



UL 1034

Underwriters Laboratories Inc. Standard for Safety

Burglary-Resistant Electric Locking Mechanisms



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UL Standard for Safety for Burglary-Resistant Electric Locking Mechanisms, UL 1034

Sixth Edition, Dated May 18, 2011

Summary of Topics

This New Edition of ANSI/UL 1034 includes a modification to the Electrical Rating Marking in 62.1.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated October 29, 2010.

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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that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

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

Future Effective Dates	References
April 2, 2012	Paragraph 62.1



MAY 18, 2011



ANSI/UL 1034-2011

1

UL 1034

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First Edition – July, 1974

Second Edition – September, 1980

Third Edition – September, 1987

Fourth Edition – July, 1994

Fifth Edition – February, 2000

Sixth Edition

May 18, 2011

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

The most recent designation of ANSI/UL 1034 as an American National Standard (ANSI) occurred on May 18, 2011. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

The Department of Defense (DoD) has adopted UL 1034 on July 1, 1992. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Comments or proposals for revisions on any part of the Standard may be submitted to 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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CONTENTS

INTRODUCTION

1 Scope	7
2 Components	8
3 Units of Measurement	8
4 Undated References	8
5 Glossary	8

CONSTRUCTION

ASSEMBLY

6 General	9
6.1 Product assembly	9
6.2 Electrical protection	10
7 Protection of Service Personnel	13
8 Enclosures	13
8.1 General	13
8.2 Product enclosure mounting	15
8.3 Doors and covers	15
8.4 Enclosure openings	15
8.5 Screens and expanded metal	18
8.6 Cast metal	18
8.7 Sheet metal	19
8.8 Polymeric materials	21
9 Electric Shock	22
10 Corrosion Protection	22

FIELD-WIRING CONNECTIONS

11 General	22
12 Cord-Connected Products	23
13 Permanently-Connected Products	25
13.1 General	25
13.2 Field-wiring terminals	26
13.3 Field-wiring leads	28
13.4 Polarity identification	29
14 Grounding	29

INTERNAL WIRING

15 General	30
16 Wiring Methods	31
17 Separation of Circuits	32
18 Bonding for Grounding	33

COMPONENTS, ELECTRICAL

19 General	36
19.1 Mounting of components	36
19.2 Insulating materials	37
19.3 Fuseholders	38
19.4 Current-carrying parts	38
20 Overcurrent Protection	38
21 Semiconductors	38
22 Switches	38
23 Transformers and Coils	39

SPACINGS

24 General	39
25 Components	41

PERFORMANCE

ALL UNITS

26 General	41
26.1 Test units and data	41
26.2 Test samples and miscellaneous data	41
26.3 Test voltages	41
26.4 Test fixture	42
27 Normal Operation Test	42
28 Input Test	43
29 Output Measurement Test	43
30 Power-Limited Circuits	44
30.1 General	44
30.2 Maximum voltage	46
30.3 Maximum current	46
30.4 $V_{A_{max}}$ (Not inherently limited circuits only)	47
31 Standby Power	47
32 Undervoltage Operation Test	47
33 Overvoltage Operation Test	47
34 Variable Ambient Test	48
35 Humidity Test	48
36 Leakage Current Tests for Cord-Connected Products	48
37 Electric Shock Current Test	52
38 Overload Test	56
38.1 General	56
38.2 Separately energized circuits	56
39 Endurance Test	57
39.1 General	57
39.2 Separately energized circuits	57
40 Jarring Test	58
41 Dielectric Voltage-Withstand Test	59
42 Temperature Test	60
43 Abnormal Operation Test	63
44 Electrical Transient Tests	63
44.1 General	63

44.2	Supply line transients	64
44.3	Internally induced transients	64
44.4	Input/output circuit transients	64
45	Polymeric Materials Test	65
46	Battery Replacement Test	65
47	Strain Relief Test	65
47.1	General	65
47.2	Field-wiring leads	66
48	Ignition Through Bottom-Panel Openings	66
48.1	General	66
48.2	Hot, flaming oil	66
49	Mechanical Strength Tests for Enclosures	67
50	Special Terminal Assemblies Tests	68
50.1	General	68
50.2	Disconnection and reconnection	68
50.3	Mechanical secureness	68
50.4	Flexing test	68
50.5	Millivolt drop test	69
50.6	Temperature test	69

OUTDOOR USE EQUIPMENT

51	General	69
52	Salt Spray Corrosion Test	69
53	Rain Test	70
54	Dust Test	74

ELECTRIC LOCKING MECHANISMS

55	Forcing Tests	74
55.1	Static and dynamic strength tests	74
55.2	Static strength test	74
55.3	Dynamic strength test	75
55.4	Torque test	76
56	Tool Manipulation Attack Test	77
57	Residual Magnetism Test	77
58	Panic Hardware	77
59	Emergency Exit	78

MANUFACTURING AND PRODUCTION LINE TESTS

60	Production Line Dielectric Voltage-Withstand Test	78
61	Production Line Grounding Continuity Test	79

MARKINGS

62	General	79
63	Marking Permanency Tests	82

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ACCESSORY EQUIPMENT

64 General	82
65 Construction	82
66 Performance (Installation) Test	83
67 Markings	83

INSTRUCTIONS

68 Installation and Operating Instructions	83
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APPENDIX A

Standards for Components.....	A1
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INTRODUCTION

1 Scope

1.1 These requirements apply to the construction, performance, and operation of burglary-resistant electric locking mechanisms and their related devices, such as control units, control switches, and power supplies, and the like used to secure and release doors.

1.2 A burglary-resistant electric locking mechanism shall be rated according to the three elements used to determine its maximum effectiveness:

- a) Static strength rating of 500 pounds-force (2224 N), 1000 pounds-force (4448 N), or 1500 pounds-force (6673 N). See 55.2.1.
- b) Dynamic strength rating of 33 foot-pounds-force (45 J), 50 foot-pounds-force (68 J), or 70 foot-pounds-force (95 J). See 55.3.1.
- c) Endurance rating of 100,000 or 250,000 cycles. See 38.2.1.

A burglary-resistant electric locking mechanism shall be rated with its maximum static strength, dynamic strength, and endurance.

1.3 A burglary-resistant electric locking mechanism is intended to be used in conjunction with an access control system or a manual-release mechanism. A burglary-resistant electric locking mechanism shall be constructed so that it either does not interfere with egress through the door or other opening cover that it is used to control, or its locking action shall be capable of being released as required by the authority having jurisdiction if an emergency egress is required.

1.4 These requirements do not pertain to the fire-retardant classification of a door and releasing-device assembly.

1.5 The term "product" as used in this standard refers to all types of burglary-resistant electric locking mechanisms.

1.6 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 or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

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

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

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

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

3 Units of Measurement

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

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

4 Undated References

4.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

5 Glossary

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

5.2 CIRCUITS, ELECTRICAL –

- a) High-Voltage (Class 1) – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage, power-limited circuit.
- b) Low-Voltage – A circuit involving a potential of not more than 30 volts AC rms, 42.4 volts DC or AC peak.
- c) Power-Limited – A circuit whose output is limited as specified in Power-Limited Circuits, Section 30.
- d) Class 2 – A circuit in which the voltage and power limitations are in accordance with the requirements of Table 30.1 for AC circuits and Table 30.2 for DC circuits.
- e) Class 3 – A circuit in which the voltage and power limitations are in accordance with the requirements of Table 30.1 for AC circuits and Table 30.2 for DC circuits.

5.3 CORD-CONNECTED PRODUCT – A product intended for connection to the power source by means of a supply cord. By the nature of its design, such a product is intended to be moved for interchange or realignment of the component of a system.

5.4 ELECTRIC LOCKING MECHANISM – An electrically-operated door strike, dead-bolt, or the like.

5.5 ELECTROMAGNETIC LOCK – An electrically-powered lock using an electromagnet magnetically coupled to an armature to provide locking power.

5.6 LINE-VOLTAGE – The voltage at any field connected source of supply, nominally 50-60 hertz (Hz); 115, 208, or 230 volts.

5.7 PRIMARY BATTERY – Any battery which, by construction, is not intended to be recharged.

5.8 SECONDARY BATTERY – Any battery which, by construction, is intended to be recharged.

5.9 STANDBY CONDITION – The ready-to-operate condition which exists prior to being operated to unlock.

CONSTRUCTION

ASSEMBLY

6 General

6.1 Product assembly

6.1.1 The product shall be factory-built as a complete assembly and shall include all the essential components necessary for its intended function when installed (used) as intended. The product may be shipped from the factory as two or more major subassemblies. See the subassembly requirement in 6.1.2.

6.1.2 If the product is not assembled by the manufacturer as a complete unit, it shall be arranged in major subassemblies. Each subassembly shall be capable of being incorporated into a final assembly without requiring alteration, cutting, drilling, threading, welding, or similar tasks by the installer. Two or more subassemblies, which must bear a definite relationship to each other for the correct installation or operation of the product, shall be arranged and constructed to permit them to be incorporated into the complete assembly only in the intended relationship with each other without need for alteration or alignment, or such subassemblies shall be assembled, tested, and shipped from the factory as one element. However, this requirement does not apply to the alteration, cutting, drilling, threading, welding, or similar tasks by the installer on the door, door jamb, or the like to install and mount the product to perform its intended function.

6.2 Electrical protection

6.2.1 Louvers and other openings in an enclosure shall be constructed and located to reduce the risk of unintentional contact with uninsulated high-voltage live parts. In determining compliance with this requirement, parts such as covers, panels, and grilles used as part of the enclosure are to be removed unless tools are required for their removal or an interlock is provided.

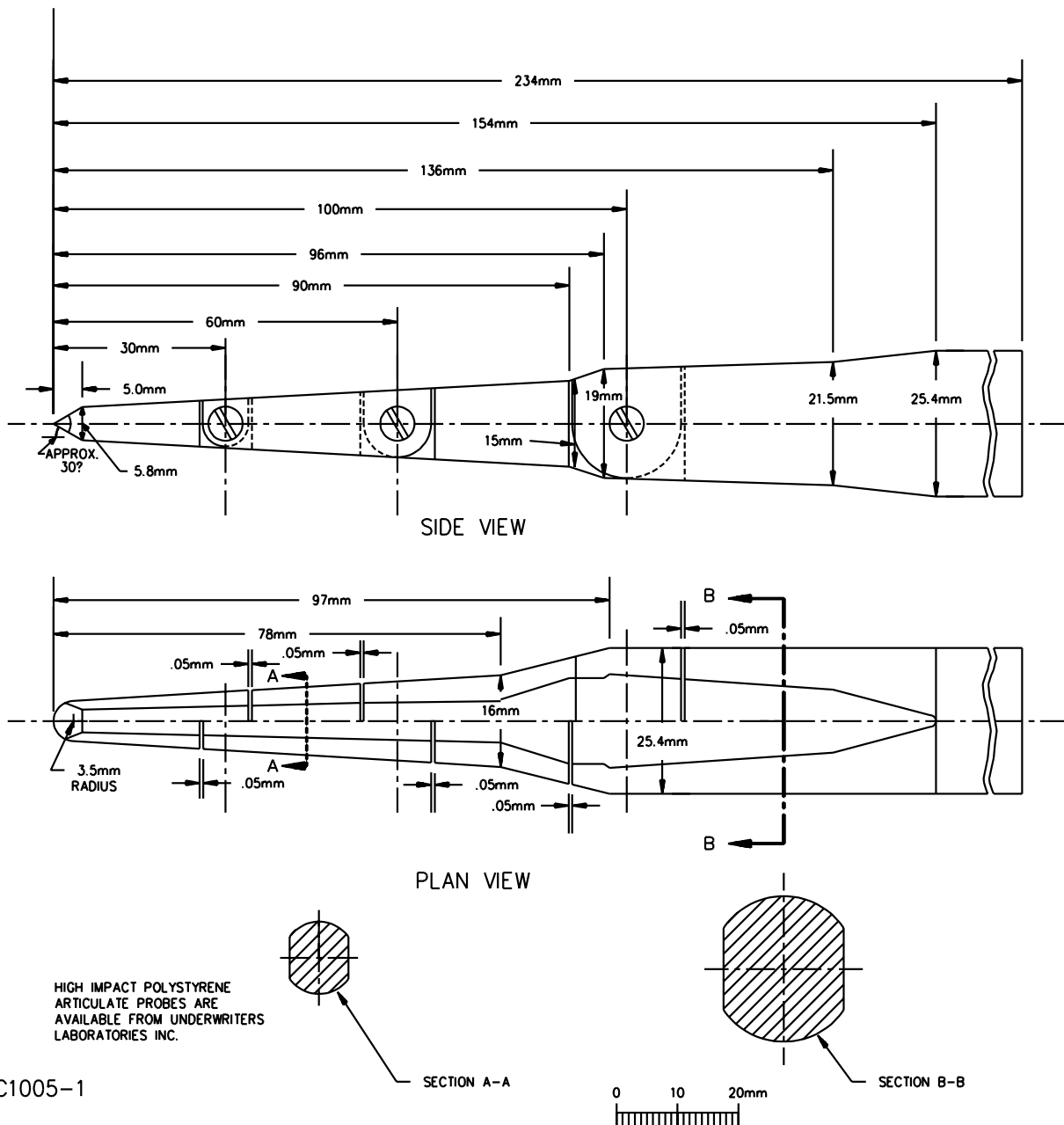
6.2.2 Uninsulated high-voltage live parts shall be located, covered, or enclosed as indicated in 6.2.3 – 6.2.5.

6.2.3 Openings directly over uninsulated high-voltage live parts shall not exceed 0.187 inch (4.75 mm) in any dimension unless the configuration prevents direct entry to uninsulated high-voltage live parts and complies with the requirements of 6.2.4 or 6.2.5. See Figure 8.2 for examples of top cover constructions that may be considered to prevent direct entry.

6.2.4 An opening in an electrical enclosure that does not permit entrance of a 1-inch (25.4-mm) diameter rod shall be sized and arranged so that a probe, as illustrated in Figure 6.1, cannot be made to contact any uninsulated live electrical part (other than low-voltage) when inserted through the opening in a straight or articulated position.

6.2.5 An opening that permits entrance of a 1-inch (25.4-mm) diameter rod may be used under the condition described in Figure 6.2.

Figure 6.1
Probe



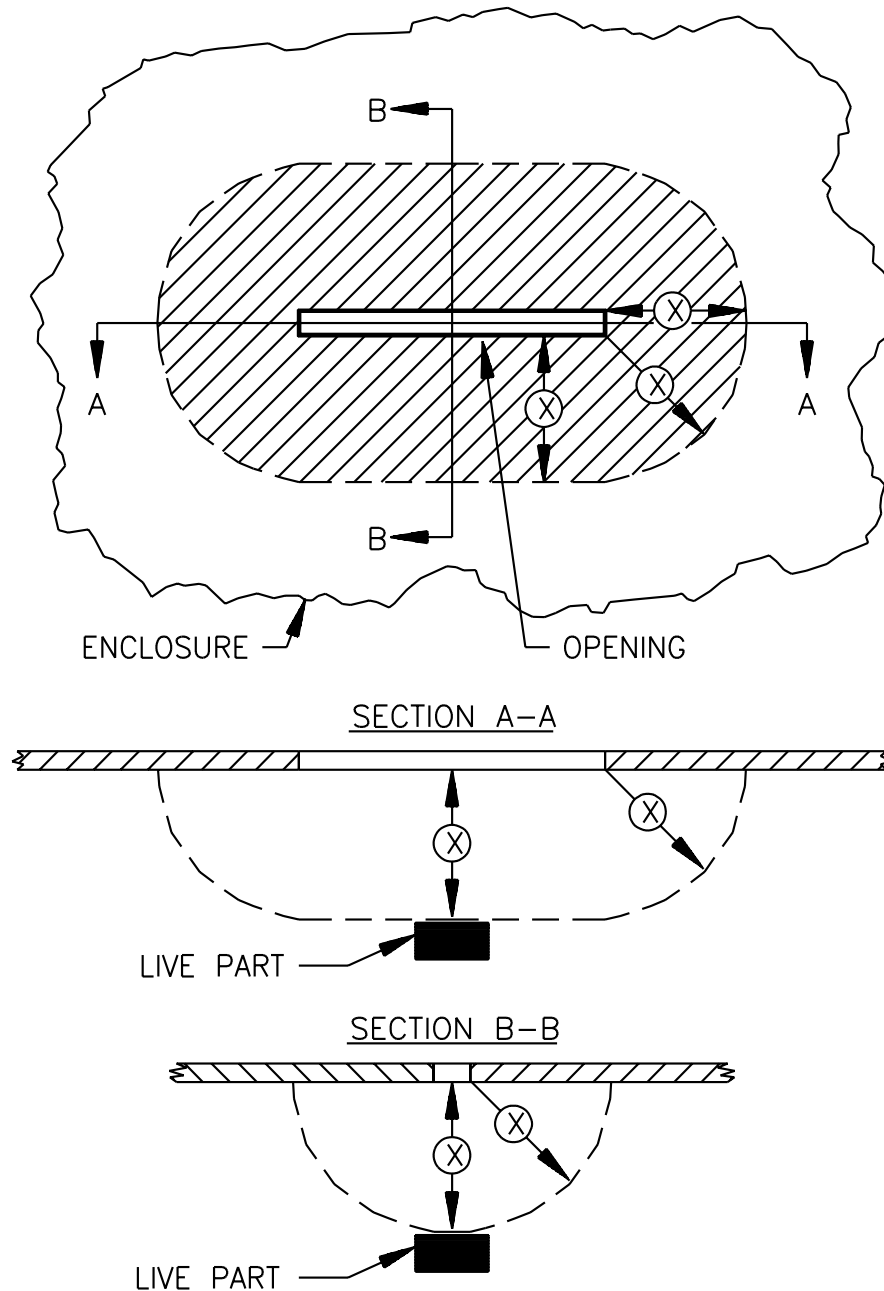
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Figure 6.2
Openings in enclosure



EC100A

The opening is not prohibited from being used when, within the enclosure, there is no uninsulated live metal part or film-coated wire less than X inches (mm) from the perimeter of the opening, as well as within the volume generated by projecting the perimeter X inches normal to its plane. X equals five times the diameter of the largest diameter rod that is capable of being inserted through the opening, and not less than 6-1/16 inches (154 mm).

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7 Protection of Service Personnel

7.1 An uninsulated live part of a high-voltage circuit within an enclosure shall be located, covered, or enclosed so as to reduce the risk of unintentional contact by persons performing service functions which may be performed while the equipment is energized.

7.2 During the examination of a product in connection with the requirements specified in 7.1, a part of the outer enclosure which may be removed without the use of tools, or part of the outer enclosure which may be removed by the user to allow access for making intended operating adjustments, is to be disregarded; that is, it will not be assumed that the part in question reduces the risk of electric shock.

7.3 An electrical component which may require examination, replacement, adjustment, servicing, or maintenance with the product energized shall be located and mounted with regard to other components and to grounded metal so that it is accessible for such service without subjecting the serviceman to the risk of electric shock from adjacent uninsulated high-voltage live parts.

7.4 The following are not considered to be uninsulated live parts:

- a) Coils of relays and solenoids, and transformer windings, if the coils and windings are provided with insulating overwraps rated for the potentials encountered;
- b) Terminals and splices with insulation rated for the potential encountered; and
- c) Insulated wire.

8 Enclosures

8.1 General

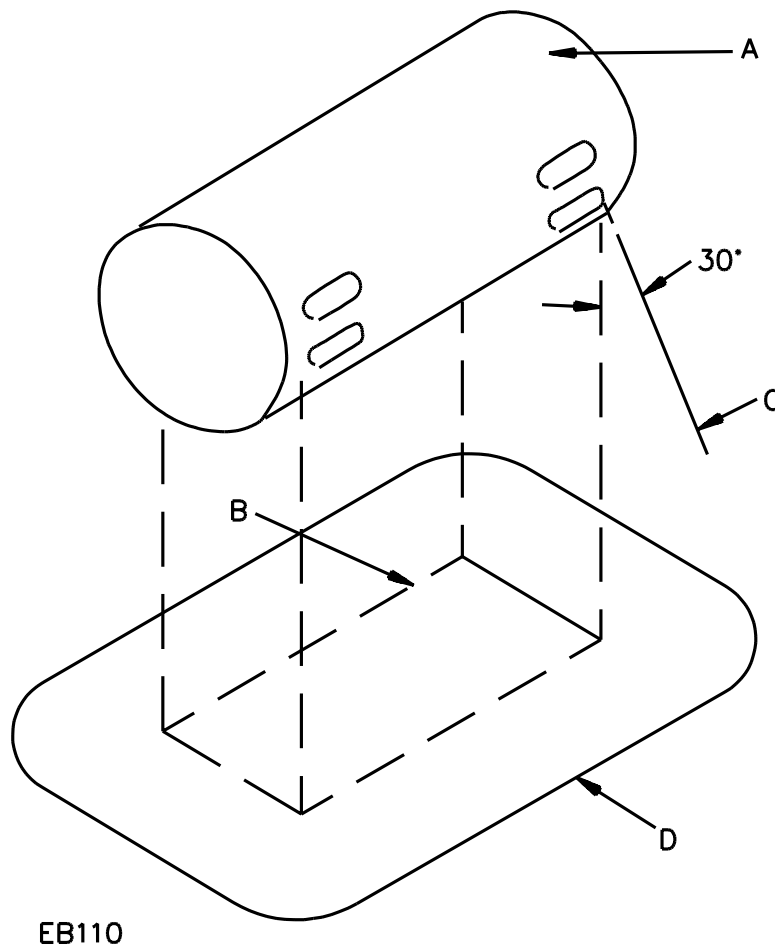
8.1.1 The frame and enclosure of a product shall have the strength and rigidity to resist total or partial collapse and the attendant reduction of spacings, loosening or displacement of parts, or other defects. See Mechanical Strength Tests for Enclosures, Section 49.

8.1.2 Operating parts, such as gear mechanisms, light-duty relays, and similar devices, shall be enclosed to protect against malfunction from dust or from other material which may impair their intended operation.

8.1.3 An enclosure containing other than power limited circuits shall be constructed to reduce the risk of emission of flame, molten metal, flaming or glowing particles, or flaming drops. See Ignition Through Bottom-Panel Openings, Section 48.

8.1.4 The requirement specified in 8.1.3 necessitates either a nonflammable bottom as specified in 8.4.2, or a barrier as described in Figure 8.1 under all areas containing combustible materials. However, see 8.4.3 for further specifications.

Figure 8.1
Barrier outline



a) The entire component under which a barrier (flat or dish with or without a lip or other raised edge) of noncombustible material is to be provided. The sketch above is of a metal enclosed component with ventilating openings to show that the barrier is required only for those openings from which flaming parts might come. If the component or assembly does not have its own noncombustible enclosure, the area to be protected would be the entire area occupied by the component or assembly.

b) Projection of the outline of the area of (A) which needs a bottom barrier vertically downward onto the horizontal plane of the lowest point on the outer edge (D) of the barrier.

c) Inclined line that traces out an area (D) on the horizontal plane of the barrier. Moving around the perimeter of the area (B) which needs a bottom barrier, this line projects at a 30-degree angle from the line extending vertically at every point around the perimeter of (A) and oriented to trace out the largest area, except that the angle may be less than 30 degrees if the barrier or portion of the bottom cover contacts a vertical barrier or side panel of noncombustible material, or if the horizontal extension of the barrier (B) to (D) would exceed 6 inches (152 mm).

d) Minimum outline of the barrier, except that the extension (B) – (D) need not exceed 6 inches (flat or dished with or without lip or other raised edge). The bottom of the barrier may be flat or formed in any manner if every point of area (D) is at or below the lowest point on the outer edge of the barrier.

8.1.5 A construction using individual barriers under components, groups of components or assemblies, as specified in Figure 8.1, is to be considered as complying with the requirement specified in 8.1.3.

8.2 Product enclosure mounting

8.2.1 An enclosure shall have means for mounting that shall be accessible without disassembly of any operating part of the product. Removal of a completely assembled panel to mount the enclosure may be performed.

8.3 Doors and covers

8.3.1 An enclosure cover shall be hinged, sliding, or similarly attached so as to prevent its being removed if:

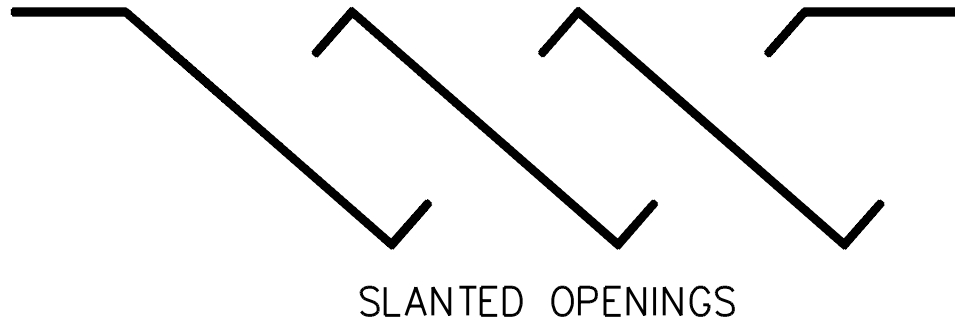
- a) It gives access to fuses or any other overcurrent protective device, the intended functioning of which requires renewal; or
- b) It is necessary to open the cover in connection with the intended operation of the product.

8.3.2 Fasteners requiring the use of a tool or key shall be used for all enclosures if access is not required for operation of the product.

8.4 Enclosure openings

8.4.1 Openings in the enclosure shall be constructed and of such size so that direct entry of foreign objects is prevented. See also 6.2.3. See Figure 8.2 for examples of top cover constructions that are considered to prevent direct entry. See also Figure 8.3 for examples of side openings.

Figure 8.2
Cross sections of top cover designs



EC500

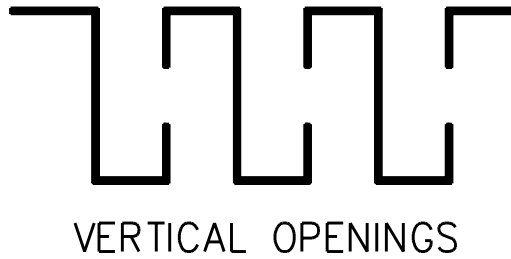
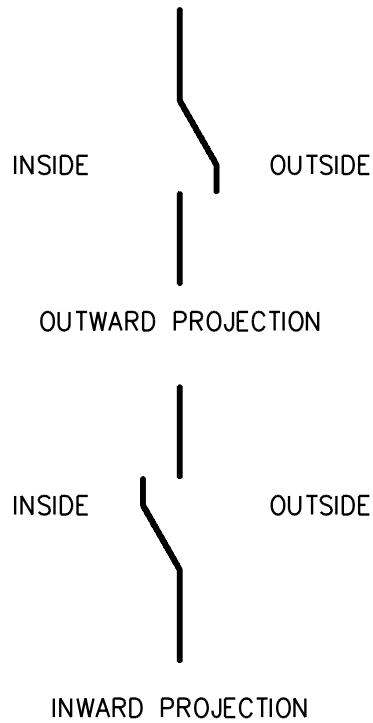


Figure 8.3
Louvers



EC510

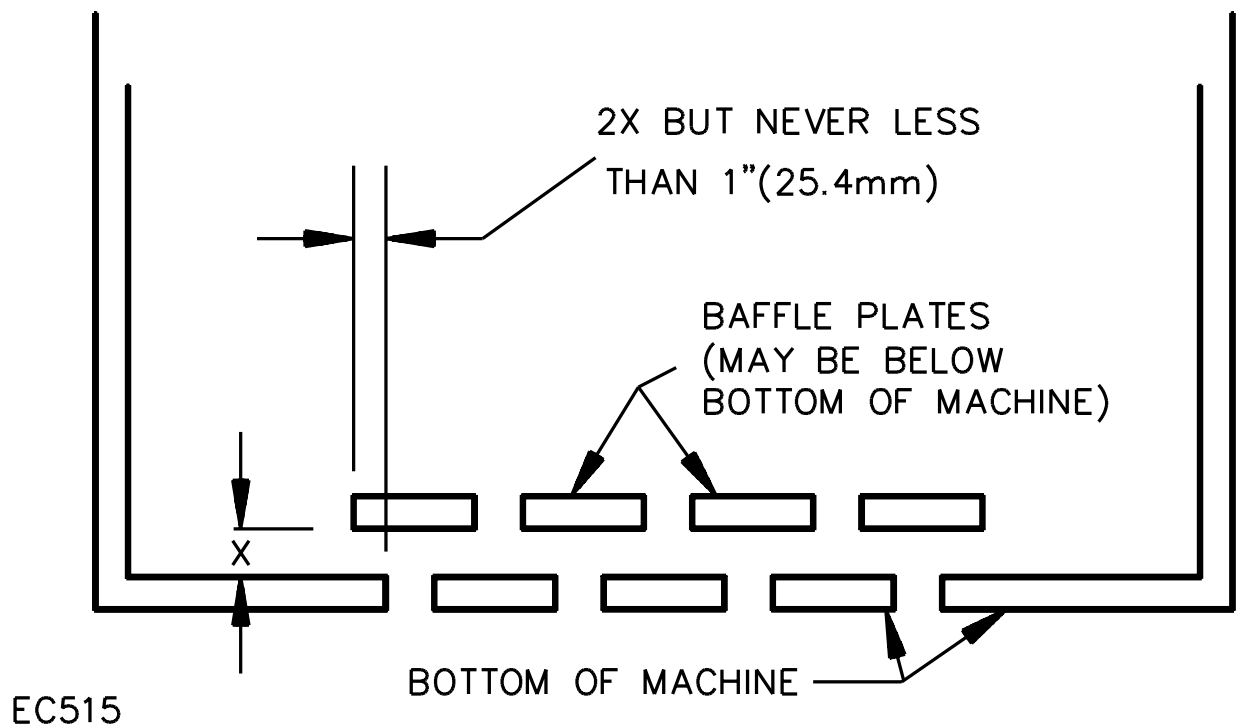
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8.4.2 Openings may be provided in the bottom panels or in pans under areas containing materials not classified as V-1 or less flammable, in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, if constructed so that materials are prevented from falling directly from the interior of the product onto the supporting surface of any other location under the product. Figure 8.4 illustrates a type of baffle that complies with this requirement. A second construction that complies with this requirement is a 0.040-inch (1.02-mm) sheet-steel bottom panel in which 5/64-inch (2.0-mm) maximum diameter round holes are spaced not closer together than 1/8 inch (3.2 mm) center-to-center. Other constructions may be used if they comply with Ignition Through Bottom-Panel Openings, Section 48.

Figure 8.4
Baffle



8.4.3 The bottom of the enclosure under areas containing only materials classified as V-1 or less flammable, may have openings not larger than 1/16 square inch (40.3 mm²).

8.4.4 Openings may be used, without limitation on size or number, in areas containing:

- a) Only PVC, TFE, CTFE, FEP, and neoprene-insulated wire or cable;
- b) Plugs and receptacles; and
- c) Underneath impedance-protected or thermally-protected motors.

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8.4.5 Openings in the enclosure shall not give access to any relays, terminals, controls, or related components that might be subject to tampering by hand or with tools.

8.5 Screens and expanded metal

8.5.1 Screens and expanded metal used as a barrier, enclosure or part of an enclosure, shall comply with the requirements specified in 8.5.2 and 8.5.3 and with the Mechanical Strength Tests for Enclosures, Section 49.

8.5.2 Perforated sheet steel and sheet steel used for expanded metal mesh shall not be less than 0.042 inch (1.07 mm) thick [0.045 inch (1.17 mm) if zinc coated] if the mesh openings or perforations are 1/2 square inch (323 mm²) or less in area, and shall not be less than 0.080 inch (2.03 mm) thick [0.084 inch (2.13 mm) if zinc coated] for larger openings. The largest dimension shall not exceed 4 inches (102 mm).

Exception: If the indentation of a barrier or the enclosure will not alter the clearance between uninsulated live parts and grounded metal so as to impair performance or reduce spacings below the minimum required values, see General (Spacings), Section 24, 0.020 inch (0.53 mm) expanded steel mesh or perforated sheet steel [0.023 inch (0.58 mm) if zinc coated] may be used if:

a) The exposed mesh on any one side or surface of the product so covered has an area of not more than 72 square inches (464 cm²) and has no dimension greater than 12 inches (305 mm) or

b) The width of the covered opening is not greater than 3-1/2 inches (89 mm).

8.5.3 The wires of a screen shall not be less than 16 AWG (1.3 mm² diameter) steel if the screen openings are 1/2 square inch (323 mm²) or less in area, and shall not be less than 12 AWG (3.3 mm² diameter) steel for larger screen openings.

8.6 Cast metal

8.6.1 The thickness of cast metal for an enclosure shall be as specified in Table 8.1.

Exception: Cast metal of lesser thickness may be used if consideration has been given to the shape, size, and function of the enclosure, and it provides equivalent mechanical strength. See Mechanical Strength Tests for Enclosures, Section 49.

Table 8.1
Cast-metal electrical enclosures

Use, or dimensions of area involved ^a	Minimum thickness, inch (mm)	
	Die-cast metal	Cast metal of other than the die-cast type
Area of 24 square inches (115 cm ²) or less and having no dimension greater than 6 inches (152 mm)	1/16 (1.6)	1/8 (3.2)
Area greater than 24 square inches or having any dimension greater than 6 inches	3/32 (2.4)	1/8 (3.2)
At a threaded conduit hole	1/4 (6.4)	1/4 (6.4)
At an unthreaded conduit hole	1/8 (3.2)	1/8 (3.2)
^a The area limitation for metal 1/16 inch (1.6 mm) thick may be obtained by the provision of reinforcing ribs subdividing a larger area.		

8.7 Sheet metal

8.7.1 The thickness of sheet metal for an enclosure shall not be less than specified in Table 8.2 or 8.3, whichever applies.

Exception: Sheet metal of lesser thickness may be used if consideration has been given to the shape, size, and function of the enclosure, and it provides equivalent mechanical strength. See Mechanical Strength Tests for Enclosures, Section 49.

8.7.2 A sheet metal member to which a wiring system is to be connected in the field shall have a thickness of not less than:

- a) 0.032 inch (0.81 mm) if of uncoated steel;
- b) 0.034 inch (0.86 mm) if of galvanized steel; and
- c) 0.045 inch (1.14 mm) if of nonferrous metal.

Table 8.2
Minimum thickness of sheet metal for electrical enclosures carbon steel or stainless steel

Without supporting frame ^a			With supporting frame or equivalent reinforcing ^a			Minimum thickness in inches (mm)	
Maximum width, ^b		Maximum length, ^c	Maximum width, ^b		Maximum length, ^c	Uncoated [MSG]	Metal coated [GSG]
inches	(cm)		inches	(cm)			
4.0	10.2	Not limited	6.25	15.9	Not limited	0.020 (0.51)	0.023 (0.58)
4.75	12.1		6.75	17.1		[24]	[24]
6.0	15.2	Not limited	9.5	24.1	Not limited	0.026 (0.66)	0.029 (0.74)
7.0	17.8		10.0	25.4		[22]	[22]
8.0	20.3	Not limited	12.0	30.5	Not limited	0.032 (0.81)	0.034 (0.86)
9.0	22.9		13.0	33.0		[20]	[20]
12.5	31.8	Not limited	19.5	49.5	Not limited	0.042 (1.07)	0.045 (1.14)
14.0	35.6		21.0	53.3		[18]	[18]
18.0	45.7	Not limited	27.0	68.6	Not limited	0.053 (1.35)	0.056 (1.42)
20.0	50.8		29.0	73.7		[16]	[16]

Table 8.2 Continued

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness in inches (mm)	
Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Uncoated [MSG]	Metal coated [GSG]
22.0 55.9 25.0 63.5	Not limited 31.0 78.7	33.0 83.8 35.0 88.9	Not limited 43.0 109.2	0.060 (1.52) [15]	0.063 (1.60) [15]
25.0 63.5 29.0 73.7	Not limited 36.0 91.4	39.0 99.1 41.0 104.1	Not limited 51.0 129.5	0.067 (1.70) [14]	0.070 (1.78) [14]
33.0 83.8 38.0 96.5	Not limited 47.0 119.4	51.0 129.5 54.0 137.2	Not limited 66.0 167.6	0.080 (2.03) [13]	0.084 (2.13) [13]
42.0 106.7 47.0 119.4	Not limited 59.0 149.9	64.0 162.6 68.0 172.7	Not limited 84.0 213.4	0.093 (2.36) [12]	0.097 (2.46) [12]
52.0 132.1 60.0 152.4	Not limited 74.0 188.0	80.0 203.2 84.0 213.4	Not limited 103.0 261.6	0.108 (2.74) [11]	0.111 (2.82) [11]
63.0 160.0 73.0 185.4	Not limited 90.0 228.6	97.0 246.4 103.0 261.6	Not limited 127.0 322.6	0.123 (3.12) [10]	0.126 (3.20) [10]

^a A supporting frame is a structure of angle or channel or a folded rigid section of sheet metal which is rigidly attached to and has essentially the same outside dimensions as the enclosure surface and which has sufficient torsional rigidity to resist the bending moments which may be applied via the enclosure surface when it is deflected. Construction that is considered to have equivalent reinforcing may be accomplished by designs that will produce a structure that is as rigid as one built with a frame of angles or channels. Construction considered to be without supporting frame includes:

- 1) A single sheet with single formed flanges (formed edges),
- 2) A single sheet which is corrugated or ribbed, and
- 3) An enclosure surface loosely attached to a frame, for example, with spring clips.

^b The width is the smaller dimension of a rectangular sheet metal piece which is part of an enclosure. Adjacent surfaces of an enclosure may have supports in common and be made of a single sheet.

^c For panels which are not supported along one side, for example, side panels of boxes, the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a flange at least 1/2 inch (12.7 mm) wide.

Table 8.3
Minimum thickness of sheet metal for electrical enclosures aluminum, copper, or brass

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness,	
Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	inches	(mm)
3.0 7.6 3.5 8.9	Not limited 4.0 10.2	7.0 17.8 8.5 21.6	Not limited 9.5 24.1	0.023	0.58
4.0 10.2 5.0 12.7	Not limited 6.0 15.2	10.0 25.4 10.5 26.7	Not limited 13.5 34.3	0.029	0.74
6.0 15.2 6.5 16.5	Not limited 8.0 20.3	14.0 35.6 15.0 38.1	Not limited 18.0 45.7	0.036	0.91
8.0 20.3 9.5 24.1	Not limited 11.5 29.2	19.0 48.3 21.0 53.3	Not limited 25.0 63.5	0.045	1.14

Table 8.3 Continued

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness, inches (mm)	
Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Maximum width, ^b inches (cm)	Maximum length, inches (cm)		
12.0 30.5	Not limited	28.0 71.1	Not limited	0.058	1.47
14.0 35.6	16.0 40.6	30.0 76.2	37.0 94.0		
18.0 45.7	Not limited	42.0 106.7	Not limited	0.075	1.91
20.0 50.8	25.0 63.5	45.0 114.3	55.0 139.7		
25.0 63.5	Not limited	60.0 152.4	Not limited	0.095	2.41
29.0 73.7	36.0 91.4	64.0 162.6	78.0 198.1		
37.0 94.0	Not limited	87.0 221.0	Not limited	0.122	3.10
42.0 106.7	53.0 134.6	93.0 236.2	114.0 289.6		
52.0 132.1	Not limited	123.0 312.4	Not limited	0.153	3.89
60.0 152.4	74.0 188.0	130.0 330.2	160.0 406.4		

^a A supporting frame is a structure of angle or channel or a folded rigid section of sheet metal which is rigidly attached to and has essentially the same outside dimensions as the enclosure surface and which has sufficient torsional rigidity to resist the bending moments which may be applied via the enclosure surface when it is deflected. Construction that is considered to have equivalent reinforcing may be accomplished by designs that will produce a structure which is as rigid as one built with a frame of angles or channels. Construction considered to be without supporting frame includes:

- 1) A single sheet with single formed flanges (formed edges),
- 2) A single sheet which is corrugated or ribbed, and
- 3) An enclosure surface loosely attached to a frame, for example, with spring clips.

^b The width is the smaller dimension of a rectangular sheet metal piece which is part of an enclosure. Adjacent surfaces of an enclosure may have supports in common and be made of a single sheet.

^c For panels which are not supported along one side, for example, side panels of boxes, the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a flange at least 1/2 inch (12.7 mm) wide.

8.8 Polymeric materials

8.8.1 Among the factors taken into consideration when determining compliance of a nonmetallic enclosure are:

- 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 under any conditions of use.

All these factors are considered with regard to aging in accordance with the Polymeric Materials Test, Section 45, and Mechanical Strength Tests for Enclosures, Section 49.

9 Electric Shock

9.1 Any part that is exposed only during operator servicing shall not present the risk of electric shock. See Electric Shock Current Test, Section 37.

10 Corrosion Protection

10.1 Iron and steel parts, other than bearings, and the like where such protection is impracticable, shall be protected against corrosion by enameling, galvanizing, sherardizing, plating, or other equivalent means. Bearing surfaces shall be constructed of materials that resist binding due to corrosion.

10.2 The requirement specified in 10.1 applies to all enclosures of sheet steel or cast iron, and to all springs and other parts upon which intended mechanical operation may depend.

Exception No. 1: This requirement does not apply to parts, such as washers, screws, bolts, and the like, if corrosion of such unprotected parts would not be likely to result in a risk of fire, electric shock, or unintentional contact with moving parts that can cause injury to persons, or to impair the operation of the unit.

Exception No. 2: Parts made of stainless steel, polished or treated, if necessary, do not require additional protection against corrosion.

10.3 Metal used in cabinets and enclosures shall be galvanically compatible.

Exception: If galvanic action does not result in impaired operation of the product, risk of fire, electric shock, or unintentional contact with moving parts that can cause injury to persons, this requirement does not apply.

10.4 Hinges and other attachments shall be resistant to corrosion.

FIELD-WIRING CONNECTIONS

11 General

11.1 Wiring terminals or leads shall be provided for connection of conductors of at least the size required by the National Electrical Code, ANSI/NFPA 70.

12 Cord-Connected Products

12.1 A portable product that is intended to be connected to high-voltage or line voltage shall be provided with not less than 6 feet (1.8 m) of flexible cord and a two- or three-prong attachment-plug intended and rated for connection to the supply circuit.

Exception: The cord may be less than 6 feet in length if it is evident that use of the longer cord:

- a) May result in damage to the cord or product;*
- b) May result in a risk of fire, electric shock, or injury to persons; or*
- c) Is not required for the intended operation of the product.*

12.2 A flexible cord may be used with a stationary product.

12.3 The flexible cord shall be Type SJ, SJT, or equivalent; minimum 18 AWG (0.82 mm²); and rated for use at the voltage and ampacity rating of the product.

12.4 The power-supply cord shall be provided with strain relief means so that a stress on the cord will not be transmitted to terminals, splices, or internal wiring. See Strain Relief Test, Section 47.

12.5 If a knot in a flexible cord serves as strain relief, a surface against which the knot may bear or with which it may come in contact shall be free from projections, sharp edges, burrs, fins, and the like which may cause abrasion of the insulation on the conductors.

12.6 Clamps of any material (metal or otherwise) may be used on cords and supply leads without varnished-cloth insulating tubing or the equivalent under the clamp, unless the tubing or its equivalent is necessary to prevent the clamp from damaging the cord or supply leads.

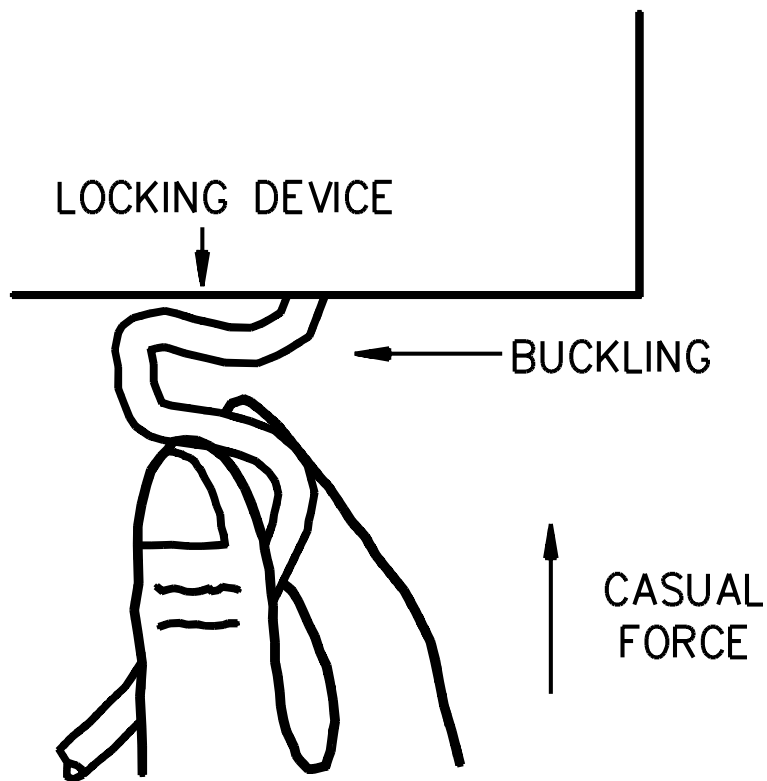
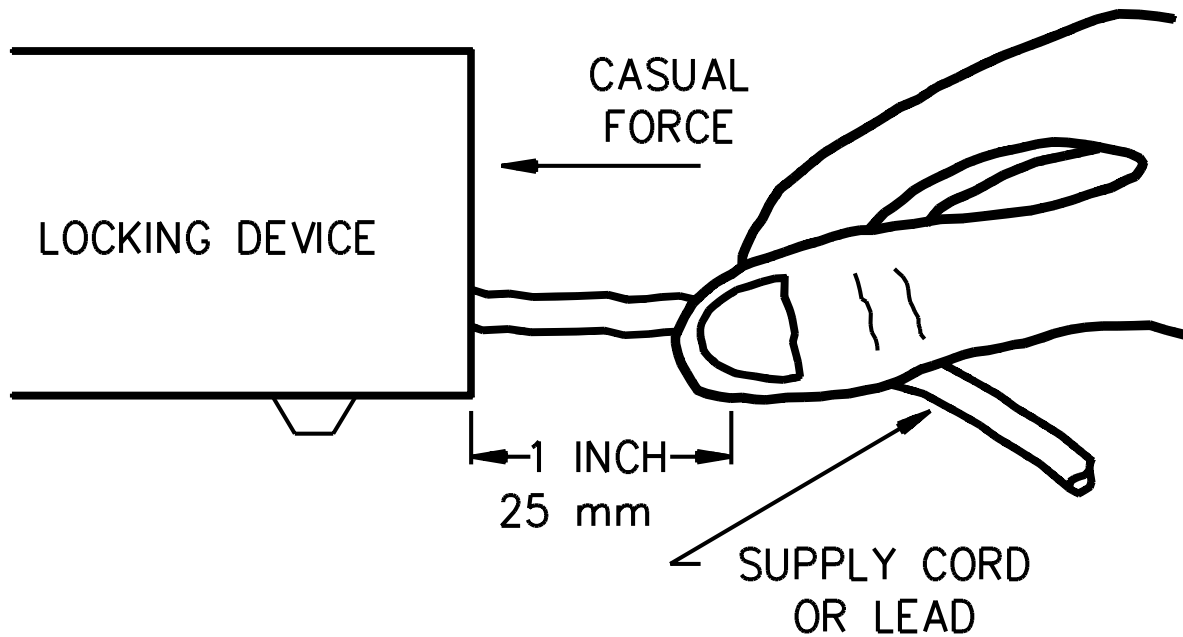
12.7 The supply cord or supply leads shall be prevented from being pushed into the product through the cord-entry hole if such displacement is likely to:

- a) Subject the cord or supply leads to mechanical damage or to exposure to a temperature higher than that for which the cord or supply leads are rated;
- b) Reduce spacings (such as to a metal strain-relief clamp) below the minimum intended values; or
- c) Damage internal connections or components.

12.8 To determine compliance with 12.7, a product shall be tested in accordance with 12.9 without occurrence of any of the conditions specified in 12.7.

12.9 The supply cord or supply leads are to be held 1 inch (25.4 mm) from the point where the cord emerges from the product and is then to be pushed back with casual force as shown in Figure 12.1. The force is to be applied until the cord is buckled but in no case shall the force exceed 6 pounds-force (26.7 N).

Figure 12.1
Supply cord or supply leads push-back/strain relief evaluation



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