UL 1574

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Track Lighting Systems

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UL Standard for Safety for Track Lighting Systems, UL 1574

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Revisions: This Standard contains revisions through and including September 14, 1999.

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The new and revised requirements are substantially in accordance with UL's Bulletin(s) on this subject dated April 5, 1999. The bulletin(s) is now obsolete and may be discarded.

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This Standard consists of pages dated as shown in the following checklist:

Page	Date
1	April 14, 1999
2	May 24, 1995
3-5	September 14, 1999
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61-66	May 24, 1995
67	July 6, 1995
68-68B	September 14, 1999

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 24, 1995

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated May 24, 1995 and July 6, 1995. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Approved as ANSI/UL 1574-1989, August 16, 1989
Approved as ANSI/UL 1574-1996, September 23, 1996

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction which conflict with specific requirements of the Standard cannot be judged to comply with the Standard. A product employing materials or having forms of construction not addressed by this Standard may be examined and tested according to the intent of the requirements and, if found to meet the intent of this Standard, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

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 70-1993. The track lighting systems covered by this standard are rated:

a) 300 volts or less;

b) 150 volts or less to ground; and

c) 50 amperes or less.

1.1.2 Lighting track is intended to be permanently installed and permanently connected to a branch circuit not exceeding 277 volts, nominal to ground, and 50 amperes.

1.1.2 added September 14, 1999

1.2 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) fixture 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.

1.3 These requirements do not cover:

a) Busways intended for lighting, receptacles, or other general-purpose adaptors covered by the Standard for Electric Busways and Associated Electrical Fittings, UL 857, and intended for use in accordance with Article 364 of the National Electrical Code, NFPA 70-1993; or

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

1.4 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.

1.5 A track lighting fixture assembly that uses a tungsten-halogen lamp shall also comply with the applicable requirements from the Standard for Incandescent Lighting Fixtures, UL 1571.

1.5 effective November 25, 1996

1.6 A track lighting fixture assembly that uses a fluorescent lamp shall also comply with the applicable requirements from the Standard for Fluorescent Lighting Fixtures, UL 1570.

1.6 effective November 25, 1996

1.7 A track lighting fixture assembly that uses a high-intensity-discharge lamp shall also comply with the applicable requirements from the Standard for High Intensity Discharge Lighting Fixtures, UL 1572.

1.7 effective November 25, 1996

1.8 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements to determine that the level of safety as originally anticipated by the intent of this standard is maintained. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard shall not be judged to comply with this standard. Where appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

1.8 revised September 14, 1999

2 Units of Measurement

2.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

2.2 Unless indicated otherwise, all 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.

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

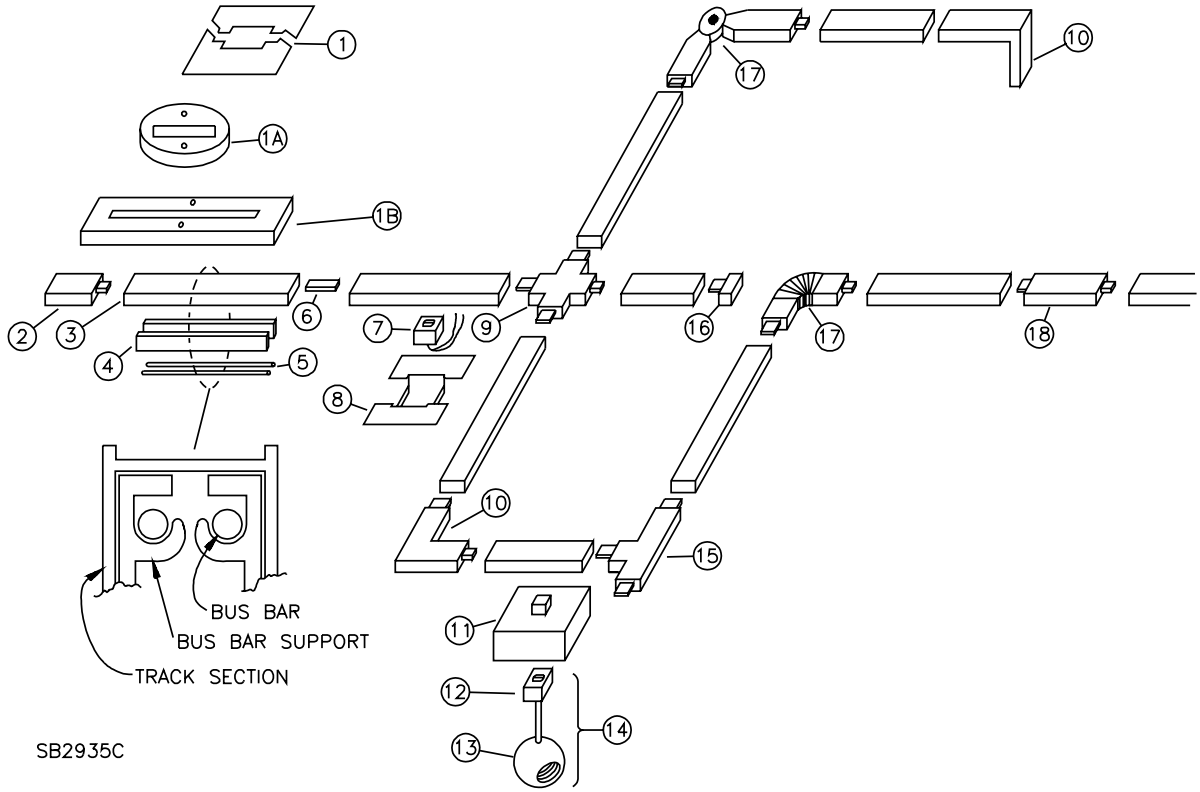
3.3 ADAPTOR – A component of a fixture assembly intended to mate with a track and provide mechanical securement and electrical connection.

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 supply connection for fixture 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.

Figure 3.1
Electrical fittings in a typical track system

Figure 3.1 revised April 14, 1999



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 3.17)

3 – Track (see 3.43)

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 3.22)

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 3.34)

12 – Adaptor (see 3.3 and 3.20)

13 – Fixture head (see 3.21)

14 – Fixture assembly (see 3.20)

15 – T-shaped intercept connector (see 3.23)

16 – End cap (see 3.16)

17 – Adjustable intercept connector (see 3.23)

18 – Center feed connector (see 3.9)

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 fixture 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 fixture 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 source of supply.

3.10 CLASS 2 CIRCUIT – A low-voltage circuit supplied by:

a) A transformer that complies with Class 2 requirements in the Standard for Class 2 and Class 3 Transformers, UL 1585; or

b) A power supply that complies with the Class 2 requirements in the Standard for Class 2 Power Units, UL 1310.

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 fixture assembly circuit.

3.14 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 42.4 volts peak and the continuous current flow through a 1500-ohm resistor exceeds 5 milliamperes.

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

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

3.17 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.

3.18 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.

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

3.20 FIXTURE ASSEMBLY – An assembly consisting of a fixture head and an adaptor.

3.21 FIXTURE 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.

3.22 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.

3.22.1 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.

3.22.1 added September 14, 1999

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.

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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″ for incandescent fixtures or a ″fluorescent tube″ for fluorescent fixtures, 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 fixture assembly. Lamp-supported lampholders are usually constructed to accept lamps with prong connectors.

3.28 LOW-VOLTAGE CIRCUIT – A circuit that operates at 30 volts or less and that is electrically isolated from the primary of a transformer.

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

3.30 OPEN HOLE – An opening without a cover or similar closure material.

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

3.32 PART – A generic term used to refer to any nonelectrical segment of an electrical fitting.

3.33 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.

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

3.35 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.

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

3.36 effective November 25, 1996

3.37 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.

3.38 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.

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

3.40 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.

3.41 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.

3.42 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.

3.43 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 fixture assemblies is accomplished through the open bottom.

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

3.45 TRACK SYSTEM – A complete assembly that includes a track network, mounting hardware, and one or more fixture 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 need not comply with a specific requirement that:

a) Involves a feature or characteristic not needed 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 recognized rating established for the intended conditions of use.

4.4 Specific components are recognized as being 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 for which they have been recognized.

CONSTRUCTION – TRACK SYSTEMS

5 Assembly

5.1 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 32.2 and 80.1 need not be prewired prior to being shipped from the factory.

5.2 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 fixtures may have provision for making electrical connections if the adaptor complies with Section 51, Pendant Fixture Adapter.

6 Packaging

6.1 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 81.4 with a marking that is visible during installation or mounting of the track.

7 Enclosures

7.1 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 7.2 for a track network and 39.1 for a fixture assembly.

7.2 An enclosure for a track network as specified in 7.1 shall be constructed of:

a) Metal; or

b) A polymeric material that complies with the requirements in 7.5.

7.3 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 7.5.

7.4 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.

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

a) The requirements in Table 7.1;

b) The requirement in 7.6;

c) The Normal Temperature Test described in Section 53;

d) The Impact Test described in Section 60; and

e) The Mold Stress Relief Test described in Section 56.

Exception No. 1: A small part as described in 7.7 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 7.1 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.

Table 7.1
Network polymeric material requirements

Table 7.1 revised September 14, 1999

Properties					
		Resistance to ignition		Electrical	
Applications	Minimum flammability class[a]	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.

7.6 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 7.7 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.

7.7 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.

7.8 A knockout in an enclosure of metal or polymeric material shall comply with the Security of Knockout Test described in Section 55.

8 Corrosion Protection

8.1 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.

9 Joining of Enclosure Parts

9.1 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 fixture may be turned, but no more than 200 degrees in either direction (for a total of 400 degrees).

9.2 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.

10 Prevention of Wire Damage

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

10.2 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 10.3.

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.

10.3 A bushing used to comply with 10.2 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.

11 Wire and conductors

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

11.2 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.

11.3 A conductor for a fixture assembly (including bonding and grounding conductors) shall be no smaller than No. 18 AWG (0.82 mm ^{2}).

Exception: Wire smaller than No. 18 AWG may be used if connected to a Class 2 circuit.

11.4 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.

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

12 Network Conductors

12.1 General

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

12.1.2 A conductor shall be of copper or copper alloy.

12.1.3 A bus bar and all conductors in a connector (including grounding and bonding conductors) shall be sized in accordance with Table 12.1.

Exception: A bus bar or conductor need not be sized in accordance with Table 12.1 if it complies with the requirements in Section 70, Direct-Current Bus Bar or Conductor Resistance Test.

Table 12.1
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)
15 or 20	12	0.081	2.05	0.0051	3.29
30	10	0.102	2.59	0.0082	5.29
40	8	0.128	3.25	0.0130	8.39
50	6	0.184	4.67	0.0206	13.29

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

12.2 Pigtail leads

12.2.1 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 12.2.

Table 12.2
Minimum wire gage for track system current rating

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

13 Splices and Connections

13.1 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 16.1; and

c) Electrically and mechanically secure.

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

13.1 revised September 14, 1999

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

14 Current-Interrupting Devices

14.1 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.

14.2 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.

15 Switches

15.1 The ampere rating of a switch other than a general-use alternating-current switch shall be multiplied by a derating factor of one-sixth for incandescent lamps and one-half for inductive loads (such as transformers or ballasts) before consideration of its current-handling capability for the specified load.

Exception No. 1: The ampere rating of an "L" rated switch need not be multiplied by a derating factor.

Exception No. 2: An adaptor need not comply with this requirement unless the contacts are being used as a switch as noted in 15.2.

15.2 An adaptor that:

a) Is constructed and intended to provide the switching function for a fixture 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.

16 Accessibility of Current-Carrying Parts

16.1 A current-carrying part shall be made inaccessible to unintentional contact by persons during intended use, including relamping, by material specified in Section 7, Enclosures, for track systems and Section 39, Enclosures, for fixture assemblies, as applicable. A component is considered inaccessible to unintentional contact if it complies with 16.2 and 16.3.

Exception No. 1: A current-carrying part need not be inaccessible if the part:

a) Involves a voltage of less than 30 volts; and

b) Is connected to the secondary circuit of a transformer that is electrically isolated from the primary of the transformer.

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 fixture is marked in accordance with 82.7; 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.

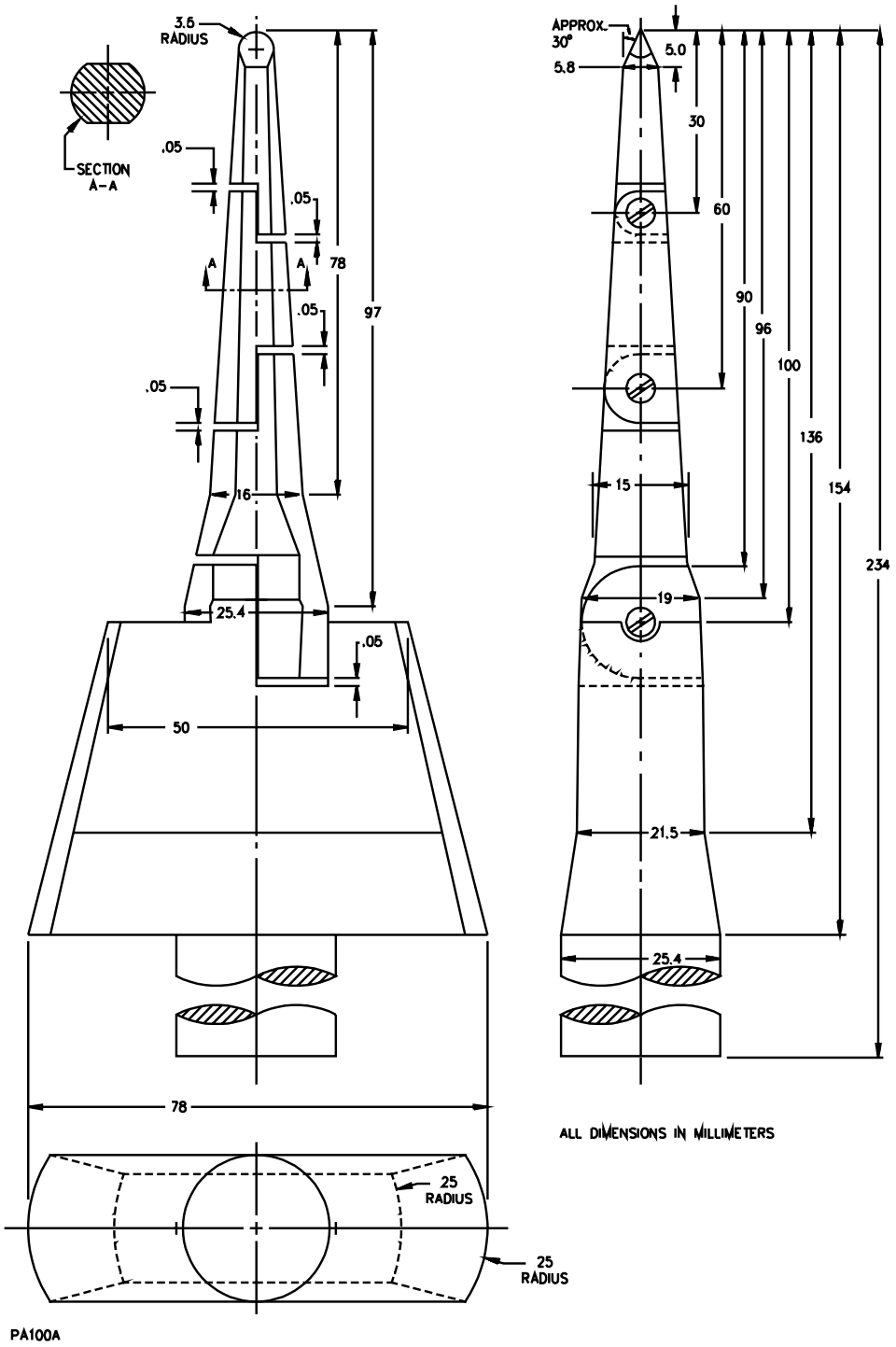
Exception No. 5: Lampholder leads that are 2 inches (50.8 mm) or less in length and insulated in accordance with 11.2 need not be inaccessible.

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.

16.2 An uninsulated live part is considered inaccessible if a probe as illustrated in Figure 16.1 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.

16.3 With respect to the requirement in 16.2, 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 16.1
Articulate probe with web stop



17 Spacings

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

17.2 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.

17.2 revised September 14, 1999

17.3 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 a branch circuit 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 the Field Track Cutting Test described in Section 62.

17.3 revised September 14, 1999

18 Polarity

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

18.2 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 fixture assembly.

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

18.4 The mechanical means required in 18.1 for maintaining polarity of the components in a track system (for example, a keying ridge or protrusion) shall meet the requirements of the Mechanical Polarity Test in Section 68.

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

18.6 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 81.3.

19 Segregation of Circuits

19.1 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 fixture adaptor rated 120 volts may be insertable into a track rated 30 volts or less.

20 Bonding

20.1 Each conductive part that:

a) Is accessible to persons, as determined by application of the accessibility probe illustrated in Figure 16.1;

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.

20.2 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.

20.3 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.

20.4 The bonding system shall comply with the Grounding Resistance Test described in Section 52.

20.5 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 7, Enclosures, for track networks or Section 39, Enclosures, for fixture assemblies and accessories; and

b) Section 56, Mold Stress Relief Distortion Test, for thermoplastics relied on for structural integrity.

20.6 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 80.1.

20.7 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 52.3.4, the adjustment of the fixture head shall be performed in the loosest condition possible without jeopardizing the integrity of the assembly.

20.7 revised September 14, 1999

20.8 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).

20.9 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.

21 Grounding Means

21.1 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.

21.2 A pressure wire terminal intended for the field connection of an equipment grounding conductor shall comply with the requirements in 23.1 and shall be plainly identified by being marked in accordance with 81.2.

21.3 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.

21.4 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.

21.5 With reference to 21.1, 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.

22 Supply Connection Means

22.1 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.

22.2 The requirement in 22.1 precludes the use of a flexible cord as a means of connecting the track to a branch circuit wiring system.

22.3 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 22.1;

b) A split single-phase circuit (120/240 volts, single-phase, 3-wire with grounded neutral), as illustrated in Figure 22.2; or

c) A polyphase circuit (208Y/120 volts, 3-phase, 4-wire), as illustrated in Figure 22.3.

Table 22.1 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 22.1
120-volt system

Figure 22.1 revised April 14, 1999

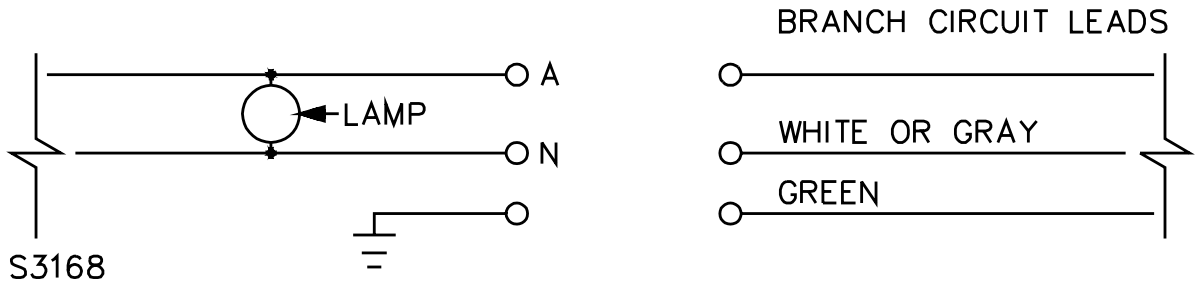


Figure 22.2
120/240-volt system

Figure 22.2 revised April 14, 1999

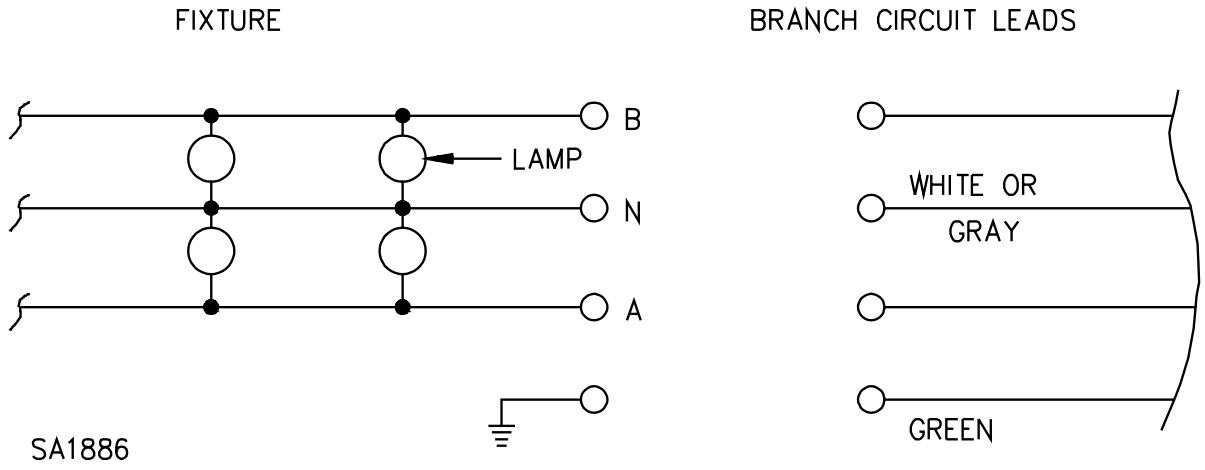


Figure 22.3
120/208-volt system

Figure 22.3 revised April 14, 1999

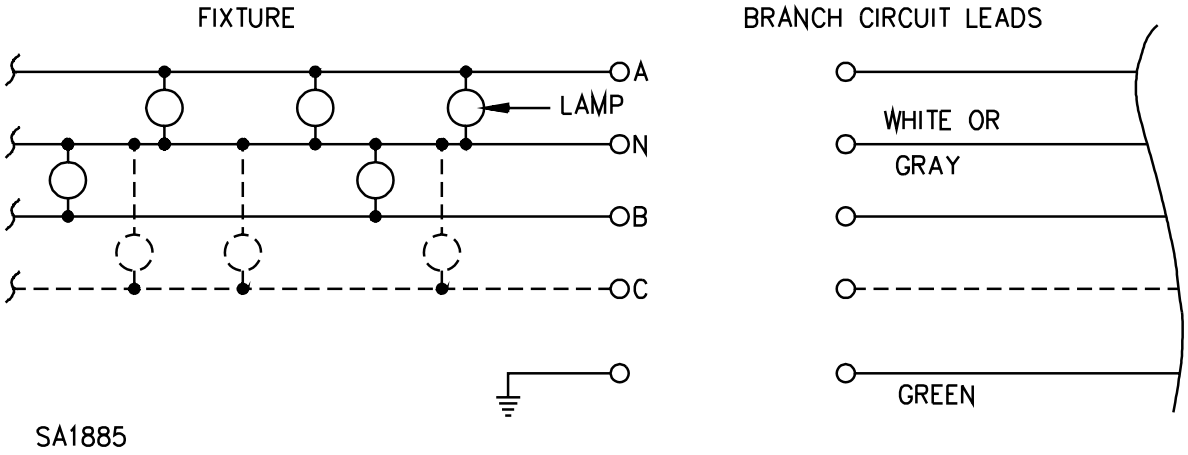


Table 22.1
Multiwire systems

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

23 Wiring Terminals

23.1 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 UL 486E. A terminal shall be sized to accept the wire required in Table 12.2.

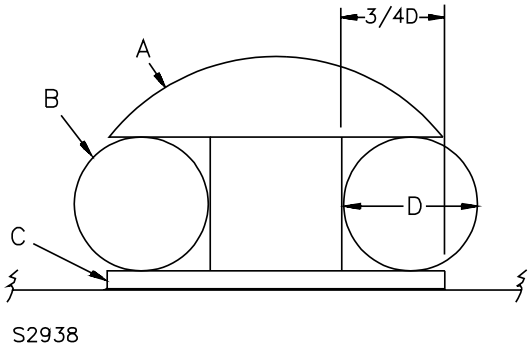
23.2 A terminal employing a screw or similar fastening means that is used for connections inside a feed connector shall have a head and a baseplate that covers at least three-quarters of the conductor. The relationship of the head of the fastening means and the baseplate to the conductor is illustrated in Figure 23.1.

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 23.1 need not be investigated for compliance with this requirement.

Figure 23.1
Terminal-conductor relationship

Figure 23.1 revised April 14, 1999



A – Screw

B – Conductor

C – Baseplate

D – Diameter of Conductor

23.3 A wire binding screw shall not be used to secure a wire larger in size than No. 10 AWG (5.3 mm^2).

23.4 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.

23.5 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.

24 Wiring Compartment Volume

24.1 If a connector is provided with pigtail leads for connection to the power supply where the connection occurs within the connector, a field wiring compartment shall be provided that has at least 2.25 cubic inches (36.9 cm^3) for each supply wire that terminates inside the compartment. One or more grounding conductors are treated collectively as one conductor.

24.2 The volume without an obstruction to be counted in determining the 2.25 cubic inches (36.9 cm^3) required per lead shall include a minimum of 1/2 inch (12.7 mm) in any direction.

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25 Conduit Connection

25.1 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.

25.2 An opening for the field connection of conduit shall have dimensions as indicated in Table 25.1.

Table 25.1
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.

25.3 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.

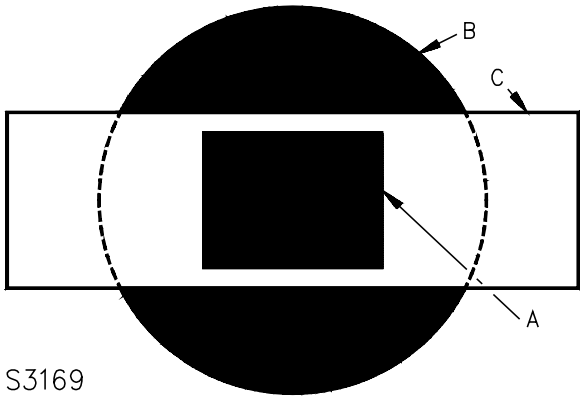
25.4 A connector intended to house supply connection splices shall be provided with an opening to permit access to the supply wiring splices for connection and inspection without removing the track or connector from the mounting surface. The opening shall have a minimum unobstructed dimension of 1 inch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

26 Outlet Box Connection

26.1 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 26.1 or 26.2.

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 26.1
Minimum opening dimensions for inspection of supply connections with access through feed connector



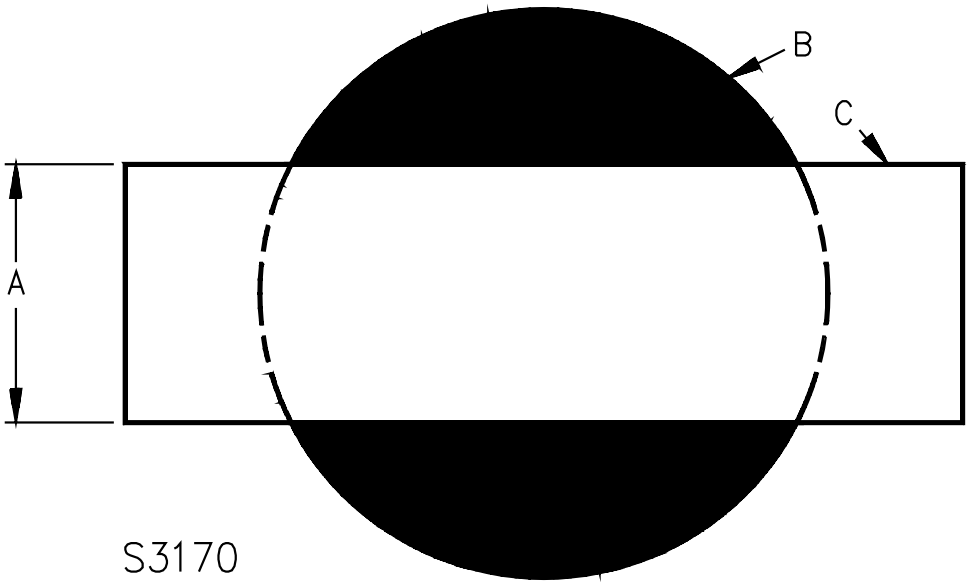
A – Access through feed connector – minimum unobstructed dimensions 1 by 2 inches (25.4 by 50.8 mm).

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

C – Feed connector.

Figure 26.2
Minimum opening dimensions for inspection of supply connections without minimum access opening through feed connector

Figure 26.2 revised April 14, 1999



26.2 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

27 Field Drilling

27.1 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 17, Spacings; and

2) Compliance with the spacing requirements for mounting openings specified in 30.2;

b) Subjected to the Field Drilling Test specified in Section 69; and

c) Provided with installation instructions as described in 83.2.8 and 83.2.9.

28 Mounting Openings

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

28.2 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 27, Field Drilling.

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

29 Mounting Means

29.1 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 described in Section 63 and determined to be equivalent to the mounting means described in (a), (b), or (c).

29.2 Mounting clips, if provided, shall comply with the Track Clip Securement Test described in Section 63.

29.3 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 83, 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 7, Enclosures, for track systems.

29.4 A track system intended for pendant mounting shall comply with the Pendant-Mounted Track Torque Test described in Section 64 and the Pendant-Mounted Track/Connector Strength Test described in Section 66.

30 Field Cutting

30.1 Tracks intended to be field cut shall be:

a) Provided with installation instructions as described in 83.2.7; and

b) Subjected to the test described in Section 62, Field Track Cutting Test.

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

30.3 A track section that is intended to be field cut shall also be evaluated to the field drilling requirements specified in Section 27, Field Drilling.

30.3 effective November 25, 1996

CONNECTORS AND CANOPIES

31 General

31.1 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 7, Enclosures, for track systems. A connector enclosure shall comply with the test results in the Pendant-Mounted Track/Connector Strength Test described in Section 66.

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 the Accessibility of Current-Carrying Parts requirements of Section 16; and

c) The non-enclosed wire or cord is provided with strain relief that complies with Strain Relief Test, Section 72.

31.1 revised September 14, 1999

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

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31.3 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.

31.4 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 described in Section 53.

32 Intercept Connectors

32.1 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 32.2 need not comply with this requirement.

32.2 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 80.1.

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

32.3 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 16, Accessibility of Current Carrying Parts, and it returns to its normal position after flexing.

32.4 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 No. 17 AWG.

Exception: The thickness may be reduced if the coil complies with the Ball Impact Test of 60.3.

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

33 Surface Raceway Connection

33.1 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 84.2 shall be provided with the feed connector to inform the user of the specific surface raceway(s) to be used.

34 Feed Connectors and Canopies

34.1 A section of track provided with a multi-point canopy shall not exceed 24 inches (61 cm) in length.

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 fixture assemblies at a time. A section of track provided with a multi-point canopy shall not exceed 48 inches (122 cm) in length.

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

35.3 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 35.4 and 35.5.

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
Fixture Wire	6	8	17	23
Appliance Wiring Material	6	8	17	23
[a] General building (also known as conductors for general wiring) and fixture wire types are described in the National Electrical Code, ANSI/NFPA 70-1993.				

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

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

35.6 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 12, 26 and 28:

a) The bus bar and conductors may be sized in accordance with 35.3 – 35.5,

b) Openings in the back of the track as specified in 28.2 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 26.1 need not be provided.

35.7 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 7.3 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.

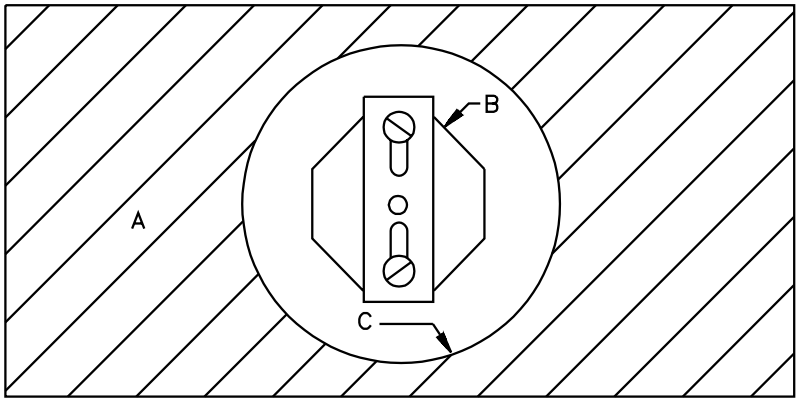
b) For a non-circular opening, the maximum linear dimension (including a diagonal dimension) shall be no greater than 26 inches (66.0 cm), as shown in Figure 35.2.

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).

35.8 A mono-, duo-, or multi-point canopy shall comply with the applicable tests described in Sections 52 – 60, 63, 65, and 68.

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



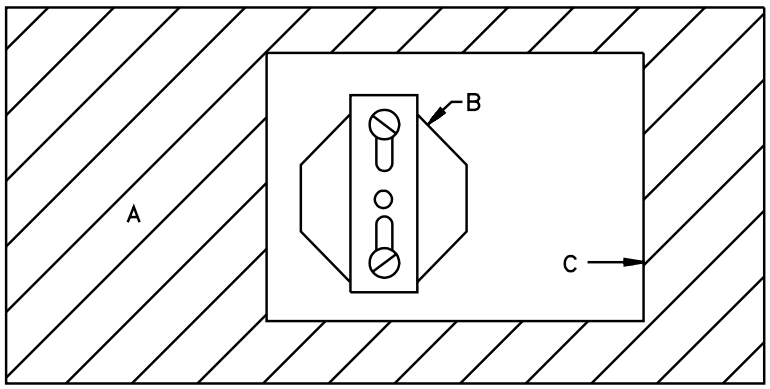
S3320

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



S3321

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 79.4.2.

36.4 A recessed track system marked in accordance with 79.4.1 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 fixture assemblies, shall comply with the Normal Temperature Test in Section 53.

36.5 effective November 25, 1996

36.6 A recessed track system employing recessed fixture assemblies, shall be provided with thermal protection complying with the requirements for thermal protective devices for lighting fixtures 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 53, and the Abnormal Recessed Temperature Test of Section 54, and be marked in accordance with 79.5.1.

36.6 effective November 25, 1996

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 20, 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 fixture if 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 fixture.

38.2 A hook or other hanging device, if packaged separately from the chain-pendant or cable-pendant fixture, 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 as described in Section 75.

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 – FIXTURE ASSEMBLIES

38A General

38A.1 Fixture 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.

Added 38A.1 effective October 14, 2000

39 Enclosures

39.1 All splices, components, wires, and leads shall be enclosed in material that complies with the requirements in 39.2.

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 11.2 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.

39.2 An enclosure as specified in 39.1 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 39.3.

39.3 A polymeric material used as an enclosure for a fixture assembly shall comply with:

a) The requirements in Table 39.1;

b) The requirement in 39.4;

c) The test results in the Normal Temperature Test described in Section 53;

d) The test results in the Impact Test described in Section 60; and

e) The test results in the Mold Stress Relief Distortion Test described in Section 56.

Exception No. 1: A small part as described in 7.7 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 39.1 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 39.1
Fixture assembly polymeric material requirements

Table 39.1 revised September 14, 1999

Properties					
		Resistance to Ignition		Electrical	
Application	Minimum flammability class[a]	Minimum hot wire (HWI)[b] Maximum performance level category	Minimum high ampere (HAI)[b] Maximum performance level category	Minimum dielectric breakdown strength[b] Minimum volts	Comparative tracking index (CTI)[b] 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	HB	–	–	–	–

[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.

39.4 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.

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

40 Lamp Containment Barriers

40.1 A fixture 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 40.2.

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 fixture does not identify the lamp as needing to be enclosed for the orientation of the lamp in the fixture;

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

c) The fixture is marked as specified in 82.11.

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 fixture does not identify the lamp as needing to be enclosed in the fixture; and

c) The fixture is marked as specified in 82.11.

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 fixture.

40.1 effective November 25, 1996

40.2 With reference to 40.1, 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 Polymeric Lamp Containment Barrier requirements in Section 74.

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 described in Section 73.

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.

40.2 effective November 25, 1996

40.3 An enclosure of a fixture head shall comply with the requirements in Section 39, Enclosures, for fixture assemblies.

41 Open Holes

41.1 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 fixture 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 fixture 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.

41.2 An open hole that is provided in an enclosure for miscellaneous purposes shall not exceed the dimensions specified in Table 41.1.

Table 41.1
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.

41.3 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.

42 Splices

42.1 A splice in a fixture head shall comply with the requirements in Section 13, Splices and Connections, and shall be inaccessible during relamping.

Exception: A splice in a low-voltage circuit need not be inaccessible.

42.2 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.

43 Wire and conductors

43.1 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).

43.2 Wires to a lamp-supported lampholder shall be provided with a strain relief device at the fixture 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 described in Section 72.

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.

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

43.4 Stranded wire or cord shall be used for connections to an adjustable, movable, or flexible part of a fixture. 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.

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

44 Cord-Pendant Fixture Assemblies

44.1 If a fixture assembly or fixture 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 fixture or fixture 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 fixture or fixture part weighs 3 pounds (1.36 kg) or less.

44.2 If a length of flexible cord is used to support the fixture from the adaptor, strain relief means that meet the requirements of the Strain Relief Test described in Section 71 shall be provided at each end of the cord.

45 Adapters

45.1 Adaptor contacts shall maintain positive electrical connections. The electrical connections shall comply with the test results in the Adaptor Overload Test described in Section 58.

45.2 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 described in Section 59.

46 Ballasts and Transformers

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

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

46.3 A fluorescent fixture 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 fixture assembly provided with straight tubular lamps may employ simple reactance ballasts which are not rated Class P.

Exception No. 2: A fixture 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.

46.3 effective November 25, 1996

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

46.5 A transformer used in a fixture assembly shall comply with the Standard for Specialty Transformers, UL 506.

Exception: A Class 2 transformer shall comply with the requirements for Class 2 transformers in UL 1585.

47 Fusing

47.1 A fixture 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.

48 Lampholders

48.1 A fluorescent lampholder shall have an electrical rating consistent with the output of the ballast used. Acceptable ballast types are specified in 46.3.

48.2 A lampholder for a high pressure sodium lamp shall have a pulse voltage rating of at least the pulse voltage output of the lamp igniter.

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

48.3 added September 14, 1999

49 Capacitors

49.1 General

49.1.1 A fixture 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.

49.1.2 To comply with 49.1.1, 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 49.1, and

C is the capacitor rating in microfarads.

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Table 49.1
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
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.

49.1.3 The requirement in 49.1.1 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.

49.2 Nonintegral oil-filled capacitors

49.2.1 If an oil-filled capacitor in an electric discharge fixture is not integral with the ballast, its characteristics and installation shall comply with 49.2.2 – 49.2.5.

49.2.2 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.

49.2.3 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.

49.2.4 For a liquid-filled capacitor, the placement and mounting of a capacitor in a fixture 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.

49.2.5 In addition to the expansion clearance space specified in 49.2.4, 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.

50 Power Packs

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

50.2 The adaptor for electrical and mechanical connection of the power pack supply to the track shall comply with the requirements in Section 45, Adapters, and Section 60, Polymeric Enclosure Impact Tests.

50.3 The female adaptor for electrical and mechanical connection of the fixture assembly to the power pack shall comply with the requirements in Section 58, Adaptor Overload Test, and Table 39.1.

51 Pendant Fixture Adaptor

51.1 Adaptor contacts shall maintain positive electrical connections. The electrical connections shall comply with the test results in the Adaptor Overload Test described in Section 58.

51.2 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 described in Section 59.

51.3 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.

51.4 An enclosure of an adaptor shall comply with the requirements in Section 60, Polymeric Enclosure Impact Tests.

51.5 An adaptor intended for use with a cord pendant fixture shall comply with 44.1 for intended cord types and weight restrictions, and with Section 71, Strain Relief Test – Cord-Pendant Fixture Head, for strain relief.

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

PERFORMANCE

SYSTEM

52 Grounding Resistance Test

52.1 General

52.1.1 A track lighting system shall have a resistance not exceeding 0.1 ohm when subjected to the grounding resistance test specified in 52.1 – 52.9 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 described in Section 53.

52.1.2 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).

52.2 Electrical fitting measurement

52.2.1 The electrical fittings to be tested shall consist of one sample of the fixture 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 fixture assembly, intercept connector, and feed connector have the highest measured resistance, the resistance is to be measured as specified in 52.3.1 between the points specified in 52.3.2 for intercept connectors, 52.3.3 for feed connectors, and 52.3.4 for fixture assemblies.

52.3 Test method

52.3.1 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).

52.3.2 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.

52.3.3 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.

52.3.4 A sample of each fixture 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 fixture assembly electrical connection point (grounded or ungrounded). The resistance between all dead metal parts of the fixture assembly and power pack, if provided, and each end of the track section is to be measured through the grounding conductor.

52.4 Test setup – Surface mounted track

52.4.1 The track lighting system assembly to be tested is to consist of three intercept connector samples, two feed connector samples, one fixture assembly sample, and four 20-inch (0.51-m) long sections of track. The connectors and fixture assembly samples are to be of the models with the highest measured resistance as specified in 52.2.1. The electrical fittings are to be assembled as shown in Figure 52.1 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 fixture 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

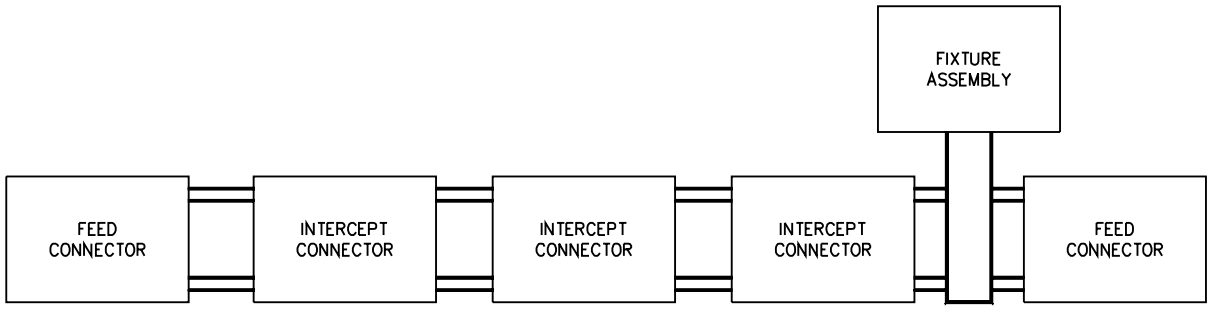
b) 1/2 inch from the connector in the end of the track;

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 52.1
Test assembly

Figure 52.1 revised April 14, 1999



52.5 Test setup – Recessed track

52.5.1 The recessed track lighting system assembly to be tested shall consist of the same electrical fittings as described in 52.4.1 except is installed in a recessed channel. A recessed channel intended for use with recessed fixture assemblies shall be installed in a test box as described in 52.6 and tested in accordance with 52.8 and 52.9. A recessed channel intended for use with non-recessed fixture assemblies shall be installed in a test box described in 52.7.1 and 52.7.2 and tested in accordance with 52.8 and 52.9.

52.5.1 effective November 25, 1996

52.6 Recessed track for recessed fixture assemblies

52.6.1 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.

52.6.1 effective November 25, 1996

52.7 Recessed track for non-recessed fixture assemblies

52.7.1 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.

52.7.1 effective November 25, 1996

52.7.2 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).

52.7.2 effective November 25, 1996

52.8 Unheated condition test

52.8.1 After the test setup has been assembled as shown in Figure 52.1, 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 fixture assembly and one feed connector; and

c) The fixture assembly and the other feed connector.

52.9 Heated condition test

52.9.1 The test assembly is to be subjected to the Normal Temperature Test described in Section 53. 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 52.8.1.

53 Normal Temperature Test

53.1 General

53.1.1 A track lighting system, including mono-, duo-, and multi-point canopies, shall be subjected to the temperature test conditions described in 53.3.1 – 53.4.4 for surface mounted track and 53.5.1 for recessed mounted track. Temperature test results are acceptable if the temperature rises attained do not exceed the values specified in Table 53.1.

53.1.1 effective November 25, 1996

53.1.2 Tests are to be conducted at an ambient temperature of 25 ±5°C (77 ±9°F); the values for temperature rise in Table 53.1 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.

53.1.3 Temperature measurements to determine compliance with Table 53.1 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 53.1
Maximum acceptable temperature rise

Table 53.1 revised September 14, 1999

	Thermocouple location	°C	(°F)
1.	Fuse	65	117
2.	Fiber employed as electrical insulation[a]	65	117
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	225
	b) A diameter of 0.015 inch or more	175	315
4.	Termination of copper conductor and pressure terminal connectors without a nickel coating or equivalent protection	125	225
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	225
11.	Metal ballast enclosure	65	117
12.	Enclosure of a potted, metal-enclosure coil type device; Class 105 insulation system	65	117
13.	Coil of device employing		
	Class 105 insulation system:		
	1. Thermocouple method	65	117
	2. Change of resistance method	75	135
	Class 130 insulation systems:		
	1. Thermocouple method	85	153
	2. Resistance method	95	171
	Class 155 insulation systems:		
	1. Thermocouple method	110	198
	2. Resistance method	115	207
	Class 180 insulation systems:		
	1. Thermocouple method	125	225
	2. Resistance method	140	252
	Class 200 insulation systems:		
	1. Thermocouple method	145	261
	2. Resistance method	160	288
	Class 220 insulation systems:		
	1. Thermocouple method	160	288
	2. Resistance method	175	315
	Class 250 insulation systems:		
	1. Thermocouple method	190	342
	2. Resistance method	205	369
14.	Capacitors[a]		
	a) Electrolytic	40	72
	b) Other types	65	117
15.	Varnished cloth insulation[a]	60	108
16.	Wood	65	117
17.	Aluminum or unplated copper lampholder screw shell, center contact, or other connecting device	175	315
18.	Track housing	65	117

Table 53.1 Continued on Next Page

Table 53.1 Continued

Thermocouple location	°C	(°F)
19. Recessed channel		
1. Intended for use with non-recessed fixture assemblies	65	117
2. Intended for use with recessed fixture assemblies	125	225
3. Recessed test box	65	117

[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 Sections 7 and 39.

[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.

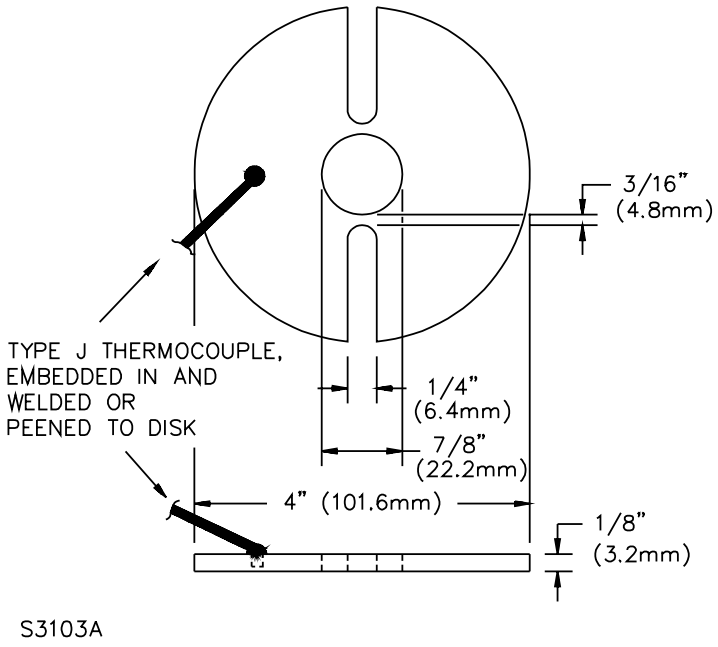
[e] Any temperature rise up to 150°C (302°F) is acceptable if consistent with the marking on the feed connector as specified in 81.5. The temperature probe is specified in 53.1.4.

53.1.4 With regard to the supply wire temperature limits specified in Table 53.1 (8), a copper temperature probe as illustrated in Figure 53.1 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 53.1
Temperature probe for supply wire temperatures

Figure 53.1 revised April 14, 1999



53.1.5 Thermocouples are to consist of wires no larger than No. 24 AWG (0.21 mm^2) and no smaller than No. 30 AWG (0.05 mm^2). It is standard practice to employ thermocouples consisting of No. 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 Table of Limits of Error of Thermocouples, ANSI MC96.1-1982.

53.1.6 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.

53.1.7 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).

53.1.8 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.

53.2 Temperature test conditions – HID fixture assembly

53.2.1 When subjected to a temperature test, an HID fixture assembly shall be provided with a nominal system consisting of a ballast, capacitor, and lamp combination that complies with 53.2.2 and 53.2.3. A fixture 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 53.2.3.

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

53.2.2 A nominal system for an HID fixture assembly shall be a combination of components such that, when connected to the supply voltage rated for the ballast and measured as specified in 53.2.3, 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.

53.2.3 To determine whether a ballast, capacitor, and HID lamp combination is considered to be a nominal system, the components are to be installed in a fixture and the fixture is to be operated in a 25 ±5°C (77 ±9°F) ambient temperature while connected to a rated supply voltage source. A nominal system is considered to exist when the measured lamp wattage after the wattage stabilizes (generally within 15 minutes) is within ±5 percent of the marked rating of the lamp. Otherwise, to be considered a nominal system, the ballast supply voltage may be adjusted to cause the lamp to operate at the marked lamp wattage.

53.2.4 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.

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53.3 Fixture assemblies measurement

53.3.1 A representative sample of each model of fixture assembly to be tested shall have thermocouples attached at the locations specified in Table 53.1 and at other locations as applicable (such as components of a power pack). Each fixture 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 52.4.1. An adjustable fixture head is to be positioned to cause the highest temperatures on the track section and then repositioned to cause the highest temperatures on the fixture head. If a single position results in the highest temperature on both the track section and the fixture head, the measurement need only be conducted with the fixture head in that position. If the fixture head is provided with accessories, the fixture assembly temperature measurement is to be conducted with the accessories and with the fixture head and accessories positioned to cause the highest temperatures on the fixture head.

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

53.3.2 Each fixture assembly is to be provided with a lamp that is rated for the wattage specified by the lamp replacement marking described in 82.1 – 82.3 at the voltage specified by the electrical rating for the track system as described in 77.1.

53.3.3 Each fixture assembly and track section, as specified in 53.3.1, is then to be connected by a feed connector to a 60-hertz supply circuit adjusted to the rated voltage specified in 77.1.

53.4 Test setup – Surface mounted track

53.4.1 The test setup is to be the same as the one used for the Grounding Resistance Test specified in Section 52 but with three additional fixture assemblies installed in the center of the track sections that did not have a fixture 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 53.4.3 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 fixture assembly. The test setup for a multi-point canopy with track 24 inches (61 cm) or less in length is one fixture, and with track 48 inches (122 cm) or less in length is two fixtures.

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

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

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

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

However, three fixture 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, fixture head, and power pack. For any number of models and types of fixture assemblies, only three fixture assemblies are to be installed.

53.4.3 For a track system, a load(s) is (are) to be connected across the leads or terminals of one feed connector as shown in Figures 53.2 and 53.3 such that the total current drawn by the fixture 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 53.2
Power supply connection example – two-circuit track network with no current flowing in the ungrounded conductor

Figure 53.2 revised April 14, 1999

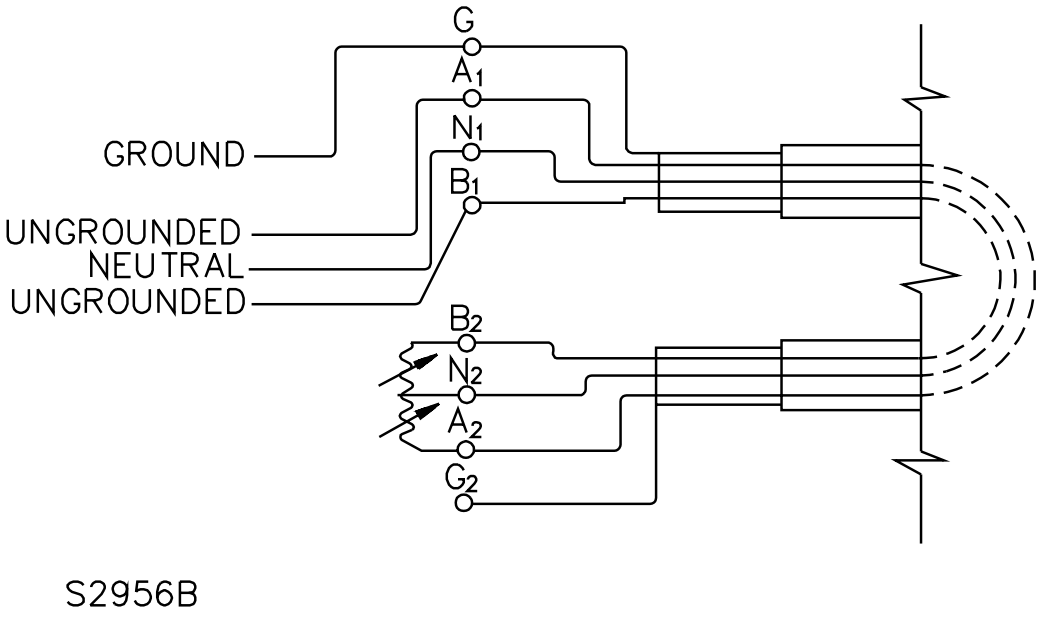
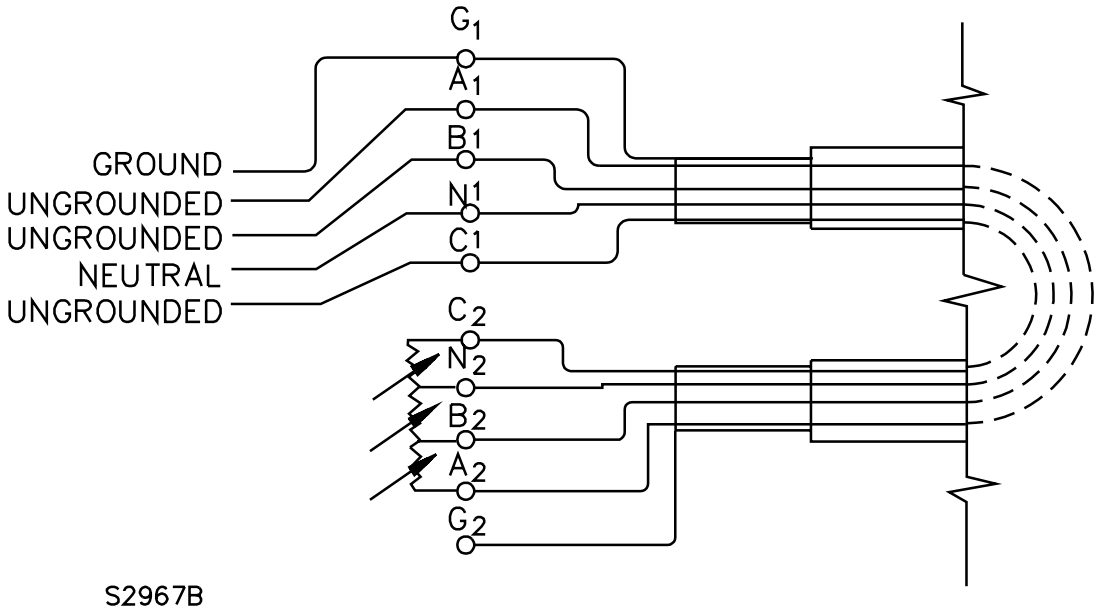


Figure 53.3
Power supply connection example – two-circuit track network with current flowing in the ungrounded conductor

Figure 53.3 revised April 14, 1999



53.4.4 The track system assembly is to be energized and operated until the temperatures stabilize as specified in 53.1.3, and, while still energized, the temperatures are to be measured as specified in 53.1.3.

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53.5 Test setup – Recessed mounted track

53.5.1 The test setup is to be the same as described in 53.4.1 – 53.4.4 except the recessed channel is installed in the appropriate test box as specified in Section 52, Grounding Resistance Test, for recessed mounted track. See 52.5.1, 52.7.1, and 52.7.2 for recessed track intended for use with non-recessed fixture assemblies, and 52.5.1 and 52.6.1 for recessed track intended for use with recessed fixture assemblies. Four fixture 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 fixture assembly center to center spacing, the recessed channel and track length shall be reduced to maintain the specified spacing. See 82.12 for recessed fixture assembly marking requirement.

53.5.1 effective November 25, 1996

54 Abnormal Recessed Temperature Test

54.1 A recessed track system intended for use with recessed fixture assemblies and marked in accordance with 79.5.1, shall be assembled and installed with the same components as described in Section 53, Normal Temperature Test, except as described in 54.2 – 54.5.

54.1 effective November 25, 1996

54.2 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.

54.2 effective November 25, 1996

54.3 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).

54.3 effective November 25, 1996

54.4 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 fixture assembly lamps are de-energized and temperatures attained on parts of the fixture 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).

54.4 effective November 25, 1996

54.5 If the thermal protector does not trip within 3 hours and the temperatures on parts of the fixture 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.

54.5 effective November 25, 1996

TRACK NETWORKS

55 Security of Knockout Test

55.1 A knockout in an enclosure of metal or polymeric material shall be subjected to the test described in 55.2 and shall comply with the test results in 55.3.

55.2 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.

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

56 Mold Stress Relief Distortion Test

56.1 A thermoplastic part as described in Section 7, Enclosures, for track systems, and Section 39, Enclosures, for fixture assemblies, and 20.5 shall be subjected to the test described in 56.2 and shall comply with the test results in 56.3.

56.2 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 56.1, 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 56.3.

56.3 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 17, 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 16.1;

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 20.5 shall comply with a repeated Grounding Resistance Test as described in Section 52.

57 Insulation Resistance Test

57.1 The insulation resistance between:

a) Conductors of opposite polarity; and

b) Conductors and grounded metal;

is to be measured using a megohmmeter.

57.2 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.

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

57.4 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.

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

58 Adaptor Overload Test

58.1 An adaptor shall be subjected to the overload test described in 58.2 and 58.3 and shall comply with the results in 58.4.

58.2 A section of track is to be connected to a source of supply as described in 53.3.3. The track is to be grounded through a 1-ampere fuse. Six samples of each type of fixture adaptor are to be connected one at a time to a tungsten load adjusted to draw 150 percent of the rated current of the fixture adaptor.

58.3 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.

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

59 Adaptor Tests

59.1 Strength of adaptor

59.1.1 An adaptor shall be tested as described in 59.1.2 and 59.1.3 and shall comply with the test results in 59.1.4.

59.1.2 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 fixture adaptor.

59.1.3 The fixture 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 fixture assembly, but no less than 10 pounds (4.5 kg), is to be suspended from the adaptor for 1 minute.

Exception: A fixture adaptor 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 82.10.

59.1.4 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 17, Spacings; and

b) The bus bars and live components are rendered not accessible as determined by using the probe illustrated in Figure 16.1.

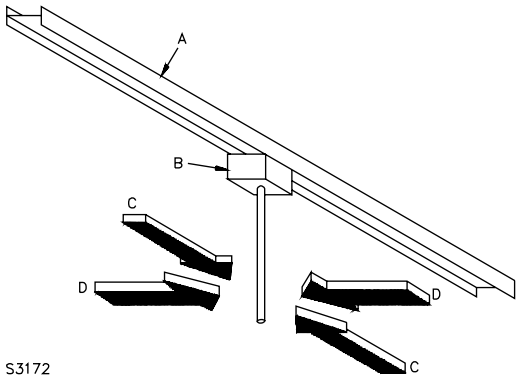
59.2 Adaptor moment

59.2.1 An adaptor is to be subjected to the test described in 59.2.2 and 59.2.3 and shall comply with the test results in 59.1.2.

59.2.2 The adaptor and stem, fixture, or other rigid object (for example, a fixture 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 59.1.2.

59.2.3 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 59.1.

Figure 59.1
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.

59.2.4 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 17, Spacings; and

c) The bus bar or live components are considered not accessible, as determined by using the probe illustrated in Figure 16.1.

60 Polymeric Enclosure Impact Tests

60.1 General

60.1.1 A polymeric enclosure of a fixture assembly shall be subjected to the drop impact test described in 60.2 and shall comply with the results in 60.1.2. A polymeric enclosure of a track network shall be subjected to the ball impact test described in 60.3 and shall comply with the results in 60.1.2.

60.1.2 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 17, Spacings;

b) Uninsulated live parts or internal wiring becoming accessible to contact, as determined by the accessibility probe described in 16.1;

c) A reduction in wire or cord insulation thickness to values below the minimum values specified in 43.1; and

d) A reduction in the effectiveness of strain relief means, as determined by the strain relief test described in Section 71 or 72.

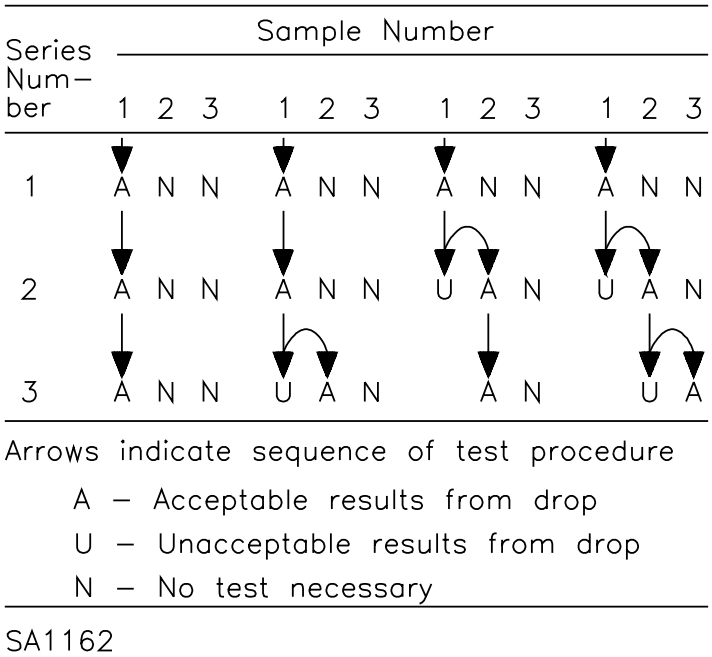
60.2 Drop impact test

60.2.1 Each of three samples of the fixture 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.

60.2.2 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 60.1. 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 60.1
Procedure for impact test

Figure 60.1 revised April 14, 1999



60.3 Ball impact test

60.3.1 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.

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

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60.3.3 The hardwood surface specified in 60.3.2 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.

60.3.4 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).

60.3.5 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.

61 Conductor Displacement Tests

61.1 General

61.1.1 Each track section to be subjected to the tests described in 61.2.1 and 61.3.1 shall be previously untested and conditioned. The track sections tested shall comply with the test results in 61.2.2 and 61.3.2, respectively.

61.2 Horizontal conductor displacement test

61.2.1 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.

61.2.2 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.

61.3 Vertical conductor displacement test

61.3.1 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.

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

62 Field Track Cutting Test

62.1 The means used to field cut a section of track shall be tested as described in 62.2 and shall comply with the test results in 62.3.

62.2 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.

62.3 Test results are acceptable if:

a) The bus bar complies with the spacings in the Exception to 17.3; and

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

63 Track Clip Securement Test

63.1 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 63.2 and 63.3. The clip shall comply with the test results in 63.4.

63.2 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.

63.3 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.

63.4 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 17, Spacings; and

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

64 Pendant-Mounted Track Torque Test

64.1 Track for which stem pendants are manufactured shall be subjected to the test described in 64.2 and 64.3 and shall comply with the test results in 64.5.

64.2 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.

64.3 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.

64.4 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.

64.5 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 17, Spacings;

2) Uninsulated live parts or internal wiring becoming accessible to contact as specified in Section 16, Accessibility of Current-Carrying Parts; and

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

65 Strength of Fixture Assembly Test

65.1 A fixture 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 65.2 and shall comply with the test results in 65.3.

65.2 The fixture assembly is to be mounted as described in 59.1.2 and 59.1.3. The 10-pound (4.5 kg) weight is to be suspended from a point as close to the center of gravity of the fixture as possible for 1 minute.

65.3 Test results are acceptable if the fixture 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 17, Spacings; and

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

66 Pendant-Mounted Track/Connector Strength Test

66.1 Each connector type for a track system for which stem pendants are manufactured shall be subjected to the test described in 66.2 and 66.3 and shall comply with the test results in 66.4. 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.

66.2 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 66.1.

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 83.2.6(e).

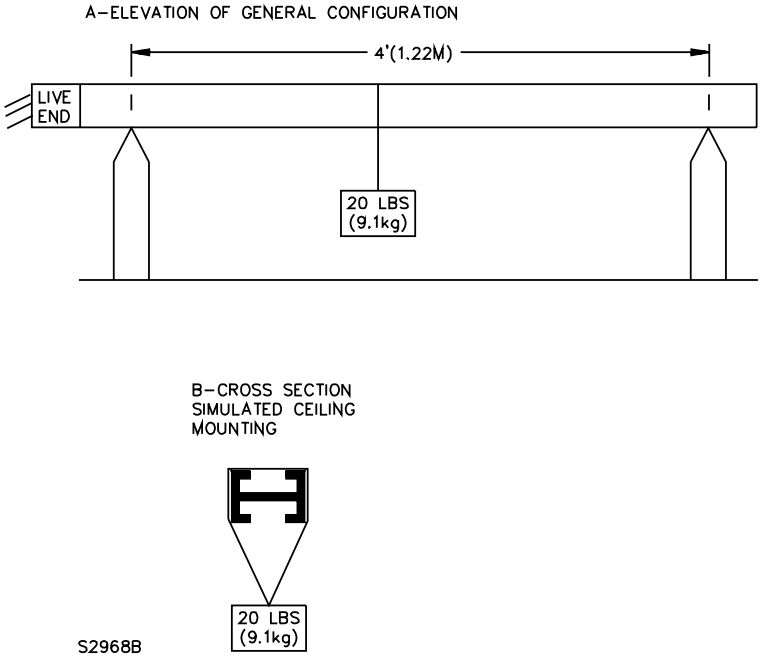
66.3 For an adjustable connector, the test is to be conducted with the track oriented so the applied weight is bearing on the track section in a direction that would tend to promote movement that the connector is not intended to accommodate.

66.4 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 16, Accessibility of Current-Carrying Parts.

Figure 66.1
Pendant-mounted track/connector strength test setup – straight, adjustable, t-shaped, and x-shaped connectors



67 Track Rigidity Test

67.1 A section of track shall be subjected to the test described in 67.2 and shall comply with the test results in 67.3.

67.2 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.

67.3 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 17, Spacings; and

b) Uninsulated live parts or internal wiring becoming accessible to contact, as determined by the accessibility probe described in 16.1.

68 Mechanical Means of Polarity Test

68.1 The mechanical means used to maintain track system polarity shall be tested as described in 68.2 – 68.4 and shall comply with the test results in 68.5.

68.2 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.

68.3 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.

68.4 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.

68.5 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 17, Spacings.

69 Field Drilling Test

69.1 A track intended to be field drilled as described in 27.1 shall be subjected to a field drilling test as recommended by the manufacturer in accordance with the installation instructions.

69.2 Test results are acceptable if, at the completion of the test, spacings are not reduced below the minimum spacing values specified in Section 17, Spacings, when mounting hardware is mounted in the drilled hole, connectors and adaptors are installed, and any other condition of use is performed.

70 Direct-Current Bus Bar or Conductor Resistance Test

70.1 With reference to the Exception of 12.1.3, a bus bar or conductor shall be subjected to the test described in 70.2 – 70.8 and shall comply with the requirements in 70.9.

70.2 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.

70.3 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.

70.4 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.

70.5 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 70.8). 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).

70.6 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).

70.7 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.

70.8 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.

70.9 Test results are acceptable if the measured values do not exceed the values specified in Table 70.1.

Table 70.1
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

FIXTURES

71 Strain Relief Test – Cord-Pendant Fixture Head

71.1 The strain relief means at each end of the flexible cord on a cord-pendant fixture head shall be subjected to a pulling force as specified in 71.2 and shall comply with the test results in 71.3.

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

71.2 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 fixture 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.

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

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

72.1 General

72.1.1 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 fixture assembly, or non-enclosed wiring for segmented, movable, or adjustable connectors described in item c of the Exception to 31.1, shall be subjected to the test described in 72.2.1 and shall comply with the test results in 72.1.2. A strain relief means for an exposed wire or cord that is relied upon to limit motion of the fixture assembly shall be subjected to the test described in 72.3.1 and shall comply with the test results in 72.1.2.

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

72.1.1 revised September 14, 1999

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

72.2 Lamp-supported lampholder and exposed wires or cords

72.2.1 The conductors supplying the lamp-supported lampholder or exposed wire or cord that is not relied upon to limit motion of the fixture 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.

72.2.1 effective November 25, 1996

72.3 Exposed wires or cords used to limit fixture motion

72.3.1 The exposed wires or cords that limit fixture 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.

73 Glass Thermal Shock/Containment Test

73.1 General

73.1.1 In accordance with Exception No. 2 of 40.2, a glass material shall be subjected to the glass thermal shock/containment test described in 73.2.1 – 73.2.3 to determine its suitability for use as a lamp containment barrier. The test results shall comply with 73.2.4.

73.2 Test method

73.2.1 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).

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73.2.2 Three arc tube segments, as specified in Table 73.1, are to be preheated to 1100°C (2012°F) for a minimum of 15 minutes.

Table 73.1
Quartz arc tube test segments

Table 73.1 effective November 25, 1996

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

73.2.3 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.

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

74 Polymeric Lamp Containment Barrier

74.1 General

74.1.1 These requirements apply only to that part of a lamp containment barrier (as defined in 3.26) that is of a polymeric material and is intended to be provided in a fixture in a location where particles from a ruptured metal halide or tungsten-halogen lamp are likely to drop to and rest.

74.1.1 effective November 25, 1996

74.1.2 In accordance with Exception No. 1 of 40.2, a polymeric material shall be subjected to the plastic flammability/containment test described in 74.2.1 – 74.2.4 to determine its suitability for use as a lamp containment barrier.

74.1.3 The polymeric lamp containment barrier is to be rated for the maximum temperature at which the fixture is intended to operate and with the maximum wattage of the lamp that the barrier is intended to contain.

74.1.3 effective November 25, 1996

74.1.4 A polymeric material used to form the lamp containment barrier shall comply with 74.1.2 and the polymeric enclosure requirements in 39.3.

Exception: The polymeric material need not comply with 39.3 if it does not serve as an enclosure in accordance with Section 39, Enclosures, for fixture assemblies.

74.2 Test method

74.2.1 Three sections, each a minimum of 6 inches (152.4 mm) square and obtained from different samples of the lamp containment barrier to be tested, are to be supported by their outer edges and oriented as they would be during normal operation. A surface located 12 inches (305 m) below the test samples is to be covered by a layer of dry absorbent cotton that is nominal 1/4 inch (6.4 mm) thick.

74.2.2 During the test, each sample of the lamp containment barrier material is to be heated to and maintained at the maximum operating temperature for each thickness of material recorded when tested in accordance with the Normal Temperature Test described in Section 53.

74.2.3 Three arc tube segments, as specified in Table 73.1, are to be preheated to 1100°C (2012°F) for a minimum of 15 minutes.

74.2.4 Each arc tube segment is then to be placed on the barrier such that the longitudinal axis of the cylinder is perpendicular to the plane of the barrier. The transfer of each arc tube segment from the oven to the surface of the containment barrier shall not exceed 2 seconds.

74.2.5 The results meet the intent of the requirement when, during the testing of the samples:

a) The dry absorbent cotton located below the test sample is not ignited by flaming drips of plastic material; or

b) No arc tube segment penetrates the lamp containment barrier material and falls on the cotton.

74.2.5 revised September 14, 1999

FITTINGS

75 Hook Test

75.1 A hook or other hanging device described in 38.1 is to be tested as described in 75.2 and shall comply with the test results in 75.3.

75.2 The hook or other hanging device is to be mounted to the center of a 4-foot (1.2-m) long track section as intended and the track is to be supported at each end. A weight equal to 150 percent of the maximum weight load for the hook recommended by the manufacturer is to be suspended from the hook for 5 minutes.

75.3 Test results are acceptable if the weight load does not distort the track or hook in a manner that would result in:

a) Reduction of electrical spacings; or

b) Deterioration of the mounting means of the accessory.

MANUFACTURING AND PRODUCTION – LINE TESTS

76 Production-Line Dielectric Voltage-Withstand Test

76.1 Each fixture assembly that contains wiring through a stem, arm, tubing, or the like, more than 1-1/2 inches (38.1 mm) long is to be tested using a voltage source of 60 hertz essentially sinusoidal potential applied between live parts and exposed dead metal parts of the fixture assembly.

76.2 To determine whether a fixture assembly complies with 76.3, the test is to be conducted using a 500 volt-ampere or larger capacity transformer, the output voltage of which is essentially sinusoidal and can be varied. The applied potential is to be increased from zero until the required test level is reached, and is to be held at that level for 1 second. The increase in the applied potential is to be at a substantially uniform rate, as rapid as is consistent with correct indication of its value by a voltmeter.

Exception: The test time may be 1 minute if the test is conducted at 1000 volts.

76.3 When tested as described in 76.1 and 76.2 each fixture assembly shall withstand without breakdown a test potential of 1000 volts plus twice the rated voltage of the track assembly.

RATINGS

77 General

77.1 The electrical rating of a feed connector shall include the voltage, frequency, and branch circuit current. The branch circuit current rating is to be 15, 20, 30, 40, or 50 amperes. The branch circuit voltage rating shall be:

a) 120 volts, 2 circuit;

b) 120/240 volts, single phase, 3-wire with grounded neutral;

c) 208 Y/120 volts, 3-phase, 4 wire; or

d) 480 Y/277 volts, 3-phase, 4 wire.

77.1 revised September 14, 1999

77.2 Track systems rated greater than 20 A shall have the track and fixture assemblies marked in accordance with 79.1.3 and 82.13.

77.2 added September 14, 1999

MARKING

GENERAL

78 Markings

78.1 Any marking required in Sections 79 – 82 that is enclosed by quotation marks shall be worded exactly as it appears in the standard.

78.2 All required markings on an electrical fitting shall be legible and permanent, and if a pressure sensitive label, shall comply with the Standard for Marking and Labeling Systems, UL 969.

78.3 Each electrical fitting or part packaged and sold individually (including a stem, canopy, or the like) shall be marked with:

a) The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product may be identified;

b) The catalog number of the electrical fitting;

c) The date or other dating period of manufacture not exceeding any consecutive three months; and

d) Any other applicable markings as specified in Sections 79 – 82.

Exception No. 1: Individual mounting means (such as screws and clips) need not be marked.

Exception No. 2: The date of manufacture may be abbreviated or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer provided that the code:

a) Does not repeat in less than 20 years; and

b) Does not require reference to the production records of the manufacturer to determine when the product was manufactured.

Exception No. 3: With reference to (c), a part packaged and sold individually need not be provided with the date or other dating period of manufacture.

78.4 If a manufacturer produces or assembles one model of electrical fitting at more than one factory, it shall have a distinctive marking, which may be in code, by which it may be identified as the product of a particular factory. The code of one factory may be the absence of a factory identification marking.

TRACK NETWORKS

79 Track

79.1 General

79.1.1 Each track section shall be marked on one end of a track section where visible after installation ″CAUTION – To reduce the risk of fire and electric shock, use only fixture assemblies marked for use with _____ track.″ The blank space is to be filled in with the manufacturer's name and the series number of the track.

79.1.2 A track system intended for use on a branch circuit exceeding 120 volts nominal between conductors shall be marked on the track "Not for use in dwellings" where readily visible during installation.

79.1.2 added September 14, 1999

79.1.3 A track system rated greater than 20 A shall be marked "Heavy-Duty Lighting Track – Suitable for ___Amp Branch Circuits". The blank space shall be filled with the appropriate ampere rating.

79.1.3 added September 14, 1999

79.2 Clip-mounted track

79.2.1 A track section designed only for use with mounting clips shall be marked ″For clip mounting only.″

79.3 Non-pendant track

79.3.1 A track section intended only for non-pendant mounting shall be marked ″Do not pendant mount this track such as by stems or wires.″

79.4 Recessed track

79.4.1 A recessed track system intended for use in poured concrete as specified in 36.4 shall be marked ″Suitable for use in poured concrete.″

79.4.2 A recessed track system intended to be an integral part of a building construction (for example, the recessed track is an integral part of a suspended ceiling grid) as specified in 36.3 shall be marked ″For use in _____ _____.″ The first blank is to be filled in with the name of the manufacturer making the building structural component. The second blank is to be filled in with the model number or other descriptive name of the building structural component.

79.5 Recessed track for recessed fixture assemblies

79.5.1 A recessed track channel for recessed fixture assemblies and intended for installation in a wall or ceiling cavity where thermal insulation is spaced at least 3 inches (76.2 mm) away from the recessed channel as specified in 36.6 and is marked ″WARNING – Risk of Fire. Do Not Install Insulation Within 3 Inches of Recessed Channel In Such A Manner To Entrap Heat″ or equivalent. In addition, a recessed track channel for recessed fixture assemblies shall be marked where readily visible after installation ″NOTICE – Thermally protected track (or fixtures). Blinking lighting may indicate insulation too close to track (or other condition causing overheating).″

79.5.1 revised September 14, 1999

80 Intercept Connectors

80.1 An ″X″ or ″T″ shaped intercept connector shall be marked ″WARNING – RISK OF FIRE AND ELECTRIC SHOCK. THIS PRODUCT REQUIRES PROPER FIELD WIRING AND IS INTENDED TO BE INSTALLED BY A QUALIFIED ELECTRICIAN ONLY″ on the smallest unit package under any of the following conditions:

a) The connector is provided with breakaway ground tabs as described in the Exception to 20.6.

b) The connector is not prewired as described in 32.2.

c) The connector is prewired but intended for use in the field where it may be rewired by a qualified electrician.

81 Feed Connectors

81.1 Each feed connector shall be marked with its electrical rating.

81.2 A pressure wire terminal intended for the connection of an equipment grounding conductor shall be marked adjacent to the terminal ″GROUND″, ″GRND″, or ″GND″. The electrical symbol for grounding, ⏚ alone is acceptable if a statement is provided in the instruction manual that defines the symbol.

81.3 In place of color identification as described in 18.6, a wiring terminal intended for the connection of a supply conductor may be identified as shown in Table 81.1. Installation instructions as described in Section 83 shall illustrate the proper connection of supply conductors and shall define each terminal marking.

81.4 A marking shall be provided where visible during installation or mounting of the track on the smallest unit packaging of the canopy. The marking on the canopy shall identify the model numbers of the feed connector to be used with the canopy.

81.5 A feed connector and canopy shall be marked where visible before or during installation in letters 1/8 inch (3.2 mm) high, ″For supply connections use wire rated for at least ____°C (____°F)″, in which the ″(____°F)″ is optional and the blank space is filled with the marked temperature specified in Table 81.2.

Exception: If the marked temperature specified in Table 81.2 for a feed connector or canopy is 60°C (140°F), the marking need not be provided on the connector or canopy.

Table 81.1
Supply terminal identification markings

Terminal	Acceptable markings
Equipment grounding conductor	GND, GRND, GROUND
Grounded conductor (neutral)	N[a], NEUT, NEUTRAL
Supply conductor	Any marking other than those used for the grounded and grounding conductors

[a] The single letter ″N″ may be used to denote the neutral terminal if the statement specified in 84.4 is included in the instruction manual.

Table 81.2
Temperature markings

Temperature attained at point of connection of supply wires		Marked temperature	
Rise[a]			
°C	(°F)	°C	(°F)
35 or less	63 or less	60	140
36 – 50	65 – 90	75[b]	167[b]
51 – 60	92 – 108	85[b]	185[b]
61 – 65	110 – 117	90[b]	194[b]
66 – 85	119 – 153	110[c]	230[c]
86 – 100	155 – 180	125[c]	257[c]
101 – 125	182 – 225	150[c]	302[c]

[a] From Table 53.1, item 8.

[b] Warning marking required, see 81.6.

[c] Marking required, see 81.7.

81.6 A feed connector and canopy marked in accordance with the requirements in 81.4 for supply connections rated more than 60°C (140°F) but no more than 90°C (194°F) shall be marked ″WARNING – RISK OF FIRE. MOST DWELLINGS BUILT BEFORE 1985 HAVE SUPPLY WIRE RATED 60°C. CONSULT A QUALIFIED ELECTRICIAN BEFORE INSTALLING.″ The marking shall be in letters 1/8 inch (3.2 mm) high:

a) On or by a tag attached to the feed connector and canopy; and

b) On or in the packaging of a feed connector and canopy where visible without opening the packaging.

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81.7 A feed connector and canopy marked in accordance with the requirements in 81.4 for supply connections rated greater than 90°C (194°F) shall be marked on both the feed connector and canopy where readily visible during installation and on the box, ″Not for use in dwellings.″ If the marking is concealed by a carton or similar construction, the carton shall also be marked.

FIXTURE

82 Fixture Assemblies

82.1 An incandescent fixture assembly shall be marked where visible during relamping ″CAUTION – (TO REDUCE THE) RISK OF FIRE.(,) USE ONLY ____ TYPE LAMP(S), ____ WATTS MAX(IMUM).″ The first blank space is to be filled in with the correct lamp type(s) (for example: A, B, T, R, PAR). The second blank space is to be filled in with the lamp wattage(s) with which the fixture assembly was tested. The use of the wording in parentheses in the marking is optional.

82.2 Fixtures that employ fluorescent lamps shall be marked where visible during relamping ″WARNING – Risk of fire. Use only lamps rated ____ watts.″

Exception: The marking is not required when the portable fixture assembly employs a Class P Ballast.

82.2 revised September 14, 1999

82.3 An HID fixture assembly shall be marked where visible during relamping with the replacement lamp wattage and ANSI designation for which the ballast is rated, as specified in Table 82.1, with the wording specified in 82.1.

Exception No. 1: A fixture intended for use with a lamp that has no ANSI lamp designation may be marked with the lamp wattage, type (H, M, or S), and voltage.

Exception No. 2: A fixture need not be marked with the ANSI lamp designation or lamp type if the fixture:

a) Is of an open lamp construction and marked in accordance with 82.4 and 82.11; or

b) Is of an enclosed lamp construction that complies with the lamp rupture requirements in 40.1 and is marked in accordance with 82.4.

82.4 A fixture that complies with Exception No. 2 of 82.3 may be marked: ″For use with max(imum) ____ watts for Type H, ____ watts for Type M, and ____ watts for Type S lamps only.″ The letters in parentheses are optional. Where the lamp wattage is the same for more than one lamp type and where one or more lamp types are not intended for use with a fixture, the marking may be adjusted accordingly. For example, ″For use with max ____ watts for Type H and M lamps only.″

82.5 The markings required in 82.1 and 82.7 shall have the word ″CAUTION″ in letters at least 3/32 inch (2.4 mm) high, and the other wording in the marking in letters at least 1/16 inch (1.6 mm) high.

82.6 A fixture assembly shall be marked ″CAUTION – To reduce the risk of fire and electric shock, use only with _____ _____ track system″. The first blank space is to be filled in with the manufacturer's name. The second blank space is to be filled in with the series number of the track.

82.7 A fixture assembly that uses a double-ended tungsten-halogen lamp shall be marked where visible after installation ″CAUTION – To reduce the risk of electric shock, remove from track before relamping.″

82.7 revised September 14, 1999

82.8 If the temperature rise measured on the enclosure surface during the Normal Temperature Test described in Section 53 exceeds 65°C (117°F) but does not exceed 125°C (225°F), the fixture assembly shall be marked with the word ″CAUTION″ and the following or the equivalent: ″Hot surface. Keep away from curtains and other combustible materials″ in letters at least 1/16 inch (1.6 mm) high. The marking shall be located on an internal or external surface where visible after installation and relamping.

Table 82.1
ANSI Lamp designations

Wattage	Mercury vapor	Low pressure sodium	Metal halide	High pressure sodium
18	–	L69	–	–
35	–	L70	–	S76
40	H45	–	–	–
50	H45	–	–	S68
55	–	L71	–	–
70	–	–	M85	S62
75	H43	–	–	–
90	–	L72	–	–
100	H38	–	M90	S54
125	H42	–	–	–
135	–	L73	–	–
150	–	–	M81	S55[a]
150	–	–	–	S56[b]
175	H39	–	M57	–
180	–	L74	–	–
200	–	–	–	S66
250	H37	–	M58	S50
310	–	–	–	S67
400	H33	–	M59	S51

[a] 55 volt lamp.
[b] 100 volt lamp.

82.9 Deleted September 14, 1999

82.10 A fixture not intended to be wall mounted as specified in the Exception of 59.1.3 shall be marked where visible during installation ″FOR USE WITH CEILING-MOUNTED TRACK ONLY″.

82.11 A fixture that complies with the Exception No. 1 or No. 2 of 40.1 shall be marked where visible after installation ″CAUTION – To reduce risk of fire, do not use lamp identified for use in enclosed fixtures only.″

82.11 effective November 25, 1996

82.12 A recessed fixture assembly intended for use with a recessed track system shall be marked with its minimum spacing to adjacent fixture assemblies.

82.12 effective November 25, 1996

82.13 A fixture assembly intended for use on a track system rated greater than 20 A shall be marked “Heavy-Duty Fixture Assembly – Suitable for ___ Amp Branch Circuits”. The blank space shall be filled with the appropriate ampere rating.

82.13 added September 14, 1999

INSTRUCTIONS

83 Installation Instructions

83.1 General

83.1.1 An instruction sheet shall be provided with the smallest unit package or carton that contains an electrical fitting. The instruction sheet shall include the installation instructions specified in 83.2.1 – 85.6 as applicable to the electrical fitting(s) with which the sheet is shipped. The important safety instructions required in 86.1 may be included on the same sheet.

83.2 Track

83.2.1 The instructions provided with each track section shall include the information specified in 83.2.2 – 83.2.6 and the Important Safety Instructions specified in Section 86.

83.2.2 Each instruction sheet shall have the title ″INSTALLATION INSTRUCTIONS″ printed on it in letters at least 3/16 inch (4.8 mm) high. All other lettering on the instruction sheet shall be in letters at least 1/16 inch (1.6 mm) high.

83.2.3 The instructions provided with each track section shall contain the following notices:

a) READ ALL OF THESE INSTALLATION INSTRUCTIONS BEFORE INSTALLING THE TRACK SYSTEM.

b) SAVE THESE INSTRUCTIONS AND REFER TO THEM WHEN ADDITIONS TO OR CHANGES IN THE TRACK CONFIGURATION ARE MADE.

83.2.4 For the purposes of identifying and correlating electrical fittings of a track system, the model or catalog number of the track shall be referred to as the ″series″ number of the track system.

Exception: The manufacturer may substitute a brand name or other descriptive name in place of the track series number.

83.2.5 The instructions included with a track section shall:

a) Identify the track system series number or name and the track model or catalog number; and

b) Specify that the track is only to be used with other electrical fittings identified for use with the track system.

83.2.6 The installation instructions shall include a statement indicating that the track system is not intended for use with a power supply cord or convenience receptacle adaptor and, where applicable, the following information:

a) This track system is to be supplied by either:

1) A single branch circuit (such as a 120-volt circuit; a 120/240-volt, single-phase, 3-wire circuit with a ground neutral; or a 208/120-volt, 3-phase, 4-wire circuit; or

2) A multiple branch circuit if the grounded conductors of the track system are not connected together.

b) The (mounting clips or screws) are to be mounted every ____ inches or ____ feet (millimeters, or meters) along the track.

c) The stems are to be mounted every _____ inches or _____ feet (millimeters or meters) along track.

d) The track is not intended to be pendant mounted such as by a stem or cable.

e) Pendant-mounted track intended to be installed by the stems only are not to be mounted by cable.

83.2.7 The installation instructions of a track that is intended to be field cut shall include provisions for:

a) Removal of burrs after cutting;

b) Shortening the bus bar;

c) The cutting depth that a tool is to be set at if a cutting tool is provided; and

d) The minimum and maximum distance that the bus bar can be cut back from the edge of the bus bar insulation.

Exception: Provisions for shortening the bus bar need not be included in the installation instructions if, after cutting the track, spacings are provided as described in 17.3.

83.2.8 The installation instructions of a track that is intended to be field drilled shall include provisions for:

a) Using the drill guide;

b) Identifying the size of drill bit to be used for field drilling of holes; and

c) Removing burrs after drilling.

83.2.9 The installation instructions of a track that is intended to be field drilled shall include the following or the equivalent: ″A single section of track that is 4 feet (1.22 m) or less in length is to be provided with one mounting opening spaced a maximum of 6 inches (152.4 mm) from each end of a track section. Additional openings may be provided. A single section of track that is greater than 4 feet (1.22 m) in length is to be provided with a mounting opening spaced a maximum of 12 inches (300 mm) from each end of the track section with additional openings being provided a minimum of every 4 feet (1.22 m) along the length of the track section.″

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83.2.10 The mounting means of a track intended to be mounted only by means of clips shall be described in the instruction manual.

84 Feed Connectors

84.1 The installation instructions for a feed connector shall describe the proper method of making connections to a power supply, including the proper method of connecting the grounding means.

84.2 The instructions for a feed connector intended for use with surface raceway as described in 33.1 shall include the following: ″For use with surface raceway ____ only″. The blank is to be filled in with the manufacturer's name and the model or catalog number of the surface raceway.

84.3 If the electrical symbol for grounding is used to denote the equipment grounding conductor as described in 81.1, a statement showing the symbol and definition shall be provided in the instruction manual.

84.4 If a single letter ″N″ is used to denote the neutral terminal as shown in Table 81.1, a statement showing the marking and definition shall be provided in the instruction manual.

85 Connectors, Fixture Assemblies, and Miscellaneous Electrical Fittings

85.1 The instructions provided with each connector, fixture, assembly, and miscellaneous electrical fitting shall include:

a) The manufacturer's name and a product description; and

b) Applicable information as described in 85.2 and 85.3.

85.2 The instructions shall include the following notice: ″FOR USE WITH ____ TRACK SYSTEM ONLY″. The blank space is to be filled in with the series number of the track as described in 83.2.4.

85.3 The proper method of mechanically securing and electrically connecting each electrical fitting to the track or to another electrical fitting shall be clearly described.

85.4 An ″X″ or ″T″ intercept connector shall be provided with installation instructions and a diagram that indicate all of the appropriate configurations possible and how the connector is to be wired under any of the following conditions:

a) The connector is not prewired as described in 32.2.

b) The connector is prewired but intended for use in the field where it may be rewired by a qualified electrician.

85.5 An ″X″ or ″T″ intercept connector that is prewired and intended for installation by the consumer shall be provided with installation instructions that detail how the connector is to be installed in the track section. The instructions shall identify the feed connector as appropriate. The instructions shall not include diagrams or information regarding how to rewire the connector.

85.6 The installation instructions for a fixture assembly intended for use with a single-ended tungsten-halogen lamp which does not have an integral outer envelope or reflector, shall have the following notice: ″CAUTION – To reduce the risk of a burn during relamping, remove from the track before relamping.″

85.6 effective November 25, 1996

86 Important Safety Instructions

86.1 Important safety instructions shall be provided with each track section. The height of lettering in the text and illustrations shall be as follows:

a) The phrases ″IMPORTANT SAFETY INSTRUCTIONS″ and ″SAVE THESE INSTRUCTIONS″ shall be in letters at least 3/16 inch (4.8 mm) high.

b) All other lettering shall be at least 1/16 inch (1.6 mm) high.

86.2 The important safety instructions shall include the information specified in 86.3. The information may be reworded or combined in any order as long as the intent is unchanged. The wording may be supplemented but not replaced by drawings or cartoons.

86.3 The important safety instructions shall include the following information:

IMPORTANT SAFETY INSTRUCTIONS

When installing or using this track system, basic safety precautions should always be followed, including the following:

a) Read all instructions.

b) Do not install this track in damp or wet locations.

c) (For track lighting systems other than those that comply with Section 30, Field Cutting) Do not cut any track sections.

d) Do not install any part of a track system less than 5 feet above the floor.

e) Do not install any fixture assembly closer than 6 inches from any curtain, or similar combustible material.

f) Disconnect electrical power before adding to or changing the configuration of the track.

g) Do not attempt to energize anything other than lighting track fixtures on the track. To reduce the risk of fire and electric shock, do not attempt to connect power tools, extension cords, appliances, and the like to the track.

h) (For track lighting systems other than 120 volts, 2-wire) Do not connect a track to more than one branch circuit unless the track is constructed so that it can be used with more than one branch circuit. Check with a qualified electrician. Although the track lighting system may seem to operate acceptably, a dangerous overload of the neutral may occur and result in a risk of fire.

SAVE THESE INSTRUCTIONS

APPENDIX A

Standards for Components

Standards under which components of the products covered by this standard are evaluated include the following:

Title of Standard − UL Standard Designation

Ballasts, Fluorescent-Lamp – UL 935
Flammability of Plastic Materials for Parts in Devices and Appliances, Tests for – UL 94
Lampholders, Edison-Base – UL 496
Marking and Labeling Systems – UL 969
Outlet Boxes, Metallic – UL 514A
Outlet Boxes, Flush-Device Boxes and Covers, Nonmetallic – UL 514C
Polymeric Materials - Fabricated Parts – UL 746D
Polymeric Materials - Long Term Property Evaluations – UL 746B
Polymeric Materials - Short Term Property Evaluations – UL 746A
Polymeric Materials - Use in Electrical Equipment Evaluations – UL 746C
Sleeving, Coated Electrical – UL 1441
Surface Metal Raceways and Fittings – UL 5
Switches, Snap, General-Use – UL 20
Switches, Special-Use – UL 1054
Tape, Insulating – UL 510
Terminal Blocks – UL 1059
Transformers, Specialty – UL 506
Transformers, Class 2 and Class 3 – UL 1585
Tubing, Extruded Insulating – UL 224
Tubing for Electric Wiring, Flexible Nonmetallic – UL 3
Wire Connectors and Soldering Lugs for Use with Copper Conductors – UL 486A
Wire Connectors for Use with Aluminum Conductors – UL 486B
Wire, Flexible Cord and Fixture – UL 62
Wires and Cables, Rubber-Insulated – UL 44
Wires and Cables, Thermoplastic-Insulated – UL 83
Wiring Terminals for Use with Aluminum and/or Copper Conductors, Equipment – UL 486E

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