

UL 962

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Household and Commercial Furnishing



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UL Standard for Safety for Household and Commercial Furnishings, UL 962

Second Edition, Dated October 31, 2003

SUMMARY OF TOPICS

This is the second edition of the Standard for Household and Commercial Furnishings, UL 962.

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

Future Effective Date	References
October 31, 2005	Entire Standard

The new requirements are substantially in accordance with UL's Bulletin(s) on this subject dated May 29, 2001, September 12, 2002, and July 9, 2003. The bulletin(s) is now obsolete and may be discarded.

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New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing, Classification and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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Page	Date
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A1-A2	October 31, 2003

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1

UL 962

Standard for Household and Commercial Furnishings

First Edition – August, 1996

Second Edition

October 31, 2003

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

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

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FOREWORD

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

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

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

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

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

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

PART 1 – ALL FURNISHINGS

INTRODUCTION

1 Scope

1.1 These requirements cover:

- a) Motor-operated furniture, such as motor-operated beds and chairs;
- b) Electrified and non-electrified furniture, such as:
 - 1) Lighted curio cabinets;
 - 2) Microwave carts; and
 - 3) Bed headboards
- c) Non-seasonal electrical decorations such as lava lamps and wave machines;
- d) Home and individual office furnishings, such as study carrels, consoles and desks;
- e) Commercial product and informational displays such as:
 - 1) Shelving units;
 - 2) Kiosks (such as the mini-stores in the middle of a mall);
 - 3) Cash station stands;
 - 4) Motorized carpet displays; and
 - 5) Product platforms
- f) Electrified building components, such as windows and built in bathroom cabinets; and
- g) Other similar miscellaneous furnishings intended for use in residential or commercial environments.

1.1 effective October 31, 2005

1.2 These requirements cover products rated 600 V ac or less.

1.2 effective October 31, 2005

1.3 These requirements cover furnishings intended to primarily function as a workstation, which also provides a surface for the support of audio or video equipment.

1.3 effective October 31, 2005

1.4 These requirements do not cover products intended for patient care including where oxygen is being used. Patient care products are covered by the Standard for Medical and Dental Equipment, UL 544, and the Standard for Medical Electrical Equipment, Part 1: General Requirements for Safety, UL 60601-1. Electrified equipment used for massaging and exercising is covered under the Standard for Motor-Operated Massage and Exercise Machines, UL 1647. Office furnishings are covered by the Standard for Office Furnishings, UL 1286. Multiple outlet strips intended for general use (i.e. Relocatable Power Taps) are not covered by this standard.

1.4 effective October 31, 2005

1.5 Lighted display cases and cabinets, such as jewelry display cases, used in commercial applications are covered by the Standard for Wired Cabinets, UL 65. Advertising displays are covered by the Standard for Electric Signs, UL 48.

1.5 effective October 31, 2005

1.6 Custom-built commercial products such as ticket machines and electronic point of sale products that dispense a product in exchange for money are covered in the Outline of Investigation for Custom Built Kiosks, Subject 2361.

1.6 effective October 31, 2005

1.7 Furnishings intended solely to provide structural support for use with audio or video equipment, which do not employ a work surface such as a keyboard shelf or desk top and are used in an institution such as a school are covered by the requirements in the Standard for Tall Institutional Carts for Use With Audio-, Video-, and Television-Type Equipment, UL 1667.

1.7 effective October 31, 2005

1.8 These requirements do not cover portable luminaires. The Standard for Portable Electric Luminaires, UL 153, covers portable luminaires.

1.8 effective October 31, 2005

1.9 A product that employs an electromagnetic interference filter shall also comply with the Standard for Electromagnetic Interference Filters, UL 1283. A product that employs a transient voltage surge suppressor shall also comply with the Standard for Transient Voltage Surge Suppressors, UL 1449. Telephone equipment and communication circuit protectors included in a furnishing shall comply with the requirements in the Standard for Telephone Equipment, UL 1459, and the requirements in the Standard for Secondary Protectors for Communications Circuits, UL 497A, respectively. A furnishing that incorporates an antenna discharge unit or provides antenna connections to a television, a high-voltage video product, or antenna shall comply with the applicable requirements in the Standard for Antenna Discharge Units, UL 452, and the Standard for Audio-Video Products and Accessories, UL 1492. A product that employs ground-fault protection shall comply with the requirements in the Standard for Ground-Fault Circuit Interrupters, UL 943.

1.9 effective October 31, 2005

1.10 Bunk bed structural requirements are covered by the Standard Consumer Safety Specification for Bunk Beds, ASTM F1427. Any electrical components of bunk beds are required to meet the applicable requirements of UL 962.

1.10 effective October 31, 2005

1.11 Chests, door chests, and dresser structural requirements are covered by the Standard Safety Specification for Chests, Door Chests, and Dressers, ASTM F2057. Any electrical components of these products are required to meet the applicable requirements of UL 962.

1.11 effective October 31, 2005

1.12 Toy chest structural requirements are covered by the Standard Consumer Safety Specification for Toy Chests, ASTM F834. Any electrical components of these products are required to meet the applicable requirements of UL 962.

1.12 effective October 31, 2005

2 Glossary

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

2.1 effective October 31, 2005

2.2 ACCESSIBLE PART – A part located so that it is able to be contacted by a person, either directly or by means of the probe illustrated in Figure 12.1.

2.2 effective October 31, 2005

2.3 APPURTENANCE – Accessory objects on a furnishing such as a door, drawer, or a sliding work surface.

2.3 effective October 31, 2005

2.4 CABINET LIGHT – A portable luminaire, see 2.19, intended for final installation into a cabinet (open or enclosed) such as a china hutch, bookcase, bar, console, bed headboard, or similar furnishing.

2.4 effective October 31, 2005

2.5 CARTS AND STANDS FOR AUDIO AND VIDEO APPLIANCES – These furnishings are solely intended to support audio and video, including televisions, appliances and are not provided with any other work surfaces.

2.5 effective October 31, 2005

2.6 COMMERCIAL DISPLAY – A furnishing other than a display case or cabinet that is used in a retail establishment to display merchandise.

2.6 effective October 31, 2005

2.7 COMMERCIAL ESTABLISHMENT – A place in which business is transacted, such as an office building, factory, warehouse, or similar location, and which is not a residence.

2.7 effective October 31, 2005

2.8 DECORATIVE FURNISHING – A non-seasonal furnishing intended to be used year round that exists for an aesthetic or ornamental purpose.

2.8 effective October 31, 2005

2.9 DISPLAY CASE – A totally enclosed lighted furnishing used to display merchandise in a retail establishment.

2.9 effective October 31, 2005

2.10 FIXED FURNISHING – Intended to be permanently connected electrically and mechanically.

2.10 effective October 31, 2005

2.11 FURNITURE POWER DISTRIBUTION UNIT – A furniture power distribution unit consists of an attachment plug cap and a length of flexible cord terminated in an enclosure in which are mounted one or more receptacles. These units are able to include power, phone, data, or video connectors. Furniture power distribution unit is intended to be installed by furniture manufacturers at their factory. They also are able to be provided with fuses or other supplementary overcurrent protection, switches, suppression components, EMI filters, uninterruptible power supplies, and/or indicator lights in any combination, or connections for cable communications, telephone and/or antenna.

2.11 effective October 31, 2005

2.12 HOME AND INDIVIDUAL OFFICE FURNISHING – A furnishing used for conducting business either in the home or an office that is intended to stand alone or be mechanically and electrically connected together. An example of a furnishing that is able to be electrically and mechanically connected together are conference room tables with power and communication receptacles that are frequently moved.

2.12 effective October 31, 2005

2.13 LEAKAGE CURRENT – All currents, including capacitively coupled currents, that flow through a person upon contact between accessible conductive surfaces of a product and ground or other accessible surfaces of the product.

2.13 effective October 31, 2005

2.14 LOW-VOLTAGE CIRCUIT – A circuit involving a peak open-circuit potential of not more than 42.4 volts supplied by a primary battery, by a Class 2 transformer, or by a combination of a transformer and a fixed impedance that, as a unit, complies with all performance requirements for a Class 2 transformer. A circuit derived from a line-voltage circuit by connecting a resistance in series with the supply circuit as a means of limiting the voltage and current is not identified as a low-voltage circuit.

2.14 effective October 31, 2005

2.15 MOTOR-OPERATED FURNISHING – An appliance provided with a motor used for sitting, laying, or used for decoration, such as a wave machine.

2.15 effective October 31, 2005

2.16 OFFICE FURNISHING – A furnishing used in an office and intended to always be mechanically connected together to form a system. It also is able to be electrically connected together.

2.16 effective October 31, 2005

2.17 PANEL – A flat rectangular vertical piece that forms part of or all of a wall or office partition.

2.17 effective October 31, 2005

2.18 PORTABLE FURNISHING – A furnishing that is capable of being carried or conveyed or easily carried or conveyed by hand. It is provided with a power-supply cord for connection to the power supply.

2.18 effective October 31, 2005

2.19 PORTABLE LUMINAIRE – A portable luminaire is a cord connected luminaire that provides illumination for a room or specific area and is able to be moved to a new location with or without the use of readily available tools. Tiffany type lamps and similar lighted decorative lamps are portable lamps rather than a decorative furnishing.

2.19 effective October 31, 2005

2.20 RACEWAY – A completely enclosed channel intended specifically for the holding and routing of wiring, excluding communication and low-voltage wiring. A raceway provides mechanical protection to the internal wiring.

2.20 effective October 31, 2005

2.21 RELOCATABLE POWER TAP (RPT) – A relocatable power tap consists of an attachment plug cap and a length of flexible cord terminated in an enclosure in which are mounted one or more receptacles. A relocatable power tap is able to be provided with suitable supplementary overcurrent protection, switches, and indicator lights singularly or in any combination. A relocatable power tap containing three or more receptacles also are able to employ a transient voltage surge suppressor (TVSS) and/or an electromagnetic interference (EMI) filter. A RPT is intended for general use.

2.21 effective October 31, 2005

2.22 RESIDENCE – A place where people live either for a short time (such as a hotel room) or indefinitely (such as a house or apartment). A hotel common area such as the lobby or a restaurant are commercial areas. The terms "household" and "residence" are equivalent. Furnishings intended for residential use are suitable for use in a business office where the number of users are limited.

2.22 effective October 31, 2005

2.23 STATIONARY FURNISHING – A cord-connected product that is intended to be fastened in place or located in a dedicated space.

2.23 effective October 31, 2005

2.24 WIRED CABINET – See 2.9.

2.24 effective October 31, 2005

3 Components

3.1 Except as indicated in 3.2, a component of products 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.

3.1 effective October 31, 2005

3.2 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.

3.2 effective October 31, 2005

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

3.3 effective October 31, 2005

3.4 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.

3.4 effective October 31, 2005

3.5 Portable luminaires used in products covered by this standard shall comply with the requirements for cabinet lights in the Standard for Portable Electric Luminaires, UL 153. Non-portable luminaires shall comply with the Standard for Luminaires, UL 1598.

3.5 effective October 31, 2005

4 Units of Measurement

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

4.1 effective October 31, 2005

4.2 Values of voltage and current are rms values, unless otherwise stated.

4.2 effective October 31, 2005

5 Undated References

5.1 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.

5.1 effective October 31, 2005

6 Assembly

6.1 A furnishing shall be completely wired with all splices and electrical connections before the furnishing leaves the factory. The furnishing itself is not prohibited from being shipped unassembled.

Exception: Electrical connections made by connectors instead of splices are not required to be wired before the furnishing leaves the factory.

6.1 effective October 31, 2005

6.2 A furnishing shall be shipped from the factory in a carton or as an unpackaged complete assembly. Unassembled parts, when required elsewhere in the standard to accompany the furnishing, shall be included. Glassware is not required to be actually mounted in a frame or holder; it is able to be separately wrapped to protect it from breakage during shipment.

6.2 effective October 31, 2005

6.3 As specified in 6.2, a carton is a box of cardboard, pasteboard, shrink film, or similar material (but not newspaper, wrapping paper, tissue paper, or similar paper products). It is not required to be rectangular in form, since the "pinch pack" of cardboard wrap with the ends pinched together and stapled is determined to be a carton.

6.3 effective October 31, 2005

6.4 A part that must be removed to assemble furnishing in the intended manner to the supply circuit is not required to be fastened, but the construction shall be such, and the hardware shall be provided, to allow field assembly.

6.4 effective October 31, 2005

6.5 Any furnishing that is not completely assembled shall be provided with assembly instructions.

6.5 effective October 31, 2005

7 General

7.1 Table 7.1 provides a summary of the differences between the requirements for household furnishings and commercial furnishings. In some circumstances, the requirements for commercial use furnishings also apply to household furnishings, depending on the design of the product.

7.1 effective October 31, 2005

Table 7.1
Comparison of household and commercial furnishing requirements

Table 7.1 effective October 31, 2005

Requirement	Household	Commercial
Construction:		
Glass Panels	None	Must meet minimum thickness and be nonshattering glass or subjected to Impact Test (57.1)
Cords	SPT-2 or better (13.2.7)	Hard Usage such as SJ (58.1)
Grounding	Grounding potentially not necessary and able to use Double Insulation (15.1.1)	All products must be grounded (57.3.1)
Performance:		
Flame	Upholstery Flame Testing (Section 9)	Potentially needs Flame and Smoke Indices (57.4)
Glass panels	None	Glass Panel Impact (58.1)
Stability	10 degree Tip (28.2.2)	Force and Impact Stability (58.2)
Markings:		
Smoke Index	None	Must be marked if over 450 (59.1)
Proprietary Wiring System	None	System identification marked on product (59.2)

CONSTRUCTION

8 General

8.1 Each electrical device and insulated conductor shall have a voltage rating at least equal to the voltage that is applied to it during intended use.

8.1 effective October 31, 2005

8.2 Each electrical device shall have an ampere rating and each insulated conductor shall have an ampacity rating for the maximum current to which it is subjected during intended use.

8.2 effective October 31, 2005

8.3 Means shall be provided to reduce the risk of contact between the surface of a cabinet and a cabinet light other than at the intended mounting means. The means provided shall have strength and rigidity to reduce the risk of distortion which facilitates installation in a manner other than intended.

8.3 effective October 31, 2005

9 Upholstery

9.1 Furnishings provided with upholstery such as a sofa or chair shall comply with the appropriate burn requirements in the ASTM standards such as, but not limited to, ASTM D4771, Standard Specification for Knitted Upholstery Fabrics for Indoor Furniture, ASTM D3690, Standard Specification for Vinyl-Coated and Urethane-Coated Upholstery, or ASTM D3597, Standard Specification for Woven Upholstery Fabrics-Plain, Tufted, or Flocked.

9.1 effective October 31, 2005

10 Frame and Enclosure

10.1 General

10.1.1 A furnishing shall be formed and assembled so that it has the strength, stability, and rigidity required to resist the abuses during normal use and maintenance to which it is subjected without increasing the risk of fire, electric shock, or injury to persons. See Section 31, Strength of Electrical Enclosure Tests.

10.1.1 effective October 31, 2005

10.1.2 A part such as a splice, tap, wire, transformer, capacitor, ballast, current-carrying part, or device with an exposed live part shall be contained in an enclosure constructed of metal, glass, ceramic, porcelain, or polymeric material. Such parts shall be contained in the enclosure during normal maintenance and use.

Exception No. 1: A current-carrying part of a wiring device (such as the screw shell and center contact of a lampholder, the lampholder contacts, starter holder contacts, or similar components of a fluorescent luminaire) that are normally fitted with a functional component (a lamp, a starter, or similar component) during use of the furnishing is not required to be additionally enclosed.

Exception No. 2: A component, such as a ballast, that has an integral outer housing that has been evaluated as an enclosure is not required to be additionally enclosed.

Exception No. 3: A power-supply cord is not required to be contained within the furnishing other than at the connection point to internal components.

10.1.2 effective October 31, 2005

10.1.3 A frame, guard, handle, or similar part; or an exposed portion of an enclosure, such as an edge, projection, or corner, shall be smooth and rounded. Such components shall not be so sharp as to constitute a risk of injury to persons during intended use and maintenance of a product, when investigated in accordance with the Standard for Test for Sharpness of Edges on Equipment, UL 1439.

10.1.3 effective October 31, 2005

10.1.4 Among the factors that shall be evaluated (refer to 10.4) when investigating a nonmetallic enclosure are resistance to:

- a) Mechanical damage;
- b) Impact;
- c) Moisture-absorption;
- d) Combustion; and

- e) Distortion at temperatures to which the material is subjected under conditions of intended use or foreseeable misuse.

10.1.4 effective October 31, 2005

10.2 Enclosures and guards

10.2.1 When the operation and maintenance of a furnishing by the user or bystanders involves the risk of injury to persons, protection shall be provided to reduce the risk.

10.2.1 effective October 31, 2005

10.2.2 When investigating a furnishing with respect to the requirement in 10.2.1, conditions of foreseeable misuse shall be evaluated.

10.2.2 effective October 31, 2005

10.2.3 A functional attachment that is made available or specified by the manufacturer for use with a furnishing shall be included in the investigation of the furnishing. Unless the manufacturer specifies the use of two or more attachments at the same time, only one attachment at a time is to be investigated with the furnishing.

10.2.3 effective October 31, 2005

10.2.4 Whether a guard, a release, an interlock, or similar device is required and whether such a device is adequate shall be determined from an investigation of the complete furnishing, its operating characteristics, and the potential risk of injury to persons. The investigation shall include evaluation of the results of breakdown or malfunction of any one component, and not more than one component at a time, unless one event contributes to another. When the investigation shows that breakdown or malfunction of a particular component results in a risk of injury to persons, that component shall be investigated for reliability.

10.2.4 effective October 31, 2005

10.2.5 The rotor of a motor, a pulley, belt, gear, fan, or other moving part that constitutes a risk of personal injury shall be enclosed or provided with other means to reduce the risk of unintentional contact. Such a part shall not be able to be contacted by the probe illustrated in Figure 12.1.

Exception: A part or portion of a part that must be exposed to enable the furnishing to perform its intended function is not required to be enclosed. Guarding shall be provided when required. See 10.2.9.

10.2.5 effective October 31, 2005

10.2.6 During the investigation of a furnishing to determine compliance with 10.2.5, a part of the enclosure that is removable without the use of a tool (such as an accessory, the cover over an opening for an operating adjustment, or similar components) is to be opened or removed.

Exception: A part that is removable without the use of a tool is not required to be opened or removed when the furnishing is marked in accordance with 46.10.

10.2.6 effective October 31, 2005

10.2.7 Among the factors to be evaluated with respect to both intended operation of the furnishing and any foreseeable misuse in investigating an exposed moving part are:

- a) The degree of exposure required to perform the intended function;
- b) The sharpness of the moving part;

- c) The risk of unintentional contact;
- d) The speed of the moving part; and
- e) The risk that a part of the body is endangered or that clothing is able to be entangled by the moving part, resulting in a risk of injury to persons.

10.2.7 effective October 31, 2005

10.2.8 A furnishing shall have no pinch points or shall have pinch points guarded to reduce the potential of contact.

Exception: Powered furnishings may have pinch points when the furnishing is provided with a means to automatically turn off power if anything enters the pinch point area.

10.2.8 effective October 31, 2005

10.2.9 Guards shall:

- a) Require the use of tools for their removal;
- b) Be removable for servicing;
- c) Have sufficient strength and rigidity;
- d) Be complete;
- e) Not present a risk of injury to persons such as a pinch point, during additional handling because of required service, such as cleaning, unjamming, or similar service; and
- f) Be self-restoring.

10.2.9 effective October 31, 2005

10.2.10 An enclosure or guard over a rotating part shall retain a part that, because of breakage or other reasons, becomes loose or separates from a rotating part, and shall retain a foreign object that is able to be struck and propelled by the rotating part.

10.2.10 effective October 31, 2005

10.2.11 When complete guarding of a moving part that constitutes a risk of injury to persons defeats the utility of a furnishing a control, such as a momentary contact switch, shall be provided. An appropriate marking shall be provided in the instructions warning the user of the potential risk, see Instructions Pertaining to a Risk of Fire, Electric Shock, or Injury to Persons, Section 51.

10.2.11 effective October 31, 2005

10.2.12 When breakage or deterioration of material adjacent to a moving part results in an increased risk of injury, the material shall have such properties as to withstand the loads it is subjected to during use of the furnishing.

10.2.12 effective October 31, 2005

10.3 Metallic electrical enclosures

10.3.1 A metal electrical enclosure employed as the enclosure for live parts and as the sole means of protecting electrical components against mechanical abuse shall be of sheet metal complying with the dimensions specified in Table 10.1.

Exception No. 1: Sheet metal other than that specified in Table 10.1 is not prohibited from being used when it provides protection for wiring equivalent to that afforded by the metal specified in Table 10.1. Equivalency shall be determined by the equivalence of thickness tests described in Section 31, Strength of Electrical Enclosure Tests.

Exception No. 2: A sheet-metal electrical enclosure that is recessed or otherwise protected from mechanical abuse such that a 2 inch (51 mm) diameter sphere is not able to contact the electrical enclosure is able to have a minimum wall thickness as specified in Table 10.1.

10.3.1 effective October 31, 2005

Table 10.1
Thicknesses of sheet-metal electrical enclosure

Table 10.1 effective October 31, 2005

Material	Minimum thickness, inch (mm)			
	Knockouts and other points of connection for a wiring system	Sheet-metal electrical enclosure	Recessed sheet-metal electrical enclosure	
Uncoated sheet steel	0.036 (0.91)	0.025 (0.64)	0.023	(0.58)
Sheet aluminum	0.050 (1.27)	0.035 (0.89)	0.029	(0.74)

10.3.2 An electrical enclosure or fitting base shall have a uniform wall thickness throughout its entire length. Both inside and outside surfaces of each length of an electrical enclosure or fitting base shall be free of scale and rust.

Exception: Sections of reduced thickness are not prohibited from being used to facilitate knockouts.

10.3.2 effective October 31, 2005

10.3.3 A metal cap or cover for an electrical enclosure shall be at least as thick as specified in Table 10.1, and shall comply with the applicable requirements in this section.

10.3.3 effective October 31, 2005

10.3.4 A cast metal electrical enclosure shall be at least as thick as specified in Table 10.2.

10.3.4 effective October 31, 2005

Table 10.2
Thickness of cast metal parts

Table 10.2 effective October 31, 2005

Material	Minimum thickness	
	inch	(mm)
Malleable iron	3/32	(2.4)
Iron other than malleable iron	1/8	(3.2)
Die-cast nonferrous:		
Part is ribbed or otherwise reinforced	1/16	(1.6)
Part is not ribbed or otherwise reinforced	3/32	(2.4)
Cast nonferrous other than die-cast	3/32	(2.4)

10.4 Electrical enclosures of polymeric material

10.4.1 A polymeric electrical enclosure employed as the enclosure for live parts and as the sole means of protecting electrical components against mechanical abuse shall have the strength to resist the mechanical stresses to which it is subjected during intended use of the product.

10.4.1 effective October 31, 2005

10.4.2 A polymeric material that is intended to support an outlet, fitting, or other part shall have the strength and rigidity required for the application.

10.4.2 effective October 31, 2005

10.4.3 To determine compliance with 10.4.1 and 10.4.2, a polymeric enclosure part is to be subjected to the equivalence of thickness and mold stress tests specified in Section 31, Strength of Electrical Enclosure Tests, as applicable.

10.4.3 effective October 31, 2005

10.4.4 Unless superseded by other requirements in this section, a polymeric enclosure part shall comply with the enclosure requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

10.4.4 effective October 31, 2005

10.5 Barriers

10.5.1 The enclosure of a motor-operated furnishing shall reduce the risk of molten metal, burning insulation, flaming particles, or similar materials falling on combustible materials, including the surface upon which the furnishing is supported.

10.5.1 effective October 31, 2005

10.5.2 The requirement in 10.5.1 necessitates that a switch, a relay, a solenoid, or similar device be individually and completely enclosed, except for terminals, unless it is shown that malfunction of the component does not result in a risk of fire, or there are no openings in the bottom of the furnishing enclosure. It also necessitates the use of a barrier:

a) Under a motor unless:

- 1) The structural parts of the motor or of the furnishing provide the equivalent of such a barrier;

2) The protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the furnishing when the motor is energized under each of the following fault conditions:

- i) Open main winding;
- ii) Open starting winding;
- iii) Starting switch short-circuited; and
- iv) Capacitor of permanent-split capacitor motor short-circuited – the short circuit is to be applied before the motor is energized, and the rotor is to be locked;

3) The motor is provided with a thermal motor protector or the motor is impedance protected. Both means of protection must comply with the Standard for Overheating Protection for Motors, UL 2111.

b) Under wiring, unless it is neoprene, cross-linked polyethylene, or thermoplastic-insulated.

10.5.2 effective October 31, 2005

10.5.3 The barrier specified in 10.5.2 shall be of noncombustible material or shall comply with the Internal Barriers section in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and shall have a comparative tracking index (CTI) of:

- a) 4 for furnishings for household use; and
- b) 3 for furnishings for commercial applications.

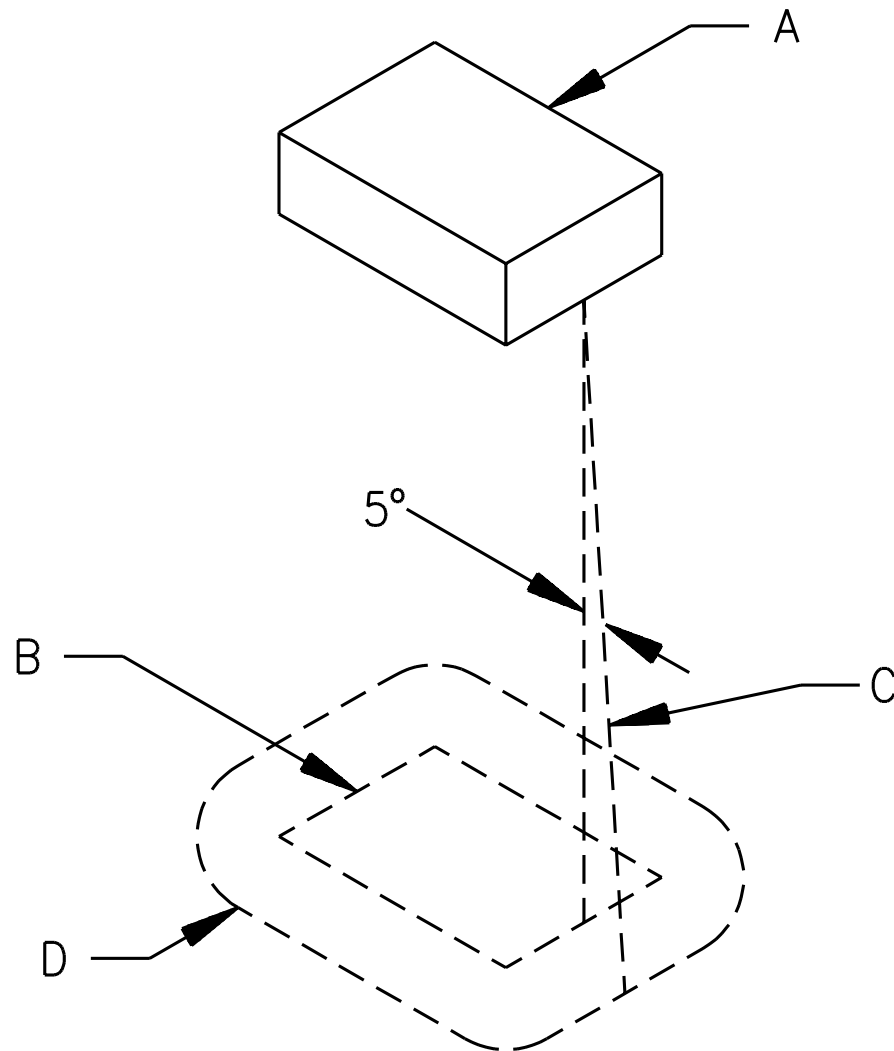
10.5.3 effective October 31, 2005

10.5.4 The barrier specified in 10.5.2 shall be horizontal, shall be located as illustrated in Figure 10.1, and shall not have an area less than that described in Figure 10.1. Openings for drainage, ventilation, or similar condition, are not prohibited from being employed in the barrier, when such openings do not allow molten metal, burning insulation, or similar materials to fall on combustible material.

10.5.4 effective October 31, 2005

Figure 10.1
Location and extent of barrier

Figure 10.1 effective October 31, 2005



SA0604-1

A – Region to be shielded by barrier. This consists of the entire component when it is not otherwise shielded and consists of the unshielded portion of a component that is partially shielded by the component enclosure or equivalent.

B – Projection of outline of component on horizontal plane.

C – Inclined line that traces out minimum area of barrier. The line is always tangent to the component, 5 degrees from the vertical, and oriented so that the area traced out on a horizontal plane is maximum.

D – Location (horizontal) and minimum area for barrier. The area that is included inside the line of intersection traced out by the inclined line C and the horizontal plane of the barrier.

10.6 Doors or covers

10.6.1 A door or a cover of an enclosure that provides access to any overload protective device requiring resetting or renewal shall be hinged or otherwise attached in an equivalent manner.

10.6.1 effective October 31, 2005

10.6.2 Means shall be provided for holding the door or cover over a fuseholder in a closed position, and the door or cover shall be tight-fitting.

10.6.2 effective October 31, 2005

10.7 Mounting means

10.7.1 An opening provided for mounting a cabinet light, or other furnishing intended for mounting, shall be located or guarded so that a nail, hook, or similar part does not displace a part that creates a risk of fire or electric shock, and does not contact one of the following:

- a) An uninsulated live part;
- b) Magnet wire;
- c) Internal wiring; or
- d) Any other part that creates a risk of fire or electric shock.

10.7.1 effective October 31, 2005

10.7.2 A furnishing intended to be mounted shall employ a mechanical means of mounting that does not rely on friction.

10.7.2 effective October 31, 2005

10.7.3 An adhesive used to secure a furnishing shall be investigated to determine that it reliably secures the product. General – Adhesives, Function Analysis, and Program of Investigation, in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations UL 746C, shall be used when performing the investigation. The maximum force as defined in UL 746C shall be the weight of the product.

10.7.3 effective October 31, 2005

11 Protection Against Corrosion

11.1 Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means, when corrosion of such parts results in a risk of fire, electric shock, or injury to persons.

Exception: This requirement does not apply to bearings, laminations, or minor parts of iron or steel, such as washers, screws, or similar parts.

11.1 effective October 31, 2005

11.2 When deterioration of a liquid container provided as a part of an furnishing results in a risk of fire or electric shock, the container shall be of a material that is resistant to corrosion by the liquid with which it is intended to be used.

11.2 effective October 31, 2005

12 Accessibility of Uninsulated Live Parts and Film-Coated Wire

12.1 To reduce the risk of unintentional contact that results in a risk of electric shock from an uninsulated live part or film-coated wire, an opening in an enclosure shall comply with either:

- a) For an opening that has a minor dimension (see 12.5) less than 1 inch (25.4 mm), such a part or wire shall not be contacted by the probe illustrated in Figure 12.1.
- b) For an opening that has a minor dimension of 1 inch (25.4 mm) or more, such a part or wire shall be spaced from the opening as specified in Table 12.1.

Exception: A motor is not required to comply with these requirements when it complies with the requirements in 12.2.

12.1 effective October 31, 2005

Figure 12.1
Articulate probe with web stop

Figure 12.1 effective October 31, 2005

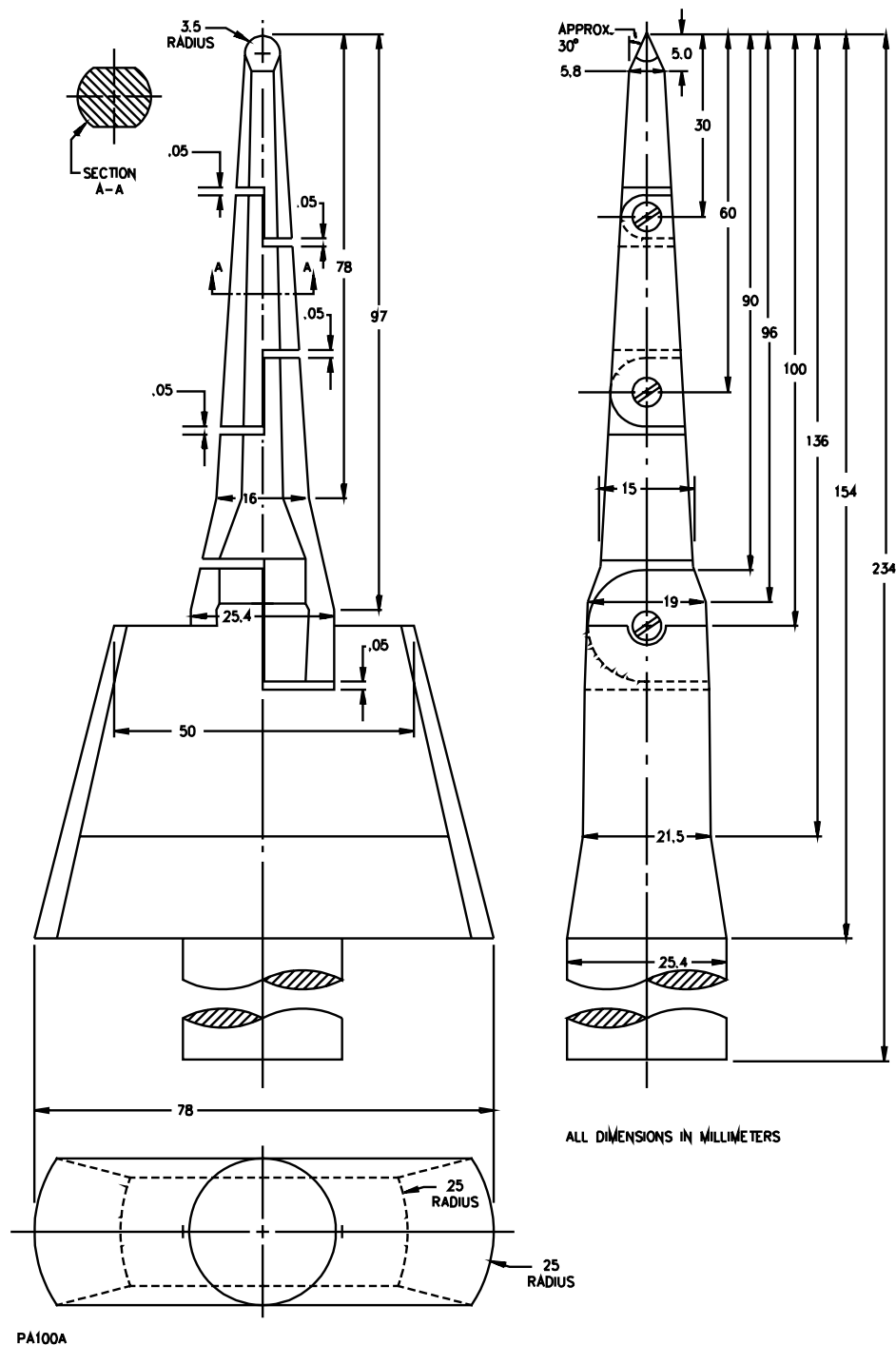


Table 12.1
Minimum required distance from an opening to a part involving a risk of electric shock

Table 12.1 effective October 31, 2005

Minimum dimension ^a of opening		Minimum distance from opening to part	
inches	(mm) ^b	inches	(mm) ^b
3/4 ^c	(19.1)	4-1/2	(114)
1 ^c	(25.1)	6-1/2	(165)
1-1/4	(31.8)	7-1/2	(191)
1-1/2	(38.1)	12-1/2	(318)
1-7/8	(47.6)	15-1/2	(394)
2-1/8	(54.0)	17-1/2	(445)
d		30	(762)
^a See 12.5. ^b Between 3/4 and 2-1/8 inches (19.1 and 54.0 mm), interpolation is to be used to determine a value between values specified in the table. ^c Any dimension less than 1 inch (25.4 mm) applies to a motor only. ^d More than 2-1/8 inches, and not more than 6 inches (152 mm).			

12.2 With respect to a part or wire as specified in 12.1, in an integral enclosure of a motor as specified in the Exception to 12.1:

a) An opening that has a minor dimension (see 12.5) less than 3/4 inch (19.1 mm) is able to be used when:

- 1) Film-coated wire is not able to be contacted by the probe illustrated in Figure 12.3;
- 2) In a directly accessible motor (see 12.6), an uninsulated live part is not able to be contacted by the probe illustrated in Figure 12.1; and
- 3) In an indirectly accessible motor (see 12.6), an uninsulated live part is not able to be contacted by the probe illustrated in Figure 12.2.

b) An opening that has a minor dimension of 3/4 inch or more is able to be used when a part or wire is spaced from the opening as specified in Table 12.1.

12.2 effective October 31, 2005

Figure 12.2
Straight probe

Figure 12.2 effective October 31, 2005

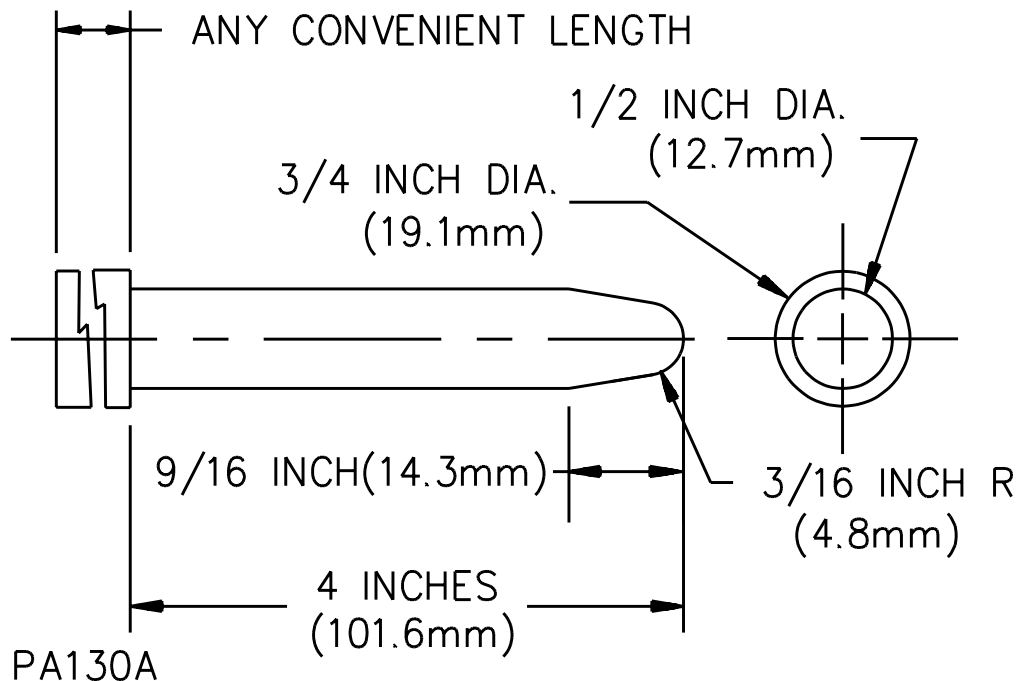
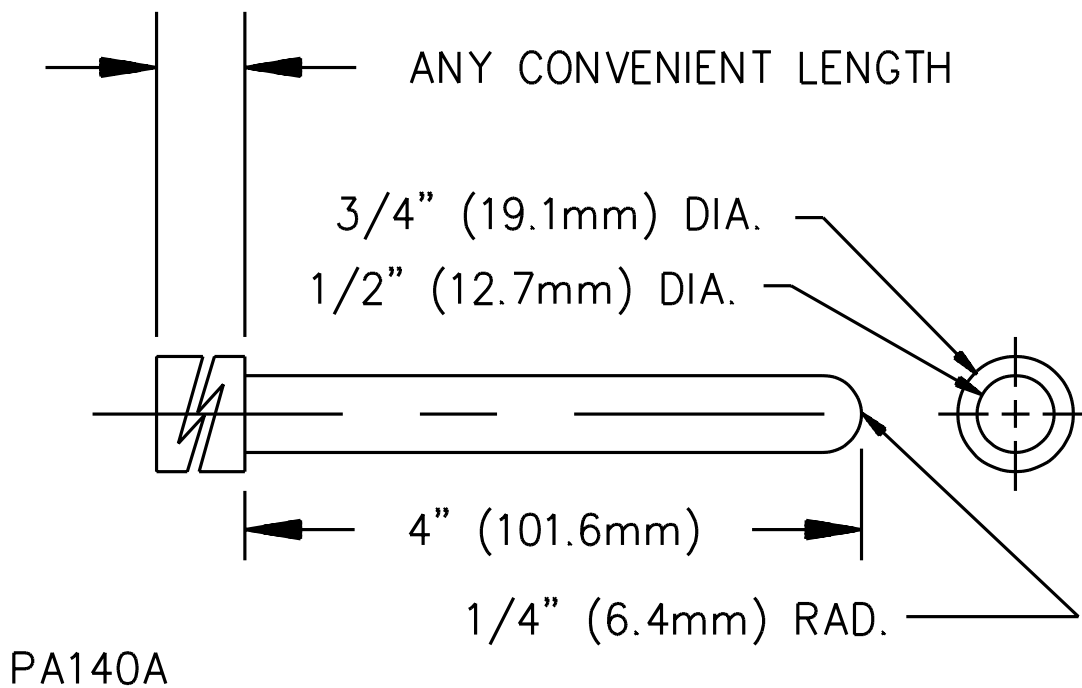


Figure 12.3
Straight probe

Figure 12.3 effective October 31, 2005



12.3 The probes specified in 12.1 and 12.2 and illustrated in Figures 12.1 – 12.3 shall be applied to any depth that the opening allows, and shall be rotated or angled before, during, and after insertion through the opening to any position required to examine the enclosure. The probe illustrated in Figure 12.1 shall be applied in any configuration allowed by the construction; and, when required, the configuration shall be changed after insertion through the opening.

12.3 effective October 31, 2005

12.4 The probes specified in 12.2 and 12.3 shall be used as measuring instruments to investigate the accessibility provided by an opening, and not as instruments to investigate the strength of a material: they shall be applied with the minimum force required to determine accessibility.

12.4 effective October 31, 2005

12.5 With reference to the requirements in 12.1 and 12.2, the minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that is able to be inserted through the opening.

12.5 effective October 31, 2005

12.6 With reference to the requirements in 12.2, an indirectly accessible motor is a motor that is accessible only by opening or removing a part of the outer enclosure (such as a guard or panel) that is able to be opened or removed without using a tool, or that is located at such a height or is otherwise guarded or enclosed so that it is not contacted during normal use of the furnishing. A directly accessible motor is one that is able to be contacted without opening or removing any part or that is located so as to be accessible to contact during normal use of the furnishing.

12.6 effective October 31, 2005

12.7 During the examination of a furnishing to determine compliance with 12.1 or 12.2, a part of the enclosure that is able to be opened or removed by the user without a tool (such as an accessory, the cover over an opening for an operating adjustment, or similar components) is to be opened or removed.

12.7 effective October 31, 2005

12.8 With reference to the requirements in 12.1 and 12.2, an insulated brush cap is not required to be additionally enclosed.

12.8 effective October 31, 2005

13 Power-Supply Connections

13.1 Permanently connected furnishing

13.1.1 A furnishing is able to be provided with means for permanent connection to the power supply.

13.1.1 effective October 31, 2005

13.1.2 A permanently connected furnishing shall be provided with field-wiring terminals or leads for the connection of conductors having an ampacity rated as intended for the furnishing, and in accordance with the National Electrical Code, ANSI/NFPA 70. A furnishing is able to be provided with a splice compartment or a junction box to make connections.

13.1.2 effective October 31, 2005

13.1.3 A lead that is intended to be connected in the field to a power-supply circuit conductor shall not be smaller than 18 AWG (0.82 mm^2), and shall be sized based on the rated current of the furnishing.

13.1.3 effective October 31, 2005

13.1.4 A terminal or splice compartment shall be complete and shall enclose all field-wiring terminals and splices to be made in the field.

13.1.4 effective October 31, 2005

13.1.5 Each terminal or splice compartment in which power-supply connections are to be made in the field shall be located so that the connections are able to be readily inspected after installation of the furnishing.

13.1.5 effective October 31, 2005

13.1.6 The compartment specified in 13.1.5 shall be located so that, when making conduit connections, internal wiring and electrical components are not exposed to mechanical abuse or strain.

13.1.6 effective October 31, 2005

13.1.7 A terminal compartment intended for connection of a supply electrical enclosure shall be attached so as to be prevented from turning with respect to the supporting surface.

13.1.7 effective October 31, 2005

13.1.8 A wiring terminal shall be prevented from turning or shifting in position.

13.1.8 effective October 31, 2005

13.1.9 A wire-binding screw at a wiring terminal shall not be smaller than No. 10 (4.8 mm diameter). If a pretapped hole is not provided, a thread-forming screw shall be used.

Exception: A No. 8 (4.2 mm diameter) screw is able to be used at a terminal intended only for connection of a 14 AWG (2.1 mm^2) conductor.

13.1.9 effective October 31, 2005

13.1.10 A terminal plate tapped for a wire-binding screw shall be of metal not less than 0.050 inch (1.27 mm) thick.

Exception: A plate not less than 0.030 inch (0.76 mm) thick is able to be used when the tapped threads comply with Section 32, Tightening Torque Test.

13.1.10 effective October 31, 2005

13.1.11 A wire-binding screw shall be provided with an upturned lug, cupped washer, or equivalent means that retains a supply conductor of the size intended.

13.1.11 effective October 31, 2005

13.1.12 A terminal (for example, a plate and screw) intended for the connection of the grounded supply conductor shall be formed of or plated with metal that is substantially white in color and shall be readily distinguishable from other terminals or shall be clearly identified in some other manner, such as on an attached wiring diagram.

13.1.12 effective October 31, 2005

13.1.13 A lead intended for the connection of the grounded power-supply conductor shall be finished to show a white or gray color, and shall be readily distinguishable from other leads.

13.1.13 effective October 31, 2005

13.1.14 The free length of a lead located inside an outlet box or field-wiring compartment and intended for field connection to a branch circuit shall not be less than 6 inches (152 mm).

13.1.14 effective October 31, 2005

13.1.15 When a terminal block is provided, it shall be usable for field wiring.

13.1.15 effective October 31, 2005

13.1.16 An opening for conduit shall have dimensions as indicated in Table 13.1.

13.1.16 effective October 31, 2005

Table 13.1
Dimensions associated with openings for conduit

Table 13.1 effective October 31, 2005

Nominal trade size of conduit	Unthreaded opening diameter ^a		Throat minimum		Diameter maximum		Minimum diameter of flat surface	
inches	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)
1/2	0.875	(22.2)	0.56	(14.2)	0.62	(15.7)	1.15	(29.2)
3/4	1.109	(28.2)	0.74	(18.8)	0.82	(20.8)	1.45	(36.8)
1	1.375	(34.9)	0.94	(23.9)	1.05	(26.7)	1.80	(45.7)
1-1/4	1.734	(44.0)	1.24	(31.5)	1.38	(35.1)	2.31	(58.7)

^a A plus tolerance of 0.031 inch (0.79 mm) and a minimum tolerance of 0.015 inch (0.38 mm) applies to the knockout diameter. Knockout diameters are measured other than at points where a tab remains after removal of knockout.

13.1.17 The minimum unobstructed diameter of the flat surface surrounding the back of an opening for unthreaded conduit shall be as indicated in Table 13.1.

13.1.17 effective October 31, 2005

13.1.18 When threads for the connection of threaded conduit are tapped all the way through a hole, there shall be no fewer than 3-1/2 or more than 5 threads. The construction of the hole shall be such that a conduit bushing is able to be properly attached and the minimum unobstructed diameter surrounding the back of the hole shall be as indicated in Table 13.1.

13.1.18 effective October 31, 2005

13.1.19 When threads for the connection of threaded conduit are not tapped all the way through a hole, there shall be no fewer than five full threads. The unthreaded parts of the hole and the back edge shall be smooth and well rounded for protection of the conductors. The unthreaded throat diameter of the hole shall have an internal diameter as noted in Table 13.1.

13.1.19 effective October 31, 2005

13.2 Cord-connected furnishing

13.2.1 A furnishing intended to be connected to the power-supply circuit by means of a flexible cord shall be provided with a flexible cord and an attachment plug for connection to the supply circuit. Furnishings supplied with more than one power supply cord shall comply with 13.3.

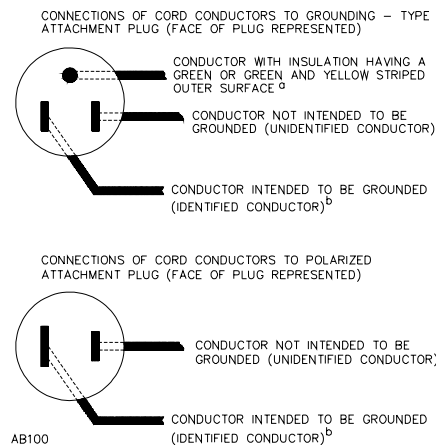
13.2.1 effective October 31, 2005

13.2.2 The attachment plug of a furnishing intended to be connected to a nominal 120 volt circuit, and, when employing devices required to be connected to a specific supply conductor, such as an Edison-screw lampholder, a single-pole switch with a marked "off" position, and a general-use receptacle, shall be a polarized type. The connections to the attachment plug shall be in accordance with Figure 13.1. The polarity identification of the supply cord shall be in accordance with Table 13.2. See 52.3.

13.2.2 effective October 31, 2005

Figure 13.1
Connections to attachment plugs

Figure 13.1 effective October 31, 2005



^a In the above illustration, the blade to which the green conductor is connected is able to have a U-shape instead of a circular cross section.

^b Signifies a conductor identified in accordance with Table 13.2. The grounded (identified) conductor is the neutral supply conductor.

Table 13.2
Polarity identification of flexible cords

Table 13.2 effective October 31, 2005

Method of identification	Usable combinations	
	Wire intended to be grounded ^{a,b}	All other wires ^a
Color of braid on individual conductors	Solid white or gray – without tracer	Solid color other than white or gray – without tracer
	Color other than white or gray, with tracer in braid	Solid color other than white or gray – without tracer

Table 13.2 Continued on Next Page

Table 13.2 Continued

Method of identification	Usable combinations	
	Wire intended to be grounded ^{a,b}	All other wires ^a
Color of insulation on individual conductors	Solid white or gray ^c	Solid color other than white or gray
	Light blue ^d	Solid color other than light blue, white, or gray
Other means	Tin or other white metal on all strands of the conductor ^e A stripe, ridge or groove on the exterior surface of the cord ^f	No tin or other white metal on the strands of the conductor
^a A wire finished to show a green color with or without one or more yellow stripes or tracers is to be used only as an equipment-grounding conductor. See 15.2.1 and Figure 13.1. ^b The grounded conductor is the neutral supply conductor. ^c Only for cords – other than Types SPE-2 and SPT-2 – having no braid on any individual conductor. ^d For jacketed cords. ^e Only for Type SPT-2 cords. ^f Only for Types SPE-2 and SPT-2 cords.		

13.2.3 A furnishing that is required to employ a polarized attachment plug, as specified in 13.2.2, and that is provided with a separate or detachable cord set shall also employ an appliance connector of the polarized type.

13.2.3 effective October 31, 2005

13.2.4 A furnishing required to be grounded shall be provided with a grounding-type attachment plug.

13.2.4 effective October 31, 2005

13.2.5 If the cord includes an equipment grounding conductor, the grounding conductor shall be connected to all exposed or accessible dead metal of the furnishing by a mechanical means in accordance with Grounding and Bonding, Section 15 and to the grounding pin of a grounding attachment plug. See Figure 13.1.

13.2.5 effective October 31, 2005

13.2.6 The power-supply cord shall be rated for use at a voltage not less than the rated voltage of the product. The power-supply cord shall be sized in accordance with Table 13.3. A furnishing provided with a receptacle shall be provided with a 12 AWG (3.3 mm²) cord when the receptacle is rated 20 amps or 14 AWG (2.1 mm²) cord when the product is rated 15 amps or less.

13.2.6 effective October 31, 2005

Table 13.3
Size of power-supply cord

Table 13.3 effective October 31, 2005

Cord size AWG (mm ²)	Maximum rating (Amperes)	
	3 current-carrying conductors	2 current-carrying conductors
12 (3.3)	20	25
14 (2.1)	15	18
16 (1.3)	10	13
18 (.82)	7	10

13.2.7 A flexible cord shall be at least Type SPT-2, SPE-2, or the equivalent. Type SVT cord is equivalent when individual conductors are provided with supplementary insulation or spaced away from metal.

13.2.7 effective October 31, 2005

13.2.8 For furnishings where the cord exits the furnishing at a height greater than 3 feet (0.9 m), the cord length shall be a minimum of 9 feet (2.74 m) and a maximum of 15 feet (4.57 m) as measured from the exit of the furnishing to the attachment plug face. For furnishings where the cord exits the furnishing at a height of 3 feet (0.9 m) or less, the cord length shall be a minimum of 5 feet (1.5 m) and a maximum of 10 feet (3.05 m). The cord length for components used in the furnishings and not connected to the wall receptacle shall be long enough to reach the next component and the cord shall be routed away from the heat sources and secured.

13.2.8 effective October 31, 2005

13.2.9 Means shall be provided to support the cord to reduce risk of contact with a cabinet light at a location other than the cord exit.

13.2.9 effective October 31, 2005

13.2.10 The furnishing shall be constructed so that neither the cord nor plug is damaged when the furnishing is placed against a wall. Examples of constructions include, but are not limited to wood blocks to hold the furnishing out from the wall and right angle (flat) cord/plugs.

13.2.10 effective October 31, 2005

13.3 Multiple power supply cords

13.3.1 Cord connected furnishings shall not be provided with more than one power supply cord unless all of the following conditions are met:

- a) Not more than two cords are provided;
- b) Each flexible cord is of the type, size, and rating required for the type of product and the load supplied;
- c) Each attachment plug cap's rating is:
 - 1) Not less than that of the furnishing and not less than the maximum current input of the furnishing when tested in accordance with the Input Test, Section 35.
 - 2) The current rating of the attachment plug of a furnishing rated more than 15 amperes shall not be less than 125 percent of the maximum current input of the furnishing when tested in accordance with the Input Test, Section 35, and not less than 125 percent of the rated current of the furnishing.

d) The total current input per Section 35, Input Test, (including current through all cords) is not more than 80 percent of the branch circuit supply for the single branch circuit to which it is connected (based on the plug configuration);

Exception No. 1: The current is not required to be less than 80 percent of the single branch circuit when the plugs are supplied by separate branch circuits, evidenced by any of the following:

- a) The attachment plugs are not the same configuration or rating and the instructions contain the information in 51.6 (a) and (b);*
- b) The rating of either or both plugs is greater than 20 Amps; or*
- c) The product is marked in accordance with 46.16 or 46.18, and the instructions contain the information in 51.6 (a) and (c).*

Exception No. 2: The current is not required to be less than 80 percent of the branch circuit rating when:

- a) Both attachment plugs are rated 15 Amps or less; and*
 - b) The total current input is equal to or less than the attachment plug rating.*
- e) With reference to Exception No. 1(a) of item (d), where detachable power supply cords are used, both the attachment plugs and the means of connecting the cord to the furnishing shall have different configurations.
- f) The product is provided with a single accessible control or switch with a marked "off" position that disconnects all ungrounded conductors of the product;

Exception: The furnishing is not required to have a single disconnect when multiple disconnect means are provided in accordance with any of the following:

- a) There is a control or switch for each of the two power supply cords, and the controls or switches are grouped and identified;*
 - b) Both power supply cords are of the detachable type, the only supplied loads are receptacles, and the cord attachment points are grouped and identified;*
 - c) The product is provided with a mechanical or electrical interlock system that results in all ungrounded conductors of the supply being disconnected in the event that either cord is disconnected; or*
 - d) A marking is provided and located adjacent to each switch in accordance with 46.19.*
- g) The furnishing is rated in accordance with 45.3;
- h) The product contains the markings in 46.15; and
- i) The furnishing is provided with instructions as indicated in 51.6.

13.3.1 effective October 31, 2005

13.4 Strain relief

13.4.1 A strain-relief means shall be provided so that mechanical stress placed on a flexible cord or flexible conduit (such as a pull or twist) is not transmitted to terminals, splices, or internal wiring. When a clamp is employed with a cord, auxiliary insulation is required when the clamp is able to damage the cord insulation.

13.4.1 effective October 31, 2005

13.4.2 To determine compliance with 13.4.1, a strain relief means is to be subjected to the applicable tests described in Section 37, Strain Relief Tests.

13.4.2 effective October 31, 2005

13.4.3 A metal strain relief clamp or band shall not be used.

13.4.3 effective October 31, 2005

13.4.4 If a knot in a flexible cord serves as strain relief, any surface against which the knot bears against or with which it potentially comes in contact shall be free from projections, sharp edges, burrs, fins, and similar protrusions.

13.4.4 effective October 31, 2005

13.5 Protection of wiring

13.5.1 The point where a flexible cord passes through an opening in a wall, barrier, or enclosure, shall be an opening that is free from sharp edges, burrs, and fins that are able to damage the conductor insulation.

13.5.1 effective October 31, 2005

13.5.2 The cord shall be provided with mechanical means that prevent the cord being pushed inside the enclosure and contacting:

- a) A lamp or heated surface;
- b) A sharp edge; or
- c) A moving part.

13.5.2 effective October 31, 2005

13.5.3 An insulating bushing shall be provided where the flexible cord or wiring enters a pendant lampholder or the base or stem of a furnishing, and at the ends of metal tubing where the cord or wiring are pulled during the adjustment of the unit.

Exception No. 1: A smooth, metal bushing is able to be used when Type SPT-2, SJ, SV, or heavier cord is used.

Exception No. 2: An insulating bushing is not required with Integral Type SPT-2 cord when:

- a) The metal through which the cord passes is not less than 0.042 inch (1.07 mm) thick and the surface is smooth, or the edge of the metal is rolled not less than 120 degrees; or*
- b) The cord at the point where it passes through the hole is provided with additional insulation that is:*

- 1) Not less than 1/32 inch (0.8 mm) thick;*

2) *Molded to the cord; and*

3) *Of thermoplastic for Type SPT-2 cord.*

13.5.3 effective October 31, 2005

13.5.4 Cord or wiring that passes through tubing or contacts the edge of a sheet-metal wall 0.042 inch (1.07 mm) or less thick shall be reliably held away from the edges of the metal or shall be protected by a nonrubber bushing or a grommet or by rolling the edge of the metal not less than 120 degrees.

13.5.4 effective October 31, 2005

13.5.5 When cords or wires pass through or contact the edges of sheet metal thicker than 0.042 inch (1.07 mm), the metal shall be treated by reaming or the equivalent to remove burrs, fins, or sharp edges that are able to damage insulation.

13.5.5 effective October 31, 2005

13.5.6 When the material through which the cord or wiring passes is wood, porcelain, phenolic composition, or other insulating material, not less than 3/64 inch (1.2 mm) thick, a smoothly rounded surface is determined to be equivalent to a bushing.

13.5.6 effective October 31, 2005

13.5.7 Ceramic materials and molded urea, phenolic, and melamine compositions are determined to meet the intent of the requirement for insulating bushings; a bushing of wood or rubber is not usable. Other compositions are able to be used when they have been investigated and found usable for the application.

13.5.7 effective October 31, 2005

13.5.8 A hard-fiber bushing is able to be employed when the bushing is not less than 3/64 inch (1.2 mm) thick.

13.5.8 effective October 31, 2005

13.5.9 An insulated metal grommet is usable in place of an insulating bushing when the insulating material used is not less than 1/32 inch (0.8 mm) thick and completely fills the space between the grommet and the metal in which it is mounted.

13.5.9 effective October 31, 2005

13.5.10 Polymeric sleeving shall not be used for reducing the risk of cutting or abrasion of wiring. Fiberglass sleeving not less than 0.010 inch (0.25 mm) thick is capable of being used.

13.5.10 effective October 31, 2005

13.5.11 A bushing shall be securely held in place.

13.5.11 effective October 31, 2005

13.6 Attachment plugs

13.6.1 The attachment plug shall have an ampacity not less than the rated current of a furnishing, or the input current under maximum normal load conditions, whichever is greater, and a voltage rating equal to the rated voltage of the furnishing. When a furnishing is able to be adapted for use on two or more different values of voltage by field alteration of internal connections, the attachment plug provided with the furnishing shall be rated for the voltage to which the furnishing is connected when shipped from the factory.

13.6.1 effective October 31, 2005

14 Alternate Power-Supply Connections

14.1 When the intended means of mounting or other features or constructions of a furnishing warrants other than the required length of power-supply cord, a shorter cord (or no cord) is able to be provided. An example of an application where a shortened cord is able to be used is when several furnishings are interconnected in the field to form one unit. Instructions shall be provided in accordance with 50.11.

14.1 effective October 31, 2005

15 Grounding and Bonding

15.1 Grounding

15.1.1 A furnishing of one or more of the following types shall have provision for grounding:

- a) A furnishing intended to be used on a circuit operating at more than 150 volts to ground;
- b) A furnishing intended for permanent connection to the electrical supply;
- c) A cord-connected motor-operated furnishing; and
- d) A furnishing having a metal part not intended to be electrically live that is accessible using the probe in Figure 12.1 and that is able to be inadvertently energized.

Exception: A furnishing is able to be provided with a means of double insulation in accordance with the applicable requirements in the Standard for Double Insulation Systems for Use in Electrical Equipment, UL 1097, in place of grounding.

15.1.1 effective October 31, 2005

15.1.2 With reference to the Exception to 15.1.1, a furnishing marked as being provided with double insulation shall not be provided with a means for grounding unless it is also provided with a receptacle.

15.1.2 effective October 31, 2005

15.1.3 When a grounding means is provided, whether required or not, it shall be in accordance with 15.1.4. When the furnishing is cord connected, the grounding means shall also comply with the requirements in 15.1.7. All exposed dead metal parts and all dead metal parts within the enclosure that are exposed to contact during user servicing and are able to become energized during or after a fault condition shall be reliably connected to the means for grounding.

15.1.3 effective October 31, 2005

15.1.4 The following are able to be used as a means for grounding:

- a) In a furnishing intended to be permanently connected, an equipment-grounding terminal or lead. See 15.1.9 and 15.1.10; or
- b) In a cord-connected furnishing, an equipment-grounding conductor in the power-supply cord.

15.1.4 effective October 31, 2005

15.1.5 The grounding conductor of a supply cord shall be secured to the frame or enclosure of the furnishing by means of a screw that is not removed during any servicing operation not involving the power-supply cord, or by other equivalent means. Servicing includes repair of the furnishing by a qualified service person.

15.1.5 effective October 31, 2005

15.1.6 The grounding conductor of a cord-connected furnishing shall be connected to the grounding member of an attachment plug. The grounding member shall be fixed.

15.1.6 effective October 31, 2005

15.1.7 A separable connection, such as that provided by an attachment plug and a mating connector or receptacle, shall be such that the equipment-grounding connection is made before connection to, and broken after disconnection from, the supply conductors.

Exception: Interlocked plugs, receptacles, and connectors that are not energized when the equipment-grounding connection is made or broken are able to be used without the grounding connection described above.

15.1.7 effective October 31, 2005

15.1.8 When a furnishing is intended to be grounded and is provided with means for separate connection to more than one power supply, each separate connection shall be provided with a means for grounding.

15.1.8 effective October 31, 2005

15.1.9 A terminal intended solely for the connection of an equipment-grounding conductor shall be capable of securing a conductor of the size required for the application.

15.1.9 effective October 31, 2005

15.1.10 A connection device that depends on solder alone shall not be provided for connecting the equipment-grounding conductor.

15.1.10 effective October 31, 2005