to be dust-resistant and drip-proof, and shall be watertight to avoid damage or failure from spilled liquids, windshield condensate or leaks.

The cab equipment layout and console configuration shall be designed to accommodate engineers and assistants from the 5th percentile female to the 95th percentile male. The layout of the cab shall consider the engineer’s relationship to the console and the windshield, and shall permit the engineer and assistant to have a continuous unobstructed field of view from 30 degrees above horizontal to a point on the tracks no more than 40 ft from the end of car. 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, including an unobstructed view of the rear-view mirror mounted on the left side of the car. Obstructions to the field of view caused by required structural members shall be minimized.

The Contractor shall demonstrate the ergonomic design of the cab for the full percentile range of engineers and assistants as specified. Documentation as provided during the cab area design review regarding the ergonomics of the cab shall include:

- Seat travel forward and rearward
- Engineer and assistant access into and out of cab seats
- Leg and knee room under the cab console for full range of seat positions
- Visibility forward, up and down, and side-to-side through front windshield
- Visibility through left- and right-side windows including view to mirrors
- Access to all controls and visibility of all gauges and indicators
- Range of motion to get into and out of crew seats
- Visibility and access to all indicators and controls

Primary console operating features shall be positioned to be accessible and functional from the engineer’s optimal seating position with all required controls and display instrumentation mounted within the operating crew console desk. Normal operation shall not require awkward and unnatural positioning, extension or excessive motion on the part of the engineer. Switches and controls on the engineer’s console shall be kept to a minimum. Gauges and instruments shall be internally illuminated and shall be positioned to avoid glare and reflection.

The console and instrument panels shall be designed to provide access to all controls, switches and indicators for routine maintenance. Instruments (such as the speedometer, air gauges, loadmeter, etc.) shall be easily replaceable from the cab interior, without requiring the removal of major panels and assemblies. Captive hardware will be used to secure all removable and/or hinged panels.

Secondary controls, switches and features that are not used in the performance of operation of the cab shall be located outside of the cab area.
16.4 Cab Equipment

The cab shall be fitted with all necessary appointments, indicators and controls, including but not limited to, the following items or devices.

16.4.1 Engineer's Side of Cab

- Engineer's desktop console
- Right side instrument panel
- Left auxiliary control panel
- Overhead indicator panel
- Side overhead circuit breaker and control panel
- Rear wall audible alarm panel
- Engineer's seat
- Trash container
- 74 Volts Direct Current (VDC) receptacle
- 120 Volt Alternating Current (VAC) receptacle
- Door to close off cab when not in use
- Overhead heat thermostat

16.4.2 Assistant's Side of Cab

- Assistant's desktop console
- Right side instrument panel
- Assistant’s seat
- Assistant’s emergency brake valve
- Door to close off area when cab not in use
- Holders for FRA inspection card and Maintenance Analysis Program (MAP) form
- Forward-facing digital video camera

16.4.3 Both Sides of Cab

- FRA Type I windshields with integral electric defogger
- Windshield sunshades
- Forced air defroster
- Windshield wipers
- Tinted-glass drop sash side windows (FRA Type II)
- Cup holders
- Coat hooks (two per side)
• Adjustable louvers for Heating, Ventilation and Air Conditioning (HVAC)
• Overhead heater
• Ceiling light with switch
• Reading light with switch
• Dimmer switch for instrument lights
• Car number plate
• Track warrant holder with clip

16.4.4 Secure Cabinet behind Engineer’s Cab
• Upper cabinet (lockable and sealable inner door):
  • Positive Train Control (PTC) components and memory module
  • Train Communication Data (TCD) and forward-facing camera system components
  • Event recorder system components
  • Event recorder download module
• Lower cabinet (open behind cabinet door):
  • Emergency equipment (fusee holder, fire extinguisher, first aid kit, snap lights, tool storage)

16.4.5 Secure Cabinet behind Assistant’s Cab
• Upper cabinet (open behind cabinet door):
  • Storage area for crew belongings
• Lower cabinet (open behind cabinet door):
  • Crew refrigerator

16.4.6 Exterior Cab Equipment
• Wind deflector/mirror (both sides of cab)
• Blue flag bracket (Engineer’s side)
• Headlights
• Crossing lights
• Marker lights
• Horn
• Bell
• Pilot/Plow
• Cab radio antenna (roof)
• PTC antennae (roof)
• Illuminated car number boards
• Retro-reflective conspicuity decals
16.5 **Engineer's Desktop Console**

The engineer’s desktop control console shall consist of a working desktop surface with major controls for train operation, and a cabinet underneath the desktop console to provide access to the wiring, piping, instrument mounting fasteners and other components mounted on or under the console.

16.5.1 **Desktop Console Arrangement**

The desktop console shall be designed and arranged to provide a comfortable operating area that is easy to clean and maintain. The desktop surface shall be angled down (towards the engineer) at least 10 degrees from horizontal. The control console shall be designed so that liquids spilled on the surface will not damage or interfere with operation of components or wiring, and shall have a finish that can be cleaned with a soap solution in water.

The desktop console operating surface shall be constructed of stainless steel, and shall be powder-coated with low-gloss black paint. The console cabinet shall be constructed of integrally colored fiberglass-reinforced polyester resin, or other Customer-approved material, to match adjacent cab lining materials.

The master throttle controller and brake controller shall mount directly to the desktop console, and shall be fastened to the console frame. Other desktop equipment and controls shall be fastened to mounting plates that are attached to the desktop surface. All control mounting panels shall be fastened to the console or cabinet surfaces with captive threaded fasteners. All hardware shall be attached with machine screws to either tapping plates or captive nuts. The console desk surface shall be removable for replacement or overhaul.

The console shall be designed and shaped in such a manner to permit the engineer to open and lean out of the cab side windows to inspect the train. The console will extend to the bottom of the windshield, and will have no hard-to-maintain areas where debris and dirt may collect.

16.5.2 **Control Components**

All switches, controls, buttons and indicators used on the control panels shall be rugged, high-quality components that are readily available from commercial sources. The number of different types of device shall be kept to a minimum, and individual functional designations shall not be marked on the device, except for the air brake gauges that may be marked on the face or cover of the gauges. Designations shall be attached to, or be part of, the console.

For commonality of train control equipment, switches and controls shall be provided as specified. A listing of the type and description of all switches in the cab area is shown in Table 16-1.

All controls and indicators shall be identified by signage as defined by Amtrak signage guidelines. Multi-position controls shall have all positions identified. Customer-approved adhesive-bonded tags will be permitted for labeling.
16.5.3 Engineer’s Console Equipment

Main engineer controls and equipment on the desktop console shall include:

- Master controller
  - Throttle/dynamic brake controller
  - Reverser with removable handle
- Brake controller
  - Automatic brake handle
  - Parking brake handle
  - Brake cutout valve
- Horn push button
- Bell push button
- Locomotive sand control push button
- Alerter reset push button
- Track warrant holder with spring clip

16.5.3.1 Master Controller

An ElectroMotive Diesel (EMD) desk-type, single-lever throttle/dynamic brake control (EMD p/n 10592830) shall be provided. Traction power increases with handle motion toward the engineer and dynamic braking increases with handle moving away from the engineer. A gate or guard will be provided to separate traction from dynamic braking. The throttle handle will be interlocked with the reverser.

- Throttle handle cannot be moved from IDLE when reverser handle has been removed.
- Reverser handle cannot be removed if throttle is in any position other then IDLE.

A separate reverser handle will incorporate FORWARD, REVERSE and NEUTRAL positions.

A holder will be provided for the reverser handle when removed from the reverser.

16.5.3.2 Brake Controller

The console will be equipped with a conventional 30CDW desk-mounted air brake controller (Wabtec p/n 593290-1001) incorporating the automatic brake handle and parking brake control handle. It shall also incorporate the brake cutoff valve.

Automatic brake handle movement shall be continuously variable between the minimum application and full service positions; however, detents shall be provided for the following positions: RELEASE, MINIMUM REDUCTION, SUPPRESSION, FULL SERVICE, HANDLE OFF and EMERGENCY.

The parking brake shall apply and release the air brakes on the cab car only. Application of the parking brake shall be equivalent to a full service brake application. The parking brake shall not include a function to bail-off the locomotive brakes via trainline.
Both brake control handles shall be non-removable.

The brake valve shall include a three position cutoff pilot valve, with positions labeled as:

- PASSENGER
- FREIGHT
- OUT

Means for a brake pipe pressure regulating valve adjustment will be provided near the brake controller.

Air brake system noise shall not be introduced into the cab. All air brake system exhaust shall be vented to the underside of the car.

Refer to Chapter 7 for further details of the air brake system.

16.5.3.3 Horn push button

A two-position push button shall be mounted on the desktop console for control of the horn. The button shall be blue mushroom-head style, and shall have positions for low volume (partially depressed) and high volume (fully depressed). Cutler-Hammer p/n 10250ED1309-5.

16.5.3.4 Bell push button

A twin-control push button shall be mounted on the desktop console for control of the bell. Button assembly shall be yellow. Top button shall be labeled ON and bottom button shall be OFF. Cutler-Hammer p/n E30CED6.

16.5.3.5 Locomotive sand control push button

A blue collar-type push button shall be mounted on the desktop console for control of the locomotive sanding function. Cutler-Hammer p/n 10250ED1309-2.

16.5.3.6 Alerter reset

A yellow mushroom-head style push button shall be mounted on the desktop console for reset of the alerter. Cutler-Hammer p/n 10250ED1309-4.

16.5.3.7 Track warrant holder with spring clip

Working space shall be provided on the desktop console for a track warrant holder. The holder shall consist of a spring clip and a flat area where track warrants and other operating papers can be secured for easy access and viewing.
16.6 **Engineer’s Right Side Instrument Panel**

The Engineer’s right side instrument panel shall include:

- Duplex air gauges
- Speedometer
- Locomotive loadmeter

### 16.6.1 Air Gauges

The following air brake pressures will be displayed on two duplex 4.5 in. gauges with black lettering on a white background as follows:

**Left or bottom gauge:**

- Main reservoir (red needle)
- Equalizing reservoir (black needle)

**Right or top gauge:**

- Brake cylinder (red needle)
- Brake pipe (black needle)

Label for needles shall be located on the gauge cover.

The gauges shall be internally illuminated and shall permit the replacement of internal bulbs from within the cab area without requiring the removal of the gauge. All gauges will be equipped with Salem test fittings for calibration checks. The fittings may be located under the gauge front cover so they are hidden from the operating crew, but must be easily accessed from the engineer's console area.

### 16.6.2 Speedometer

An analog speedometer shall be provided on both engineer's and assistant's sides of the cab, with display range of 0 to 120 mph. The speedometer may employ a mechanical movement or solid-state simulation. Unit face will be black, with white lettering, and shall include a digital display.

The speedometer motion shall be smooth, continuous movement that shall accurately depict vehicle speed in real time (less than 1 second delay). The speedometer shall have a resolution of at least 1 mph. The display and readout shall not flicker between values. The speedometer shall be internally illuminated.

### 16.6.3 Loadmeter

A remote locomotive loadmeter (EMD p/n 10620135) shall be provided which will be compatible with the 27-point MU trainline and locomotive sending units. The loadmeter shall be internally illuminated.
16.7 Engineer’s Left Side Auxiliary Console

The Engineer’s left side auxiliary console shall include:

- Cab radio/PA handset and keypad
- Headlight selector switch and control panel
- PTC display panel
- Windshield wiper control switch
- Alerter acknowledgement light (duplicate to alerter status panel)
- Car number plate

16.7.1 Cab Radio/PA Handset

A handset shall be provided for use with the cab radio and the train’s Public Address (PA)/intercom system. The handset control panel shall have a selector switch that allows the engineer to choose whether the handset works with the radio, PA (train), PA (cab car only) or intercom (trainline). There shall be a push-to-talk button on the inside of the handset. The handset shall be Amtrak standard locomotive handset (EMD p/n 10623456), and shall connect to the PA control panel via multi-pin connector.

The handset shall rest in a cradle when not in use.

16.7.2 Headlight Selector Switch

A four-position headlight selector switch shall be provided (Electro Switch Corp p/n 101405A-S). The positions shall control the headlights as follows:

- Top (12 o'clock): Headlights dim and crossing lights on
- Right (3 o'clock): Headlights dim and crossing lights off
- Bottom (6 o'clock): headlights high and crossing lights on
- Left (9 o'clock): Headlights and crossing lights off

Placing the switch in the right (3 o'clock) position shall cause the crossing lights to be extinguished, even if they are flashing as a result of the horn being blown. Blowing the horn while the switch is in this position shall cause the crossing lights to illuminate and flash for the established duration, then re-extinguish.

Placing the headlight selector switch in the OFF position shall cause the headlights and crossing lights to extinguish and stay extinguished.

If the marker light switch in the electrical locker is set to F-END, then the marker lights shall come on when the headlight switch is in the OFF position, and be extinguished when the headlight selector switch is in any other position.
16.7.3 **Positive Train Control (PTC) Display Panel**

The display screen for the PTC system shall be located on the left side auxiliary console, and shall be oriented so that the screen is clearly and easily viewed by the engineer when seated, without glare or reflection from instruments, controls or lights, and without requiring excessive or unsafe diversion of the engineer’s view forward from the cab. All controls related to the function of the display screen; including brightness control, shall be located in the immediate vicinity of the screen and be easily accessed.

The PTC display screen shall not hinder access to, or view of, other controls.

The display panel shall be removable from within the cab without requiring the removal of other controls or components.

16.7.4 **Windshield Wiper Control**

A switch to control the windshield wipers shall be located on the left side auxiliary console, adjacent to the headlight selector switch. The windshield wiper control shall be a rotary switch with variable speed control and intermittent operation, and shall control wipers on both sides of cab. The windshield wipers shall automatically park to one side when turned off.

16.7.5 **Alerter Reset Indicator Light**

A red Light Emitting Diode (LED) light shall be located on the left auxiliary console to give the engineer a visual indication that the alerter requires resetting or acknowledgement. This light shall be in parallel with the indicator light on the alerter control head on the overhead indicator panel, and shall be clearly visible to the engineer under all lighting conditions. The alerter “request for acknowledgement” indicator light shall be appropriately labeled as to its function.

16.7.6 **Car Number Plate**

A metal or polycarbonate plate with the car’s road number and reporting marks shall be located on the left auxiliary console. Numerals shall be no less than 1 in. tall, and shall have a high contrast with the background in order to be readable in low lighting conditions.

16.8 **Overhead Indicator Panel**

The overhead indicator panel shall be mounted on the cab wall above the engineer’s console and forward-facing windshield. The panel shall be mounted so that all indicators are easily seen and recognized by the engineer while seated.

16.8.1 **Indicator Lights**

LED indicator lights shall be of a “push to test lamp” style button, with the lettering for each indicator etched into the lens so that it will not wear off from lamp testing. Lamps shall be replaced by removing the indicator faceplate from the cab. Lamp lenses shall be secured into the lens housing so that they will not fall out when the housing is removed. The console shall have labels adjacent to each lamp under the housings to aid troubleshooting indicators when the housing is off, and prevent the wrong housing from being installed over an indicator unit.
The indicator lights to be provided are shown in the following table.

<table>
<thead>
<tr>
<th>Light Group</th>
<th>Condition</th>
<th>Indicator Lights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Status</td>
<td>MU power on</td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>PCS open</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Sanding (loco)</td>
<td>White</td>
</tr>
<tr>
<td></td>
<td>Wheel slip (loco)</td>
<td>White</td>
</tr>
<tr>
<td></td>
<td>Dynamic brake warning</td>
<td>Amber</td>
</tr>
<tr>
<td></td>
<td>Loco Alarm: failure</td>
<td>Red</td>
</tr>
<tr>
<td>Safety Equipment Status</td>
<td>Automatic Train Stop (ATS) penalty*</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>ATS cutout*</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Alerter cutout</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Overspeed (cab signal)*</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Overspeed cutout</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Spare</td>
<td>Red</td>
</tr>
<tr>
<td>Cab Car Status</td>
<td>Heated windshield on</td>
<td>Amber</td>
</tr>
<tr>
<td></td>
<td>HEP on</td>
<td>Blue</td>
</tr>
<tr>
<td></td>
<td>HEP off</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>No battery charge</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Spare</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Spare</td>
<td>Amber</td>
</tr>
<tr>
<td>Train Status</td>
<td>Brakes applied</td>
<td>Amber</td>
</tr>
<tr>
<td></td>
<td>Brakes released</td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>Car doors closed</td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>Car door summary bypass on</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Hot journal</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Spare</td>
<td>Red</td>
</tr>
</tbody>
</table>

* If so equipped

**16.8.2 Alerter Control Head and Test Button**

The control head and test button for the alerter shall be mounted on the overhead indicator panel. Another alerter acknowledgement request light, in parallel with the light on the alerter control panel, shall be mounted on the left side auxiliary console.

**16.8.3 Headlight and Crossing Light Indicator**

The overhead indicator panel shall be equipped with a visual indicator that displays the status of the headlights, crossing lights and marker lights that are mounted on the F-end of the cab/baggage car. The indicator shall graphically represent the end of the car, and shall have LEDs that are illuminated whenever the respective light is illuminated on the exterior of the car. The LED shall only be illuminated when the exterior light is also illuminated, and shall not illuminate if the exterior light is off, burned out or disconnected.
16.9    Right Side Overhead Circuit Breaker and Control Panel

Low voltage circuit breakers and auxiliary cab equipment control switches shall be mounted on a panel on the upper console on the right hand side in the cab, accessible to the seated engineer. All circuits and devices will be clearly labeled by name and position. A label shall be included which provides instructions for switch and circuit breaker positions for lead and cutout operation in push-pull service.

16.9.1    Circuit Breaker Panel

Circuit breakers and switches shall include at a minimum:

- Locomotive control/MU trainline power (trainlines 4 and 13)
- Dynamic brake cutout
- Engine run switch
- Generator field switch
- Door summary circuit bypass (sealed switch)
- Heated windshield
- Windshield defogger
- Cab heat
- Crossing lights (VAC)/Car number boards
- Crossing Lights (VDC)
- Headlights
- Radio
- Indicator and gauge lights
- Event Recorder/Alerter/Speedometer (sealed)
- PTC (sealed)
- Forward-facing video system (sealed)
- 74VDC Receptacle
- 120VAC receptacle
- Refrigerator
- Spare

Other circuit breakers may be needed. The Contractor shall submit a list of circuit breakers and the panel layout for review and approval by the Customer.
16.9.2 Control Panel

The right side overhead control panel shall include at a minimum:

- Windshield defogger switch
- Windshield defroster switch
- Instrument light dimmer switch
- Cab ceiling light switch
- Reading light switch (white reading light)
- Reading light switch (red reading light)
- Locomotive alarm silence push button
- Emergency locomotive shutdown push button
- Locomotive fault reset push button

16.10 Audible Alarms

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, and be readily accessible for maintenance. 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 levels shall be determined during acceptance testing. The alarm panel shall be located at the top of the rear wall of the engineer’s cab.

The audible alarms and signals shall include, but not be limited to:

16.10.1.1 Audible Alarm Panel

- Loco alarm (Sonalert) 2.9 kilohertz (kHz) intermittent fast pulse tone
- Conductor signal (Buzzer) 4.5 kHz continuous tone
- Wheel slip/brake warning (Sonalert) 1.9 kHz continuous tone

16.10.1.2 Alerter Panel

- Alerter audible alarm (yelp)
- Overspeed (whistle under engineer’s console)

16.11 Assistant’s Cab Area

The assistant’s side of the cab shall include the following controls and indicators. Unless otherwise specified, all controls and indicators used on both Engineer’s and assistant’s side cabs shall be identical components.
16.11.1 Desktop Console

- Bell push button (ON/OFF)
- Horn push-button (3 position)
- B-3-B emergency brake valve
- Track warrant holder with spring clip

16.11.2 Right Auxiliary Console

- Reading light switch
- Ceiling light switch
- Windshield wiper control
- Speedometer
- Cab reading light dimmer

16.11.3 Left Auxiliary Console

- Radio handset, control panel and handset storage cradle
- Radio keypad
- Car number plate

16.12 Locomotive Control 27-Point MU Trainline Operation

The cab/baggage car shall be capable of operating the train in push-pull mode with a locomotive equipped for operation using APTA standard 27-point MU trainlines. During push-pull operation, the MU controls and communications will be interfaced using the existing trainline protocol (see Chapter 13).

16.12.1 Trainline Circuit Protection

The 74VDC control power for the MU functions will be provided from the locomotive via the #13 and #4 pins. A two-pole, 15-amp circuit breaker shall be provided between the #13 and #4 trainlines and the cab MU electrical equipment, and shall be labeled LOCOMOTIVE CONTROL. This will serve two functions:

1. To protect cab equipment from faults in the outgoing MU trainline system.
2. To provide on/off switch function to activate or deactivate the cab for changing ends.

A green MU POWER ON pilot light will be provided on the load side of this circuit breaker to provide the engineer an indication that MU trainline power is available.
16.12.2 Trainline Functions

MU trainline functions will conform to APTA Standard RP-E-017-99 (see Chapter 13). All MU trainlines shall provide APTA standard locomotive control functions, except as listed below.

16.12.2.1 Locomotive Alarm Silence

MU trainline #2 provides a circuit to provide a locomotive fault alarm in the cab area of the cab/baggage car. Locomotive faults which cause this alarm include:

- Prime mover (traction engine) shutdown
- HEP engine shutdown
- HEP loss (local and/or trainline)

The ALARM SILENCE push button is to be provided to allow the engineer to silence the locomotive alarm. This will be via a self-latching relay so that if the locomotive fault clears, the cab alarm is automatically restored to normal condition, and will respond to a new alarm.

16.12.2.2 Emergency Locomotive Shutdown

Pressing the EMERGENCY LOCOMOTIVE SHUTDOWN button causes the following:

- Shuts off power feed to throttle/dynamic brake commands; and
- Energizes the MU trainline #3 (only), which shuts down all diesel engines in the locomotive (prime mover and HEP engine).

This button shall be latching in both positions - push to activate, and pull to reset.

16.12.2.3 Remote Locomotive Loadmeter

MU trainlines #18 and #19 provide a current loop to operate the remote locomotive loadmeter in the cab area of the cab/baggage car.

16.12.2.4 Trainline Ground/Electronic Air Brake (EAB) Alarm Silence

A push button will be provided to apply 74VDC to MU trainline #26 to reset the locomotive. The push button shall be labeled TRAINLINE GROUND/EAB ALARM SILENCE.

16.12.3 Throttle/Dynamic Brake Control and Reverser

An EMD desk-type, single-lever throttle/dynamic brake control will be provided. This controller regulates the traction current generated by the locomotive via trainline commands, per APTA Recommended Practice RP-E-017-99. Traction power increases with handle motion toward the engineer and dynamic braking increases with handle moving away from the engineer. A gate or guard will be provided to separate traction from dynamic braking. This handle will be suitably interlocked with the reverser. The reverser will incorporate forward, reverse and neutral positions.

The master controller incorporates a dynamic brake zone of movement that will cause only dynamic brake operation. Use of the dynamic brake controller will activate the dynamic brakes.
on the locomotive but will not make an air brake application. Use of the automatic brake valve (trainline air brakes) will automatically activate the blended brakes on any locomotive so equipped, which combine air braking and dynamic braking. These functions shall conform to APTA Recommended Practice RP-E-006-99.

16.12.4 Power Knockout Functions

Power Knock/Out (PKO) will occur in response to emergency or penalty brake applications. The MU propulsion control system will receive the PKO signal from the brake system and immediately remove traction power by deenergizing the GF, A, B, C, and D valve control trainlines, and also lighting the PCS OPEN indicator on the console.

16.13 Brake Control System

The cab/baggage car shall be capable of controlling the operation of the train in push–pull mode with a standard locomotive equipped with 26L type air brake equipment. The cab/baggage car shall be designed to interface with locomotives equipped with pneumatic, dynamic and blended brake systems. Blended brakes operate in response to brake pipe pressure reduction (there is no electrical trainline function). This function shall conform to APTA Recommended Practice RP-E-014-99.

16.13.1 Features

The cab/baggage car shall be equipped with 26L brake equipment. It will include the following features:

- A 30CDW desk type air brake controller, which shall include:
  - Automatic brake control
  - Parking brake control
  - A 3-position cutoff pilot valve, with Passenger (PASS), Freight (FRT) and Out (OUT) positions.
    - In the FRT position the system shall provide for gradual application and direct release of the trainline brakes. Once applied, brake cylinder pressure is maintained until the automatic brake handle is placed in the RELEASE position.
    - In the PASS position the system shall provide for gradual application and gradual release of the trainline brakes. Once applied, brake cylinder pressure may be reduced by increasing the brake pipe pressure until the automatic brake handle is placed in the RELEASE position.
    - In the OUT position the automatic brake valve operation is blocked.
    - When the pilot valve is in the cutout position, the following brake interfaces are inoperative:
      - Alerter
      - Overspeed
      - Parking brake
      - ATS/Cab signal (if so equipped)
16.13.2 Brake Operation

The Engineer’s desktop console will be equipped with a desk-mounted air brake controller, incorporating the automatic brake handle and parking brake control handle as well as the brake valve cutoff device. The automatic brake handle will control the application and release of the air brakes on the entire train, including the locomotive. It will also initiate blended braking, on locomotives so equipped, through brake pipe pressure reduction.

Braking effort shall be continuously variable between the minimum application and full service positions; however, detents shall be provided for the following positions: RELEASE, MINIMUM REDUCTION, SUPPRESSION, FULL SERVICE, HANDLE OFF and EMERGENCY. Both automatic and parking brake control handles will be non-removable.

An equalizing reservoir cut off valve shall be provided and coordinated with the brake valve operation in the FREIGHT position such that the system shall stop the brake valve from increasing the pressure in the equalizing reservoir except with the brake valve handle in the RELEASE position. The equalizing reservoir cut off valve may be separate from the brake valve.

Penalty brake application will be at the full service rate. The braking system shall provide electrical interlocking to remove traction power (power knockout/PKO) in the event of a penalty or emergency brake command. Procedure for recovery of both an emergency brake application and a penalty brake application shall be as follows:

16.13.2.1 Process for traction recovery from emergency:

1. Place automatic brake handle in emergency position;
2. Reset source of emergency application if initiated from other than cab (such as broken air line or B-3-B valve);
3. Wait 60 seconds from application of emergency;
4. Place throttle in idle or dynamic brake setup positions;
5. Move automatic brake handle to release position; and
6. Move throttle to power or dynamic brake position.
16.13.2.2 Process for traction recovery from penalty:

1. Place automatic brake handle in suppression position;
2. Move throttle to idle or dynamic brake setup position;
3. Satisfy requirements of system that initiated penalty (e.g. acknowledge alerter);
4. Move automatic brake handle to release position; and
5. Move throttle to power or dynamic brake position

These procedures shall be described in the operating manual for the cab/baggage cars.

16.13.3 Parking Brake

The parking brake handle provides the ability to make a brake application of the air brakes on the cab car, regardless of the state of the automatic brake. This will allow the train brakes to be released while the brakes on the cab car hold the train stationary. The parking brake will be either applied or released; it is not modulated. When the automatic brake valve is cutout, parking brake function is disabled, causing the cab/baggage car’s brakes to respond to brake pipe pressure in the normal way. This shall occur regardless of parking brake handle position when the pilot valve is cutout.

16.14 Communication Equipment

The cab shall incorporate an integrated communication system that combines functions for the cab radio, public address and intercom systems into one handset in each cab compartment for use by the engineer and assistant. A selector switch on the handset panel shall allow the engineer or assistant to choose the function of the handset – radio, PA (cab car only), PA (train) and intercom. This selector switch shall provide a visible indication of the function selected.

The handset shall have a push-to-talk (PTT) switch, and shall plug into a receptacle on the faceplate of the handset panel. A cradle shall be provided for handset storage when not in use.

The cab area PA/Intercom interface shall provide a connection to the car’s public address/intercom system.

The cab radio shall be a separate unit and shall not have an interactive function with the PA/Intercom unit.

16.14.1 Two Way Radio

The cab will be equipped with an Amtrak standard 2-way radio. The radio will be located at the engineer's console. A press-to-talk handset and holder will be provided for the engineer and the assistant positions. The radio case and the antenna shall be securely grounded to the cabbody to ensure an excellent standing wave ratio.

A 160-162 Mhz railroad-band roof-mounted cab radio antenna shall be installed on a flat mounting plate on the centerline of the roof over the cab compartment. All mounting and conduit holes shall be fully watertight. Removal and installation of the antenna shall be possible from the roof of the car without requiring access to the underside of the roof.
Installation of the radio antenna shall be within the clearance requirements of Amtrak Bi-Level Clearance Drawing B-066-00050, Rev A.

16.14.2 Conductor Signal

The cab will be equipped with a conductor signal buzzer, (communication trainline #22 74VDC). This buzzer shall alert the engineer and/or assistant to an incoming request to communicate by intercom.

16.14.3 Public Address System

The Radio/PA/Intercom function control panel shall provide an interface to the car-borne public address/intercom system. Function of this panel shall be similar to the PA/Intercom control panel used at the Conductor's PA control station, except for the cab radio interface. See Chapter 12 for details of the PA system.

16.15 Event Recorder and Alerter

16.15.1 Event Recorder

An event recorder/alerter system shall be provided. It shall be Wabtec Train Trax model TTX-REC-M5.

The event recorder, including memory and download modules, shall be designed and installed in accordance with 49CFR Section 229.135. Memory modules shall be painted orange for easy identification following an accident. These components shall be located in the secure top portion of the cabinet behind the Engineer's cab.

The parameters to be recorded, and the rate of scan for those parameters, shall be provided to the Customer for review. Time, date, car number and distance traveled shall also be recorded.
At a minimum, the system shall record the following parameters:
<table>
<thead>
<tr>
<th>No.</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Digital</td>
<td>Brake Cylinder Pressure 15 psig (bench mark)</td>
</tr>
<tr>
<td>2</td>
<td>Digital</td>
<td>Alerter Reset (use of alerter reset button)</td>
</tr>
<tr>
<td>3</td>
<td>Digital</td>
<td>Brake Pipe Charging Cut-off (Port 53) (lead/trail)</td>
</tr>
<tr>
<td>4</td>
<td>Digital</td>
<td>Operator Initiated Emergency</td>
</tr>
<tr>
<td>5</td>
<td>Digital</td>
<td>Bell Use (Air Signal)</td>
</tr>
<tr>
<td>6</td>
<td>Digital</td>
<td>Horn Use (Full Volume Horn Blast, Air Signal)</td>
</tr>
<tr>
<td>7</td>
<td>Digital</td>
<td>Self Test of Alerter</td>
</tr>
<tr>
<td>8</td>
<td>Digital</td>
<td>Alerter Control Override (Electric Cutout)</td>
</tr>
<tr>
<td>9</td>
<td>Digital</td>
<td>ATS Enabled (combination electronic &amp; pneumatic)*</td>
</tr>
<tr>
<td>10</td>
<td>Digital</td>
<td>Generator Field Excitation</td>
</tr>
<tr>
<td>11</td>
<td>Digital</td>
<td>Throttle Valve “A”</td>
</tr>
<tr>
<td>12</td>
<td>Digital</td>
<td>Throttle Valve “B”</td>
</tr>
<tr>
<td>13</td>
<td>Digital</td>
<td>Throttle Valve “C”</td>
</tr>
<tr>
<td>14</td>
<td>Digital</td>
<td>Throttle Valve “D”</td>
</tr>
<tr>
<td>15</td>
<td>Digital</td>
<td>Direction of Travel - Forward</td>
</tr>
<tr>
<td>16</td>
<td>Digital</td>
<td>Direction of Travel - Reverse</td>
</tr>
<tr>
<td>17</td>
<td>Digital</td>
<td>Dynamic Brake Setup</td>
</tr>
<tr>
<td>18</td>
<td>Digital</td>
<td>Sand Magnet Valve (locomotive sander only)</td>
</tr>
<tr>
<td>19</td>
<td>Digital</td>
<td>Penalty Brake (Output to Alerter Magnet Valve)</td>
</tr>
<tr>
<td>20</td>
<td>Digital</td>
<td>Headlight Switch – Headlights On (high or dim)/Off</td>
</tr>
<tr>
<td>21</td>
<td>Digital</td>
<td>Crossing Lights On/Off</td>
</tr>
<tr>
<td>22</td>
<td>Digital</td>
<td>Horn Sequencer Foot Switch Use</td>
</tr>
<tr>
<td>23</td>
<td>Digital</td>
<td>HEP ON/OFF</td>
</tr>
<tr>
<td>24</td>
<td>Digital</td>
<td>Door Closed Summary Circuit (Doors Closed/Not Closed)</td>
</tr>
<tr>
<td>25</td>
<td>Digital</td>
<td>Holding Brake Pressure (HBPS) (Parking Brake Applied)</td>
</tr>
<tr>
<td>26</td>
<td>Digital</td>
<td>PCS Open</td>
</tr>
<tr>
<td>27</td>
<td>Digital</td>
<td>ATS Acknowledge*</td>
</tr>
<tr>
<td>28</td>
<td>Digital</td>
<td>ATS Request for Acknowledgement*</td>
</tr>
<tr>
<td>29</td>
<td>Digital</td>
<td>High Horn</td>
</tr>
<tr>
<td>30</td>
<td>Digital</td>
<td>Low Horn</td>
</tr>
<tr>
<td>31</td>
<td>Digital</td>
<td>Cab Signal High Overspeed Select (ATS is cutin)*</td>
</tr>
<tr>
<td>32</td>
<td>Digital</td>
<td>Door Closed Summary Circuit Status (Normal/Bypass)</td>
</tr>
<tr>
<td>33</td>
<td>Digital</td>
<td>Not Used</td>
</tr>
<tr>
<td>A1</td>
<td>Analog</td>
<td>Brake Pipe Pressure</td>
</tr>
<tr>
<td>A2</td>
<td>Analog</td>
<td>Brake Cylinder Pressure</td>
</tr>
<tr>
<td>A3</td>
<td>Analog</td>
<td>Headlights High/Dim/Off</td>
</tr>
<tr>
<td>A4</td>
<td>Analog</td>
<td>Crossing Lights On/Flashing/Off</td>
</tr>
<tr>
<td>A5</td>
<td>Analog</td>
<td>Not Used</td>
</tr>
<tr>
<td>A6</td>
<td>Analog</td>
<td>Cab Signal</td>
</tr>
<tr>
<td>A7</td>
<td>Analog</td>
<td>Not Used</td>
</tr>
<tr>
<td>F1</td>
<td>Freq.</td>
<td>Speed (1 mph increments)</td>
</tr>
<tr>
<td>F2</td>
<td>Freq.</td>
<td>Not Used</td>
</tr>
<tr>
<td>F3</td>
<td>Freq.</td>
<td>Not Used</td>
</tr>
<tr>
<td>F4</td>
<td>Freq.</td>
<td>Not Used</td>
</tr>
</tbody>
</table>

* If so Equipped

The memory module shall be crash-hardened, tamper resistant and waterproof. The system
shall retain data during extended loss of power to the system, shall provide physical protection during vehicle catastrophic occurrences, be flame resistant and contain constraints against accidental or deliberate data erasure or over-writing. The system shall retain, at a minimum, the last 60 hours of data collected in normal railroad operation.

Train operating data will also be provided to the non-removable memory module to record operational performance data. Minimum scan rate occurs as a result of a change. Data retained will cover a period of at least 60 hours in normal railroad operation. Recorded data will be capable of convenient down-load on demand to a compatible Windows-based computer and a removable memory storage device. The credit card memory device will be the primary means of download. The list of recorded inputs is to be submitted for Customer approval.

16.15.1.1 Speed signal

A single speed signal will be used for speedometer and event recorder. Axle #1 shall be used. The installation of speed sensor and truck wiring shall be similar to that described for the wheel slide system (see Chapter 7). End–of–axle drive type speed pickups shall not be used. Design of the system will minimize pickup and wiring vulnerability to damage from wayside debris. This speed signal may also be used for the PTC system.

16.15.1.2 Overspeed

The speedometer will include an overspeed function, with 83 mph setting for 79 mph territory. Overspeed shall be provided for operations above 79 mph if the PTC system is disabled. Should the car with the active cab exceed the allowed speed, the overspeed indicator will flash, and after a time delay of 3-5 seconds, a penalty brake application will occur, with power knockout. To recover brake control, the brake controller 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.

It shall be possible to do a self-test on the overspeed when the car is stationary. Terminals to inject a speed signal into the unit without disconnecting any wiring will be provided. Adjustment for wheel size shall be done easily.

If the overspeed fails, it shall be possible to cut it out through the use of a sealed cutout cock, handle coded white in color, co-located with the alerter and ATS cutout cocks. Actuation of the cutout will provide an indication on the engineer's overhead indicator panel.

16.15.1.3 Data download

Recorded data shall be capable of convenient download on demand to a standard Windows-based laptop computer through the use of a cable with a Universal Serial Bus (USB) 2.0 connector on one end.

Data shall also be downloaded through the use of commercially available portable memory modules [Personal Computer Memory Card International Association (PCMCIA), flash memory or USB memory module] inserted into a memory module reader located in the vicinity of the event recorder.

All event recorder data shall include the car number and the date and time of download. Data shall be downloadable at any time including during operation.
16.15.1.4 Deliverables

The Contractor shall supply the following prior to acceptance of the first cab/baggage car to support the event recorder system:

- Three copies of required event recorder software, needed for retrieving and manipulating the event recorder data, shall be provided. Instructions for using the software will be provided. Software packages will incorporate both methods to download data and will be compatible with commercially available series microprocessors and Windows software. There will be no additional cost or use restrictions associated with this software.
- One memory module is to be provided with each cab/baggage car.
- Ten download cables shall be provided.

16.15.2 Alerter System

An alerter function shall be provided by the event recorder system.

The engineer's activities shall be monitored over time intervals that decrease in duration as train speed increases. Lack of recorded activity for certain functions during this period shall result in a continuous audio alarm, a continuous visual alarm, and, if unacknowledged, a penalty brake application with power knockout.

To recover from a penalty brake application, the brake controller must be moved to the suppression position, the alerter must be reset by normal reset actions, wait for the PCS light to go out, and then release the brakes. It shall not be necessary to stop the train.

An alerter reset is generated every time the engineer:

- Changes throttle setting;
- Initiates dynamic brake setup;
- Changes reverser position;
- Makes an automatic brake adjustment of more than 5 psi;
- Changes the position of the headlight selector switch;
- Blows the horn; or
- Presses the alerter reset push button.

Alerter reset interval shall decrease as speed increases. This interval shall be adjustable and shall be set per Customer requirements.

The alerter shall become dormant if the pilot valve on the 30CDW brake controller is cut out.

It shall be possible to do a self-test of the system while the car is stationary.

If the alerter system fails, it shall be possible to cut it out through the use of a sealed switch or through the use of a sealed cutout cock, handle yellow in color, co-located with the overspeed and PTC cutout cocks. Activation of the cutout will provide an indication on the engineer's console indicator panel.

Alerter magnet valves shall be Graham-White, or approved equivalent.
Event recorder system and alerter specifications shall be provided to the Customer for approval during design review.

16.16 Positive Train Control (PTC)

Each cab/baggage car shall be equipped with Positive Train Control (PTC). The PTC system shall conform to all applicable Amtrak, AAR, APTA and FRA standards and regulations, and be fully functional with PTC systems in use or planned for use on the host railroads over which Amtrak trains operate. The system shall meet all requirements for being a vital system as determined by the host railroads.

The PTC system shall be Wabtec’s Electronic Train Management System (ETMS) or approved equivalent.

The video display screen for the PTC system shall be mounted on the left side auxiliary console in the engineer’s cab, at a height and orientation that maximizes the engineer’s ability to clearly see the display without glare or reflection, and without requiring that the engineer’s vision be distracted from the view forward to the tracks. A brightness control shall be provided.

The PTC ancillary equipment (processor, radio equipment and hardened memory) shall be located in the secure cabinet behind the engineer’s cab, adjacent to the event recorder equipment. The equipment shall be oriented and installed to facilitate removal and reinstallation, downloading/uploading of data using a laptop computer, and troubleshooting.

Antennae shall be mounted on the car for train-to-wayside communication and GPS. The antenna shall be installed in a location that maximizes communication between the train and the wayside equipment, and shall conform to the clearance requirements of Amtrak Bi-Level Clearance Drawing B-066-00050, Rev A.

The system shall be programmed with all required data in order for the cars to be fully functional on the operational territory as specified by the Customer.

PTC system design, including brake system interface and system isolation procedures, shall be evaluated during design review.

16.17 Train Communication Data System

The cab/baggage car shall be equipped with Amtrak’s Train Communications Data (TCD) system as applies to cab control cars. This system provides train data communications to a central data processing center for purposes of train status monitoring, location, speed, video camera access and other operational and mechanical information.

System requirements include communication and Global Positioning System (GPS) antennae (mounted on the roof), data processor and memory module, digital video camera and recording system, color touch screen in engineer’s cab, and associated cables and hardware. These components shall be located in the secure cabinet behind the engineer’s cab, except as noted.

The Contractor shall demonstrate the system’s functionality and connectivity with Amtrak’s TCD system through real-time tests while in service. See Chapter 19.
16.17.1 Forward-Facing Audio/Video Camera

The cab compartment shall be equipped with a forward-facing digital audio/video camera and recording system. The system shall be fully compliant with Amtrak's train communication data system.

The video camera shall be mounted behind the windshield in the assistant's area, in a location that shall not obstruct the view of the assistant. Location of the camera shall be subject to Customer approval.

The audio/video recording system components (except the camera) shall be installed in the same secure locker as the event recorder. The audio/video cable connecting the camera to the recording system shall be routed in a dedicated conduit. A separate sealable 74VDC circuit breaker shall be provided in the circuit breaker panel in the cab compartment for the recording system.

16.18 Cab Glazing and Accessories

Forward-facing windshields and side-facing drop-sash windows shall be provided in the engineer's and assistant's cab compartments. The end frame door shall be equipped with Type I glazing in the upper portion of the door panel. All glass used in the construction of cab windshields and windows shall be laminated safety glass meeting FRA 49CFR Part 223 requirements.

16.18.1 Windshields

The windshields in the engineer's and assistant's cabs shall be electrically heated and incorporate a spall shield that shall be factory laminated to the inner surface of the glass panel. Windshields shall not be tinted. Windshields shall be FRA Type I compliant in conformance with 49CFR Part 223.

16.18.2 Side Windows

The side windows on each side of each cab shall be FRA Type II compliant, tinted, and shall be a drop sash design, complete with latch. The window shall be air and water-tight when latched closed, and shall drop down to open and rise up to close and latch. The windows shall be effectively weather stripped, reinforced for rough usage and designed to eliminate rattles. The sash and sash housing shall be sealed and constructed so that all collected water drains to the outside of the car. Windows shall be easily replaceable.

The sash shall be designed to move freely in either direction (up or down). The sash design shall allow the moving portion to maintain any desired opening during normal operating conditions; it shall also permit a crew member to lean out of the window and view the station platform in either direction. The entire window unit will be removable as a single assembly. The latch shall not require the use of a key or tool to open the window, and shall not require more than 20 lbs of force to raise and latch the sash closed.
16.18.3 **Sun Shade**

An adjustable roll-down, tinted, translucent sun shade shall be provided in each of the cab areas for the engineer and assistant. The shades shall be designed such that the engineer or assistant can limit sunlight coming through either windshield (but not the end frame door) while maintaining adequate forward visibility for safe train operation. The sun shade shall be adjustable over the full height of the windshields. Vibration and normal vehicle motions shall not cause the shades to change adjusted position.

16.18.4 **Windshield Wipers**

Electric windshield wipers shall be provided for each windshield. At least 80% of the width and 60% of the height of the total windshield area shall be swept over a complete cycle. Total sweep of the wipers shall be demonstrated to the Customer. The windshield wipers shall be functional at all vehicle speeds and all weather conditions.

The wiper drive units shall provide variable speeds of operation and shall return the wiper blades to a PARK position at extreme inward position of their sweep in the OFF position. Drive units shall be electrically operated. The wiper mechanism shall operate smoothly without hesitation throughout its cycle under all conditions. Wiper operating mechanisms and drive units shall be easily accessible for repair and replacement. The operating mechanisms shall be enclosed. The windshield wiper motor assembly (with blade attached) shall be accessible and replaceable from inside the cab.

16.18.5 **Mirrors/Wind Deflectors**

Retractable type wind deflectors with full-length mirrors, Prime Manufacturing SC-875-28, will be installed on both sides of the cab in front of the side windows to provide the engineer with a view towards the rear of the train. Left side mirror must be capable of allowing either the engineer or the assistant to see down the left side of the train in the mirror. Mirrors shall be capable of folding against the side of the car when not in use, and shall not lose adjustment or position while in use under all operating conditions. Mirrors must conform to Amtrak Bi-Level Clearance Drawing B-066-00050, Rev A.

16.19 **Seating**

Operator and assistant cab seats shall be in the cab area. The cab seat shall have perforated vinyl or cloth seat covering. The seat shall either have moveable armrests or shall swivel to allow convenient access to the seat. The seat and mounting shall meet APTA Standard SS-C&S-011-99 requirements.

The seats shall be located in such a manner as not to obstruct normal train operation or emergency egress.

Seat location, range of motion and adjustment, visibility forward and side to side, and relationship to console and controls shall be simulated electronically and demonstrated through the cab area mockup.
16.20 **Miscellaneous Cab Appointments**

16.20.1 **Trash Containers**

A removable stainless steel trash container shall be provided in the cab within reach of the engineer when seated. It shall be designed to be leak-proof and easily cleaned, and shall be secured to its mounting surface to prevent rattling. The trash container shall be designed to accommodate commercially available trash container liners.

16.20.2 **FRA Inspection Card and MAP Form Holders**

The rear wall of the assistant’s cab shall be equipped with the following inspection card and form holders:

- Multiple card holder, Power Parts p/n 17672.
- Single card holder, Power Parts p/n 17673.

16.20.3 **Coat Hooks**

Four spring retracted coat hooks will be provided in the cab area (two in the engineer’s cab and two in the assistant’s cab), high on the rear cab wall, for hanging crew coats.

16.20.4 **Crew Storage Locker**

A secure area shall be provided for crew belongings in the top half of the secure cabinet behind the assistant’s cab. The area shall be large enough to hold a large briefcase (sample case), and an overnight bag measuring 10 in. wide by 17 in. long by 22 in. deep.

16.20.5 **Track Warrant Holder**

The engineer’s and assistant’s consoles shall each be equipped with a track warrant holder that includes a spring-loaded clip at the top to secure the operating paperwork (similar to a clip board).

16.20.6 **Fusee Holder**

A fusee holder shall be provided in the lower half of the secured cabinet behind the engineer’s cab on the upper level of the F-end of the cab car. See Chapter 17.

16.20.7 **Fire Extinguisher and First Aid Kit**

A fire extinguisher, first aid kit and package of snap lights shall be provided in the lower half of the secured cabinet behind the engineer’s cab on the upper level of the F-end of the cab car. See Chapter 17.
16.20.8 Arm Rest

An armrest shall be molded into the drop sash window liner in the engineer’s and assistant’s cabs.

16.20.9 Cup Holders

Cup holders shall be mounted on both the engineer’s and assistant’s side of the cab. The cup holder must be designed and built to withstand use in the railroad environment, and must accommodate a variety of beverage containers. The location and design shall be simulated on the cab mockup, and shall be submitted to the Customer for approval during design review. DR

16.20.10 Crew Refrigerator

A locomotive-style, railroad-grade refrigerator for crew storage of water and other provisions shall be provided in the lower half of the secure cabinet behind the assistant’s cab. The refrigerator shall operate on 74VDC. Exterior dimensions of the refrigerator shall not exceed 42 in. tall by 15 in. wide. The refrigerator shall be securely mounted to the car floor. The door to the refrigerator shall open to the right (same as the secured cabinet door). Adequate air flow, in accordance with manufacturer’s recommendations, shall be provided to vent the hot air discharge back into the HVAC return air.

16.20.11 Convenience Outlets

Standard receptacle convenience outlets, operating on 120VAC and 74VDC, will be located in the engineer console footrest area, convenient for equipment servicing. These outlets shall have a spring cover. The 74VDC outlet shall be orange to differentiate it from the 120VAC outlet. Both outlets shall be appropriately labeled to indicate their voltage.

16.21 Cab Doors

The cab area shall be equipped with five doors, as follows:

- A structural end-frame door that closes off the end of the car between the collision posts;
- An engineer’s compartment door that closes off the engineer’s compartment, and opens to latch parallel to and adjacent to the end frame door;
- A compartment door that closes off the assistant’s cab area, and also latches closed at the rear of the cab compartment to separate the cab from the passenger seating area; and
- Two secured locker doors, one on each of the secure equipment lockers located immediately behind the cab area on either side of the center aisle.
16.21.1 Cab End Frame Door

The end frame door shall be of robust construction consistent with leading-end operation of up to the full rated speed of the train, including headwinds. The door shall be equipped with FRA Type-I compliant glazing to provide forward visibility. The door shall be secured and sealed to be water- and air-tight against all weather conditions at all rated speeds, in either direction of travel. The door shall also be designed to resist penetration of solids, liquids and vapors as might be encountered in collisions, such as grade crossing accidents.

The door shall be secured in the CLOSED position with both of the following:

- A robust door latch with the following features:
  - Roller on the plunger
  - Keyed lock, operable from outside and inside the door, keyed to Amtrak standard coach key
  - Three wedge-type latches operable from both inside and outside the door

A latch shall be provided to firmly hold the door in the fully open position when the cab/baggage car is in mid-train use. The door shall be hinged on the left side (assistant’s side) of the door panel, and swing into the car. A threshold shall be provided at the bottom of the door opening to seal the doorway and drain water to the underside of the car.

16.21.2 Engineer’s Compartment Door

The engineer’s compartment door shall be of robust construction and will close against the carbody end frame door when the cab is in use, or close off the engineer’s compartment when the cab is not in use. The door will be equipped with a rugged positive latch that incorporates a lock keyed to the Amtrak standard coach key. The key will operate from the aisle side of the door (the side of the door facing the aisle when the cab is closed off). The door latch will operate from inside the engineer’s compartment via a release handle. The door will be equipped with a clear Lexan window (FRA Type I or II not required for this door) to permit visibility through the glazing on the end frame door.

16.21.3 Assistant’s Compartment Door

The assistant’s side of the cab will have a door that isolates the cab from the passenger area when the cab is in use. The door will be equipped with a rugged positive latch that incorporates a lock keyed to the Amtrak standard coach key. The key will operate from the aisle/seating area side of the door. The inside of the door will be equipped with a “panic bar” type release which will allow the crew to leave the cab quickly in an emergency. The door latch shall also have a handle on the inside to release the latch and open the door in normal use without requiring the use of the panic bar. The door will be solid (no window) and shall be equipped with a wide-angle viewing port (“peep hole”) to permit the engineer to see activity in the passenger seating area.
16.21.4 Equipment Lockers behind Cab

The equipment lockers behind the cab shall have full-height doors that are secured with a standard Amtrak coach key. The doors shall be hinged on the edge toward the cab so that an open locker door will not interfere with the crew opening the cab door and leaving the cab in the event of an emergency. The door behind the engineer's cab shall be equipped with signage identifying the emergency equipment contained therein.

The cabinet door on the engineer’s side shall remain locked at all times. There shall be a secure area within this cabinet where the event recorder, PTC control module, and other train data are stored. This secure storage area shall have a tamper-proof door that can be locked with a padlock and sealed with a serialized Amtrak-issued seal.

The latch on the assistant’s side cabinet door shall be capable of being locked or unlocked. A handle shall be used to open this door.

16.22 Cab Interior Lights

16.22.1 Cab Ceiling Lights

Each side of the cab interior shall be equipped with a flush-mounted dust-proof ceiling light. The ceiling lights shall be powered by the 74VDC power supply. The ceiling lights shall provide adequate lighting for the safe and efficient operation of the cab equipment under low-light conditions.

The cab console shall be illuminated for daytime and nighttime operation without causing any reflections or glare on the windshield. The fixtures shall be suitably placed in the ceiling to illuminate the engineer’s console and the general cab area. The illumination intensity measured on the engineer’s controls shall be 20 foot-candles and 15 foot-candles at the floor. Lighting shall meet the requirements of Chapter 11, in both cab and pass-through configurations.

The cab ceiling light at the engineer seat shall be controlled from a two-position (ON/OFF) switch on the engineer’s console and likewise for the assistant on his console. A separately controlled, dimmable reading light for lighting the console shall be provided each for the engineer and assistant.

The operative complete cab lighting arrangement shall be included and reviewed in the cab mockup.

16.22.2 Reading Lights

The Engineer’s and assistant’s consoles shall each be equipped with a white reading light. In addition, the engineer’s console will have a red reading light. Light shall be directed over the minimal area necessary to clearly read operating instructions at night, but shall be designed and oriented to provide the Engineer and assistant with adequate light levels for reading of track warrants and other operating papers. A dimmer switch shall be provided for the white reading light for each location. All reading lights shall include a gimbal mount to permit swiveling.
16.22.3 Gauge Lights

Instrument and gauge lights shall identify all controls and their functions during night operation without additional cab lighting being on. Gauge lights shall be replaceable from within the cab without requiring the removal of the instrument from the panel.

16.23 Exterior Operating Lights

16.23.1 Headlights

Two headlights, 200W, PAR56, 30VDC, shall be provided on the F-end, in a twin-beam fixture. Each headlight shall be 200,000 candela minimum, with performance measured to demonstrate compliance with FRA 49CFR Section 229.125. Geometry of the headlight/crossing light installation and headlight/crossing light illumination pattern shall be subject to Customer and FRA review. Headlight fixtures shall be installed so that the arrow on headlight bulbs always points up. Replacement of headlight bulbs shall be possible without requiring the use of tools. Lenses shall be held in a hinged frame that is secured with a knurled hand-tightened knob.

16.23.2 Crossing Lights

Two crossing lights shall be mounted on the F-end in conformance with the requirements of FRA 49CFR Section 229.125. Each crossing light shall be 200,000 candela minimum. Two lamps, 350 W, PAR56, 75VDC, will be provided on the F-end. Crossing lights shall flash alternately in response to the horn being blown, as controlled by the event recorder system, and shall continue to flash for 30 seconds after the horn is blown. Crossing light fixtures shall be installed so that the arrow on crossing light bulbs always points up.

16.23.3 Marker Lights

Two red LED-type marker lamps shall be provided on the F-end, on either side of the diaphragm and below the cab windshields. See Chapter 11 for details.

16.23.4 Car Number Board

Lighted signs shall be provided on the F-end of the car to display the car's road number. Number boards shall be illuminated by while LEDs. Numerals shall be a minimum of 4 in. tall, Helvetica, white numerals on a black background. Car number shall be specified by the Customer (see Chapter 23).

The number boards and housing shall be watertight and shall provide access to the LEDs for replacement.

16.24 Air Horn and Bell

The F-end of the cab car shall be equipped with an Amtrak standard 5-chime horn and an air-actuated warning bell, configured to operate as described below. The horn and bell will be located at the F-end of the car. The horn will be in an alcove directly above the F-end coupler so sound emanates toward the front. The bell will be under the F-end underframe, located
rearward as much as possible to prevent damage from road debris and grade crossing accidents.

16.24.1 Air Horn

The horn will be an Amtrak standard five-chime Nathan K5LA air horn, with all flutes facing forward.

The horn will have two controls for actuation:

1. A push button that allows two-level horn control to modulate the sound as required. Pressing the button half way will produce reduced horn volume, while pressing the button all the way will produce full horn volume. The assistant engineer shall also have a horn control push-button.

2. A foot pedal to activate repeating cycles of preprogrammed horn blasts for approaching public crossings at grade, per the horn use requirements of 49CFR Section 222.21. Total duration of the sequence shall be 15 to 20 seconds. The automatic horn sequences shall consist of two long blasts followed by one short blast and a third long blast. The horn shall sound this sequence once, and then stop. Pressing the pedal or console-mounted horn push button during the sequence shall terminate the sequence. The pedal function shall be inoperative below 5 mph.

When the horn is actuated at full volume, the bell shall also sound and continue to sound for 30 seconds or until reset with the bell button.

The horn sound level at full volume shall be 96 dBA, minimum, at a distance of 100 ft forward of the cab and meet FRA requirement 49CFR Section 229.129. The Contractor shall demonstrate through testing that the horn sound distribution meets these requirements.

Control valves and supply piping shall be sized to handle the required air flow, and an accessible cutout cock shall also be provided as close to the horn as possible. The horn shall also be quick-acting so that there is no delay in the build-up to full volume when activated.

16.24.2 Bell

A 12 in. pneumatic bell with ringer shall be located under the end underframe at the F-end of the cab car. It shall be shock-mount isolated from the carbody and shall be equipped with its own cutout cock. The bell shall be located back from the end sheet of the car as practical to avoid damage from road debris and grade crossing accidents.

16.25 Other Exterior Equipment

16.25.1 Pilot

The F-end of the cab/baggage car shall be equipped with a plow pilot to deflect snow and debris, and to prevent objects from being rolled under the car. The pilot shall meet the requirements of 49CFR Section 229.123 and Amtrak Bi-Level Clearance Drawing B-066-00050, Rev A.
The pilot shall be designed and manufactured in accordance with Caltrans Drawing D-16-907. The pilot shall be constructed of low alloy, high tensile steel properly coated for corrosion resistance and painted to match the end sheet of the car.

The pilot shall not interfere with, or affect the condition or performance of, the coupler, draft gear, uncoupling lever, air hoses, electrical cables and receptacles or undercar equipment, and shall not create a safety hazard for crews working between or under cars.

The pilot shall be installed on the end sheet of the F-end of the cab/baggage car so that the clearance above top of rail shall be 6 in. maximum and 3 in. minimum with all new parts on car at load value AW0. Clearance shall be adjustable.

The pilot shall be attached to the carbody by mechanical fasteners. The connection between the pilot and the carbody end sheet shall be designed and constructed to facilitate installation and removal and to permit interchangeability among cars. The portions of the carbody to which the pilot is attached shall be substantially stronger than the pilot, so that if the pilot is overloaded from impact, damage to the portions of the car to which it is attached will be minimized. Longitudinal struts shall be provided to carry the longitudinal loads from the pilot into the carbody, and their inboard ends shall be attached to the bottom of the draft sill.

16.25.2 Blue Flag Holder

A holder for a blue flag shall be provided on the car exterior adjacent to the engineer’s side window. It shall be capable of holding a standard Amtrak blue flag, and shall be mounted in a location so that a seated engineer will be able to see the blue flag from the cab, and maintenance crews will be able to see the blue flag from any location along the engineer’s side of the train. The blue flag and holder shall not interfere with the operation of the drop sash window or mirror.

16.25.3 Conspicuity Decals

The F-end of the cab car shall be affixed with retro-reflective conspicuity decals to increase visibility of the car while at night. Colors and design of the conspicuity graphics shall be consistent with the graphics on the car exterior, and shall be submitted to the Customer for approval.

16.26 Environmental and Ergonomics

16.26.1 Cab Interior Sound Levels

The cab shall be well insulated and employ additional sound absorbing techniques to obtain the lowest practical sound levels.

Under normal operating conditions, the cab noise level shall be in compliance with the interior sound level requirements of 49CFR Section 229.121.

When the train is stationary, with doors and windows closed and the climate control system operating normally, the noise level in the cab shall not exceed 75 dBA.

Sound levels in the cab shall not exceed 85 dBA under normal operating conditions when the horn (at maximum volume) and bell are being used simultaneously.
Normal operating conditions shall be defined as operation at all speeds up to top-rated speed, with the cab/baggage car in leading position, doors and windows closed, and all motorized cab equipment is operating (wipers, defroster, etc.).

Unless otherwise noted, cab interior sound levels shall be tested at the location of the seated engineer's head (ear level for 95th percentile male and 5th percentile female).

All equipment installed in the cab shall be designed to reduce or eliminate rattling, vibration and noise transmission, especially that of the horn. The operating cab shall incorporate sound and vibration engineering techniques, proper dampening and/or gaskets, to prevent rattling and vibrational noise.

The contractor shall use the appropriate construction materials for attenuation and abatement of noise emissions. Insulating materials or coatings shall meet all Federal requirements for smoke and toxicity. Confined materials shall be non-hygroscopic and of a type which does not settle or gradually lose noise attenuation properties over the service life of the car.

16.26.2 Heating, Ventilation and Air Conditioning

16.26.2.1 Climate Control

The cab shall be provided with a quiet, forced-air supply from the car's main HVAC system. Full climate control with air supply through individual fully adjustable diffusers for each of the seat locations shall be provided. Care shall be taken to avoid drafts blowing directly onto seated crewmembers. The arrangement of this system shall be part of the cab mock-up review. See Chapter 10. DR

The cab will be equipped to provide a comfortable cab climate regardless of ambient conditions, train operations, or the number of cab occupants.

Cab climate control equipment shall include:

- Conditioned air from car's main HVAC system;
- Local overhead heater and thermostat; and
- Forced-air defroster for each windshield.

16.26.2.2 Performance

In addition to meeting 49CFR Section 229.119, cab temperature requirements, the HVAC system shall:

- Supply a minimum of 100 cfm conditioned air, equally distributed to both sides of cab;
- Maintain the relative humidity inside the cab at a level not greater than 50% at design load and not greater than 55% at loads less than design, when HVAC system is operating normally;
- Maintain a cab temperature of 76°F or less at all ambient outside temperatures up to and including 120°F;
- Maintain a cab temperature of no less than 70°F at -30°F ambient outside temperature, by using local overhead heat only;
• Maintain air duct and heater grill temperature of 140°F or less under all conditions; and
• Maintain a temperature gradient throughout the cab that is no greater than 5°F, except within 6 in. of the floor.

16.26.2.3 Controls

The local overhead heat shall be controlled independently of the HVAC unit with crew-adjusted thermostat control.

16.26.2.4 Air distribution

The cab shall have durable individually adjustable diffusers with manual direction and volume, infinite adjustment between maximum and minimum air volume and direction, for each seat location. The diffusers shall not create drafts on the cab occupants.

16.26.3 Crew Safety

The cab area shall be free from sharp edges and corners, pinch points and safety hazards. The cab design shall conform to all applicable FRA, OSHA and APTA standards regarding safety, signage, emergency equipment, occupational and environmental conditions and comfort.

16.27 Cab Arrangement Mockup

A cab area interior mock-up shall be provided by the Contractor at its facility for Customer’s review and approval. This mockup shall be constructed at the Continuing Design Review phase of the design review process, so that input from the mockup evaluation may be incorporated into the design prior to final design review. See Chapter 3.
Figure 16-1: Cab Arrangement
Figure 16-2: Engineer’s Cab Compartment Concept
Figure 16-3: Assistant’s Cab Compartment Concept
Table 16-1: Controls and Switches (other than throttle, reverser and brake)

<table>
<thead>
<tr>
<th>Location</th>
<th>Switch Function</th>
<th>Switch Type/color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop</td>
<td>Alerter Reset</td>
<td>Yellow, mushroom- style push button (Cutler-Hammer 10250ED1309-4)</td>
</tr>
<tr>
<td>Horn</td>
<td>Blue, mushroom-style push button, 3 position (Off, Low, High) (Cutler-Hammer 10250ED1309-5)</td>
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</tr>
<tr>
<td>Bell Control</td>
<td>Yellow, square, two button, push button (On, Off buttons) (Cutler-Hammer E30CED6)</td>
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<tr>
<td>Sand</td>
<td>Blue collar type push button (Cutler-Hammer 10250ED1309-2)</td>
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<tr>
<td>Floor (foot space)</td>
<td>Horn Automatic Sequence</td>
<td>Pedal (yellow) (Square-D AW-13)</td>
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<td>Left Auxiliary</td>
<td>Headlight Selector</td>
<td>4-position rotary (Electro Switch Corp 101405A-S)</td>
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<tr>
<td>Console</td>
<td>Cab Reading Light Dimmer</td>
<td>Rotary dimmer switch with off detent</td>
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<tr>
<td></td>
<td>Windshield Wiper</td>
<td>Rotary switch with variable speed</td>
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<td>Right Side Overhead</td>
<td>Defogger</td>
<td>Rotary (On/Off) (Cutler-Hammer 10250ED1309-6)</td>
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<tr>
<td>Console</td>
<td>Defroster</td>
<td>Rotary (On/Off) (Cutler-Hammer 10250ED1309-9)</td>
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<td>Console Light Dimmer</td>
<td>Rotary Switch (Angstrohm Precision 5ES443.1)</td>
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<td>Cab Ceiling Light</td>
<td>Rocker Switch (NKK SW3821D/328)</td>
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<td>White Reading Light</td>
<td>Rocker (NKK SW3821D/328)</td>
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<td>Red Reading Light</td>
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<td></td>
<td>Intercar End Door Light</td>
<td>Rocker (NKK SW3821D/328)</td>
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<td></td>
<td>Locomotive alarm Silence</td>
<td>Red Collar type Push button (Cutler-Hammer 10250ED1309-8)</td>
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<tr>
<td></td>
<td>TL GRD/EAB Loco Fault Reset</td>
<td>Black Collar type Push button (Cutler-Hammer 10250T23B)</td>
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<tr>
<td></td>
<td>Emergency Locomotive Shutdown</td>
<td>Push button, Red jumbo mushroom type. Two position – push to activate, pull to reset (Cutler-Hammer 10250ED1309-7)</td>
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* End of Chapter 16 *