UL 1088

STANDARD FOR SAFETY

Temporary Lighting Strings

UL Standard for Safety for Temporary Lighting Strings, UL 1088

Seventh Edition, Dated July 10, 2015

Summary of Topics

These revisions of ANSI/UL 1088 dated March 21, 2022 include the following changes:

– Addition of Cord Tags Evaluated to CAN/UL 969A; 40.1.1 and Annex A

– Clarification of Permanence of Cord Tag Test Conditioning; 40.2.3

This is a ULC/UL Binational Standard and the requirements contained in ANSI/UL 1088 are identical to the First Edition of CAN/ULC-S1088 used in Canada. There are some requirements that are unique to one country or the other and these have been identified as country-specific.

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

The revised requirements are substantially in accordance with Proposal(s) on this subject dated September 3, 2021.

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CAN/ULC-S1088
First Edition

Underwriters Laboratories Inc.
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Temporary Lighting Strings

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ANSI/UL 1088-2022

NATIONAL STANDARD OF CANADA
STANDARDS COUNCIL OF CANADA
CONSEIL CANADIEN DES NORMES
NORME NATIONALE DU CANADA

Commitment for Amendments

This Standard is issued jointly by Underwriters Laboratories Inc. (UL) and ULC Standards. Amendments to this Standard will be made only after processing according to the Standards writing procedures by UL and ULC Standards.

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This ANSI/UL Standard for Safety consists of the Seventh Edition including revisions through March 21, 2022.

The most recent designation of ANSI/UL 1088 as an American National Standard (ANSI) occurred on March 21, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

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Preface

This is the common UL and ULC Standard for Temporary Lighting Strings. It is the First edition of CAN/ULC-S1088 and the Seventh edition of ANSI/UL 1088.

This Joint Standard was prepared by Underwriters Laboratories Inc., ULC Standards, and the Technical Committee on Temporary Lighting Strings (TCTLS). The standard was formally approved by the UL/ULC Technical Committee on Temporary Lighting Strings (TCTLS). The efforts and support of the Technical Committee are gratefully acknowledged.

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

Annex A and Annex B, both identified as normative, form a mandatory part of this Standard.

Note: *Although the intended primary application of this Standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.*

Level of Harmonization

This Standard is published as an identical standard between UL and ULC Standards. An identical standard is a standard that is the same in technical content except for conflicts in Codes and Governmental Regulations. Presentation shall be word for word except for editorial changes.

Interpretations

The interpretation by the SDO of an identical or equivalent standard shall be based on the literal text to determine compliance with the standard in accordance with the procedural rules of the SDO. If more than one interpretation of the literal text has been identified, a revision shall be proposed as soon as possible to each of the SDOs to more accurately reflect the intent.

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INTRODUCTION

1 Scope

1.1 These requirements cover temporary lighting strings rated not more than 20 A, 125 V, intended for indoor and outdoor use to provide temporary illumination during the period of construction, remodeling, maintenance, repair, or demolition of buildings or structures, or similar activities, in accordance with the Canadian Electrical Code (CE Code), Part I, CSA C22.1, Section 76, and the U.S. National Electrical Code (NEC), ANSI/NFPA 70, Article 590.

1.2 These requirements cover temporary lighting strings consisting of a factory assembly of flexible cord, or cable, incorporating at least two non-replaceable light sources or two lampholders provided with lamp guards. The complete assembly is intended for connection to a branch circuit.

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.

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

4 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.

4.2 Throughout this standard, the CSA standard references apply to products intended for use in Canada, while the UL standard references apply to products intended for use in the United States. Combined references are commonly separated by a slash (“ / ”).

5 Glossary

5.1 For the purposes of this standard, the following definitions apply.

5.2 EQUIPMENT-GROUNDING CONDUCTOR – A conductor that is defined in the National Electrical Code (NEC) and the Standard for Electrical Installations as “Grounding Conductor, Equipment,” and defined in the Canadian Electrical Code (CE Code), Part I, as “Bonding conductor.”

Note: The term “grounding conductor” is used throughout this standard.

5.3 LAMP – A replaceable light source provided with a base for connection to an intended lampholder.

5.4 LAMPHOLDER – A wiring device intended for making connection to the electrical circuits of a lamp and in some cases, providing support.

5.5 LAMP, SELF-BALLASTED – A device provided with a lamp base and incorporating a non-replaceable light source and any additional elements necessary for starting and stabilizing operation of the light source, which cannot be dismantled without being permanently damaged.

5.6 LIGHT SOURCE NON-REPLACEABLE – A source of illumination that is integral to a temporary lighting string and is not replaceable in the field.

CONSTRUCTION

6 General

6.1 A temporary lighting string shall employ materials throughout that are acceptable for the particular use, and shall be made and finished with the degree of uniformity and grade of workmanship practicable in a well-equipped factory.

6.2 Splices, taps, and other points of electrical termination of a temporary lighting string shall not be subject to tension or other mechanical stress when the string is supported as intended.

6.3 A temporary lighting string shall not incorporate a switch.

6.4 A temporary lighting string shall employ a minimum of two non-replaceable light sources or two lampholders and shall have a minimum length of 7.6 m (25 ft).

6.5 Adjacent lampholders or non-replaceable light sources of a temporary lighting string shall be spaced a maximum of 7.6 m (25 ft) apart.

6.6 A temporary lighting string employing cable shall not be provided with an attachment plug or a cord connector unless specifically evaluated for the application and complying with applicable requirements of Fittings, Section 12, and Cord Connectors, Section 13.

6.7 An attachment plug provided with a temporary lighting string shall be in accordance with applicable requirements of Fittings, Section 12.

6.8 A cord connector provided with a temporary lighting string employing lampholders shall be in accordance with Cord Connectors, Section 13, and applicable requirements of Fittings, Section 12.

6.9 A cord connector provided with a temporary lighting string employing non-replaceable light sources shall be in accordance with 13.7.

6.10 A self-ballasted lamp provided with a temporary lighting string shall be suitable for damp or wet locations in accordance with the marking required by 44.7 and comply with the applicable requirements in CSA C22.2 No. 1993 / UL 1993.

6.11 Light emitting diode (LED) components and subassemblies integral to a temporary lighting string covered by this standard shall comply with the applicable requirements in CAN/CSA-C22.2 No. 250.13 / UL 8750.

6.12 A through cord power supply provided with a temporary lighting string that employs non-replaceable light sources shall be provided with integral overcurrent protection that complies with the applicable requirements of CSA C22.2 No. 248.1 / UL 248-1, and CAN/CSA-C22.2 No. 248.14 / UL 248-14.

Exception: A temporary lighting string employing a through cord power supply that complies with the applicable requirements in CAN/CSA-C22.2 No. 223 / UL 1310, need not be provided with integral overcurrent protection.

7 Identification

7.1 A terminal which is identified for the connection of either a grounded or a grounding conductor shall be connected to a corresponding identified conductor.

7.2 A lampholder screw shell shall be connected to the identified grounded conductor of the assembly.

8 Spacings

8.1 There shall be a spacing through air and over surface of 1.2 mm (0.047 in) or more between an uninsulated live part and a dead metal part that is likely to be grounded or exposed to contact by persons when installed in the intended manner.

8.2 If a barrier or liner of insulating material is used to provide spacings, it shall be of a nonhygroscopic material and not be less than 0.71 mm (0.028 in) thick. The barrier shall be so located, or of such material, that it will not be affected adversely by arcing.

9 Mechanical Assembly

9.1 A temporary lighting string shall be provided with a closed-loop hanger or other equivalent means at each lampholder that provides for temporary but positive mounting. An open hook is not acceptable.

9.2 A lamp guard shall be provided for each lampholder. If a lamp guard is not assembled to the lampholder, when it is shipped, all shipping containers shall be marked in accordance with 44.17.

Note: Metals and nonconductive (e.g. thermoplastic) materials are commonly used for the construction of lamp guards.

9.3 A guard is not required to be provided when the temporary lighting string employs non-replaceable light sources that:

a) Comply with the Crushing Test, Section 23;

b) Comply with the Cold Impact Test, Section 24; and

c) Are made of materials that do not exceed 90°C (194°F) when the temporary lighting string is subjected to the Normal Temperature Test, Section 19.

9.4 Conductors shall be secured before soldering or secured by wire connectors, welding, bolts, clamps or other equivalent means to provide a good electrical connection. Insulation-piercing-type contact connections shall only be employed in lampholders, see 26.3.

9.5 All electrical connections shall be made so that strands of any conductor cannot contact uninsulated live parts of opposite polarity or dead metal parts.

9.6 Bonding connections shall be secured by riveting, bolting, welding, soldering or equivalent means.

9.7 The component parts of a bonding path through a temporary lighting string shall be of a copper-base alloy.

Exception: A metal lamp guard is not required to comply with this requirement.

9.8 A copper-base-alloy rivet that is used to secure parts in the bonding path shall not contain less than 80% copper.

Exception: Plated steel shall be permitted for a rivet, bolt, or clamp that is used to secure parts in the bonding path, but that is not an essential conductor in the bonding path.

9.9 The enclosure of a non-replaceable light source shall be assembled by fasteners that are tamper resistant, such as by one-way fasteners, uniquely keyed screws, rivets, welding or adhesives.

10 Corrosion Protection

10.1 All exposed metal parts shall be protected against corrosion unless the metal is inherently resistant to corrosion.

10.2 The thickness of a non-ferrous metal coating on the surface of a ferrous metal part shall be not less than 0.0127 mm (0.0005 in). See Metallic Coating Thickness Test, Section 39.

Exception No. 1: The minimum coating thickness of a steel wire guard is not specified, except that the coating must be visible.

Exception No. 2: Hot dipped mill galvanized sheet steel coating that is designated G60 or A60 is exempt from the Metallic Coating Thickness Test.

11 Exposure of Live Parts

11.1 A temporary lighting string shall:

a) When in use have no uninsulated live parts normally exposed to contact by persons, and

b) Have no uninsulated live parts, other than the contacts of the lampholders, that are accessible during relamping.

12 Fittings

12.1 An attachment plug, cord connector, lampholder, splice or tap shall be of a material resistant to moisture, sunlight, and crushing. Hygroscopic materials shall not be used.

12.2 An attachment plug, cord connector, lampholder, splice, or tap shall adhere tightly to the cable or flexible cord insulation at the point where it enters the fitting so as to exclude moisture.

12.3 An attachment plug or cord connector shall be one rated 15 or 20 A, 125 V, having a configuration in accordance with ANSI/NEMA WD 6. See Figure 1.

12.4 A fitting shall be for use with the type and size of cord or wire used in the overall assembly.

12.5 A cord connector and attachment plug of a temporary lighting string shall have identical ratings. It is acceptable for an attachment plug and cord connector used in a temporary lighting string to be of a different configuration, such as locking and nonlocking.

12.6 All lampholders of a temporary lighting string shall be of the same base configuration.

12.7 The insulating body of an attachment plug, cord connector, tap, or splice of a molded-on fitting shall have a minimum thickness of 2.4 mm (0.0938 in) covering all live parts at other than contact openings, pins, or blade projections.

12.8 The thickness mentioned in 12.7 is to be measured from any live contacts, pins, blades, and uninsulated conductor to the nearest point on the outer surface of the insulating body. A mating attachment plug using the maximum length male blades is to be fully inserted into the outlet of a cord connector prior to the measurement.

13 Cord Connectors

13.1 Other than as specified in 13.7, the cord connector shall be of a single outlet grounding type as shown in Figure 1 and shall comply with 13.2 – 13.6.

13.2 A cord connector molded of resilient material shall employ a rigid barrier of insulating material molded beneath the face of the connector between the plane of the contact opening and the female contacts to prevent an improper insertion of the grounding contact or line blade from contacting a live part.

13.3 The rigid barrier shall have slots that conform to the standard dimensions of the appropriate configuration. The barrier shall have a minimum thickness of 1.50 mm (0.058 in) and shall be molded securely within the body of the cord connector at a depth sufficient to accomplish its intended purpose.

13.4 There shall be an obstruction on a 15 A parallel-slot and a 20 A “T”-slot cord connector to prevent any matching 15-A attachment plug from being inserted in the cord connector with the grounding pin on the outside of the cord connector. The obstruction shall be sufficiently large and substantial to necessitate appreciable deliberate displacement of the grounding pin or other attachment-plug contact member during and as the result of improper mating of the plug with the cord connector.See Figure 2.

13.5 A cord connector shall be provided with a means for support or shall be spaced not more than 304.8 mm (1 ft) from the face of the fitting to the center line of its adjacent lampholder.

13.6 A cord connector shall be provided with a means for closing or covering the cord-connector face when not in use. Such a closure or cover shall not be readily removable from the string.

13.7 Except for temporary lighting strings constructed of continuous line to load conductors, a cord connector provided with a temporary lighting string that employs non-replaceable light sources shall be of a nonstandard multi-pin configuration and shall comply with the following:

a) The applicable requirements of CSA C22.2 No. 42 / UL 498, or CSA C22.2 No. 21 / UL 817, and be suitable for making and breaking under load with respect to the Overload, Temperature, and Resistance to Arcing tests described in CSA C22.2 No. 42 / UL 498.

Exception: A cord connector on a temporary lighting string employing a through cord Power Supply that complies with CAN/CSA-C22.2 No. 223 / UL 1310, need not be evaluated for making and breaking under load.

b) The pins shall be recessed such that the male and female connectors are mechanically secured prior to any electrical connection.

c) The connectors shall be subjected to the Water Spray Test, Section 34, in any position where the pins initially make an electrical connection (i.e. the pins are partially inserted and any connector ring or latch may be opened).

d) The connector shall be keyed so that the wires are connected to the correct circuit.

14 Taps and Splices

14.1 Tap or splice insulation shall be at least equivalent to the insulation of the flexible cord or cable to which it is assembled. The properties to be considered in determining the equivalency are its insulating properties, the secureness of insulation, the exclusion of moisture and resistance to sunlight, crushing, and low temperature.

15 Lampholders

15.1 A screw lampholder shall be of the medium or admedium Edison keyless-base weatherproof type.

15.2 A screw lampholder shall comply with the requirements in 15.3 – 15.17, Lampholder Cavities, Section 16, Accelerated Aging Tests, Section 27, and the Security of Screw Shell Test, Section 38.

Exception No. 1: A weatherproof lampholder complying with CSA C22.2 No. 43 / UL 496, is exempt from the requirements of 15.3 – 15.6 and 15.8 – 15.17 and Section 16.

Exception No. 2: A wet location lampholder complying with CSA C22.2 No. 43 / UL 496, is exempt from the requirements of 15.8 – 15.17 and Section 16.

15.3 The wall thickness of nonrigid, rubber, vinyl and similar materials shall be not less than 2.4 mm (0.094 in) thick covering all live parts. See 12.8.

15.4 The lampholder-body insulating material shall be:

a) Phenolic rated 150°C (302°F) or 90°C (194°F) for GU24 lampholders;

b) Urea rated 100°C (212°F) or 90°C (194°F) for GU24 lampholders;

c) Rubber (see Accelerated Aging Tests, Section 27);

d) PVC materials (see Accelerated Aging Tests, Section 27); or

e) Other materials investigated for use at 90°C (194°F) or higher temperatures.

15.5 A polymeric material used in a GU24 lampholder shall have the following properties:

a) Minimum flammability rating of V-2 as determined by the burning tests described in CSA C22.2 No. 0.17 / UL 94;

b) Minimum electrical relative thermal index (RTI) of 90°C (194°F) as determined in accordance with the methods described in CSA C22.2 No. 0.17 / UL 746B; and

c) Minimum comparative tracking index (CTI) of 175 as determined in accordance with the methods described in CSA C22.2 No. 0.17 / UL 746A, and UL 746B.

15.6 The acceptability of an insulating material shall include consideration of the aging characteristics relative to its normal steady-state operating temperatures and its resistance to the effects of sunlight and weather.

15.7 Insulating materials shall not operate at temperatures in excess of their temperature limits established with respect to aging characteristics.

Exception: It is acceptable for insulating materials to operate in excess of their temperature limits in areas adjacent to the screw shell or lamp (that is, the lampholder rim or screw shell enclosure) when found to comply with the Extended Use Test, Section 33).

15.8 The screw shell of a lampholder shall not be capable of turning relative to its enclosure (see Security of Screw Shell Test, Section 38).

15.9 The screw shell of a lampholder shall be tinned or otherwise treated to resist corrosion that might result from contact of the metal with the enclosure material or from exposure to the elements.

15.10 Aluminum shall not be used as the screw shell material.

15.11 Corrosion-resistant steel (stainless) shall not be used as screw shell material unless the results of an investigation indicate that the material is acceptable for the application.

15.12 It is acceptable for lampholder screw shells to have either right- or left-hand threads.

15.13 Screw shells having right-hand threads shall be made go and no-go when tested by means of gauges made in accordance with ANSI C81.63.

15.14 Screw shells having left-hand threads shall be subjected to investigation to determine the equivalency of the measurement in 15.13.

15.15 A screw lampholder shall provide threads or their mechanical equivalent, that engage at least two full threads of a standard lamp base and provide electrical contact therewith while the lamp is fully seated.

Exception: The skeleton type of construction is acceptable in place of a female screw shell if it complies with the Security of Screw Shell Test of 38.1 – 38.3.

15.16 The skeleton type of construction does not provide electrical contact through 360 degrees, but it does give, within the limitations of its construction, electrical contact through two turns of its threaded body. Such construction generally consists of one or more narrow strips of metal secured to a molded, threaded body of insulating material. The strip generally extends the length of and conforms in shape to the molded threads.

15.17 The minimum thickness of lampholder screw shells shall be 0.30 mm (0.012 in) if of copper or copper alloy. Brass shall not be used unless its composition is resistant to corrosion cracking.

16 Screw Lampholder Cavities

16.1 The minimum depth of an Edison-screw lampholder cavity measured vertically from the plane of the depressed center contact to the plane of the rim of the insulating lampholder enclosure, shall be as indicated in Table 1.

16.2 To provide a seal against water, a lampholder shall be permitted to utilize a design in which the lampholder cavity has a depth greater than the maximum depth requirement specified in 16.1, if the lampholder accommodates lamps of the intended type.

16.3 Uninsulated live parts of a screw shell shall not be exposed above the rim of the lampholder cavity.

17 Flexible Cord, Cable, and Conductors

17.1 All conductors shall be of the same size and shall not be smaller than 2.1 mm^2 (14 AWG).

17.2 A temporary lighting string rated greater than 15 A shall employ conductors not smaller than 3.3 mm^2 (12 AWG).

17.3 Except for splices or taps used for the connection of a lampholder, conductors of a temporary lighting string shall be continuous throughout the overall length of the string.

17.4 A flexible cord employed in a temporary lighting string shall be suitable for outdoor use and have a serviceability rating equal to or greater than that of hard-usage type cords such as SJW, SJEW, SJOW, SJEOW, SJTW, or equivalent power-supply cords.

17.5 Cables employed in a temporary lighting string shall be a standard wet-location of:

In Canada:

Type TC cable, or equivalent, additionally complying with the requirements for low-temperature and sunlight-resistant use as applicable to outdoor cords.

In the United States:

Type UF cable, Type TC cable, or equivalent, additionally complying with the requirements for low-temperature and sunlight-resistant use as applicable to outdoor cords.

These cable types are required to be supported by messenger wire and marked in accordance with 44.18 when used overhead.

18 Lamp Guards

18.1 General

18.1.1 Each lampholder shall be provided with a lamp guard. The lamp guard shall be dimensioned, located, and secured in a manner to protect the lamp.

18.1.2 For a lamp guard constructed of a polymeric material, the acceptability of the material shall include consideration of the aging characteristics relative to its normal steady state operating temperature and its resistance to the effects of sunlight and weather.

18.1.3 A lamp guard shall not be provided with a hook.

18.1.4 A metal lamp guard with or without a nonmetallic coating shall be positively bonded to the equipment grounding conductor of the string.

Exception No. 1: A metal lamp guard that is shipped separate from the lampholder shall be provided with instructions (see 44.17) for positive connection to the equipment grounding conductor of the string unless the bonding connection is automatically obtained.

Exception No. 2: A metal lamp guard that must be removed for relamping shall be designed so that the bonding connection is automatically provided on assembly to the lampholder.

Exception No. 3: This requirement does not apply to an optional metal lamp guard secured to the outer insulating enclosure of a temporary lighting string that complies with 9.3.

18.1.5 A lamp guard that is removed for relamping shall be designed so that proper reassembly is obvious and can be readily accomplished.

18.2 Water shields and gaskets

18.2.1 A polymeric water shield that is relied upon to comply with the Water Spray Test, Section 34, shall be made of a UV rated material.

18.2.2 A polymeric water shield that operates at a temperature higher than 65°C (149°F), but not higher than 95°C (171°F), as determined by Normal Temperature Test, Section 19, and that does not have a recognized temperature rating for the measured temperature shall comply with the Polymeric Thermal Conditioning Test, Section 28.

18.2.3 A gasket or bushing material that is relied upon to comply with the Water Spray Test, Section 34, shall be subject to the Accelerated Aging Separate Gasket Test, Section 29, or the Accelerated Aging Integral Gasket Test, Section 30.

18.2.4 A gasket secured by adhesive that is relied upon to comply with the Water Spray Test, Section 34, shall be subject to the Adhesion Separate Gasket Test, Section 31, or the Adhesion Integral Gasket Test, Section 32.

PERFORMANCE

19 Normal Temperature Test

19.1 The temperatures of lampholders shall not exceed the limit specified in 19.7 when tested as described in 19.2 – 19.6.

19.2 A temporary lighting string shall be tested while supported in free air with the lamps oriented as intended in service.

19.3 The test lamps shall be of the maximum individual lamp wattage indicated by the marking at each lampholder, where required by 44.6.

19.4 The envelope of a medium-base incandescent test lamp shall be as specified in Table 2.

19.5 The temporary lighting string shall be operated continuously at the total rated wattage of the test lamps until temperatures have stabilized as demonstrated by three consecutive readings approximately 10 min apart.

19.6 Temperature readings are to be obtained by means of thermocouples consisting of 0.08 – 0.032 mm^2 (28 – 32 AWG) iron and constantan wires. Iron and constantan wires of size 0.05 mm^2 (30 AWG) and a potentiometer-type of indicating instrument are to be used whenever referee temperatures are necessary.

19.7 The temperature limits of Table 3 are based on a room ambient temperature of 25°C (77°F). It is acceptable to conduct the temperature test at any ambient temperature within the range of 10 – 40°C (50

– 104°F) and the variation from 25°C (77°F) shall be added to or subtracted from the observed temperature readings.

20 Dielectric Voltage-Withstand Test

20.1 A temporary lighting string shall be capable of withstanding without breakdown for a period of 1 min, the application of a 60-Hz essentially sinusoidal potential of 1250 V between each pair of conductors.

20.2 With the lamps removed, the test voltage is to be applied. The test is to be repeated until each conductor has been tested with respect to every other conductor.

20.3 The test potential is to be supplied from a 500 VA or larger capacity test transformer having an output that is essentially sinusoidal and can be varied. The applied potential is to be increased from zero until the required test voltage is reached, and is to be held at that voltage for a period of 1 min. The increase in the applied potential is to be at a uniform rate and as rapidly as consistent with its value being correctly indicated by the voltmeter. If the output of the test transformer is less than 500 VA, a voltmeter shall be used in the output circuit to directly measure the applied voltage.

21 Abnormal Operation Test

21.1 A temporary lighting string shall not produce a fire or electric shock when operated continuously as described in 21.2.

21.2 With the lamp guards and the maximum rated wattage lamps in place, the temporary lighting string is to be operated continuously at the total rated wattage of the string. Each lampholder is to be resting on a white tissue paper covered softwood surface. A 3 A non-time-delay plug fuse is to be connected between earth ground and the grounded conductor. The string is to be operated continuously until ultimate results have been observed. In most cases, continuous operation for 7 to 8 h will be necessary to determine that the ultimate results have been observed. The results are considered to be acceptable if the tissue paper is not ignited and if the 3 A grounding fuse does not open.

22 Integrity of Assembly Test

22.1 An attachment plug, cord connector, lampholder, splice or tap shall withstand a pull of 133 N (30 lbf) applied for 1 min to the cord or cable applied perpendicular to the plane of entry to the device. The device body shall not separate or break and internal parts shall not be adversely affected so as to result in a possible fire or electric-shock condition. The conductors shall not break and the insulation shall not be damaged (exhibit cuts, rips, or tears). Stress shall not be transmitted, by the pull, to wiring connections unless a factory connection is made by welding, riveting, crimping, or the equivalent. Soldering is considered equivalent if an offset or one or more right angle bends in the conductor prevents a pull on the conductor from being transmitted directly to the connection. An unbroken through conductor is also considered equivalent.

22.2 If connections are not made by welding, riveting or the equivalent, special representative devices are to be employed in which the internal connections have been severed. Displacement of the conductors, conductor insulation, or outer jacket of a cord by 0.8 mm (0.031 in) or more is unacceptable unless the displacement would not have stressed the connections.

22.3 Six representative devices are to be tested. The device is to be securely supported by a rigid flat plate mounted horizontally. The plate is to have a hole just large enough for the conductors to pass through. A pull of 133 N (30 lbf) is to be applied by means of a weight to the cord or cable in a direction perpendicular to the plane of conductor entry. The force is to be applied gradually.

23 Crushing Test

23.1 An attachment plug, cord connector, tap, splice, non-replaceable light source, and lampholder body without guard or lamp shall be capable of withstanding for 1 min a crushing force of 334 N (75 lbf) applied in any direction at right angles to the major axis of the device.

23.2 The crushing force is to be applied gradually using any testing equipment that can apply a steady force of 334 N (75 lbf) to the device. The force is to be applied at the point or points most likely to result in an adverse effect on the device being tested.

23.3 The device is to be tested between two parallel flat steel plates measuring 50 by 100 by 13 mm (2 by 4 by 0.5 in) thick.

23.4 At the conclusion of the test, each device shall be usable and shall comply with the Dielectric Voltage-Withstand Test, Section 20.

24 Cold Impact Test

24.1 A temporary lighting string employing non-replaceable light sources shall comply with all of the following after being tested as described in 24.2 – 24.6:

a) There shall not be any visible damage to the enclosure of the light source that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 3;

b) There shall not be any cracking or denting of the enclosure of the light source that would affect the function of any safety controls or constructional features such as overload protective devices, water seals, or strain relief, or result in the exposure of moving parts capable of causing injury to persons; and

c) There shall not be any damage to the enclosure of the light source that would result in the increase of the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 20.

24.2 Three samples of the non-replaceable light source are to be cooled to a temperature of -35.0 ±2.0°C (-31.0 ±3.6°F) and maintained at this temperature for a period of 3 h. Within 30 s of removal from the chamber, the light sources are to be subjected to the test as described in 24.3 to 24.6.

24.3 Each of three non-replaceable light sources is to be subjected to a single impact. The impact is to be produced by dropping or swinging a 50.8-mm (2-in) diameter steel sphere, weighing 0.535 kg (1.18 lbs) from a height which will produce an impact of 6.8 J (5 ft-lbs). The light source is to be rigidly supported and the impact is to be made normal to the spots on the enclosure that are most vulnerable to a blow during intended use. The steel sphere is to strike a different surface of a light source for each impact. Either the unit is to be supported on the side and subjected to the impact mentioned above, or the steel sphere is to be suspended by a cord and swung as a pendulum, dropping through the vertical distance necessary to cause it to strike the surface with the specified impact. Refer to Figure 4 with respect to the ball drop impact test or to Figure 5 for the ball pendulum impact test.

24.4 With reference to Figure 4 and Figure 5, the “H” designation represents the vertical distance the sphere must travel to produce the desired impact. For the pendulum impact, the sphere is to contact the non-replaceable light source under test when the string is in the vertical position.

24.5 The supporting surface for the ball drop impact shall be made of hardwood consisting of a layer of nominal 25 mm (1 in) tongue-and-groove oak flooring [actual size 18 by 57 mm (0.75 by 2.25 in)] mounted on two layers of nominal 19 mm (3/4 in) plywood. The assembly is to rest on a concrete floor or an equivalent non-resilient floor during the test.

24.6 The supporting surface for the pendulum impact is to consist of any rigid surface. The backing surface for the pendulum impact is to consist of 19 mm (3/4 in) plywood over a rigid surface of concrete or an equivalent nonresilient backing surface.

25 Adhesion Test

25.1 To determine the acceptability of the adhesion between the cord jacket or conductors and the body of a device, the cord or conductor is to be bent sharply to an angle of 90 degrees with the plane of its entry to the device and visually examined for openings which might permit the entry of moisture into the device. Where the conductors enter as a bunch, they are to be bent as a bunch for examination. Where the conductors enter individually, they are to be individually bent in turn for examination.

25.2 In the application of 25.1, any opening between the flexible cord or individual conductors and the device is to be considered to result in the entrance of moisture and is unacceptable. If the joint is sealed at some inner point, it is permitted to cut away part of the connection to determine that positive adhesion is provided between the cord or individual conductors and the device body. The seal shall be complete around the periphery of the cord or each conductor.

26 Conductor Secureness Test

26.1 If a conductor is connected to an element (male blade, female contact, or grounding contact blade or pin) of a device or lampholder before the element has been assembled into the device, the connection shall not break under a pull of 89 N (20 lbf) applied for 1 min between the element and the conductor. The force shall be applied before the element has been assembled into the device.

Exception: Insulation-piercing type contact connections of a lampholder shall comply with the temperature test described in 26.3.

26.2 The test mentioned in 26.1 is to be performed with the angle between the element and the conductor at the same value as it would be in the completely assembled device. The force is to be applied gradually.

26.3 The temperature rise on insulation-piercing type contact connections of a lampholder shall not be more than 30°C (54°F) when the contact connections are carrying the current corresponding to the ampere rating of the lampholder. Lampholders are to be tested without lamps in place with the lampholder contacts shorted by a solid 2.1 mm^2 (14 AWG) conductor or equivalent shorting plug. Thermocouples are to be attached at points as close as possible to the connection. The test is to be continued for 15 d without interruption and the temperature values are to be measured at the end of each working day.

27 Accelerated Aging Tests

27.1 General

27.1.1 A device having a body of a material other than rubber, polyvinyl chloride, or a copolymer thereof, shall be subjected to an investigation to determine that its properties are equivalent to the properties determined by the tests indicated in 27.2.1 – 27.3.1.

Exception: A polymeric material that has a mechanical and electrical relative thermal index (RTI) of at least the temperature measured during the Normal Temperature Test in accordance with UL 746C is exempt from the Accelerated Aging Tests.

27.2 Rubber compounds

27.2.1 When tested as indicated in 27.2.2 – 27.2.5, a molded rubber attachment plug, cord connector, splice, or current tap shall not show apparent deterioration, such as cracking, discoloration, shrinking, swelling, melting, or warping, and shall not show any change in hardness greater than 10 numbers after being tested as described in 27.2.2.

27.2.2 The hardness of the rubber is to be determined as the average of five readings with a gauge such as the Rex Hardness Gauge or the Shore Durometer. The device is then to be placed for 70 h in a full-draft circulating-air oven at a temperature of 100.0 ±2.0°C (212.0 ±3.6°F). The device is to rest at room temperature for 4 or more hours after removal from the air oven. The hardness is to be determined again as the average of five readings. The difference between the average original hardness reading and the average reading taken after exposure in the air oven is the change in hardness.

27.2.3 Following the air oven exposure mentioned in 27.2.1, a molded rubber device having male blades shall be capable of withstanding a pull of 89 N (20 lbf) for 2 min without loosening. If parallel blades are involved, the two blades tested together shall also be capable of withstanding a pull of 89 N (20 lbf) for 2 min without loosening.

27.2.4 To determine if the device complies with the requirement in 27.2.3, the fitting (wired in the intended manner) is to be supported on a horizontal steel plate with the blades and pin projecting downward through a single hole of a size sufficiently large to permit only the blades, plus a grounding pin, if used, to pass through it. A 9.1 kg (20 lb) weight is to be supported by each blade and pin in succession and then, if parallel blades are involved, by the two blades tested together (blades parallel and weight supported by pin through holes in blades). In a nonrigid construction (for example, where soft molded material is employed), a displacement of either blade or pin of more than 2.4 mm (0.094 in) measured 2 min after removal of the weight is not acceptable.

27.2.5 The accelerated aging test mentioned in 27.2.1 – 27.2.4 is to be made on specimens of each color of rubber and on specimens of each basic rubber compound employed for the device.

27.2.6 The physical properties of a molded rubber compound used for part of a lampholder, unaged and after oven aging, shall be as indicated in Table 4 and 27.2.7.

27.2.7 All determinations are to be made in accordance with the applicable requirements of CSA C22.2 No. 38 / UL 44. Test specimens are to be taken from lampholders, and are to be prepared and handled with great care.

27.3 PVC compounds

27.3.1 A lampholder, attachment plug, cord connector, splice, or tap having a body or other parts of molded polyvinyl chloride or a copolymer thereof shall not show any change in hardness number greater than 5, cracks, discoloration, or other visible signs of deterioration as a result of the exposure, in a full-draft circulating-air oven to the applicable aging program as outlined in Table 5.

28 Polymeric Thermal Conditioning Test

28.1 When tested as indicated in 28.2, a polymeric water shield that operates at a temperature between 65 – 95°C (149 – 203°F) and does not have a recognized temperature rating for the measured temperature shall have no obvious deterioration or deformation after conditioning.

28.2 A polymeric water shield shall be conditioned in a circulating oven for 168 h at a temperature in accordance with Table 6 and as determined by the Normal Temperature Test in Section 19. The conditioning time is able to be reduced by one-half for each increase in oven temperature of 10°C (50°F).

29 Accelerated Aging Separate Gasket Test

29.1 After being subjected to the test as indicated in 29.2 – 29.3, a gasket or bushing material shall have a tensile strength of not less than 60% and an elongation of not less than 75% of the values determined before conditioning.

29.2 Three samples each of the gasket or bushing material is to be tested for elongation and tensile strength in the as-received condition and after removal from the oven conditioning. The test methods and apparatus are described in ASTM D412.

29.3 The oven conditioning specified in 29.2 shall be for 168 h in a circulating air oven at a temperature 20°C (36°F) above the temperature measured on the gasket or bushing during the temperature test.

30 Accelerated Aging Integral Gasket Test

30.1 A sample of the temporary lighting string with the gasket or bushing installed shall be conditioned in a circulating air oven for 240 h at 20°C (36°F) above the temperature measured on the gasket during the Normal Temperature Test, Section 19. After the conditioning, any joints that use the gasket or bushing for sealing are to be opened.

30.2 The results are acceptable when a visual inspection shows no damage to the gasket or bushing and the gasket or bushing has remained in place. A minimum of 2 gaskets or bushings shall be inspected. The joints are then to be closed and the temporary lighting string is to be subjected to the Water Spray Test, Section 33.

31 Adhesion Separate Gasket Test

31.1 After being subjected to the test as indicated in 31.2 – 31.3, a gasket shall have an adhesion strength, determined as indicated in 31.4, of not less than 60% of the value determined before conditioning.

31.2 Three samples of the gasket attached to the intended mounting surface shall be tested in the as-received condition, three samples 0.5 h after removal from the oven conditioning, and three samples 24 h after removal from the oven conditioning.

31.3 The oven conditioning specified in 31.2 shall be for 168 h in a circulating air oven at a temperature 20°C (36°F) above the temperature measured on the gasket adhesive during the temperature test.

31.4 The force required to remove the gasket from its mounting surface is to be measured by pulling the gasket strip from the test panel at an angle of 90 degrees and a cross head speed of 12.7 mm/min (0.5 in per min).

32 Adhesion Integral Gasket Test

32.1 A sample of the temporary lighting string with a gasket secured in place by adhesive is to be conditioned in a circulating air oven for 240 h at 20°C (36°F) above the temperature measured on the gasket during the Normal Temperature Test, Section 19. After the conditioning, any joints that use the gasket for sealing are to be opened.

32.2 The results are acceptable when a visual inspection shows that there is no damage to the gasket and the gasket has remained in place.

33 Extended Use Test

33.1 The insulating materials referenced in the Exception to 15.7 shall not crack, crumble, or otherwise deteriorate so that they do not perform their intended function as the result of the flexure inherent in the lamp and guard replacement, after exposure for 60 d of continuous operation at a temperature 10°C (18°F) higher than the highest enclosure temperature measured during the normal temperature test.

34 Water Spray Test

34.1 After being tested as indicated in 34.2 – 34.4, attachment plugs, cord connectors, lampholders, splices and taps shall comply with the requirements of the Dielectric Voltage-Withstand Test, Section 20, and the Insulation Resistance Test, Section 35.

34.2 The cord connector, attachment plug, splice, or tap is to be supported in its intended position of use (with the cord or conductors either vertical or horizontal). The closure or cover of a cord connector shall be in place for the test. A lampholder is to be tested both while supported in the vertical position (filament down, base up) and in a horizontal position. A lamp is to be placed in the lampholder. The string is to be unenergized. Each device is to be subjected for 1 h to a downward spray of water applied at an angle of 45 degrees to the vertical, applied in the direction or directions most likely to cause water to enter the device.

34.3 At the end of the exposure to the water spray before being tested for dielectric voltage-withstand or insulation resistance, the lamps are to be removed from the lampholders and the exterior surfaces of each device are to be wiped dry.

34.4 The water-spray apparatus is to consist of three spray heads mounted as shown in Figure 6. The spray heads are to be constructed in accordance with the details shown in Figure 7. The water pressure is to be maintained at 34.5 kPa (5 lbf/in^2) at each spray head. The device is to be positioned in the area of water spray so that the greatest quantity of water is likely to enter the device.

35 Insulation Resistance Test

35.1 When tested as described in 35.2 – 35.6, both before and after the Water Spray Test, Section 34, the insulation resistance of an attachment plug, cord connector, lampholder, splice, or tap shall be not less than 100 megohms:

a) Between a molded-in live part and any dead metal part or surface of insulating material that is exposed for persons to contact or that could be in contact with ground in service, and

b) Between any internal surface that is contacted by a molded-in or other live part and any surface of insulating material that is exposed for persons to contact or that could be in contact with ground in service.

35.2 This test is to be made on rubber and similar materials of any color. Other materials are to be tested if they contain sufficient free carbon to color the material gray or black.

35.3 In determining compliance with the requirement of 35.1, the insulation resistance is to be measured by a magneto megohmmeter which has an open-circuit output of 500 V or by equivalent equipment.

35.4 In measuring insulation resistance to the surface of an insulating material, it is necessary to apply an electrode to the insulating material as described in 35.5.

35.5 To provide electrode contact to an exterior surface, a quantity of No. 7 lead drop shot [approximate diameter 2.5 mm (0.10 in)] is to be placed in a container that is open at the top and, after holes and other openings through which the shot could enter are plugged with a high-resistance insulating material, the

device is to be immersed in the shot so that the shot serves as an electrode in contact with the exterior surface to which the test is to be applied. A cavity that has a molded-in live part, or a cavity from which assembled-in live parts have been removed, is to be similarly filled with No. 7 drop shot to provide the other electrode.

35.6 All rubber parts are to be conditioned for at least 48 h at room temperature before being subjected to the above tests.

36 Sunlight Resistance Test

36.1 An attachment plug, cord connector, splice, tap, lampholder, and nonmetallic hanger fittings and lamp guard shall exhibit no deterioration or other change in hardness greater than 5 numbers as the result of 720 h of exposure in the specimen drum of carbon-arc-radiation and water-spray exposure equipment as described in 36.2 – 36.4.

Exception No. 1: A lampholder complying with the weatherproof requirements of CSA C22.2 No. 43 / UL 496, is exempt from the Sunlight Resistance Test.

Exception No. 2: A polymeric material that has ultraviolet (UV) resistance rating in accordance with CSA C22.2 No. 0.17 / UL 746C, is exempt from the Sunlight Resistance Test.

36.2 Complete representative devices are to be fastened to the specimen drum and after 720 h of exposure, the specimens are to be removed from the drum, examined for deterioration and tested for hardness. A nonmetallic hanger is additionally to be subjected to the Hanger Strength Test, Section 37.

36.3 The specimens are to be exposed to ultraviolet light from two carbon arcs formed between vertical electrodes 12.7 mm (0.5 in) in diameter, located at the center of a removable vertical metal cylinder 787 mm (31 in) in diameter and 451 mm (17.75 in) high. Each arc is to be enclosed by a clear globe of heat-resistant optical glass (9200-PX Pyrex glass or its equivalent).

36.4 The specimens are to be mounted vertically on the inside of the cylinder, facing the arcs, and the cylinder is to be rotated about the arcs at 1 rpm. A system of nozzles is to be provided that sprays each specimen in turn with water as the cylinder revolves. The operating cycle is to consist of 102 min of only light and 18 min of light and water. The temperature within the cylinder while the apparatus is in operation is to be 63.0 ±5.0°C (145.4 ±9.0°F), and the test is to be continued until a total of 720 h has elapsed.

37 Hanger Strength Test

37.1 A hanger provided for support of a temporary lighting string shall be tested before and after the Sunlight Resistance Test, Section 36, by causing it to support a force of 356 N (80 lbf) maintained for a period of 2 min. There shall not be damage to the hanger or the string as a result of the applied force.

37.2 Six representative hanger assemblies assembled to the string with lamps and guards in place are to be suspended by means of a 3.2 mm (0.125 in) diameter steel pin through the hanging means. The weight is to be applied in a manner that simulates the hanger supporting the temporary lighting string. The force is to be applied by applying weights, each not larger than 9.1 kg (20 lbs), gradually at intervals of 1 min until the 356 N (80 lbf) has been applied. That force is to be maintained for a period of 2 min.

38 Security of Screw Shell Test

38.1 A medium screw shell shall be so secured in a lampholder that the shell does not turn, pull out, or become loose or distorted enough to adversely affect the assembly when the shell is subjected for 1 min to a straight pull of 89 N (20 lbf) and a torque of 2.3 N·m (20 lbf·in).

Exception: A lampholder complying with the applicable requirements of CSA C22.2 No. 43 / UL 496, is not required to comply with the Security of Screw Shell Test.

38.2 Six representative devices are to be tested by means of:

a) A weight that applies a force of 89 N (20 lbf), attached to a threaded plug that can be screwed into a female shell; and

b) A threaded plug to which a torque of 2.3 N·m (20 lbf·in) can be imparted while the plug engages the screw shell and thrusts against the center contact of the lampholder.

38.3 In conducting the torque test, the threaded plug is to be made to engage fully with the screw shell being tested and then, with the lampholder firmly held, the torque is to be applied gradually so that there is no sudden pull on the screw shell.

39 Metallic Coating Thickness Test

39.1 The solution to be used for the metallic-coating-thickness test is to be made from distilled water and is to contain 200 g/L of reagent grade chromic acid (CrO_3) and 50 g/L of reagent grade concentrated sulfuric acid (H_2SO_4). The latter is equivalent to 27 mL/L of reagent grade concentrated sulfuric acid, specific gravity 1.84, containing 96% of H_2SO_4.

39.2 The test solution is to be contained in a glass vessel such as a separatory funnel with the outlet equipped with a stopcock and a capillary tube of approximately 0.64 mm (0.025 in) inside bore and 140 mm (5.5 in) long. The lower end of the capillary tube is to be tapered to form a tip, the drops from which are about 0.05 mL each. To maintain a constant level, a small glass tube is to be inserted in the top of the funnel through a rubber stopper and its position is to be adjusted so that, when the stopcock is open, the rate of dropping is 100 ±5 drops per min. If desired, use an additional stopcock in place of the glass tube to control the rate of dropping.

39.3 The representative device and the test solution are to be kept in the test room long enough to acquire the temperature of the room, which is to be noted and recorded. The test is to be conducted at a room temperature of 21.1 – 32.2°C (70.0 – 90.0°F).

39.4 Each representative device is to be thoroughly cleaned before testing. All grease, lacquer, paint, and other nonmetallic coatings are to be removed completely by means of solvents. Representative devices are then to be thoroughly rinsed in water and dried with clean cheesecloth. Care is to be exercised to avoid contact of the cleaned surface with the hands or any foreign material.

39.5 The representative device to be tested is to be supported from 18 – 25 mm (0.7 – 1.0 in) below the orifice, so that the drops of the solution strike the point to be tested and run off quickly. The surface to be tested is to be inclined about 45 degrees from the horizontal.

39.6 After cleaning, the representative device to be tested is to be placed under the orifice. The stopcock is to be opened and the time in seconds is to be measured with a stopwatch until the dropping solution dissolves the protective metallic coating, exposing the base metal. The end point is the first appearance of the base metal recognizable by the change in color at that point.

39.7 Each representative device of a test lot is to be subjected to the test at three or more points, excluding cut, stenciled, and threaded surfaces, on the inside surface and at an equal number of points on the outside surface, at places where the metallic coating is expected to be the thinnest.

39.8 To calculate the thickness of the coating being tested, the thickness factor appropriate for the temperature at which the test was conducted is to be selected from Table 7 and multiplied by the time in seconds required to expose the base metal.

40 Permanence of Cord Tag Test

40.1 General

40.1.1 When tested as described in 40.3, a cord tag containing the markings specified in Marking, Section 44, shall comply with all of the following:

a) The tag shall resist tearing longer than 1.6 mm (0.063 in) at any point;

b) The tag shall not separate from the cord;

c) There shall not be permanent shrinkage, deformation, cracking, or any other condition that will render the marking of the tag illegible; and

d) An overlamination shall remain in place and shall not be torn or otherwise damaged. The printing shall remain legible.

Exception: A cord tag that complies with CAN/UL 969A for the cord type and size to which it is intended to be applied is exempt from the Permanence of Cord Tag Test. The tag shall be suitable for the intended use environment of the temporary lighting string.

Note 1: A minimum slippage rating is not required.

Note 2: Tags rated either for “indoor dry use” or “indoor use” are suitable for temporary lighting strings intended for indoor use only

40.2 Test conditions

40.2.1 Each of nine cord tags is to be applied to a cord and conditioned as described in 40.2.2 – 40.2.4, as indicated, before being tested as described in 40.3.1 and 40.3.2. If the tag is applied by an adhesive, the conditioning is to be conducted at least 24 h after the application of the tag.

40.2.2 Each of three cord tags is to be tested in the as-received condition.

40.2.3 Each of three cord tags is to be placed in a 60 ±1°C (140 ±1.8°F) circulating-air oven for 240 h. The cord tags are then to be conditioned at a room temperature of 23 ±2°C (73.4 ±3.6°F) and 50 ±5% relative humidity for 30 min.

Exception: The conditioning of 40.2.3 is not performed when the tags are intended to be applied to an outdoor use temporary lighting string and samples of the tags will be subjected to the conditioning of 40.2.5.

40.2.4 Each of three cord tags is to be tested within 1 min of being exposed to a humidity of 85 ±5% at 32 ±2°C (89.6 ±3.6°F) for 72 h.

40.2.5 In addition to the conditioning described in 40.2.2 – 40.2.4, if the tag is intended to be applied to the cord of a product intended for outdoor use, twelve additional cord tags are each to be applied to a cord and conditioned as described in 40.2.6 – 40.2.9, as indicated, before being tested as described in 40.3.1 and 40.3.2.

40.2.6 Each of three tags is to be tested after 24 h of exposure conditioning at 23 ±2°C (73.4 ±3.6°F) and 50 ±5% relative humidity, followed by 48 h of immersion to a depth of not less than 3.2 mm (0.125 in) in demineralized water at a temperature of 23°C (73.4°F). Testing in accordance with 40.3.1 and 40.3.2 shall be performed within 1 min of the conditioning.

40.2.7 Each of three tags is to be tested after 24 h of exposure conditioning at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5% relative humidity, followed by 10 d of exposure in an air-circulating oven at a temperature of 60°C (140°F). Testing in accordance with 40.3.1 and 40.3.2 shall be performed 30 min after the conditioning.

40.2.8 Each of three tags is to be tested after 24 h of exposure conditioning at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5% relative humidity, followed by 7 h of exposure in a cold box at a temperature of -10 ±2°C (14.0 ±3.6°F). Testing in accordance with 40.3.1 and 40.3.2 shall be performed within 1 min of the conditioning.

40.2.9 Each of three tags is to be tested after 24 h of exposure conditioning at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5% relative humidity, followed by exposure to water and ultraviolet light using either of the following methods:

a) Twin enclosed carbon-arc Type D or DH, in accordance with ASTM G153. The tags are to be exposed for 720 h. The operating cycle is to be 20 min consisting of 17 min of light exposure only and 3 min of water spray and light; or

b) Xenon-arc, Type B, in accordance with ASTM G155. The tags are to be exposed for 1000 h. The operating cycle is to be 120 min consisting of 102 min of light exposures only and 18 min of exposure to water spray and light.

40.2.10 Testing in accordance with 40.3.1 and 40.3.2 shall be performed after 24 h of exposure at 25 ±5°C (77 ±9°F).

40.3 Test method

40.3.1 The tag is to be tested with each cord size to which it is intended to be applied. The cord, with the attachment plug or current tap pointing up, is to be held tautly in a vertical plane. A force of 22.2 N (5 lbf) is to be applied for 1 min to the uppermost corner of the tag farthest from the cord, within 6.4 mm (0.25 in) of the vertical edge of the tag. The force is to be applied vertically downward in a direction parallel to the major axis of the cord. In determining compliance with 40.1.1(d), manipulation, such as straightening of the tag by hand, is permissible.

40.3.2 To determine compliance with 40.1.1(d), each cord tag assembly is to be scraped 10 times across printed areas and edges, with a force of approximately 8.9 N (2 lbs), using the edge of a 2.0 mm (5/64 in) thick steel blade held at a right angle to the test surface. The portion of the blade contacting the test surface shall have a radius of curvature of 25.4 mm (1.00 in) and the edges of the blade shall be rounded to a radius of approximately 0.4 mm (0.016 in).

PRODUCTION LINE TESTS

41 Grounding Continuity Test

41.1 The manufacturer shall determine by means of a routine production-line continuity test that each temporary lighting string that includes a grounding conductor has the grounding conductor connected to each metallic guard, grounding contact of the attachment plug, grounding contact of the cord connector, and any other exposed metal parts.

41.2 Any indicating device (an ohmmeter, a low-voltage battery-and-buzzer combination, or similar device) is to be used for the test mentioned in 41.1.

42 Dielectric Voltage-Withstand Test

42.1 Each temporary lighting string shall withstand without electrical breakdown, as a routine production-line test, the application of a 40 – 70 Hz potential between each conductor and each other conductor, including the grounding conductor, if provided, with the string completely assembled except for the lamps.

42.2 A full test potential of 1500 V shall be applied for 1 s.

42.3 The test equipment shall include a transformer having an essentially sinusoidal output.

42.4 If the output of the test-equipment transformer is less than 500 VA, the equipment shall include a voltmeter in the output circuit to directly indicate the test potential, and an audible or visual indication of breakdown. In the event of breakdown, manual reset of an external switch is required or an automatic reject of the unit under test is to result.

42.5 If the output of the test-equipment transformer is 500 VA or larger, the test potential shall be indicated by one of the following:

a) A voltmeter in the primary circuit or in a tertiary winding circuit,

b) A selector switch marked to indicate the test potential, or

c) A marking in a readily visible location to indicate the test potential of equipment having a single test-potential output.

When marking is used without an indicating voltmeter, the equipment shall include a positive means, such as a power-on-lamp to indicate the manual reset switch has been reset following a tripout. In the event of breakdown, manual reset of an external switch is required or an automatic reject of the unit being tested is to result.

42.6 Test equipment other than described in 42.3 – 42.5 is acceptable for use if found to accomplish the intended factory control.

RATING

43 Details

43.1 A temporary lighting string shall be rated in volts, amperes, and watts. The voltage rating shall be 125 V. The ampere rating shall not exceed:

a) 20 A (including up to the maximum number of temporary lighting strings that may be series-connected together);

b) The ampacity of the flexible cord or cable;

c) The ampacity of line and load fittings; or

d) 80% of the rating of the attachment plug.

The wattage rating shall be the product of the voltage and ampere rating.

43.2 Each lampholder shall be individually rated for its maximum intended wattage lamp. The maximum wattage rating of an individual lampholder shall not exceed 200 W.

MARKING

44 Details

44.1 A temporary lighting string shall be plainly marked where the marking will be readily visible with:

a) The name or trade name of the manufacturer, or other descriptive marking used to identify the organization responsible for the product;

b) The electrical rating; and

c) The date or other dating period of manufacture not exceeding any three consecutive months. The date of manufacture shall comply with the format in ISO 8601.

44.2 If a manufacturer produces or assembles temporary lighting strings at more than one factory, each finished temporary lighting string shall have a distinctive marking to identify it as the product of a particular factory.

44.3 A temporary lighting string having conductors, attachment plug, or cord connector whose ampacity is less than 20 A shall be marked: “CAUTION – To reduce the risk of electric shock and fire, do not exceed marked lampholder wattage or string maximum wattage including any additional string loads” or equivalent wording.

44.4 A temporary lighting string provided with an attachment plug, cord connector, or both shall be marked: “CAUTION – To reduce the risk of electric shock do not connect or disconnect when wet” or equivalent wording. In addition, these temporary lighting strings shall also be marked “For use only on GFCI protected circuits.”

44.5 The marking on the temporary lighting strings required by 44.1 – 44.4 shall be applied by a tag that complies with Permanence of Cord Tag Test, Section 40, and shall be of a size that facilitates the legibility of the required markings and shall be applied at the line end of the string. The tags shall be either of the following forms:

a) A flat tag having a hole large enough to accommodate the conductors. To discourage tag removal or destruction the tag shall not be slit from the hole.

b) A flat-type tag with an adhesive back. The tag is to be wrapped tightly once around and to adhere to the conductors. The ends of the tag are to adhere to each other and project as a flag.

44.6 A temporary lighting string that employs lampholders shall have the maximum intended lamp wattage marked on or adjacent to each lampholder so as to be visible when relamping, “_____ watts maximum” or equivalent.

Exception: A maximum lamp wattage marking is not required for temporary lighting strings employing non-replaceable light sources.

44.7 A temporary lighting string that employs a GU24 lampholder, or that employs a screw lampholder and is intended for use with self-ballasted lamps, shall specify the permitted lamp type(s), self-ballasted compact fluorescent (CFL) or self-ballasted LED lamp, or both.

44.8 The lamp type marking specified in 44.7 shall include the environmental rating of the replacement self-ballasted lamps (i.e. damp or wet location).

44.9 It is acceptable to provide the lamp type marking specified in 44.7 on the lampholder or on a flag tag attached to the temporary lighting string. The marking text shall be “Suitable for use with (Damp or Wet location) self-ballasted (CFL or LED) lamps” or equivalent.

If the self-ballasted lamp type information is only provided on the tag, the lampholder marking shall include the text “SEE TAG FOR LAMP TYPE(S)” or equivalent. The tag shall be waterproof and tear resistant, of a size that facilitates the legibility of the marking and shall be applied at the load end of the temporary lighting string.

44.10 The lampholder marking required by 44.6 – 44.9 shall be plain and permanent in letters at least 2.4 mm (0.0938 in) high, contrasting with the background by embossing, indent printing, or color.

44.11 The cover or closure of a cord connector shall be permanently marked “Insert in cord connector when not in use” or an equivalent statement.

44.12 A temporary lighting string without an attachment plug shall be provided with instructions for fixed connection to the branch circuit. The marking shall be on the string, on a stuffer sheet or on the package.

44.13 A temporary lighting string provided with lampholders shall be marked: “CAUTION – To reduce the risk of electric shock, only use self-ballasted lamps with this product if a self-ballasted lamp type is identified on the lampholder or tag” or equivalent wording.

44.14 A temporary lighting string that employs non-replaceable light sources shall be marked: “The light sources are not replaceable.”

44.15 A temporary lighting string provided with a nonstandard multi-pin connector shall be marked within 76.2 mm (3 in) of the face of the load fitting with the word “CAUTION” and the following:

a) “This temporary lighting string is rated ___ Watts (___ Amps), do not overload. Connect end-to-end only temporary lighting strings of the same model number from the same manufacturer.”

b) “Do not replace or modify any connectors on this product, do not use product if connector is damaged.”

c) “Make sure connectors are fully inserted and any connector rings are twisted until completely secured such that the ring can no longer be turned and the two portions of the connector are completely assembled.”

44.16 The marking required by 44.13 – 44.15 shall be waterproof or provided on a waterproof and tear resistant tag of a size that facilitates the legibility of the required markings. The tag shall be applied at the load end of the temporary lighting string.

44.17 If lamp guards are shipped disassembled from lampholders, each shipping container shall be marked or provided with instructions for proper assembly. Instructions shall indicate that the guards are to be attached to lampholders prior to using the temporary lighting string. Instructions shall clearly indicate the method of assembly unless the proper method is obvious. If a metallic guard is provided, instructions shall clearly indicate the proper method of making a good electrical bonding connection to the guard unless positive grounding is automatically provided. If guards are packaged separate from the rest of the temporary lighting string, the marking shall indicate on each container the guards that are to be employed and the string with which the guards are to be used.

44.18 Temporary lighting strings employing cable types as described in 17.5 shall be provided with instructions indicating that the cables shall be supported by messenger wire when used overhead. This marking shall be on the string, a stuffer sheet, or the package.

TABLES

Table 1
Depth of lampholder cavity

Trade size of lampholder	Depth of cavity in mm (in)	
	Minimum	Maximum
Admedium	28.6 (1-1/8)	30.2 (1-3/16)
Medium	23.8 (15/16)	25.4 (1)

Table 2
Test-lamp envelope

Lamp wattage	Lamp envelope
25, 40, 50, 60, 75, 100	A-19
150, 200	A-23

Table 3
Maximum temperatures

Parts and materials	Temperature	
	°C	(°F)
Insulated wire or flexible cord	a	a
Insulating materials[b]	a	a
Sealing compound	c	c
Lampholder screw shell[d]	200	(392)
Accessible surfaces	90	(194)
Thermoplastic watershields[e]	65	(149)
Gaskets of silicone rubber	230	(446)
Gaskets of EPDM	90	(194)
Rubber gaskets	70	(158)
Neoprene gaskets	90	(194)
Gaskets of cork or other fibrous material	90	(194)

[a] Rated temperature of the component or material.

[b] Rated temperature of the insulating material or a higher temperature determined acceptable based upon successful completion of the Extended Use Test, Section 33. See 15.7.

[c] 15°C (27°F) less than the softening point of a sealing compound.

[d] A temperature higher than 200°C (392°F) is acceptable on screw shells if the parts are reinforced by or formed of monel metal, stainless steel, or other metal acceptable for the higher temperature.

[e] A temperature higher than 65°C (149°F) is acceptable on thermoplastic water shield when the material has been investigated and found to meet the requirement for a higher temperature.

Table 4
Physical properties of natural or synthetic rubber compounds used in lampholders

Condition of specimens at time of measurement	Maximum acceptable set in recovery test [25-mm (1-in) bench marks] stretched to 63.5 mm (2.5 in)	Maximum acceptable ultimate elongation [25-mm (1-in) bench marks]	Minimum acceptable tensile strength
Unaged	25% [6.2 mm (0.25 in)]	250% [62.5 mm (2.5 in)]	5.9 MN/m^2 (850 lbf/in^2)
Aged in an air oven for 70 h at 100.0 ±2.0°C (212.0 ±3.6°F)	Not Measured	65% of the result with unaged specimens	75% of the result with unaged specimens

Table 5
PVC accelerated-aging program

Temperature limits of PVC compounds		Oven temperature		Aging period (h)
°C	(°F)	°C	(°F)	
60	(140)	100 ±1	(212 ±2)	96
75	(167)	100 ±1	(212 ±2)	240
90	(194)	121 ±1	(250 ±2)	168
105	(221)	136 ±1	(277 ±2)	168
Over 105	(221)[a]	136 ±1	(277 ±2)	168

[a] The Extended Use Test, Section 33, is required for materials operating at temperatures of 105°C (221°F) or more on PVC materials.

Table 6
Thermal conditioning exposure temperature

Normal test temperature in °C (°F)	Oven test temperature in °C (°F)
65 – 75 (149 – 167)	85 (185)
76 – 85 (168 – 185)	95 (203)
86 – 95 (186 – 203)	105 (221)

Table 7
Coating thickness factors

Temperature, degrees		Thickness factors, 0.00025 mm (0.00001 in) per second	
C	(F)	Cadmium platings	Zinc platings
21.1	(70)	1.331	0.980
21.7	(71)	1.340	0.990
22.2	(72)	1.352	1.000
22.8	(73)	1.362	1.010
23.3	(74)	1.372	1.015

Table 7 Continued on Next Page

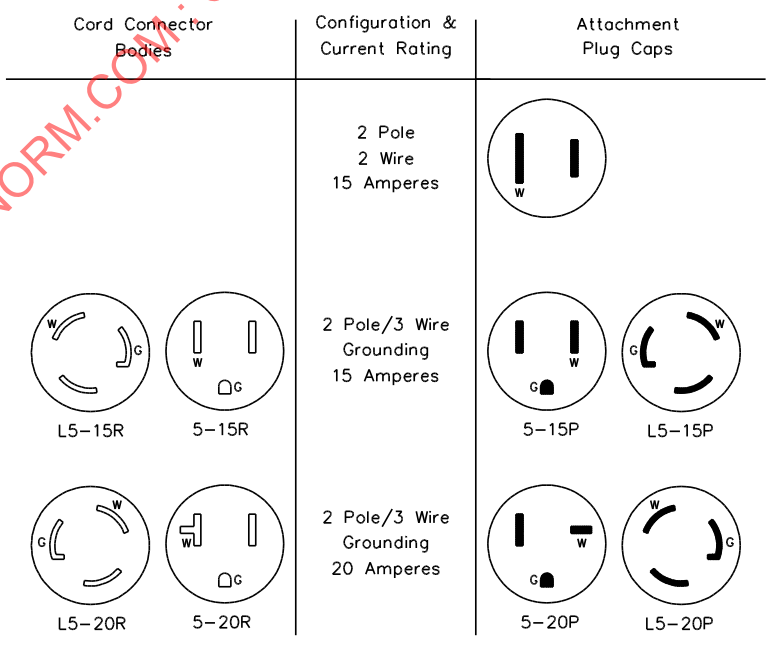
Table 7 Continued

Temperature, degrees		Thickness factors, 0.00025 mm (0.00001 in) per second	
C	(F)	Cadmium platings	Zinc platings
23.9	(75)	1.383	1.025
24.4	(76)	1.395	1.033
25.0	(77)	1.405	1.042
25.6	(78)	1.416	1.050
26.1	(79)	1.427	1.060
26.7	(80)	1.438	1.070
27.2	(81)	1.450	1.080
27.8	(82)	1.460	1.085
28.3	(83)	1.470	1.095
28.9	(84)	1.480	1.100
29.4	(85)	1.490	1.110
30.0	(86)	1.501	1.120
30.6	(87)	1.513	1.130
31.1	(88)	1.524	1.141
31.7	(89)	1.534	1.150
32.2	(90)	1.546	1.160

FIGURES

Figure 1

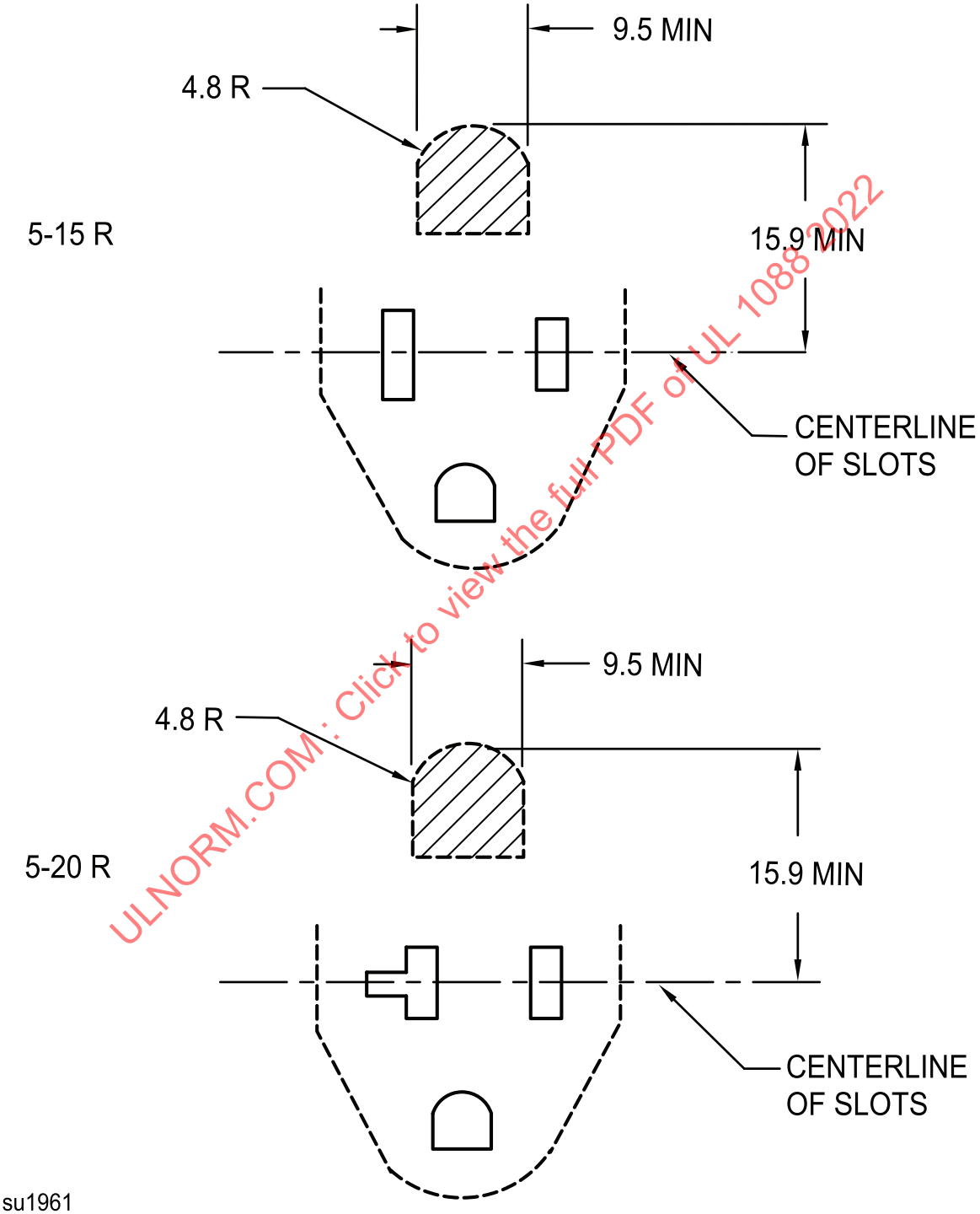
Face view of general-purpose 125-V fittings showing configuration of contact



Note: Images only show the location of contacts. Refer to ANSI/NEMA WD 6 for dimensions.

Figure 2

Face of 15- and 20-A, 125-V parallel-slot cord connectors showing the smallest acceptable obstruction (shown shaded) for the grounding pin on the mating plug

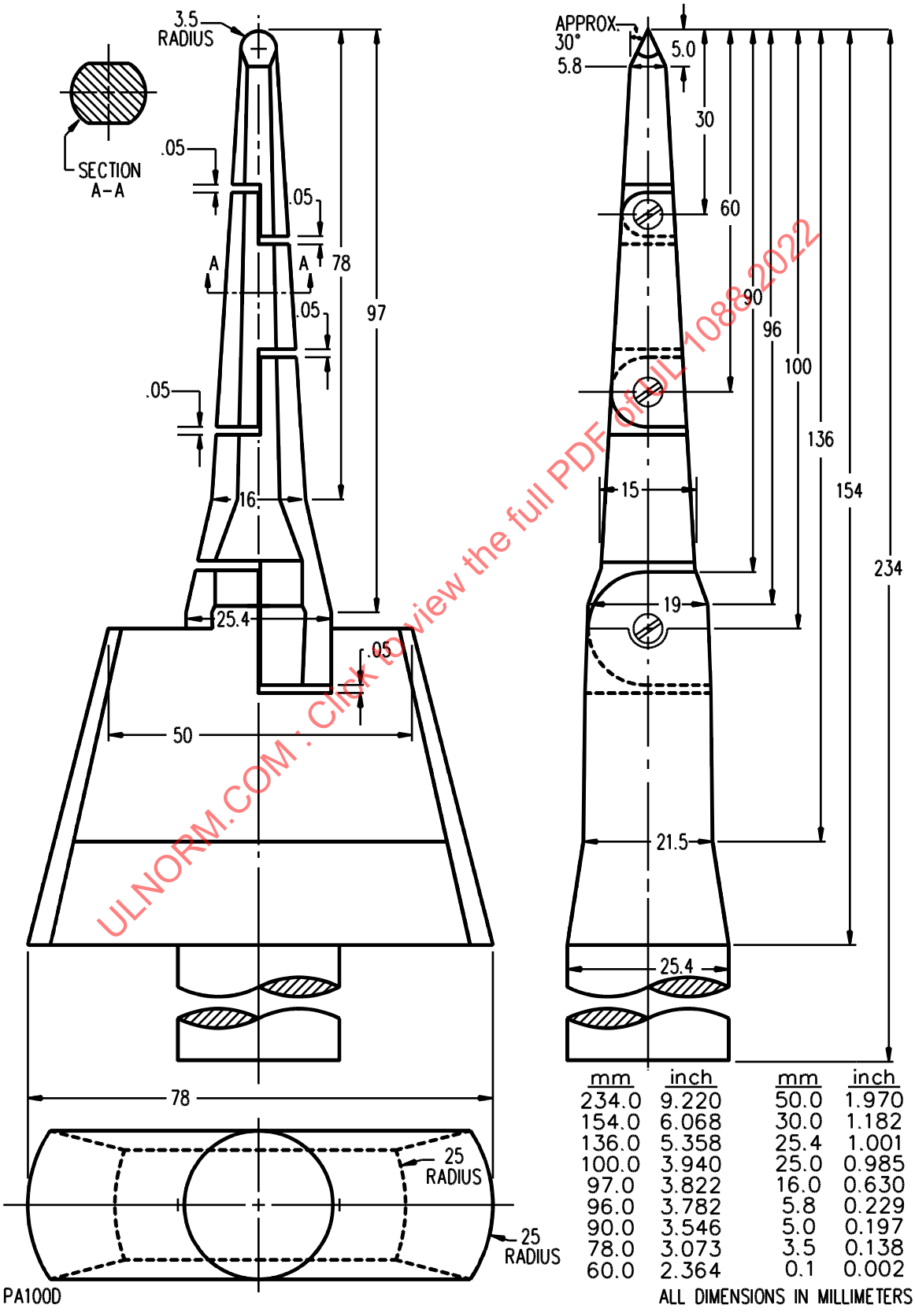


Note: All dimensions in mm

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

Figure 3

Accessibility probe



mm	inch	mm	inch
234.0	9.220	50.0	1.970
154.0	6.068	30.0	1.182
136.0	5.358	25.4	1.001
100.0	3.940	25.0	0.985
97.0	3.822	16.0	0.630
96.0	3.782	5.8	0.229
90.0	3.546	5.0	0.197
78.0	3.073	3.5	0.138
60.0	2.364	0.1	0.002

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