Chapter 11

Lighting System

Revision K
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11.0 Lighting System

11.1 Overview

This chapter describes the interior and exterior lighting system that shall be provided on all car types. The lighting system as designed shall enhance the appeal of interior furnishings and create a comfortable and pleasant atmosphere while providing for maximum passenger and crewmember safety. Normal and emergency lighting shall conform to the requirements of all applicable APTA standards and FRA regulations.

The lighting system shall provide four modes of interior lighting: normal, quiet car, standby and emergency. Interior and exterior lighting shall be provided by Light Emitting Diodes (LEDs) or a combination of LEDs and fluorescent lights. LEDs are the preferred method of providing interior passenger seating area lighting. Lights in toilet rooms, stairways, vestibules, passageways, as well as reading lights and indicator lights shall be LED. Incandescent lights shall not be used except as specified. Halogen lights shall not be used.

For lighting requirements in the lounge and galley areas of the café/lounge car, see Chapter 14. For lighting requirements in the cab control compartment and F-end of the cab/baggage car, see Chapter 16.

The Contractor shall prepare an interior and exterior lighting plan for Customer review that describes the type of lighting to be used in all applications, including fixture type, voltage and color temperature, illumination levels at specified locations for all lighting modes, and compliance with emergency lighting and signage regulations and standards. This lighting plan shall be submitted to the Customer during the design review.

11.2 General Requirements

Unless otherwise specified in this section, lighting design (both on the exterior and in the interior of the car) shall meet or exceed the minimum standards defined by APTA Standards SS-PS-002-98 and SS-PS-004-99 and APTA Recommended Practice RP-E-012-99.

Fixtures installed on the vehicle exterior, and in the interior within 2 ft of a doorway, shall be watertight, except for interior ceiling lights.

Car interior lighting shall provide adequate and convenient illumination under all ambient lighting conditions from complete darkness to bright sunlight. Lighting in all locations shall be arranged to minimize shadows, avoid glare and excessive brightness ratios. Lighting shall be appropriate for the application, easily maintainable and compliant with all regulations and standards including this specification.

All lighting lamps and fixtures shall be suitable for rough duty service found in the railroad environment throughout North America. All lamps shall be commercially available from multiple sources.

The use of LED and fluorescent lighting is the preferred method for interior and exterior lighting. Halogen lamps shall not be used. Incandescent lamps shall not be used, except headlights and crossing lights on cab/baggage cars.
Each type of lamp shall have a distinct fixture design for its specific voltage. Lamps of differing voltages shall not share the same base design and lamps shall not be interchangeable between fixtures with differing voltages.

The lighting fixture housing or socket shall not be used as a ground return for any other electrical circuits.

### 11.3 Lighting Plan Design Review

The Contractor shall submit their design plan incorporating all requirements listed for review and approval. Design drawings and calculations showing the complete lighting system including fixture design, fixture locations, lighting illumination, modes of lighting and electrical schematics shall be submitted for evaluation during design review.

The Contractor shall provide drawings of the lighting arrangement of each car type for Customer approval during design review. The location of each lighting fixture, circuit breaker size and location, switch, control, lamp type, color, luminance value (in foot-candles) and quantity shall be clearly identified. Fixtures providing standby and emergency lighting shall be identified. Proposed charging light levels for photoluminescent emergency exit signage and Low Location Exit Pathway Markings (LLEPM) components will be identified.

Examples of each lighting fixture shall be provided for Customer approval at the final design review.

Lighting fixtures shall not be a source of Electromagnetic Interference (EMI) and shall be included in the Electromagnetic Compatibility (EMC) plan required by APTA Standard SS-E-010.98. See chapter 19.

### 11.4 Interior Lighting Levels

All light level measurements shall be made in accordance with the minimum standards defined by APTA Recommended Practice RP-E-012-99.

#### 11.4.1 Lighting Color Temperatures

The lighting color for all interior lights and lamps in the passenger rail car shall be 3500° - 4100° Kelvin (K). The Contractor is to provide suggested light color plan for Customer's review and approval during the preliminary design review.

#### 11.4.2 Minimum Lighting Illumination

The minimum spatial average of illumination shall be at the points listed in Table 11-1, and shall meet the minimum value(s), measured in foot-candles, with all lights on and at the rated voltage when the equipment is new.
11.5 Interior Lighting Modes

11.5.1 Normal Lighting Mode

Normal lighting mode is that which is available when the car is operating from a 480VAC power source. All lighting fixtures and elements intended for use while the car is in revenue service shall be available during normal lighting mode. Minimum illumination levels for normal lighting mode are shown in Table 11-1.

11.5.2 Quiet Car Mode

Normal lighting mode in the car shall be arranged to allow the level of lighting to be reduced for passenger comfort during early morning and late evening operation, while maintaining sufficient lighting for passenger and crew safety, and compliance with standards and regulations. This reduced light level, referred to as “Quiet Car” mode, may use any combination of lighting elements so long as minimum light levels are maintained at “Standby” illumination levels throughout the car, and all light fixtures operating during quiet car mode remain powered at all times, either through the Alternating Current (AC) system or the low-voltage power supply. Car lighting during quiet car mode shall be adequate to charge the photoluminescent emergency signage and LLEPM system per the required standards. A dedicated, clearly labeled switch in the electric locker shall permit operating personnel to easily select either normal lighting or quiet car mode lighting. Minimum illumination levels for quiet car mode are shown in Table 11-1 under the “Standby Lighting” column.

11.5.3 Standby Lighting Mode

Standby lighting is that which is available when the car has lost Head End Power (HEP) but the battery has not yet discharged to load shed. This lighting mode is intended to keep sufficient lighting operational for a period of at least two hours so that short term loss of 480VAC power will not affect the passengers’ ability to safely move throughout the train. Car lighting during standby mode shall be adequate to maintain the light charge for the photoluminescent emergency signage and LLEPM system per the required standards. Minimum illumination levels for Standby mode are shown in Table 11-1.

11.5.4 Load Shed Lighting Mode

Load shed mode is when the car batteries have discharged sufficiently after HEP loss that non-essential loads are shed in order to preserve battery power for essential loads. Interior lighting is reduced to 5 foot-candles in order to maintain charging light levels for High Pressure Photoluminescent (HPPL) exit signage and pathway markings. Reading lights, equipment room lights and other Direct Current (DC) loads are shed. Load shed conditions continues for approximately one hour until the battery voltage drops to roughly 45VDC, at which time the load drop relay disconnects the batteries from the DC supply circuit, which initiates the Emergency Lighting mode. See chapter 13 for details regarding load shed.
11.5.5 Emergency Lighting Mode

Emergency lighting mode is that which is available after load drop has occurred when the car’s batteries have reached approximately 45VDC. This lighting provides passenger orientation and sufficient light levels for passengers to move about safely within the car and if necessary, to find the nearest safe exit point. It is especially important in stairways, aisles, vestibules and enclosed spaces, such as toilet rooms. Once the low voltage system reaches a low-voltage threshold, which occurs at about 45VDC, all standby lighting is extinguished and emergency lighting shall illuminate. This lighting system may use dedicated fixtures, may provide a reduced level of illumination from the normal lighting system, or may use some but not all of the normal lighting fixtures. The emergency lighting system shall be powered by capacitors, or by batteries if capacitors cannot comply with FRA requirements for emergency lighting, and shall provide emergency lighting for a minimum of 90 minutes. Emergency lighting shall comply with APTA Standard SS-E-013-99.

The Contractor shall provide for Customer approval during design review an Emergency Lighting Plan that describes and illustrates the emergency lighting system, including location, type and design of all lighting fixtures and the level of illumination that shall be provided at all points as identified in APTA Standard SS-E-013-99. The Contractor shall demonstrate compliance with emergency lighting requirements and shall provide to the Customer written certification of compliance.

11.6 Interior Lighting Requirements

11.6.1 Passenger Area

The following describes the individual lighting fixture applications and specifications for all areas of the car. Lights may be fluorescent or LED unless otherwise specified. Light fixtures in toilet room ceiling, stairway ceiling, vestibule ceiling and hallway ceiling shall be identical units if possible.

11.6.1.1 Main Ceiling

Two longitudinal rows of lights shall provide the primary lighting for the seating area in the revenue seating areas of coaches, cab/baggage and café/lounge cars, and shall be located adjacent to the center ceiling panels/air diffusers. These fluorescent fixtures provide the main light source to the car and provide lighting to the aisle as well as general lighting to the seating areas. The fixtures shall be trough-construction units, mounted end-to-end. They shall be equipped with terminal blocks wired in parallel fixture-to-fixture, including all bus wiring for the entire fixture string for normal, quiet car and standby modes. LED units may be used in place of fluorescent tubes provided that they create an even light output and similar appearance to fluorescent lights.

11.6.1.2 Passenger Reading Lights

Individual reading lights shall be white LEDs powered by 24VDC. They shall be mounted in an adjustable gimbal mount that allows for individual directional adjustment. Each reading light shall have an ON/OFF switch. A reading light shall be provided for each coach seat and the wheelchair parking location.
Passenger reading lighting shall be mounted in an adjustable track so that the reading light fixtures can be relocated to match the seat pitch as specified by the Customer. See Chapters 9 and 23.

11.6.2 Vestibules, Stairways and other Non-Seating Areas

11.6.2.1 Flush-Mounted Overhead Light Fixtures

Flush-mounted overhead light fixtures with LED light elements shall be provided in the following locations for the purposes of commonality and interchangeability:

- Vestibule ceilings
- Toilet room ceilings
- Stairway ceilings
- Hallway ceilings
- Checked baggage room
- Above upper-level luggage racks

11.6.2.2 Diaphragm/End Passageway

The end passageway light shall be a weatherproof, sealed LED unit mounted overhead to the side of the passageway on the diaphragm side of the end doors on all car types. The unit shall cast adequate light throughout the diaphragm and passageway area including handholds, door panel, walkway surface, signage and handbrake.

11.6.2.3 Vestibule Ceiling at Lower Level Side Doors

Flush-mounted light fixtures shall provide overhead light to the areas adjacent to the side entry doors. The lights shall provide adequate illumination to charge all required emergency signage on and around door panels and emergency door releases. The same fixture shall be used at all side entrance locations, including service vestibules in the café/lounge and cab/baggage cars.

11.6.2.4 Stairway Ceiling

Flush-mounted light fixtures shall provide overhead light to the stairways.

11.6.2.5 Stairway Sidewall

Step lights shall be sealed, recessed, wall-mounted LED units. Fixture shall be impact-resistant and shall not present a tripping hazard. Each light unit may illuminate several steps. All steps shall be illuminated.
11.6.2.6 Hallway

A flush-mounted fluorescent fixture shall provide light in the ceiling of the hallways. These lights shall be used in the following locations, at a minimum:

- Hallway at accessible toilet
- Hallway past café galley
- Hallway adjacent to utility lockers, luggage racks and toilet rooms at end doors

11.6.2.7 Luggage Rack/Bike Rack Area

A pair of recessed can-type LED fixtures shall be provided in the ceiling of the luggage rack/bike rack area in the lower level A-end vestibule of coach cars.

11.6.2.8 Checked Baggage Room

The baggage room shall be equipped with no less than four flush-mounted ceiling fixtures over the luggage racks, similar to those in the luggage rack/bike rack area in the A-end vestibule of coach cars. Each fixture shall be equipped with a robust guard to protect the lens from damage. These fixtures are in addition to those in the vestibule above the side entrance doors.

11.6.3 Toilet Rooms

11.6.3.1 Toilet Ceiling and Mirror

Two light fixtures shall be mounted on the ceiling of each toilet room to provide general lighting to the toilet room.

The lighting fixtures shall be wired in parallel and shall be provided as part of the toilet module.

11.6.3.2 Toilet Room Occupied/Out of Service Sign

The toilet OCCUPIED/OUT OF SERVICE light fixture shall be mounted on the toilet room exterior wall, adjacent to the toilet room door for all toilet rooms. This light shall consist of a two-light LED fixture with a sign containing text and/or a pictorial symbol which provides indication as to when the toilet room door is locked (occupied) and a second light that provides indication that the toilet room is “out of service” (when the toilet system is not functioning). Lights shall be on when the toilet is occupied or out of service, and shall be extinguished when the toilet is available for use. These LEDs shall be yellow. Artwork for the labels shall be submitted to the Customer for approval during the design review.

A yellow LED indicator shall be provided inside the toilet room, adjacent to the door, that illuminates when the door is locked (parallel with the toilet occupied indicator outside the toilet room). This indicator shall be labeled DOOR LOCKED WHEN LIGHT IS ON.

The LEDs used for these indicators shall be no less than 0.25 in. in diameter for clear visibility to passengers.
11.6.4 Service and Utility Rooms

11.6.4.1 Electrical Locker

The electrical locker shall be illuminated by at least two overhead lights, controlled by a wall-mounted manual ON/OFF switch located adjacent to the door. The light fixtures shall be protected by a clear shatterproof glass or polycarbonate lens, or other suitable protection, and shall not be vulnerable to damage during normal maintenance activities. Electric locker lights shall be operable during all lighting modes.

11.6.4.2 Utility Locker

At least one light fixture shall be installed in each interior utility locker, and shall be energized by means of an automatic light switch that turns the lights on when the door is opened and off when the door is closed. If necessary to illuminate the space, multiple light fixtures shall be installed and operated by the single ON/OFF switch. The lights shall be so located as to provide general illumination within the locker and be readily accessible for replacement.

11.6.4.3 Equipment Rooms

Each equipment room shall be equipped at least four flush-mounted waterproof fixtures to provide good lighting throughout the equipment rooms for inspecting and servicing the equipment. The light fixtures shall be protected by a clear shatterproof glass or polycarbonate lens, or other suitable protection, and shall not be vulnerable to damage during normal maintenance activities. The lamps shall be LED or DC-based compact fluorescent. The light design shall provide sufficient light to illuminate the entire room interior and allow all equipment within it to be serviced in place without the need for additional portable lighting. A manual, moisture-proof, over-travel type limit switch shall be installed inside the door opening adjacent to the door.

11.6.4.4 Control Cab

Lighting requirements for the control cab compartment in the cab/baggage cars are described in Chapter 16.

11.6.4.5 Café/Lounge Galley and Lounge Area

Lighting requirements for the food service galleys (upper and lower) and the lounge seating area of the café/lounge car are described in Chapter 14, except as noted.

11.7 Exterior Lighting Requirements

11.7.1 Marker Lights

All cars shall be equipped with two red marker lights at each end of the car.

The marker lights shall be an LED matrix and shall meet FRA requirements in 49CFR Part 221.

The marker lights shall be operable during normal, quiet car and standby lighting modes.
The marker lights will be controlled by a 3-position switch in the electric locker, having A-END, OFF, and B-END positions (the A-END position marking will be replaced by F-END on cab cars).

The marker lights on the F-end of the cab cars shall illuminate when the selector switch in the electrical locker is placed in the F-END position, except when the headlights and/or crossing lights are illuminated. Placing the headlight selector switch in any position other than OFF shall extinguish the marker lights. Returning the headlight selector switch to OFF shall re-illuminate the marker lights when the marker light selector switch is in the F-END position.

11.7.2 Platform Lights

Each side door opening shall have a platform light that will illuminate the platform area adjacent to that door opening when those doors are opened. This light shall be mounted flush into the carshell or the threshold area and not protrude beyond the side of the car. The light shall be aimed downward so as to not shine directly into the eyes of passengers or crew standing on the platform or in the vestibule of the car, and shall be mounted in an impact-resistant and waterproof housing. The platform lights shall illuminate when one or both door panels in the adjacent door opening is opened, either by command from the door control system, or by use of the emergency door release. The platform light shall remain off when both door panels are closed and latched, or locked with a mortise lock.

At a minimum, the Contractor shall meet the requirements of 49CFR Section 38.101.

The platform lights shall also be a part of the emergency lighting system and shall conform to APTA Standard SS-E-013-99.

11.7.3 Exterior Indicator Lights

Each car shall be equipped with exterior door open indicator lights, four per car. These indicators shall be red LEDs and shall be located on the exterior of the car adjacent to doors 2, 3, 6 and 7, so that their status is visible to the engineer when viewed down the side of the train. They shall display a red indication when any door in the adjacent vestibule is open (i.e., not closed and latched, or locked with the mortise lock) and shall be dark when all doors in that vestibule area are closed and latched.

Each car shall be equipped with two exterior brake indicator light units, one on each side of the car, adjacent to doors 2 and 6. Brake indicators shall be green and yellow LEDs, and shall display the following indications:

| Solid Yellow | Air brakes applied (handbrake released) |
| Flashing Yellow | Handbrake applied (air brakes applied or released) |
| Solid Green | Air brakes and handbrake released |

The brake indicator unit may be combined with the door open indicator light.

The single-light door indicator units shall be Dialight p/n 566-0001-805.

The three-light door/brake indicator unit shall be Dialight p/n 566-0003-802. This unit shall be mounted with the indicator lights oriented top to bottom: green/yellow/red.
11.7.4 Exterior Door ADA Lights

A flashing blue LED fixture shall be mounted above or adjacent to each side door opening to serve as a visual beacon to ADA passengers when the adjacent door is open. This indicator shall be viewable from all angles on the exterior of the car. The light shall flash at a rate of 1 Hz when the door is open, and 2 Hz for five seconds before the door closes.

11.7.5 Headlights and Crossing Lights

Requirements for cab car headlights and crossing lights are described in Chapter 16.

11.8 Systems Indicator Panel

A multi-LED systems indicator panel shall be located on the B-end vestibule wall adjacent to the electrical locker door, and shall serve to provide a visual indication of the status of designated systems. The panel shall be mounted in a location that will prevent tampering or damage from routine maintenance or cleaning, and will be visible from the vestibule area. The indicators shall be as follows:

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<tr>
<td>Wheel slide control system</td>
<td>Green</td>
</tr>
<tr>
<td>Toilet system</td>
<td>Yellow</td>
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<tr>
<td>Battery charger</td>
<td>Red</td>
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<tr>
<td>Communication/public address system</td>
<td>White</td>
</tr>
<tr>
<td>Door system</td>
<td>Yellow</td>
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Specific function of the indicator lights is described in the applicable chapter for each subsystem. Indicator lights shall be flashing on and off at 1 Hz when the system has developed a fault or is not functioning properly, as defined in each chapter, and shall be on continuously when the system is functioning as intended. All LEDs shall be appropriately labeled. The systems indicator panel shall have a lamp test button to verify that the LEDs illuminate when energized.

11.9 Lighting Fixture Requirements

11.9.1 Fluorescent Lighting

Fluorescent lighting shall use rapid-start, T-8 lamps with a color temperature of 3500°-4100°K.

Where possible, the lighting fixtures shall be arranged with one-rapid start inverter ballast controlling two lamps in a master and slave arrangement. Stand-alone fixtures shall contain a ballast configured for efficient, single-lamp operation. The main interior light fixture shall be arranged for a F32T8 lamp or a F25T8 lamp.

Fixture design shall meet APTA Recommended Practice RP-E-012-99. Lampholder sockets shall be designed to support the ends of the lamp. Terminal pins shall not be the sole source of lamp support. Lampholders shall meet or exceed the requirements of UL542. Lamps shall
be secured in the fixture and be able to withstand rough duty service as found in the railroad environment. Fixtures shall be dust and moisture resistant.

The main interior light fixture shall consist of a reflector and door joined by an integral, concealed hinge latched by captive quarter-turn Phillips head fasteners, minimum two per door. The fixture assemblies shall be positioned to maximize the light output projected towards the illuminated surface and center of the car.

The master fixture housing shall contain a ballast mounted on an integral hinged ballast plate retained by captive fasteners designed for repeated use (no self tapping screws allowed). All wiring shall be accessible by hinging the ballast plate down. The BALLAST ON LED shall be visible from the bottom of the ballast plate.

Fluorescent lamps shall be designed to use standard, commercially available length bulbs.

Each light fixture shall have a permanent label and/or stamping, visible when the light cover is removed or swung down, that contains the following information:

- Supplier part number
- Voltage and current or wattage ratings
- Lamp identification, wattage, including color

11.9.2 Light Emitting Diode (LED) Lighting

LED fixtures shall conform to the requirements of the Energy Policy Act of 2005, and shall utilize white LEDs. The color temperature shall be 3500°-4100°K.

An LED driver designed to ensure proper operation of the LEDs shall be mounted on the LED assembly. LED assemblies shall be removable without special hardware. Each LED assembly shall be removable after removing only the hinged lens. LED units shall be connected via interlocking, self-polarizing and modular connectors accessible when the light fixture is opened.

All fixtures shall be dust- and moisture-resistant, and shall be arranged to facilitate replacement of the LED assembly from the passenger compartment after opening the lens.

Fixtures equipped with lenses shall have a one-piece polycarbonate translucent white lens, uniform in color and smooth on the exposed side, which will provide the specified intensity of illumination on the reading plane, while diffusing the light to illuminate adjacent wall and ceiling surfaces, increasing the overall brightness level in the interior of the car. The lens shall be mounted on a hinged bezel and shall be secured with captive fasteners.

LEDs used in passenger area overhead lighting (in lieu of fluorescent lights) shall be mounted on replaceable boards installed in the light fixture. Boards shall be connected to the fixture by screws, and shall be plug-connected electrically for easy replacement. The LEDs shall be sized and spaced so that the failure of up to two LEDs on an individual board shall not create an appearance of a dark area on the fixture.

LED lights shall operate on 74VDC, unless specified otherwise. See Chapter 13 for additional details.

LED lighting shall be sized to provide the level of lighting as outlined in Table 11-1.
Changeable LED lamps are preferred and LED lighting may be dedicated to its fixture where the design is necessary.

### 11.9.3 DC/AC Ballasts

The fluorescent lighting fixtures shall contain DC inverter and/or AC electronic ballasts. Ballasts shall be high performance, rapid start and solid-state.

Ballasts shall incorporate reverse polarity, overload, open circuit, over-temperature, over-voltage, transient and internal short circuit protection. Inverter ballasts shall withstand transients of 10 Joules and have an electronic clamp to ground feature. The inverter ballasts shall be designed to operate normally from a 74VDC supply, with capability for continuous operation over 45-86VDC supply. Under-voltage protection shall be provided. The ballast shall automatically restart when voltage within the normal range is again applied, and require no reset, such as interrupting a circuit breaker under any conditions. Likewise, if a lamp is changed while the ballast is powered, no action shall be required to restart the ballast. Ballasts shall be equipped with an LED BALLAST ON indicator that illuminates when the ballast is functioning normally and power is on.

All ballasts shall have an over temperature protection feature that automatically resets when the temperature drops to an acceptable level.

The ballasts shall be integral parts of the fixtures, conveniently located and easily removed from the fixtures without disturbing other components and wiring. The ballast on ceiling lighting fixtures shall be replaceable with the fixture remaining in position. All ballasts shall meet the requirements of ANSI C82.

### 11.9.4 Capacitor-Based Lighting

The capacitors must be rated for a minimum of 500,000 charge cycles. The capacitor based power source for emergency lighting shall have a label located on the side of the unit exposed for service that includes the following information:

- OEM name and manufacturer’s address
- OEM part number — revision/modification level and date
- Date of manufacture
- Unit serial number
- Voltage and capacity rating

### 11.10 Housings, Lenses and Diffusers

The overhead light assembly shall be designed for lamp replacement from below. The hinged light lens shall swing down allowing easy lamp replacement.

No material shall suffer any loss of performance when exposed to temperatures ranging from -30°F to 150°F or exhibit degradation of properties (including color) under long-term exposure to ultraviolet light.

Lighting fixtures shall have hinged lenses, which will aid in light distribution, prevent glare and facilitate easy lamp replacement. The design of the fixture shall permit easy cleaning and easy
lamp renewal. The lenses shall project light with an even brightness without patterns, and shall have a smooth surface on all sides and edges that are open to the passenger seating area to avoid injury. Tamper-proof fasteners shall retain door to the housing. A neoprene foam gasket around the lens assembly shall make the joining of door and reflector dust-resistant and rattle free. The hinged lens shall be removable for replacement. The lenses shall be easily replaceable without having to disassemble the light fixture, and shall be made of an approved Ultraviolet (UV)-stabilized polycarbonate and meet the Flammability, Smoke Emission and Toxicity requirements specified in Chapter 18.

### 11.11 Controls

All lighting shall be circuit breaker protected. Lights identified for ON/OFF control shall have an ON/OFF switch in addition to the circuit breaker. Controls shall be labeled AC LIGHTS and DC LIGHTS and also NORMAL and QUIET CAR and housed in the electric locker, except as listed below, where local controls shall be provided:

- Each reading light shall have a separate ON/OFF switch located adjacent to the reading light.
- Each reading light at a wheelchair location shall have an ON/OFF switch located in accordance with the requirements of ADA.
- Electrical lockers and equipment rooms shall have manual light switches located inside the equipment room adjacent to the entry door.
- Utility lockers shall have automatic light switches located inside the locker adjacent to the entry door.
- Selected lighting circuits in the food service area shall have ON/OFF switches. See Chapter 14 for details.
- Selected lighting circuits in the cab control compartment of the cab/baggage car shall have ON/OFF switches. See Chapter 16 for details.

### 11.12 Testing

Car lighting shall be tested for compliance with this specification as well as all applicable APTA standards and FRA regulations regarding minimum illumination requirements and recommendations during normal, quiet car, standby and emergency modes. This shall include charging light levels for photoluminescent decals as part of the emergency signage system.

Test reports shall document lighting levels achieved during these modes, test methodology used during testing, and the standard or regulated light level for all measured locations to demonstrate compliance.

The Contractor shall provide certification to the Customer that the car’s lighting system meets all standards and regulations. All required material certifications shall be provided to the Customer.

See chapter 19 for more details.
### Table 11-1: Minimum Illumination Levels

<table>
<thead>
<tr>
<th>Area</th>
<th>Measured at: (See APTA Recommended Practice RP-E-012-99 for specifics)</th>
<th>Normal Lighting (foot-candles)</th>
<th>Quiet Car Lighting (foot-candles)</th>
<th>Standby Lighting (foot-candles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Overhead</td>
<td>Table top</td>
<td>30</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Aisle way Lighting</td>
<td>Floor</td>
<td>30</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Indirect Lighting</td>
<td>Table top</td>
<td>5</td>
<td>5</td>
<td>N/A</td>
</tr>
<tr>
<td>Stairway Lighting</td>
<td>Stair treads</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Vestibules</td>
<td>Floor, threshold, side door panels</td>
<td>30</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>General Seating Areas</td>
<td>Table top</td>
<td>30</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Reading Lights</td>
<td>Table top</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>End Passageway / Diaphragm Area</td>
<td>Grab handles, Door panel at floor level.</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Bike / Luggage Rack Area</td>
<td>Floor</td>
<td>10</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Luggage Rack Tower</td>
<td>Lowest shelf</td>
<td>10</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Toilet Room – ATR</td>
<td>Floor</td>
<td>30</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Toilet Room – UTR</td>
<td>Sink</td>
<td>30</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Toilet</td>
<td>30</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Mirror</td>
<td>30</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Baby changing</td>
<td>30</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Door handles</td>
<td>30</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Café Car-Lounge Area</td>
<td>Floor</td>
<td>30</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Galley</td>
<td>Floor</td>
<td>30</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Elevator</td>
<td>Floor</td>
<td>30</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Service Counter Area</td>
<td>Counter</td>
<td>30</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Food Preparation Area</td>
<td>Counter</td>
<td>30</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Electric Locker</td>
<td>Floor</td>
<td>30</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Utility Closet</td>
<td>Floor</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Equipment Rooms</td>
<td>Floor</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Cab Overhead</td>
<td>Floor, cab console</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Cab Reading Lamp</td>
<td>Table height</td>
<td>20</td>
<td>20</td>
<td>20</td>
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</tbody>
</table>

* End of Chapter 11 *