UL 817

STANDARD FOR SAFETY

Cord Sets and Power-Supply Cords

UL Standard for Safety for Cord Sets and Power-Supply Cords, UL 817

Thirteenth Edition, Dated February 24, 2025

Summary of Topics

This new Thirteenth edition of ANSI/UL 817 dated February 24, 2025 incorporates editorial changes including renumbering and reformatting to align with current style, as well as the following changes in requirements:

– Addition of New 9.9.8 and Section 4, Referenced Publications, to Align with Requirements Related to Reese's Law in UL 4200A

– Addition of SS2-50R for RV Cord Sets, Revised 10.11.1 and 10.11.4

– Power-Supply Cords for Portable LED Luminaires, New Annex F

The new requirements are substantially in accordance with Proposal(s) on this subject dated September 6, 2024 and September 13, 2024.

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Standard for Cord Sets and Power-Supply Cords

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The most recent designation of ANSI/UL 817 as an American National Standard (ANSI) occurred on February 24, 2025. 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 ULSE at any time. Proposals should be submitted via a Proposal Request in ULSE's Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

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INTRODUCTION

1 Scope

1.1 This Standard specifies the requirements for cord sets and power-supply cords employing molded-on or assembled-on fittings, rated 600 V maximum, and intended for use in non-hazardous locations in accordance with the National Electrical Code, NFPA 70.

1.2 This Standard also specifies the requirements for molded-on general-use attachment plugs and cord connectors.

1.3 This Standard also specifies the requirements for hospital grade attachment plugs and cord connectors.

1.4 This Standard also specifies the requirements for cord restraint devices.

1.5 These requirements do not cover cord sets intended for temporary outdoor use – not to exceed 90 days – with outdoor equipment, Christmas-tree, and other seasonal decorative-lighting outfits. Such devices are covered by the Standard for Outdoor Seasonal-Use Cord-Connected Wiring Devices, UL 2438.

1.6 Cord sets employing assembled enclosures provided with means for mounting or intended for use in furniture are covered by the Standard for Furniture Power Distribution Units, UL 962A.

1.7 Cord sets employing assembled enclosures, standard configuration outlets, and a surge protective device (SPD) are covered by the Standard for Surge Protective Devices, UL 1449.

1.8 These requirements also cover general-use extension cord sets employing supplementary charging circuits and induction power transmitters. See Supplementary charging circuits and induction power transmitters, 9.8.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this Standard shall comply with the requirements for that component. 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.

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

a) Involves a feature or characteristic not required in the application of the component in the product covered by this Standard;

b) Is superseded by a requirement in this Standard; or

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

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

2.4 A component that is also intended to perform other functions such as overcurrent protection, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable standard(s) that cover devices that provide those functions.

3 Units of Measurement

3.1 The values given in SI (metric) units shall be normative, except for AWG/kcmil conductor sizes. Any other values are for information only.

4 Referenced Publications

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

4.2 The following publications are referenced in this Standard:

ABYC E-8, *AC Electrical Systems*

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

ASTM D412, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension*

ASTM D573, *Standard Test Method for Rubber—Deterioration in an Air Oven*

ASTM G152, *Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials*

ASTM G153, *Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials*

ASTM G155, *Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials*

IEC 60320-1, *Appliances couplers for household and similar general purposes – Part 1: General requirements*

IEC 60320-2-2, *Appliance Couplers for Household and Similar General Purposes – Part 2-2: Interconnection Couplers for Household and Similar Equipment*

NEMA WD 6, *Wiring Devices – Dimensional Specifications*

NFPA 70, *National Electrical Code*

NFPA 302, *Fire Protection Standard for Pleasure and Commercial Motor Craft*

UL 20, *General-Use Snap Switches*

UL 62, *Flexible Cords and Cables*

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

UL 224, *Extruded Insulating Tubing*

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 310, *Electrical Quick-Connect Terminals*

UL 486A-486B, *Wire Connectors*

UL 486E, *Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors*

UL 498, *Attachment Plugs and Receptacles*

UL 507, *Electric Fans*

UL 588, *Seasonal and Holiday Decorative Products*

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 746D, *Polymeric Materials – Fabricated Parts*

UL 758, *Appliance Wiring Material*

UL 796, *Printed-Wiring Boards*

UL 962A, *Furniture Power Distribution Units*

UL 969, *Marking and Labeling Systems*

UL 969A, *Marking and Labeling Systems – Flag Labels, Flag Tags, Wrap-Around Labels and Related Products*

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

UL 1310, *Class 2 Power Units*

UL 1441, *Coated Electrical Sleeving*

UL 1449, *Surge Protective Devices*

UL 1577, *Optical Isolators*

UL 1659, *Attachment Plug Blades for Use in Cord Sets and Power-Supply Cords*

UL 1681, *Wiring Device Configurations*

UL 1682, *Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type*

UL 2438, *Outdoor Seasonal-Use Cord-Connected Wiring Devices*

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

UL 2885, *Acid Gas, Acidity and Conductivity of Combusted Materials and Assessment of Halogens*

UL 4200A, *Products Incorporating Button Batteries or Coin Cell Batteries*

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

UL 60730-1, *Automatic Electrical Controls – Part 1: General Requirements*

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

UL 61058-1, *Switches for Appliances – Part 1: General Requirements*

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

5 Glossary

5.1 The following terms and definitions apply in this Standard.

5.2 ADAPTER CORD SET – A cord set, without a switch, intended to provide power from a single NEMA plug to a maximum of 6 NEMA outlets, convert from one contact configuration to another, or both.

Adapter cord sets are intended for use at construction sites and similar locations.

5.3 ALLOWABLE AMPACITY – The maximum continuous current-carrying capacity of electrical cord sets or power-supply cords, as determined by the lowest ampere rating of any individual component.

5.4 APPLIANCE CONNECTOR – A type of cord connector which mates with an inlet.

5.5 APPLIANCE/FLAT-IRON PLUG – A type of appliance coupler with a cord guard and a slot configuration specified for use with heating or cooking appliance.

5.6 ATTACHMENT PLUG – A male contact device which mates with an outlet.

5.7 CORD CONDUCTORS – The total number of conductors in a cord.

5.8 CORD CONNECTOR – A female contact device which mates with an attachment plug.

5.9 CORD CONNECTOR LATCHING TYPE – A cord connector intended for use with extension cord sets of the 1-15R, 5-15R, 5-20R, 6-15R, or 6-20R configurations, employing integral means intended to retain a mated attachment plug in place after its blades have been inserted into the female contacts. See 8.7.

5.10 CORD RESTRAINT DEVICE – A device provided with retention means intended to reduce the likelihood of an attachment plug becoming unintentionally detached from a mating cord connector of a cord set or any outlet device. This device is not an integral or permanently attached component of a cord set or outlet device, but rather is a separate add-on device. A latching type cord connector is not considered a cord restraint device. See 5.9.

5.11 CORD SET – A length of flexible cord having an attachment plug at one end and a cord connector at the other end. See Annex G for pictorial representation of examples.

5.12 CURRENT-CARRYING CONDUCTOR – A cord conductor excluding both the grounding conductor and the neutral conductor that carries only the unbalanced current from the other conductors.

5.13 CURRENT TAP – An attachment plug with an integral outlet device.

5.14 DIMMER – A device intended to change lighting to various intensities.

5.15 EXTENSION CORD SET – A cord set having NEMA fittings on both ends with an attachment plug and a cord connector of the same mating configuration.

5.16 FITTING – Any device that can be molded or assembled on flexible cord.

5.17 GROUNDED CONDUCTOR – The circuit conductor that is intentionally grounded.

5.18 GROUNDING CONDUCTOR – A conductor in a flexible cord or cable intended to connect the non-current-carrying parts of electrical equipment, raceways, or enclosures to the service equipment or system grounding conductor, and which has:

a) A green covering;

b) A green covering with one or more yellow stripes; or

c) No covering in certain specific flexible cord and cable constructions.

5.19 HOSPITAL GRADE – Intended for use in hospitals and health care facilities.

5.20 HOSPITAL GRADE ATTACHMENT PLUG – A molded-on or assembled-on attachment plug of configuration 5-15P, 5-20P, 6-15P or 6-20P, either of straight or right angle type, intended for use in hospital and health care facilities in other than hazardous locations.

5.21 HOSPITAL GRADE CONNECTOR – A molded-on or assembled-on cord connector of configuration 5-15R, 5-20R, 6-15R or 6-20R, either of straight or right angle type, intended for use in hospital and health care facilities in other than hazardous locations.

5.22 HOSPITAL GRADE EXTENSION CORD SET – A cord set having a hospital grade attachment plug and a hospital grade cord connector of the same mating configuration.

5.23 IDENTIFIED CONDUCTOR – A conductor in a flexible cord or cable which is identified to be a grounded conductor or a neutral conductor, and which has:

a) A white or grey covering;

b) One or more raised longitudinal ridges on the surface of the extruded covering on certain flexible cords; or

c) A light blue covering when the flexible cord or cable is made in accordance with the International System of colors.

5.24 INDOOR USE – Power-supply cords and cord sets in which materials and constructions have been found suitable to withstand the elements of indoor exposure.

5.25 INDUCTION POWER TRANSMITTER – The equipment consisting of the supply connections, control circuitry, induction transmitting coils, power platform, and overall enclosure.

5.26 JOINT – Branching of a flexible cord into two or more cords.

5.27 LINE CONDUCTOR – Any conductor in a flexible cord or cable which is not the identified conductor or the grounding conductor.

5.28 OUTDOOR USE – Power-supply cords and cord sets in which the materials and construction have been found suitable to withstand the elements of outdoor exposure.

5.29 OVERCURRENT – Any current in excess of the rated current (ampacity) that can result from an overload or a short circuit condition.

5.30 OVERCURRENT PROTECTIVE DEVICE – Any replaceable or manually-resettable type device capable of automatically opening an electric circuit, under both predetermined overload and short-circuit conditions.

5.31 OVERLOAD – Operation of conductors or fittings in excess of normal, full-load ampacity rating that, when it persists for a sufficient length of time, would cause damage or dangerous overheating.

5.32 PENDANT SWITCH – A switch intended to be installed at the end of a flexible cord.

5.33 POLARIZATION – A means to identify and to provide continuity of a neutral (the identified) conductor and the grounding conductor when an attachment plug is mated with a cord connector or outlet.

5.34 POWER-SUPPLY CORD – A length of flexible cord with an attachment plug at one end and individual cord conductors not terminated in a cord connector at the opposite end. It may have additional components such as an integral strain relief bushing or individual terminals.

5.35 SPECIAL-USE – A cord set or power supply cord employing a non-NEMA plug or cord connector.

5.36 STRAIN RELIEF – A device molded on or assembled to flexible cord to inhibit any pull stress from being transmitted to the terminal attachments.

5.37 SUPPLEMENTARY CHARGING CIRCUIT – A Class 2 or limited power source (LPS) circuit intended for charging electronic devices, which may interface with a cord set or power supply cord through a device such as a USB female connector.

5.38 SWITCH – A device for making, breaking, or changing the connection in an electric circuit.

CONSTRUCTION

6 Fittings – General

6.1 Configurations and dimensions

6.1.1 Configurations, terminal identification, and required dimensions and spacings of various attachment plugs, cord connectors, and receptacle combinations are found in UL 60320-1, IEC 60320-1, IEC 60320-2-2, NEMA WD 6, and UL 1681. Dimensional compliance to a standard configuration shall be verified by measurement. Other configurations shall be evaluated as required.

6.1.2 A fitting shall be investigated for use with the rating, type, and size of flexible cord used in the assembly.

6.2 Flammability

6.2.1 A polymeric material used in the fittings of a cord set or power-supply cord shall have a minimum flammability rating of HB in accordance with UL 94, or comply with the 12 mm flame test in accordance with UL 746C.

6.3 Combustible materials

6.3.1 If a device employs flexible cord or the equivalent that is marked "HF" on the body of the cord, and where all individual combustible materials used in the construction of the device (e.g., inner mold/enclosure, outer mold/enclosure, etc.) are determined to be halogen free in accordance with UL 2885, the device may be surface marked on the plug and/or cord connector with the suffix "HF" after the catalog number.

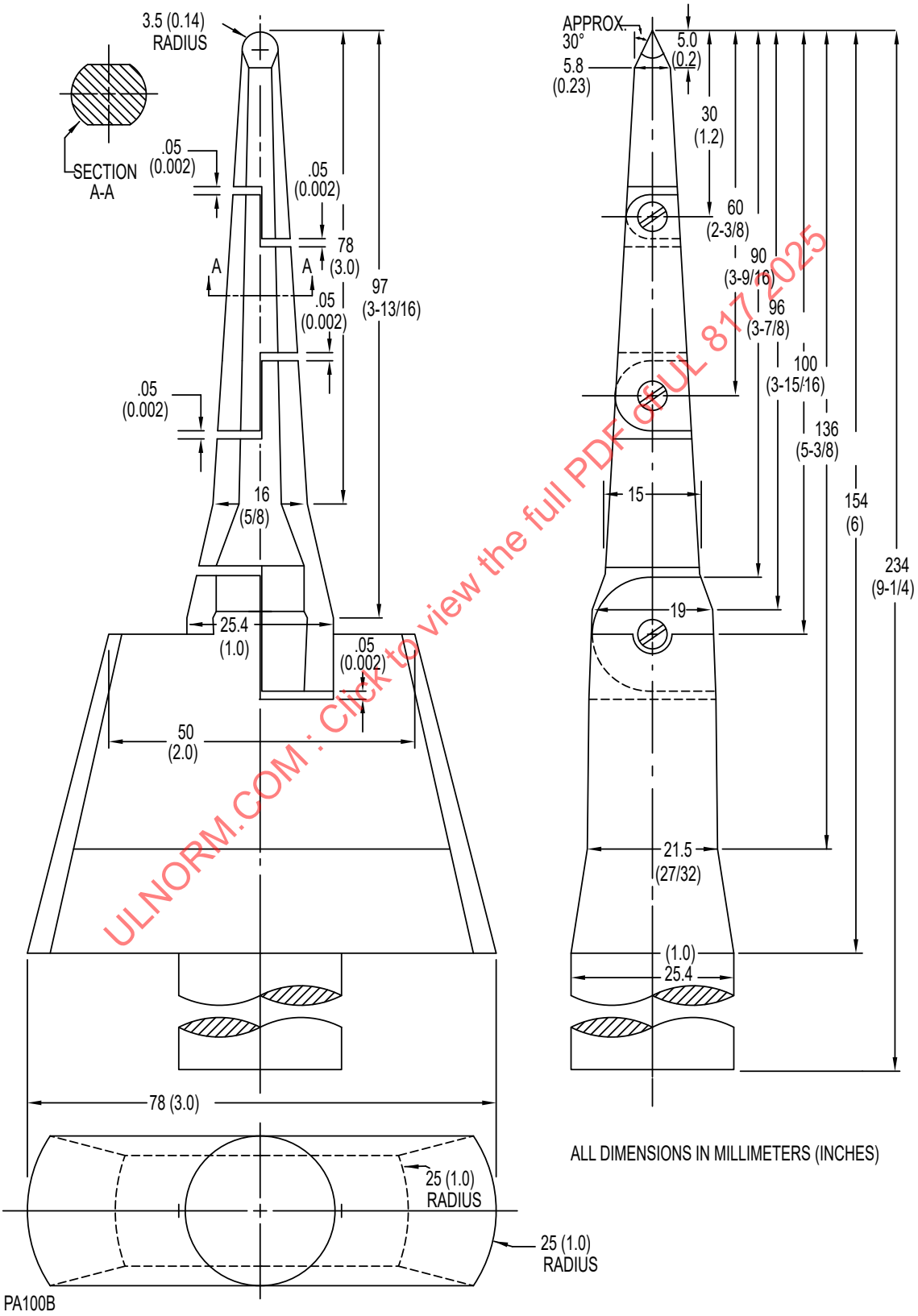
6.4 Accessibility of live parts

6.4.1 The electrical parts of a cord set or a power-supply cord that do not require use of a tool for access shall be located or enclosed so that persons are protected against inadvertent contact with uninsulated live parts and film-coated magnet wire.

6.4.2 The probe shown in Figure 6.1 shall not be able to contact uninsulated live parts of the connector. The probe shall be applied to any depth that the opening permits, and shall be rotated or angled before, during, and after insertion through the opening to any position that is required to examine the enclosure. The probe shall be applied in any possible configuration; and, when required, the configuration may be changed after insertion through the opening.

Figure 6.1

Articulate Probe with Web Stop



6.4.3 The probe shall be used as a measuring instrument to evaluate the accessibility provided by an opening and not as an instrument to evaluate the strength of a material; it shall be applied with the minimum force required to determine accessibility.

6.5 Connection to fittings

6.5.1 Each conductor shall be attached to the terminals of fittings in a manner that:

a) Keeps strands of any conductor from contacting either uninsulated live parts of opposite polarity or dead metal parts;

b) Provides mechanical security in accordance with 11.1;

c) Provides adequate ampacity in accordance with 12.2; and

d) Keeps strands from surfacing in a molded-on fitting.

6.5.2 Other forms of attachment of a conductor to the terminal of a fitting include the following:

a) Soldering and welding, when found to comply with the Conductor secureness test in 11.1 (see 6.5.3); and

b) Crimping, when found to comply with the Conductor secureness test in 11.1 and provide adequate ampacity in accordance with the Temperature test in 12.2.

6.5.3 When soldering is used as the means of connection, the construction shall ensure that there will be at least one right-angle bend or an offset in the conductor to prevent stress on the conductor from being transmitted directly to the connection.

6.6 Identification and wiring

6.6.1 A terminal on a fitting that is identified for the connection of either a grounded (the identified) conductor or the grounding conductor shall be correctly connected to the corresponding conductor of the cord.

6.6.2 A flexible cord assembled to a fitting that has any of the configuration contacts as illustrated in UL 1681 (C3.1 – C3.8), UL 60320-1, IEC 60320-1 and IEC 60320-2-2, or NEMA WD 6, shall comply with 6.6.3 and 6.6.4.

6.6.3 The conductor in the cord identified as follows shall be connected to the contact designated by the letter "W" or an equivalent means to designate the identified conductor:

a) Finished to show a white or gray color;

b) Covered by a white or gray braid;

c) Equivalently identified by:

1) A white or gray separator,

2) A stripe, ridge, or groove on the outside surface of the insulation, or

3) A tin or other white metallic coating on each strand.

d) Has light blue colored or light blue coated insulation; and:

1) The cord has a jacket not integral with the circuit conductor insulation,

2) The power-supply cord or cord set is factory installed in, or packaged with, an appliance, and

3) The shipping package is marked in accordance with 22.6.

6.6.4 The conductor in the cord identified as follows shall be connected to the contact designated by the letter "G" or an equivalent means to designate the grounding conductor:

a) Green with or without one or more yellow stripes; or

b) Covered by a green braid with or without one or more yellow tracers.

6.6.5 Terminals for devices with IEC 60320 configurations shall comply with the following:

a) Terminals for an IEC 60320-1 connector, when looking at the face of the connector, shall be as follows:

1) Earthing contact: upper central position,

2) Line contact: lower right-hand position, and

3) Neutral contact: lower left-hand position.

b) Terminals for an IEC 60320-2-2 plug, when looking at the face of the plug, shall be as follows:

1) Earthing contact: upper central position,

2) Line contact: lower left-hand position, and

3) Neutral contact: lower right-hand position.

c) Cord conductors shall be connected to the IEC connector and plug terminals in the following manner:

1) Green/yellow or green core to the earthing contact,

2) Brown or black core to the line contact, and

3) Light blue or white core to the neutral contact.

6.6.6 A flexible cord containing a grounding conductor shall not be assembled to a non-grounding plug or a non-grounding connector.

6.7 Treatment of cord-conductor coverings

6.7.1 The insulation, braid, or sheath on the flexible cord shall not be removed more than that necessary to make the proper connections within a fitting.

6.7.2 Suitable means shall be provided to inhibit fraying or slipping of the braid or insulation of the cord that would cause conductors external to a fitting to become exposed. Tubing or sleeving that complies with UL 224 or UL 1441 meets the intent of this requirement.

6.8 Outdoor-use fittings

6.8.1 Except as noted in 6.8.2, materials used for outdoor fittings when molded of polymeric material shall be subjected to:

a) The Weather (sunlight) resistance test in UL 746C for 720 hours for carbon arc or 1000 hours for Xenon-arc; and

b) The Crushing and Impact Resistance tests as indicated in 11.7 and 11.8, respectively.

6.8.2 Fittings molded of solid butyl rubber, neoprene, thermoplastic elastomer, or polyvinyl chloride shall not be required to comply with 6.8.1.

6.8.3 Except as indicated in 6.8.4, a molded fitting attachment plug of butyl rubber, neoprene, or polyvinyl chloride is acceptable if in compliance with the Adhesion test, 11.11. Molded-on cord connectors of other materials are acceptable if determined so by the results of special investigation.

NOTE: Special forms of construction not specified in this Standard shall be subject to special investigation.

6.8.4 A fitting rated 250 V or less and 30 A or less or a joint or other enclosure intended for use in:

a) Outdoor power supply cords;

b) Outdoor cord sets;

c) Outdoor extension cord sets; or

d) Outdoor special use power supply cords and cord sets;

Employing braided flexible cord types SPT-1W, SPT-2W, SJTW, STW, SJEW, or SEW with "-B" suffix, where the braid extends inside the device, the braid shall be terminated such that there is a minimum of 6.4 mm (1/4 inch) of insulating material separating the braid from any live part, and the power supply cord or cord set shall comply with the Rain test, 11.13.

7 Plugs

7.1 General

7.1.1 A blade used in a 15- or 20-A NEMA attachment plug cap shall comply with UL 1659. Where a blade is crimped and soldered, or welded, and/or where a blade is made mechanically secure and soldered directly to the conductor, connections need not comply with the performance requirements of UL 1659.

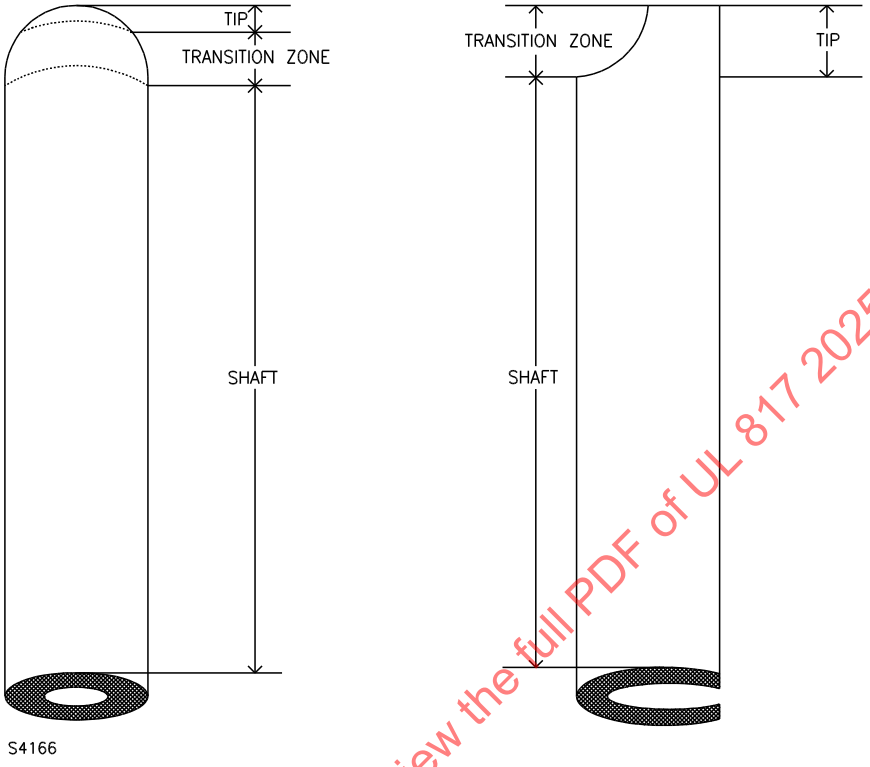
7.1.2 The grounding blade or pin of a 15- or 20-A non-locking type attachment plug shall not contain surface discontinuities that would tend to interfere with insertion into, or withdrawal from, a grounding contact of an outlet device. Abrupt surface transitions such as gaps, steps, offsets, detents, holes or sharp chamfers shall be specifically prohibited in the following areas shown in Figure 7.1:

a) The shaft; and

b) The transition zone between the tip and the shaft which is likely to engage the grounding contact during insertion or withdrawal.

Figure 7.1

Grounding Pin Profiles

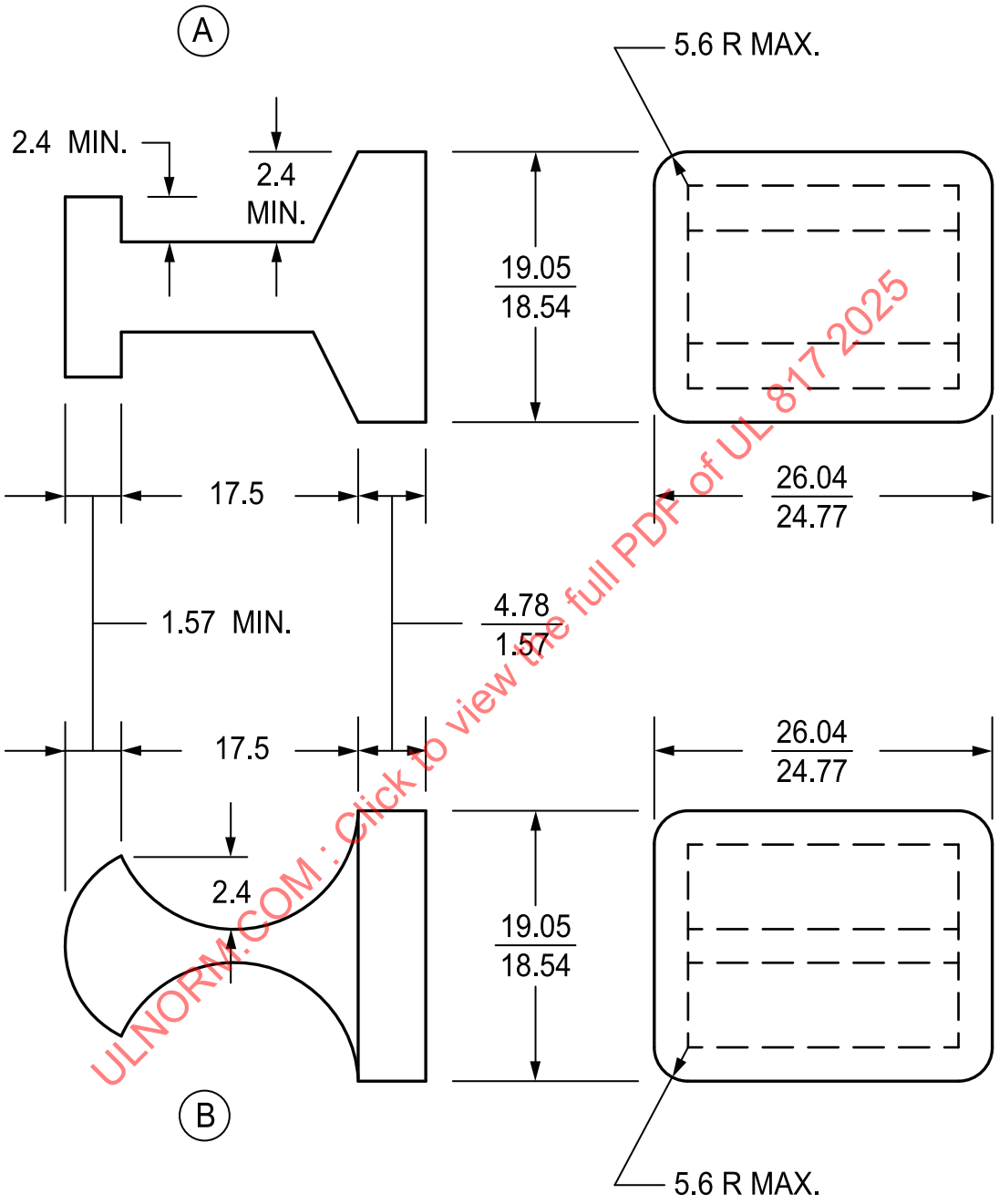


7.2 Attachment plug grip

7.2.1 The body of a molded-on NEMA attachment plug of the configuration 1-15P shall be shaped such that it is not likely to be grasped at the face periphery, but rather invites gripping at a section formed for such a purpose. The gripping area shall extend over a distance of at least 17.5 mm (0.688 inch) located between two higher sections. The section at the rear shall provide a sharply defined projection at least 2.4 mm (0.094 inch) high with a base of at least 1.57 mm (0.062 inch), and an overall width of at least 6.4 mm (0.25 inch), in accordance with Figure 7.2. In place of the gripping area, a finger grip in the form of a substantial closed loop capable of accommodating one or more fingers shall be permitted. Other gripping surfaces shall be permitted provided that they comply with 12.3. A grip or gripping surface might need to be additionally investigated for the ability to withstand the conditions of normal use such as flexing, mechanical strength, and similar conditions.

Figure 7.2

Attachment Plug Finger Grip and Blade Guards



2.4 MIN-MATERIAL OVER LIVE PARTS

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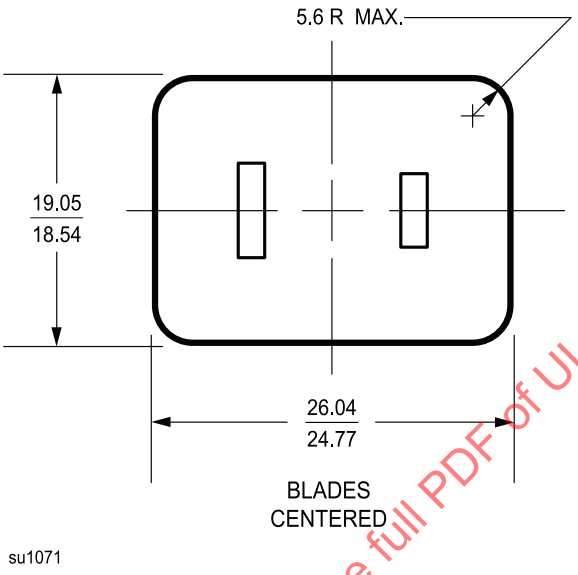
NOTE: All dimensions in mm.

mm	1.57	2.4	4.78 1.57	5.6	17.5	19.05 18.54	26.04 24.77
(inch)	(0.062)	(3/32)	(0.188) (0.062)	(7/32)	(11/16)	(0.750) (0.730)	(1.025) (0.975)

7.2.2 Two-wire attachment plugs shall have a face size equal to or larger than that indicated in Figure 7.3.

Figure 7.3

Male Fitting Face Dimensions



NOTE: All dimensions in mm.

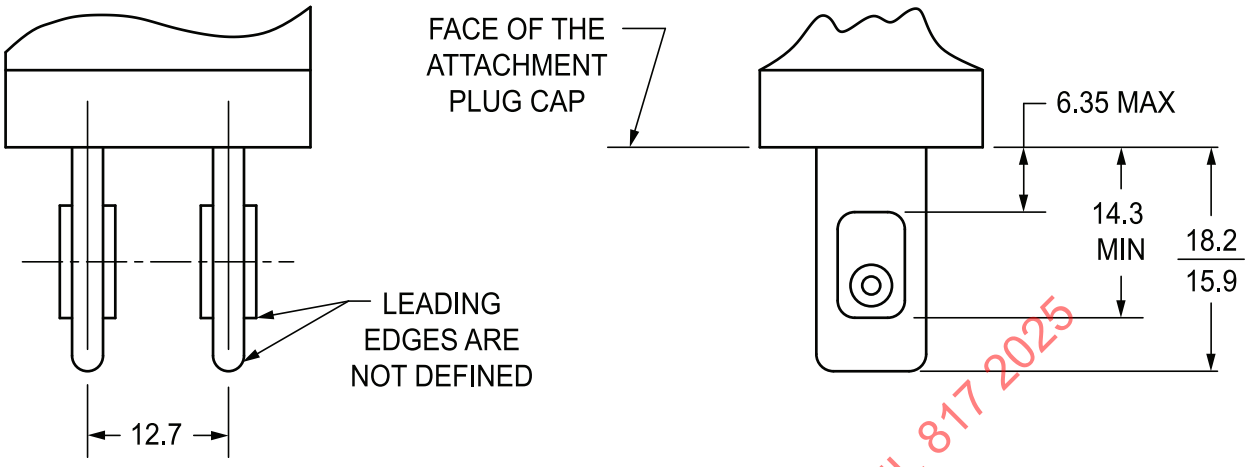
mm	5.6	19.05 18.54	26.04 24.77
(inch)	(7/32)	(0.750) (0.730)	(1.025) (0.975)

7.2.3 A shallow-bodied right-angle plug may exceed the maximum face size.

7.2.4 The blades shall be located as shown in Figure 7.4 and parallel to one another. Compliance shall be determined by full insertion, as described in 14.2, into a 1-15R.

Figure 7.4

Blade Construction of 2-Pole, 2-Wire Attachment Plug



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NOTE: All dimensions in mm.

mm	6.35	12.7	14.3	18.2 15.9
(inch)	(0.250)	(0.500)	(0.562)	(0.718) (0.625)

7.3 Hospital grade attachment plugs

7.3.1 A hospital grade molded-on attachment plug shall comply with the requirements in 7.3 and Section 18, Hospital Grade Molded-On Plugs and Connectors, and with all other applicable requirements in this Standard. These requirements are applicable only to configurations 5-15P, 5-20P, 6-15P, and 6-20P in accordance with NEMA WD 6. Attachment plugs shall be of the straight type (longitudinal axis of flexible cord parallel to that of the line blades), or right-angle type (longitudinal axis of flexible cord at right angle to that of the line blades), molded onto flexible cord.

7.3.2 Blades shall be formed of solid brass material in conformance with NEMA WD 6. The grounding pin shall not be capable of being easily bent or removed without the use of tools.

7.3.3 The size of the attachment plug shall allow the full insertion of two attachment plugs into a duplex receptacle.

7.3.4 The strain relief system shall comply with the requirements of 18.2, and shall not permit any forces applied to the cord to be transmitted to the point of electrical termination of the cord conductors inside the fitting.

7.3.5 A hospital grade plug shall be marked in accordance with Section 29, Hospital Grade Attachment Plugs, Connectors and Hospital Grade Extension Cords.

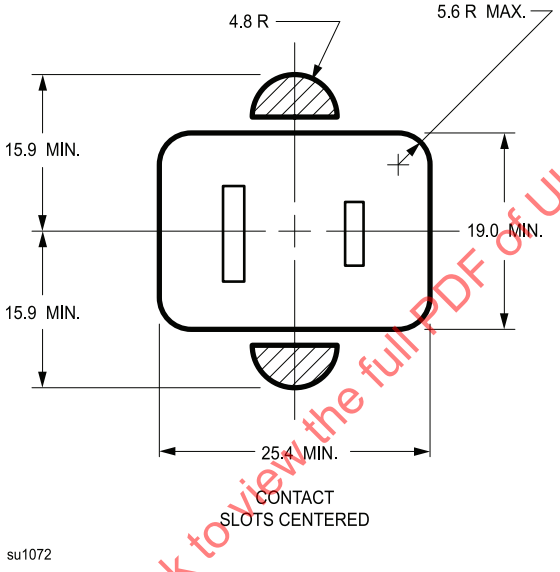
8 Cord Connectors

8.1 General

8.1.1 The perimeter of the outlet face of a 1-15R configuration shall meet the requirements of Figure 8.1. Two-wire molded-on cord connectors shall have a face size equal to or larger than that indicated in Figure 8.1.

Figure 8.1

Female Plug Face Dimensions



NOTE: All dimensions in mm.

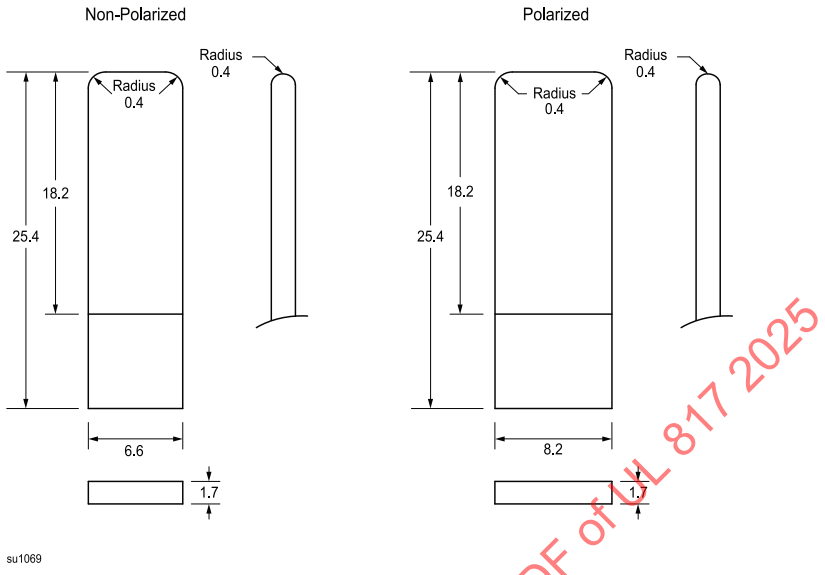
mm	4.8	5.6	15.9	19.0	25.4
(inch)	(3/16)	(7/32)	(5/8)	(3/4)	(1)

8.1.2 The female contacts of a 1-15R cord connector shall be recessed at least 6.4 mm (1/4 inch) from the face of the fitting.

8.1.3 A 1-15R cord connector shall accommodate a 1-15 plug without any blade exposure between the faces of the fittings as determined by the Depth of cavity test in 14.1. The depth gauge shall be as shown in Figure 8.2.

Figure 8.2

Depth of Cavity Gauge



NOTE: All dimensions in mm.

mm	0.4	1.7	6.6	8.2	18.2	25.4
(inch)	(1/64)	(0.065)	(0.260)	(0.322)	(0.718)	(1.0)

8.1.4 When two or more 1-15R outlets are on the same surface of a cord connector, they shall be spaced apart so as to allow adjacent plugs with the dimensions in Figure 7.3 to be fully inserted with no exposed blades.

8.1.5 The contact openings of all, or all but one, of the outlets of a cord connector shall be effectively and reliably closed by means that comply with the Closure of openings test, 14.11. The closure shall:

a) Be formed of insulating material having physical properties that can withstand the rigors of use and reasonably foreseeable abuse;

b) In no case, be removable from the cord set. A closure that is removable from the outlet shall remain within 150 mm (6 inches) of the cord connector while not in use after being tested in accordance with 14.11.2;

c) When positioned as intended, be capable of obstructing a straight steel wire that is 0.25 mm (0.010 inch) from touching any female contact;

d) Be capable of insertion into and withdrawal from the outlet in the intended manner without breakage or damage both before and after the cord connector and closure have been tested in accordance with 14.11.1.1;

e) Not impair the performance of the cord connector after three simulated insertions and withdrawals of the closure in the intended manner, after testing in accordance with 14.11.1.4; and

f) Not serve as a tab or handle used to open another closing means on the cord connector.

8.1.6 If the closing means consists of an insulating closure, it shall not be provided with handles, loops, knobs, or similar means that possibly facilitate removal. Such means shall not have been removed from an outlet after being subjected to a straight pull of 4.4 N (1 lbf) perpendicular to the face of the outlet.

NOTE: Special forms of construction not specified in this Standard shall be subject to special investigation.

8.1.7 Contact material shall be either copper or copper alloy.

8.2 Holes, indentations, and projections

8.2.1 A connector of a cord set may be provided with a means, such as a hole, hook, indentation, or similar means, molded to the cord connector body, to facilitate temporary positioning during use. A hole shall have a minimum inside diameter of 9.5 mm (3/8 inch). A projection shall not be used. A hole, hook, or indentation that could be used for permanent hang-up mounting of the connector shall not be used.

8.3 Improper insertion

8.3.1 Molded-on cord connectors of the 1-15R configuration, 5-15R configuration, or the non-polarized 1-15R configuration shall prevent the improper insertion of the mating attachment plug and/or the insertion of a ground pin into any contact opening so that it might contact live parts. Compliance is determined in accordance with 14.8.

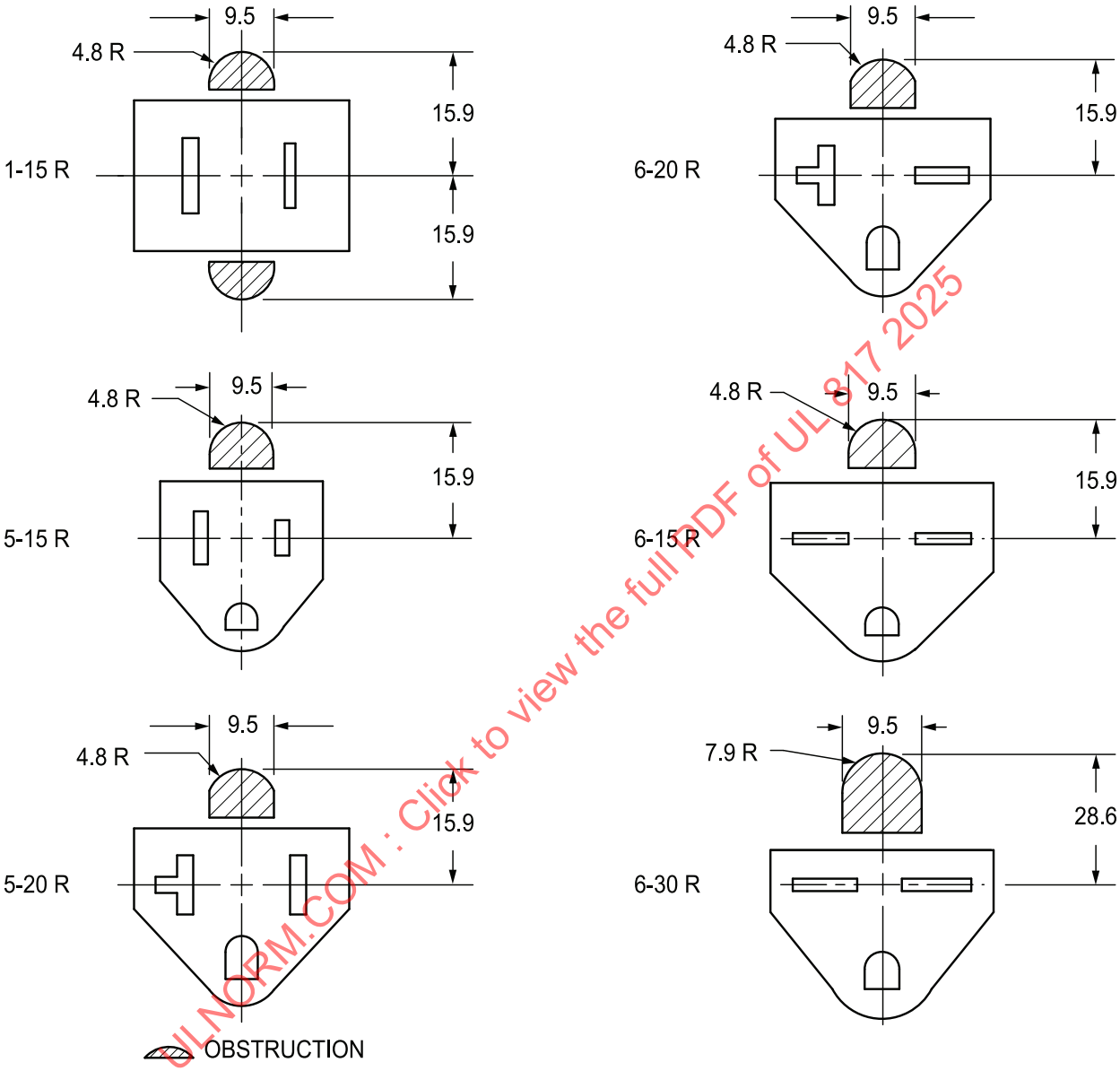
8.4 Mismating

8.4.1 Except as noted in 8.4.2, the face of a 1-15R cord connector shall be in compliance with Figure 8.1 and shall obstruct the insertion of an attachment plug of the 5-15P configuration.

8.4.2 The face of a cord connector of the 5-15R, 6-15R, 5-20R, 6-20R, or 6-30R configuration shall be in compliance with Figure 8.3 and obstruct the insertion of either its respective mating plug in the reverse direction in an attempt to deflect the ground pin to the outside of the face when inserting the line blades, or a dissimilarly rated grounding attachment plug.

Figure 8.3

Faces of Outlet Devices Showing Smallest Acceptable Obstructions



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NOTE: All dimensions in mm.

mm	4.8	9.5	15.9
(inch)	(3/16)	(3/8)	(5/8)

8.5 Cord connector – outdoor

8.5.1 A cord connector shall be resistant to sunlight and mechanical abuse, and shall exclude moisture by tightly adhering to the jacket of the cord at the point that the cord enters the body, in accordance with the Adhesion test, 11.11.

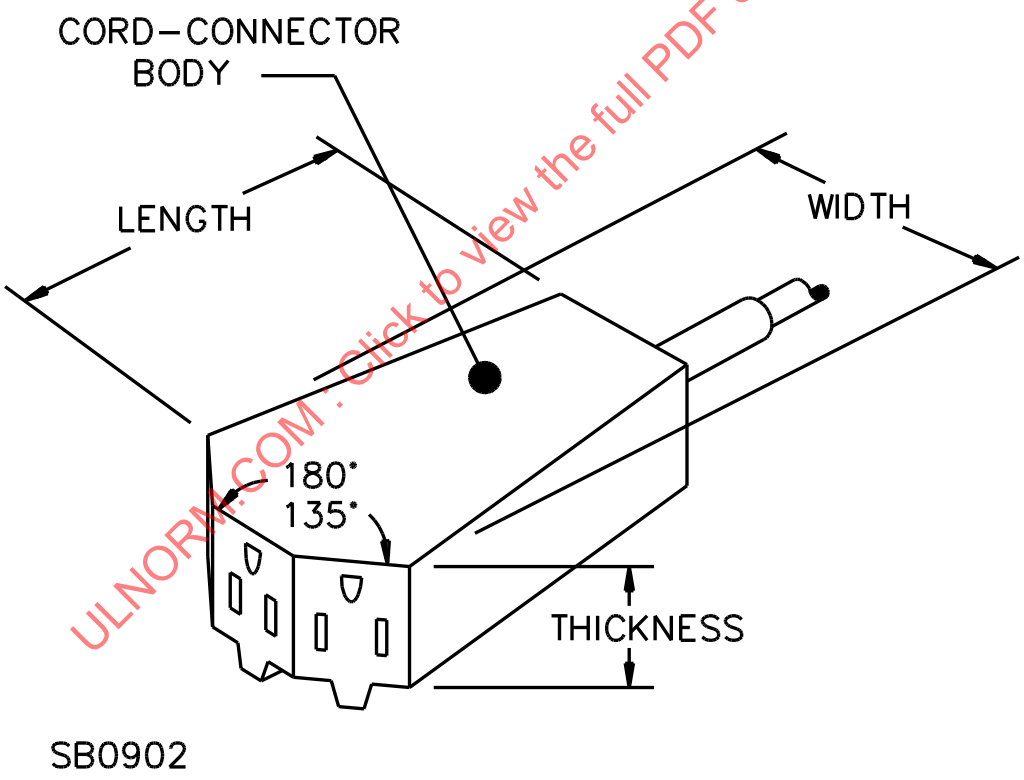
8.5.2 A cord connector shall have a maximum of three outlets. The configuration of the cord connector shall be the same as the attachment plug.

Exception: A cord connector body may have a maximum of six outlets when in accordance with Exceptions 1 – 3 of 10.7.2.1.7.

8.5.3 Each multi-outlet of a cord connector intended for outdoor-use shall have the outlets positioned in a vertical plane (the outlet faces not positioned face up or face down) as shown in Figure 8.4 in accordance with the Random drop test, 14.10.

Figure 8.4

Outdoor-Use Cord Set 3-Outlet Cord Connector



8.5.4 A 5-15R outlet face of a 3-outlet cord connector need not comply with 8.5.3 when:

a) The length and width dimensions are at least three times the maximum thickness dimensions, excluding the grounding pin obstruction(s);

b) There is no outlet in the surfaces formed by the length and width dimensions; and

c) The angle between the adjacent faces containing outlets is not less than 135°. See Figure 8.4.

8.5.5 When two or more 1-15R or 5-15R outlets are on the same surface of a cord connector, they shall be spaced apart so as to enable adjacent plugs having the minimum face size shown in Figure 7.3 to be fully inserted with no exposed blades.

8.5.6 Each outlet of a cord connector for an outdoor-use cord set shall be tested as described in the Low-temperature insertion test, 14.9, to determine that connector(s) are capable of low-temperature connection.

8.6 Hospital grade connectors

8.6.1 A hospital grade molded-on connector shall comply with the requirements in Section 18 and with all other applicable requirements in this Standard. These requirements are applicable only to configurations 5-15R, 5-20R, 6-15R, and 6-20R in accordance with NEMA WD 6. Connectors shall be of the straight type (longitudinal axis of flexible cord parallel to that of the contacts), or right-angle type (longitudinal axis of flexible cord at right angle to that of the contacts), molded onto flexible cord.

8.6.2 A hospital grade connector shall be marked in accordance with Section 29.

8.7 Latching type cord connectors

8.7.1 A cord connector of the 1-15R, 5-15R, 5-20R, 6-15R, or 6-20R configuration is permitted to be provided with an integral latching mechanism.

8.7.2 A cord connector with an integral latching mechanism shall be subjected to the applicable tests in Tests for Cord Connectors, Section 14, with the mechanism in place and defeated. In addition, a cord connector provided with a manual or spring-activated latching mechanism shall be subjected to the Latching Mechanism Tests, Section 21.

8.7.3 A spring employed in a cord connector with an integral latching mechanism shall be copper or copper alloy, of a corrosion-resistant steel (stainless), or protected against corrosion by metallic plating or other metal coating.

9 Other Components

9.1 General

9.1.1 The construction requirements in this section cover components other than plugs and cord connectors, such as strain relief clamps, switches, and overcurrent devices used in power-supply cords and cord sets.

9.2 Metal strain relief clamps

9.2.1 A strain relief clamp shall not affect the performance of round jacketed cable.

9.2.2 A strain relief that is part of a wiring device applied on Types SP-1, SPT-1, NISP-1, NISPT-1, SP-2, SPT-2, and NISP-2 and NISPT-2 cords or on tinsel cords shall be acceptable only after previous investigation, and used with supplementary insulation tested in accordance with 11.3.3.

9.2.3 A strain relief clamp for Type SPT-3 shall comply with the test in 11.3.3 if the design of the clamp appears to cause damage to the cord.

9.2.4 A strain relief for flexible cords other than Type HSJ or Type C and heavier general-use cords shall have between the strain relief clamp and the cable of at least one layer of supplementary insulation, unless the construction of the clamp is such that the cord jacket will not be adversely affected.

9.3 Switches

9.3.1 A through-cord or pendant switch shall comply with the performance requirements of UL 20. An AC/DC rated through-cord or pendant switch shall be rated not less than "6 A, 120 V - 3 A, 250 V". An AC-only rated through-cord or pendant switch shall be rated not less than "10 A, 120 V AC". These requirements apply to all switches, including supplementary protectors being used as a switch actuator, and having a reset button or containing symbols, words, or letters, meaning "ON/OFF".

9.3.2 A supplementary protector located within the plug body, having a reset button that is similar in shape to a switch actuator and marked "Not to be used as a switch" or equivalent, shall comply with UL 61058-1. The marking shall be located as identified in 23.1.10.

9.3.3 A switch in a cord set or power-supply cord that is not polarized shall simultaneously open all of the supply conductors.

9.3.4 A switch in a polarized cord set or power-supply cord shall simultaneously open all current carrying conductors.

9.3.5 A switch shall not open the grounding conductor of a cord set.

9.3.6 A dimmer switch for use only with an incandescent lamp load, having a rating of at least 300 W and marked in accordance with 23.1.7, shall be used as the pendant switching device on the cord set described in 10.7.4.2.2.

9.3.7 A pendant switch used in an extension cord set shall not be of a dimmer type.

9.4 Switches – outdoor

9.4.1 A switch provided on an outdoor-use cord set shall comply with the requirements for switches described in 9.3.1 – 9.3.7 in addition to the requirements in this section.

9.4.2 Each switch provided on an outdoor-use cord set shall have an enclosure to reduce the likelihood of persons unintentionally contacting uninsulated live parts of the switch.

9.4.3 The enclosure of a switch provided on an outdoor-use cord set shall be comprised of material that has a minimum flammability rating of HB, in accordance with UL 746C.

9.4.4 A switch enclosure shall be of a material having moisture absorptive properties in accordance with UL 746A. Molded phenolic and similar thermosetting polymeric materials are considered to have moisture-absorptive properties for use as the enclosure of a switch. Fiber and similar absorptive materials are not considered to have moisture-absorptive properties for use as the enclosure of a switch.

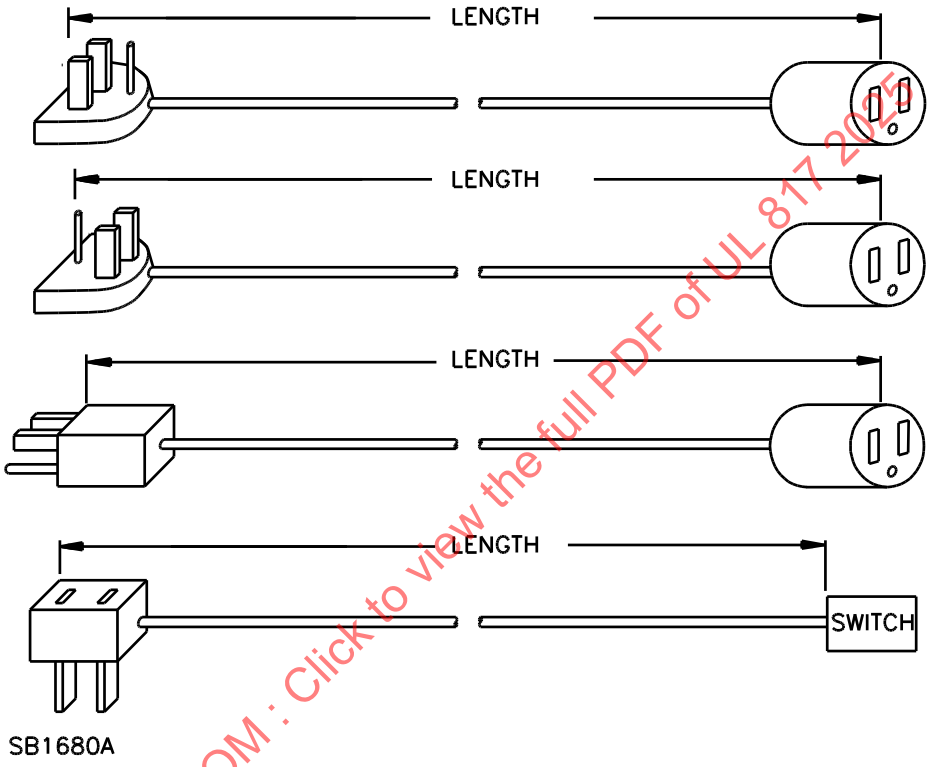
9.4.5 The enclosure of a switch intended for use on an outdoor-use cord set shall not permit water to enter that portion of an attachment plug or current tap that serves as the enclosure of the switch so as to contact live parts as determined by the Water exclusion test, 17.6.

9.5 Current taps and pendant switches

9.5.1 A single or multiple series-connected current tap may be provided on a general-use cord set if the series-connected flexible cord terminates in a pendant switch or a dimmer device and the flexible cord is not less than 1.8 m (6 feet) long when measured as described in Figure 9.1.

Figure 9.1

Cord Set and Power-Supply Cord Length Measurement



9.5.2 The outlets of a cord connector on a polarized cord set may be controlled by a single-pole pendant switch located on a flexible cord. The unidentified (switched) conductor of the flexible cord shall be continuous from the attachment plug, through the switch, to the cord connector.

9.6 Through-cord heating-pad switch

9.6.1 Each through-cord heating-pad switch shall be assembled with a means to provide strain relief unless all connections in the switch (except for a soldered joint in a slack portion of the through conductor) are riveted or welded, or unless such connections are made by means of eyelets, pressure wire connectors with closed-loop tangs, soldered loops in the conductors, or soldered joints where mechanical security is provided without depending upon the joint. Terminal binding screws shall not unthread completely when the switch is assembled. The through-cord heating-pad switch shall comply with the requirements of 11.3.6.

9.7 Fittings intended to accommodate overcurrent protective devices

9.7.1 An enclosure shall be provided for each overcurrent protective device provided on a cord set or power-supply cord.

9.7.2 The material of molded-on bodies of attachment plugs or current taps that serve as the enclosure for an overcurrent protective device shall operate within its recognized temperature limits when tested in accordance with the temperature test in 12.2. The test shall be performed with a rated fuse installed. The material shall not flame or melt to the extent that live parts are exposed or a replaceable fuse cannot be replaced. The material of any other type of enclosure shall be comprised of material in compliance with this Standard, and shall have a minimum flammability rating of V-2.

9.7.3 An overcurrent protective device enclosure shall:

a) Be of a material having moisture absorptive, flammability, and mechanical strength properties acceptable for the purpose and shall retain these properties when exposed to the maximum temperatures and other conditions of normal use;

b) Prevent unintentional contact with uninsulated live parts of the fuse and fuseholder; and

c) Confine the effects of a fuse rupture to the interior of the enclosure.

9.7.4 Fiber and similar absorptive materials shall not be considered to have moisture-absorptive properties acceptable for use as the enclosure of a fuse.

9.7.5 Molded phenolic and similar thermosetting polymeric materials are considered to be acceptable for use as a fuse enclosure.

9.7.6 The construction of a fusible plug that has male pins or blades, such as an attachment plug or current tap, shall be such that the fuse or fuses are not removable when the pins or blades are energized.

9.7.7 A fuseholder, attachment plug, or current tap intended to accommodate replaceable fuses shall be plainly and permanently marked in accordance with 23.1.2.

9.7.8 The enclosure of an overcurrent protective device intended for use on an outdoor-use cord set or power-supply cord shall be constructed so that water does not enter a through-cord fuseholder or that portion of an attachment plug or current tap which serves as the enclosure of the protective device (fuse or supplementary protector) so as to contact live parts when tested in accordance with 17.6.

9.8 Supplementary charging circuits and induction power transmitters

9.8.1 A supplementary charging circuit, including that which provides power to an induction power transmitter, provided in a general-use cord set or power-supply cord shall, with regard to separation of circuits and output voltage, current, and power limitations, comply with the requirements for a Class 2 circuit of UL 1310, or with UL 60950-1, or UL 62368-1.

9.8.2 A supplementary charging circuit provided in a special-use power-supply cord intended for ITE equipment shall comply with the requirements of UL 1310 or UL 62368-1.

9.8.3 Induction power transmitters shall comply with the performance requirements of UL 2738.

9.8.4 The construction and performance of an enclosure of a supplementary charging circuit or an induction power transmitter shall comply with the requirements of electrical, fire, and mechanical enclosures, of UL 60950-1 or UL 62368-1.

9.8.5 A general use extension cord employing a supplementary charging circuit shall be marked in accordance with 23.1.15.

9.9 Devices employing remote control features

9.9.1 In addition to the requirements of this Standard, general-use cord sets and special-use nondetachable power-supply cords employing remote control features shall comply with UL 244A. Compliance with UL 60730-1 and/or the applicable Part 2 standard from the UL 60730 series fulfills these requirements.

9.9.2 The electrical tungsten rating of the switching device shall be greater than or equal to the rating of the cord set or power-supply cord.

9.9.3 The switching device shall be capable of controlling up to and including a 1/2 HP motor. If the cord set or special-use power-supply cord is not intended for use with a motor load, the unit shall be marked as noted in 23.4.1 or 10.9.6.4, respectively.

9.9.4 The output shall not only be controlled by the remote controller. A separate individual switch/interface shall be provided on the unit to disconnect the main power of the device.

9.9.5 A switch used to directly control a load fitting, shall comply with the performance requirements contained in UL 20, for an AC only through cord switch or a special-use switch that complies with UL 61058-1. The switch shall be AC tungsten rated and have an electrical rating equal to or greater than the rating of the cord set or power-supply cord. These requirements apply to all switching mechanisms such as relays, supplementary protectors, and switches which contain symbols, words, or letters meaning ON/OFF.

9.9.6 A general-use cord set employing a remote control feature shall be marked in accordance with 23.1.12 and 23.1.13.

9.9.7 A special-use nondetachable power supply cord employing a remote control feature shall be marked in accordance with 10.9.5.2 and 10.9.6.3.

9.9.8 The battery compartment of an appliance or any accessory, such as a wireless control, incorporating one or more button batteries or coin cell batteries shall comply with UL 4200A, if the appliance or any accessory:

a) Is intended for use with one or more single cell batteries having a diameter of 32 mm (1.25 inch) maximum with a diameter greater than its height; and

b) The appliance is intended for household use.

9.10 Overcurrent protection

9.10.1 Cord sets and power-supply cords that comply with 10.1 – 10.16 may be provided with overcurrent protection (short circuit and overload protection) rated to equal to or less than the ampacity of the flexible cord. Supplementary overcurrent protection found in compliance with UL 1077, and with the requirements for overcurrent protective devices in Section 17, Tests for Overcurrent Protective Devices, of this Standard, meets the intent of this requirement.

9.10.2 Supplementary overcurrent protection is an acceptable method of providing the protection required in 9.10.1; however, thermal cutouts, thermal relays, and other devices not intended to open short circuits shall not be used.

9.10.3 The overcurrent protective device may be of the replaceable or manually resettable, but not of the automatic resetting type, and shall have a minimum short circuit rating of 1000 A.

9.10.4 The overcurrent protective device shall be located in the attachment plug or current tap, or be of a through-cord design located not more than 150 mm (6 inches) from the face of the plug to the rear of the fuseholder. A fuseholder, when provided, shall comply with UL 4248-1 and the requirements in Section 17.

9.10.5 The overcurrent protective device shall provide protection for each unidentified circuit conductor, but not for any identified (grounded) circuit conductor or grounding conductor unless all branch circuit conductors are simultaneously open. The overcurrent protective device shall not open the grounding conductor.

9.11 Cord restraint devices

9.11.1 In addition to the applicable general requirements, a cord restraint device shall comply with the requirements in 9.11.2 – 9.11.4.

9.11.2 A cord restraint device is intended to reduce the likelihood of an attachment plug becoming unintentionally detached from a mating cord connector of a cord set or any outlet device.

9.11.3 Cord restraint devices shall not be integral with or permanently attached to a cord set or outlet device, but are considered separate add-on devices. A cord connector employing latching mechanism shall comply with the requirements as described in Latching Type Cord Connectors, 8.7.

9.11.4 If the cord restraint device encapsulates or confines the air space within the enclosure, it shall comply with the Temperature test for cord restraint devices as described in 19.1.

9.12 Electronic circuitry

9.12.1 Except as indicated in 9.8.4, a polymeric material used as an enclosure or in contact with electrical components shall have a suitable relative thermal index rating in accordance with UL 746A or UL 746B.

9.12.2 Except as indicated in 9.8.4, a printed wiring board shall comply with UL 796, and have a minimum flammability rating of HB as determined by the applicable tests in UL 94.

9.12.3 The temperature measured on a printed wiring board shall not exceed its maximum operating temperature when tested in accordance with the Temperature Test, 12.2, when corrected to 25 °C (77 °F) ambient temperature.

10 Assembly

10.1 Power-supply cords

10.1.1 General

10.1.1.1 A power-supply cord shall be constructed with a flexible cord as defined in Table 10.1, a male plug at one end and non-terminated leads on the opposite end.

Table 10.1
Types of Flexible Cord, Cable, and Wire for Power-Supply Cords and Cord Sets

Tinsel cords	Heater cords	General-use cords				Specific-purpose cords, cables, and wires
TPT	HPD	C	SP-1	SV	SJ	XTW
TST	HPN	PD	SPT-1	SVO	SJO	CXTW
	HSJ	S	SPE-1	SVOO	SJOO	Clock
	HSJO	SO	SP-2	SVT	SJT	SRD
	HSJOO	SOO	SPT-2	SVTO	SJTO	SRDT
	HSJOOW	ST	SPE-2	SVTOO	SJTOO	SRDE
	HSJOW	STO	SP-3	SVE	SJE	Shaver
		STOO	SPT-3	SVEO	SJEO	
		SE	SPE-3	SVEOO	SJEOO	
		SEO	NISP-1	NISPE-1	NISPT-2	
		SEOO	NISPT-1	NISP-2	NISPE-2	
			STW	SJEW	SW	
			STOW	SJEOW	SOW	
			STOOW	SJEOOW	SOOW	
			SEW	SJTW		
			SEOW	SJTOW	SJOW	
			SEOOW	SJTOOW	SJOOW	

NOTES:

1 – It is intended that this table be used in conjunction with applicable end-use product Standards to ensure selection of the proper size and type.

2 – Tinsel cords are limited to use in power-supply cords not larger that 2.4 m (8 feet) overall, including the plug and connector (when provided) but excluding the blades of an attachment plug.

3 – Type SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW, SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, or SJEOW cord that is marked "outdoor" is not acceptable for use in power-supply cords.

4 – Type SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, and SEOOW cord that is marked "For mobile-home use: ___ amperes" is limited to use in power-supply cords for mobile homes. A Type SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, or SEOOW cord marked "For recreational vehicle use: ___ amperes" is limited to use in power-supply cords for recreational vehicles.

5 – Types SP-3, SPT-3, and SPE-3 cords are acceptable for use in power-supply cords for certain appliances that are not frequently moved.

6 – In SP-1, NISP-1, SP-2, NISP-2, SP-3, SPT-1, NISPT-1, SPT-2, NISPT-2, SPT-3, SPE-1, NISPE-1, SPE-2, NISPE-2, SPE-3, SV, SVO, SVOO, SVT, SVTO, SVTOO, SVE, SVEO, SVEOO, and HPN type cords, the third conductor is for grounding purposes only.

7 – Types SP-2, SPT-2, SPE-2, NISP-2, and NISPE-2 cords employing 30 AWG (0.05 mm^2) stranding are limited to use in extension cord sets that are not likely to be subjected to frequent flexing.

8 – Types XTW, CXTW, clock cords, and shaver cords are limited to use in power-supply cords marked as required in 32.2.

9 – Types SRD, SRDT, and SRDE cables are limited to use where they are not subject to frequent flexing such as with electric ranges and clothes dryers and other appliances rated 30 A or greater that are not frequently moved.

10 – Cord constructions that can be demonstrated to be equivalent to integral Type SPT-2 flexible cord may be used in power-supply cords having a retractile (coiled) cord construction.

11 – Cord types that employ a shield or a shield and drain wire (see 10.1.4.2) are identified by the word "shielded" marked on the outer surface of the cord.

Table 10.1 Continued on Next Page

Table 10.1 Continued

Tinsel cords	Heater cords	General-use cords	Specific-purpose cords, cables, and wires
12 – The use of shaver cord is limited to factory-assembled power-supply cords intended for hand-held hair clippers and shaving appliances rated 50 W or less. 13 – Appliance Wiring Material constructed similarly to Type SPT-1 flexible cord, except that the extruded PVC insulation thicknesses are 1.02 mm (40 mils) average minimum, 0.889 mm (35 mils) minimum at any point before separation, 0.483 mm (19 mils) minimum at any point after separation, and 1.52 mm (60 mils) minimum between conductors, is acceptable for use with chain-suspended portable lamps. 14 – A 20 AWG (0.52 mm^2) power-supply cord, constructed of Appliance Wiring Material having 36 – 34 AWG (0.013 – 0.020 mm^2) stranding and insulation (and jacket, if appropriate), having a thickness equal to the insulation thickness of the flexible cord type it is intended to replace, is acceptable for use as described in 10.1.2.1 and 10.1.2.2. 15 – Conductors sized 20 AWG (0.52 mm^2) have been approved only for Types CXTW, XTW, SP-1, NISP-1, SPE-1, NISPE-1, Clock and SPT-1 and NISPT-1. 16 – Conductors sized 22 AWG (0.33 mm^2) have been approved only for Type CXTW. 17 – Flexible cord constructions that have been evaluated to UL 62 requirements for -R cable and to the end product requirement for the use in fans and heaters and that require extra heavy wall flexible cord shall be identified with the -R designation appearing on the cord jacket. 18 – Flexible cord constructions that have been evaluated to UL 62 requirements for a "-B" suffix, shall be identified with the "-B" designation appearing on the cord jacket or on a marker tape beneath the braid.			

10.1.1.2 Power-supply cords shall comply with the applicable requirements of 5.1 – 5.4 and the applicable requirements of 10.1.1 – 10.1.7.

10.1.1.3 There shall be a conductor attached to each blade or pin in the attachment plug and there shall be a blade or pin provided for each conductor in the cord.

10.1.1.4 An outdoor-use power-supply cord is intended for use on outdoor appliances that are to be stored indoors while not in use. It is also acceptable for indoor use.

10.1.1.5 Each outdoor-use power-supply cord may be either the non-grounding type containing 2 circuit conductors or the grounding type containing 2 or 3 circuit conductors and a grounding conductor.

NOTE: The attachment plug of an outdoor-use power-supply cord need not be polarized.

10.1.1.6 In addition to the cord types specified in Table 10.1, SPT-2W and SPT-2W-R may also be employed in power-supply cords as noted in UL 507 and in UL 588.

10.1.1.7 An outdoor-use power-supply cord employing SPT-1W, SPT-2W, SJTW, STW, SJEW, or SEW type flexible cord with "-B" suffix shall comply with 6.8.4.

10.1.2 Attachment to fittings – plugs

10.1.2.1 Except as noted in 10.1.2.2 – 10.1.2.4, 2-wire power-supply cords with polarized or non-polarized parallel-blade attachment plugs or current taps rated 15 A, 125 V and employing the following 2-conductor flexible cord shall employ attachment plugs or current taps that comply with 7.2:

a) 27 AWG, Types TPT, TST, and shaver cord.

b) 20 AWG (0.52 mm^2), Types SP-1, NISP-1, SPE-1, SPT-1, NISPE-1, and NISPT-1.

c) 20 AWG (0.52 mm^2), Appliance Wiring Material constructed in accordance with note 14 of Table 10.1.

d) 20 AWG (0.52 mm^2), clock cord.

e) 18, 20, 22, 24 AWG (0.824, 0.052, 0.33, 0.20 mm^2), Types XTW and CXTW.

f) 18 AWG (0.824 mm^2), Types CXTW, HPD, HPN, HSJO, SP-1, NISP-1, SP-2, NISP-2, SPT-1, SPT-1W, NISPT-1, SPT-2, SPT-2W, NISPT-2, SPE-1, NISPE-1, SPE-2, NISPE-2, SV, SVO, SVOO, SVT, SVTO, SVTOO, SVE, SVEO, SVEOO, SJ, SJO, SJOO, SJOW, SJOOW, S, SO, SOO, SOOW, SOW, SPT-3, SJT, SJTW, SJTO, SJTOO, STO, STOO, ST, STW, SJTOW, SJTOOW, STOW, and STOOW.

g) 17 AWG (1.04 mm^2), Types HPN, HPD, SV, SVO, SVOO, SVT, SVTO, SVTOO, SVE, SVEO, SVEOO, SJT, SJTO, SJTOO, SJTW, SJTOW, and SJTOOW.

h) 16 AWG (1.31 mm^2), Types CXTW, HPD, HPN, HSJO, SP-2, NISP-2, SPT-2, NISPT-2, SPE-2, NISPE-2, SV, SVO, SVOO, SJ, SJO, SJOO, SJOW, SJOOW, S, SO, SOO, SOOW, SOW, SPT-1, NISPT-1, SPT-3, SJT, SJTW, SJTO, SJTOO, STO, STOO, ST, STW, SVT, SVTO, SVTOO, SJTOW, SJTOOW, STOW, and STOOW.

10.1.2.2 A power-supply cord having 20 AWG (0.52 mm^2) conductors and employing either appliance wiring material constructed in accordance with note 14 to Table 10.1, or Type SP-1, NISP-1, SPE-1, NISPE-1, SPT-1, or NISPT-1 flexible cord shall:

a) Have a 2-pole, 2-wire line plug of the 15-A, 125-V Type that complies with 7.2; and

b) Be provided with overcurrent protection in accordance with 9.10.

10.1.2.3 A power-supply cord of a toy transformer or electric toy need not comply with 10.1.2 (see 10.2.3).

10.1.2.4 A 2-conductor power-supply cord intended for use with a vacuum cleaner or floor finishing machine that meets the following conditions may have an attachment plug larger than that specified in Figure 7.3:

a) The flexible cord employed is Type SV, SVO, SVOO, SVT, SVTO, SVTOO, SVE, SVEO, or SVEOO;

b) The cord employed is at least 4.6 m (15 feet) long; and

c) The power-supply cord is marked in accordance with 32.4 and 32.5.

10.1.2.5 A current tap may be used for the plug on power-supply cords not intended for outdoor use.

10.1.3 Other components

10.1.3.1 The power-supply cord may include a through-cord switch or other intermediate device connected in the flexible cord.

10.1.3.2 A crimped-on terminal connector (such as a ring, tongue, or quick connect type) that complies with UL 310, UL 486A-486B, or UL 486E, may be applied at the load end on one or more of the conductors.

10.1.3.3 A strain relief or antikink device, or both, assembled to the cord may be used.

10.1.3.4 A through-cord switch may be employed on a power-supply cord except for:

a) Those types covered in 10.10; and

b) Those intended for replacement use.

10.1.3.5 A through-cord switch employed on a power-supply cord shall comply with the requirements of 9.3.

10.1.4 Flexible cord

10.1.4.1 The flexible cord of a power-supply cord shall be one of the cords in Table 10.1. The maximum circuit-conductor ampacity of cords used in power-supply cords is shown in Table 10.2 and Table 10.3.

Table 10.2
Circuit-Conductor Ampacity and Voltage Rating for Jacketed Cords in Extension Cord Sets and Power-Supply Cords

Types of cord	Size of conductors in cord		Number of cord conductors	Number of current carrying conductors[a]	Ampacity of current carrying conductors, (A)		Voltage rating of cord
	AWG	(mm^2)			0 – 15.2 m (0 – 50 feet)	Over 15.2 m (over 50 feet)	
S, SO, SOO, SOOW, SOW, ST, STO, STOO, STW, STOW STOOW, SE, SEO, or SEOO	18	(0.824)	2, 3 or 4	2	10	7	600
			3 or 4	3	7	5.6	600
	16	(1.31)	2, 3 or 4	2	13	10	600
			3 or 4	3	10	7	600
	14	(2.08)	2, 3 or 4	2	18	13	600
			3 or 4	3	15	10	600
	12	(3.31)	2, 3 or 4	2	25	18	600
			3, 4 or 5	3	20	15	600
	10	(5.26)	2, 3 or 4	2	30	25	600
			3, 4 or 5	3	25	20	600
	8	(8.37)	2, 3 or 4	2	40	30	600
			3, 4 or 5	3	35	25	600
	6	(13.3)	2, 3 or 4	2	55	40	600
			3, 4 or 5	3	45	35	600
	4	(21.2)	2, 3 or 4	2	70	55	600
			3, 4 or 5	3	60	45	600
	2	(33.6)	2, 3 or 4	2	95	70	600
			3, 4 or 5	3	80	60	600
SJ, SJO, SJOO, SJT, SJTO, SJTOO, SJE, SJEO, SJEOO, SJTOW, SJTOOW, SJOW, SJOOW, SJTW	18	(0.824)	2, 3 or 4	2	10	7	300
			3 or 4	3	7	5.6	300
	16	(1.31)	2, 3 or 4	2	13	10	300
			3 or 4	3	10	7	300
	14	(2.08)	2, 3 or 4	2	18	13	300
			3 or 4	3	15	10	300
	12	(3.31)	2, 3 or 4	2	25	18	300
			3, 4 or 5	3	20	15	300
	10	(5.26)	2, 3 or 4	2	30	25	300

Table 10.2 Continued on Next Page

Table 10.2 Continued

Types of cord	Size of conductors in cord		Number of cord conductors	Number of current carrying conductors[a]	Ampacity of current carrying conductors, (A)		Voltage rating of cord
	AWG	(mm^2)			0 – 15.2 m (0 – 50 feet)	Over 15.2 m (over 50 feet)	
			3, 4 or 5	3	25	20	300
SV, SVO, SVOO, SVT, SVTO, SVTOO, SVE, SVEO, or SVEOO	18	(0.824)	2 or 3	2	10	7	300
	17	(1.31)	2 or 3	2	12	10	300
	16	(1.31)	2 or 3	2	12	10	300

[a] A conductor that is used to carry an unbalanced current from the other conductors shall not be considered to be a current-carrying conductor.

Table 10.3
Circuit-Conductor Ampacity and Voltage Rating for Braidless Parallel Cord in General-Use Cord Sets and Power-Supply Cords

Types of cord	Size of conductors in cord		Number of cord conductors	Number of current carrying conductors[a]	Ampacity of current carrying conductors, A		Voltage rating of cord
	AWG	(mm^2)			0 – 15.2 m (0 – 50 feet)	Over 15.2 m (over 50 feet)	
Appliance Wiring Material[c]	20[b]	(0.519)	2	2	2[d]	–	300
HPN	18	(0.824)	2 or 3	2	10	7	300
	17	(1.04)	2 or 3	2	12	10	300
	16	(1.31)	2 or 3	2	15	12	300
	14	(2.08)	2 or 3	2	20	17	300
	12	(3.31)	2 or 3	2	30	20	300
SP-1[b], SPT-1[b], SPE-1[b], NISP-1, NISPT-1, or NISPE-1	20	(0.519)	2	2	2[d]	–	300
	18	(0.824)	2 or 3	2	10	7	300
SP-2[g] SPT-2[g] SPE-2[g] NISP-2, NISPT-2, or NISPE-2	18	(0.824)	2 or 3	2	10	7	300
	16	(1.31)	2 or 3	2	13	10	300
SP-3[g]	18	(0.824)	2 or 3	2	10	7	300
	16	(1.31)	2 or 3	2	13	10	300
	14	(2.08)	2 or 3	2	18	13	300
	12	(3.31)	2 or 3	2	25	18	300
SPT-3[g] or SPE-3[g]	18	(0.824)	2 or 3	2	10	7	300
	16	(1.31)	2 or 3	2	13	10	300
	14	(2.08)	2 or 3	2	18	13	300
	12	(3.31)	2 or 3	2	25	18	300
	10	(5.26)	2 or 3	2	30	25	300
	18	(0.824)	3	2	10	–	300

Table 10.3 Continued on Next Page

Table 10.3 Continued

Types of cord	Size of conductors in cord		Number of cord conductors	Number of current carrying conductors[a]	Ampacity of current carrying conductors, A		Voltage rating of cord
	AWG	(mm^2)			0 – 15.2 m (0 – 50 feet)	Over 15.2 m (over 50 feet)	
TPT, TST	27		2	2	0.5	–	300
HSJO, HPN	18	(0.824)	2 or 3	–	10	–	300
	16	(1.31)	2 or 3	2	15	–	300
	14	(2.08)	2 or 3	2	20	–	300
	12	(3.31)	2 or 3	2	25	–	300
	10	(5.26)	4	3	30[f]	–	300
	8	(8.37)	4	3	50[f]	–	300
	6	(13.3)	4	3	50[f]	–	300
	4	(21.2)	4	3	60[f]	–	300

[a] A conductor intended for equipment grounding shall not be considered to be a current-carrying conductor.

[b] Applicable to power-supply cords only.

[c] Constructed in accordance with note 14 of Table 10.1.

[d] Limited to a maximum length of 3.6 m (12 feet).

[e] 20 AWG (0.52 mm^2) has been approved only for Type SPT-1.

[f] These current ratings are for Type DRT dryer and range cables only.

[g] Each of these 3-conductor parallel cord types shall not be acceptable for use on cord sets more than 3.0 m (15 feet) in length.

NOTE: It is intended that this table be used in conjunction with applicable end-use product Standards to ensure selection of the proper size and type.

10.1.4.2 Except as noted in 10.1.4.3, a power-supply cord may employ shielded cord, provided that the shield or drain wire is terminated, along with the grounding conductor, to both the grounding terminal of the attachment plug and, in the case of a cord set, to the grounding terminal of the appliance connector.

10.1.4.3 A power-supply cord or cord set employing shielded cord that does not have the shield or drain wire terminated, along with the grounding connector, to the grounding terminal of the attachment plug, connector, or both, shall be indelibly marked in accordance with 28.1.

10.1.5 Length

10.1.5.1 Maximum allowable lengths shall be in compliance with Table 10.2.

10.1.6 Ratings

10.1.6.1 Ratings shall be determined by the lowest rated component of the assembly and Table 10.4.

Table 10.4
Smallest Acceptable Conductor Size with Respect to Fittings used on Outdoor-Use Cord Sets and Outdoor-Use Power-Supply Cords[e]

Ampere rating of plugs	Number of cord conductors	Number of current-carrying conductors in cord[a]	Grounding required	Maximum number of outlets in cord connector when provided	Smallest acceptable conductor size AWG (mm^2)		Ampacity rating of cord (A)
					1.8 – 15.2 m (6 – 50[b] feet)	Over 15.2 m to 30.5 m (Over 50 – 100 feet)	
	2	2	No	1	–	18 (0.824)	7
	3 or 4	2	Yes	1	–	18 (0.824)	7
	4	3	Yes	1	–	18 (0.824)	7
	2	2	No	1	18 (0.824)	16 (1.31)	10
	3 or 4	2	Yes	1	18 (0.824)	16 (1.31)	10
	4	3	Yes	1	18 (0.824)	16 (1.31)	7 (10)[c]
15	2	2	No	1	16 (1.31)	14 (2.08)	13
	3 or 4	2	Yes	3	16 (1.31)	14 (2.08)	13
	4	3	Yes	1	16 (1.31)	14 (2.08)	10 (13)[c]
	2	2	No	1	14 (2.08)	12 (3.31)	15
	3 or 4	2	Yes	1	14 (2.08)	12 (3.31)	15
	4	3	Yes	1	14 (2.08)	12 (3.31)	15
	3	2	Yes	3	14 (2.08)	12 (3.31)	15
	3	2	Yes	4 – 6	12	10[d]	15
	3	2	Yes	4 – 6	14[f]	12[d]	15
20	3 or 4	2	Yes	1	12 (3.31)	10 (5.26)	20
	4	3	Yes	1	12 (3.31)	10 (5.26)	20
30	3 or 4	2	Yes	1	10 (5.26)	8	30
	4	2	Yes	1	10 (5.26)	8 (8.36)	30
50	3 or 4	2	Yes	1	6 (13.3)	4 (21.1)	50
	4	3	Yes	1	4 (21.1)	2 (33.6)	50
60	4	2	Yes	1	4 (21.1)	2 (33.6)	60
	4	3	Yes	1	4 (21.1)	2 (33.6)	60

[a] For the purpose of this table, a conductor that is used to carry the unbalanced current from the other conductors shall not be counted as a circuit conductor.

[b] Lengths specified are for outdoor-use cord sets only.

[c] The ampacity rating for over 15.2 m (50 feet).

[d] The maximum length of a cord set with 3 – 6 outlets in the cord connector(s) shall be 100 feet (30.5 m). The overall length of a cord set with a joint shall be determined from the sum of the lengths of the main cord (from plug to joint) plus the longest length of flexible cord after the joint to the cord connector.

[e] See the applicable Section for the specific requirements for each type of outdoor-use cord set.

[f] When a 14 AWG flexible cord is employed, an overcurrent protective device (OCP) device rated 15 Amps is required. See 10.7.1.3.

NOTE: Constructions over 30.5 m (100 feet) shall be evaluated under special investigations. Evaluation dependent upon end use.

10.1.7 Markings

10.1.7.1 An individually packaged power-supply cord intended for replacement purposes shall be marked in accordance with Section 31, Power-Supply Cords for Replacement Use.

10.2 Special-use power-supply cords

10.2.1 Each power-supply cord intended for special use shall consist of a length of flexible cord that employs a minimum of two circuit conductors assembled or molded without a cord connector or appliance connector but with a plug or current tap of a non-standard configuration, with or without a through-cord switch/overcurrent protective device, for direct connection to an appliance, and that incorporates design features (such as special cords and plugs) for a specific application.

10.2.2 The flexible cord of a power-supply cord shall be one of the cords in Table 10.1. The maximum circuit-conductor ampacity of cords used in power-supply cords is shown in Table 10.2 and Table 10.3.

10.2.3 A special-use power-supply cord intended for use with a toy transformer or electric toy shall employ Type SPT-2, NISPT-2, or equivalent or heavier flexible cord with an attachment plug having the distance measured from any point on the blades to the perimeter of the face at least 7.9 mm (5/16 inch).

10.2.4 A special-use power-supply cord intended to be woven in the links of a chain-suspended portable lamp shall:

a) Be at least 4.6 m (15 feet) long;

b) Have insulation acceptable for use at 105 °C (221 °F);

c) Employ a 1-15 polarized attachment plug or a 5-15 grounding-type attachment plug;

d) Be marked to indicate the intended use (see 32.6); and

e) Be constructed of:

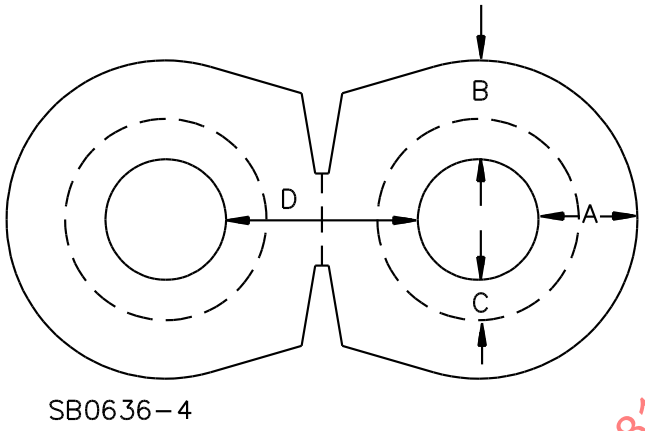
1) Type SPT-2 or NISPT-2, or heavier flexible cord,

2) Type SPT-1 or NISPT-1 flexible cord provided with a separate jacket of nylon, or

3) Appliance wiring material having 36 – 34 AWG (0.013 – 0.020 mm^2) stranding and complying with the insulation requirements specified in Figure 10.1.

Figure 10.1

Minimum Insulation Thicknesses for Appliance Wiring Material used in a Chain-Suspended Lamp



Legend:

A – Minimum acceptable average thickness away from tear area and outside point – 1.02 mm (0.040 inch)

B – Minimum acceptable thickness at any point before separation – 0.89 mm (0.035 inch)

C – Minimum acceptable thickness at any point after separation – 0.49 mm (0.019 inch)

D – Minimum acceptable distance between copper conductors – 1.52 mm (0.060 inch)

10.3 Recreational vehicle power-supply cords

10.3.1 General

10.3.1.1 The minimum cord-exposed length for power-supply cords for recreational vehicles shall be:

a) 7.5 m (25 feet) if intended for side entry; or

b) 9 m (30 feet) if intended for rear entry.

10.3.1.2 Overall length shall be augmented by the difference between the height of the entry point on the recreational vehicle and 0.9 m (3 feet), if the intended entry point is above 0.9 m (3 feet).

10.3.2 Flexible cord

10.3.2.1 The flexible cord used in power-supply cords for recreational vehicles shall be Type SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, or SEOOW for recreational-vehicle use. The size and number of conductors shall be in accordance with Table 10.5. The insulation on the grounding conductor shall be green, or green with one or more yellow stripes.

Table 10.5
Sizes and Number of Conductors in Recreational-Vehicle Power-Supply

Power-supply cord rating	Total number of conductors	Number of circuit conductors	Size of circuit conductors		Size of grounding conductor	
			AWG	(mm^2)	AWG	(mm^2)
15 A	3	2	14	(2.08)	14	(2.08)
20 A	3	2	12	(3.31)	12	(3.31)
30 A	3	2	10	(5.26)	10	(5.26)
40 A	4	3	8	(8.36)	8	(8.36)
50 A	4	3	6	(13.3)	8	(8.36)
50 A	4	3	6	(13.3)	6	(13.3)

10.3.3 Plugs

10.3.3.1 The attachment plug shall be in accordance with 10.3.3.2 and 10.3.3.3. The attachment plug shall be molded of butyl rubber, neoprene, or polyvinyl chloride (or other equivalent materials), and shall be so molded to the flexible cord that it adheres tightly to the jacket of the cord at the point where the cord enters the attachment plug (see 11.11). If a right-angle attachment plug is used, the configuration shall be so oriented that the grounding member is the member farthest from the point of cord entry.

10.3.3.2 The attachment plug used with 14 AWG (2.08 mm^2), 12 AWG (3.31 mm^2), or 10 AWG (5.26 mm^2) conductors shall be 5-15P, 5-20P, or TT-30P configuration.

10.3.3.3 The attachment plug used with 8 AWG (8.36 mm^2) or 6 AWG (13.3 mm^2) conductors shall be a 14-50P configuration.

10.3.3.4 A power-supply cord for recreational-vehicle use having 6 AWG (13.3 mm^2) circuit conductors may have the attachment plug marked 50 A. The attachment plug of a power-supply cord having 8 AWG (8.36 mm^2) circuit conductors shall not be marked with a current rating.

10.4 Mobile home power-supply cords

10.4.1 General

10.4.1.1 The overall length of each power-supply cord for mobile homes, measured from the end of the cord (including bared leads) to the end of the plug, shall not be less than 6 m (21 feet) nor more than 11.1 m (36.5 feet). The length of the cord from the end of the plug to the point at which the outer jacket of the cord is removed shall be at least 6.2 m (20.5 feet). See Figure 9.1.

10.4.2 Flexible cord

10.4.2.1 The flexible cord used in power-supply cords for mobile homes shall be Type SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, or SEOOW containing four 6 AWG (13.3 mm^2) conductors or four 8 AWG (8.36 mm^2) conductors or three 6 AWG (13.3 mm^2) circuit conductors and one 8 AWG (8.36 mm^2) grounding conductor.

10.4.2.2 The insulation on the grounding conductor in the cord mentioned in 10.4.2.1 shall be green, or green with one or more yellow stripes.

10.4.2.3 The outer surface of the cord shall be marked in accordance with the requirements of Section 28, Power-Supply Cords – Shielded.

10.4.3 Plugs

10.4.3.1 The attachment plug shall have a 14-50P grounding configuration. The attachment plug shall be molded butyl rubber, neoprene, or polyvinyl chloride (or other equivalent materials), and shall be so molded to the flexible cord that it adheres tightly to the jacket of the cord at the point where the cord enters the attachment plug (see 11.11.1). If a right-angle attachment plug is used, the configuration shall be so oriented that the grounding member is the member farthest from the point of cord entry.

10.4.3.2 A power-supply cord for mobile-home use having 6 AWG (13.3 mm^2) circuit conductors may have the attachment plug marked 50 A.

10.4.4 Rating

10.4.4.1 The current rating is:

a) 40 A for cord containing four 8 AWG (8.36 mm^2) conductors; and

b) 50 A for cord containing three 6 AWG (13.3 mm^2) circuit conductors and a 6 AWG (13.3 mm^2) or 8 AWG (8.36 mm^2) grounding conductor.

10.5 Range and dryer power-supply cords

10.5.1 General

10.5.1.1 Each power-supply cord for range and dryer application shall be non-detachable and employ Type SRD, SRDT, or SRDE flexible cable and shall be rated in accordance with Table 10.6.

Table 10.6
Circuit-Conductor Ampacity and Voltage Rating for Range and Dryer Cables
(Types SRD, SRDT, and SRDE)

Number, size, and use of conductors in cable		Ampacity of circuit conductors of cable (Amperes)	Voltage rating of cable (Volts)
2	10 AWG (5.26 mm^2) unidentified circuit and	30[a]	300
1	10 AWG (5.26 mm^2) grounded circuit		
2	10 AWG (5.26 mm^2) unidentified circuit and	30[a]	300
1	10 AWG (5.26 mm^2) grounded circuit and		
1	10 AWG (5.26 mm^2) grounding		
3	10 AWG (5.26 mm^2) unidentified circuit and	25[a]	300
1	10 AWG (5.26 mm^2) grounded circuit		
2	8 AWG (8.36 mm^2) unidentified circuit and	40[a]	300
1	10 AWG (5.26 mm^2) grounded circuit		
2	8 AWG (8.36 mm^2) unidentified circuit and	40[a]	300
1	10 AWG (5.26 mm^2) grounded circuit and		
1	10 AWG (5.26 mm^2) grounding		
3	8 AWG (8.36 mm^2) unidentified circuit and	36[c]	300
1	10 AWG (5.26 mm^2) grounded circuit		

Table 10.6 Continued on Next Page

Table 10.6 Continued

Number, size, and use of conductors in cable		Ampacity of circuit conductors of cable (Amperes)	Voltage rating of cable (Volts)
2	8 AWG (8.36 mm^2) unidentified circuit and	40[a]	300
1	8 AWG (8.36 mm^2) grounded circuit		
3	8 AWG (8.36 mm^2) unidentified circuit and	35[c]	300
1	8 AWG (8.36 mm^2) grounded circuit		
2	6 AWG (13.3 mm^2) unidentified circuit and	55[b,d]	300
1	8 AWG (8.36 mm^2) grounded circuit		
2	6 AWG (13.3 mm^2) unidentified circuit and	55[b]	300
1	8 AWG (8.36 mm^2) grounded circuit and		
1	8 AWG (8.36 mm^2) grounding		
3	6 AWG (13.3 mm^2) unidentified circuit and	45[c]	300
1	8 AWG (8.36 mm^2) grounded circuit		
2	6 AWG (13.3 mm^2) unidentified circuit and	55[b,d]	300
1	6 AWG (13.3 mm^2) grounded circuit		
3	6 AWG (13.3 mm^2) unidentified circuit and	45[c]	300
1	6 AWG (13.3 mm^2) grounded circuit		
2	4 AWG (21.1 mm^2) unidentified circuit and	70[b,d]	300
1	6 AWG (13.3 mm^2) grounded circuit		
2	4 AWG (21.1 mm^2) unidentified circuit and	70[b,e]	300
1	6 AWG (13.3 mm^2) grounded circuit and		
1	6 AWG (13.3 mm^2) grounded		
3	4 AWG (21.1 mm^2) unidentified circuit and	60[c]	300
1	6 AWG (13.3 mm^2) grounded circuit		
2	4 AWG (21.1 mm^2) unidentified circuit and	70[b,d]	300
1	4 AWG (21.1 mm^2) grounded circuit		
3	4 AWG (21.1 mm^2) unidentified circuit and	60[c]	300
1	4 AWG (21.1 mm^2) grounded circuit		

[a] The circuit-conductor ampacity shall be reduced by 5 A if grounded circuit conductor carries current other than unbalanced current.

[b] The circuit-conductor ampacity shall be reduced by 10 A if grounded circuit conductor carries current other than unbalanced current.

[c] The circuit-conductor ampacity shall be reduced to 80 % of the value shown if the grounded circuit conductor carries other than unbalanced current.

[d] When assembled into power-supply cords, the ampacity shall be limited to 50 A to correlate with rating of the standard 3-pole, 3-wire attachment plug configuration employed.

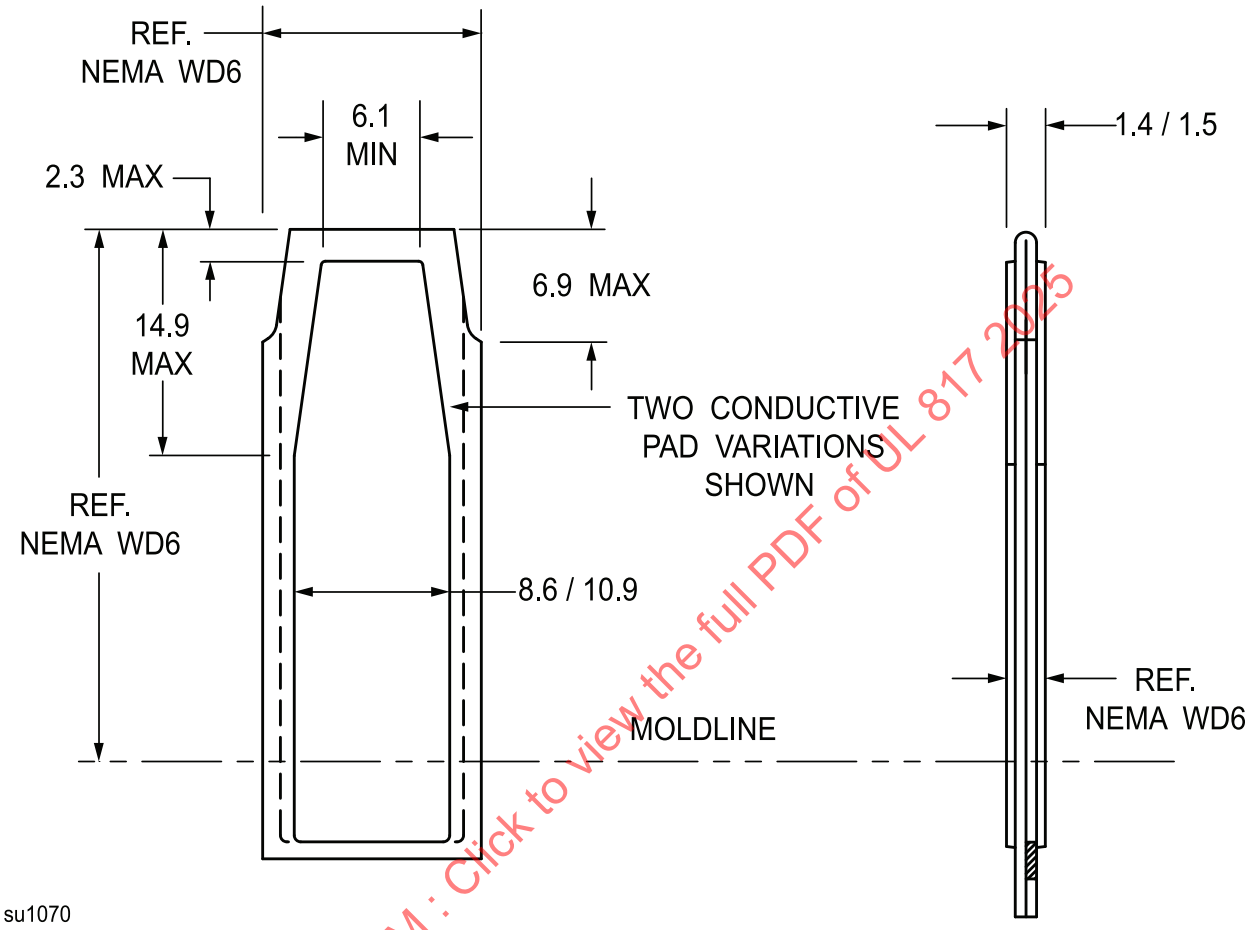
[e] When assembled into power-supply cords, the ampacity shall be limited to 60 A to correlate with the rating of the standard 3-pole, 4-wire attachment plug configuration employed.

10.5.2 Attachment plug

10.5.2.1 A power-supply cord intended for use with a range or dryer shall be provided with an attachment plug having a 10-30P, 14-30P, 10-50P, or 14-50P configuration. The attachment plug blades shall comply with the dimensional requirements specified either in NEMA WD 6, or in Figure 10.2.

Figure 10.2

Padded and Folded-Over Blade Construction for 30- and 50-A Attachment Plugs for use with Range and Dryer Power-Supply Cords



NOTES:

1 – All dimensions in mm.

mm	1.4	1.5	2.3	6.1	6.9	8.6	10.9	14.9
(inch)	(0.054)	(0.058)	(0.090)	(0.240)	(0.270)	(0.340)	(0.430)	(0.585)

2 – Alternate blade profile for NEMA blade configurations 10-30, 10-50, 14-30, and 14-50. All location dimensions shall be as described in the applicable NEMA configurations.

3 – The minimum material thickness for the padded and folded-over blade is 0.7 mm (0.0270 inch).

10.6 Range and dryer power-supply cord kits

10.6.1 General

10.6.1.1 A power-supply cord kit shall consist of a suitable power-supply cord, a strain relief clamp or molded-on strain relief, reducing washers when required for proper installation, and assembly instructions.

10.6.1.2 A power-supply cord kit intended for use with a range or dryer shall be provided with all of the materials necessary to comply with the requirements in 10.5. A stranded lead shall be treated so that no loose strands result – for example, by tinning of the conductor ends, or the use of crimped-on connector terminals or banding strips.

10.6.1.3 When assembled properly, the completed kit shall comply with the requirements of the appropriate end-product standard, and meet the requirements of Section 13, Tests for Range and Dryer Power-Supply Cord Kits.

10.6.2 Flexible cord

10.6.2.1 Power-supply cord kits intended to be used with range and dryers shall be provided with flexible cords as defined in 10.5.1.

10.6.3 Length

10.6.3.1 The length of a power-supply cord for use with a range or dryer shall not be less than 1.22 m (4 feet), and not exceed 1.83 m (6 feet) when measured from the end of the plug to the point at which the outer covering of the cord is removed.

10.6.4 Strain relief

10.6.4.1 Strain relief means shall be provided so that a mechanical stress applied to the flexible cord is not transmitted to terminals, splices, or internal wiring when tested in accordance with Section 13, Tests for Range and Dryer Power-Supply Cord Kits.

10.6.4.2 The strain relief shall be constructed so as to prevent the power-supply cord from contacting the edges of the opening in the sheet metal pate when tested as described in Section 13, Tests for Range and Dryer Power-Supply Cord Kits, with the cord installed in the most adverse position.

10.6.4.3 For strain relief consisting of a threaded bushing secured by a threaded locknut, the locknut shall:

a) Be provided with notches or the equivalent for easy tightening; and

b) Have a maximum outside diameter as specified in Table 10.7.

Table 10.7
Diameter of Locknut

Maximum diameter of connection opening		Maximum outside diameter of locknut	
mm	(inch)[a]	mm	(inch)[a]
28.96	(1.140)	36.07	(1.420)
35.71	(1.406)	44.96	(1.770)
44.83	(1.765)	57.94	(2.281)

[a] The applicable maximum diameter of connection opening is determined in accordance with Table 13.1.

10.6.5 Cord push-back relief

10.6.5.1 Means shall be provided to prevent the flexible cord from being pushed into the appliance through the strain relief mounting opening after installation. Compliance shall be determined in accordance with 13.3.

10.6.6 Termination of conductors

10.6.6.1 The following shall apply:

a) Closed loop, copper alloy terminals – or an equivalent type such as spade- or hook-type connector with upturned ears – may be provided on the conductors at the free end of the cord if the conductor terminal assembly has an ampacity equivalent to that of the flexible cord to which it is assembled. The acceptability of the assembly shall be demonstrated by compliance with the applicable test requirements in Temperature test, 12.2 and the Conductor secureness test, 11.1; and

b) The terminal shall be sized to accommodate a No. 10 or larger wire-binding screw or stud.

10.7 Extension cord sets

10.7.1 Construction – Outdoor-use assemblies

10.7.1.1 An outdoor-use extension cord set is intended to be used with portable electric equipment that is used outdoors. The cord set is intended for use outdoors only while the portable equipment is in operation. It is intended to be stored indoors where it is not exposed to sunlight, weather, or both while not in use. It may also be used indoors.

10.7.1.2 An outdoor-use cord set shall be either of the non-grounding type containing two circuit conductors including the identified conductor, or of the grounding type containing two or more circuit conductors.

10.7.1.3 An outdoor-use cord set employing a 14 AWG flexible cord with 4 – 6 cord connectors shall employ an over current protective device and shall comply with the applicable requirements in 9.7, 9.10 and Section 17, Tests for Overcurrent Protective Devices. The rating of the over current device shall be equal to the rating of the cord set.

10.7.1.4 An outdoor-use cord set employing SPT-1W, SPT-2W, SJTW, STW, SJEW, or SEW type flexible cord with "-B" suffix shall comply with 6.8.4.

10.7.2 Fittings (indoor and outdoor)

10.7.2.1 General

10.7.2.1.1 Fittings shall comply with the construction requirements in Sections 6 – 8.

10.7.2.1.2 Assemblies designated for outdoor use shall employ attachment plugs and cord connectors designated for outdoor use.

10.7.2.1.3 The attachment plug and cord connector in an assembly shall be of the same mating configuration.

10.7.2.1.4 An assembled-on or molded-on extension cord set shall employ an attachment plug and cord connector having one of the following configurations: 1-15, 5-15, 5-20, 5-30, 6-15, 6-20, 6-30, L1-15, L5-15, L5-20, L5-30, L6-15, L6-20, or L6-30.

10.7.2.1.5 An outlet fitting, such as a cord connector, shall not be connected between the end fittings of a general use cord set except in the case of an adapter cord set.

10.7.2.1.6 An outlet fitting, such as a cord connector, shall not be connected between the end fittings of an outdoor-use cord set.

Exception No. 1: An adapter cord set described in 10.8.1.2(d) is able to be provided with outlet fittings connected between the end fittings.

Exception No. 2: An outdoor-use cord set marked in accordance with 23.3.5 may employ up to two in-line cord connectors in addition to an end cord connector.

10.7.2.1.7 The outdoor use cord connector may have a maximum of three outlets. The configuration of the contact members shall be the same for the cord connector as the attachment plug.

Exception No. 1: Up to six outlets may be provided in an outdoor-use extension cord set employing 12 AWG, Type SJ or equivalent flexible cord that is constructed in accordance with 10.7.2.2.6 and marked in accordance with 23.3.5.

Exception No. 2: Up to six in-line outlets, including the end fitting, may be provided in an outdoor-use extension cord set employing 12 AWG, Type SJ or equivalent flexible cord and marked in accordance with 23.3.5.

Exception No. 3: Up to six outlets on a single cord connector body may be provided in an outdoor-use extension cord set employing 12 AWG, Type SJ or equivalent flexible cord and marked in accordance with 23.3.5. The total number of outlets on an extension cord set shall not exceed six.

10.7.2.1.8 Plugs having a 1-15 configuration employed on an extension cord set shall be polarized.

10.7.2.1.9 Cord connectors shall not have more than three outlets and shall be of the same configuration as the plug.

Exception: A cord connector body may have a maximum of six outlets when in accordance with Exceptions 1 – 3 of 10.7.2.1.7.

10.7.2.1.10 Notwithstanding 10.7.2.1.9, the maximum number of outlets for indoor extension cord set assemblies shall be six if 12 AWG (3.31 mm^2), Type SJ, or equivalent flexible cord is employed.

10.7.2.1.11 A general-use cord set may optionally be provided with a remote control feature. A remote control feature shall comply with the requirements of 9.9.

10.7.2.1.12 An outlet fitting, such as a cord connector, may be connected in the cord between the end fittings (in-line cord connector) of a general-use cord set.

10.7.2.1.13 A general-use cord set employing in-line cord connectors shall be marked as indicated in 23.1.1.

10.7.2.1.14 A general-use cord set employing in-line cord connectors shall employ SJ or equivalent cords.

10.7.2.2 Joints for use on extension cord sets

10.7.2.2.1 An extension cord set with more than one single-outlet load fitting may have a joint in the flexible cord with the cord branching to two cords, each terminating in a single-outlet load fitting. See Figure 10.5 for typical construction.

10.7.2.2.2 An extension cord set employing a joint shall employ SJ or equivalent cord.

10.7.2.2.3 A joint between two flexible cords shall have a minimum insulating-body thickness of 3/32 inch (2.4 mm) covering all live parts.

10.7.2.2.4 The thickness mentioned in 10.7.2.2.9 is to be measured from any part of the live contacts and uninsulated flexible-cord conductors (conductors from which the flexible-cord insulation has been removed) to the nearest point on the outer surface of the insulating body.

10.7.2.2.5 An extension cord set with more than one single-outlet load fitting may have a joint in the flexible cord and shall be marked in accordance with 23.1.11.

10.7.2.2.6 An outdoor-use extension cord set may have a joint in the flexible cord with the cord branching to two cords, each terminating in a load fitting provided with a maximum of three outlets, or to three cords, each terminating in a load fitting provided with a maximum of two outlets. In either case, the total number of outlets provided on the cord set shall not be more than six.

10.7.2.2.7 The resistance of the joint insulation to sunlight and mechanical abuse for outdoor use extension cord sets shall be at least equal to that of the interconnecting flexible cord. Molded-on joint insulation shall be compatible with the material used in the jacket of the flexible cord and shall adhere tightly to the jacket so as to exclude moisture.

10.7.2.2.8 A joint between two flexible cords in an outdoor-use extension cord set shall have a minimum insulating-body thickness of 3/32 inch (2.4 mm) covering all live parts.

10.7.2.2.9 The thickness mentioned in 10.7.2.2.8 is to be measured from any part of the live contacts and uninsulated flexible-cord conductors (conductors from which the flexible-cord insulation has been removed) to the nearest point on the outer surface of the insulating body.

10.7.2.2.10 Insulation of neoprene, polyvinyl chloride, or butyl rubber is acceptable provided its adhesion to the cord jacket complies with 11.11. Joint insulation of other material may be investigated to determine its acceptability.

10.7.2.2.11 The overall length of a cord set with a joint shall be determined from the sum of the lengths of the main cord (from plug to joint) plus the longest length of flexible cord from the joint to the cord connector.

10.7.2.3 Cold-usage cord sets

10.7.2.3.1 A cold-usage cord set shall consist of a grounded attachment plug, flexible cord rated for at least minus 50 °C in accordance with the requirements of UL 62 and a cord connector, in accordance with 8.5.6.

10.7.2.3.2 A cold-usage cord set shall comply with the Low-temperature insertion test described in 14.9.5 in addition to other applicable tests.

10.7.2.3.3 A cold-usage cord set shall be marked in accordance with 24.8 in addition to other applicable markings.

10.7.3 Other components

10.7.3.1 Overcurrent protection

10.7.3.1.1 Overcurrent protection, when provided, shall comply with 9.7 and 9.10.

10.7.3.1.2 Fuses or circuit breakers shall not be of the automatic resetting type.

10.7.3.1.3 Overcurrent protection employed on outdoor-use extension cords shall not permit water to enter the enclosure so as to contact live parts.

10.7.3.1.4 All extension cord sets employing flexible cord incorporating 18 or 17 AWG conductors shall be provided with overcurrent protection (short circuit and overload protection) rated equal to or less than the ampacity of the flexible cord.

10.7.3.2 Switches

10.7.3.2.1 A through-cord or pendant switch may be employed on an indoor-use extension cord provided it complies with 9.3 and is rated not less than "6 A, 120 V – 3 A, 250 V", or "10 A, 120 V".

10.7.4 Flexible cord

10.7.4.1 General

10.7.4.1.1 Flexible cord shall be of one of the Types in Table 10.8 and the size of the conductors shall be either 16 AWG (1.31 mm^2), 14 AWG (2.08 mm^2), 12 AWG (3.31 mm^2), or 10 AWG (5.26 mm^2).

Table 10.8
Flexible Cord for Extension Cord Sets[c]

HPN	ST	SPE-2[b]
SJ	STO	NISPE-2[b]
SJO	STOO	SPE-3[b]

Table 10.8 Continued on Next Page

Table 10.8 Continued

SJOO	SE	SV
SJT	SEO	SVO
SJTO	SEOO	SVOO
SJTOO	SP-2[b]	SVT
SJE	NISP-2[b]	SVTO
SJEO	SP-3[b]	SVTOO
SJEOO	SPT-2[a,b]	SVE
S	NISPT-2[b]	SVEO
SO		SVEOO
SOO	SPT-3[b]	

[a] Cord constructions that can be demonstrated to be equivalent to integral Type SPT-2 flexible cord may be used in extension cord sets having a retractile (coiled) cord construction.

[b] These 3-conductor parallel cord types are not acceptable for use on cord sets more than 4.5 m (15 feet) in length.

[c] Flexible cord constructions that have been evaluated to UL 62 requirements for a "-B" suffix, shall be identified with the "-B" designation appearing on the cord jacket or on a marker tape beneath the braid.

10.7.4.2 Indoor use

10.7.4.2.1 An extension cord set consisting of two separate lengths shall employ 2-conductor, 16 AWG (1.31 mm^2), Type SP-2, NISP-2, SPT-2, NISPT-2, SPE-2, or NISPE-2 flexible cord, each no greater than 1.8 m (6 feet), connected in parallel to a single 1-15P molded-on attachment plug, with each length terminating in a cord connector of the 1-15R configuration.

10.7.4.2.2 An extension cord set consisting of a length of flexible cord not less than 1.8 m (6 feet) in length, with a single or multiple series-connected current tap at one end, and a switching device in compliance with 9.3 at the other end, to provide remote outlet switching, is allowable.

10.7.4.2.3 An extension cord set consisting of a length of flexible cord not less than 1.8 m (6 feet) in length, with a single or multiple series-connected current tap at one end, and a dimmer device in compliance with 9.3.6 at the other end, to provide remote outlet dimming, is allowable. The single or multiple series-connected current tap shall be of the 1-15 or the 5-15 configuration.

10.7.4.3 Outdoor use

10.7.4.3.1 Outdoor-use extension cord sets shall use flexible cord of the Type SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW, SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, or SJEOOW and use 16 AWG (1.31 mm^2), 14 AWG (2.08 mm^2), 12 AWG (3.31 mm^2), or 10 AWG (5.26 mm^2) size conductors, in compliance with Table 10.4, Table 10.9, Table 10.10, Table 10.11, Table 10.12, and Table 10.13.

Table 10.9
Ratings of Outdoor Extension Cord Sets 125-V, 2-Pole, 2-Wire, and 2-Pole, 3-Wire Grounding

Description of cord set			
Ratings of fittings used	**Length of cord set**	**Flexible cord used[a]**	**Ratings of cord set**
15 A at 125 V	over 15.2 m (over 50 feet)	2 or 3-conductor 18 AWG (0.824 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	7 A (875 W) maximum at 125 V maximum
	0 – 15.2 m (0 – 50 feet)	2 or 3-conductor 18 AWG (0.824 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	10 A (1250 W) maximum at 125 V maximum
	over 15.2 m (over 50 feet)	2 or 3-conductor 16 AWG (1.31 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
	0 – 15.2 m (0 – 50 feet)	2 or 3-conductor 16 AWG (1.31 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	13 A (1625 W) maximum at 125 V maximum
	over 15.2 m (over 50 feet)	2 or 3-conductor 14 AWG (2.08 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
	0 – 15.2 m (0 – 50 feet)	2 or 3-conductor 14 – 2 AWG (2.08 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	15 A (1875 W) maximum at 125 V maximum
	over 15.2 m (over 50 feet)	2 or 3-conductor 12 – 2 AWG (3.31 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
20 A at 125 V	0 – 15.2 m (0 – 50 feet)	3-conductor 12 - 2 AWG (3.31 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	20 A (2500 W) maximum at 125 V maximum
	over 15.2 m (over 50 feet)	3-conductor 10 – 2 AWG (5.26 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
30 A at 125 V	0 – 15.2 m (0 – 50 feet)	3-conductor 10 – 2 AWG (5.26 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	30 A (3750 W) maximum at 125 V maximum
	over 15.2 m (over 50 feet)	3-conductor 8 – 2 AWG (8.36 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	

Table 10.9 Continued on Next Page

Table 10.9 Continued

Description of cord set			
Ratings of fittings used	**Length of cord set**	**Flexible cord used[a]**	**Ratings of cord set**
50 A at 125 V	0 – 15.2 m (0 – 50 feet)	3-conductor 6 – 2 AWG (13.3 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	50 A (6250 W) maximum at 125 V maximum
	over 15.2 m (over 50 feet)	3-conductor 4 AWG (21.1 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	

[a] Each of the conductors is of the same size. Two-current carrying conductors; the third (when provided) conductor is the grounding conductor.

Table 10.10
Ratings of Outdoor Extension Cord Sets 250-V, 2-Pole, 3-Wire Grounding

Description of cord set			
Ratings of fittings used	**Length of cord set**	**Flexible cord used[a]**	**Ratings of cord set**
15 A at 250 V	over 15.2 m (over 50 feet)	3-conductor 18 AWG (0.824 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	7 A (1750 W) maximum at 250 V maximum
	0 – 15.2 m (0 – 50 feet)	3-conductor 18 AWG (0.824 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	10 A (2500 W) maximum at 250 V maximum
	over 15.2 m (over 50 feet)	3-conductor 16 AWG (1.31 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
	0 – 15.2 m (0 – 50 feet)	3-conductor 16 AWG (1.31 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	13 A (3250 W) maximum at 250 V maximum
	over 15.2 m (over 50 feet)	3-conductor 14 AWG (2.08 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
	0 – 15.2 m (0 – 50 feet)	3-conductor 14 – 2 AWG (2.08 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	15 A (3750 W) maximum at 250 V maximum
	over 15.2 m (over 50 feet)	3-conductor 12 – 2 AWG (3.31 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
20 A at 250 V	0 – 15.2 m	3-conductor 12 – 2 AWG (3.31 – 33.6 mm^2)	20 A (5000 W) maximum at 250 V maximum

Table 10.10 Continued on Next Page

Table 10.10 Continued

Description of cord set			
Ratings of fittings used	**Length of cord set**	**Flexible cord used[a]**	**Ratings of cord set**
	(0 – 50 feet)	SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
	over 15.2 m (over 50 feet)	3-conductor 10 – 2 AWG (5.26 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
30 A at 250 V	0 – 15.2 m (0 – 50 feet)	3-conductor 10 – 2 AWG (5.26 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	30 A (7500 W) maximum at 250 V maximum
	over 15.2 m (over 50 feet)	3-conductor 8 – 2 AWG (8.36 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
50 A at 250 V	0 – 15.2 m (0 – 50 feet)	3-conductor 6 – 2 AWG (13.3 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	50 A (12500 W) maximum at 250 V maximum
	over 15.2 m (over 50 feet)	3-conductor 4 AWG (21.1 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	

[a] Each of the conductors is of the same size and one is the grounding conductor.

Table 10.11
Ratings of Outdoor Extension Cord Sets 277-V, 2-Pole, 3-Wire Grounding

Description of cord set			
Ratings of plugs used	**Length of cord set**	**Flexible cord used[a]**	**Ratings of cord set**
15 A at 277 V	over 15.2 m (over 50 feet)	3-conductor 18 AWG (0.824 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	7 A (1939 W) maximum at 277 V maximum
	0 – 15.2 m (0 – 50 feet)	3-conductor 18 AWG (0.824 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	10 A (2770 W) maximum at 277 V maximum
	over 15.2 m (over 50 feet)	3-conductor 16 AWG (1.31 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
	0 – 15.2 m (0 – 50 feet)	3-conductor 16 AWG (1.31 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	13 A (3601 W) maximum at 277 V maximum
	over 15.2 m	3-conductor 14 AWG (2.08 mm^2)	

Table 10.11 Continued on Next Page

Table 10.11 Continued

Description of cord set			
Ratings of plugs used	**Length of cord set**	**Flexible cord used[a]**	**Ratings of cord set**
	(over 50 feet)	SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
	0 – 15.2 m (0 – 50 feet)	3-conductor 14 – 2 AWG (2.08 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	15 A (4155 W) maximum at 277 V maximum
	over 15.2 m (over 50 feet)	3-conductor 12 – 2 AWG (3.31 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
20 A at 277 V	0 – 15.2 m (0 – 50 feet)	3-conductor 12 – 2 AWG (3.31 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	20 A (5540 W) maximum at 277 V maximum
	over 15.2 m (over 50 feet)	3-conductor 10 – 2 AWG (5.26 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
30 A at 277 V	0 – 15.2 m (0 – 50 feet)	3-conductor 10 – 2 AWG (5.26 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	30 A (8310 W) maximum at 277 V maximum
	over 15.2 m (over 50 feet)	3-conductor 8 – 2 AWG (8.36 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
50 A at 277 V	0 – 15.2 m (0 – 50 feet)	3-conductor 4 – 2 AWG (21.1 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	50 A (13850 W) maximum at 277 V maximum
	over 15.2 m (over 50 feet)	3-conductor 4 – 2 AWG (21.1 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	

[a] Each of the conductors is of the same size and one is the grounding conductor.

Table 10.12
Ratings of Cord Sets 125/250-V, 3-Pole, 4-Wire Grounding

Description of cord set			
Ratings of fittings used	**Length of cord set**	**Flexible cord used[a]**	**Ratings of cord set**
15 A at 125/250 V (3-wire)	0 – 15.2 m (0 – 50 feet)	4-conductor 18 AWG (0.824 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	10 A (2500 W) maximum at 125/250 V maximum (3-wire)
	over 15.2 m	4-conductor 16 AWG (1.31 mm^2)	

Table 10.12 Continued on Next Page

Table 10.12 Continued

Description of cord set			
Ratings of fittings used	**Length of cord set**	**Flexible cord used[a]**	**Ratings of cord set**
	(over 50 feet)	SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
	0 – 15.2 m (0 – 50 feet)	4-conductor 16 AWG (1.31 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	13 A (3250 W) maximum at 125/250 V maximum (3-wire)
	over 15.2 m (over 50 feet)	4-conductor 14 AWG (2.08 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
	0 – 15.2 m (0 – 50 feet)	4-conductor 14 – 2 AWG (2.08 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	15 A (3750 W) maximum at 125/250 V maximum (3-wire)
	over 15.2 m (over 50 feet)	4-conductor 12 – 2 AWG (3.31 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
20 A at 125/250 V (3-wire)	0 – 15.2 m (0 – 50 feet)	4-conductor 12 – 2 AWG (3.31 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	20 A (5000 W) maximum at 125/250 V maximum (3-wire)
	over 15.2 m (over 50 feet)	4-conductor 10 – 2 AWG (5.26 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
30 A at 125/250 V (3-wire)	0 – 15.2 m (0 – 50 feet)	4-conductor 10 – 2 AWG (5.26 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	30 A (7500 W) maximum at 125/250 V maximum (3-wire)
	over 15.2 m (over 50 feet)	4-conductor 8 – 2 AWG (8.36 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
50 A at 125/250 V (3-wire)	0 – 15.2 m (0 – 50 feet)	4-conductor 6 – 2 AWG (13.1 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	50 A (12500 W) maximum at 125/250 V maximum (3-wire)
	over 15.2 m (over 50 feet)	4-conductor 4 – 2 AWG (21.1 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
60 A at 125/250 V (3-wire)	0 – 15.2 m (0 – 50 feet)	4-conductor 4 – 2 AWG (21.1 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	60 A (15000 W) maximum at 125/250 V maximum (3-wire)
	over 15.2 m (over 50 feet)	4-conductor 2 AWG (33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	

[a] Each conductor is the same size and one is the grounding conductor.

Table 10.13
Ratings of Cord Sets 250-V, 3-Pole, 4-Wire, 3-Phase Delta

Description of cord set			
Ratings of fittings used	**Length of cord set**	**Flexible cord used[a]**	**Ratings of cord set**
15 A at 250 V (3-pole, 4-wire, 3-phase delta)	0 – 15.2 m (0 – 50 feet)	4-conductor 18 AWG (0.824 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	7 A (3031 W) maximum at 250 V maximum (3-pole, 4-wire, 3-phase delta)
	over 15.2 m (over 50 feet)	4-conductor 16 AWG (1.31 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
	0 – 15.2 m (0 – 50 feet)	4-conductor 16 AWG (1.31 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	10 A (4330 W) maximum at 250 V maximum (3-pole, 4-wire, 3-phase delta)
	over 15.2 m (over 50 feet)	4-conductor 14 AWG (2.08 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
	0 – 15.2 m (0 – 50 feet)	4-conductor 14 – 2 AWG (2.08 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	15 A (6495 W) maximum at 250 V maximum (3-pole, 4-wire, 3-phase delta)
	over 15.2 m (over 50 feet)	4-conductor 12 – 2 AWG (3.31 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
20 A at 250 V (3-pole, 4-wire, 3-phase delta)	0 – 15.2 m (0 – 50 feet)	4-conductor 12 – 2 AWG (3.31 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	20 A (8660 W) maximum at 250 V maximum (3-pole, 4-wire, 3-phase delta)
	over 15.2 m (over 50 feet)	4-conductor 10 – 2 AWG (5.26 – 33.6 mm^2) SJOW, SJOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
30 A at 250 V (3-pole, 4-wire, 3-phase delta)	0 – 15.2 m (0 – 50 feet)	4-conductor 8 – 2 AWG (8.36 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	30 A (12990 W) maximum at 250 V maximum (3-pole, 4-wire, 3-phase delta)
	over 15.2 m (over 50 feet)	4-conductor 6 – 2 AWG (13.3 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
50 A at 250 V (3-pole, 4-wire, 3-phase delta)	0 – 15.2 m (0 – 50 feet)	4-conductor 4 – 2 AWG (21.1 – 33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	50 A (21650 W) maximum at 250 V maximum (3-pole, 4-wire, 3-phase delta)
	over 15.2 m (over 50 feet)	4-conductor 4 AWG (21.1 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	

Table 10.13 Continued on Next Page

Table 10.13 Continued

Description of cord set			
Ratings of fittings used	**Length of cord set**	**Flexible cord used[a]**	**Ratings of cord set**
60 A at 250 V (3-pole, 4-wire, 3-phase delta)	0 – 15.2 m (0 – 50 feet)	4-conductor 4 – 2 AWG (21.1 – 3.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	60 A (25980 W) maximum at 250 V maximum (3-pole, 4-wire, 3-phase delta)
	over 15.2 m (over 50 feet)	4-conductor 2 AWG (33.6 mm^2) SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, SEOOW	
[a] Each conductor is the same size and one is the grounding conductor.			

10.7.5 Lengths

10.7.5.1 Indoor use

10.7.5.1.1 The length of an indoor-use extension cord set shall be in compliance with Table 10.2, Table 10.3, and Table 10.8.

10.7.5.2 Outdoor use

10.7.5.2.1 An outdoor-use extension cord set shall have a minimum length of 1.8 m (6 feet).

10.7.5.2.2 The maximum length of an outdoor-use cord set with a 3-outlet cord connector shall be in compliance with Table 10.4, Table 10.9, Table 10.10, Table 10.11, Table 10.12, and Table 10.13.

10.7.6 Ratings

10.7.6.1 General

10.7.6.1.1 Each extension cord set shall be rated in amperes, volts, and watts.

10.7.6.2 Indoor use

10.7.6.2.1 The rating of the extension cord set described in 10.7.4.2.1 shall not be more than 125 V, 15 A. Each individual leg of the extension cord set described in 10.7.4.2.1 may be rated equal to or less than the ampacity of the cord, as provided in Table 10.2 and Table 10.3, provided the total does not exceed 15 A.

10.7.6.2.2 The voltage rating of the extension cord set shall be determined by the voltage rating of the attachment plug configuration and shall not exceed that of the flexible cord or switch or dimmer device (if provided), whichever is less.

10.7.6.2.3 The ampere rating of the extension cord set shall be determined by the ampere rating of the attachment plug, flexible cord, cord connector, or switch or dimmer device (if provided), whichever is less.

10.7.6.2.4 When provided with a switch or dimmer device rated for alternating current only, the extension cord set voltage rating shall also include "AC".

10.7.6.2.5 The wattage rating of the extension cord set shall be determined by multiplying the ampacity of the cord (Table 10.2 and Table 10.3) or ampere rating of a cord connector, or a switch or dimmer device

(if provided), whichever is less, by the voltage rating of the attachment plug. For example, for 18 AWG [0.824 mm^2 Type SPT-2: 10 (amperes) × 125 (volts) = 1250 watts (for a connector rated 125 volts); and 10 (amperes) × 250 (volts) = 2500 watts (for a connector rated 250 volts)].

10.7.6.3 Outdoor use

10.7.6.3.1 A cord set in which the attachment plug and cord connector are of the same configuration shall comply with the ratings in Table 10.9 – Table 10.13.

10.7.6.3.2 The voltage rating of the extension cord set shall be determined by the voltage rating of the plug configuration and shall not exceed that of the flexible cord or switch (if provided), whichever is less.

10.7.6.3.3 The ampere rating of the extension cord set shall be determined by the ampere rating of the attachment plug, flexible cord, cord connector, or switch (if provided), whichever is less.

10.7.6.3.4 The ampacity for each cord set in Table 10.9 – Table 10.13 shall be the maximum current rating in amperes of either the flexible cord or the fittings used, whichever is lower. The maximum voltage rating of the cord set is the voltage rating of the fittings used.

10.7.6.3.5 When determining the maximum wattage rating of an outdoor-use cord set, the following items shall be considered:

a) The wattage rating of the extension cord set shall be determined by multiplying the ampacity of the cord (Table 10.9 – Table 10.13) or ampere rating of a cord connector, or a switch (if provided), whichever is less, by the voltage rating of the attachment plug;

b) When 3-phase fittings are used, the wattage rating of the cord set is 1.732 times higher than the rating determined in 10.7.6.2.5; and

c) When fittings with a dual rating of 125/250 V are used in a 3-wire circuit, the maximum wattage rating of the cord set shown in Table 10.12 is the result of multiplying the maximum voltage rating of the fittings, 250 V, by the lowest ampacity of either the flexible cord, the cord connector, or a switch (if provided).

10.7.6.4 General use extension cords employing supplementary charging circuits and/or induction power transmitters

10.7.6.4.1 General use extension cords are permitted to employ supplementary charging circuits or induction power transmitters or both in accordance with 9.8.

10.7.6.4.2 General use extension cords employing 18 AWG (0.82 mm^2) flexible cord and both supplementary charging circuits and an induction power transmitter shall be provided with overcurrent protection in accordance with 9.7 and 9.10, except that the overcurrent protection is permitted to be located in the enclosure that houses the outlet(s), supplementary circuit(s), and induction power transmitter.

10.7.6.4.3 The number of outlets, supplementary circuit output connectors, and induction power transmitters shall be as indicated in Table 10.14.

Table 10.14
Number of Permitted Outlets, Outputs, and Circuits for Devices Employing Supplementary Charging Circuits and/or Induction Power Transmitters

Cord size AWG (mm^2)	Max. No. of NEMA outlets	Max. no. of supplementary charging circuit outputs		Max. no. of induction power transmitter circuits
		Type USB-A or USB-B	Type USB-C	
18 (0.82)	1	2	1	1
16 (1.31)	2	3	1	1
14 (2.08)	3	5	1	1
12 (3.31)	3	5	1	1

10.8 Adapter cord sets

10.8.1 General

10.8.1.1 In addition to the requirements in 10.8.1 – 10.8.5, an adapter cord set shall comply with the requirements in 10.7.4.3.

10.8.1.2 An adapter cord set is intended for use at locations such as construction sites and is designed:

a) To provide power from one plug configuration to a single-outlet configuration. See Figure 10.3 and Table 10.15;

b) To provide 2 or 6 outlets on one connector body of the same configuration as the plug or convert to another configuration. See Figure 10.4 and Table 10.15;

c) To convert from one plug to 2 or 3 single-outlets of the same configuration as the plug or convert to another configuration. See Figure 10.5 for typical constructions and Table 10.15; and

d) To provide power to a maximum of either 3 or 6 in-line single outlets, based on the wire gauge and length specified in Table 10.16. See Figure 10.6 and Table 10.16.

Table 10.15
Adapter Cord Set Fittings and Cord Length

Attachment plug rating	Cord connector rating	Max. cord length		Minimum gauge	
		m	(feet)	AWG	(mm^2)
15 A	15 A	15.2	(50)	14	(2.08)
15 A	15 A	30.5	(100)	12	(3.31)
15 A	20 A	0.6	(2)	14	(2.08)
20 A	15 A	15.2	(50)	14	(2.08)
20 A	15 A	30.5	(100)	12	(3.31)
20 A	20 A	15.2	(50)	12	(3.31)
20 A	20 A	30.5	(100)	10	(5.26)

NOTES:

1 – It is permitted to have 2 or 3 lengths of cord exiting the joint.

2 – Other NEMA configurations rated 30, 50, and 60 A employing 10 AWG (5.26 mm^2), 6 AWG (13.3 mm^2), and 4 AWG (21.2 mm^2) cord respectively are also permitted.

3 – Adapter cord sets utilizing 15 or 20 A attachment plugs may employ the same or different configurations of plugs and connectors.

Table 10.16
Fittings and Cord Length for Adapter Cord Sets Employing In-Line Outlets

Attachment plug rating	Cord connector rating	Max. cord length		Minimum gauge		Max. no. of outlets
		m	(feet)	AWG	(mm^2)	
15 A	15 A	15.2	(50)	14	(2.08)	3
15 A	15 A	30.5	(100)	12	(3.31)	3
20 A	15 A and/or 20A	15.2	(50)	12	(3.31)	6[a]
20 A	15 A and/or 20A	30.5	(100)	10	(5.26)	6[a]

[a] Only one 20 A outlet may be provided on an adapter cord set provided with more than 3 outlets.

Figure 10.3
Single to Single Configuration

S4405

Figure 10.4
Multiple Outlets with No Joints

S4406

Figure 10.5

Multiple Single Outlets with Joints

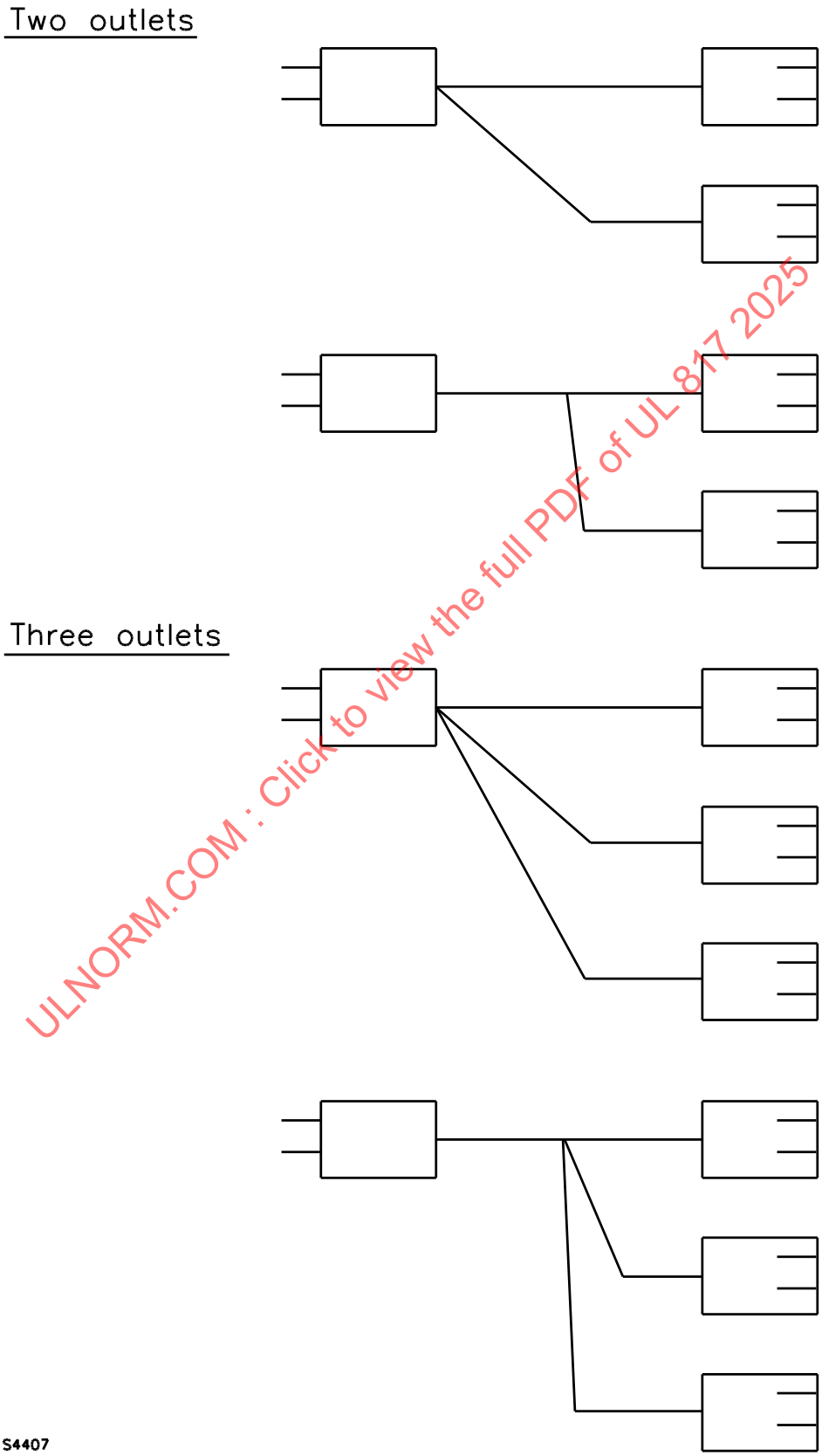
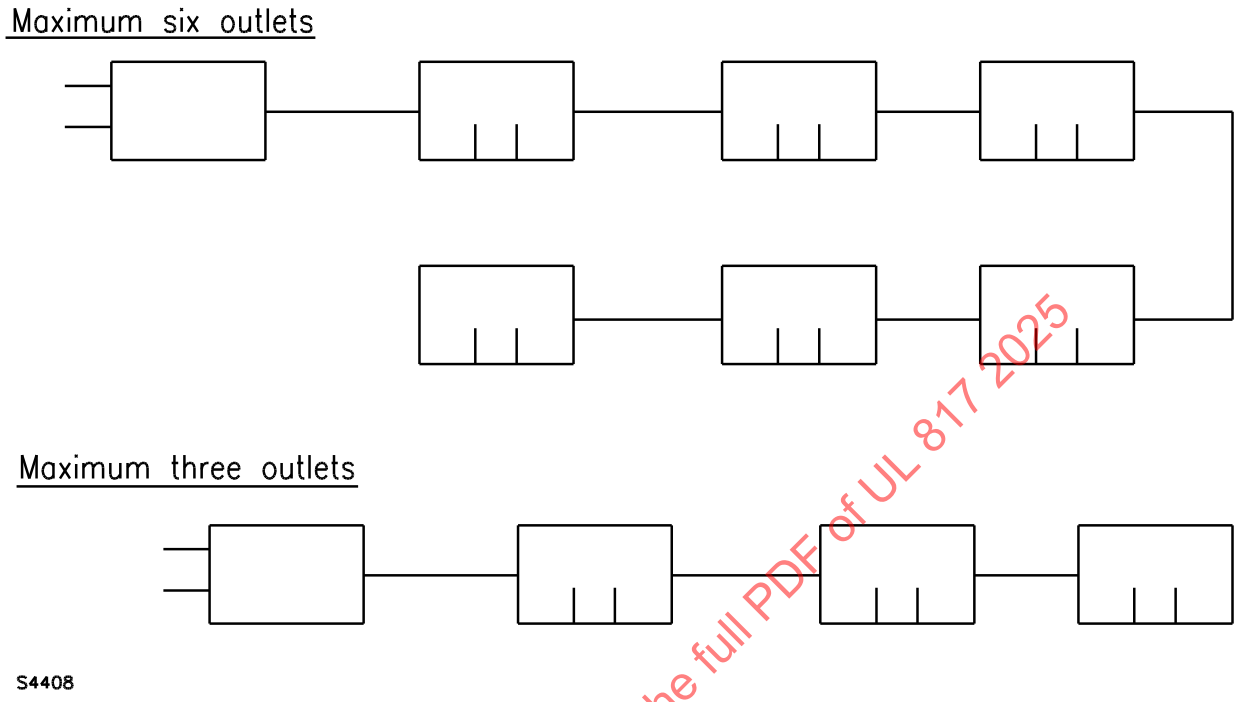


Figure 10.6

Adapter Cord Sets Employing In-Line Outlets



10.8.1.3 An adapter cord set is an assembly consisting of an attachment plug, a length of extra-hard-usage flexible cord, and one or more connector fittings providing a total of not more than 6 outlets.

10.8.2 Fittings

10.8.2.1 An adapter cord set may employ the same or different NEMA configurations of plug and connector fittings and may include more than one configuration of connector fittings. An adapter cord set with a multiple-outlet connector fitting that incorporates both straight-blade and locking configurations on the same multiple-outlet fitting meets the intent of this requirement.

10.8.2.2 The plug and connector fittings shall be of the grounding type, and their voltage and current ratings shall be the same except that an attachment plug rated 20 A used in combination with an outlet or outlets rated 15 A or an attachment plug rated 15 A used in combination with a single outlet rated 20 A meets the intent of the requirement.

10.8.3 Flexible cord

10.8.3.1 The interconnecting flexible cord shall be Type SOW, SOOW, STW, STOW, STOOW, SEW, SEOW, or SEOOW with a grounding conductor. The conductors shall not be smaller than 14 AWG (2.08 mm^2), 12 AWG (3.31 mm^2), 10 AWG (5.26 mm^2), 6 AWG (13.3 mm^2), and 4 AWG (21.1 mm^2) when end fittings rated 15, 20, 30, 50, and 60 A, respectively, are employed.

10.8.3.2 With the exception of 10.8.3.3, the length of an adapter cord set shall be measured from the face of the plug to the face of any connector and shall not exceed 30.5 m (100 feet).

10.8.3.3 The length of an adapter cord set employing a 15-A plug and 20-A outlet shall not be greater than 0.6 m (2 feet).

10.8.4 Joints

10.8.4.1 An adapter cord set with more than one single-outlet connector fitting may have a joint in the flexible cord with the cord branching to two or three cords, each terminating in a single-outlet connector fitting.

10.8.4.2 The resistance of the joint insulation to sunlight and mechanical abuse shall be at least equal to that of the interconnecting flexible cord. Molded-on joint insulation shall be compatible with the material used in the jacket of the flexible cord and shall adhere tightly to the jacket so as to exclude moisture.

10.8.4.3 A joint between two or more flexible cords in an adapter cord set shall have a minimum insulating-body thickness of 2.38 mm (3/32 inch) covering all live parts.

10.8.4.4 The thickness mentioned in 10.8.4.3 shall be measured from any part of the live contacts and uninsulated flexible-cord conductors (conductors from which the flexible-cord insulation has been removed) to the nearest point on the outer surface of the insulating body.

10.8.4.5 Insulation of neoprene, polyvinyl chloride, or butyl rubber is acceptable, provided that its adhesion to the cord jacket complies with 11.11. Joint insulation of other material may be investigated to determine its acceptability.

10.8.4.6 Joints shall comply with the tests described in 11.3.4 and 12.2.2.

10.8.5 Ratings

10.8.5.1 An adapter cord set shall comply with Table 10.15 and Table 10.16. The values for cord set lengths of 2 – 15 m (6 – 50 feet) shall be used for adapter cord sets less than 15-m (50-feet) long.

10.8.5.2 The electrical ratings of the adapter cord set shall be based on the ampere rating of the lowest rated fitting used.

10.8.5.3 An adapter cord set shall be rated in maximum volts, maximum amperes, and maximum watts.

10.9 Special-use cord sets

10.9.1 General

10.9.1.1 A special-use cord set shall consist of a length of flexible cord, an assembled or molded on attachment plug, and a cord connector or appliance connector in accordance with UL 498; UL 1681; UL 1682; NEMA WD 6; UL 60320-1; IEC 60320-1 and IEC 60320-2-2; or of another non-NEMA approved configuration.

10.9.1.2 A special-use cord set may incorporate a through-cord switch.

10.9.1.3 A special-use cord set may incorporate an overcurrent protection device.

10.9.1.4 The flexible cord shall comply either with:

a) The requirements of UL 62; or

b) The requirements of UL 758, and the minimum construction requirements for flexible cord in accordance with UL 62.

10.9.1.5 A special-use cord set incorporating design features not covered by this Standard shall be evaluated with respect to the requirements for the specific application and any other items involved with its special use.

10.9.2 Plugs

10.9.2.1 Each special-use cord set shall have a conductor attached to each blade, pin, or contact in each plug; and a blade, pin, or contact in each plug for each conductor.

10.9.2.2 Corresponding terminals of the plug and connector of a special-use cord set shall be connected to the same conductor of the cord.

10.9.2.3 The current rating of a cord connector may be less than the current rating of the attachment plug.

10.9.2.4 The voltage rating of the cord connector shall be identical to that of the attachment plug.

10.9.2.5 An outlet fitting shall not be connected in the cord between the end fittings of a special use cord set.

10.9.2.6 Appliance plugs are limited to use on heater cord.

10.9.2.7 Except as noted in 10.9.2.8, if a 3-wire outlet fitting having an offset center contact is of other than a configuration specified in NEMA WD 6, it shall be wired according to 10.9.2.7.

10.9.2.8 The special-use cord sets for replacement use only, mentioned in 10.9.2.7, need not comply with these requirements.

10.9.2.9 A special-use cord set having 20 AWG (0.52 mm^2) conductors and employing a cord that complies with UL 758 and is constructed in accordance with note 14 to Table 10.1, or Type SP-1, NISP-1, SPE-1, NISPE-1, SPT-1, or NISPT-1 flexible cord shall:

a) Have an attachment plug of the 1-15P configuration that complies with the requirements in Section 7, Plugs;

b) Have a 2-pole, 2-wire cord connector with configuration other than 1-15R; and

c) Be provided with overcurrent protection in accordance with 9.7 and 9.10.

10.9.3 Flexible cord

10.9.3.1 The flexible cord of a special-use cord set shall be one of the cords in Table 10.1.

10.9.4 Length

10.9.4.1 Except as noted in 10.9.4.2, the overall length of a special-use cord set shall be measured in accordance with Figure 9.1. However, the requirements governing the equipment with which it is intended to be used shall determine the required overall length of the special use cord set required for each application.

10.9.4.2 The length of a special-use cord set if constructed with a NEMA or non-NEMA plug and a parallel-type cord shall have a maximum length of 6.1 m (20 feet). If made with jacketed cord, the maximum length shall be 15.2 m (50 feet).

10.9.5 Nondetachable

10.9.5.1 A special-use nondetachable power supply cord may optionally be provided with a remote control feature. A remote control feature shall comply with the requirements of 9.9.

10.9.5.2 A special-use nondetachable power-supply cord employing a remote control feature shall be molded or hot stamped on the device body with the following or equivalent, "Remote Controlled Device". Lettering shall not be less than 3/32 inch (2.4 mm) high.

10.9.6 Markings

10.9.6.1 Special-use cord sets shall comply with Section 33, Special Use Cord Sets.

10.9.6.2 Special-use cord sets using a single outlet having 1-15R configuration shall be marked in accordance with 34.4.

10.9.6.3 A special-use nondetachable power-supply cord employing a remote control feature shall be marked, "WARNING" and the following or the equivalent, "The special-use cord set could turn on unexpectedly without the user being present. To Reduce the Hazardous Condition – Unplug the appliance that is plugged into the receptacle(s) of the device before servicing." Lettering shall not be less than 3/32 inch (2.4 mm) high and shall either be molded or hot stamped on the remote control device with letters not less than 1/20 inch (1.3 mm) high so as to be visible during use, or be provided on a permanent tag attached to the flexible cord. The leading edge of the tag shall be located within 3 inches (76.2 mm) of the point where the cord enters the body of the remote control device. The tag shall be attached in a manner that it cannot be easily removed. The tag shall have the added marking in letters not less than 3/32 inch (2.4 mm) high: "Do not remove this tag."

10.9.6.4 A special-use nondetachable power supply cord not intended for use with a motor load shall be marked, "WARNING" and the following or the equivalent, "This special-use power supply cord is not to be used with a motor load." Lettering shall not be less than 3/32 inch (2.4 mm) high and shall either be molded or hot stamped on the remote control device with letters not less than 1/20 inch (1.3 mm) high so as to be visible during use, or be provided on a permanent tag attached to the flexible cord. The leading edge of the tag shall be located within 3 inches (76.2 mm) of the point where the cord enters the body of the remote control device. The tag shall be attached in a manner that it cannot be easily removed. The tag shall have the added marking in letters not less than 3/32 inch (2.4 mm) high: "Do not remove this tag."

10.10 Vacuum cleaner and floor-finishing machine cord sets

10.10.1 A 1-15P cord set intended for use with a vacuum cleaner or floor finishing machine that meets the following conditions may have a plug larger than that specified in Figure 5 and shall be considered for special use:

a) The flexible cord employed is Type SV, SVO, SVOO, SVT, SVTO, SVTOO, SVE, SVEO, or SVEOO;

b) The cord employed is at least 4.6 m (15 feet) long; and

c) The power-supply cord is marked in accordance with 32.4 and 32.5.

10.11 Recreational vehicle cord sets

10.11.1 A cord set for use with a recreational vehicle shall consist of an attachment plug and a length of flexible cord connected to a single outlet cord connector that complies with 10.11.2 – 10.11.4. The attachment plug and flexible cord employed shall comply with the requirements in 10.3.3 and 10.3.2.1, respectively. The markings on the flexible cord shall comply with 27.1. A special-use cord set for use with a recreational vehicle shall not employ a through-cord switch.

10.11.2 Except as noted in 10.11.3, the length of the finished assembly shall not be less than 9.1 m (30 feet) when measured according to Figure 9.1.

10.11.3 The minimum length for a cord set intended for shipment to an OEM is 7 m (23 feet).

10.11.4 The cord connector shall be of a locking-type, L5-15, L5-20, L5-30, or SS2-50 configuration identical in ratings to the attachment plug attached to the supply end of the cord set. The cord connector shall be molded of butyl rubber, neoprene, or polyvinyl chloride (or other equivalent materials) and shall be molded to the flexible cord so that it adheres tightly to the jacket of the cord at the point at which the cord enters the connector body (see 11.11). If a right-angle body is used, the configuration shall be oriented so that the grounding member is the member farthest from the point of cord entry.

10.11.5 The cord connector of a cord set having 8 AWG (8.36 mm^2) circuit conductors shall not be marked with a current rating.

10.12 Hospital grade power-supply cords, extension cords, and cord sets

10.12.1 Hospital grade power-supply cords

10.12.1.1 Hospital grade power-supply cords shall employ plugs as described in 7.3.

10.12.1.2 Hospital grade power-supply cords shall employ flexible cord of the Type SJO, SJT, SJTO, SVO, SVT, SVTO, or other jacketed type cord of equal or harder usage.

10.12.2 Hospital grade extension cords

10.12.2.1 Hospital grade extension cords shall employ one of the plugs described in 7.3 and one of the connectors described in 8.6, and both fittings shall be of the same mating configuration.

10.12.2.2 The flexible cord employed shall be Type SJO, SJT, SJTO, or other jacketed type cord of equal or harder usage and either 16 AWG (1.31 mm^2), 14 AWG (2.08 mm^2), 12 AWG (3.31 mm^2), or 10 AWG (5.26 mm^2) size of conductors.

10.12.2.3 A hospital grade extension cord set shall have a maximum length of 4.6 m (15 feet).

10.12.3 Hospital grade cord sets

10.12.3.1 Hospital grade cord sets shall employ plugs described in 7.3 and connectors meeting the requirements of IEC 60320-1 or of another non-NEMA approved configuration.

10.12.3.2 A special use cord set incorporating design features not covered by this Standard shall be evaluated with respect to the requirements for the specific application and any other items involved with its special use.

10.12.3.3 Hospital grade cord sets shall employ flexible cord of the Type SJO, SJT, SJTO, SVO, SVT, SVTO, or other jacketed type cord of equal or harder usage or an equivalent Appliance Wiring Material.

10.12.4 Markings

10.12.4.1 Hospital grade power-supply cords, extension cords, and cord sets shall be marked in accordance with Section 29, Hospital Grade Attachment Plugs, Connectors, and Hospital Grade Extension Cords.

10.13 Cord sets with appliance plugs

10.13.1 Each cord set for use with heating appliances shall consist of an attachment plug and an appliance plug (appliance connector) as described in UL 498 assembled to a length of heater cord and may include a through-cord switch. See Table 10.1 and Table 10.17.

Table 10.17
Pins of Appliance and Flatiron Plugs

Type and rating of plug that accommodates the pins	Configuration of pins		Dimension of pins		
	Number	Arrangement	Spacing between centers mm (Inch)	Diameter mm (Inch)	Length mm (Inch)
Appliance plug rated 5 A at 250 V and 10 A at 125 V	2	In Line	12.7 (1/2)	4.0 ±0.13 (0.156 ±0.005)	14.3 – 15.9 (9/16 – 5/8)
Flatiron plug rated 5 A at 250 V and 10 A at 125 V	2	In Line	17.5 (11/16)	4.8 ±0.13 (0.188 ±0.005)	19.1 – 22.2 (3/4 – 7/8)
Jumbo appliance plug rated 10 A at 250 V and 15 A at 125 V	2	In Line	27.0 (1-1/16)	4.8 ±0.13 (0.188 ±0.005)	19.1 – 22.2 (3/4 – 7/8)
Reversible plug (for two-heat control) rated 10 A at 250 V and 15 A at 125 V[a]	3	In Line	22.2 (7/8)	4.8 ±0.13 (0.188 ±0.005)	19.1 – 22.2 (3/4 – 7/8)
Reversible plug (for two-or three-heat control) rated 10 A at 250 V and 15 A at 125 V[a]	3	One pin at apex of an equilateral triangle	22.2 (7/8)	4.8 ±0.13 (0.188 ±0.005)	19.1 – 22.2 (3/4 – 7/8)

[a] Usually this plug is made without a contact in one of the holes.

10.13.2 The length of heater cord in a special-use cord set for use with appliances with a heating element shall not be less than 0.6 m (2 feet). See Figure 9.1 unless otherwise specified in the relevant standard.

10.13.3 An appliance plug (appliance connector) that is rated more than 10 A but not more than 15 A shall not be used with a heater cord having conductors smaller than 16 AWG (1.31 mm^2).

10.14 Cord sets with flatiron plugs

10.14.1 Each special-use cord set for use with flatirons shall consist of an attachment plug and a flatiron plug (appliance connector) as described in UL 498 assembled to a 1.8 m (6 feet) or longer length of heater cord. See Figure 9.1, Table 10.1, and Table 10.17 unless otherwise specified in the relevant standard.

10.15 Cord sets for appliances rated 50 W or less

10.15.1 General

10.15.1.1 These requirements apply to special-use cord sets intended for use on hand-held appliances rated 50 W or less such as electric shavers, electric scissors, electric combs, or similar hand-held appliances.

10.15.2 Flexible cord

10.15.2.1 The flexible cord shall be Type TST or TPT, or shaver cord.

Exception: 2-wire, Type SP-1, NISP-1, SPT-1, NISPT-1, SPE-1, or NISPE-1 flexible cord may be used provided that it employs individual strands of 36 AWG (0.013 mm^2).

10.15.2.2 The flexible cord shall be at least 1.5 m (5 feet) long but not longer than 2.4 m (8 feet). See Figure 9.1.

10.15.3 Appliance coupler

10.15.3.1 The appliance connector shall have only one outlet.

10.15.3.2 The two contacts in an appliance connector having tubular contacts with the longitudinal axis parallel shall be as indicated in Table 10.18.

Table 10.18
Contacts

Contact	Minimum		Maximum	
	mm	(inch)	mm	(inch)
Inside diameter	1.2	(3/64)	4.0	(5/32)
Spacing between centers	4.8	(3/16)	7.9	(5/16)

10.15.4 Ratings

10.15.4.1 A special-use cord set with a connector as described in 10.15.3.2 shall be rated 50 W, 125 V (or 250 V) depending on the voltage rating of the attachment plug.

10.16 Replacement-use with nonstandard polarization

10.16.1 A special-use cord set for replacement use only may employ a connector (with an offset center contact) that has the contacts arranged in a manner other than that described in 6.6 only if it is marked in accordance with 34.5.

10.16.2 Special-use cord sets for replacement use only need not comply with the requirements of Figure 7.3.

PERFORMANCE

11 Attachment Plugs and Cord Connectors

11.1 Conductor secureness test

11.1.1 If a conductor of a flexible cord is connected to an element (male blade or pin or female contact) of a fitting before the element has been assembled to the fitting, the connection shall not break under a pull applied for 1 minute between the element and the conductor before the element has been assembled into the fittings. A pull of 90 N (20 lbf) shall be applied if the conductor is 18 AWG (0.824 mm^2) or larger in size. If a smaller cord is used, the pull shall be 36 N (8 lbf).

11.1.2 While the test in 11.1.1 is being performed, the angle between the element and the cord conductor shall be the same as in the completely assembled fitting. The test shall be performed by using dead weights or, at the manufacturer's option, a power driven tensile testing machine. If a tensile testing machine is used it shall have jaws suitable for holding the specimen and capable of applying the minimum required tensile load to the specimen while separating at a uniform rate not exceeding 25 mm/min (1 in/min). The machine shall be equipped with a scale from which the load can be read to a value of 0.4 N (0.1 lbf). The accuracy of the scale shall be within 2 % of the value read, and weights shall be provided for calibrating the machine.

11.2 Security of insulation test

11.2.1 A parallel cord that has a nominal insulation thickness less than 1.52 mm (0.060 inch) (such as Types HPN, SP-1, SP-2, SPT-1, SPT-1W, SPT-2, SPT-2W, SPE-1, SPE-2, and XTW) shall be so secured within the fitting that the insulation is kept from slipping away from the terminal connections. Unless the conductor insulation is secured by a knot in the cord inside the fitting, or by an equivalent positive means, the assembly shall be capable of withstanding a pull of 67 N (15 lbf) for 2 minutes. See 11.2.2.

11.2.2 To determine that the conductor insulation is secured as required in 11.2.1, the fitting shall be wired as intended with a 152 – 203 mm (6 – 8 inch) length of the flexible cord. The insulation on each conductor of the cord shall be slit parallel to the conductors for a short distance at a point approximately 25 mm (1 inch) from its entry into the fitting, and all strands of the conductor and the separator (if any) shall be severed at the slit portion. While the connector fitting is securely held (by its blades in the case of an attachment plug or current tap), a pull of 67 N (15 lbf) shall be applied for a period of 2 minutes at the free end of the cord. Detachment of the insulation from the holding means within the fitting, or baring of the conductors at the entry of the fitting, is considered to be unacceptable.

11.2.3 When the conductor insulation on Type HPN flexible cord is seated 9.5 mm (3/8 inch) minimum inside the fitting after molding, the length of cord specified in 11.2.2 shall be 254 – 305 mm (10 – 12 inches) long. The slit in the insulation shall be made approximately 152 mm (6 inches) from the entry into the fitting, and all strands of the conductor and the separator (if any) shall be severed at the slit portion. The 67 N (15 lbf) pull test shall be applied and evaluated as described in 11.2.2.

11.2.4 If an insulation crimp connection is used, the conductor insulation shall be removed as close as possible to the insulation crimp. The pull shall then be applied between the bare conductor strands and the blade or contact.

11.3 Strain relief test

11.3.1 General

11.3.1.1 A pull exerted on a cord of constructions other than those that have been subjected to the test described in 12.5 shall not be transmitted directly to the terminals of a fitting.

11.3.1.2 The test shall be performed by using dead weights or, at the manufacturer's option, a power-driven tensile testing machine. If a tensile testing machine is used, it shall have jaws suitable for holding the specimen and capable of applying the minimum required tensile load to the specimen while separating at a uniform rate not exceeding 25 mm/min. The machine shall be equipped with a scale from which the load can be read to a value of 0.4 N. The accuracy of the scale shall be within 2 % of the value read, and weights shall be provided for calibrating the machine.

11.3.2 General-use fittings

11.3.2.1 The assembly of the cord to a fitting other than a flatiron plug, an appliance plug (see 11.3.5), or a through-cord heating-pad switch shall be capable of withstanding a straight pull of 133 N (30 lbf), if the conductors are 18 AWG (0.824 mm^2) or larger, and 89 N (20 lbf) if smaller than 18 AWG (0.824 mm^2).

11.3.2.2 To determine compliance with 11.3.2.1, the fitting shall be securely supported by a rigid, flat plate mounted horizontally. The plate shall have a hole just large enough for the supply cord to pass through. The specified pull shall be applied to the flexible cord for the required time, in a direction perpendicular to the plane of the cord-entry hole. Right-angle fittings may be supported by the blades as the test is performed.

11.3.3 Investigation of strain relief clamps requiring supplementary mechanical protection

11.3.3.1 Each of six representative complete strain relief assemblies shall be used for this test. Each of three unaged assemblies, as well as each of three assemblies after aging, shall be tested for 7 days in a forced-draft circulating-air oven at 90.0 ±2.0 °C (194.0 ±3.6 °F). Each assembly shall be subjected to a dielectric voltage-withstand test as required for the device, followed by a 133 N (30 lbf) strain-relief test for 1 minute, and then again subjected to the dielectric voltage-withstand test for 1 minute. The dielectric voltage-withstand test shall be conducted both between conductors and between metal parts of the clamp and the conductors connected together. In no case shall there be any dielectric breakdown or arc-over, and the strain-relief means shall prevent any movement of the cord that might transmit the strain to the wiring terminals of the device. Prior to the test of the oven-aged assemblies, these assemblies shall be visibly examined and show no evidence of damage to the cord insulation.

11.3.4 Joints and general-use fittings

11.3.4.1 A joint in the flexible cord shall be capable of withstanding a straight pull of 133 N (30 lbf) applied between the joint and the cord.

11.3.4.2 To determine that a joint complies with 11.3.4.1, the joint shall be securely supported by a rigid, flat plate mounted horizontally. The plate shall have a hole just large enough for the supply cord to pass through. The pull as specified in 11.3.4.1 shall be applied by means of a weight for 1 minute to the flexible cord in a direction perpendicular to the plane of the cord-entry hole. The detachment of either conductor of the cord from the termination at the joint is not acceptable.

11.3.5 Flatiron and appliance plugs

11.3.5.1 The strain relief provided in a flatiron or appliance plug shall keep a stress applied to a cord (in the form of a pull or twist) from being transmitted to the plug terminals when the assembly is tested as described in 11.3.5.2.

11.3.5.2 The plug shall be wired as received, except that the cord conductors shall be disconnected from the female contacts of the plug, and a pull of 35 lbf (156 N) shall be applied for 1 minute between the cord and the plug. The force may be exerted by any convenient means, but shall not be applied suddenly. Where there is slack between the strain-relief point and the terminal connection, a slight amount of slippage at the point where the strain relief itself is applied is not objectionable, but the results shall not be

acceptable if the ends of the cord are pulled away from the terminal cut. Disconnecting of the molded-on plug female contacts does not apply.

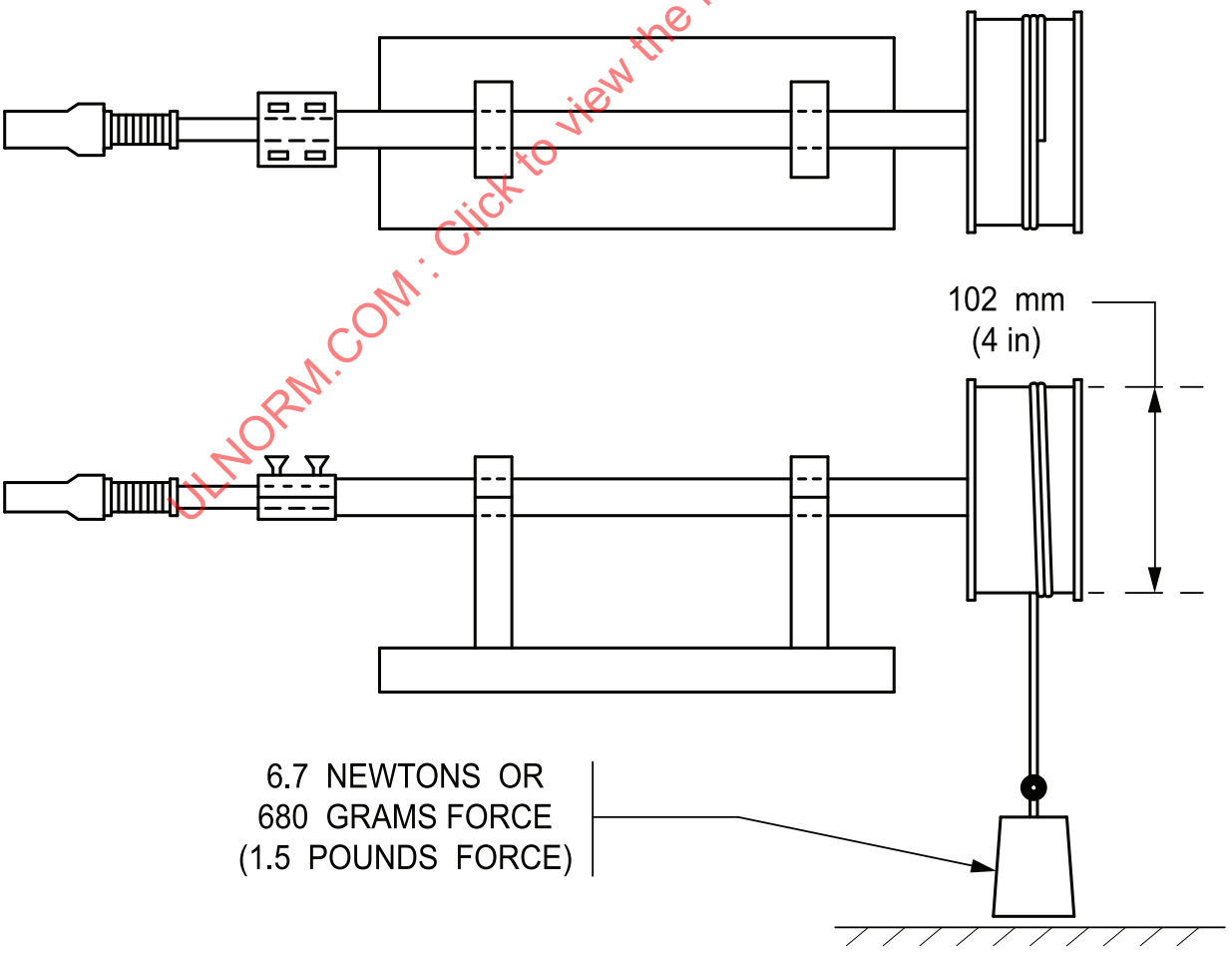
11.3.5.3 A flatiron or appliance plug wired with cord of round cross-section shall be so constructed that the assembly is capable of withstanding a torque of 0.34 N·m (3 lbf-inch) when tested as described in 11.3.5.4 and 11.3.5.5.

11.3.5.4 The plug shall be wired as received, except that the cord conductors shall be disconnected from the contacts. Disconnecting of the molded-on plug female contacts does not apply. The torque shall be applied to the assembly by any method at a point close to the guard that does not cause any compression of a spring or rubber nozzle. There shall be no pull on the cord during the test and the axis of the cord shall coincide with the main axis of the plug. The duration of the test shall be 1 minute. If the cord twists more than 90° within the plug body at the point of separation of the 2 conductors, the strain-relief means shall not be acceptable.

11.3.5.5 The illustration in Figure 11.1 shows a device acceptable for making the torsion test. The cord shall be gripped in a clamp at the end of the shaft, and the plug shall then be twisted slowly by hand until the weight is lifted clear of its support or until failure occurs. With the weight hanging freely, the applied torque shall be 0.34 N·m (3 lbf-inch).

Figure 11.1

Torque Testing Equipment



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11.3.6 Through-cord heating pad switches

11.3.6.1 The connections, strain relief, or the combination thereof in a through-cord heating-pad switch shall be capable of withstanding for 1 minute a straight pull of 222 N (50 lbf) when tested as described in 11.3.6.2.

11.3.6.2 To determine that the switch connections comply with 11.3.6.1, the cord shall be gripped with a clamp on each side of the switch. One clamp shall be held securely while the pull is applied to the other. Unless all connections in the switch are made by one of the means described in 9.6, the cord conductors shall be severed near the switch terminals prior to the application of the pull. If the ends of the conductor, after having been severed, are pulled away from the terminals by the application of the force, the results of the test shall be unacceptable. If the conductors were not severed prior to the test, the results shall be unacceptable if there is any breakage of the conductors or disruption of connections in the switch as a result of the application of the force.

11.3.7 Through-cord assemblies

11.3.7.1 No conductor of a through-cord assembly shall detach from a terminal of the fitting when subjected to a pull of 133 N (30 lbf), if the conductors are 18 AWG (0.824 mm^2) or larger, and 89 N (20 lbf) if smaller than 18 AWG (0.824 mm^2). A through-cord assembly shall be tested cord-to-cord. The pull shall be applied to the flexible cord in a direction perpendicular to the plane of the cord entry hole.

11.4 Dielectric voltage-withstand test

11.4.1 Each cord set or power-supply cord shall be capable of withstanding without breakdown for a period of 1 minute, before and after conducting the Crushing test, 11.7, and the Impact resistance test, 11.8, the application of a 60-Hz potential of 1250 V between any two conductors (see 11.4.2).

11.4.2 Bared ends of a power-supply cord may be separated from each other while the test in 11.4.1 is being conducted. The test shall be repeated until each conductor has been tested with respect to every other conductor.

11.4.3 The test potential shall be supplied from a 500 VA or larger capacity testing transformer whose output is essentially sinusoidal and can be varied except when a voltmeter is used in the output circuit to directly measure the applied potential. The applied potential shall be increased from zero until the required test voltage is reached, and shall be held at that voltage for 1 minute. The increase in the applied potential shall be at a substantially uniform rate and as rapid as is consistent with its value being correctly indicated by a voltmeter.

11.4.4 An attachment plug with solid blades of maximum length shall be fully inserted into a cord connector or current tap when the test described in 11.4.1 is conducted.

11.5 Insulation resistance test

11.5.1 The insulation resistance of a fitting shall not be less than 100 megohms between:

a) Live parts of opposite polarity;

b) Live parts and dead metal parts that are exposed to contact by persons or that may be grounded in service; and

c) Live parts and any surface of insulating material that is exposed to contact by persons or that may be in contact with ground in service.

11.5.2 To determine compliance with 11.5.1, the insulation resistance shall be measured by a magneto-megohmmeter that has an open-circuit output of 500 V or by equivalent equipment.

11.5.3 The use of a megohmmeter between live parts requires no special clarification or instruction. However, in measuring insulation resistance to the surface of an insulating material, the electrode shall be applied to the insulating material as described in 11.5.4.

11.5.4 A quantity of steel drop shot [approximate diameter 2.5 mm (0.10 inch)] shall be placed in a container that is open at the top. After cord holes or other openings through which the shot can enter have been plugged carefully with a high-resistance insulating material, the fitting shall be immersed in the shot so that the shot serves as an electrode in contact with the surface to which the test is to be applied.

11.5.5 All rubber parts shall be kept for at least 48 hours at room temperature before being subjected to the test mentioned in 11.5.1 – 11.5.4.

11.6 Accelerated aging test

11.6.1 Rubber compounds

11.6.1.1 Molded rubber for the insulation of a joint or a molded rubber device shall show no apparent deterioration and shall show no greater change in hardness than 10 numbers after being tested as described in 11.6.1.2 – 11.6.1.4.

11.6.1.2 If possible, the molded rubber joint or device shall be used complete. The hardness of the rubber shall be determined as the average of 5 readings with a gauge such as the Rex Hardness Gauge or the Shore Durometer. The joint or device shall then be placed for 70 hours in a full-draft circulating-air oven at a temperature of 100 ±2 °C (212 ±3.6 °F). The joint or device shall be allowed to rest at room temperature for 4 or more hours after removal from the oven. The hardness shall be determined again as the average of 5 readings. The difference between the average original hardness reading and the average reading taken after oven aging is the change in hardness.

11.6.1.3 Following the oven aging mentioned in 11.6.1.1 and 11.6.1.2, a molded rubber joint or device shall be capable of withstanding the pull test described in 11.3.4.1.

11.6.1.4 The accelerated-aging tests described in 11.6.1.1 – 11.6.1.3 shall be made on specimens of each color of rubber and on specimens for each basic rubber compound employed for the joint or device.

11.6.2 PVC compounds

11.6.2.1 A joint having a body of molded polyvinyl chloride or a copolymer thereof shall show no crack, discoloration, or other visible signs of deterioration as the result of exposure for 96 hours in a full-draft circulating-air oven at a temperature of 100.0 ±1.0 °C (212.0 ±1.8 °F).

11.7 Crushing test

11.7.1 Except as noted in 11.7.3, a plug with a configuration of plug 1-15, 2-15, 5-15 or 6-15 shall be capable of withstanding for 1 minute a crushing effort of 330 N (75 lbf) applied in any direction at right angles to its major axis. There shall not be any cracking or breaking to the extent that:

a) The fitting becomes unfit for use; or

b) Live parts become exposed to unintentional contact.

The fitting shall be conditioned in a circulating-air oven for 7 days at 90.0 ±1.0 °C (194.0 ±8 °F) and then cooled to room temperature before being subjected to the Crushing test. See also 11.8.1. The fitting shall comply with the requirements of the dielectric voltage withstand test described in 11.4.

11.7.2 Any testing equipment that can apply a steady pressure of 334 N (75 lbf) to the fitting may be employed. The fitting shall be tested between two 13-mm (1/2-inch) or thicker parallel flat maple blocks. Care shall be taken so that the crushing force is not applied suddenly.

11.7.3 Bodies molded of solid polyvinyl chloride, TPE, or thermoset need not be tested.

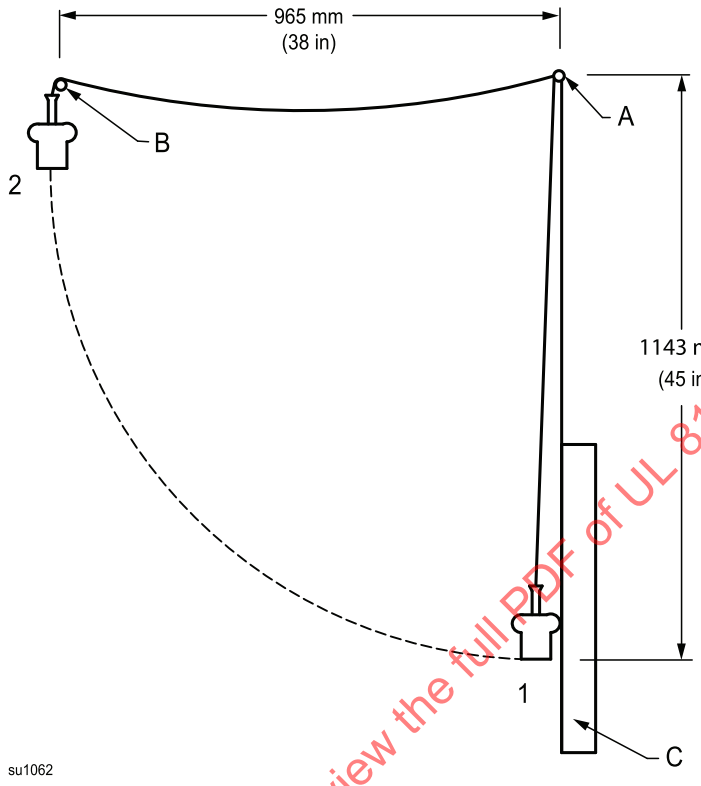
11.8 Impact resistance test

11.8.1 When subjected to the Impact test, 11.8.2, each molded-on fitting shall not crack or break to the extent that it becomes unfit for use, or live parts become exposed to unintentional contact, and it shall comply with the Dielectric voltage-withstand test in 11.4. The fitting shall be conditioned in a circulating-air oven for 7 days at 90.0 ±1.0 °C (194.0 ±1.8 °F) and then cooled to room temperature before being subjected to the Impact test.

11.8.2 Each of six representative molded-on fittings shall be tested. Each fitting shall be connected with nylon rope, the free end of which shall be passed through and knotted behind a bushing located at the point labeled A in Figure 11.2. The rope shall be free to rotate in the bushing. Initially, the rope and fitting shall hang freely and rest in the position labeled "1" in Figure 11.2 against the vertical face of the block C, which is a piece of maple 40 – 50 mm (1.5 – 2 inches) thick that is sufficiently high and wide to keep a fitting from striking near one of the edges of the block. The grain shall run vertically. The plane of the face of block C shall contain point A. The distance from the bushing to the contact end of the fitting shall be 1.1 m (45 inches). Lifting member B of the machine shall lift the fitting by the rope to the position labeled "2" in Figure 11.2. At this point, the edge of member B farthest from point A shall be approximately 1 m (38 inches) from the plane of the face of block C on a line normal to the plane A. The rope shall be released from member B and the fitting shall fall freely to strike block C. The machine shall repeat the operation continuously for 1000 cycles.

Figure 11.2

Impact Resistance Test



Legend:

A – Supporting bushing

B – Lifting Member

C – Maple block

1 and 2 – See 11.8.2

11.8.3 Bodies molded of solid polyvinyl chloride, TPE, or thermoset need not be tested.

11.9 Flexing test

11.9.1 A molded-on attachment plug, cord connector, or current tap of a cord set or power- supply cord that employs a parallel-type flexible cord having 18 AWG (0.824 mm^2), 16 AWG (1.31 mm^2), or 14 AWG (2.08 mm^2) conductors shall be capable of withstanding a minimum of 2500 flexing cycles when tested in accordance with 11.9.2 – 11.9.5.

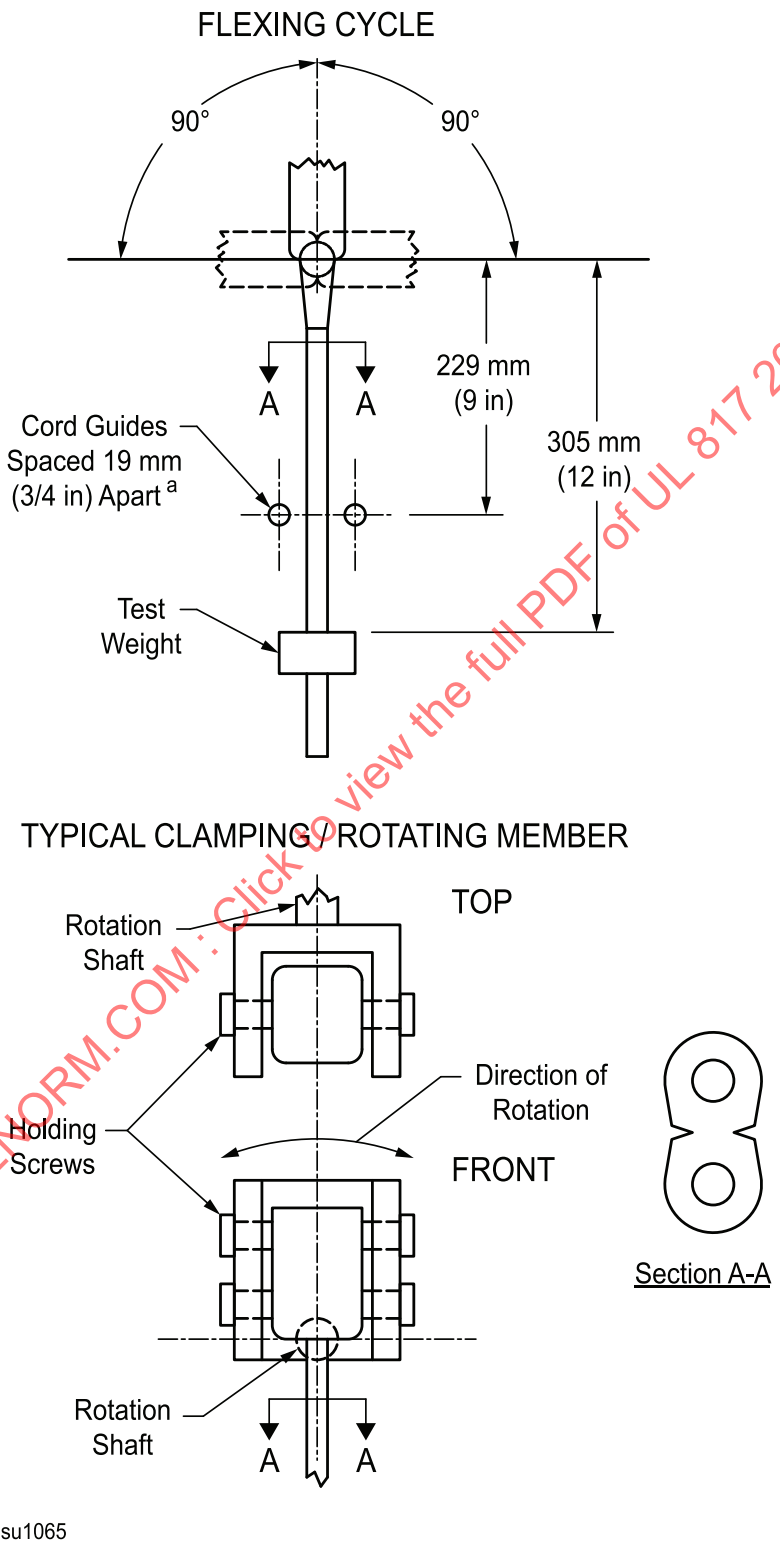
11.9.2 Representative fittings molded to flexible cord 500 mm (20 inches) in length shall be secured to the flexing apparatus so that the flexible cord assumes the natural bend permitted by the fitting construction. The major axis of any right cross-section of the cord shall be parallel to the longitudinal axis of the rotation shaft of the test fixture (see Section A-A in Figure 11.3) so as to allow the cord to flex without any twisting of the parallel conductors. The test weights shall be as follows:

a) For SPT Types (SP-1, NISP-1, SPT-1, NISPT-1, SPE-1, NISPE-1, SP-2, NISP-2, SPT-2, NISPT-2, SPE-2, NISPE-2, SP-3, SPT-3, SPE-3 and appliance wiring material in accordance with 10.2.4, 113 g (4 oz); and

b) For Type HPN, 0.28 kg (10 oz).

Figure 11.3

Flexing Test Apparatus



NOTE: Cord guides are used only to control oscillation of the flexible cord during testing and can therefore be adjusted, if necessary, so that the cord does not contact the guides in a manner that could increase the degree of bend present at its entry to the plug during the test.

11.9.3 Each molded-on representative fitting shall be secured in the jaws of the flexing machine so that the point of cord exit is at the center of rotation. The rotating jaws shall be adjusted to rotate to an angle of 90° to each side of the centered position. At the centered position, the cord shall hang vertically and the weight, selected in accordance with 11.9.2, shall be attached to each cord approximately 0.3 m (12 inches) from the point of rotation. See Figure 11.3.

11.9.4 Each representative fitting shall be subjected to complete flexing cycles. A flexing cycle consists of: rotation of the jaws from the vertical (centered) position until 90° to one side, back past the vertical position until 90° to the other side, and back to the vertical (centered) position. The test shall be conducted at a rate of 10 cycles per minute.

11.9.5 The representative fitting shall be considered to comply with this test if the conductors have not opened after 2500 flexing cycles, as determined by a continuously-monitoring detection circuit.

11.10 Jacket retention test

11.10.1 General

11.10.1.1 Following the tests described in 11.10, there shall not be any fillers, separators, insulation, or bare conductors visible at the point where the cord enters the fitting. A plug, connector, or current tap of a cord set or power-supply cord, including a nonintegral parallel-type cord, employing 18 AWG (0.824 mm^2), 16 AWG (1.31 mm^2), or 14 AWG (2.08 mm^2) conductors shall be so tested to determine the ability of the fitting to acceptably retain the jacket of the flexible cord to which it is molded.

11.10.2 Method I – applicable to molded-on assemblies employing attachment plugs and current taps

11.10.2.1 The molded-on fittings of each of six representative assemblies, with 0.3 m (12 inches) of flexible cord attached, shall be rigidly secured by the blades to the test apparatus used for the Abrupt pull test described in 12.5. The flexible cord of each assembly shall be subjected to 10 impacts using the method described in 12.5. Immediately following the 10 impacts, compliance with 11.10.1 shall be determined using the procedure described in 11.10.2.2 and 11.10.2.3.

11.10.2.2 Using any convenient method, each molded-on fitting shall then be connected – by the body – to a test apparatus having a vertical assembly capable of rotating through 360° and securing the fitting so that the cord exits the fitting being tested with the longitudinal axis of the cord in a horizontal direction, perpendicular to the plate face.

11.10.2.3 A weight of 1.4 kg (3 lb) shall be suspended at a point 0.2 m (8 inches) from where the cord enters the fitting for 15 seconds. With the weight still attached, the test apparatus mounting plate shall be rotated 360° about the horizontal axis of the cord exit (from the fitting) in 15 seconds, during which time the cord-body interface shall be visually examined to determine compliance with 11.10.1.1.

11.10.3 Method II – applicable to all molded-on plug assemblies

11.10.3.1 Each of six previously untested representative assemblies, with 0.30 m (12 inches) of flexible cord attached, shall be used for the test in Method II. The cord jacket of each of the assemblies shall be slit for a distance at a point 0.15 m (6 inches) from the point of cord entry to the fitting no longer than necessary to sever all internal conductors, conductor insulation, fillers, and separators.

11.10.3.2 Representative assemblies shall then be secured by the body of the molded-on fitting so that the flexible cord jacket is hanging vertically, and a 67 N (15 lbf) shall be applied for 2 minutes at a point 0.2 m (8 inches) from where the cord enters the fitting.

11.10.3.3 Compliance with 11.10.1.1 shall then be determined using the procedure described in 11.10.2.2 and 11.10.2.3.

11.11 Adhesion test

11.11.1 Adhesion between the cord and the body of the fitting shall be determined by bending the cord to an angle of 90° with the plane of the cord entry. The area shall be examined visually for openings that would likely permit the entry of moisture into the body.

11.11.2 If the visual examination called for in 11.11.1 cannot verify that acceptable adhesion exists, but there is reason to suspect that an acceptable seal may exist between the cord and the plug at some concealed location within the plug, the representative power-supply cords may be cut apart for examination. The adhesion may be determined to be acceptable if the examination of the inner construction reveals a positive seal at all points around the periphery of the cord.

11.12 Cycling heat test

11.12.1 General

11.12.1.1 Compliance with this test is optional, since cycling heat testing is determined not to be required to achieve levels of safe performance established by national consumer regulations.

11.12.1.2 An extension cord shall not have a temperature rise on the current-carrying parts of terminal fittings exceeding 30 °C (86 °F) above room temperature when carrying rated current, after being subjected to the test described in 11.12.2 – 11.12.3.

11.12.1.3 The extension cord shall have a temperature on the insulating body of the terminal fittings not exceeding the recognized temperature rating of the insulating body material when carrying rated current, based on a room temperature of 25 °C (77 °F).

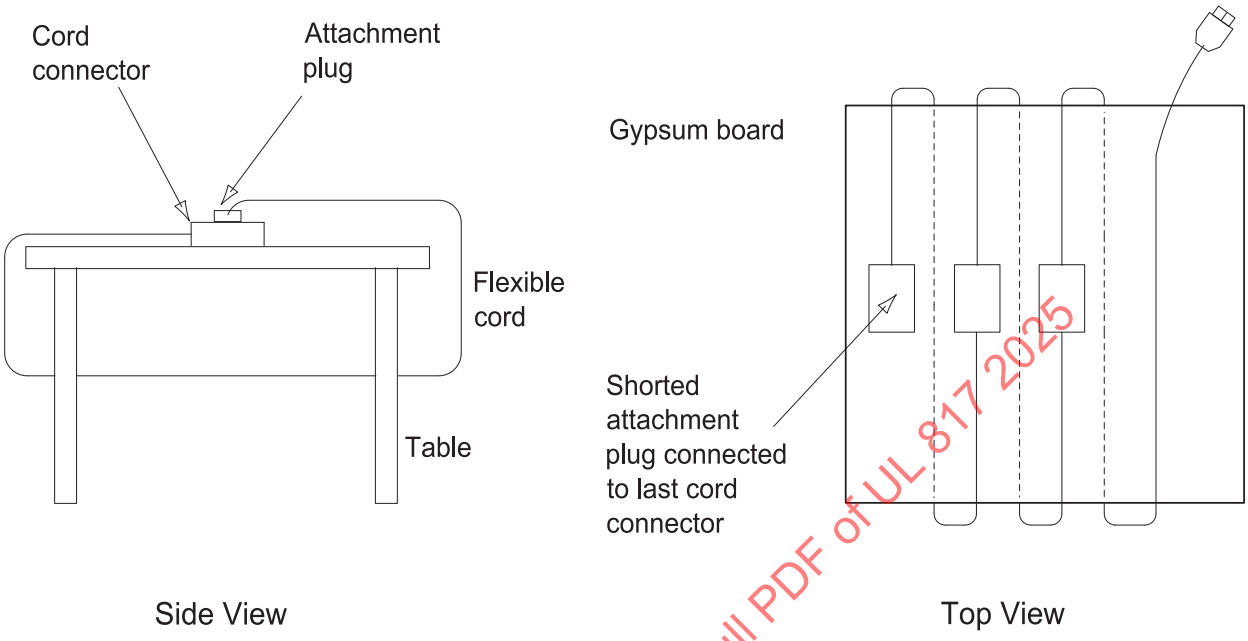
11.12.1.4 There shall be no visible evidence of melting, cracking, or other deterioration of the body material of the terminal fittings as a result of the test described in 11.12.3.

11.12.2 Preparation of specimens and test apparatus

11.12.2.1 Extension cord specimens having a length of at least 1.5 m (4.5 feet) shall be laid out on a table covered by a base board at least 0.6 × 0.6 m (24 × 24 inches) made of gypsum board 13 mm (0.5 inch) in thickness. Each pairing of extension cord specimens shall be spaced 76 mm (3 inches) apart and shall be permitted to be looped around the table, as shown in Figure 11.4.

Figure 11.4

Cycling Heat Test



11.12.2.2 A top to prevent air circulation shall cover the test table. The top shall consist of a box made of cardboard or other material that is 0.5 × 0.5 × 0.2 m (20 × 20 × 8 inches), with nine 40-mm (1.6-inch) diameter holes in the top, spaced 130 mm (5 inches) apart in both directions.

11.12.2.3 Ambient temperatures shall be measured on the inside of the box, in the center of the front and back faces, or on an upper-lower (corner) diagonal.

11.12.2.4 Temperatures of plugs shall be measured using thermocouples on the point anticipated to be the hottest of each current-carrying blade within the plug body, as well as the outside surface of the plug body. The location on the outside surface shall be on the same transverse plane as the blade thermocouples and as near as possible to two adjacent blade thermocouples.

11.12.2.5 Temperatures of cord connectors shall be measured using thermocouples on the outside surface of each contact blade carrying current, where contact on the inside surface with a plug is expected to be made during the test. Where this is not possible, the position of the thermocouple shall be determined by mutual agreement between the manufacturer and testing agency. A thermocouple shall also be placed on the outside surface of the cord connector body at a point where it is most likely to be the hottest, but not within the face area of the connected attachment plug.

11.12.2.6 Thermocouples shall be oriented such that they do not displace during the test. In addition, no forces shall be introduced to the connection, other than those normally occurring before, during, and after connection without thermocouples present.

11.12.2.7 The circuit shall be closed by connecting all plugs to cord connectors in series. At the end of the series connection a short-circuited plug shall be inserted into the last cord connector body to create a closed path for the current.

11.12.2.8 Timers shall be adjusted to the specified cycling time lapses: 3-1/2 hours on time and 1/2 hours off time, meaning that the current shall be applied for 3-1/2 hours and subsequently cut off for 1/2 hours.

11.12.3 Test procedure

11.12.3.1 Test specimens shall be attached to the test current supply. The cycling counting unit shall be reset to zero at the start of each test.

11.12.3.2 When all adjustments have been made, the test table and specimens shall be covered and thermocouples placed on the inside faces of the cover, as specified in 11.12.2.5, to read ambient temperatures.

11.12.3.3 The current output shall be adjusted to the required level. The first cycle shall be at 100 % of rated current, followed by 30 cycles at 125 % of rated current. Upon completion of the 30th cycle, the extension cord shall be operated at 100 % of rated current until three measurements at 30 minute intervals indicate that the temperature is stabilized, or until the temperature rise exceeds 10 °C.

11.13 Rain test for fittings, joints, and other enclosures employing cords with decorative braids

11.13.1 An assembly consisting of a fitting, joint, or enclosure constructed in accordance with 6.8.4 shall be tested as described in 11.13.2 – 11.13.5. The construction shall prevent water from reaching current-carrying parts.

11.13.2 The fitting, joint, or enclosure, connected to a minimum of 0.61 m (2 foot) length of the supplied braided cord shall be suspended by any convenient means as shown in Figure 11.5 such that the cord exit from the fitting, joint, or enclosure is positioned in the focal area of the three spray heads as shown in Figure 11.6. Any exposed blades or pins of a male fitting and contact slots of a female fitting shall be covered with an insulating material.

Figure 11.5

Position of Part Under Test

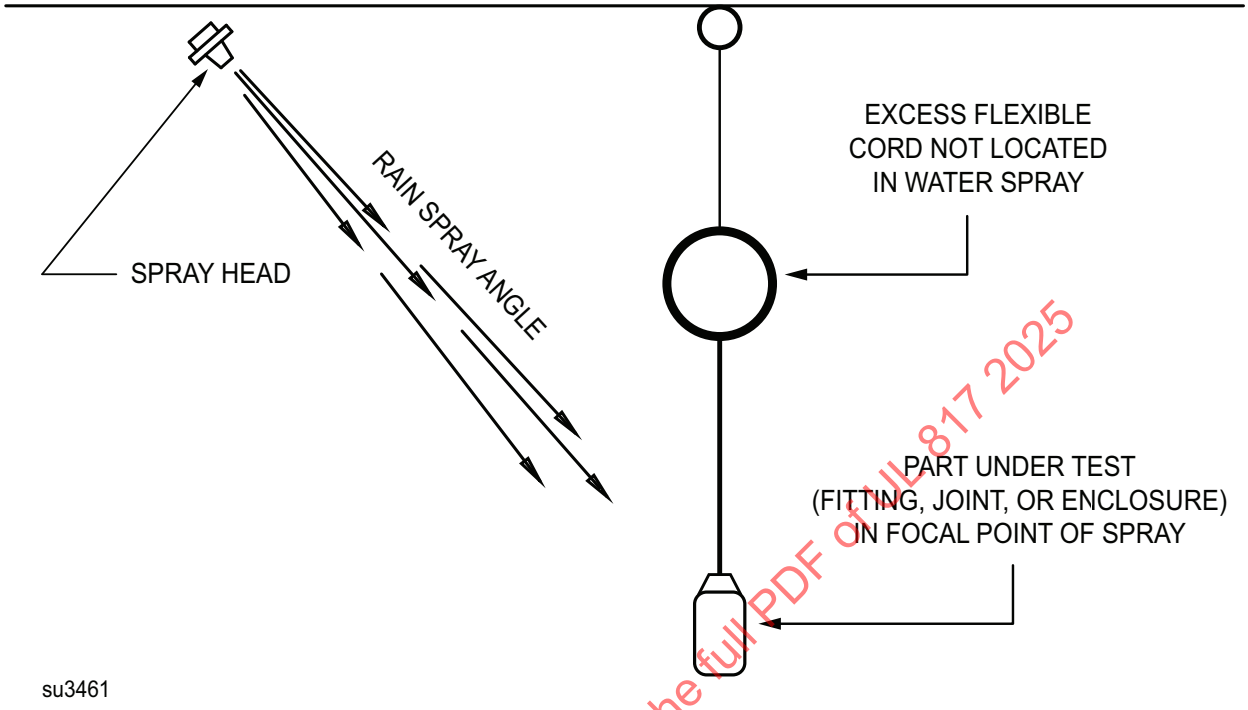
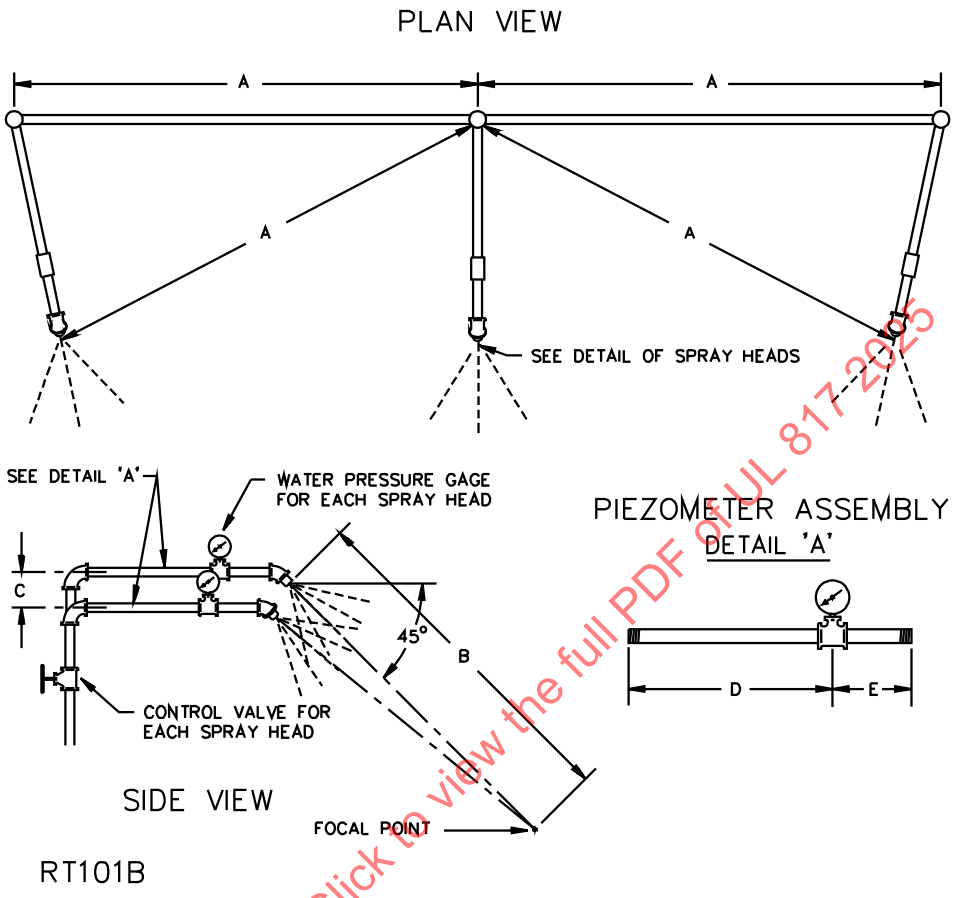


Figure 11.6

Rain-Test Spray-Head Piping



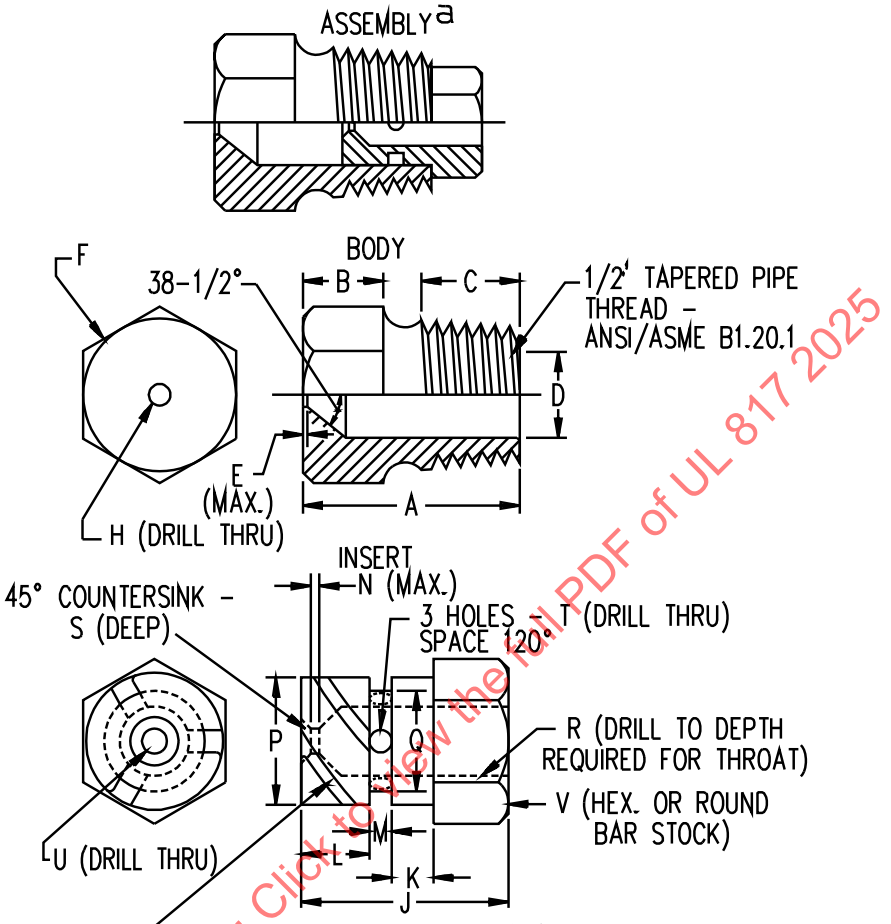
Item	mm	(inch)
A	710	(28)
B	1400	(55)
C	55	(2-1/4)
D	230	(9)
E	75	(3)

11.13.3 The assembly shall be subjected to one hour of a downward spray of tap water applied at an angle of 45° to the vertical, in the direction or directions most likely to cause water to enter the unit. The water temperature shall be 20 – 40 °C (68 – 104 °F).

11.13.4 The water-spray apparatus shall consist of three spray heads mounted as shown in Figure 11.6. The spray heads shall be constructed in accordance with Figure 11.7. The water pressure at each spray head shall be maintained at 34.5 kPa (5 lb/in^2).

Figure 11.7

Spray Head



Item	mm	inch	Item	mm	inch
A	31.0	1-7/32	N	0.80	1/32
B	11.0	7/16	P	14.61	.575
C	14.0	9/16		14.63	.576
D	14.68	.578	Q	11.51	.453
	14.73	.580		11.53	.454
E	0.40	1/64	R	6.35	1/4
F	c	c	S	0.80	1/32
G	1.52	.06	T	2.80	(No. 35)[b]
H	5.0	(No.9)[b]	U	2.50	(No. 40)[b]
J	18.3	23/32	V	16.0	5/8
K	3.97	5/32	W	1.52	0.06
L	6.35	1/4			
M	2.38	3/32			

[a] Nylon Rain-Test Spray Heads are available from Underwriters Laboratories

[b] ANSI B94.11M Drill Size

[c] Optional – To serve as a wrench grip.

RT100F

11.13.5 Within five minutes after the completion of the test, and in the same orientation as during the application of the water spray, the assembly shall comply with the Dielectric voltage-withstand test, 11.4, with the dielectric trip current set for a maximum of 150 mA. In addition to the test locations indicated in 11.4.2, the assembly shall be tested between live parts and metal foil. The metal foil shall be placed over the fitting, joint, or enclosure and a minimum of 76.2 mm (3 inches) of cord, and shall be arranged to conform to its shape. The Crushing test and Impact resistance test referenced in 11.4.1 shall not be conducted as part of this test.

12 Tests for Attachment Plugs

12.1 Security of blades and pins test

12.1.1 If the blades or pins of an attachment plug or current tap rated 20 A/250 V and NEMA 6-20P or less are not secured within the fitting prior to their being connected to the conductors of the cord, then each blade or pin shall be capable of withstanding a pull of 89 N (20 lbf) for 2 minutes without loosening, when tested in accordance with 12.1.3. In a fitting of non-rigid construction, the residual displacement of either blade measured 2 minutes after the removal of the weight shall not exceed 2.4 mm (3/32 inch).

12.1.2 Each blade of a special use, miniature type attachment plug intended for use inside equipment, which is not accessible during normal servicing without the use of a tool, or provided with any means for retention of the blades in the mating female contacts, including provision for locking, shall be capable of withstanding a pull of 27 N (6 lbf) for 2 minutes without loosening.

12.1.3 The fitting shall be wired in the intended manner and then supported on a horizontal steel plate with the blades or pins, or both, projecting downward through a single hole just large enough to permit the blades or pins, or both, to pass through it. A weight that exerts the specified pulling force shall then be supported by each blade or pin in succession.

12.2 Temperature test

12.2.1 General

12.2.1.1 The connection of the conductors to the blades or pins of a plug shall be capable of carrying the rated current of the flexible cord or the plug, whichever is less, without a temperature rise of more than 30 °C, when tested in accordance with 12.2.1.2. A product that employs a fuse shall be tested with the fuse in place, and the fuse shall remain intact following the test.

Exception: In the case of a connection using binding head screws or the equivalent, this test is not required.

12.2.1.2 The blades or pins of the plug shall be connected to each other by means of copper wire having a length not exceeding 38 mm, with one end soldered to each blade or pin. The wire shall be 14 AWG (2.08 mm^2) if the rated ampacity of the cord is not more than 18 A, and 8 AWG (8.36 mm^2) for a cord that is rated for a higher ampacity. With the assembly carrying either an alternating or direct current equal to the acceptable ampacity of the cord, temperatures shall be measured by means of thermocouples on the blades at the plane of the face of the plug.

12.2.2 Joints

12.2.2.1 A joint in an adapter cord set shall be capable of carrying continuously, without a temperature rise of more than 30 °C (54 °F), a current equal to the rating of the adapter cord set.

12.2.2.2 To determine that a joint complies with 12.2.2.1, the adapter cord set shall be caused to carry a current equal to the rating of the adapter cord set; temperatures shall be measured by means of thermocouples placed in contact with the joint adjacent to the conductor.

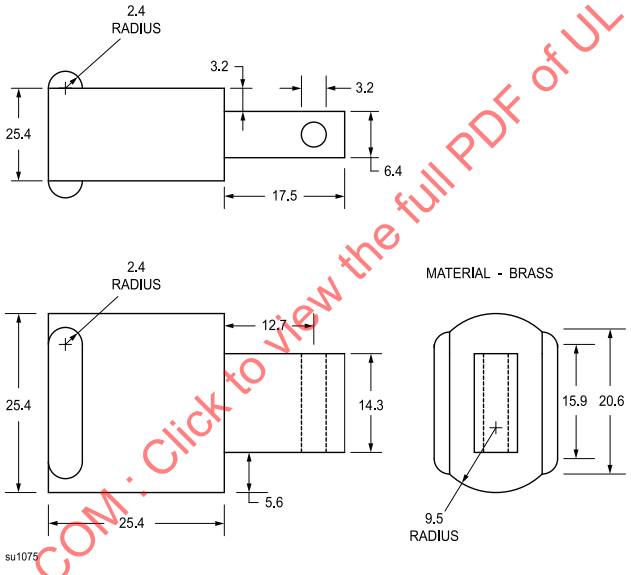
12.3 Plug grip test

12.3.1 The attachment plug shall be tested as described in 12.3.2 – 12.3.9 to determine compliance with 7.2.1.

12.3.2 Prior to testing, the reference plug shown in Figure 12.1 shall be cleaned with a metal cleaner. The reference plug, the representative plugs, and the hands of each individual conducting the test shall be washed with soap and water, rinsed, and then dried.

Figure 12.1

Reference Plug



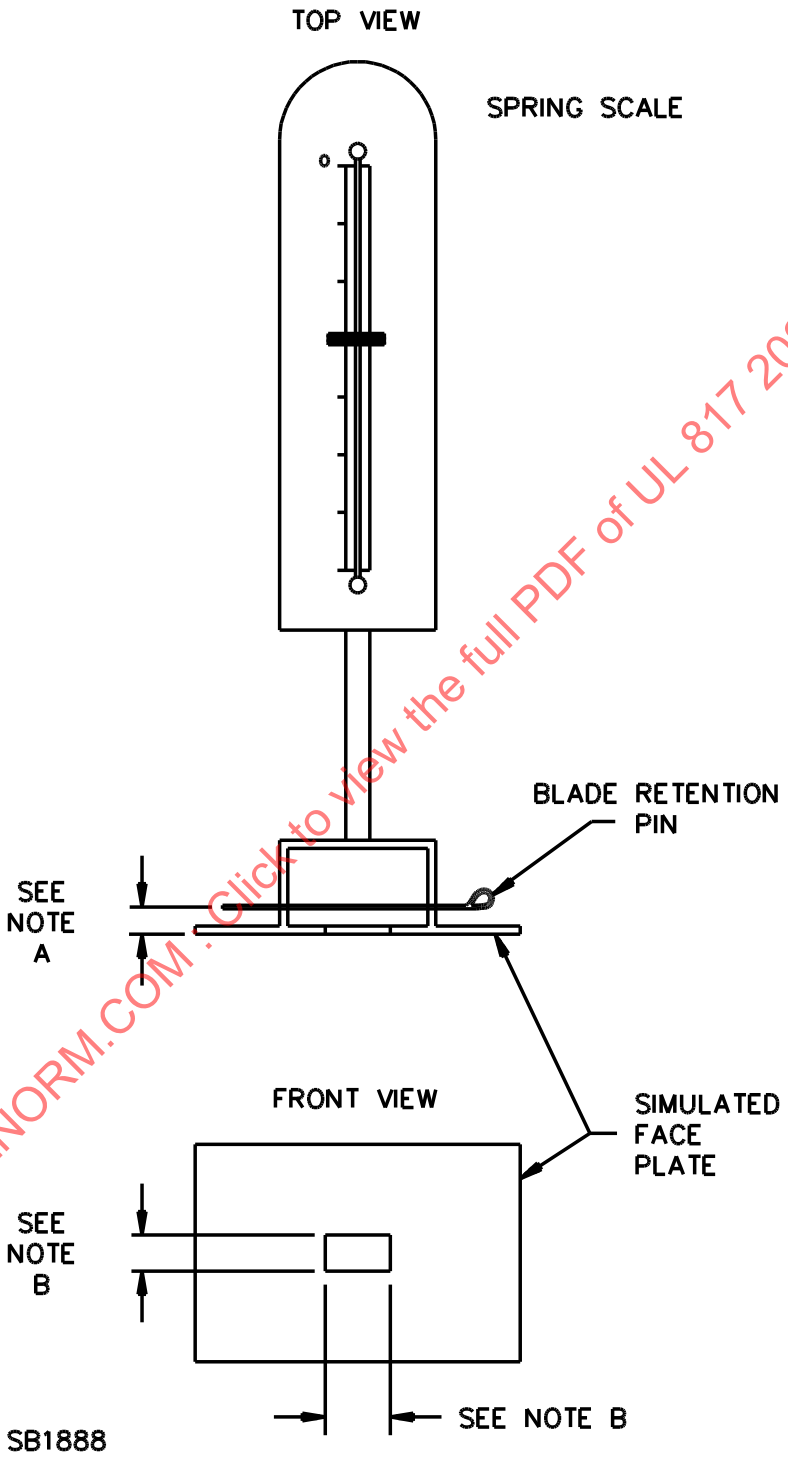
NOTE: All dimensions in mm.

mm	2.4	3.2	5.6	6.4	9.5	12.7	14.3	15.9	17.5	20.6	25.4
(inch)	(3/32)	(1/8)	(7/32)	(1/4)	(3/8)	(1/2)	(9/16)	(5/8)	(11/16)	(13/16)	(1.0)

12.3.3 The test apparatus shall consist of a spring scale equipped with a means to securely attach both the reference plug and test representative plugs in a manner that prevents rotational movement during pulls. A simulated face plate, having an opening for the plug blades, shall be secured to the movable member. The mounting arrangement for the plug under test shall be such that the face of the plug is flush with the face plate. A typical apparatus is shown in Figure 12.2.

Figure 12.2

Typical Test Apparatus



NOTES:

A – Retaining pin through blades spaced to keep plug close to plate.

B – Large enough for blades to pass through.

12.3.4 A representative plug, with cord cut off close to the plug, shall be securely attached to the test apparatus. The individual performing the test shall grip the representative plug with either hand in a manner intended to apply the maximum pull force. A steady straight pull shall be applied until the plug pulls free from the individual's hand. The individual applying the force shall not view the force indicator during the pull. The maximum pull force applied during the pull shall be recorded. Immediately following the pull test, the reference plug shall be attached to the test apparatus and a comparison pull made using the same hand. The maximum pull force shall be recorded. The ratio of the force for the representative plug to the reference plug shall be calculated and recorded.

12.3.5 The comparison pull procedure described in 12.3.4 shall be repeated on the same representative plug an additional two times by the same individual. The ratio for each pair of pulls (test/reference) shall be calculated and recorded.

12.3.6 Each individual shall test each of three representative plugs as described in 12.3.4 and 12.3.5 with the ratio for each pair of pulls being calculated and recorded for all three plugs.

12.3.7 Two additional individuals shall test each of three representative plugs (for a total of 9 comparison pulls per individual), as described in 12.3.4, 12.3.5, and 12.3.6. The ratio for each pair of pulls (test/reference) shall be calculated and recorded.

12.3.8 The results shall be considered acceptable if all of the following conditions are met:

a) The ratio for each pair of pulls (test/reference) is 0.55 or larger for at least two pulls (of the three pulls performed) on each representative plug;

b) At least two (of the three) representative plugs tested by each individual comply with (a); and

c) The test results of at least two individuals comply with (b).

12.3.9 If only one individual obtains results that comply with 12.3.8(b), at the manufacturer's request, two individuals not previously involved in testing may test each of three representative plugs as described in 12.3.4, 12.3.5, and 12.3.6. The results shall be considered acceptable if the test results of both individuals comply with 12.3.8 (a) and (b).

12.4 Blade pull test at elevated temperature

12.4.1 Following the oven conditioning described in 12.4.2 – 12.4.6, a plug or current tap shall be capable of withstanding the 45 N (10 lbf) pull indicated without displacing either blade from its original position in the molded body by more than 1.6 mm (1/16 inch).

12.4.2 Except as noted in 12.4.3, each of six representative plugs or current taps molded to a length of cord no more than 150 mm (6 inches) long shall have a line scribed on both sides and both edges of the blades to indicate the point where the blade enters the device body. Each plug or current tap shall then be securely mounted so that the line blades are positioned downward through a circular hole (diameter just large enough to allow the line blades and any grounding pin to pass through) in a 6.4 mm (1/4 inch) thick steel plate mounted horizontally within an air circulating oven that has been heated to 60 °C (140 °F). After the plugs have been positioned, a weight that exerts 44.5 N (10 lbf) shall be attached to each of the individual line blades. The oven shall then be maintained at 60 °C (140 °F) for 4 hours, after which the weights shall be removed and the plugs or current taps taken from the oven and allowed to cool to room temperature. The displacement of the blades from their original position shall then be determined as described in 12.4.5.

12.4.3 In reference to 12.4.2, to facilitate the placement of test weights within the test chamber, testing may instead be accomplished by exerting the pull on just one blade of each attachment plug or current tap.

Of the 12 attachment plugs or current taps that would be required, 6 shall be tested using the right-hand blade and the remaining 6 tested using the left-hand blade.

12.4.4 The circular hole mentioned in 12.4.2 should be the smallest diameter capable of accommodating the line blades and, if the plug is of a grounding type, any grounding pin. For example, a hole sized to accommodate a 5-15 plug cannot be used to test a 1-15 plug since the opening for the blades and grounding pin of the 3-wire plug would be larger than the minimum size necessary for the blades of the 2-wire plug to just pass through.

12.4.5 The distance from the scribed lines, on each of the sides and both edges of the blades, to the face shall be measured after the thermal conditioning. The average of the four measurements for each blade shall be used to determine compliance with the 1.6 mm (1/16 inch) maximum displacement requirement.

12.4.6 This requirement is for plugs with 1-15P, 5-15P, 6-15P, 5-20P, and 6-20P configurations.

12.5 Abrupt pull test

12.5.1 Three-conductor cords

12.5.1.1 Plugs and the male portion of molded-on current taps used on cord sets and power-supply cords employing a grounding conductor shall prevent discontinuity from occurring in the grounding conductor or either of the two line conductors of three-conductor cords employing conductors smaller than 10 AWG (5.26 mm^2), when tested in accordance with 12.5.3.

12.5.1.2 With regard to 12.5.1.1, discontinuity of any line conductor shall not occur as a result of 5 impacts, and discontinuity of the grounding conductor shall not occur prior to that of any line conductor nor as a result of 25 impacts.

12.5.2 Two-conductor cords other than tinsel cords, clock cords, or shaver cords

12.5.2.1 The plugs and the male portion of molded-on current taps used on cord sets and power-supply cords shall prevent discontinuity from occurring in either of the two line conductors of two-conductor cords employing conductors smaller than 10 AWG (5.26 mm^2), when tested in accordance with 12.5.4.

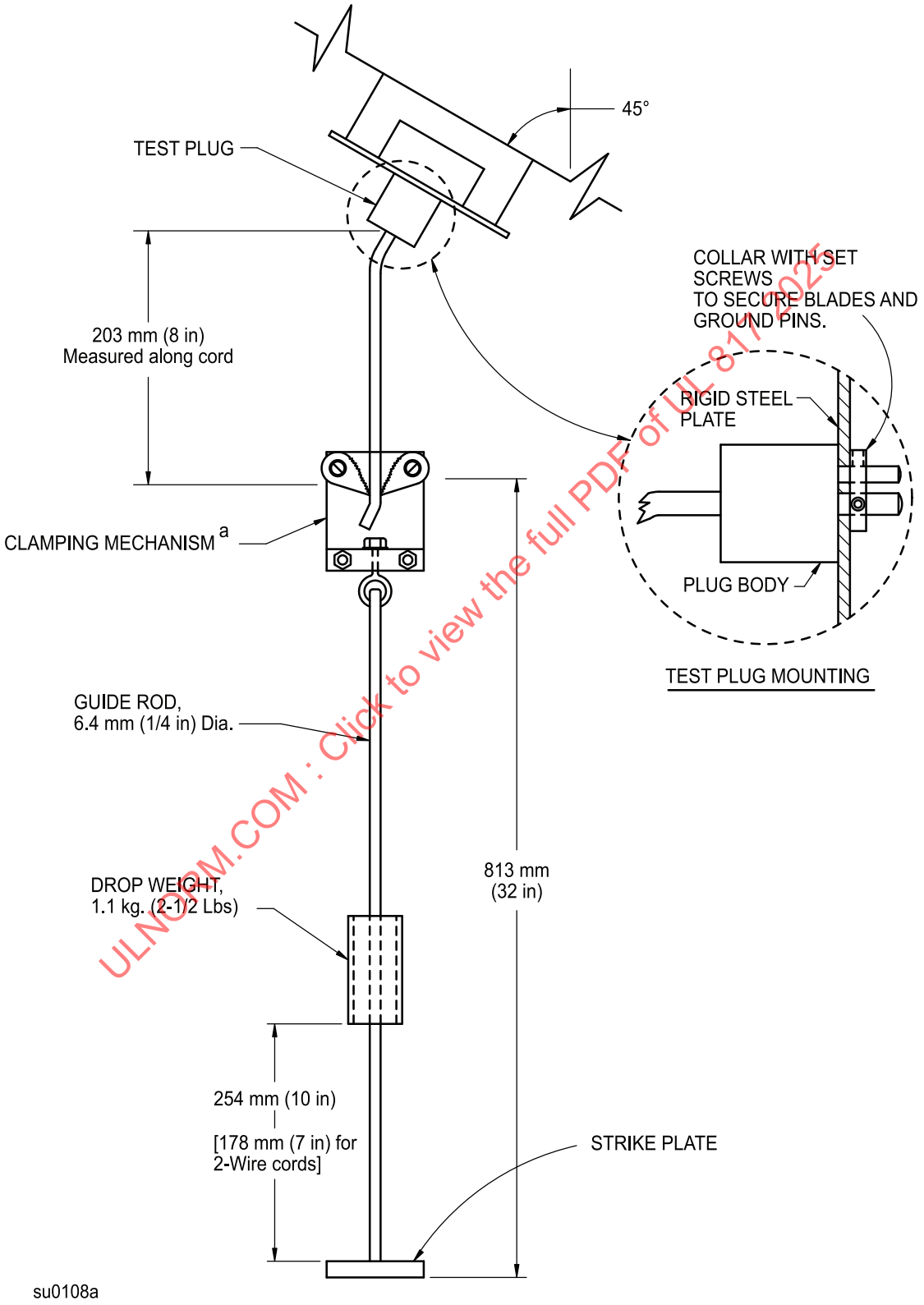
12.5.3 Test procedure for three-conductor cords

12.5.3.1 Six representative assemblies consisting each of an attachment plug or current tap molded onto a flexible cord 0.3 m (12 inches) in length are necessary for the test. Those having a ground pin shall be tested with the ground pin in the up position, except for right-angle plugs, which shall be tested only in the cord down position.

12.5.3.2 The plug shall be securely attached by the blades to the mounting plate of the test apparatus shown in Figure 12.3 and the plate positioned so that the plug is pointing downward at an angle of 45° to the vertical.

Figure 12.3

Abrupt Pull Test Apparatus

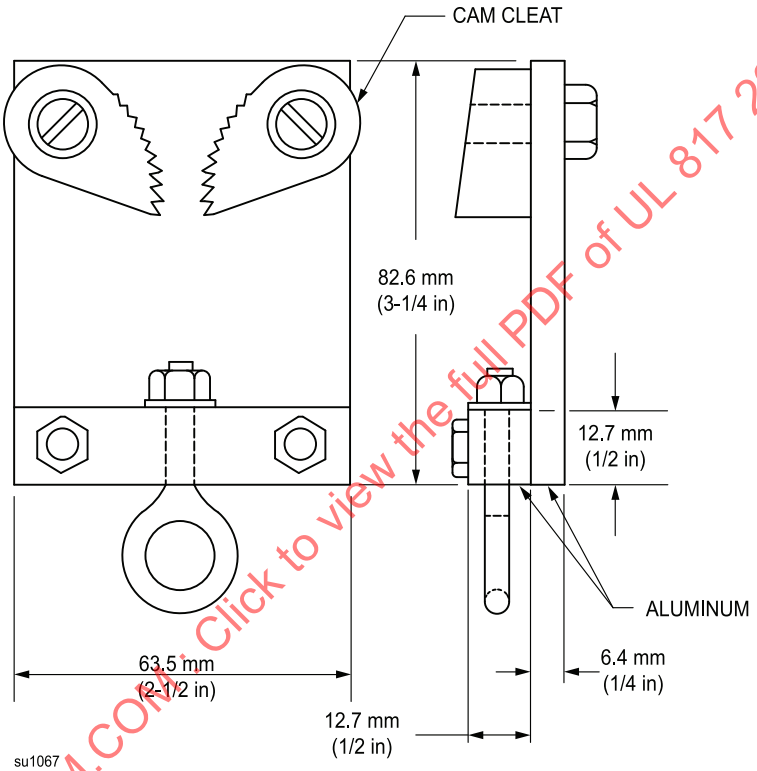


NOTE: See Figure 12.4 for detail of clamping mechanism.

12.5.3.3 The strike-plate/weight assembly shall be suspended from the cord, using a clamping mechanism similar to that depicted in Figure 12.4. The distance, measured along the cord, from the center of the gripping area of the clamping mechanism to the point where the flexible cord exits the plug shall be approximately 0.2 m (8 inches). The distance between the point of the striker-plate assembly's connection to the flexible cord (center of gripping area) to the bottom of the striker plate shall be not more than 0.8 m (32 inches). The combined weight of the striker-plate assembly and holding clamp, exclusive of the 1.1 kg (2-1/2 lb) drop weight, shall be 907 ±85 g (2 lb ±3 oz).

Figure 12.4

Clamping Mechanism



12.5.3.4 The representative assemblies being tested shall be subjected to an impact by raising and releasing a 1.1-kg (2-1/2-lb) weight, allowing it to fall freely for a distance of 0.25 m (10 inches) to impact the strike plate. This procedure shall be repeated until:

a) Discontinuity of the grounding conductor or either line conductor occurs; or

b) 25 impacts are completed.

The opening of line and grounding conductors shall be determined using a continuously-monitoring detection circuit.

12.5.3.5 For each discontinuity obtained through the testing described in 12.5.3.3, the following information shall be recorded:

a) The number of impacts necessary to produce the discontinuity; and

b) The circuit (grounding or line) in which it occurred.

12.5.3.6 In the event that the grounding conductor does not break before any of the line conductors or the test is discontinued after the maximum of 25 impacts has been reached, the acceptability of the grounding conductor shall be verified by subjecting it to a current of 40 A at any voltage between 0 and 12 V for 2 minutes.

12.5.4 Test procedure for two-conductor cords

12.5.4.1 Except as noted in 12.5.4.4 and 12.5.4.5, the procedure for performing the abrupt pull test on plugs molded onto 2-wire cords is essentially that which is described in 12.5.3. Two-conductor cords shall be considered to be in compliance if they can complete 5 impacts without the opening of any conductors. When applying the test in 12.5.3 on 2-conductor devices, any reference to testing or detection of discontinuity in the grounding conductor shall be disregarded. See also 12.5.4.2 and 12.5.4.3.

12.5.4.2 The abrupt pull test shall not be required for power-supply cords employing Types XTW, CXTW, TPT, TST, shaver, and clock cords.

12.5.4.3 The abrupt pull test shall not be required for cord sets and power-supply cords employing 10 AWG (5.26 mm^2) and larger flexible cords.

12.5.4.4 Instead of the test value indicated in 12.5.3.4, the 1.1-kg (2-1/2-lb) weight shall be released to fall freely for 180 mm (7 inches) to impact the strike plate.

12.5.4.5 Instead of the test orientations described in 12.5.3.1, of the six representative devices required, two shall be tested in each of the following orientations:

a) Blades in the vertical position;

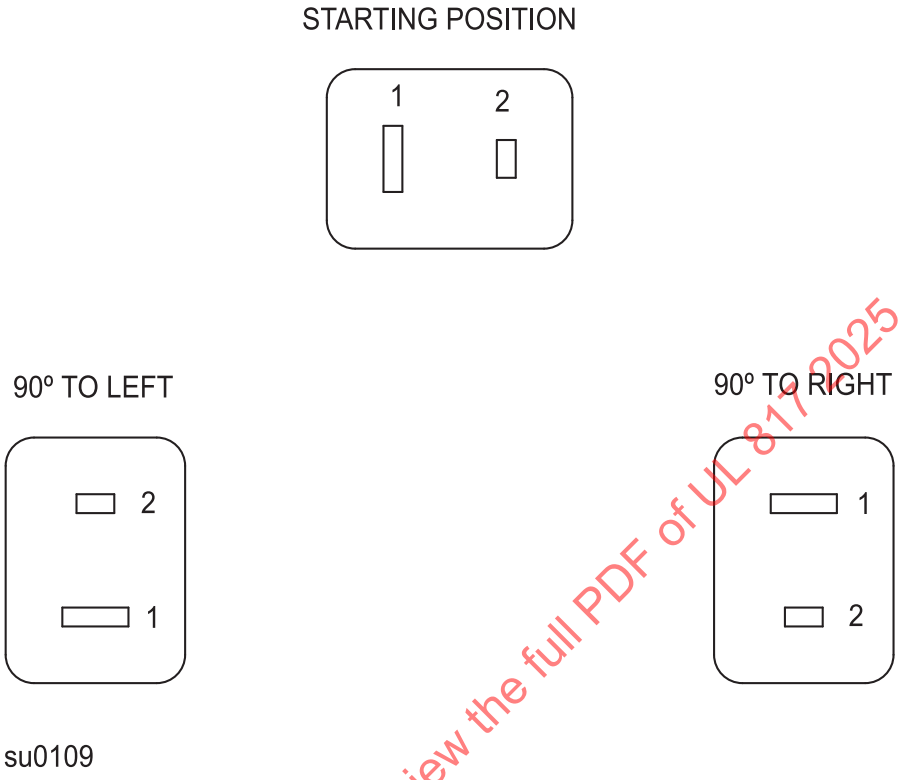
b) Plug rotated 90° to the right of the vertical position; and

c) Plug rotated 90° to the left of the vertical position. See Figure 12.5.

Right-angle plugs shall be tested only in the cord-down position.

Figure 12.5

Orientations for Abrupt Pull Test for Two Conductor Representative Devices



13 Tests for Range and Dryer Power-Supply Cord Kits

13.1 Strain relief test

13.1.1 After being subjected to the procedure in 13.1.2 – 13.1.4, the strain relief means provided with a range or dryer power-supply cord kit shall prevent:

a) Damage to the cord insulation or jacket;

b) Movement of the cord with respect to the strain relief that would allow stress on the internal connections; and

c) Contact between the cord and the edge of the hole in the test plate.

13.1.2 Previously untested representative means of strain-relief shall be assembled to a power-supply cord using the installation instructions provided and then mounted in a round hole in the center of a 1.2 mm (3/64 inch) thick sheet metal test plate having a length and width of 0.3 mm (12 inches). The diameter of the mounting hole shall be the applicable maximum connection opening diameter specified in Table 13.1. The test plates shall be rigidly supported, one in each of the following positions:

a) Horizontal;

b) Vertical, with the major cross-section axis of the power-supply cord in a horizontal position; and

c) Vertical, with the major cross-section axis of the power-supply cord in a vertical position.

A 15.9-kg (35-lb) weight shall be suspended from the external part of each power-supply cord for 1 minute.

13.1.3 When testing a round power-supply cord, the combination of the two tests with the test plate in the vertical position into one test, with the strain relief arranged in the most adverse position, is optional.

Table 13.1
Range and Dryer Power-Supply Cords

Number, size, and use of conductors		Current rating A	Voltage rating V	Plug type and configuration	Diameter of connection opening mm (inch)		
					Minimum	Nominal	Maximum
2	10 AWG (5.26 mm^2) unidentified circuit and	30	125/250	3 pole, 3 wire,	27.79	28.58	28.96
1	10 AWG (5.26 mm^2) grounded circuit			(10 – 30P)	(1.094)	(1-1/8)	(1.140)
2	10 AWG (5.26 mm^2) unidentified circuit and	30	125/250	3 pole, 4 wire, grounding	27.79	28.58	28.96
1	10 AWG (5.26 mm^2) grounded circuit and			(14 – 30P)	(1.094)	(1-1/8)	(1.140)
1	10 AWG (5.26 mm^2) grounding						
2	8 AWG (8.36 mm^2) unidentified circuit and	40	125/250	3 pole, 3 wire,	34.54	34.93	35.71
1	10 AWG (5.26 mm^2) grounded circuit			(10 - 50P)	(1.360)	(1-3/8)	(1.406)
2	8 AWG (8.36 mm^2) unidentified circuit and	40	125/250	3 pole, 4 wire, grounding	34.54	34.93	35.71
1	10 AWG (5.26 mm^2) grounded circuit and			(14 – 50P)	(1.360)	(1-3/8)	(1.406)
1	10 AWG (5.26 mm^2) grounding						
2	6 AWG unidentified circuit and	50, marked for use with 1-3/8 inch opening	125/250	3 pole, 3 wire,	34.54	34.93	35.71
1	8 AWG (8.36 mm^2) grounded circuit			(10 – 50P)	(1.360)	(1-3/8)	(1.406)
2	6 AWG (13.3 mm^2) unidentified circuit and	50, marked for use with 1-3/8 inch opening	125/250	3 pole, 4 wire, grounding	34.54	34.93	35.71
1	8 AWG (8.36 mm^2) grounded circuit and			(14 – 50P)	(1.360)	(1-3/8)	(1.406)
1	8 AWG (8.36 mm^2) grounding						
2	6 AWG (13.3 mm^2) unidentified circuit and	50, marked for use with 1-3/4 inch opening	125/250	3 pole, 3 wire,	43.66	44.45	44.83
1	8 AWG (8.36 mm^2) grounded circuit			(10 -– 50P)	(1.719)	(1-3/4)	(1.765)
2	6 AWG (13.3 mm^2) unidentified circuit and	50, marked for use with 1-3/4 inch opening	125/250	3 pole, 4 wire, grounding	43.66	44.45	44.83
1	8 AWG (8.36 mm^2) grounded circuit and			(14 – 50P)	(1.719)	(1-3/4)	(1.765)
1	8 AWG (8.36 mm^2) grounding						

13.1.4 The entire test described in 13.1.2 shall be repeated on three previously untested representative means of strain relief that are assembled and mounted in a hole having the applicable minimum connection opening diameter specified in Table 13.1.

13.2 Accelerated aging test

13.2.1 An integral strain relief of rubber-like material shall show no signs of deterioration or cracks after being tested in accordance with 13.2.3.

13.2.2 An integral strain relief made of resilient plastic or synthetic elastomeric material shall show no cracks when flexed in accordance with 13.2.3, or other visible signs of deterioration resulting from exposure in a circulating air oven. The oven temperature and the duration of the test shall be in accordance with Table 13.2.

Table 13.2
Oven Temperatures for Aging Test for Range and Dryer Strain Relief

Temperature rating of material, °C	Duration of test days	Oven temperature, °C
75	10	100 ±1
90	7	121 ±1
105	7	136 ±1

13.2.3 A flat section of a rubber specimen shall be exposed in a circulating air oven maintained at 100 °C for a period of 70 hours. The specimen shall then be cooled to room temperature and bent 90° around a mandrel having a diameter of approximately four times the thickness of the specimen at the point of bend.

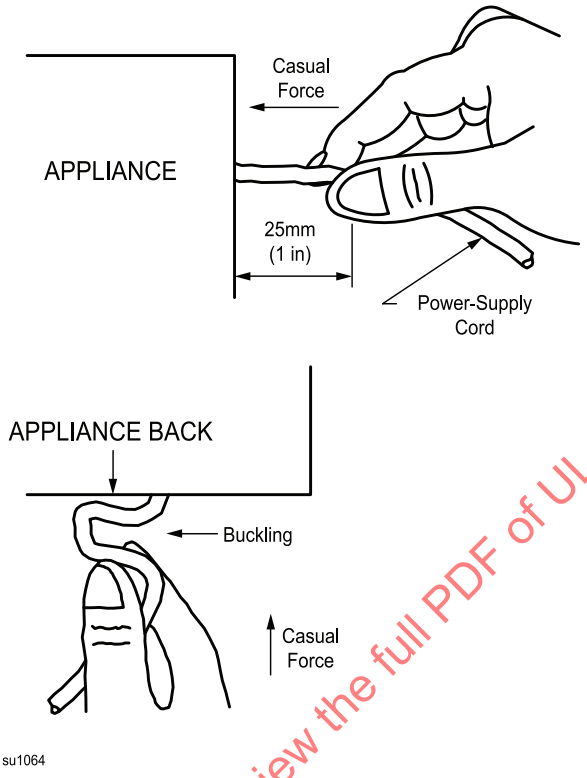
13.3 Push-back force test

13.3.1 The strain relief means provided with a range or dryer power-supply cord kit shall prevent the flexible cord from being pushed into the cord mounting opening of an appliance, when tested in accordance with 13.3.2.

13.3.2 The flexible cord shall be held by the fingers 25 mm (1 inch) from the point where the cord emerges from the cord-mounting opening. The metal plate such as the one described in 13.1.2 shall be appropriate for simulating the cord mounting in an appliance. The flexible cord shall be pushed back with a force not exceeding 27 N (6 lbf). See Figure 13.1.

Figure 13.1

Power-Supply Cord Push-Back Evaluation



14 Tests for Cord Connectors

14.1 Depth of cavity test

14.1.1 As required by 8.1.3, a cord connector shall accommodate a parallel-blade attachment plug without any blade exposure between the faces of the fittings. The determination shall be made by insertion of a depth gauge as described in Figure 8.2 in each slot. The depth gauge shall have a cross section of 6.6 × 1.7 mm (0.260 × 0.065 inch) for checking non-polarized slots and 8.2 × 1.7 mm (0.322 × 0.065 inch) for checking polarized slots. Each gauge shall have a scribed mark located 18.2 mm (0.718 inch) from the end of the gauge inserted in the slot. A force of not more than 67 N or 6.8 kgf (15 lbf) may be used to determine if the gauge is fully inserted into the slot; after full insertion, the scribed mark shall not be located outside the plane of the face of the cord connector. The gauge shall be made of tool steel and sharp edges shall be removed to a radius of 0.4 mm (1/64 inch).

14.2 Conditioning cycles for blade retention test

14.2.1 Connector fittings shall be subjected to ten conditioning cycles of manual insertion and withdrawal of the standard test gauge described in UL 498. The force needed for the initial insertion of an attachment plug into a cord connector shall not exceed 180 N or 18.4 kgf (40.5 lbf).

14.3 Retention of blades test

14.3.1 A connector fitting having a 1-15R, 5-15R, 5-20R, 6-15R, or 6-20R configuration shall be subjected to the retention of blades test described in 14.3.2 – 14.3.5.

14.3.2 Each of six devices shall be tested. The standard test gauge shall be configured as outlined in Table 14.1, except when testing a 1-15R, the grounding pin shall be removed. The gauge shall have the dimensions indicated in the test gauge figure in UL 498 but shall not have holes in the outer ends of the blades.

Table 14.1
Test Gauge Configurations for Conditioning

Device under test	Test gauge	No. of devices tested
1-15R	1-15P	6
5-15R	5-15P	6
5-20R[a]	5-15P	3
	5-20P	3
6-15R	6-15P	6
6-20R[a]	6-15P	3
	6-20P	3

[a] If the construction will accept both the 15 A and 20 A configurations, then 3 units of each shall be tested. If the construction will accept only 20 A configuration, then 6 units of each shall be tested.

14.3.3 The standard test gauge shall be configured as shown in Table 14.2 using the line blades without holes and with the grounding pin removed. The gauge shall then be inserted in the connector and a static 13 N (3 lbf) (including the weight of the gauge), which tends to remove the gauge from the connector, shall be applied for a period of 1 minute in a direction normal to the plane of the face of the connector. There shall not be more than 2 mm (0.08 inch) displacement of the gauge. If the construction will accept both the 15-A and 20-A configurations, then 3 units of each shall be tested. If the construction will accept only the 20-A configuration, then 6 units of each shall be tested.

Table 14.2
Test Gauge Configurations for Retention Testing

Device under test	Test gauge	No. of devices tested
1-15R	1-15P	6
5-15R	1-15P	6
5-20R[a]	1-15P	3
	5-20P[b]	3
6-15R	2-15P	6
6-20R[a]	2-15P	3
	6-20P[b]	3

[a] If the construction will accept both the 15 A and 20 A configurations, then 3 units of each shall be tested. If the construction will accept only 20 A configuration, then 6 units of each shall be tested.

[b] Shall have the grounding pin removed.

14.3.4 The standard test gauge shall be configured as shown in Table 14.3 using the line blades with holes in the end and with the grounding pin in place. The 1-15R device shall be tested with the 1-15P test gauge without a grounding pin. The gauge shall then be inserted in the connector and a force applied in a direction normal to the plane of the face of the connector that tends to remove the gauge. The static force required to withdraw the gauge shall not exceed 67 N (15 lbf) (including the weight of the gauge).

Table 14.3
Test Gauge Configurations for Withdrawal Testing

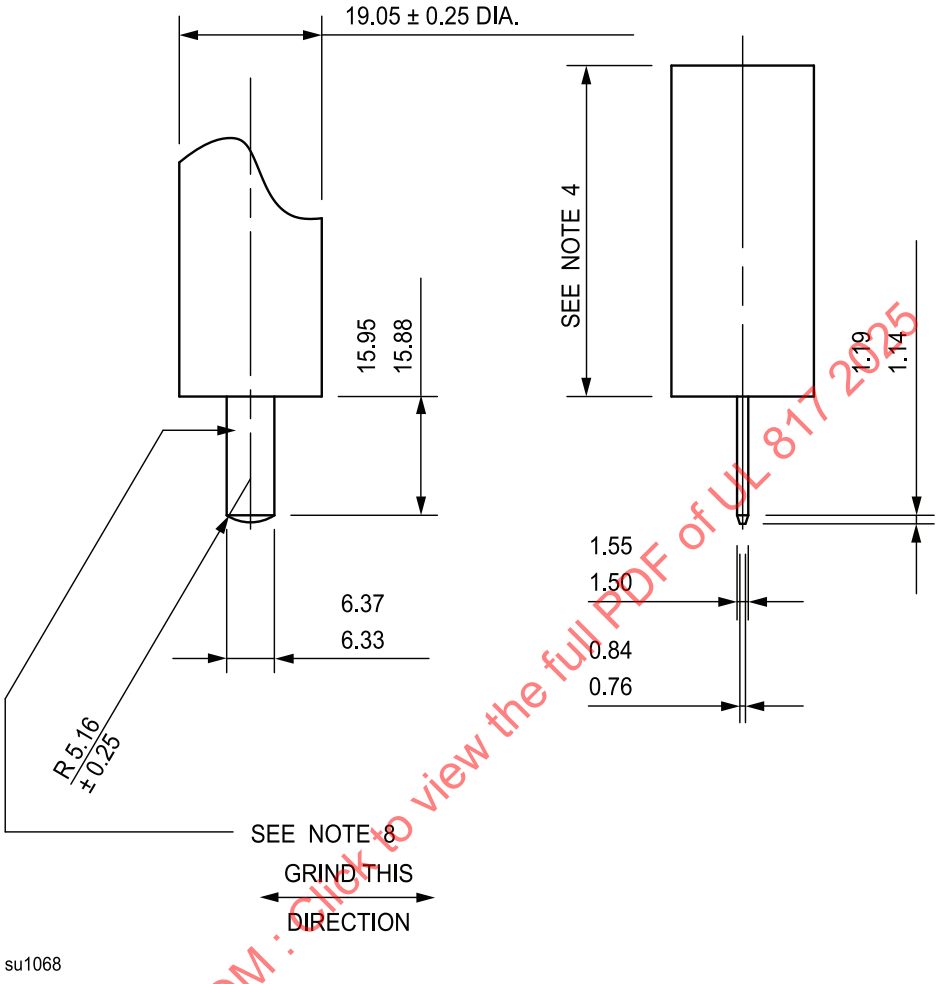
Device under test	Test gauge	No. of devices tested
1-15R	1-15P	6
5-15R	5-15P	6
5-20R[a]	5-15P	3
	5-20P	3
6-15R	6-15P	6
6-20R[a]	6-15P	3
	6-20P	3

[a] If the construction will accept both the 15 A and 20 A configurations, then 3 units of each shall be tested. If the construction will accept only 20 A configuration, then 6 units of each shall be tested.

14.3.5 Each of the line contacts of the connector shall be tested using the test blade illustrated in Figure 14.1. Each line contact shall be capable of withstanding for 1 minute a static 2.2 N (0.5 lbf) applied to the test blade in a direction normal to the plane of the face of the specimen and in a direction that tends to remove the test blade, when the test blade is fully inserted in the contact opening. There shall not be more than 2 mm (0.08 inch) displacement of the test blade.

Figure 14.1

Test Blade



NOTES:

1 – All dimensions in mm.

mm	0.25	0.76	0.84	1.14	1.19	1.50	1.55	5.16	6.33	6.37	15.88	15.95	19.05
(inch)	(0.010)	(0.030)	(0.033)	(0.045)	(0.047)	(0.059)	(0.061)	(0.203)	(0.249)	(0.251)	(0.625)	(0.628)	(0.750)

2 – Metric equivalents are based upon 1.00 inch = 25.4 mm.

3 – Axis of blade and axis on holder shall have a combined concentricity and axial alignment tolerance of 0.15 mm (0.006 inch) maximum T.I.R.

4 – Length to suit total tool weight of 0.50 pounds (2.2 N).

5 – The blade shall be fastened to the handle in a rigid manner.

6 – Sharp edges shall be removed to a maximum radius of 0.38 mm (0.015 inch).

7 – The blade shall be of steel having a Rockwell Hardness of C58 to C60. The handle shall be cold rolled steel.

8 – The blade surfaces shall not exceed a 32 microinch finish grind in a direction perpendicular to the major axis. Finish shall be determined visually using a comparative method and 10X optical magnification.

14.4 Overload test

14.4.1 A connector fitting shall be subjected to the overload test described in 14.4.2 – 14.4.8. There shall not be any electrical or mechanical failure of the device or pitting or burning of the contacts that would affect the intended function.

14.4.2 The test shall be conducted using direct current with a resistive load. Devices rated AC only may be tested using AC voltage with a power factor of 0.7 – 0.8.

14.4.3 Each of six connector fittings shall be tested, by machine or manually, as outlined in 14.4.4 and 14.4.5, by inserting and withdrawing an attachment plug of the configuration specified in Table 14.4 having rigidly secured solid blades that are connected through a flexible cord to a suitable load. A grounding type attachment plug shall be used and the grounding pin of the attachment plug shall be connected to the grounding contact of the connector fitting under test. The grounding contact of the connector fitting under test shall be connected through a fuse to the ground. The connector fitting shall be caused to make and break 150 % of rated current for 50 cycles of operation at a rate not faster than 10 cycles per minute. The blade of the attachment plug shall mate with the contact of the connector fitting for not more than 1 second during each cycle. If the construction will accept both the 15-A and 20-A configurations, then 3 units of each shall be tested. If the construction will accept only the 20-A configuration, then 6 units of each shall be tested.

Table 14.4
Mating Plug Configurations for Overload Testing

Device under test	Mating plug	No. of devices tested
1-15R	1-15P	6
5-15R	5-15P	6
5-20R[a]	5-15P	3
	5-20P	3
6-15R	6-15P	6
6-20R[a]	6-15P	3
	6-20P	3

[a] If the construction will accept both the 15 A and 20 A configurations, then 3 units of each shall be tested. If the construction will accept only 20 A configuration, then 6 units of each shall be tested.

14.4.4 If conducted by machine, the connector fitting shall withdraw and insert an unrestricted attachment plug with an average velocity of 760 ±75 mm/s (30 ±3 in/s) in each direction during a 64 mm (2-1/2 inch) stroke measured from the fully inserted position. The velocity shall be determined without the connector fitting installed on the machine in order to eliminate restrictions on the attachment plug motion.

14.4.5 In the event of failures during machine testing, referee tests may be conducted manually under conditions similar to those described in 14.4.4.

14.4.6 The open circuit voltage of the test circuit shall not exceed 105 % of the rated voltage, and the closed circuit voltage shall not be less than 95 % of the rated voltage. At the option of the manufacturer the open circuit voltage may exceed 105 % of the rated voltage.

14.4.7 Neither the blades nor the contacts shall be adjusted, lubricated, or conditioned, other than as required by the Retention of blades test, 14.3, before or during the test.

14.4.8 The fuse in the grounding circuit shall be a 15-A fuse. The fuses in the test circuit shall not exceed the ratings of the device. Where the fuse rating does not exist for the current rating of the device, the next size larger fuse shall be used. If any fuse opens during the test, the results shall not be acceptable.

14.5 Temperature test

14.5.1 The contact temperature rise of a connector fitting shall not be more than 30 °C (54 °F) when the connector is carrying its maximum rated current.

14.5.2 The temperature measurement mentioned in 14.5.1 shall be taken at points as close to the face of the connector fitting as possible on the male blades of an attachment plug inserted in the outlet.

14.5.3 The Temperature test(s) shall be conducted following the Overload test on six connector fitting and shall continue until stabilized temperatures are attained. A temperature shall be considered to be stabilized when three consecutive readings, taken at 5-minute intervals, indicate no further rise above the ambient temperature. The contact temperatures shall be measured at the contacts previously subjected to the Overload test.

14.5.4 The overloaded contacts of individual connector fitting shall be connected together by means of a shorted attachment plug of the configuration shown in Table 14.5. A standard solid blade attachment plug shall be used. The terminals of the plug shall be short-circuited by means of the shortest feasible length of wire that has an ampacity at least equal to that of the connector fitting. The shorting wire may be soldered to the plug terminals in order to minimize the generation of heat from sources other than the contacts. If the construction will accept both the 15-A and 20-A configurations, then 3 units of each shall be tested. If the construction will accept only the 20-A configuration, then 6 units of each shall be tested.

Table 14.5
Mating Plug Configurations for Temperature Testing

Device under test	Mating plug	No. of devices tested
1-15R	1-15P	6
5-15R	5-15P	6
5-20R[a]	5-15P	3
	5-20P	3
6-15R	6-15P	6
6-20R[a]	6-15P	3
	6-20P	3

[a] If the construction will accept both the 15 A and 20 A configurations, then 3 units of each shall be tested. If the construction will accept only 20 A configuration, then 6 units of each shall be tested.

14.5.5 The connector fittings under test shall be connected in series in the test circuit with flexible cord using lengths of no less than 150 mm (6 inches).

14.6 Retention of blades test (repeated)

14.6.1 Following the Temperature test(s), the overloaded contacts of a connector fitting having a 1-15R, 5-15R, 5-20R, 6-15R, or 6-20R configuration shall be subjected to repeated Retention of blades test in accordance with 14.3.

14.7 Resistance to arcing test

14.7.1 The connector fittings that were subjected to 50 cycles of operation in the Overload test described in 14.4 shall perform acceptably when subjected to an additional 200 cycles of operation under the overload test conditions following the temperature test and the repeated retention of plugs test.

14.7.2 Alternatively, six representative connector fittings may be subjected to the 50 cycles of operation in the Overload test described in 14.4, followed by the Temperature test and repeated Retention of blades test on the connector fittings, and then, to determine resistance to arcing, a second, previously untested set of connector fittings may be subjected to 250 cycles of operation under the overload-test conditions.

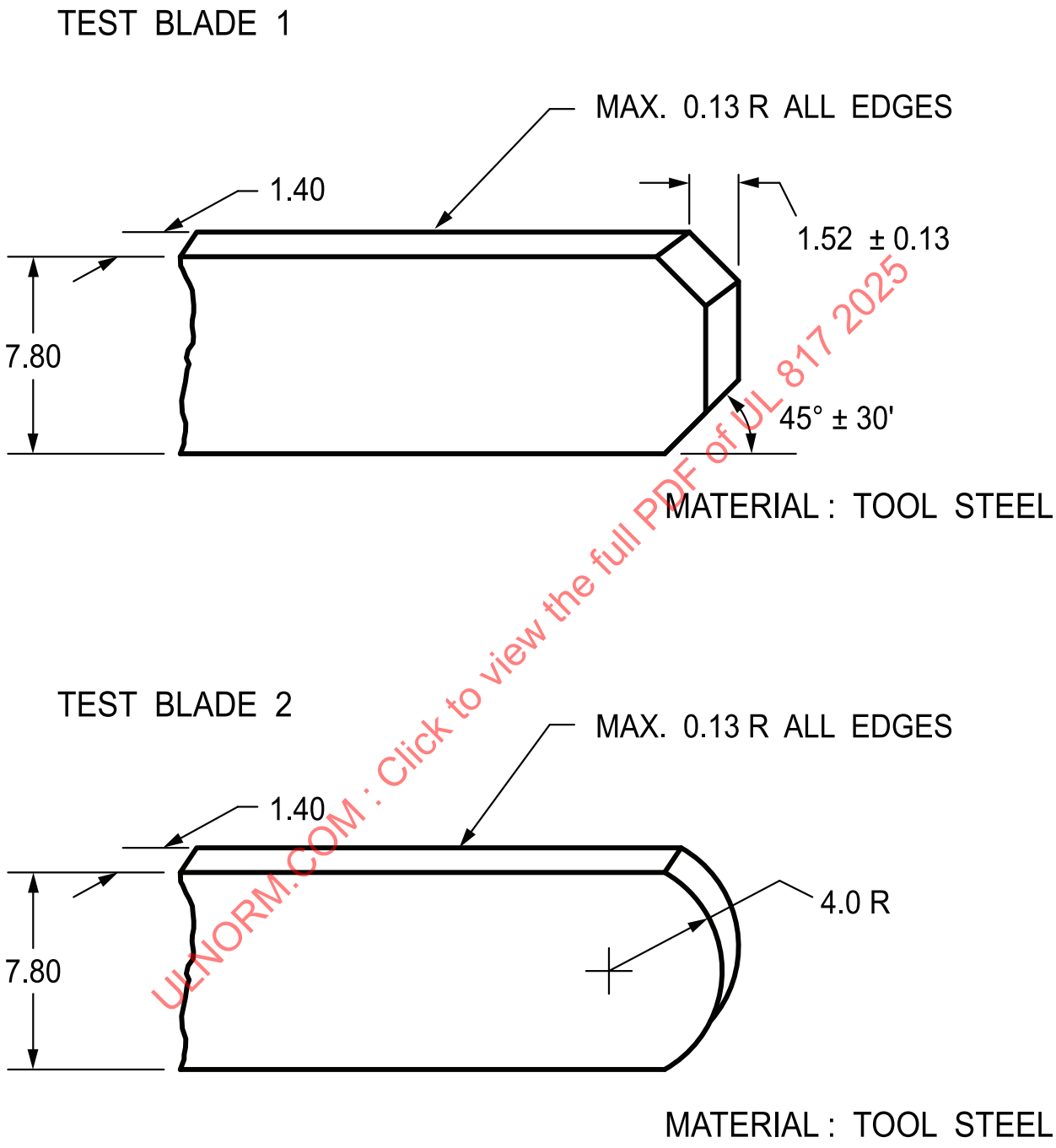
14.7.3 The attachment plug used for this test may be changed after every 50 operations. There shall not be any sustained flaming of the material in excess of five seconds duration. There shall not be any electrical tracking or the formation of a permanent carbon conductive path that results in a dielectric breakdown, as determined by the application of a 60 Hz essentially sinusoidal potential of 1500 V applied for 1 minute between live parts of opposite polarity and between live parts and dead metal parts.

14.8 Improper insertion test

14.8.1 Cord connectors shall be capable of obstructing an attempted insertion of 156 N (35 lbf) when tested in accordance with the apparatus described in Figure 14.2 and procedures described in 14.8.2 and 14.8.3.

Figure 14.2

Improper Insertion Test Blades



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NOTE: All dimensions in mm.

mm	0.13	1.40	1.52	4.0	7.80
(inch)	(0.005)	(0.055)	(0.060)	(5/32)	(0.307)

14.8.2 Each cord connector specimen shall be tested while being supported on a flat steel plate. Rigid spacing materials may support a cord connector that, due to its shape, does not lie flat on the steel plate, provided that by doing so, pressure is not exerted against the cord connector that will influence the test results. The test blades shall be supported and centered above the smaller contact slot of the cored connector specimen.

14.8.3 Each test blade shall be inserted into the smaller contact slot with a force that is gradually increased from zero to the specified force. The specified force shall be maintained for 1 minute. One half of the specimens shall be tested using test blade 1, the other half, using test blade 2. In each case, the test blades shall be obstructed to the extent that they do not make electrical contact with the device contact relating to the smaller slot.

14.9 Low-temperature insertion test

14.9.1 Each outlet of a cord connector of an outdoor-use cord set employing one of the configurations 1-15R, 5-15R, or 5-20R shall be capable of being mated with a solid-blade attachment plug, of the mating configuration, at a temperature of minus 20.0 ±1 °C (minus 4 ±1.8 °F) without resulting in a gap, between the faces of the mated fittings, exceeding 2 mm (0.079 inch).

14.9.2 Each of six representative cord connectors, assembled onto a 0.3 m (12 inch) length of flexible cord, and six representative mating attachment plugs, shall be conditioned at a temperature of minus 20.0 ±1 °C (minus 4 ±1.8 °F) for 4 hours.

14.9.3 Following the four-hour conditioning period, one cord connector and one mating attachment plug shall be taken from the conditioning chamber, and immediately upon removal, the fittings shall be mated with an insertion force of 178 N (40 lbf) applied for a maximum of 1 minute. This procedure shall be repeated five additional times using a previously unused plug and connector for each consecutive mating, until all connectors have been tested.

14.9.4 With cord connectors having multiple outlets, one random outlet of each cord connector shall be subjected to the insertions described in 14.9.3.

14.9.5 Optionally, an outdoor-use cord set may be subjected to this test at a temperature of minus 40.0 ±1 °C (minus 40 ±1.8 °F) and marked in accordance with 24.8.

14.10 Random drop test

14.10.1 After completion of the test described in 14.10.2, no outlet face of a cord connector employed on an outdoor-use cord set shall land face up or face down upon coming to rest on a horizontal surface.

14.10.2 Each of three representative outdoor-use cord sets shall be grasped with one hand on the cord connector and the other hand on the flexible cord or attachment plug body, leaving 1.8 m (6 feet) of slack in the flexible cord. Each cord set shall be dropped three times through a distance of 0.9 m (3 feet) to strike a concrete floor in the positions most likely to produce adverse results. In each drop, the cord connector shall strike the surface in a position different from those in the other two drops.

14.11 Closure of openings test

14.11.1 General

14.11.1.1 The closure required in 8.1.5 shall comply with the requirements in 14.11.1.2 – 14.11.1.5.

14.11.1.2 One set of representative cord sets employing removable closures shall be tested as received and an additional set of the same shall be tested after being conditioned at 70 ±1 °C (158.0 ±1.8 °C) for 7 hours in a full-draft circulating air oven. Cord sets employing closures removable from the outlet shall be conditioned inserted in the cord connector. Additional representative closures shall be conditioned with the closures not inserted.

14.11.1.3 Three withdrawal and insertion operations shall be performed in the intended manner following conditioning described in 14.11.1.1 after parts have been cooled to room temperature.

14.11.1.4 The closure is in compliance with 8.1.5(b) when after being removed from its outlet, it does not slip or move along the length of the cord more than 13 mm (0.50 inch), or cause visible damage to the cord or closure, after being tested as described in 14.11.1.2.

14.11.1.5 The cord connector is in compliance with 8.1.5 (d) and (e) if after examination there is no damage and cord connector performance has not been impaired after three simulated cycles of withdrawal and insertion of the closure in the intended manner.

14.11.2 Cord connector closure movement test

14.11.2.1 The cord connector closure required in 8.1.5, when removed from the outlet, shall not slip or move along the length of the cord more than 13 mm (1/2 inch) and there shall be no visible damage to the cord or closure, when tested in accordance with 14.11.2.2.

14.11.2.2 Three representative cord sets employing removable closures shall be tested in the as-received condition, and three of the same shall be tested after being conditioned as described in 14.11.1.1. Each cord set shall be held in a vertical plane with the cord connector pointing up and the closure removed from the outlet. A force of 22.2 N (5 lb), which includes the weight of the clamp, shall be applied for 1 minute to the center of the closure. The force shall be applied by affixing a C-clamp with a pad diameter of 9.5 mm (3/8 inch) to the closure and securing the weight of the C-clamp. The force shall be applied vertically downward in a direction parallel to the major axis of the cord.

15 Tests for Flatiron and Appliance Plugs

15.1 Flatiron and appliance plugs shall comply with the requirements in UL 498.

16 Test for Permanence of Warning Tag

16.1 Cords other than outdoor type

16.1.1 Tag specimens shall be those applied to the flexible cord in the intended manner and three tags of each set shall be tested for each exposure in accordance with 16.1.2 – 16.1.4. Tags applied by adhesive shall be tested no sooner than 24 hours after being applied to the cord.

16.1.2 One set of tag specimens shall be tested as received.

16.1.3 A second set of tags shall be tested after being conditioned at 23.0 ±2.0 °C (73.4 ±3.6 °F) for 30 minutes at 50 ±5 % relative humidity, following conditioning in an air-circulating oven at 60 ±1 °C (140 ±1.8 °F) for 240 hours.

16.1.4 A third set of tags shall be tested within 1 minute after being exposed for 72 hours to a relative humidity of 85 ±5 % at a temperature of 32 ±2 °C (89.6 ±3.6 °F).

16.2 Outdoor-type (W) cords

16.2.1 Tag specimens shall be those applied to the flexible cord in the intended manner and sets of three tags of each shall be tested in accordance with 16.1.2 and 16.2.2 – 16.2.5.

16.2.2 Each of a set of untested tags is to be tested after 24 hours of exposure conditioning at 23 ±2 °C (73.4 ±3.6 °F) and 50 ±5 % relative humidity, followed by 48 hours of immersion to a depth of not less than 1/8 inch (3.2 mm) in demineralized water at a temperature of 23 °C (73.4 °F). Testing in accordance with 16.4 shall be performed within 1 minute of the conditioning.

16.2.3 Each of a set of untested tags shall be tested after 24 hours of exposure conditioning at 23.0 ±2.0 °C (73.4 ±3.6 °F) and 50 ±5 % relative humidity, followed by 10 days of exposure in an air-circulating oven at a temperature of 60 ±1 °C (140 ±1.8 °F). Testing in accordance with 16.4 shall be performed within 30 minutes of the conditioning.

16.2.4 Each of a set of untested tags shall be tested after exposure conditioning at 23.0 ±2.0 °C (73.4 ±3.6 °F) at 50 ±5 % relative humidity for 24 hours, followed by exposure in a cold box at minus 10 ±2 °C (14.0 ±4 °F) for 7 hours. Testing in accordance with 16.4 shall be performed within 1 minute of the conditioning.

16.2.5 Each of a set of untested shall be tested after exposure conditioning at 23.0 ±2.0 °C (73.4 ±3.6 °F) at 50 ±5 % relative humidity for 24 hours, followed by exposure to ultraviolet light and water spray with ultraviolet light by the method described in either (a) or (b) below:

a) Exposure shall be permitted by a twin-enclosed carbon-arc weatherometer (Type D or DH) as described in ASTM G152/ASTM G153. Tags shall be exposed to ultraviolet light and water spray with ultraviolet light for 720 hours. The operating cycle shall be 20 minutes; 176 minutes of ultraviolet light only and 3 minutes of water spray with ultraviolet light.

b) Exposure shall be permitted by a xenon-arc weatherometer (Type B or similar) as described in ASTM G155, Method A. Tags shall be exposed to 1000 hours of continuous exposure to ultraviolet light and water spray with ultraviolet light, using a programmed cycle of 120 minutes (102 minutes ultraviolet light exposures and 18 minutes exposure to water spray with ultraviolet light). The apparatus shall include a 6500 W water-cooled xenon-arc lamp, borosilicate glass inner and outer optical fibers, a spectral irradiance of 0.35 W/m^2 at 340 mm and a black-panel temperature of 63.0 ±3.0 °C (145.0 ±5.4 °F).

Testing in accordance with 16.4 shall be performed after 24 hours of exposure at 23.0 ±2.0 °C (73.4 ±3.6 °F) at 50 ±5 % relative humidity.

16.3 Oil-resistant cords

16.3.1 Tags intended to be applied to oil-resistant cords (Type O or OO) shall be tested within 2 minutes in accordance with 16.4 after being immersed in IRM 902 at a temperature of 23.0 ±2.0 °C (73.4 ±3.6 °F) for 48 hours.

16.4 Test procedure

16.4.1 Each test shall be performed on a length of flexible cord to which the tag has been applied. The cord shall be held taught in a vertical plane with the attachment plug pointing up.

16.4.2 A force of 22 N (5 lbs), which includes the weight of the clamp, shall be applied for 1 minute to the uppermost corner of the tag farthest from the flexible cord, within 6.4 mm (0.25 inch) of the vertical edge of the tag. The force shall be applied by affixing a C-clamp with a pad diameter of 9.5 mm (3/8 inch) to the tag

and securing the weight to the C-clamp. The force shall be applied vertically downward in a direction parallel to the major axis of the cord.

16.4.3 Each tag shall be scraped 10 times vertically across printed areas and edges, with a force of approximately 9 N (2 lbs) using the edge of a 2 mm (5/64 inch) thick steel blade held at a right angle to the test surface. The edges of the steel blade shall be just rounded so as not to be sharp.

16.5 Evaluation

16.5.1 Following the procedure described in 16.4:

a) The tag shall not have become separated from the flexible cord. A hang type tag shall not have separated from its securement strap and the securement strap shall not have separated from the flexible cord.

b) The tag shall not have been torn longer than 1.6 mm (1/16 inch) at any point.

c) The tag or securement strap shall not have slipped or moved along the length of the flexible cord more than 13 mm (1/2 inch), with no visible damage to the cord.

d) The tag shall not have shown any permanent shrinkage, deformation, cracking, or any other condition that renders the marking on the tag illegible (straightening of the tag by hand is permitted).

e) Overlamination, if provided, shall have remained in place and not be torn or otherwise damaged. After subjecting printed areas and edges to the procedure in 16.4, printing shall remain legible.

17 Tests for Overcurrent Protective Devices

17.1 General

17.1.1 An overcurrent protective device, as mentioned in 9.7 and 9.10, shall be subjected to the calibration, short-circuit, abnormal operation, and water exclusion tests described in 17.2 – 17.6.

17.1.2 An overcurrent protective device, as mentioned in 9.10, shall be subjected to the short-circuit tests described in 17.3 and the abnormal operation tests described in 17.5.

17.1.3 Each representative device for the calibration and short-circuit tests in 17.2 and 17.3 shall consist of the overcurrent protective device in its enclosure and a length of cord sufficient to permit the necessary electrical connections to be made (approximately 76 mm or 3 inches).

17.2 Calibration test

17.2.1 The calibration test consists of testing each of three representative devices at 135, 150, and 200 % of its current rating. These devices shall open the circuit within 60 minutes while carrying 135 %, within 10 minutes when carrying 150 %, and within 2 minutes when carrying 200 % of its rating. No externally soldered connections shall melt, and the casing or enclosure shall not char or rupture in any manner.

17.3 Short-circuit tests for all products with overcurrent protection

17.3.1 The short-circuit test consists of testing each of three representative devices and its enclosure (total of six) on 120-V, 60 Hz circuits capable of delivering 200 A and 1000 A, at a power factor of 70 – 80 %, with the protective devices in series with a 20 A time-delay fuse. During the test, the protective

device enclosure shall be surrounded with absorbent cotton. Results shall be acceptable if the cotton is not ignited.

17.3.2 Cord sets and power-supply cords incorporating overcurrent protective devices shall be subjected to a second short-circuit test (in addition to the one described in 17.3.1). The representative device shall consist of the plug, and for cases involving a through-cord protector, the maximum length of cord used between the plug and the protective device, the protector and its enclosure, plus an additional 1.8 m (6 feet) of cord beyond the protective-device enclosure.

17.3.3 Each test representative device shall be prepared by removing approximately 13 mm (0.5 inch) of the insulation from the end of each circuit conductor. The stripped end of one conductor shall be twisted to join it with the conductor of opposite polarity.

17.3.4 Each of three representative devices described in 17.3.2 and 17.3.3, with their protective devices in place, shall be subjected to the 120 V, 200- and 1000-A, 60 Hz short-circuit tests described in 17.3.1. The representative device shall be connected to the power source by means of its attachment plug blades. The protector enclosure shall be surrounded with absorbent cotton. The results shall be acceptable if:

a) There is no ignition of the cotton; and

b) The cord does not flame or melt to the extent that bare conductors are exposed.

17.4 Short-circuit test for fuses

17.4.1 Fuses employed as overcurrent protective devices shall be tested as described in UL 248-14, to determine that they function up to their marked short-circuit current rating without introducing a risk of fire, electric shock, or injury to persons.

17.5 Abnormal test

17.5.1 Except as noted in 17.5.2, three complete cord sets or power-supply cords shall be subjected to each of the abnormal tests described in 17.5.3 and 17.5.4. For each test, the protector shall be surrounded with absorbent cotton. The results are acceptable if:

a) There is no ignition of the cotton; and

b) The cord and fuseholder do not flame or melt to the extent that bare conductors are exposed.

17.5.2 Three complete power-supply cords having 20 AWG (0.52 mm^2) conductors, and employing either Appliance Wiring Material constructed in accordance with note 14 to Table 10.1, or Type SP-1, NISP-1, SPE-1, NISPE-1, SPT-1, or NISPT-1 flexible cord, shall instead be subjected to the abnormal test described in 17.5.6.

17.5.3 Overcurrent protective devices shall be subjected to 110 % of their marked rating for 7 hours.

17.5.4 For products that employ replaceable fuses, the supplied fuse shall be replaced with a dummy fuse (short circuited) and the product subjected to 135 % of its marked rating for 60 minutes.

17.5.5 Products employing replaceable fuses shall be tested as described in 17.5.4 but with 150 % of the marked rating applied for 10 minutes.

17.5.6 To determine compliance with 17.5.2, three complete power-supply cords having 20 AWG (0.52 mm^2) conductors and employing either Appliance Wiring Material constructed in accordance with note 14 to Table 10.1, or Type SP-1, NISP-1, SPE-1, NISPE-1, SPT-1, or NISPT-1 flexible cord, shall be tested as follows:

a) Each overcurrent protective device shall be subjected to 110 % of its marked ampere rating for 7 hours.

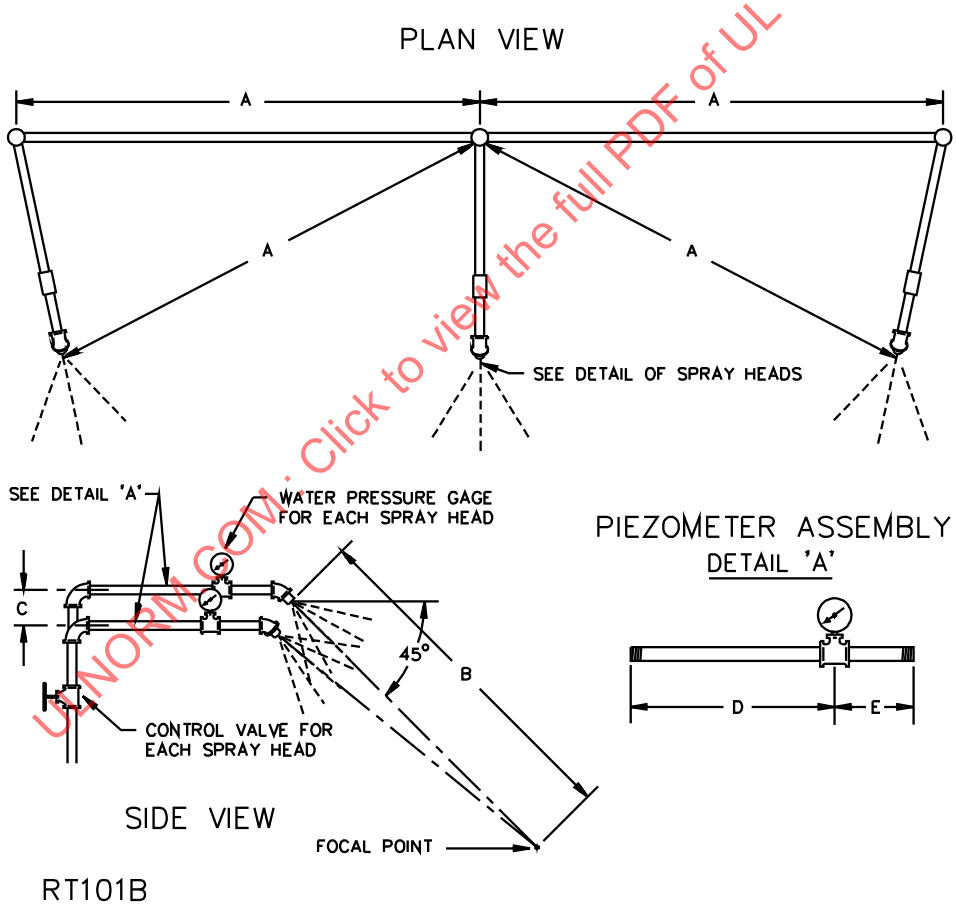
b) If the power-supply cord is provided with a replaceable overcurrent protective device, each cord shall be additionally tested with the overcurrent protective device short-circuited and the test current increased to 135 % for 60 minutes, and then 200 % for 2 minutes.

17.6 Water exclusion test for enclosures of outdoor-use products

17.6.1 The enclosure of an overcurrent protective device intended for use on an outdoor-use cord set or power-supply cord and the enclosure of a switch intended for use on an outdoor-use cord set shall be tested to determine that water does not contact live parts when tested using the water-spray apparatus shown in Figure 17.1.

Figure 17.1

Water-Spray-Head Piping



Item	mm	(inch)
A	711	(28)
B	1397	(55)
C	57	(2.25)
D	229	(9)
E	76	(3)

17.6.2 Through-cord fuseholders and cord connectors serving as overcurrent protective device enclosures and switch enclosures shall be subjected to the water-spray test while placed flat on a board and positioned so that the focal point of the water spray is that most likely to result in the entrance of water. Any receptacle openings shall be sealed against the entrance of water prior to the test.

17.6.3 Attachment plugs and current taps serving as overcurrent-protective-device enclosures shall be tested while mounted in a receptacle, which is likewise mounted in a vertical position, so that the attachment plug or current tap is located at the focal point of the water spray in the position and orientation most likely to result in the entrance of water.

17.6.4 The test shall be continued for one hour.

18 Hospital Grade Molded-On Plugs and Connectors

18.1 General

18.1.1 In addition to the representative devices required for the general testing specified elsewhere in this Standard, the following representative devices shall be required:

a) A minimum of 40 molded-on assemblies, of which 20 shall be complete and 20 shall be complete but without internal electrical connection of the conductors to the blades and grounding pin; and

b) 10 unmolded representative devices that are complete but without the molded-on body.

NOTE: for these representative devices, clear identification of conductor size is required.

Previously untested representative devices shall be used for each test.

18.2 Strain relief tests

18.2.1 General

18.2.1.1 After being subjected to the strain relief tests described in 18.2.2 – 18.2.4, there shall not be any displacement of the conductors, conductor insulation, or outer jacket of the flexible cord exceeding 0.8 mm (1/32 inch). There shall not be any cuts, rips, or tears in the cord insulation nor any breakage of the attachment plug that could adversely affect the enclosure of live parts, strain relief, or grounding path integrity.

18.2.2 Method A – Static pull

18.2.2.1 Each of six representative plugs molded onto flexible cord, without the conductors terminated to the blades or grounding pin, shall be subjected to a gradually applied pull of 133 N (30 lbf) to the free end of the cord while the plug is securely supported. The force shall be applied for 1 minute in a direction perpendicular to the plane of cord entry.

18.2.3 Method B – Rotary pull

18.2.3.1 Each of six representative plugs molded onto flexible cord, without the conductors terminated to the blades or grounding pin, shall be subjected to a rotary cord motion while a force of 44.5 N (10 lbf) is applied for 2 hours. The cord shall be rotated at a rate of approximately 9 r/min in a 75-mm diameter (3-inch) circle at a point 150 mm (6 inches) below the cord exit with the plug rigidly mounted.

NOTE: This test is conveniently done with secureness test apparatus described in UL 486A-486B.

18.2.4 Method C – Abrupt removal

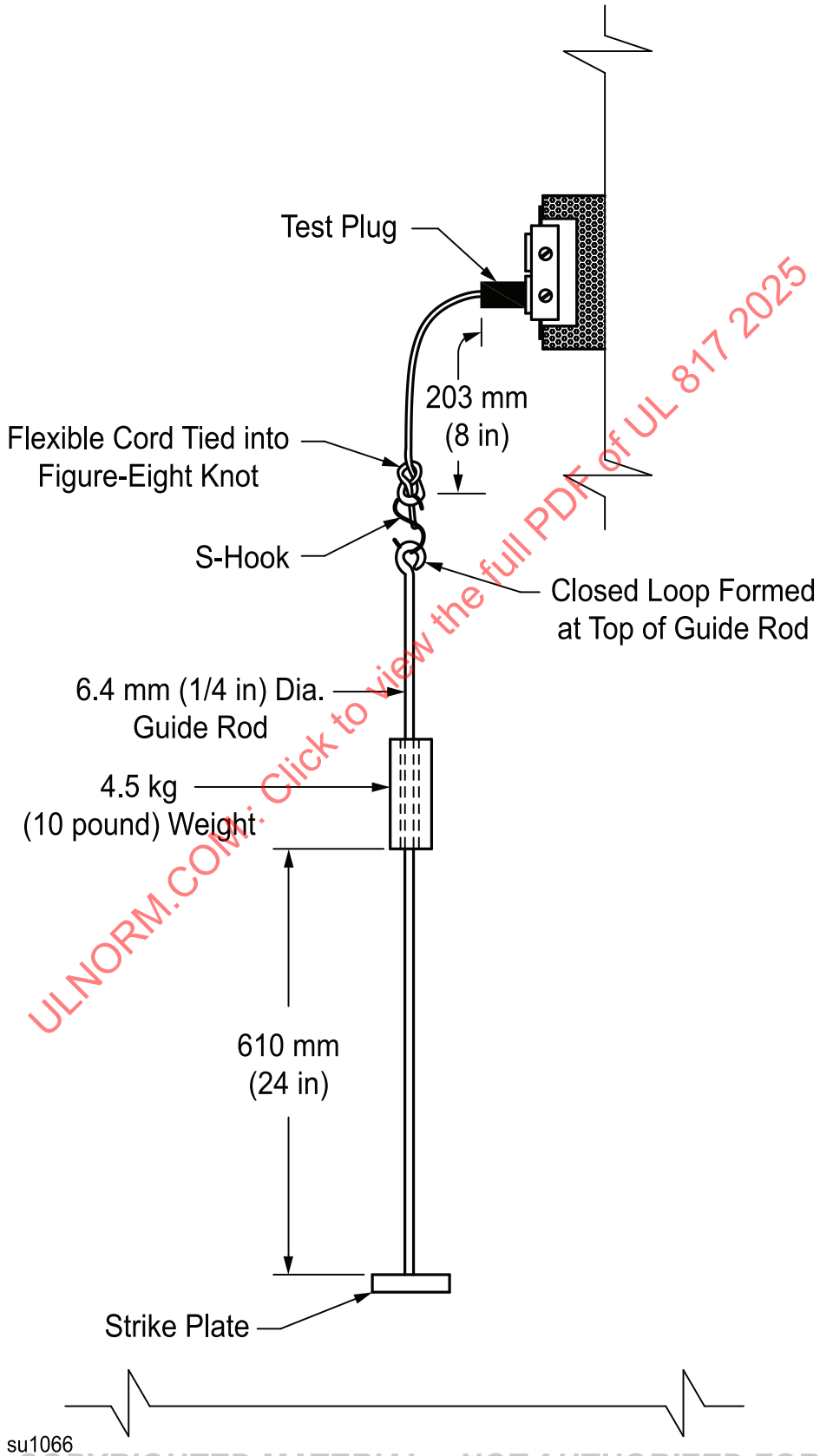
18.2.4.1 Each of six representative plugs molded onto flexible cord, without the conductors terminated to the line blades or grounding pin, shall be subjected to one abrupt removal from a hospital grade receptacle in accordance with the procedure described in 18.2.4.3. Each of three attachment plugs shall be removed with the test receptacle horizontal and three with the receptacle vertical, grounding contact up. One half of the plugs shall be tested using a receptacle that has the grounding contact integral with the strap. The remaining attachment plugs shall be tested with a receptacle having separate grounding contacts riveted to the strap. A new plug shall be used for each abrupt removal.

18.2.4.2 The hospital grade receptacle shall first be mounted to represent a typical installation and a 0.76 + 0.08 – 0.0 mm (0.030 + 0.003 – 0.0 inch) thick steel faceplate rigidly mounted as intended, being supported around its perimeter. The receptacle face shall be in a vertical plane in a manner that will facilitate the necessary test orientations.

18.2.4.3 Each abrupt removal shall consist of the full insertion of the plug followed by the complete withdrawal by means of a 4.5-kg (10-lb) weight dropped from a height of 610 mm (24 inches) (measured from the bottom of the weight) onto a striker plate attached to the plug by a 6.4-mm (1/4-inch) diameter guide rod using the method described in 18.2.4.4. The guide rod shall be located vertically below the outlet being tested, and 50 mm (2 inches) in front of the plane of the receptacle face (see Figure 18.1). The applied force shall cause the removal of the test plug in one continuous motion.

Figure 18.1

Test Set-Up For Abrupt Removals Test



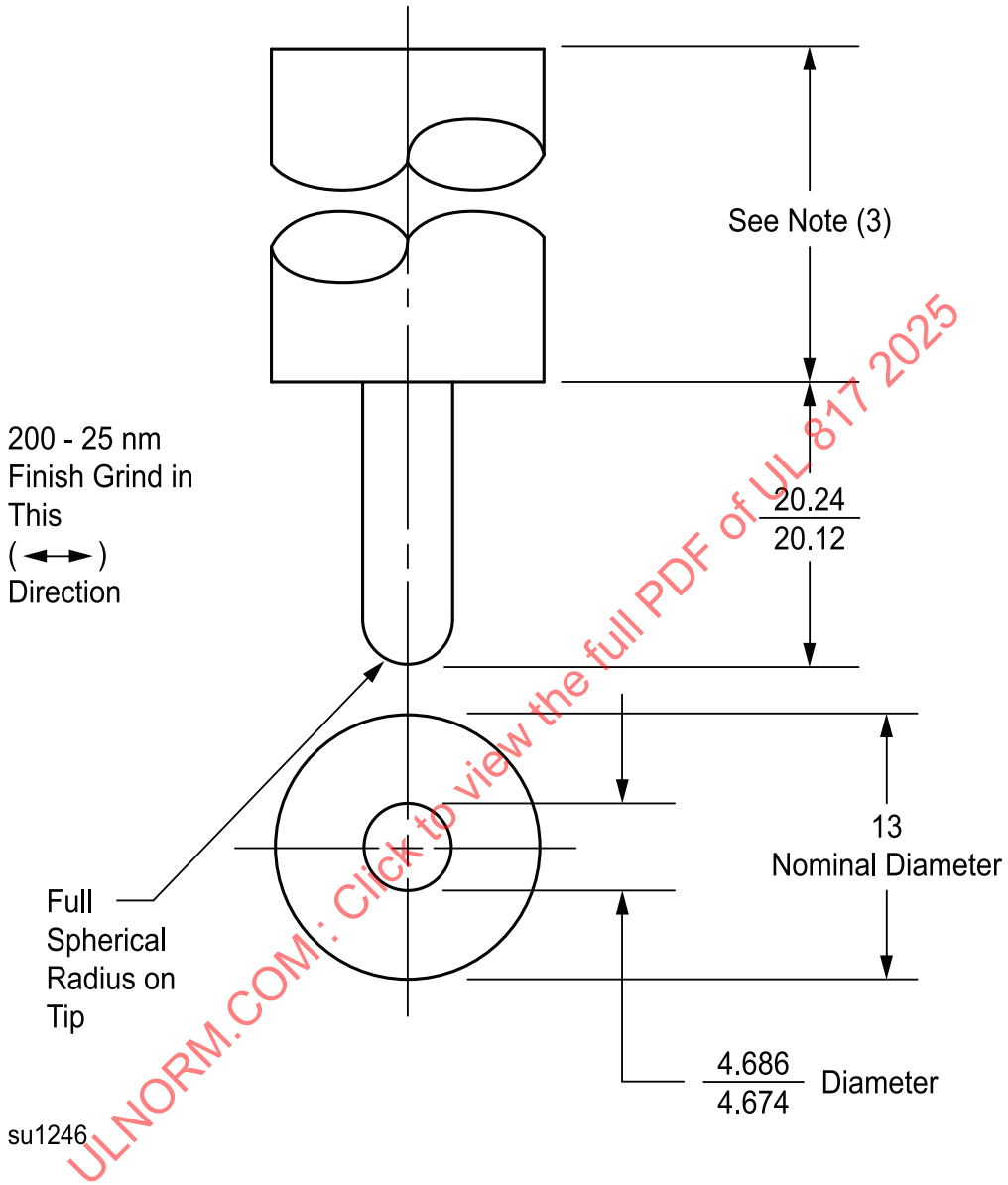
18.2.4.4 The means to connect the plug to be tested to the 6.4-mm (1/4-inch) diameter guide rod shall be as follows. The representative plug shall include a 0.3-m (12-inch) length of flexible cord. A figure-eight knot shall be tied in the flexible cord such that when an S-hook is inserted into the lower loop of the knot its top is located 0.2 m (8 inches) from the point of cord entry to the plug, measured along the cord. To facilitate hanging the guide rod from the S-hook, the top of the rod shall be formed into a loop. See Figure 18.1.

18.3 Bonding (grounding) pin retention – hospital grade cord connector

18.3.1 The bonding contact in the cord connector, when tested as outlined in 18.3.2, shall retain for 1 minute without displacement in excess of 1 mm, a 113 g standard test bonding pin (see Figure 18.2).

Figure 18.2

Standard Test Bonding Pin



NOTES:

1 – All dimensions in millimeters unless otherwise specified.

mm	4.686	4.675	13	20.12	20.24
(inch)	(0.184)	(0.184)	(0.512)	(0.792)	(0.797)

2 – The bonding pin shall be fastened to the handle in a rigid manner.

3 – The length shall suit. The total tool mass shall be sufficient to apply a force of 1 N.

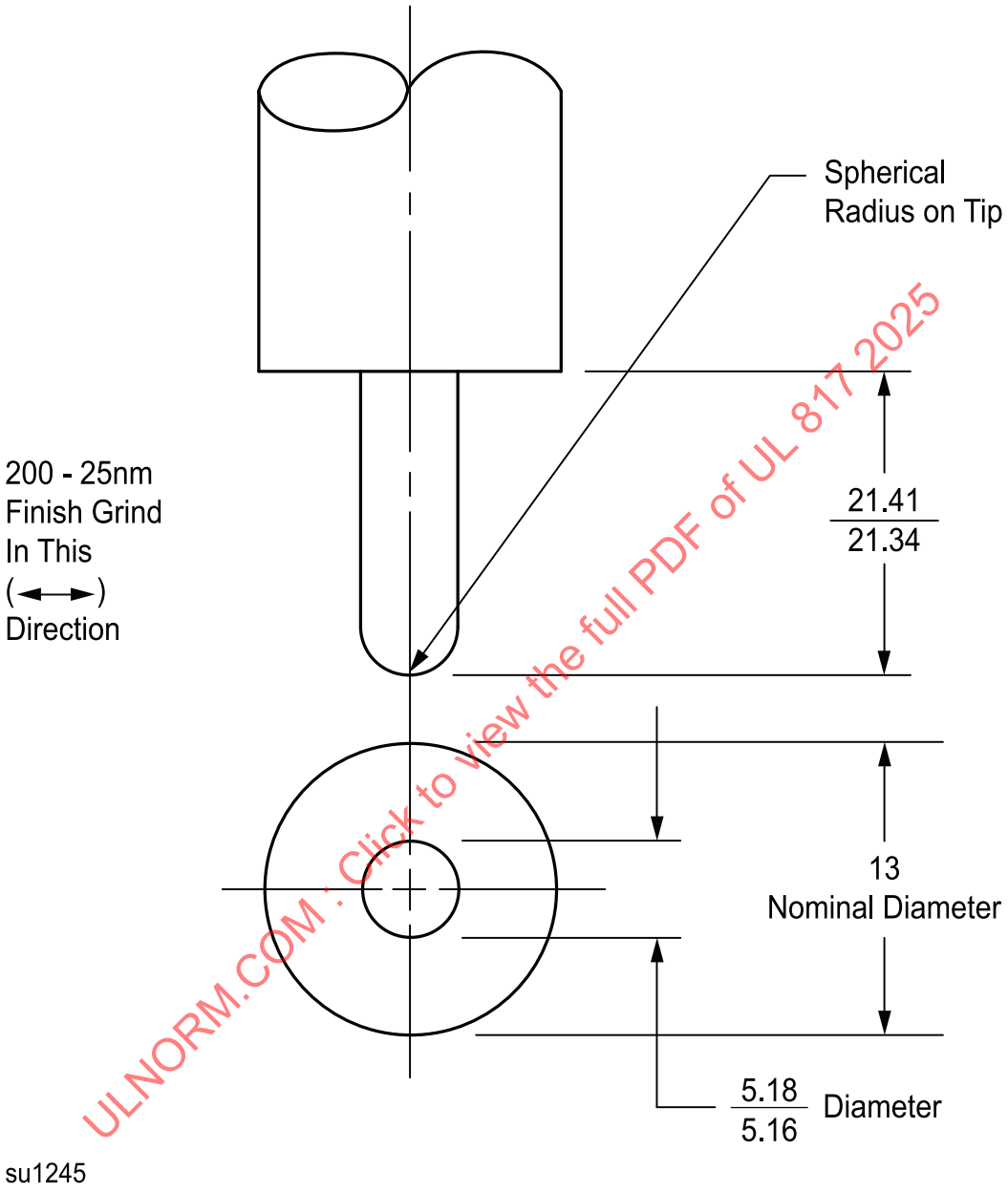
4 – The axis of the blade and the axis of the handle shall have a combined concentricity and axial alignment of 0.15 mm (0.006 inch) maximum T.I.R. measured at the tip of the pin.

5 – The material used for the pin shall be steel, hardened Rockwell C58 to C60, and the material for the handle shall be cold-rolled steel.

18.3.2 Specimens shall be tested using each outlet. Using a hardened steel oversize test bonding pin 5.17 ±0.01 mm (0.2 ±0.00039 inch) in diameter (see Figure 18.3), the grounding contact shall be conditioned by 20 insertions and withdrawals. After conditioning, a 4.680 ±0.006 mm (0.18 ±0.00024 inch) diameter standard test bonding pin weighing 113 g (0.25 lb) (see Figure 18.2) shall be inserted in the contact with the force of the mass applied in a direction normal to the face of the cord connector body and tending to withdraw the pin from the device.

Figure 18.3

Oversize Test Bonding Pin



NOTES:

1 – All dimensions in millimeters unless otherwise specified.

mm	5.16	5.18	13	21.34	21.41
(inch)	(0.203)	(0.204)	(0.512)	(0.840)	(0.843)

2 – The bonding pin shall be fastened to the handle in a rigid manner.

3 – The length of the tool handle is not specified.

4 – The material used for the pin shall be steel, hardened Rockwell C58 to C60, and the material for the handle shall be cold-rolled steel.

18.4 Attachment plug connection and separation – hospital grade cord connector

18.4.1 A hospital grade cord connector shall maintain grounding path integrity through the cord connector and the integrity of the cord connector insulating enclosure under all conditions of use with a hospital grade attachment plug, including the abrupt removal of the plug in any direction by the pulls on the attachment plug cord.

NOTE: Abrupt removal by pulls on the cord tends to align the mating parts when the cord exit is straight to the rear of each device. However, it is possible to generate relatively severe forces during connection and separation of an attachment plug and cord connector body. This is due in part to the angular approach of the mating parts, using the longer grounding pin as a guide, and in part to the wiggling and twisting action employed to facilitate separation. For this reason, 18.4.2 outlines a test that deliberately employs severe forces in the connection and separation of these devices, forces sufficiently comprehensive to overstress the grounding contact.

18.4.2 Specimens previously subjected to the grounding pin retention test shall be tested by insertion of a hospital grade attachment plug from the maximum angle permitted by the slot limits so as to maximize the grounding contact stress. The direction of the insertion shall relate to the specific design under test. The fully inserted attachment plug shall then be firmly grasped in one hand and the cord connector in the other in preparation for separation. Each specimen shall be subjected to a total of nine connections and separations. Severe movements from side to side and twisting in such a manner that the body of the cord connector is rotated in a direction opposite to the rotation of the attachment plug during the withdrawal shall be used in the first three separations. The next three separations shall be effected by a severe breaking action in one direction, in such a manner that the grounding pin of the mated attachment plug applies a force tending to deform the grounding contact construction in the cord connector body. The final three separations shall be effected by a severe breaking action in the opposite direction. After this conditioning, a 113-g (0.25-lb), 4.680 ±0.006-mm (0.18 ±0.00024-inch) diameter standard test bonding pin (see Figure 18.2) shall be inserted in the grounding contact with the force of the weight applied in a direction normal to the face of the cord connector body and tending to withdraw the pin from the device.

18.4.3 Each outlet shall retain the 113-g (0.25-lb) pin for a period of 1 minute without displacement in excess of 1 mm (0.039 inch).

18.5 Grounding contact temperature hospital grade cord connector

18.5.1 Specimens of the cord connector that were previously subjected to the attachment plug connection and separation test shall be wired in a series circuit through the grounding conductor paths of each device and its mating hospital grade attachment plug. The test current shall be determined by the ampacity of the flexible cord. The attachment plugs and cord connectors shall be wired for the cord connector rating. The temperature shall be measured on the grounding pin close to the face of the inserted attachment plug until constant temperature is attained. The temperature rise over the room ambient temperature shall not exceed 30 °C.

18.6 Ground resistance hospital grade cord connector

18.6.1 The specimen assemblies used for the temperature test of 18.5 shall be used for this test. The resistance between the attachment plug grounding pin terminal and the cord connector grounding terminal shall be measured with the test current flowing. The test current shall be determined by the ampacity of the flexible cord. The total resistance shall not exceed 10 mΩ.

18.7 Crushing hospital grade attachment plug and cord connector

18.7.1 Specimens wired with flexible cord shall be placed horizontally between rigid, horizontal steel plates and a crushing force applied, increasing gradually to a value of 2.2 kN (495 lbf) and then decreased.

18.7.2 There shall be no breakage, deformation, or other effect that may interfere with the function of the device as a hospital grade attachment plug or cord connector as a result of this test.

18.8 Impact hospital grade attachment plug and cord connector

18.8.1 Specimens molded on flexible cords shall be subjected to an impact caused by dropping a cylindrical 4.54-kg (10.0-lb) weight, having a flat face 50 mm (2 inches) in diameter, from a height of 0.5 m (19 inches). Each specimen shall be placed on a hardwood surface in any natural position. In the case of a cylindrical body, the major axis shall be parallel to the surface. The hardwood shall be a maple block 110 × 110 mm (5 × 5 inches) and approximately 40-mm (1.6-inch) thick, and it shall rest on a rigid fixed surface such as a concrete floor.

18.8.2 There shall be no breaking of the body or other damage that may interfere with the hospital grade attachment plug or connector body function.

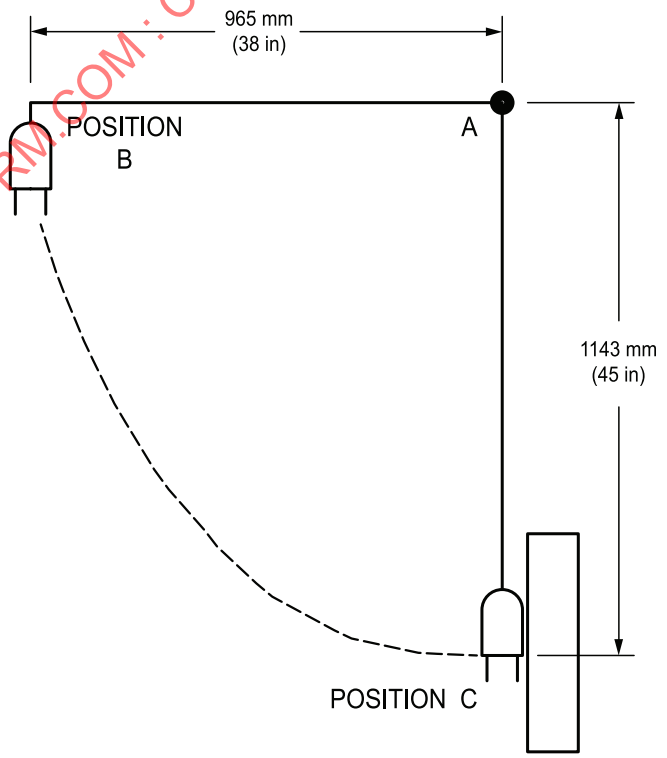
18.9 Mechanical drop hospital grade attachment plug and cord connector

18.9.1 Attachment plugs or cord connectors made of material other than an elastomeric material such as plasticized vinyl or rubber shall be tested in accordance with 18.9.2 and 18.9.3.

18.9.2 Specimens molded on flexible cords shall be tested. A nylon rope may be spliced to the cord to facilitate handling by the machine. Each specimen shall be mounted on the test machine shown in Figure 18.4. The cord and device shall be supported at point A so that when hanging freely the device strikes the maple slab 1.1 m (45 inches) below point A. A moving member of the test machine shall lift the cord and device assembly to test position B, and shall then release it so that it falls freely and strikes the impact board at position C.

Figure 18.4

Mechanical Drop Hospital Grade Attachment Plug and Cord Connector



18.9.3 Each specimen shall be subjected to the drop test described in 18.9.2 for 1300 cycles or for the number of cycles that results in one of the following events, whichever occurs first:

a) Cracking or breaking of the body of the device, other than chipping of edges; or

b) Displacement of live parts (the bending of projecting blades shall not be considered a failure).

18.9.4 Following the impact described in 18.9.2 and 18.9.3, a dielectric strength test, using an ac voltage of 1250 V, shall be applied between live parts of opposite polarity and between live metal parts and grounded metal parts for a period of 1 minute without breakdown.

18.9.5 The specimens shall meet the requirements of the dielectric strength test of 18.9.4 and shall comply with (a) and (b) as follows:

a) Each specimen shall complete not less than 500 cycles; and

b) The average number of cycles completed for all specimens tested shall be not less than 1000 cycles.

19 Tests for Cord Restraint Devices – Temperature Test

19.1 After being tested as described in 19.2 – 19.4, the Temperature Results of the representative devices that were placed in the cord restraint device shall be compared with the Temperature Results of the representative devices that were removed from the cord restraint device. There shall not be a difference in temperature rise greater than +3 °C between the results of the representative devices that were placed in the cord restraint device and the representative devices that were not placed in the cord restraint device. The maximum temperature rise for both devices that were placed in the cord restraint device and devices that were not placed in the cord restraint device shall not exceed 30 °C above ambient.

19.2 Three representative cord restraint devices shall be used and placed on a table of the size to allow all three devices and cord sets to be spaced approximately 305 mm (12 inches) apart. Three cord sets of the maximum cord set size, as specified by the Instructions, shall be assembled together by inserting the attachment plug of one cord set into the next cord set cord connector body, thus forming a series circuit. The cord sets shall be looped over and under the table and spaced approximately 305 mm (12 inches) apart. To complete the series circuit, the last cord connector body shall be shorted with a short-circuited attachment plug and the blades of the attachment plug shall be shorted by a bare solid copper conductor. Each of the interconnected cord sets plugs shall be placed/encapsulated in the cord restraint device.

19.3 The plug of the first cord set shall be connected to a low voltage source of supply and the current equal to the ampacity of the cord shall be adjusted in the circuit and shall be allowed to operate until temperatures stabilized or (minimum of 4 hours, which ever is longer). Thermocouples shall be placed on the blades of the attachment plugs, as close to the face of the body as possible. Thermocouples shall also be placed on the body of each plug. The ambient temperature shall be measured on the inside, in the top/center of the cord restraint device.

19.4 The test method described in 19.2 and 19.3 shall be repeated except the fittings are to be removed from cord restraint device.

20 Tests for Electrical Components

20.1 The breakdown of an electrical component as simulated by the test described in 20.2 – 20.9 shall not result in the risk of injury to persons, or the risk of fire or electric shock as determined by the existence of any of the following conditions:

a) Glowing, charring, or flaming of the cheesecloth or tissue paper specified in 20.4;

b) The opening of the 3 A fuse connected to ground specified in 20.5;

c) Emission of flame, sparks, or molten metal from the enclosure;

d) Development of an opening in the overall enclosure that exposes live parts and increases the risk of electric shock (see 6.4); or

e) Loss of structural integrity to such a degree that the equipment collapses or experiences displacement of parts that may:

1) Lead to short-circuiting or grounding of live parts,

2) Affect the function of any safety controls such as thermostats, overload protective devices, waterseals, or strain relief.

A component located in the supplementary circuit in accordance with 9.8 or an optical isolator that complies with the requirements in UL 1577 need not be subjected to this test.

20.2 The malfunction of a component such as a diode, a transistor, a thyristor, an electrolytic capacitor, an integrated circuit, an optical isolator, or other electronic component which has not been determined to be reliable by a reliability investigation and which could result in a risk of fire or electric shock, are to be simulated. In order to simulate the malfunction of a component, the circuit between any two terminals of the component is to be opened and/or shorted. Only one of the two simulated fault conditions is to be imposed at one time. For a multi-terminal device, only two terminals are to be short-circuited at a time. Simulated circuits may be used, but if the tests performed on simulated circuits indicate likely damage to other parts of the product to the extent that the safety of the product may be affected, the test is to be repeated on the product.

20.3 Each simulated fault condition is to be conducted on a separate unit unless it is agreeable to all those concerned that more than one test be conducted on the same unit.

20.4 The unit is to be placed on a softwood surface covered with white tissue paper. A single layer of cheesecloth is to be draped loosely over the entire enclosure.

20.5 Exposed dead-metal parts of the unit are to be connected to ground through a 3 A non-time-delay fuse.

20.6 The unit is to be connected to a 60 Hz, 120 V supply source. The supply circuit is to have a minimum 20 A branch circuit overcurrent protection.

20.7 The test is to be conducted for 7 hours or until at least one of the following results are observed:

a) A risk of fire or electric shock develops;

b) The branch-circuit overcurrent protection opens;

c) The equipment protective device opens;

d) Any other circuit component opens; or

e) A minimum of one hour elapses, circuit conditions stabilize, and there is no further evidence of overheating of parts.

20.8 With reference to of 20.7(e), the overheating of parts may be detected by an indicator such as an odor, smoke, discoloration, cracking of materials, charring, flaming, glowing, arcing, changes in circuit current through the applied fault, or any similar phenomenon.

20.9 If a fault condition is terminated by opening of a circuit component as specified in 20.7(d), the test is to be conducted two more times using new components for each test.

21 Latching Mechanism Tests

21.1 Tests for manually- or spring-activated latching cord connectors

21.1.1 A cord connector of the 1-15R, 5-15R, 5-20R, 6-15R, or 6-20R configurations, employing a manually- or spring-actuated latching mechanism for locking a mated attachment plug in place after its blades have been inserted into the female contacts shall comply with the Pull test, 21.2.

21.2 Pull test

21.2.1 After completion of this test:

a) There shall not be any damage to the cord connectors or the blades of the attachment plugs or other evidence of increased risk of injury or electric shock;

b) The latching means shall remain functional;

c) There shall not be any loosening of the plug blades nor displacement of the plugs blades at the attachment plug face exceeding 2.4 mm (3/32 inch), nor compression of the folded blades to less than 1.40 mm (0.055 inch);

d) The attachment plug shall be capable of being inserted into a standard mating receptacle; and

e) There shall not be any damage, arcing, or dielectric breakdown during application of the test potential.

21.2.2 Previously untested devices and mating plugs are to be used. The mating plugs are to have the configurations shown in Table 21.1. Three devices are to be tested using attachment plugs with rigidly mounted solid blades with standard detent holes. Three devices are to be tested using attachment plugs with folded blades and standard detent holes. With the device firmly secured in place, a mating attachment plug is to be inserted into the device and the latching mechanism activated to lock the plug in place. A pull of 20 lbf (89 N) in a direction perpendicular to the plane of the face of the cord connector and tending to withdraw the plug from the device is then to be applied to the plug and the plug shall not be withdrawn by the force. The force is then to be removed from the plug, the latching mechanism de-activated to release the plug, and the plug removed from the cord connector. This is to be repeated for a total of 250 cycles.

Table 21.1
Mating Plug Configurations for Pull Testing

Device under test	Mating plug	Number of devices tested
1-15R	1-15P	6
5-15R	1-15P	6
5-20R[a]	5-15P	3
	5-20P	3
6-15R	6-15P	6
6-20R[a]	6-15P	3
	6-20P	3

[a] If the construction will accept and latch both the 15 A and 20 A configurations, then 3 units of each shall be tested. If the construction will accept or latch only 20 A configuration, then 6 units of each shall be tested.

21.2.3 Each device shall then be subjected to the Retention of Blades Test, 14.3.

21.2.4 Each device shall then be subjected to the Dielectric voltage-withstand test, 11.4, except the test potential shall be 1000 V plus twice the rated voltage.

MARKINGS

22 General

22.1 Each cord set or power-supply cord, except as noted in 22.2, shall be marked where it will be plainly visible, as described in the requirements appropriate to the specific type of cord set or power-supply cord, with the following:

a) The manufacturer's name, trade name, or trademark or other descriptive marking by which the organization responsible for the product may be identified;

b) The electrical rating in volts, amperes, and watts. The international symbol "  " for AC shall be used and "  " for DC. The symbol for amperes shall be "A", for volts "V" and for watts "W"; and

c) A distinctive fitting catalog number or the equivalent where practical.

22.2 Power-supply cords intended for shipment to original equipment manufacturers shall have any applicable markings provided on the outer surface of the shipping carton, or on a tag or the equivalent inside the carton. The electrical rating need not be marked.

22.3 If a manufacturer produces or assembles cord sets or power-supply cords at more than one factory, each finished cord set or power-supply cord shall have a distinctive marking, which may be in code, by which it can be identified as the product of a particular factory.

22.4 The manufacturer of a cord set or power-supply cord is considered to be the one who completes the assembly of the cord and fittings.

22.5 Each cord set or power-supply cord that terminates in an attachment plug or fitting having a movable, self-restoring grounding member shall be marked "For hand-held tools and hand-held appliances." The marking shall be on the plug, flag, bracelet, or other acceptable location where it will be readily visible after the power-supply cord has been put into use.

22.6 The smallest unit shipping package containing a cord set or power-supply cord with a grounded conductor having a light blue colored insulation shall be marked to indicate its destination and shall also be marked with the following statement (or equivalent):

> "This package contains cords having a grounded conductor with a light blue colored insulation instead of the usual white or grey colored insulation."

22.7 Illustrations of outdoor applications, illustration of appliances that are generally used outdoors, and other references to and suggestions for outdoor use shall not appear on any cord set or power-supply cord or on any label, package, wrapper, or other item attached to, associated with, or otherwise giving information on a cord set or power-supply cord unless the cord set or power-supply cord in question complies with 6.8.

22.8 A cord connector provided with a latching mechanism that is part of an extension cord set in accordance with Latching Type Cord Connectors, 8.7, shall be marked with a statement instructing the user how to disengage the latching mechanism so that a mated attachment plug can be removed from the cord connector. The marking shall be within 50.8 mm (2 inches) of the cord connector body.

22.9 Cord sets and power supply cords constructed in accordance with 6.8.4, employing a flexible cord with a "-B" suffix, shall be marked to indicate the complete flexible cord type. Such marking shall appear as required in Sections 22, 23, 24, 32, 33, and 34, as applicable.

22.10 Unless specifically indicated otherwise, all markings in Sections 23 – 34, inclusive, that are required to be attached to the flexible cord shall be suitable for the intended cord type, and be rated for the intended environmental conditions, such as indoor use or outdoor use or exposure to oil. The markings shall be considered permanent, tear-resistant, and legible in compliance with:

a) Section 16, Test for Permanence of Warning Tag; or

b) UL 969A and rated for limited slippage.

22.11 Unless specifically indicated otherwise, all markings in Sections 23 – 34, inclusive, required to be provided on an enclosure shall be considered permanent and legible if it is:

a) Die-stamped into the unit;

b) Molded as part of the unit; or

c) Indelibly stamped or printed on a tag or pressure sensitive adhesive-backed label. An adhesive-backed label shall comply with the requirements in UL 969, and be for the temperature, type of surface, and environment, such as indoor or outdoor, for which it is intended.

23 Extension Cord Sets

23.1 General

23.1.1 The marked length of any extension cord set shall not be less than its measured length as determined by Figure 9.1. Packaging of cord sets shall indicate the length of the cord.

23.1.2 A fuseholder, attachment plug, or current tap intended to accommodate replacement fuses shall be plainly and permanently marked, "Use only with a fuse rated __ amperes, ___ volts." The values to be inserted in the blanks shall be those appropriate for the product.

23.1.3 The electrical rating shall be printed on one of the marker devices described as follows:

a) Printed on a doughnut-, flat-, or bracelet-type label.

b) Printed on a tag of tough paper, cloth, or the equivalent (of any color) having a hole large enough to accommodate the cord, and not resembling the shapes described in (c). The tag shall not be slit from the edge of the hole to the edge of the tag. The cord shall be passed through the hole in the tag prior to assembly of the end fittings on the cord set.

c) Printed in a contrasting color on a background of a solid color other than blue, green, or yellow on one of the following:

1) A ring-shaped (doughnut) tag of tough paper, cloth, or the equivalent having a hole large enough to accommodate the cord. The tag shall not be slit from the edge of the hole to the edge of the tag. The cord shall be passed through the hole in the tag prior to the assembly of the end fittings of the cord set.

2) A flag-type tag with an adhesive back. The tag shall be wrapped around and adhere to the cord, and the ends of the tag shall adhere to each other and project as a flag.

3) A bracelet wrapped around and affixed to the cord with an adhesive.

23.1.4 Each extension cord set employing Type SP-2, SP-3, SPT-2, SPT-3, SPE-2, or SPE-3 flexible cord, employing 30 AWG (0.05 mm^2) stranded conductors, shall be permanently and legibly marked according to 23.1.3: "FOR USE ONLY WHERE NOT SUBJECT TO FREQUENT FLEXING", or the equivalent.

23.1.5 A nonrewireable (molded-on or factory-assembled) fitting may be marked with a current rating only if the ampacity of the flexible cord and any through-cord switch is equal to or higher than that of the fitting configuration.

23.1.6 A nonrewireable (molded-on or factory-assembled) plug may be marked with the current rating of the lowest rated component of the power-supply cord.

23.1.7 Except as noted in 23.1.8, the dimmer switch described in 9.3.6 shall be indelibly marked where plainly visible on or directly adjacent to the connector with the following statement or its equivalent: "CAUTION: To reduce the risk of fire, use with ___ watt maximum incandescent lamp load only." The word "CAUTION" shall be in letters not less than 2.4 mm (3/32 inch) high. The maximum wattage inserted in the blank shall not exceed the rated wattage of the dimmer switch.

23.1.8 The marking required in 23.1.7 may be provided on a permanent tag attached to the dimmer switch, the current tap, or the flexible cord. The tag shall be attached in a manner such that it cannot be easily removed. The tag shall have the added marking in letters not less than 2.4 mm (3/32 inch) high: "Do not remove this tag."

23.1.9 The length of an extension cord set that is shorter than 1.8 m (6 feet) shall be plainly and permanently marked on the individual wrapper, tag, or equivalent attached to the cord set.

23.1.10 The marking for a supplementary protector described in 9.3.2 shall be provided in either of the following forms:

a) A flag-type tag with an adhesive back. The tag shall be wrapped around and adhered to the cord, adjacent to the plug body. The ends of the tag shall adhere to each other and project as a flag. The tag shall be tear-resistant and permanently affixed to the cord. The marking shall be indelible.

b) The marking shall be molded into or embossed on the surface of the plug body.

23.1.11 A general-use cord set employing in-line cord connectors (see 10.7.2.1.13) or a joint (see 10.7.2.2.6) shall be marked on a tag permanently attached to the cord set, with the following or equivalent wording following the word "WARNING":

a) "WARNING – To reduce the risk of electric shock, this product is for indoor use only. Not for use on construction sites or other similar locations." Alternately, this marking may be added to the marking tag in 23.3.1; and

b) Within 3 inches (76 mm) of each cord connector: "WARNING – To reduce the risk of fire, the total amperes drawn from all the cord connectors shall not exceed ____ Amps". The blank shall be filled in with the maximum current rating of the general-use cord set.

Lettering shall be a minimum of 1/16 inch (1.6 mm) high. The markings and tags shall comply with the permanence requirements of 23.3.1.

23.1.12 A general-use cord set employing a remote control feature shall be molded or hot stamped on the device body with the following or equivalent, "Remote Controlled Device". Lettering shall not be less than 3/32 inch (2.4 mm) high.

23.1.13 A general-use cord set employing a remote control feature shall be marked, "WARNING" and the following or the equivalent, "The general-use cord set could turn on unexpectedly without the user being present. To Reduce the Hazardous Condition – Unplug the appliance that is plugged into the receptacle(s) of the device before servicing." Lettering shall not be less than 3/32 inch (2.4 mm) high and shall either be molded or hot stamped on the remote control device with letters not less than 1/20 inch (1.3 mm) high so as to be visible during use, or be provided on a permanent tag attached to the flexible cord. The leading edge of the tag shall be located within 3 inches (76.2 mm) of the point where the cord enters the body of the remote control device. The tag shall be attached in a manner that it cannot be easily removed. The tag shall have the added marking in letters not less than 3/32 inch (2.4 mm) high: "Do not remove this tag."

23.1.14 A general-use cord set not intended for use with a motor load shall be marked, "WARNING" and the following or the equivalent, "This general-use cord set is not to be used with a motor load." Lettering shall not be less than 3/32 inch (2.4 mm) high and shall either be molded or hot stamped on the remote control device with letters not less than 1/20 inch (1.3 mm) high so as to be visible during use, or be provided on a permanent tag attached to the flexible cord. The leading edge of the tag shall be located within 3 inches (76.2 mm) of the point where the cord enters the body of the remote control device. The tag shall be attached in a manner that it cannot be easily removed. The tag shall have the added marking in letters not less than 3/32 inch (2.4 mm) high: "Do not remove this tag."

23.1.15 A required marking for a general use extension cord employing a supplementary charging circuit shall be durable, legible, and permanent in accordance with 22.10 or 22.11 as appropriate, and located where plainly visible on or directly adjacent to the connector with the rated voltage and current using the symbols as indicated in 22.1(b).

23.1.16 The height and depth of lettering of the required markings shall be as follows:

a) Upper case letters shall not be less than 1/12 inch (2.1 mm) in height.

b) Lower case letters shall not be less than 1/16 inch (1.6 mm) in height.

c) The letters of the text shall be in a color contrasting with the background color or shall be recessed or raised against their background at least 0.2 mm (0.008 inch).

23.1.17 A general use extension cord employing an induction power transmitter shall be durably, legibly, and permanently marked in accordance with 22.11 on or directly adjacent to the supporting surface with

the rated voltage and current using the symbols as indicated in 22.1(b) and the following or equivalent: "Wireless Charging Device". Letter heights shall be as indicated in 23.1.16 (a) – (c).

23.2 Polarization

23.2.1 Extension cord sets having 1-15 plug with a polarized configuration, shall be marked in a legible, distinct and prominent manner, in a color that contrasts with a solid color background, with the following marking: "CAUTION: This is a POLARIZED extension cord set. To prevent electric shock, match wide blade of plug to wide slot and insert. The polarized plug is not intended to be mated with nonpolarized outlets (having both slots the same size)".

23.2.2 The caution marking specified in 23.2.1 shall be displayed either on the outer surface of the smallest unit package or included in an instruction sheet or on a tag (or its equivalent), in which case, the word "polarized" shall appear on the outer surface of the smallest unit package.

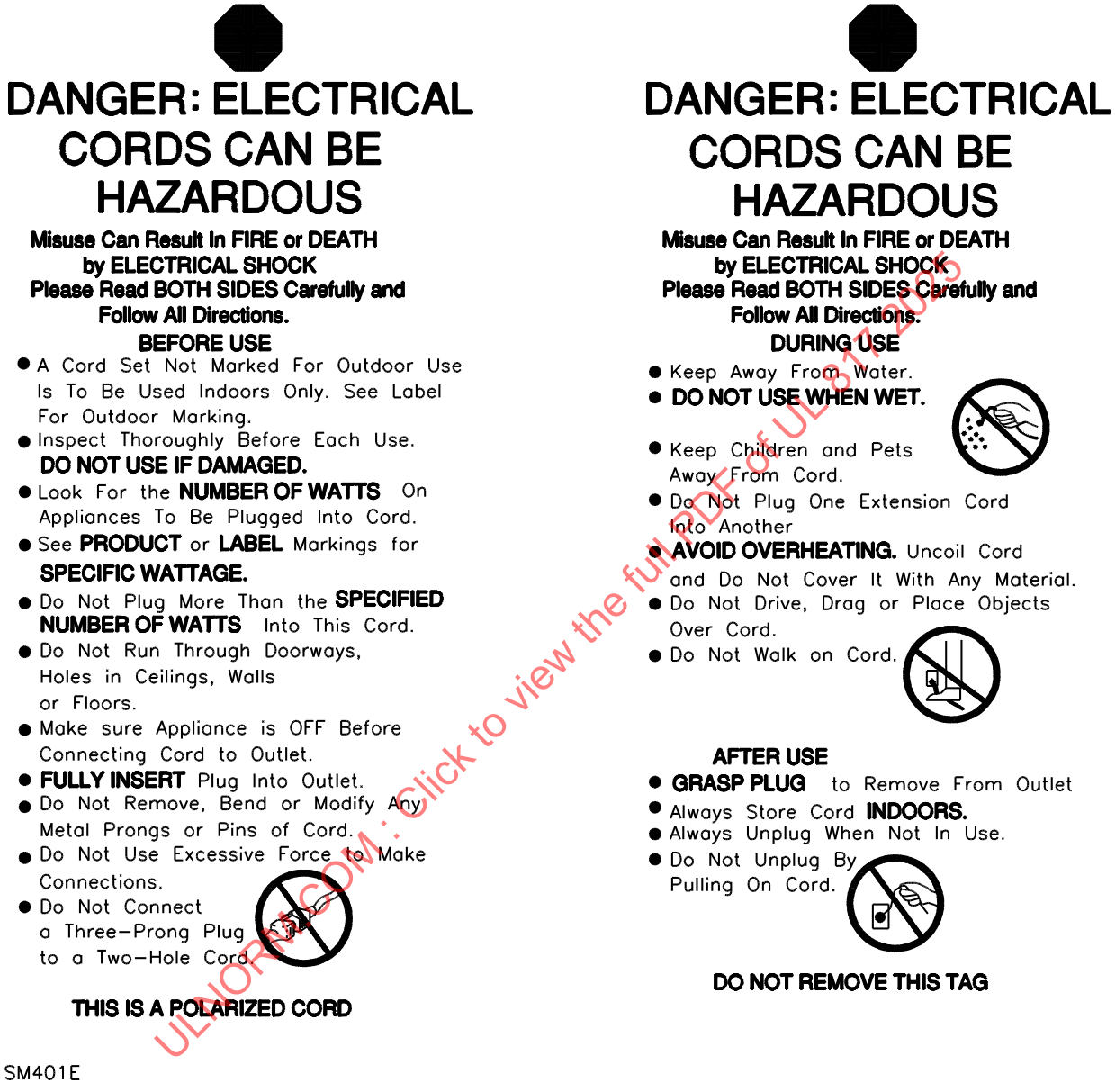
23.2.3 The words "POLARIZED" and "CAUTION" in the first element of each marking of where they appear separately shall be in boldface capital letters that are a minimum of 3.6 mm (9/64 inch) in height. The remaining words shall be a minimum height of 1.6 mm (1/16 inch).

23.3 Warning tag

23.3.1 An extension cord set shall be provided with a tear-resistant flag tag or flag label as shown in Figure 23.1 that is permanently affixed to the cord set as indicated in 22.10. The leading edge of the tag shall be located within 0.45 m (18 inches) of the point where the cord enters the body of the attachment plug. Markings shall be indelible.

Figure 23.1

Marking Tag



23.3.2 Illustrations shall be black with a solid white background. Each marking shall be preceded by a solid red octagon that is a minimum 7.9 mm (5/16 inch) across, and oriented so as to resemble a "stop" sign. Required illustrations shall be located within red circles that are a minimum 11 mm (7/16 inch) in diameter, crossed through with a red diagonal line.

23.3.3 Lettering shall be black with a solid white background. All letters in capitals and/or in boldface shall be as shown in Figure 23.1. The words "DANGER: ELECTRICAL CORDS CAN BE HAZARDOUS" shall be a minimum height of 3.6 mm (9.64 inch). All remaining words shall be a minimum height of 1.6 mm (1/16 inch).

23.3.4 Warnings tags shall be either a hanging type having a hole that permits securement of the cord by a plastic strap or equivalent that cannot be removed without cutting, or a flag type with an adhesive back, wrapped around to adhere to the cord, with the ends adhered to each other to project as a flag.

23.3.5 An outdoor-use cord set employing in-line cord connectors (see Exception No. 2 to 10.7.2.1.6 and Exception No. 2 to 10.7.2.1.7) or a joint (see 10.7.2.2.6) shall be marked on a tag permanently attached to the cord set, with the following or equivalent wording following the word "WARNING":

a) "WARNING – To reduce the risk of electric shock, this product is not for use on construction sites or similar locations." Alternately, this marking may be added to the marking tag in 23.3.1; and

b) Within 3 inches (76 mm) of each cord connector: "WARNING – To reduce the risk of fire, the total amperes drawn from all the cord connectors shall not exceed ____ Amps". The blank shall be filled in with the maximum current rating of the outdoor-use cord set.

Lettering shall be a minimum of 1/16 inch (1.6 mm) high. The markings and tags shall comply with the permanence requirements of 22.10.

23.4 Indoor-use extension cord sets

23.4.1 An extension cord set as described in 10.7 shall comply with 23.3.1 – 23.3.4.

23.4.2 In addition to the marking required by 23.3.1 – 23.4.1 and except as noted in 23.4.3, an extension cord set shall be marked as indicated below. The blank shall be filled in with the appropriate wattage.

ATTENTION: INSTRUCTIONS FOR PROPER USE
COVER UNUSED OUTLETS
FULLY EXTEND BEFORE USING
RATED 125-VOLTS

USE WITHIN THE ELECTRICAL RATING MARKED ON THE CORD SET

DO NOT PLUG MORE THAN TOTAL OF _____ WATTS IN THIS CORD SET

If watts not marked on appliance, multiply ampere rating (on nameplate) by 125 to determine equivalent watts. Add determined watts for each plugged-inch appliance or lamp (sum of watts on bulbs) to find total watts being used.

23.4.3 The requirement of 23.4.2 is modified by the following:

a) A single outlet cord set longer than 6.1 m (20 feet) need not comply with this requirement.

b) If the cord set employs only one outlet, the statement "Add determined watts for each plugged-in appliance or lamp (sum of watts on bulbs) to find total watts being used." may be omitted.

c) "RE-COVER UNUSED OUTLETS" may be used in place of "COVER UNUSED OUTLETS."

d) If the cord set employs only one outlet, or the outlets are self-closing, "COVER UNUSED OUTLETS" or "RE-COVER UNUSED OUTLETS" may be omitted.

e) If a cord set is so packaged that it is not likely to be used while coiled, "FULLY EXTEND BEFORE USING" may be omitted.

23.4.4 The marking in 23.4.2 shall be on one of the following:

a) The surface of the connector;

b) An individual wrapper; or

c) A tag attached to the cord set. The tag or wrapper may be removable from the cord set. Each element in the marking shall be an obvious individual item. The marking itself shall be either:

1) Indelible on the wrapper or tag, or

2) Integral with the surface of the connector. If the marking is included on the tag in Figure 23.1, it shall comply with 22.10.

23.4.5 All of the elements of the marking required by 23.4.2 need not be provided on a single surface. These elements may appear at separate locations. "DO NOT PLUG MORE THAN TOTAL OF _____ WATTS IN THIS CORD SET" and the explanation of wattage determination shall be provided entirely on a single surface. If any of the individual elements appear at different locations, then "ATTENTION: INSTRUCTIONS FOR PROPER USE" shall be provided at each location.

23.4.6 The marking mentioned in 23.4.2 shall be legible to the user during the procedures usually followed in preparation for use (unwrapping, unhanking, and so forth).

23.4.7 Except as noted in 23.4.8, the marking mentioned in 23.4.2 shall be considered acceptable if:

a) All letters are boldface capital letters except for the explanation of wattage determination.

b) The letters are a minimum of 1.6 mm (1/16 inch) high.

c) The letters whether indelible, embossed, or indented contrast with a solid-color background surrounded by a contrasting-color border at least 3.2 mm (1/8 inch) wide. The letters may be the same color as the border.

23.4.8 With regard to 23.4.7, the 3.2-mm (1/8-inch) border of contrasting color need not be provided if the required marking remains sufficiently distinctive to draw the reader's immediate attention to each element.

24 Outdoor-Use Extension Cord Sets

24.1 Each outdoor-use cord set shall be legibly marked with all of the following:

a) The type letter designation of the cord shall appear on the cord jacket. See Table 10.4.

b) The electrical ratings (see Rating, 10.7.6).

c) The wording "Suitable for use with outdoor appliances – store indoors while not in use" (see 24.2).

24.2 The markings specified in 24.1 shall be made by one of the means described in 23.1.3. The first part ("Suitable for use with outdoor appliances") of the marking specified in 24.1(c) shall be marked on the manufacturer's portion of the combination label. The second part ("store indoors while not in use") shall be the same type and size as the first if marked on the manufacturer's portion of the combination label. If the second part is marked elsewhere, the cord set shall be in its own package or wrapper that is marked with both parts, the second part immediately following the first, and both parts in the same type and size letters [letters with a height of 3.2 mm (1/8 inch) are the smallest ones acceptable].

24.3 Each 1-15, 2-15 NEMA type fitting cord set intended for use with outdoor appliances shall be permanently marked "CAUTION – To reduce the risk of electric shock, do not use with any appliance or tool with a 3-wire grounding-type plug", or the equivalent. The marking specified shall be on a tear-resistant tag permanently affixed to the cord set within 0.3 m (12 inches) of the connector.

24.4 The wrapper or equivalent packaging of a 1-15 or 2-15 NEMA type fittings cord set intended for use with outdoor appliances shall be marked "CAUTION – This cord set is specifically designed for 2-wire appliances. To minimize the risk of electric shock, do not use with any appliance or tool with a 3-wire grounding-type plug", or the equivalent.

24.5 Outdoor-use cord sets having 1-15 NEMA type fittings shall be marked in accordance with 23.2.

24.6 The plug and connector of an outdoor-use cord set may be marked with a current rating only if they meet the requirements in 23.1.5 and 23.1.6, respectively.

24.7 An outdoor-use cord set shall comply with the marking tag requirements in 23.3.1 – 23.3.4.

24.8 A cold usage cord set in accordance with 10.7.2.3 shall be marked with the following or equivalent: "THIS IS A COLD USAGE CORD SET SUITABLE FOR USE AT -40 °C." The marking shall be printed on a tear-resistant tag or flat bracelet type label or the equivalent (of any color) affixed within 152 mm (6 inches) of the cord connector body. The marking may also appear on the packaging or stuffer sheet.

25 Adapter Cord Sets

25.1 The following marking requirements for adapter cord sets apply:

a) Each adapter cord set shall be legibly marked with all of the following:

1) The type letter designation for the cord shall appear on the cord jacket. See Table 10.4.

2) The electrical ratings (see Ratings, 10.8.5).

3) The wording, "Suitable for use with outdoor appliances – store indoors while not in use" [see 24.1(c) and 24.2(c)].

4) The wording, "Intended for use on construction sites or similar locations".

25.2 An adapter cord set having the plug fitting rated less than the connector fitting shall be additionally marked by one of the means described in 23.1.3 to caution the user not to overload the branch circuit and the adapter cord set. The cautionary marking shall also include the rating of the adapter cord set in accordance with Ratings, 10.8.5.

26 Cord Restraint Devices

26.1 Each cord restraint device shall be individually packaged and shall be marked with the words "Cord Restraint Device" along with the marked cord ranges that the cord restraint device can accommodate. Abbreviations such as wire size, type and No. of conductors are considered to meet the intent.

27 Recreational Vehicle and Mobile Home Applications

27.1 In accordance with UL 62, the outer surface of a cord having 14 AWG (2.08 mm^2), 12 AWG (3.31 mm^2), or 10 AWG (5.26 mm^2) conductors shall be marked at intervals not exceeding 0.6 mm (24 inches) with the statement "For recreational-vehicle use: __ amperes." The outer surface of a cord having 8 AWG (8.36 mm^2) or 6 AWG (13.3 mm^2) conductors shall be similarly marked with "For mobile-home or recreational-vehicle use: __ amperes" or "For recreational-vehicle use: __ amperes" or "For mobile-home use:____ amperes." The blank space shall be filled in with the appropriate current rating.

28 Power-Supply Cords – Shielded

28.1 A power-supply cord employing shielded cord in accordance with 10.1.4.3 shall be indelibly marked with the following or the equivalent: "CAUTION: The shield in this cord is not terminated to any of the terminals in the ____." The blank shall be filled in with one of the following: "attachment plug", "appliance" connector, or "attachment plug or appliance" connector, as appropriate.

28.2 The marking described in 28.1 shall be provided on a permanent tag attached to flexible cord within 152 mm (6 inches) of the plug.

29 Hospital Grade Attachment Plugs, Connectors and Hospital Grade Extension Cords

29.1 An attachment plug and connector shall be marked "Hospital Grade" and with a green dot. One or both markings on the face of the plug shall be permitted. The marking "Hospital Grade" shall also be permitted on other external surfaces of the plug and connector.

29.2 The green dot shall be a minimum of 4.8 mm (3/16 inch) and a maximum of 6.4 mm (1/4 inch) in diameter and shall be a contrasting shade of green if on a green-bodied device. Additionally, the dot shall be ink stamped, painted, or otherwise applied in a manner determined to be indelible. A label or sticker marked with the green dot shall be accompanied by the marking "Hospital Grade" and shall be attached by an adhesive or other means to the device so that it is not readily removable without destroying its significance if reapplied.

29.3 A hospital grade extension cord shall be provided with all marking(s) required for indoor use extension cords in accordance with 23.4.

29.4 In addition to the markings for indoor use extension cords, hospital grade extension cords shall also be marked: "Not for use in Anesthetizing Locations". The marking shall be indelible and provided by a tear-resistant tag that is permanently affixed to the cord set in accordance with 22.10 and shall be located 152 – 356 mm (6 – 14 inches) from the cord connector.

30 Range and Dryer Power-Supply Cord Kits

30.1 Range and dryer power-supply cord kits shall be visibly marked on the smallest shipping container or packaging with the following information:

a) The electrical rating in volts and amperes as specified in Table 13.1.

b) A statement indicating acceptability for use with household electric ranges or household electric clothes dryers, or both, as applicable.

30.2 Complete installation instructions shall be provided with a power-supply cord kit that is intended for use with a range or dryer. The instructions shall:

a) Describe the method of assembly and installation, including the appropriate connection opening diameter specified in Table 13.1 which matches the amperage rating of the power-supply cord supplied (see 30.4 – 30.6).

b) Advise the installer that after the power-supply cord has been installed, the installer shall check the continuity of the grounding conductor with an acceptable indicating device.

c) Contain information regarding end-use application and installation, including polarization and strain relief.

30.3 The instructions in 30.2 shall not specify:

a) The cutting or splicing of connections; or

b) The soldering of connections.

30.4 A power-supply cord kit that is rated 50 A and intended for use only in a nominal 1-3/4 inch diameter connection opening shall be marked with the following or equivalent: "For use with nominal 1-3/4 inch diameter connection opening".

30.5 A power-supply cord kit that is rated 50 A and intended for use only with a nominal 1-3/8 inch diameter connection opening shall be marked with the following or equivalent: "For use only with nominal 1-3/8 inch diameter connection opening".

30.6 A power-supply cord kit that is rated 50 A and intended for use with both nominal 1-3/8 and 1-3/4 inch diameter connection openings shall be marked with the following or equivalent: "Suitable for use with nominal 1-3/8 and 1-3/4 inch diameter connection opening".

31 Power-Supply Cords for Replacement Use

31.1 An individually packaged power-supply cord intended for replacement use shall be marked to indicate its cord type, cord length, conductor size, number of conductors, electrical rating, and temperature rating if other than the lowest temperature rating permissible for the particular cord type used. The marking shall be provided on the packaging material except when provided on the cord and visible through the packaging. See 23.1.3.

31.2 A power-supply cord rated 50 W or less shall also be marked "For use with hand-held appliances rated 50 watts or less, 125 volts" (or 250 V, depending on the rating of the attachment plug).

31.3 Individually packaged power-supply cords intended for replacement use having polarized 1-15 type plugs or current taps, shall be marked with the following information:

This is a POLARIZED power-supply cord.

It has a polarized plug (one blade is wider than the other).

This plug is not intended to be mated with a nonpolarized outlet (having both slots the same size).

Install so that original polarity is maintained.

31.4 The markings required by 31.3 shall be legible, distinct, and prominently displayed on the outer surface of the smallest unit package and shall comply with the following:

a) The word "POLARIZED" in the first element of the marking shall be of boldface capital letters a minimum of 3.6 mm (9/64 inch) high and the remaining words shall be a minimum of 1.6 mm (1/16 inch) high.

b) The color of the letters shall contrast with a solid color background.

31.5 The marking of a replacement-use power-supply cord shall include installation instructions which address each of the following items:

a) Whether the power-supply cord is of the grounding or nongrounding type;

b) If nongrounding, whether the power-supply cord is polarized or nonpolarized (for example, by a pictorial representation depicting the difference in blade widths);

c) If polarized, how to identify the ungrounded (neutral) conductor (for example, using a pictorial representation or through precise instructions);

d) Instructions for the user to disconnect the appliance at the plug before attempting to remove the old power-supply cord from terminals on the appliance; and

e) Instructions for the user not to plug in the replacement power-supply cord until all necessary terminals on the appliance have been completed and the product is completely reassembled.

31.6 Bulk-packaged power-supply cords intended for replacement use shall be provided with installation instructions as described in 31.5, attached to each power-supply cord in the bulk shipping carton.

31.7 The instructions described in 31.5 shall appear on the smallest unit carton, card, or blister pack, or on a stuffer sheet included inside an individual package.

32 Special-Use Power Supply Cords

32.1 Except as noted in 32.5 and 32.6, each special-use power-supply cord shall be prominently marked to indicate its specific use, electrical rating, and temperature, if other than the lowest temperature rating permissible for the particular cord type used.

32.2 Power-supply cords employing Type CXTW, XTW cord, or clock cord, or shaver cord, shall be marked "Power-supply cord having ____ AWG Type ___ special-use cord (wire)" on the shipping package where obvious. See note 8 to Table 10.1. The appropriate wire gauge and type designation shall be inserted in the blank spaces.

32.3 A special-use power-supply cord intended for use with a toy transformer or electric toy shall be marked "For use with toy transformers or electric toys" or an equivalent statement.

32.4 The special-use power-supply cord for use with a vacuum cleaner or floor finishing machine mentioned in 10.10 shall be marked with "Only for use with vacuum cleaners," or "Only for use with floor finishing machines," or the equivalent.

32.5 The markings for special-use power-supply cords indicated in 32.3 and 32.4 shall be on the outer surface of the smallest unit package or on a tag inside the smallest unit package, or its equivalent.

32.6 A special-use power-supply cord intended to be woven in the links of a chain-suspended portable lamp shall be marked to indicate the intended use on the shipping package where obvious. See 10.2.4.

33 Special Use Cord Sets

33.1 A special-use cord set shall be marked with electrical rating, and its temperature rating if other than the lowest temperature rating permissible for the particular cord type use. Marking can be on cord or on packaging.

33.2 Each cord set rated 50 W or less shall also be marked "For use with hand-held appliances rated 50 watts or less, 125 volts" (or 250 V, depending on the rating of the attachment plug).

33.3 Except as indicated in 33.4, cord sets intended for shipment to original equipment manufacturers shall have any applicable markings (see Section 22, 33, and 34) provided on the outer surface of the shipping carton, or on a tag or the equivalent inside the carton.

33.4 The electrical rating shall be marked on each individual cord set unless the ampere rating of the flexible cord is equal to or greater than the ampere rating of either fitting. Alternatively, the plug may be marked with the current rating of the lowest rated component of the cord set.

33.5 The special-use cord set intended for use with a vacuum cleaner or floor finishing machine mentioned in 10.10 shall be marked with "Only for use with vacuum cleaners", or "Only for use with floor finishing machines", or the equivalent.

33.6 The markings mentioned in 33.5 shall be on the outer surface of the smallest unit package or on a tag inside the smallest unit package, or its equivalent.

34 Special Use Cord Sets Intended for Replacement Use

34.1 An individually packaged cord set intended for replacement use shall be marked to indicate its cord type, cord length, conductor size, number of conductors, electrical rating, and temperature rating if other than the lowest temperature rating permissible for the particular cord type used. The markings shall be on the packaging material. Any markings provided on the cord need not be repeated on the packaging.

34.2 Each individually packaged cord set intended for replacement use with polarized 15-A, 125-V outlet(s) having a 1-15 configuration shall be marked as indicated in 23.2.1 – 23.2.3 except that the words "extension cord set" shall be replaced by "cord set."

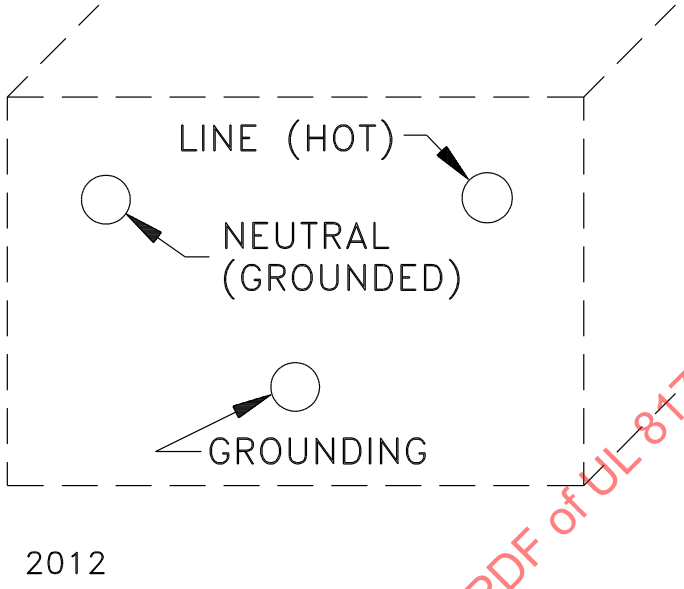
34.3 Each individually packaged cord set intended for replacement use with a non-polarized 15-A, 125-V outlet(s) having a 1-15 configuration shall be marked with the following or equivalent after the word CAUTION, "CAUTION: This is a NONPOLARIZED cord set and is not for use with appliances that have a polarized plug – one blade wider than the other.

34.4 Each cord set with a connector having a 1-15 configuration shall be permanently marked with the following or equivalent statement after the word CAUTION, "CAUTION: To reduce the risk of electric shock, do not use as an extension cord. Connect directly to an appliance. Do not connect to a 3-wire grounding-type appliance."

34.5 A cord set intended for replacement use only that employs a connector fitting with nonstandard polarization, as described in 10.16, shall be marked as illustrated in Figure 34.1. The marking specified shall be on a tear-resistant tag permanently affixed to the cord within 305 mm (12 inches) of the connector fitting.

Figure 34.1

Example of Marking Required in 34.5



CAUTION – This special-use cord is manufactured as a replacement cord. Its load plug has the nonstandard polarization shown below:

Make sure this polarization is the same as the polarization of the load plug on the cord being replaced.

ANNEX A (Normative) – SEASONAL-USE CORD SETS

INTRODUCTION

A1 Scope

A1.1 The requirements of this supplement cover seasonal-use cord sets that are only intended for indoor use with Christmas-tree and other seasonal decorative-lighting outfits.

CONSTRUCTION

A2 General

A2.1 A seasonal-use cord set shall comply with all of the applicable construction requirements for general-use cord sets in this Standard except as modified by the requirements of this supplement.

A2.2 A seasonal-use cord set shall not exceed 15 feet (4.6 m) in length when measured in accordance with 6.2 of this Standard.

A3 Flexible Cord

A3.1 The flexible cord used in a seasonal-use cord set shall be of the size and type in Table A3.1. The cord shall comply with UL 62 and shall have a minimum flame rating of VW-1 and minimum insulation temperature of 105 °C (221 °F).

Table A3.1
Flexible Cord and Overcurrent Protection for Seasonal-Use Cord Sets

Wire size		Wire type	Maximum overcurrent protector rating (A)
AWG	(mm^2)		
18	(0.824)	SP-2, SPT-2, SPE-2, SV, SVO, SVOO, SVT, SVTO, SVTOO, SVE	8
17	(1.0)	SV, SVO, SVOO, SVT, SVTO, SVTOO, SVE	9
16	(1.3)	SP-2, SPT-2, SPE-2	10

A4 Fittings

A4.1 An attachment plug, cord connector, or current tap provided on a seasonal-use cord set shall be of the 2-pole, 2-wire polarized 1-15 configuration.

A4.2 A seasonal-use cord set employing an outlet fitting (a cord connector connected between the end fittings) shall comply with all of the following:

a) There shall not be more than a total of 9 outlets (including those provided at the end fittings);

b) There shall not be more than 3 feet (0.9 m) of flexible cord between each of the outlet fittings;

c) The outlet fittings shall be factory-assembled to the flexible cord and shall not be field rewireable; and

d) Insulating outlet closures that comply with 14.11 of this Standard shall be provided for each outlet opening of each outlet fitting provided between the end fittings of the cord set.

A4.3 All fittings of a seasonal-use cord set shall comply with the spacings requirements in UL 498.

A4.4 The insulating materials used in the line and load fittings of a seasonal-use cord set shall comply with the flammability requirements for enclosures in UL 588 and with the high-current arc resistance to ignition (HAI), hot wire resistance to ignition (HWI), comparative tracking index (CTI), and relative thermal index (RTI) requirements in UL 498.

A5 Fittings Intended to Accommodate Fuses or Other Overcurrent Protective Devices

A5.1 The enclosure of an overcurrent protective device shall comply with the material requirements in A4.4.

A5.2 A fused attachment plug or current tap shall be constructed so that there shall not be exposure of live parts during removal or replacement of the fuse, nor exposure of live parts with the fuse cover partially open while the plug or current tap is inserted 0.08 inch (2.03 mm) into a receptacle. Exposure of live parts shall be determined by contact with the articulate probe illustrated in Figure 6.1 of this Standard. The fuse cover of a fused attachment plug or current tap shall not be detachable from the device.

A6 Overcurrent Protection

A6.1 A seasonal-use cord set shall be provided with integral overcurrent protection (short circuit and overload protection) rated in accordance with Table A3.1.

A6.2 The integral overcurrent protective device shall also comply with UL 248-1 and UL 248-14.

A6.3 The overcurrent protective device shall be an integral part of the line fitting (attachment plug or current tap).

A6.4 A seasonal-use cord set shall employ only one overcurrent protective device, which shall be connected to the ungrounded (narrow) blade of the attachment plug or current tap.

PERFORMANCE

A7 General

A7.1 In addition to the applicable performance requirements for cord sets in Assembly, 10.1, of this Standard, except as modified by Tests on Female Devices, A8; Conductor Secureness Test, A9; Strain Relief Test, A10; Crushing Test, A11; and Overcurrent Protective Devices, A12, a seasonal-use cord set shall comply with the applicable tests in UL 498 as described in Table A7.1, and the tests in UL 588 as described in Table A7.2.

Table A7.1
Tests from UL 498

	Wiring device	Test
All devices		Comparative Tracking Index Test
		Glow Wire Test
		High-Current Arc Resistance to Ignition Test
		Mold Stress Relief Test
		Moisture Absorption Resistance Test
		Dielectric Withstand Test
		Conductor Secureness Test
Attachment plugs	All	General

Table A7.1 Continued on Next Page

Table A7.1 Continued

	Wiring device	Test
		Secureness-Of-Cover Test
		Terminal Temperature Test
	Pin-type terminals	Assembly Test
		Temperature Test
		Strain Relief Test
		Fault Current Test
		Dielectric Voltage-Withstand Test
Cord connectors	All	General
		Retention of Plugs Tests
		Overload Tests
		Temperature Test
		Resistance to Arcing Test
	Pin-type terminals	Assembly Test
		Temperature Test
		Strain Relief Test
		Fault Current Test
		Dielectric Voltage-Withstand Test
Current taps	All	General
		Secureness-Of-Cover Test
		Contact Security Test
		Retention of Plugs Test
		Overload Test
		Temperature Test
		Resistance to Arcing Test
	Pin-type terminals	Assembly Test
		Temperature Test
		Strain Relief Test
		Fault Current Test
		Dielectric Voltage-Withstand Test

Table A7.2
Tests from UL 588

Test
Leakage Current Test
Leakage Current Following Humidity Conditioning
Temperature Tests for Devices Employing Insulation-Piercing Terminals
Enclosure Mold Stress Relief Test
Drop Test
Impact Test

Table A7.2 Continued on Next Page

Table A7.2 Continued

Test
Adhesive Test
Fuseholder Temperature Test
Fuseholder Cover Test
Strain Relief Test
Reliability of Conductor Connections Test
Flexing Test
Temperature Test After Flexing

A8 Tests on Female Devices

A8.1 Female devices shall be tested in accordance with Table A7.1.

A9 Conductor Secureness Test

A9.1 Instead of the conductor secureness test of this Standard, a device shall comply with the reliability of conductor connections test in UL 588. See also Table A7.2.

A10 Strain Relief Test

A10.1 Instead of the strain relief test of this Standard, a seasonal-use cord set shall comply with the strain relief test in UL 588.

A11 Crushing Test

A11.1 General

A11.1.1 After being tested as described in A11.2 – A11.3, a fitting shall comply with each of the following:

a) There shall not be any visible damage to any part of the fitting that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 6.1 of this Standard;

b) There shall not be any cracking or denting of the fitting that would make it unfit for use, or affect the function of any safety controls or constructional features such as overcurrent protective devices, strain relief, or similar features; and

c) There shall not be any damage to the fitting that would result in an increase in the risk of electric shock as determined by compliance with the dielectric voltage-withstand test in UL 588.

A11.2 Molded-on fittings

A11.2.1 After being conditioned in a circulating-air oven for 7 days at 90.0 ±1.0 °C (194.0 ±1.8 °F) and then cooled to room temperature, each of two representative molded-on fittings shall be subjected for 1 minute to a crushing effort of 75 lbf (334 N) applied in any direction at right angles to its major axis.

A11.2.2 Any testing equipment that can apply a steady pressure of 75 lbf (334 N) to the fitting may be employed. The fitting shall be tested between two 1/2-inch (12.7 mm) or thicker parallel flat maple blocks. Care shall be taken that the crushing force is not applied suddenly.