UL 1773

STANDARD FOR SAFETY

Termination Boxes

UL Standard for Safety for Termination Boxes, UL 1773

Sixth Edition, Dated October 9, 2018

Summary of Topics

This revision of ANSI/UL 1773 dated April 22, 2020 includes an Increase Voltage Threshold to 1000 Volts and Expand Requirements for Insulation Materials; 1.1, 1.4, 13.1, Table 15.1, and Table 15.2.

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

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated November 1, 2019 and January 10, 2020.

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ANSI/UL 1773-2020

UL 1773

Standard for Termination Boxes

Previous numbered and unnumbered editions of standards covering termination boxes have been published since 1988.

First Edition – April, 1988
Second Edition – May, 1993
Third Edition – April, 1998
Fourth Edition – August, 2007
Fifth Edition – October, 2011

Sixth Edition

October 9, 2018

This ANSI/UL Standard for Safety consists of the Sixth Edition including revisions through April 22, 2020.

The most recent designation of ANSI/UL 1773 as an American National Standard (ANSI) occurred on April 22, 2020 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 UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover termination boxes rated 1000 V or less that consist of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both and are intended to be used in accordance with the National Electrical Code, NFPA 70. Termination boxes are investigated for use on the line or load side of service equipment.

1.2 The incoming and outgoing conductors may be routed through knockouts or openings in the box for cable, conduit, or electrical metallic tubing. The termination box may also have special openings to match with similar openings in other equipment such as meter sockets, panelboards, switch or circuit breaker enclosures, wireways, and the like.

1.3 These requirements also cover termination bases to be field installed in termination boxes and termination boxes in which termination bases are to be field installed.

1.4 This category covers mounting posts and pedestals rated 1000 V ac or less intended to serve as a raceway for underground wiring that is being brought above grade to feed an outdoor electrical distribution device, such as a power outlet, panelboard, meter socket, circuit breaker enclosure or the like. They are intended to support the distribution device, which is installed either in the factory or in the field. They may contain electrical termination points for underground wiring and for wiring to the distribution device.

1.5 This standard specifically does not apply to:

a) Equipment connected only by bus bars for both input and output circuits;

b) Equipment containing switching devices, relays, or overcurrent protective devices;

c) Busway fittings known as "End Cable Tap Boxes" which are covered by the Standard for Busways, UL 857; and

d) Inlet assemblies for cord connection of generators used in conjunction with transfer switch equipment which are covered by the Standard for Transfer Switch Equipment, UL 1008, Annex J, Inlet Assemblies for Transfer Switch Equipment.

2 Components

2.1 Except as indicated in 2.2, 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.

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

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

b) Is superseded by a requirement in this standard.

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

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

3 Units of Measurement

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

4 Undated References

4.1 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.

5 Glossary

5.1 For the purpose of this standard, the following definition applies.

5.2 TERMINATION BASE – An assembly mounted as a common structure constituting all the elements of a termination box except for the enclosure and intended for use in one or more specific termination boxes.

CONSTRUCTION

6 Enclosure

6.1 General

6.1.1 Unless specified otherwise in this standard, a termination box enclosure shall comply with the Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50.

Exception No. 1: A termination box enclosure may be constructed with a special opening for connection to other equipment if the termination box is marked as specified in 28.5.1 and the construction complies with 6.1.2.

Exception No. 2: A termination box intended for floor mounting or of a post or pedestal type may have an open bottom.

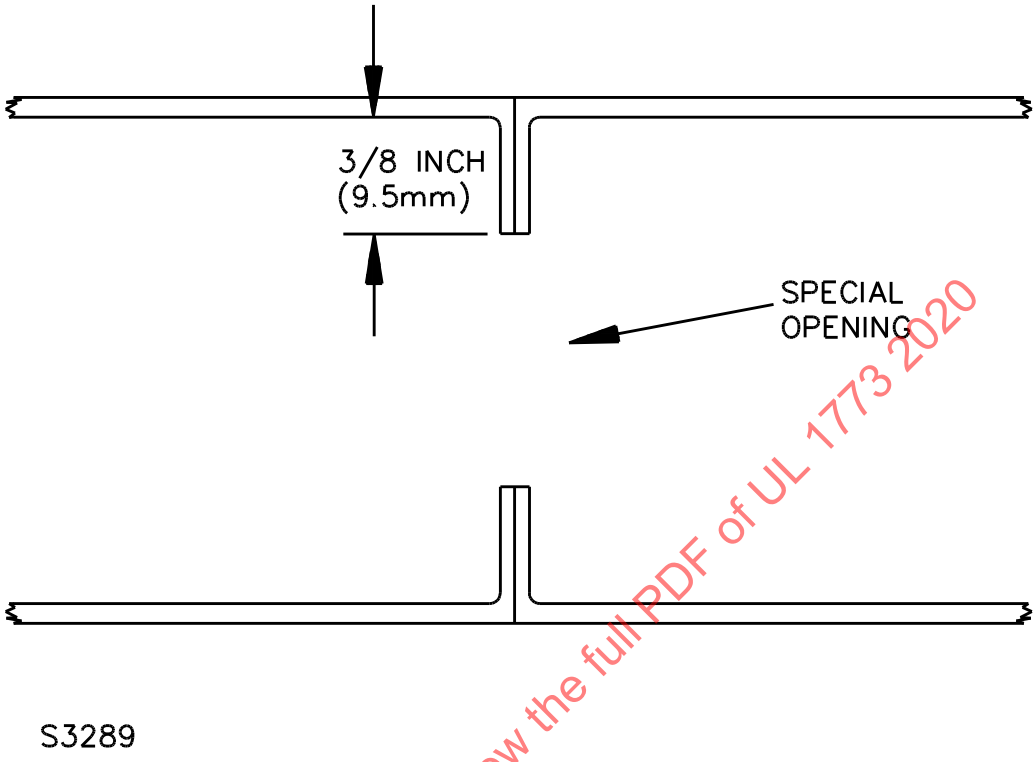
6.1.2 A termination box provided with special openings shall be provided with:

a) Mating surfaces of at least 3/8 inch (9.5 mm) on each side of the opening as shown in Figure 6.1.

b) Means to close the end of an enclosure with an available fitting marked for use with the termination box.

Figure 6.1

Overlap at special opening



6.2 Conduit connections

6.2.1 A nonmetallic enclosure shall have a bonding means provided to maintain continuity of grounding between all conduit openings. For a construction having a threaded opening or nipple for metal conduit, the bonding means shall be assembled to the enclosure. For a construction having a non-threaded opening, the bonding means may be provided as separate parts for field installation. An enclosure intended for field assembly of the bonding means shall be provided with instructions for installation. The instructions shall include the identification of the parts and their method of installation.

Exception: The bonding means need not be provided in a nonmetallic enclosure not intended for use with a metallic conduit system if the enclosure is marked as specified in 28.8.1.

6.2.2 A nonmetallic enclosure having provision for connection of rigid metallic conduit or rigid nonmetallic conduit shall be investigated for such use as specified in the Conduit Connection Tests, Section 22.

6.3 Provision for support

6.3.1 Provision for support or other mounting means for a nonmetallic termination box shall be outside the termination box, unless the termination box is constructed such that the conductors within the box cannot contact the supporting screws.

6.3.2 So that contact between a supporting screw and conductors within a box will be prevented as required in 6.3.1, a hole in a box for a screw shall be located in a recess constructed such that there will be a spacing of not less than 1/32 inch (0.8 mm) between the plane of the top of the recess and the head of the largest screw that is provided with the box. If a screw is not provided with a box, this spacing shall be measured using the largest:

a) Round-head screw, specified in Table 6.1, that can be inserted in a hole that is not chamfered; or

b) Flat-head screw that can be inserted in a hole that is chamfered.

Table 6.1
Supporting-screw hole dimensions

Nominal screw size	Diameter of hole,		Minimum dimensions of recess			
			Diameter,		Depth,	
	inch	(mm)	inch	(mm)	inch	(mm)
6	0.138	(3.51)	1/4	(6.4)	4/32	(3.2)
8	0.164	(4.17)	19/64	(7.5)	9/64	(3.6)
10	0.190	(4.83)	11/32	(8.7)	5/32	(4.0)
12	0.216	(5.49)	25/64	(9.9)	11/64	(4.4)
1/4	0.250	(6.35)	29/64	(11.5)	13/64	(5.2)
5/16	0.313	(7.95)	9/16	(14.3)	15/64	(6.0)

6.4 Enclosures containing inlet assemblies

6.4.1 All inlet assemblies shall be installed within the termination box such that the enclosure completely encloses all uninsulated parts, both with and without the inlet cables connected to the assembly.

6.4.2 Where used to connect inlet conductors, enclosures shall separate inlet conductors from internal terminal box wiring. Access to the inlet conductors shall be possible without exposing the internal terminal box conductors or uninsulated live parts.

6.4.3 The enclosure shall be such that when the covers and doors are properly secured, accidental contact with the body of all separable connectors is prevented.

6.4.4 Access panels and doors provided for the attachment and removal of inlet conductors shall be secured by means of a latching mechanism incorporating a lock and key, a fastener requiring the use of a tool, or shall have provision for locking.

6.4.5 Where intended for outdoor use, the enclosure shall comply with the requirements of the Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50 and the Standard for Electrical Equipment, Environmental Considerations, UL 50E for the intended use, with and without the inlet conductors connected.

6.4.6 Marking and instructions on the exterior of an enclosure shall be permanent and suitable for the intended use. See Markings, Section 28.

7 Mounting Post or Pedestal

7.1 General

7.1.1 A mounting post or pedestal shall not be less than 12 square inches (77 cm^2) in cross-sectional area and 2-1/2 inches (63.5 mm) deep, and at least three sides shall be fabricated of galvanized steel not less than 0.070 inch (1.8 mm) thick.

Exception: A mounting post or pedestal that complies with the Torque Deformation Test, Section 19, and the Beam Loading Deflection Test, Section 20, need not be 12 square inches in cross-sectional area or

less than 2-1/2 inches deep, and may be fabricated of galvanized steel not less than 0.056 inch (1.42 mm) thick.

7.1.2 That portion of a post located below grade level and up to 12 inches (305 mm) above grade level shall be painted on both the inside and outside surfaces in addition to being galvanized.

7.1.3 Where intended for outdoor use, the mounting post or pedestal shall comply with the requirements of the Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50 and the Standard for Electrical Equipment, Environmental Considerations, UL 50E for the intended use. Mounting posts or pedestals with an integral door or cover intended to provide environmental protection of factory or field installed receptacles shall provide environmental protection with and without attachment plugs connected. See Rain and Splash Test specified in Section 23.

7.2 Cover

7.2.1 A cover or cap for a mounting post or pedestal shall be of metal not thinner than as required in 7.1.1, or nonmetallic material complying with the Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50. A cover or cap fabricated from 0.056 inch (1.4 mm) thick steel may be any length provided its width does not exceed 10 inches (254 mm).

Exception: A cover or cap provided on a mounting post or pedestal to close unused openings intended to accommodate a field-installed unit may be thinner than 0.056 inch if the cover or cap complies with the deflection test described in the Deflection Test, Section 21.

7.3 Grade level

7.3.1 The distance between the marked final grade level of a mounting post as covered in 28.7.1 or the bottom of the base of a mounting pedestal and the lowest live part shall not be less than 12 inches (305 mm).

7.4 Wire opening

7.4.1 The opening provided in the base of a mounting post for the entrance of underground wiring shall be rolled, flanged, or equipped with a bushing so that there will be a smoothly rounded surface against which the cables can bear. The upper edge of the opening shall be at least 18 inches (457 mm) below the marked final grade level.

7.5 Instructions

7.5.1 A mounting post or pedestal shall be provided with instructions indicating the correct mounting procedure.

7.6 Mounting provision

7.6.1 A pedestal shall have mounting holes or similar provision in the base for securing the pedestal to a concrete slab. Aluminum in a pedestal enclosure shall not be in contact with the concrete mounting pad. A metallic or nonmetallic coating used to separate aluminum from a concrete pad shall be tested to demonstrate resistance to corrosion not less than that of galvanized (G90 zinc coating) steel that is 0.061 inch (1.55 mm) thick.

7.7 Luminaires (illuminated mounting posts and pedestals)

7.7.1 A mounting post or pedestal provided with luminaire (s) shall comply with the requirements specified in 7.7.2, and the applicable requirements in Appendix A.

7.7.2 Luminaire(s) that may be supplied by a source separate from equipment intended to be mounted to the post or pedestal shall comply with the following:

a) Luminaire wiring compartment(s) and any lamp(s) that are intended for field replacement shall be separated from other wiring compartments provided in the post or pedestal by a barrier to provide separation of circuits.

b) The mounting post or pedestal shall be provided with a field installable label that specifies that the equipment may be supplied by multiple sources. See 28.10.2.

8 Ventilation Openings

8.1 If ventilation openings are provided, they shall comply with 8.2 – 8.10.

8.2 Ventilation openings shall be guarded so that there is no direct access to a live part as covered in 8.3 and 8.4.

8.3 Ventilation openings shall be:

a) Screened or louvered openings with internal barriers; or

b) Hoods or stacks with labyrinth air passages.

8.4 A barrier shall be of such dimensions and located so that a straight line drawn from any live part past the edge of the barrier will intersect the enclosure minimum 1/4 inch (6.4 mm) from the edge of an opening.

8.5 A ventilation opening – slot, louver, or the like – shall be protected by one or more baffles, barriers, or other obstructions of such dimensions and locations that any access path to a live part requires at least two changes of direction, one of which involves an angle of 90 degrees or more from a straight line, as shown in Figure 8.1. In addition, if the minor dimension of a ventilation opening is larger than 1/4 inch (6.4 mm), it shall be protected by a screen having a minor dimension not larger than 1/4 inch.

8.6 The size, shape, and location of a screened opening shall not weaken the overall enclosure.

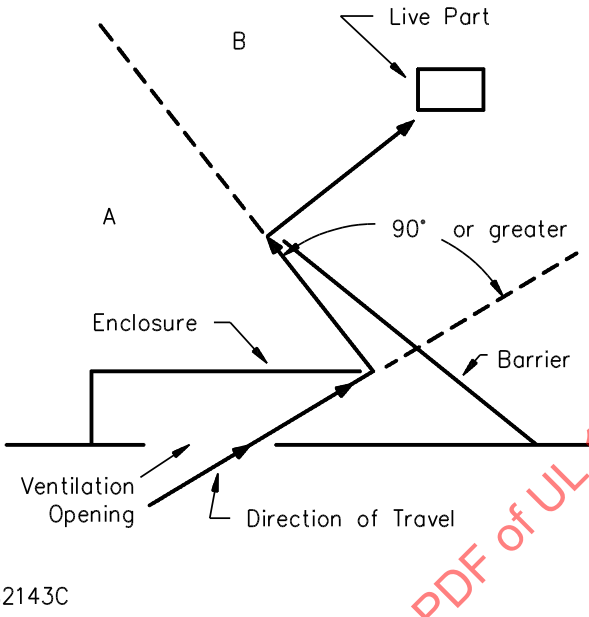
8.7 The wires of a screen required to protect a ventilation opening shall not be smaller than 16 AWG (1.3 mm^2) and the openings in the screen shall not exceed 1/4 inch (6.4 mm) in any dimension.

8.8 Perforated sheet steel or expanded-steel mesh shall not be less than 0.042 inch (1.07 mm) thick if uncoated, or 0.045 inch (1.14 mm) thick if zinc-coated, if the mesh openings or perforations are 1/2 square inch (3.23 cm^2) or less in area. For larger openings, the steel or mesh shall not be less than 0.080 inch (2.03 mm) thick if uncoated or 0.084 inch (2.13 mm) thick if zinc-coated.

Exception: If deflection of the expanded-steel mesh will not alter the clearance between the uninsulated live parts and grounded metal so as to reduce spacings to values below the minimum values specified in Table 15.1 or Table 15.2, as applicable, expanded-steel mesh may be made of minimum 0.024 inch (0.61 mm) thick sheet steel if uncoated or 0.028 inch (0.71 mm) thick sheet steel if zinc-coated.

Figure 8.1

Angle of change of direction



A – No live parts permitted in this area.

B – Live parts acceptable this side of barrier.

8.9 The width of a ventilation louver in an enclosure shall be such that at least 1/6 of the enclosure material will remain at each end of the louver.

8.10 A separate louvered panel that is riveted or welded in place over a ventilation opening in the enclosure shall not be less than 0.032 inch (0.81 mm) thick sheet steel.

9 Wire Bending Space

9.1 Wire bending space shall be provided opposite any wire connector intended for field installed wire as specified in 9.2 and 9.3.

Exception: Provision of wire bending space for wire connectors intended for field installed conductors routed through special openings of adjacent enclosures, as specified in Enclosure, Section 6, may be based on the combined space available.

9.2 Other than as indicated in 9.3, the wire bending space shall be as specified in Table 9.1 and Table 9.2. A wire is considered likely to enter or leave a top, back, or side surface if there is an opening or knockout for a wireway or conduit.

Exception: The wire bending space may be in accordance with Table 9.3 if:

a) A barrier is provided between the connector and the opening; or

b) Drawings are provided specifying that the conductors are not to enter or leave the enclosure directly opposite the wire connector.

9.3 If a conductor is not likely to enter or leave the enclosure surface opposite its wire connector, the wire bending space shall be as specified in Table 9.3.

9.4 If a conductor is restricted by a barrier or other means from being bent at the point where it leaves the connector, the distance shall be measured from the end of the barrier.

9.5 The wire bending space shall be measured in a straight line from the edge of the wire terminal closest to the wall in a direction perpendicular to the enclosure wall, barrier, or other obstruction. The wire terminal shall be turned so that the axis of the wire opening in the connector is as close to perpendicular to the wall of the enclosure as it can assume without defeating any means provided to prevent its turning, such as a boss, shoulder, walls of a recess, multiple bolts securing the connector, or the like. A barrier, shoulder, or the like shall be disregarded when the measurement is being made if the barrier, shoulder, or the like does not reduce the radius to which the wire must be bent. If a terminal is provided with one or more connectors for the connection of conductors in multiple, the distance shall be measured from the wire opening closest to the wall of the enclosure. If the connectors for a circuit are fixed in position (for example, by the walls of a recess) so that they are turned toward each other, the distance shall be measured at the wire opening nearest to the wall in a direction perpendicular to the wall.

Table 9.1
Minimum wire bending space at terminals in inches

Wire size, AWG or kcmil (mm^2)[a]				Minimum bending space, inches							
				Wires per terminal (pole)							
All other conductors		Compact stranded AA-8000 aluminum alloy conductors		1		2		3		4 or more	
14 – 10	(2.1 – 5.3)	12 – 8	(2.1 – 8.4)	Not Specified		–		–		–	
8	(8.4)	6	(13.3)	1-1/2		–		–		–	
6	(13.3)	4	(21.2)	2		–		–		–	
4	(21.2)	2	(33.6)	3		–		–		–	
3	(26.7)	1	(42.4)	3		–		–		–	
2	(33.6)	1/0	(53.5)	3-1/2		–		–		–	
1	(42.4)	2/0	(67.4)	4-1/2		–		–		–	
1/0	(53.5)	3/0	(85.0)	5-1/2		5-1/2		7		–	
2/0	(67.4)	4/0	(107)	6		6		7-1/2		–	
3/0	(85.0)	250	(127)	6-1/2	[6]	6-1/2	[6]	8		–	
4/0	(107)	300	(152)	7	[6]	7-1/2	[6]	8-1/2	[8]	–	
250	(127)	350	(177)	8-1/2	[6-1/2]	8-1/2	[6-1/2]	9	[8]	10	
300	(152)	400	(203)	10	[7]	10	[8]	11	[10]	12	
350	(177)	500	(253)	12	[9]	12	[9]	13	[10]	14	[12]
400	(203)	600	(304)	13	[10]	13	[10]	14	[11]	15	[12]
500	(253)	700 – 750	(355 – 380	14	[11]	14	[11]	15	[12]	16	[13]
600	(304)	800 – 900	(405 – 456)	15	[12]	16	[11]	18	[15]	19	[16]
700	(355)	1000	(507)	16	[13]	18	[15]	20	[17]	22	[19]
750	(380)	–	–	17	[13]	19	[16]	22	[17]	24	[21]
800	(405)	–	–	18		20		22		24	
900	(456)	–	–	19		22		24		24	

Table 9.1 Continued on Next Page

Table 9.1 Continued

Wire size, AWG or kcmil (mm²)[a]				Minimum bending space, inches			
				Wires per terminal (pole)			
All other conductors		Compact stranded AA-8000 aluminum alloy conductors		1	2	3	4 or more
1000	(506)	–	–	20	–	–	–
1250	(633)	–	–	22	–	–	–
1500	(760)	–	–	24	–	–	–
1750	(887)	–	–	24	–	–	–
2000	(1013)	–	–	24	–	–	–

NOTE – The values in [ ] are in inches and only apply to:

1) Lay-in or removable wire connectors receiving one wire each (there may be more than one lay-in or removable wire connector per terminal); and

2) The removable wire connectors can be removed from their intended location without disturbing structural or electrical parts other than a cover, and can be reinstalled with the conductor in place.

[a] Wire size shall be as determined in Wiring Terminals, Section 10.

Table 9.2
Minimum wire bending space at terminals in millimeters

Wire size, AWG or kcmil (mm²)[a]				Minimum bending space, millimeters							
				Wires per terminal (pole)							
All other conductors		Compact stranded AA-8000 aluminum alloy conductors		1		2		3		4 or more	
14 – 10	(2.1 – 5.3)	12 – 8	(2.1 – 8.4)	Not Specified		–		–		–	
8	(8.4)	6	(13.3)	38.1		–		–		–	
6	(13.3)	4	(21.2)	50.8		–		–		–	
4	(21.2)	2	(33.6)	76.2		–		–		–	
3	(26.7)	1	(42.4)	76.2		–		–		–	
2	(33.6)	1/0	(53.5)	88.9		–		–		–	
1	(42.4)	2/0	(67.4)	114		–		–		–	
1/0	(53.5)	3/0	(85.0)	140		140		178		–	
2/0	(67.4)	4/0	(107)	152		152		190		–	
3/0	(85.0)	250	(127)	165	[152]	165	[152]	203		–	
4/0	(107)	300	(152)	178	[152]	190	[152]	216	[203]	–	
250	(127)	350	(177)	216	[165]	229	[165]	254	[203]	254	
300	(152)	400	(203)	254	[178]	254	[203]	279	[254]	305	
350	(177)	500	(253)	305	[229]	305	[229]	330	[254]	356	[305]
400	(203)	600	(304)	330	[254]	330	[254]	356	[279]	381	[305]
500	(253)	700 – 750	(355 – 380)	356	[279]	356	[279]	381	[305]	406	[330]
600	(304)	800 – 900	(405 – 456)	381	[305]	406	[330]	457	[381]	483	[406]
700	(355)	1000	(507)	406	[330]	457	[381]	508	[432]	559	[483]
750	(380)	–	–	432	[356]	483	[406]	559	[483]	610	[533]

Table 9.2 Continued on Next Page

Table 9.2 Continued

Wire size, AWG or kcmil (mm^2)[a]				Minimum bending space, millimeters			
				Wires per terminal (pole)			
All other conductors		Compact stranded AA-8000 aluminum alloy conductors		1	2	3	4 or more
800	(405)	–	–	457	508	559	610
900	(456)	–	–	483	559	610	610
1000	(506)	–	–	508	–	–	–
1250	(633)	–	–	559	–	–	–
1500	(760)	–	–	610	–	–	–
1750	(887)	–	–	610	–	–	–
2000	(1013)	–	–	610	–	–	–

NOTE – The values in [ ] are in millimeters and only apply to:

1) Lay-in or removable wire connectors receiving one wire each (there may be more than one lay-in or removable wire connector per terminal); and

2) The removable wire connectors can be removed from their intended location without disturbing structural or electrical parts other than a cover, and can be reinstalled with the conductor in place.

[a] Wire size shall be as determined in Wiring Terminals, Section 10.

Table 9.3
Wire bending space

Size of wire, AWG or kcmil (mm^2)				Wires per terminal									
				1		2		3		4		5	
All other conductors		Compact stranded AA-8000 aluminum alloy conductors		inches (mm)		inches (mm)		inches (mm)		inches (mm)		inches (mm)	
14 – 10	(2.1 – 5.3	12 – 8	(2.1 – 8.4)	Not Specified		–	–	–	–	–	–	–	–
8 – 6	(8.4 – 13.3)	6 – 4	(13.3 – 21.1)	1-1/2	(38.1)	–	–	–	–	–	–	–	–
4 – 3	(21.1 – 26.7)	2 – 1	(33.6 – 42.4)	2	(50.8)	–	–	–	–	–	–	–	–
2	(33.6)	0	(53.5)	2-1/2	(63.5)	–	–	–	–	–	–	–	–
1	(42.4)	2/0	(67.4)	3	(76.2)	–	–	–	–	–	–	–	–
1/0 – 2/0	53.5 – 67.4	3/0 – 4/0	(85 – 107)	3-1/2	(88.9)	5	(127)	7	(178)	–	–	–	–
3/0 – 4/0	(85.0 – 107)	250 – 300	(127 – 152)	4	(102)	6	(152)	8	(203)	–	–	–	–
250	(127)	350	(177)	4-1/2	(114)	6	(152)	8	(203)	10	(254)	–	–
300 – 350	(152 – 177)	400 – 500	(203 – 253)	5	(127)	8	(203)	10	(254)	12	(305)	–	–
400 – 500	(203 – 253)	600 – 700-750	(304 – 355-380)	6	(152)	8	(203)	10	(254)	12	(305)	14	(356)
600 – 700	(304 – 355)	800-900 – 1000	(405-456 – 507)	8	(203)	10	(254)	12	(305)	14	(356)	16	(406)
750 – 900	(380 – 456)	–	–	8	(203)	12	(305)	14	(356)	16	(406)	18	(457)
1000 – 1250	(507 – 633)	–	–	10	(254)	–	–	–	–	–	–	–	–
1500 – 2000	(760 – 1013)	–	–	12	(305)	–	–	–	–	–	–	–	–

NOTE – The table includes only those multiple-conductor combinations that are likely to be used. Combinations not mentioned may be given further consideration.

10 Wiring Terminals

10.1 General

10.1.1 A termination box shall be provided with pressure terminal connectors and/or inlet assemblies. Inlet assemblies may consist of a single multipole inlet, or multiple single pole inlets, installed in a completely enclosed assembly as covered in 10.4 and 10.5. Pressure terminal connectors shall be rated for the corresponding wire size intended for the connection of conductors corresponding in size to the rating as covered in 28.1.1 and Ratings, General, Section 26.

Exception No. 1: Wiring terminals may be omitted as specified in 10.1.2 and 10.1.3.

Exception No. 2: Wire binding screws that comply with the requirements specified in 10.3.1– 10.3.4 may be provided for securing copper conductors sized 14 – 10 AWG (2.1 – 5.3 mm^2).

10.1.2 Wiring terminals may be omitted if the termination box:

a) Has mounting provision for specific termination bases; and

b) Is marked in accordance with 28.3.9.

10.1.3 Pressure terminal connectors for field connection (line or load) need not be provided if all of the following conditions are met:

a) Terminal assemblies shall be available from the equipment manufacturer, or one or more pressure terminal connectors shall be specified for field installation on the equipment.

b) Fastening devices such as studs, nuts, bolts, spring washers, flat washers, or the like shall either be provided as part of the component terminal assembly or be mounted on or separately packaged with the equipment.

c) The installation of the terminal assembly shall not involve the loosening or disassembly of parts other than a cover or other part giving access to the terminal location.

d) If the pressure terminal connector provided in a component terminal assembly requires the use of other than an ordinary tool for securing the conductor, any necessary instructions shall be included in the component assembly package or with the equipment.

e) Installation of the pressure terminal connectors in the intended manner shall result in a product that meets the requirements of this standard.

f) The equipment shall be marked in accordance with 28.3.9.

10.1.4 The size and type of a field-installed conductor shall be determined as follows:

a) For currents as indicated in Table 10.1:

1) Wire rated at 75°C (167°F) will be used for 1/0 AWG (53.5 mm^2) and larger sizes.

2) Wire rated at 60°C (140°F) will be used for 1 AWG (42.4 mm^2) and smaller sizes.

b) It is assumed that aluminum wire will be used at any terminal identified (on a wiring diagram or the like as covered in 28.3.1 – 28.3.5) as being rated for use with such wire, whether or not that terminal is also identified as being rated for use with copper wire.

Table 10.1
Ampacity of insulated conductors

Wire size		60°C (140°F) ampacities[a]		75°C (167°F) ampacities[a]	
AWG or kcmil	(mm^2)	Copper	Aluminum	Copper	Aluminum
14	(2.1)	20	–	20	–
12	(3.3)	25	20	25	20
10	(5.3)	30	25	35	30
8	(8.4)	40	30	50	40
6	(13.3)	55	40	65	50
4	(21.2)	70	55	85	65
3	(26.7)	85	65	100	75
2	(33.6)	95	75	115	90
1	(42.4)	110	85	130	100
1/0[b]	(53.5)[b]	see footnote c	see footnote c	150	120
2/0[b]	(67.4)[b]	see footnote c	see footnote c	175	135
3/0[b]	(85.0)[b]	see footnote c	see footnote c	200	155
4/0[b]	(107.2)[b]	see footnote c	see footnote c	230	180
250[b]	(127)[b]	see footnote c	see footnote c	255	205
300[b]	(152)[b]	see footnote c	see footnote c	285	230
350[b]	(177)[b]	see footnote c	see footnote c	310	250
400[b]	(203)[b]	see footnote c	see footnote c	335	270
500[b]	(253)[b]	see footnote c	see footnote c	380	310
600[b]	(304)[b]	see footnote c	see footnote c	420	340
700[b]	(355)[b]	see footnote c	see footnote c	460	375
750[b]	(380)[b]	see footnote c	see footnote c	475	385
800[b]	(405)[b]	see footnote c	see footnote c	490	395
900[b]	(456)[b]	see footnote c	see footnote c	520	425
1000	(506)	see footnote c	see footnote c	545	445
1250	(633)	see footnote c	see footnote c	590	485
1500	(760)	see footnote c	see footnote c	625	520
1750	(887)	see footnote c	see footnote c	650	545
2000	(1013)	see footnote c	see footnote c	665	560

NOTE– These values of ampacity are based on a maximum of three current carrying conductors being field installed in a single conduit.

[a] The numbers 60°C (140°F) and 75°C (167°F) indicate the conductor temperature rating.

[b] For a multiple conductor connector at a terminal, the ampacity value is to be multiplied by the number of conductors that the terminal will accommodate [1/0 AWG (53.5 mm^2) and larger].

[c] For wire sizes 1/0 AWG and larger, it is assumed that wire with a 75°C (167°F) temperature rating will be used.

10.1.5 A multiconductor connector provided at a wiring terminal shall be capable of securing all conductors in the intended manner. In determining the number and size of conductors, it is assumed that parallel conductors will not be smaller than 1/0 AWG (53.5 mm^2).

10.1.6 A pressure terminal connector provided with or specified for use with a termination box shall comply with:

a) The Standard for Wire Connectors, UL 486A-486B.

b) The Standard for Equipment Wiring Terminals for Use With Aluminum and/or Copper Conductors, UL 486E.

Pressure wire connectors that comply with UL 486E shall not be provided in a termination box having an rms symmetrical short-circuit current rating greater than 10,000 amperes unless the termination box using the wire connectors is tested for the higher short-circuit current rating.

10.1.7 A wiring terminal provided for the connection of a service conductor rated at 40 amperes or less shall be capable of accommodating a minimum size 8 AWG (8.4 mm^2) copper conductor. The terminal shall also accommodate a minimum size 6 AWG (13.3 mm^2) aluminum conductor if the termination box is marked for use with aluminum wire in accordance with 28.3.1.

10.2 Tightening torque

10.2.1 The tightening torque for a field-wiring terminal shall be marked as required in 28.3.12. The specified tightening torque shall not be less than 90 percent nor more than 100 percent of the value in the static heating test as specified in:

a) The Standard for Wire Conductors, UL 486A-486B.

b) The Standard for Equipment Wiring Terminals for Use With Aluminum and/or Copper Conductors, UL 486E,

for that wire size corresponding to the ampere rating of the terminal.

Exception: The torque value of the conductor may be less than 90 percent if the connector is investigated in accordance with the lesser assigned torque value in UL 486A-486B, or UL 486E.

10.2.2 A wire connector intended for field wiring shall be tested as covered in the Strength Test of Insulating Base and Support, Section 17.

10.3 Screw terminals

10.3.1 A wire binding screw or stud of a wiring terminal shall not be smaller than a No. 10 (4.8 mm diameter) machine screw, with not more than 32 threads per inch. The terminal shall be provided with upturned lugs, a cupped washer, or the equivalent capable of retaining a 14 AWG (2.1 mm^2) solid conductor even though the screw or nut becomes slightly loose.

Exception: A No. 8 (4.2 mm diameter) machine screw having not more than 32 threads per inch may be used at a terminal intended only for the connection of a 14 AWG conductor.

10.3.2 A wire binding screw terminal design is one in which the conductor encircles the terminal screw at least three-fourths the distance without overlapping.

10.3.3 A wire binding screw shall thread into metal.

10.3.4 A terminal plate tapped for a wire binding screw shall be of metal not less than 0.030 inch (0.76 mm) thick. There shall be two or more full threads in the metal, which may be extruded if necessary to provide the threads.

10.4 Multiple pole power inlets

10.4.1 The requirements of 10.4.1 – 10.4.7 apply to enclosed multiple pole power inlets. These requirements do not apply to inlets consisting of single pole separable connectors, see 10.5.

10.4.2 The inlet shall be of a construction with male phase and neutral mating contacts. An inlet shall have a rating no less than the rating of the termination box.

10.4.3 The inlet shall have sufficient number of poles to accommodate the ground, neutral, and all ungrounded supply conductors in one connector.

10.4.4 The inlet shall be of a design such that the ground connection is the first connection made when inserting a plug, and is the last connection to be opened when removing the plug.

10.4.5 The inlet shall be suitable for connection and disconnection under load.

10.4.6 All parts of inlet assemblies shall be securely mounted in position and prevented from loosening or turning if such motion may adversely affect the intended performance of the equipment, or may affect the risk of fire and injury to persons incident to the operation of the equipment.

10.4.7 The inlet shall be completely enclosed. When intended for outdoor use in wet locations, enclosures shall comply with all requirements for Type 3, 3R, 3S, 4, 4X, 6, or 6P enclosures, as detailed in Section 6, Enclosure, with the cord connector installed as well as with the connector withdrawn.

10.5 Single pole power inlets

10.5.1 These requirements do not apply to multiple pole inlet assemblies, see 10.4.

10.5.2 Single pole inlets shall be of the locking, pin-and-sleeve type and shall be suitable for the voltage and current involved.

10.5.3 Single pole Inlet assemblies are not intended to be used for connection to, disconnection from, or transfer of loads.

10.5.4 All parts of inlet assemblies shall be securely mounted in position and prevented from loosening or turning if such motion may adversely affect the intended performance of the equipment, or may affect the risk of fire and injury to persons incident to the operation of the equipment.

10.5.5 The inlet shall be completely enclosed. When intended for outdoor use in wet locations, enclosures shall comply with all requirements for Type 3, 3R, 3S, 4, 4X, 6, or 6P enclosures, as detailed in Section 6, Enclosure, with the cord connector installed as well as with the connector withdrawn.

10.5.6 Single pole inlet(s) provided for the equipment grounding conductor shall be green or green with yellow stripes unless marked in accordance with 28.9.6.

10.5.7 Single pole inlet (s) provided for the grounded circuit conductor shall be white or gray unless marked in accordance with 28.9.6.

10.5.8 Equipment shall use a single source of supply only. Equipment with single pole inlets shall not be used for parallel conductors unless marked in accordance with 28.9.7.

10.5.9 Single pole inlet (s) shall be mounted to panels not having magnetic properties. Metals with magnetic properties include iron and steel.

Exception No. 1: This requirement does not apply to single pole inlets mounted to panels having magnetic properties where the openings for each inlet are connected by slots cut in the metal panel. Inlets shall not be mounted to an insulating block unless no metal bracket, brace, or the like is placed across the insulating material between the individual inlets.

Exception No. 2: This requirement does not apply to single pole inlets mounted to panels having magnetic properties where the combination has been investigated in accordance with and complies with the Temperature Test – Inlet Assemblies, Section 24.

11 Current-Carrying Parts

11.1 Current-carrying parts shall be judged under the requirements of the Standard for Switchboards, UL 891.

12 Termination Bases

12.1 Termination bases for field assembly in specified termination boxes as specified in 1.3 and marked as specified in 28.3.9 and 28.3.10 shall comply with the applicable requirements in this standard that would apply if the termination base was a factory installed part of the termination box.

13 Bases and Supports – Insulation Material

13.1 For the mounting of an uninsulated live part, cold-molded or phenolic compositions are acceptable but nonvulcanized fiber, rubber, and hot-molded shellac and tar compositions are not acceptable. All other insulation materials in contact with live parts shall comply with one of the following:

a) Insulation material requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C;

b) Insulation material requirements in the Outline of Investigation for Power Distribution Blocks, UL 1953;

c) Insulation material requirements in the Standard for Terminal Blocks, UL 1059; or

d) Insulation material requirements in the Standard for Switchboards UL 891.

13.2 The strength of insulating and metal supports of current carrying parts shall be judged as specified in 10.2.2, the Short-Circuit Current Test, Section 16, and the Strength Test of Insulating Base and Support, Section 17.

13.3 A live screw head, rivet, or nut on the underside of a base intended for surface mounting shall be countersunk not less than 1/8 inch (3.2 mm) in the clear, and covered to a depth of not less than 1/8 inch with a waterproof, insulating sealing compound that will not soften at a temperature of 90°C (194°F) as determined by the test for softening point by the ball pressure test in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

Exception No. 1: The test is not required for a thermosetting material.

Exception No. 2: A sealing compound is not required if the requirement in 13.4 is met.

13.4 If the screw or nut specified in 13.3 is prevented from loosening by being staked or upset by a lock washer or by other means, it may be insulated from the mounting surface by material other than sealing compound or by a spacing through air from the mounting surface not less than as indicated in Table 15.1 or Table 15.2, as applicable.

14 Provision for Bonding and Grounding

14.1 Termination boxes marked as being suitable for use on the line side of service equipment, as described in 28.6.1, and which have a provision for accommodating a grounding electrode conductor, shall

be provided with a main bonding jumper not connected at one end at the factory to bond the enclosure to the grounded conductor of an alternating-current system. The grounding electrode conductor terminal shall be sized in accordance with Table 14.1. The jumper shall be of copper or aluminum and shall have a cross-sectional area as specified in Table 14.1. When the jumper is not used, the minimum required spacings shall be maintained. Unless the intended use and method of installation of the jumper are obvious, instructions for its installation shall be provided.

Exception No. 1: The bonding jumper is not prohibited from being a steel or brass screw as specified in notes (c) – (f) of Table 14.1.

Exception No. 2: The grounding electrode conductor terminal is not prohibited from being omitted when the main bonding jumper is also omitted.

14.2 Thermoplastic material shall not be depended on to maintain continuity of a grounding or bonding connection.

Table 14.1
Minimum size of grounding electrode conductor and main bonding jumper

Termination box ampere rating not exceeding	Size of main bonding jumper (minimum)[a,b]				Cross section of main jumper (minimum)[a,b]				Size of grounding electrode conductor (minimum)[a,b]			
	Copper,		Aluminum,		Copper,		Aluminum,		Copper,		Aluminum,	
	AWG or kcmil	(mm^2)	AWG or kcmil	(mm^2)	$inch^2$	(mm^2)	$inch^2$	(mm^2)	AWG	(mm^2)	AWG or kcmil	(mm^2)
90	8	(8.4)	6	(13.3)	0.013	(8.39)[c]	0.021	(13.55)[c]	8	(8.4)	6	(13.3)
125	6	(13.3)	4	(21.2)	0.021	(13.55)[c]	0.033	(21.29)[c]	6	(13.3)	4	(21.2)
150	6	(13.3)	4	(21.2)	0.021	(13.55)[d]	0.033	(21.29)[d]	6	(13.3)	4	(21.2)
200	4	(21.2)	2	(33.6)	0.033	(21.29)[d]	0.052	(33.55)[d]	4	(21.2)	2	(33.6)
225	2	(33.6)	1/0	(53.6)	0.052	(33.55)[e,f]	0.083	(53.55)[e,f]	2	(33.6)	1/0	(53.6)
400	1/0	(53.6)[g]	3/0	(85.0)[g]	0.083	(53.55)[f,g]	0.132	(85.16)[f,g]	1/0	(53.6)	3/0	(85.0)[g]
500	1/0	(53.6)	3/0	(85.0)[g]	0.083	(53.55)	0.132	(85.16)	1/0	(53.6)	3/0	(85.0)
800	2/0	(67.4)	4/0	(107.2)	0.105	(67.74)	0.166	(107.10)	2/0	(67.4)	4/0	(107.2)
1000	3/0	(85.0)	250	(127)	0.132	(85.16)	0.196	(126.45)	3/0	(85.0)	250	(127)
1200	250	(127)	250	(127)	0.177	(114.19)	0.196	(126.45)	3/0	(85.0)	250	(127)
1600	300	(152)	400	(203)	0.236	(152.26)	0.294	(189.68)	3/0	(85.0)	250	(127)
2000	400	(203)	500	(253)	0.294	(189.68)	0.353	(227.74)	3/0	(85.0)	250	(127)
2500	500	(253)	700	(355)	0.353	(227.74)	0.515	(332.26)	3/0	(85.0)	250	(127)
3000	600	(304)	750	(380)	0.412	(265.81)	0.589	(380.00)	3/0	(85.0)	250	(127)
4000	750	(380)	1000	(506)	0.589	(380.00)	0.810	(522.58)	3/0	(85.0)	250	(127)

[a] The cross section may be reduced to 12.5 percent of the total cross section of the largest main section of the largest main service conductor(s) of the same material (copper or aluminum) for any phase on equipment rated 1200 amperes and above. This applies when the cross section of the service conductor is limited by the wire terminal connectors provided.

[b] For termination boxes rated 1200 amperes or more that have wiring terminals intended to connect service conductor wires sized larger than 600 kcmil (304 mm^2) aluminum, the cross section of the main bonding jumper shall be at least 12.5 percent of the total cross section of the largest main service conductor(s) of the same material (copper or aluminum) for any phase.

[c] A No. 8 (4.2 mm diameter) or larger brass or No. 10 (4.8 mm diameter) or larger steel screw with a green colored head that is visible after installation may be used.

[d] A No. 10 or larger brass or steel screw with a green colored head that is visible after installation may be used.

Table 14.1 Continued on Next Page

Table 14.1 Continued

Termination box ampere rating not exceeding	Size of main bonding jumper (minimum)[a,b]				Cross section of main jumper (minimum)[a,b]				Size of grounding electrode conductor (minimum)[a,b]			
	Copper,		Aluminum,		Copper,		Aluminum,		Copper,		Aluminum,	
	AWG or kcmil	(mm^2)	AWG or kcmil	(mm^2)	$inch^2$	(mm^2)	$inch^2$	(mm^2)	AWG	(mm^2)	AWG or kcmil	(mm^2)
[e] A No. 10 or larger brass screw with a green colored head that is visible after installation may be used.												
[f] A 1/4 inch (6.4 mm) diameter or larger brass or steel screw with a green colored head that is visible after installation may be used.												
[g] When the ampere rating is 400 and the wire terminal connectors for the main service conductors are rated for two 3/0 AWG (85 mm^2) copper or two 250 kcmil (127 mm^2) aluminum conductors but will not accept a 600 kcmil (304 mm^2) conductor, these values may be reduced to 2 AWG (33.55 mm^2) copper or 1/0 AWG (53.55 mm^2) aluminum.												

14.3 The provision for connection of the grounding electrode conductor specified in 14.1 shall be on the grounded conductor terminal, bus or the like.

Exception: The provision may be on the equipment-grounding terminal assembly, bus, or the like if the main bonding jumper is a bus bar or wire and is connected, or is intended to be field connected, directly from the grounded conductor terminal to the equipment-grounding-terminal assembly.

14.4 With respect to Exception No. 1 of 14.1, a threaded part that receives the screw shall not have fewer than two full, clean-cut threads. If the screw does not extend all the way through a threaded part, the taper or lead thread and the first full thread are to be disregarded in determining the number of threads engaged.

15 Spacings

15.1 General

15.1.1 The minimum spacings in a termination box marked as being suitable for use on the line side of service equipment in accordance with 28.6.1 or rated greater than 100 amperes shall be as indicated in Table 15.1 or not marked for use on the line side of service equipment and rated not greater than 100 amperes shall be as indicated in Table 15.2. Grounded dead metal includes the enclosure and any dead metal that may be electrically connected to the enclosure.

Table 15.1
Minimum spacings if marked for use on line side of service equipment or rated greater than 100 amperes

Voltage involved		Between uninsulated live parts of opposite polarity				Between uninsulated live parts and any grounded dead metal			
		Through air,		Over surface,		Through air,		Over surface,	
Greater than	Maximum	inch	(mm)	inches	(mm)	inch	(mm)	inch	(mm)
0	125	1/2	(12.7)	3/4	(19.1)	1/2	(12.7)	1/2	(12.7)
125	250	3/4	(19.1)	1-1/4	(31.8)	1/2	(12.7)	1/2	(12.7)
250	600	1	(25.4)	1-1/2	(38.1)	1/2	(12.7)	1	(25.4)
600	1000	1	(25.4)	2	(50.8)	1	(25.4)	1	(25.4)
NOTE – See 14.1 and 28.6.1.									

Table 15.2
Minimum spacings if not marked for use on line side of service equipment and rated maximum 100 amperes

Voltage involved		Between uninsulated live parts of opposite polarity and between an uninsulated live part and an exposed or uninsulated dead metal part other than the enclosure				Between uninsulated live parts and the walls of a metal enclosure, including fittings for conduit or armored cable	
		Through air,[a]		Over surface,		Shortest distance,	
Greater than	Maximum	inch	(mm)	inch	(mm)	inch	(mm)
0	150	1/8	(3.2)	1/4	(6.4)	1/2	(12.7)
150	300	1/4	(6.4)	3/8	(9.5)	1/2	(12.7)
300	600	3/8	(9.5)	1/2	(12.7)	1/2	(12.7)
600	1000	1	(25.4)	2	(50.8)	1	(25.4)

[a] The spacing between wiring terminals of opposite polarity shall not be less than 1/4 inch (6.4 mm) in any case if the terminals are in the same plane. A metal piece attached to the enclosure shall be considered to be a part of the enclosure for the purpose of this note if deformation of the enclosure is likely to reduce the spacing between the metal piece and a live part.

15.1.2 In applying Table 15.1 and Table 15.2, it is assumed that:

a) The voltage from a live part (other than the neutral) to grounded dead metal equals the line-to-line voltage of the system.

b) The voltage from a neutral live part to grounded dead metal equals the line-to-neutral voltage of the system.

15.1.3 With respect to Table 15.1 and Table 15.2:

a) An isolated dead metal part (such as a screw head or a washer) interposed between uninsulated live parts of opposite polarity or between an uninsulated live part and grounded dead metal is considered to reduce the spacing by an amount equal to the dimension of the interposed part along the path of measurement.

b) In measuring an over surface spacing, any slot, groove, or the like, that is 0.013 inch (0.33 mm) wide or less in the contour of insulating material is to be disregarded.

c) In measuring spacings, an air space of 0.013 inch or less between a live part and an insulating surface is to be disregarded, and the live part is to be considered in contact with the insulating material.

15.1.4 In measuring between an uninsulated live part and a bushing installed in a knockout, it shall be assumed that a bushing having the dimensions indicated in Table 15.3 is in place, in conjunction with a single locknut.

15.1.5 A pressure wire connector shall be prevented from turning to the extent that spacings would be reduced to less than those required in 15.1 and Table 15.1 or Table 15.2.

Exception: If such minimum spacings are maintained when wire connectors are turned 30 degrees toward each other or toward another uninsulated live or grounded metal part, a means to prevent turning need not be provided.

Table 15.3
Dimensions of bushings

Trade size of conduit, inches	Bushing dimensions			
	Overall diameter,		Height,	
	inches	(mm)	inches	(mm)
1/2	1	(25.4)	3/8	(9.5)
3/4	1-15/64	(31.4)	27/64	(10.7)
1	1-19/32	(40.5)	33/64	(13.1)
1-1/4	1-15/16	(49.2)	9/16	(14.3)
1-1/2	2-13/64	(56.0)	19/32	(15.1)
2	2-45/64	(68.7)	5/8	(15.9)
2-1/2	3-7/32	(81.8)	3/4	(19.1)
3	3-7/8	(98.4)	13/16	(20.6)
3-1/2	4-7/16	(113)	15/16	(23.8)
4	4-31/32	(126)	1	(25.4)
4-1/2	5-35/64	(140)	1-1/16	(27.0)
5	6-7/32	(156)	1-3/16	(30.2)
6	7-7/32	(183)	1-1/4	(31.8)

15.1.6 Spacings are to be measured through cracks unless a clamped joint has passed the test described in 18.2.1. A clamped joint is a joint between two pieces of insulation that are under pressure as shown in Figure 15.1. Adhesives, cements, and the like, if used to effect a seal in place of a tightly mated joint, shall comply with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

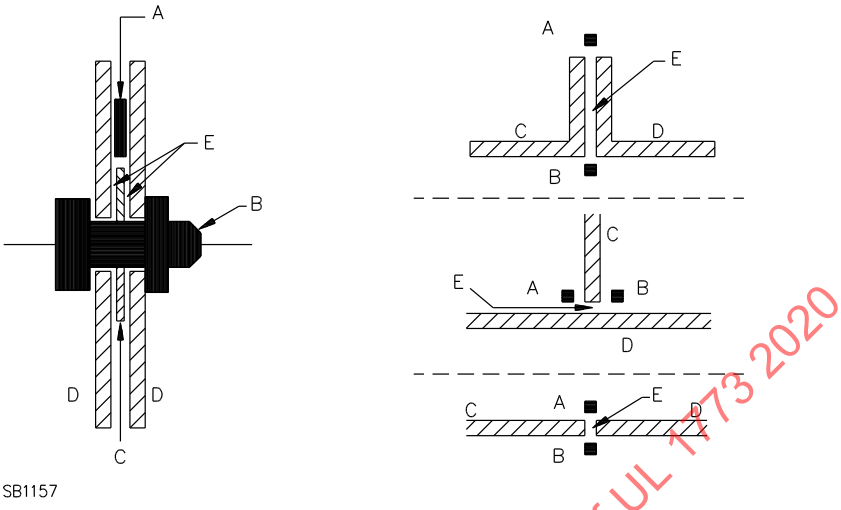
15.2 Insulating barriers

15.2.1 In 15.2.3 – 15.2.7, the insulating material referred to is a barrier that separates uninsulated live parts of opposite polarity or separates an uninsulated live part from a grounded dead metal part (including the enclosure) if the through air spacing between the parts would otherwise be less than the minimum acceptable value specified in Table 15.1.

15.2.2 In a termination box having an open bottom for underground wiring, fiber used as an insulating barrier shall be waxed, varnished, or otherwise treated to prevent absorption of moisture.

Figure 15.1

Clamped joint



Parts A, B – Live parts of opposite polarity, or a live part and grounded metal part with spacing through the crack between C and D less than required in Table 15.1 or Table 15.2.

Parts C, D – Insulators clamped tightly together so that the dielectric strength between A and B is greater than the equivalent air spacing.

Part E – The clamped joint.

15.2.3 Insulating material that comprises the sole separation shall:

a) Be of material rated for supporting an uninsulated live part.

Exception: Insulating material between the enclosure and an uninsulated part electrically connected to a grounded circuit conductor may be of fiber.

b) Have a thickness of not less than 0.028 inch (0.71 mm).

Exception: Insulating material other than fiber having a thickness less than 0.028 inch may be used if it has been found to be acceptable in accordance with 15.2.7.

15.2.4 Insulating material used in conjunction with an air space shall have a thickness of 0.028 inch (0.71 mm) or more.

Exception No. 1: Insulating material other than fiber used in conjunction with an air space of one-half or more of the required through air spacing may have a thickness of not less than 0.013 inch (0.33 mm) if it is:

a) Of material acceptable for supporting uninsulated live parts;

b) Of such strength to withstand exposure to mechanical damage; and

c) Secured in place.

Exception No. 2: Insulating material other than fiber having a thickness less than 0.028 inch may be used if it is in accordance with 15.2.7.

15.2.5 If the insulating material specified in 15.2.4 is of fiber, the air space shall not be less than 1/32 inch (0.8 mm).

15.2.6 If the insulating material specified in 15.2.4 is of material (other than fiber) that does not comply with 13.1, the material and air spacings shall be judged under the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

15.2.7 Insulating material less than 0.028 inch (0.71 mm) thick that is used in accordance with 15.2.3 or 15.2.4 shall be subjected to the application of a 5000 volt, 60 hertz potential in accordance with 18.3.1. A barrier less than 0.013 inch (0.33 mm) thick that is used in accordance with Exception No. 1 to 15.2.4 shall be subjected to the application of a 2500 volt, 60 hertz potential in accordance with 18.3.1.

15.2.8 A wrap of thermoplastic tape, rated for use as sole insulation, may be used if the following conditions are met:

a) The tape is not subject to compression;

b) The tape is not wrapped over a sharp edge;

c) At a point where the spacing prior to the application of the tape is not less than one-half the required through air spacing, the wrap is not less than 0.013 inch (0.33 mm) thick and is applied in two or more layers; and

d) At a point where the spacing prior to the application of the tape is less than one-half the required through air spacing, the wrap is not less than 0.028 inch (0.71 mm) thick.

15.2.9 If spacings would otherwise be less than the minimum values specified in Table 15.1, thermoplastic tubing may be used if the following conditions are met:

a) The tubing is not subjected to compression, repeated flexure, or sharp bends;

b) All edges of the conductor covered with the tubing are rounded and free from sharp edges;

c) For chemically dilated tubing, a solvent recommended by the tubing manufacturer is used; and

d) The wall thickness of the tubing (after assembly) is not less than 0.022 inch (0.56 mm) for tubing 1/2 inch (12.7 mm) or less in diameter, not less than 0.027 inch (0.69 mm) for tubing 9/16 or 5/8 inch (14.3 or 15.9 mm) in diameter, and not less than 0.028 inch (0.71 mm) for tubing larger than 5/8 inch in diameter.

PERFORMANCE

16 Short-Circuit Current Test

16.1 Other than as covered in 16.2 and 16.4 – 16.6 and with respect to 13.2 and 28.4.2 – 28.4.4, and Short-Circuit Current, Section 27, a termination box shall comply with the applicable requirements for through bus in the Standard for Switchboards, UL 891, for an rms symmetrical short-circuit current rating exceeding 10,000 amperes.

16.2 The results are acceptable if the termination box complies with the applicable conditions of the short-circuit test as specified in the Standard for Switchboards, UL 891, or other standard as covered in 16.3.

16.3 If the termination box is intended to be connected to other equipment through a special opening as covered in Exception No. 1 to 6.1.1 or is intended to be connected to adjacent equipment by means of cable, the short-circuit test shall be conducted in accordance with the standard for the other equipment.

16.4 Line connections and load connections to the shorting point shall be made with cable 4 feet (1.22 m) in length per terminal. Longer line connections may be provided if the additional length is included in the circuit calibration.

16.5 Pressure terminal connectors are to be tightened to the torque specified in the marking covered in 28.3.12 (the lower value is to be used if a range of torque values is specified).

16.6 Separate short-circuit tests shall be conducted using the maximum size and minimum size conductors for each size and type of wire connector included in the markings specified in 28.3.8 – 28.3.14. If some load terminals are rated for less current than the line terminals so that load connections may use smaller size wires or a smaller number of parallel wires, each combination shall be tested.

Exception: Some tests may be considered to represent others as specified in the Standard for Switchboards, UL 891.

17 Strength Test of Insulating Base and Support

17.1 An insulating base or support and the bus or strap upon which wire connectors for field wiring are mounted shall be subjected to the force created when the connectors, securing short lengths of conductors of rated ampacity, are torqued to 110 percent of the value marked on the termination box. The results are acceptable if the insulating base is not damaged as specified in 17.2.

17.2 Damage is considered to have occurred if:

a) The insulating base insulating material cracks or rotates;

b) Bosses, recesses, or other means to prevent turning do not perform their intended function;

c) Straps or bus bars bend or twist; or

d) Members other than the wire connector move at electrical joints.

Minor chipping or flaking of brittle insulating material is acceptable if the performance is not otherwise impaired. Momentary flexing of metallic members without permanent deformation is acceptable.

18 Dielectric Voltage-Withstand Test

18.1 General

18.1.1 A termination box is to be subjected for 1 minute to the application of a 60 hertz essentially sinusoidal potential of 1000 volts plus twice the rated voltage between a live part and a dead metal part and between live parts of opposite polarity. The results are acceptable if there is no dielectric breakdown.

18.1.2 The test potential is to be supplied from a 500 volt-ampere or larger capacity testing transformer, the output voltage of which can be varied. The applied potential is to be increased from zero at an essentially uniform rate and as rapidly as is consistent with its value being correctly indicated by the voltmeter until the required test value is reached, and is to be held at that level for 1 minute. The voltage is then to be reduced to zero at the same uniform rate.

Exception: A 500 volt-ampere or larger capacity transformer need not be used if the transformer is provided with a voltmeter to measure directly the applied output potential.

18.2 Clamped insulating joint

18.2.1 With respect to 15.1.6, a clamped joint between two insulators is to be tested using two samples, as described in (a) and (b):

a) The first sample is to have the clamped joint opened up to produce a space 1/8 inch (3.2 mm) wide. This may be accomplished by loosening the clamping means or by drilling a 1/8 inch diameter hole at the joint between the insulators at a point of minimum spacing between the metal parts on the opposite polarity parts as measured through the crack between the insulators. The 60 hertz dielectric breakdown voltage through this hole is then determined by applying a gradually increasing voltage (500 volts per second) until breakdown occurs.

b) The second sample with the clamped joint intact is to be subjected to a gradually increasing 60 hertz voltage until 110 percent of the breakdown voltage of (a) has been reached. If the breakdown voltage of (a) was less than 4600 volts rms, the voltage applied to the second sample is to be further increased to 5000 volts rms and held for 1 second. The clamped joint is acceptable if there is no dielectric breakdown of the second sample.

18.3 Insulating barriers

18.3.1 With respect to 15.2.7, the test specimen is to be placed between two opposing electrodes. The electrodes are to be cylindrical brass or stainless steel rods 1/4 inch (6.4 mm) in diameter with edges rounded to a 1/32 inch (0.8 mm) radius. The upper movable electrode is to weigh 50 ±2 grams to exert sufficient pressure on the specimen to provide for electrical contact. The test potential is to be increased to the test value and the maximum test potential is to be maintained for 1 second. The result is acceptable if there is no dielectric breakdown.

19 Torque Deformation Test

19.1 A mounting post or pedestal, when tested in accordance with 19.3, shall not have a vertical displacement "h" greater than the values shown in the formulas specified in 19.3. The vertical displacement is to be measured by means other than the weight bar shown in Figure 19.1 and is not to exceed an axial rotation of 2-1/2 degrees.

19.2 The sample of a post is to be prepared by securing the post to a fixed support at the grade level mark. When testing a pedestal, the sample is to be firmly mounted in the intended manner to the fixed support. The top of the post or pedestal is to be subjected to a torque of 2400 pound-inches (271 N·m) applied at right angles to the longitudinal axis of the post or pedestal. The weight "W" is to be attached to the horizontal weight bar at a distance "d_1", not less than 24 inches (610 mm) from the pivot, as shown in Figure 19.1.

$$\text{Torque} = Wd_1 = 2400\,\text{pound-inch}(271\,N\cdot M)$$

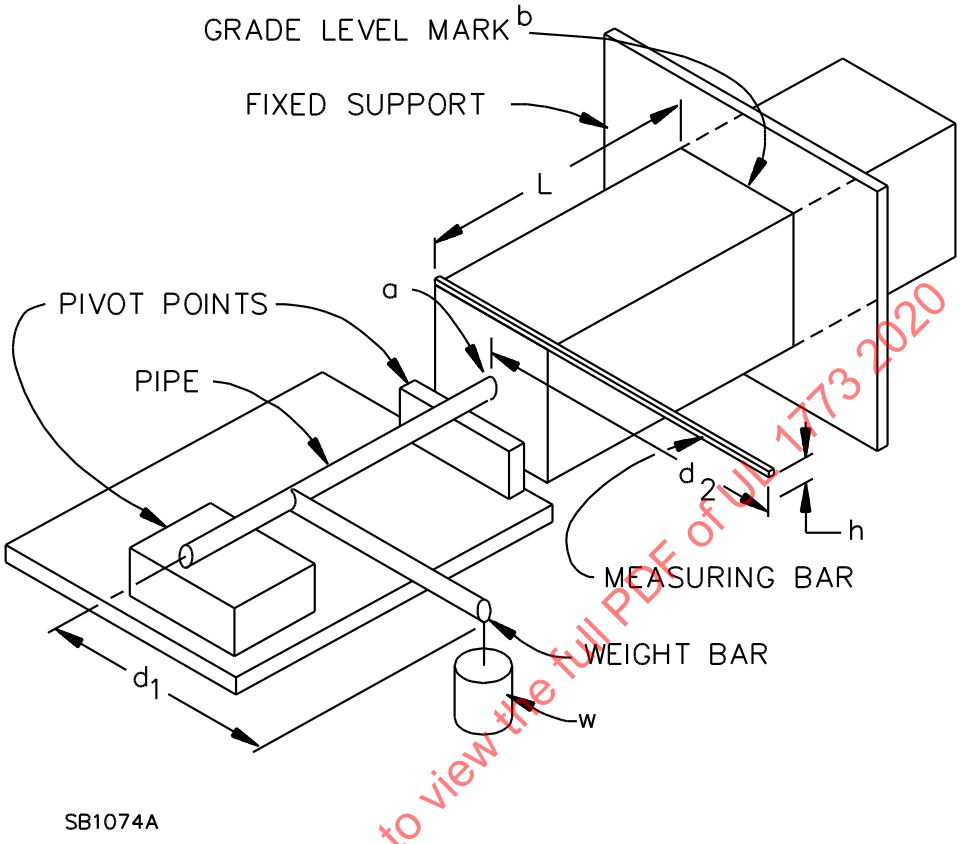
19.3 The vertical displacement "h" in inches (mm) is to be less than or equal to the constant 0.0437 (0.1432 for SI units) times the product of the length "d_2" in inches (mm) of the horizontal measuring bar and the length of the sample "L" in feet (m) as shown in Figure 19.1.

$$h\,(in) \le 0.0427 \times d_2\,(in) \times L\,(ft)$$

$$h\,(mm) \le 0.1432 \times d_2\,(mm) \times L\,(m)$$

Figure 19.1

Torque deformation



[a] For a metallic post or pedestal having a flat top, a conduit hub may be used to apply the torque from the pipe to the sample. For a non-metallic enclosure or a post with an open top over which a power outlet is mounted, a four-sided frame shall be provided to maintain the shape of the power outlet. The frame is to be inside or outside the enclosure or post, overlapping not more than 1 inch (25.4 mm). The pipe shall be secured to the frame in any convenient manner to transmit the torque from the pipe to the sample.

[b] For a post, the hole in the fixed support is maintained at the grade level mark. For a pedestal, a hole is not necessary for the rigid surface since the sample is secured to the supporting surface by the mounting means.

d_1 – The horizontal distance from the center line of the pipe to the point on the weight bar where the weight is attached.

d_2 – The distance from the middle of the surface of the post or pedestal to the end of the measuring bar.

L – The length of the enclosure between the measuring bar and the rigid surface.

W – The weight applied to provide torque as specified in 19.2.

h – Vertical displacement.

20 Beam Loading Deflection Test

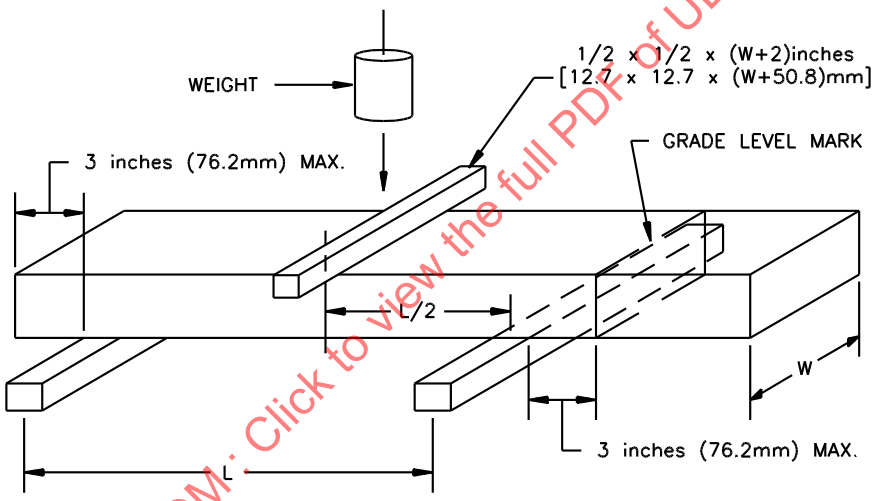
20.1 A mounting post or pedestal shall have such longitudinal stiffness that, when located as a beam supported near each end, a force created by placing a 200 pound (90.7 kg) weight on a 1/2 by 1/2 inch (12.7 by 12.7 mm) steel bar spanning the widest surface midway between the supports will produce a deflection not in excess of 0.015 inch per foot (1.25 mm/m) of distance between supports.

20.2 The sample is to be prepared for the test described in 20.1 by supporting it on two fixed members located not more than 3 inches (76.2 mm) from each end for a pedestal and not more than 3 inches from the top end and not more than 3 inches from the marked grade level as shown in Figure 20.1 for a post.

20.3 Deflection of the post or pedestal is determined by a dial micrometer used to measure the displacement on either lower side corner below the 1/2 inch (12.7 mm) square pressure bar.

Figure 20.1

Beam loading deflection



Vertical Displacement (D) measured at point A with weight applied.

$$Deflection = \frac{D\ (in\ thousands\ of\ an\ inch)}{L\ (in\ feet)} = 0.015\ inch\ per\ foot\ (1.25\ mm\ per\ m)\ maximum$$

L=Measurement between support blocks [blocks 2 by 2 inch (50.8 by 50.8 mm) cross section].

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21 Deflection Test

21.1 A cover or cap as described in 7.2.1 may be used provided it is not deflected more than 1/8 inch (3.2 mm) when subjected to a force created by placing a 30-pound (13.6-kg) weight at any point 1 inch (25.4 mm) from the edge. The test is to be conducted with the cover mounted on the enclosure in the intended manner. The force is to be applied through the end of a steel probe having a square face 1/2 by 1/2 inch (12.7 by 12.7 mm).

21.2 The sample is to be prepared for the test described in 21.1 by supporting it on a flat, rigid surface.

22 Conduit Connection Tests

22.1 A nonmetallic enclosure having provision for connection of rigid metallic conduit or rigid nonmetallic conduit shall be subjected to the polymeric enclosure tests specified in the Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50.

23 Rain and Splash Test

23.1 A mounting post or pedestal provided with a cover or door to provide environmental protection of receptacles (whether intended to be installed in the field or in the factory) shall be subjected to the Rain and Splash Test as specified in the Standard for Power Outlets, UL 231.

24 Inlet Assemblies

24.1 General

24.1.1 The performance of inlet assemblies shall be investigated by subjecting a representative device or devices in commercial form to the tests described in Sections 16 – 24. Unless otherwise indicated, the various tests shall be conducted at rated supply frequency and voltage.

24.1.2 All tests shall be conducted on enclosed samples. One sample is to complete the temperature, and dielectric voltage-withstand tests. A previously untested sample may be used for the short circuit withstand tests.

24.2 Temperature test – inlet assemblies

24.2.1 Inlet assemblies, when tested under the conditions described in 24.2.2 – 24.2.7 shall not attain a temperature at any point high enough to constitute a risk of fire or to damage any materials employed in the device, and shall not show temperature rises at specific points greater than those indicated in Table 24.1.

Table 24.1
Maximum acceptable temperature rises

Materials and compounds	°C	°F
1. Buses, connecting joints, moving or hinge contacts:		
a. Where both mating surfaces are copper	30	54
b. Where one mating surface is copper and the other is silver, tin or equivalent	50	90
c. Where both mating surfaces are silver, tin, or the equivalent	65	117
2. Field-wiring terminals		
a. Terminals rated up to 400 A	50	90
b. Terminals rated more than 400 A	60	108
3. Insulation materials	a	a
4. Face of inlets	30	54
5. Parts subject to contact by personnel:		
a. Parts handled by operator in normal use of duty	50[b]	90[b]
b. Parts accessible to operator during normal course of duty	70[b]	126[b]

[a] Total temperature for insulation materials or parts in contact with insulation materials shall not exceed the Relative Thermal Index (RTI) for the insulation material. For maximum allowable rise, subtract test ambient from the RTI for the material.

[b] Limits shown are total temperature limits. For maximum allowable rise, subtract test ambient from total limit shown.