UL 817

STANDARD FOR SAFETY

Cord Sets and Power-Supply Cords

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

Twelfth Edition, Dated March 11, 2015

SUMMARY OF TOPICS

This revision of ANSI/UL 817 dated May 16, 2023 includes the addition of the Standard for Marking and Labeling Systems – Flag Labels, Flag Tags, Wrap-Around Labels and Related Products, UL 969A; 16.1.1, 16.2.1 – 16.2.5, 16.3.1, 16.4.1, 16.4.2, 16.5.1, 20.10, 20.11, 21.1.15, 21.1.17, 21.3.1, 21.3.5, 21.4.4, 27.4 and SA14.3.

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated January 20, 2023.

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Standard for Cord Sets and Power-Supply Cords

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March 11, 2015

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The most recent designation of ANSI/UL 817 as an American National Standard (ANSI) occurred on May 16, 2023. 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 the Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

CONSTRUCTION

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, ANSI/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. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

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

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

b) Is superseded by a requirement in this standard.

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

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

3 Units of Measurement

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

4 Undated References

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

5 Glossary

5.1 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.

5.8A 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.

5.9 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 5.8A.

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

5.11 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.

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

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

5.14 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.

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

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

5.17 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.

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

5.19 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.

5.20 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.

5.21 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.

5.22 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.

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

5.23A INDUCTION POWER TRANSMITTER – The equipment consisting of the supply connections, control circuitry, induction transmitting coils, power platform, and overall enclosure.

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

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

5.26 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.

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

5.28 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.

5.29 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.

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

5.31 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.

5.32 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.

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

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

5.34A 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.

5.35 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 the Standard for Appliance Couplers for Household and Similar General Purposes – Part 1: General Requirements, UL 60320-1, Appliances couplers for household and similar general purposes – Part 1: General requirements, IEC 60320-1, Appliance Couplers for Household and Similar General Purposes – Part 2-2: Interconnection Couplers for Household and Similar Equipment, IEC 60320-2-2, Wiring Devices – Dimensional Specifications, ANSI/NEMA WD 6, and the Standard for Wiring Device Configurations, 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 the Standard for Tests for Flammability of Plastic Materials for

Parts in Devices and Appliances, UL 94, or comply with the 12 mm flame test in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

6.2A Combustible materials

6.2A.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 the Outline of Investigation for Acid Gas, Acidity and Conductivity of Combusted Materials and Assessment of Halogens, UL 2885, the device may be surface marked on the plug and/or cord connector with the suffix "HF" after the catalog number.

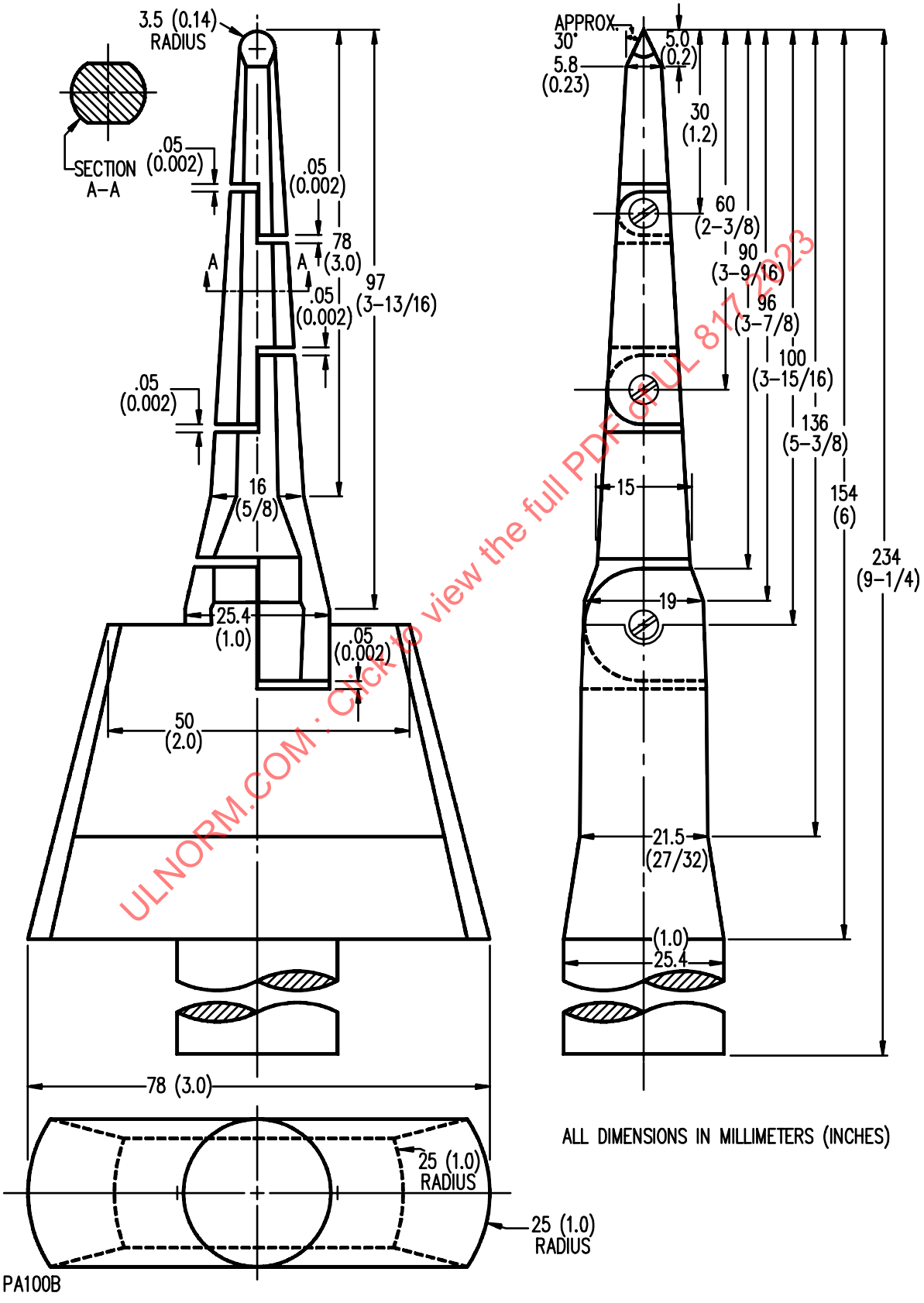
6.3 Accessibility of live parts

6.3.1 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.

6.3.2 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



6.3.3 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.

6.4 Connection to fittings

6.4.1 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.

6.4.2 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 6.4.3); 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.

6.4.3 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.

6.5 Identification and wiring

6.5.1 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.

6.5.2 A flexible cord assembled to a fitting that has any of the configuration contacts as illustrated in the Standard for Wiring Device Configurations, UL 1681 (C3.1 – C3.8), the Standard for Appliance Couplers for Household and Similar General Purposes – Part 1: General Requirements, UL 60320-1, Appliances couplers for household and similar general purposes – Part 1: General requirements, IEC 60320-1 and Appliance Couplers for Household and Similar General Purposes - Part 2-2: Interconnection Couplers for Household and Similar Equipment, IEC 60320-2-2, or Wiring Devices – Dimensional Specifications, ANSI/NEMA WD 6, shall comply with 6.5.3 and 6.5.4.

6.5.3 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 20.6.

6.5.4 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.

6.5.5 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.

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

6.6 Treatment of cord-conductor coverings

6.6.1 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.

6.6.2 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.

6.7 Outdoor-use fittings

6.7.1 Except as noted in 6.7.2, materials used for outdoor fittings when molded of polymeric material shall be subjected to:

a) The Weather (sunlight) resistance test in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C for 720 h for carbon arc or 1000 h for Xenon-arc; and

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

6.7.2 Fittings molded of solid butyl rubber, neoprene, thermoplastic elastomer, or polyvinyl chloride shall not be required to comply with 6.7.1.

6.7.3 Except as indicated in 6.7.4, 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.

6.7.4 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 in) 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 Plugs

7.1.1 A blade used in a 15- or 20-A NEMA attachment plug cap shall comply with the Standard for Attachment Plug Blades for Use in Cord Sets and Power-Supply Cords, 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.

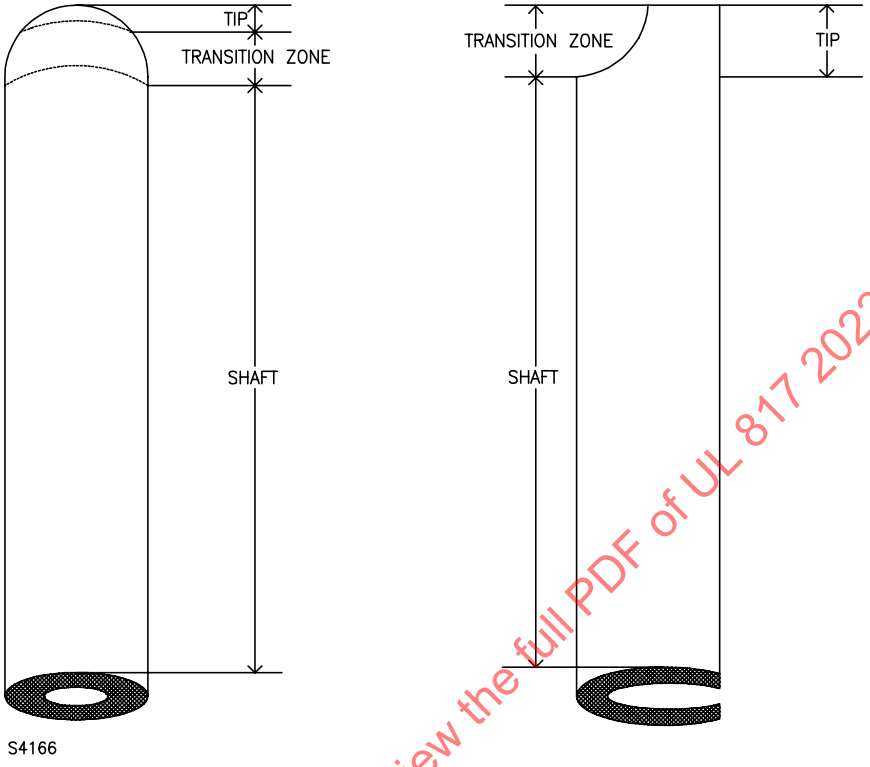
7.1.2 The grounding blade or pin of a 15- or 20-A non-locking type attachment plug shall not contain surface discontinuities that would tend to interfere with insertion into, or withdrawal from, a grounding contact of an outlet device. Abrupt surface transitions such as gaps, steps, offsets, detents, 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

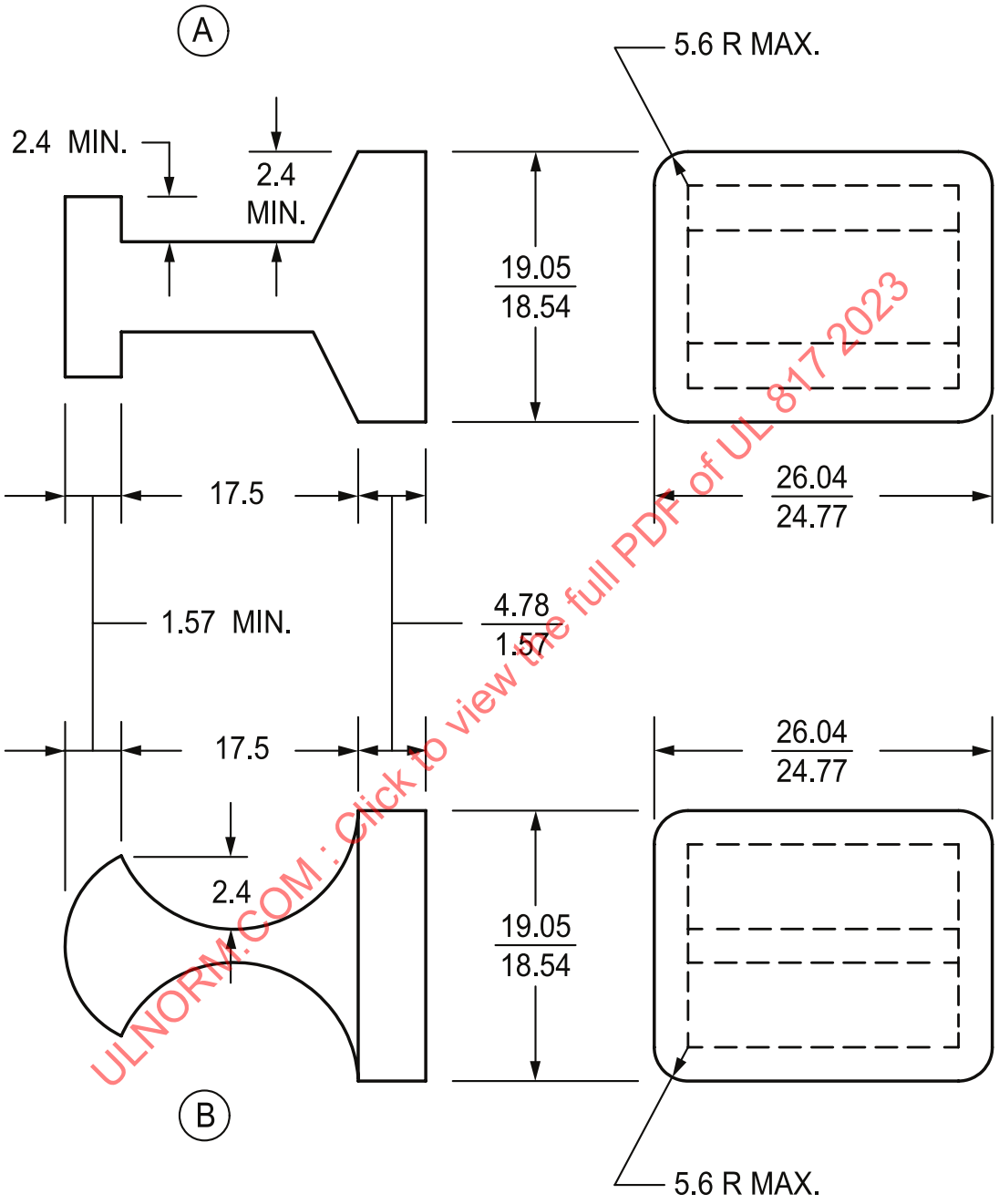


7.2 Attachment plug grip

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 in) located between two higher sections. The section at the rear shall provide a sharply defined projection at least 2.4 mm (0.094 in) high with a base of at least 1.57 mm (0.062 in), and an overall width of at least 6.4 mm (0.25 in), 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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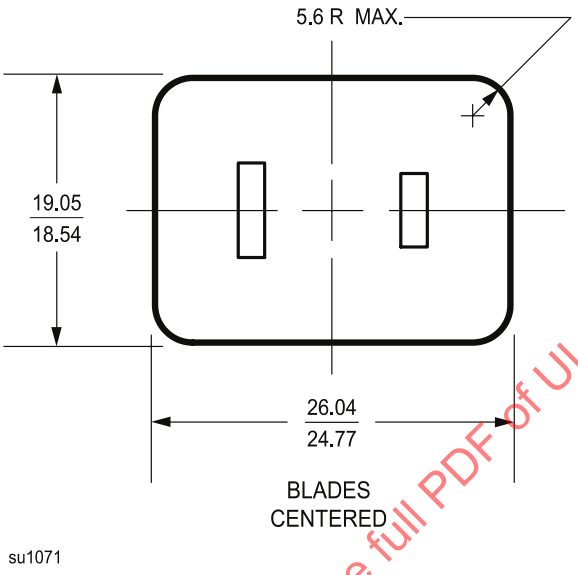
Note – All dimensions in mm.

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.

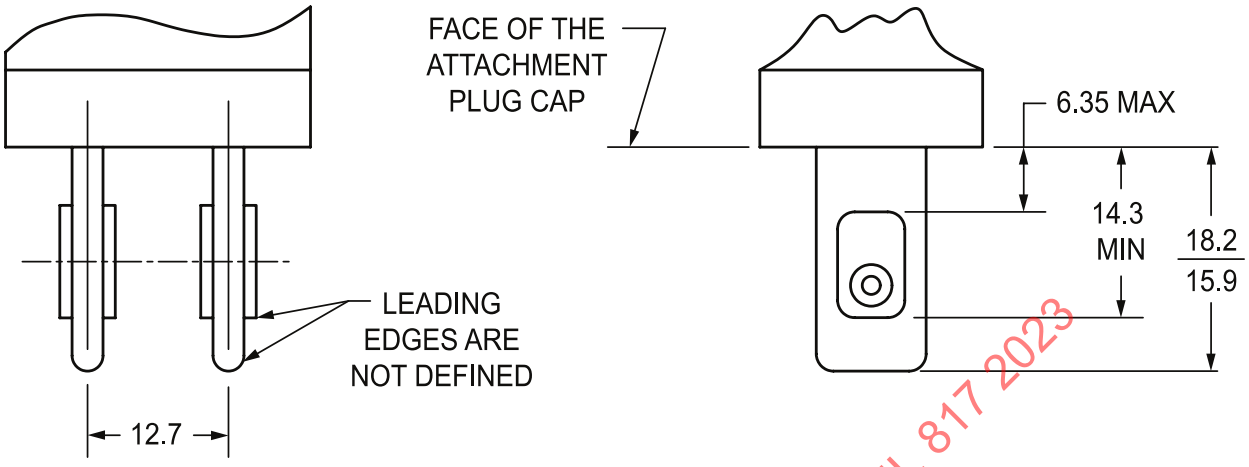
mm	5.6	19.05 18.54	26.04 24.77
(inch)	(7/32)	(0.750) (0.730)	(1.025) (0.975)

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 ANSI/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 ANSI/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 27, Hospital Grade Attachment Plugs, Connectors and Hospital Grade Extension Cords.

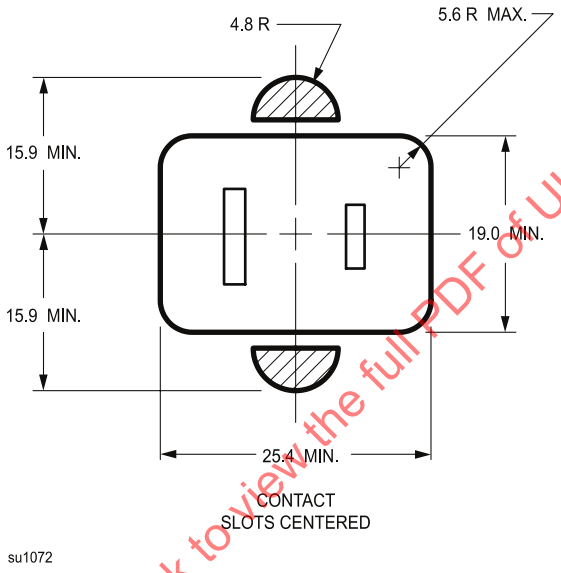
8 Cord Connectors

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.

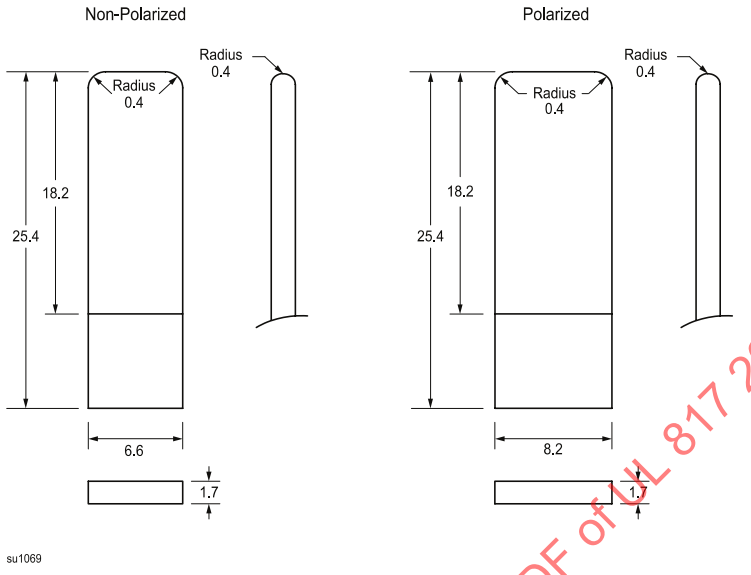
mm	4.8	5.6	15.9	19.0	25.4
(inch)	(3/16)	(7/32)	(5/8)	(3/4)	(1)

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

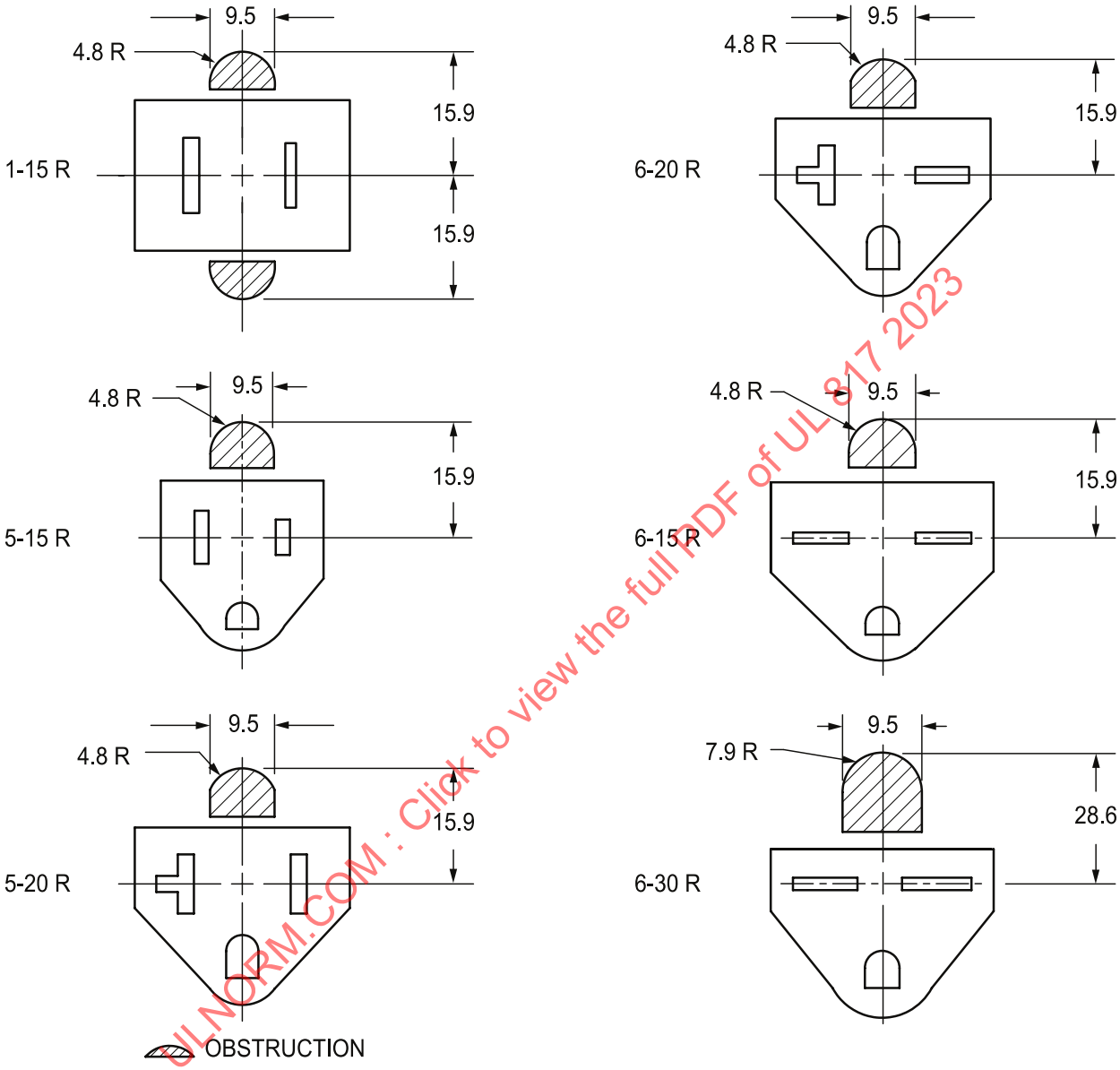
8.4 Mismating

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



su1080

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.

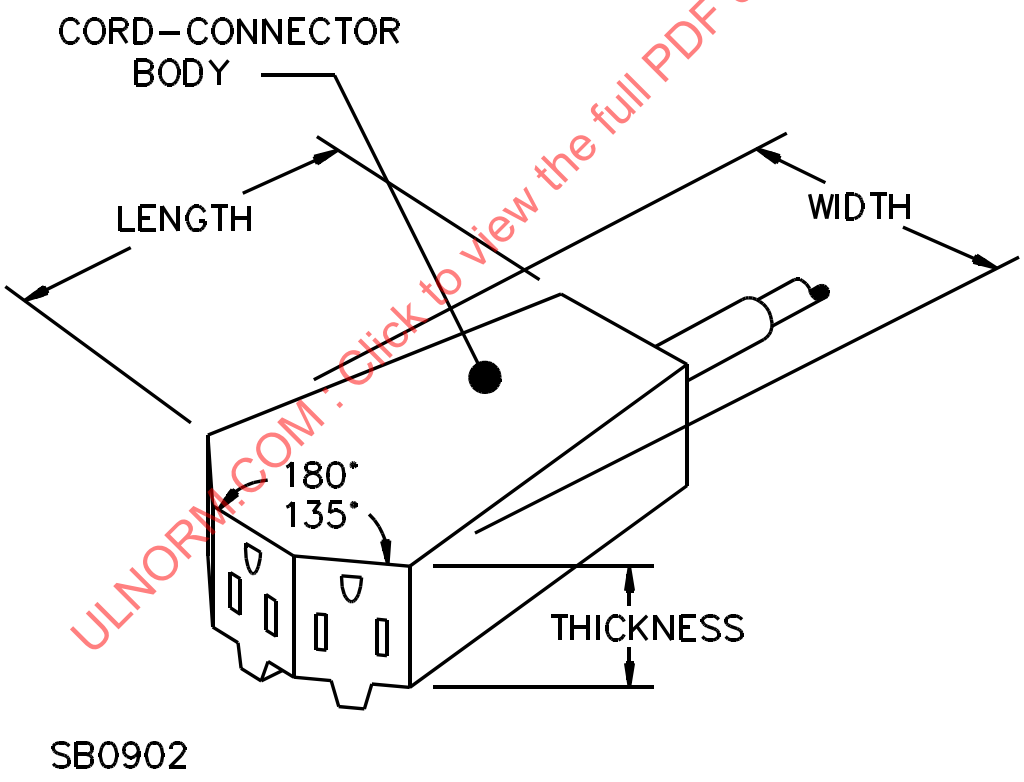
8.5.2 A cord connector shall have a maximum of three outlets. The configuration of the cord connector shall be the same as the attachment plug.

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 degrees. 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 ANSI/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 27.

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 19B.

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 the Standard for General-Use Snap Switches, 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 the Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1. The marking shall be located as identified in 21.1.10.

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 21.1.7, 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 the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

9.4.4 A switch enclosure shall be of a material having moisture absorptive properties in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, 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.

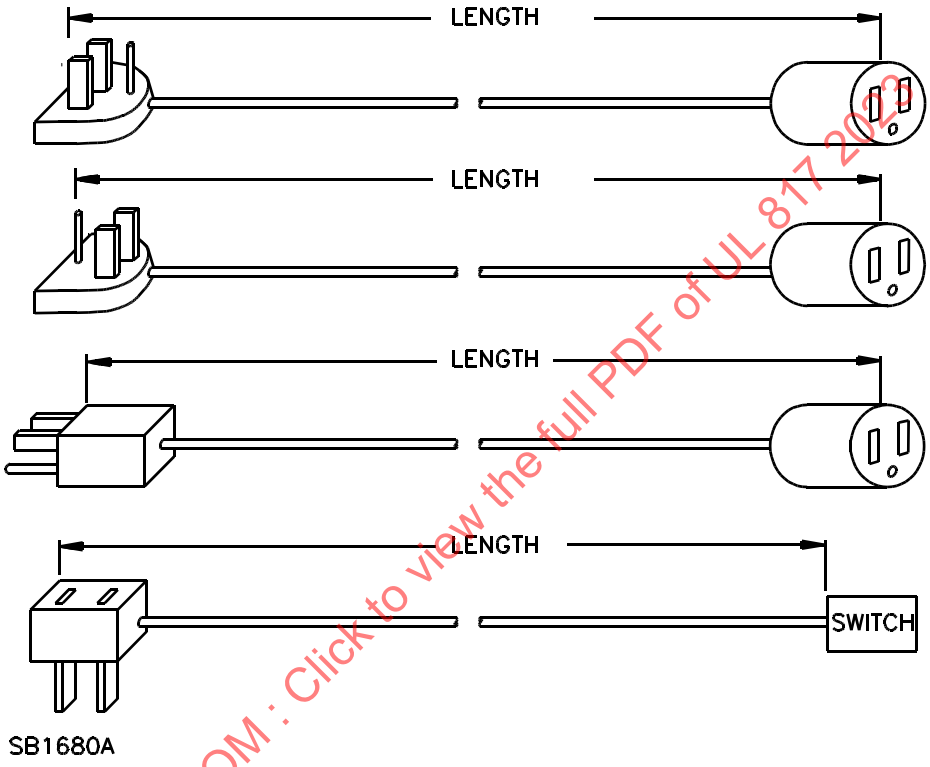
9.4.5 The enclosure of a switch intended for use on an outdoor-use cord set shall not permit water to enter that portion of an attachment plug or current tap that serves as the enclosure of the switch so as to contact live parts as determined by the Water exclusion test, 17.6.

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 ft) 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 21.1.2.

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 the Standard for Class 2 Power Units, UL 1310 or with the requirements of a limited power source (LPS) of the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1 or the Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, 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 the Standard for Class 2 Power Units, UL 1310, or the Standard for Audio/Video, Information and Communication Technology Equipment – Safety – Part 1: General Requirements, UL 62368-1.

9.8.3 Induction power transmitters shall comply with the performance requirements of the Standard Induction Power Transmitters and Receivers for use with Low Energy Products, 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 the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1 or the Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1.

9.8.5 A general use extension cord employing a supplementary charging circuit shall be marked in accordance with 21.1.15.

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 the Standard for Solid-State Controls for Appliances, UL 244A. Compliance with the Standard for Automatic Electrical Controls – Part 1: General Requirements, 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 21.4.1 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 the Standard for General-Use Snap Switches, UL 20, for an AC only through cord switch or a special-use switch that complies with the Standard for Switches for Appliances – Part 1: General Requirements, 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 21.1.12 and 21.1.13.

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.

9.10 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 the Standard for Supplementary Protectors for Use in Electrical Equipment, 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 in) from the face of the plug to the rear of the fuseholder.

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 the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A, or the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B.

9.12.2 Except as indicated in 9.8.4, a printed wiring board shall comply with the Standard for Printed-Wiring Boards, UL 796, and have a minimum flammability rating of HB as determined by the applicable tests in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, 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 ft) 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 30.2.

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.

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

Table 10.1 Continued on Next Page