

**STANDARD FOR EGRESS DOOR SECURING AND
RELEASING DEVICES**



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STANDARD FOR EGRESS DOOR SECURING AND RELEASING DEVICES

PREFACE

This is the Fourth Edition of the Standard for Egress Door Securing and Releasing Devices, CAN/ULC-S533-15.

This Edition of the Standard was formally approved by the ULC Standards Committee on Fire Alarm and Life Safety Equipment and Systems.

Requirements in this Standard have been developed in consideration of the requirements of the National Building Code of Canada.

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

Appendix A, identified as Normative, is mandatory and forms part of the requirements of the Standard. Appendix B, identified as informative, is for informational purposes only.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require markings and/or installation instructions to be in both official languages.

This Fourth Edition National Standard of Canada is based on, and now supersedes, the Third Edition CAN/ULC-S533-08.

Attention is drawn to the possibility that some of the elements of this Canadian standard may be the subject of patent rights. ULC Standards shall not be held responsible for identifying any or all such patent rights.

Requests for interpretation of this Standard should be sent to the ULC Standards. The requests should be worded in such a manner as to permit a “yes” or “no” answer based on the literal text of the requirement concerned.

The initiation of the review of this Standard will commence within 5 years of the date of publication, unless the Standard is identified as fitting within a stabilized category, whereby the review will commence within the appropriate time frame set out by ULC Standards.

This Standard is intended to be used for conformity assessment.

1 SCOPE

1.1 This Standard shall apply to *egress door securing and releasing devices* to perform the function of holding a door in the closed position and releasing the door to permit free egress when operated. *Egress door securing and releasing devices* are considered *ancillary devices* and are not an integral part of the *fire alarm system*.

1.2 This Standard covers physical and performance requirements for *egress door securing and releasing devices* for use in accordance with CAN/ULC S524, Standard for Installation of Fire Alarm Systems, in accordance with CSA C22.1, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, and as permitted by the National Building Code of Canada.

1.3 These requirements cover *egress door securing and releasing devices* for use in *ordinary locations, dry locations, damp locations, wet locations, indoor locations* and locations opening to the outdoors.

1.4 *Egress door securing and releasing devices* for use in hazardous locations shall comply with the requirements of this Standard, and the manufacturer's recommended wiring methods shall comply with the applicable requirements of CSA C22.1, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, with respect to the hazard location.

2 REFERENCE PUBLICATIONS

The documents shown below are referenced in the text of this Standard. Unless otherwise stated elsewhere in this Standard such reference shall be considered to indicate the edition and/or revisions of the document available at the date on which the Committee approved this ULC Standard. All undated references shall be interpreted as referring to the latest edition of that document.

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- ASTM B117-11, Standard Practice for Operating Salt Spray (Fog) Apparatus

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- CSA C22.1-15, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations
- CSA C22.2 No. 0.15-01, Adhesive Labels
- CAN/CSA-C22.2 No. 0.17-00 (R2013), Evaluation of Properties of Polymeric Materials
- CSA C22.2 No. 0.4-04 (R2013), Bonding of Electrical Equipment
- CSA C22.2 No. 38-14, Thermoset-Insulated Wires and Cables
- CSA C22.2 No. 49-14, Flexible Cords and Cables
- CAN/CSA C22.2 No. 65-03 (R2008), Wire Connectors

- CSA C22.2 No. 66.1-06, Low Voltage Transformers – Part 1: General Requirements
- CSA C22.2 No. 66.2-06, Low Voltage Transformers – Part 2: General Purpose Transformers
- CSA C22.2 No. 75-14, Thermoplastic-Insulated Wires and Cables
- CSA C22.2 No. 77-14, Motors with Inherent Overheating Protection
- CAN/CSA C22.2 No. 94.1-07 (R2012), Enclosures for Electrical Equipment, Non-Environmental Conditions
- CAN/CSA C22.2 No. 94.2-07 (R2012), Enclosures for Electrical Equipment, Environmental Conditions
- CSA C22.2 No. 111-10, General-Use Snap Switches
- CSA C22.2 No. 197-M1983 (R2008), Polyvinyl Chloride Insulating Tape
- CAN/CSA C22.2 No. 198.1-06 (R2010), Extruded Insulating Tubing
- CSA C22.2 No. 4248.1-07, Fuseholders – Part 1: General Requirements
- CSA C22.2 No. 4248.4-07, Fuseholders – Part 4: Class CC
- CSA C22.2 No. 4248.5-07, Fuseholders – Part 5: Class G
- CSA C22.2 No. 4248.6-07, Fuseholders – Part 6: Class H
- CSA C22.2 No. 4248.8-07, Fuseholders – Part 8: Class J
- CSA C22.2 No. 4248.9-07, Fuseholders – Part 9: Class K
- CSA C22.2 No. 4248.11-07, Fuseholders – Part 11: Type C (Edison Base) and Type S Plug Fuse
- CSA C22.2 No. 4248.12-07, Fuseholders – Part 12: Class R
- CSA C22.2 No. 4248.15-07, Fuseholders – Part 15: Class T
- CSA C22.2 No. 60065-03 (R2007), Audio, Video and Similar Electronic Equipment

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- IEC 60417-1-2002, Graphical Symbols for Use on Equipment – Part 1: Overview and Application

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- CAN/ULC S524, Standard for Installation of Fire Alarm Systems
-

3 GLOSSARY

Note: Terms used in this Standard that are in *italic* print are defined as follows.

3.1 *ANCILLARY DEVICE* – A *device* that has a life safety application, and is actuated by the *fire alarm system*, but is not part of the *fire alarm system*.

3.2 *CONTROL UNIT* – A component that provides the control and logic processing for a *fire alarm system*.

3.3 *EGRESS DOOR SECURING AND RELEASING DEVICE* – An assembly of co-ordinated or matched parts of the equipment associated with the door that performs the function of holding a door in the closed position and/or releasing the door.

3.4 *FIRE ALARM SYSTEM* – A combination of devices consisting of at least a *control unit*, a manual station and an audible signal device, designed to warn the building occupants of an emergency fire condition.

3.5 *LOCATION**

3.5.1 *DAMP LOCATION* – A location protected from sun, rain, and water, but which may be subject to moisture or condensation. Such locations may include, but are not limited to, basements, barns, cold-storage warehouses, greenhouses and indoor swimming facilities. They may also include but are not limited to partially protected locations under canopies, marquees, roofed open porches, and the like.

3.5.2 *DRY LOCATION* – A location with a controlled ambient that is not subject to dampness or wetness

3.5.3 *ORDINARY LOCATION* – A *dry location* in which, at normal atmospheric pressure and under normal conditions or use, electrical equipment is not unduly exposed to damage from mechanical causes, excessive dust, moisture or extreme temperatures, and in which electrical equipment is entirely free from the possibility of damage through corrosive, flammable or explosive atmosphere.

3.5.4 *OUTDOOR LOCATION* – Any location exposed to the weather.

NOTE: Locations that are sheltered from the weather are not considered *outdoor locations*.

3.5.5 *WET LOCATION* – A location subject to rain (or the spray of noncorrosive and nonflammable liquids) that may become saturated with water or that is unprotected from the weather.

* Definitions are consistent with CSA C22.21, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations

4 GENERAL

4.1 COMPONENTS

4.1.1 Except as indicated in Clause 4.1.3, a component of a product covered by this Standard shall comply with the requirements for that component. See Appendix A (Normative), Standards for Components, for a list of Standards that apply to components generally used in the products covered by this standard.

4.1.2 A component need not comply with a specific requirement that:

- A Involves a feature or characteristic not needed in the application of the component in the product covered by this Standard; or
- B Is superseded by a requirement in this Standard.

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

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

4.1.5 The egress door securing mechanism shall not incorporate latches, pins or other similar components, which upon failure (electrical or mechanical), would impede the door from opening.

4.1.6 An egress door releasing mechanism shall be constructed so that a force of not more than 90 N applied to the egress door releasing mechanism shall initiate an irreversible process that will release the locking device within 15 s and will not relock until the door has been opened.

4.1.7 After being released, the egress door securing mechanism shall only be manually reactivated either individually or as part of an installed system.

4.1.8 The egress door securing mechanism shall be secured in the energized condition and shall withstand a designated force applied to the door, without releasing.

4.1.9 When de-energized, the egress door securing mechanism shall be positively released so that the door can be opened.

4.2 UNITS OF MEASUREMENT

4.2.1 Unless otherwise indicated, all voltage and current values mentioned in this Standard are root-mean-square (rms).

4.2.2 The metric unit shall be designated as the official unit for purposes of this standard. Where values of measurement are specified in both SI and English units, either unit is used. In cases of dispute, the metric unit shall be used.

5 INSTRUCTIONS AND DRAWINGS

NOTE: In Canada, there are two official languages, French and English. Attention is drawn to the fact that some Canadian authorities may require instruction and installation wiring diagrams to be in either or both official languages.

5.1 Each egress door securing mechanism shall include installation instructions and drawings as specified in Clauses 5.2 through 5.5. Refer to Appendix B (Informative), Installation Guidelines.

5.2 Installation drawings shall include the typical location, mounting, orientation and spacing of units;

5.3 Installation wiring drawings shall include the following items:

- A Typical wiring material type designation;
- B Typical wire gauge related to circuit voltage and power rating and circuit length;
- C Typical wiring method which shall be in accordance with CSA C22.1, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, Section 32; and CAN/ULC-S524 Installation of Fire Alarm Systems
- D Wire connections to the device, including equipment grounding by wire colour code and identified terminals, as applicable; and
- E Compatible interface equipment, such as *control unit* and end-of-line devices or the applicable parameters of the interface equipment for voltage, power, and supervision compatibility specified.

5.4 Typical instructions shall include a statement to caution against changing factory applied finishes.

5.5 The information required by Clauses 5.2 through 5.4 may be incorporated on the device if it is visible after installation. Alternatively it may be incorporated inside of the device if it is visible by opening the enclosure cover or by the removal of not more than two mounting screws.

6 CONSTRUCTION

6.1 GENERAL

6.1.1 The construction of an *egress door securing and releasing device* shall comply with the construction requirements contained in this Section, unless where permitted by test, the construction is determined to be equivalent to these requirements.

6.1.2 Unless specifically indicated otherwise, the construction requirements specified for a product also apply to any remote accessories with which it is to be employed

6.2 ENCLOSURES

6.2.1 General

6.2.1.1 The frame and enclosure of an *egress door securing and releasing device* shall be sufficiently strong and rigid to resist total or partial collapse with attendant reduction of spacings, loosening or displacement of parts or development of other conditions which could impair operation of the *egress door securing and releasing device* and increase the risk of fire or electrical shock. See Subsection 8.23, Mechanical Strength Tests for Enclosures.

6.2.1.2 Electrical parts of an *egress door securing and releasing device* shall be located or enclosed to provide protection from unintentional contact with un-insulated energized parts.

6.2.1.3 Operating parts, which may be affected by dust, shall be enclosed to exclude entry of dust. See Subsection 8.19, Dust Exposure.

6.2.1.4 The enclosure of a device shall be provided with means for mounting in the intended manner. Any fittings, such as brackets, hangers, or similar hardware required for mounting shall be furnished with the device.

6.2.1.5 The mounting means of an enclosure shall be accessible without disassembly of any components of the *egress door securing and releasing device*. Removal of a complete assembly is not considered to be disassembly of a component.

6.2.1.6 An enclosure shall be constructed to minimize the possibility of emission of flame, molten metal, flaming or glowing particles, or flaming drops. See Subsection 8.12, Burnout.

6.2.1.7 The enclosure of an *egress door securing and releasing device* intended for mounting on exterior doors shall incorporate the following:

- A External means for mounting, or internal means for mounting designed so as to prevent water from entering the enclosure. See Subsection 8.18, Water Spray (Rain Exposure);
- B Holes for conduit shall be threaded unless they are located below the lowest termination point or other energized part within the enclosure. If knockouts or unthreaded holes are provided, there shall be provision for drainage of the enclosure; and
- C A gasket shall be of material, which will resist moisture and shall be cemented, pinned, or otherwise secured to one of the contacting surfaces.

6.2.2 Openings

6.2.2.1 Openings in the top of the enclosure shall be so constructed and shall be of such size that the entry of foreign objects is prevented.

6.2.2.2 To ensure compliance with Clause 6.2.2.1, openings directly over un-insulated energized parts or operating parts shall not exceed 5 mm in any dimension unless the configuration of the opening prevents entry of foreign objects. See Figure 1, Cross Sections of Top Cover Designs, for examples of acceptable top cover designs.

6.2.2.3 Openings in the sides of the enclosure shall be so constructed and shall be of such size that entry of foreign objects or personnel contact is prevented. Louvers are acceptable if shaped to deflect external falling objects outward. See Figure 2, Cross Sections of Louvre Designs, for examples of acceptable louver designs.

6.2.2.4 Openings in the bottom of enclosures containing materials which do not have flammability rating of at least 0.6 V 1, as determined by the Flammability Classification Test of CSA C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials, may be permitted if constructed so that dropping through of material from the enclosure would be prevented. Figure 3, Cross Sections of Baffle Design, illustrates a type of baffle that meets this requirement. A second acceptable construction is a nominal 1 mm thick sheet steel bottom panel in which 2 mm diameter round holes are spaced no closer than 1.5 times the hole diameter, centre to centre. Other constructions are acceptable if the *egress door securing and releasing device* complies with Subsection 8.12, Burnout.

6.2.2.5 The bottom of an enclosure containing materials having a flammability rating of 0.6 V 1 or better, as determined by the Flammability Classification Test of CAN/CSA-C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials, may have openings not larger in area than 40 mm².

6.2.2.6 Except as noted in Clause 6.2.2.7, an enclosure intended for recessed mounting and whose front panel is to be flush with the surface of the wall, shall have no openings that vent into concealed spaces of a building structure such as into hollow spaces in the wall, when the *egress door securing and releasing device* is mounted as intended.

6.2.2.7 The requirement in Clause 6.2.2.6 does not apply to an opening for a mounting screw or nail or for a manufacturing operation (such as paint drainage) if:

- A No such opening has dimension greater than 7 mm or an area greater than 36 mm²; and
- B There is no more than one mounting screw hole for each 300 mm of length of mounting surface, or fraction thereof.
- C An opening for mounting does not have a dimension of greater than 19 mm or an area greater than 430 mm² or there are no more holes than needed for mounting of the product

6.2.2.8 A opening shall not permit entrance of a 19 mm diameter rod and shall be of such size and so arranged that a probe, as illustrated in Figure 4, Accessibility Probe, cannot be made to contact any un-insulated energized electrical part, other than extra low voltage, when inserted through the opening in a straight or articulated position.

6.2.2.9 Notwithstanding the requirement of Clause 6.2.2.8, enclosure openings which are exposed after installation shall be sized and so arranged that a straight rod of circular cross section 6.4 mm diameter with a hemispherical end cannot be made to contact any un-insulated energized part and cannot damage any part of the *egress door securing and releasing device* by a push force of 4.5 N so as to impair operation, reduce electrical spacings or otherwise reduce the reliability of the *egress door securing and releasing device*.

6.2.3 Cast Metal Enclosures

6.2.3.1 The thickness of cast metal for an enclosure shall be as indicated in Table 1, Cast Metal Enclosures.

Exception: Cast metal of lesser thickness may be employed if, consideration being given to the shape, size, and function of the enclosure, it provides equivalent mechanical strength. See Subsection 8.23, Mechanical Strength Tests for Enclosures.

6.2.3.2 If threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, there shall be not less than 3.5 nor more than 5 threads in the metal, and the construction shall be such that a standard conduit bushing can be properly attached.

6.2.3.3 If threads for the connection of conduit are tapped only part of the way through a hole in an enclosure wall, there shall be not less than 3.5 full threads in the metal and there shall be a smooth, rounded inlet hole which shall afford protection to the conductors equivalent to that provided by a standard conduit bushing.

6.2.3.4 An *egress door securing and releasing device* designed to be supported by rigid conduit shall be provided with conduit hubs, or the equivalent, having not less than 5 full threads.

6.2.4 Sheet Metal Enclosures

6.2.4.1 The thickness of sheet metal employed for the enclosure of an *egress door securing and releasing device* shall be not less than that indicated in Table 2, Minimum Thickness of Sheet Metal for Enclosures and Barriers – Carbon Steel or Stainless Steel; and Table 3, Minimum Thickness of Sheet Metal for Enclosures and Barriers – Aluminum, Copper, or Brass.

Exception: Sheet metal of lesser thickness may be employed if, consideration being given to the shape, size, and function of the enclosure, it provides equivalent mechanical strength.

6.2.4.2 A plate or plug closure for an unused conduit opening or other hole in the enclosure shall have a thickness not less than:

- A 0.36 mm for steel or 0.43 mm for non-ferrous metal for a hole having a 6.4 mm maximum dimension; and
- B 0.69 mm for steel or 0.81 mm for non-ferrous metal for a hole having a 35 mm maximum dimension.

6.2.4.3 A hole larger than 35 mm diameter shall have a closure whose thickness is not less than that required for the enclosure of the *egress door securing and releasing device* or shall have a standard knockout seal. Such plates or plugs shall be securely mounted.

6.2.4.4 A knockout in a sheet metal enclosure shall be secured but shall be capable of being removed without undue deformation of the enclosure.

6.2.4.5 A knockout shall be provided with a surrounding surface area of sufficient size to permit seating of a conduit bushing, and shall be so located that a bushing employed at any knockout likely to be used during installation will not result in spacings between uninsulated energized parts and the bushing of less than those indicated in Subsection 6.8, Spacings.

6.2.4.6 A sheet metal member to which a wiring system is to be connected in the field shall have a thickness not less than 0.81 mm if of uncoated steel, of not less than 0.86 mm if of galvanized steel, and of not less than 1.14 mm if of non-ferrous metal.

6.2.5 Non-metallic Enclosures

6.2.5.1 An enclosure or parts of an enclosure of non-metallic material shall have the mechanical strength and durability and be so formed that operating parts will be protected against damage. The mechanical strength of the enclosure shall be at least equivalent to a sheet metal enclosure of the minimum thickness specified in Table 2, Minimum Thickness of Sheet Metal for Enclosures and Barriers, Carbon Steel or Stainless Steel. See Subsection 8.23, Mechanical Strength Tests for Enclosures.

6.2.5.2 Among the factors taken into consideration when judging the acceptability of a non-metallic enclosure with respect to aging are: the mechanical strength; resistance to impact; moisture absorptive properties; flammability and resistance to ignition from electrical sources; dielectric strength, insulation resistance, and resistance to arc tracking; and resistance to distortion and creeping at temperatures to which the material may be subjected. See Subsection 8.22, Tests on Plastic Materials; and Subsection 8.23, Mechanical Strength Tests for Enclosures.

6.2.5.3 Among the factors taken into consideration when judging the acceptability of a non-metallic enclosure are the following:

- A The mechanical strength;

- B Resistance to impact;
- C Moisture-absorptive properties;
- D Flammability and resistance to ignition from electrical sources;
- E Dielectric strength, insulation resistance, and resistance to arc tracking; and
- F Resistance to distortion and creeping at temperatures to which the material may be subjected.

NOTE: All these factors are considered with respect to aging in accordance with Subsection 8.22, Tests on Polymeric Materials.

6.2.6 Enclosure Cover

6.2.6.1 An enclosure cover shall be secured by means requiring the use of a tool or key for opening.

6.3 CORROSION PROTECTION

6.3.1 Ferrous metal, iron and steel parts other than bearings and similar parts where such protection is impractical, shall be protected against corrosion by enameling, galvanizing, sherardizing, plating, or other equivalent means. See Subsection 8.17, Corrosion.

Exception: 1. This requirement does not apply to parts such as washers, screws, bolts, and the like, if failure of such unprotected parts would not be likely to result in a risk of fire or electrical shock, or affect the performance of the egress door securing and releasing device.

Exception: 2. Parts made of stainless steel, polished or treated, do not require additional protection against corrosion.

6.3.2 The requirement of Clause 6.3.1 applies to all enclosures of sheet steel or cast iron, and to all springs and other parts upon which intended mechanical operation may depend.

6.3.3 Bearing surfaces shall be of such materials and design as to resist binding due to corrosion.

6.3.4 Metal shall not be used in combinations such as to cause galvanic action. See Subsection 8.17, Corrosion.

6.3.5 Cabinets and enclosures of corrosion resistant material may be employed without special corrosion protection.

6.3.6 An enclosure of an *egress door securing and releasing device*, intended for mounting on an interior door, of sheet steel less than 3.05 mm in thickness, 3.18 mm or less if zinc coated, shall be galvanized by the hot dip process after forming and assembly; or shall be made from hot dipped sheets; or shall be provided with a coating which is at least the equivalent, with respect to corrosion protection, of zinc applied by the hot dip process.

6.3.7 Metal shall not be used in combinations such as to cause galvanic action. Refer to CAN/CSA C22.2 No. 60065, Audio, Video and Similar Electronic Equipment, Annex F, Table of Electrochemical Potentials.

6.3.8 Enclosures of corrosion-resistant material may be employed without special corrosion protection.

6.3.9 For outdoor-use, an enclosure of sheet steel less than 3.05 mm in thickness, 3.18 mm or less if zinc coated, shall be galvanized by the hot-dip process after forming and assembly, or shall be made from hot-dipped sheets, or shall be provided with a coating which is at least the equivalent, with respect to corrosion protection, of zinc applied by the hot-dip process.

6.4 FIELD WIRING CONNECTIONS

6.4.1 General

6.4.1.1 Wiring terminals or leads shall be provided for connection of conductors of at least the size required by CSA C22.1, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, corresponding to the rating of the *egress door securing and releasing device*.

6.4.1.2 Wiring terminals shall be prevented from turning.

6.4.1.3 Dual terminals, dual leads, or equivalent means to achieve electrical supervision, shall be provided for each incoming and each outgoing circuit connection. A common terminal may be used for connection of both incoming and outgoing wires, provided that the design and construction of the terminal does not permit an un-insulated section of a single conductor to be looped around the terminal and serve as two separate connections, thereby precluding supervision of the connection in the event that the wire becomes dislodged from under the terminal. A notched clamping plate under a single securing screw, where separate conductors of an initiating circuit are intended to be inserted in each notch, is acceptable, but this arrangement shall be supplemented by additional marking in the wiring area or on the installation wiring diagram specifying the intended connections to the terminals.

6.4.2 Field Wiring Compartment

6.4.2.1 The field wiring compartment in which connections are made shall be of sufficient size for completing all wiring connections specified by the installation wiring drawing, without damage to wire insulation or to internal components. There shall be space within the compartment to permit the use of a standard conduit bushing on conduit connected to the compartment when a bushing is required.

6.4.2.2 The device wiring and internal components in the wiring area of a device designed for mounting to an outlet box shall be located or protected so that, they and the field wiring in the outlet box are not forced against sharp edges to prevent damage.

6.4.2.3 The wiring of an *egress door securing and releasing device* designed for mounting to an outlet box shall be so located or protected that upon installation, the wiring in the outlet box is not forced against sharp edges so as to damage the conductor insulation.

6.4.2.4 An outlet box or compartment in which field wiring connections are to be made shall be located such that the connections may be inspected after the *egress door securing and releasing device* is installed as intended. The removal of screws, or equivalent arrangement and dismounting of an assembly, of not more than 4.5 kg mass to view the field wiring connections, is considered to comply with this requirement.

6.4.2.5 An *egress door securing and releasing device* without a field wiring compartment shall be constructed so that the following requirements are met:

- A Field wiring and leads shall be prevented from contacting moving parts of the *egress door securing and releasing device* when such contact would result in damage to the wire insulation or interfere with the operation of the *egress door securing and releasing device*;

- B Field wiring and leads shall be prevented from contacting parts of the *egress door securing and releasing device* which under any condition of operation may achieve a temperature exceeding the temperature rating of the wire or lead insulation. See Subsection 8.7, Temperature; and
- C Field wiring and leads shall be prevented from contacting un-insulated energized parts which under any condition of operation may be at a potential exceeding the voltage rating of the wire or lead insulation. See Subsections 6.5.2, Separation of Circuits and 6.8, Spacings.

6.4.3 Field Wiring Terminals and Leads

6.4.3.1 Types and Sizes

6.4.3.1.1 Terminals for field connection of conductors larger than No.10 AWG shall consist of non-ferrous soldering lugs or non-ferrous solderless (pressure) wire connectors.

6.4.3.1.2 Terminals for field connection of conductors No.10 AWG or smaller may consist of means for clamping the conductor if such means are constructed so that:

- A They will firmly grip the conductors and securely hold them in place; and
- B Solid conductors cannot come out from under the clamping means even though the latter is loosened sufficiently to allow lateral movement of the conductors with respect to the means.

6.4.3.2 Size of Screws

6.4.3.2.1 If binding head screws or machine screws and washers are used as clamping means for conductors, the size of screw shall be not less than:

- A No. 10 if for use with conductors larger than No. 14 AWG;
- B No. 8 if for use with conductors of No. 14 AWG; or
- C No. 6 if for use with conductors smaller than No. 14 AWG.

6.4.3.3 Material for Terminal Parts

6.4.3.3.1 Binding head screws, bolts, studs, nuts and washers shall be of non-ferrous metal except that in sizes No. 10 or larger, iron or steel may be used if:

- A Such parts are suitably protected with a plating of cadmium, zinc, or equivalent material having a thickness not less than 0.003 mm; and
- B The conductor or terminal to be secured is clamped against a surface of non-ferrous metal, which will carry the greater part of the current.

6.4.3.4 Terminal Plates and Threading

6.4.3.4.1 Wiring terminal screws shall thread into metal.

6.4.3.4.2 The threading of binding head screws and machine screws, other than wiring terminal screws, into material other than metal shall be made the subject of investigation.

6.4.3.4.3 Terminal plates through which binding head screws or machine screws are threaded shall have a thickness at least equal to twice the pitch of the thread of the screw, but not less than 0.76 mm, and shall have at least two complete clean cut full threads.

6.4.3.4.4 Terminal plates for solderless connectors or solderless lugs shall: have a thickness of not less than 1.27 mm; have at least two complete full threads, if threaded; and provide contact areas, such that the full contact area of the tongue of the largest lug which would normally be used will be properly utilized.

6.4.3.4.5 Screws engaging threaded holes in plates shall have not less than two full threads engaging under any condition of service.

6.4.3.4.6 If terminal screws do not pass entirely through threaded holes, they shall engage clean cut full threads for a distance not less than the major diameter of the screw.

6.4.3.5 Grounding Terminals and Leads

6.4.3.5.1 For an appliance intended for connection to an AC Mains source of supply, only by means of other than a metal-enclosed wiring system, such as non-metallic-sheathed cable, all of the following shall be provided:

- A An equipment grounding terminal or lead, the size of which shall be the same as that of the supply terminal or lead, but in no case less than 18 AWG (0.82 mm²);
- B A marking to indicate the system or systems for which it is intended; and
- C Reliable connection of the grounding means to all exposed dead metal parts that are likely to become energized, and all dead metal parts within the enclosure that are exposed to contact during servicing and maintenance.

6.4.3.5.2 The surface of an insulated lead intended solely for the connection of an equipment grounding conductor shall be green, with or without one or more yellow stripes. No other leads visible to the installer, other than the grounding conductors, shall be so identified.

6.4.3.5.3 A field wiring terminal intended for connection of an equipment grounding conductor shall be plainly identified, with the marking G, GR, GROUND, GROUNDING, by the graphic symbol 5019 from IEC 60417-1, Graphical Symbols for Use on Equipment – Part 1: Overview and Application, or the equivalent, or by a marking on a wiring diagram provided on the appliance. The field wiring terminal shall be located so that it is unlikely to be removed during servicing of the appliance. Grounded Supply Terminals and Leads. Refer to Figure 5, for the ground symbol.

6.4.3.5.4 A field wiring terminal for the connection of the grounded supply conductor of an AC Mains supply circuit shall be identified by means of a white metallic-plated coating and shall be distinguishable from the other terminals. Otherwise, identification of the terminal for the connection of the grounded conductor shall be shown in some other manner, such as on an attached connection diagram.

6.4.3.5.5 A field wiring lead provided for connection of the grounded supply conductor of an AC Mains supply circuit shall be finished white or gray and shall be distinguishable from other leads. No other leads visible to the installer, other than grounded conductors, shall be so identified.

6.4.3.5.6 A terminal or lead identified for the connection of the grounded supply conductor shall not be electrically connected either to a single-pole manual switching device that has an "off" position or to a single-pole overcurrent (not thermal) protective device.