



UL 514A

STANDARD FOR SAFETY

Metallic Outlet Boxes

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UL Standard for Safety for Metallic Outlet Boxes, UL 514A

Eleventh Edition, Dated February 1, 2013

Summary of Topics

The new edition dated February 1, 2013 was issued to incorporate minor editorial changes, some clarifications, organizational changes, renumbering changes, and the following:

- ***Addition of knockout requirements for 1-1/2 and 2 trade size knockouts to Table 6 and Figure 15.***
- ***Addition of Testing and Marking Requirements for Adjustable Fixture Rated Supporting Devices.***
- ***Mounting Brackets to Support Multiple Metallic Boxes.***
- ***Requirements for Adjustable Mud Rings.***
- ***Revision to Clause 9.5.1.3.1.***
- ***Floor Boxes-Required Markings.***
- ***Combination Rigid (threaded) and EMT (set screw) products for use in wet locations.***
- ***Revision of Clause 12.2.***
- ***UL 50E Clarifications.***
- ***Revision to Ceiling-Suspended Fan Support Requirement for Canada in Clause 5.7 to Reflect Proposed Changes to the CEC.***
- ***Revision to Supporting Nail Hole Requirements for Canada in Clauses 9.5.2.1 and 9.5.2.2.***
- ***Revision to the Maximum Diameter Value for Trade Size 1/2 (16) Conduit in Table 6.***

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated May 11, 2012 and September 21, 2012.

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The following table lists the future effective dates with the corresponding item.

Future Effective Date	References
February 15, 2015	Section 2, 3.2, 3.3, 5.7.1, 5.7.2, 5.10.1, 5.11.4, Section 5.15, Section 5.16, 6.2.1, Section 6.5, 9.5.1.4, 9.5.2.1, 9.5.2.3, 9.6.1.1, 9.6.2.1, Section 9.18, Section 9.19, 10.1.2, 10.1.3, 10.1.4, 12.2.2, 12.2.6, 12.11.1, 12.11.2, 12.14.1.1, 12.22.1, Section 12.23, Table 6, Table 9, Figure 8, Figure 16, Figure 18, and Annex A
February 15, 2018	5.8.1, 5.8.2, and 11.5.2



Association of Standardization and Certification
NMX-J-023/1-ANCE
Third Edition



CSA Group
CSA-C22.2 No. 18.1-13
Second Edition



Underwriters Laboratories Inc.
UL 514A
Eleventh Edition

Metallic Outlet Boxes

February 1, 2013



ANSI/UL 514A-2013

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This ANSI/UL Standard for Safety consists of the Eleventh Edition.

The most recent designation of ANSI/UL 514A as an American National Standard (ANSI) occurred on February 1, 2013. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

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 <http://csds.ul.com>.

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Preface

This is the harmonized ANCE, CSA Group, and UL standard for *Metallic Outlet Boxes*. It is the third edition of NMX-J-023/1-ANCE, the second edition of CSA C22.2 No. 18.1, and the eleventh edition of UL 514A. This harmonized standard has been jointly revised on February 1, 2013. This edition of CSA C22.2 No. 18.1 supersedes the previous edition(s) published in 2004.

This harmonized standard was prepared by the Association of Standardization and Certification (ANCE), CSA Group, and Underwriters Laboratories Inc. (UL). The efforts and support of the Technical Harmonization Committee for Switch and Outlet Boxes, of the Council on the Harmonization of Electrotechnical Standards of the Nations of the Americas (CANENA), are gratefully acknowledged.

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

This standard was reviewed by the CSA Integrated Committee on Wiring Devices, under the jurisdiction of the CSA Technical Committee on Wiring Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee.

This standard has been approved by the American National Standards Institute (ANSI) as an American National Standard.

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

Level of Harmonization

This standard uses the IEC format but is not based on, nor is it to be considered equivalent to, an IEC standard. This standard is published as an equivalent standard for ANCE, CSA Group, and UL.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

Reasons for differences from IEC

The Technical Harmonization Committee identified the following IEC standard within the scope of this standard: IEC 60670 (1989-11), *General requirements for enclosures for accessories for household and similar fixed electrical installations* and Amendment No. 1 (1994-01). It was further recognized that significant revision of this IEC standard is in process, with participation by the IEC National Committees in each of the three countries that are party to this standard.

The THC determined that the safe use of electrical boxes is critically dependent on the design and performance of the system with which they are intended to be installed. Significant investigation is required to assess safety and system compatibility issues that may lead to harmonization of traditional

North American electrical boxes with those presently addressed in the known IEC standards. The THC agreed such future investigation might be facilitated by completion of harmonization of the North American standards for electrical boxes.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

ANCE Effective Date

The effective date for ANCE will be announced through the *Diario Oficial de la Federación (Official Gazette)*.

CSA Group Effective Date

The effective date for CSA Group will be announced through CSA Informs or a CSA Group certification notice.

UL Effective Date

As of February 1, 2013, all products Listed by UL must comply with the requirements in this standard except for the Sections, Clauses, Tables and Figures in the following lists, which are effective on the date indicated.

Section 2, Clauses 3.2, 3.3, 5.7.1, 5.7.2, 5.10.1, 5.11.4, Section 5.15, Section 5.16, Clause 6.2.1, Section 6.5, Clauses 9.5.1.4, 9.5.2.1, 9.5.2.3, 9.6.1.1, 9.6.2.1, Section 9.18, Section 9.19, Clauses 10.1.2, 10.1.3, 10.1.4, 12.2.2, 12.2.6, 12.11.1, 12.11.2, 12.14.1.1, 12.22.1, Section 12.23, Table 6, Table 9, Figure 8, Figure 16, and Figure 18, and Annex A are effective February 15, 2015.

Clauses 5.8.1, 5.8.2, and 11.5.2 are effective February 15, 2018.

A UL effective date is one established by Underwriters Laboratories Inc. and is not part of the ANSI approved standard.

Metallic Outlet Boxes

1 Scope

1.1 This standard applies to metallic OUTLET BOXES, flush-DEVICE BOXES, FLOOR BOXES, CONCRETE BOXES, EXTENSION RINGS, COVERS, CONDUIT BODIES, BAR HANGERS, bar-hanger assemblies, and all accessories whose principal function is for support of boxes. The products covered by this standard are intended for installation in accordance with the National Electrical Code (NEC), NFPA 70, the Canadian Electrical Code (CEC), Part I, and the Standard for Electrical Installations, NOM-001-SEDE.

In Canada, CONDUIT BODIES are not evaluated as OUTLET BOXES; they are fittings. Requirements in this standard for CONDUIT BODIES intended for use as OUTLET BOXES do not apply in Canada.

1.2 This standard also applies to marine application metallic OUTLET BOXES, flush-DEVICE BOXES, special purpose boxes, EXTENSION RINGS, and covers.

1.3 This standard also applies to marine products intended for installation in accordance with the manufacturer's instructions and the applicable requirements of the United States Coast Guard (USCG), IEEE Recommended Practice for Electric Installation on Shipboard, IEEE Standard 45; the American Boat and Yacht Council (ABYC); the Standard for Pleasure and Commercial Motor Craft, NFPA 302; and the Canadian Electrical Code (CEC), Part I.

1.4 This standard does not apply to cabinets and cutout boxes, boxes, and covers intended for use with raceway systems for surface wiring other than rigid or flexible conduit or electrical metallic tubing. This standard does not apply to boxes having a volume of more than 1640 cm³ (100 in³), other than multiple-gang boxes, flush-DEVICE BOXES, and CONDUIT BODIES intended for the larger trade sizes of conduit.

1.5 This standard does not apply to cover plates for flush-mounted wiring devices.

1.6 This standard does not apply to OUTLET BOXES OR OUTLET BOX COVERS for use in hazardous (classified) locations as defined in the National Electrical Code (NEC), NFPA 70, the rules of the Canadian Electrical Code (CEC), Part I, and the Standard for Electrical Installations, NOM-001-SEDE.

2 Normative references

2.1 Products covered by this standard shall comply with the reference installation codes and standard as appropriate for the country where the product is to be used. When the product is intended for use in more than one country, the product shall comply with the installation codes and standards for all countries where it is intended to be used.

2.2 Where reference is made to any Standard, such reference shall be considered to refer to the latest edition and revisions thereto available at the time of printing, unless otherwise specified.

ANCE Standards

NMX-W-047-SCFI

Aluminum and its Alloys – Mechanical Properties – Determination of Tensile Strength

NMX-H-146-SCFI

Unified Screw Threads – Specifications

NMX-J-017-ANCE

Fittings for Outlet Boxes and Conduit

NMX-J-170-ANCE

Electrical Products – Copper Compression Type Connectors – Specifications and Test Methods

NMX-J-235-ANCE

Enclosures for Electrical Equipment, Part 1 and Part 2

NMX-J-235/2-ANCE-2007

Enclosures for Electrical Equipment, Environmental Considerations

NMX-J-508-ANCE

Wiring Devices – Safety Requirements – Specifications and Test Methods

CSA Group Standards

C22.1-12

Canadian Electrical Code, Part I

C22.2 No. 0.5-1982 (R2008)

Threaded Conduit Entries

C22.2 No. 0.15-01 (R2006)

Adhesive Labels

CAN/CSA-C22.2 No. 0.17-00 (R2009)

Evaluation of Properties of Polymeric Materials

C22.2 No. 18.3-04 (R2009)

Conduit, Tubing, and Cable Fittings

CSA C22.2 No. 45.1-07

Electrical Rigid Metal Conduit – Steel

C22.2 No. 65-03 (R2008)

Wire Connectors

CAN/CSA-C22.2 No. 94-M91 (R2001)

Special Purpose Enclosures

CAN/CSA-C22.2 No. 94.2-07

Enclosures for Electrical Equipment, Environmental Considerations

UL Standards

UL 6

Electrical Rigid Metal Conduit - Steel

UL 50

Enclosures for Electrical Equipment

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UL 50E*Enclosures for Electrical Equipment, Environmental Considerations***UL 486A-486B***Wire Connectors***UL 514B***Conduit, Tubing, and Cable Fittings***UL 746A***Polymeric Materials – Short Term Property Evaluations***UL 746B***Polymeric Materials – Long Term Property Evaluations***UL 969***Marking and Labeling Systems***ASME¹ Standards****ANSI/ASME B1.1-1989 (R2001)***Unified Inch Screw Threads (UN and UNR Thread Form)***ASME B1.20.1-1983 (R2001)***Pipe Threads, General Purpose (INCH)***ASTM² Standards****B 117-97***Standard Practice for Operating Salt Spray (Fog) Apparatus***D 1654-92(2000)***Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments***F 1137-00***Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners***G 151-00***Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources***G 153-00ae1***Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials***IEC³ Standards****IEC 60417-1***Graphical symbols for use on equipment – Part 1: Overview and application*

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IEC 60695-11-10

Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods

IEEE⁴ Standards

IEEE 45-1998

IEEE Recommended Practice for Electric Installations on Shipboard

ISO⁵ Standards

ISO 4892-2:1994

Plastics – Methods of exposure to laboratory light source – Part 2: Xenon-arc sources

Mexican Official Standards

NOM-001-SEDE

Standard for Electrical Installations

NFPA⁶ Standards

NFPA 70-2011

National Electrical Code

NFPA 302-1998

Fire Protection Standard for Pleasure and Commercial Motor Craft

¹American Society of Mechanical Engineers

²American Society for Testing and Materials

³International Electrotechnical Commission

⁴Institute of Electrical and Electronics Engineers

⁵International Organization for Standardization

⁶National Fire Protection Association

3 Definitions

3.1 For the purpose of this standard, the following definitions apply. Terms used throughout this standard which have been defined in this clause are in small roman capital type font.

3.2 **ADJUSTABLE MUD RING:** A mud ring with an adjustable sleeve intended for use with a flush-mounted device. It positions a wiring device flush with the finished wall surface.

3.3 **ADJUSTABLE SLEEVE EXTENDER:** A sleeve intended to be mechanically secured to an adjustable sleeve. It extends the adjustable sleeve to position a flush mounted wiring device flush with the finished wall surface.

3.4 **BAR HANGER:** A means to support an **OUTLET BOX**, **CONDUIT BOX**, or **DEVICE BOX** between two structural members.

3.5 **CLAMP:** A means intended to secure raceway, tubing, conduit, or cable to the box.

3.6 **CONCRETE BOX:** A box intended for use in poured concrete.

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3.7 CONCRETE RING: A ring, which is not necessarily round, intended for use in poured concrete, that accommodates end-to-end extension and the application of covers on top and bottom.

3.8 CONDUIT BODY: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction of two or more conduit or tubing sections or at the terminal point of a conduit or tubing.

In Mexico and the United States, a CONDUIT BODY is investigated as an OUTLET BOX.

In Canada, a CONDUIT BODY is not investigated as an OUTLET BOX; it is a fitting. Requirements in this standard for CONDUIT BODIES intended for use as OUTLET BOXES do not apply in Canada.

3.9 CONDUIT BOX: A box having threaded openings or knockouts for conduit, electrical metallic tubing, or fittings.

3.10 DEVICE BOX: A box with provisions for mounting a wiring device directly to the box.

3.11 DRIPPROOF: Designation for a type of marine product that is constructed or protected so that falling drops of liquid or solid particles striking the enclosure do not interfere with the intended operation of the equipment.

3.12 EXTENSION RING: A ring, which is not necessarily round, intended to extend the sides of an OUTLET BOX or flush-DEVICE BOX to increase the box depth, volume, or both.

3.13 FLOOR BOX: A box mounted in the floor intended for use with a FLOOR BOX COVER or other components to complete the enclosure.

3.14 FLOOR BOX COVER: A component of a FLOOR-MOUNTED ENCLOSURE assembly intended to complete the enclosure.

3.15 FLOOR-MOUNTED ENCLOSURE: A box and cover assembly provided with a means for mounting in a floor.

3.16 FLUSH FLOOR BOX COVER: A FLOOR BOX COVER that, when installed as intended, is essentially flush with the floor's finished surface.

Note: A FLUSH FLOOR BOX COVER may have openings for access to flush-mounted receptacle outlets or openings or knockouts for attachment of conduits or fittings. Openings may be provided for access to data and communications outlets.

3.17 NON-DETACHABLE HUB: An integral, non-detachable protuberance from a box intended for the attachment of a raceway essentially independent of the box. Conduit body hubs are not included.

3.18 OUTLET BOX: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either of the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables. The box has provisions for the mounting of an OUTLET BOX COVER; however, it does not have provisions for mounting a wiring device directly to the box.

3.19 OUTLET BOX COVER: A means intended to close or cover an OUTLET BOX when the cover has been mounted directly to an OUTLET BOX or to an OUTLET BOX EXTENSION RING.

3.20 PARTITION: A barrier used to separate sections of a box.

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3.21 PEDESTAL FLOOR BOX COVER: A FLOOR BOX COVER that, when installed as intended, provides a means for typically vertical or near-vertical mounting of receptacle outlets above the floor's finished surface.

Note: The PEDESTAL FLOOR BOX COVER may provide a means for attachment of conduits or fittings above the floor's finished surface. Openings may be provided in the cover for access to data and communications outlets.

3.22 PLASTER RING COVER: A means intended for mounting directly onto a box to provide for the attachment of wiring devices or fixtures/luminaires. The center portion is raised to accommodate a specific wall or ceiling thickness and is intended for the mounting of the wiring devices or fixtures/luminaires flush with the surface.

3.23 POKE-THROUGH FLOOR FITTING: An assembly intended to provide passage of wiring from one building story to another through a penetration drilled through a concrete floor. It is used in conjunction with FLUSH, PEDESTAL, OR RECESSED ACCESS FLOOR BOX COVERS.

3.24 RAISED COVER: A cover intended for mounting directly onto a box to provide for the attachment of accessories and to increase the internal volume of the enclosure.

3.25 RAISED-FLOOR BOX: A FLOOR BOX intended for use in a raised floor, such as in an electronic computer/data processing equipment room.

3.26 RECESSED ACCESS FLOOR BOX: A FLOOR BOX with provisions for mounting wiring devices below the floor surface.

3.27 RECESSED ACCESS FLOOR BOX COVER: A FLOOR BOX COVER that, when installed as intended, is essentially flush with the floor's finished surface and provides access to and passage of cords to recessed wiring devices mounted within a recessed floor box.

3.28 STRUCTURE, UNFINISHED (NEW WORK): Construction where structural framing members are accessible for direct mounting and support of boxes.

3.29 STRUCTURE, FINISHED (OLD WORK): Construction where structural framing members are not accessible for mounting and supporting boxes.

3.30 SUPPORTING-NAIL HOLE: A hole provided in a box for the purpose of mounting the box to a structure using nails or screws. The following are not considered nail holes:

- a) A hole that is 3 mm (0.120 in) or smaller in diameter, and
- b) A hole that is located so as to prevent insertion of a 3-mm (0.120-in) diameter drill rod through both walls.

3.31 WATERTIGHT: Designation for a type of marine product that is constructed so that moisture does not enter the enclosure.

4 General requirements

4.1 Except as indicated in Clause 4.2, a component of a product covered by this standard shall comply with the requirement for that component. See Annex A for a list of standards covering components generally used in the products covered by this standard. A component shall comply with the ANCE, CSA, or UL standards as appropriate for the country where the product is to be used.

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

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

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

4.4 The values given in SI (metric) units shall be normative. Any other values given shall be for information purposes only.

4.5 Each part of the box shall be so designed and constructed that, when mounted and installed as for normal use, the box ensures adequate electrical and mechanical protection to the parts enclosed and minimizes danger to the user or surroundings.

5 Marking

5.1 General

5.1.1 In Canada and Mexico, units of measure for markings shall include SI (metric) units, unless otherwise specified. Markings expressed in equivalent units shall be optional.

In the United States, units of measure for markings shall be in SI (metric), equivalent units, or both, unless otherwise specified.

5.1.2 A box, and a cover intended to be shipped separately from a box, shall be marked with the manufacturer's name, trademark, or other descriptive marking identifying the organization responsible for the product. The catalog number or an equivalent designation shall be marked on the product or the smallest unit shipping carton.

5.1.3 All required markings shall be permanent and legible. All markings on the product shall be visible after the product is installed. The following types of markings or the equivalent meet the intent of this requirement with respect to permanency:

- a) Etched,
- b) Molded,
- c) Die stamped,
- d) Paint stenciled, or
- e) In Canada and the United States, indelibly stamped on a pressure sensitive label secured by adhesive and complying with CSA C22.2 No. 0.15 or UL 969, and in Mexico, indelibly stamped on a pressure sensitive label in accordance with Clause 12.21.

5.1.4 A box shall be marked on the inside surface of the box and the marking shall not be located on a knockout unless it is duplicated on another part of the box.

5.1.5 In the United States, when a manufacturer produces or assembles boxes or covers at more than one factory, each finished product shall have a distinctive marking to identify it as a product of a particular factory.

In Canada and Mexico, this requirement does not apply.

5.2 Box CLAMPS

5.2.1 General

5.2.1.1 In Canada and the United States, a CLAMP or other securement means furnished as part of an OUTLET BOX shall be marked to indicate the type of application for which it is intended to be used. The following abbreviations marked in lieu of the name of the cable, conduit, and tubing shall apply:

- a) A for armored cable, TECK cable, or aluminum sheathed cable,
- b) F for flexible metal conduit,
- c) N for nonmetallic-sheathed cable,
- d) T for flexible tubing,
- e) MCI for metal-clad interlocking armored cable (steel and aluminum type),
- f) MCS for metal-clad continuous smooth sheath cable,
- g) MCC for metal-clad continuous corrugated sheath cable, and
- h) ALL for all types of applications.

In Mexico, this requirement does not apply.

5.2.1.2 The marking shall be on the CLAMP or other securement means or on the box near the securement means.

5.2.2 Box CLAMPS for armored cable, metal-clad cable, and flexible metal conduit

5.2.2.1 In Mexico and the United States, an armored cable CLAMP shall be marked with the minimum and maximum cable size designation for which it is intended to be used. When the minimum cable size is 14/2, the CLAMP shall also be marked with the diameter of the cable for which the CLAMP is intended to be used. The marking shall be located on the CLAMP or the smallest unit shipping carton in which the box is packed.

In Canada, this requirement does not apply.

5.2.2.2 In Mexico and the United States, a metal-clad cable CLAMP shall be marked with the type of cable and range of cable diameters for which the CLAMP is intended to be used. The marking shall be located on the CLAMP or the smallest unit shipping carton in which the box is packed.

In Canada, this requirement does not apply.

5.2.2.3 A flexible metal conduit CLAMP shall be marked in accordance with the requirements for carton markings for flexible metal conduit fittings, as specified in UL 514B, CSA C22.2 No. 18.3, or NMX-J-017-ANCE. The marking shall be located on the CLAMP or the smallest unit shipping carton in which the box is packed.

5.2.3 Box CLAMPS for nonmetallic-sheathed cable

5.2.3.1 A CLAMP intended to secure more than one nonmetallic-sheathed cable per opening shall be marked with the number of cables it is intended to secure. The marking shall be located on the CLAMP or the smallest unit shipping carton in which the box is packed.

5.2.3.2 A CLAMP shall secure a 14 AWG (2.08 mm²) two-wire cable and bare ground wire up to the largest cable which can be passed through the box pryout. Otherwise the range that the CLAMP can accommodate shall be marked on the CLAMP or the smallest unit shipping carton in which the box is packed.

5.3 Grounding screw

5.3.1 A metal box that is provided with a tapped hole for a grounding screw other than a No. 10-32 shall be marked with the symbol for grounding (⏏) (IEC 60417-1, Symbol 5019a) adjacent to the hole.

In Canada, this requirement does not apply (see Clause 8.1.1).

In Mexico, the marking "T" or "Tierra" complies with this requirement.

In the United States, the marking "GR" or "GRD" complies with this requirement.

5.4 Closures for CONCRETE BOXES

5.4.1 When a box is provided with a sheet-metal plug or plate in accordance with Clause 9.4.4.5, the box or the carton in which it is shipped shall be marked to indicate that the box is intended for installation only in poured concrete.

5.5 Box volume

5.5.1 A box, an EXTENSION RING, or a RAISED COVER shall be permanently and legibly marked with a volume that does not exceed its actual volume. The marking shall be visible after installation. A box or EXTENSION RING of one of the trade sizes having the minimum volume as specified in the National Electrical Code (NEC), NFPA 70, the Canadian Electrical Code (CEC), Part I, or the Standard for Electrical Installations, NOM-001-SEDE, shall not be required to be marked. The volume of a box shall be indicated to the lower full integer or rounded up one decimal point. The marked volume shall be rounded to the nearest cm³ or the nearest 1/4 cubic inch. Volumes of 1/4 cubic inch shall be marked as 0.3 cubic inch, and volumes of 3/4 cubic inch shall be marked as 0.8 cubic inch.

In Canada and Mexico, the volume markings shall be in cm³ or ml.

In the United States, the volume markings shall be in cm³ or cubic inches.

5.6 Specific conditions

5.6.1 A box that only complies for specific conditions of installation, for use with specific conduit or cable construction or sizes, or for use with a specific wiring system shall be marked with the conditions of installation or intended use. The marking shall be on the smallest unit shipping carton. See Table 1 for specific conditions of use and the associated markings. Where unusual assembly techniques are needed for proper assembly of a box, a marking on the carton or instructions for proper assembly shall be provided with the box when the box is shipped from the factory.

5.6.2 A CONDUIT BODY that has been investigated for a specific combination of conductors shall be permanently marked with the maximum number and maximum size of the conductors for which the CONDUIT BODY is intended. See Clauses 7.8.4 and 7.8.5.

5.6.3 With reference to Clause 9.5.1.7, a box support supplied separately, or a box with integral support, whose performance is dependent upon the thickness of the material to which it is intended to be mounted or its mounting position, shall be marked to indicate the material type, thickness or thickness range, and mounting position (vertical or horizontal) for which the support has been found acceptable. The marking shall appear on the product or its smallest unit shipping container.

5.7 Ceiling-suspended fan support

5.7.1 An OUTLET BOX intended to support a ceiling-suspended fan weighing a maximum of 15.9 kg (35 lb), 23 kg (50 lb), or 32 kg (70 lb) shall be marked "Acceptable for Fan Support of ____ kg (____ lb) or less." The blank spaces shall be filled in with maximum values. See Clause 9.12.

Note: In Canada, a ceiling fan and all possible accessories weighing 16 kg or more is required to be supported independently of the outlet box.

5.7.2 In Mexico and the United States, an OUTLET BOX intended to support a ceiling-suspended fan that is provided with screws, or a screw and nut assembly, other than No. 8-32 or No. 10-32, shall be marked on the inside surface with the thread designation of the screws or nuts. See Clause 9.12.1(a).

In Canada, this requirement does not apply. See Clause 9.12.1(a).

5.8 Wet location

5.8.1 A DEVICE BOX, an OUTLET BOX, an OUTLET BOX COVER and CONDUIT BODY intended for use in wet locations shall comply with Clauses 11.5 and 12.20.1 and shall be marked "Wet Locations." An additional marking, "Damp Locations", shall be acceptable. When a part such as a box, box cover, or a wiring device is shipped separately or when installation material such as sealing compound is specified, the part required to complete the assembly or the specified sealing compound shall be clearly identified in the installation instructions.

When a BOX or CONDUIT BODY and its cover are shipped assembled, the box or CONDUIT BODY shall not be required to be marked when the marking is provided on the cover.

5.8.2 A threaded CONDUIT BODY as described in Clause 11.5.2 shall be marked "Wet location use with threaded rigid metal conduit only" or "Wet location use with threaded intermediate metal conduit" or "Wet location use with threaded intermediate metal conduit and rigid metal conduit," or equivalent wording.

In Canada, conduit bodies are not evaluated as outlet boxes; they are fittings.

5.9 Damp location boxes

5.9.1 A DEVICE BOX, an OUTLET BOX, and an OUTLET BOX COVER intended for use in a damp location shall comply with Clauses 11.5 and 12.20.1 and shall be marked "Damp Locations."

5.10 Other application environments

5.10.1 A box intended for installation in particular environmental conditions, such as conditions with Type ratings complying with Clause 12.22, shall be marked to indicate the enclosure Type in accordance with CAN/CSA-C22.2 No. 94.2-07, UL 50E, or NMX-J-235/2-ANCE-2007. A box that complies with the requirements for more than one Type may have multiple designations.

5.11 Fixture/luminaire support boxes

5.11.1 With reference to Clause 9.6.2.1, the smallest unit shipping carton of an OUTLET BOX or separately supplied box support, such as a BAR HANGER, intended to support a fixture/luminaire weighing 23 kg (50 lb) in a ceiling shall be marked in accordance with Table 1.

5.11.2 In Mexico and the United States, with reference to Clauses 9.6.2.2 and 9.7.2.1, a box or separately supplied box support, such as a BAR HANGER, shall be marked for the intended end-use application "wall" or "WL" and marked "For Support of ____ kg (or ____ lb) Fixture/Luminaire or Product (or specific product identification) in the wall only." The blank shall be filled in with a number, in 0.5 kg (1 lb) increments, from 3.5 kg (7 lb) to 22.2 kg (49 lb).

In Canada, this requirement does not apply.

5.11.3 In Mexico and the United States, with reference to Clause 9.6.2.1, an OUTLET BOX, with or without a bracket or BAR HANGER, or separately supplied box support, such as a BAR HANGER, intended to support a fixture/luminaire weighing more than 23 kg (50 lb) shall be marked "For Fixture/Luminaire Support of ____ kg (or ____ lb) or less." The blank shall be filled in with the weight intended to be supported in 4.5-kg (10-lb) increments, for example 31.8, 36.4, 40.9, 45.5, 50.0 kg (70, 80, 90, 100, 110 lb). Marking the carton in addition to marking the box complies with the requirement.

In Canada, this requirement does not apply.

5.11.4 In Mexico and the United States, with reference to Clause 9.6.2.1 an OUTLET BOX with a bracket or BAR HANGER, or separately supplied box support, such as a BAR HANGER tested in accordance with 12.14.1.1 shall include the following marking for each rated span. The first two blanks shall be filled in with rated weight (kg and lbs) intended to be supported in 4.5-kg (10-lb) increments and the second two blanks shall be filled in with the corresponding span (mm and in) that each weight was tested and rated for. "For Fixture Support of ____ kg (____ lbs) or less at ____ mm (____ in) span." The following is an example of a marking for a multiple span rated supporting device:

For Fixture Support of 31.7 kg (70 lbs) or less at 609.6 mm (24 in) span

For Fixture Support of 40.8 kg (90 lbs) or less at 406.4 mm (16 in) span

Note: A tabular format may also be used.

In Canada, this requirement does not apply.

5.12 FLOOR BOXES

5.12.1 With reference to Clause 12.16.1.3, a FLOOR BOX COVER intended for use only in a floor covered with carpet or wood shall be marked on the product or smallest unit shipping carton "Not for use with tile covered floors" or the equivalent.

5.13 BAR HANGERS

5.13.1 A BAR HANGER not intended to be used with a box for fixture/luminaire or ceiling-suspended fan support, and having provision to support a box only from a ceiling grid, such as a drop ceiling, shall be marked "Not for fixture/luminaire or fan support" or the equivalent. See Clause 9.15.1.

5.13.2 The marking of a BAR HANGER intended to be used with a box for fixture/luminaire support shall be in accordance with Clause 5.11.

5.14 Marine boxes

5.14.1 In the United States, Clauses 5.14.2 – 5.14.4 apply.

In Canada and Mexico, Clauses 5.14.2 – 5.14.4 do not apply.

5.14.2 The shipping carton or label shall be marked "Acceptable For Marine Use" or the equivalent.

5.14.3 In addition to the applicable markings required in Clause 5.8.1, a product or the smallest unit shipping carton shall be marked "WATERTIGHT" or "DRIPPROOF," as applicable.

5.14.4 In addition to Clause 5.14.3, a product or the smallest unit shipping carton may be marked with an enclosure Type number, for example, "Type _____," indicating the environmental conditions for which the product is rated in accordance with Clause 5.10.1.

5.15 ADJUSTABLE MUD RINGS

5.15.1 The following markings shall be marked on an ADJUSTABLE MUD RING and shall be visible after installation:

a) An ADJUSTABLE MUD RING that relies solely on the adjustment of screws for mechanical securement between the sleeve and mud ring shall be marked:

- 1) "Leave adjustment screws accessible", and
- 2) "Torque screws after adjustment to - _____ lbs in". The blank space shall be filled in with the appropriate torque value, according to Table 8 or in accordance with the manufacturer's instructions (see 12.23.7.2).

b) An ADJUSTABLE MUD RING assembled and shipped as a complete assembly shall be marked: "Do not adjust after final installation".

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5.15.2 The following shall be marked on an ADJUSTABLE MUD RING and shall be visible during installation:

- a) Minimum and maximum sleeve adjustment depth,
- b) Minimum depth of device box to be used, and
- c) Minimum surface covering thickness, or range in millimeters.

Practical guides that are part of the product construction may be substituted for markings.

5.16 ADJUSTABLE SLEEVE EXTENDERS

5.16.1 ADJUSTABLE SLEEVE EXTENDERS shall have the following or equivalent markings on the sleeve extender:

- a) "Refer to Installation Instructions".
- b) "Adds ____ inches to wall thickness". The blank space shall be filled in with the appropriate additional amount of wall thickness that the extender is intended to accommodate. See 9.19.2.
- c) "For Use Only With Cat. No. ____ Adjustable Sleeve". The blank space shall be filled in with the appropriate Adjustable Sleeve Catalog Number.

6 Instructions

6.1 Fixture/luminaire support boxes for use in a finished structure (old work)

6.1.1 A fixture/luminaire support box that complies with Clause 9.7.2.1 shall be provided with:

- a) Installation instructions for mounting of the box, and
- b) Installation instructions that specify the type and thickness of the finished surface in which the box is intended to be mounted.

6.2 FLOOR BOXES, FLOOR-MOUNTED ENCLOSURES, and POKE-THROUGH FLOOR FITTINGS

6.2.1 FLOOR BOXES, FLOOR-MOUNTED ENCLOSURES, and POKE-THROUGH FLOOR FITTINGS shall be provided with installation instructions indicating the:

- a) Type of floor structure for which they are intended to be installed (e.g. concrete, raised, etc.);
- b) Model number(s) and brands of floor box covers, floor-mounted enclosure covers, or poke-through floor fitting covers for which they are intended to be installed; and
- c) Type of finished floor surface for which the products are intended to be installed.

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6.3 Ceiling-suspended fan support boxes

6.3.1 An OUTLET BOX intended to support a ceiling-suspended fan (see Clause 9.12) shall be provided with:

- a) Installation instructions for mounting of the box, and
- b) Installation instructions for securement of the fan mounting bracket to the box specifying that only the screws provided with the OUTLET BOX shall be used.

6.4 Wet location boxes

6.4.1 All parts required to comply with the applicable requirements in Clause 12.20 shall be provided with installation and assembly instructions.

6.5 ADJUSTABLE MUD RING with adjustable sleeve not assembled to the mud ring at the factory

6.5.1 An ADJUSTABLE MUD RING shall be provided with instructions to ensure proper installation and to avoid damage to the mud ring during assembly of the wall finish surface and to conductors and wiring devices.

6.5.2 A mud ring or sleeve of an ADJUSTABLE MUD RING that is shipped separately shall be provided with instructions specifying the model number and manufacturer of the mud ring or sleeve of the ADJUSTABLE MUD RING for which it is intended to be assembled.

6.5.3 All ADJUSTABLE SLEEVE EXTENDERS shall be provided with installation and assembly instructions.

7 Dimensions and volume

7.1 Sheet steel

7.1.1 In Canada, boxes, PARTITIONS and box covers made of sheet steel shall not be less than 1.3 mm (0.05 in) thick. Where used in device and OUTLET BOXES with pryouts for nonmetallic-sheathed cable, armored cable, or flexible conduit, a sheet steel box shall not be less than 1.1 mm (0.04 in) thick. The spacer section of all sectional boxes (body of the box excluding sides) for nonmetallic-sheathed cable, armored cable, or flexible conduit shall not be less than 1.3 mm (0.05 in) thick. For all other boxes, the spacer section shall not be less than 1.5 mm (0.06 in) thick.

In Mexico and the United States, boxes, PARTITIONS, and box covers of sheet steel shall not be less than 1.59 mm (0.0625 in) thick, and the thickness at or within 6.4 mm (1/4 in) of any right-angle bend in a drawn sheet-steel box shall not be less than 1.04 mm (0.041 in). The average thickness of the sides and ends of a drawn box shall not be less than 1.47 mm (0.058 in) based on three measurements made both on the side and on the end of the box. The measurements shall be taken at points not less than 9.5 mm (3/8 in) from a right-angle bend. The three measurements shall be made in a line perpendicular to the front of the box at a point 6.4 mm (1/4 in) from the front, at a point 6.4 mm from the right-angle bend at the back, and at a point equidistant between the two. A laminated sheet-steel cover shall have a total thickness not less than 1.59 mm (0.0625 in).

7.2 Sheet aluminum

7.2.1 A sheet aluminum box and cover shall have a minimum tensile strength of 117 MPa (17,000 psi) and shall not be less than 2.31 mm (0.091 in) thick at all points. A sharply bent section having a radius of curvature of 6.4 mm (1/4 in) or less shall not be less than 2.21 mm (0.087 in) thick.

In Mexico, determination of the minimum tensile strength shall be in accordance with NMX-W-047-SCFI.

7.3 Cast metal boxes

7.3.1 A cast metal box shall not be less than 3.2 mm (1/8 in) thick. A malleable iron box and a die-cast or permanent-mold cast aluminum, brass, or bronze box shall not be less than 2.4 mm (3/32 in) thick. A box having a minimum wall thickness of 2.4 mm (3/32 in) shall be usable for the clearance of a cover screw in the area directly beneath the cover mounting lug when the area is not greater than 32.26 mm² (0.050 in²) and has no straight-line dimension more than 12.7 mm (1/2 in).

7.4 Cast metal covers

7.4.1 A cast metal cover shall not be less than 3.2 mm (1/8 in) thick. A malleable iron cover and a die-cast or permanent-mold cast aluminum, brass, or bronze cover shall not be less than 2.4 mm (3/32 in) thick, when the cover is lined with a firmly attached insulating material not less than 0.8 mm (1/32 in) thick.

7.5 Box width

7.5.1 Boxes for switches rated 347 V ac

7.5.1.1 The minimum inside width of a box intended to accommodate a switch rated at 347 V ac shall not be less than 57 mm (2.24 in), except for multi-gang boxes, for which a minimum inside width of 44.4 mm (1.75 in) shall be acceptable when a PARTITION of insulating material having a minimum thickness of 1.5 mm (0.06 in) is installed securely between sections and at each end wall of the outside sections. Where the distance between the center of the section and the end wall is at least 28.6 mm (1.13 in), the insulating material at the end wall shall not be required. Multi-gang boxes that have a 57 mm (2.24 in) distance between their sections also require a PARTITION, which shall be of metal.

7.5.1.2 The requirement in Clause 7.5.2 does not apply to boxes for switches rated at 347 V ac.

7.5.2 Sectional boxes

7.5.2.1 The distance between the centerlines of the device-mounting holes for sectional (gangable) boxes, as well as multi-gang boxes, shall be 46 mm (1.81 in).

7.5.3 Minimum width

7.5.3.1 A flush-DEVICE BOX shall have an internal width not less than 44.4 mm (1.75 in) unless it is intended to accommodate only narrow wiring devices.

7.6 Internal volume

7.6.1 Side pocket volume

7.6.1.1 The volume of a side pocket provided to increase the volume of an outlet or flush-DEVICE BOX shall be calculated using a depth-of-pocket not more than the smallest dimension of the opening into that side pocket.

7.6.2 Measurement

7.6.2.1 With reference to Clause 5.5.1, the internal volume shall be determined in accordance with Clause 12.1 or by another equivalent means. An EXTENSION RING made from a trade size box specified in Clause 5.5.1 shall be determined to have a volume equal to that trade size box. A box provided with a PARTITION shall have the volume of each partitioned section verified as described in Clause 12.1 or by an equivalent means.

7.6.2.2 PLASTER RING COVERS and RAISED COVERS shall be marked in accordance with Clause 5.5.1 and the volume shall be measured in accordance with Clause 12.1 or by an equivalent means.

7.7 Cover mounting hole-spacing

7.7.1 The cover mounting-hole spacing for trade sizes 4-11/16 square, 4 square, 4 octagonal, and 4 circular boxes shall be as indicated in Figures 1, 2, 3, and 4.

7.8 Measurement of CONDUIT BODY dimensions (Mexico and United States only)

7.8.1 In Mexico and the United States, the requirements in Clauses 7.8.2 – 7.8.12, Tables 2 – 5, and Figures 5 and 6 apply.

In Canada, the requirements in Clauses 7.8.2 – 7.8.12, Tables 2 – 5, and Figures 5 and 6 do not apply.

7.8.2 A CONDUIT BODY shall have a cross-sectional area not less than that specified in Table 2, based on the largest size raceway that is intended to be connected to it.

7.8.3 A CONDUIT BODY having provision for the connection of conduit or tubing larger than the 1/2 (16) trade size:

- a) Shall have a removable blank cover, and

- b) Shall comply with Clauses 7.8.4 and 7.8.5.

This requirement does not apply to a CONDUIT BODY marked for use only with 6 AWG (13.30 mm²) or smaller conductors.

This requirement does not apply to a CONDUIT BODY having an internal length (measured as shown in Figure 5) that is equal to or greater than the dimensions specified in Table 3. See Clause 5.6.2.

7.8.4 A CONDUIT BODY that does not change the direction of wiring passing through it shall have a length not less than eight times the trade size of the connected largest tubing or conduit. The length shall be measured inside the CONDUIT BODY from the end stop of the conduit hub, away from the center of the body, to an equivalent point on the conduit hub on the opposite wall, or for a CONDUIT BODY having a single raceway entry, to the opposite wall. See Figure 5.

Note: Measurements expressed as multiples of trade sizes are determined by converting the trade size of the raceway (not the metric designator) to a value expressed in millimeters. Example: 1/2 trade size $\times 8 = 4$ inches, and 4 inches = 101.6 mm.

A shorter CONDUIT BODY may be used when it complies with the wire pull test in UL 514B, CSA C22.2 No.18.3, or NMX-J-017-ANCE for installation of a combination of conductors that are less than the specified maximum fill for the largest conduit size that the CONDUIT BODY will accommodate. See Clause 5.6.2.

7.8.5 A CONDUIT BODY constructed to enable a change in the direction of the axis of a tubing or conduit system (see Figure 5) shall:

- a) Have a distance inside the body between each tubing or conduit entry and the entry hub on the opposite wall of the body intended to enclose a common conductor not less than six times the trade size of the largest tubing or conduit for which the body is intended, or
- b) Have a distance inside the body between each tubing or conduit entry and the opposite wall not less than the sum of six times the trade size of the largest tubing or conduit for which the body is intended and the sum of the diameters of all other tubing or conduit entries in the same wall of the body. See note to Clause 7.8.4.

Note: Measurements expressed as multiples of trade sizes are determined by converting the trade size of the raceway (not the metric designator) to a value expressed in millimeters. Example: 1/2 trade size $\times 6 = 3$ inches, and 3 inches = 76.2 mm.

A CONDUIT BODY having smaller dimensions shall be investigated in accordance with the wire pull test referenced in Clause 7.8.4 for installation of a combination of conductors, including 4 AWG (21.2 mm²) or larger, that is less than the specified maximum fill for the largest conduit size that the CONDUIT BODY is intended to accommodate. See Clause 5.6.2.

A CONDUIT BODY having a raceway entry in the wall opposite the removable cover specified in Clause 7.8.3(a) shall have a distance from the cover to the opposite wall not less than that specified in Table 4.

7.8.6 With reference to Clause 7.8.5, the distance shall be measured from points located at each of the raceway entries where the axis of the raceway passes through the plane of the end stop of the conduit hub to the inside surface of the cover. See Figure 5.

7.8.7 Mating surfaces of a cover and body shall provide a close fit. A gasket, where required to provide a tight fit, shall be provided with the cover. The gasket shall not be required to be cemented or otherwise secured in place on the cover.

7.8.8 A cover shall be attached to the body by No. 6 or larger machine screws not having more than 32 threads per 25.4 mm (1 in). The screws shall thread into metal having at least two full threads.

7.8.9 The throat diameter of a CONDUIT BODY shall not be less than as specified in Table 5, as determined either by application of the limit gauges illustrated in Figure 6, or by measurement as described in Clauses 7.8.11 and 7.8.12. The dimensions of the gauges are given in Figure 6.

7.8.10 The curved surfaces of the limit gauges illustrated in Figure 6 shall be ground and lapped to the diameters and within the tolerances specified in the figure. The handles for these gauges are not specified, nor is the means by which the handles are joined to the gauges. Each gauge for an internally threaded adapter shall have the letters FEM or some other designation on the same face on which the size appears.

7.8.11 The measurements from which the throat diameter of a finished CONDUIT BODY shall be determined, for comparison with the minimum specified in Table 5, shall be made by means of a machinist's inside micrometer caliper that is equipped with a ratchet. The calibration of the scale shall facilitate estimation of each measurement to 0.001 mm or 0.0001 in.

7.8.12 The throat diameter at any point in a CONDUIT BODY shall be within the limits of the values specified in Table 5. Four measurements of the throat diameter of each CONDUIT BODY shall be made to determine the smallest diameter. Each measurement shall be estimated to the nearest 0.001 mm or 0.0001 in and shall be recorded. The smallest of all of the recorded diameters shall be rounded to 0.01 mm or 0.001 in. When rounding, an even number in the third decimal place shall not change when the number in the fourth decimal place is five and there is no number or zero in the fifth place.

8 Provisions for grounding

8.1 Connection means

8.1.1 A metal box intended for connection to a metal raceway or metal sheathed cable shall have a provision for a continuous electrical grounding connection. All exposed metal parts of a box or cover, other than parts that do not enclose wiring, shall be in electrical connection.

In Mexico and the United States, compliance shall be achieved by any of the following means:

- a) A tapped hole for a No. 10-32 grounding screw,
- b) A minimum 8-32 tapped hole when provided with a No. 8-32 grounding screw and marked in accordance with Clause 5.3.1, or