UL 884

STANDARD FOR SAFETY

Underfloor Raceways and Fittings

UL Standard for Safety for Underfloor Raceways and Fittings, UL 884

Thirteenth Edition, Dated May 20, 2016

Summary of Topics

This revision of ANSI/UL 884 dated April 18, 2024 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

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

The requirements are substantially in accordance with Proposal(s) on this subject dated March 1, 2024.

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Standard for Underfloor Raceways and Fittings

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The most recent designation of ANSI/UL 884 as a Reaffirmed American National Standard (ANS) occurred on April 18, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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

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INTRODUCTION

1 Scope

1.1 These requirements cover metal underfloor duct systems designed for use as raceways for the installation of wires and cables in accordance with the National Electrical Code (NEC), NFPA 70.

1.2 These requirements do not cover rigid or flexible conduit surface raceways or other products of a similar nature that are covered by individual requirements separate from these requirements.

1.3 General compliance of underfloor raceway systems in accordance with the construction and performance requirements in this standard shall be determined by a study of an actual installation of the system or a completely representative sample installation.

2 Undated References

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

3 Units of Measurement

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

CONSTRUCTION

4 General – System

4.1 All boxes, couplings, elbows, bends, duct supports, and other parts of an underfloor raceway system shall be for use with the duct that is provided to form the complete underfloor raceway system. The construction of boxes and fittings shall block the entrance of fresh concrete wherever joints are made in any actual installation (either between sections of duct, or between duct and boxes or other fittings).

4.2 A component of an underfloor raceway system shall comply with the requirements for the construction, performance, and use of that component.

4.3 The materials used for underfloor raceways and fittings shall be compatible with all other materials in the raceway and fittings system.

4.4 Fittings for use with an underfloor raceway system include all devices and accessories, other than junction boxes and the duct itself, that are designed to form a part of the complete system.

4.5 For convenience in these requirements, fittings are divided into three general groups: duct fittings, outlet fittings, both covered in Section 10, and duct supports which are covered in Section 11.

5 Grounding Continuity

5.1 A reliable path for electrical current shall be provided between all parts of a system of duct and fittings when the system is installed in the intended manner.

5.2 The resistance of the connection of a duct with a fitting shall be tested in accordance with the Grounding Continuity Test, Section 14.

5.3 A sheet metal screw shall not be used for the connection of an equipment grounding conductor.

6 Protective Coatings

6.1 Preset inserts and ducts

6.1.1 Each preset insert made of iron or steel and all surfaces of duct that are not specifically excepted in 6.1.2 shall be protected against corrosion by one of the following coatings:

a) A coating of zinc (applied by any method) that complies with the test requirements in 15.1;

b) A metal coating other than zinc but at least as protective as the coating of zinc that is mentioned in (a);

c) A system of organic paint or enamel that evaluation shows to be at least as protective as the coating of zinc mentioned in (a); see 15.2.

d) A system of epoxy coating, which upon evaluation demonstrates the same level of protection as the coating of zinc mentioned in (a); see 15.3.

6.1.2 In the case of zinc-coated sheet-steel duct (zinc applied by any method), a zinc coating is not required at any cut edge or at spot welds.

6.1.3 The edges of holes for preset insets are bare if the holes are cut after the duct is painted or enameled. Paint or enamel is to be added to the edges unless the inserts are made of a zinc-base alloy.

6.1.4 The zinc coating on the inside and outside of finished duct shall be of uniform quality throughout and shall have a smooth and even appearance. Visual inspection shall determine whether duct complies with this requirement.

6.2 Outlet boxes and fittings

6.2.1 A junction box or duct fitting, if made of iron or steel, shall be protected against corrosion by enameling, galvanizing, cementation, plating, or other equivalent means. If constructed of aluminum, it shall have a protective coating of asphalt, varnish, or enamel.

6.2.2 An outlet fitting, if made of iron or steel, shall be protected against corrosion by means of a zinc coating specified in 6.1.1(a) or an equivalently protective coating of another metal.

6.2.3 At any time up to one year from the time of manufacture, an enamel coating on a junction box or fitting shall comply with the requirements in 15.2.

6.2.4 At any time up to one year from the time of manufacture, an epoxy coating on a junction box or fitting shall comply with the requirements in 15.3.

7 Duct

7.1 Duct shall be made of sheet steel. Both inside and outside surfaces of each length of duct shall be cleaned of all scale and rust. The cleaning process shall leave the surface of the duct in a condition that results in the protective coating adhering firmly and having a smooth surface.

7.2 The partitions between cells of a multicellular duct shall not have any openings through which wires or cables are likely to be passed from one cell to another in normal use.

7.3 After cleaning and before the protective coating is applied, the interior surface of each length of duct shall be examined to determine the absence or presence of scale.

7.4 Ordinarily, scale can be identified as a sharply defined edge or a rough surface extending for some distance along the duct, causing a slight but noticeable decrease in the internal dimensions. At the ends of the duct, scale may be identified by scraping the surface of the duct and thus removing the hard, brittle film of the scale.

7.5 Welded seams shall be made so that each length of duct has strength for the conditions of use.

7.6 Duct shall be of dimensions applicable to the size and quantity of wires to be installed in the raceway. Upper corners shall be rounded to a radius (outside) of not less than 3/16 inch (5 mm), except that flush duct need not have its upper corners rounded. See 21.2.

7.7 Duct shall provide a smooth wireway for pulling in wires and cables and shall not have any burrs, fins, or other projections that can damage wiring.

7.8 The thickness of single-celled and multicellular sheet-steel duct and of the sheet-steel partitions between the cells of multicellular duct shall not be less than indicated in Table 7.1.

Table 7.1
Minimum acceptable thickness of sheet-steel duct and partitions

Internal measurements of single-celled duct or individual cells in multicellular duct					Measurement made on duct partition after its fabrication from uncoated sheet steel but before addition of corrosion protection according to 15.1		Measurement made on duct or partition after its fabrication from zinc-coated[a] sheet steel but before any other coating is applied	
Row	Depth	Cross-sectional area	Width	Thickness of covering over duct	inch	(mm)	inch	(mm)
A	Not greater than 4 inches (102 mm)	Not greater than 8 inches^2 (51.6 cm)^2	Not greater than 4 inches (102 mm)	At least 1-1/2 inches (38 mm)	0.042[b,c]	(1.07)[b,c]	0.045[b,d]	(1.14)[b,d]
B	Any duct that is constructed in accordance with 12.2 and Section 13		Not greater than 8 inches (203 mm)	At least 1 inch (25.4 mm) of concrete	0.042[b,c]	(1.07)[b,c]	0.045[b,d]	(1.14)[b,d]
C	Any duct that is other than indicated in row B and whose depth, cross-sectional area, width, and/or thickness of covering is other than as indicated in row A				0.067	(1.70)	0.070	(1.78)

[a] Zinc applied by any method – galvanizing, electroplating, or cementation.

[b] See 20.2.3 – 20.2.5.

[c] Partitions between cells are to be 0.067 inch (1.70 mm) thick.

[d] Partitions between cells are to be 0.070 inch (1.78 mm) thick.

7.9 The means by which partitions between cells in multicellular duct are attached to the duct shall comply with both of the following:

a) The means of attachment shall be smooth and without any projections that can damage wiring.

b) The means of attachment shall remain secure and preclude any damage to the duct or partition during the application of torque as described in Section 12, Torque Test.

Exception: Permanent distortion is acceptable in duct that is constructed in accordance with 12.2.

7.10 Duct with covers intended to be installed with their upper surfaces flush with finished concrete shall be tested to determine that the covers provide mechanical strength and rigidity for the intended use. These covers shall be tested as described in the Rigidity of Cover Test, Section 16.

8 Preset Inserts

8.1 Each insert shall be made of metal and shall not be less than 0.067 inch (1.70 mm) thick if constructed of uncoated sheet steel – 0.070 inch (1.78 mm) if zinc-coated – or shall be formed from the metal of the duct. If a separate insert is attached to the duct, the joint shall be mechanically strong and shall block the entry of fresh concrete. An insert shall be capable of withstanding the Pull Test, Section 17.

8.2 Each insert shall provide a continuous metal passage from the duct or raceway to the underside of the floor covering and shall be constructed to provide a smooth wire-pulling radius without any obstruction(s) within the duct or the outlet.

8.3 Visual inspection is to be made to determine whether an insert complies with the requirements in 8.2.

8.4 Each insert shall be capable of accommodating fittings designed for use with the raceway system in a manner that establishes and maintains continuity of the metal grounding connection between the fitting and the duct.

8.5 If compliance of an insert with the requirement in 8.4 cannot be determined by visual inspection, the bonding in question is to be investigated with particular attention to the reliability and the resistance of joints. See the Grounding Continuity Test, Section 14.

9 Junction Boxes

9.1 There shall be provision for closing each unused duct, conduit, and other opening in a box (see 9.2 for cover plates). The box and its accessory parts shall be constructed to make closures fit tightly and close all joints to exclude fresh concrete from the box. Electrical bonding of all metal parts other than duct or conduit closures to the box shall also be established and maintained. The thickness of a sheet-steel closure for an unused conduit or duct opening shall not be less than indicated in Table 9.1.

Table 9.1
Minimum acceptable thickness of a sheet-steel closure

Use of closure	Measurement made on closure after its fabrication from zinc-coated[a] sheet steel but before any other coating is applied, inch	(mm)	Measurement made on closure after its fabrication from uncoated sheet steel but before addition of corrosion protection according to 6.2, inch	(mm)
For an unused opening not larger than 5 inches^2 (32.3 cm^2)	0.017	(0.43)	0.014	(0.36)
For an unused opening larger than 5 inches^2 (32.3 cm^2)	0.029	(0.74)	0.026	(0.66)

[a] Zinc applied by any method – galvanizing, electroplating, or cementation.

9.2 A box shall be provided with a hand hole or holes located to facilitate access to all of the compartments within the box. A cover plate or its equivalent shall be provided for each hand hole, shall be made of metal, and shall be capable of withstanding the Torque Test, Section 12.

9.3 An underfloor junction box shall be constructed as indicated in Table 9.2. Each interior surface that can be touched by a wire or cable shall be smooth and without any projections that can damage the wire or cable.

Table 9.2
Construction of an underfloor junction box

Material	Type of construction	Thickness
Uncoated sheet steel[a]	Fabricated[a]	The sheet shall be at least 0.067 inch (1.70 mm) thick before fabrication[a].
Galvanized sheet steel[a]	Fabricated[a]	The sheet shall be at least 0.070 inch (1.78 mm) thick before fabrication[a].
Aluminum base alloy containing 0.40 percent or less copper	Die-cast	The finished casting shall be at least 0.094 inch (2.39 mm) thick.
	Cast by a process other than die-casting	The finished casting shall be at least 0.125 inch (3.18 mm) thick.
Zinc-base alloy (see also 20.1.1)	Die-cast	The finished casting shall be at least 0.094 inch (2.39 mm) thick.
Malleable iron	Cast	The finished casting shall be at least 0.094 inch (2.39 mm) thick.
Metal other than mentioned above	Cast	The finished casting shall be at least 0.125 inch (3.18 mm) thick.
[a] Sheet steel is to be used only if evaluation shows the construction to be acceptable for the purpose.		

9.4 A box designed for use with a multiple-duct system shall have an interior construction that entirely and permanently separates the conductors of signaling systems from light and power wires by partitions or barriers. These barriers shall be integral with the box or securely fastened to the box so that there are no projections of screws, nuts, or fasteners within the box. Metal thicknesses shall comply with Table 9.2. The cross section anywhere in a wireway or compartment formed by such barriers:

a) Shall not be smaller in area than 80 percent of the cross-sectional area of the duct itself, and

b) Shall accommodate a rectangle that:

1) Is not smaller in area than 65 percent of the cross-sectional area of the duct itself, and

2) Is at least 3/4 inch (19 mm) high.

Each compartment or wireway shall facilitate wires being pulled through crossovers and around bends without any occurrence of damage.

9.5 A box shall be provided with openings in its sides for the permanent and reliable connection of duct. Each such opening shall be provided with a smooth, round flange or stop on the inside of the box for entrance of the duct for a distance of not less than 1/2 inch (13 mm). In the case of a sheet-metal box, a special duct-connecting fitting may be employed if applicable to the use. The means for attaching duct to a box shall result in thorough mechanical and electrical connection.

9.6 Regarding 9.5, setscrews are an acceptable means for bonding duct to a junction box. If the acceptability of the connection cannot be determined by visual inspection, the bonding in question is to be evaluated with particular attention to the mechanical reliability and electrical resistance of joints and shall be subjected to the Grounding Continuity Test, Section 14.

9.7 Conduit openings in a box shall have end stops for the conduit designed and located to provide smooth, well-rounded inlets for insulated wires. A special conduit-connecting fitting may be used if it is

determined to be applicable. Conduit openings in a cast metal box shall be threaded, in which case each opening shall have no fewer than five full threads to engage the conduit. An unthreaded opening is acceptable if:

a) A special conduit-connecting fitting intended for the particular application is used or

b) The intended size of conduit fits closely in the hole, and the connection is mechanically secure and electrical bonding is reliable. Means other than direct-bearing setscrews shall be provided at unthreaded openings to provide reliable bonding.

10 Fittings

10.1 Duct fittings are intended to be connected to the ends of duct and form a part or an extension of the raceway. These fittings include couplings, elbows and other bends, cross-unders, dead ends, offsets, adapters, conduit extension fittings, Y fittings for duct, blank or tapped washers for duct openings in junction boxes.

10.2 Outlet fittings are those that are used above the outlet openings in duct, in connection with either preset or afterset inserts. Such fittings include floor-outlet inserts, receptacle outlets, receptacle covers, bushed outlets, afterset inserts, insert extensions, flanges, floor markers, insert caps, and insert-marker caps.

10.3 A wiring device cover constructed to support a flush duplex receptacle shall be provided with more than one securement point for the receptacle.

10.4 The interior surfaces of a fitting that wires or cables can touch shall be smooth and free from projections that can damage wiring.

10.5 A duct fitting of malleable iron or die-cast metal shall not be less than 0.094 inch (2.39 mm) thick. Duct fittings of other cast metal shall not be less than 0.125 inch (3.18 mm) thick.

10.6 A duct fitting of sheet steel shall not be less than 0.067 inch (1.70 mm) thick – 0.070 inch (1.78 mm) if zinc-coated.

10.7 There shall be provision for closing each unused duct, conduit, outlet, and other opening in a duct fitting. The duct fitting, and its accessory parts shall be designed and constructed to make closures fit tightly and close all joints to exclude fresh concrete from entering the duct fitting. The thickness of a:

a) Closure fabricated from zinc-coated sheet steel (zinc applied by any method – galvanizing, electroplating, or cementation) shall not be less than 0.029 inch (0.74 mm) after fabrication of the closure but before any other coating is applied;

b) Closure fabricated from uncoated sheet steel shall not be less than 0.026 inch (0.66 mm) after fabrication of the closure but before addition of corrosion protection according to the requirements in Protective Coatings, Section 6;

c) Sheet-steel closure for an unused conduit, outlet, or duct opening shall not be less than indicated in Table 9.1.

Electrical bonding of all metal parts (other than duct or conduit closures to the fittings) shall also be established and maintained.

10.8 A duct fitting (such as a coupling, elbow, or cross-under) intended to hold one end of a section of duct in position shall have mechanical strength that establishes and maintains the intended alignment of

the duct. Such a fitting shall have a cross-sectional area for wires and cables that is not smaller than that of the duct itself.

10.9 A fitting for use with duct shall have provision for the mechanically secure attachment of duct that establishes permanent and reliable electrical bonding. See 9.6.

10.10 Conduit openings in a duct fitting shall comply with requirements in 9.7.

10.11 An outlet fitting shall have strength and rigidity to withstand the abuses to which the fitting is subjected during use. See 10.12 (metal fitting) and 10.13 (polymeric housing).

10.12 A metal outlet fitting is acceptable if the fitting has at least the thickness indicated in Table 10.1.

Table 10.1
Minimum acceptable thickness of metal outlet fittings

Material		Minimum acceptable thickness at any point, inch	(mm)
Cast brass, aluminum cast by a process other than die casting, or nonmalleable cast iron		0.125	(3.18)
Wrought iron, malleable cast iron, die-cast zinc alloy, die-cast aluminum, or extruded aluminum:			
Surface Area	Longest Dimension		
Not over 24 inches^2 (155 cm^2)	Not over 6 inches (152 mm)	0.063	(1.60)
	Over 6 inches (152 mm)	0.094	(2.39)
Over 24 inches^2 (155 cm^2) but not over 144 inches ^{2}(929 cm^2)	Any	0.094	(2.39)
Over 144 inches^2 (929 cm^2)	Any	Evaluation required	
Sheet Aluminum:			
Cover plate (such as receptacle face plate)			
Surface Area	Longest Dimension		
Less than 14 inches^2 (90.3 cm^2)	Less than 5 inches (127 mm)	0.040	(1.02)
	At least 5 inches (127 mm)	0.090	(2.29)
At least 14 inches^2 (90.3 cm^2)	Any	0.090	(2.29)
Parts other than cover plates		0.090	(2.29)
Sheet steel before application of protective coating:			
Cover plate (such as receptacle faceplate)			
Surface Area	Longest Dimension		
Less than 14 inches^2 (90.3 cm^2)	Less than 5 inches (127 mm)	0.030	(0.76)
	At least 5 inches (127 mm)	0.067	(1.70)
At least 14 inches^2 (90.3 cm^2)	Any	0.067	(1.70)
Parts other than cover plate		0.067	(1.70)
Zinc-coated sheet steel		0.070	(1.78)

10.13 A polymeric housing (including a polymeric cover that affords access to live parts) for a receptacle outlet that supports a power wiring device shall comply with the Flame Test, Section 19 and shall comply with the applicable requirements in the Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers, UL 514C. A grounding jumper shall be supplied with the housing for connecting the power wiring device or devices to the metal raceway system enclosure.

10.14 The parts comprising an outlet (in conjunction with either a preset or afterset insert) shall be designed for installation with at least 3/4 inch (19 mm) of concrete above the raceway in the case of duct having a flat top that is not wider than 4 inches (102 mm). The corresponding thickness of concrete shall be at least 1-1/2 inches (38 mm) for a duct having a flat top wider than 4 inches (102 mm).

11 Duct Supports

11.1 A multiple-duct support shall have provision for separating the ducts and maintaining the same spacing between centers of the ducts throughout the system.

11.2 Duct legs and supports shall be provided with nailing holes of a size that accommodates strong concrete nails for securing the support to the form or rough slab during the process of concrete pouring.

11.3 A duct support shall support a load of 200 lbf (890 N or 91 kgf) at any point on the bridge. See 18.1.

PERFORMANCE

12 Torque Test

12.1 To determine whether the mechanical strength of duct is acceptable, one end of a 10-ft (3-m) length of the duct is to be secured in a vise or clamp, and a torque of 200 lb-ft (271 N·m or 27.7 kgf·m) is to be applied for 60 seconds at the free end of the duct by means of a wrench or other gripping device. The duct is not acceptable if any of the following conditions result from the application of torque:

a) Collapse of the duct,

b) Opening of the seam at any point, or

c) Permanent distortion.

12.2 Permanent distortion in a duct is acceptable as a result of the test in 12.1 if:

a) The duct complies with (a) and (b) and the additional Loading Test described in Section 13, and

b) The duct is marked as indicated in 20.2.5.

12.3 Permanent distortion is not acceptable in any duct that is for mounting on supports.

13 Loading Test

13.1 For duct intended and marked for specific installations in accordance with 20.2.5, the following loading test is to be conducted in addition to the Torque Test described in Section 12. A vertical load of 500 lbf (2224 N or 227 kgf) is to be applied for 60 seconds to the center of a cell on a specimen of the duct that is at least 5 ft (1.5 m) long and placed flat on a concrete floor or other solid horizontal surface. In the case of a multicellular duct, the cell that is most likely to deform permanently is the cell that is to be tested. The load is to be applied at a point no closer than 1 ft (305 mm) to one end of the duct. The application means is to be a round solid steel cylinder having a diameter of 2 inches (50.8 mm) with flat ends that are perpendicular to the longitudinal axis of the cylinder. The cylinder is to be stood on end on the duct with its longitudinal axis vertical. The load is to be applied vertically downward through the longitudinal axis of the cylinder by means of a weight or by machine.

13.2 The application of the load shall not result in permanent deformation greater than 1/8 in (3 mm).

14 Grounding Continuity Test

14.1 As specified in 5.1, a fitting is to be assembled to a section of duct in the intended manner, and a direct current of 30 A is to be passed from the duct to the fitting. The resulting drop in potential is to be measured between a point (file mark) on the duct 1/16 inch (1.5 mm) from the connection and a similar point on the fitting. The resistance in ohms is to be determined by dividing the drop in potential in volts by the current in amperes passing through the connection.

14.2 The resistance of the connection of duct with a fitting shall not exceed 0.005 ohm.

15 Protective Coatings Tests

15.1 Zinc

15.1.1 The zinc coating on a specimen cut from finished duct shall not show a bright, adherent deposit of copper after whichever of the following number of immersions in a solution of copper sulphate is applicable to the construction:

a) Two immersions for duct that is marked (see 20.2.6) for installation not on grade and only in concrete;

b) Four immersions for all other duct.

15.1.2 The solution of copper sulphate is to be made from distilled water and the American Chemical Society (ACS) reagent grade of cupric sulphate ($CuSO_4$). In a copper container or in a glass, polyethylene, or other chemically nonreactive container in which a bright piece of copper is present, a quantity of the cupric sulphate is to be dissolved in hot distilled water to obtain a solution that has specific gravity slightly higher than 1.186 after the solution is cooled to a temperature of 18.3°C (65.0°F). Any free acid that might be present is to be neutralized by the addition of approximately 1 g of cupric oxide (CuO) or 1 g of cupric hydroxide [$Cu(OH)_2$] per liter of solution. The solution is to be diluted with distilled water to obtain a specific gravity of exactly 1.186 at a temperature of 18.3°C (65.0°F). The solution is then to be filtered.

15.1.3 The 6-inch (150-mm) specimens are to be cut from a sample length of finished raceway. With prudent attention to health and fire risks, the specimens are to be cleaned with an organic solvent.

15.1.4 Each specimen is to be examined for evidence of damage to the zinc coating, and only specimens that are not damaged are to be selected for use in the test.

15.1.5 The selected specimens are to be rinsed in water, and all surfaces are to be dried with clean cheesecloth. As much of the water as possible is to be removed in the drying operation, because water slows the reaction between the zinc and the solution, thereby adversely affecting the test results. The surface of the zinc is to be dry and clean before a specimen is immersed in the copper sulphate solution. The specimens are not to be touched by hands or anything else that can contaminate or damage the surfaces.

15.1.6 A glass, polyethylene, or other chemically nonreactive beaker having a diameter equal to twice the diameter measured over the specimen is to be filled with the solution of copper sulphate to a depth of not less than 3 inches (76 mm). The temperature of the solution is to be maintained at 18.3 ±1.1°C (65.0 ±2.0°F). One of the selected specimens is to be immersed in the solution and supported on end in the center of the beaker so that not less than 2-1/2 inches (64 mm) of its length are immersed. The specimen is to remain in the solution for 60 seconds, during which time it is not to be moved nor is the solution to be stirred.

15.1.7 At the end of the 60-second period, the specimen is to be:

a) Removed from the beaker,

b) Rinsed immediately in running tap water,

c) Rubbed with clean cheesecloth until any loosely adhering deposits of copper are removed,

d) Dried with clean cheesecloth.

Hands and other damaging and contaminating objects and substances are not to touch the surfaces that were immersed. The part of the specimen that was immersed is to be examined, considering each broad surface separately and disregarding the portions of the specimen within 1/2 inch (13 mm) of any edge cut in the process of specimen preparation.

15.1.8 If the part of the specimen that was immersed has any deposit of bright, firmly adhering copper outside the 1/2 inch (13 mm) portions, an estimate is to be made and recorded of the percentage of each broad surface that is covered with copper.

15.1.9 Regardless of whether the first dip resulted in a bright, adherent deposit of copper, the immersion, washing, rubbing, drying, examining, estimating, and recording operations are to be repeated using the same specimen and beaker of solution until the total number of dips indicated for the construction in 15.1.1 is achieved. After the last dip, the solution in the beaker is to be discarded.

15.1.10 The remaining specimens are each to be subjected to the 2- or 4-dip procedure described in 15.1.6 – 15.1.9.

15.1.11 The raceway shall not have any broad surface where there is any bright, adherent copper showing outside the 1/2 inch (13 mm) end portion of any specimen.

15.2 Enamel

15.2.1 An enamel coating shall be of uniform quality throughout, shall have a smooth and even appearance, and shall not soften at 49.0°C (120.2°F) or a lower temperature.

15.2.2 A short piece of an enamel coating sliced from a sample box or fitting by means of a sharp knife shall come off as a unit and show a tendency to curl as the knife edge travels along the sample.

15.2.3 An enamel coating shall feel tough and have body but shall not feel hard or be brittle. To determine the effectiveness of the coating, a box or fitting shall be struck with a 1/2-inch (13-mm) pipe that is 10 – 12 inches (250 – 300 mm) long. The coating shall not show an unbroken surface even when the metal surface is slightly dented or flattened by the force of the hard, nonglancing blow.

15.3 Epoxy

15.3.1 An epoxy coating shall be subjected to the requirements required for enamel coatings indicated in 15.2.

15.3.2 An epoxy coating that complies with the requirements in the Standard for Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment, UL 1332, is not required to comply with 15.2.

16 Rigidity of Cover Test

16.1 To determine the rigidity of a raceway cover, a load is to be applied by a weight that exerts 300 lbf (1334 N or 136 kgf) through the flat end of a 3-inch (76-mm) right-circular rigid metal cylinder 3 inches in diameter and 2 inches (51 mm) long. Before loading, all adjusting screws are to be raised at least 1/8 inch

(3 mm). If the unit is designed for use in concrete, it may be installed in concrete for this test. The force is to be applied to the cover at any selected point that would appear to obtain maximum deflection. During the test, two adjoining lengths of flush duct are to be rigidly supported in concrete, as they would be in the field. The concrete is to be given at least 28 days to cure.

16.2 The cover shall support a load of 300 lbf (1334 N or 136 kgf) without deflecting more than 1/8 inch (3 mm). The permanent deformation at any point on the duct cover, exclusive of gasket depression, shall not exceed 1/32 inch (0.8 mm).

17 Pull Test

17.1 The mechanical strength of an insert is to be determined by subjecting the insert to a straight pull of 200 lbf (890 N or 91 kgf) for 60 seconds, the force being applied between the insert and the duct. The duct is to be held in position by any secure means, and a pulling device is to be threaded into the insert. If the insert is not of the threaded type, the pulling device is to be securely fastened to the insert. The force is not to be applied suddenly and, if a weight is used, care is to be taken that the pull on the insert is not exerted with a jerk.

17.2 There shall be no deformation or damage to the insert as a result of the pull.

18 Duct Support Test

18.1 To determine whether a duct support complies with the requirement in 11.3, the support is to be fastened in position under conditions approximating those of actual service. A vertically downward load of 200 lbf (890 N or 91 kgf) is then to be applied by any convenient means for 60 seconds. Deflection of the bridge shall not be greater than 1/8 inch (3 mm).

19 Flame Test

19.1 The finished polymeric housing (including any polymeric cover for the polymeric housing if the cover affords access to live parts) shall not flame longer than 60 seconds following five 5-second applications of the test flame, the period between applications being 5 seconds. The housing shall not ignite combustible materials in its vicinity, and holes shall not appear in the housing. The test is to be conducted as described in 19.2 – 19.9.

19.2 Three 4 – 18 inch (102 – 460 mm) segments of the complete finished housing body (or three such lengths of the complete finished polymeric cover for the polymeric housing) are to:

a) Be aged in a full-draft circulating-air oven for 168 hours at a temperature equal to the sum of the highest temperature to which the housing or cover is exposed in the normal intended use of the raceway system (this temperature is to be determined by actual measurement in the sample installation mentioned in 1.3) plus 10°C (18°F) but not less than 70.0 ±1.0°C (158 ±1.8°F) in any case);

b) Cool to room temperature in still air.

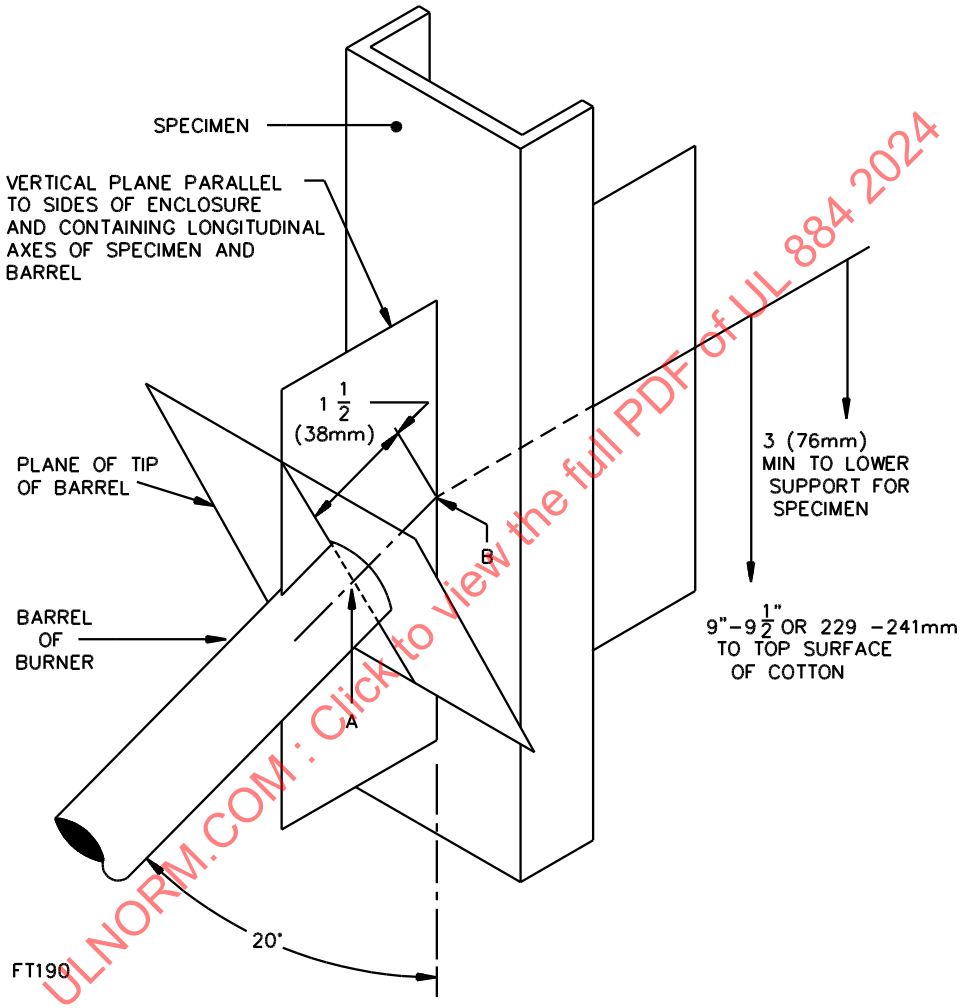
Exception: The specimens need not be aged if the polymeric material of which the housing or cover is made does not increase in flammability as a result of long-term thermal aging using specimens that are not thicker than the thinnest point of the finished housing or cover.

19.3 The test is to be conducted in a 3-sided metal enclosure in an exhaust hood or cabinet. The metal enclosure is to be 12 inches (305 mm) wide, 14 inches (355 mm) deep, 24 inches (610 mm) high, and the top and front are to be open. A specimen as mentioned in 19.2 is to be secured with its longitudinal axis vertical in the center of the enclosure, its transverse axis parallel to the rear of the enclosure, and the

inside surface of the housing or cover facing the rear of the enclosure. A flat horizontal layer of untreated surgical cotton 1/4 – 1 inch (6 – 25 mm) thick is to cover the floor of the enclosure. The upper surface of the cotton is to be 9 – 9-1/2 inches (229 – 241 mm) below point B, which is the point at which the tip of the blue inner cone of the test flame touches the specimen (as shown in Figure 19.1).

Figure 19.1

Essential dimensions in inches (mm) for flame test



Proportions exaggerated for clarity of detail