



UL 514C

STANDARD FOR SAFETY

Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

UL Standard for Safety for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers, UL 514C

Fourth Edition, Dated April 8, 2014

Summary of Topics

This revision of ANSI/UL 514C dated April 26, 2024 includes the addition of requirements for deck boxes and rooftop deck boxes; [1.4](#), [3.6A](#), Section [10](#) title, [10.1](#), [10.4](#), [92.1.15](#) and [93.7](#).

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

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated March 3, 2023, August 25, 2023, November 24, 2023, and March 1, 2024.

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APRIL 8, 2014
(Title Page Reprinted: April 26, 2024)



ANSI/UL 514C-2024

1

UL 514C

Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

First Edition – August, 1979
Second Edition – October, 1988
Third Edition – December, 1996

Fourth Edition

April 8, 2014

This ANSI/UL Standard for Safety consists of the Fourth Edition including revisions through April 26, 2024.

The most recent designation of ANSI/UL 514C as an American National Standard (ANSI) occurred on April 26, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 514C on August 17, 1989. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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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CONTENTS

INTRODUCTION

1 Scope 9

2 Terminology 9

3 Glossary.....9

4 Units of Measurement 10

4A Normative References.....10

BOXES AND COVERS

CONSTRUCTION

5 General 10

5.1 All boxes and covers 10

5.2 Boxes and covers intended for use with nonmetallic-sheathed cable or open wiring.....11

5.3 Boxes and covers intended for use with rigid nonmetallic conduit 11

5.4 Nonmetallic outlet box covers for use in damp and wet locations 12

5.5 Boxes and covers intended for use with electrical nonmetallic tubing 12

6 Protection Against Corrosion.....12

7 Assembly 13

8 Dimensions 14

9 Device Support 14

10 Floor Boxes, Deck Boxes 14

11 Ceiling-Suspended Fan Support 15

12 Partitions 15

PERFORMANCE

13 General 15

14 Protection Against Corrosion.....16

15 Volume Verification Test.....17

16 Scrub-Water Exclusion Test 18

17 Floor Box and Cover Loading Test 18

18 Support for Floor Boxes 18

BOXES INTENDED FOR USE WITH NONMETALLIC-SHEATHED CABLE OR OPEN WIRING

CONSTRUCTION

19 Materials.....18

PERFORMANCE

20 Hot-Wire Ignition 19

21 Dielectric Voltage Withstand.....19

BOXES INTENDED FOR USE WITH NONMETALLIC-SHEATHED CABLE OR OPEN WIRING

CONSTRUCTION

22 Knockouts 20

23 Connections for Wiring Systems 20

24	Clamps for Nonmetallic-Sheathed Cable	21
25	Supports	21
26	Grounding	22
27	Extension Rings	22
28	Box Extenders	22

PERFORMANCE

29	Knockouts	23
30	Clamps for Nonmetallic-Sheathed Cable	24
	30.1 Pull Test	24
	30.2 Assembly at Low Temperature Test	24
31	Clamps for Flexible Nonmetallic Tubing	24
32	Supports	24
	32.1 General	24
	32.2 Fixture/Luminaire support	25
	32.3 Ceiling-suspended fan support	26
	32.4 Boxes intended to be installed in a finished structure	26
	32.5 Boxes for support of products up to 50 pounds (22.7 kg)	27
	32.6 Polymeric supporting means	27
33	Water Absorption	27
34	Flammability	28
	34.1 Materials	28
	34.2 Boxes	30
35	Mold Stress	32
36	Resistance to Crushing	32
37	Resistance to Impact	33
38	Threaded or Unthreaded Holes for Screws in Molded Bosses	34
39	Openings Employing Quick-Set Fastening Devices	35

COVERS FOR BOXES INTENDED FOR USE WITH NONMETALLIC-SHEATHED CABLE OR OPEN WIRING

CONSTRUCTION

40	Materials	36
	40.1 General	36
	40.2 Relative thermal index	36
41	Holes in Outlet Box Covers	36

PERFORMANCE

42	Flammability	37
43	Outlet Box Covers for Support of a Device	38

NONMETALLIC OUTLET BOX COVERS FOR USE IN DAMP AND WET LOCATIONS

CONSTRUCTION

44	General	38
45	Protection Against Corrosion	39
46	Relative Thermal Index of Materials	39
47	Gaskets	39
48	Installation of Receptacles	39

PERFORMANCE

49 General 39

50 Sealing Compound 40

51 Gaskets 40

52 Resistance to Moisture 40

 52.1 General.....40

 52.2 Assemblies for use in wet locations and wet locations with cover closed 41

 52.3 Assemblies for use in wet locations 41

53 Resistance to Ultraviolet Light and Water 42

54 Mold Stress.....43

55 Water Absorption 43

56 Dielectric Voltage Withstand.....43

57 Hot-Wire Ignition 43

58 Crushing.....44

59 Impact 44

60 Flammability 44

BOXES INTENDED FOR USE WITH ELECTRICAL NONMETALLIC TUBING

CONSTRUCTION

61 General 45

PERFORMANCE

62 General 45

COVERS INTENDED FOR USE WITH BOXES INTENDED FOR USE WITH ELECTRICAL
NONMETALLIC TUBING

CONSTRUCTION

63 General 46

PERFORMANCE

64 General 46

BOXES AND COVERS INTENDED FOR USE WITH RIGID NONMETALLIC CONDUIT

CONSTRUCTION

65 General 46

66 Bodies, Boxes, and Covers 47

 66.1 General.....47

 66.2 Thickness 47

 66.3 Connections for conduit.....47

 66.4 Covers 49

67 Boxes Intended for Use in Wet Locations 52

68 Conduit Bodies.....52

PERFORMANCE

69	General	54
70	Knockouts	54
71	Supports	54
72	Closures	54
73	Water Absorption	55
74	Flame-Retardant Properties	55
75	Heat Distortion	55
76	Extrusion or Molding Process	55
77	Physical Properties	56
	77.1 General	56
	77.2 Preparation of specimens	56
	77.3 Test method	58
78	Identification Tests	58
79	Flexural Strength	59
80	Resistance to Crushing	59
81	Low-Temperature Handling	59
82	Resistance to Impact	59
83	Bending	60
84	Pull Out	61
85	Resistance to Specific Reagents	61
86	Wet Locations	62
87	Concrete Tightness	66

FLOOR NOZZLES

CONSTRUCTION

88	Materials	66
	88.1 General	66
	88.2 Relative thermal index	67

PERFORMANCE

89	General	67
90	Resistance to Impact	67
91	Resistance to Crushing	68

MARKING

92	Details	69
	92.1 General	69
	92.2 Boxes intended for use with nonmetallic-sheathed cable or open wiring	71
	92.3 Boxes intended for use with rigid nonmetallic conduit	72
	92.4 Outlet box covers for use in wet and damp locations	72
	92.5 Boxes intended for use with electrical nonmetallic tubing	72
	92.6 Assemblies encompassing receptacles and nonmetallic covers	72
93	Instructions	73

SUPPLEMENT SA – NONMETALLIC OUTLET BOXES FOR MARINE USE

GENERAL

SA1	Scope	75
SA2	Glossary	75

CONSTRUCTION

SA3 General.....75

SA4 Mounting.....75

SA5 Supply Connections.....75

PERFORMANCE

SA6 Watertight Test 76

SA7 Dripproof Test.....76

SA8 Air-Oven Conditioning Test – Gaskets 76

MARKING

SA9 General.....76

SUPPLEMENT SB – NONMETALLIC BOXES FOR INSTALLATION IN FIRE RESISTANCE RATED WALL AND PARTITION ASSEMBLIES

GENERAL

SB1 Scope 77

SB2 Glossary 77

CONSTRUCTION

SB3 General.....77

PERFORMANCE

SB4 General.....78

SB5 Test Assembly 78

 SB5.1 General 78

 SB5.2 Materials 82

 SB5.3 Construction of the test assembly 82

 SB5.4 Testing 83

SB6 Acceptance Criteria 83

MARKING

SB7 General.....83

No Text on This Page

INTRODUCTION

1 Scope

1.1 These requirements cover nonmetallic outlet boxes, conduit bodies, flush-device boxes, extension rings, covers, floor boxes, floor nozzles, and concrete boxes to be employed in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements do not cover boxes and covers for use in hazardous locations as defined in the National Electrical Code, NFPA 70.

1.3 These requirements do not cover cabinets and cutout boxes.

1.4 These requirements do not cover junction boxes for swimming pool luminaires.

2 Terminology

2.1 In the following text, a requirement that applies only to one or more types of box or cover is so identified by a specific reference in that requirement to the type or types of boxes or covers involved. Absence of such reference indicates that the requirement applies to all types of boxes or covers.

3 Glossary

3.1 For the purpose of this standard the following definitions apply.

3.2 **BAR HANGER** – An adjustable supporting device intended for the support of an outlet box, conduit box, or device box between two structural members in a finished or unfinished structure.

3.3 **BOX EXTENDER** – A component installed in or on a box that is mounted in a finished structure intended to extend the electrical enclosure up to the new finished surface. The box extender rests on the edge of the existing box (fixed depth) or extends into the box (adjustable depth). The flange of the box extender, if provided, rests on the finished surface.

3.4 **CLAMP** – Part of a box intended to secure raceway, tubing, or cable to the box.

3.5 **CONCRETE BOX** – A box intended for support in concrete. It may be constructed to permit end-to-end extension and the application of covers on two sides. It is not intended for installation in a floor.

3.6 **CONDUIT BODY** – A separate part of a raceway system intended to provide access to the interior of the system through one or more removable covers and/or sockets at a junction of two or more sections or at a terminal point. Boxes, such as FS, FD, and larger boxes, and fittings, such as capped elbows and service entrance elbows, are not considered to be conduit bodies.

3.6A **DECK BOX** – A box provided with means for flush mounting in outdoor deck applications.

3.7 **EXTENSION RING** – A ring, which is not required to be round, intended to extend the sides of an outlet box or flush-device box to increase the box depth, volume or both. It is mechanically secured to the box.

3.8 **FLOOR BOX** – A box provided with means for flush mounting in a floor. It is sealed against the entrance of scrub water at the floor level.

3.9 FLOOR NOZZLE – An enclosure used on a wiring system, intended primarily as a housing for a receptacle. It is provided with a means, such as a collar, for surface-mounting on a floor, and it may or may not include a stem to support it above the floor level. It is sealed against the entrance of scrub water at the floor level.

3.10 FLUSH-DEVICE BOX – A box provided with ears or flanges with No. 6-32 threaded or unthreaded holes spaced to accept the mounting yoke of a wiring device or devices. This box is provided with a mounting means, and it may or may not include clamps for connection of cable, tubing, or conduit.

3.11 OUTLET BOX – A box used on a wiring system, usually at an outlet. It is provided with means for connection to a wiring system and intended primarily to enclose splices and wiring devices, but may also be acceptable as the support of a fixture/luminaire or other equipment intended for similar installation. This box may or may not be provided with studs or a bar hanger or with clamps for securing cable, tubing, or conduit.

3.12 OUTLET BOX COVER – A cover intended to provide enclosure for the face of a box. The cover may or may not support or be provided with means for support of a wiring device, pendant cord, or the like.

3.13 PARTITION – A barrier used to separate sections of a box.

3.14 RAISED-FLOOR BOX – A floor box intended for use in raised floors, such as in electronic computer/data processing equipment rooms.

4 Units of Measurement

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

4A Normative References

UL 514A
Metallic Outlet Boxes

UL 514B
Conduit, Tubing, and Cable Fittings

BOXES AND COVERS

CONSTRUCTION

5 General

5.1 All boxes and covers

5.1.1 The construction of a box or cover shall provide sufficient strength and rigidity in the finished product to enable the product to resist the rough handling that can be encountered during shipment, installation, and use.

5.1.2 The inner and outer surfaces of a box or cover shall not be subject to peeling, scaling or flaking and shall be smooth and free from blisters, cracks, and other defects. In the case of a molded product, excess flashing shall be removed from the mold line of all interior surfaces so that there are no sharp edges or undue obstructions to the passage of wiring or mating of parts in the intended use of the product.

5.1.3 A partition shall comply with the requirements in Partitions, Section [12](#).

5.1.4 A box intended for use with a partition shall have provision for proper placement of the partition during and after installation.

5.1.5 A box extender shall comply with Box Extenders, Section [28](#).

5.1.6 An outlet box cover constructed to support a flush duplex receptacle shall be provided with more than one securement point for the receptacle.

5.1.7 A cover shall comply with Installation of Receptacles, Section [48](#).

Exception: The face of a receptacle may be located behind a nonmetallic cover provided it complies with all of the following:

- a) The receptacle and cover shall be evaluated as an assembly, including compliance with [48.1](#);*
- b) The assembly shall be evaluated for compliance to requirements in this Standard, and the Standard for Attachment Plugs and Receptacles, UL 498;*
- c) The receptacle and cover shall be permanently attached or uniquely constructed to prevent securement of the cover to any other receptacle; and*
- d) The assembly shall be marked in accordance with [92.6.1](#), and provided with installation instructions in accordance with [93.6](#).*

5.2 Boxes and covers intended for use with nonmetallic-sheathed cable or open wiring

5.2.1 The requirements in Sections [6](#) – [42](#) cover boxes and covers intended for use with nonmetallic sheathed cable or open wiring and boxes with a volume of less than 100 cubic inches (1639 cm³), and multiple-gang flush-device boxes.

5.3 Boxes and covers intended for use with rigid nonmetallic conduit

5.3.1 The requirements in Sections [6](#) – [15](#) and [65](#) – [93](#) cover rigid nonmetallic, such as unplasticized polyvinyl chloride, boxes and covers, including blank covers.

5.3.2 The products covered by the requirements in Sections [6](#) – [15](#) and [65](#) – [93](#) are intended to be joined in the field to rigid nonmetallic conduit.

5.3.3 The nonmetallic products covered by the requirements in Sections [6](#) – [15](#) and [65](#) – [93](#) are considered to be inherently resistant to the corrosive influences of common industrial atmospheres including the vapors and mists of bases, hydrofluoric and chromic acids, and chromic acids, and pickling and plating baths. Resistance to specific reagents is covered in Resistance to Specific Reagents, Section [85](#) and in [92.3.1](#) and [92.3.2](#).

5.3.4 The outlet boxes covered by the requirements in Sections [6](#) – [15](#) and [65](#) – [93](#) have an interior volume of 100 cubic inches (1639 cm³) or less and are intended to provide access to wiring during installation of the wiring. They are also intended to enclose splices, taps, and wiring devices. From one to four unthreaded conduit-connection sockets are provided integrally with a PVC box, or the box is blank.

5.3.5 The conduit bodies covered by the requirements in Sections [6](#) – [15](#) and [65](#) – [93](#) are pull boxes intended for use with nonmetallic conduit to enclose splices and taps and to support wiring devices not involving the generation of heat – for example, lampholders are not acceptable – mounted on cover plates.

Blank covers are to be provided with the bodies. From one to four unthreaded conduit-connections sockets are to be provided integrally with the body.

5.3.6 The flush-device boxes covered by the requirements in Sections [6 – 15](#) and [65 – 93](#) have an interior volume of 100 cubic inches (1639 cm³) or less. Flush-device boxes made of PVC material are intended for use with nonmetallic conduit for the support of wiring devices not involving the generation of heat – for example, lampholders are not acceptable – with the wiring devices mounted directly in the box rather than on the cover but can also be used as junction and conduit bodies. Flush-device boxes may be provided with blank covers or flush-device cover plates. At least one unthreaded conduit-connection socket or knockout is provided integrally with a PVC box, or the box is blank.

5.3.7 A flush-device box that is not multi-gang, a junction box, or an outlet box, the interior of which is larger in volume than 100 cubic inches (1639 cm³), is covered as a junction or pull box under the requirements in the Standard for Enclosures for Electrical Equipment, UL 50.

5.4 Nonmetallic outlet box covers for use in damp and wet locations

5.4.1 An outlet box cover intended for use in damp or wet locations shall comply with the applicable requirements in Sections [44 – 60](#) when installed as intended and shall be marked in accordance with [92.4.1 – 92.4.4](#).

Exception No. 1: An outlet box cover intended for use in a wet location with the cover closed is not required to comply with the requirements in [52.3.1](#) and [52.3.3](#).

Exception No. 2: An outlet box cover intended for use in a damp location is not required to comply with the requirements in [52.2.1 – 52.3.3](#).

5.5 Boxes and covers intended for use with electrical nonmetallic tubing

5.5.1 The products covered by the requirements in Sections [6 – 43](#) and [61 – 64](#) are boxes and covers intended for use with electrical nonmetallic tubing.

6 Protection Against Corrosion

6.1 All surfaces of all attached metal parts of a box, including screws, shall be protected against corrosion unless the metal is inherently resistant to corrosion.

Exception: The cut edges, punched holes, and the threaded surfaces of tapped holes of a part formed from galvanized stock do not need additional protection.

6.2 The thickness of the coating on a screw is not specified, but the presence of a coating is to be determined by visual inspection.

6.3 The thickness of a zinc coating on the exposed surface of a permanently attached ferrous metal mounting bracket or a clamp shall not be less than specified in [Table 6.1](#).

Table 6.1
Thickness of coating

Material	Minimum thickness of coating inch [millimeter (mm)]			
	Intended for assembly			
	Outside of box		Inside of box	
Sheet steel	0.0005	(0.013)	0.00015	(0.0038)
Cast iron, including malleable iron	0.00015	(0.0038)	0.00015	(0.0038)

7 Assembly

7.1 Except as noted in [7.2](#), an assembly screw shall not have fewer than the number of threads per inch of the American National Coarse-Thread Series, in accordance with the diameter of the screw, unless it is found by investigation that the screw is not likely to abrade conductor insulation, and that the assembly is not adversely affected by vibration.

7.2 An assembly screw used to secure a cover to a box shall not have a fewer than the number of threads per inch specified in the American National Coarse-Thread Series for the diameter of the screw.

7.3 An outlet box intended to support a fixture/luminaire, but not intended to support a ceiling-suspended fan, may or may not be provided with two or more steel No. 8-32 cover retaining or fixture/luminaire support screws, and shall be provided with threaded or unthreaded holes for No. 8-32 screws.

7.4 An outlet box intended to support a fixture/luminaire, and also intended to support a ceiling-suspended fan, shall comply with Ceiling-Suspended Fan Support, Section [11](#).

7.5 Metal that is part of or provided with an outlet box and with which a wire or cable may make contact shall be located or protected so that contact with the part by a person or by metal outside the box will be prevented.

Exception: A grounding strap or plate may contact wires within an outlet box provided the construction complies with the requirements in [26.1](#).

7.6 So that contact between a supporting eyelet, nail, rivet, or screw and conductors within a box will be prevented as required by [25.3](#), a hole in a box that may be used for an eyelet nail, rivet, or screw shall be located in a recess, designed so 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 eyelet, nail, rivet, or screw that is provided with the box. If a screw or nail is not provided with the box, this spacing shall be measured:

- a) Using the largest round-head screw, specified in [Table 7.1](#), that can be inserted in a hole that is not chamfered, or
- b) Using the largest flat-head screw that can be inserted in a hole that is chamfered.

Table 7.1
Supporting screw hole dimensions

Nominal screw	Maximum diameter of threads		Minimum dimensions of recess, inch (mm)			
size	inch (mm)		Diameter		Depth	
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)

7.7 An assembly screw that can be tightened with a screwdriver is to be tightened with the torque specified in [Table 7.2](#).

Table 7.2
Tightening torque

Nominal screw	Tightening torque	
size	pound-inch	(N·m)
6	12	(1.36)
8	20	(2.26)
10	35	(3.96)

8 Dimensions

8.1 A flush-device box shall have a minimum internal width of not less than 1-3/4 inches (44.5 mm).

8.2 The volume of any box, raised cover, extension ring, or fitting that increases significantly the volume of a box assembly shall be verified as described in Volume Verification Test, Section [15](#), or by any equivalent means. See [92.1.5](#) and [92.1.7](#) for marking requirements.

8.3 A box provided with a partition shall have the volume of each partitioned section verified as described in Volume Verification Test, Section [15](#), or by any equivalent means. Each partitioned section of the box shall be marked in accordance with [92.1.5](#).

9 Device Support

9.1 Provision for supporting a device to be enclosed in a box shall be independent of the screws used to support the box.

10 Floor Boxes, Deck Boxes

10.1 In addition to the requirements for nonmetallic outlet boxes in this Standard, a floor box, deck box shall comply with the appropriate requirements for Floor Boxes in the Standard for Metallic Outlet Boxes, UL 514A, including markings and installation instructions indicated as applicable to outlet boxes for use in the United States.

10.2 Where appropriate, floor boxes shall be marked in accordance with [92.3.5](#) or [92.5](#).

10.3 *deleted*

10.4 A deck box shall have a minimum Type rating of 3R in accordance with the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E.

11 Ceiling-Suspended Fan Support

11.1 In addition to the requirements for nonmetallic outlet boxes in this Standard, an outlet box intended to support a ceiling-suspended fan shall comply with the requirements in Section [32.2](#) and the appropriate requirements for Fixture/Luminaire Support and for Ceiling Suspended Fan Support in the Standard for Metallic Outlet Boxes, UL 514A, including markings and installation instructions indicated as applicable to outlet boxes for use in the United States.

11.2 *deleted*

12 Partitions

12.1 A partition shall fit the inside of the box in which it is intended to be used. Any openings or gaps of any length between the partition and the inside surface of the box shall not be greater than 0.080 inch (2.0 mm).

12.2 A polymeric material used for a partition shall have a relative thermal index of not less than 80°C (176°F) for properties of electrical and mechanical without impact determined in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B.

12.3 A partition manufactured from a polymeric material shall comply with the requirements for the Flammability Test as specified in [34.1.1](#) – [34.1.7](#).

Exception: A material designated 5VA, in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, need not be tested.

12.4 A partition manufactured from a polymeric material shall comply with the requirements for the Mold Stress Test, Section [35](#).

12.5 A partition manufactured from a polymeric material shall comply with the requirements for the Water Absorption Test, Section [33](#).

12.6 A partition manufactured from a polymeric material shall not ignite within 15 seconds after application of the test current, when subjected to the Hot-Wire Ignition Test, in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

Exception: A polymeric material with a Performance Level Category (PLC) of 0, 1, 2, or 3 in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A, need not be tested.

PERFORMANCE

13 General

13.1 Unless otherwise stated, not less than six samples of each type of box, cover, and the like are to be subjected to each test.

Exception: When a line of at least four sizes of boxes or the like, of a particular design, is being investigated, not less than three samples of each box are to be tested.

14 Protection Against Corrosion

14.1 The metallic-coating-thickness test described in [14.2](#) – [14.9](#) is to be used to determine the thickness of zinc coatings. The test is only to be conducted when a required coating thickness is specified.

14.2 The solution to be used for the test is to be made from distilled water and is to contain 200 grams per liter of reagent grade chromic acid (CrO_3); and 50 grams per liter of reagent grade concentrated sulfuric acid (H_2SO_4). The latter is equivalent to 27 milliliters per liter of reagent grade concentrated sulfuric acid, specific gravity 1.84, containing 96 percent of H_2SO_4 .

14.3 The test solution is to be contained in a glass vessel such as a separatory funnel with the outlet equipped with a stopcock and a capillary tube having an inside bore of 0.025 inch (0.64 mm) and a length of 5.5 inches (140 mm). The lower end of the capillary tube is tapered to form a tip, the drops from which are about 0.05 milliliter each. To preserve an effectively constant level, a small glass tube is inserted in the top of the funnel through a rubber stopper and its position is to be adjusted so that, when the stopcock is open, the rate of dropping is 100 ± 5 drops per minute. An additional stopcock may be used in place of the glass tube to control the rate of dropping.

14.4 The sample and the test solution are to be kept in the test room long enough to acquire the temperature of the room, which is to be noted and recorded. The test is to be conducted at a room temperature of $21 - 32^\circ\text{C}$ ($70 - 90^\circ\text{F}$).

14.5 Each sample is to be thoroughly cleaned before testing. All grease, lacquer, paint, and other nonmetallic coatings are to be removed completely by means of solvents. Samples are then to be thoroughly rinsed in water and dried with clean cheesecloth. Care is to be exercised to avoid contact of the cleaned surface with the hands or any foreign material.

14.6 The sample to be tested is to be supported 0.7 – 1.0 inch (18 – 25 mm) below the orifice, so that the drops of solution strike the point to be tested and run off quickly. The surface to be tested should be inclined about 45 degrees from horizontal.

14.7 After cleaning, the sample to be tested is to be put in place under the orifice. The stopcock is to be opened and the time in seconds is to be measured with a stop watch until the dropping solution dissolves off the protective metallic coating, exposing the base metal. The end point is the first appearance of the base metal recognizable by a change in color at that point.

14.8 Each sample of a test lot is to be subjected to the test at three or more points, excluding cut, stenciled, and threaded surfaces, on the inside surface and at an equal number of points on the outside surface, at places where the metallic coating may be expected to be the thinnest. On parts made from precoated sheets, a bend or the like that is subjected to the greatest deformation is likely to have thin coatings.

14.9 To calculate the thickness in inches (mm) of the coating being tested, select from [Table 14.1](#) the thickness factor appropriate for the temperature at which the test was conducted and multiply by the time in seconds required to expose the base metal as measured in [14.7](#).

Table 14.1
Coating thickness factors

Temperature, Degrees		Thickness factors, 0.00001 inches (0.0003 mm) per second
F	(C)	Zinc platings
70	(21.1)	0.980
71	(21.7)	0.990
72	(22.2)	1.000
73	(22.8)	1.010
74	(23.3)	1.015
75	(23.9)	1.025
76	(24.4)	1.033
77	(25.0)	1.042
78	(25.6)	1.050
79	(26.1)	1.060
80	(26.7)	1.070
81	(27.2)	1.080
82	(27.8)	1.085
83	(28.3)	1.095
84	(28.9)	1.100
85	(29.4)	1.110
86	(30.0)	1.120
87	(30.6)	1.130
88	(31.1)	1.141
89	(31.7)	1.150
90	(32.2)	1.160

15 Volume Verification Test

15.1 A box, partitioned section, raised cover, extension cover, or fitting shall hold a volume of water equal to or greater than the marked volume when tested in accordance with [15.2](#) – [15.5](#).

15.2 All separable cable clamps, associated screws, and fixture/luminaire studs are to be removed. Any projections that extend outside the plane of the open face of a box, such as ears for mounting a cover or a flush device, are to be ground flush with the face of the box.

15.3 All large openings are to be closed by flat, rigid plates clamped in place across the openings. One of the plates is to contain two small holes, one for the entrance of a measuring fluid, the other for venting air.

15.4 Using modeling clay, putty, glazing compound, or similar material:

- a) A hole through the side or bottom of the sample and a hole between the sample and the plate mentioned in [15.3](#) are to be filled flush with the inside surface.
- b) An internal hub, if tapped through, is to be filled flush with the end of the hub.
- c) A bushed opening is to be filled flush with the conduit stop.

15.5 Using a clean, graduated vessel – pipette or the equivalent – having a volume equal to or greater than the marked volume of the sample and containing water at room temperature, water is to be transferred to the test sample through the hole in the plate mentioned in [15.3](#). The results are acceptable if the test sample holds a volume of water equal to or greater than the marked volume.

16 Scrub-Water Exclusion Test

16.1 *deleted*

16.2 *deleted*

16.3 *deleted*

16.4 *deleted*

16.5 *deleted*

16.6 *deleted*

17 Floor Box and Cover Loading Test

17.1 *deleted*

17.2 *deleted*

17.3 *deleted*

Figure 17.1

Figure deleted

17.4 *deleted*

18 Support for Floor Boxes

18.1 *deleted*

18.2 *deleted*

18.3 *deleted*

BOXES INTENDED FOR USE WITH NONMETALLIC-SHEATHED CABLE OR OPEN WIRING

CONSTRUCTION

19 Materials

19.1 A material used for a box that has not been investigated for the application shall be investigated for combustibility, aging characteristics, temperature stability, resistance to ignition, dielectric strength, and physical strength.

19.2 A material that is employed in a box not intended for the support of a fixture/luminaire, or in a box intended to support a fixture/luminaire weighing 49 lbs (22.2 kg) or less and marked for use in a wall, shall have relative thermal indices of not less than 80°C (176°F) for properties of electrical (RTI Elec) and mechanical strength (RTI Str). See [92.1.9](#).

19.3 A material that is employed in a box that is marked intended for support of a fixture/luminaire in a ceiling, or a ceiling suspended fan shall have relative thermal indices of not less than 90°C (194°F) for properties of electrical (RTI Elec) and mechanical strength (RTI Str).

19.3A An overmold or overlay material applied to a box described in [19.2](#) or [19.3](#) for the purpose of closing openings in air-seal applications, shall have relative thermal indices of not less than 50°C (122°F) for properties of electrical (RTI Elec) and mechanical strength (RTI Str). No openings shall be greater than 0.625 inch (15.90 mm) by 0.844 inch (21.44 mm). Overmold or overlay material does not apply to gaskets used to cover up knockouts or clamps.

19.4 The relative thermal index specified in [19.2](#), [19.3](#), [19.3A](#), [40.2.1](#), and [46.1](#) is to be determined in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B.

PERFORMANCE

20 Hot-Wire Ignition

20.1 When tested as described in [20.2](#), a polymeric material used for a box shall not ignite within 15 seconds after the application of the test current.

Exception: A material that has been previously investigated and found to be rated for the application is not required to be tested.

20.2 To determine whether a material complies with the requirement in [20.1](#), three 1/2-inch (12.7 mm) by 5-inch (127-mm) specimens of polymeric material in sheet form having a thickness of not more than the minimum thickness used for the box are to be tested in accordance with the requirements for hot-wire ignition described in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

21 Dielectric Voltage Withstand

21.1 The molded material used for a box shall withstand for 1 minute without breakdown the application of a 60-hertz, essentially sinusoidal potential of 2500 volts when tested as described in [21.2](#).

Exception: A box made of a molded material that has been previously investigated and found to be rated for the application.

21.2 To determine whether a box complies with the requirement in [21.1](#), sample boxes are to be tested by applying the test potential across the thinnest section of the box, excluding knockouts. Each box is then to be conditioned for 24 hours in moist air having a relative humidity of 85 ±5 percent at a temperature of 32 ±2°C (90 ±4°F). Following this conditioning, each box is again to be subjected to the specified test potential.

BOXES INTENDED FOR USE WITH NONMETALLIC-SHEATHED CABLE OR OPEN WIRING

CONSTRUCTION

22 Knockouts

22.1 A knockout shall completely cover the opening in which it is located, and the clearance between the knockout and the opening shall not be more than 0.030 inch (0.76 mm).

22.2 The maximum dimension of a knockout intended for use with a nonmetallic fixture/luminaire stud shall not exceed 27/32 inch (21.4 mm).

22.3 The dimensions of a knockout intended for use with nonmetallic-sheathed cable shall not be more than:

- a) 0.500 inch (12.70 mm) by 0.625 inch (15.90 mm) for a single-stage cable knockout, and
- b) 0.500 by 0.625 inch for the first stage of a multi-stage knockout and 0.625 by 0.844 inch (21.44 mm) for the second stage. See [29.4](#).

Exception: A box intended for use with nonmetallic-sheathed cable and either provided with or having provision for a separable cable clamp may have a single-stage knockout that does not exceed 0.625 by 0.844 inch.

23 Connections for Wiring Systems

23.1 A box shall be provided with means for connection to a wiring system.

23.2 A box intended for use with open wiring or concealed knob and tube wiring shall have provisions for the separate entry of each conductor through a hole.

23.3 Each box shall be provided with a number of means for securing open wiring, concealed knob and tube wiring, and nonmetallic - sheathed cables entering the box. This number shall be consistent with the box volume but need not exceed the number of knockouts in the box. See [23.4](#).

Exception: A box nominally 2-1/4 by 4 inches or smaller (single-gang) need not be provided with a means for securing nonmetallic-sheathed cable. A round or octagonal box is not considered to be such a box.

23.4 To determine the minimum number of wiring and cable securing means that shall be provided with a box, the following method shall be used:

- a) For a securing means intended for use with open wiring or concealed knob and tube wiring, the number shall be calculated from the formula:

$$C = \frac{V}{2} - 1$$

in which:

C is the number of securing means, and

V is the marked volume of the box. A further subtraction of 1 is acceptable for each device intended to be fastened to the box.

- b) For a securing means that is acceptable only for nonmetallic-sheathed cable, dividing the number calculated in accordance with (a) by 2 is acceptable. See [23.5](#).

23.5 The result calculated as described in [23.4](#)(a) and (b) shall be rounded, if necessary, to the nearest integer.

23.6 The securing means required by [23.3](#) shall be integral with, fastened to, or packed securely inside each box.

Exception: A securing means may be separate from a box provided the number of means required for each box is included in the smallest unit carton in which the box is shipped, and both the box and the means are marked in accordance with [92.2.2](#) and [92.2.3](#), respectively.

23.7 Nonmetallic boxes not larger than 2-1/4 by 4 inches (57 by 100 mm) intended for installation in a finished existing structure shall be either supplied with a means of securing the cable or conduit to the box or marked in accordance with [92.2.7](#).

24 Clamps for Nonmetallic-Sheathed Cable

24.1 A clamp provided in a box and intended for securing nonmetallic-sheathed cable shall substantially close the opening in the box surrounding the cable.

24.2 A clamp provided as part of a box and intended for use with nonmetallic-sheathed cable shall secure cable ranging in size from 14 AWG (2.1 mm²), two-wire cable with an uninsulated grounding wire to the largest oval or round multiconductor cable that can be accommodated by the clamp unless the clamp is marked to indicate its use with other cable sizes. See [30.1.1](#), [92.2.4](#), and [92.2.5](#).

25 Supports

25.1 A box shall be provided with means for support so that it can be securely fastened in place without depending upon the support furnished by any wiring system.

25.2 Sheet-steel end-supporting ears furnished with a box shall not be less than 0.036 inch (0.91 mm) thick if formed from uncoated stock, and not less than 0.039 inch (0.99 mm) thick if formed from galvanized stock. The ears shall be attached to the box and prevented from turning relative to the box.

25.3 Provision for support or other mounting means shall be outside the box, unless the box is constructed so that the conductors within the box cannot contact supporting screws.

25.4 A molded, threaded boss intended for support of a fixture/luminaire shall not be recessed more than 1/8 inch (3.2 mm) from the plane of the open face of the box. See [32.2.7](#)–[32.4.1](#).

25.5 Where the supporting means is constructed of a polymeric material, the supporting means shall also comply with Polymeric Supporting Means, Section [32.6](#).

25.6 In addition to the requirements for nonmetallic outlet boxes in this standard, an outlet box intended for fixture/luminaire support shall comply with the requirements in Section [32.2](#) and the appropriate requirements for Fixture/Luminaire Support and for Ceiling Suspended Fan Support in the Standard for Metallic Outlet Boxes, UL 514A, including markings and installation instructions indicated as applicable to outlet boxes for use in the United States.

25.7 An outlet box and bar hanger assembly shall comply with the appropriate requirements for Fixture/Luminaire Support, including markings indicated as applicable to outlet boxes for use in the United States.

25.8 *deleted*

25.9 *deleted*

25.10 *deleted*

26 Grounding

26.1 A metal strap or plate provided in a box and intended for connection of a grounding conductor shall be provided with one or more grounding screws. The strap or plate shall provide a continuous conductive path from each screw to the mounting yokes or straps of all devices that may be mounted in the box.

26.2 A grounding screw provided in a box shall be No. 8-32 or larger, have a green-colored head that is slotted or hexagonal, or both, and be plated steel, stainless steel, copper, or copper alloy. A grounding screw shall engage at least two full threads and shall be used in conjunction with upturned lugs, a cupped washer, or an equivalent method that is capable of retaining a 10 AWG conductor under the head of the screw.

27 Extension Rings

27.1 An extension ring shall fit closely with a box of the type and size with which it is intended to be used.

27.2 An extension ring manufactured from a polymeric material shall comply with the following:

- a) The relative thermal index in accordance with [19.2](#) and [19.4](#),
- b) Hot-Wire Ignition, Section [20](#),
- c) Dielectric Voltage Withstand, Section [21](#),
- d) Water Absorption, Section [33](#),
- e) Flammability, Section [34](#),
- f) Mold Stress, Section [35](#),
- g) Resistance to Crushing, Section [36](#), and
- h) The Impact Test described in [37.1](#) and [37.2](#).

28 Box Extenders

28.1 A box extender shall not be used to secure any type of product and shall be provided with installation instructions in accordance with [93.4](#) and [93.5](#).

28.2 A fixed box extender shall fit on the open face of the box. There shall not be openings between the box extender and the plane of the open face of the box.

28.3 An adjustable box extender shall fit inside the box in which it is intended to be used. There shall not be openings between the box extender and the plane of the open face of the box under any intended adjustment.

28.4 An adjustable box extender shall be marked to show the maximum allowable amount of extension in accordance with [92.1.20](#).

28.5 A polymeric material employed in a box extender used with boxes not intended for the support of a fixture/luminaire, or for boxes intended to support a fixture/luminaire weighing 49 lb (22.2 kg) or less and marked for use in a wall, shall have relative thermal indices in accordance with [19.2](#) and [19.4](#). A polymeric material employed in a box extender used with boxes marked for support of a fixture/luminaire in a ceiling

or with boxes marked to support a ceiling suspended fan shall have relative thermal indices in accordance with [19.3](#) and [19.4](#). See [93.4](#).

28.6 A polymeric material used for a box extender shall not ignite within 15 seconds after application of the test current when subjected to the Hot-Wire Ignition Test in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

Exception: A polymeric material with a Performance Level Category (PLC) of 0, 1, 2, or 3 in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A, is not required to be tested.

28.7 A box extender manufactured from a polymeric material shall comply with Flammability, Section [34](#). With reference to [34.2](#), the flame shall be applied only to the exterior edge and interior flat surface.

Exception: A box extender manufactured from a polymeric material designated 5VA, in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, is not required to be tested.

28.8 A box extender manufactured from a polymeric material shall comply with the following:

- a) Dielectric Voltage Withstand, Section [21](#),
- b) Water Absorption, Section [33](#),
- c) Mold Stress, Section [35](#),
- d) The Impact Test described in [37.1](#) and [37.2](#).

PERFORMANCE

29 Knockouts

29.1 A force of 10 pounds (44.5 N) shall be applied to a knockout or integral cable clamp for 1 minute by means of a minimum 1-1/2 inch (38.1 mm) long by 1/4 inch (6.4 mm) diameter mandrel with a flat end. The force is to be applied in a direction perpendicular to the plane of the knockout or clamp and at the point most likely to cause movement. The knockout or clamp shall remain in place and the clearance between the knockout or clamp and the opening shall not be more than 0.030 inch (0.75 mm) when measured 1 hour after the force has been removed.

29.2 A knockout shall be easily removed by means of a screw driver, used as a chisel, without leaving any sharp edges or causing any damage to the box. The side edge of a screwdriver may be run along the edge of the knockout opening once, to remove any fragile tabs remaining along the edge.

29.3 A box that is constructed of a material that is known to be affected by low temperatures is to be conditioned for 5 hours in air maintained at minus 20 $\pm$ 1°C (minus 4 $\pm$ 2°F). Immediately following this conditioning, the test described in [29.2](#) shall be repeated on the box.

29.4 For a box employing multi-stage knockouts, there shall be no displacement of a larger stage when a smaller stage is removed as described in [29.1](#) and [29.2](#).

30 Clamps for Nonmetallic-Sheathed Cable

30.1 Pull Test

30.1.1 A box provided with a nonmetallic-sheathed-cable clamp(s) shall comply with the appropriate requirements in Clause 8.25 of the Standard for Conduit, Tubing, and Cable Fittings, UL 514B, CSA C22.2 No. 18.3, or NMX-J-017-ANCE. The box shall be prepared for testing in accordance with [30.1.2](#) and [30.1.3](#).

30.1.2 Knockout removal is to be in accordance with [29.2](#). For an integral nonmetallic clamp, the holding tabs of the clamp are to be cut. The integral clamp is not to be removed.

30.1.3 Three sample assemblies from each set of boxes having an integral nonmetallic clamp for nonmetallic-sheathed cable are to be tested in the as-received condition. Three sample assemblies from each set are to be tested immediately after being removed from being conditioned for 24 hours in air at a temperature of minus $25 \pm 1^\circ\text{C}$ (minus $13 \pm 2^\circ\text{F}$).

30.2 Assembly at Low Temperature Test

30.2.1 When tested as described in [30.2.2](#), an integral cable clamp shall remain usable and stay in place during installation of nonmetallic-sheathed cable at low temperatures.

30.2.2 After being conditioned in air maintained at minus $20 \pm 1^\circ\text{C}$ (minus $4 \pm 2^\circ\text{F}$) for 5 hours, a box provided with an integral nonmetallic sheathed cable clamp is to be assembled using the largest size nonmetallic sheathed cable(s) that the clamp is intended to secure where the cable complies with the Standard for Nonmetallic-Sheathed Cables, UL 719. The cable is to be assembled to the box in the conditioned air or within 15 seconds after removal. See [92.2.4](#) and [92.2.5](#). Knockout removal during assembly is to be in accordance with [30.1.2](#).

31 Clamps for Flexible Nonmetallic Tubing

31.1 A clamp for flexible nonmetallic tubing shall secure the tubing, with a wire in place as in actual service, so that it will withstand for 5 minutes a steady pull of 30 pounds (133 N) in either direction, and so that it cannot be readily removed by bending or flexing. The pull shall be applied between the tubing and a box in which the clamp is mounted in the intended manner.

31.2 The tubing to be employed in conducting the test described in [32.1.1](#) is to be standard 7/32-inch flexible nonmetallic tubing; Type T, TW, or THW, 14 AWG (2.1 mm^2) wire is to be used, and is to project approximately 6 inches (152 mm) inside the box. A screw that can be tightened with a screwdriver is to be tightened as specified in [7.7](#).

32 Supports

32.1 General

32.1.1 A bracket or other device for securing a flush-device or other box not intended to support a fixture/luminaire to a structural wall stud shall withstand a pull of 50 pounds (222 N) when tested in accordance with [32.1.2](#). The bracket may bend; but the results of the test are not acceptable if the bracket breaks, or if the box is pulled loose from the bracket.

32.1.2 The bracket is to be secured so that the plane of the front of the box is vertical, and a 50-pound (22.7-kg) weight is to be suspended from the lower outer edge of the box for 5 minutes.