

UL 50

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Enclosures for Electrical Equipment

Underwriters Laboratories Inc. (UL)
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UL Standard for Safety for Enclosures for Electrical Equipment, UL 50

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Revisions: This Standard contains revisions through and including November 19, 1999.

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The revised requirements are substantially in accordance with UL's Bulletin(s) on this subject dated July 6, 1999. The bulletin(s) is now obsolete and may be discarded.

The revisions dated November 19, 1999 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

As indicated on the title page (page1), this UL Standard for Safety has been adopted by the Department of Defense.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if

the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing, Recognition, Classification, and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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

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1-10B	November 19, 1999
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1

UL 50

Standard for Enclosures for Electrical Equipment

The First and Second editions were titled Standard for Cabinets and Cutout Boxes. The Third – Ninth editions were titled Standard for Cabinets and Boxes.

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Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated October 19, 1995 . These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

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

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The Department of Defense (DoD) has adopted UL 50 on April 5, 1982 . The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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

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FOREWORD

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

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

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

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

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

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

INTRODUCTION

1 Scope

1.1 These requirements cover electrical equipment enclosures for use in accordance with the National Electrical Code, NFPA 70.

1.2 Specific applications covered by this standard include cabinets and cutout boxes and junction and pull boxes.

1.3 Specific applications not covered by this standard are junction boxes of the swimming pool type.

1.4 Each type of enclosure covered by this standard is described in general and functional terms where practicable, and omits reference to structural details and specific applications except where they are essential to the identification of the enclosure type. Such additional details and specifications are included in the applicable standards for the end-product involved.

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

1.5 revised November 19, 1999

2 Glossary

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

2.1.1 **ACCESSORY** – A part or combination of parts intended for installation in or connection to a product for the purpose of modifying or supplementing the functions of the product. It may be factory installed or intended for installation by the user or service personnel.

2.1.1 added October 1, 1996

2.2 **CABINET** – An enclosure intended either for flush or surface mounting, and provided with a frame, mat, or trim in which a door or doors may be hung.

2.3 **CUTOUT BOX** – An enclosure intended for surface mounting and having a swinging cover secured directly to the box proper.

2.4 **COVER** – An unhinged portion of an enclosure that covers an opening.

2.4 revised October 1, 1996

2.4.1 **DEGREE OF PROTECTION** – The extent of protection provided by an enclosure against access to parts which result in a risk of injury, ingress of foreign solid objects, and/or ingress of water as verified by standardized test methods.

2.4.1 added October 1, 1996

2.5 **DOOR** – A hinged portion of an enclosure that covers an opening.

2.5 revised October 1, 1996

2.6 ENCLOSURE – A surrounding case constructed to provide a degree of protection against incidental contact with the enclosed equipment and to provide a degree of protection to the enclosed equipment against specified environmental conditions.

2.7 **Deleted October 1, 1996**

2.7.1 INDOOR LOCATIONS – Areas which are protected from exposure to the weather.

2.7.1 added October 1, 1996

2.8 JUNCTION OR PULL BOX – An enclosure intended either for flush or surface mounting, having a solid unhinged cover secured directly to the box proper.

2.8 revised October 1, 1996

2.9 KNOCKOUT – A portion of the wall of an enclosure so fashioned that it is capable of being readily removed by a hammer, screw driver, and pliers at the time of installation in order to provide an opening or hole for the attachment of an auxiliary device, raceway, cable, or fitting.

2.9 added October 1, 1996

2.10 NON-VENTILATED – Constructed to provide no intentional circulation of external air through the enclosure.

2.10 added October 1, 1996

2.11 OIL RESISTANT GASKETS – Gaskets made of material which is resistant to oil and oil fumes.

2.11 added October 1, 1996

2.12 OUTDOOR LOCATIONS – Areas which are exposed to the weather.

2.12 added October 1, 1996

2.13 VENTILATED – Constructed to provide for the circulation of external air through the enclosure for the purposes of removing excess heat, fumes, or vapors.

2.13 added October 1, 1996

Figure 2.1 **Door and hinged cover constructions**

Figure 2.1 deleted October 1, 1996

3 References

3.1 *Deleted November 19, 1999*

4 Units of Measurement

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

CONSTRUCTION

GENERAL

5 General

5.1 An edge on an enclosure shall not be sufficiently sharp to constitute a risk of injury in normal maintenance or use.

5.2 An enclosure shall be made of iron, steel, brass, copper, or aluminum.

Exception: Other material may be used if the material is investigated and found to be acceptable and the enclosure has at least the equivalent strength and rigidity.

5.3 Both the inside and outside surfaces of an enclosure, including means for fastening, shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means.

Exception No. 1: An enclosure and means for fastening that are of metal that is inherently resistant to corrosion.

Exception No. 2: This requirement does not apply to:

a) Bearings, sliding surfaces of a hinge, or shaft and the like where such protection is impractical; and

b) Parts made of stainless steel.

5.4 The outside of a cast-aluminum enclosure marked in accordance with 50.4 shall be coated with asphalt paint, one coat of baked enamel, or other material that provides equivalent protection.

5.4 revised November 19, 1999

5.5 An enclosure shall have the necessary strength and rigidity to maintain its shape so that an enclosure door closes tightly.

5.5 revised October 1, 1996

5.6 Metal into which screws are threaded shall provide for the engagement of at least two full threads. Rivets, screws, bolts, and similar fastenings in a sheet-metal enclosure shall have a diameter at least 50 percent greater than the thickness of the finished sheet metal with which they are used.

5.7 A screw with 32 threads per inch (32 threads per 25.4 mm) installed in 0.053 inch (1.35 mm) thick minimum sheet metal shall be considered acceptable.

5.7 revised November 19, 1999

5.8 Sheet metal may be extruded at a tapped hole to give the thickness necessary for two full threads if the original thickness is not less than the pitch of the thread.

5.9 A fastener for use with a conventional screw, other than a tapped hole or nut, is acceptable if it has the necessary mechanical strength and is otherwise acceptable for the application.

5.10 Neutral terminals and equipment-grounding terminals provided as part of an enclosure are evaluated in accordance with the Standard for Panelboards, UL 67, and with regard to their intended use.

ENCLOSURES

6 General

6.1 A complete enclosure shall be provided for all live parts that may be housed in it.

6.1 revised October 1, 1996

6.2 An enclosure flange, or the side wall of an enclosure, may be punched to form an ear that may be bent out to facilitate the mounting of the enclosure or to form a bracket for securing a trim, provided that:

- a) There is no direct opening into the enclosure when the ear is in any position; and
- b) The overlap between the edges of the opening and the edge of the flange or other closing metal is not less than 1/8 inch (3.2 mm).

6.3 An enclosure shall be one or more of the types defined in Table 6.1 and described in Table 6.2.

Exception: An enclosure marked in accordance with 50.4.

6.3 revised November 19, 1999

Table 6.1
Enclosure types

Type	Intended use and description	Requirements or qualification tests, paragraph or section numbers
1	Indoor use primarily to provide a degree of protection against limited amounts of falling dirt.	Corrosion Protection – 5.3 or Rust Resistance – Section 38
2	Indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.	Corrosion Protection – 5.3 or Rust Resistance– Section 38, Drip – Section 31, Gaskets– Section 14, and Gasket Tests – Section 43
3	Outdoor use primarily to provide a degree of protection against rain, sleet, wind blown dust and damage from external ice formation.	Rain – Section 30, Outdoor Dust or Hose – Section 32 or 35, Icing – Section 34, Protective Coating – Section 15, Gaskets– Section 14, and Gasket Tests – Section 43
3R	Outdoor use primarily to provide a degree of protection against rain, sleet, and damage from external ice formation.	Rain – Section 30, Icing – Section 34, Protective Coating – Section 15, Gaskets – Section 14, and Gasket Tests – Section 43

Table 6.1 Continued on Next Page

Table 6.1 Continued

Type	Intended use and description	Requirements or qualification tests, paragraph or section numbers
3S	Outdoor use primarily to provide a degree of protection against rain, sleet, windblown dust and to provide for operation of external mechanisms when ice laden.	Rain – Section 30, Outdoor Dust or Hose – Section 32 or 35, Icing – Section 34, Protective Coating – Section 15, Gaskets – Section 14, and Gasket Tests – Section 43

Table 6.1 Continued on Next Page

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Table 6.1 Continued

Type	Intended use and description	Requirements or qualification tests, paragraph or section numbers
4	Indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, hose-directed water and damage from external ice formation.	Hosedown – Section 35, Protective Coating – Section 15, Icing – Section 34, Gaskets – Section 14, and Gasket Tests – Section 43
4X	Indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, hose-directed water, and damage from external ice formation.	Hosedown – Section 35, Protective Coating – Section 15, Corrosion Resistance – Section 39, Icing – Section 34, Gaskets – Section 14, and Gasket Tests – Section 43
5	Indoor use primarily to provide a degree of protection against settling airborne dust, falling dirt, and dripping noncorrosive liquids.	Corrosion Protection – 5.3 or Rust Resistance – Section 38, Drip – Section 31, Indoor Settling Airborne Dust or Atomized Water Method B – Section 32 or 33, Gaskets – Section 14, and Gasket Tests – Section 43
6	Indoor or outdoor use primarily to provide a degree of protection against hose-directed water, and the entry of water during occasional temporary submersion at a limited depth and damage from external ice formation.	Hosedown – Section 35, Icing – Section 34, Submersion – Section 36, Protective Coating – Section 15, Gaskets – Section 14, and Gasket Tests – Section 43
6P	Indoor or outdoor use primarily to provide a degree of protection against hose-directed water, the entry of water during prolonged submersion at a limited depth and damage from external ice formation.	Hosedown – Section 35, Icing – Section 34, Protective Coating – Section 15, Air Pressure – Section 40, Gaskets – Section 14, and Gasket Tests – Section 43
12, 12K	Indoor use primarily to provide a degree of protection against circulating dust, falling dirt, and dripping noncorrosive liquids.	Corrosion Protection – 5.3 or Rust Resistance – Section 38, Drip – Section 31, Indoor Circulating Airborne Dust or Atomized Water Method A – Section 32 or 33, Gaskets – Section 14, and Gasket Tests – Section 43
13	Indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and noncorrosive coolant.	Corrosion Protection – 5.3 or Rust Resistance – Section 38, Oil – Section 37, Gaskets – Section 14, and Gasket Tests – Section 43

Table 6.2
Environmental related constructional features for enclosure types

Table 6.2 revised November 19, 1999

Type	Requirements – Paragraph or section number
1	Equipment Openings – 8.2.1 Mounting Openings – 8.4.1 and 8.4.2 Conduit Knockouts and Conduit Openings – 8.5.1 Additional Openings – 8.6.1
2	Equipment Openings – 8.2.1 Drainage Openings – 8.3.1 Mounting Openings – 8.4.1 and 8.4.2 Conduit Knockouts and Conduit Openings – 8.5.1 Additional Openings – 8.6.2 Markings – 49.2, 49.3, 49.4, 49.5 and 49.7
3	Polymeric Enclosures/Parts – 7.1.2 Equipment Openings – 8.2.1 Mounting Openings – 8.4.1, Conduit Knockouts and Conduit Openings – 8.5.1 Covers and Doors – 16.4 Markings – 49.2, 49.6 and 49.7
3R	Polymeric Enclosures/Parts – 7.1.2 Equipment Openings – 8.2.1 Drainage Openings – 8.3.1 Mounting Openings – 8.4.1 and 8.4.2 Conduit Knockouts and Conduit Openings – 8.5.1 Additional Openings – 8.6.2 Covers and Doors – 16.4 Markings – 49.2, 49.3, 49.4, 49.5, 49.6 and 49.7
3S	Polymeric Enclosures/Parts – 7.1.2 Equipment Openings – 8.2.1 Mounting Openings – 8.4.1 and 8.4.3 Conduit Knockouts and Conduit Openings – 8.5.1 Covers and Doors – 16.4 Markings – 49.2, 49.6 and 49.7
4	Polymeric Enclosures/Parts – 7.1.2 Equipment Openings – 8.2.1 Mounting Openings – 8.4.1 and 8.4.3 Conduit Knockouts and Conduit Openings – 8.5.1 Markings – 49.2 and 49.7
4X	Polymeric Enclosures/Parts – 7.1.2 Equipment Openings – 8.2.1 Mounting Openings – 8.4.1 and 8.4.3 Conduit Knockouts and Conduit Openings – 8.5.1 Markings – 49.2 and 49.7
5	Equipment Openings– 8.2.1 Mounting Openings– 8.4.1 and 8.4.2 Conduit Knockouts and Conduit Openings – 8.5.1 Covers and Doors – 16.4 and 16.5 Markings – 49.2 and 49.7

Table 6.2 Continued on Next Page

Table 6.2 Continued

Type	Requirements – Paragraph or section number
6	Polymeric Enclosures/Parts – 7.1.3 Equipment Openings – 8.2.1 Mounting Openings – 8.4.1 and 8.4.3 Conduit Knockouts and Conduit Openings – 8.5.1 Markings – 49.2 and 49.7
6P	Polymeric Enclosures/Parts – 7.1.3 Equipment Openings – 8.2.1 Mounting Openings – 8.4.1 and 8.4.3 Conduit Knockouts and Conduit Openings – 8.5.1 Markings – 49.2 and 49.7
12	Equipment Openings – 8.2.1 Mounting Openings – 8.4.1 and 8.4.4 Conduit Knockouts and Conduit Openings – 8.5.2 Markings – 49.2 and 49.7
12K	Equipment Openings – 8.2.1 Mounting Openings – 8.4.1 and 8.4.4 Conduit Knockouts and Conduit Openings – 8.5.1 Markings – 49.2 and 49.7
13	Equipment Openings – 8.2.1 Mounting Openings – 8.4.1 and 8.4.5 Conduit Knockouts and Conduit Openings – 8.5.4 Markings– 49.2 and 49.7

7 Polymeric Enclosures/Parts

7.1 General

7.1.1 A polymeric electrical enclosure or a polymeric part (such as a plug or other closure) that is relied upon to complete and maintain the integrity of an electrical enclosure shall comply with the Flammability – 5 Inch (127 mm) Flame, Crushing Resistance, Resistance to Impact (both normal and cold), and Mold Stress – Relief Distortion tests in the Standard for Polymeric Materials – Use In Electrical Equipment Evaluations, UL 746C, and also with the additional requirements specified in this standard. Polymeric parts may be tested separately or may be tested as part of the overall electrical enclosure.

Exception No. 1: A polymeric plug or other closure made of a material classed in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, and that serves to complete and maintain the integrity of an electrical enclosure is acceptable if the closure is:

a) Not more than 1 square inch (650 mm²) in area and is:

1) Classed 5VA, 5VB, V-0, V-1, or V-2; or

2) Classed HB and complies with the Flammability – 5 Inch (127 mm) Flame test in the Standard for Polymeric Materials – Use In Electrical Equipment Evaluations, UL 746C.

b) More than 1 square inch (650 mm²) in area and is:

1) *Classed 5VA and complies with the Resistance to Impact (both normal and cold) test in the Standard for Polymeric Materials – Use In Electrical Equipment Evaluations, UL 746C; or*

2) *Classed 5VB, V-0, V-1, V-2 or HB and complies with the Flammability – 5 Inch (127 mm) Flame and the Resistance to Impact (both normal and cold) test in the Standard for Polymeric Materials – Use In Electrical Equipment Evaluations, UL 746C.*

Exception No. 2: Polymeric fastenings, hinges, or both that are relied upon to maintain the integrity of an electrical enclosure need not comply directly to the testing detailed in 7.1.1 because the strength and rigidity of these polymeric parts would be indirectly tested when the overall polymeric electrical enclosure complies with the Crushing Resistance, Resistance to Impact (both normal and cold), and Mold Stress – Relief Distortion tests detailed in 7.1.1.

7.1.1 revised November 19, 1999

7.1.2 In addition to the requirements in 7.1.1, polymeric materials used for Types 3, 3R, 3S, 4 and 4X enclosures or polymeric materials used for fastenings or hinges for these enclosure types shall comply with the Ultraviolet Light Exposure test in the Standard for Polymeric Materials– Use In Electrical Equipment Evaluations, UL 746C.

7.1.3 In addition to the requirements in 7.1.1, polymeric materials used for Types 6 and 6P enclosures or polymeric materials used for fastenings or hinges for these enclosure types shall comply with the Ultraviolet Light Exposure and the Water Exposure and Immersion tests in the Standard for Polymeric Materials – Use In Electrical Equipment Evaluations, UL 746C.

7.2 Bonding

7.2.1 An enclosure made of insulating material, either wholly or in part, shall have an acceptable bonding means to provide continuity of grounding between all conduits entering the enclosure. The bonding means shall comply with the Polymeric Enclosure Bonding Test, Section 42. The bonding means shall be either completely assembled on the product or available as separate parts in the form of an accessory for field installation. When provided as an accessory, the enclosure and the bonding means shall comply with Section 50A, Markings and Instructions for Field Installed Accessories.

7.2.1 revised October 1, 1996

7.2.2 The continuity of a conduit system shall be provided by metal-to-metal contact not relying on a polymeric material.

7.2.3 A separate bonding conductor, whether in a plastic or metal enclosure shall be copper, a copper alloy, or other material acceptable for use as an electrical conductor. Ferrous metal parts in the grounding path shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means. Unless the bonding conductor is unlikely to be omitted after removal and replacement of the fastener, a separate bonding conductor shall:

- a) Be protected from mechanical damage or be located within the confines of the outer enclosure or frame; and
- b) Not be secured by a removable fastener used for any purpose other than bonding.

7.2.4 **Deleted October 1, 1996**

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7.3 Nonmetallic-sheathed cable clamps

7.3.1 A clamp provided in an enclosure and intended for securement of nonmetallic-sheathed cable shall comply with the applicable requirements in the Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers, UL 514C.

7.4 Rigid nonmetallic conduit

7.4.1 A polymeric enclosure intended for use with rigid nonmetallic conduit – glued, threaded, or the like – shall comply with the applicable requirements in the Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers, UL 514C.

7.5 Rigid metallic conduit

7.5.1 A polymeric enclosure intended for connection to a rigid metallic conduit system shall comply with the requirements in Polymeric Enclosure Rigid Metallic Conduit Connection Tests, Section 41.

7.6 Provisions for support or mounting

7.6.1 Provisions for support or other mounting means shall be outside the polymeric enclosure, unless the enclosure is constructed so that the conductors within the enclosure cannot contact the supporting screws.

7.6.2 To comply with 7.6.1, a hole in an enclosure intended for an eyelet, a nail, a rivet, or a 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 enclosure. If a screw or a nail is not provided with an enclosure, this spacing shall be measured:

- a) Using the largest round head screw that can be inserted in a hole that is not chamfered; or
- b) Using the largest flathead screw that can be inserted in a hole that is chamfered.

8 Openings in Enclosures

8.1 General

8.1.1 Openings provided in any enclosure type shall be in accordance with this section and shall comply with the applicable tests in Table 6.1 with these openings unfilled.

Exception: Openings in accordance with 8.2.1 and 8.4.1 – 8.5.4, shall be appropriately filled to maintain the environmental integrity of the enclosure.

8.2 Equipment openings

8.2.1 All enclosure types may have openings that will be closed by field installed equipment (such as pushbutton switches, door latches, and the like) if these enclosures are marked in accordance with 49.7.

Exception: A Type 1 enclosure may have unmarked openings that will be closed by field installed equipment if these openings comply with Table 8.1.