UL 1574

STANDARD FOR SAFETY

Track Lighting Systems

UL Standard for Safety for Track Lighting Systems, UL 1574

Third Edition, Dated September 7, 2004

Summary of Topics

This revision of ANSI/UL 1574 dated February 6, 2025 includes the following changes in requirements:

– Installation Instructions published on publicly available website; 84.1.2.

– Inherently protected recessed luminaire assemblies; 3.30A, 36.6, 36.7, Table 54.1, Section 54A, and 83.12

– Flammability of decorative parts and parts in class 2 circuits; Table 40.1

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

The new requirements are substantially in accordance with Proposal(s) on this subject dated February 23, 2024 and August 16, 2024.

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UL 1574

Standard for Track Lighting Systems

Prior to the first edition, the requirements for the products covered by this standard were included in the Standard for Electric Lighting Fixtures, UL 57.

First Edition – January, 1987
Second Edition – May, 1995

Third Edition

September 7, 2004

This ANSI/UL Standard for Safety consists of the Third edition including revisions through February 6, 2025.

The most recent designation of ANSI/UL 1574 as an American National Standard (ANSI) occurred on February 6, 2025. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

Comments or proposals for revisions on any part of the Standard may be submitted to ULSE at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover track lighting systems intended for permanent connection to sources of supply in commercial or residential ordinary locations in accordance with the National Electrical Code, NFPA 70. The track lighting systems covered by this standard are:

a) connected to a branch circuit not rated more than 300 volts and not more than 50 amperes; or

b) connected to a remotely located power source rated not more than 30 Vac or 60 Vdc and not more than 25 amperes.

1.2 *Deleted*

1.3 These requirements cover:

a) Track networks consisting of track and connectors;

b) Mono-, duo-, and multi-point canopies;

c) Incandescent, fluorescent, and high intensity discharge (HID), and LED luminaire assemblies intended to be electrically connected to and physically supported by the track in track networks and canopies;

d) Mounting means for the track; and

e) Accessories.

1.4 These requirements do not cover:

a) Busways intended for lighting, receptacles, or other general-purpose adaptors covered by the Standard for Busways, UL 857, and intended for use in accordance with Article 364 of the National Electrical Code, NFPA 70; or

b) Track lighting systems for marine use aboard a ship or boat.

1.5 Track lighting systems are not intended for use:

a) In wet or damp locations;

b) In installations where the track is concealed;

c) In hazardous locations;

d) Where subject to physical damage;

e) Where the track is extended through walls or partitions of building structures;

f) Where subject to corrosive vapors; or

g) In storage battery rooms.

1.6 A track lighting luminaire assembly that uses a tungsten-halogen lamp, fluorescent lamp, high-intensity-discharge, or LED lamp shall also comply with:

a) The applicable requirements from the Standard for Luminaires, UL 1598, if rated more than 30 Vac or 60 Vdc; or

b) The applicable requirements from the Standard for Low Voltage Lighting Systems, UL 2108, if rated 30 Vac or 60 Vdc or less.

1.7 Light emitting diode (LED) components and subassemblies integral to lighting track or a luminaire assembly covered by this standard shall comply with the applicable requirements of the Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products, UL 8750.

2 Units of Measurement

2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

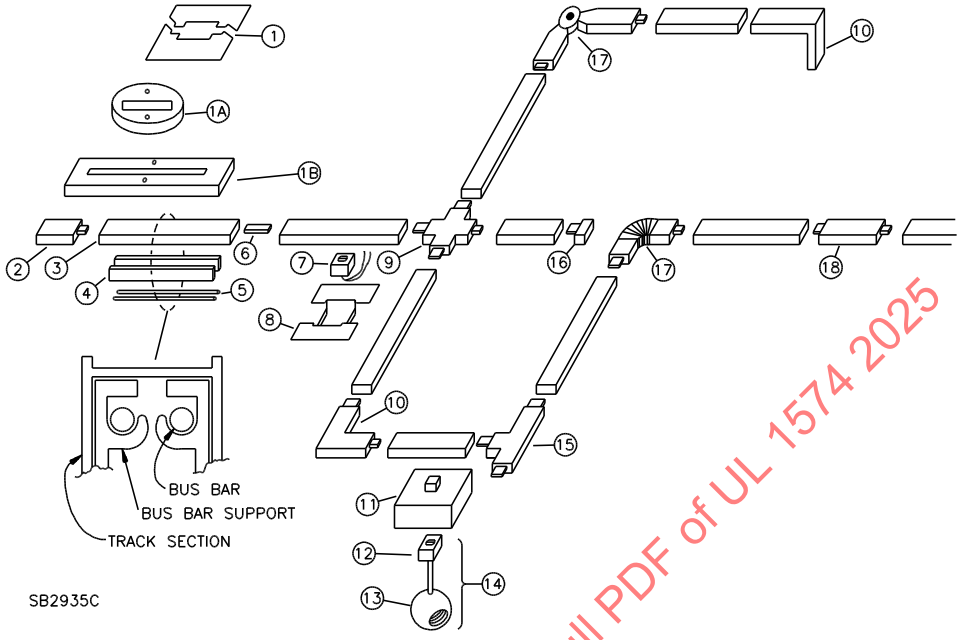
2.2 Unless indicated otherwise, all ac voltage and current values mentioned in this standard are root mean square (rms).

3 Glossary

3.1 For the purpose of this standard, the following definitions apply. Some terms unique to track systems are illustrated in Figure 3.1.

Figure 3.1

Electrical fittings in a typical track system



1 – Canopy (see 3.6)

1A – Mono- or duo-point canopy (see 3.7)

1B – Multi-point canopy (see 3.8)

2 – End feed connector (see 3.18)

3 – Track (see 3.46)

4 – Bus bar support– mounted inside track section (see 3.5)

5 – Bus bars – mounted inside bus bar support (see 3.4)

6 – Straight intercept connector (see 3.23)

7 – Floating feed connector (see 3.21)

8 – Canopy for floating feed connector (see 3.6)

9 – X-shaped intercept connector (see 3.23)

10 – L-shaped intercept connector (see 3.23)

11 – Power pack (see 3.37)

12 – Adaptor (see 3.3 and 3.30)

13 – Luminaire head (see 3.31)

14 – Luminaire assembly (see 3.30)

15 – T-shaped intercept connector (see 3.23)

16 – End cap (see 3.17)

17 – Adjustable intercept connector (see 3.23)

18 – Center feed connector (see 3.9)

3.2 ACCESSORY – An attachment (such as a shutter, barn door assembly, or iris) provided by the manufacturer for connection to a luminaire assembly.

3.3 ADAPTOR – A component of a luminaire assembly intended to mate with a track and provide mechanical securement and electrical connection.

3.4 BUS BAR – A conductor electrically connected to the source of supply and physically located inside a track (conductors in connectors are considered internal wiring). The bus bar provides power for luminaire assemblies along the length of the track.

3.5 BUS BAR SUPPORT – An insert, usually made of a polymeric material, that runs the length of a section of track and serves to support the bus bars and to isolate them while providing an opening that makes electrical contact between the bus bars and an adaptor possible.

3.6 CANOPY – A cover, either provided integral with or separate from a feed connector, that is intended to cover the outlet box by securing to the outlet box feed connector or directly to the ceiling.

3.7 CANOPY, MONO- OR DUO-POINT – A canopy which mounts directly over an outlet box and is provided with a section of track that can accept one or two luminaire assemblies at a time. A mono- or duo-point canopy is constructed such that additional lengths of track cannot be mechanically or electrically connected to the canopy.

3.8 CANOPY, MULTI-POINT – A canopy which mounts directly over an outlet box and is provided with a section of track that can accept more than one luminaire assembly at a time. A multi-point canopy is constructed such that additional lengths of track cannot be mechanically or electrically connected to the canopy.

3.9 CENTER FEED CONNECTOR – An intercept connector provided with means for connection between two sections of track and to a power source.

3.10 CLASS 2 CIRCUIT – A circuit supplied by an isolating source that complies with the requirements of the Standard for Class 2 Power Units, UL 1310, or the Class 2 requirements of the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3.

3.11 COMPONENT – An electrical device such as a lampholder, current-interrupting device, fuse wire, or transformer.

3.12 CONNECTOR – A generic term used to refer to an electrical fitting that connects:

a) Track sections to each other (intercept connectors); and

b) A track system to a power supply (feed-type intercept connectors).

3.13 CURRENT-INTERRUPTING DEVICE – A component (such as a switch or breaker) intended to stop the flow of current in a track network or luminaire assembly circuit.

3.14 DECORATIVE PART – A part of the luminaire, outside the enclosure, that has no safety function.

3.15 ELECTRIC SHOCK – A risk of electric shock is considered likely to occur at any part if the potential between the part and earth ground or any other accessible part is more than 30 Vac or 60 Vdc and the continuous current flow through a 1500-ohm resistor exceeds 5 milliamperes.

3.16 ELECTRICAL FITTING – A generic term used to refer to each separate electrical portion of a track system. (For example: adaptors, connectors, luminaire assemblies, and track sections are electrical fittings.)

3.17 END CAP – A cover intended to close the open end of a track.

3.18 END FEED CONNECTOR – An electrical fitting intended to connect a source of supply to the end of a track. The connector is provided with a knockout or canopy for permanent connection to a source of supply.

3.19 FEED CONNECTOR – An electrical fitting (such as an end feed connector or a floating feed connector) intended to connect a track network to a power supply.

3.20 FITTING – A hook, stem, or other part of a track system intended primarily to perform a mechanical rather than an electrical function.

3.21 FLOATING FEED CONNECTOR – An electrical fitting intended to connect a track to a source of supply at any point along the length of the track. This is accomplished by attaching the connector to the bus bars in the same manner as an adaptor connects to the bus bars.

3.22 HEAVY-DUTY LIGHTING TRACK – A lighting track identified for use on circuits exceeding 20 amperes, but not greater than 50 amperes. Each lighting fitting attached to a heavy-duty lighting track has individual supplementary overcurrent protection.

3.23 INTERCEPT CONNECTOR – An electrical fitting intended to connect two or more sections of track together. The connector may be L-shaped, T-shaped, X-shaped, straight, or adjustable. An intercept connector that is also intended to connect a track system to the power supply is considered to be a feed connector.

3.24 KNOCKOUT – A precut portion of a feed connector that can be readily removed at the time of installation to provide an open hole for the attachment of a permanent wiring system.

3.25 LAMP – A part, commonly called a "light bulb" or "bulb" intended to be inserted into a lampholder (socket) to produce light.

3.26 LAMP CONTAINMENT BARRIER – A barrier that consists of the top, sides, and bottom that enclose the lamp compartment. The barrier may consist of a metal housing, a polymeric enclosure, a glass diffuser or lens, a metal screen, or the like.

3.27 LAMP-SUPPORTED LAMPHOLDER – A lampholder that, when connected as intended, is supported by the lamp, which is in turn supported by the luminaire assembly. Lamp-supported lampholders are usually constructed to accept lamps with prong connectors.

3.28 LIVE PART – A conductive part without basic insulation, where a risk of electric shock exists. The neutral conductor is considered to be a live part.

3.29 LOW-VOLTAGE CIRCUIT – A circuit that operates less than 30 Vac or 60 Vdc and that is not electrically isolated from the primary of a transformer or power supply.

3.29A LOW-VOLTAGE ISOLATED CIRCUIT – A circuit that operates at less than 30 Vac or 60 Vdc and that is electrically isolated from the primary of a transformer or power supply.

3.30 LUMINAIRE ASSEMBLY – An assembly consisting of a luminaire head and an adaptor. In this standard, designs where the luminaire head and adaptor are manufactured as a one-piece assembly is identified as an integral luminaire assembly.

3.30A LUMINAIRE ASSEMBLY, RECESSED, INHERENTLY PROTECTED – A recessed luminaire assembly that does not require a thermal protective device and that complies with the normal temperature limits under normal and abnormal operating conditions described in this standard.

3.31 LUMINAIRE HEAD – An assembly that includes a lamp enclosure or lamp compartment and any components and parts necessary for connecting the lamp compartment to the adaptor.

3.32 MOUNTING MEANS – Hardware (such as screws or clips) provided for mechanically securing a track to a mounting surface.

3.33 OPEN HOLE – An aperture in an enclosure that is not covered or filled by another part.

3.34 OPENING – An aperture in an enclosure that is covered or filled by a plug or knockout and that has the potential of becoming an open hole.

3.35 PACKAGING OF TRACK – A single section of track individually wrapped or multiple sections of track packaged together.

3.36 PENDANT-TYPE TRACK – A ceiling-mounted track system in which the track sections and connectors are suspended from the ceiling by a metal stem, metal chain, or metal cable.

3.37 POWER PACK – Generally a separate unit connected between the track and the adaptor of the luminaire assembly. It is provided with a switching power supply, linear power supply, or isolating transformer to supply power to a track lighting luminaire.

3.37.1 RACEWAY – A channel which serves to enclose wires or cables. Some examples of raceways are: rigid metal or nonmetallic conduit, electrical metal tubing, conduit fittings, flexible metal or nonmetallic conduit, flexible metal or nonmetallic tubing, metal or nonmetallic surface raceway.

3.38 RECESSED CHANNEL – A metal channel intended to be recessed into a wall or ceiling with a means provided for securing a track lighting system within it. The channel may be integral with the track.

3.39 RECESSED LUMINAIRE ASSEMBLY – A luminaire assembly intended for installation in a recessed channel such that all or part of the luminaire head is recessed into a wall or ceiling. A luminaire assembly, where only the stem and/or adapter is recessed when installed, is not considered a recessed luminaire assembly.

3.40 RECESSED TRACK – A track intended to be installed in a recessed channel such that all or part of the track is behind the mounting surface.

3.41 STRAIN RELIEF DEVICE – A knot, bushing, or the equivalent intended to prevent strain from being transmitted to a wire or cord at a termination point.

3.42 SURFACE-MOUNTED TRACK – A non-recessed track.

3.43 TERMINAL, PRESSURE-WIRE – A terminal where one or more conductors are clamped under a pressure plate or saddle by one or more screws or nuts.

3.44 TERMINAL, PUSH-IN – A terminal where the stripped end of a conductor is pushed into the terminal and the clamping pressure is maintained by a spring mechanism, without the use of screws.

3.45 TERMINAL, WIRE-BINDING SCREW – A terminal in which a single conductor is clamped directly under the head of the screw when it is tightened. The single conductor is either bent around the screw in a 3/4 loop or is otherwise retained by interference fit.

3.46 TRACK – An enclosure that houses the bus bars and that houses or is integral with the bus bar support. Track is usually made of extruded material that usually resembles an "H" in cross section, with two vertical members connected by a horizontal member. The bus bar support and bus bars are factory-mounted in the lower half of the "H" and the connection of luminaire assemblies is accomplished through the open bottom.

3.47 TRACK NETWORK – An electrical distribution system consisting of track and connectors.

3.48 TRACK SYSTEM – A complete assembly that includes a track network, mounting hardware, and one or more luminaire assemblies.

4 Components

4.1 Except as indicated in 4.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

4.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

4.3 A component shall be used in accordance with its rating established for the intended conditions of use.

4.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

5 Undated References

5.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

CONSTRUCTION – TRACK SYSTEMS

6 Assembly

6.1 The electrical portion of each electrical fitting shall be completely assembled and wired prior to being shipped from the factory.

Exception: An "X" or "T" shaped intercept connector complying with 33.2 and 81.1 need not be prewired prior to being shipped from the factory.

6.2 Adaptors shall be of such construction as to preclude the user from making electrical connections.

Exception: A pendant adaptor intended for cord or chain suspended luminaires may have provision for making electrical connections if the adaptor complies with Section 52, Pendant Luminaire Adapter.

7 Packaging

7.1 If a feed connector is intended to be used with a separable canopy, the canopy shall be included in the same package as the feed connector or marked as specified in 82.4 with a marking that is visible during installation or mounting of the track.

8 Enclosures

8.1 When a track system is installed as intended, all splices, wires, components, and leads or terminals for connection of supply wires shall be enclosed in accordance with 8.2 for a track network and 40.1 for a luminaire assembly.

8.2 An enclosure for a track network as specified in 8.1 shall be constructed of:

a) Metal; or

b) A polymeric material that complies with the requirements in 8.5.

8.3 A canopy shall be made of metal at least 0.016 inch (0.4 mm) thick or of a polymeric material that complies with the requirements in 8.5.

8.4 The minimum wall thickness of a pendant mounted metal stem shall be:

a) 0.025 inch (0.64 mm) without threads or with pressed (rolled) threads; and

b) 0.040 inch (1.02 mm) with die-cut threads.

8.5 A polymeric material used as an enclosure for a track network shall comply with:

a) The requirements in Table 8.1;

b) The requirement in 8.6;

c) The Normal Temperature Test, Section 54;

d) The Polymeric Enclosure Impact Test, Section 61; and

e) The Mold Stress Relief Distortion Test, Section 57.

Exception No. 1: A small part as described in 8.7 that is not used for direct support of a live part need not comply with the requirements in (a) – (e).

Exception No. 2: A polymeric material that is not rated for or does not comply with the hot wire ignition or high current arc resistance to ignition requirements in Table 8.1 may be determined to be acceptable if the part fabricated with the polymeric material is tested in accordance with, and found to comply with, the applicable tests for stationary equipment described in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

Exception No. 3: A polymeric material associated with a track intended for connection to a Class 2 circuit need not comply with Table 8.1 but shall have a minimum flammability rating of HB.

Table 8.1
Network polymeric material requirements

Properties					
Applications	Minimum flammability class[a]	Resistance to ignition		Electrical	
		Minimum hot wire (HWI)[b]	Minimum high current (HAI)[b]	Minimum dielectric breakdown strength[b]	Comparative tracking index (CTI)[b]
		Maximum performance level category	Maximum performance level category	Minimum volts	Maximum performance level category
Enclosure[c]	V-0	–	3	–	–
Enclosure – indirect support of live parts[d]	V-0	–	3	–	–
Enclosure – direct support of live parts[e]	V-0	4	3	5000	5
	V-0	4	3	5000	5
Bus bar support	V-1	3	2	5000	5

[a] The flammability classification is to be determined by the tests described in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

[b] Tests are to be conducted in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

[c] An enclosure of an electrical fitting that is not used for direct or indirect support of live parts (such as cover) and where there are no uninsulated live parts enclosed.

[d] An enclosure in direct contact with insulated live parts or where uninsulated live parts are enclosed and spaced greater than 1/32 inch (0.8 mm) from enclosure.

[e] An enclosure in direct contact with or within 1/32 inch (0.8 mm) of uninsulated live parts.

8.6 A polymeric material used in the construction of a part shall have a temperature rating consistent with the temperature measured on the part during the temperature test.

Exception: A polymeric material used for a small part as defined in 8.7 need not have a temperature rating if the small part is not used for the direct or indirect support of a live part or if the small part is not used as electrical insulation.

8.7 A small part is one that:

a) Has a volume not exceeding 0.012 cubic inches (0.2 cm^3);

b) Has a maximum dimension not exceeding 1.2 inches (3.0 cm); and

c) Cannot propagate flame from one area to another or act as a bridge between a possible source of ignition and other ignitable parts because of its location.

8.8 A knockout in an enclosure of metal or polymeric material shall comply with Section 56, Security of Knockout Test.

9 Corrosion Protection

9.1 All ferrous sheet-metal parts shall be plated, galvanized, enameled, painted, varnished, lacquered, or the equivalent.

Exception No. 1: Parts need not be provided with corrosion protection if they are intended only for decoration.

Exception No. 2: A coating need not be applied to:

a) The cut edges of precoated stock;

b) Steel nuts, bolts, and screws; and

c) The inside surface of a pipe stem.

Exception No. 3: A coating need not be applied to stainless steel.

Exception No. 4: Mounting hardware need not be provided with corrosion protection.

10 Joining of Enclosure Parts

10.1 The method of making a joint between metal parts and fastening arms and supports shall provide strength and rigidity and shall prevent turning that could result in movement that may be adverse to the wires after the assembly is completed.

Exception: A swivel lighting luminaire may be turned, but no more than 200 degrees in either direction (for a total of 400 degrees).

10.2 Friction between parts is not acceptable as the sole means to prevent turning. Turning shall be prevented by the use of:

a) A star washer;

b) A locking-type nut;

c) A nut seated against another nut;

d) Some other mechanical method where two parts mate by interference fit; or

e) A suitable factory-applied adhesive.

11 Prevention of Wire Damage

11.1 A wire enclosure shall be free from burrs, fins, and other sharp edges that can contact wires.

11.2 If a conductor passes through an opening or crosses over the edge of sheet metal, it shall be:

a) Secured away from the edges of the metal;

b) Protected by a bushing or a grommet; or

c) Protected by rolling the edge of the metal not less than 120 degrees.

Sleeving is not an acceptable means of preventing cutting and abrasion of wires. A bushing used to prevent cutting and abrasion shall comply with the requirements in 11.3.

Exception: The edges of sheet metal thicker than 0.042 inch (1.07 mm) need only be treated to remove burrs, fins, and sharp edges.

11.3 A bushing used to comply with 11.2 shall be securely held in place. If the bushing is constructed of insulating material, it shall be at least 3/64 inch (1.2 mm) thick. A rubber bushing is not acceptable.

Exception: A bushing less than 3/64 inch (1.2 mm) thick is acceptable if an investigation shows that the bushing provides mechanical properties equivalent to those provided by a bushing 3/64 inch (1.2 mm) thick.

12 Wire and Conductors

12.1 A conductor shall be made of copper or copper alloy.

12.2 A conductor shall have insulation rated for the voltage, temperature, and condition of service to which it will be subjected under conditions of intended use.

Exception: The insulation of a conductor need not be rated for the voltage, temperature, or condition of service if connected to a Class 2 circuit.

12.3 A conductor for a luminaire assembly (including bonding and grounding conductors) shall be no smaller than 18 AWG (0.82 mm^2), except as noted in 12.3A – 12.3C.

12.3A Current-carrying conductors within a Class 2 circuit are permitted to be smaller than 18 AWG (0.82 mm^2).

12.3B Current-carrying conductors smaller than 18 AWG (0.82 mm^2), but not smaller than 24 AWG (0.21 mm^2), are permitted when the conductors are:

a) Completely enclosed;

b) Not subject to movement under normal use; and

c) In the secondary of a transformer or on the load side of a circuit containing solid-state devices.

Note: The term 'solid-state devices' refers to semiconductor devices such as transistors, diodes, and integrated circuits (ICs). A circuit containing solid-state devices is not necessarily isolated.

12.3C With regard to 12.3B, such conductors are permitted within a movable joint when:

a) The conductors comply with the criteria in 12.3B(a) and 12.3B(c); and

b) The joint complies with the Movable Joint Cycling test in 75.3.

12.4 An insulated wire connector shall be rated for the voltage and temperature involved.

Exception: An insulated wire connector need not be rated for the voltage and temperature involved if connected to a Class 2 circuit.

12.5 If stranded internal wiring is connected to a wire-binding screw or stud terminal, the construction shall be such that no loose strands result.

13 Network Conductors

13.1 General

13.1.1 A bus bar shall be a single, solid conductor at each point where a connector or adaptor can mate with it.

13.1.2 A conductor shall be of copper or copper alloy.

13.1.3 A bus bar and all conductors in a connector (including grounding and bonding conductors) shall be sized in accordance with Table 13.1.

Exception No. 1: A bus bar or conductor need not be sized in accordance with Table 13.1 if it complies with the requirements in Section 71, Direct-Current Bus Bar or Conductor Resistance Test.

Exception No. 2: A bus bar or conductor connected within a Class 2 circuit is not required to be sized in accordance with Table 13.1 providing all insulating materials operate within their respective thermal limits.

Table 13.1
Minimum bus bar and conductor cross-sectional area

Tracking rating	For a conductor with a circular cross section			For a conductor with a cross section other than circular	
		Diameter		Area	
Amperes	AWG	Inch	(mm)	Inch^2	(mm^2)
20 or lower	12	0.081	2.05	0.0051	3.29
above 20 through 30	10	0.102	2.59	0.0082	5.29
above 30 through 40	8	0.128	3.25	0.0130	8.39
above 40 through 50	6	0.184	4.67	0.0206	13.29

13.1.4 A bonding conductor shall be enclosed by the track and connectors after installation.

13.2 Pigtail leads

13.2.1 The conductor of a pigtail lead shall be made of copper and of a size (wire gage) sufficient for the rated current of the track system as indicated in Table 13.2.

Exception: A conductor of a pigtail lead connected within a Class 2 circuit is not required to be sized in accordance with Table 13.2 as long as the conductor insulation does not exceed its assigned temperature rating.

Table 13.2
Minimum wire gage for track system current rating

Current rating of track system	Minimum wire gage	
Amperes	AWG	(mm^2)
20 or lower	12	3.3
above 20 through 30	10	5.3
above 30 through 40	8	8.4
above 40 through 50	6	13.3

14 Splices and Connections

14.1 A splice shall be:

a) Made with solder, a wire connector, or an equivalent means;

b) Inaccessible to contact using the probe illustrated in Figure 17.1; and

c) Electrically and mechanically secure.

Exception: A splice is not required to be inaccessible when it is connected to a low-voltage isolated circuit or a Class 2 circuit.

14.2 A soldered splice and a splice made with an uninsulated wire connector shall be covered with insulation rated for the voltage and temperature involved.

Exception: The insulation is not required if the splice connection is within low-voltage isolated circuit or a Class 2 circuit.

15 Current-Interrupting Devices

15.1 A current-interrupting device (such as a switch or fuse) shall be rated for the voltage and current of the circuit in which it is connected.

15.2 A current-interrupting device shall not be connected in the grounded (neutral) conductor unless the device connects and disconnects the grounded conductor and all ungrounded conductors simultaneously.

16 Switches

16.1 A switch shall have a minimum ampere rating equal to the total load current it controls multiplied by the load factor shown in Table 16.1.

Table 16.1
Switch rating load factor

Type of load	Special use switches				General use switches
	L-rated (ac only)	T-rated (ac/dc)	Ampere rated (ac only)	Ampere rated (ac/dc)	Ampere rated (ac only)
Tungsten filament	1	1	3	3	1
Inductive	1	1	2	2	1
Receptacle	1	1	3	3	1
LED	–	–	–	1	1

16.2 An adaptor whose contacts function as a switch shall comply with 16.1.

16.3 An adaptor that:

a) Is constructed and intended to provide the switching function for a luminaire assembly; and

b) Has a lever, knob, handle, or the like as part of the switching function

shall comply with the requirements in the Standard for General-Use Snap Switches, UL 20.

17 Accessibility of Current-Carrying Parts

17.1 A current-carrying part shall be made inaccessible to unintentional contact by persons during intended use, including relamping, by material specified in Section 8, Enclosures, for track systems and Section 40, Enclosures, for luminaire assemblies, as applicable. A component is considered inaccessible to unintentional contact if it complies with 17.2 and 17.3.

Exception No. 1: A current-carrying part need not be inaccessible if the part is connected to a low voltage isolated circuit or a Class 2 circuit.

Exception No. 2: An enclosure provided as an integral part of a lampholder and the exposed current-carrying parts of an Edison-base lampholder that electrically contact a lamp need not be inaccessible.

Exception No. 3: A pair of end contact lampholders for double contact lamps may be accessible during relamping if:

a) The luminaire is marked in accordance with 83.7; or

b) The lampholders are of the circuit-interrupting type which disconnect the ungrounded supply from the accessible live parts of the lampholder when the end of the lamp connected to the grounded supply is removed.

Exception No. 4: Wiring need not be inaccessible if it consists of:

a) Leads within a single 0.020 inch (0.51 mm)-thick glass fiber sleeve;

b) AWM Style 20288;

c) Flexible cord with insulation equal to or greater than Type SPT-2; or

d) The equivalent.

Exception No. 5: Lampholder leads that are 2 inches (50.8 mm) or less in length and insulated in accordance with 12.2 need not be inaccessible.

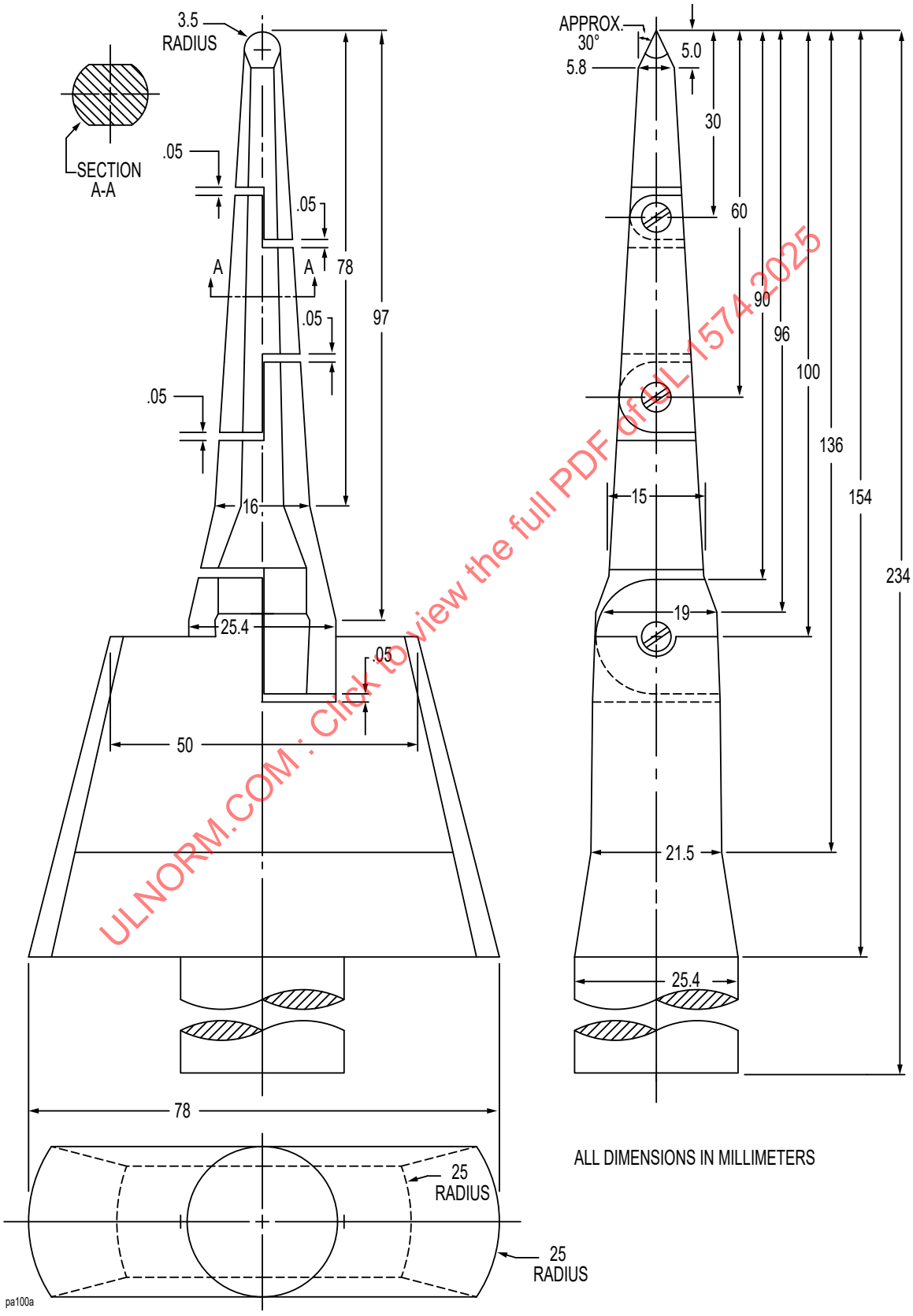
Exception No. 6: An electrical device such as a transformer, ballast, or user-replaceable automatic starter provided with an integral metal enclosure need not be inaccessible.

17.2 An uninsulated live part is considered inaccessible if a probe as illustrated in Figure 17.1 cannot be made to touch any part that involves electric shock to earth ground or to another uninsulated live part when the system is completely installed as intended. No force is to be used when inserting the probe into the opening.

17.3 With respect to the requirement in 17.2, the probe may be articulated into any configuration and may be rotated or angled to any position before, during, or after inserting into the opening. The penetration may be to any depth allowed by the opening size, including minimum depth combined with maximum articulation.

Figure 17.1

Articulate probe with web stop



18 Spacings

18.1 A spacing of at least 1/4 inch (6.4 mm) over surface and through air shall be maintained between field wiring terminals.

18.2 At other than field wiring terminals, a spacing of at least 1/16 inch (1.6 mm) over surface and through air for circuits involving voltages of up to 150 volts, and 1/8 inch (3.2 mm) for circuits up to 300 volts, shall be maintained between:

a) Live parts of opposite polarity; and

b) A live part and a dead metal part that may be grounded when a track system is installed.

Compliance of a track section with the spacing requirements shall not be dependent on the bus bar being recessed from the end of the track.

18.3 A bus bar in a track that is intended to be field cut shall have minimum 3/16 inch (4.76 mm) spacings maintained between bus bars of opposite polarity and between bus bars and grounded metal.

Exception: A track system for connection to a branch circuit or power source not exceeding 120 volts nominal between conductors has the option of being constructed with a minimum 1/16 inch (1.6 mm) spacing when the track system complies with Section 63, Field Track Cutting Test.

19 Polarity

19.1 Polarity shall be maintained electrically through all components of a track system intended for use on polarized supplies by mechanical means between electrical fittings.

19.2 The screw shell of an Edison-base lampholder and the grounded (neutral) conductor of a ballast shall be connected to the grounded (neutral) conductor of the luminaire assembly.

19.3 A track section shall have a designated grounded (neutral) conductor that electrically connects to an electrical fitting (such as a luminaire assembly) when the electrical fitting is connected to the track.

19.4 The mechanical means required in 19.1 for maintaining polarity of the components in a track system (for example, a keying ridge or protrusion) shall meet the requirements of the Mechanical Means of Polarity Test, Section 69.

19.5 A grounded (neutral) conductor shall have insulation that is white or gray in color where visible to the installer or, if a braid is employed, the braid shall be white or gray in color.

19.6 A field wiring terminal to which the designated grounded conductor is electrically connected shall be of metal white in color or shall be identified by means of a metal-plated coating white in color.

Exception: A terminal need not be white in color if all the supply connection terminals are marked as described in 82.3.

20 Interchangeable Fittings

20.1 An electrical fitting shall not be interchangeable with a corresponding electrical fitting with a different voltage rating.

Exception No. 1: An electrical fitting may be mechanically interchangeable with a corresponding electrical fitting if, when it is mechanically secured to the track, the electrical fitting does not electrically connect to the ungrounded conductor of a supply source.

Exception No. 2: A luminaire adaptor rated 120 volts may be insertable into a track rated 30 volts or less.

21 Bonding

21.1 Each conductive part that:

a) Is accessible to persons, as determined by application of the accessibility probe illustrated in Figure 17.1;

b) Is not intended to be electrically live; and

c) Could inadvertently become energized

shall be conductively bonded to a common point that incorporates provision for grounding the track system.

21.2 For any part that is provided with enamel, paint, or a similar coating:

a) A bonding connection means shall be provided that penetrates the surface coating; or

b) The bonding connection points shall remain free of coating.

21.3 An inductive device (such as a transformer or ballast) shall be bonded to grounded dead metal in the track system whether or not the device is accessible.

21.4 The bonding system shall comply with the Grounding Resistance Test, Section 53.

21.5 The continuity of the bonding system shall not rely on the mechanical properties (mold stress, cold flow, and the like) of a polymeric material.

Exception: A material may be relied on if investigated and found to comply with:

a) Section 8, Enclosures, for track networks or Section 40, Enclosures, for luminaire assemblies and accessories; and

b) Section 57, Mold Stress Relief Distortion Test, for thermoplastics relied on for structural integrity.

21.6 The continuity of the bonding system shall not rely on breakaway ground tabs.

Exception: Breakaway ground tabs may be employed on an "X" or "T" shaped intercept connector marked in accordance with 81.1.

21.7 The continuity of the bonding system shall not be compromised by the loosening of parts that rely upon adjustments made without the use of a tool. When tested in accordance with 53.3.4, the adjustment of the luminaire head shall be performed in the loosest condition possible without jeopardizing the integrity of the assembly.

21.8 Each end of a bonding wire or jumper conductor shall be secured by a mechanical means such as:

a) A screw and nut;

b) A screw of the standard or thread-cutting type that threads into metal with at least two full threads in the metal;

c) A rivet; or

d) Other means determined by an investigation to be equivalent to (a), (b), or (c).

21.9 A grounding wire or jumper conductor shall be terminated by a screw, rivet, or equivalent means that does not secure another component or is not likely to be removed during replacement of any component.

22 Grounding Means

22.1 A grounding means shall consist of a pigtail lead grounding conductor, a pressure wire terminal, a wire binding screw or the equivalent. The grounding means shall be at the same location as the power supply connection means.

22.2 A pressure wire terminal intended for the field connection of an equipment grounding conductor shall comply with the requirements in 24.1 and shall be plainly identified by being marked in accordance with 82.2.

22.3 The insulation on a pigtail lead grounding conductor shall be green with or without one or more yellow stripes. A grounding wire with a braid shall have a braid of continuous green color with or without a yellow tracer.

22.4 An equipment grounding conductor shall not be terminated by a screw, rivet, or equivalent device that is:

a) Located on a cover or other removable part; or

b) Used as the fastening means of the cover.

22.5 With reference to 22.1, a wire binding screw intended for the field connection of an equipment grounding conductor shall have a green head that is hexagonal, slotted, or both.

23 Supply Connection Means

23.1 A track system shall be constructed so that it can be connected to a branch circuit wiring system by at least one of the following means:

a) A canopy and mounting means for mounting over an outlet box;

b) A knockout or hole for connection of conduit; or

c) A tab and opening for connection of surface raceway.

23.2 A flexible cord shall not be used to connect a track lighting system to the branch circuit.

Exception: For a pendant-type track assembly having a canopy and complying with 30.3, the wiring in items (a) through (c) may be used providing the construction complies with items (d) through (h):

a) A flexible cord at least of hard-usage type.

b) A construction consisting of individual 600-V wires covered by minimum 0.020-in (0.51-mm) thick glass fiber sleeving, or

c) AWM style 20369 or equivalent.

d) Strain relief complying with test in 55A.1 shall be provided at connection points at the canopy and the track or track adapter.

e) Conductors shall be sized in accordance with Table 13.2.

f) Installation instructions shall instruct the installer to ensure that after installation the wire or cord:

1) Shall be visible over its entire length,

2) Shall not drape below the horizontal plane of the track,

3) Shall not be secured to the building structure, and

4) Shall be of sufficient length so as not to be providing support for the track.

g) A maximum 6-in (152-mm) long section of raceway may additionally be provided as part of the canopy for attachment to an outlet box above a suspended ceiling. If provided, Installation instructions shall indicate that the outlet box must be directly above the track to permit connection of the raceway to the outlet box.

h) When the cord or wire may be shortened during installation, the installation instructions shall explain the correct procedure including the correct method of providing strain relief.

23.3 A track system shall be intended for connection to a single branch circuit or to more than one branch circuit if the grounded (neutral) conductors of the track system are not connected together. In addition, connectors and adaptors shall be constructed to prevent the combination of two separate branch circuits to complete a circuit. A branch circuit shall be:

a) A single-phase circuit (120 volts), as illustrated in Figure 23.1;

b) A split single-phase circuit (120/240 volts, single-phase, 3-wire with grounded neutral), as illustrated in Figure 23.2; or

c) A polyphase circuit (208Y/120 volts, 3-phase, 4-wire), as illustrated in Figure 23.3.

Table 23.1 describes the voltage characteristics of the different branch circuit wiring systems. Connection of the track to switched inputs that are derived from a single branch circuit may be considered acceptable.

Exception: A track system may be intended for connection to a low-voltage circuit.

Figure 23.1

120-volt system

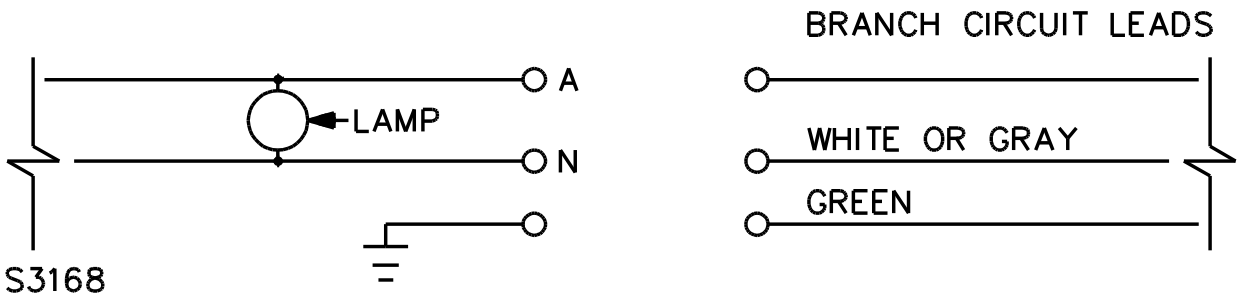


Figure 23.2

120/240-volt system

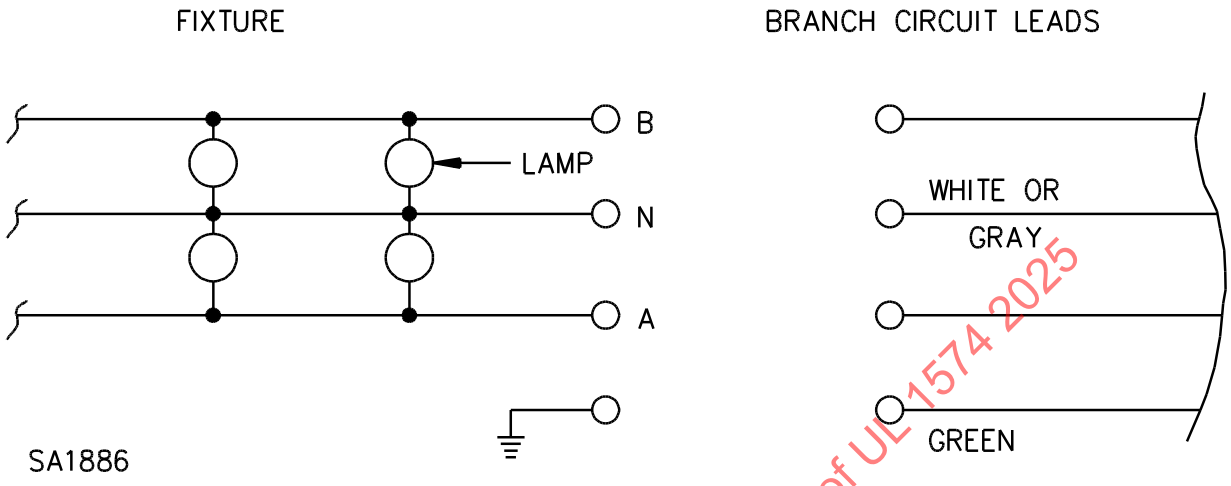


Figure 23.3

120/208-volt system

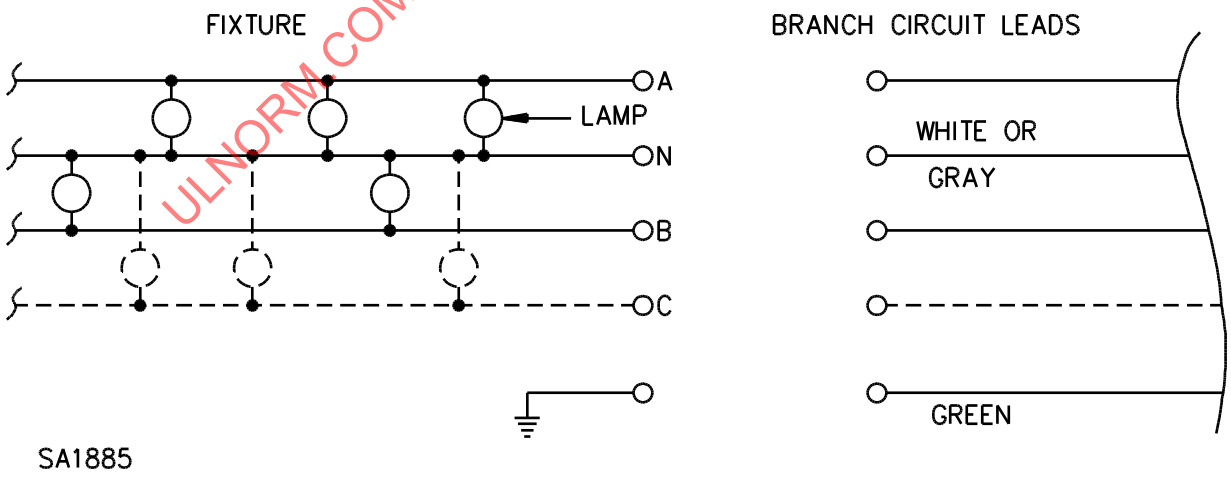


Table 23.1
Multiwire systems

System type	Number of wires	Voltage between conductors						Voltage to ground			
		AN	BN	CN	AB	AC	BC	A	B	C	N
120	2	120	–	–	–	–	–	120	–	–	0
120/240	3	120	120	–	240	–	–	120	120	–	0
120/208	3	120	120	–	208	–	–	120	120	–	0
120/208	4	120	120	120	208	208	208	120	120	120	0

24 Wiring Terminals

24.1 A pressure-type wire terminal intended for field connection shall comply with the requirements for equipment wiring terminals for use with aluminum or copper conductors or both in the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E. A terminal shall be sized to accept the wire required in Table 13.2.

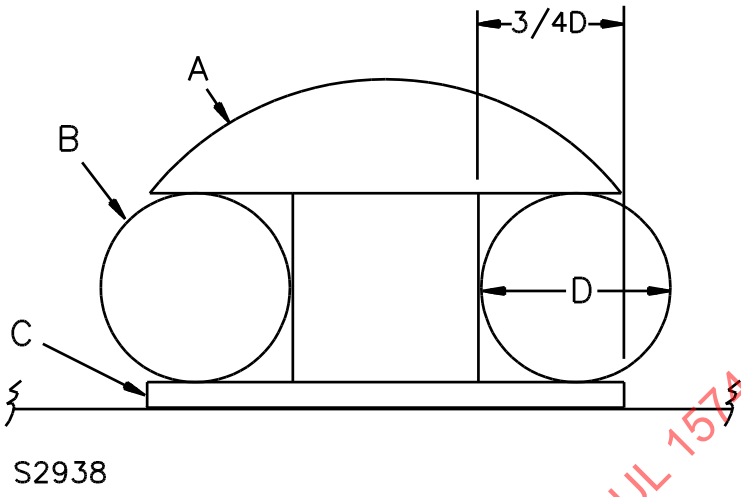
24.2 A terminal employing a screw or similar fastening means that is used for connections inside a feed connector shall have a head and a baseplate that covers at least three-quarters of the conductor. The relationship of the head of the fastening means and the baseplate to the conductor is illustrated in Figure 24.1.

Exception No. 1: A push-in terminal may be used in place of a rivet, screw, or similar fastening means if the terminal complies with the requirements for push-in terminals in the Standard for Attachment Plugs and Receptacles, UL 498.

Exception No. 2: A terminal that has been investigated in accordance with the requirement in 24.1 need not be investigated for compliance with this requirement.

Figure 24.1

Terminal-conductor relationship



A – Screw

B – Conductor

C – Baseplate

D – Diameter of Conductor

24.3 A wire binding screw shall not be used to secure a wire larger in size than 10 AWG (5.3 mm^2).

24.4 A wire binding screw shall be No. 8 (4.2 mm diameter) or larger and shall be provided with a cupped washer or similar means to hold the wire under the head of the screw. A sheet metal screw is not acceptable.

24.5 A terminal plate having a tapped hole for a wire binding screw shall be of metal no less than 0.030 inch (0.76 mm) in thickness and shall have no fewer than two full threads in the metal.

Exception: The terminal plate metal may be less than 0.030 inch (0.76 mm) in thickness if a tapped hole for a screw having 32 or more threads per inch is provided and the metal extruded at the screw hole provides two full threads.

25 Wiring Compartment And Junction Box Volume For Branch Circuit Conductors

25.1 The minimum volume of a field wiring compartment of a track fitting with pigtail leads to connect it to the branch circuit conductors shall not be less than 98 cm^3 (6 in^3) and shall be determined as follows:

a) By calculating the required minimum volume in accordance with 25.2 and 25.3; or

b) By providing a representative sample for engineering evaluation in accordance with 25.4 and 25.5.

25.2 The calculation shall include the following:

a) Branch circuit conductors entering the wiring compartment;

b) Insulated grounding conductors;

c) Insulated bonding conductors;

d) Other accessory conductors.

25.3 Table 25.1 shall be used to determine the conductor volume for the calculation, and the following conditions shall apply:

a) The volume of a wiring compartment with only one conduit or cable entry shall be calculated using two 12 AWG branch circuit conductors and one 12 AWG insulated grounding conductor;

b) Where the track requires branch circuit conductors larger than 12 AWG, the input ampere rating shall determine the conductor size; and

c) Uninsulated grounding or bonding conductors integral to the track fitting shall not be counted.

Table 25.1
Conductor volume for determination of the minimum wiring compartment or junction box volume

Wire size, AWG	Conductor volume	
	cm^3	(in^3)
18	8.2	(0.5)
16	9.8	(0.6)
14	12.3	(0.75)
12	16.4	(1.0)
10	27.9	(1.7)

25.4 A sample of the wiring compartment provided for engineering evaluation shall be wired as intended, and the following shall apply:

a) Conductors entering, or residing in the wiring compartment shall extend at least 150 mm (6 in) inside;

b) Wire connectors of the appropriate type and size shall be used;

c) A wiring compartment with only one conduit or cable entry shall be wired with at least two 12 AWG branch circuit conductors and one 12 AWG insulated grounding conductor;

d) The required number of insulated or uninsulated bonding conductors shall be installed; and

e) All conductors and other accessories intended to be provided with the track shall be installed.

25.5 The covers shall be installed as intended without damage to the conductors, wire connectors, and other accessories.

26 Conduit Connection

26.1 One open hole shall be provided in a feed connector enclosure intended only for the connection of conduit; knockouts shall not be provided in the same enclosure.

Exception No. 1: One or more knockouts may be provided in a feed connector enclosure if no open hole is provided.

Exception No. 2: One or more knockouts may be provided in a feed connector enclosure if a cover or plug is provided for the open hole.

26.2 An opening for the field connection of conduit shall have dimensions as indicated in Table 26.1.

Table 26.1
Dimensions associated with openings for conduit

Nominal trade size of conduit	Opening diameter[a]		Minimum diameter of flat surface	
Inch	Inches	(mm)	Inches	(mm)
1/2	0.88	22.4	1.15	29.2
3/4	1.11	28.2	1.45	36.8
1	1.38	35.1	1.80	45.7

[a] A plus tolerance of 0.031 inch (0.79 mm) and a minus tolerance of 0.015 inch (0.38 mm) applies to the knockout diameter. Knockout diameters will be measured at points other than where a tab may remain after removal of knockout.

26.3 Leads provided in a compartment shall reach either the open hole or the farthest knockout provided in the compartment, whichever is farther from the point of origin of the leads.

26.4 A connector intended to house supply connection splices shall be provided with an opening to permit access to the supply wiring splices for connection and inspection without removing the track or connector from the mounting surface. The opening shall have a minimum unobstructed dimension of 1 inch (25.4 mm) and a minimum area of 1.25 square inches (8.06 cm^2).

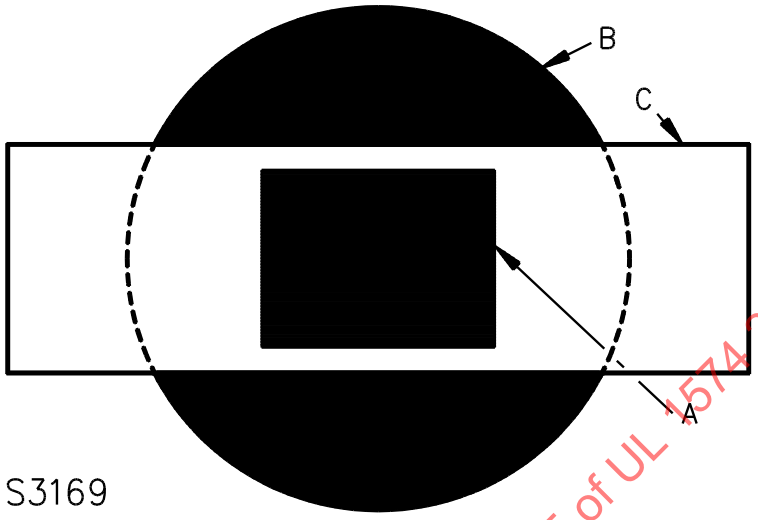
27 Outlet Box Connection

27.1 For inspection of supply connections, the surface area of the track or feed connector or both over the opening of a standard 4 inch (102 mm) outlet box as measured at the ceiling line shall be as shown in Figure 27.1 or Figure 27.2.

Exception: The track may be removed from the mounting surface for inspection of splices at outlet box connections if the track system is provided with mounting hardware that is constructed such that the entire track system, in an already mounted position, can be dropped a minimum of 2 inches (50.8 mm) from the ceiling for inspection of splices.

Figure 27.1

Minimum opening dimensions for inspection of supply connections with access through feed connector



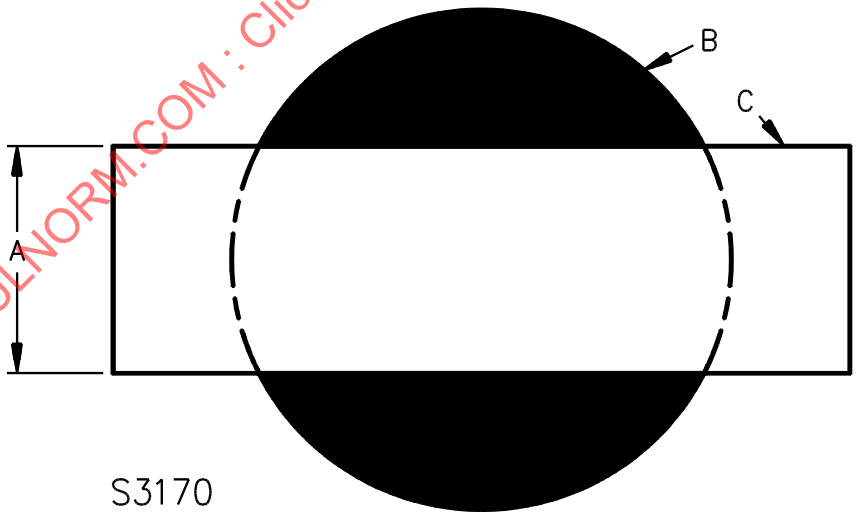
A – Access through feed connector – minimum unobstructed dimensions 1 by 2 inches (25.4 by 50.8 mm).

B – Circle 4 inches (101.6 mm) in diameter to represent standard 4 inch round junction box.

C – Feed connector.

Figure 27.2

Minimum opening dimensions for inspection of supply connections without minimum access opening through feed connector



A – Access around feed connector – maximum width of track at this point 1-3/4 inch (44.5 mm).

B – Circle 4 inches (101.6 mm) in diameter to represent standard 4-inch round junction box.

C – Feed connector or, for floating feed connector, section of track.

27.2 Leads provided for connection in an outlet box shall be at least 6 inches (152.4 mm) in length with the measurement beginning at the point where the leads exit the connector.

CONSTRUCTION – TRACK NETWORKS

TRACK

28 Field Drilling

28.1 A track that is intended to be mounted using field-drilled holes shall be:

a) Provided with a drill guide on the track housing or bus bar insulation to verify;

1) That placement of mounting hardware in the holes does not reduce spacings below those specified in Section 18, Spacings; and

2) Compliance with the spacing requirements for mounting openings specified in 31.2;

b) Subjected to the Field Drilling Test, Section 70; and

c) Provided with installation instructions as described in 84.2.8 and 84.2.9.

29 Mounting Openings

29.1 Only mounting openings may be provided on the back of the track.

29.2 A single section of track that is 4 feet (1.22 m) or less in length shall be provided with two mounting openings. One mounting opening shall be spaced a maximum of 6 inches (152.4 mm) from each end of the track section. Additional openings may be provided. A single section of track that is greater than 4 feet (1.22 m) in length shall have a mounting opening spaced a maximum of 12 inches (300 mm) from each end of the track section and have additional mounting openings spaced a minimum of every 4 feet (1.22 m) along the length of the track section.

Exception No. 1: Openings in the back of the track need not be provided if the track is only intended to be mounted with clips.

Exception No. 2: Openings in the back of the track need not be provided if the track is intended to be field drilled, and it complies with the requirements in Section 28, Field Drilling.

29.3 With respect to open holes, recessed track shall comply with Section 36, Recessed Track and Channels.

30 Mounting Means

30.1 Mounting means shall be provided with each section of track. The mounting means shall consist of:

a) Screws for mounting the track to a building structure;

b) Bolts for mounting the track to other than structural surfaces; or

c) Clips and:

1) Screws for mounting the clips to a building structure; or

2) Bolts for mounting the clips to other than structural surfaces.

Exception: A different mounting means may be provided if it has been subjected to the Track Clip Securement Test, Section 64 and determined to be equivalent to the mounting means described in (a), (b), or (c).

30.2 Mounting clips, if provided, shall comply with the Track Clip Securement Test, Section 64.

30.3 A track system intended for pendant mounting shall be mounted to the building structure by metal stems, metal chains, or metal cables. Instructions as specified in Section 84, Installation Instructions, shall be provided to describe the correct method of installing the track and pendant.

Exception: Plastic stems may be used if the material complies with the requirements in Section 8, Enclosures, for track systems.

30.4 A track system intended for pendant mounting shall comply with the Pendant-Mounted Track Torque Test, Section 65 and the Pendant-Mounted Track/Connector Strength Test, Section 67.

31 Field Cutting

31.1 Tracks intended to be field cut shall be:

a) Provided with installation instructions as described in 84.2.7; and

b) Subjected to the test described in Section 63, Field Track Cutting Test.

31.2 Tracks intended to be field cut using a special tool shall be provided with the tool in each packaging of track sections.

31.3 A track section that is intended to be field cut shall also be evaluated to the field drilling requirements specified in Section 28, Field Drilling.

CONNECTORS AND CANOPIES

32 General

32.1 All splices, wires, components, and leads or terminals for field connection of supply wires shall be enclosed in metal or in a polymeric material that complies with Section 8, Enclosures, for track systems. A connector enclosure shall comply with the test results in the Pendant-Mounted Track/Connector Strength Test, Section 67.

Exception: Wiring is not required to be enclosed in a segmented, movable, or adjustable connector when it:

a) Contains no splices, leads, or terminals for field connections;

b) Complies with Section 17, Accessibility of Current-Carrying Parts; and

c) The non-enclosed wire or cord is provided with strain relief that complies with Strain Relief Test – Lamp-Supported Lampholders and Exposed Wires or Cords, Section 73.

32.2 Stranded wire shall be used in a segmented, movable, or adjustable connector.

32.3 A connector shall be constructed so it fits into a track in a manner that maintains a positive electrical and mechanical connection. A connector shall mechanically insert at least 1/2 inch (12.7 mm) into a track section.

32.4 To determine that a positive electrical connection exists between a connector and track, each connector-track connection point shall comply with the test results in the Normal Temperature Test, Section 54.

33 Intercept Connectors

33.1 An intercept connector shall be intended for only one polarity configuration and shall be prewired for that configuration at the factory.

Exception No. 1: A swivel connector may have mechanical (nonelectrical) parts that can be changed in the field.

Exception No. 2: An intercept connector complying with 33.2 need not comply with this requirement.

33.2 An "X" or "T" shaped intercept connector may have multiple polarity configurations under the following conditions:

a) The connector is not prewired at the factory.

b) The appropriate number of leads of adequate length having the insulation stripped off of each end are provided with each connector.

c) The connector is marked in accordance with 81.1.

d) Installation instructions are provided to indicate all of the appropriate configurations possible and how the connector is to be wired.

33.3 Placement of the inner and outer coils of a flexible intercept connector shall be positioned such that when flexed, the wiring or terminals are not accessible as specified in Section 17, Accessibility of Current Carrying Parts, and it returns to its normal position after flexing.

33.4 The inner and outer steel spring of a flexible intercept connector shall be a minimum of 0.046 inch (1.2 mm) in diameter or 17 AWG.

Exception: The thickness may be reduced if the coil complies with the Ball Impact Test of 61.3.

33.5 The coil ends of a flexible intercept connector shall be mechanically secured and bonded to the track system grounding means.

34 Surface Raceway Connection

34.1 A feed connector intended for connection to surface raceway shall be investigated with respect to the specific raceway to be used in the field. Instructions as specified in 85.2 shall be provided with the feed connector to inform the user of the specific surface raceway(s) to be used.

35 Mono-, Duo-, or Multi-Point Canopies

35.1 A mono- or duo-point canopy shall be constructed with receptacles to accept one or two luminaire assemblies at a time.

35.2 A section of track provided with a mono- or duo-point canopy shall not exceed 24 inches (61 cm) in length and a section of track provided with a multi-point canopy shall not exceed 48 inches (122 cm) in length.

35.3 A mono-, duo-, or multi-point canopy shall be constructed so that additional lengths of track cannot be mechanically connected.

35.4 Conductors for mono-, duo-, or multi-point canopies shall be sufficient for the rated current of the system in accordance with Table 35.1 and as described in 35.5 and 35.6.

Table 35.1
Maximum ampacities of wires with copper conductors

Types of wire[a]	Ampacity			
	18 AWG	16 AWG	14 AWG	12 AWG
S1 equivalent, mm^2 sectional area	0.82	1.3	2.1	3.3
General Building Wires			20	25
Luminaire Wire	6	8	17	23
Appliance Wiring Material	6	8	17	23

[a] General building (also known as conductors for general wiring) and luminaire wire types are described in the National Electrical Code, ANSI/NFPA 70.

35.5 A mono-point canopy shall have bus bars and conductors (including grounding conductors) no smaller than 18 AWG (0.82 mm^2).

35.6 A duo- or multi-point canopy (including grounding conductors) shall have bus bars and conductors no smaller than 12 AWG (3.3 mm^2).

Exception No. 1: Duo- and multi-point canopies with track sections 24 inches (61 cm) or less in length may employ bus bars and conductors not smaller than 18 AWG (0.82 mm^2).

Exception No. 2: A multi-point canopy provided with integral overcurrent protection not exceeding 6 amperes may employ bus bars and conductors not smaller than 18 AWG (0.82 mm^2).

35.7 Track and connectors used with a mono-, duo-, or multi-point canopy shall comply with applicable track system requirements for track, connectors and canopies.

Exception: The following need not comply with Sections 13, 27 and 29:

a) The bus bar and conductors may be sized in accordance with 35.4 – 35.6,

b) Openings in the back of the track as specified in 29.2 need not be provided if the track is an integral part of a mono-, duo-, or multi-point canopy; and

c) An opening for the inspection of supply connection as specified in 27.1 need not be provided.

35.8 A mono-, duo-, or multi-point canopy shall be provided with a back enclosure that may contain an opening with a maximum area of 180 square inches (1160 cm^2). The back enclosure shall comply with the requirements in 8.3 and the dimensions of the opening shall be as specified in (a) or (b).

a) For a circular opening, the diameter shall be no greater than 15 inches (38.1 cm), as shown in Figure 35.1.

b) For a non-circular opening, the maximum linear dimension (including a diagonal dimension) shall be no greater than 26 inches (66.0 cm), as shown in Figure 35.2.

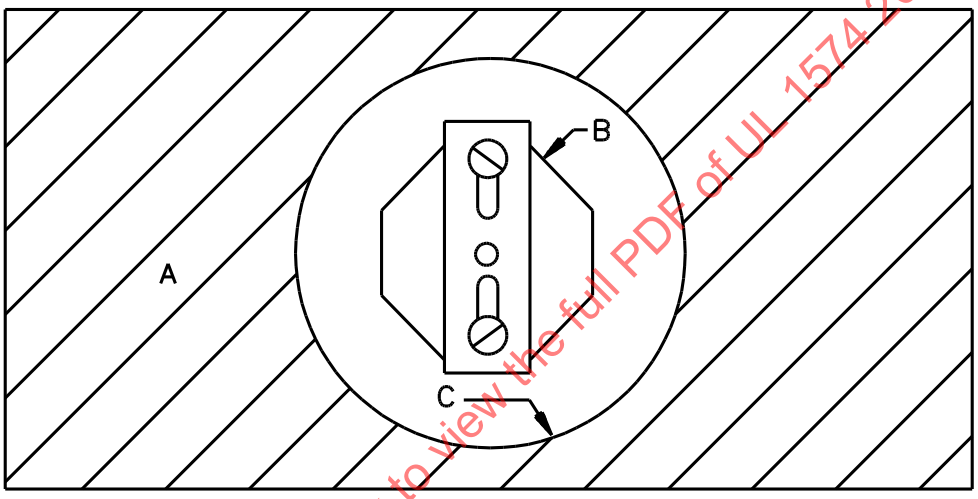
Exception: A mono-, duo-, or multi-point canopy need not be provided with a back enclosure if the back of the canopy is less than 180 square inches in area and has an overall dimension less than as specified in (a) or (b).

35.9 A mono-, duo-, or multi-point canopy shall comply with the applicable tests described in Sections 53 – 61, 64, 66, and 69.

Exception: Where a specific track length is specified in the test method, the actual canopy and/or track section shall be used.

Figure 35.1

Dimensions of circular opening



S3320

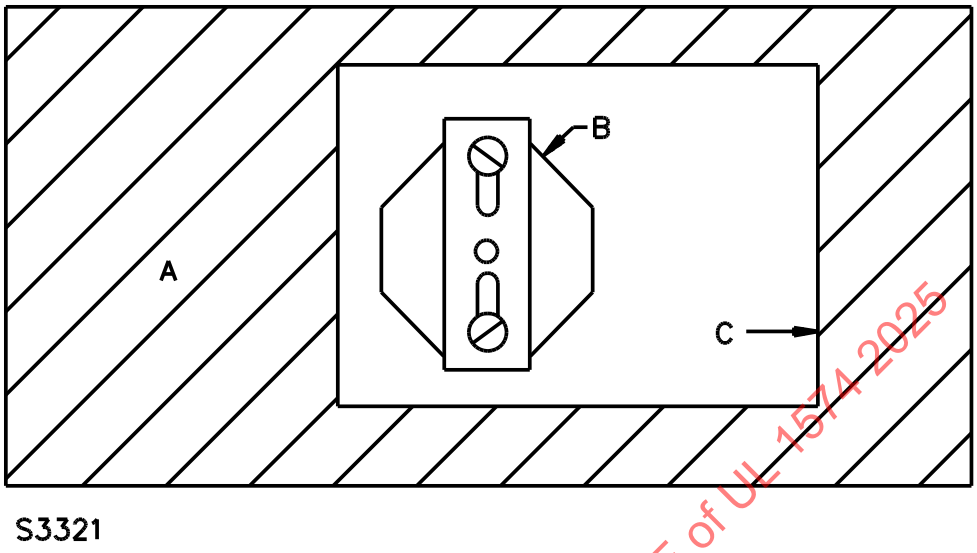
A – Enclosure (canopy) back

B – Outlet box

C – Circular opening with maximum 15 inch (38.1 cm) diameter

Figure 35.2

Dimensions of non-circular opening



A – Enclosure (canopy) back

B – Outlet box

C – Non-circular opening with maximum linear dimension (usually diagonal) of 26 inches (66.0 cm)

36 Recessed Track and Channels

36.1 A recessed channel shall be constructed of metal at least 0.026 inch (0.66 mm) thick for uncoated steel, 0.029 inch (0.74 mm) thick for coated steel, or 0.032 inch (0.81 mm) for other metals.

36.2 A recessed channel shall have no open holes in the portion of the channel that is concealed by the building structure after the recessed channel is installed as intended.

36.3 If a recessed track is an integral part of a building construction (for example, the recessed track is an integral part of a suspended ceiling grid), the track shall be investigated with the specific building structure for which the track is intended and shall be marked in accordance with 80.4.2.

36.4 A recessed track system marked in accordance with 80.4.1 to indicate that it is for use in poured concrete shall have a recessed housing with all knockouts, seams, or the like of the recessed housing tight and closed to prevent the entrance of concrete into the wiring compartments.

36.5 A recessed track system employing non-recessed luminaire assemblies, shall comply with the Normal Temperature Test, Section 54.

36.6 A recessed track system employing recessed luminaire assemblies that are not inherently protected, shall be provided with thermal protection complying with the requirements for thermal protective devices for lighting luminaires as specified in the Standard for Temperature-Indicating and -Regulating Equipment, UL 873. The recessed track system shall comply with the Normal Temperature Test, Section 54, and the Abnormal Recessed Temperature Test, Section 55, and be marked in accordance with 80.5.1. Compliance with the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1, and/or the applicable Part 2 standard from the UL 60730 series fulfills these requirements.

36.7 In lieu of 36.6, inherently protected recessed luminaire assemblies shall comply with the Normal Temperature Test – Inherently Protected Recessed Luminaire Assemblies, Section 54A. The recessed luminaire assemblies may be marked in accordance with 83.12.

FITTINGS

37 General

37.1 A miscellaneous fitting or electrical fitting shall not reduce spacings or damage an installation when used as intended.

37.2 All exposed metal parts of a miscellaneous fitting or electrical fitting that may become energized shall be conductively grounded to the track as described in Section 21, Bonding.

37.3 Filters, baffles, louvers, barn-door shutters, and similar accessories shall be investigated in the conditions likely to cause the most adverse results with a luminaire when such accessories are available.

37.4 An electrical fitting shall not be provided with a general purpose receptacle.

38 Hooks

38.1 A hook or other hanging device shall be intended for use only with a chain-pendant or cable-pendant luminaire.

38.2 A hook or other hanging device, if packaged separately from the chain-pendant or cable-pendant luminaire, shall be provided with installation instructions.

38.3 A hook or other hanging device provided for use in a track is to be investigated by conducting a Hook Test, Section 76.

38.4 The test specified in 38.3 shall be conducted using the maximum weight indicated in the installation instructions provided with the hook or other hanging device.

CONSTRUCTION – LUMINAIRE ASSEMBLIES

39 General

39.1 Luminaire assemblies with lamp holders directly connected to a branch circuit rated 120 volts or higher shall not accept single-ended bi-pin lamp bases that are restricted to low-voltage (30 Vrms or less) use only. Examples of ANSI base designations reserved by UL for low-voltage lamps are: G4, GU4, GX5.3, GU5.3, G6.35, GY6.35, and GU7.

40 Enclosures

40.1 All splices, components, wires, and leads shall be enclosed in material that complies with the requirements in 40.2.

Exception No. 1: The contact blades of an adaptor need not be enclosed.

Exception No. 2: Wiring need not be enclosed if it consists of:

a) Leads within a single 0.020 inch (0.51 mm)-thick glass fiber sleeve;

b) AWM Style 20288;

c) Flexible cord with insulation equal to or greater than Type SPT-2; or

d) The equivalent.

Exception No. 3: Neither a lampholder nor lampholder leads that are 2 inches (50.8 mm) or less in length and insulated in accordance with 12.2 need be enclosed.

Exception No. 4: Leads that are in a Class 2 circuit need not be enclosed.

Exception No. 5: An electrical device such as a transformer, ballast, or user-replaceable automatic starter provided with an integral outer enclosure need not be additionally enclosed.

40.2 An enclosure as specified in 40.1 shall be constructed of:

a) Metal at least 0.016 inch (0.41 mm) thick for steel or 0.020 inch (0.51 mm) thick for other metals; or

b) A polymeric material that complies with the requirements in 40.3.

40.3 A polymeric material used as an enclosure for a luminaire assembly shall comply with:

a) The requirements in Table 40.1;

b) The requirement in 40.4;

c) The test results in the Normal Temperature Test, Section 54;

d) The test results in the Impact Test, Section 61; and

e) The test results in the Mold Stress Relief Distortion Test, Section 57.

Exception No. 1: A small part as described in 8.7 that is not used for the direct support of a live part need not comply with the requirements in (a) – (e).

Exception No. 2: A polymeric material that is not rated for or does not comply with the hot wire ignition or high current arc resistance to ignition requirements in Table 40.1. may be determined to be acceptable if the part fabricated with the polymeric material is tested in accordance with, and found to comply with, the applicable tests for portable equipment described in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

Table 40.1
Luminaire assembly polymeric material requirements

Properties					
		Resistance to Ignition		Electrical	
		Minimum hot wire (HWI)[b]	Minimum high ampere (HAI)[b]	Minimum dielectric breakdown strength[b]	Comparative tracking index (CTI)[b]
Application	Minimum flammability class[a]	Maximum performance level category	Maximum performance level category	Minimum volts	Maximum performance level category
Enclosure[c]	V-0	–	3	–	–
	V-1	–	2	–	–
	V-2	–	2	–	–
Enclosure – indirect support of live parts[d]	V-0	3	3	–	–
	V-1	2	2	–	–
	V-2	2	2	–	–
Enclosure – direct support of live parts[e]	V-0	4	3	5000	5
	V-1	4	2	5000	5
	V-2	4	2	5000	5
Decorative parts	–	–	–	–	–
Parts within Class 2 circuits	–	–	–	–	–

[a] The flammability classifications V-0, V-1, V-2, and HB are to be determined by the tests described in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

[b] Tests are to be conducted in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A. Information concerning the specific requirements for each test can be found in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

[c] An enclosure of an electrical fitting that is not used for direct or indirect support of live parts (such as cover) and where there are no uninsulated live parts enclosed.

[d] An enclosure in direct contact with insulated live parts or where live parts are enclosed and are spaced greater than 1/32 inch (0.8 mm) from enclosure.

[e] An enclosure in direct contact with or within 1/32 inch (0.8 mm) of uninsulated live parts.

40.4 A polymeric material used in the construction of a part shall have a temperature rating consistent with the temperature measured on the part during the temperature test.

40.5 The glass envelope of a screw-base lamp shall not contact any part of the luminaire head in a manner that would increase the possibility of breakage of the envelope when the lamp is installed in the lampholder.

41 Lamp Containment Barriers

41.1 A luminaire assembly intended and marked for use with metal halide or tungsten-halogen lamps shall be provided with a lamp containment barrier. The lamp containment barrier shall not have any open holes greater than 1/8 inch (3.2 mm) diagonally or in diameter. That part of the lamp containment barrier where particles from a ruptured lamp are likely to drop to and rest, shall be of a material as specified in 41.2.

Exception No. 1: A lamp containment barrier need not be provided for metal halide lamps if:

a) The manufacturer of the lamp intended to be used in the luminaire does not identify the lamp as needing to be enclosed for the orientation of the lamp in the luminaire;

b) The major axis of the lamp is oriented ±15 degrees from vertical when the luminaire is installed as intended; and

c) The luminaire is marked as specified in 83.9.

Exception No. 2: A lamp containment barrier need not be provided for tungsten-halogen lamps if:

a) The lamps are single-ended and provided either with an integral outer envelope or employ a non-pressurized lamp;

b) The manufacturer of the lamp intended to be used in the luminaire does not identify the lamp as needing to be enclosed in the luminaire; and

c) The luminaire is marked as specified in 83.9.

Exception No. 3: A lamp containment barrier, at points other than where particles from a ruptured lamp are likely to drop to and rest, may be provided with open holes greater than 1/8 inch diagonally or in diameter if additional barriers are located such that there is no line-of-sight opening between the arc tube of the lamp and any point external to the luminaire.

41.2 With reference to 41.1, the surface of the lamp containment barrier, where particles from a ruptured lamp are likely to drop to and rest, shall be constructed of:

a) Metal at least 0.016 inch (0.41 mm) thick;

b) Metal screen with open holes of maximum 1/8 inch (3.2 mm) diagonally or in diameter;

c) Heat resistant glass such as tempered, annealed, or borosilicate glass 1/8 inch (3.2 mm) thick (3.0 mm for metric trade size glass);

d) Porcelain; or

e) Ceramic.

Exception No. 1: A lamp containment barrier of a polymeric material may be used if it complies with the requirements in Polymeric Lamp Containment Barrier, Section 75.

Exception No. 2: A glass material other than tempered, annealed, or borosilicate glass may be used if it complies with the Glass Thermal Shock/Containment Test, Section 74.

Exception No. 3: A lamp containment barrier intended for a tungsten-halogen lamp shall be at least 3/32 inch (2.4 mm) thick if it is intended for use with lamps rated less than 100 W.

41.3 An enclosure of a luminaire head shall comply with the requirements in Section 40, Enclosures, for luminaire assemblies.

42 Open Holes

42.1 There shall be no open holes in an enclosure containing:

a) An open coil type device;

b) Splices; or

c) A fuse mounted in an open type fuseholder.

Exception No. 1: An enclosure of a fluorescent luminaire assembly may have an open hole no greater than 1 inch (25.4 mm) in diameter for a replaceable automatic starter.

Exception No. 2: An open hole may be provided in an enclosure that contains only a Class 2 circuit, wiring, splices, fuses, and fuse holders.

Exception No. 3: A luminaire that incorporates a power supply may have open holes in the enclosure if the power supply has been investigated to determine compliance with the Abnormal, Burnout, and Short-Circuit Tests specified in the Standard for Power Units Other Than Class 2, UL 1012.

42.2 An open hole that is provided in an enclosure for miscellaneous purposes shall not exceed the dimensions specified in Table 42.1.

Table 42.1
Maximum size of miscellaneous open holes

Opening shape	Dimension		Maximum area	
	Inch	(mm)	Inches^2	(cm^2)
Slot[a]	3/8 (width)	9.6	1-1/2	9.68
Square	1/2 (side)	12.7	–	–
Round	1/2 (diameter)	12.7	–	–
Irregular	–	–	1-1/2	9.68

[a] An open hole between two assembled parts that does not exceed 1/32 inch (0.8 mm) need not comply with the area limitation.

42.3 The total area of one or more open holes shall not be more than 15 percent of the area of the surface in which the holes are located. This total area includes holes in the surface of the wiring compartment or integral outlet box compartment.

43 Splices

43.1 A splice in a luminaire head shall comply with the requirements in Section 14, Splices and Connections, and shall be inaccessible during relamping.

Exception: A splice in a low-voltage isolated circuit or a Class 2 circuit need not be inaccessible.

43.2 A splice shall be located so that it will not be disturbed when a lamp is being replaced.

Exception: Splices connected to a Class 2 circuit need not be so located.

44 Wire and conductors

44.1 A wire, appliance wiring material, or each insulated conductor of a cord that is rated for 90°C (194° F), 105°C (221°F), or 125°C (257°F) is considered as rated for 150°C (302°F) if each wire is individually provided with supplementary insulation that consists of snugly fitting woven-glass sleeving at

least 0.010 inch (0.25 mm) thick or woven-glass tape of sufficient number of layers (but not less than two in any case) to provide a total thickness of not less than 0.010 inch (0.25 mm).

Exception: The supplementary insulation for each insulated conductor for Types SPT-1, SV, SVT, SVE, SVO, SVOO, SVTO, and SVTOO cords shall be not less than 0.015 inch (0.38 mm).

44.2 Wires to a lamp-supported lampholder shall be provided with a strain relief device at the luminaire end. Nonenclosed wire or cord shall be provided with strain relief devices at both ends. The devices shall comply with the test results in the Strain Relief Test – Lamp-Supported Lampholders and Exposed Wires or Cords, Section 73.

Exception: A fluorescent lamp construction is considered to have acceptable strain relief provision if the four lampholder leads are connected inside a ballast or transformer with no intervening splice.

44.3 A nonenclosed wire or cord that limits motion of the luminaire head shall not rely on intervening splices or wire connectors for the strain relief means.

44.4 Stranded wire or cord shall be used for connections to an adjustable, movable, or flexible part of a luminaire. The stranded wire or cord shall be secured so that it will not be cut or abraded under conditions of intended use, including relamping and servicing. A wire or cord with asbestos insulation shall not be provided.

44.5 A wire shall be located so that it will not be damaged when a lamp is being replaced.

45 Cord-Pendant Luminaire Assemblies

45.1 If a luminaire assembly or luminaire assembly component or part is intended to be supported by a flexible cord, the flexible cord shall be one of the following types:

a) Cord Type SJ, SJE, SJO, SJOO, SJT, SJTO, SJTOO, or heavier cord if the luminaire or luminaire part weighs 10 pounds (4.54 kg) or less; or

b) Cord Type SV, SVE, or SVT if:

1) The cord is not likely to be subjected to kinks or sharp bends; and

2) The luminaire or luminaire part weighs 5 pounds (2.8 kg) or less.

45.2 If a length of flexible cord is used to support the luminaire from the adaptor, strain relief means that meet the requirements of the Strain Relief Test – Cord-Pendant Luminaire Head, Section 72 shall be provided at each end of the cord.

46 Adapters

46.1 Adaptor contacts shall maintain positive electrical connections. The electrical connections shall comply with the test results in the Adaptor Overload Test, Section 59.

46.2 The electrical contacts in the adaptor shall not be relied upon to provide positive mechanical securement of the adaptor to the track, as determined by conducting the Adaptor Tests, Section 60.

47 Ballasts and Transformers

47.1 A luminaire shall be provided with a ballast or transformer for the operation of lamps of the size intended for use with the luminaire and shall be wired in accordance with the diagram or instructions on or with the ballast or transformer.

47.2 A fluorescent ballast used in a luminaire assembly shall comply with the requirements in the Standard for Fluorescent-Lamp Ballasts, UL 935.

47.3 A fluorescent luminaire assembly shall use only ballasts of the Class P, thermally protected type (including dimming types), with a rated output of 300 volts or less.

Exception No. 1: A luminaire assembly provided with straight tubular lamps may employ simple reactance ballasts which are not rated Class P.

Exception No. 2: A luminaire assembly may be provided with a ballast that involves a potential of more than 300 volts but no more than 1000 volts if a lampholder of the circuit interrupting type is provided at the low-voltage end of the ballast output. The lampholder at the high voltage end shall be rated 600 volts or more.

Exception No. 3: A luminaire assembly may be provided with a ballast that involves a potential of not more than 600 volts if the lamp is a single-ended compact fluorescent type.

47.4 An HID ballast used in a luminaire assembly shall comply with the requirements in the Standard for High-Intensity-Discharge Lamp Ballasts, UL 1029.

47.5 A transformer used in a luminaire assembly shall comply with the Standard for Low Voltage Transformers – Part 2: General Purpose Transformers, UL 5085-2.

Exception: A Class 2 transformer shall comply with the requirements in the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3.

48 Fusing

48.1 A luminaire assembly intended for connection to a track network rated greater than 20 amperes shall be protected by a circuit breaker or by a fuse. The circuit breaker or fuse shall be rated for branch circuit protection.

49 Lampholders

49.1 A fluorescent lampholder shall have an electrical rating consistent with the output of the ballast used. Acceptable ballast types are specified in 47.3.

49.2 A lampholder intended to be used with a lamp that requires high-voltage starting pulses shall have a pulse rating suitable for the lamp starting voltage.

49.3 An incandescent lampholder of the medium-base screwshell type shall not be used on a branch circuit exceeding 120 volts nominal between conductors.

50 Capacitors

50.1 General

50.1.1 A luminaire having a capacitor as a component separate from the ballast shall incorporate means, such as a bleeder resistor, for the automatic discharge of the capacitor within 1 minute after removal of the lamp from the circuit or after opening of the primary circuit, or both. The voltage (V) at the end of 1 minute across the terminals shall be reduced to a value of 50 volts or less, and the energy stored (J) shall be less than 20 joules as determined by the equation:

$$J = 5 \times 10^{-7} CV^2$$

in which:

C is the capacitor rating in microfarads.

50.1.2 To comply with 50.1.1, the maximum resistance value of a bleeder resistor shall be determined by the equation:

$$R = \frac{K}{C}$$

in which:

R is the resistance value in megohms,

K is the resistor factor determined from Table 50.1, and

C is the capacitor rating in microfarads.

Table 50.1
Bleeder resistor factor (K)

Voltage		Factor (K)
Peak	rms[a]	
0 – 100	0 – 70	85
101 – 110	71 – 78	76
111 – 120	79 – 85	70
121 – 130	86 – 92	63
131 – 140	93 – 99	55
141 – 150	100 – 106	54
151 – 170	114 – 120	50
171 – 200	121 – 141	44
201 – 240	142 – 169	39
241 – 280	170 – 197	35
281 – 325	198 – 230	32
326 – 375	231 – 265	30
376 – 450	266 – 318	27

Table 50.1 Continued on Next Page

Table 50.1 Continued

Voltage		
Peak	rms[a]	Factor (K)
451 – 500	319 – 353	26
501 – 700	354 – 495	23
701 – 1000	496 – 707	19

[a] For a transformer type ballast, the voltage value to be applied from this table is the rms voltage rating of the capacitor as specified by the ballast.

50.1.3 The requirement in 50.1.1a may be met without the use of a bleeder resistor if the capacitor is located in a closed loop of the circuit and if the loop is not opened by removal of the lamp or by the opening of a switch, fuse, or similar device.

50.2 Nonintegral oil-filled capacitors

50.2.1 If an oil-filled capacitor in an electric discharge luminaire is not integral with the ballast, its characteristics and installation shall comply with 50.2.2 – 50.2.5.

50.2.2 The capacitor shall comply with the requirements in the Standard for Capacitors, UL 810, and shall be rated for the voltage to which it is to be connected. Such capacitors relieve an internal fault condition by movement of the terminal end of the capacitor enclosure to break the circuit internally. Movement is initiated by internal pressure during a fault condition, causing expansion of the capacitor body.

50.2.3 The capacitor shall be rated no less than the maximum fault current to which it may be subjected, as follows:

a) A value of 10,000 amperes when connected across the ballast primary; that is, when the capacitor is in parallel with the ballast input circuit;

b) A value of 200 amperes when connected in series with a ballast coil; or

c) The maximum current available to the capacitor under capacitor short-circuit condition, as determined by an investigation.

50.2.4 For a liquid-filled capacitor, the placement and mounting of a capacitor in a luminaire shall be such that a free air space is provided in front of the capacitor end-terminals to enable the capacitor to expand, without obstruction, under a fault condition. This expansion clearance space shall be sufficient to allow the front enclosure and terminals of the capacitor, with associated wire connectors and supply leads attached, to travel 1/2 inch (12.7 mm) in a direction perpendicular to the mounting surface of the terminals.

Exception: The expansion clearance space may be less than 1/2 inch (12.7 mm) if an investigation determines that the space needed for a particular capacitor is provided.

50.2.5 In addition to the expansion clearance space specified in 50.2.4, an electrical air spacing between any exposed live part of the capacitor, such as exposed terminals and wire connectors, and:

a) Any uninsulated live part of opposite polarity; or

b) Uninsulated, grounded dead metal parts shall (after expansion) be:

1) At least 1/16 inch (1.6 mm) if the voltage involved does not exceed 300 volts; or

2) At least 1/8 inch (3.2 mm), if the voltage involved exceeds 300 volts.

51 Power Packs

51.1 A power pack shall comply with the requirements in the Standard for Power Units Other Than Class 2, UL 1012.

51.2 The adaptor for electrical and mechanical connection of the power pack supply to the track shall comply with the requirements in Section 46, Adapters, and Section 61, Polymeric Enclosure Impact Tests.

51.3 The female adaptor for electrical and mechanical connection of the luminaire assembly to the power pack shall comply with the requirements in Section 59, Adaptor Overload Test, and Table 40.1.

52 Pendant Luminaire Adaptor

52.1 Adaptor contacts shall maintain positive electrical connections. The electrical connections shall comply with the test results in the Adaptor Overload Test, Section 59.

52.2 The electrical contacts in the adaptor shall not be relied upon to provide positive mechanical securement of the adaptor to the track, as determined by conducting the Adaptor Tests, Section 60.

52.3 An adaptor that is provided with means for power supply connection within the connector shall have a field wiring compartment that has at least 1.5 cubic inches (24.6 cm^3) for each supply wire that terminates inside the compartment.

52.4 An enclosure of an adaptor shall comply with the requirements in Section 61, Polymeric Enclosure Impact Tests.

52.5 An adaptor intended for use with a cord pendant luminaire shall comply with 45.1 for intended cord types and weight restrictions, and with Section 72, Strain Relief Test – Cord-Pendant Luminaire Head, for strain relief.

52.6 An adaptor shall be provided with installation instructions that specify the electrical rating, maximum luminaire weight, and intended cord type recommended by the manufacturer. In addition, the proper method of electrically connecting the pendant mounted luminaire to the adaptor and the adaptor to the track shall be specified.

PERFORMANCE

SYSTEM

53 Grounding Resistance Test

53.1 General

53.1.1 A track lighting system shall have a resistance not exceeding 0.1 ohm when subjected to the grounding resistance test specified in 53.1 – 53.9 in an unheated and a heated condition. The track lighting system to be tested is considered to be heated after being subjected to the Normal Temperature Test, Section 54.

53.1.2 Samples subjected to the unheated condition of this test shall not have been subjected to any other tests. All measurements and tests are to be conducted at an ambient temperature of 25 ±5°C (77 ±9°F).

53.2 Electrical fitting measurement

53.2.1 The electrical fittings to be tested shall consist of one sample of the luminaire assembly, three samples of the intercept connector, and two samples of the feed connector having the highest measured resistance in their grounding circuit with four 20 inch (0.51 m) long sections of track. To determine which luminaire assembly, intercept connector, and feed connector have the highest measured resistance, the resistance is to be measured as specified in 53.3.1 between the points specified in 53.3.2 for intercept connectors, 53.3.3 for feed connectors, and 53.3.4 for luminaire assemblies.

53.3 Test method

53.3.1 An ohmmeter with an output of 5 volts or less may be used to measure the circuit resistance. If the results using an ohmmeter are unacceptable, the resistance shall be determined by measuring the voltage drop across the circuit. To measure the voltage drop across the circuit, either an alternating or direct current of at least 25 amperes from a power supply of 5 volts or less is to be passed from the point of connection of the equipment grounding means to a point in the grounding circuit. The voltage drop is to be measured across the circuit. The resistance is then to be calculated by dividing the value of the drop in potential (in volts) by the value of the current (in amperes).

53.3.2 A sample of each model of intercept connector is to be connected between two 20 inch (0.51 m) long sections of track. For T- and X-shaped intercept connectors, the assembly is to be connected with only the two track sections specified such that a straight line configuration exists. For L-shaped intercept connectors, the left and right turn connectors are to represent each other. The resistance between opposite ends of the assembly is to be measured through the grounding conductor.

53.3.3 A sample of each model of feed connector is to be connected to one end of a 20 inch (0.51 m) long section of track in accordance with the manufacturer's installation instructions. A floating feed connector is to be connected into the track section such that there is exactly 1 inch (25.4 mm) between the end of the track and the closest feed connector electrical connection point (grounded or ungrounded). The resistance between the grounding lead or terminal of the feed connector and the grounding conductor at the opposite end of the track section is to be measured.

53.3.4 A sample of each luminaire assembly, including low voltage type power packs, is to be inserted into a 20 inch (0.51 m) long section of track in accordance with the manufacturer's installation instructions so that there is exactly 1 inch (25.4 mm) between the end of the track and the closest luminaire assembly electrical connection point (grounded or ungrounded). The resistance between all dead metal parts of the luminaire assembly and power pack, if provided, and each end of the track section is to be measured through the grounding conductor.

53.4 Test setup – Surface mounted track

53.4.1 The track lighting system assembly to be tested is to consist of three intercept connector samples, two feed connector samples, one luminaire assembly sample, and four 20 inch (0.51 m) long sections of track. The connectors and luminaire assembly samples are to be of the models with the highest measured resistance as specified in 53.2.1. The electrical fittings are to be assembled as shown in Figure 53.1 and mounted to one side of a plywood test ceiling consisting of 1/2 inch (12.7 mm) thick Grade A – C or A – D plywood of such dimensions that the plywood extends at least 1 foot (305 mm) beyond each portion of the network and luminaire assembly. A 4 inch by 1-1/2 inch deep octagonal trade size standard metal outlet box is to be secured inside a wooden box by screws through the back of the outlet box. The wooden box is to be constructed of 2 inch by 4 inch trade size pine. The inside dimensions of the wooden box are to be 4 inches by 3-7/8 inches by 1 inch (102 mm by 98.4 mm by 25.4 mm). The wooden box is to be mounted to the plywood over a 4 inch by 4 inch opening. Each section of track is to be secured to the plywood by two wood screws through openings, each of which is:

a) 3 inches (76.2 mm) from the end of a track section; or

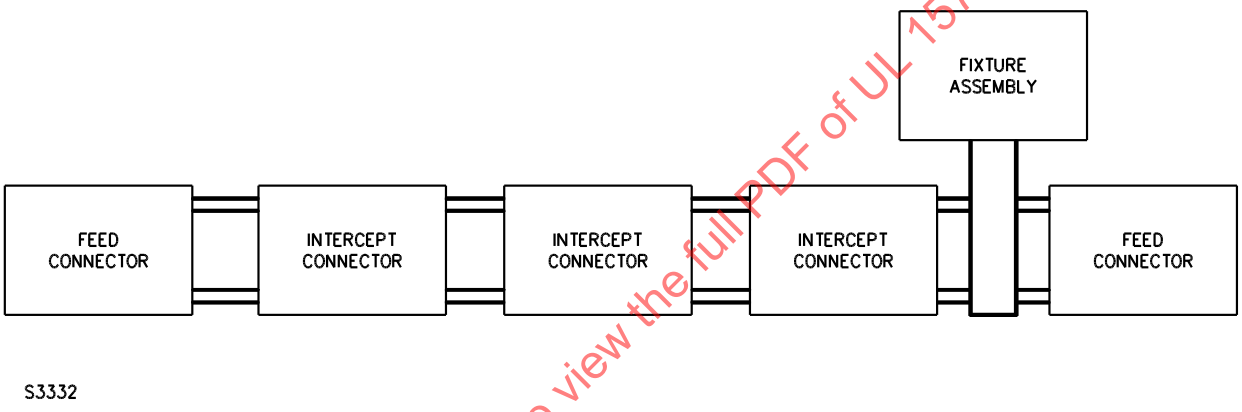
b) 1/2 inch from the connector in the end of the track;

whichever is the greater distance from the end. The feed connector is to be mounted to or over the outlet box. The side of the plywood to which the track system is not mounted is to be completely covered with a layer of foil-faced R19 glass fiber batt insulation with the non-foil-faced side of the insulation facing the plywood test ceiling. The plywood surface is then to be suspended or supported so that a simulated ceiling mounting of the track assembly results.

Exception: If, as a result of measuring the resistance of the intercept connectors, a right or left turn intercept connector is determined to have the highest resistance and is to be subjected to the grounding resistance test, two right and one left intercept connector samples may be tested in the test assembly.

Figure 53.1

Test assembly



53.5 Test setup – Recessed track

53.5.1 The recessed track lighting system assembly to be tested shall consist of the same electrical fittings as described in 53.4.1 except is installed in a recessed channel. A recessed channel intended for use with recessed luminaire assemblies shall be installed in a test box as described in 53.6 and tested in accordance with 53.8 and 53.9. A recessed channel intended for use with non-recessed luminaire assemblies shall be installed in a test box described in 53.7.1 and 53.7.2 and tested in accordance with 53.8 and 53.9.

53.6 Recessed track for recessed luminaire assemblies

53.6.1 The recessed channel shall be mounted in accordance with manufacturer's instructions in a rectangular box with cover and built of 1/2 inch (12.7 mm) thick fir plywood, A – D grade. The plywood test box is to have dimensions such that each wall and cover is 1/2 inch (12.7 mm) from the nearest point of the recessed channel, junction box, or any incidental projection.

53.7 Recessed track for non-recessed luminaire assemblies

53.7.1 The recessed channel shall be mounted in accordance with manufacturer's instructions in a rectangular box built of 1/2 inch (12.7 mm) thick fir plywood, A – D grade. The plywood test box is to have dimensions such that each wall is 8-1/2 inches (216 mm) from the nearest point of the recessed channel,

junction box, or any incidental projection. The top edge of each wall is 8-1/2 inches (216 mm) above the height of the installed recessed channel and the top of the box is open.

53.7.2 The interior space between the plywood box and the interior surface of the recessed channel is to be filled with loose fill cellulosic insulation rated for a thermal resistance of 3.75 – 3.85 R/inch with a conditioned density of 2.0 – 2.5 pounds per cubic foot (32 – 40 Kg/m).

53.8 Unheated condition test

53.8.1 After the test setup has been assembled as shown in Figure 53.1, the setup is to be conditioned for 24 hours in an ambient temperature of 25 ±5°C (77 ±9°F). The resistance is to be measured between:

a) The grounding leads or terminals in the feed connectors at opposite ends of the assembly;

b) The luminaire assembly and one feed connector; and

c) The luminaire assembly and the other feed connector.

53.9 Heated condition test

53.9.1 The test assembly is to be subjected to the Normal Temperature Test, Section 54. After the temperature test the test assembly is to be disconnected from its source of supply and, while the test assembly is still in a heated condition, the resistance is to be measured as specified in 53.8.1.

54 Normal Temperature Test

54.1 General

54.1.1 A track lighting system, including mono-, duo-, and multi-point canopies, shall be subjected to the temperature test conditions described in 54.3.1 – 54.4.4 for surface mounted track and 54.5.1 for recessed mounted track. Temperature test results are acceptable if the temperature rises attained do not exceed the values specified in Table 54.1.

54.1.2 Tests are to be conducted at an ambient temperature of 25 ±5°C (77 ±9°F); the values for temperature rise in Table 54.1 are based on an assumed ambient temperature of 25°C (77°F). The ambient temperature is to be monitored by means of a thermocouple immersed in 15 milliliters of light mineral oil in a glass container.

54.1.3 Temperature measurements to determine compliance with Table 54.1 are to be obtained by the thermocouple method. Temperature measurements for enclosed-coil type devices are to be obtained by the change-of-resistance method. Temperature measurements are to be made 3-1/2 hours after the start of the test at 1/2 hour intervals. A temperature is considered to be constant when three successive readings taken at 1/2 hour intervals indicate no further change.

Table 54.1
Maximum acceptable temperature rise

Thermocouple location		°C	(°F)
1.	Fuse	65	149
2.	Fiber employed as electrical insulation[a]	65	149
3.	Copper conductors (bare or insulated) without a nickel coating or equivalent protection		
	a) A diameter less than 0.015 inch (0.38 mm)	125	257
	b) A diameter of 0.015 inch or more	175	347
4.	Termination of copper conductor and pressure terminal connectors without a nickel coating or equivalent protection	125	257
5.	Splices and terminals	b	b
6.	Polymeric material	c	c
7.	Wire or cord	d	d
8.	Point of connection of supply wires by thermocouple or temperature probe	e	e
9.	Point of connection		
	Point of bus bar adjacent to connector or adaptor	c	c
10.	Lampholder enclosure of thermosetting material[a]	125	257
11.	Metal ballast enclosure	65	149
12.	Enclosure of a potted, metal-enclosure coil type device; Class 105 insulation system	65	149
13.	Coil of device employing		
	Class 105 insulation system:		
	1. Thermocouple method	65	149
	2. Change of resistance method	75	167
	Class 130 insulation systems:		
	1. Thermocouple method	85	185
	2. Resistance method	95	203
	Class 155 insulation systems:		
	1. Thermocouple method	110	230
	2. Resistance method	115	239
	Class 180 insulation systems:		
	1. Thermocouple method	125	257
	2. Resistance method	140	284
	Class 200 insulation systems:		
	1. Thermocouple method	145	293
	2. Resistance method	160	230
	Class 220 insulation systems:		
	1. Thermocouple method	160	230
	2. Resistance method	175	347
	Class 250 insulation systems:		
	1. Thermocouple method	190	374
	2. Resistance method	205	401

Table 54.1 Continued on Next Page

Table 54.1 Continued

Thermocouple location		°C	(°F)
14.	Capacitors[a]		
	a) Electrolytic	40	104
	b) Other types	65	230
15.	Varnished cloth insulation[a]	60	140
16.	Wood	65	230
17.	Aluminum or unplated copper lampholder screw shell, center contact, or other connecting device	175	347
18.	Track housing	65	149
19.	Recessed channel		
	1. Intended for use with non-recessed or inherently protected recessed luminaire assemblies	65	149
	2. Intended for use with recessed luminaire assemblies other than inherently protected assemblies	125	257
	3. Recessed test box	65	149

[a] These limitations do not apply to compounds or components that have been investigated and found acceptable for a higher temperature.

[b] Any temperature rise is acceptable if, when corrected to a 25°C (77 °F) ambient temperature, it is less than the temperature ratings of adjacent materials.

[c] The investigation of a polymeric material shall comply with the appropriate requirements in Section 8, Enclosures, and Section 40, Enclosures.

[d] The maximum temperature measured on the wire or cord, when corrected to a 25°C (77 °F) ambient temperature, is not to exceed the temperature rating of the wire or cord used.

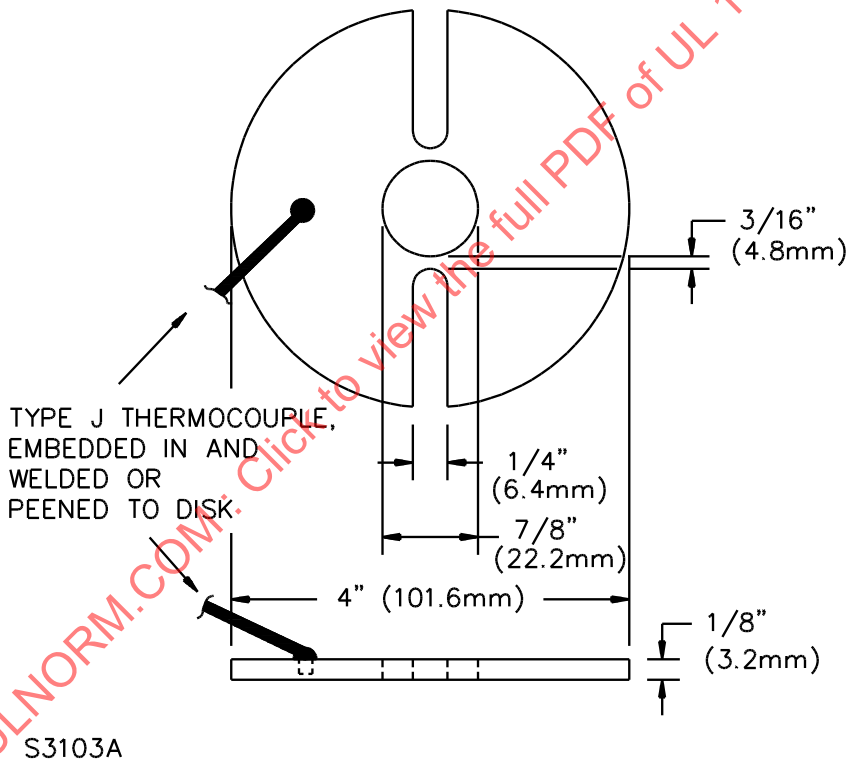
[e] Any temperature rise up to 125°C (257°F) is acceptable if consistent with the marking on the feed connector as specified in 82.5. The temperature probe is specified in 54.1.4.

54.1.4 With regard to the supply wire temperature limits specified in Table 54.1(8), a copper temperature probe as illustrated in Figure 54.1 is to be placed between the back of the canopy and the outlet box, with the two screws used for mounting the canopy passing through the elongated openings on the probe (or, if a nipple is used to support the canopy, the nipple is to pass through the center opening in the probe). The probe is to be placed below the crossbar with the thermocouple facing into the junction box. The canopy supply leads are to be routed through the center opening in the probe (or, if a nipple is used, through the elongated opening), and the probe is to rest on the insulation (if provided) or on the uppermost interior surface of the canopy without mechanical tension or pressure.

Exception: The probe may be placed above the crossbar if a back cover on the canopy does not permit the probe to be placed between the canopy and crossbar without causing the canopy to be spaced away from the plywood surface.

Figure 54.1

Temperature probe for supply wire temperatures



54.1.5 Thermocouples are to consist of wires no larger than 24 AWG (0.21 mm^2) and no smaller than 30 AWG (0.05 mm^2). It is standard practice to employ thermocouples consisting of 30 AWG iron and constantan wires and a potentiometer type instrument; such equipment is also to be used whenever referee temperature measurements by thermocouples are necessary. Thermocouple wires are to conform with the requirements for special thermocouples as specified in the Tolerances on Initial Values of EMF versus Temperature tables in the Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, ANSI/ASTM E230/E230M.

54.1.6 A thermocouple junction and the adjacent thermocouple lead wire are to be held securely in thermal contact with the surface of the material and should be placed on the hottest parts. Tape used to secure a thermocouple shall not be located within 3 inches (76.2 mm) of the thermocouple junction.

54.1.7 The temperature of a polymeric part in a track system (such as a thermoplastic enclosure, lens, or diffuser) is to be measured by placing one or more thermocouples in contact with the part so the thermocouple is between the part and any metallic material or other source of conducted heat. Temperatures generated by a source of radiated or convective heat are to be measured by inserting the thermocouples into holes in the enclosure and positioning them so the thermocouple tips are flush with the plane of the inside surface. The thermocouples are to be sealed in place with fullers earth and sodium silicate (waterglass).

54.1.8 A device such as a shutter, an iris, or a barndoor that is:

a) Permanently mounted to; or

b) Intended to be used with a lighting assembly and is intended to alter the light beam;

is to be adjusted so the aperture is uniformly reduced in area by 70 percent.

Exception: If the aperture opening cannot be uniformly reduced in area by 70 percent, it may be adjusted to the smallest possible opening.

54.2 Temperature test conditions – HID luminaire assembly

54.2.1 When subjected to a temperature test, an HID luminaire assembly shall be provided with a nominal system consisting of a ballast, capacitor, and lamp combination that complies with 54.2.2 and 54.2.3. A luminaire assembly is to be operated at rated frequency and at:

a) A supply voltage rated for the ballast; or

b) The supply voltage necessary to be considered a nominal system in accordance with 54.2.3.

Exception: A nominal system need not be provided if the luminaire is provided with a self-ballasted lamp.

54.2.2 A nominal system for an HID luminaire assembly shall be a combination of components such that, when connected to the supply voltage rated for the ballast and measured as specified in 54.2.3, the lamp operates at its marked wattage rating ±5 percent. The capacitance of the capacitor is to be within ±5 percent of the capacitance rated for the ballast.

Exception: A lamp need not operate within ±5 percent of its marked rating when operated by a ballast intended to operate the lamp at other than the lamp's marked rating. Such a construction is to be documented by the ballast manufacturer.

54.2.3 The test lamp, when evaluated in open air, using the same ballast and capacitor that will be used in the luminaire shall operate within 5 percent of the rated lamp wattage, after a 15 minute stabilization period. The voltage may be adjusted to be within the 5 percent range, and this voltage shall be used as the test voltage.

54.2.4 The test of one HID ballast to represent others is acceptable with the following exceptions:

a) A metal halide or mercury vapor type may not represent a high pressure sodium (HPS) type.

b) An HPS type may not represent a metal halide or mercury vapor type.

c) A lower wattage type may not represent a higher wattage type.

d) A ballast with one class insulation system may not represent a ballast with a different class insulation system.

e) For a ballast of other than the enclosed and potted type with a Class 105 insulation system, a ballast with a bench-test temperature may not represent a ballast with a higher bench-test temperature.

54.3 Fixture assemblies measurement

54.3.1 A representative sample of each model of luminaire assembly to be tested shall have thermocouples attached at the locations specified in Table 54.1 and at other locations as applicable (such as components of a power pack). Each luminaire assembly is then to be installed in the center of a 20 inch (0.51 m) long section of track that has been mounted to a plywood surface by two wood screws through openings in the track which are located as specified in 53.4.1. An adjustable luminaire head is to be positioned to cause the highest temperatures on the track section and then repositioned to cause the highest temperatures on the luminaire head. If a single position results in the highest temperature on both the track section and the luminaire head, the measurement need only be conducted with the luminaire head in that position. If the luminaire head is provided with accessories, the luminaire assembly temperature measurement is to be conducted with the accessories and with the luminaire head and accessories positioned to cause the highest temperatures on the luminaire head.

Exception: For mono-, duo-, and multi-point canopies, the luminaire assembly is to be installed in the canopy rather than in a 20 inch (0.51 m) track section.

54.3.2 Each luminaire assembly is to be provided with a lamp that is rated for the wattage specified by the lamp replacement marking described in 83.1 – 83.3 at the voltage specified by the electrical rating for the track system as described in 78.1.

54.3.3 Each luminaire assembly and track section, as specified in 54.3.1, is then to be connected by a feed connector to a 60-hertz supply circuit adjusted to the rated voltage specified in 78.1.

54.4 Test setup – Surface mounted track

54.4.1 The test setup is to be the same as the one used for the Grounding Resistance Test, Section 53 but with three additional luminaire assemblies installed in the center of the track sections that did not have a luminaire assembly installed during the grounding resistance test and with one feed connector installed at each end of the track assembly. If available, a floating feed connector is to be used as one of the feed connectors in the setup described above. The load specified in 54.4.3 is to be connected across the other feed connector. If different types of feed connectors are used, the test is also to be conducted with the load and supply reversed so that each type of feed connector experiences the full rated current.

Exception: The test setup for a mono- or duo-point canopy is with only one luminaire assembly. The test setup for a multi-point canopy with track 24 inches (61 cm) or less in length is one luminaire, and with track 48 inches (122 cm) or less in length is two luminaires.

54.4.2 For the track system, the three luminaire assemblies to be installed in the center of the sections of track not already having a luminaire assembly installed from the grounding resistance test are to consist of:

a) The model of the luminaire assembly that resulted in the highest temperatures on the track or mounting surface;

b) The model of the luminaire assembly that resulted in the highest temperatures on the luminaire head, including accessories; and

c) The model of the luminaire assembly that resulted in the highest temperatures on the power pack, if provided.

However, three luminaire assemblies, each of the same model, are to be used if the same model resulted in the highest temperatures on the track or mounting surface, luminaire head, and power pack. For any number of models and types of luminaire assemblies, only three luminaire assemblies are to be installed.

54.4.3 For a track system, a load(s) is (are) to be connected across the leads or terminals of one feed connector as shown in Figure 54.2 and Figure 54.3 such that the total current drawn by the luminaire assemblies and load(s) as measured through the leads of the supply feed connector is the full rated current through each ungrounded conductor in each circuit of the track network.

Figure 54.2

Power supply connection example – two-circuit track network with no current flowing in the ungrounded conductor

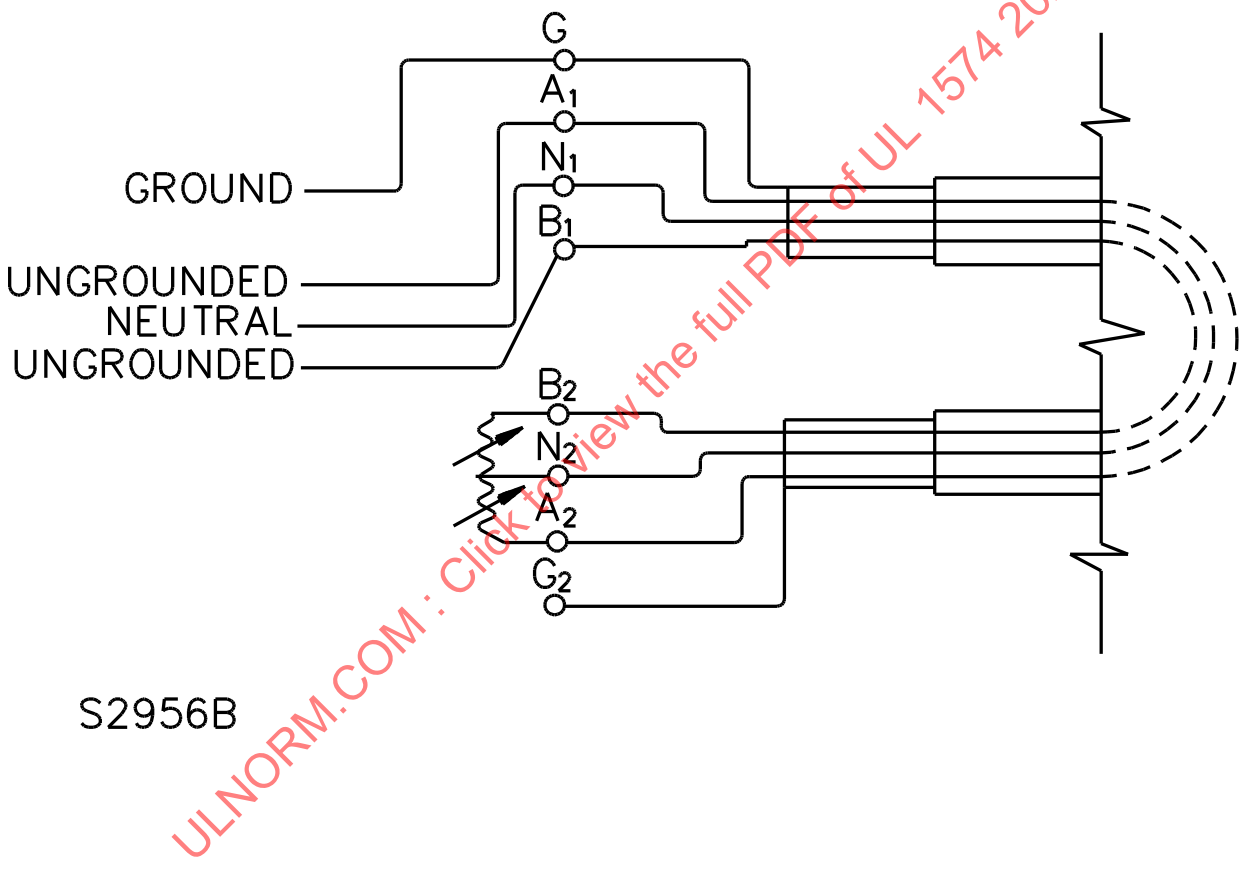
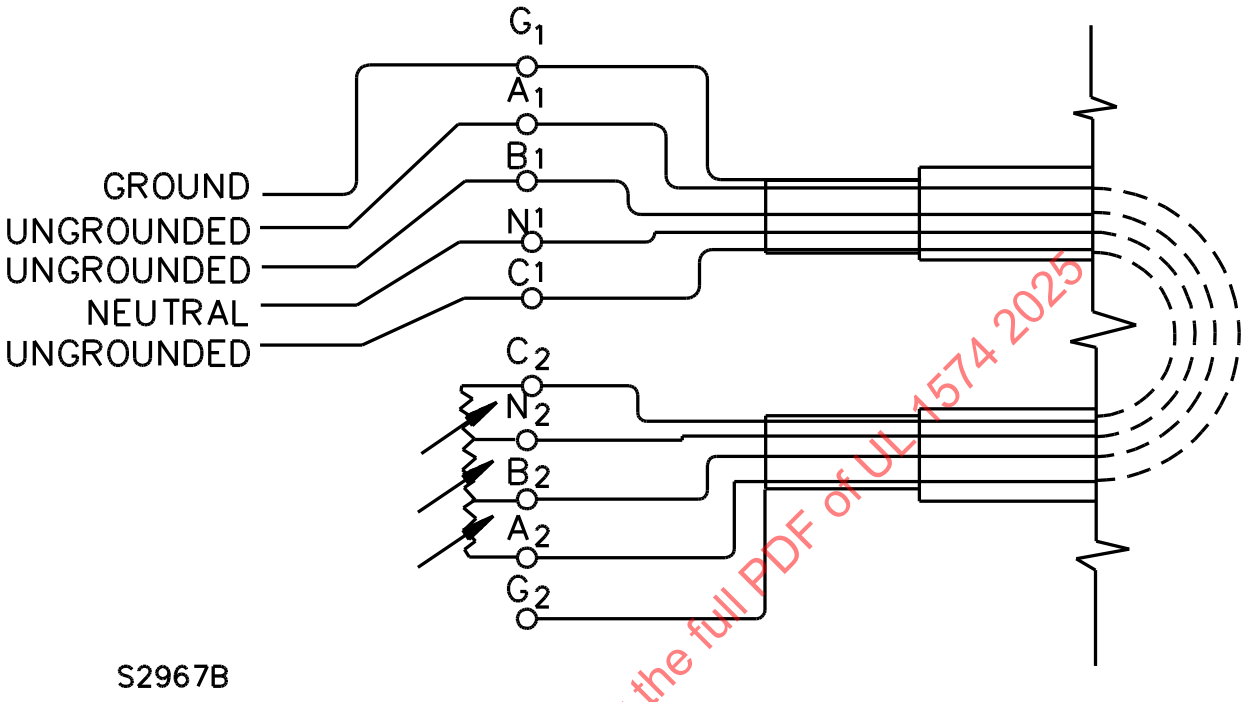


Figure 54.3

Power supply connection example – two-circuit track network with current flowing in the ungrounded conductor



54.4.4 The track system assembly is to be energized and operated until the temperatures stabilize as specified in 54.1.3, and, while still energized, the temperatures are to be measured as specified in 54.1.3.

54.5 Test setup – Recessed mounted track

54.5.1 The test setup is to be the same as described in 54.4.1 – 54.4.4 except the recessed channel is installed in the appropriate test box as specified in Section 53, Grounding Resistance Test, for recessed mounted track. See 53.5.1, 53.7.1, and 53.7.2 for recessed track intended for use with non-recessed luminaire assemblies, and 53.5.1 and 53.6.1 for recessed track intended for use with recessed luminaire assemblies. Four luminaire assemblies shall be installed in the test setup, with each assembly centered in a 20 inch (0.51 m) long section of track.

Exception: If the manufacturer's markings allow a closer luminaire assembly center to center spacing, the recessed channel and track length shall be reduced to maintain the specified spacing. See 83.10 for recessed luminaire assembly marking requirement.

54A Normal Temperature Test – Inherently Protected Recessed Luminaire Assemblies

54A.1 An inherently protected luminaire recessed assembly shall comply with the normal temperature test of Section 54, as amended by 54A.2 to 54A.4.

54A.2 The test setup is to be the same as described in 54.5, except that the recessed channel shall be installed in the test box specified in 55.2.

54A.3 The interior space between the plywood box and the interior surface of the recessed channel is to be filled to a depth of 8-1/2 inches (215 mm) over the top of the recessed channel with loose fill cellulosic insulation rated for a thermal resistance of 3.75 – 3.85 R/inch with a conditioned density of 2.0 – 2.5 pounds per cubic foot (32 – 40 Kg/m).

54A.4 The resulting temperatures shall not exceed those specified in Table 54.1, and any integral overheating protective device shall not operate.

55 Abnormal Recessed Temperature Test

55.1 A recessed track system intended for use with recessed luminaire assemblies and marked in accordance with 80.5.1, shall be assembled and installed with the same components as described in Section 54, Normal Temperature Test, except as described in 55.2 – 55.5.

55.2 The recessed channel shall be mounted in a rectangular box built of 1/2 inch (12.7 mm) thick fir plywood, A – D grade. The plywood test box is to have dimensions such that each wall is 8-1/2 inches (216 mm) from the nearest point of the recessed channel, junction box, or any incidental projection. The top edge of each wall is 8-1/2 inches (216 mm) above the height of the installed recessed channel and the top of the box is open.

55.3 The interior space between the plywood box and the interior surface of the recessed channel is to be filled with a 4 inch (102 mm) level of loose fill cellulosic insulation rated for a thermal resistance of 3.75 – 3.85 R/inch with a conditioned density of 2.0 – 2.5 pounds per cubic foot (32 – 40 Kg/m).

55.4 The recessed track system shall be operated for 7-1/2 hours or until the thermal protector trips, whichever occurs first. If the thermal protector trips within 3 hours, test results are acceptable if one or more luminaire assembly lamps are de-energized and temperatures attained on parts of the luminaire assembly or recessed channel in contact with combustible materials (for example, the test box and recessed channel support surfaces) do not exceed 160°C (320°F).

55.5 If the thermal protector does not trip within 3 hours and the temperatures on parts of the luminaire assembly or recessed channel in contact with combustible materials do not exceed 90°C (194°F), the test is to be reconducted with an additional 2 inches (50 mm) of cellulosic insulation. The test is to be repeated in this manner with additional levels of insulation until:

a) The protector trips within 3 hours; or

b) The protector does not trip within 3 hours and the temperatures exceed the 90°C (194°F) limit specified above; or

c) The maximum depth of insulation reaches 8-1/2 inches (215 mm) over the top of the recessed channel and the temperatures do not exceed the 90°C (194°F) limit specified above.

55A Strain Relief Test

55A.1 A pull force of 35 lbs. (156 N) shall be applied for 1 min to the flexible cord or wire in a direction perpendicular to the plane of the entrance into the canopy, track or track adapter.

55A.2 Test results shall be acceptable if there is no movement of the flexible cord of more than 0.0625 in (1.6 mm).

TRACK NETWORKS

56 Security of Knockout Test

56.1 A knockout in an enclosure of metal or polymeric material shall be subjected to the test described in 56.2 and shall comply with the test results in 56.3.

56.2 A force of 10 pounds (44.5 N) is to be gradually applied and maintained for 1 minute perpendicular to the plane of the enclosure surface in which the knockout is located. The flat end of a metal rod 1/4 inch (6.4 mm) in diameter is to be pressed against the knockout from the outside surface at the point(s) evaluated most likely to provide separation of the knockout from the enclosure.

56.3 Test results are acceptable if the knockout does not separate more than 1/16 inch (1.6 mm) from the enclosure.

57 Mold Stress Relief Distortion Test

57.1 A thermoplastic part as described in Section 8, Enclosures, for track systems, and Section 40, Enclosures, for luminaire assemblies, and 21.5 shall be subjected to the test described in 57.2 and shall comply with the test results in 57.3.

57.2 One sample of track, minimum 20 inches (508 mm) in length, with the bus bar support and bus bar installed as intended, or a thermoplastic part as described in 57.1, shall be placed in a full-draft circulating-air oven maintained at a uniform temperature of at least 10°C (18°F) higher than the measured temperature of the thermoplastic part other than the bus bar insulation or 70°C (158°F), whichever is greater. The sample is to remain in the oven for 7 hours. After removal from the oven, the sample is to be allowed to return to room temperature and is to be inspected for compliance with 57.3.

57.3 The results are acceptable if:

a) There is no softening of the material as determined by handling immediately after the conditioning;

b) No shrinkage, warpage, or other distortion of the part as judged after cooling to room temperature, that results in any of the following:

1) Spacings being reduced to values less than the minimum spacing values specified in Section 18, Spacings, for spacings between:

i) Live parts of opposite polarity;

ii) Live parts and accessible dead or grounded metal; and

iii) Live parts and the enclosure,

2) Live parts being considered accessible as determined by the probe illustrated in Figure 17.1;

3) Integrity of the thermoplastic part being defeated so mechanical protection is not afforded to the live parts; and

4) Intended operation of the track lighting system being impaired; or

c) Any parts relied on for structural integrity described in the Exception of 21.5 shall comply with a repeated Grounding Resistance Test, Section 53.

58 Insulation Resistance Test

58.1 The insulation resistance between:

a) Conductors of opposite polarity; and

b) Conductors and grounded metal;

is to be measured using a megohmmeter.

58.2 Each connector, in turn, is to be assembled onto a section of track that is not less than 20 inches (0.51 m) and that has a feed connector at the opposite end.

58.3 The track network is to be at 25 ±1°C (77 ±1.8°F) at the beginning of the test.

58.4 To measure the resistance, the megohmmeter is to be connected, in turn, between each combination of the feed connector supply leads or terminals, including the grounding terminal.

58.5 Test results are acceptable if the minimum resistance measured is 1 megohm for each track section with the connector.

59 Adaptor Overload Test

59.1 An adaptor shall be subjected to the overload test described in 59.2 and 59.3 and shall comply with the results in 59.4.

59.2 A section of track is to be connected to a source of supply as described in 54.3.3. The track is to be grounded through a 1-ampere fuse. Six samples of each type of luminaire adaptor are to be connected one at a time to a tungsten load adjusted to draw 150 percent of the rated current of the luminaire adaptor.

59.3 Connections between the track and the adaptor are to be made and broken 50 times for each sample. The on – off cycling rate is to be at least 2 seconds on (or the minimum time required to insert and remove the adaptor) and 15 seconds off.

59.4 Test results are acceptable if the 1-ampere fuse does not open.

60 Adaptor Tests

60.1 Strength of adaptor

60.1.1 An adaptor shall be tested as described in 60.1.2 and 60.1.3 or 60.1.3A and shall comply with the test results in 60.1.4.

60.1.2 A 4 foot (1.22 m) section of track with two mounting openings, each of which is located 6 inches (150 mm) from each end of the track section, is to be mounted as intended on a flat plywood surface. The electrical contact blades are to be removed from the luminaire adaptor.

60.1.3 The luminaire adaptor is to be mounted to the track with the track first in a ceiling-mounted position and then in a wall-mounted position. A weight equal to two times the weight of the heaviest luminaire assembly, but no less than 10 pounds (4.5 kg), is to be suspended from the adaptor for 1 minute.

60.1.3A An integral luminaire assembly (see 3.30) is to be mounted to the track first in a ceiling-mounted position and then in a wall-mounted position. A weight equal to two times the weight of the integral assembly shall be suspended from the assembly for a period of one minute.

Exception: An integral luminaire assembly not intended for use on a wall-mounted track system need not be tested in a wall-mounted position and shall be marked as specified in 83.8.

60.1.4 Test results are acceptable if:

a) The track is not deformed in a manner that would:

1) Increase the risk of fire or electric shock; or

2) Reduce spacings below the minimum values specified in Section 18, Spacings; and

b) The bus bars and live components are rendered not accessible as determined by using the probe illustrated in Figure 17.1.

60.2 Adaptor moment

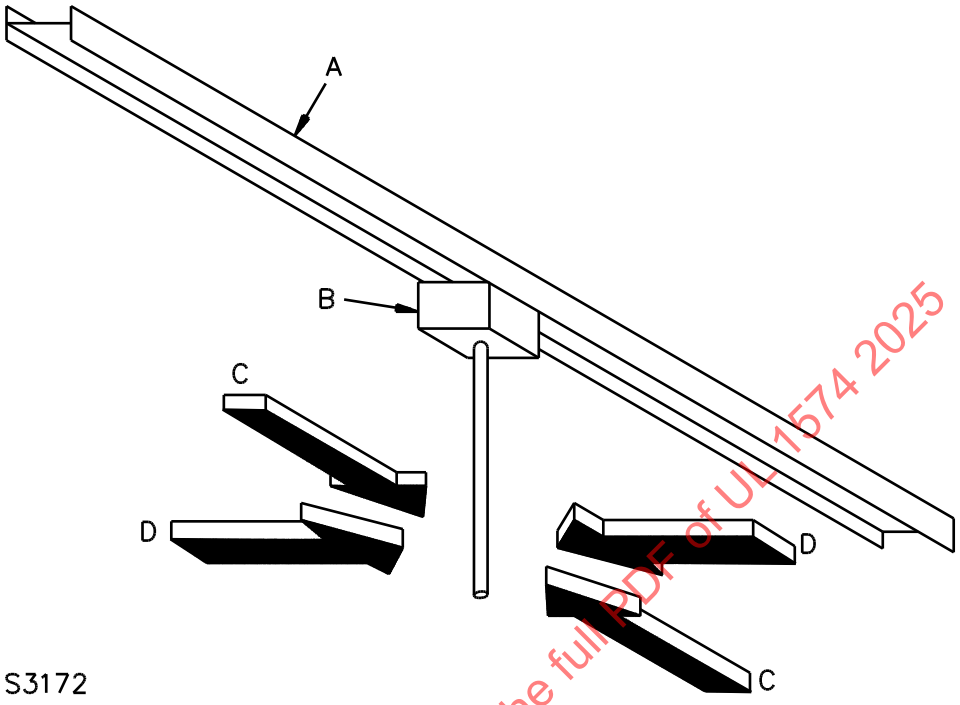
60.2.1 An adaptor is to be subjected to the test described in 60.2.2 and 60.2.3 and shall comply with the test results in 60.1.2.

60.2.2 The adaptor and stem, luminaire, or other rigid object (for example, a luminaire head and stem) of a length equal to the maximum length of stem intended to be provided on an adaptor are to be installed as intended in the track described in 60.1.2.

60.2.3 A 5 pound (22 N) force is to be applied to the end of the stem farthest from the track for 1 minute. The force is to be applied parallel to the plane of the mounting surface, in each direction parallel to the orientation of the track and in each direction perpendicular to the orientation of the track, as illustrated in Figure 60.1.

Figure 60.1

Application of force to adaptor



A – Track section installed as intended.

B – Adaptor and stem installed as intended.

C – Force applied in each direction parallel to the orientation of the track.

D – Force applied in each direction perpendicular to the orientation of the track.

60.2.4 Test results are acceptable if:

a) The stem and adaptor remain in the intended mounting position;

b) Spacings are not reduced to values below the minimum values specified in Section 18, Spacings; and

c) The bus bar or live components are considered not accessible, as determined by using the probe illustrated in Figure 17.1.

61 Polymeric Enclosure Impact Tests

61.1 General

61.1.1 A polymeric enclosure of a luminaire assembly shall be subjected to the drop impact test described in 61.2 and shall comply with the results in 61.1.2. A polymeric enclosure of a track network shall be subjected to the ball impact test described in 61.3 and shall comply with the results in 61.1.2.

61.1.2 Test results are acceptable if the polymeric enclosure withstands the three impacts without:

a) A reduction of spacings to values below the minimum acceptable values as specified in Section 18, Spacings;

b) Uninsulated live parts or internal wiring becoming accessible to contact, as determined by the accessibility probe described in 17.1;

c) A reduction in wire or cord insulation thickness to values below the minimum values specified in 44.1; and

d) A reduction in the effectiveness of strain relief means, as determined by the strain relief test described in Section 72 or 73.

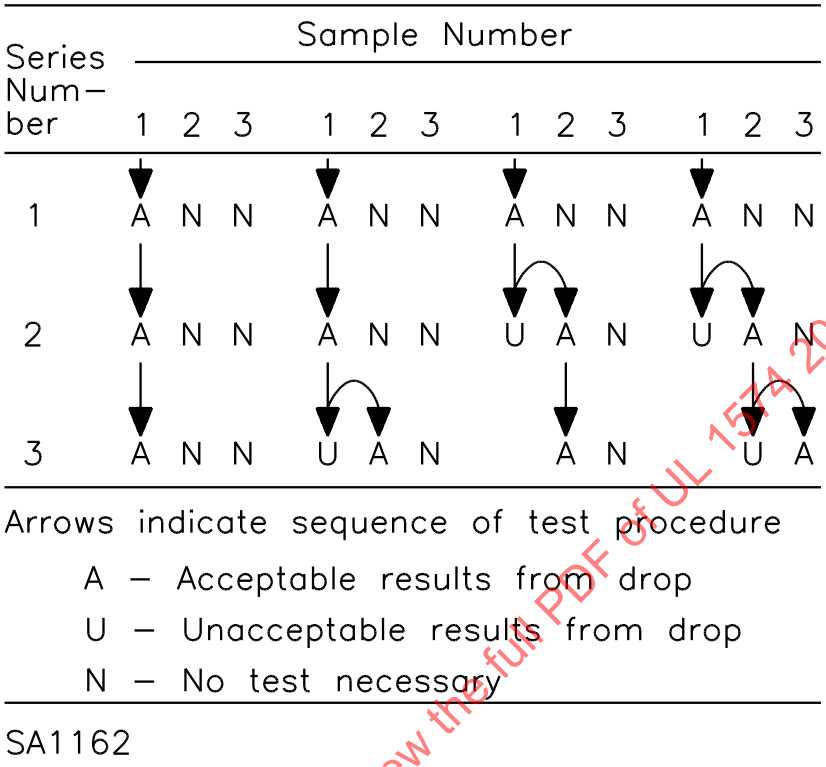
61.2 Drop impact test

61.2.1 Each of three samples of the luminaire assembly is to be dropped through 3 feet (0.91 meter) to strike a hardwood surface in the position most likely to produce adverse results. The hardwood surface is to consist of a layer of nominal 1 inch (25 mm) tongue-and-groove oak flooring mounted on two layers of nominal 3/4 inch (19 mm) plywood. The oak flooring is to be nominally 3/4 inch thick (actual size 3/4 by 2-1/4 inch or 18 by 57 mm). The assembly is to rest on a concrete floor or an equivalent nonresilient floor during the test.

61.2.2 Each sample is to be dropped three times so that, in each drop, the sample strikes the surface in a position different from those in the other two drops. Three samples shall be employed for the test; however, if the manufacturer so elects, fewer samples may be used in accordance with Figure 61.1. The overall performance is acceptable upon completion of any one of the procedures represented in that figure. If any sample does not comply on its first series of three drops, the results of the test are unacceptable.

Figure 61.1

Procedure for impact test



61.3 Ball impact test

61.3.1 Three samples of each type of a track section and connector are to be subjected to the ball impact test in the as-received condition.

61.3.2 The three samples are to be placed on a hardwood surface in the positions most likely to produce adverse results.

61.3.3 The hardwood surface specified in 61.3.2 is to consist of a layer of nominal 1 inch (25 mm) tongue-and-groove oak flooring mounted on two layers of nominal 3/4 inch (19 mm) thick plywood. The oak flooring is to be nominally 3/4 inch thick (actual size 3/4 inch by 2-1/4 inches or 18 mm by 57 mm). The assembly is to rest on a concrete floor or an equivalent nonresilient floor during the test.

61.3.4 The impact force is to be obtained using a solid smooth steel sphere 2 inches (50.8 mm) in diameter and weighing 1.18 pounds (0.53 kg). The sphere is to fall freely from rest through the distance required to cause it to strike the test sample with a force of 5 foot-pounds (6.78 N·m).

61.3.5 Each of three impacts is to be made in a different location on each sample so a total of 9 different points are impacted on the enclosure of each type of electrical fitting.

62 Conductor Displacement Tests

62.1 General

62.1.1 Each track section to be subjected to the tests described in 62.2.1 and 62.3.1 shall be previously untested and conditioned. The track sections tested shall comply with the test results in 62.2.2 and 62.3.2, respectively.

62.2 Horizontal conductor displacement test

62.2.1 A force of 1-1/2 pounds (6.7 N) is to be applied to either end of each bus bar in a 4 foot (1.22 m) track section held in a horizontal position. The force is to be applied parallel to the longitudinal centerline of the track in an attempt to push the bus bar or bus bar insulation (or both) out of the track.

62.2.2 Test results are acceptable if both the bus bars and the bus bar supports show no signs of movement as a result of the applied force.

62.3 Vertical conductor displacement test

62.3.1 A 4 foot (1.22 m) track section shall be held for a period of 15 seconds in the vertical position most likely to cause the bus bars or bus bar insulation to slip out of the track housing.

62.3.2 Test results are acceptable if both the bus bars and the bus bar insulation show no signs of movement.

63 Field Track Cutting Test

63.1 The means used to field cut a section of track shall be tested as described in 63.2 and shall comply with the test results in 63.3.

63.2 A section of track is to be cut in accordance with the manufacturer's instructions for each connector and end cap intended to be inserted into the track.

63.3 Test results are acceptable if:

a) The bus bar complies with the spacings in the Exception to 18.3; and

b) The bus bar and bus bar insulation show no evidence of damage such as bending or breaking.

64 Track Clip Securement Test

64.1 To determine whether a mounting clip can support a section of track, the mounting clip shall be investigated by subjecting the clip to the test described in 64.2 and 64.3. The clip shall comply with the test results in 64.4.

64.2 A clip is to be mounted to a 4 foot (1.22 m) section of track as intended. The section of track is to be:

a) Supported at both ends (with the track horizontal); and

b) Oriented so the clip is on the underside center of the track.

A 25 pound (11.4 kg) weight is to be suspended from the clip for 5 minutes.

64.3 The test is to be repeated with the track:

a) In a position that simulates wall mounting; and

b) Oriented so the longitudinal openings on the track are horizontal.

64.4 Test results are acceptable if:

a) The clip remains in the intended mounting position without evidence of pulling away from the track; and

b) The track is not distorted to a point that would result in:

1) A reduction of spacings to values below the minimum acceptable values specified in Section 18, Spacings; and

2) Uninsulated live parts or internal wiring becoming accessible to contact.

65 Pendant-Mounted Track Torque Test

65.1 Track for which stem pendants are manufactured shall be subjected to the test described in 65.2 and 65.3 and shall comply with the test results in 65.5.

65.2 The longest section of track available from the manufacturer is to be mounted as specified in the manufacturer's instructions. The number of stems used in mounting the track is to be the minimum number specified by the manufacturer; the stems are to be spaced from each other the maximum distance recommended by the manufacturer.

65.3 A 20 pound (89 N) force is to be applied horizontally to one end of the track section. The force is to be applied parallel to the plane of the track mounting surface in a direction that would tend to cause the track to turn on an axis located at the opposite end of the track.

65.4 If the track has been displaced from its original position after the 20 pound (89 N) force has been applied, opposite forces (the hands of the individual conducting the test) are to be applied to return the track to its original position.

65.5 Test results are acceptable if:

a) During and after the test, none of the mounting means detach from the mounting surface and the track; and

b) After the test, there is no deformation of the track, the stems, and the mounting means that would result in:

1) A reduction of spacings below the minimum acceptable values specified in Section 18, Spacings;

2) Uninsulated live parts or internal wiring becoming accessible to contact as specified in Section 17, Accessibility of Current-Carrying Parts; and

3) Damage to any insulating material (such as cutting, splitting, or abrading).

66 Strength of Luminaire Assembly Test

66.1 A luminaire assembly constructed so its center of gravity is 2 inches (50.8 mm) or more from the centerline of the adaptor shall be tested as described in 66.2 and shall comply with the test results in 66.3.

66.2 The luminaire assembly is to be mounted as described in 60.1.2 and 60.1.3. The 10 pound (4.5 kg) weight is to be suspended from a point as close to the center of gravity of the luminaire as possible for 1 minute.

66.3 Test results are acceptable if the luminaire assembly:

a) Does not pull out of the track or deform the track in a manner that would:

1) Increase the risk of fire or electric shock; or

2) Reduce spacings to values below acceptable minimum values as specified in Section 18, Spacings; and

b) Remains mounted to the track in the intended manner.

67 Pendant-Mounted Track/Connector Strength Test

67.1 Each connector type for a track system for which stem pendants are manufactured shall be subjected to the test described in 67.2 and 67.3 and shall comply with the test results in 67.4. For a multiple-point connector (such as a T-shaped connector), the test shall be conducted on each pair of connection points. For an adjustable connector, the test shall be conducted with the connector adjusted as close as possible to a straight line position.

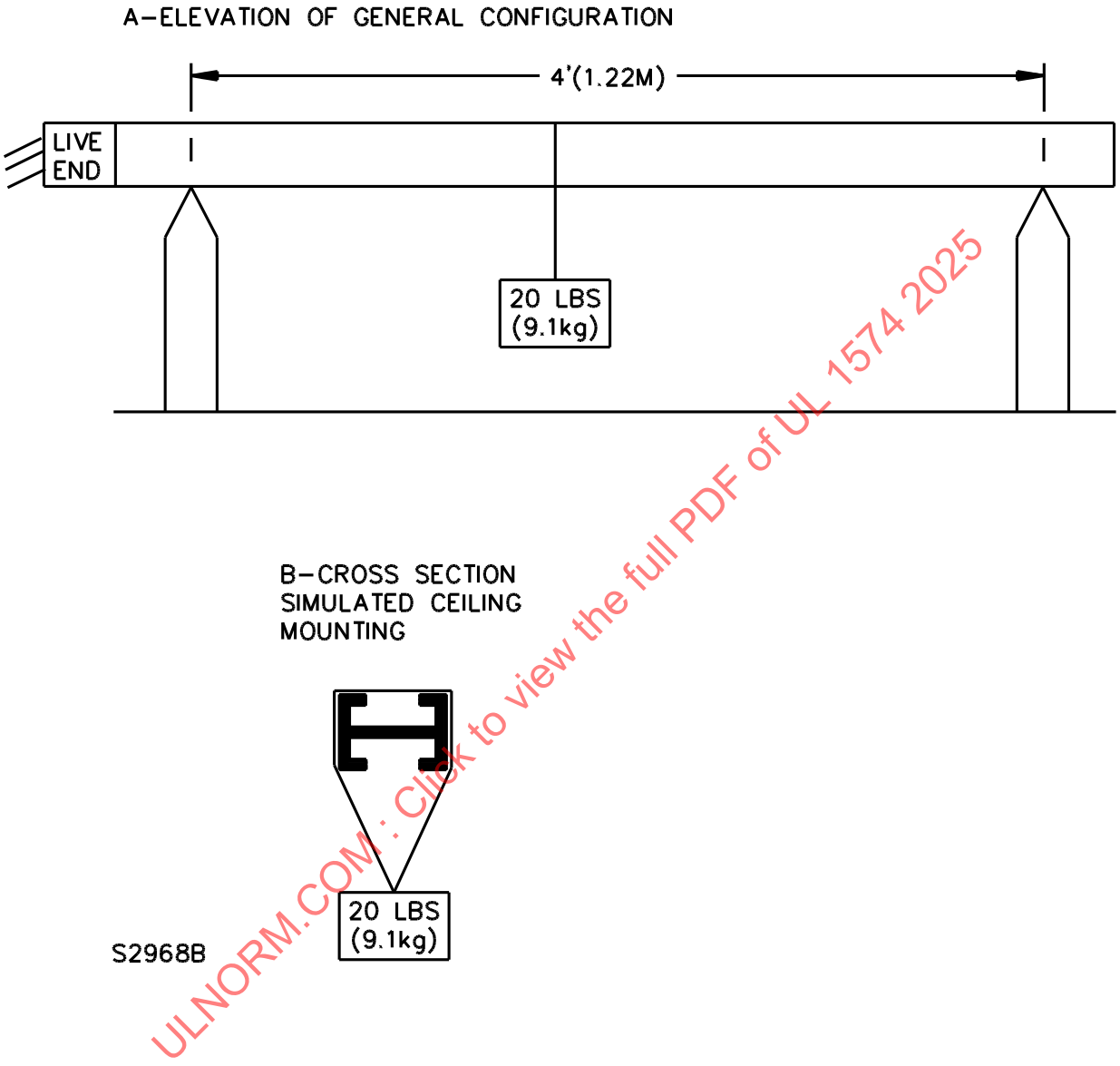
67.2 A connector is to be installed as intended between two sections of track and an end feed connector is to be installed on either track section. The assembly is to be placed on supports 4 feet (1.22 m) apart so the joint created by the connector is centered between the supports. An ohmmeter is to be connected between the ungrounded conductors and the grounded (neutral) and grounding conductors at the end feed connector's leads or terminals. A 20 pound (9.1 kg) weight is to be gradually applied to the track and maintained for 1 minute. The weight is to be suspended by a wire or cable that is looped around a track section. The weight is to be suspended at a point on one track section 1/2 inch (12.7 mm) from the connector. If, as a result of track distortion, the cable supporting the weight is likely to move from the 1/2 inch (12.7 mm) point, the cable is to be fixed in position at the 1/2 inch (12.7 mm) point. The test setup and suspended weight are to be supported so that the weight does not contact the supporting surface during the test. The test is to be conducted with the assembly supported in the horizontal position as shown in Figure 67.1.

Exception No. 1: If mounting stems are intended to be provided at greater than 4 foot (1.22 m) intervals, the test shall be conducted to simulate the mounting interval recommended by the manufacturer.

Exception No. 2: If a pendant-mounted track is intended to be installed by stem only, the test may be conducted in accordance with the manufacturer's installation instructions as specified in 84.2.6(e).

Figure 67.1

Pendant-mounted track/connector strength test setup – straight, adjustable, t-shaped, and x-shaped connectors



67.3 For an adjustable connector, the test is to be conducted with the track oriented so the applied weight is bearing on the track section in a direction that would tend to promote movement that the connector is not intended to accommodate.

67.4 Test results are acceptable if:

a) During and after the test, there is no indication of short-circuiting of the ungrounded bus bar conductors to grounded and grounding conductors; and

b) After the test, there is no accessibility to current-carrying parts as determined by the accessibility requirements in Section 17, Accessibility of Current-Carrying Parts.

68 Track Rigidity Test

68.1 A section of track shall be subjected to the test described in 68.2 and shall comply with the test results in 68.3.

68.2 The track is to be supported horizontally at both ends with supports 4 feet (1.2 m) apart. A 50 pound (22.7 kg) weight is to be applied to the center of the track for 1 minute by suspending the weight from a wire or cable looped around the track section. The test is to be conducted with the force applied in a direction consistent with a ceiling-mounted track.

68.3 Test results are acceptable if the applied force causes no deformation of the track that would result in:

a) A reduction of spacings to values below the minimum acceptable values as specified in Section 18, Spacings; and

b) Uninsulated live parts or internal wiring becoming accessible to contact, as determined by the accessibility probe described in 17.1.

69 Mechanical Means of Polarity Test

69.1 The mechanical means used to maintain track system polarity shall be tested as described in 69.2 – 69.4 and shall comply with the test results in 69.5.

69.2 One end of each bus bar is to be connected to a lead on an ohmmeter; the resulting circuit is to be an open circuit that would be completed if electrical contact were to be made during the test.

69.3 Each type of connector (straight intercept, X-shaped intercept, end feed, and the like) is to be pushed into the track in a reverse-polarity position in an attempt to defeat the means of maintaining polarity. A force of 30 pounds (13.6 kg) is to be applied to the connector for 1 minute.

69.4 An adaptor is to be inserted into the track in an attempt to defeat the means of maintaining polarity. If a twist motion is normally used to insert the device, a torque of 15 pound-inches (1.7 N·m) is to be applied for 1 minute.

69.5 Test results are acceptable if:

a) The connector, the adaptor, and the track show no damage affecting performance or construction;

b) The open circuit between the ohmmeter and the bus bars shows no evidence that permanent electrical contact was made;

c) The connector and track remain assembled; and

d) There is no reduction of spacings to values below the minimum spacing values specified in Section 18, Spacings.

70 Field Drilling Test

70.1 A track intended to be field drilled as described in 28.1 shall be subjected to a field drilling test as recommended by the manufacturer in accordance with the installation instructions.

70.2 Test results are acceptable if, at the completion of the test, spacings are not reduced below the minimum spacing values specified in Section 18, Spacings, when mounting hardware is mounted in the drilled hole, connectors and adaptors are installed, and any other condition of use is performed.

71 Direct-Current Bus Bar or Conductor Resistance Test

71.1 With reference to the Exception of 13.1.3, a bus bar or conductor shall be subjected to the test described in 71.2 – 71.8 and shall comply with the requirements in 71.9.

71.2 A determination of the direct-current resistance of a bus bar or conductor is to be made to an accuracy of 0.2 percent or better by means of a general-purpose Kelvin bridge or its equivalent using a straight specimen of the bus bar or conductor that is 24 – 48 inches (610 – 1220 mm) long.

71.3 Each general-purpose Kelvin-bridge current electrode is to be attached to a stranded specimen in such a way – adjacent strands in mutual contact, each strand of the outer layer in full-length contact with the electrode, no strands damaged or bent, uniform pressure by the electrode at all points of strand contact, and the like – that results in an essentially uniform distribution of current among the strands.

71.4 The distance between each general-purpose Kelvin-bridge potential electrode and its corresponding current electrode is to equal or exceed 1.5 times the circumference of the bus bar or conductor specimen. The resistance of the Kelvin-bridge yoke between the reference standard and the specimen is not to be more than 0.1 percent of the resistance of the reference standard or the specimen, whichever is less, unless compensation is made for the potential leads or the coil and lead ratios are balanced.

71.5 Each general-purpose Kelvin-bridge potential electrode shall contact the bus bar or conductor specimen with a surface that is a sharp knife edge (see 71.8). The length of the bus bar or conductor specimen between the knife edges is to be measured to the nearest 0.01 inch (0.2 mm).

71.6 When using the general-purpose Kelvin-bridge, bus bar, or conductor specimen, all equipment and the surrounding air are to be in thermal equilibrium with one another at a temperature of 25°C (77°F).

71.7 Because the general-purpose Kelvin-bridge measuring current raises the temperature of the specimen, the magnitude of the current is to be as low as possible and the time of its use is to be brief. Too much current, too much time, or both are being used for a measurement if any change in resistance is detected with the galvanometer in two successive readings.

71.8 The contact surfaces of the general-purpose Kelvin-bridge current electrodes, the surface of the bus bar or conductor specimen, and the knife edges of the general purpose Kelvin-bridge potential electrodes are to be clean and undamaged. Contact-potential error is to be eliminated by taking four readings in direct succession: the first with the current flowing in one direction, the second with the current flowing in the other direction, then – after the specimen has been turned end for end – the third with the current flowing in one direction, and the fourth with the current flowing in the other direction. Contact-potential imbalance is to be minimized by having the potential electrodes made of the same material.

71.9 Test results are acceptable if the measured values do not exceed the values specified in Table 71.1.

Table 71.1
Bus bar and conductor resistance equivalency at 25°C (77°F)

Track rating amperes	Maximum milliohms/foot	Maximum ohms/kilometer
15 or 20	1.65	5.42
30	1.04	3.41
40	0.65	2.13
50	0.41	1.35

LUMINAIRES

72 Strain Relief Test – Cord-Pendant Luminaire Head

72.1 The strain relief means at each end of the flexible cord on a cord-pendant luminaire head shall be subjected to a pulling force as specified in 72.2 and shall comply with the test results in 72.3.

Exception: This test need not be conducted on a strain relief means in a Class 2 circuit.

72.2 For the test, the conductors of the flexible cord are to be severed immediately adjacent to the terminals or splices. The flexible cord is to be subjected, for 1 minute, to a pulling force equal to the weight of the suspended portion of the luminaire head plus 10 pounds (4.6 kg) or 35 pounds (15.9 kg), whichever is greater. The pull is to be applied in a direction perpendicular to the plane of the surface through which the flexible cord enters the enclosure.

72.3 Test results are acceptable if the pull is not transmitted to the terminals, splices, or internal wiring, where strain on the connections would result.

73 Strain Relief Test – Lamp-Supported Lampholders and Exposed Wires or Cords

73.1 General

73.1.1 A strain relief means for a wire of a lamp-supported lampholder or an exposed wire or cord that is not relied upon to limit motion of the luminaire assembly, or non-enclosed wiring for segmented, movable, or adjustable connectors described in item c of the Exception to 32.1, shall be subjected to the test described in 73.2.1 and shall comply with the test results in 73.1.2. A strain relief means for an exposed wire or cord that is relied upon to limit motion of the luminaire assembly shall be subjected to the test described in 73.3.1 and shall comply with the test results in 73.1.2.

Exception: This test is not required to be conducted on a strain relief means in a Class 2 circuit.

73.1.2 Test results are acceptable if the pull is not transmitted to the terminals, splices, or internal wiring, where strain on the connections would result.

73.2 Lamp-supported lampholder and exposed wires or cords

73.2.1 The conductors supplying the lamp-supported lampholder or exposed wire or cord that is not relied upon to limit motion of the luminaire assembly shall be subjected to a pulling force of 20 pounds (89 N) for 1 minute. The pull is to be applied in a direction perpendicular to the plane of the surface through which the wires enter the enclosure.

73.3 Exposed wires or cords used to limit luminaire motion

73.3.1 The exposed wires or cords that limit luminaire motion shall be subjected to a pulling force as specified in (a) or (b):

a) For a strain relief device which is independent of the conductor connections for the strain relief means, the conductors are to be severed immediately adjacent to the terminals or splices. The wire is then to be subjected to a pulling force of 20 pounds (89 N) for a period of 1 minute; or

b) For a strain relief device which depends upon the conductor connections for the strain relief means, the wire with un-severed conductors are subjected to a pulling force of 35 pounds (155 N) for a period of 1 minute.

The pull is to be applied in a direction perpendicular to the plane of the surface through which the wires enter the enclosure.

74 Glass Thermal Shock/Containment Test

74.1 General

74.1.1 In accordance with Exception No. 2 of 41.2, a glass material shall be subjected to the glass thermal shock/containment test described in 74.2.1 – 74.2.3 to determine its suitability for use as a lamp containment barrier. The test results shall comply with 74.2.4.

74.2 Test method

74.2.1 Each of three samples of the lamp containment barrier material to be tested is to be supported by its outer edges and oriented as it would be during normal operation. The lamp containment barrier material is to be maintained at a temperature of 25 ±5°C (77 ±9°F).

74.2.2 Three arc tube segments, as specified in Table 74.1, are to be preheated to 1100°C (2012°F) for a minimum of 15 minutes.

Table 74.1
Quartz arc tube test segments

Lamp wattage	Outside diameter		Wall thickness		Length	
	Inch	(mm)	Inch	(mm)	Inch	(mm)
150 or less	0.55	14.0	0.040	1.0	1/4	6.4
151 to 400	0.85	21.6	0.049	1.24	1/4	6.4
Greater than 400	1.0	25.8	0.07	1.9	1/2	12.7

74.2.3 Each arc tube segment is then to be removed from the oven and, within 2 seconds, placed on the thinnest part of each lamp containment barrier. Each arc tube segment is to be placed on the barrier such that the longitudinal axis of the cylinder is perpendicular to the plane of the barrier.

74.2.4 The results are acceptable if none of the samples of the glass lamp containment barrier material shatter or crack.