

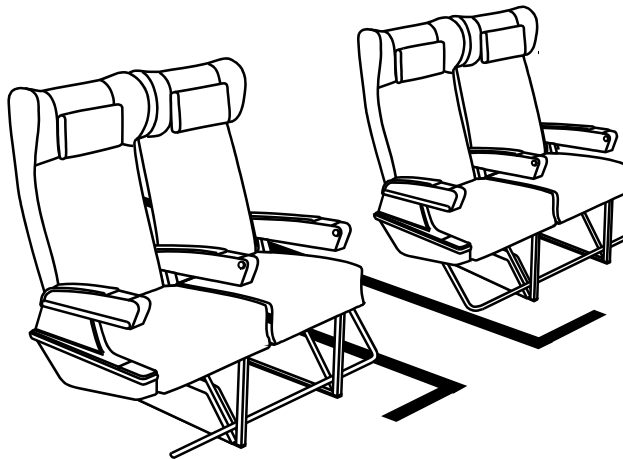



SYSTEM MAINTENANCE and INSTALLATION MANUAL

Floor Mounted Photoluminescent

Emergency Egress Lighting (PLEEL) System

Bombardier DHC-8-100/200/300 Series Aircraft



	TRANSPORT CANADA
Approved:	
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HIGHLIGHTS

This document represents the System Maintenance and Installation Manual for the LSI Photoluminescent Emergency Egress Lighting (PLEEL) System providing floor mounted Floor Proximity Escape Path Marking in DHC-8-100/200/300 Series Aircraft.

This System Maintenance and Installation Manual employs the philosophy that the system is composed of a number of Line Replaceable Units.

The System Maintenance and Installation Manual covers all items of the system.

This document is to be used in conjunction with the following documents:
33-50-15 IPC, PLEEL System, DHC-8-100/200/300 Series Aircraft

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-	Title	Dec 12, 2000
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LEP-2	(blank)	Oct 13, 2000
TOC-1	through TOC-2	Dec 12, 2000
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LOF-2	(blank)	Oct 13, 2000
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1	through 1	Nov 30, 2000
2	through 3	Oct 13, 2000
4	(blank)	Oct 13, 2000
1001	through 1002	Oct 13, 2000
1002	(blank)	Oct 13, 2000
2001	through 2001	Oct 13, 2000
2002	(blank)	Oct 13, 2000
3001	through 3001	Dec 12, 2000
3002	(blank)	Oct 13, 2000
4001	through 4002	Oct 13, 2000
5001	through 5002	Dec 12, 2000
6001	through 6001	Oct 13, 2000
6002	(blank)	Oct 13, 2000
7001	through 7004	Oct 13, 2000
8001	through 8001	Oct 13, 2000
8002	(blank)	Oct 13, 2000
9001	through 9001	Oct 13, 2000
9002	(blank)	Oct 13, 2000
A1	through A1	Oct 13, 2000
A2	(blank)	Oct 13, 2000

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TABLE OF CONTENTS

SUBJECT	PAGE
COPYRIGHT AND PROPRIETARY	CP-1
HIGHLIGHTS	HIGHLIGHTS-1
RECORD OF REVISIONS	ROR-1
RECORD OF TEMPORARY REVISIONS	RTR-1
SERVICE BULLETIN LIST	SBL-1
LIST OF EFFECTIVE PAGES	LEP-1
TABLE OF CONTENTS	TOC-1
LIST OF FIGURES	LOF-1
LIST OF TABLES	LOT-1
DESCRIPTION & OPERATION	1
Introduction	1
PLEEL Design Concept	1
Photoluminescence	1
System Description	1
Aisle Lighting with PL Track	2
Aisle/Galley Lighting with Fiber Glass Encapsulated PL	2
PLEEL System Operation	2
PLEEL Layout	2
General	2
DHC-8-100/200/300	2
DHC-8 PLEEL Layout	3
PLEEL Layout Description	3
Emergency Exits	3
Aisle and Galley Lighting	3
TESTING AND FAULT ISOLATION	1001
General	1001
System Testing and Fault Isolation	1001
AUTOMATIC TEST REQUIREMENTS	2001
General	2001
DISASSEMBLY	3001
General	3001
Disassemble/Remove PL Track Housing	3001
Remove PL Track	3001
Disassemble/Remove PL Galley Light	3001
Remove Fiber Glass PL Galley Light	3001
CLEANING	4001
General	4001
Clean LEXAN® PL Track Components	4001
Clean Fiber Glass Encapsulated Components	4001
Ultrasonic Cleaning	4001
CHECK	5001
General	5001
Installation	5001
Regular Check Interval	5001
Long Term Check Interval	5001
Life Limit	5002
REPAIR	6001
General	6001
ASSEMBLY AND INSTALLATION	7001
General	7001

TABLE OF CONTENTS

SUBJECT	PAGE
Install PL Floor Track Assembly - Preparation	7001
Install PL Track Base	7001
Install End Caps	7001
Install Carpet	7002
Install Track Lens	7002
Install PL Galley Lights	7003
Check List for Proper System Installation	7003
Floor Strips	7003
Storage	7004
PL Track	7004
Fiber glass encapsulated PL galley lights	7004
FITS AND CLEARANCES	8001
General	8001
In-service Wear	8001
SPECIAL TOOLS, FIXTURES AND EQUIPMENT	9001
General	9001
Tool List	9001
Fixtures List	9001
Equipment List	9001
APPENDIX A: AOG PROCEDURES	A-1
Requirement	A-1
General Approach	A-1

LIST OF FIGURES

FIGURE	DESCRIPTION	PAGE
Figure 1:	Location of PLEEL System in Cabin Aisle	2
Figure 2:	DHC-8 Aircraft Floor Plan with PLEEL System Layout	3
Figure 7001:	PL Track Base Installation	7001
Figure 7002:	End Cap Installation	7002
Figure 7003:	Application of Silicone Sealant	7002
Figure 7004:	Installation of Track Lens	7003
Figure 7005:	Installed PL Track System	7003

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LIST OF TABLES

TABLE N°	TITLE	PAGE
Table 101:	General Chemical Resistance of LEXAN® Polycarbonate Resins	4002

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DESCRIPTION & OPERATION

1. Introduction

As part of the Federal Aviation Administration's (FAA) continuing efforts to upgrade aircraft cabin safety and improve occupant survivability in aircraft accidents, the provisions of Part 25 of the Federal Aviation Regulation (FAR) requiring Floor Proximity Emergency Escape Path Marking (FPEEPM) were established. Guidelines were issued in FAA AC25.812-2 to include photoluminescent FPEEPM as an alternative to powered systems.

2. PLEEL Design Concept

Floor path marking based on photoluminescent (PL) phosphors will survive a crash without losing its ability to light up, even with loss of power. As it provides a continuous line of light it provides passengers the best orientation possible to help find the exits.

In order to meet requirements for ease of installation and maintain a level of high reliability for both airframe manufacturers and retrofitting airlines, LSI developed its Photoluminescent Emergency Egress Lighting (PLEEL) System with a number of very important goals in mind including:

- Capability of receiving damage and still remaining operational
- No fragile parts
- Very easy and straight forward installation
- Light weight

In addition, the system has to offer the following advantages to airlines:

- Short installation time
- Modularity, to allow easy re-configuration
- High durability
- Virtually no maintenance requirements from C-check to C-check
- Low cost of ownership
- Minimal delays

3. Photoluminescence

Photoluminescence (PL) is the phenomenon whereby phosphor particles (the photoluminescent material) absorbs mainly invisible light energy (photons) in the presence of a light source, and re-emits the stored energy as visible green light when the light source is removed.

As the process is a direct conversion of energy to light, PL is a cold light source operating at ambient temperature. Light is emitted from the entire area of the PL.

In addition, PL lights are solid state. They withstand shock and vibration, thermal cycling and further thermal processing without breakage, providing extreme ruggedness and reliability.

Other major advantages include weight savings and freedom from catastrophic failure.

4. System Description

The PLEEL system for the DHC-8 consists of aisle lighting with PL track or fiber glass encapsulated PL lights (galley lights). The lighting elements either have no markings or arrow markings depending on where they are located in between emergency exits or the dead end area of the cabin respectively.

- A. **Aisle Lighting with PL Track**
The main part of the floor lighting system is located in the aisle(s) of the aircraft cabin (Figure 1). The PL phosphor material is housed in a durable LEXAN® track enclosure which is cut to size.

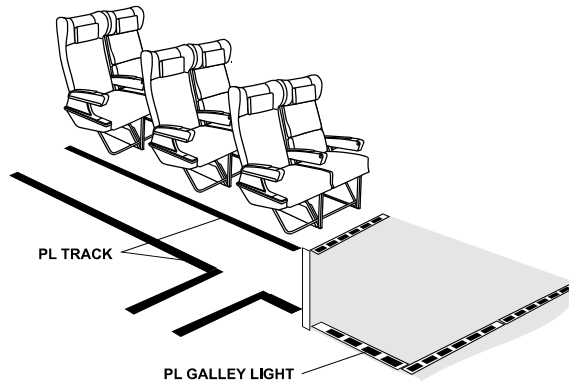


Figure 1: Location of PLEEL System in Cabin Aisle

Aisle lighting with arrows is used to indicate the exit direction in dead end sections, such as the back of the aircraft.

The floor track bottom is in floor panel lengths to allow easy removal of floor panels for access to underfloor equipment. The floor track top is one continuous length piece.

- B. **Aisle/Galley Lighting with Fiber Glass Encapsulated PL**
For those sections of the aisle lighting installed in non-textile floor (NTF) areas such as the galley area, LSI provides a unique PL marker light that is very thin having approximately the same thickness as the NTF (Figure 1). The PL phosphor material is housed in durable fiber glass which can be cut to size at discrete lengths.

5. PLEEL System Operation

The photoluminescent strips are charged before and during flight by exposing them to ambient cabin lighting. In darkness, they will emit their light with no command function required. The low level exit markers are retained from the original aircraft installation and are connected to the emergency lighting system batteries. They operate under the same control laws as the emergency lighting.

6. PLEEL Layout

A. **General**

The PLEEL system for any DHC-8 aircraft type follows the regulations called for in 14 CFR 25.812. Guidance is provided in FAA Advisory Circular 25.812-2, Floor Proximity Emergency Escape Path Marking Systems Incorporating Photoluminescent Elements.

B. **DHC-8-100/200/300**

Individual DHC-8-100/200/300 installations are dependent of the aircraft cabin configuration, seating arrangement and floor covering.

- C. DHC-8 PLEEL Layout
Figure 2 shows a typical DHC-8 layout.

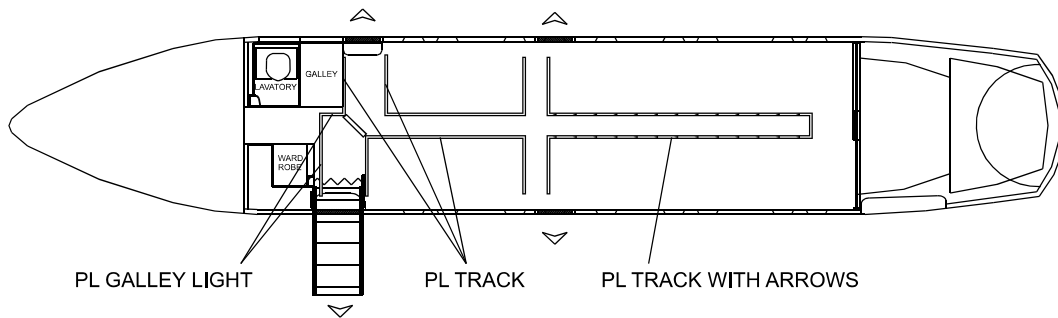


Figure 2: DHC-8 Aircraft Floor Plan with PLEEL System Layout

7. PLEEL Layout Description

A. Emergency Exits

- (1) Regulations: FAR 25.812(e)(2)
- (2) Each emergency exit should be marked with an exit marker located below 4 ft (1.2 m). To meet CAA regulations, the exit marker should be mounted at least 1.5 ft (0.45 m) above the floor. This marker is retained from the OEM installation.

B. Aisle and Galley Lighting

- (1) Regulations: FAR/JAR 25.812(e)(1) and (2), CAA AWN 56 §2.2 and §2.7.2.
- (2) The PL track must be installed on both sides of the aisle(s).
- (3) Placement of the PL track should be such that it is fully visible up to 4 feet above the floor and in such a way that charging by the overhead cabin lighting is not impeded.
- (4) Galley lights are much thinner and have better mechanical resistance to damage than the floor track and are used in heavy traffic or moisture areas (near lavatories, galleys, entry ways or doors) and for non-textile flooring.
- (5) FAA AC 25.812-2 states that the track must "outline the escape path". To accommodate this requirement and to indicate exits along the cabin aisle, such as overwing exits, a PL track section of minimum 9 inches (230 mm) has been added, at a right angle turn towards the cabin wall. LBA/JAA requires PL coverage from the aisle to the exit.
- (6) FAA requires overlay arrows to indicate that there are no exits to be found in the direction opposite to the arrows (typically in dead ends).
- (7) End caps are used to terminate the PL track sections.

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TESTING AND FAULT ISOLATION

1. General
The PLEEL System is made up of line replaceable units.
The PL Strips are all passive devices.
2. System Testing and Fault Isolation
Not applicable.

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AUTOMATIC TEST REQUIREMENTS

1. General
Not applicable.

Automatic test requirements do not apply to the LSI PLEEL system.

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DISASSEMBLY

1. General

Disassembly of the PLEEL system can be accomplished with normal tools.

2. Disassemble/Remove PL Track Housing

A. Remove PL Track.

NOTE: Top PL track is one continuous length piece.

- (1) Take hold of the PL track at one end and pull it away from the floor.
- (2) Remove remaining double-sided carpet tape from the floor panels and PL track.

3. Disassemble/Remove PL Galley Light

CAUTION: DO NOT DAMAGE THE FIBER GLASS LAMINATE OF THE GALLEY LIGHT.

A. Remove Fiber Glass PL Galley Light.

- (1) Put a flat head screwdriver in the gap between the PL galley light and aircraft floor panels.
- (2) Lift the galley light.
- (3) Gently pull the galley light away from the floor panels.

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CLEANING

1. General

Cleaning of the PLEEL system is straightforward and industry accepted practices should be used. This section highlights the special care that needs to be taken with respect to fragile parts and the materials used during cleaning.

CAUTION: DO NOT USE HARSH CLEANING COMPOUND OR SOLVENTS AS THEY MAY FOG THE TRANSPARENT LENS OR LEAD TO CRYSTALLIZATION AND STRESS CRACKING OF THE LEXAN® COMPONENTS (SEE TABLE101).

CAUTION: DO NOT USE HIGHLY ALKALINE SOLUTIONS AS THESE MAY CAUSE THE LEXAN COMPONENTS TO DEGRADE;.

2. Clean LEXAN® PL Track Components

Clean these parts with a mild soap solution, applying with a slightly damp, clean, soft lint-free cloth every A-check or at intervals of 30 days or sooner. Avoid excess moisture. Refer to Table 101 for compatibility.

3. Clean Fiber Glass Encapsulated Components

Clean all fiber glass components with a mild soap solution, applying with a slightly damp, clean, soft lint-free cloth every A-check or at intervals of 30 days or sooner. The fiber glass encapsulated components are galley lights and exit markers.

4. Ultrasonic Cleaning

CAUTION: PROLONGED OR UNCONTROLLED EXPOSURE OF THE ASSEMBLIES TO ULTRASONICS CAN RESULT IN DAMAGE TO, OR DESTRUCTION.

Exposure of the assemblies to ultrasonic cleaning is not recommended.

CHEMICAL CLASS	EFFECT
ACIDS (Mineral)	No effect under most conditions of concentration and temperature. Generally compatible.
ALKALIS	Acceptable at low concentration and temperature. Higher concentrations and temperatures result in etching and attack, evidenced by decomposition.
ALIPHATIC HYDROCARBONS	Generally compatible.
AMINES	Avoid the use of this material. Surface crystallization and chemical attack.
AROMATIC HYDROCARBONS	Avoid the use of this material. Partial solvents and severe stress cracking agents.
DETERGENTS and CLEANERS	Mild soap solutions are compatible. Strong alkaline materials should be avoided.
ESTERS	Avoid the use of this material. Causes severe crystallization. Partial solvents.
GREASES and OILS	Pure petroleum types generally compatible. Many additives used with them are not. Thus, materials containing additives should be tested.
HALOGENATED HYDROCARBONS	Solvents. Avoid the use of this material.
KETONES	Avoid the use of this material. Causes severe crystallization and stress cracking. Partial solvents.
SILICONE OILS and GREASES	Generally compatible up to 85 °C (185 °F). Fluids should be tested, as some contain aromatic hydrocarbons.

Table 101: General Chemical Resistance of LEXAN® Polycarbonate Resins

CHECK

1. General

Checking the PLEEL system consists of both individual parts inspection as well as inspection on the system level.

2. Installation

Upon installation of the PL strips an overall systems check should be performed:

A. PLEEL System Check

The PLEEL system check can be accomplished by:

- (1) Leaving the strips in the dark or sealed from light sources (using an opaque material or tape), for 16 hours minimum.
- (2) At night or in a darkened area: remove the sealing (if necessary) and charge the strips for 15 minutes in accordance with paragraph 2. above.
- (3) Turn of all lighting in the aircraft and visually inspect the strips to ensure that they are all producing adequate light to find the exits.
- (4) If there is noticeable degradation of any strip it must be changed and the replacement retested.

See applicable aircraft manuals and checklist.

3. Regular Check Interval

Unless otherwise specified, the system shall be checked every A-check.

A. Daily Maintenance

The following requirement must become part of the Operators Daily Inspection Procedure: Prior to the first flight of the day the Photoluminescent Emergency Egress Lighting System must be charged using the following procedure:

- (1) For all series aircraft the cabin overhead lighting must be ON for a minimum of 15 minutes with no less than the MMEL permitted lighting. This period of time shall occur prior to departure at a time when there is minimal traffic in the cabin.
- (2) For all series aircraft where the cabin overhead lighting is above the passenger baggage bins, it is additionally required that the doors of the baggage bins be closed during the charging period.
- (3) When an aircraft has cold soaked overnight at temperatures below 4°C (39 F) the cabin lights must be allowed to reach their maximum intensity, and the cabin warmed, prior to charging the Photoluminescent emergency system.

B. PL Aisle Strips and Galley Lights Check

Check the PL track for any evidence of breakage or other damage.
Replace broken or severely delaminated PL floor track.

C. PL Galley Light Check

Check PL fiberglass galley light laminate for delaminating.
Replace severely delaminated galley light.

4. Long Term Check Interval

An overall systems check should be performed at every C-check:

A. PLEEL System Check

The PLEEL system check can be accomplished by:

- (1) Leaving the strips in the dark or sealed from light sources (using an opaque material or tape), for 16 hours minimum.
- (2) At night or in a darkened area: remove the sealing (if necessary) and charge the strips for 15 minutes in accordance with paragraph 2. above.
- (3) Turn of all lighting in the aircraft and visually inspect the strips to ensure that they are all producing adequate light to find the exits.
- (4) If there is noticeable degradation of any strip it must be changed and the

replacement retested.
See applicable aircraft manuals and checklist.

5. Life Limit
PL strips must be replaced within 6 years from the date of manufacture stamped on the strips.

REPAIR

6. General
The PLEEL system components are Line Replaceable Units (LRU), which are not line or shop repairable.

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ASSEMBLY AND INSTALLATION

1. General

The PLEEL system is a custom installed system within all aircraft types. The components can be fitted together to form a complete emergency lighting system.

The following paragraphs describe the basic installation sequence of the PLEEL system.

2. Install PL Floor Track Assembly - Preparation

- A. Carpet
Cut carpet or mat one inch (25 mm) wide just inboard of the seat armrest on both sides of the aisle.
- B. Attach double-sided carpet tape of 1 inch width minimum to the floor panels where the PL track will be fitted.

3. Install PL Track Base

CAUTION: REMOVE ALL BURRS AND SHARP EDGES AFTER CUTTING THE TRACK TO AVOID INJURY.

- A. Cut PL floor track to the desired floor panel length with a miter saw and miter box. Cut straight across or at an 45° angle as needed.

NOTE: Make sure that adjacent tracks are tightly butted together without a gap.

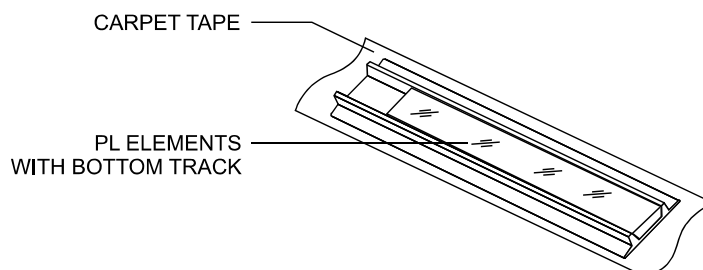


Figure 7001: PL Track Base Installation

- B. Remove burrs and sharp edges present on the PL track ends and miters.
 - C. Attach the PL track base to the double-sided carpet tape.
- ### 4. Install End Caps
- A. Close the end of each track section using end caps by pushing the tab end of the end cap onto the track base and snapping it into place (Figure 7002).

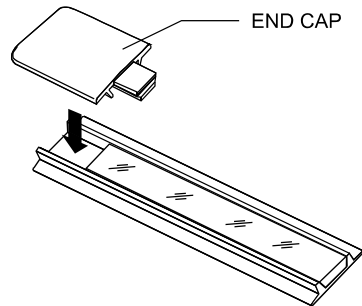


Figure 7002: End Cap Installation

NOTE: For adhesion to the track base, remove the adhesive liner from the foam tape on the tab of the end cap.

NOTE: The end cap should be snapped onto the track base for $.75 \pm .05$ inches (19 mm \pm 1.2 mm).

NOTE: The end cap may also be secured using the optional hole supplied. Use a #6 1/4 inch (6.4 mm) screw.

5. Install Carpet
Procedure is straightforward.

NOTE: Leave a 0.040 inches (1 mm) gap between track base and the carpet edge. This is necessary as the track lens snaps over the outside of the track base.

6. Install Track Lens

CAUTION: Only use non-acetic acid or alcohol based curing RTV (non-corrosive for electrical installations).

- A. Lay track lens along the length of the track base.

NOTE: Do not let track base and track lens butt-joints coincide. Offset track lens butt-joints from track base butt-joints by a minimum of 4 inches (100 mm).

NOTE: To protect against moisture ingress, RTV sealant can be applied at all end cap and track base intersections, joints, miters (Figure 7003).

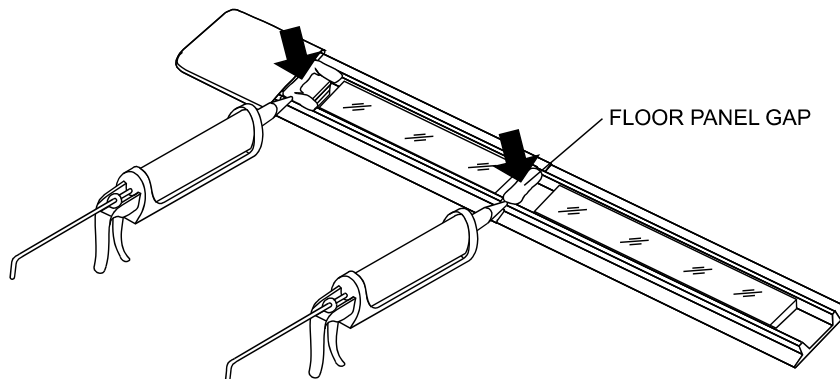


Figure 7003: Application of Silicone Sealant

- B. Starting at one end of the housing (usually at an end cap or at track-to-track butt-joints of

the lens), hook one side or leg of the track lens to the mating side or leg of the track base section (Figure 7004). Position tight to end cap or adjacent track lens.

- C. Apply pressure on the opposite edge of the track lens until that area snaps down and becomes secure to the track base.

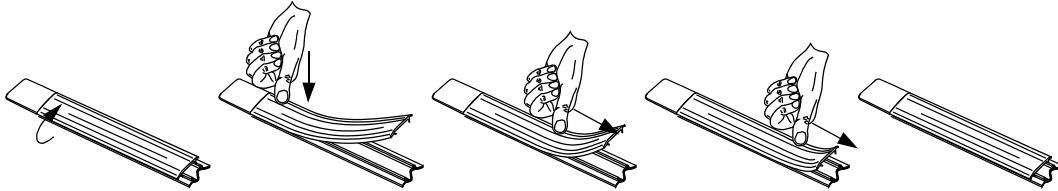


Figure 7004: Installation of Track Lens

- D. Continue applying pressure at short intervals, 2-4 inches (50-100 mm), working along the entire length of the track lens.
- E. At the end of the installation or a butt joint mark and cut the track lens to the appropriate size. Remove any burrs or sharp edges.

NOTE: Make sure that the track lens is cut straight at butt joints.

- F. Snap the final section of the track lens into place.
- G. Immediately remove squeezed out excess RTV sealant.
- H. Check the entire length of the section (both sides) to ensure that the track lens is completely snapped onto the track base.

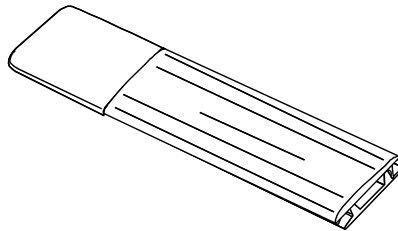


Figure 7005: Installed PL Track System

7. Install PL Galley Lights

- A. Galley light location: install galley light per drawing.

8. Check List for Proper System Installation

When the LSI PLEEL System is properly installed, there is minimal opportunity for damage caused by passenger traffic.

A. Floor Strips

- (1) Joints should be cut straight and smooth, free of rough edges.
- (2) Cuts should be made perpendicular to the mating part face.
- (3) Pieces of floor track shorter than 1 foot (300 mm) should not be used.

9. Storage
- A. PL Track
PL track storage parameters:
(1) dark area
(2) < 20% Relative Humidity
(3) 21.0 °C ± 3.0°C (70 °F ± 5.0 °F)
- B. Fiber glass encapsulated PL galley lights
Fiber glass encapsulated PL galley light storage parameters:
(1) dark area
(2) < 20% Relative Humidity
(3) 21.0 °C ± 3.0°C (70 °F ± 5.0 °F)
- C. PL Parts Life Limit
PL parts are to be replaced 6 years after the date of manufacture indicated on the PL parts.

FITS AND CLEARANCES

1. General

The fits and clearances data of the PL components can be found in the Illustrated Parts Catalogs (IPC) for the corresponding aircraft type.

The IPC references the weight, installation related dimensions and other characteristics of each component.

The weight data may be desired in order to obtain total system weight as installed in an aircraft, whereas the dimensions of each of component are necessary to determine the correct location of the aisle lighting components to meet regulations.

2. In-service Wear

None of the parts experience any wear under normal service conditions.

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SPECIAL TOOLS, FIXTURES AND EQUIPMENT

1. General
Only common hand tools and standard workshop equipment are required for fitting or removing the PLEEL system.
2. Tool List
No special tools are required.
3. Fixtures List
No special fixtures are required.
4. Equipment List
No special equipment is required.

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APPENDIX A: AOG PROCEDURES

1. Requirement

The ATA Airline Suppliers Guide requires that "suppliers make every effort to ship AIRCRAFT ON GROUND (AOG) material within 4 hours of request and to ship other critical material within 24 hours. For these purposes, suppliers will need to operate 24 hours a day, 7 days a week".

2. General Approach

A. LSI has established a 24 hour telephone number to take any AOG call, or other emergency after office hours.

LSI AOG PHONE NUMBER: +1 802 295 0408

The operator will take:

- (1) callers name
- (2) airline name
- (3) telephone number
- (4) any message that the caller wishes to leave.

The operator will then pass the message to the appropriate individual within LSI. It will be the responsibility of this individual to:

- (5) call the airline back
- (6) get all pertinent information (see list below)
- (7) take the necessary AOG action required to get the necessary parts shipped.

B. LSI requires the following information from the caller for prompt and correct action:

- (1) callers name
- (2) airline name
- (3) telephone number
- (4) date and time of call
- (5) part number(s)
- (6) material quantity
- (7) aircraft type
- (8) purchase order n°
- (9) ship to address
- (10) bill to address
- (11) special instructions.

C. AOG Shipment.

- (1) Federal Express (Fedex) is the best method of shipping from Lebanon, New Hampshire. Fedex:
 - (a) leaves Lebanon with packages received before 6:15 p.m.
 - (b) ships late packages the following evening
 - (c) provides no service out of either Lebanon, NH or Boston, MA on Sundays or holidays.
- (2) Local airlines offer counter to counter service which interconnect to major carriers. This service is available daily from Lebanon, NH at an extra service fee. Last drop off time at FedEx in Lebanon, NH is 6.15 pm.
- (3) Please specify clearly which shipping method is preferred.

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