UL 962

STANDARD FOR SAFETY

Household and Commercial Furnishings

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

Fifth Edition, Dated October 21, 2022

SUMMARY OF TOPICS

This new edition of ANSI/UL 962 dated October 21, 2022 is being issued to correct cross references, address mandatory language, reflect standards writing conventions, clarify requirements, and other miscellaneous updates.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated April 15, 2022 and September 16, 2022.

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UL 962

Standard for Household and Commercial Furnishings

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Fifth Edition

October 21, 2022

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

The most recent designation of ANSI/UL 962 as an American National Standard (ANSI) occurred on October 21, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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 https://csds.ul.com.

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PART 1 – ALL FURNISHINGS

INTRODUCTION

1 Scope

1.1 These requirements cover:

a) Motor-operated furniture, such as motor-operated beds, chairs, audio/video motorized carts/stands and blood donor chairs as well as the motorized drives for these units;

b) Electrified and non-electrified furniture;

c) Non-seasonal electrical decorations such as lava lamps and wave machines;

d) Home office furnishings, such as consoles, tables and desks;

e) Electrified building components, such as heated and electro-chromatic windows and illuminated mirror and bathroom cabinets;

f) Illuminated mirrors, which may include heaters and/or monitors;

g) Commercial tables, lab benches, and similar furnishings not provided with work surfaces, which includes secondary surfaces (shelves);

h) Commercial work surfaces, which include secondary surfaces (shelves) intended to be used with the furnishings covered in (g);

i) Massage tables and chairs;

j) Laboratory benches with and without sinks;

k) Enclosed rooms, such as booths and rooms with ceilings (these are not considered furnishings); and

l) Other similar miscellaneous furnishings intended for use in residential or commercial environments.

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

1.3 A furnishing intended to support audio/video equipment shall be evaluated in accordance with one of the following:

a) If the audio/video support system is not motorized and an entertainment center, cart, or a stand and it is intended for support or attachment of audio/video equipment, UL 1678 applies;

b) If the audio/video support system is intended to be mounted to walls, ceilings or another part of a building structure as the primary support means (it is not touching the floor), UL 2442 applies.

c) If a cart, stand or support surface is supplied with the audio or video equipment by the manufacturer of the audio or video equipment, the requirements specified in UL 62368-1 applies;

d) Information technology and communications equipment cabinets, enclosure and rack systems are investigated to UL 62368-1;

e) For retail product displays and all other type of furnishings incorporating audio/video equipment to attract attention to the products for sale, this Standard applies.

1.4 These requirements do not cover products intended for patient care areas. Patient care area products utilized under the supervision of a health care professional are covered by UL 60601-1.

1.5 Motorized equipment used for massaging and exercising is covered under UL 1647.

1.6 Office furnishing systems (panel systems) are covered by UL 1286 and individual commercial office furnishings are covered by UL 2999.

1.7 Illuminated display cases, showcases and cabinets, such as jewelry display cases, used in commercial applications are covered by UL 65.

1.8 Advertising displays may also be covered by UL 48.

1.9 Self-contained, custom-built kiosks that provide information, ticket machines, electronic point-of-sale products, customer self-checkout stands, and business application products are covered by UL 2361.

1.10 These requirements do not cover portable luminaires. UL 153 covers portable luminaires.

1.11 A product that employs an electromagnetic interference filter shall also comply with UL 1283. A product that employs a transient voltage surge suppressor shall also comply with UL 1449. 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 UL 452 and UL 1492. A product that employs ground-fault protection shall comply with the requirements in UL 943.

1.12 Bunk bed structural requirements are covered by ASTM F1427. Any electrical components of bunk beds are required to comply with the applicable requirements of UL 962.

1.13 Toy chest structural requirements are covered by ASTM F963. Any electrical components of these products are required to comply with the applicable requirements of UL 962.

1.14 These requirements do not cover products that are specifically intended for infants or juveniles. Cribs are covered by Federal Register 16 CFR Parts 1219, 1220, and 1500.

1.15 Furnishings incorporating low pressure inflators are covered by UL 1450, and in addition shall comply with the applicable requirements of UL 962.

1.16 These requirements do not cover seasonal (holiday products) – A product painted in colors to suggest a holiday theme such as a snow covering, a figure in a holiday costume, or any decoration associated with a holiday or particular season of the year.

1.17 These requirements do not cover retail case goods or merchandise displays. These displays are covered by UL 970.

2 Glossary

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

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 13.1.

2.3 ACCESSORY – An optional part that electrically and/or mechanically interfaces with the basic furnishing and is intended to be attached to the furnishing by the user or installer. Subassemblies field assembled to form the basic furnishing are not accessories.

2.4 ADVERTISING DISPLAYS – Advertising displays are intended to draw attention, demonstrate, or advertise products, but do not hold the products.

2.5 APPLIANCE CONNECTOR – The mating part of the appliance coupler integral with, or intended to be attached to, the power supply cord.

2.6 APPLIANCE COUPLER – A means of enabling the connection and disconnection at will, of a cord to an appliance or other equipment. It consists of two parts: an appliance connector and an appliance inlet.

2.7 APPLIANCE INLET – The mating part of the appliance coupler integrated or incorporated in the appliance or equipment or intended to be fixed to it.

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

2.9 ATTENDED FURNISHING – A furnishing that only preforms its intended function when the user is present to operate the furnishing.

2.10 BELLOWS – A telescoping guard that hinders someone from contacting a part that could create a risk of fire, electric shock, or injury to persons.

2.11 BOOTH – An area less than 16-foot square (1.50 square m) with no side exceeding 4 feet (1.2 m) provided with a ceiling means of access and egress.

2.12 BUNK CAPSULE CABIN – Box-like sleeping compartments secured one on top commonly equipped with an alarm, fan, radio/tv, and similar equipment.

2.13 CABINET LIGHT – A portable luminaire, see 2.68, intended for final installation into a cabinet (open or enclosed as specified in the installation instructions) such as a china hutch, bookcase, bar, console, bed headboard, or similar furnishing.

2.14 CART – A stand provided with casters, wheels, or rollers intended to make it easily mobile.

2.15 CATHODE RAY TUBE (CRT) – A vacuum tube containing an electron gun used to create images on the screen.

2.16 CEILING, ADJUSTABLE – Ceilings that have electrically adjustable louvers that allow the ceiling to be completely closed, partially closed, or completely opened.

2.17 CEILING, OPEN-GRID – A ceiling that has sufficient openings so that the ceiling does not interfere with the sprinkler system in the event of a fire. This includes ceilings that have electrically adjustable louvers that allow the ceiling to be completely closed or open.

2.18 CEILING, DROP-OUT – A suspended ceiling with ceiling tiles that distort under heat to the extent that it drops from the ceiling grid system in the event of a fire and the sprinkler system discharges.

2.19 CLASS 2 CIRCUIT – A circuit that complies with UL 5085-3 or with UL 1310.

2.20 COMMERCIAL – A place in which business is transacted, such as an office building, factory, warehouse, or similar location, and which is not a residence. It also includes institutions, health care facilities, old age convalescent board and care homes, college dormitories, schools, residence halls, jails, prisons, nursing care homes, and public auditoriums.

2.21 CONTROL – A device responsible for overseeing, regulating and altering the operation of an electronic system.

2.22 CONTROL, AUTOMATIC ACTION – A control in which at least one aspect is non-manual.

2.23 CONTROL, AUXILIARY – A control that provides a functional utility, is not relied upon as an operational or protective control, and therefore is not relied upon for safety. For example, an efficiency control not relied upon to reduce the risk of electric shock, fire, or injury to persons during normal or abnormal operation of the end product is considered an auxiliary control.

2.24 CRITICAL COMPONENTS – Any component that if changed may have an effect on the safety and/or performance of the furnishing or that is restricted by the construction requirements.

2.25 CONTROL, MANUAL – A device that requires direct human interaction to activate or reset the control.

2.26 CONTROL, OPERATING – A control, the operation of which starts or regulates the end product during normal operation. For example, a thermostat, the failure of which a thermal cutout/limiter or another layer of protection would reduce the risk of electric shock, fire, or injury to persons, is considered an operating control.

2.27 CONTROL, PROTECTIVE (LIMITING) – A control, the operation of which is intended to reduce the risk of electric shock, fire or injury to persons during normal and reasonably anticipated abnormal operation of the appliance. For example, a thermal cutout/limiter, or any other control/circuit relied upon for normal and abnormal conditions, is considered a protective control. (During the testing of the protective control/circuit, the protective functions are verified under normal and single-fault conditions of the control.) For example, a thermal cutout/limiter, a control used to sense abnormal temperatures of components within the appliance; an interlock function to de-energize a motor; temperature protection of the motor due to locked rotor, running overload, or loss of phase or any other control/circuit relied upon for normal and abnormal conditions, is considered a protective control. (During the testing of the protective control/circuit, the protective functions are verified under normal and single-fault conditions of the control.)

2.28 CONTROL, TYPE 1 ACTION – The actuation of an automatic control for which the manufacturing deviation and the drift (tolerance before and after certain conditions) of its operating value, operating time, or operating sequence has not been declared and tested under this standard.

2.29 CONTROL, TYPE 2 ACTION – The actuation of an automatic control for which the manufacturing deviation and the drift (tolerance before and after certain conditions) of its operating value, operating time, or operating sequence have been declared and tested under this standard.

2.30 CONTROL, REMOTE – A device used to operate a product that is not physically connected to the product.

2.31 DIRECT AND INDIRECT CONTACT WITH LIVE PARTS – A non-metallic part is considered in direct contact with a live part when it is touching the live part or within 1/32 inch (0.8 mm) of the live part. Indirect contact is when a non-metallic part is supporting a material that is in direct contact with the live part.

2.32 DISPLAY CASE – A totally enclosed lighted furnishing used to display products.

2.33 DRIVE – Motor and other components that provide the force to move parts of the furnishings.

2.34 ENCLOSURE, ELECTRICAL – That part of the product that:

a) Renders inaccessible all or any parts of the equipment that may otherwise present a risk of electric shock; and/or

b) Retards propagation of flame initiated by electrical disturbances occurring within.

2.35 ENCLOSURE, MECHANICAL – A part of the equipment intended to reduce the risk of injury that could be cause by mechanical and other physical parts.

2.36 ENTRAPMENT ENVIRONMENTS:

Usage Area I – An area where children or people with cognitive disabilities are anticipated to be present and likely not constantly supervised. Examples include residences, hotel rooms, and retail stores.

Usage Area IA – An area where children under the age of 8 or people with cognitive disabilities are anticipated to be present and likely directly supervised by a care giver and older children will be indirectly supervised by adults in the area, such as theaters, restaurants, and classrooms. Situations where someone would be underneath the furnishing are unlikely.

Usage Area II – An area where children or people with cognitive disabilities are anticipated to be present, but the furnishings are locked out and only operated by a trained person. Examples include medical exam rooms, customer service areas, and retail sales areas, such as carpet dispensers.

Usage Area III – An area where it is anticipated adults with normal cognitive abilities are present, trained to use the furnishings present, and children or people with cognitive disabilities are rarely present or if present are closely supervised, such as in a commercial office.

2.37 ENTRAPMENT FORCE – The amount of force that has the potential for causing injury.

2.38 FIXED FURNISHING – Intended to be permanently connected electrically to a source of supply.

2.39 FUNCTIONAL LOAD[a] – The level of loading or force typical of hard use.

[a] With the permission of BIFMA, this definition is reproduced from the BIFMA/ANSI Standard for Small Office/Home Office Furniture – Tests, SOHO S6.5. BIFMA shall not be responsible for the manner in which the information is presented, used, nor for any interpretations thereof.

2.40 FURNISHING SUPPORT SYSTEM – A system of components intended to secure a furnishing to the building or other structure.

2.41 FURNITURE POWER DISTRIBUTION UNIT – An outlet assembly that complies with UL 962A.

2.42 GLASS, SHEETS – A glass sheet, usually formed from sheet stock, the overall shape of which is essentially flat. The sheet can have a slight curvature or bend, and the surface may be smooth or textured.

2.43 HAZARD OCCUPANCY – Relates to the following types of area where a sprinkler system is used:

a) Light: The quantity of combustibles and the combustibility is low. It is expected that there will be low rates of heat release. Examples include: office areas and dwellings.

b) Ordinary, Group 1: The quantity of combustibles is moderate and the combustibility is low. It is expected that there will be moderate rates of heat release. Examples include: kitchens and storage rooms with a height equal to or less than 8.0 feet (2.44 m).

c) Ordinary, Group 2: The quantity of combustibles and the combustibility is moderate. It is expected that there will be moderate to high rates of heat release. Examples include: retail and storage rooms with a height equal to or less than 12.0 feet (3.66 m).

2.44 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.

2.45 ISOLATED SECONDARY CIRCUIT – A circuit derived from an isolated secondary winding of a transformer and that has no direct connection back to the line-connected circuit (other than through grounding means). A secondary circuit that has a direct connection back to the line-connected circuit is determined to be part of the line-connected circuit.

2.46 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.

2.47 LIMITED POWER SOURCE (LPS) – A limited power source is as defined in UL 62368-1 and shall comply with the requirements of UL 62368-1.

2.48 LIVE PART – Any part where current is flowing.

2.49 LOCATION, DAMP– An exterior or interior location that is normally or periodically subject to condensation of moisture in, on, or adjacent to, the furnishing, and includes partially protected locations.

2.50 LOCATION, DRY – A location not normally subject to dampness, but may include a location subject to temporary dampness, as in the case of a building under construction, provided ventilation is adequate to prevent an accumulation of moisture.

2.51 LOCATION, WET – A location in which water or other liquid can drip, splash, or flow on or against the furnishing.

2.52 LOCKED-ROTOR – The armature or rotor is prevented from rotating.

2.53 LOSS OF SERVICEABILITY[a] – The failure of any product to carry its intended load or to perform its normal function or adjustment.

2.54 LOW-VOLTAGE CIRCUIT – A circuit involving a potential of not more than 30 volts alternating current (42.4 peak) open circuit.

2.55 MATTRESS – A resilient material or combination of materials enclosed by ticking used alone or in combination with other products intended or promoted for sleeping upon. The term includes but is not limited to adult mattresses, youth mattresses, crib mattresses, bunk beds mattresses, futons, flip chairs without permanent backs or arm rests, sleeper chairs, water or air beds if they contain upholstery material between the ticking and mattress core.

2.56 MATTRESS FOUNDATION – A ticking covered structure used to support a mattress or sleep surface. The structure may incorporate other materials such as foam, springs, and the like used alone or in combination.

2.57 MATTRESS SET – A mattress provided with or without the mattress foundation.

2.58 MOTOR-OPERATED FURNISHING – A furnishing provided with a motor used for sitting, laying, or used for decoration, such as a wave machine.

2.59 NORMAL USE – The intended function applied by the user or operator utilizing the installation and operation instructions for the furnishing.

2.60 OFFICE FURNISHING – Consists of panels, study carrels, work stations and pedestal-style systems that may be mechanically interconnected to form an office furnishing system to be installed in accordance with Article 605 of ANSI/NFPA 70. They may be provided with an electrical distribution system, including switches and receptacles. They may contain channels for routing communication cable within the system components separate from power-circuit raceways. The systems may include filing cabinets, desks, work surfaces, shelves, storage units, etc., that have a particular electrical or mechanical function unique to an office furnishing system.

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

2.62 PINCH POINTS – Accessible locations on a furnishing where two parts of the furnishing may come together or a part of the furnishing and an external object coming together could cause personal injury. Also, see Entrapment Force, 2.37. Examples include:

a) A powered adjustable table with a modesty panel and the floor, or a chair, or another object.

b) A powered adjustable chair or sofa between the footrest, backrest, arms, and other chair parts or a chair or sofa and a wall.

2.63 PORTABLE FURNISHING – Meets all of the following:

a) Not secured to the building structure unless provided with a securement means that allows the furnishing to be removed without the use of tools;

b) Connected electrically to an electrical source of supply with a power supply cord and plug; and

c) Likely to be frequently relocated due to its small size and weight or configuration. (A product that allows an average person to pick up without tools or equipment.) A mass exceeding 40 lbs (18 kg) is not generally considered to be portable.

2.64 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.

2.65 PRIMARY SURFACE – A surface that has the apparent potential for the highest loading or a surface on which a person may sit. In cases where more than one horizontal surface exists, there may be more than one primary surface. In cases where all surfaces are intended for equipment there may be no primary surfaces.

2.66 PROOF LOAD[a] – The level of loading or force in excess of hard use.

2.67 PRESSURE-RELIEF DEVICES – A device used to control or limit the pressure in a system or vessel.

2.68 PUBLIC OCCUPANCIES – Include but are not limited to health care facilities, old age convalescent and care homes, college dormitories, residence halls, jails, prisons, nursing care homes, public auditoriums, hotels and motels.

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

2.70 RECEPTACLE, TAMPER RESISTANT – A receptacle provided with spring-loaded shutters that close off the contact openings or slots of the receptacles when the receptacle not in use.

2.71 RECEPTACLE, DEDICATED – A female contact device intended to supply current to utilization equipment that is provided with the furnishing when built and is not accessible to the user.

2.72 RELOCATABLE POWER TAP (RPT) – An outlet assembly that complies with UL 1363.

2.73 RESIDENCE – A place where people live (such as a house or apartment). A hotel common area such as the lobby or a restaurant are public occupancy areas. The terms "household" and "residence" are equivalent.

2.74 RISK OF ELECTRIC SHOCK – A risk of shock is considered to exist at parts accessible to the user or operator in a normally dry location during the intended use or servicing if the voltage exceeds 42.4 Vac peak (the peak voltage of a 30-Vac sine wave), 60Vdc and in a normally wet location if the voltage exceeds 21.2 Vac peak (the peak voltage of a 15-Vac sine wave), 30Vdc and the available current exceeds the leakage current levels specified in Leakage Current Test.

2.75 RISK OF FIRE – A risk of fire is considered to exist at a component part or assembly if an investigation shows that the supply for such part or assembly is capable of delivering a power of more than 15 W into an external resistor connected between the point in question and any return to the power supply.

2.76 RFID – Radio-frequency identification.

2.77 ROOM-IN-ROOM – A room that may have electrical components field or factory installed and is hard wired or cord and plug connected to the building electrical system. It is provided with a ceiling and means of access and egress. The total area is equal to or greater than 16 square feet (1.50 m^2) or one side is exceeds 4 feet (1.2 m).

2.78 SAFETY CIRCUIT – A control circuit designed to guard against or mitigate risk of fire, shock or personal injury.

2.79 SECONDARY SURFACE – A surface that is vertically separated from and smaller than the primary work surface(s). It is used for storage (that is, a shelf) or occupied exclusively by the equipment placed on the surface.

2.80 SECURITY LOCKOUT DEVICE – A device that prevents unauthorized users from operating the equipment, such as a lock and key, or a keypad with a code.

2.81 SHOWCASE – A specific type of store fixture identified in ANSI/NFPA 70. A cabinet provided with a transparent enclosure for displaying or protecting merchandise.

2.82 SIGN – An electrically operated product that through illumination or mechanical means uses words, symbols, numbers, art, or other advertisement intended to convey information, attracts attention, provides information, or serves as decoration. A sign does not have shelving or storage to display merchandise.

2.83 STAND – A structure on or in which audio and/or video equipment and accessories are intended to be placed, contained, or mounted for support.

2.84 STATIONARY FURNISHING –

a) Intended to be fastened in place requiring tools for removal and connected electrically to an electrical source of supply with a power supply cord and plug; or

b) Unlikely to be frequently relocated due to size, weight or configuration and connected electrically to an electrical source of supply with a power supply cord and plug.

2.85 SUB-ASSEMBLY – An individual component or a group of components that when combined form the complete furnishing. Sub-Assemblies are shipped from different manufacturing locations and are assembled in the field to form a complete product.

2.86 SURFACE – A moveable, typically stowable, surface whose primary function is to support office equipment such as printers and scanners.

2.87 TALL CART –

a) A cart where the television or apparatus supporting surface is more than 39.4 inches (1 m) above the floor and the cart is recommended by the manufacturer to be used in areas where children, or people with diminished capacity are likely to move or may be asked to move the cart; or

b) A cart where the television when mounted to the mounting surface of the cart places the center line of the television surface more than 39.4 inches (1 m) above the floor and the cart is recommended by the manufacturer to be used in areas where children, or people with diminished capacity are likely to move or may be asked to move the cart.

2.88 TICKING – The outer most layer of fabric or related material of a mattress or mattress foundation.

2.89 TIP OVER[a] – The condition where the unrestricted unit will not return to its normal upright position.

2.90 WIRED CABINET – See 2.81.

2.91 WIRING, INTERNAL – Wiring that is totally within an appropriate electrical and mechanical enclosure.

2.92 WORK SURFACE – A horizontal surface used to perform tasks and/or for storage space.

2.93 WORKING PRESSURE – The maximum system pressure measured during normal operating conditions. When more than one pressurized system is provided the furnishing is capable of having multiple working pressures.

3 Components

3.1 A component of a product covered by this Standard shall:

a) Comply with the requirements for that component as specified in this Standard;

b) Be used in accordance with its rating(s) established for the intended conditions of use; and

c) Be used within its established use limitations or conditions of acceptability.

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.

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

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.

3.5 Luminaires used in products covered by this Standard shall comply with the requirements in one or more of the following standards: UL 153, UL 1574, UL 1598, UL 2108 or UL 8750.

3.6 Furnishings which incorporate neon lamps shall comply with UL 2161 and shall also comply with the requirements of UL 962.

3.7 Video or audio equipment shall comply with the Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1. Video or audio equipment intended for use in a damp or wet locations shall comply with the tropical humidity requirements in these Standards.

3.8 A fuse shall comply with UL 248-1 and the appropriate Part 2 for the specific fuse type.

3.9 A supplementary overcurrent protector shall comply with UL 1077.

3.10 Wireless charging pad shall comply with UL 2738.

3.11 All plumbing parts shall comply with the appropriate standards, such as ASME A112.18.1.

4 Units of Measurement

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

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

5 Referenced Publications

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.

5.2 The following publications are referenced in this Standard:

ANSI Z97.1, *Safety Glazing Materials Used In Buildings – Safety performance Specifications And Methods Of Test*

ASME A112.18.1, *Plumbing Supply Fittings*

ASME B1.20.3, *Dryseal Pipe Threads (Inch)*

ASME B16.1, *Gray Iron Pipe Flanges and Fittings Classes 25, 125 and 250*

ASME B16.5, *Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard*

ASME B16.9, *Factory-Made Wrought Buttwelding Fittings*

ASME B16.11, *Forged Fittings, Socket-Welding and Threaded*

ASME B16.18, *Cast Copper Alloy Solder Joint Pressure Fittings*

ASME B16.22, *Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings*

ASME B16.26, *Cast Copper Alloy Fittings for Flared Copper Tubes*

ASTM A653/A653M, *Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*

ASTM B209/B209M, *Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate*

ASTM B555, *Standard Guide for Measurement of Electrodeposited Metallic Coating Thicknesses by the Dropping Test*

ASTM C62, *Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)*

ASTM C90, *Specification for Loadbearing Concrete Masonry Units*

ASTM E28, *Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus*

ASTM E162, *Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source*

ASTM E230/E230M, *Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples*

ASTM F963, *Standard Consumer Safety Specification for Toy Chests*

ASTM F1427, *Standard Consumer Safety Specification for Bunk Beds*

CFR 16 – Part 1219, *Safety Standard for Full-Size Baby Cribs*

CFR 16 – Part 1220, *Safety Standard for Non-Full-Size Baby Cribs*

CFR 16 – Part 1500, *Hazardous Substances and Articles Administration and Enforcement Regulations*

CFR 16 – Part 1632, *Flammability of Mattresses and Mattress Pads*

CFR 16 – Part 1633, *Standard for the Flammability (Open Flame) of Mattress Sets*

IEC 61000-4-5, *Electromagnetic Compatibility (EMC) – Part 4-5: Testing and Measurement Techniques – Surge Immunity Test*

ISO 16030, *Pneumatic Fluid Power – Connections – Ports and Stud Ends*

ANSI/NFPA 70, *National Electrical Code (NEC)*

NFPA 289, *Standard Method of Fire Test for Individual Fuel Packages*

NFPA 701, *Standard Test Methods of Fire Tests for Flame Propagation of Textiles and Films*

SAE J512, *Automotive Tube Fittings*

SAE J513, *Refrigeration Tube Fittings – General Specifications*

SOHO S6.5, *Small Office/Home Office Furniture – Tests*

Technical Bulletin 117 (March 2013), *State of California Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation – Requirements, Test Procedure and Apparatus for Testing the Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture*

Technical Bulletin 129, *State of California Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation – Flammability Test Procedure for a Mattress for use in Public Buildings*

UL 33, *Heat Responsive Links for Fire-Protection Service*

UL 48, *Electric Signs*

UL 65, *Wired Cabinets*

UL 94, *Test for Flammability of Plastic Materials for Parts in Devices and Appliances*

UL 111, *Outline of Investigation for Multioutlet Assembly*

UL 130, *Electric Heating Pads*

UL 153, *Portable Electric Luminaires*

UL 244A, *Solid-State Controls for Appliances*

UL 248-1, *Low Voltage Fuses – Part 1: General Requirements*

UL 248-14, *Low-Voltage Fuses – Part 14: Supplemental Fuses*

UL 353, *Limit Controls*

UL 452, *Antenna – Discharge Units*

UL 489, *Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures*

UL 498, *Attachment Plugs and Receptacles*

UL 499, *Electric Heating Appliances*

UL 508, *Industrial Control Equipment*

UL 508C, *Power Conversion Equipment*

UL 514B, *Conduit, Tubing, and Cable Fittings*

UL 514D, *Cover Plates for Flush-Mounted Wiring Devices*

UL 521, *Heat Detectors for Fire Protective Signaling Systems*

UL 635, *Insulating Bushings*

UL 723, *Test for Surface Burning Characteristics of Building Materials*

UL 723S, *Outline of Investigation for Drop-Out Ceilings Installed Beneath Automatic Sprinklers*

UL 746A, *Polymeric Materials – Short Term Property Evaluations*

UL 746B, *Polymeric Materials – Long Term Property Evaluations*

UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*

UL 796, *Printed Wiring Boards*

UL 810, *Capacitors*

UL 817, *Cord Sets and Power-Supply Cords*

UL 840, *Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment*

UL 864, *Control Units and Accessories for Fire Alarm Systems*

UL 873, *Temperature-Indicating and -Regulating Equipment*

UL 943, *Ground-Fault Circuit Interrupters*

UL 962A, *Furniture Power Distribution Units*

UL 964, *Electrically Heated Bedding*

UL 969, *Marking and Labeling Systems*

UL 970, *Retail Fixtures and Merchandise Displays*

UL 991, *Tests for Safety-Related Controls Employing Solid-State Devices*

UL 1004-1, *Rotating Electrical Machines – General Requirements*

UL 1004-2, *Impedance Protected Motors*

UL 1004-3, *Thermally Protected Motors*

UL 1012, *Power Units Other Than Class 2*

UL 1030, *Sheathed Heating Elements*

UL 1077, *Supplementary Protectors for Use in Electrical Equipment*

UL 1097, *Double Insulation Systems for Use in Electrical Equipment*

UL 1278, *Movable and Wall- or Ceiling-Hung Electric Room Heaters*

UL 1283, *Electromagnetic Interference Filters*

UL 1286, *Office Furnishing Systems*

UL 1310, *Class 2 Power Units*

UL 1363, *Relocatable Power Taps*

UL 1434, *Thermistor Type Devcies*

UL 1439, *Tests for Sharpness of Edges on Equipment*

UL 1449, *Surge Protective Devices*

UL 1450, *Motor-Operated Air Compressors, Vacuum Pumps, and Painting Equipment*

UL 1481, *Power Supplies for Fire-Protective Signaling Systems*

UL 1492, *Audio-Video Products and Accessories*

UL 1557, *Electrically Isolated Semiconductor Devices*

UL 1574, *Track Lighting Systems*

UL 1577, *Optical Isolators*

UL 1598, *Luminaires*

UL 1647, *Motor-Operated Massage and Exercise Machines*

UL 1678, *Household, Commercial, and Institutional-Use Carts, Stands and Entertainment Centers for Use with Audio and/or Video Equipment*

UL 1975, *Fire Tests for Foamed Plastics Used for Decorative Purposes*

UL 1977, *Component Connectors for Use in Data, Signal, Control and Power Applications*

UL 1989, *Standby Batteries*

UL 1998, *Software in Programmable Components*

UL 2054, *Household and Commercial Batteries*

UL 2097, *Reference Standard for Double Insulation Systems for Use in Electronic Equipment*

UL 2108, *Low Voltage Lighting Systems*

UL 2161, *Neon Transformers and Power Supplies*

UL 2361, *Outline of Investigations for Custom Built Kiosks*

UL 2442, *Wall- and Ceiling-Mounts and Accessories*

UL 2459, *Insulated Multi-Pole Splicing Wire Connectors*

UL 2738, *Induction Power Transmitters and Receivers for Use with Low Energy Products*

UL 2999, *Individual Commercial Office Furnishings*

UL 5500, *Remote Software Updates*

UL 5085-3, *Low Voltage Transformers – Part 3: Class 2 and 3 Transformers*

UL 8750, *Light Emitting Diode (LED) Equipment for Use in Lighting Products*

UL 60320-1, *Appliance Couplers for Household and Similar General Purposes – Part 1: General Requirements*

UL 60335-1, *Household and Similar Electrical Appliances, Part 1: General Requirements*

UL 60601-1, *Medical Electrical Equipment, Part 1: General Requirements for Safety*

UL 60691, *Thermal-Links – Requirements and Application Guide*

UL 60730-1, *Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements*

UL 60730-2-6, *Automatic Electrical Controls – Part 2-6: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements*

UL 60730-2-7, *Automatic Electrical Controls for Household and Similar Use, Part 2-7: Particular Requirements for Timers and Time Switches*

UL 60730-2-9, *Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls*

UL 60730-2-12, *Automatic Electrical Controls for Household and Similar Use; Part 2-12: Particular Requirements for Electrically Operated Door Locks*

UL 60730-2-15, *Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls*

UL 60947-4-1, *Low-Voltage Switchgear and Controlgear – Part 4-1: Contactors and Motor-Starters – Electromechanical Contactors and Motor-Starters*

UL 60947-5-2, *Low-voltage Switchgear and Controlgear – Part 5-2: Control Circuit Devices and Switching Elements – Proximity Switches*

UL 60950-1, *Information Technology Equipment – Safety – Part 1: General Requirements*

UL 61131-2, *Programmable Controllers – Part 2: Equipment Requirements and Tests*

UL 62368-1, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*

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 that are made by connectors instead of splices are not required to be made before the furnishing leaves the factory, if the connections made by the connectors maintain polarity and grounding, when grounding is provided.

6.2 Furnishings shipped unassembled from the same manufacturing location 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.

6.3 Furnishings shipped unassembled from different manufacturing locations to the field for assembly shall be constructed so that each sub-assembly is incorporated into the final assembly without requiring alteration by the installer. Subassemblies that must bear a definite relationship to each other for the intended operation of the product shall be arranged and constructed to permit them to be incorporated into the complete assembly only in the correct relationship with each other, without requiring alteration or realignment. See Section 95, Instructions for Sub-Assemblies.

6.4 When wires pass through a joint between sections of a furnishing that are separable for packing purposes, the joint shall be such that rotation of one section with respect to the other during the assembly of the sections is limited to not more than 360°. Friction alone does not meet the intent of the requirement to prevent rotation.

Exception: When all of the following conditions exist, rotation between sections of a furnishing is not limited to 360°:

a) The internal diameter of the tubing through which the wires pass is 1/2 inch (12.7 mm) or more;

b) The rotation during assembly is limited to not more than one revolution for each 3 inches (76 mm) of unobstructed tubing length through which the wires pass, when such rotation does not place any stress on the conductors; and

c) The conductors do not involve splices unless the splices are:

1) Inaccessible during assembly in accordance with Figure 13.1, Articulate Probe; and

2) Secured and provided with strain relief that has been shown to be reliable and not easily defeated by the user.

6.5 When a splice or an electrical connection is located in a section of a furnishing that is separable for packing purposes, as noted in 6.1, the unit shall be provided with strain relief to reduce the risk of stress being transmitted to the splice or electrical connection during unpackaging and assembly of the furnishing. The strain relief shall be reliable and not easily defeated by the user. See the Strain relief for internal conductors and connectors test, 69.2.

6.6 When wires pass through a joint between sections of a furnishing that are separable for packing purposes the joint or section shall comply with 10.6, Protection of cord and wiring, while unassembled.

6.7 When in any position of adjustment, a spring-loaded or adjustable section of a furnishing shall not transmit stress to a splice or wiring within any section of the unit either during assembly or when completely assembled. For example, the stem of an adjustable height floor-furnishing unit shall raise and lower without binding or crimping the wiring of the unit.

6.8 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.

6.9 A part that must be removed to assemble a 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.

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

7 Accessories

7.1 A furnishing having provision for the use of an accessory shall be constructed so that the use of the accessory does not introduce a risk of fire, electric shock, or injury to persons.

7.2 A furnishing shall comply with the requirements in this Standard with or without the accessory installed.

7.3 Installation of an accessory by the user shall be restricted to an arrangement by which the electrical connections are accomplished by means of mating connectors, attachment plugs and receptacles, or attachment plugs and cord connectors that maintain correct polarity.

7.4 Installation of an accessory intended to be made by the installer or service personnel shall be by means of mating connectors, attachment plugs and receptacles, plug-in connectors, pigtail leads and insulated wire connectors, or by connection to existing wiring terminals such as a terminal block or an installed electrical device.

7.5 With reference to 7.4, installation of an accessory shall not require cutting of wiring or the soldering of connections by the installer.

7.6 Strain-relief means shall be provided for the wiring of an accessory where stress may be transmitted to the connections during or after installation.

7.7 The mounting method and location of an accessory shall be specified in the installation instructions for the furnishing. See Section 94, Accessory Instructions.

7.8 Instructions shall be provided with the accessory covering the model number or series of furnishing the accessory is intended for use with. See Section 94, Accessory Instructions.

7.9 An accessory shall be trial-installed to determine that the installation is feasible, that the instructions are detailed and accurate, and that the furnishing complies with the requirements of this standard with the accessory installed.

7.10 An accessory may be shipped with or separately from the basic furnishing.

7.11 A part that is required for the furnishing to perform its basic function is not considered an accessory and shall be supplied with the basic furnishing.

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.

8.2 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.

8.3 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.

8.4 When wires pass through a joint between sections of a furnishing the construction shall comply with the requirements in 6.4.

9 Ventilation for Utilization Equipment

9.1 Each enclosed area of a furnishing intended to accommodate electrical utilization equipment shall be provided with natural convection openings or a mechanical ventilation system for the equipment installed within the enclosed area. Installation and use instructions shall be used to determine the intended use of an enclosed area.

10 Power-Supply Connections

10.1 Permanently connected furnishing

10.1.1 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 ANSI/NFPA 70. A furnishing shall be provided with a splice compartment, junction box or length of raceway to make connections.

10.1.2 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.

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

10.1.4 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 accessible for inspection after installation of the furnishing.

10.1.5 The compartment specified in 10.1.4 shall be located so that, when making conduit connections, internal wiring and electrical components are not exposed to mechanical abuse or strain.

10.1.6 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.

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

10.1.8 A wire-binding screw at a wiring terminal shall not be smaller than No. 10 (4.8 mm diameter). If a pre-tapped 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) or smaller conductor.

10.1.9 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 63, Tightening Torque Test.

10.1.10 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.

10.1.11 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.

10.1.12 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.

10.1.13 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).

10.1.14 When a terminal block is provided, it shall be suitable for field wiring.

10.1.15 An opening for conduit shall have dimensions as indicated in Table 10.1.

Table 10.1
Dimensions Associated with Openings for Conduit

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.

10.1.16 The minimum unobstructed diameter of the flat surface surrounding the back of an opening for unthreaded conduit shall be as indicated in Table 10.1.

10.1.17 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 10.1.

10.1.18 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 10.1.

10.1.19 The minimum usable volume of a field wiring compartment shall be as specified in Table 10.2.

Table 10.2
Minimum Usable Volume of Terminal Compartment

Size of conductors		Volume for each conductor that originates outside the compartment and terminates or is spliced within the compartment, and each conductor that passes through the compartment without splice or termination, including a grounding conductor.	
AWG	(mm^2)	cm^3	(cubic inches)
18	(0.8)	24.6	(1.50)
16	(1.3)	28.7	(1.75)
14	(2.8)	32.77	(2.00)
12	(3.3)	36.87	(2.25)
10	(5.3)	40.97	(2.50)
8	(5.5)	49.2	(3.0)
6	(6.5)	81.9	(5.0)

10.2 Cord-connected furnishing

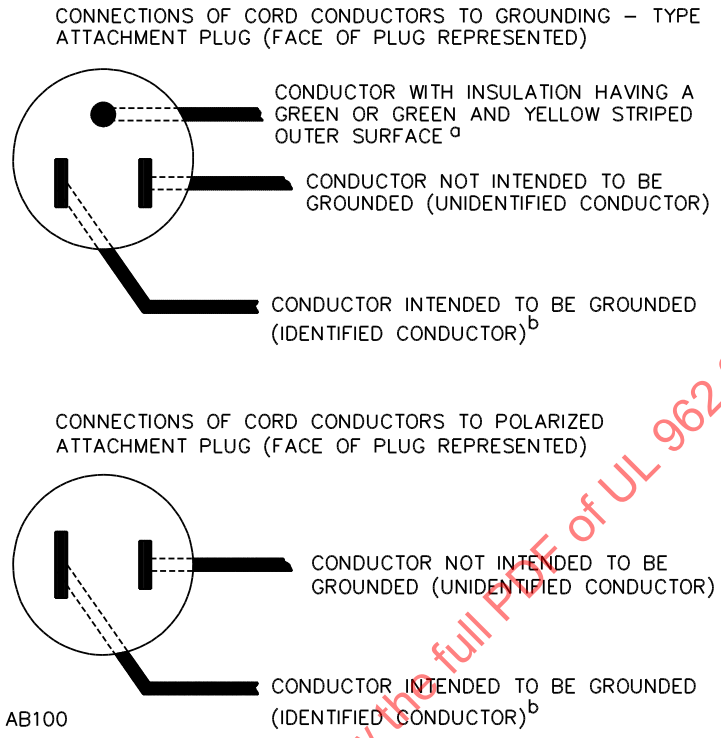
10.2.1 A furnishing intended to be connected to the power-supply source by means of a flexible cord and plug shall be provided with a flexible cord and an attachment plug for connection to the supply source. Furnishings supplied with more than one power supply cord shall comply with 10.3.

10.2.2 When a 3-wire grounding-type or a 2-wire polarized attachment plug is provided, the circuit conductors in the flexible cord shall be connected to the plug and to the wiring in the product so that any of the following devices used in the primary circuit shall be connected in an ungrounded current carrying conductor: the center contact of the Edison-Base lampholder, a single pole switch, an automatic control with a marked off position, a single fuseholder, and any other single-pole overcurrent protective device.

10.2.3 When a 3-wire grounding-type attachment plug or a 2-wire polarized attachment plug is provided, the attachment plug connection shall comply with Figure 10.1 and the polarity identification of the flexible cord shall comply with Table 10.3. See Section 97, Operating Instructions.

Figure 10.1

Connections to Attachment Plugs



[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 10.3. The grounded (identified) conductor is the neutral supply conductor.

Table 10.3
Polarity Identification of Flexible Cords

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
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]	No tin or other white metal on the strands of the conductor
	A stripe, ridge or groove on the exterior surface of the cord[f]	

[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 16.2.1 and Figure 10.1.

[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.

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

10.2.5 If the cord includes an equipment grounding conductor, the grounding conductor shall be connected to all exposed or accessible unenergized metal parts of the furnishing by a mechanical means in accordance with Grounding and Bonding, Section 16 and to the grounding pin of a grounding attachment plug. See Figure 10.1.

10.2.6 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 10.4. A furnishing provided with a 20 Amp rated receptacle shall be provided with a minimum 12 AWG (3.3 mm^2) conductor cord or when provided with a 15 Amp receptacle with a minimum 14 AWG (2.1 mm^2) conductor cord.

Table 10.4
Power Supply Cord Ampacity

Cord size AWG (mm^2)	Furniture maximum rating (Amperes) per cord	
	3 current-carrying conductors	2 current-carrying conductors
6 (13.3)	45	55
8 (8.4)	35	40
10 (5.3)	25	30
12 (3.3)	20	25
14 (2.1)	15	18
16 (1.3)	10	13
18 (0.82)	7	10

10.2.7 The flexible cord shall be of a type indicated in Table 10.5 or shall have properties such that it will be at least equally as serviceable for the particular application.

Table 10.5
Acceptable Types of Cord and Applicable Limitations on Their Use

Product on which the cord is to be used	Cords acceptable where temperatures are more than 121 °C (250 °F) are attained on any surface the cord can contact	Cords acceptable where 121 °C (250 °F) or lower temperatures are attained on any surface the cord can contact
Household use products	HPN, HSJ, HSJO	NISP-2, NISPT-2 SP-2, SPE-2, SPT-2, SPT-3, SV, SVE, SVO, SVT, SVTO, SJ, SJE, SJO, SJT, SJTO or equivalent.
Commercial use counter top and table top use products[a]	HSJ, HSJO, HSJOW	NISPT-2, SP-2, SPE-2, or SPT-2, SPT-3, SV, SVE, SVO, SJ, SJT, SJE, SJEO, S, SO, SOW, SOO, SOOW, STO, STOW, STOO, STOOW, SEO or SEOW or equivalent.
Other Commercial products	HSJ, HSJO, HSJOW	SJ, SJT, SJE, SJEO, S, SO, SOW, SOO, SOOW, STO, STOW, STOO, STOOW, SEO or SEOW or equivalent

[a] A cord that is protected by the physical construction of the furnishing such as being recessed in a cord channel, routed within a passageway or the like and exits the commercial furnishing such that the cord cannot contact the floor due to the intended location of the commercial furnishing such as a shelf or rack mounted display (refer to the installation instructions 92.8 – 92.9).

10.2.8 SV, SVE, SVO and equivalent power supply cords shall have the individual conductors provided with supplementary insulation where the conductors exit the jacket of the cord.

10.2.9 A direct plug-in power supply with a Class 2 or LPS output shall comply with the output cord conductor requirements specified for the power supply.

10.2.10 A power supply with a supply cord input and a secondary load side power output in excess of Class 2 shall comply with 10.2.6 – 10.2.8 or Annex A for a SELV power level output.

10.2.11 When a furnishing employs a direct plug-in power supply the length of the output conductors shall be in compliance with Table 10.6 requirements.

10.2.12 When a furnishing employs a power supply with a supply cord input and output conductors the combined length of the supply cord and the output conductors shall be in compliance with Table 10.6 requirements.

10.2.13 The length of a power supply cord shall be within the limits specified in Table 10.6.

Table 10.6
Length of Power Supply Cord

Type of furnishing	Minimum acceptable length		Maximum acceptable length	
	Feet	(mm)	Feet	(mm)
Table, or shelf (Rack, Gondola) supported	4.0	(1219)	10	(3048)
Floor supported with a cord exit point lower than 3 feet from the floor	5.0	(1524)	25	(7620)
Floor supported with a cord exit point greater than 3 feet from the floor	9.0	(2743)	25	(7620)

10.2.14 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 92.12.

10.2.15 The current rating of the attachment plug of a furnishing shall not be less than 125 % of the maximum current input of the furnishing or the marked rating when no electrical load is provided as part of the furnishing.

10.2.16 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.

10.2.17 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.

10.2.18 Power supply cords and interconnecting cords that constitute a risk of injury from damage shall be protected from moving parts of a furnishing.

10.2.19 A power cord run through the interior structure of a furnishing, room-in-room, or booth shall be visible along its length or be able to be visually inspected by removing a cover without the use of tools. The product shall meet the requirements for wiring protection in 19.1.2 and 19.1.3.

10.3 Multiple power supply cords

10.3.1 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;

Exception: Furnishings intended for use in commercial or institutional occupancies may be equipped with more than two cords. Also, see 86.16.

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 67, and

2) The current rating of the attachment plug of a furnishing rated more than 15 amperes shall not be less than 125 % of the maximum current input of the furnishing when tested in accordance with the Input Test, Section 67, and not less than 125 % of the rated current of the furnishing.

d) The total current input in accordance with Section 67, Input Test, (including current through all cords) is not more than 80 % 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 % 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 96.6 (a) and (b);

b) The rating of any plugs is greater than 20 Amps; or

c) The product is marked in accordance with 86.15, and the instructions contain the information in 96.6 (a) and (c).

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

a) All 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 10.3.1(d), where detachable power supply cords are used, all the attachment plugs and the inlets 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) All 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 any cord is disconnected; or

d) A marking is provided and located adjacent to each switch in accordance with 86.17.

g) The furnishing is rated in accordance with 85.3;

h) The product contains the markings in 86.15; and

i) The furnishing is provided with instructions as indicated in 96.6.

10.4 Detachable power supply cords

10.4.1 A detachable power supply cord shall be provided with:

a) A ANSI/NEMA WD-6 configuration mating attachment cord connector body and inlet; or

b) A UL 60320-1 configuration mating appliance attachment cord connector body and inlet.

10.4.2 The power supply cord ampacity shall be rated for the maximum current rating of the appliance inlet configuration provided.

10.4.3 Adjacent to the inlet shall be marked the maximum voltage and current rating of the furnishing and a WARNING statement as specified in 86.25.

10.5 Strain relief

10.5.1 A strain-relief means shall be provided so that mechanical stress placed on a flexible cord or flexible conduit 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.

10.5.2 Insulating bushings serving as strain relief shall comply with UL 635. Tests specified in this Standard (e.g. Strain Relief Test) may still be required to be performed to confirm the combination of the insulating bushing and the supporting parts are suitable in combination.

10.5.3 If wood, pressed board, or other fibrous material is used to secure the strain-relief assembly, the fibrous material shall be secured to the furnishing by a positive means.

10.5.4 Means shall be provided to reduce the likelihood of an attached supply cord or lead from being pushed into the enclosure of a furnishing through the cord-entry hole if damage to cord could result from contact with internal mechanical and electrical components or systems.

10.5.5 To determine compliance with 10.5.1, a strain relief means is to be subjected to the applicable tests specified in Section 69, Strain Relief Tests.

10.5.6 A metal strain relief clamp or band shall not be used unless it has been evaluated to UL 514B, for the size of, number of and type of cord or conductor.

10.6 Protection of cord and wiring

10.6.1 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.

10.6.2 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.

10.6.3 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°; 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.

10.6.4 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 non-rubber bushing or a grommet or by rolling the edge of the metal not less than 120°.

10.6.5 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.

10.6.6 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.

10.6.7 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.

10.6.8 A hard-fiber bushing or grommet form is able to be employed when the bushing is not less than 3/64 inch (1.2 mm) thick. A rubber bushing is not suitable for use.

10.6.9 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.

10.6.10 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.

10.6.11 A bushing shall be securely held in place.

10.6.12 A cord shall be supported through an individual furnishing and between mechanically contiguous furnishings. The supports shall be such that the cord, has a maximum unsupported distance of 16 inches (406 mm).

10.6.13 When a power supply cord is routed internally or externally along a furnishing or a cord is utilized for the interconnection of electrical components provided with the furnishing the cord shall be protected from damage by any of the following means:

a) Recessing the cord in a channel or a complete enclosure;

b) Providing projections extending out from the furnishing at least equivalent to the depth of the diameter of the cord; and/or

c) Providing a removable protective cover.

11 Frame and Enclosure

11.1 General

11.1.1 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.

11.1.2 Among the factors taken into consideration in determining the acceptability of an enclosure are its:

a) Physical strength;

b) Resistance to impact;

c) Moisture absorptive properties;

d) Combustibility;

e) Resistance to corrosion; and

f) Resistance to distortion at temperatures to which the enclosure may be subjected under conditions of normal or abnormal use.

For a nonmetallic enclosure, all of these factors are to be considered with respect to thermal aging.

11.1.3 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.

Exception No. 4: Components in a Class 2 or LPS circuit are not required to be in an enclosure, but if one is provided it shall comply with Section A3.

11.1.4 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 UL 1439.

11.2 Personal injury, entrapment, pinch points, and shear considerations

11.2.1 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. All moving parts shall be made inaccessible by guards or bellows, or, if accessible, not present any risk of injury.

11.2.2 When investigating a furnishing with respect to the requirement in 11.2.2, conditions of foreseeable misuse shall be evaluated.

11.2.3 Among the factors, which shall be considered simultaneously, 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. Moving parts shall have accessible edges rounded to a radius of 0.8 mm (0.03 inches) and accessible corners to 1.6 mm (0.06 inches)[b];

c) The risk of unintentional contact by the user or someone in the area. A furnishing that when installed or placed in its intended location and its highest point of travel is 84 inches (2,130 mm) above the floor is not considered a risk of unintentional contact. Installation and operation instructions shall warn against placing a fixed structure at a point less than 85 inches (2,159 mm) above the movable component of the furnishing;

d) The speed of the moving part. Usage III: Moving parts that may cause entrapment traveling less than 1 inch/second (2.54 cm/second) are not considered a risk of entrapment provided the requirements for Commercial Operator Attended Products – Usage Area III, Section 32 are followed. If two parts are in motion, the combined speed of the parts shall be considered. The speed for rotating parts shall be measured at the fastest moving point. Space around accessible pinch points shall not be constrained such that a user is unable to retract a body part with sufficient speed from the space to avoid injury;

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;

f) The force involved when loaded with the rated load; and

g) A force of 2 lbs (9 Newtons) or greater is required for the person to become dislodged.

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11.2.4 When considering entrapment or pinch points, consideration shall be given to the body part(s) that may become trapped. See Table 11.1 for dimension requirements for spacing to prevent entrapment.

Table 11.1
Entrapment Space Requirements

Body part	Child Inches (cm)		Adult Inches (cm)	
	Less than	Equal to or more than	Less than	Equal to or more than
Arm	0.16 (0.41)	5.0 (12.7)	0.16 (0.41)	5.0 (12.7)
Body	None	20.0 (50.8)	None	20.0 (50.8)
Finger	0.16 (0.41)	1.0 (2.5)	0.32 (0.8)	1.0 (2.5)
Foot	1.0 (2.5)	4.72 (12.7)	1.4 (3.5)	5.0 (12.7)
Hand	0.16 (0.41)	4.0 (10.2)	0.16 (0.41)	4.0 (10.2)
Head	2.4 (6.1)	12.0 (30.5)	4.8 (12.0)	12.0 (30.5)
Leg	0.16 (0.41)	7.0 (17.8)	0.16 (0.41)	7.0 (17.8)
Toes	0.16 (0.41)	2.0 (5.1)	0.16 (0.41)	2.0 (5.1)

11.2.5 When considering entrapment or pinch points, consideration shall be given to the ability to reach the potential entrapment area. See Table 11.2. Potential entrapment areas that are beyond the dimensions given are not considered a risk of injury to the user or person near the furnishing.

Table 11.2
Entrapment Reach Requirements

Body Part	Inches (cm)	Comment
Height	84 (213)	Measured from the floor
Arm	59 (150)	Measured from hip and presumes individual may move upper body
Leg	43 (110)	Measured from crotch

11.2.6 A mounting system used with a cart, stand or entertainment center that is intended to support a video display with a weight greater than 15 lbs (6.8 kg) shall be constructed to prevent the video display from being inadvertently dislodged or removed from the mounting system. Gravity shall not be the sole means of securement for the video display.

11.2.7 Supporting surfaces on a tall cart which are located more than 39.4 inches (1 m) above the floor shall be provided with a mechanical means for securing equipment. Acceptable means for securement include screws, straps and similar securement means. The assembly of the equipment to the supporting surface shall comply with the Instructions, Section 92.

11.2.8 A tall cart shall be provided with casters having a minimum diameter of 4 inches (101.6 mm).

11.2.9 A furnishing provided with two or more mounting surfaces for video displays shall be provided with instructions specifying the order in which the video displays are to be installed; unless installation in any order does not cause the product to become unstable. The product shall be tested for stability in accordance with 43.2.

11.2.10 A furnishing provided with two or more mounting surfaces for video displays shall specify both the maximum and minimum weight of the equipment or maximum weight and allowable percent difference to be supported if equipment that is less than the maximum weight when mounted will cause the product to become unstable. The product shall be tested for stability in accordance with 43.2.

11.2.11 A furnishing provided with two or more mounting surfaces where removal of one or more pieces of video displays could cause the product to become unstable shall be permanently marked as specified in 86.41.

11.3 Mechanical enclosures and guards – Mechanical considerations

11.3.1 Bellows shall:

a) Require the use of tools for their removal;

b) Be removable for servicing;

c) Have sufficient strength and rigidity to avoid the articulate probe with web stop (Figure 13.1) from being inserted to a depth that causes entrapment or damages the guard, when pressed with a force of 10 lbs (44.5 N); and

d) Be complete so that there are no opens that would allow an appendage to enter, such as an arm for leg. See Table 11.1.

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

11.3.3 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, its intended installation location, the intended user group (youth, adult, persons with diminished capacity, elderly), trained or untrained users 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.

11.3.4 A moving part, lifting or reclining mechanism, the rotor of a motor, a pulley, belt, gear, fan, or other part that constitutes a risk of injury shall be enclosed or provided with means to reduce the risk of injury. Such a part shall not be able to be contacted by the user or someone in the area. Compliance shall be determined by the probe illustrated in Figure 13.1 unless the furnishing is provided with a safety system and complies with 11.3.5. A force greater than 40 pounds between a moving part and any object that can be entrapped by the moving part is considered a risk of injury. The furnishing shall be subjected to the Entrapment Test, Section 61, if there is a possibility that the force may be less than 40 lb. When using the probe to determine if a potential entrapment area can be reached, there are several items to be considered:

a) If the entrapment area beyond the distances specified in Table 11.2;

b) That children may go into places that an adult would not, such as crawling on the floor; and

c) The probe shall be adjusted in any position that it can be manipulated along with the probe users arm.

Exception: Instead of the 40 lbs (178 N) force, the maximum dynamic force shall not exceed 90.0 lbs (400 N) during the first 0.75 seconds. The static force shall not exceed 34.0 lbs (150 N) from 0.75 to 5.00 seconds and shall not exceed 5.6 lbs (25 N) force after 5.00 seconds. See 61.1, Entrapment Force Measurement Test.

11.3.5 Furnishings that present a risk of injury as specified in 11.3.4 shall be provided with either an active safety circuit or passive guard to prevent injury.

11.3.6 A mechanical safety system, such as a guard, shall comply with 11.3.8.

11.3.7 During the investigation of a furnishing to determine compliance with 11.3.4, a part of the enclosure that is removable without the use of a tool shall be 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 86.12.

11.3.8 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.

11.3.9 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.

11.3.10 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.

11.3.11 A portable furnishing that does not incorporate a shade as specified in UL 153, for portable lamps shall comply with Section 77, Lamp Drape Test, and shall be marked with the maximum wattage lamp intended for use with the furnishing in accordance with the requirements of UL 153.

11.3.12 When unintentional operation of a switching device results in a risk of injury to persons, the actuator of the switch shall be located or guarded so that such unintentional operation does not occur. A switch that is located or guarded so that it cannot be turned on by moving a 2 inch (51 mm) diameter sphere at any angle to the switch or actuator complies with this requirement.

11.4 Metallic electrical enclosures

11.4.1 A furnishing shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it is likely to be subjected, without increasing the risk of fire, electric shock or injury to persons due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts, or other serious defects.

11.4.2 For unreinforced, flat surfaces in general, cast metal shall not be less than 1/8 inch (3.2 mm) thick, except that malleable iron may be not less than 3/32 inch (2.4 mm) and die cast metal may be not less than 5/64 inch (2.0 mm) thick. Corresponding thicknesses of not less than 3/32 inch (2.4 mm), 1/16 inch (1.6 mm), and 3/64 inch (1.2 mm), respectively, may be acceptable if the surface under consideration is curved, ribbed, or otherwise reinforced, or if the shape or size, or both, of the surface is such that the necessary mechanical strength is provided.