



UL 291

STANDARD FOR SAFETY

Automated Teller Systems

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UL Standard for Safety for Automated Teller Systems, UL 291

Sixth Edition, Dated February 15, 2012

Summary of Topics

This new edition of UL 291 includes mounting specifications for concrete and one inch steel equivalency parameters, new paragraph 13.1.8 and revised paragraph 13.2.3.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated June 10, 2011.

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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that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.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 Date	Reference
May 13, 2013	Paragraphs 13.1.7, 13.1.8, 13.2.6, and Section 36



February 15, 2012

1



ANSI/UL 291-2012

UL 291

Standard for Automated Teller Systems

First Edition – October, 1976
Second Edition – November, 1977
Third Edition – July, 1987
Fourth Edition – August, 1995
Fifth Edition – May, 2001

Sixth Edition

February 15, 2012

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

The most recent designation of ANSI/UL 291 as an American National Standard (ANSI) occurred on February 15, 2012. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

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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INTRODUCTION

1 Scope

1.1 These requirements cover the construction and security of equipment intended to automatically dispense currency when operated as intended by an authorized customer, and to provide a limited degree of protection against unauthorized removal of currency.

1.2 If the product also receives deposits, the same degree of protection shall also be provided for the deposits.

1.3 Records shall be made in order that the authorized customer may be debited for the currency dispensed. A limited degree of protection against unauthorized manipulation or removal of the records that will prevent proper debit shall be provided.

1.4 A teller's cash dispenser is not required to make records.

1.5 These requirements cover products intended for permanent connection to 600-volts or lower-potential branch circuits, and products intended for cord connection to 300-volt or lower-potential branch circuits. The branch circuits and the means of supplying the units from them are intended to comply with the National Electrical Code, ANSI/NFPA 70.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, 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 used in the products covered by this standard.

2.1.2 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.

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

2.1.4 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.

2.2 Units of measurement

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

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

2.3 Undated references

2.3.1 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.

2.4 Terminology

2.4.1 The term "product" as used in this standard refers to any equipment covered by this standard.

3 Glossary

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

3.2 AUTHORIZED CUSTOMER – A person authorized to conduct transactions at an automated teller system.

3.3 AUTOMATED TELLER MACHINE (ATM) – An unattended machine that will dispense currency when operated as intended by an authorized customer and which will provide a limited degree of protection against unauthorized removal of currency. The product may also receive deposits.

3.4 BUSINESS HOUR SERVICE – A product that is available during business hours only, is under observation by responsible persons, and is emptied of all valuables at the close of business.

3.5 CIRCUITS, ELECTRICAL –

a) HIGH-VOLTAGE – 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 (POWER-LIMITED) – A circuit involving a potential of not more than 30 volts alternating current (AC) rms, 42.4 volts direct current (DC) or AC peak, and providing not more than 100 volt-amperes (VA) rated output. The 100 VA limit shall be provided by the design of the transformer, a fixed impedance, a non-interchangeable fuse, a nonadjustable manual reset circuit protective device, or a reliable regulating network;

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

3.6 CUSTOMER ACCESS PANEL – That portion of an automated teller system that is made available to an authorized customer for the performance of transactions.

3.7 ENCLOSURE – The word enclosure refers only to parts that enclose electrical components, including uninsulated live parts involving a shock or energy hazard. It may be an integral part of a component, a separate item, part of the ultimate enclosure, or the ultimate enclosure (outer cabinet).

3.8 ENERGY, RISK OF RELEASE OF – A risk of fire or electric shock due to release of energy is considered to exist at any exposed live part of a piece of equipment if, between the exposed live part and an adjacent exposed live or dead metal part of different polarity, there exists a potential of 2 volts or more and either:

- a) An available continuous power level of 240 VA (or more) or
- b) A reactive energy level of 20 joules (or more).

3.9 FISHING – Introducing into the product any form of lines, wires, or similar items to which one or more hooks or other devices may be attached, that may be manipulated so as to grasp the currency or a deposit and then withdraw it.

3.10 FORCING – The use of pry bars, screwdrivers, wrenches, or similar tools, to enlarge an opening, or to create an opening by breaking out or distorting a part, to gain access to the currency, deposits or records.

3.11 FREESTANDING INSTALLATION – The installation of an automated teller machine that is not through a building wall, a counter structure, or within a kiosk or similar structure that restricts the physical removal of the unit by requiring the damage or destruction of the structure. The freestanding automated teller machine may be recessed into a wall, but is open on one or more sides.

3.12 LIVE PARTS – Denotes metal or other conductive parts that, in normal use, have a potential difference with respect to ground or any other conductive part.

3.13 MAXIMUM NORMAL LOAD – In testing a product, maximum normal load is considered to be the load that approximates as closely as possible the most severe conditions of normal use. It is not a deliberate overload except as the conditions of actual use can be more severe than the maximum load conditions that are recommended by the manufacturer of the product.

3.14 OPERATOR PERSONNEL – Persons authorized to perform the functions defined in 3.15.

3.15 OPERATOR SERVICING – Any form of servicing that might be performed by personnel other than those who are trained to maintain the particular product. Changing ribbons is considered to be a serviceman's function rather than operator servicing if the act involves extensive disassembly of the machine. Some examples of operator servicing are as follows:

- a) The attachment of accessories by means of attachment-plug caps and receptacles or by means of other separable connectors;
- b) The changing of tapes or ribbons that do not involve complicated operations;
- c) The replacement of recording tapes, discs, program boards, punched cards, or paper forms;
- d) Resetting of circuit breakers, replacement of fuses, replacement of lamps that are accessible without the use of tools; and replacement of lamps likely to require frequent replacement, such as lamps of the projector type, whether or not the operation requires the use of tools;
- e) The making of routine operating adjustments necessary to adapt the product for its different intended functions;
- f) Routine cleaning, or removal of jams of data-handling media, currency, deposits and records; and

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- g) The loading and removal of currency, removal of deposits, or removal of items retained by the product.

3.16 **PRODUCT** – A product is a freestanding portion of a system to which an identification number is applied. It is supported by a frame or frames and is self-enclosed or designed to be attached to another device.

- a) **FIXED** – A fixed product is one that is fastened or otherwise secured to the building at a specific location;
- b) **STATIONARY** – A stationary product is one that is not easily moved from one place to another in its intended use;
- c) **PORTABLE** – A portable product is one that actually is moved or can easily be moved from one place to another in its intended use.

3.17 **REMOTE AND AUTOMATIC CONTROL** – A unit of a product is considered to be remotely controlled if it is out of sight of and removed from the user. A unit of a product is considered to be automatically controlled if:

- a) Energization of such as a motor, solenoid, or magnet will occur without manual intervention or
- b) During any single predetermined cycle of operation, automatic changing of the mechanical load can reduce the speed of a motor sufficiently to reestablish starting-winding connections to the branch circuit.

3.18 **SECURITY CONTAINER** – An enclosure used to provide physical security for the currency used for dispensing, deposits received, and components that can be operated by unauthorized persons to obtain currency without debiting to proper accounts. The security container is rated as follows:

- a) Business Hour Service,
- b) 24-Hour Service – Level 1, and
- c) 24-Hour Service – Level 2.

3.19 **SHOCK, RISK OF ELECTRIC** – A risk of electric shock is considered to exist at any exposed live part of a product or system if the available open-circuit potential is higher than 42.4 volts peak and the available current through a 1500-ohm resistance is more than 5 milliamperes.

3.20 **TELLER'S CASH DISPENSER** – A product that will dispense currency when properly operated by an authorized teller or other employee of the financial institution using the product. The currency may be dispensed directly to a customer or to the teller.

3.21 **TRAPPING (CURRENCY DISPENSER)** – The use of a device or materials which may be introduced into the product in such a manner as to avoid detection, by an authorized user, in order to prevent the dispensed currency from reaching the customer. The dispensed currency can then be withdrawn after the customer has left.

3.22 **TRAPPING (DEPOSITS)** – The use of a device or materials which may be introduced into the product in such a manner as to avoid detection, by an authorized user, in order to prevent the deposit from reaching its security container. The deposit can then be withdrawn after the customer has left.

3.23 TWENTY-FOUR HOUR SERVICE – A product that is available for use at any time during both business and non-business hours.

4 Installation and Operating Instructions

4.1 A copy or draft of the installation and operating instructions intended to accompany each product or component, or equivalent information, is to be used as a guide in the examination and test of the product or component.

4.2 The instructions shall include such directions and information as deemed by the manufacturer to be necessary for the proper and safe installation, maintenance, and operation of the product.

CONSTRUCTION

5 Enclosures

5.1 General

5.1.1 Additional requirements contained in Security Container, Section 13, apply to parts of the product enclosure where resistance to physical attack is involved.

5.1.2 The frame and enclosure of a product shall be sufficiently strong and rigid to resist total or partial collapse with attendant reduction of spacings, loosening or displacement of parts and development of other conditions which could impair operation of the product and increase the risk of fire, electric shock, or personal injury.

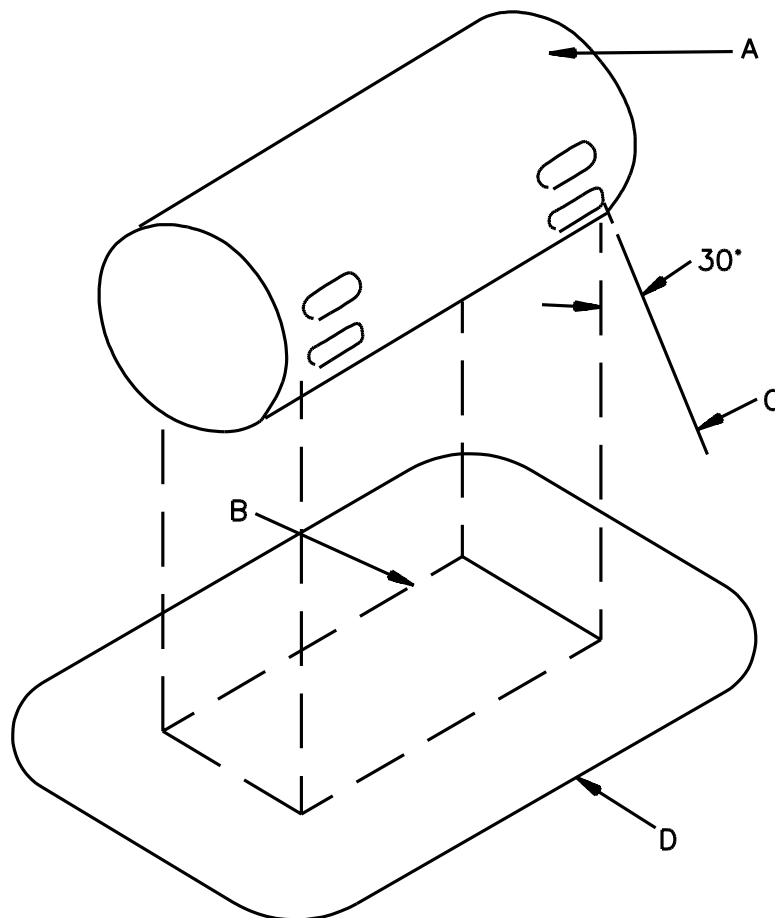
5.1.3 The mounting means of an enclosure shall be accessible without disassembly of any operating part of the product. Removal of a completely assembled panel to mount the enclosure is not considered to be disassembly of an operating part.

5.1.4 An enclosure containing other than power-limited circuits shall be constructed to minimize the possibility of emission of flame, molten metal, flaming or glowing particles, or flaming drops. See the Ignition Test, Section 28.

5.1.5 The requirement in 5.1.4 necessitates either a noncombustible bottom in accordance with 5.2.4, or a protective barrier as described in Figure 5.1 under all areas containing flammable materials.

Exception: Materials or assemblies classified as V-1, when tested in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, need not comply with this requirement.

Figure 5.1
Protective pan



EB110

A – The entire component under which a barrier (flat or dished with or without a lip or other raised edge) of noncombustible material is to be provided. The figure above is of a metal enclosed component with ventilating openings to show that the protective 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 (150 mm).

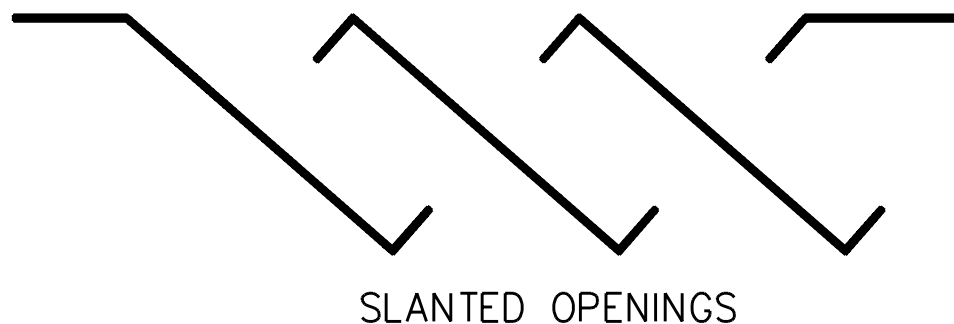
D – Minimum outline of the barrier, except that the extension B–D need not exceed 6 inches (150 mm) (flat or dished with or without lip or other raised edge). The bottom of the barrier may be flat or formed in any manner provided that every point of area (D) is at or below the lowest point on the outer edge of the barrier.

5.1.6 A construction using individual barriers under components, groups of components or assemblies, as specified in Figure 5.1, is to be considered as complying with the requirement in 5.1.4.

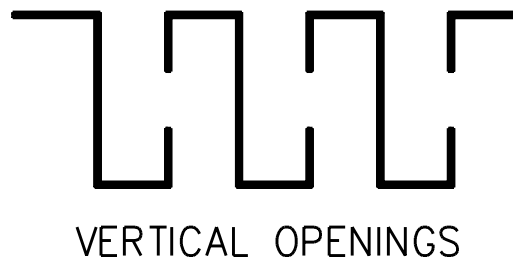
5.2 Openings

5.2.1 Openings in the top of the enclosure of desk mounted products and in the top of the enclosure of floor mounted products more than 48 inches (1.2 m) in height shall be so located and of such size as to prevent entry of foreign objects. Openings directly over uninsulated live parts shall not exceed 0.187 inch (4.75 mm) in any dimension unless the configuration of the openings prevents direct entry to such parts. See Figure 5.2 for examples of acceptable top cover designs.

Figure 5.2
Cross sections of top cover designs



EC500



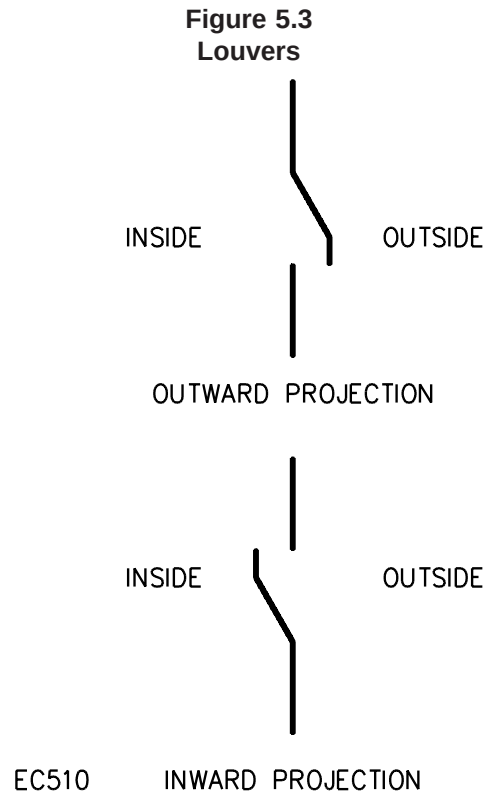
5.2.2 There shall not be openings directly over uninsulated live parts involving risk of electric shock and release of energy in the top of the enclosure of a floor mounted unit 48 inches (1.2 m) or less in height.

5.2.3 Openings in the sides of the enclosure shall be so located and of such size as to prevent entry of a foreign object and to prevent personnel contact with internal parts. See also 5.6.1 – 5.6.12. Louvers may be used if shaped to deflect external falling objects outward. See Figure 5.3 for examples of louver designs.

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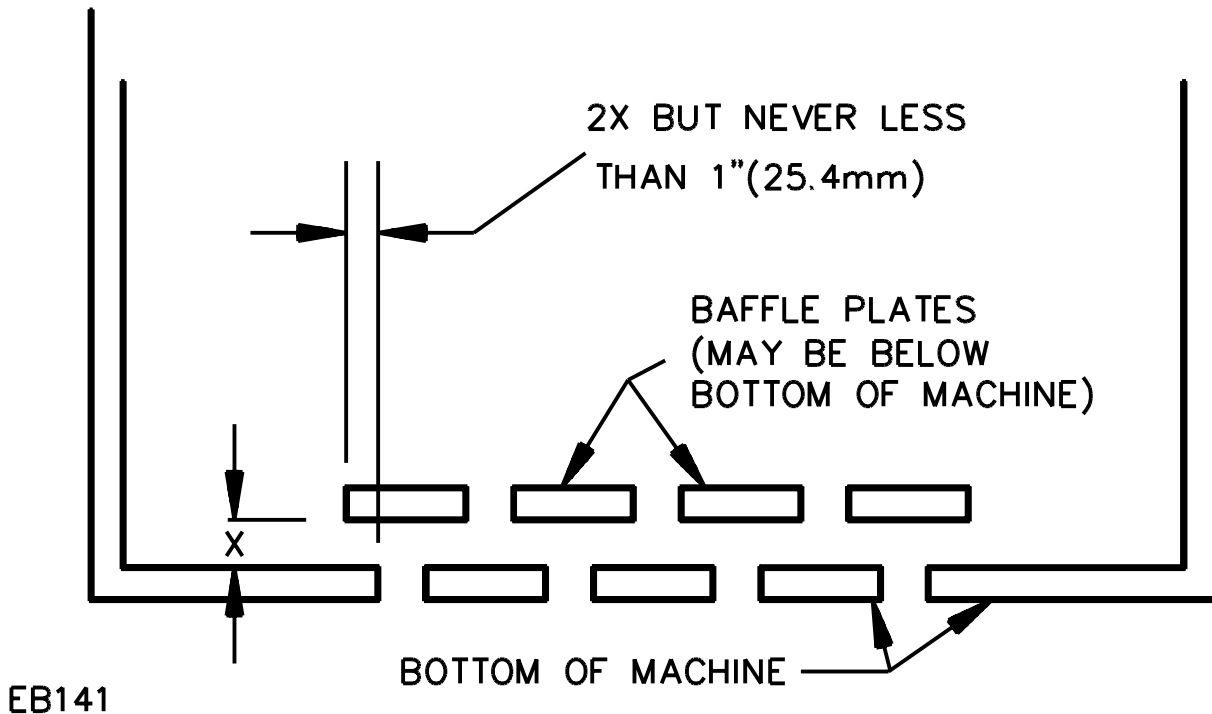
5.2.4 Ventilating openings may be provided in the bottom panels or protective pans under areas containing materials not classified at least V-1 (see 5.1.5), if constructed in a manner that prevents materials from falling directly from the interior of the product onto the supporting surface or into an air-handling area or any other location under the product. Figure 5.4 illustrates a type of baffle that meets this requirement. A second type of construction which may be used is a 0.040-inch (1.02-mm) sheet-steel bottom panel in which 5/64-inch (2.0-mm) maximum round holes are spaced no closer than 1/8 inch (3.2 mm) center-to-center. Other constructions may be used provided they comply with the requirements of the Ignition Test, Section 28.

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Figure 5.4
Baffle



5.2.5 The bottom of the enclosure under areas containing only materials classified as at least V-1 (see 5.1.5) may have openings not larger than 1/16 inch² (40.3 mm²).

5.2.6 Openings may be used without limitation of the size or number of openings in areas:

- a) Containing PVC, TFE, CTFE, FEP, or neoprene insulated wire cable;
- b) Containing plugs and receptacles; and
- c) Under impedance protected or thermally protected motors.

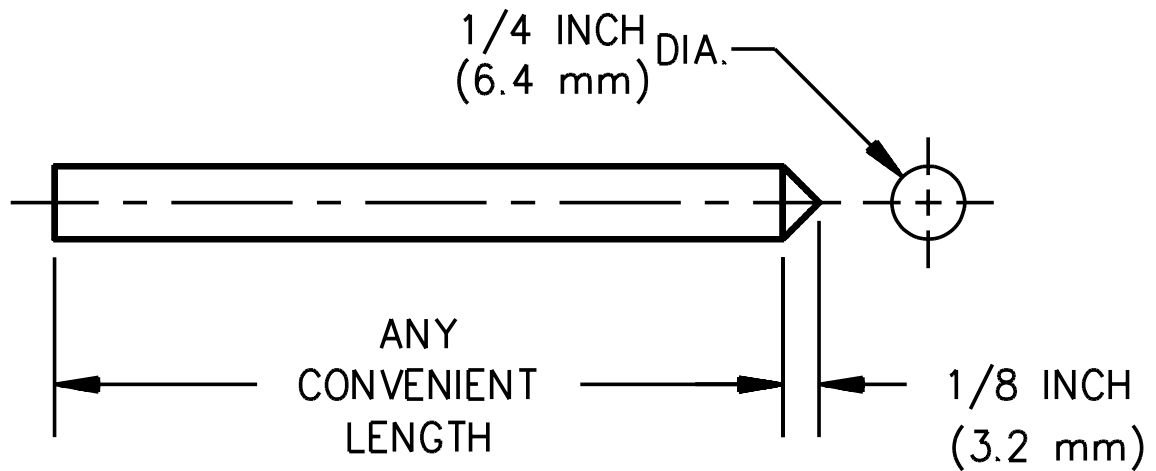
5.2.7 Openings in the enclosure shall not give access to any relays, terminals, controls, or related components that might be subject to tampering by hand or with tools smaller in diameter than the probe shown in Figure 5.5 that will affect the security of the product.

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Figure 5.5
Probe for hand-held units and hand-held portions of units



PA190

5.3 Cast metal

5.3.1 The thickness of cast metal for an enclosure shall be as indicated in Table 5.1.

Table 5.1
Cast-metal enclosures

Use, or dimensions of area involved ^a	Minimum thickness			
	Die-cast metal,		Cast metal of other than the die-cast type,	
	inch	(mm)	inch	(mm)
Area of 24 square inches (155 cm ²) or less having no dimension greater than 6 inches (152 mm)	1/16	1.6	1/8	3.2
Area greater than 24 square inches (155 cm ²) or having any dimension greater than 6 inches (152 mm)	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) in thickness may be obtained by the provision of reinforcing ribs subdividing a larger area.

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5.4 Sheet metal

5.4.1 The thickness of sheet metal used for the enclosure of a product shall not be less than that indicated in Table 5.2 or 5.3, whichever applies.

Table 5.2
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	
Maximum width, ^b	Maximum length, ^c	Maximum Width, ^b	Maximum length,	Uncoated,	Metal coated,
inches (cm)	inches (cm)	inches (cm)	inches (cm)	inch (mm) [MSG]	inch (mm) [GSG]
4.0 (10.2)	Not limited	6.25 (15.9)	Not limited	0.020 (0.51)	0.023 (0.58)
4.75 (12.1)	5.75 (14.6)	6.75 (17.1)	8.25 (21.0)	[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)	8.75 (22.2)	10.0 (25.4)	12.5 (31.8)	[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)	11.5 (29.2)	13.0 (33.0)	16.0 (40.6)	[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)	18.0 (45.7)	21.0 (53.3)	25.0 (63.5)	[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)	25.0 (63.5)	29.0 (73.7)	36.0 (91.4)	[16]	[16]
22.0 (55.9)	Not limited	33.0 (83.8)	Not limited	0.060 (1.52)	0.063 (1.60)
25.0 (63.5)	31.0 (78.7)	35.0 (88.9)	43.0 (109.2)	[15]	[15]
25.0 (63.5)	Not limited	39.0 (99.1)	Not limited	0.067 (1.70)	0.070 (1.78)
29.0 (73.7)	36.0 (91.4)	41.0 (104.1)	51.0 (129.5)	[14]	[14]
33.0 (83.8)	Not limited	51.0 (129.5)	Not limited	0.080 (2.03)	0.084 (2.13)
38.0 (96.5)	47.0 (119.4)	54.0 (137.2)	66.0 (167.6)	[13]	[13]
42.0 (106.7)	Not limited	64.0 (162.6)	Not limited	0.093 (2.36)	0.097 (2.46)
47.0 (119.4)	59.0 (149.9)	68.0 (172.7)	84.0 (213.4)	[12]	[12]
52.0 (132.1)	Not limited	80.0 (203.2)	Not limited	0.108 (2.74)	0.111 (2.82)
60.0 (152.4)	74.0 (188.0)	84.0 (213.4)	103.0 (261.6)	[11]	[11]
63.0 (160.0)	Not limited	97.0 (246.4)	Not limited	0.123 (3.12)	0.126 (3.20)
73.0 (185.4)	90.0 (228.6)	103.0 (261.6)	127.0 (322.6)	[10]	[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 5.3
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	Maximum length, ^c (cm)	Maximum width, ^b inches	Maximum length, (cm)	inch	(mm)
3.0	7.6	Not limited	7.0 17.8	0.023	0.58
3.5	8.9	4.0 10.2	8.5 21.6	9.5 24.1	
4.0	10.2	Not limited	10.0 25.4	0.029	0.74
5.0	12.7	6.0 15.2	10.5 26.7	13.5 34.3	
6.0	15.2	Not limited	14.0 35.6	0.036	0.91
6.5	16.5	8.0 20.3	15.0 38.1	18.0 45.7	
8.0	20.3	Not limited	19.0 48.3	0.045	1.14
9.5	24.1	11.5 29.2	21.0 53.3	25.0 63.5	
12.0	30.5	Not limited	28.0 71.1	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	0.075	1.91
20.0	50.8	25.0 63.4	45.0 114.3	55.0 139.7	
25.0	63.5	Not limited	60.0 152.4	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	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	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.

5.4.2 A sheet metal member to which a wiring system is to be connected in the field shall have a thickness of not less than 0.032 inch (0.81 mm) if of uncoated steel, of not less than 0.034 inch (0.86 mm) if of galvanized steel, and of not less than 0.045 inch (1.14 mm) if of nonferrous metal.

5.5 Nonmetallic

5.5.1 If nonmetallic material is used for an enclosure, it shall be judged in accordance with 5.5.2 and shall have a wall thickness of not less than 1/16 inch (1.6 mm).

5.5.2 Among the factors taken into consideration when evaluating the acceptability 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.

All these factors are considered with respect to aging.

5.6 Accessibility of live or hazardous parts

5.6.1 The uninsulated live parts and hazardous parts of a product shall be so located or enclosed that protection is provided against the risk of fire, electric shock or accident from unintentional contact with them. Insulated brush caps do not require an additional enclosure.

5.6.2 Devices using glass envelopes, such as electron tubes, glass-enclosed relays, and similar parts, shall be enclosed or protected against mechanical damage.

5.6.3 Fan blades, blower wheels, pulleys, belts, and similar parts shall be so enclosed or guarded as to reduce the likelihood of injury to persons.

5.6.4 An interlocking mechanism which operates to disconnect power to a motor when a cover or panel is removed or opened for access to moving parts is considered to provide compliance with 5.6.3.

5.6.5 The degree of protection required in 5.6.3 depends upon the general design and the intended use of the product. The location where the product ordinarily will be used is considered when judging the acceptable degree of exposure of mechanical parts. Other factors taken into consideration in evaluating the acceptability of exposed moving parts are the:

- a) Degree of exposure;
- b) Sharpness of the moving parts;
- c) Risk of accidental contact with the moving parts;
- d) Speed of movement of those parts; and
- e) Risk of fingers, arms, or clothing being drawn into the moving parts such as at points where belts travel onto a pulley or where moving parts close in a pinching or shearing action.

5.6.6 Where the starting or restarting of a motor driving a moving part such as described in 5.6.3 is provided by an automatic cycling device such as an overcurrent device or thermal protector, the requirement of 5.6.3 will require the use of a guard if the part is exposed when making operating adjustments or changing replaceable parts or if the part is accessible without requiring the use of tools.

5.6.7 With reference to 5.6.6, the scroll of a centrifugal blower may be used as a guard for the blower wheel.

5.6.8 If any part of the external enclosure of a product must be removed for operator servicing, that part shall be removed before the product is examined in connection with the requirement in 5.6.1.

5.6.9 The following parts may be used for securing doors, covers, and panels that are not opened or removed for operator servicing if supplementary guards or similar parts are provided as described in 14.1 – 14.3:

- a) Thumbscrews;
- b) Finger latches;
- c) Screwdriver-, wrench-, and coin-operated latches;
- d) Magnetic and spring latches that cannot be accidentally bumped open; and
- e) Similar parts that result in reliable holding of a door or cover or support of a panel.

5.6.10 Panels as described in 5.6.9 are not to be opened or removed for the application of the probes mentioned in 5.6.4 and 5.6.5 in connection with the investigation of the accessibility of live or hazardous parts. See also 5.6.7.

5.6.11 In the enclosure of a unit an opening that does not permit entrance of 3/4-inch (19.1-mm) diameter rod may be used if a probe as illustrated in:

- a) Figure 5.6 cannot be made to touch any uninsulated live part or hazardous moving part while inserted through the opening and
- b) Figure 5.7 cannot be made to touch film-coated wire while inserted through the opening.

An opening that permits entrance of a 3/4-inch diameter rod may be used under the conditions described in 5.6.6. See Figure 5.8.

Figure 5.6
Probe for uninsulated live parts

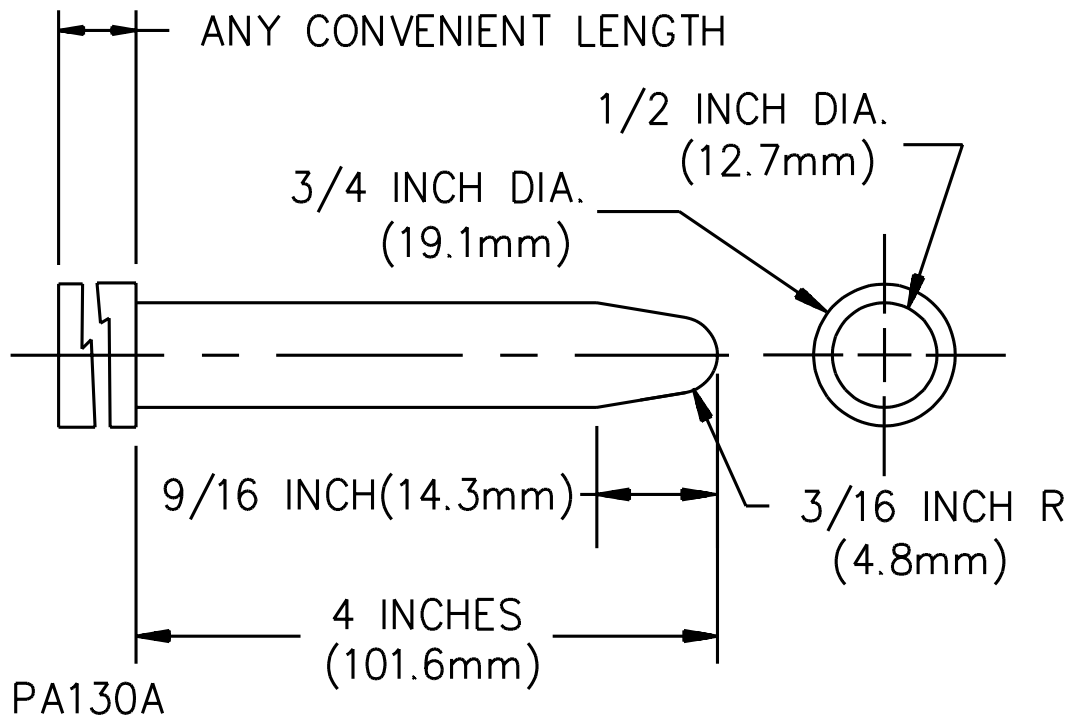
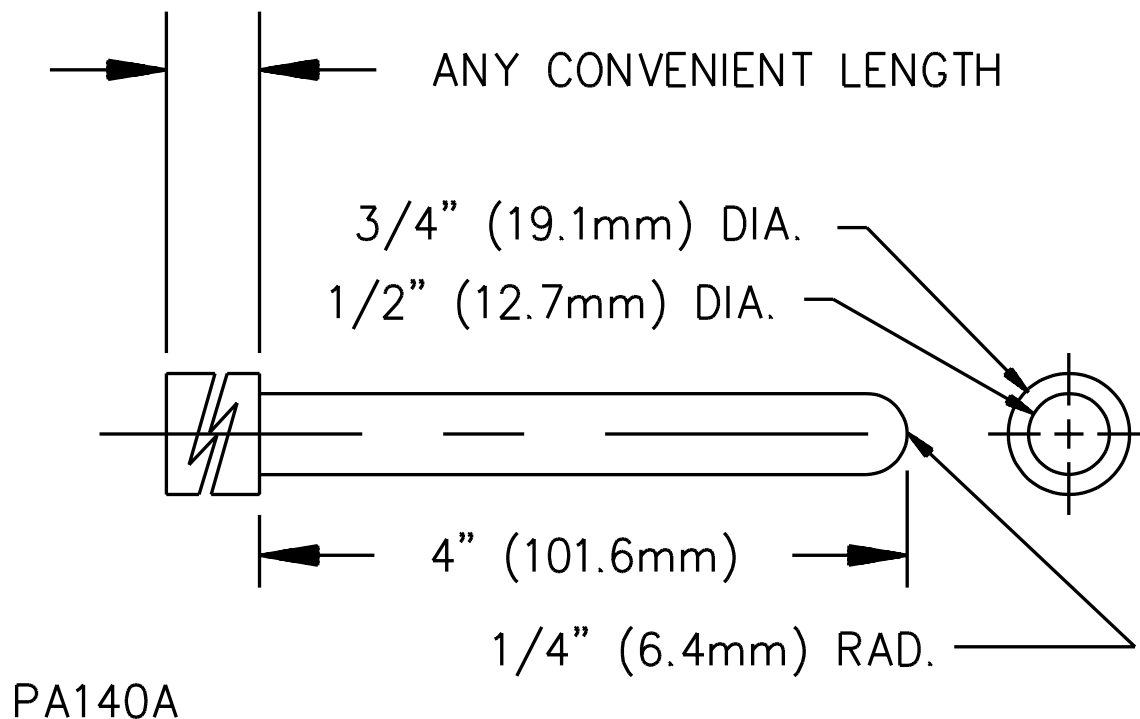


Figure 5.7
Probe for film-coated wire



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