P3010
Los Angeles LRV

LIGHTING

Section 0600
RUNNING MAINTENANCE & SERVICING MANUAL

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line.

Total number of pages in this section (0600) is **68** consisting of the following:

Draft	Draft	December 2014
Draft	Final Draft	December 2015
Draft	Final Draft-A	July 2016
Draft	Final Draft-B	November 2019

PAGE	CHANGE NO.	PAGE	CHANGE NO.
i through x	Final Draft-B		
1-1 through 1-8	Final Draft-B		
2-1 through 2-16	Final Draft-B		
3-1 through 3-2	Final Draft-B		
4-1 through 4-4	Final Draft-B		
5-1 through 5-6	Final Draft-B		
6-1 through 6-2	Final Draft-B		
7-1 through 7-16	Final Draft-B		
8-1 through 8-2	Final Draft-B		
I-1 through I-2	Final Draft-B		

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SAFETY SUMMARY

Some of the procedures in this section are preceded by warnings/cautions regarding potential hazards in handling this equipment. These warnings/cautions should be carefully read and understood before proceeding. Failure to observe these precautions may result in serious injury to personnel performing the work and/or bystanders. The key warnings for this equipment are as follows:

Electrical - The electrical equipment described in this section operates at voltages and currents that are extremely dangerous to life. Personnel should closely observe all generally prescribed cautions and warnings before performing any work on the LRV.

Location – Special caution should be taken when accessing or servicing equipment located on the roof and under the car.

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CHAPTER 1.0

GENERAL DESCRIPTION

1.1 Introduction

The following paragraphs provide an overview of the lighting equipment used on the Los Angeles Light Rail Vehicle (LRV).

All lighting equipment, except for the headlights, for this LRV is designed to operate from the 28.5 VDC on-board Low Voltage Power Supply (LVPS), or from the 24 VDC battery. The headlights operate from the vehicle 12 VDC power supply. Except where indicated, solid state LED lamps are used throughout.

1.2 Interior Lighting

Figure 1-1 shows the general layout of the LRV interior lighting.

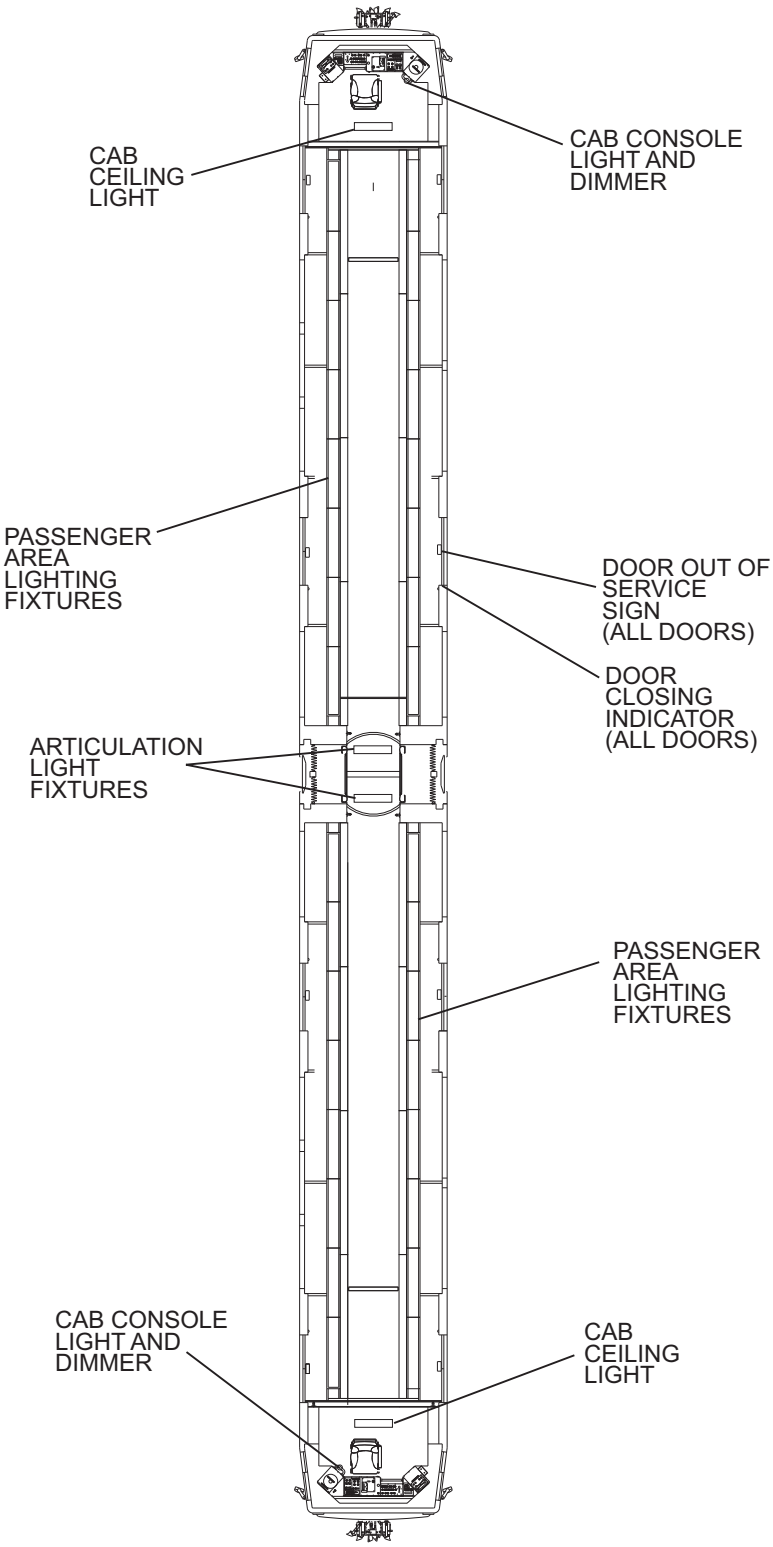

Figure 1-1: Lighting Layout, Interior

1.2.1 Passenger Area Lighting

The main passenger area is illuminated by two rows of LED light fixtures flush-mounted above the seats on each side of the center aisle. Each fixture contains one 1220 mm LED tube lamp. There are a total of 32 fixtures.

Under normal lighting conditions, these lights are powered by the LVPS. If a power interruption occurs, eight of the fixtures are wired to provide emergency back-up lighting. Figure 1-2 shows the emergency lighting configuration.

Fixtures are mounted to the car body and have an air diffuser assembly mounted adjacent to their frame. Each fixture contains a retainer spring at each end to secure the LED tube lamps in place.

To illuminate the articulation section of the LRV, there are two ceiling mounted box fixtures. Each fixture contains one 610 mm LED tube lamp.

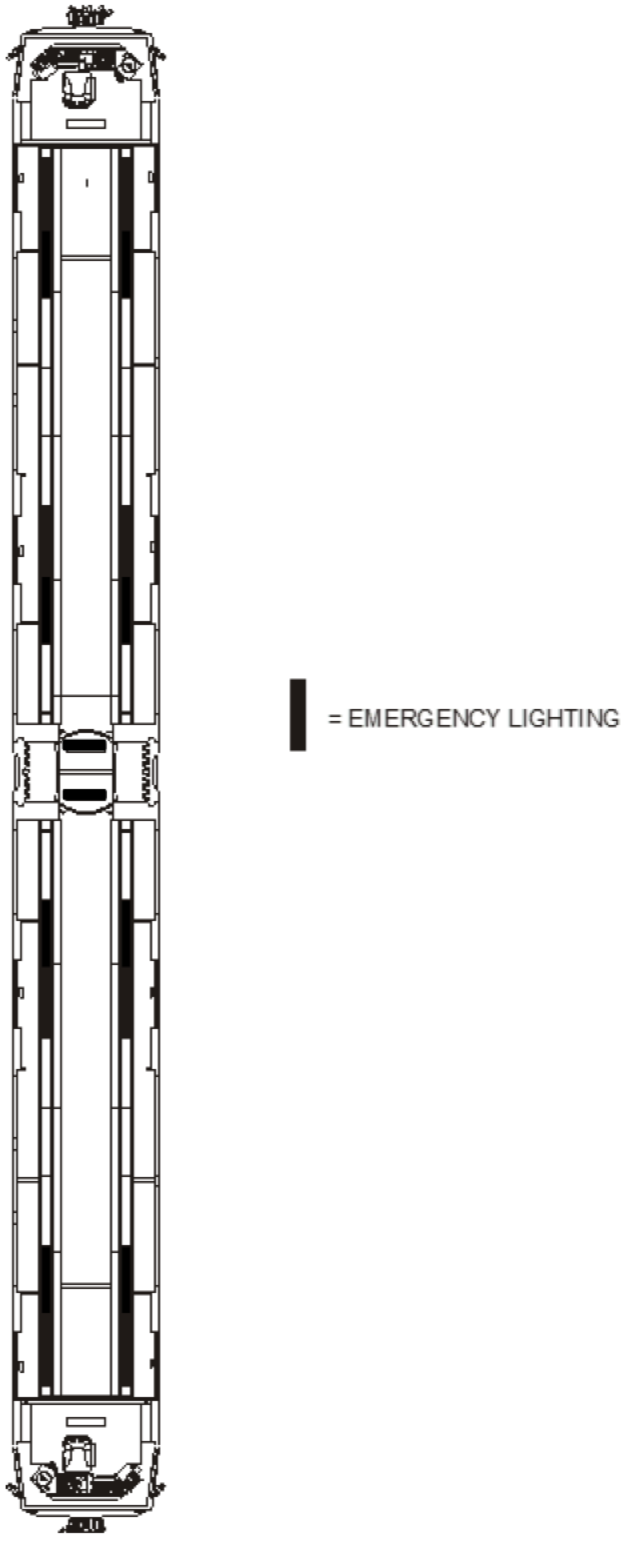

Figure 1-2: Lighting Layout, Emergency

1.2.2 Cab Area Lighting

General illumination of the cab area is provided by a ceiling mounted box fixture. This fixture contains two 610 mm LED tube lamps.

An adjustable cab console light is also located overhead, and can be adjusted manually ±30 degrees from the centerline of the light. Light output from this fixture is also adjustable via a dimmer control located on the console.

1.3 Exterior Lighting

Figure 1-3 shows the configuration of the exterior lighting.

At the front of the LRV below the windshield are the headlight and tail light assemblies. The headlight assembly contains a rectangular incandescent halogen lamp that operates from the vehicles 12 VDC power supply. The tail light assembly contains two modules that operate from the 28.5 VDC LVPS:

- A red LED lamp module that has both "stop" and "tail" functionality.
- An amber LED lamp module that serves as a turn signal and emergency flasher.

Centered above the windshield is the roof headlight. This single lamp fixture contains an incandescent sealed-beam lamp.

On the roof of the cab is a silent alarm light. It is a flashing amber high intensity LED module designed to be visible from above the vehicle at a minimum distance of 153 meters.

On the side of the vehicle, above each passenger doorway, is a red LED status indicator that illuminates when the door is open.

At the midpoint of each section of the LRV, just below the window line, is an amber LED turn signal indicator.

At the top right corner of the cab is the cutout active indicator.

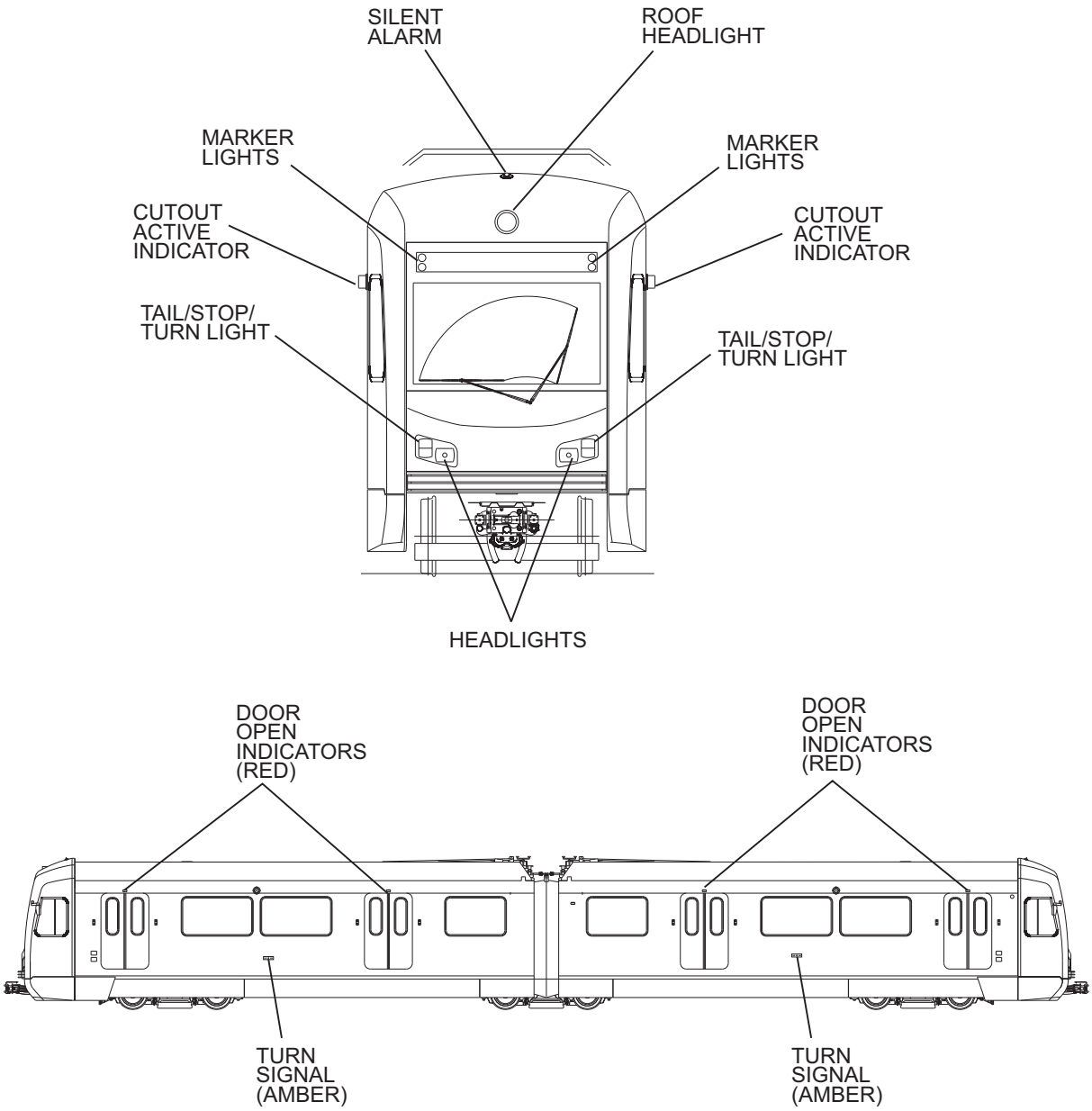

Figure 1-3: Lighting Layout, Exterior

1.4 Reference Data

Table 1-1. Reference Data, Interior Lighting

Item / Characteristic	Specification
Passenger Area Light Fixture • Lamp • Lamp Type • Dimension • Quantity • Voltage • Power	 TUB3021x LED tube 26x1200 mm (1 in. x 47.25 in.) 32 28.5 VDC 21 watts
Articulation Light • Lamp • Lamp Type • Dimension • Quantity per vehicle section • Voltage • Power	 TUB3008 LED tube 26x590 mm (1 in. x 23.2 in.) 2 28.5 VDC 8 watts
Cab Ceiling Light • Lamp • Lamp Type • Dimension • Quantity per vehicle section • Voltage • Power	 TUB3008 LED tube 26x590 mm (1 in. x 23.2 in.) 2 per light 28.5 VDC 8 watts
Cab Overhead Console Light • Lamp • Lamp Type	 D8901-4-7 LED on PC board
Cab Overhead Console Dimmer Control • Dimmer Control	 S-8869-4
Door Out Of Service Sign • Lamp • Lamp Type	 S-8334-2 LED on PC board
Door Closing Indicator • Lamp • Lamp Type	 TL-10212 LED (white with amber diffuser cover)

Table 1-2. Reference Data, Exterior Lighting

Item / Characteristic	Specification
Silent Alarm • Lamp • Lamp Type	 M8794-12 (amber) LED on PC board
Roof Headlight • Lamp • Lamp Type	 AD-4578-1 Incandescent, Sealed beam, PAR 56
Tail Lights • Lamp • Lamp Type	 M-8602-1 (amber) M-8602-2 (red) LED on PC board
Headlights • Lamp • Lamp Type	 AD-4578-20 Incandescent, Halogen H5054
Door Open Indicator • Lamp • Lamp Type	 M-9451-R (red) LED, bayonet mount
Turn Signal • Lamp • Lamp Type	 M-9001-2 LED on PC board
Cutout Active Indicator • Lamp • Lamp Type	 M-9452-B (blue) LED, bayonet mount

CHAPTER 2.0

FUNCTIONAL DESCRIPTION

2.1 Introduction

This chapter describes the lighting equipment used on the Los Angeles LRV.

With the exception of a few light fixtures, all equipment uses solid state LED lamps as the source of light. Although the main power source for the lights is the 28.5 VDC LVPS, there are some lamps powered from the 24 VDC main battery. The voltage used by each fixture is identified in its description.

2.2 Equipment Description

Each item of lighting equipment is described in detail in the following paragraphs. Line illustrations are also provided.

2.2.1 Interior: Passenger Area Lighting

The passenger area lighting fixtures (Figure 2-1) are ceiling mounted in two rows above the seats on each side of the aisle. There are eight fixtures on each side of the aisle in each car, for a total of 32 fixtures.

Each fixture holds one 1220 mm LED tube lamp and operates from the 28.5 VDC power source. Should a power interruption occur, eight of the fixtures are wired to provide emergency back-up lighting. Refer to Figure 1-2 to see which fixtures are used for emergency back-up.

The frame/reflector assembly mounts to the car body with its bezel/lens assembly. An air diffuser assembly mounts adjacent to the frame. Frames are made of extruded aluminum and sheet metal with all exposed surfaces powder-coated.

The reflector is painted white aluminum and equipped with a retainer spring at each end to prevent the LED tube lamp from dropping out of the fixture due to vibration.

The lens assembly is an extruded polycarbonate with ribbing for light diffusion and strength. It is hinged to the frame for ease of service and uses quarter-turn captive stainless steel fasteners to secure it to the frame.

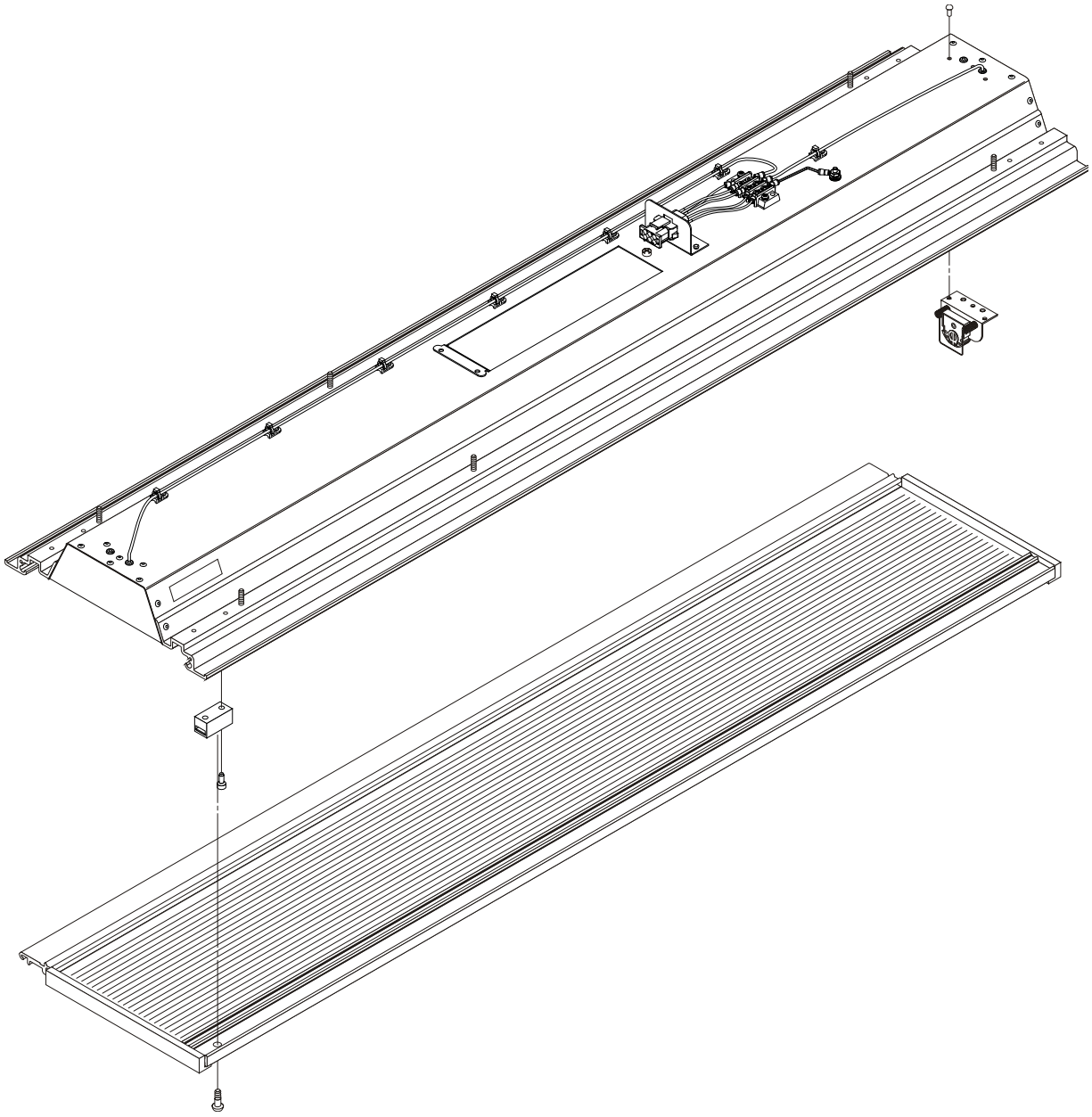

Figure 2-1: Passenger Area Light Fixture

2.2.2 Interior: Passenger Area Air Diffusers

Air diffusers (Figure 2-2) are mounted adjacent to each lighting fixture frame. The double slotted design evenly distributes conditioned air in the passenger area. They have no provision to adjust the volume of discharged air. Diffusers are made of extruded aluminum with all exposed surfaces powder-coated.

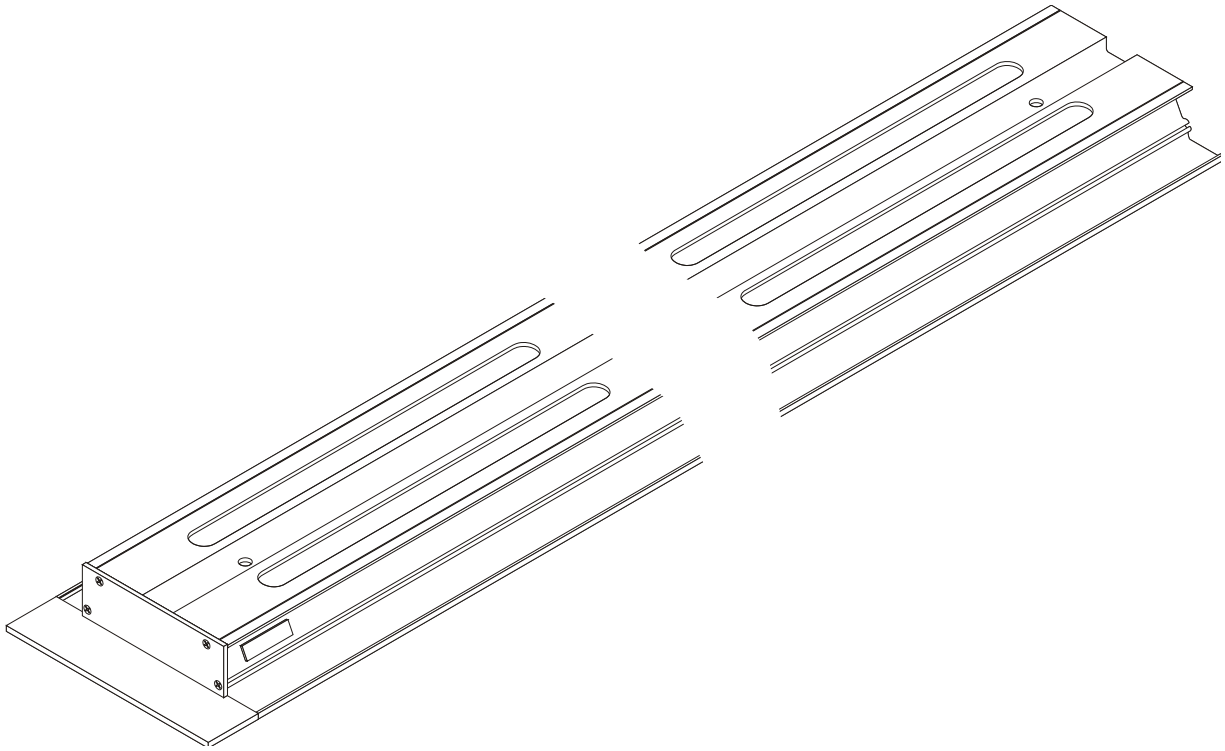

Figure 2-2: Passenger Area Air Diffuser

2.2.3 Interior: Passenger Area "Door Out Of Service" Sign

The "Door Out Of Service" sign (Figure 2-3) is located above each passenger doorway. This fixture has a painted aluminum bezel with a gasket suitable for an interior location. The housing is black anodized aluminum with a polycarbonate lens. Characters are 13 mm high and illuminated by a red LED PC board assembly powered from the 28.5 VDC LVPS.

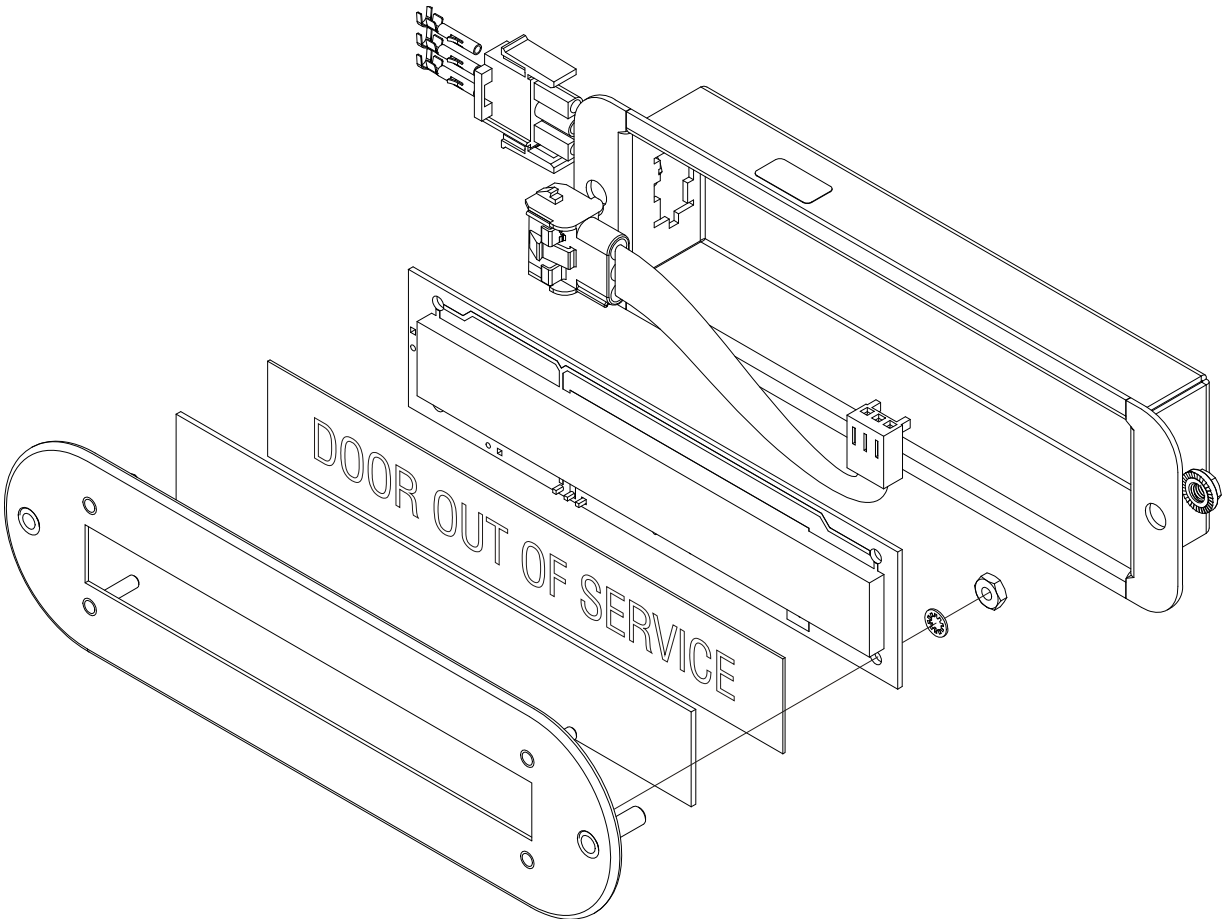

Figure 2-3: Passenger Area "Door Out Of Service" Sign

2.2.4 Interior: Passenger Area Door Closing Indicator

The door closing indicator (Figure 2-4) is located at each passenger doorway and flashes whenever a passenger door opens. This indicator has an anodized housing with an amber diffuser lens. It uses a white LED lamp and is powered from the 28.5 VDC LVPS.

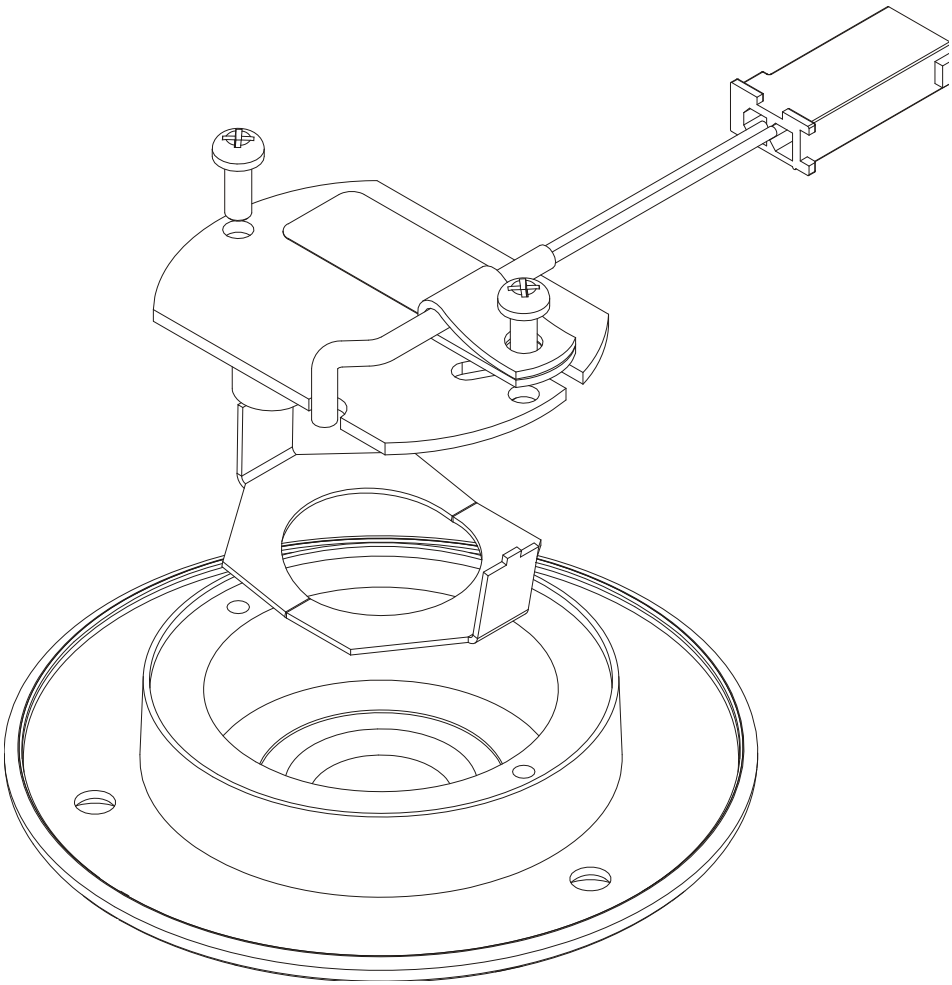

Figure 2-4: Passenger Area Door Closing Indicator

2.2.5 Interior: Passenger Area Articulation Lighting

Lighting in the Articulation, between the two units, is supplied by two flush-mounted box fixtures (Figure 2-5). The frame is aluminum with a powder coating. Each fixture holds one 610 mm LED tube lamp and is powered from the 28.5 VDC LVPS. The lens is polycarbonate with a prismatic pattern that matches the passenger area lights.

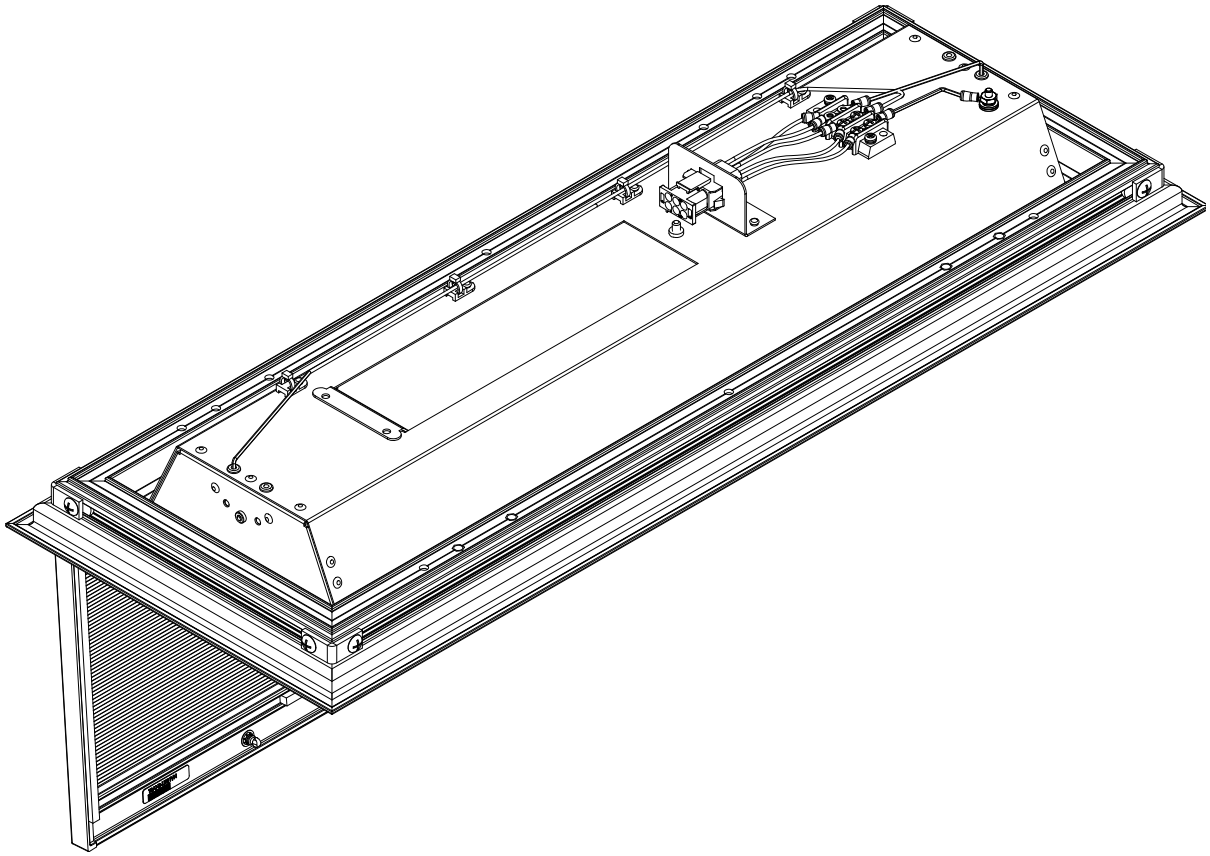

Figure 2-5: Articulation Light Fixture

2.2.6 Interior: Cab General Lighting

General lighting in the cab is provided by a ceiling mounted box fixture (Figure 2-6) that contains two 610 mm LED tube lamps. The frame is aluminum with a powder coating and the lens is polycarbonate with a prismatic pattern. This fixture is powered from the 28.5 VDC LVPS.

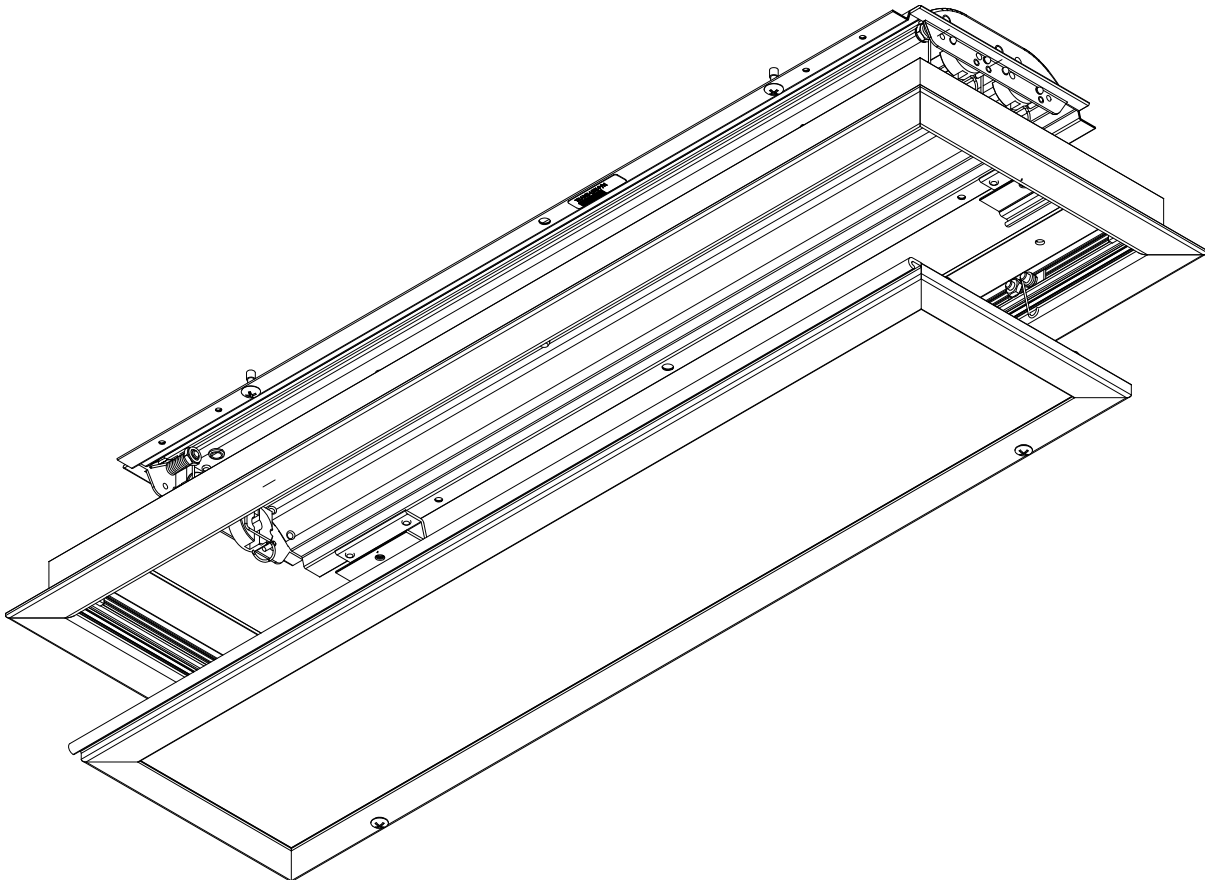

Figure 2-6: Cab General Light Fixture

2.2.7 Interior: Cab Console Lighting

An adjustable cab console light (Figure 2-7) is mounted in the ceiling over the console and contains a single high output white LED lamp. Direction of the light can be adjusted manually ±30 degrees from the centerline of the light. Lamp output can also be adjusted from 20% to 100% using the dimmer control mounted on the console. This fixture is powered from the 28.5 VDC LVPS.

The fixture housing is aluminum with a black wrinkle powder coat finish.

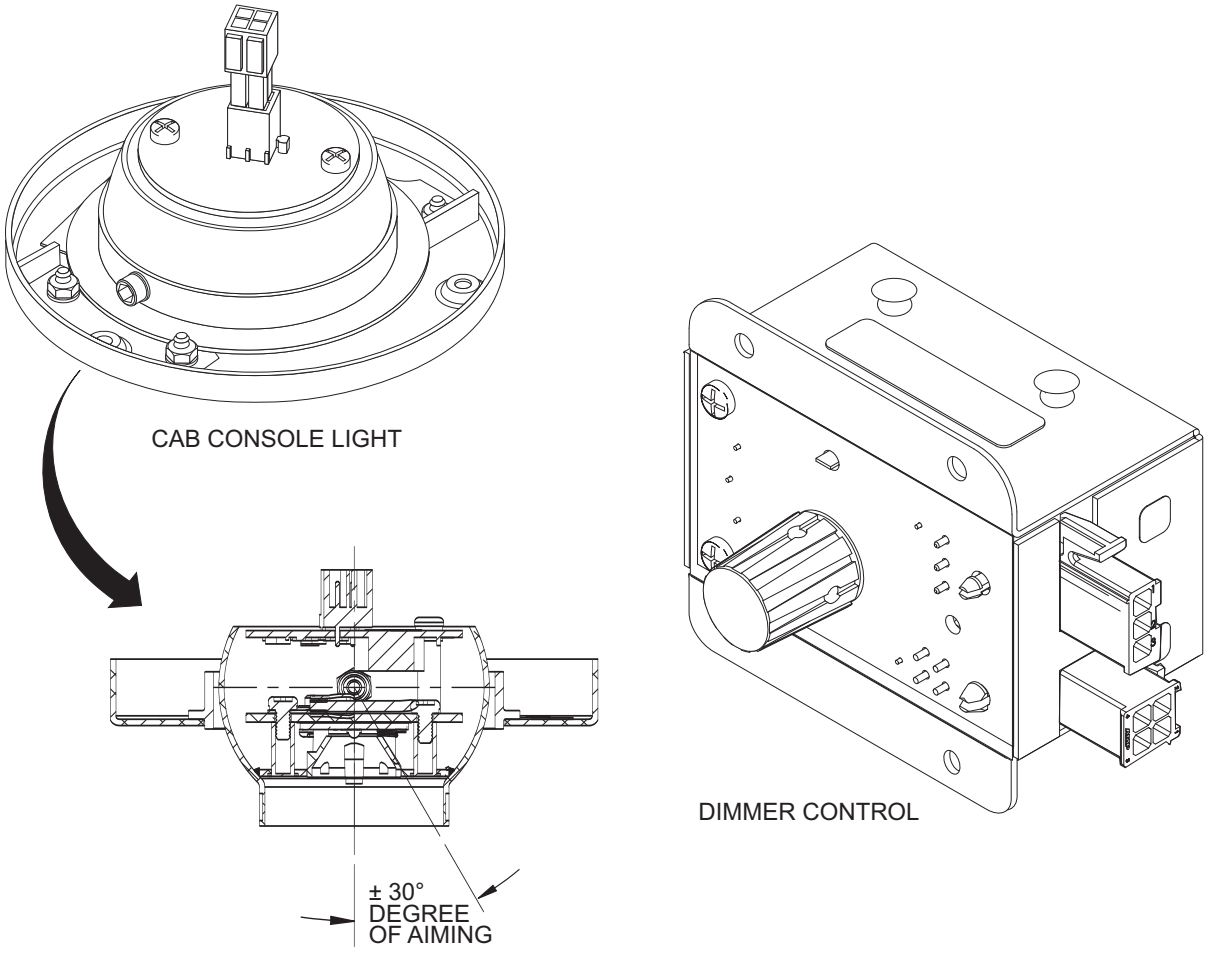

Figure 2-7: Cab Console Light and Dimmer Control

2.2.8 Exterior: Headlight

The headlight assembly (Figure 2-8) contains a rectangular, sealed beam, incandescent lamp that operates from the LRV 12 VDC power supply. The lamp is the halogen type and has dual filaments to allow high/low beam operation.

There are two headlight assemblies at each end of the vehicle. Left and right side headlights are identical. Aiming can be accomplished from the car exterior without dismantling the fixture.

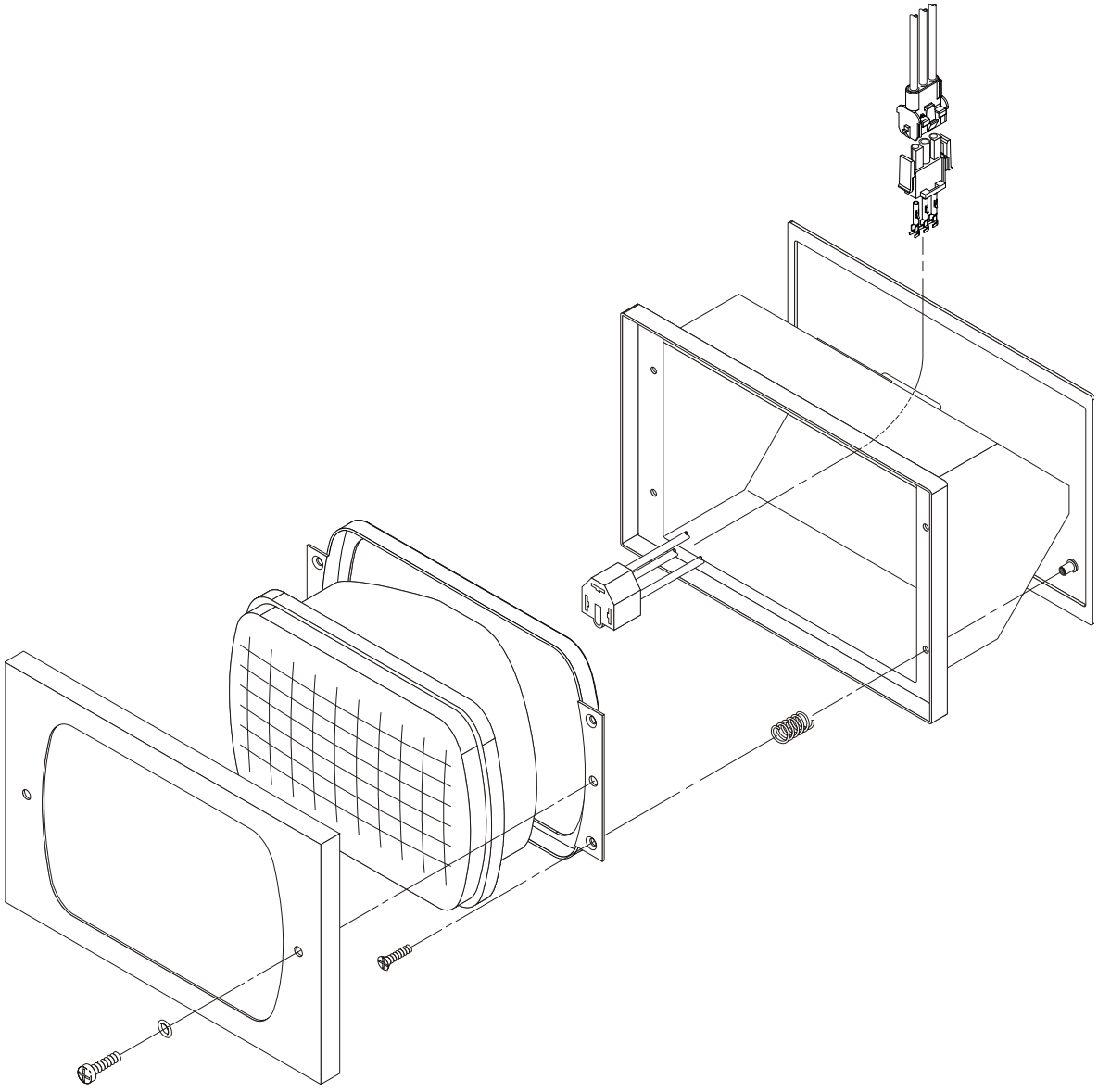

Figure 2-8: Headlight Assembly

2.2.9 Exterior: Tail Light Assembly

The tail light assembly (Figure 2-9) contains two LED lamp modules that operate independently and receive power from the 28.5 VDC LVPS. The red LED lamp module functions as the stop light and tail light. The amber LED lamp module functions as the turn signal and emergency flasher.

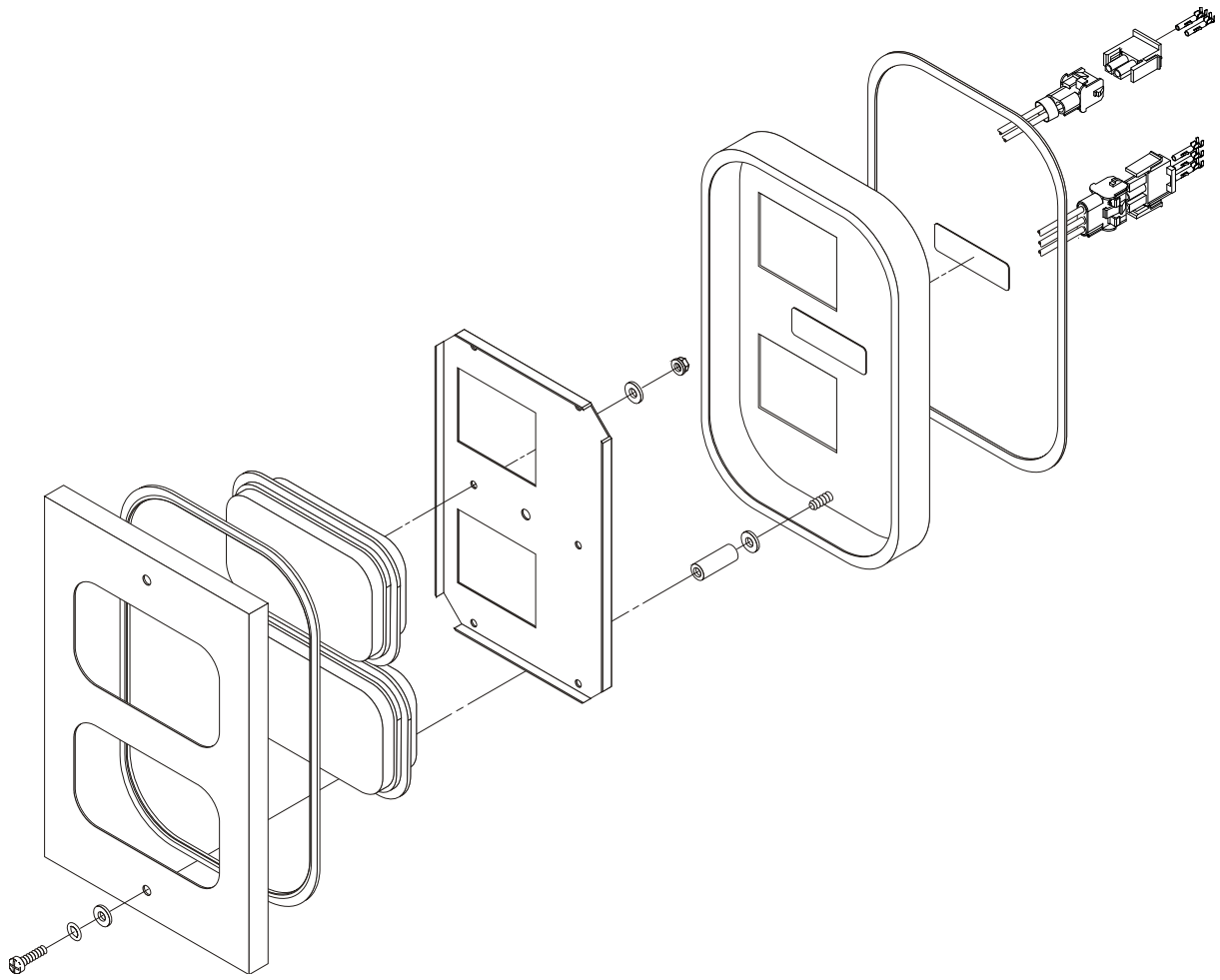

Figure 2-9: Tail Light Assembly

2.2.10 Exterior: Roof Headlight

The roof headlight (Figure 2-10) is a single, 200 watt incandescent sealed beam lamp is normally powered by the 28.5 VDC, but for lower intensity a separate 12 VDC power supply is used. The bezel, mounting ring, and fasteners are stainless steel. The lamp and fixture are keyed to ensure correct alignment of the lens grid pattern and filament orientation. The lamp can be aimed without disassembly by inserting a screwdriver through adjustment openings in the bezel.

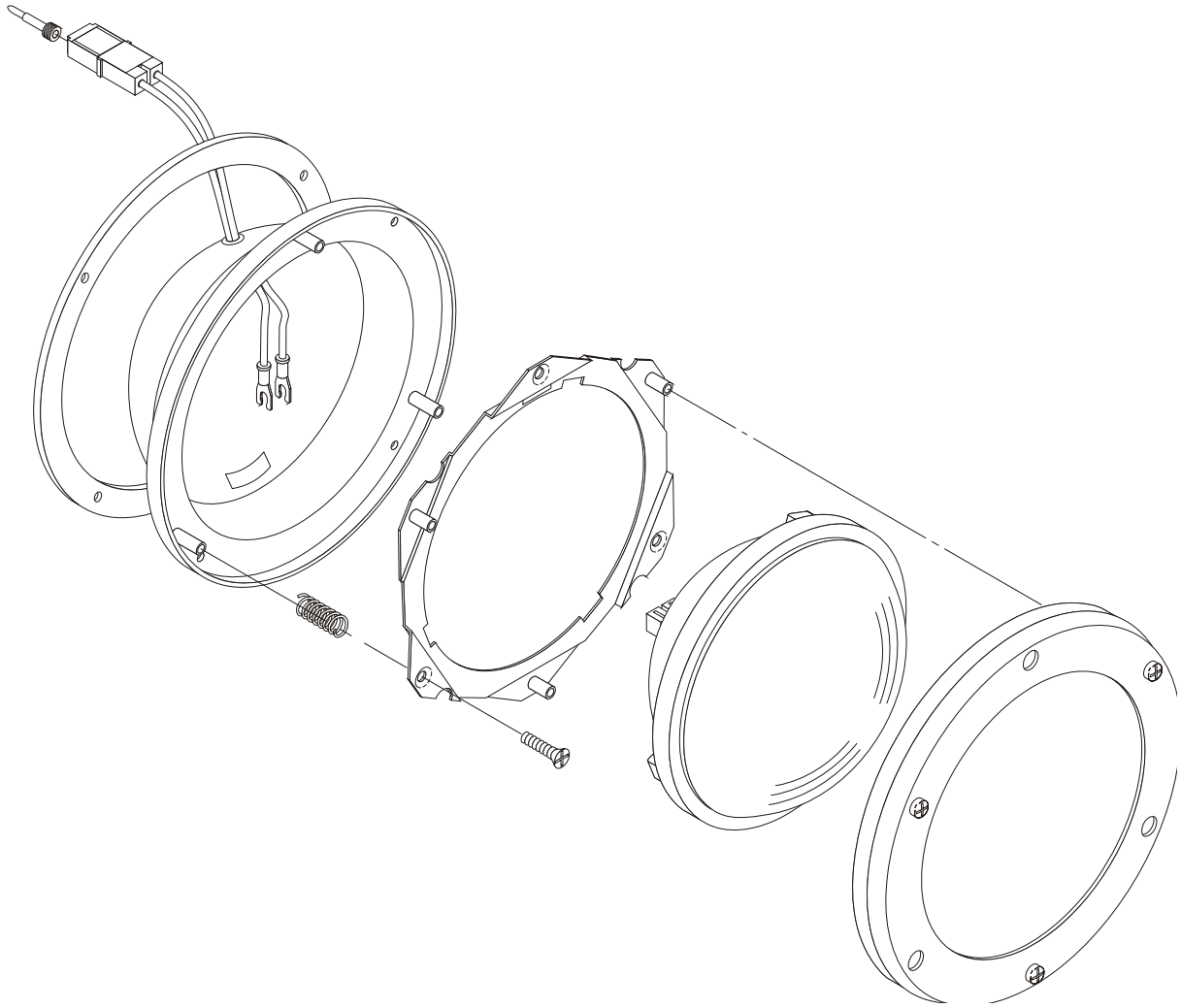

Figure 2-10: Roof Headlight

2.2.11 Exterior: Silent Alarm

A silent alarm indicator (Figure 2-11) is located on the roof of the cab at each end of the vehicle. It is a high intensity LED lamp module that flashes (flashing controlled by carbuilder) when activated. This amber colored indicator is designed to be visible from above the vehicle at a minimum distance of 153 meters and operates from a separate 12 VDC power supply.

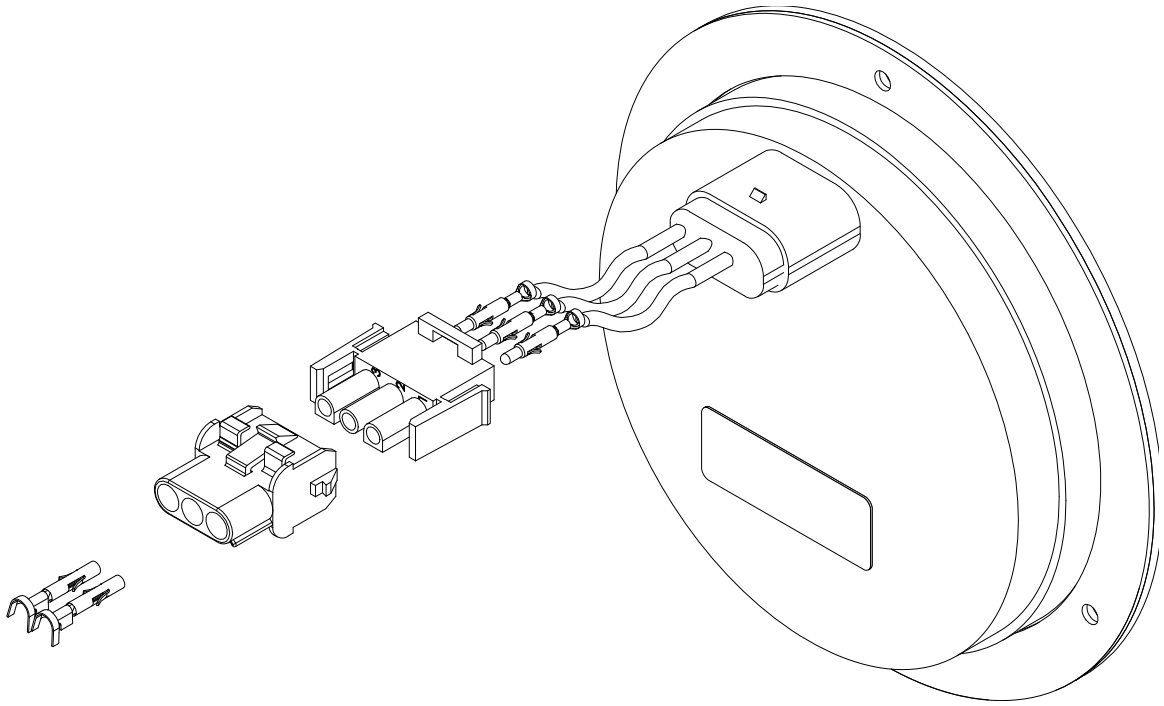

Figure 2-11: Silent Alarm Indicator

2.2.12 Exterior: Door Open Indicator

The door open indicator (Figure 2-12) is located above each passenger doorway and illuminates when the door is open. It has a painted cast aluminum housing and aluminum mounting plate. The glass lens is clear with a red LED lamp that is powered by the 28.5 VDC LVPS.

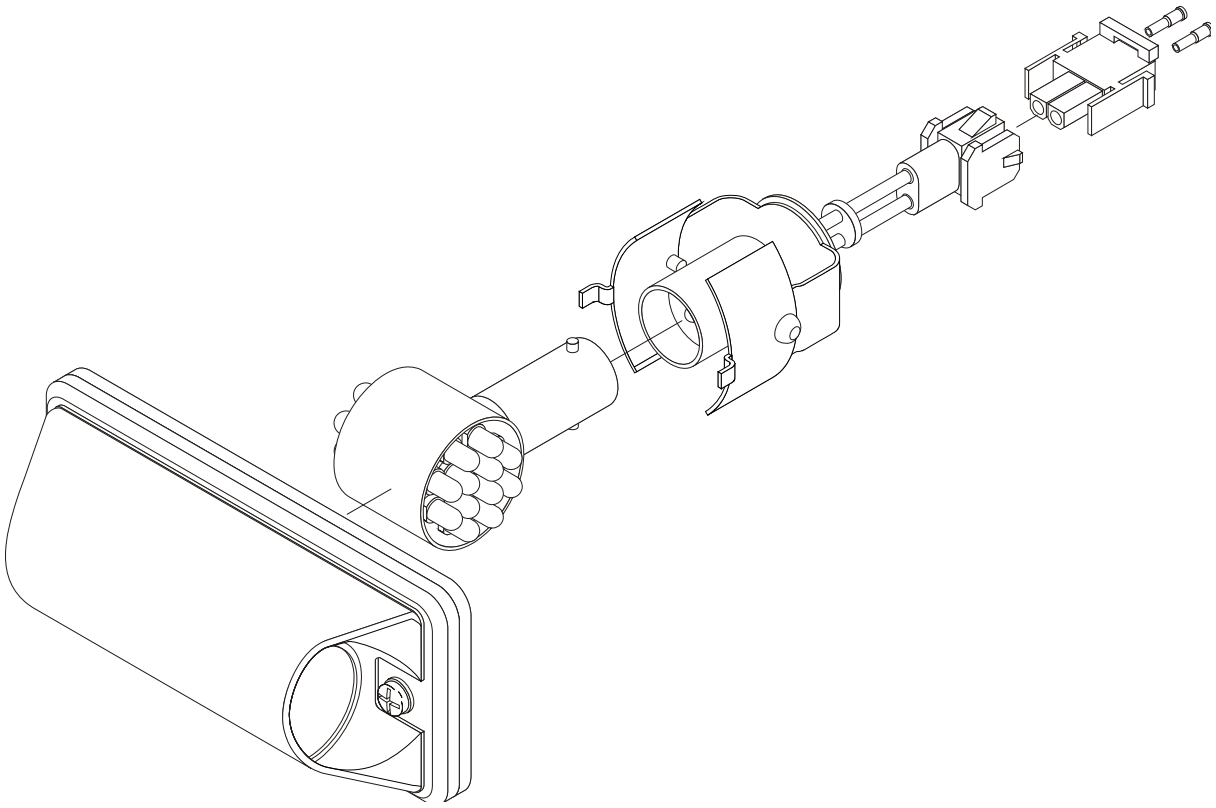

Figure 2-12: Door Open Indicator

2.2.13 Exterior: Side Turn Signal

The amber turn signal indicator (Figure 2-13) is located on the side of each vehicle unit. This fixture contains an LED lamp module powered by the 28.5 VDC LVPS. The bezel and window are attached with a gasket to protect the PC board assembly from the weather.

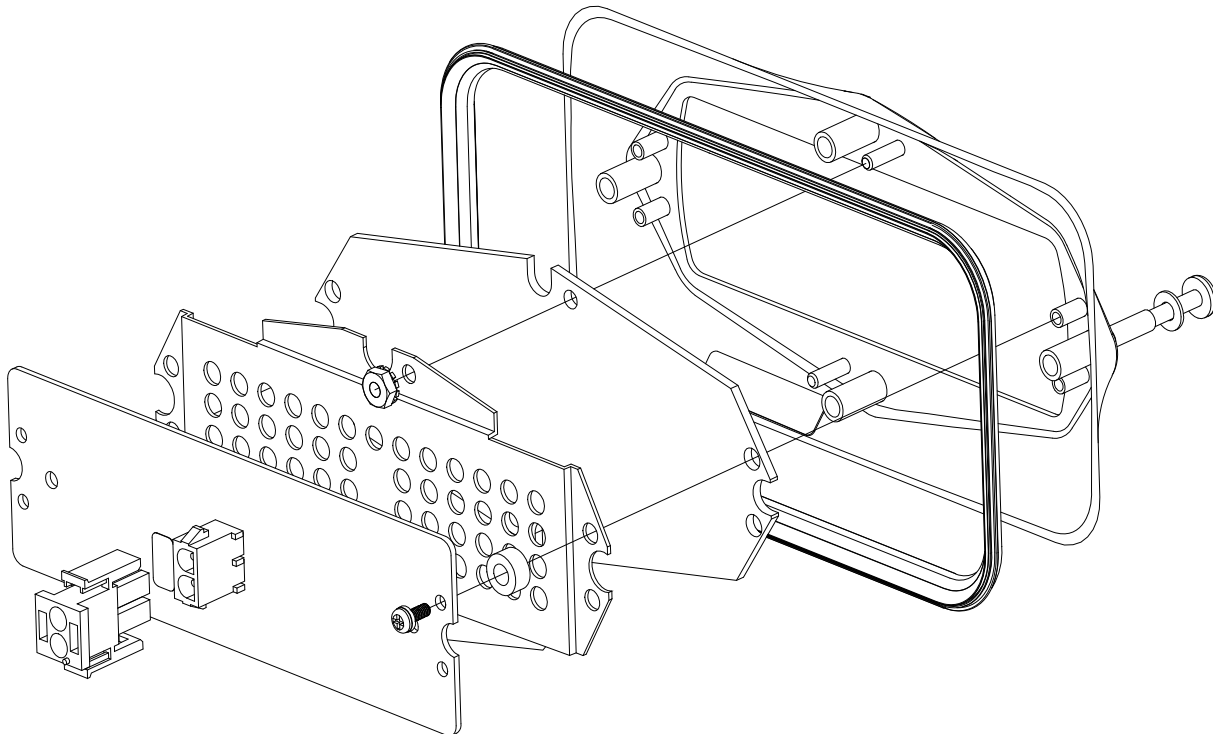

Figure 2-13: Turn Signal Indicator

2.2.14 Exterior: Cutout Active Indicator

The cutout active indicator (Figure 2-14) is located on the upper right corner of the cab and is powered by the 28.5 VDC LVPS. It uses a blue LED lamp module with a bayonet base. The bezel and fasteners are stainless steel with a clear polycarbonate lens.

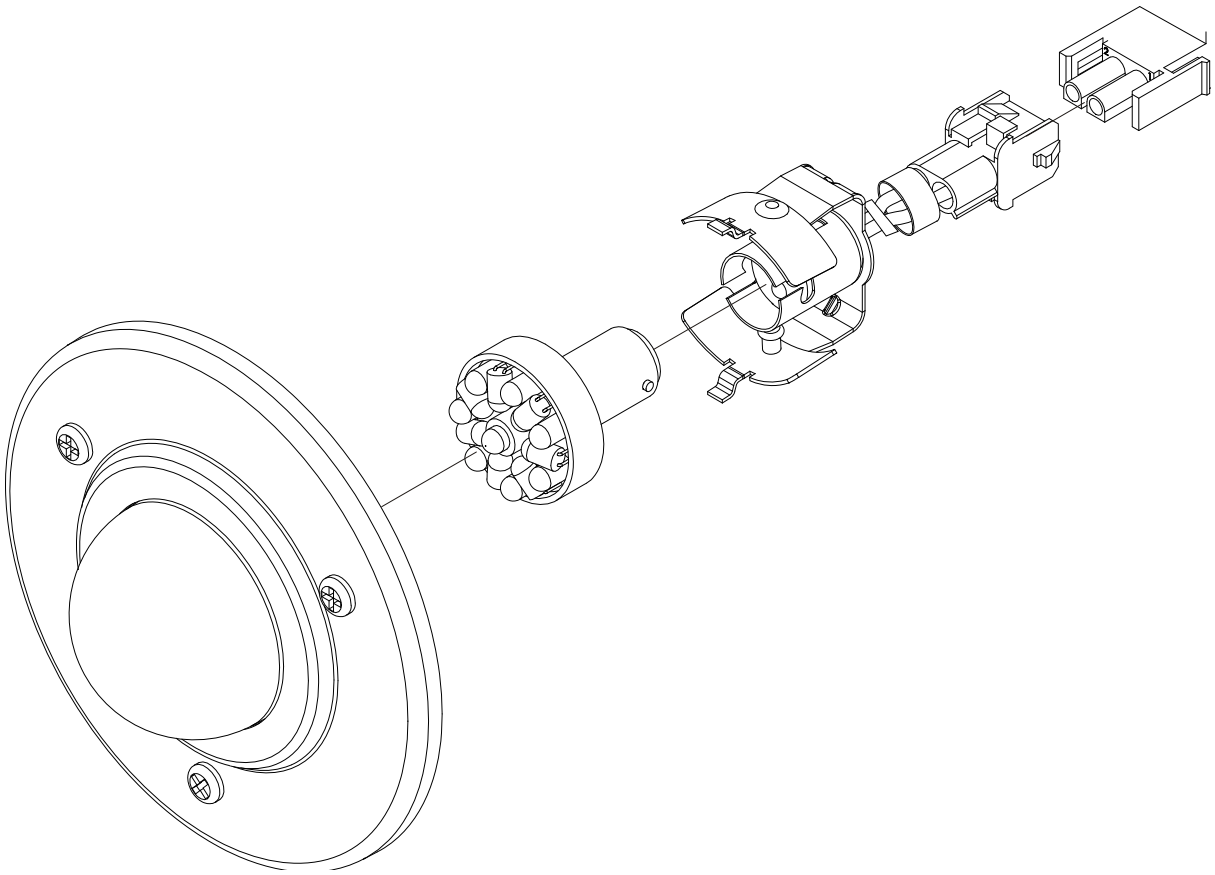

Figure 2-14: Cutout Active Indicator

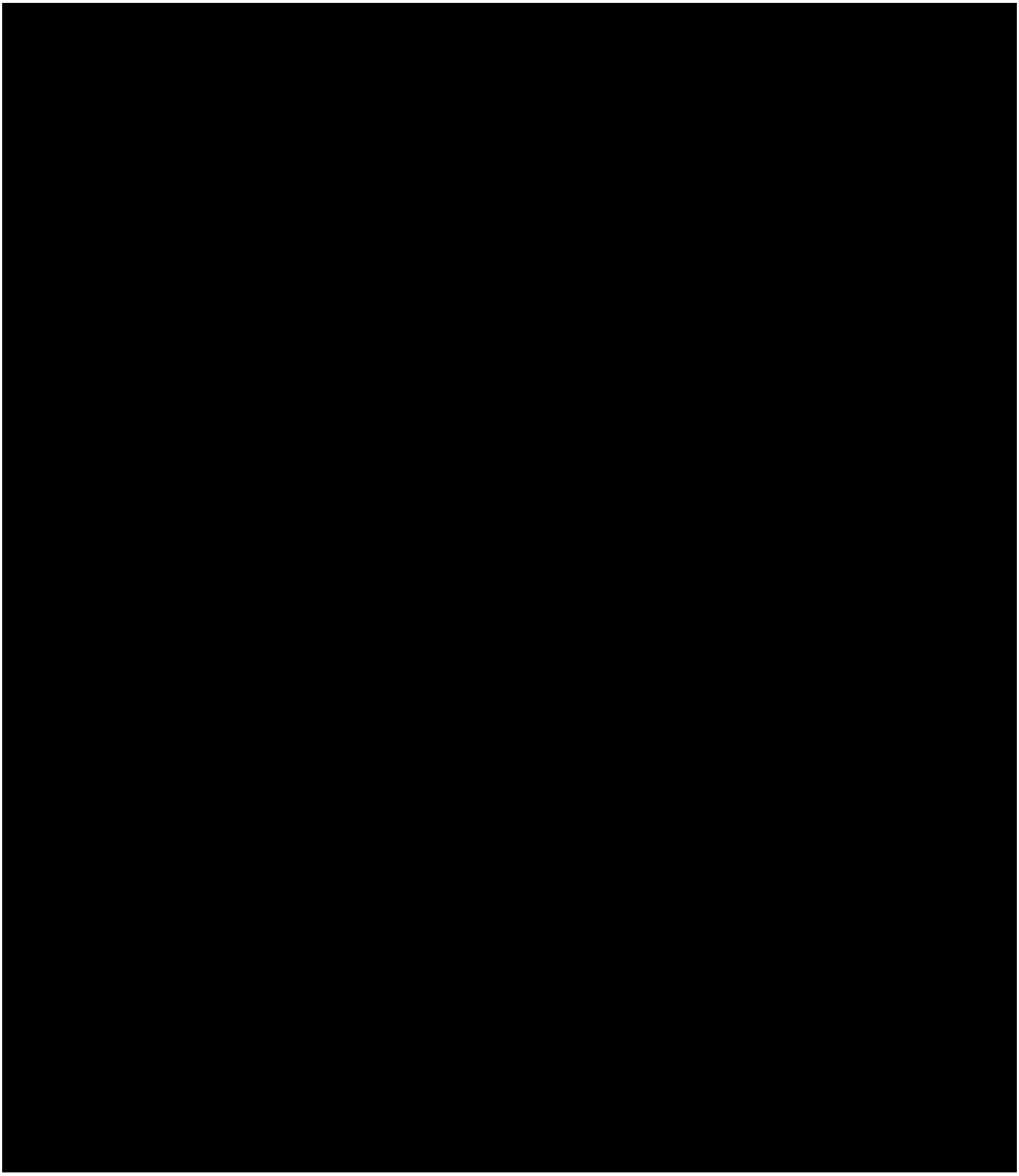

Figure 2-15: Block Diagram

CHAPTER 3.0

SPECIAL TOOLS AND MATERIALS

3.1 Introduction

Maintenance of this equipment requires no special tools.

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CHAPTER 4.0

SCHEDULED MAINTENANCE TASKS

4.1 Introduction

This section provides information about maintenance tasks that are performed on a regular schedule. Table 4-1 is a summary of those tasks and how often they are performed. The procedure for each task is detailed in Section 4.3.

4.2 Scheduled Maintenance Index

The Scheduled Maintenance Index provides a comprehensive maintenance schedule. It includes all scheduled performance tests, preventive maintenance procedures, overhaul and replacement schedules.

Table 4-1. Scheduled Maintenance

Maintenance Interval	Part Description	Scheduled Maintenance Task	Section 0600, Lighting Running Maintenance Manual Section Reference
Daily	Passenger Area	Check passenger area lighting.	4.3.1
Daily	Emergency Lighting	Check operation of emergency lighting.	4.3.2
Daily	Door Indicators	Check operation of door indicators.	4.3.3
Daily	Cab	Check operation of cab lighting.	4.3.4
Daily	Exterior	Check LRV exterior lighting.	4.3.5
10,000 Miles	Headlight Aiming	Check aim of headlights for compliance with 49 CFR 229.125.	4.3.6 & 4.3.7

4.3 Scheduled Maintenance Procedures

4.3.1 Check Passenger Area Lighting

1. Turn all passenger area lighting ON.
2. Visually check that all overhead lamps are illuminated.
3. Visually check that Articulation lamps are illuminated.
4. Replace lamps that do not illuminate.

4.3.2 Check Operation Of Emergency Lighting

1. Turn all passenger area lighting ON.
2. Place circuit breakers ILCBA and ILCBB in the OFF position.
3. Visually check that four overhead lights in each vehicle unit remain illuminated.
4. If designated light fixtures do not illuminate, refer to Chapter 8 for troubleshooting.

4.3.3 Check Operation Of Door Indicators

1. Activate the "Door Out Of Service" sign for each passenger door.
2. Verify that the sign illuminates.
3. Open the passenger doors and observe that the Door Open indicators (located outside) illuminate when the door is open.
4. Close the passenger doors and observe that the Door Closing indicators (located inside) illuminate.
5. Refer to Chapter 8 for troubleshooting if any indicator fails to illuminate.

4.3.4 Check Operation Of Cab Lighting

1. Turn ON the overhead lighting fixture.
2. If lamp does not illuminate, replace lamp.
3. Turn ON overhead console light.
4. Rotate dimmer fully clockwise and then counter-clockwise.
5. If lamp does not illuminate or vary in brightness as dimmer is rotated, refer to Chapter 8 for troubleshooting.

4.3.5 Check LRV Exterior Lighting

NOTE: This procedure is best performed with two persons. One person is located in the cab to operate the light switches, the other person is located outside to perform observations.

1. Activate the following lights, one at a time, while the person outside observes their operation:

   - Silent Alarm,
   - Roof Headlight,
   - Main Headlights,
   - Tail Light Assembly (turn signal, stop light, emergency flasher),
   - Side Turn Signal,
   - Cutout Active Indicator.

2. If any indicator fails to illuminate, refer to Chapter 8 for troubleshooting.

4.3.6 Check Aim Of Roof Headlight

NOTE: This procedure is performed at both the A-end and B-end of the vehicle.

WARNING

DO NOT LOOK DIRECTLY INTO THE ROOF HEADLIGHT. SERIOUS EYE INJURY MAY RESULT.

Tools and Equipment:

- Tape measure; minimum 8 meter,
- Windex or similar cleaner to clean the lens covers.

1. Clean the Roof Headlight at both ends of the vehicle.
2. Turn the Roof Headlight switch to ON.
3. The greatest concentration of light should be centered between the tracks, and parallel to the ground.
4. Refer to Section 5.4 if adjustment is necessary.

4.3.7 Check Aim Of Headlights

NOTE: This procedure is performed at both the A-end and B-end of the vehicle.

Tools and Equipment:

- Tape measure; minimum 8 meter,
- Windex or similar cleaner to clean the lens covers.

1. Clean the left and right Headlights at both ends of the vehicle.
2. Turn the Headlight switch to ON.
3. The greatest concentration of light should be directly in-line with the front of each Headlight, and parallel to the ground.
4. Refer to Section 5.4 if adjustment is necessary.

CHAPTER 5.0

CORRECTIVE MAINTENANCE

5.1 Introduction

This chapter provides information regarding equipment adjustment and any special inspections not identified in the scheduled maintenance task list.

5.2 Safety Information

The lighting equipment on the LRV presents minimal safety risk to maintenance personnel. However, there are two areas that persons working on this equipment should be aware of:

- The light from the roof headlight is very bright and could cause eye injury. Never look directly into the light when illuminated.
- When working with the low voltage system, both 28.5 VDC and 12 VDC, always remove power to the equipment being serviced. This will prevent tripping circuit breakers that could cause misdiagnosis of equipment problems.

5.3 Inspection

There are no special inspections required for this equipment.

5.4 Adjustments

5.4.1 Adjust Aim Of Roof Headlight

Equipment Needed:

- 6 ft. Folding Ladder or scaffold.

WARNING

DO NOT LOOK DIRECTLY INTO THE ROOF HEADLIGHT. SERIOUS EYE INJURY MAY RESULT.

1. Set up the aiming screen at 7,620 mm (25 ft) ahead of the coupler face. See Figure 5-1.
2. Turn on the roof mounted Roof Headlight.

3. Verify the Roof Headlight is adjusted as follows:

   The roof headlight is aimed so that the center of the high intensity zone is at the intersection of 3,296 mm high from top of rail and the Vehicle Axis. Use Figures 5-1 and 5-2 to adjust. (3,296 mm is calculated from the relation shown in Figure 5-2).

4. If adjustments are required, proceed with the following steps"

a. Position the ladder (or scaffold) on the exterior of the car, forward of the cab, to gain access to the Roof Headlight.

b. Locate adjustment access holes (1, Figure 5-3) on roof headlight bezel.

c. Insert screwdriver into appropriate access hole to adjust for greatest concentration of light centered between the tracks and parallel to the ground.

5. If adjustments are not required, proceed to step 6.

6. Change ends and repeat steps 1 through 4.

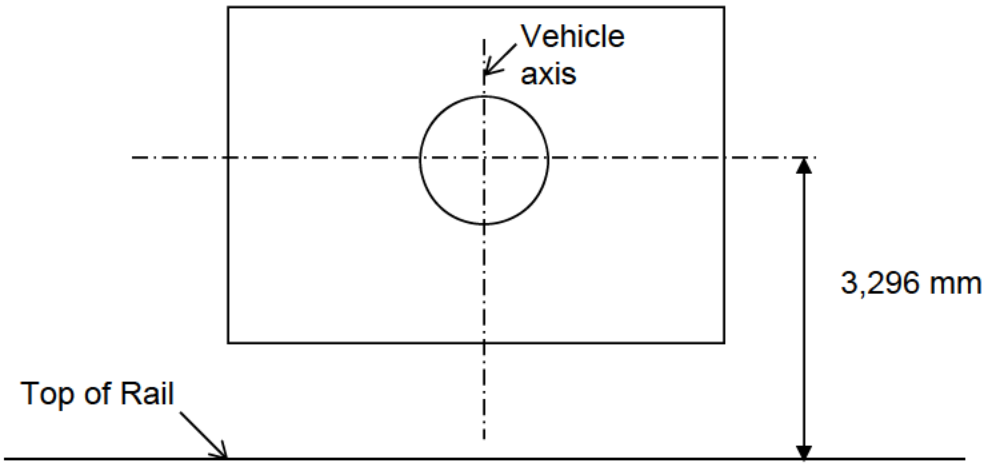

Figure 5-1: Aiming Screen for Roof Headlight

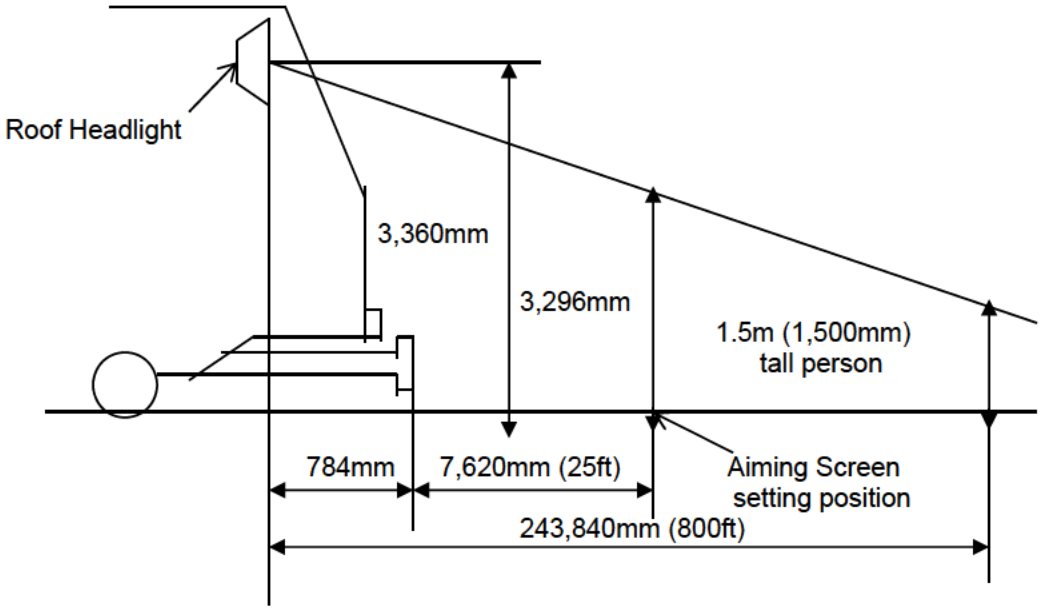

Figure 5-2: The Relation Between Roof Headlight and Aiming Screen for Roof Headlight

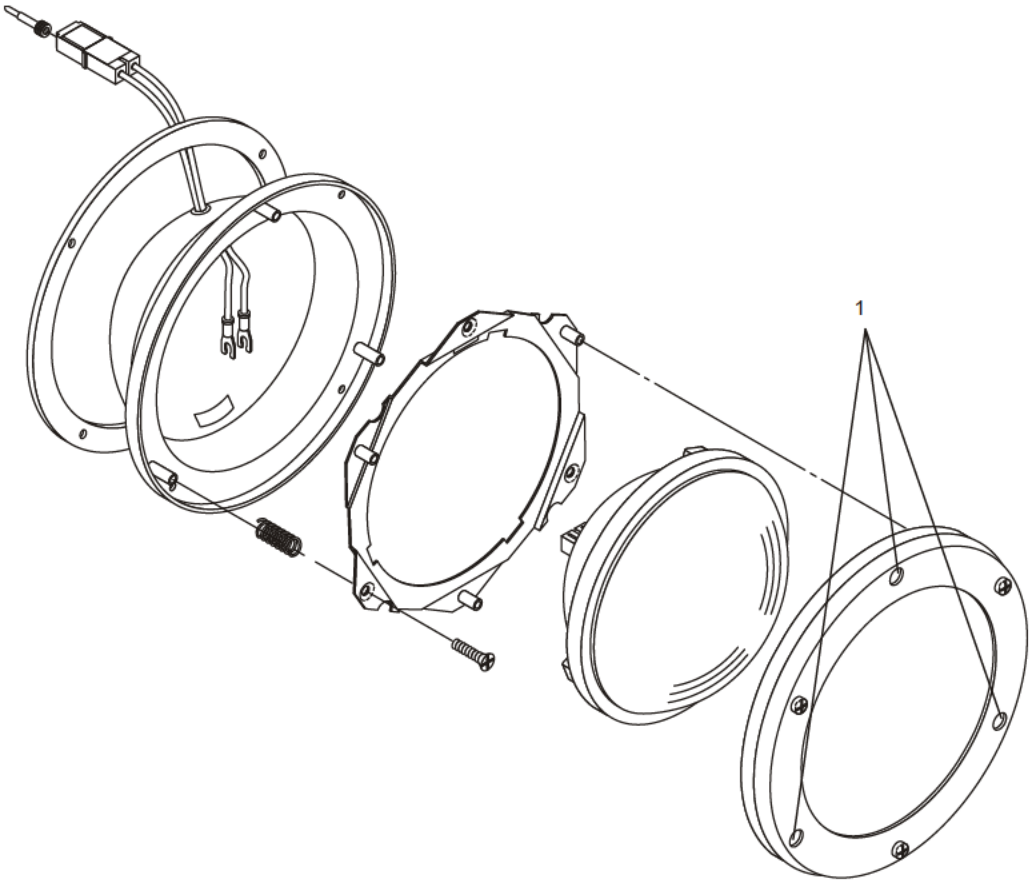

Figure 5-3: Adjustment of Roof Headlight

5.4.2 Adjust Aim Of Headlights

1. Set up the aiming screen at 7,620 mm (25 ft) ahead of the coupler face on one end of the car. See Figure 5-4.
2. Turn on the headlights to the low beam position.
3. The headlights must be adjusted as follows:

   Low beam headlights are aimed so that the top edge of the high-intensity zone is at the height of the headlight center and the left edge of the high-intensity zone is at the vertical centerline of the headlight. See Figure 5-4.

4. Verify the headlights are adjusted correctly.
5. If adjustments are required, proceed with the following steps:

a. Remove two catch screws (1, Figure 5-5) and two round washers (2) from the headlight bezel (3).

b. Turn the Headlight switch to ON.

c. Use a screwdriver to adjust the appropriate 10-32 x 3/4 flat head Phillips screw (4) to adjust as appropriate.

6. If adjustments are not required, proceed to step 7.
7. Change ends and repeat steps 1 through 5.

"Front Light Installation"

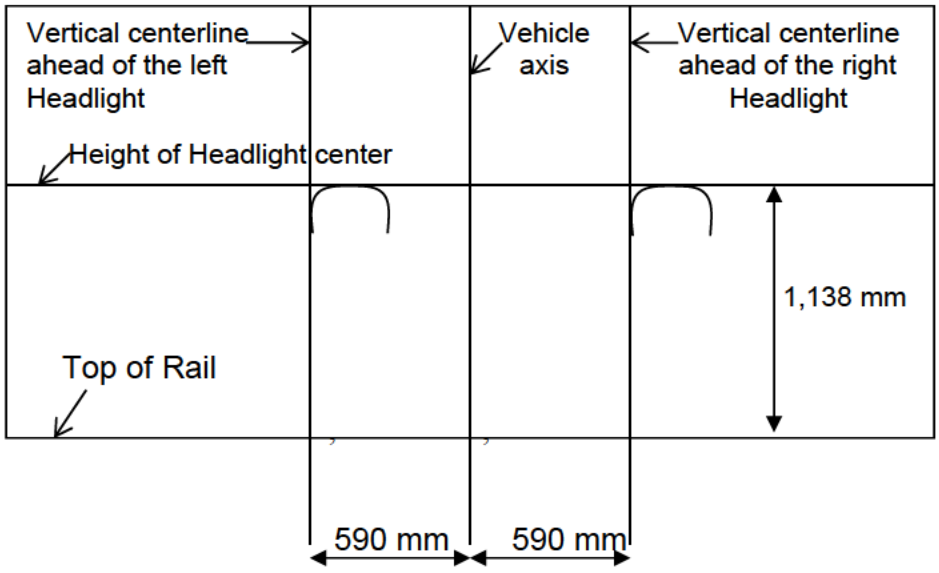

Figure 5-4: Aiming Screen for Headlight

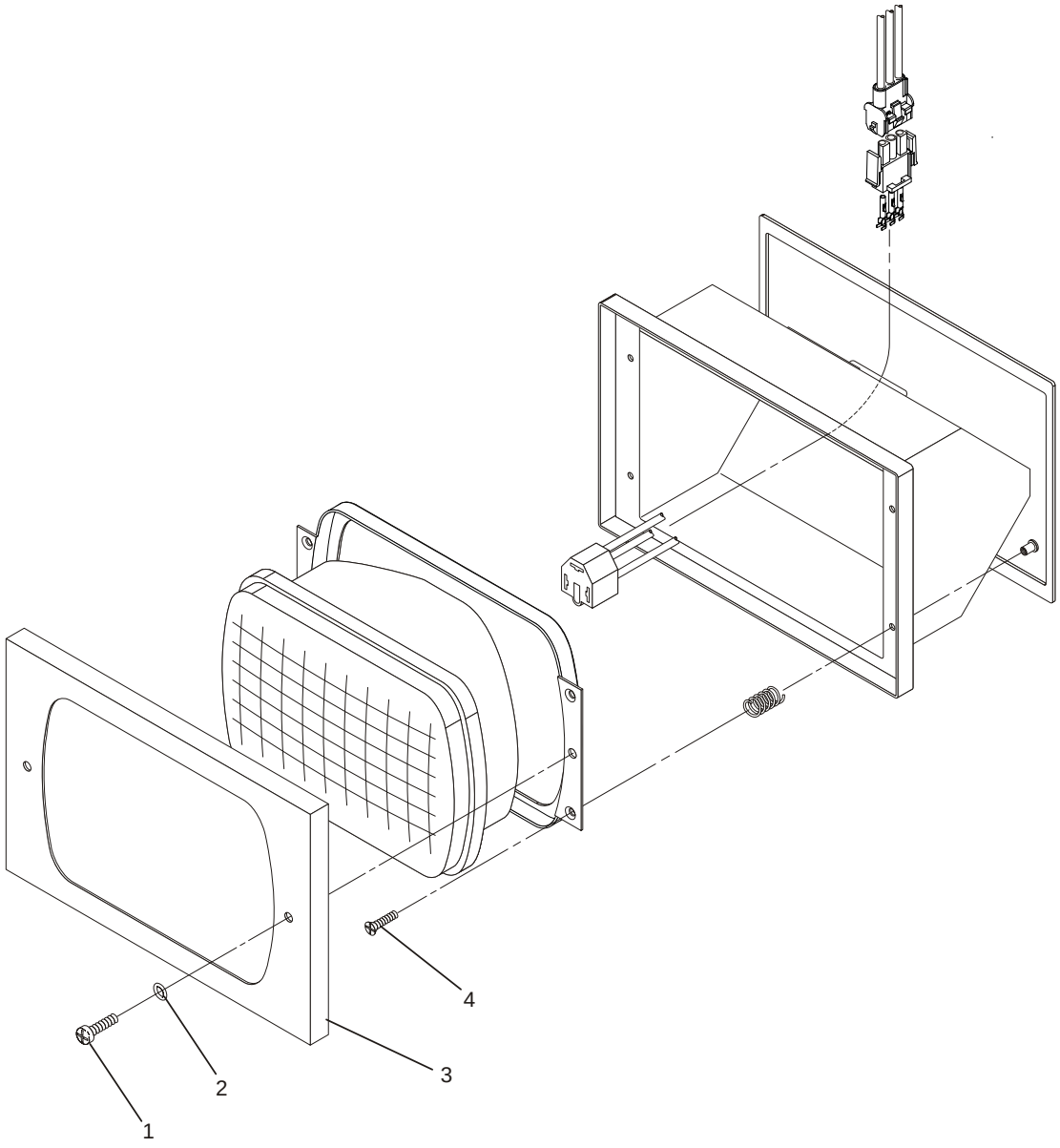

Figure 5-5: Adjustment Of Headlight

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CHAPTER 6.0

LUBRICATION

6.1 Introduction

No lubrication is required for the equipment described in this manual.

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CHAPTER 7.0

COMPONENT REMOVAL AND INSTALLATION

7.1 Introduction

This chapter provides instructions for the removal and installation of various lighting equipment components when necessary for repair.

7.2 Safety Information

The lighting equipment on the LRV presents minimal safety risk to maintenance personnel. However, there are two areas that persons working on this equipment should be aware of:

- The light from the roof headlight is very bright and could cause eye injury. Never look directly into the light when illuminated.
- When working with the low voltage system, both 28.5 VDC and 12 VDC, always remove power to the equipment being serviced. This will prevent tripping circuit breakers that could cause misdiagnosis of equipment problems.

7.3 Component Removal and Installation

7.3.1 Replace Passenger Area LED Tube Lamp

1. Remove power to the fixture.
2. Rotate three quarter-turn Torx head fasteners (1, Figure 7-1) one-quarter turn to the left on the lens door assembly (2).
3. Remove lamp retainer spring (3) from the socket (4) at each end of the fixture.
4. Rotate lamp tube (5) one-quarter turn and remove.
5. Install replacement lamp tube (5) and rotate one-quarter turn in the opposite direction.
6. Attach two lamp retainer springs (3).
7. Close the lens door assembly (2) and rotate three quarter-turn Torx head fasteners (1) one quarter-turn to the right.

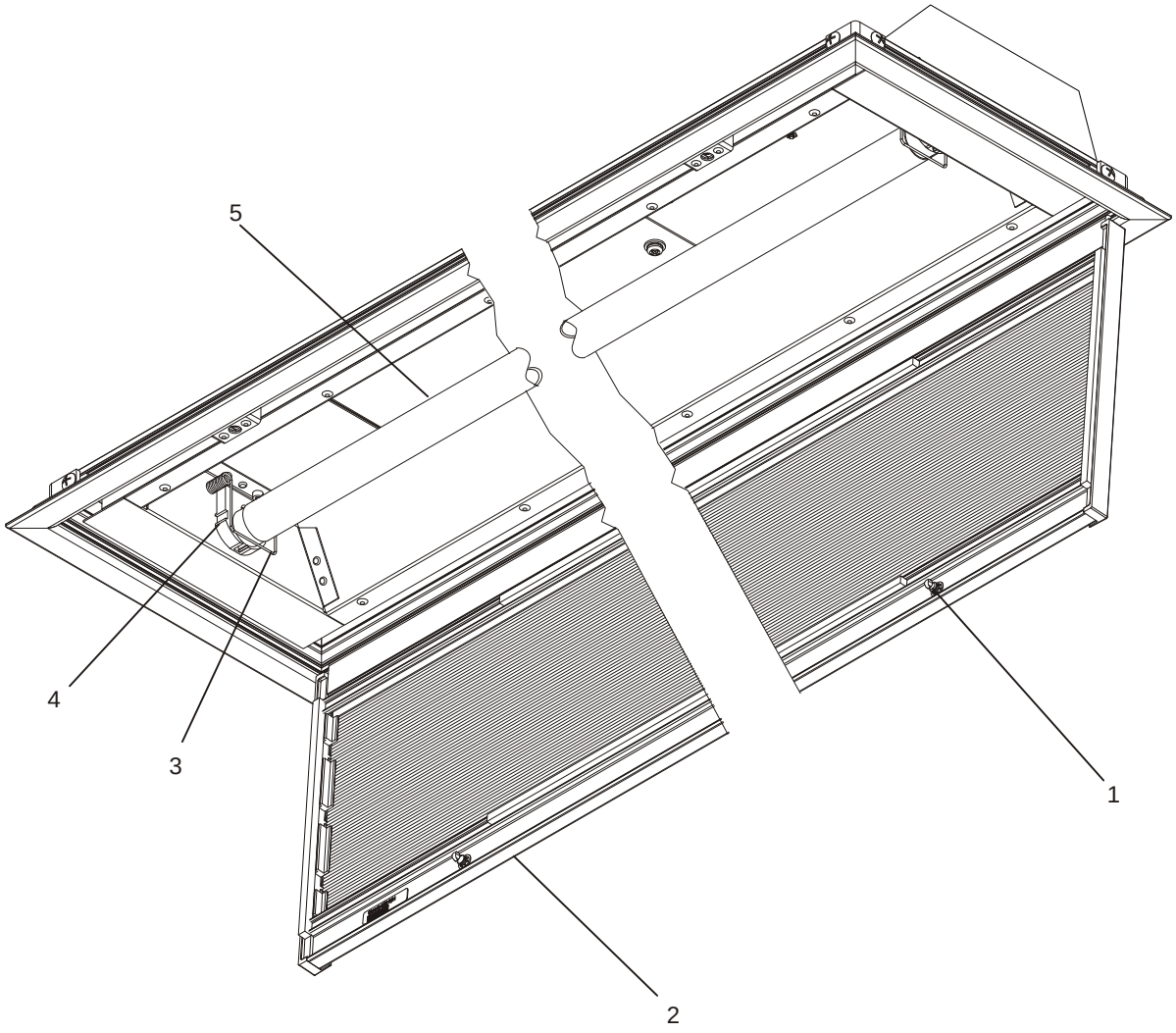

Figure 7-1: Replace Passenger Area LED Tube Lamp

7.3.2 Replace Articulation LED Tube Lamp

1. Remove power to the fixture.
2. Rotate two fasteners (1, Figure 7-2) on the bezel/lens assembly (2) one-quarter turn to the left.
3. Remove lamp retainer spring from the socket at each end of the fixture.
4. Rotate lamp tube (3) one-quarter turn and remove.
5. Install replacement lamp tube (3) and rotate one-quarter turn in the opposite direction.
6. Attach two lamp retainer springs at each end of the fixture.
7. Close bezel/lens assembly (2) and rotate two fasteners (1) one-quarter turn to the right.

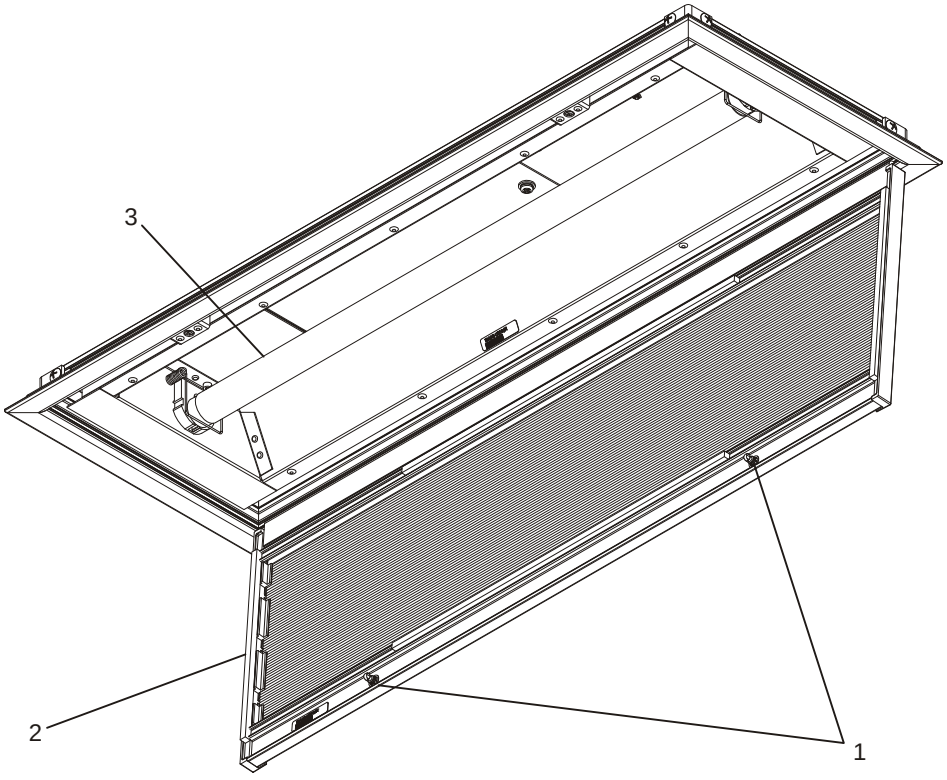

Figure 7-2: Replace Articulation LED Tube Lamp

7.3.3 Replace Cab Ceiling LED Tube Lamp

1. Remove power to the fixture.
2. Unfasten two captive 8-32 Torx head screws (1, Figure 7-3) from the lens door assembly (2).
3. Remove lamp retainer spring (3) from the socket (4) at each end of the fixture.
4. Rotate lamp tube (5) one-quarter turn and remove.
5. Install replacement lamp tube (5) and rotate one-quarter turn in the opposite direction.
6. Attach two lamp retainer springs (3).
7. Close lens door assembly (2) and fasten with two captive 8-32 Torx head screws (1).

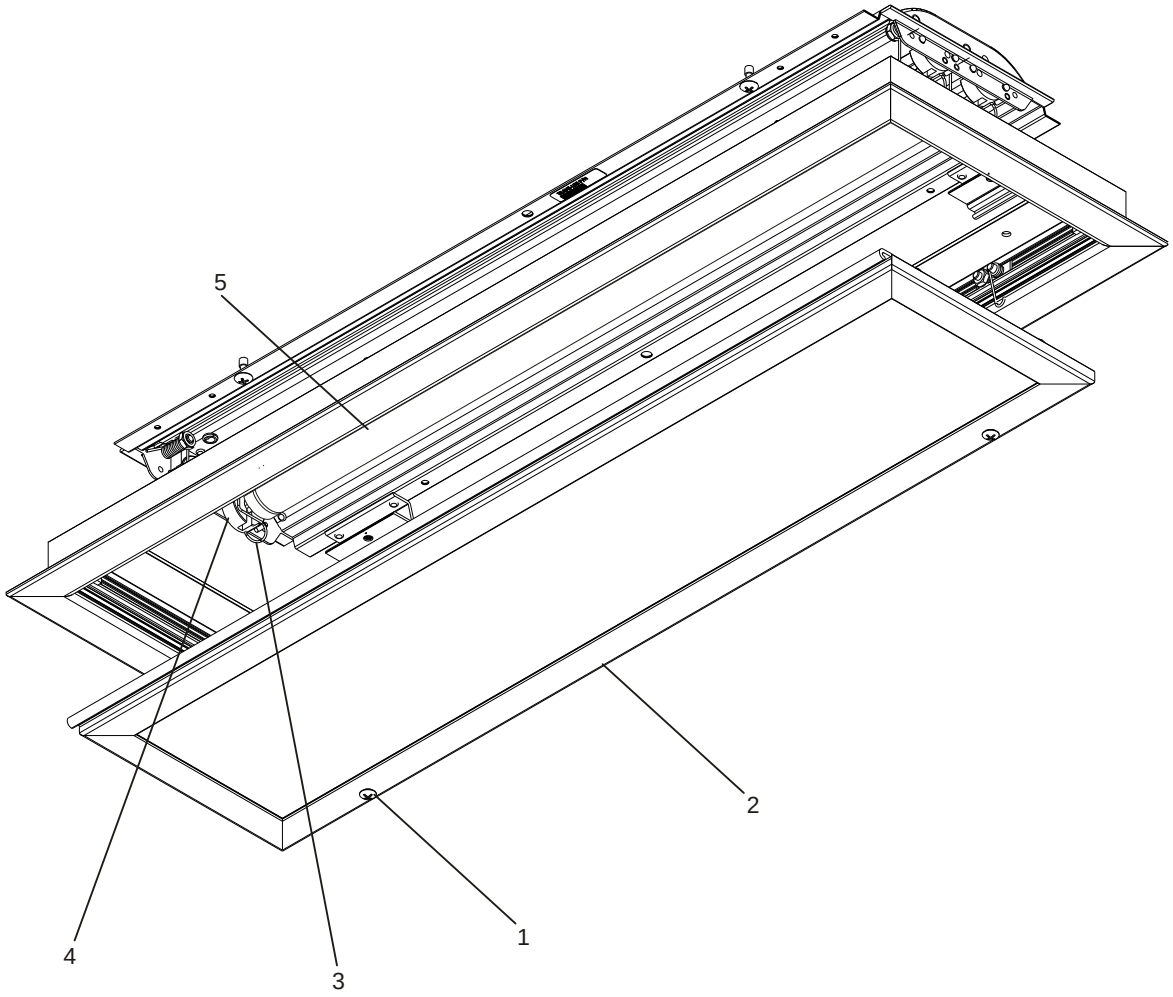

Figure 7-3: Replace Cab Ceiling LED Tube Lamp

7.3.4 Replace Overhead Cab Console Light

1. Remove power to the fixture.
2. Remove three screws (1, Figure 7-4) from fixture cover (2).
3. Partially remove the cab console light assembly (3) and disconnect the four-circuit nylon connector plug (4) at the back of the assembly. The complete cab console light assembly (3) may now be removed.
4. Align the replacement cab console light assembly (3) with cab ceiling.
5. Connect the four-circuit nylon connector plug (4).
6. Install the complete cab console light assembly (3) and fasten the cover (2) with three screws (1).

7.3.5 Replace Cab Console Light Dimmer Control

1. Remove power to the control.
2. Rotate the knob (1, Figure 7-5) fully counter-clockwise and note the position of the two set screws on the side of the knob.
3. Loosen two set screws (2) on the side of the knob.
4. Remove knob (1).
5. Remove Dimmer Control cover plate.
6. Remove four screws (9) holding the housing (8) to its mounting surface.
7. Partially remove the housing (8) from its mounting surface.
8. Disconnect one three-circuit nylon connector plug (6) and one four-circuit nylon connector plug (7) from the dimmer control PC board (5).
9. Remove three 4-40 x 7/16 Phillips head screws (3) and three #4 split lock washers (4) from the PC board assembly (5).
10. Install the replacement dimmer control PC board (5) with three 4-40 x 7/16 Phillips head screws (3) and three split lock washers (4).
11. Connect one three-circuit nylon connector plug (6) and one four-circuit nylon connector plug (7) to the dimmer control PC board (5).

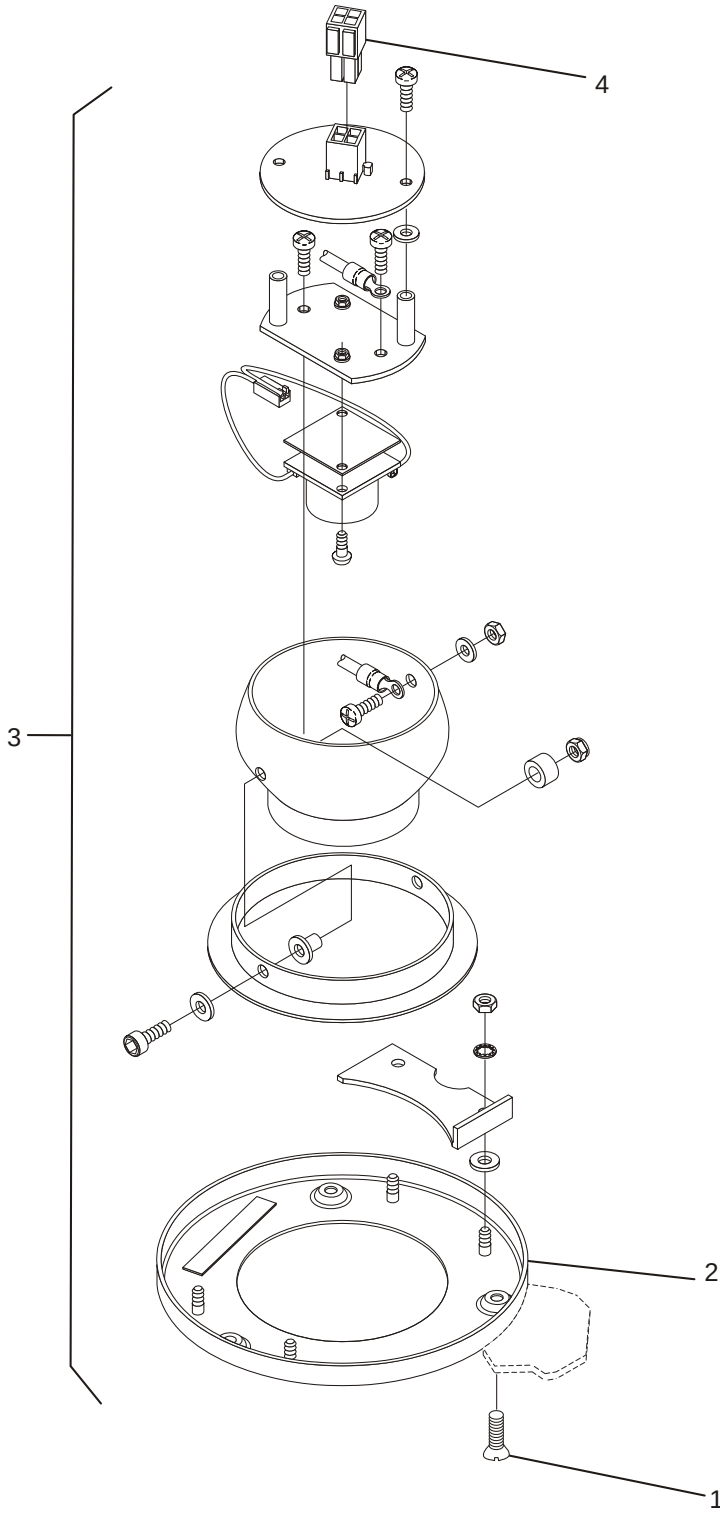

Figure 7-4: Replace Overhead Cab Console Light

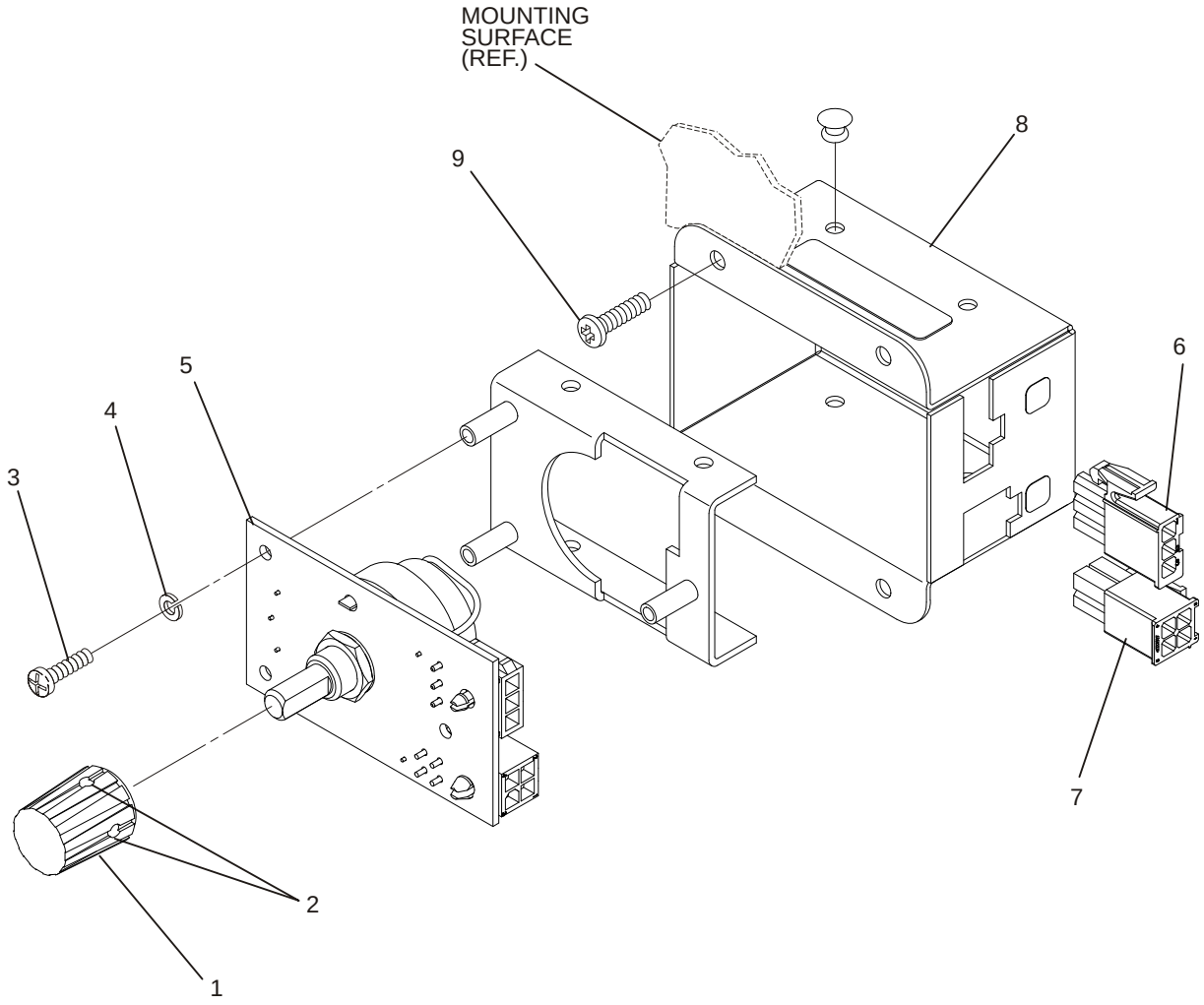

Figure 7-5: Replace Cab Console Light Dimmer Control

12. Insert the housing (8) into its mounting surface.
13. Attach four screws (9) to hold the housing (8) to its mounting surface.
14. Install Dimmer Control cover plate.
15. Rotate Dimmer Control shaft (without knob) fully counter-clockwise.
16. Install knob (1) with set screw holes in position noted previously.
17. Install two set screws (2) on the knob (1).

7.3.6 Replace "Door Out Of Service" Lamp

1. Remove power to the fixture.
2. Remove fixture from its mounting surface.
3. Remove two M5 x 0.8 serrated nuts (1, Figure 7-6) from the back of the bezel assembly (2).
4. Disconnect the three-circuit plug (3) from the PC board assembly (6).
5. Remove four 6-32 x 1/4 hex nuts (4) and four split washers (5) from the PC board assembly (6).
6. Install a replacement PC board assembly (6) and attach using four 6-32 x 1/4 hex nuts (4) and four split washers (5).
7. Connect the three-circuit plug (3) from the fixture to the PC board assembly (6).
8. Attach the bezel assembly (2) to the fixture using two M5 x 0.8 serrated nuts (1).
9. Install the fixture to its mounting surface. After re-installing the fixture to the mounting surface, confirm that that the lens is properly sealed to the bezel.

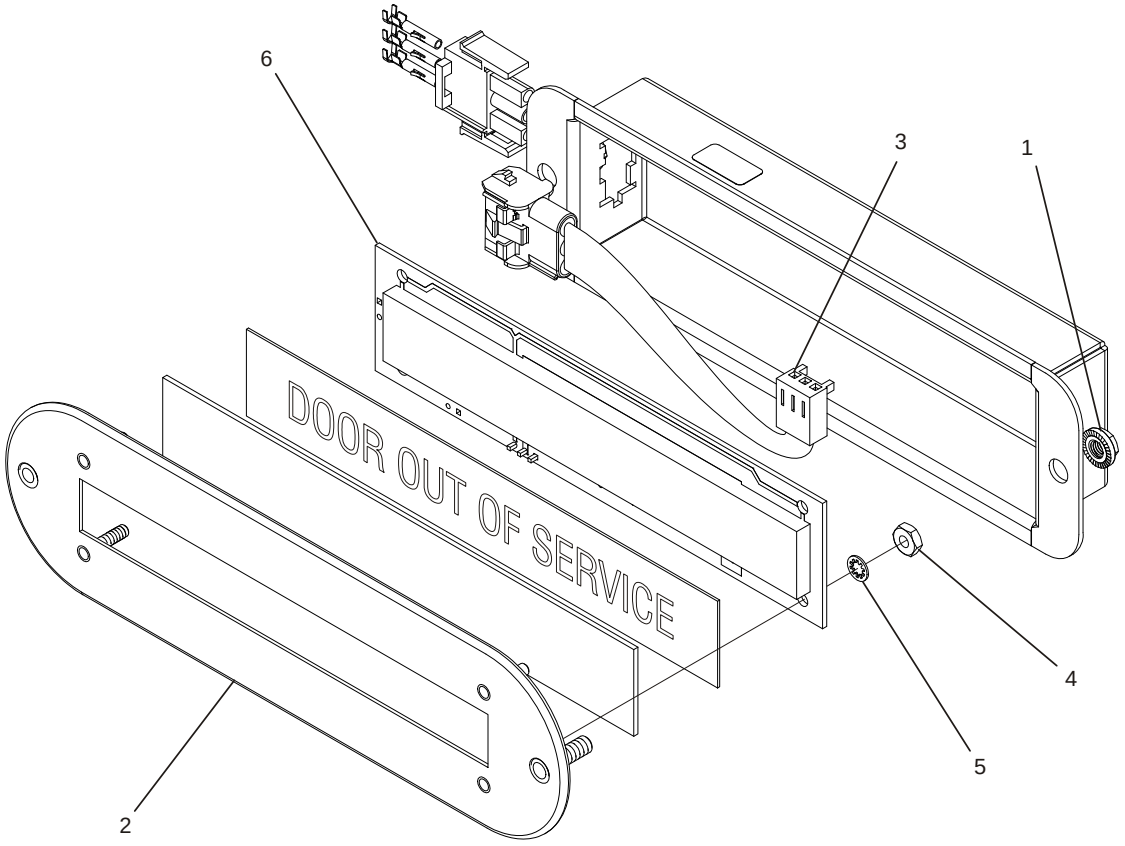

Figure 7-6: Replace Door Out Of Service Lamp

7.3.7 Replace Door Closing Indicator

1. Remove power to the indicator fixture.
2. Remove the indicator fixture from its mounting location.
3. Disconnect the 2-circuit plug (1, Figure 7-7).
4. Remove two 3 x 8 mm (1/8 x 5/16 inch) Phillips head screws (2) from the back of the LED lamp assembly (3).
5. Install replacement LED lamp assembly (3) with attached 2-circuit plug (1) using two 3 x 8 mm (1/8 x 5/16 inch) Phillips head screws (2).
6. Install the indicator fixture to its mounting location.

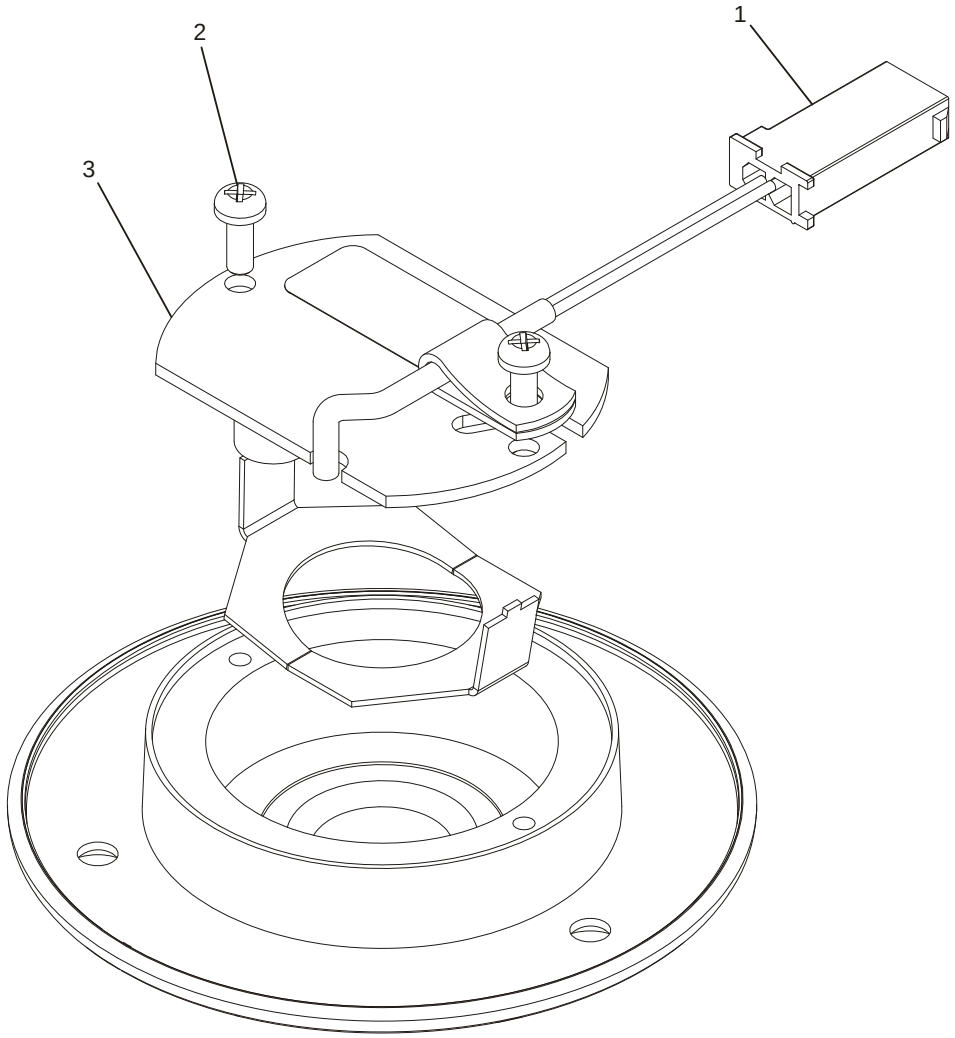

Figure 7-7: Replace Door Closing Indicator

7.3.8 Replace Roof Headlight

1. Remove power to the fixture.
2. Remove three 10-32 catch screws (1, Figure 7-8) from the bezel (2).
3. Partially remove the lamp (3) from the ring assembly (4) and disconnect the two spade terminals (5) from the back of the lamp (3).
4. Remove the lamp (3).
5. Attach the two spade terminals (5) to the back of the replacement lamp (3).
6. Align the notches (6) on the ring assembly (4) to the protrusions (7) on the lamp (3).
7. Install the bezel (2) using three 10-32 catch screws (1).

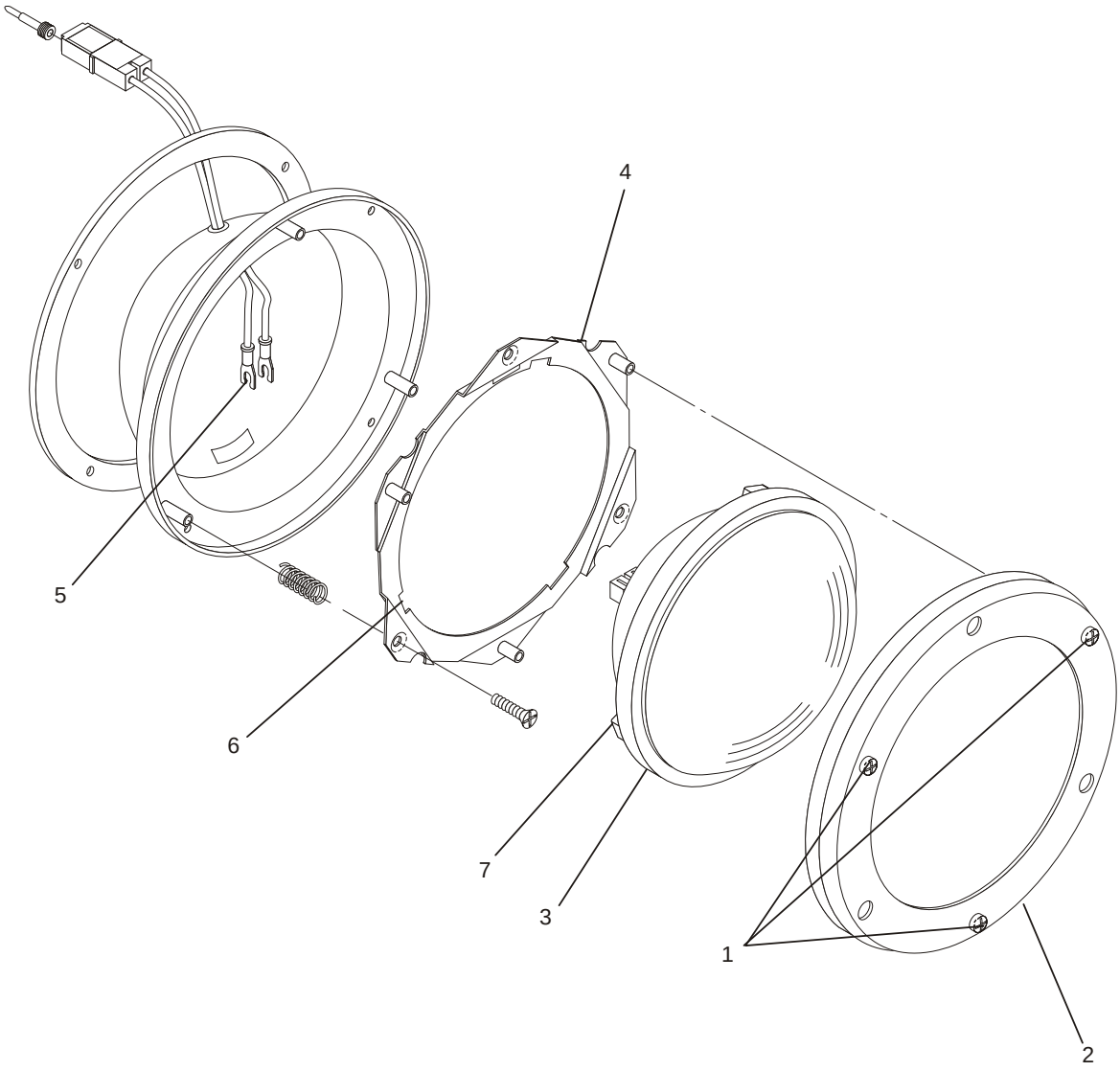

Figure 7-8: Replace Roof Headlight

7.3.9 Replace Silent Alarm Indicator

1. Remove power to the fixture.
2. Remove three screws (1, Figure 7-9) from the bezel (2).
3. Partially remove the Silent Alarm assembly (3) from its mounting surface.
4. Disconnect the three-circuit nylon connector (4) to remove the complete assembly (3).
5. Attach the three-circuit nylon connector (4) to the replacement assembly (3).
6. Mount the assembly and install three screws (1).

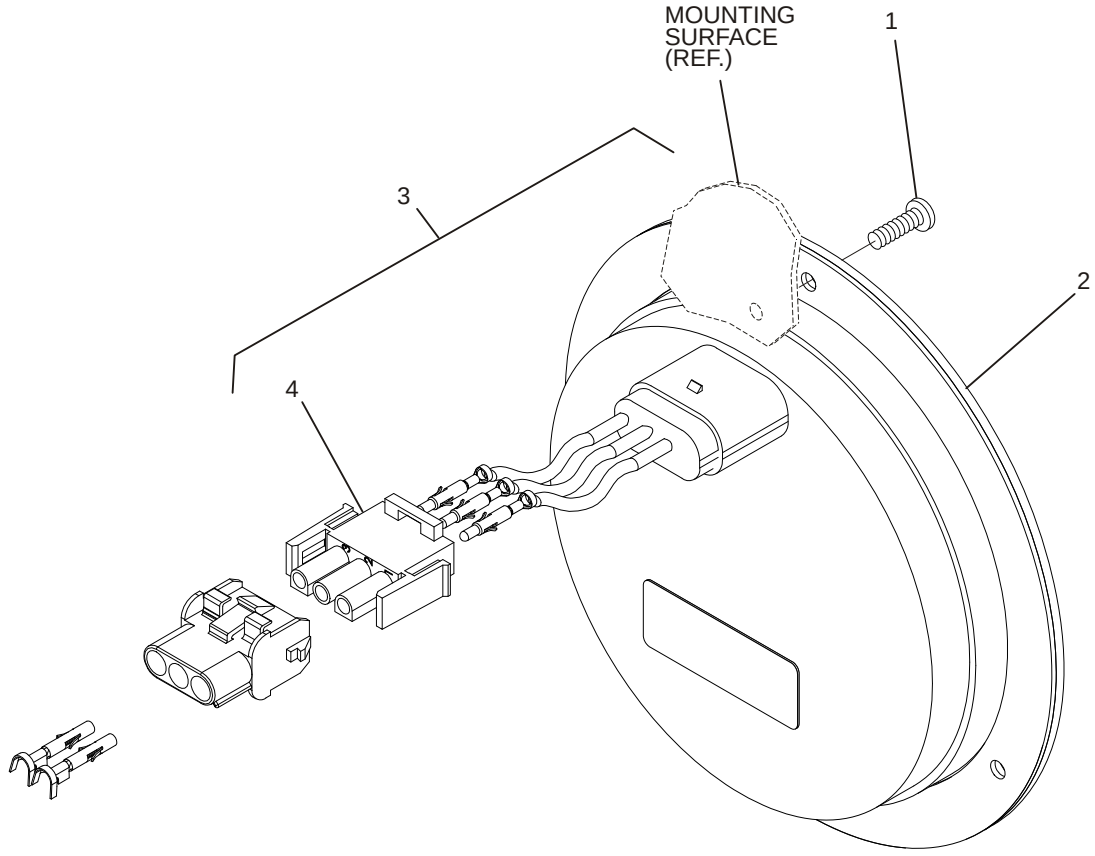

Figure 7-9: Replace Silent Alarm Indicator

7.3.10 Replace Tail Light Lamps

1. Remove power to the fixture.
2. Remove two 10-24 catch screws (1, Figure 7-10), two round washers (2), and two flat stamped washers (3) from the bezel (4).
3. Partially remove the lamp assembly (5) and disconnect the two-conductor nylon connector (6), and the three conductor nylon connector (7).
4. Replace the defective LED lamp assembly (8, amber; 9, red).
5. Connect the replacement lamp assembly to the two-conductor nylon connector (6), and the three conductor nylon connector (7).
6. Install the bezel using two 10-24 catch screws (1), two round washers (2), and two flat stamped washers (3).

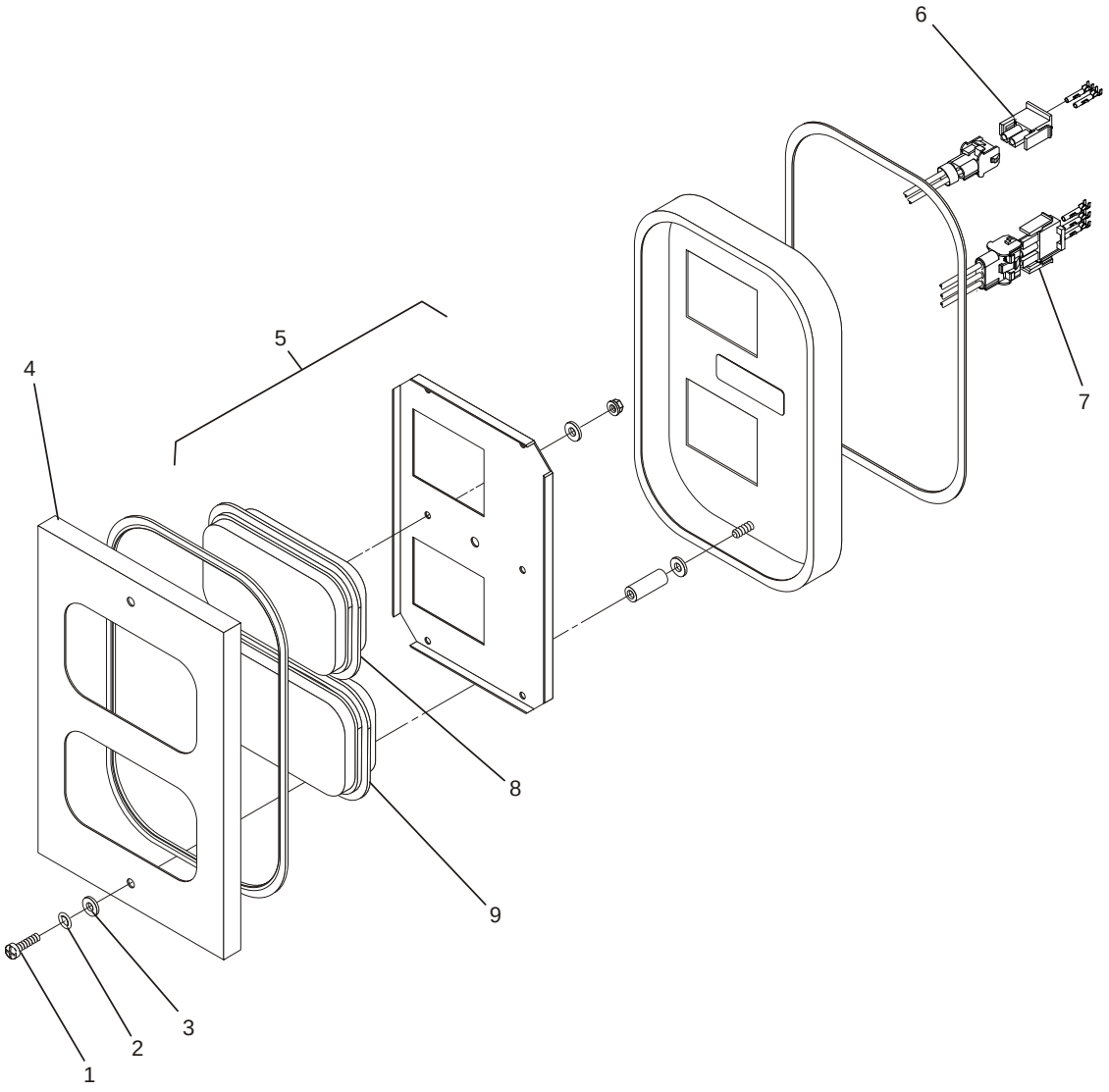

Figure 7-10: Replace Tail Light Lamps

7.3.11 Replace Headlight Lamp

1. Remove power to the fixture.
2. Remove two catch screws (1, Figure 7-11) and two round washers (2) from the bezel (3).
3. Partially remove the lamp (4) from the mounting plate (5).
4. Disconnect the 3-conductor socket (6) from the lamp (4).
5. Connect replacement lamp (4) to the 3-conductor socket (6).
6. Install the lamp (4) into the mounting plate (5).
7. Install bezel (3) using two catch screws (1) and two round washers (2).

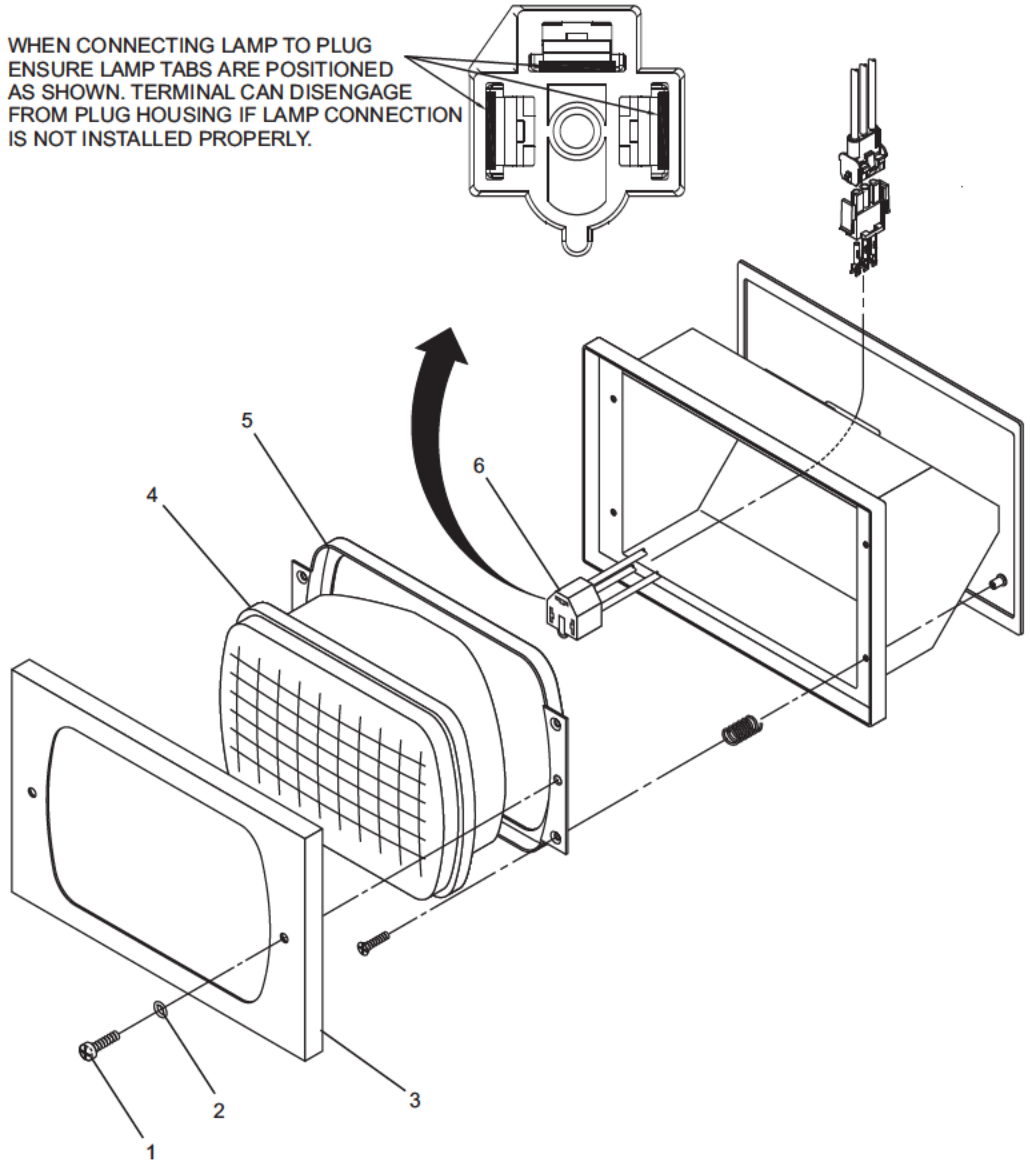

Figure 7-11: Replace Headlight Lamp

7.3.12 Replace Door Open Indicator Lamp

1. Remove power to the fixture.
2. Remove two cross recessed screws (1, Figure 7-12) from the housing (2).
3. Push down on the lamp unit (3) gently and rotate the lamp unit one-quarter turn to the left.
4. Remove the defective lamp unit from the socket assembly (4).
5. Install a replacement lamp unit (3) by inserting it into the socket assembly (4) and pushing down on it gently while rotating one-quarter turn to the right.
6. Replace the housing (2) using two cross recessed screws (1).

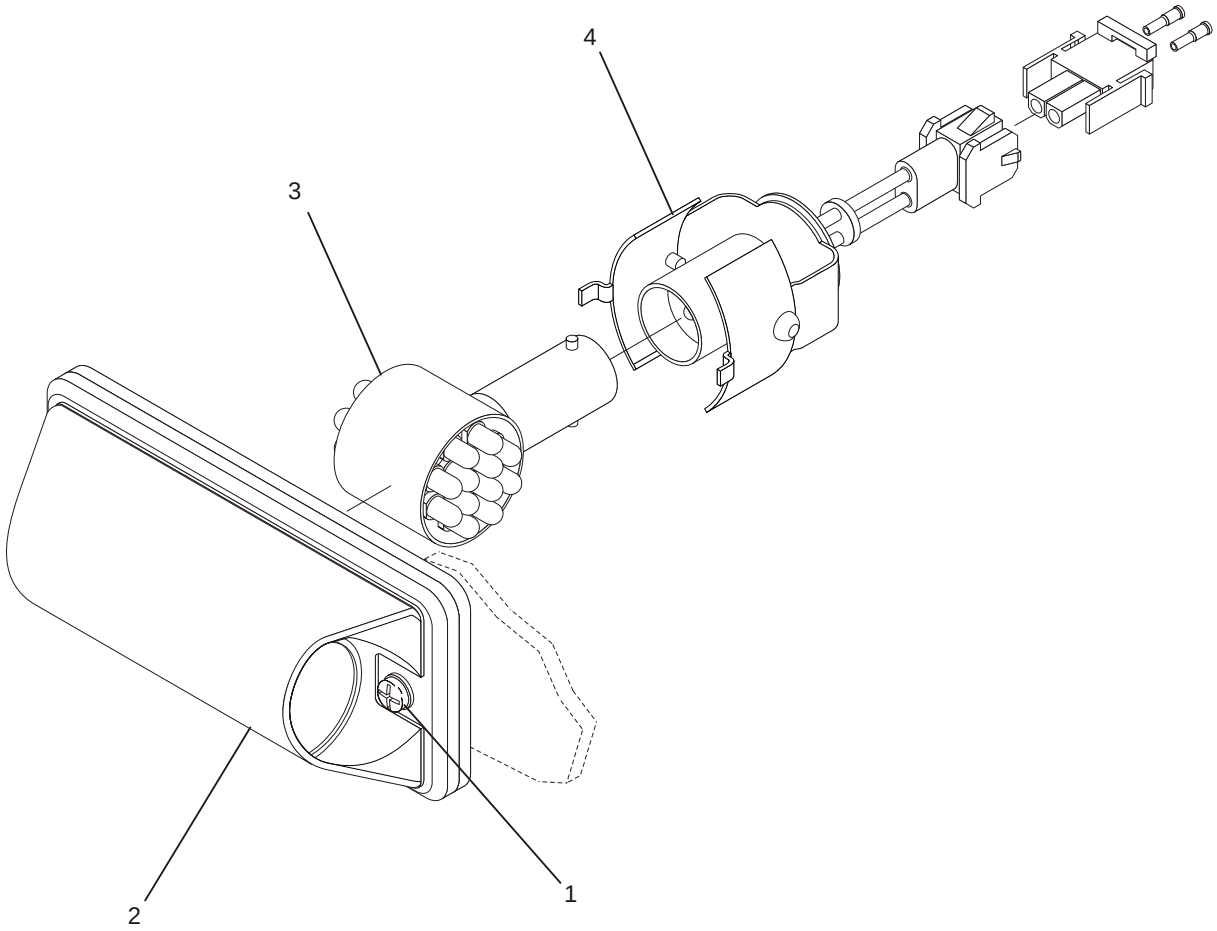

Figure 7-12: Replace Door Open Indicator

7.3.13 Replace Turn Signal Indicator Lamp

1. Remove power to the fixture.
2. Remove two metric catch screws (1, Figure 7-13) and two nylon washers (2) from the bezel (3).
3. Partially remove the complete turn signal assembly (4) from its mounting surface.
4. Disconnect the 2-conductor nylon connector (5).
5. Remove four 4-40 x 5/16 sems screws (6) from the back of the PC board assembly (7).
6. Install the replacement PC board assembly (7) using four 4-40 x 5/16 sems screws (6).
7. Connect the 2-conductor nylon connector (5).
8. Install the complete turn signal assembly (4) with bezel (3) to its mounting surface using two metric catch screws (1) and two nylon washers (2).

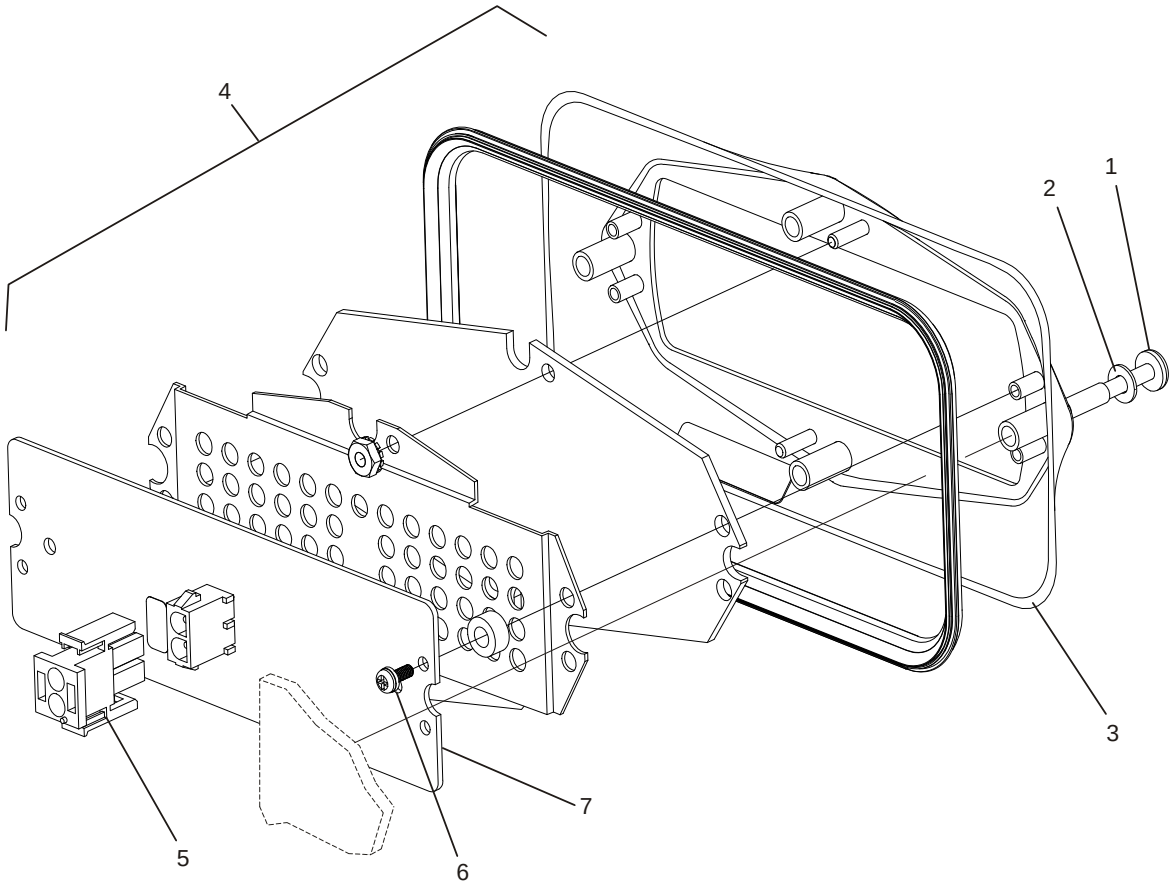

Figure 7-13: Replace Turn Signal Indicator Lamp

7.3.14 Replace Cutout Active Indicator Lamp

1. Remove power to the fixture.
2. Remove three cross recessed screws (1, Figure 7-14) from the housing (2).
3. Push down on the lamp unit (3) gently and rotate the lamp unit one-quarter turn to the left.
4. Remove the defective lamp unit from the socket assembly (4).
5. Install a replacement lamp unit (3) by inserting it into the socket assembly (4) and pushing down on it gently while rotating one-quarter turn to the right.
6. Replace the housing (2) using three cross recessed screws (1).

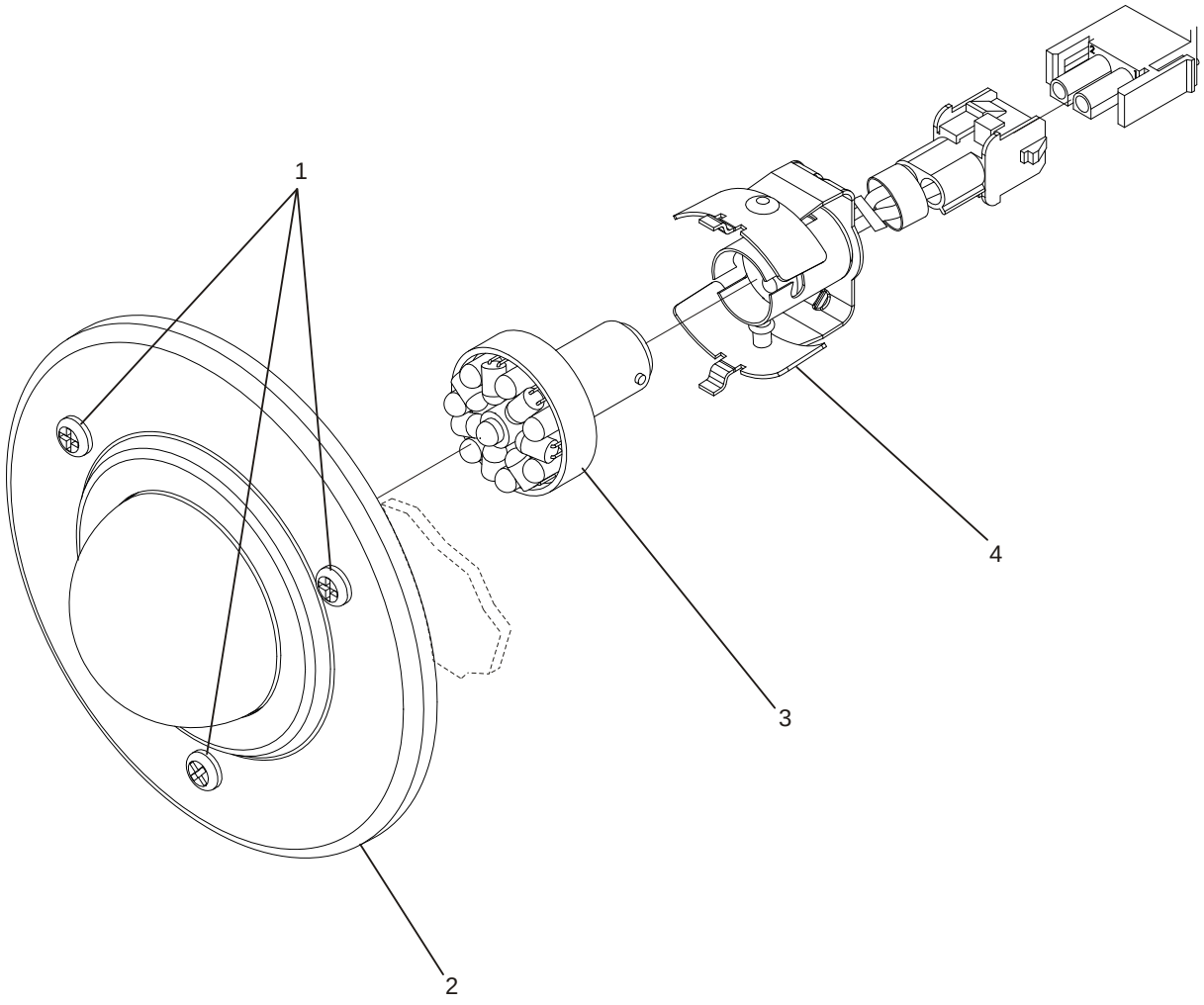

Figure 7-14: Replace Cutout Active Indicator Lamp

CHAPTER 8.0

TROUBLESHOOTING

8.1 Introduction

This chapter contains information to be used as a guide when diagnosing lighting equipment problems.

8.2 Troubleshooting

Table 8-1 lists the most common problems encountered with the lighting equipment used on the Los Angeles LRV.

Table 8-1. Troubleshooting

Step	Symptom	Cause	Remedy
	Single passenger area light fixture does not illuminate.	Lamp is defective.	Replace lamp.
	All non-emergency light fixtures in passenger area do not illuminate.	Circuit breaker is tripped.	Verify that circuit breaker is ON.
		Problem with LVPS.	Troubleshoot LVPS.
	All emergency light fixtures in passenger area do not illuminate.	Circuit breaker is tripped.	Verify that circuit breaker is ON.
		Problem with 24 VDC supply circuit.	Troubleshoot 24 VDC supply circuit.
	One articulation lamp is not illuminated.	Lamp is defective.	Replace lamp.
	Both articulation lamps are not illuminated.	Circuit breaker is tripped.	Verify that circuit breaker is ON.
	Door Closing indicator does not illuminate.	Lamp is defective.	Replace lamp.
		Problem with control circuit.	Troubleshoot control circuit.
	"Door Out Of Service" sign does not illuminate.	Lamp is defective.	Replace lamp.
		Problem with control circuit.	Troubleshoot control circuit.
	Cab ceiling light does not illuminate.	Lamp is defective.	Replace lamp.
		Circuit breaker is tripped.	Verify that circuit breaker is ON.
	Cab console light does not illuminate.	Lamp is defective.	Replace lamp.
		Dimmer control defective.	Replace dimmer control.
		Circuit breaker is tripped.	Verify that circuit breaker is ON.
	Cab console light dimmer control does not operate correctly.	Dimmer control defective.	Replace dimmer control.
	Silent Alarm not flashing or operating correctly.	Supply voltage low or missing.	Verify voltage at indicator is 12 VDC.
		Silent Alarm assembly is defective.	Replace assembly.
		Problem with control circuit.	Troubleshoot control circuit.

Table 8-1. Troubleshooting (cont'd.)

	Roof Headlight does not illuminate.	Lamp is defective.	Replace lamp.
		Circuit breaker is tripped.	Verify that circuit breaker is ON.
		Problem with control circuit.	Troubleshoot control circuit.
	Tail Light not working correctly.	One or both lamps defective.	Check each lamp. Replace lamp if not illuminating.
		Circuit breaker is tripped.	Verify that circuit breaker is ON.
		Problem with control circuit.	Troubleshoot control circuit.
	Headlight does not illuminate.	Lamp is defective.	Replace lamp.
		Circuit breaker is tripped.	Verify that circuit breaker is ON.
		Problem with control circuit.	Ensure lamp tabs are positioned correctly. Troubleshoot control circuit.
	Door Open indicator does not illuminate.	Lamp is defective.	Replace lamp.
		Circuit breaker is tripped.	Verify that circuit breaker is ON.
		Problem with control circuit.	Troubleshoot control circuit.
	Side Turn Signal indicator does not operate correctly.	Lamp is defective.	Replace lamp.
		Circuit breaker is tripped.	Verify that circuit breaker is ON.
		Problem with control circuit.	Troubleshoot control circuit.
	Cutout Active indicator does not illuminate.	Lamp is defective.	Replace lamp.
		Circuit breaker is tripped.	Verify that circuit breaker is ON.
		Problem with control circuit.	Troubleshoot control circuit.

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