UL 588

STANDARD FOR SAFETY

Seasonal and Holiday Decorative Products

UL Standard for Safety for Seasonal and Holiday Decorative Products, UL 588

Nineteenth Edition, Dated October 26, 2015

Summary of Topics

This revision of ANSI/UL 588 dated September 8, 2023 clarifies requirements for series-connected lighting strings employing shrink tubing; 22.2.1.2 – 22.2.1.2C and 22.2.2.3.

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 March 24, 2023 and August 4, 2023.

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UL 588

Standard for Seasonal and Holiday Decorative Products

The First through Seventeenth Editions were titled Christmas-Tree and Decorative-Lighting Outfits.

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Nineteenth Edition

October 26, 2015

This ANSI/UL Standard for Safety consists of the Nineteenth Edition including revisions through September 8, 2023.

The most recent designation of ANSI/UL 588 as an American National Standard (ANSI) occurred on September 8, 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

1 Scope

1.1 These requirements cover temporary-use, seasonal decorative-lighting products and accessories with a maximum input voltage rating of 120 V to be used in accordance with the National Electrical Code, ANSI/NFPA 70. Temporary-use is considered to be a period of installation and use not exceeding 90 days. This Standard also covers factory-assembled parallel-connected string lights intended for year round use as described in Supplement SD.

1.2 These requirements cover factory-assembled seasonal lighting strings with push-in, midget-screw, or miniature-screw lampholders or non-replaceable lamps connected in series for across-the-line use or with candelabra- or intermediate-screw lampholders connected in parallel for direct-connection use. These requirements also cover factory-assembled seasonal decorative outfits such as wreaths, stars, light sculptures, crosses, candles or candle sets without lamp shades, products in the shape of, or in resemblance to, Christmas trees with simulated branches and needles, products in the shape of, or in resemblance to, wreaths provided with simulated branches and needles, blow-molded figures or objects, animated figures, tree tops, controllers, tree stands, electric tree poles, and motorized decorative displays. These requirements cover products which are portable and not permanently connected to a power source.

1.3 These requirements additionally cover ornaments which are provided with an adapter for connection to a push-in lampholder and are intended to replace a push-in lamp in a series-connected decorative-lighting string or decorative outfit.

1.4 These requirements do not cover strings employing lampholders larger than intermediate-screw, non-seasonal lighting, non-seasonal products, permanently connected products, non-decorative lighting intended for illumination only, cord sets, or temporary power taps. These requirements also do not cover nightlights which are covered under the Standard for Direct Plug-In Nightlights, UL 1786, or flexible lighting products that are not part of a decorative outfit which are covered under the Standard for Flexible Lighting Products, UL 2388.

1.5 These requirements do not cover portable electric lamps intended for general illumination with a seasonal decoration and a typical lamp shade construction open at the top and bottom, which are covered under the Standard for Portable Electric Luminaires, UL 153.

1.6 Christmas trees exceeding 30 in (762 mm) in height but not exceeding 12 ft (3.7 m) in height, as measured from the top of the tree to the bottom of the base of the tree and provided with simulated branches and needles, products in the shape of, or in resemblance to, a wreath exceeding 48 in (1219 mm) in outer diameter and provided with simulated branches and needles, or other similar seasonal-use decorative outfits shall additionally be investigated to the Outline of Investigation for Fire Tests of Pre-Lit Artificial Seasonal Use Trees and Other Seasonal Decorative Items, UL 2358.

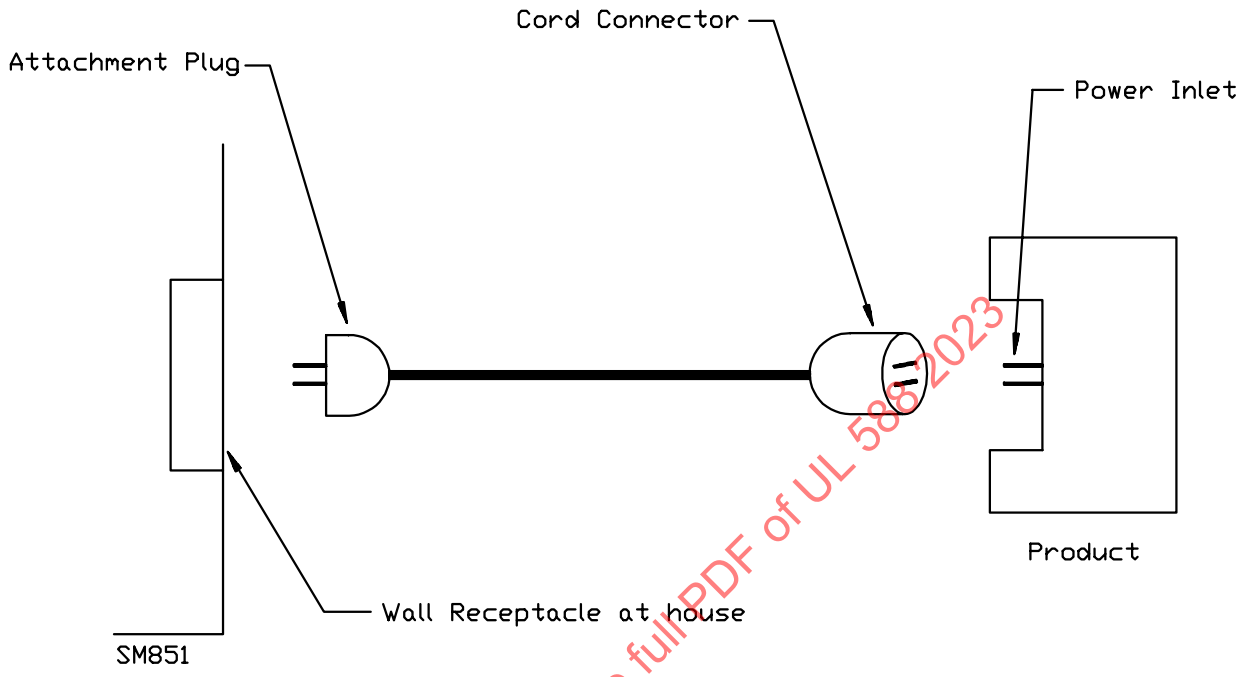
2 Glossary

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

2.2 ATTACHMENT PLUG – A male contact device, which may be provided with integral overcurrent protection, for the temporary connection of a flexible cord or cable to a receptacle, cord connector, or other outlet device. The male screw of a lamp base would additionally be considered as meeting this definition when used for the connection. See Figure 2.1.

Figure 2.1

Example of a cord set or detachable power-supply cord



2.3 BUBBLE LIGHT – A light assembly consisting of a liquid filled container assembled to a housing which contains a lamp. The lamp is used to heat and brighten the liquid producing an illuminated bubbling effect.

2.4 CLASS 2 CIRCUIT – A circuit powered from the output of a Class 2 transformer or a Class 2 power unit. See 18.1.

2.5 CONTROLLER – A product designed to electronically or electromechanically vary the power to or the on/off cycle of the seasonal decorative lighting product or products which it is intended to control. A controller may additionally provide sound effects. A controller may be a separate unit or an integral part of a string or decorative outfit.

2.6 CORD CONNECTOR – A female contact device which is part of a cord set, string, or detachable power-supply cord for connection to a male contact device such as an attachment plug, current tap, or power inlet. See Figure 2.1.

2.7 CORD SET – A length of flexible cord assembled with an attachment plug or current tap as a line fitting and a cord connector as a load fitting. A cord set is sometimes referred to as an extension cord. See 1.4.

2.8 CURRENT TAP – A male and female contact device that, when connected to an outlet receptacle, provides multiple load fittings. A load fitting may consist of a slot configuration and provision for the connection of a flexible cord. A current tap may be provided with integral overcurrent protection. See 13.3.4.

2.9 DECORATIVE LIGHTING HARNESS – A factory-assembled lighting assembly employing candelabra-, intermediate-, or medium-screw lampholders connected in parallel across the line and neutral blades of the attachment plug or current tap. A decorative lighting harness is employed in a decorative outfit and it is provided with overcurrent protection.

2.10 DECORATIVE OUTFIT – A factory-assembled, electrically-powered unit providing a seasonal theme such as a wreath, star, light sculpture, cross, candle or candle set without lamp shades, a product in the shape of, or in resemblance to, a Christmas tree not exceeding 12 ft (3.7 m) in height as measured from the top of the tree to the bottom of the base of the tree with simulated branches and needles, products in the shape of, or in resemblance to, a wreath provided with simulated branches and needles, a blow-molded figure or object, such as a pumpkin, a snowman, or a tree, an animated figure, a tree top, a tree stand, and a motorized decorative display having illumination or other decorative effects. It is provided with overcurrent protection and a means for attachment to an electrical outlet. It may be provided with either a lighting string as part of the illumination of the decorative outfit, or with a controller, or both. A lighting string or lighting harness provided with decorative covers over the lamps is considered as a decorative outfit.

2.11 DIRECT PLUG-IN UNIT – A power unit which employs a blade assembly on its enclosure for connection to the branch circuit and a means for connection to a seasonal lighting product. The unit may employ a transformer if the seasonal product requires a low-voltage supply source. A controller may be a direct plug-in unit.

2.12 ENCLOSURE – Any surface or surrounding structure that reduces the likelihood of access to any or all parts of the product that may otherwise present a risk of electric shock or injury to persons and reduces the likelihood of propagation of flame initiated by electrical disturbances occurring within. See 10.1.1 and 12.1.

2.13 FUSEHOLDER – A device which holds an overcurrent-protective fuse.

2.14 LAMP, BALLAST – A series-connected lamp used in conjunction with an individual-flashing lamp to limit the current flow to less than 0.6 A if all individual-flashing lamps were in their shorted state. See 28.3 and 28.4.

2.15 LAMP, CANDELABRA-BASE (E12) – A lamp employing a screw base approximately 0.47 inches (12 mm) in diameter. An E12 lamp is the ANSI designation for a candelabra-base lamp.

2.16 LAMP, FLASHING – A series- or parallel-connected lamp that automatically cycles on and off by means of a bimetallic strip connected in series with the filament. For series-connected strings, the flashing lamp causes all lamps connected in series with it to flash. For parallel-connected strings, only the flashing lamp is intended to flash.

2.17 LAMP, INDIVIDUAL-FLASHING – A series-connected lamp that automatically cycles on and off by means of a bimetallic strip connected in parallel with the filament. The cycling of the bimetallic strip causes only the individual-flashing lamp to flash by momentarily placing a short across the filament to turn the lamp on and off. An individual-flashing lamp is intended to be used in combination with a ballast lamp unless used in a light string whose construction is described in the Exception to 28.3. See 28.3 and 28.4.

2.18 LAMP, INTERMEDIATE-BASE (E17) – A lamp employing a screw base approximately 0.67 inches (17 mm) in diameter. An E17 lamp is the ANSI designation for an intermediate-base lamp.

2.19 LAMP, MEDIUM-BASE (E26) – A lamp employing a screw base approximately 1.02 inches (26 mm) in diameter. An E26 lamp is the ANSI designation for a medium-base lamp.

2.20 LAMP, MIDGET-BASE (E5) – A lamp employing a screw base approximately 0.20 inches (5 mm) in diameter. An E5 lamp is the ANSI designation for a midget-base lamp.

2.21 LAMP, MINIATURE-BASE (E10) – A lamp employing a screw base approximately 0.39 inches (10 mm) in diameter. An E10 lamp is the ANSI designation for a miniature-base lamp.

2.22 LAMP, PUSH-IN – A low-voltage lamp, intended for series connection, with a glass envelope provided with wire leads for electrical connection to the lampholder. The glass envelope is provided with an adapter which separates the leads and secures the entire assembly into the lampholder by push-in friction fit. The adapter may be provided with a positive latching mechanism.

2.23 LAMP, PUSH-IN LED – A light emitting diode (LED), intended for series connection, provided in an encapsulating enclosure with wire leads for electrical connection to the lampholder. The enclosure is provided with an adapter which separates the leads and secures the entire assembly into the lampholder by push-in friction fit. The adapter may be provided with a positive latching mechanism.

2.24 LAMP, SCREW-BASE (EDISON-SCREW) – A lamp provided with an Edison-screw base for electrical and mechanical connection to the lampholder.

2.25 LAMPHOLDER, CANDELABRA-SCREW (E12) – A screw-type lampholder which accepts a candelabra-base (E12) lamp. An E12 lampholder is the ANSI designation for a candelabra-screw lampholder.

2.26 LAMPHOLDER, INTERMEDIATE-SCREW (E17) – A screw-type lampholder which accepts an intermediate-base (E17) lamp. An E17 lampholder is the ANSI designation for an intermediate-screw lampholder.

2.27 LAMPHOLDER, MEDIUM-SCREW (E26) – A screw-type lampholder which accepts a medium-base (E26) lamp. An E26 lampholder is the ANSI designation for a medium-screw lampholder.

2.28 LAMPHOLDER, MIDGET-SCREW (E5) – A screw-type lampholder which accepts a midget-base (E5) lamp. An E5 lampholder is the ANSI designation for a midget-screw lampholder.

2.29 LAMPHOLDER, MINIATURE-SCREW (E10) – A screw-type lampholder which accepts a miniature-base (E10) lamp. An E10 lampholder is the ANSI designation for a miniature-screw lampholder.

2.30 LAMPHOLDER, SEASONAL LIGHTING – A lampholder that is restricted for use with seasonal-lighting strings and decorative-lighting outfits and which, by its construction and intended application, is not suitable for general use.

2.31 LAMPHOLDER, SKELETON-TYPE – An Edison-screw lampholder that does not use conductive screw shell threads to make electrical contact with the lamp screw base. Electrical contact with the lamp screw base is made with one or more separate contacts in the side wall of the lamp base cavity or a contact in the bottom of the lamp base cavity, such as ring contact. The lampholder also employs a center contact.

2.32 LIGHTING STRING – A factory-assembled series, series-parallel, or parallel string of replaceable lamps consisting of an attachment plug or current tap, lampholders, lamps, wire, and overcurrent protection. A lighting string optionally may be provided with a load fitting (cord connector), a controller, or both. A lighting string is intended to be draped over or around an object to provide a decorative effect. A lighting string may also be a factory-assembled series- or series-parallel string consisting of non-replaceable lamps without shunts, an attachment plug, wire, and overcurrent protection. See 28.1 and 29.1.

2.33 LIGHTING STRING, PARALLEL-CONNECTED – A lighting string employing either candelabra- or intermediate-screw lampholders connected in parallel across the line and neutral blades of the attachment plug or current tap.

2.34 LIGHTING STRING, SERIES-CONNECTED – A lighting string employing push-in, midget-screw, or miniature-screw lampholders or non-replaceable lamps connected in series with each other. The series-connected assembly is connected across the line and neutral by means of an attachment plug or current tap. Lighting strings configured in the shape of a net (see Exception No. 2 to 13.2.4), as icicles, or other configurations, are series-connected lighting strings. LED lighting strings that employ lamps with covers that are not removable are also considered as lighting strings.

2.35 LIGHTING STRING, SERIES-PARALLEL-CONNECTED – A lighting string consisting of two or more series-connected strings of lampholders or non-replaceable lamps connected in parallel to each other and across the line and neutral by means of an attachment plug or current tap.

2.36 LIGHT SCULPTURE – A polymeric or coated metallic rigid or flexible frame to which lampholders and lamps are attached. The lamps provide outline illumination of the figure or object created by the frame.

2.37 LIVE PART – A current-carrying component other than a Class 2 circuit.

2.38 LOAD FITTING – A female contact device, such as a cord connector or dedicated receptacle, which is part of a lighting string or decorative outfit and is intended for connection to an attachment plug.

2.39 ORNAMENT – A unit provided with a lampholder adapter or input leads and an adapter intended to take the place of a push-in lamp in a series-connected lighting string or decorative outfit. An ornament may be electronically- or non-electronically-operated.

2.40 ORNAMENT, ELECTRONICALLY-OPERATED – An ornament which employs a motor, a printed wiring assembly, electronic components, or similar item. This type of ornament may produce sound, be illuminated, animated, or similar effect, or a combination of the above.

2.41 ORNAMENT, NON-ELECTRONICALLY-OPERATED – An ornament provided with a wiring assembly consisting of only a lamp and lampholder, or of more than a single lamp connected in series or parallel, on one end and an adapter on the other end. This type of ornament is illuminated only.

2.42 POWER INLET (MOTOR ATTACHMENT PLUG) – A male contact device to be mounted on the product to provide an integral blade configuration for the connection of a cord connector. See Figure 2.1.

2.43 RECEPTACLE, DEDICATED – A receptacle that is intended for connection to the attachment plug or current tap of a specific product such as a decorative-lighting string or a decorative outfit and which is not for general use.

2.44 SEASONAL (HOLIDAY) PRODUCT – A product painted in colors to suggest a holiday theme or a snow covering, a figure in a holiday costume, or any decoration associated with a holiday or particular season of the year.

2.45 SHUNT, LAMP – A device used in series-connected lamps to provide a current path when the filament of a lamp opens so that the remaining lamps in the series-connected string or decorative outfit remain illuminated. A shunt typically consists of several turns of aluminum wire wound around the pair of filament support posts. The aluminum oxide coating on the wire acts as an insulator, allowing current to normally flow through the filament. When the filament of the lamp opens, a high voltage (approximately 120 V) is present across the support posts causing the oxide coating of the shunt to break down. The shunt then becomes electrically connected to the support posts and allows current to continue to flow through the shunt despite the open filament.

2.46 TERMINAL, INSULATION-PIERCING – A terminal having a contact pin that punctures the conductor insulation and penetrates between the conductor strands. This does not include an insulation-displacement terminal which has a contacting member that forces the conductor insulation aside and presses against the side of the conductor to make contact.

2.47 TREE POLE, ELECTRIC – A unit that is designed to provide electrical power to a Christmas tree or equivalent either directly to integral lighting strings or through load fittings (cord connector) of a standard or non-standard configuration, with or without a through-cord switch.

2.48 WIRING DEVICE – A device which is wired on flexible cord for temporary connection of the cord to a receptacle, cord connector, or other outlet device, to make a detachable electrical connection to an attachment plug, to provide multiple outlet configurations, or similar connection. An attachment plug, current tap, cord connector, and load fitting are examples of a wiring device.

3 Components

3.1 Except as indicated in 3.2, 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.

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

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

b) Is superseded by a requirement in this standard.

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

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

4 Units of Measurement

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

5 References

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

CONSTRUCTION

ALL PRODUCTS

6 General

6.1 If a product employs a component or another product as part of its construction, each part of the product shall comply with its applicable construction requirements. For example, if a series-connected string employs a controller, construction requirements for a series-connected string, controller, cord-connected wiring device, and series-connected lampholder and lamp shall all be applied.

6.2 The wire type and overcurrent protection requirements for a seasonal lighting product are summarized in Table 6.1 and Table 6.2.

Table 6.1
Wire types and overcurrent protection ratings for series-connected seasonal lighting products

	Non-polarized fittings		Polarized fittings	
	With load fitting	**Without load fitting**	**With load fitting**	**Without load fitting**
Minimum wire size, AWG (mm^2)	22 (0.32)[a]	22 (0.32)[a]	20 (0.52)[a]	22 (0.32)[a]
Wire type	CXTW, XTW[a]	CXTW, XTW[a]	CXTW, XTW[a]	CXTW, XTW[a]
Minimum wire temperature	105°C	105°C	105°C	105°C
Maximum current rating, Amperes	0.6	0.6	0.6	1.8
Total maximum wattage of strings allowed to be connected together, end-to-end	216 Watts	–	432 Watts	–
Fuse rating, Amperes	3	3	5	3
Fuse location	Grounded and ungrounded conductor	Grounded and ungrounded conductor	Ungrounded conductor (hot)	Ungrounded conductor (hot)
On/Off switch and type (if located in other than a Class 2 circuit)	Double-pole in both conductors	Double-pole in both conductors	Single-pole ungrounded conductor (hot)	Single-pole ungrounded conductor (hot)
See Figure	Figure 7.4, Figure 7.6, Figure 7.15	Figure 7.3, Figure 7.7, Figure 7.13	Figure 7.6, Figure 7.10, Figure 7.16	Figure 7.5, Figure 7.9, Figure 7.14

[a] A motorized product shall employ minimum 20 AWG Type SPT-2 wire for the supply connections. See Figure 7.11 – Figure 7.16.

Table 6.2
Wire types and overcurrent protection ratings for parallel-connected seasonal lighting products[c]

	With load fitting		Without load fitting	
Minimum wire size, AWG (mm^2)	20 (0.52)[a]	18 (0.82)[b]	20 (0.52)[a]	18 (0.82)[b]
Wire type	XTW	SPT-1, SP-2, SPT-2, S, ST, SE, SO, SOO, SJ, SJT, SJE, SJO, SJOO	XTW	SPT-1, SP-2, SPT-2, S, ST, SE, SO, SOO, SJ, SJT, SJE, SJO, SJOO
Minimum wire temperature	105°C		105°C	
Fuse location	Ungrounded conductor (hot)		Ungrounded conductor (hot)	
On/Off switch and type (if located in other than a Class 2 circuit)	Single-pole ungrounded conductor (hot)		Single-pole ungrounded conductor (hot)	
See Figure	Figure 7.2, Figure 7.12		Figure 7.1, Figure 7.11	

[a] A motorized product shall employ minimum 20 AWG Type SPT-2 wire for the supply connections. (See Figure 7.11 – Figure 7.16).

[b] The wire Type for products intended for outdoor use shall be SPT-1W, SP-2W, SPT-2W, STW, SEW, SOW, SOOW, SJTW, SJEW, SJOW, or SJOOW.

[c] For current rating and overcurrent protection refer to Table 13.1.

7 Overcurrent Protection

7.1 A product covered by this standard shall be provided with integral overcurrent protection which complies with the Standard for Low-Voltage Fuses – Part 1: General Requirements, UL 248-1, and the

Standard for Low-Voltage Fuses – Part 14: Supplemental Fuses, UL 248-14. Refer to Table 13.1 for overcurrent protection ratings for each wire size.

Exception No. 1: An ornament need not be provided with integral overcurrent protection.

Exception No. 2: A product employing a direct plug-in or a through cord power supply provided with a minimum 18 AWG input cord in accordance with Section 18, Class 2 Circuits, need not be provided with integral overcurrent protection.

Exception No. 3: Direct plug-in products provided with a maximum of three load fittings with no external wiring need not be provided with overcurrent protection, provided that the product is capable of carrying 15A of current.

7.2 A product employing a power inlet intended for use with a cord set or a detachable power-supply cord shall be provided with fusing in accordance with this Section:

a) In the power inlet or adjacent to the point of connection to the power-supply source provided by the product, and

b) In the detachable power-supply cord if provided.

7.3 The overcurrent protection shall be either an integral part of the attachment plug or current tap, or of a through-cord design (in-line fuseholder) located so that there is not more than 6 inches (152 mm) between the face of the attachment plug or current tap and the side of the fuseholder furthest from the attachment plug or current tap. If a through-cord design is employed, a minimum 20 AWG (0.52 mm^2) wire shall be used between the attachment plug or current tap and the fuseholder.

Exception No. 1: A product employing minimum 16 AWG (1.31 mm^2) flexible cord is permitted to have the overcurrent protection located inside the enclosure.

Exception No. 2: A product that is not provided with a load fitting is permitted to have the overcurrent protection located inside the enclosure provided that the fuse is the first electrically connected item in the circuit after entrance into the enclosure, and is before any other electrical components in the product.

7.4 The rating of the overcurrent protection shall be as indicated in Table 6.1 or Table 6.2.

Figure 7.1

Parallel-connected string with a polarized line fitting and without a load fitting (See note 1)

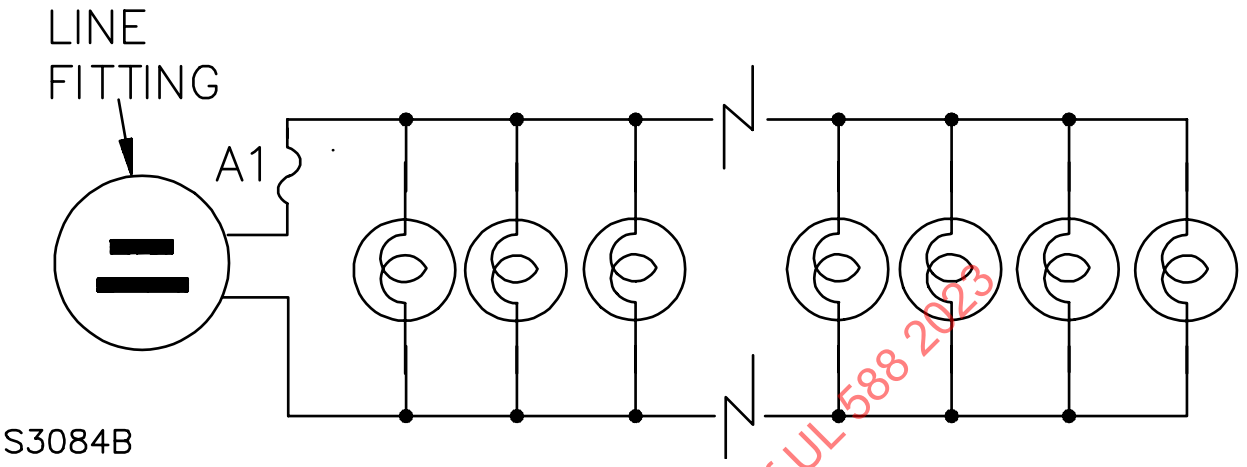


Figure 7.2

Parallel-connected string with a polarized line and load fitting (See note 1)

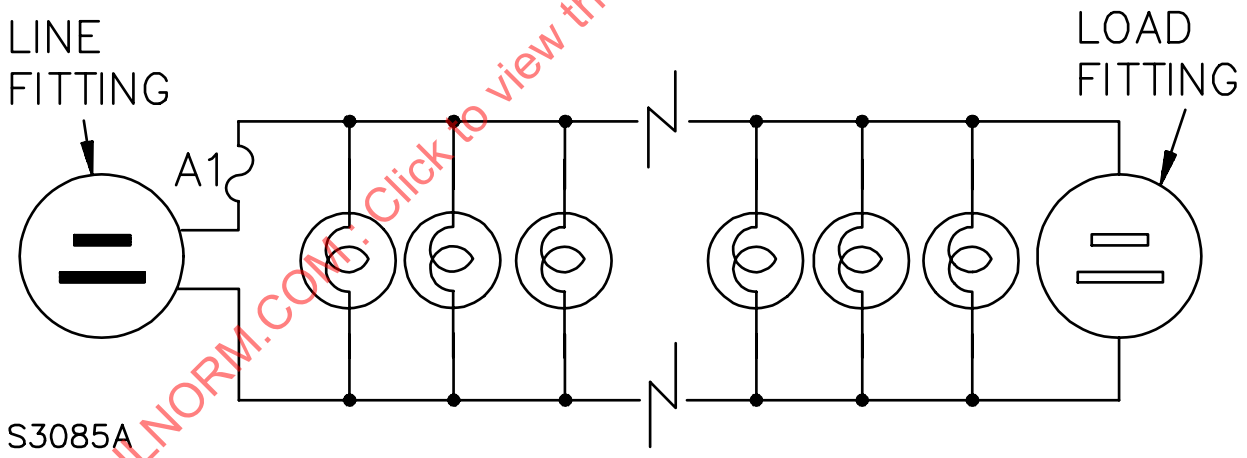


Figure 7.3

Series-connected string with a non-polarized line fitting and without a load fitting (See note 1)

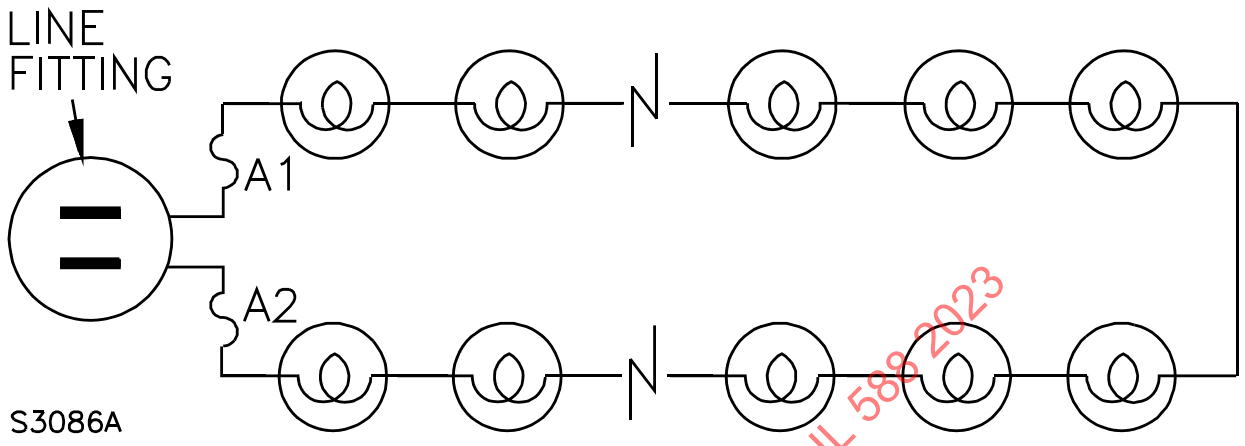


Figure 7.4

Series-connected string with a non-polarized line and load fitting (See notes 1, 2, 3)

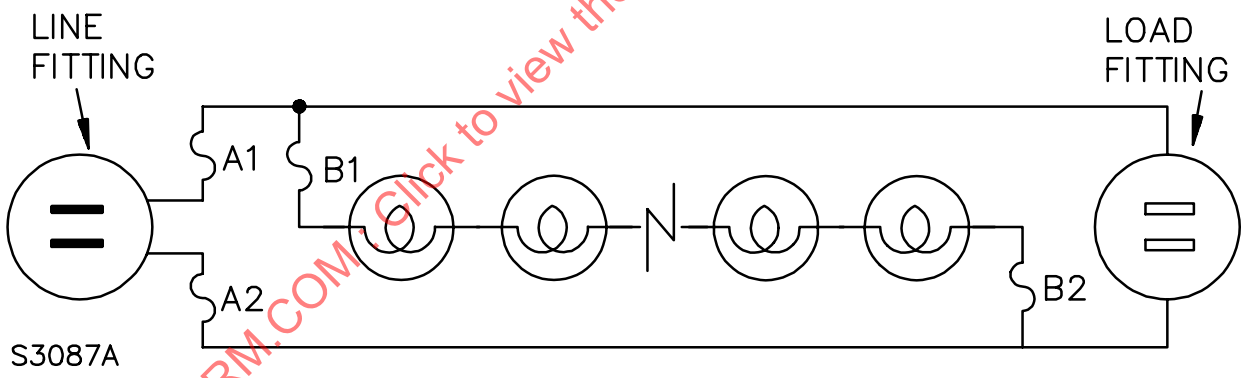


Figure 7.5

Series-connected string with a polarized line fitting and without a load fitting (See note 1)

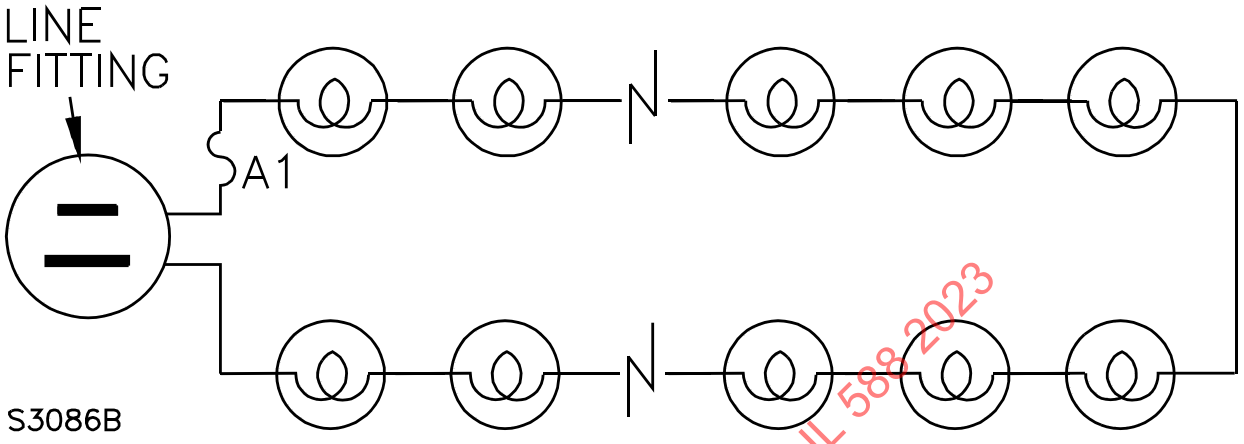


Figure 7.6

Series-connected string with a polarized line and load fitting (See note 1)

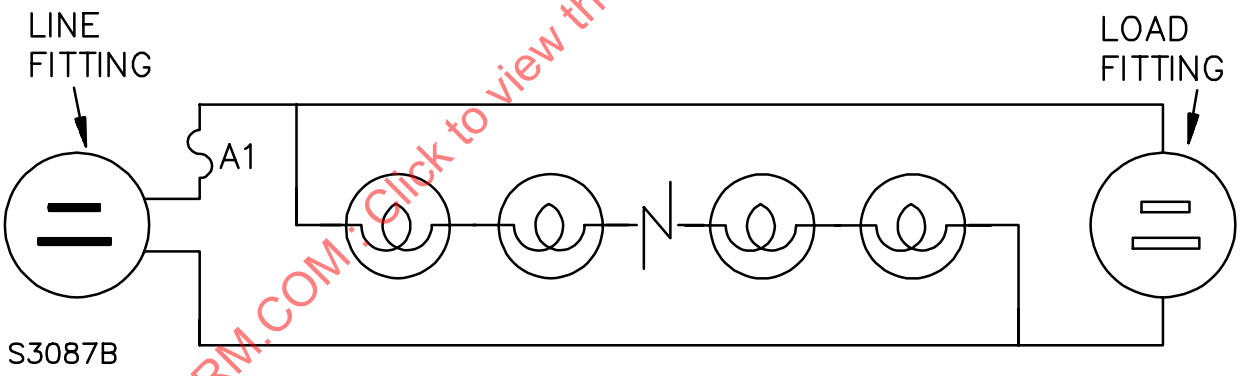


Figure 7.7

Series-parallel-connected string with a non-polarized line fitting and without a load fitting (See notes 1, 2, 3)

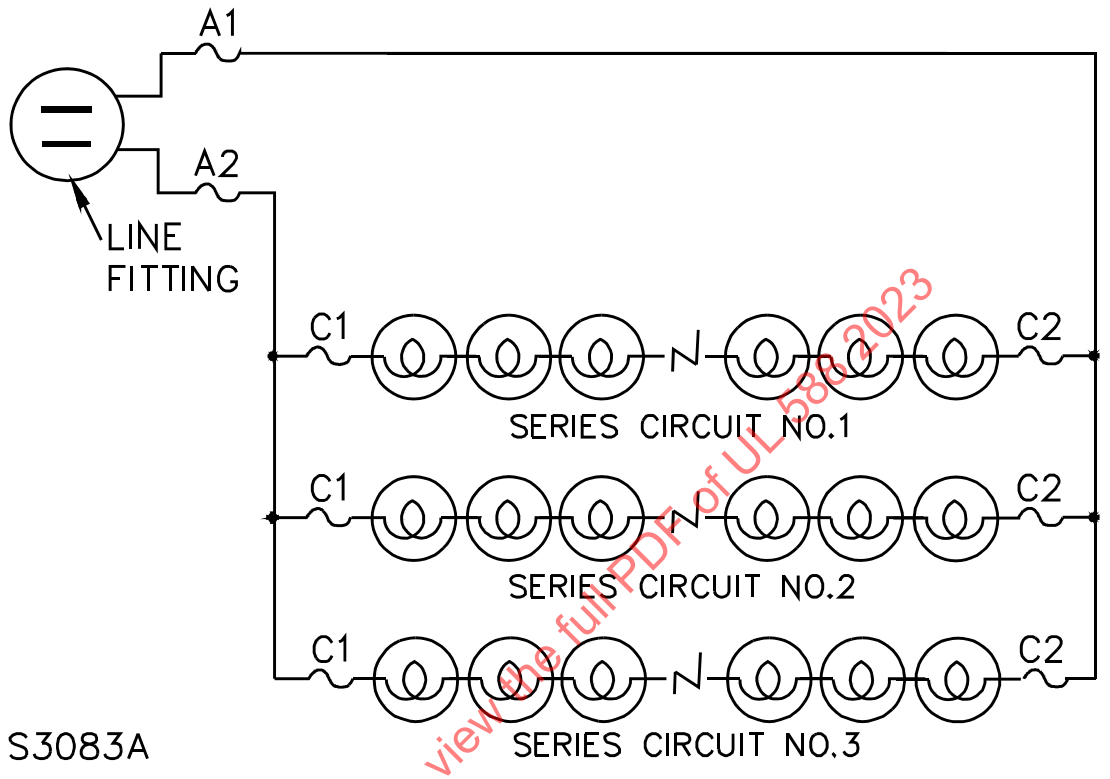


Figure 7.8

Series-parallel-connected string with a non-polarized line and load fitting (See notes 1, 2, 3)

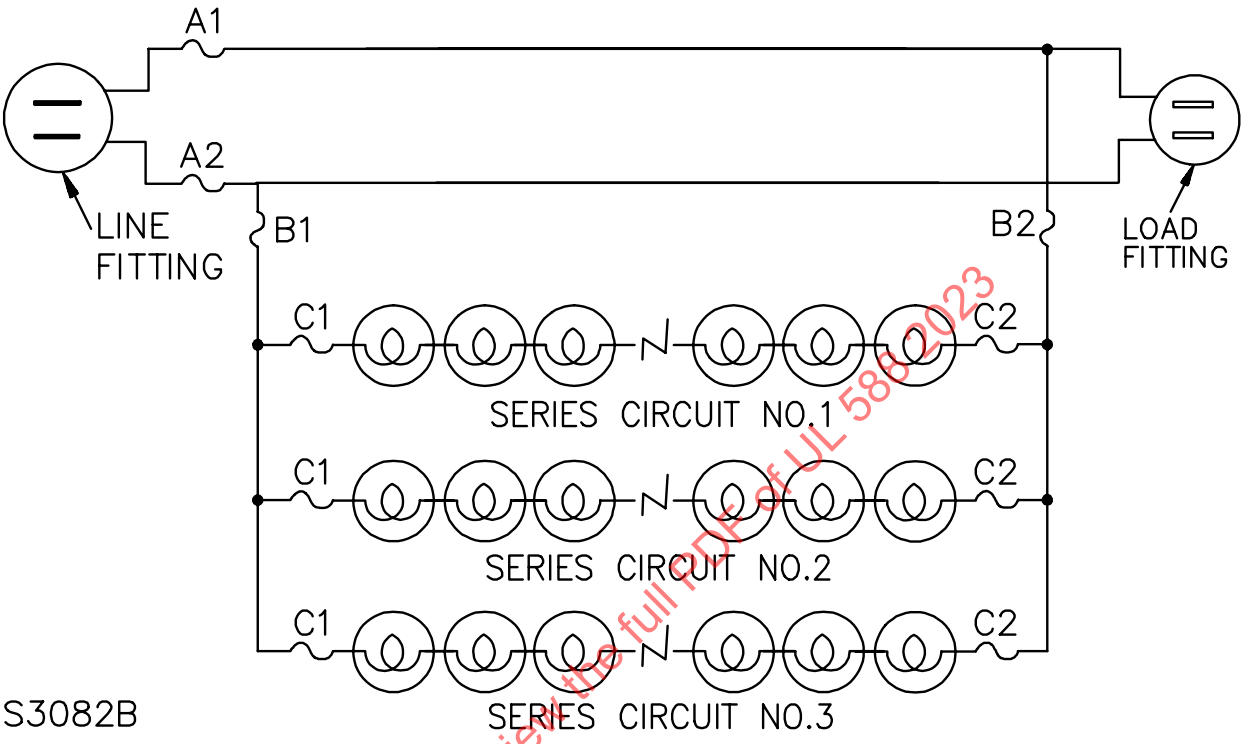


Figure 7.9

Series-parallel-connected string with a polarized line fitting and without a load fitting (See note 1)

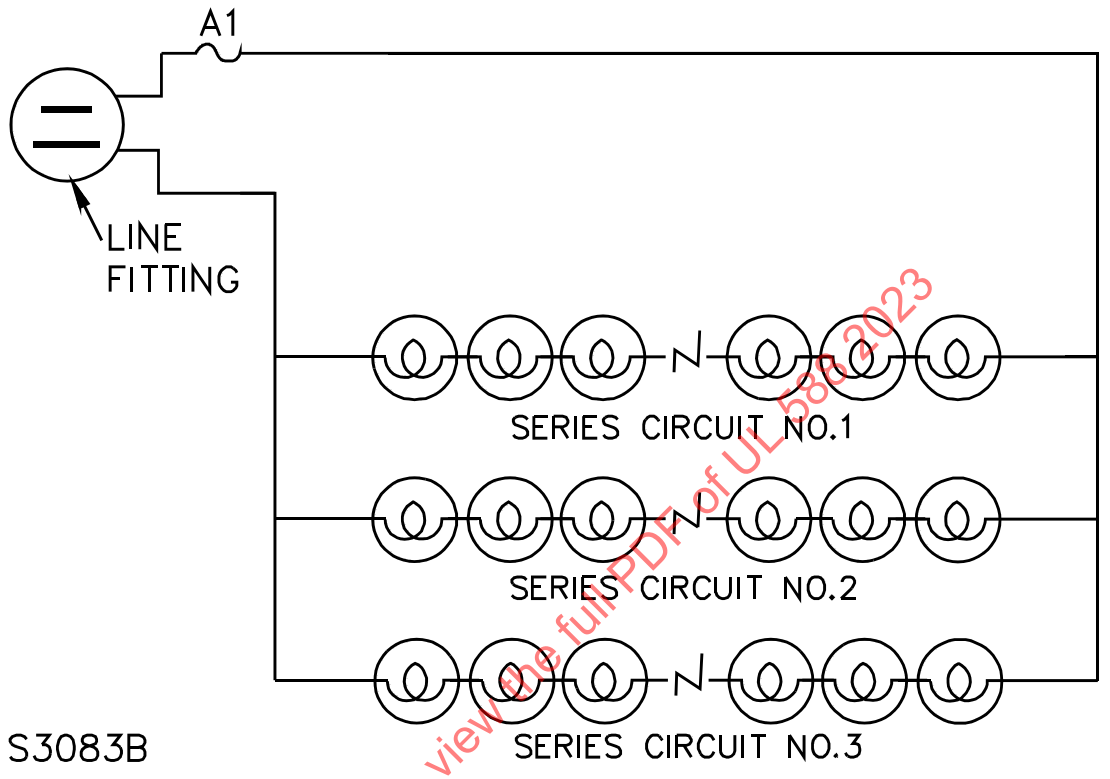


Figure 7.10

Series-parallel-connected string with a polarized line and load fitting (See note 1)

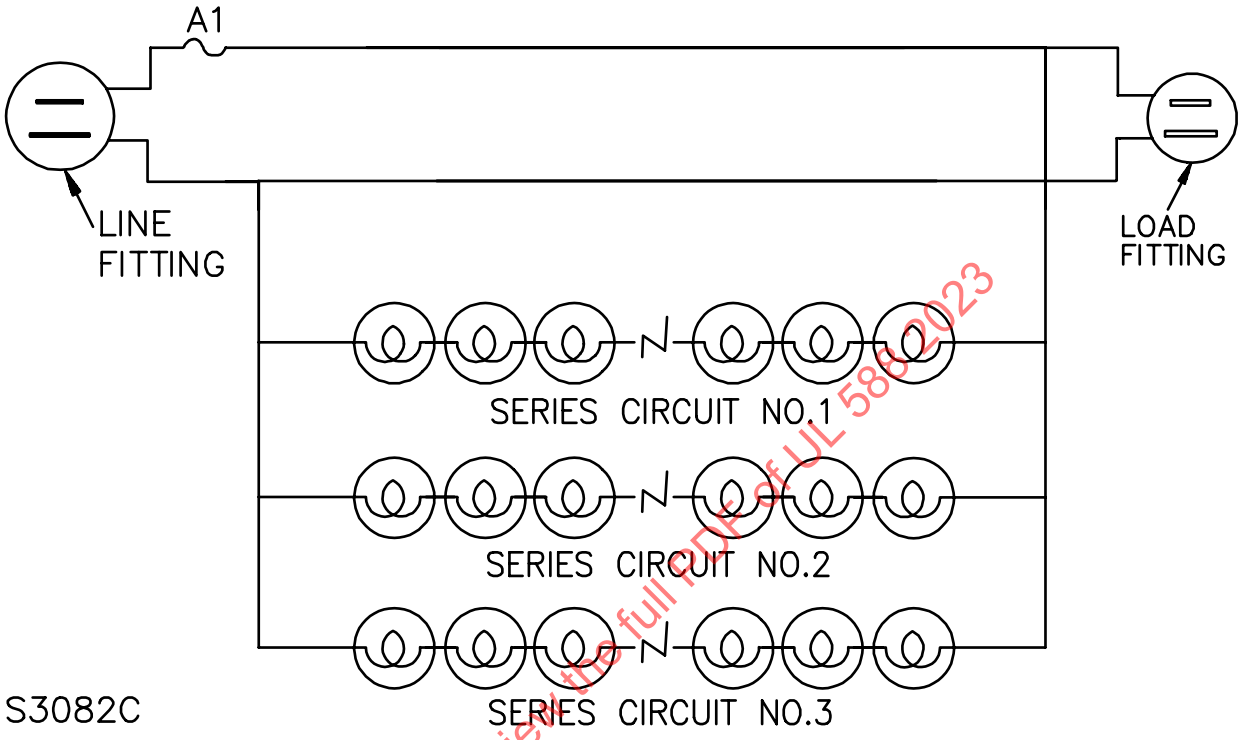


Figure 7.11

Decorative outfit or tree stand without a load fitting
Decorative lighting harness or parallel-connected string
(See notes 1, 4)

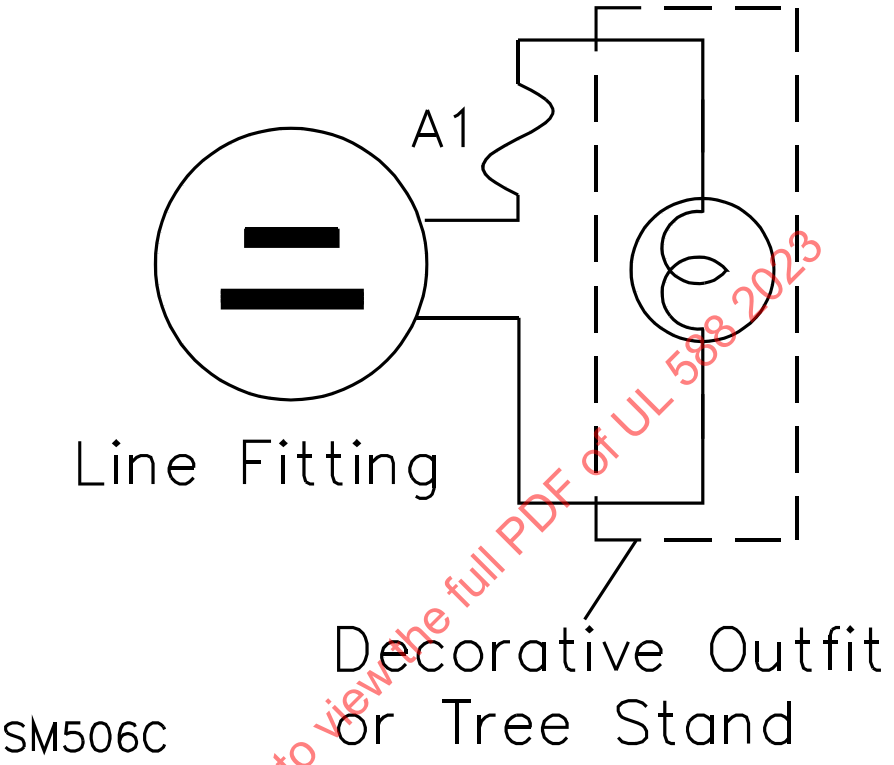


Figure 7.12

Decorative outfit or tree stand with a load fitting
Parallel-connected string
(See notes 1, 4)

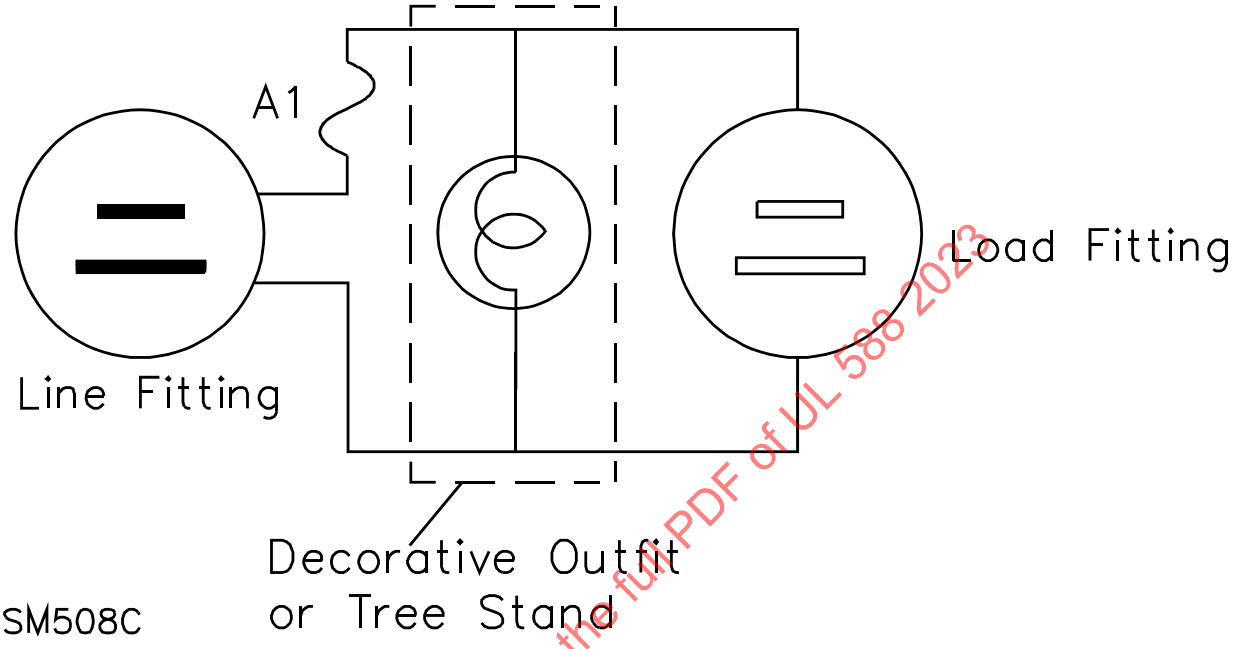


Figure 7.13

Decorative outfit or tree stand with a non-polarized line fitting without a load fitting
Series-connected string
(See notes 1, 4, 5)

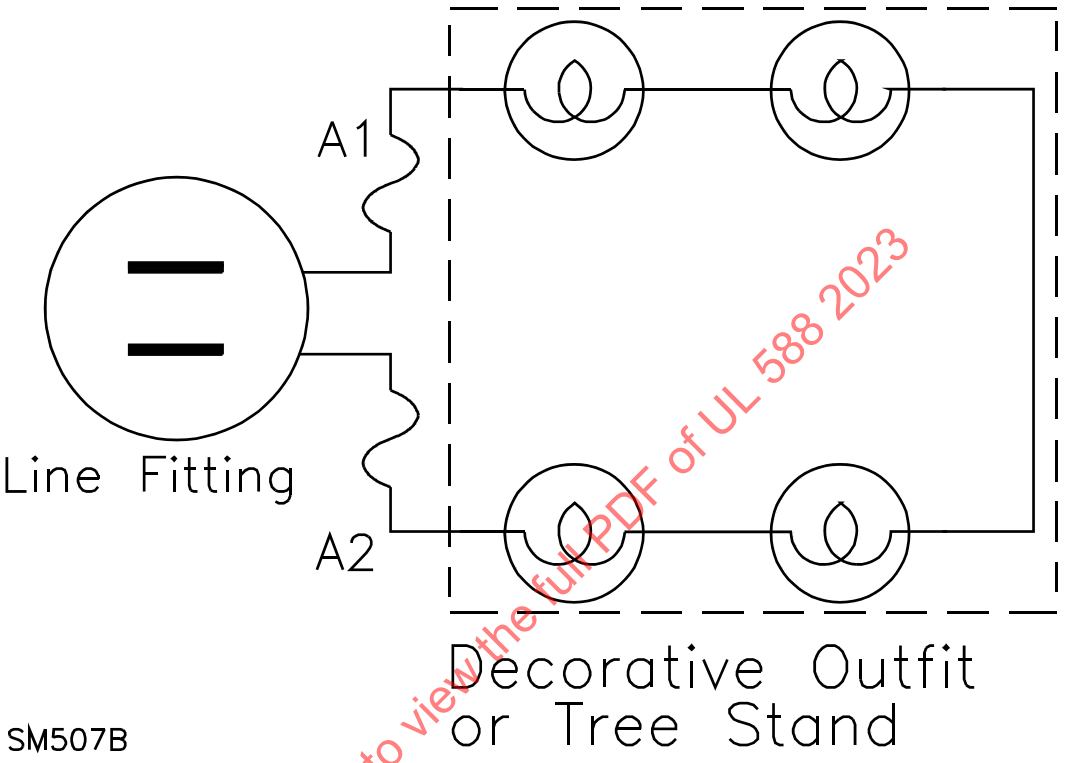


Figure 7.14

Decorative outfit or tree stand with a polarized line fitting and without a load fitting
Series-connected string
(See notes 1, 4, 5)

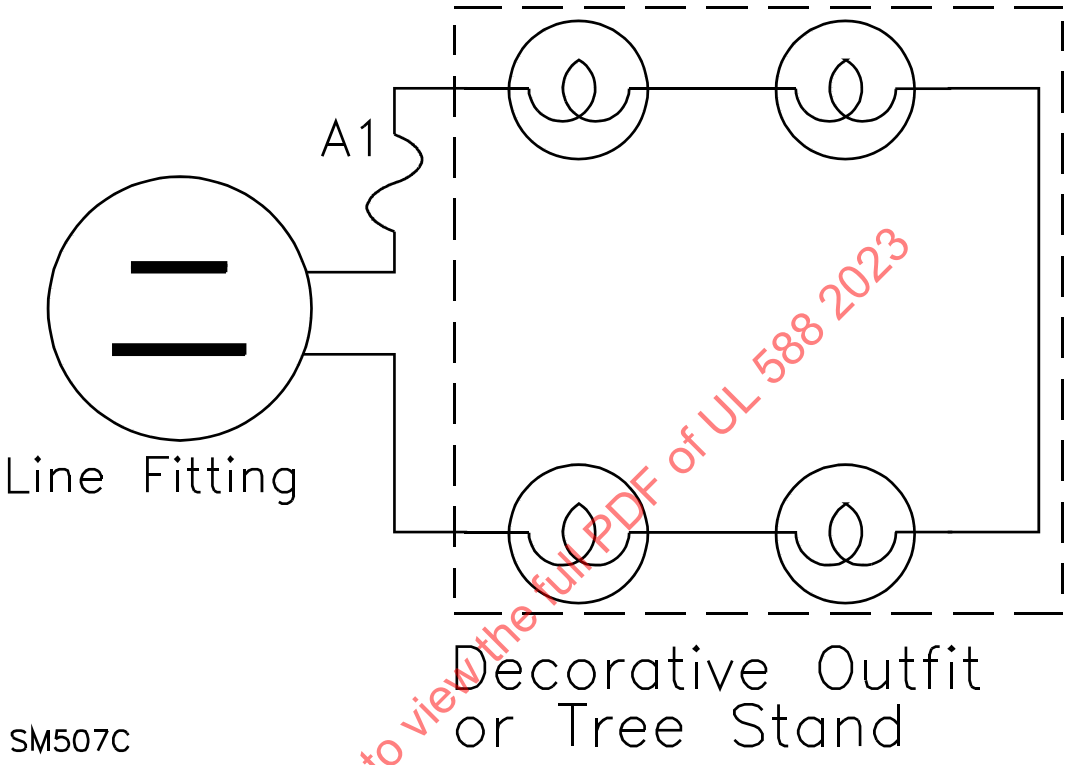


Figure 7.15

Decorative outfit or tree stand with a non-polarized line and load fitting
Series-connected string
(See notes 1, 2, 3, 4, 6)

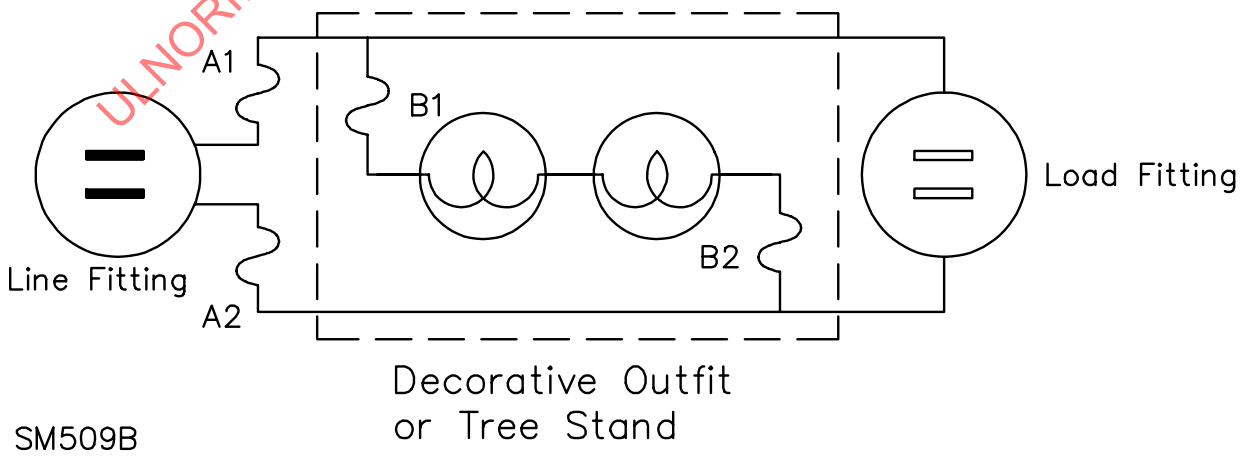
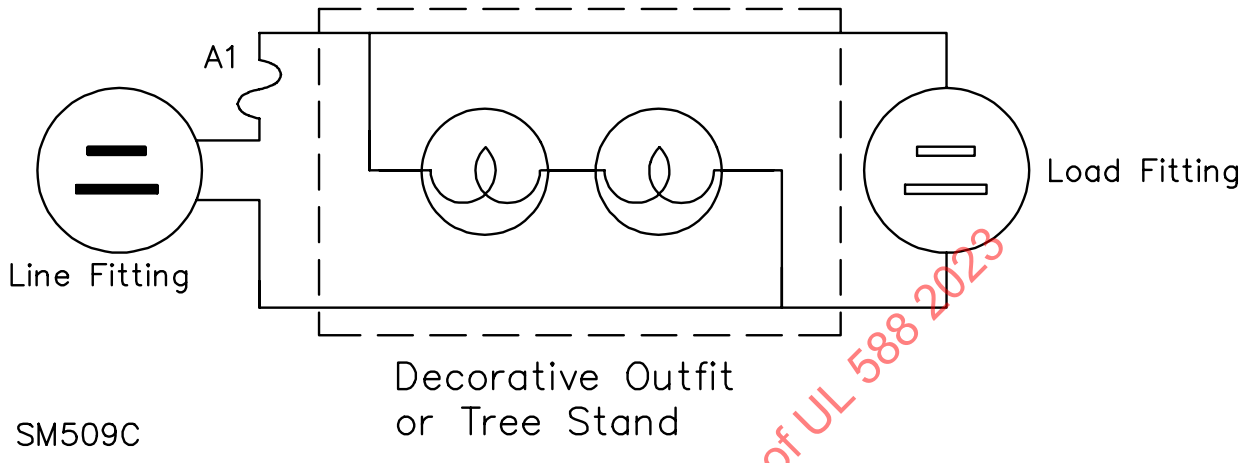


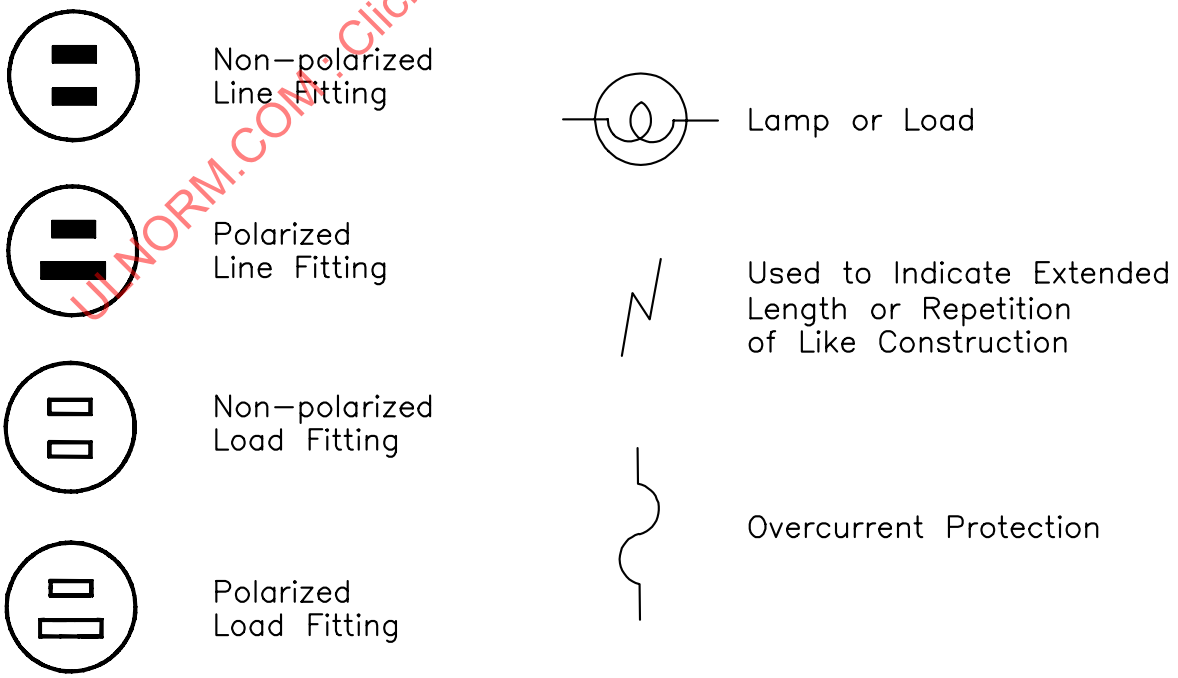
Figure 7.16

Decorative outfit or tree stand with a polarized line and load fitting
Series-connected string
(See notes 1, 2, 3, 4, 6)



Notes 1 – 6 for Figure 7.1 to Figure 7.16, applicable as indicated in each figure:

1. Represents overcurrent protection provided in accordance with this section.
2. If all wire is the same gauge size, fuse A1 or both fuses A1 and A2 may serve to protect the entire assembly.
3. If wire of varying gauge size is used, fuses B1 and B2 or C1 and C2 shall be provided and rated in accordance with Table 6.1 and Table 6.2.
4. This figure represents a decorative outfit or tree stand that may employ a motor.
5. See Figure 7.7 for series-parallel combination without load fitting.
6. See Figure 7.8 for series-parallel combination with load fitting.
7. The following is a key for Figure 7.1 – Figure 7.16:



7.5 A product provided with a polarized line fitting shall employ one fuse which shall be connected to the ungrounded (narrow) blade of the attachment plug or current tap, and be replaceable.

Exception No. 1: Fuses provided with a series- or series-parallel lighting string provided with a polarized line fitting need not be replaceable.

Exception No. 2: A product that is not provided with a load fitting and with the overcurrent protection located inside the enclosure as described in 7.3, the overcurrent protection is permitted to be non-replaceable.

7.6 A product employing a replaceable fuse shall be provided with at least one spare fuse.

Exception: A decorative outfit without a load fitting need not be provided with a spare fuse if it does not employ:

a) A series-connected string as described in 28.1, or

b) A parallel-connected string as described in 29.1.

7.7 A product provided with a non-polarized line fitting shall employ two fuses, one connected to each conductor, which are not required to be replaceable.

Exception: A product that is not provided with a load fitting and with the overcurrent protection located inside the enclosure as described in 7.3, the overcurrent protection is permitted to be non-replaceable.

7.8 The supplementary protection used for the midget push-in series- or series-parallel connected lighting string employing self-shorting lampholder contacts shall be of the non-automatically re-settable type, and if provided in a lamp, shall be nonreplaceable and not be provided with a shunt. It may be in a glass lamp or otherwise suitably enclosed in a material that complies with Section 10, Enclosures. The protector shall comply with Calibration Test, Section 65, Fault Current Test, Section 66 and if provided in a lamp, the Cascading Lamp Temperature Test, Section 85.

Exception: It is acceptable to replace the supplementary protection provided in the lamp when it meets the following criteria:

a) The lighting string is constructed such that the fused lamp cannot be replaced by another push-in lamp,

b) The lampholder is constructed such that the steady illuminating lamps cannot fit into the lampholder such that it makes an electrical connection with the lampholder intended for the fused lamp,

c) The fused lamp is permanently secured to the lamp adapter without relying on adhesive,

d) The lamp adapters are additionally secured to the lamp by an adhesive that complies with the requirements outlined in the Adhesive Test, Section 63,

e) The fused lamp and mating lampholders are uniquely identified, or otherwise coded to insure proper fused lamp replacement,

f) The additional user servicing instructions described in 131.9 are provided.

8 Materials

8.1 A shade, diffuser, or decorative part employed in a seasonal lighting product shall be constructed of a material with a maximum vertical downward burning rate of 4 inches (102 mm) per minute as determined by the Downward Burning Rate Test, Section 50.

8.2 Simulated needles, leaves, small twigs, and other loose decorative parts shall be constructed of insulating material, as determined by compliance with the Conductivity of Decorative Parts Test, Section 51, if they are:

a) Located within 2 inches (51 mm) of a lampholder employed in a seasonal product, or

b) Employed in a seasonal product to which one or more lighting strings may be attached.

8.3 A polymeric material used to provide all or any part of an enclosure employed in a seasonal lighting product shall comply with the requirements for Enclosures, Section 10.

8.4 No edge, point, or burrs of an uninsulated live part shall contact the insulation of the wire or the insulation of the conductor of a cord that is connected at opposite polarity.

8.5 Insulation on which current-carrying parts are mounted shall be of cold-molded or phenolic composition or of an equivalent insulating material.

8.6 Hard fiber is acceptable for insulating bushings, washers, separators, and barriers, but not for the sole support of live parts.

9 Mechanical Assembly

9.1 A splice, a non-enclosed motor, a printed wiring board, a switch without enclosed terminals, and any wiring shall be located in an enclosure which complies with the requirements in Enclosures, Section 10.

Exception: Type CXTW, parallel conductor XTW, SPT-1, SPT-2, SJ, SJT, S, and ST wire of the minimum gauge specified in Supply Connections, Section 13, need not be enclosed.

9.2 A controller, splice compartment, direct plug-in unit, or electronically-operated ornament shall employ an enclosure which complies with the requirements in Enclosures, Section 10.

9.3 A seasonal lighting product or accessory shall have all parts reliably secured in place.

9.4 An adhesive used to secure parts of the enclosure of a product shall comply with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and the Adhesive Test, Section 63.

Exception: An adhesive used to secure parts of the enclosure of an ornament need comply only with the Adhesive Test, Section 63.

9.5 If a seasonal lighting product or component employs an enclosure, the unit shall be constructed such that it is not necessary to open or remove the enclosure when the unit is used as intended. If the enclosure is held together by screws, then commonly removable fasteners, such as flathead or cross recessed, square recessed, or star recessed head screws or a combination thereof, or a standard bolt pattern, shall not be used unless the screws are covered by an insulating material determined suitable for the application.

9.6 Each switch, receptacle, lampholder, and similar device shall be mounted securely such that it is kept from turning. A means, other than friction alone, shall be provided to prevent the device from turning. This means may consist of a lockwasher for a device employing a single hole mounting means.

Exception No. 1: The turning of a switch, receptacle or other similar device is permitted if the turning of such a device is part of the design of the unit and introduces no additional risk of fire or electric shock, such as a reduction of spacings below the minimum acceptable values, or stress on a connection.

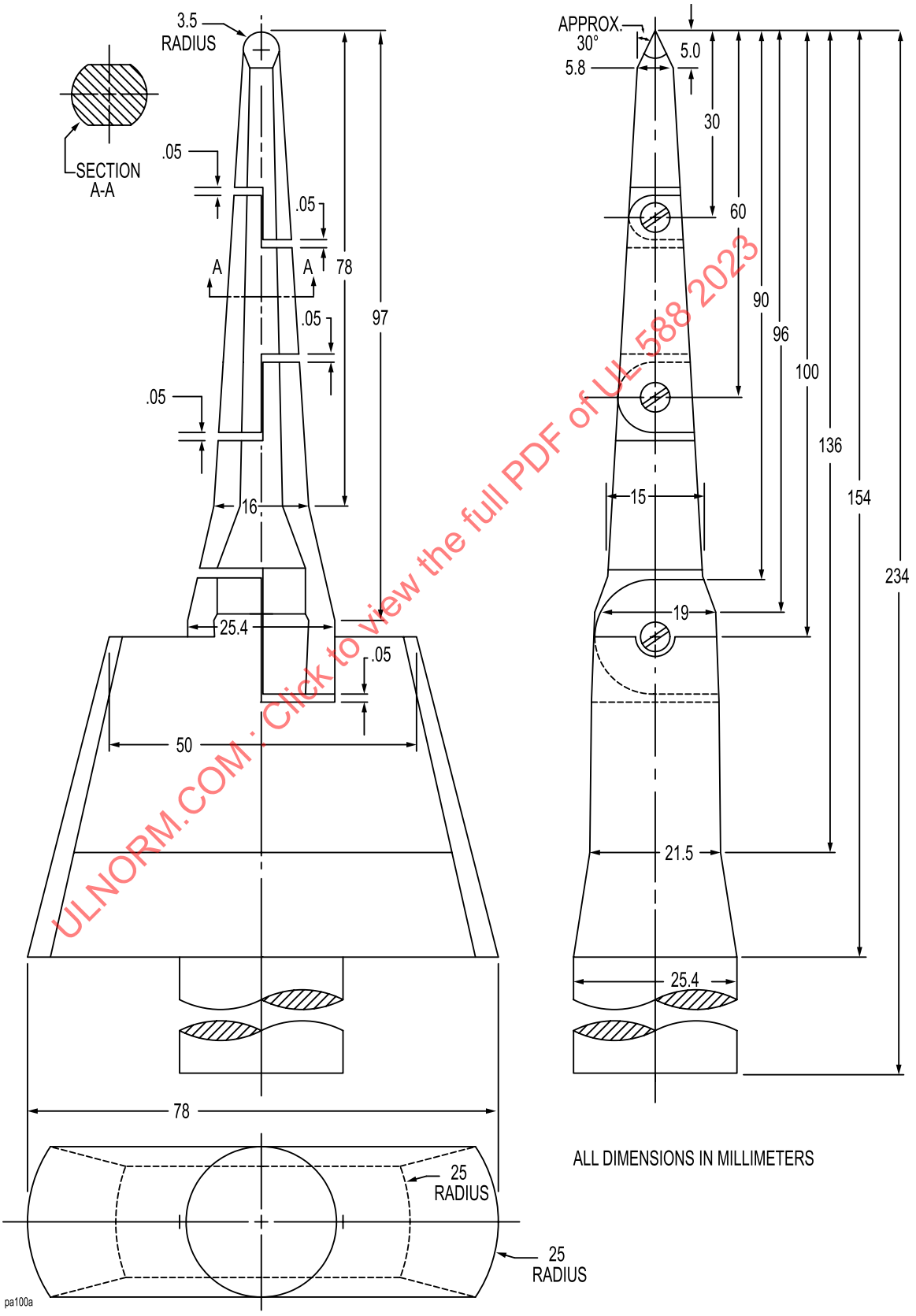
Exception No. 2: A lampholder need not be mounted such that it is kept from turning if it is likely to be held by hand during relamping.

9.7 A switch in the primary circuit or an overcurrent-protective device shall be located within an enclosure in such a manner as to not be accessible or exposed to tampering, or subject to damage during normal use. A switch shall also comply with Switches, Section 19.

9.8 The actuating means of a switch, such as a toggle, handle, or similar device, shall comply with the requirement in 9.7 if dislodging such a part results in the exposure of live parts (see 12.1) or film-coated magnet wire as determined by contact with the probe illustrated in Figure 9.1.

Figure 9.1

Accessibility probe



9.9 If the exterior part of the switch or control forms part of an enclosure, the part shall comply with the requirement in 10.3.4(b) and shall be mechanically secured in place.

10 Enclosures

10.1 General

10.1.1 An enclosure employed in a seasonal lighting product shall be formed and assembled with the strength and rigidity necessary to resist the abuses to which it is likely to be subjected, without increasing the risk of fire, electric shock, or injury to persons due to total or partial collapse of the enclosure with a resulting reduction of spacings, loosening or displacement of parts, or other defects.

10.1.2 The enclosure of a controller, direct plug-in unit, or electronically-operated ornament shall be constructed of a polymeric material which complies with 10.3.1 – 10.3.10.

10.1.3 The enclosure of an open-winding motor or transformer, splices, or wiring other than the power-supply cord shall be constructed of metal or a polymeric material which complies with 10.2.1 – 10.3.10.

Exception: The enclosure of fixed internal wiring that does not include splices or taps need not be enclosed if it provides mechanical protection for the wiring, and if the wiring consists of CXTW, parallel-conductor XTW, SPT-1, SPT-2, or jacketed flexible cord. See Supply Connections, 13, for the minimum gauge required.

10.1.4 Means shall be provided to prevent external wires from being pushed into the enclosure of the product. Compliance shall be determined by the Wire Push-Back Relief Test, Section 47.

10.2 Metallic enclosures

10.2.1 An enclosure of sheet metal shall be constructed either of uncoated steel, whose thickness is not less than 0.032 inch (0.81 mm), or of another metal that provides strength and rigidity equivalent to that of 0.032 inch (0.81 mm) steel.

10.2.2 Sheet steel shall be coated with a corrosion-resistant material such as zinc, paint, enamel, or lacquer.

10.3 Polymeric enclosures

10.3.1 A thermoplastic or thermosetting material used to provide all or any part of the enclosure as specified in 10.1.1 and 12.1, or to provide structural support in the product, shall comply with the requirements in 10.3.4 – 10.3.10.

10.3.2 Polymeric materials employed in an attachment plug, current tap, power inlet, load fitting, or in-line fuseholder shall comply with the requirements in 10.3.4 – 10.3.10.

10.3.3 Lampholders constructed of polymeric materials shall comply with 10.3.10 in addition to the requirements in Lampholders, Section 22. When electronic circuitry is encapsulated in a polymeric material employed inside a lampholder the polymeric material shall also comply with 10.3.10.

10.3.4 A material used to enclose or provide structural support for electrical live parts shall be considered acceptable if:

a) The material has a minimum flammability rating as specified in 10.3.10,

b) The enclosure complies with the Drop Test, Section 59, and the Impact Test, Section 60, and

c) The enclosure complies with the Enclosure Mold Stress Relief Test, Section 58.

10.3.5 The impact evaluation of a polymeric enclosure of outdoor units, described in 10.3.4(b), shall be performed after low-temperature conditioning at minus 35°C (minus 31°F) as described in the Cold Impact Test, Section 61.

10.3.6 During either of the tests specified in 10.3.4(b), snap fit parts of the enclosure shall not separate as a result of the impact if it exposes live parts.

10.3.7 In addition to the applicable requirements in this section, a polymeric enclosure employed in a product intended for outdoor use shall comply with the requirements for Outdoor-Use Products, Section 27.

10.3.8 The ultraviolet (UV) conditioning described in the Ultraviolet (UV) Light Exposure and Water Immersion Tests, Section 94, shall be conducted on outdoor units in which polymeric material is used as an enclosure or for structural support, and all other units subjected to ultraviolet radiation from integral fluorescent lamps.

Exception: An enclosure fabricated of material evaluated for resistance to ultraviolet light in accordance with the requirements specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, need not be further evaluated.

10.3.9 With regard to consideration of thermal endurance in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, the material shall possess a mechanical temperature index, with impact, as a result of long term aging or a generic temperature index of at least the measured temperature in the Temperature Test, Section 43.

10.3.10 Polymeric materials employed for an enclosure, attachment plug, current tap, load fitting, in-line fuseholder, or series-connected lampholder, or any device not mounted within an enclosure shall have a minimum flammability rating as indicated in Table 10.1. The flammability rating is to be determined by the applicable tests in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

Exception: Polymeric materials, other than those used in lampholders less than 0.15 inch^3 (2500 mm^3) in volume employed in series or series-parallel connected strings, may comply with either of the following end product flame tests if they have a minimum HWI (hot-wire resistance to ignition) Performance Level Category (PLC) of 3 and a minimum HAI (high-current arc resistance to ignition) PLC of 3:

a) If the component material is greater than 0.15 inch^3 (2500 mm^3) in volume, the flame tests contained in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, shall be performed. Specifically, products required to comply with the V-0 or V-1 flame rating shall be subjected to the 3/4-inch or 12-mm flame test as applicable. At the conclusion of the test there shall not be openings large enough to enable a 1/4-inch (6.4-mm) diameter rod to enter the hole in order to provide flame containment and there shall not be ignition of the cotton indicator. The indicator is to be absorbent, 100 percent cotton thinned to approximately 2 by 2 inches (50 by 50 mm) and a maximum thickness of 0.24 inches (6 mm). The cotton is to be placed horizontally 11.8 ±0.39 inches (300 ±10 mm) below the component material; or

b) If the component material is less than or equal to 0.15 inch^3 (2500 mm^3) in volume, it shall be subjected to the Flammability Test for Small Components specified in the Standard for Tests for Flammability of Small Polymeric Component Materials, UL 1694. Total consumption of the component or specimen or ignition of the cotton indicator by flaming particles or drops shall not be allowed.

Table 10.1
Material flammability requirements

Material and application[a]	Minimum required flammability rating[b]	Minimum HWI (PLC)[d]	Minimum HAI (PLC)[d]
Polymeric materials used as a non-decorative part of the enclosure for all products[c]	V-1 V-0	3 not required	3 not required
Polymeric materials used as a non-decorative part of the enclosure for a product which employs a Class 2 circuit	e	not required	not required

[a] A decorative part of a product shall comply with the requirements in Materials, Section 8.

[b] Alternative end product flammability tests may be performed in accordance with the Exception to 10.3.10.

[c] Refer to Seasonal-Lighting Lampholders, Supplement SB, for parallel-connected lampholders.

[d] The HWI and HAI performance level categories (PLC) are described in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

[e] Material shall have a maximum vertical downward burning rate of 4 inches (102 mm) per minute as determined by the Downward Burning Rate Test, Section 50.

11 Enclosure Openings

11.1 There shall not be openings in the enclosure except for the passage of wiring, a rotating shaft, or a power-supply cord, if employed, or for ventilation. These openings shall not be larger than necessary and shall comply with 11.2. Any opening in the enclosure shall not permit accessibility of live parts as determined by contact with the probe illustrated in Figure 9.1. A ventilation opening shall also comply with 11.3 – 11.6.

Exception: A product or device which contains a replaceable fuse may employ an opening not larger than necessary to determine if the fuse is intact and shall comply with the Fault Current Test, Section 66.

11.2 If wiring passes through an opening in a metal wall, it shall be protected by a bushing, a grommet, or by rolling the edge of the metal at the opening not less than 120 degrees. The edges of an opening shall be free of burrs, fins, and other sharp edges. See 21.1.

11.3 A ventilation opening employed in the enclosure of a product shall be of such size and shape that the opening does not exceed a major dimension of 0.15 inches (3.8 mm).

11.4 A ventilation opening employed in the enclosure of a product shall be provided with a barrier between the opening and any live part or possible source of arcing, such as a switch, fuse, printed wiring board, splice, or similar device. A ventilation opening shall comply with 11.5 and 11.6.

Exception: A ventilation opening with a major dimension of 0.02 inches (0.5 mm) or less need not be provided with a barrier.

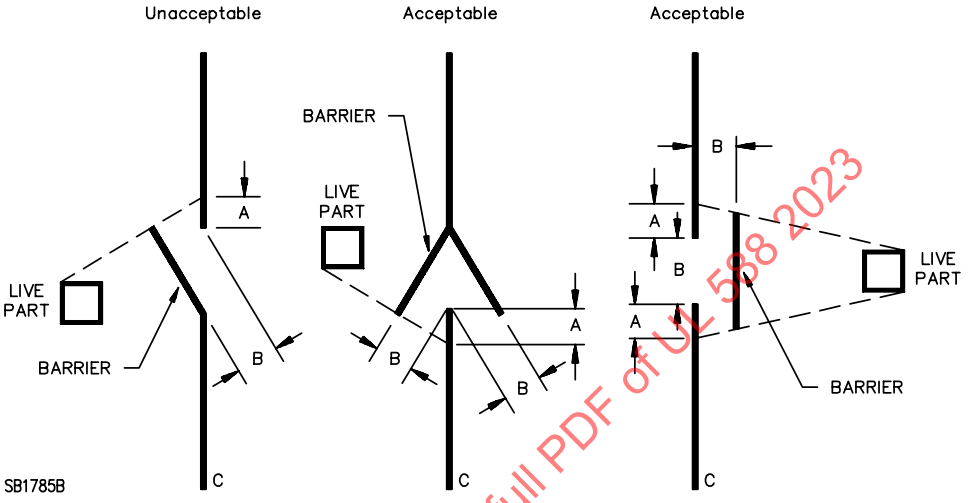
11.5 A ventilation opening shall not be located in any horizontal surface of the product. A horizontal surface is considered to be any surface in which the included angle is less than 45 degrees as measured between the inside surface of the enclosure containing the ventilation opening and the horizontal.

11.6 The barrier specified in 11.4 shall be of such dimensions and located such that a straight line drawn from any live part or arcing part, past the edge of the barrier, will intersect the enclosure a minimum of 0.25 inch (6.4 mm) from the edge of the opening. A live part shall not be located below the opening. Examples of both unacceptable and acceptable constructions are illustrated in Figure 11.1.

Exception: For a ventilation opening with a major dimension between 0.04 inches (1 mm) and 0.02 inches (0.5 mm), the 0.25 inch distance may be reduced proportional to the maximum major dimension of 0.15 inches (3.8 mm).

Figure 11.1

Ventilation openings



Notes:

A = The minimum 0.25 inch (6.4 mm) distance specified in 11.6

B = The opening sized in accordance with 11.3

C = The enclosure wall

12 Accessibility of Live Parts

12.1 Electric parts shall be located or enclosed so as to reduce the likelihood of unintentional contact with an uninsulated live part or any current-carrying live part, other than a class 2 circuit, considered to be a potential risk of electric shock. An uninsulated live part is considered to exist if the open-circuit potential between uninsulated live parts and ground is greater than 42.4 volts peak (30 V rms) and the available current through a 1500-ohm resistance, shunted by a capacitance of 0.15 µF, is more than 0.5 mA.

12.2 Accessibility of uninsulated live parts is to be determined by contact with the probe illustrated in Figure 9.1. The probe is to be applied to the area being investigated and rotated, changed in configuration, or angled to any position before, during, and after application. The probe is to be applied with a force of 1 lb (4.4 N).

12.3 The grounded (neutral) conductor shall not be accessible except during relamping of a parallel-connected, screw-base lamp.

13 Supply Connections

13.1 General

13.1.1 A seasonal lighting product shall be provided with a means for connection to the supply circuit. This means shall consist of one of the following:

a) An attachment plug or current tap provided as part of the product, such as for a lighting string,

b) An integral power-supply cord consisting of a length of flexible cord and an attachment plug or current tap,

c) A blade assembly located on the enclosure of the product for direct connection to the supply circuit, or

d) A power inlet intended for use with a cord set or detachable power-supply cord if the manufacturer:

1) Recommends the use of a cord set which complies with the Standard for Cord Sets and Power-Supply Cords, UL 817, and if a statement indicating the availability of such a cord set is marked on the product or is included in the instruction manual provided with the product, or

2) Provides a detachable power-supply cord with the product which complies with UL 817 and 13.1.3.

13.1.2 An ornament shall be provided with a means for connection to the push-in lampholder of a series-connected string or decorative outfit, such as a lampholder adapter or input leads and an adapter.

13.1.3 The length of a detachable power-supply cord provided with a product shall not be less than 8 inches (203 mm).

13.1.4 The conductor employed in a decorative lighting string shall be continuous, without a splice or tap, from fitting to fitting. A decorative outfit, or similar decorative products, may employ splices in accordance with Splices, Section 17.

13.1.5 The maximum current flow permitted in a fully loaded conductor of a seasonal product shall be in accordance with Table 13.1.

Table 13.1
Maximum conductor current and overcurrent protection

Wire size, AWG (mm^2)	Maximum conductor current / wattage amperes / watts	Overcurrent protection amperes
12 (3.31)	12 / 1440	N/A
14 (2.08)	12 / 1440	N/A
16 (1.31)	10 / 1200	10[b]
18 (0.82)	8[a] / 960	8[a]
20 (0.52)	3.6 / 432	5
22 (0.32)	1.8 / 216	3

[a] When an 8 A fuse is employed, the maximum current shall not exceed 8 A. When a 5 A fuse is employed, the maximum current shall not exceed 3.6 A.

[b] Overcurrent is required only when more than 3 load fittings are employed. A maximum of 6 load fittings are permitted when overcurrent protection is provided.

13.1.6 The conductors of the flexible cord or wire shall be fastened securely and in a workmanlike manner to the terminals of the attachment plug, current tap, or load fitting as determined by the Reliability of Conductor Connections Test, Section 72.

13.1.7 The supply connection requirements for a seasonal product are outlined in Table 6.1 and Table 6.2.

13.1.8 A seasonal product shall not employ wire positioning devices on non-enclosed flexible cord, wires, or conductors.

Exception: Products provided with a rigid frame employing wire positioning devices that do not deform the insulation of the flexible cord, wires, or conductors, need not comply with this requirement.

13.1.9 *Deleted*

13.1.10 A series-connected LED lighting string is permitted to be provided with a candelabra-base (E12) or intermediate-base (E17) male screw base for connection to the lampholders of a parallel-connected lighting string.

13.2 Cords

13.2.1 Cords employed in a seasonal product shall comply with the Standard for Flexible Cords and Cables, UL 62. All wire and cord shall have a minimum flame rating of VW-1.

Exception: Wire in a Class 2 or battery circuit with a maximum available power of 15 Watts and employs insulation less than 1/64 inch (0.4 mm) is not required to comply with the Standard for Flexible Cords and Cables, UL 62, or be rated VW-1.

13.2.2 In a decorative outfit with one or more medium-screw lampholders, the minimum cord size shall be 20 AWG (0.52 mm^2).

13.2.3 The flexible cord employed in an indoor-use parallel-connected seasonal product shall be a minimum 20 AWG (0.52 mm^2), Type XTW, parallel conductor cord or a minimum 18 AWG (0.82 mm^2) Type SPT-1 or SPT-2, all wire with a minimum insulation temperature of 105°C (221°F). Types SPT-1 and SPT-2 are suitable for both indoor and outdoor use when the cord type designation ends with the letter "W".

13.2.4 The wire employed in a series-connected seasonal product shall have a minimum insulation temperature of 105°C (221°F) and in accordance with the following:

a)Type CXTW, twisted conductor, minimum 22 AWG (0.32 mm^2);

b)Type XTW, 22 AWG (0.32 mm^2); or

c)Type CSTW-ES, CXTW-IS or CXTW-S, single conductor, a minimum 22 AWG (0.32 mm^2), when connected to attachment plugs/current taps/load fittings and for other power connectors, those connections shall meet the requirements in 43.14.1.

Type CXTW, CXTW-ES, CXTW-IS, CXTW-S and XTW wire are suitable for both indoor and outdoor use.

Exception No. 1: A decorative outfit is able to employ single-conductor Type CXTW wire as indicated in 31.7 provided that the lampholders or the wire or both are secured to and supported by a rigid frame.

Exception No. 2: When a net lighting string employs single conductor Type CXTW flexible cord, it shall be a minimum 18 AWG (0.82 mm^2).

Exception No. 3: When a series-connected seasonal product employs a polarized line and load fitting, it shall employ a minimum 20 AWG (0.52 mm^2) Type CXTW twisted conductor wire or 20 AWG (0.52 mm^2) XTW wire.

Exception No. 4: Single conductor CXTW wire is permitted to be employed if the wire is twisted with a non-current carrying polymeric supporting rope which is rated for at least 105°C and:

a) Complies with 82.1 when the support rope has a minimum diameter equivalent to the CXTW wire, or

b) Complies with 82.2 when the diameter of support rope is less than that of the CXTW wire.

When the seasonal product is for outdoor-use, then the non-current carrying polymeric rope shall also comply with the requirements in 94.2.

Exception No. 5: A lighting string that complies with 82.2 is permitted to be provided with a single CXTW conductor with integral parallel construction.

13.2.5 The maximum length of lay of CXTW twisted conductors shall not exceed an average, between any two fittings, of 15 times the sum of the outside diameters of the wires which are twisted together.

13.2.6 A detachable power-supply cord provided with a seasonal lighting product which employs a power inlet shall be Type SPT-2, or the equivalent.

13.2.7 The power-supply cord of a motorized product shall be minimum 20 AWG (0.52 mm^2), Type SPT-2, SJ, SJT, SJE, SJO, SJOO, S, ST, SE, SO, SOO, or S cord.

13.2.8 The power-supply cord of either a splice compartment or a controller, that is provided with an integrally-attached lighting string, shall be at least the same gauge and equivalent type of wire as the lighting string and shall be within the ampacity of the wire gauge as indicated in Table 13.1. The power-supply cord of a controller or splice compartment not provided with an integrally-attached lighting string, but provided with a dedicated receptacle, shall be suitable for the ampacity of the wire, but not smaller than 18 AWG (0.82 mm^2), and not lighter than Type SP-2 or SPT-2.

13.2.9 Non-exposed internal wiring in an enclosure may be appliance wiring material (AWM) with temperature, current, and voltage ratings suitable for the intended application.

13.2.10 The wire of flexible cord employed in a Class 2 circuit with a maximum available power of 50 Watts as measured in 49.2 – 49.4, shall be suitable for the current with a minimum of 1/64-inch (0.4-mm) thick insulation.

Exception: Wire employed in a Class 2 or battery circuit with a maximum available power of 15 Watts is able to have less than 1/64 inch (0.4 mm) of insulation.

13.2.11 A flexible cord provided with an additional decorative insulated covering over the insulation of the cord shall have a minimum flame rating of VW-1 for the combination of the decorative covering and flexible cord insulation. The combination shall not affect the integrity of the wire connections as determined by performing the appropriate conductor secureness or strain relief testing.

13.3 Wiring devices

13.3.1 In addition to the applicable requirements in this standard, an attachment plug, cord connector, current tap, power inlet, or other wiring device employed in a seasonal lighting product shall comply with the applicable requirements in the Standard for Attachment Plugs and Receptacles, UL 498, or the Standard for Cord Sets and Power-Supply Cords, UL 817.

Exception No. 1: Series-connected lighting strings or decorative outfits consisting of a series-connected lighting string with decorative covers, with a non-polarized fitting employing an integral controller and a nonstandard multi-pin connector shall comply with the following:

a) A minimum of 2 pins shall be provided.

b) The applicable requirements of the Standard for Attachment Plugs and Receptacles, UL 498, or the Standard for Cord Sets and Power Supply Cords, UL 817, and be suitable for making and breaking under load with respect to the Overload, Temperature, and Resistance to Arcing tests described in the Standard for Attachment Plugs and Receptacles, UL 498.

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

d) The connectors shall be subjected to the Rain Test, Section 89, in any position where the pins initially make an electrical connection.

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

f) The nonstandard multi-pin connector shall not be between the attachment plug and a controller, nor between the attachment plug and the first lampholder.

Exception No. 2: For seasonal products employing a Universal Serial Bus (USB) connector, the USB connector shall comply with the applicable requirements described in the Standard for Component Connectors for Use in Data, Signal, Control and Power Applications, UL 1977. Seasonal products employing a USB connector shall be considered as being employed in a Class 2 circuit where the available power does not exceed 15 Watts and comply with the applicable requirements.

Exception No. 3: Series-connected LED lighting strings provided with a candelabra-base (E12) or intermediate-base (E17) male screw base shall comply the applicable requirements described in Enclosures, Section 10, the applicable requirements for male screw bases described in Supplement SA, and with the following:

a) A hanging means shall be provided and secured near the first lampholder.

b) The maximum weight of the lighting string shall not exceed 7.4 lb when provided with an E12 male screw-base and 10.5 lb when provided with an E17 male screw-base.

c) The maximum total wattage of the lighting string shall not exceed 7 Watts.

d) A cord connector or other female fitting shall not be provided.

e) Overcurrent protection shall be provided in the male screw base for the following wire gauges used in the light string:

1) 3 Amp overcurrent protection for 22 AWG

2) 5 Amp overcurrent protection for 20 AWG

13.3.2 An attachment plug, current tap, or load fitting provided with a seasonal product shall be of a 2-pole, 2-wire, non-grounding configuration.

Exception: A 2-pole, 3-wire, grounding-type configuration is permitted to be used in a decorative outfit accessory employing minimum 14 AWG (2.08 mm^2) flexible cord.

13.3.3 A seasonal product shall not employ more than 3 loads or load fittings. For this requirement, a load or load fitting is considered to be a cord connector, a dedicated receptacle, the female contacts of a current tap, or a string or decorative outfit which is an integral part of the product.

Exception No. 1: A decorative outfit accessory is permitted to employ a maximum of 6 load fittings when a minimum 14 AWG (2.08 mm^2) flexible cord is provided or minimum 16 AWG (1.31 mm^2) when overcurrent protection as shown in Table 13.1 is provided.

Exception No. 2: A tree pole that employs a seasonal use cord set that complies with the requirements of the Standard for Cord Sets and Power-Supply Cords, UL 817, and is either attached or integrally installed, is permitted to employ a maximum of 9 load fittings.

13.3.4 A current tap employed in a seasonal lighting product shall be other than the screw shell type and shall not provide more than 3 loads or load fittings, including the string or outfit to which it is attached.

13.3.5 The face of a cord connector, current tap, or dedicated receptacle employed in a seasonal lighting product shall be:

a) Circular with a minimum area equal to the area of a 9/16-inch (14.2-mm) radius circle, the center point of which is coincident with the intersection of a center line drawn through the center of the slots. See Figure 13.1 for details; or

b) Rectangular with a minimum area equal to the area of a 1- by 3/4-inch (25.4- by 19.0-mm) rectangle with a 7/32-inch (5.6-mm) radius at the corners and provided with a 3/16-inch (4.8-mm) radius half-circle projection from the center of each of the 1-inch (25.4-mm) sides. See Figure 13.2 for minimum dimensions.

Exception No. 1: The projections need not be in the shape of a half-circle if they are located as shown in Figure 13.2, provide a minimum overall dimension of 1-1/4 inches along the center line between the contact slots, and occupy an area equal to or greater than that indicated by the shading in the figure.

Exception No. 2: The half-circle projections need not be provided if the face is sized such that the dimension along the center line between the contact slots is a minimum of 1-1/4 inches so that the face provides the obstruction that would have been provided by the half-circle projections. See Figure 13.2.

Figure 13.1

Slot location and face size

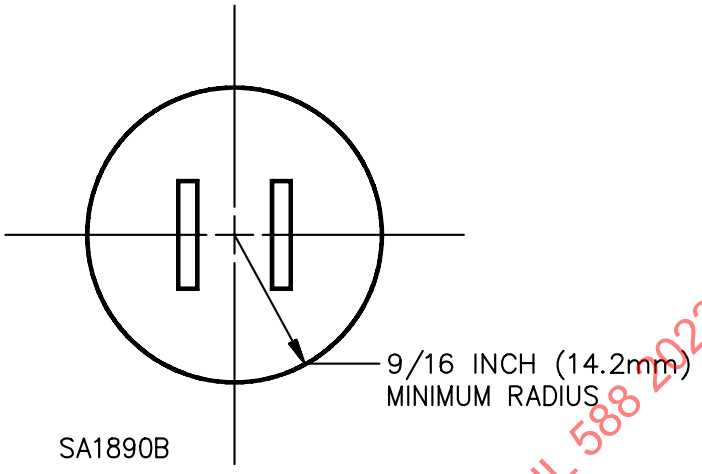
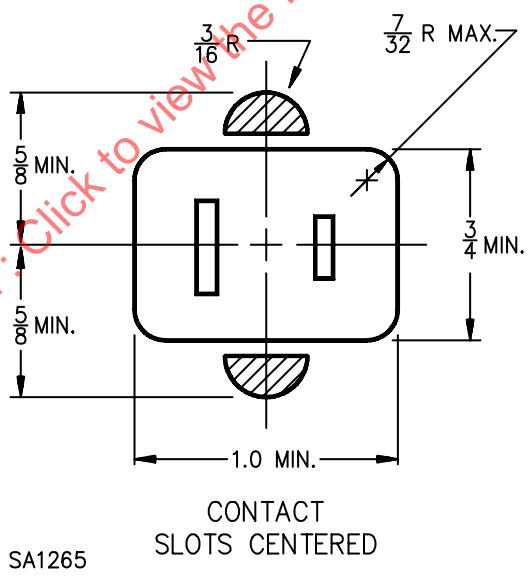


Figure 13.2

Face dimensions

All dimensions are in inches



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

13.3.6 An attachment plug, a power inlet, or a load fitting employed in a seasonal product shall be rated in accordance with Table 13.2. A current tap shall be rated 15 A.

Table 13.2
Minimum wiring device rating

Conductor Size		
AWG	(mm^2)	Minimum Wiring Device Rating
12	(3.31)	15
14	(2.08)	15
16	(1.31)	10
18	(0.82)	8[a]
20	(0.52)	5
22	(0.32)	3

[a] For 18 AWG products with a 5 Amp fuse rating, the wiring device rating shall be a minimum of 5 amps.

13.3.7 A ground-supported seasonal lighting product shall be constructed such that the power inlet or similar means will not come in contact with the ground when it is situated in the intended operating position.

13.3.8 If a seasonal lighting product employs a power inlet intended for use with a cord set or detachable power-supply cord, the connecting means to the power supply of the product shall be constructed such that, when the cord connector of a cord set or detachable power-supply cord is inserted, the blades will not be energized until they are inaccessible to contact by persons. Compliance shall be determined by the Accessibility Test, Section 76.

13.3.9 A seasonal lighting product employing a power inlet intended for use with a cord set or detachable power-supply cord, shall not be provided with terminal pins that will accommodate a standard flatiron or appliance coupler.

13.4 Polarization

13.4.1 The attachment plug, current tap, or power inlet of a seasonal product employing a parallel-connected string, parallel-connected lampholders, or a decorative lighting harness shall be of the polarized type. The attachment plug, current tap, or power inlet of a series-connected seasonal product employing a series-connected string or series-connected lampholders shall be of the non-polarized type.

Exception No. 1: A series-connected string marked in accordance with 125.4.3 shall employ a polarized line and load fitting.

Exception No. 2: A series-connected string marked in accordance with 125.5.2 shall employ a polarized attachment plug.

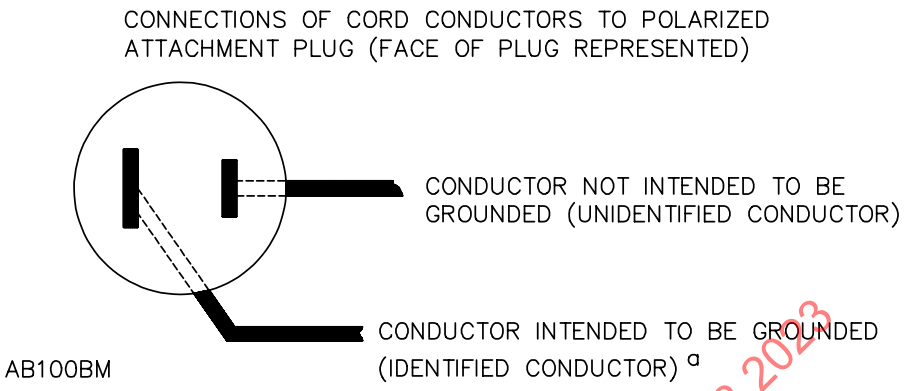
13.4.2 A non-polarized configuration shall not be employed on a product with an input current greater than 0.6 A.

13.4.3 If a polarized attachment plug or current tap is provided, the connection shall comply with Figure 13.3 and the polarity identification of the flexible cord shall comply with Table 13.3.

Exception: A string employing Type CXTW conductor wire need not comply with this requirement.

Figure 13.3

Connection to attachment plugs



Note: [a] Signifies a conductor identified in accordance with Table 13.3.

Table 13.3
Polarity identification of flexible cords

Method of identification	Acceptable combinations	
	Wire intended to be grounded	All other wires
Color of insulation on individual conductors for jacketed cord[a]	Solid white or gray	Solid color other than white or gray
	Light blue	Solid color other than light blue, white, or gray
Other means for parallel conductor construction	Tin or other white metal on all strands of the conductor[b]	No tin or other white metal on the strands of the conductor[b]
	A stripe, ridge, or groove on the exterior surface of the cord[c]	Without a stripe, ridge or groove on the exterior surface of the cord[c]

[a] For jacketed wire, a wire finished to show a green color with or without one or more yellow stripes or tracers shall not be used.

[b] Only for Types XTW, SPT-1 and SPT-2 cords with transparent insulation.

[c] Only for Types XTW, SPT-1, and SPT-2 cords.

13.4.4 A current tap or a load fitting, such as a cord connector or dedicated receptacle, employed in a seasonal lighting product provided with a polarized attachment plug shall be of the polarized type. A current tap or load fitting employed in a seasonal lighting product provided with a non-polarized attachment plug shall be of the non-polarized type.

13.4.5 The conductor of the power-supply cord that is intended to be ungrounded (hot) shall have the following items connected to it, if provided:

a) The center contact of a parallel-connected screw lampholder,

b) The terminal or lead of a load fitting intended to be ungrounded (hot),

c) The overcurrent-protective device in a parallel-connected product, and

d) A manually-operated, line-connected, single-pole switch.

13.4.6 A polarized configuration shall only be employed on a product with 20 AWG (0.52 mm^2) or larger wire.

Exception: A series- or series-parallel-connected decorative lighting string or decorative outfit without a load fitting, employing Type CXTW 22 AWG (0.32 mm^2) wire, and marked in accordance with 125.5.2 shall employ a polarized attachment plug.

13.4.7 A product employing a polarized detachable power-supply cord shall not accommodate a non-polarized cord.

13.5 Grounding

13.5.1 A load fitting, such as a cord connector or dedicated receptacle, employed in a decorative outfit accessory provided with a grounding type attachment plug shall also be of the grounding type.

13.5.2 The conductor of the power-supply cord that is intended for grounding shall be connected to the grounding terminal of the load fitting.

14 Terminals and Conductive Parts

14.1 Terminals and conductive parts shall not be constructed of copper plated steel.

14.2 A terminal shall be suitable for the gauge and insulation thickness of the wire intended to be used.

14.3 Current-carrying parts shall be of silver, copper, copper alloy, or other material acceptable for the particular application and shall be mounted on polymeric, phenolic or urea composition or on another insulating material acceptable for the purpose. LED lamp leads shall not be plated steel.

15 Strain Relief

15.1 A seasonal lighting product shall be provided with strain relief such that a pull exerted on the supply cord cannot be transmitted directly to terminals, splices, or interior wiring of the unit.

Exception No. 1: Strain relief need not be provided if the conductors of the supply cord are permanently assembled to a wiring device, such as a switch or lampholder, by the manufacturer of the device or at the point of final assembly of the device in such a manner that replacement of the cord requires disassembly of the device by removal of a rivet, drive screw, drive pin, or the equivalent. If assembled at the point of final assembly, the device is to be capable of withstanding the pull stated in 46.2.

Exception No. 2: An ornament shall instead comply with the strain relief requirements described in 15.5.

15.2 If a seasonal lighting product is provided with a wiring device, such as an attachment plug, cord connector, or current tap, strain relief shall be provided such that a pull exerted on the wire or cord cannot be transmitted directly to the terminals or interior wiring of the wiring device. Compliance shall be determined by the Strain Relief Test, Section 71.

15.3 If a seasonal lighting product is provided with a series-connected lampholder, strain relief shall be provided for the wire attachments at each lampholder, and the insulation on each connected wire shall be held securely. Compliance shall be determined by the Lampholder Strain Relief Tests, Section 79.

Exception: An ornament shall instead comply with the strain relief requirements described in 15.5.

15.4 Each surface borne upon or otherwise contacted by a strain-relief knot in a flexible cord shall be free from all burrs, fins, and other projections or sharp edges that can damage the wires.

15.5 An electronically-operated ornament shall be provided with strain relief such that a pull exerted on any external leads subject to handling cannot be transmitted directly to the terminals, splices, or internal wiring of the unit, including the adaptor. Acceptability shall be determined by the Strain Relief Test, Section 107. A non-electronically-operated ornament shall comply with the Lampholder Strain Relief Tests, Section 79.

16 Spacings

16.1 The minimum spacings between live parts of opposite polarity, between live and dead-metal parts, and between live parts and an accessible metal enclosure shall be as specified in Table 16.1. If a live part is not rigidly secured in position by means other than friction between surfaces, or if a movable dead-metal part is in proximity to an uninsulated live part, the construction shall be such that the minimum acceptable spacings are maintained. All uninsulated live parts connected to different circuits, including all secondary circuits, shall be spaced from one another as though they were parts of opposite polarity and shall be judged on the basis of the highest voltage involved.

Exception No. 1: Spacings are not specified between two uninsulated parts if the power available between them is less than 15 watts as determined in accordance with the Component Power Measurement Test, Section 49.

Exception No. 2: A lampholder shall instead comply with the spacing requirements described in Lampholders, Section 22, and Seasonal-Lighting Lampholders, Supplement SB.

Exception No. 3: An ornament shall instead comply with the spacing requirements described in 16.4.

Exception No. 4: An attachment plug, current tap, or load fitting shall instead comply with the spacing requirements in the Standard for Attachment Plugs and Receptacles, UL 498.

Exception No. 5: A switch shall instead comply with the spacing requirements in the Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1.

Table 16.1
Spacings

Potential involved, volts rms[a]	Minimum spacings, inches (mm)		
	Through air	Over surface	Shortest distance to accessible metal enclosure
0 – 50	1/16 (1.6)	1/16 (1.6)	1/16 (1.6)
51 – 150	1/16 (1.6)	1/16 (1.6)	1/8 (3.2)

[a] For peak voltages, multiply applicable rms voltage by 1.414.

16.2 Film-coated wire is considered to be a live part in determining compliance of a product with the spacing requirements.

Exception: If the film-coated wire is used as turn-to-turn insulation in coils, the spacings between turns need not comply with the spacing requirements.

16.3 Spacings on a printed wiring board assembly employed in a seasonal lighting product shall comply with the values in Table 16.1.

Exception No. 1: The spacings on a printed wiring board assembly may be a minimum of 1/32 inch (0.8 mm) if the spacing has been determined acceptable for use with a conformal coating that is used to cover

the conductors. The conformal coating shall comply with the requirements for conformal coating in the Standard for Polymeric Materials– Use in Electrical Equipment Evaluations, UL 746C.

Exception No. 2: The spacings on a printed wiring board assembly employed in an electronically-operated ornament shall instead comply with the spacing requirements in 16.4.

16.4 For an ornament, the spacings between uninsulated live parts of opposite polarity, and uninsulated live parts and the metal enclosure shall:

a) Be a minimum 1/32 inch (0.8 mm), or

b) Be subjected to the Abnormal Operation Test, Section 48.

17 Splices

17.1 The number of splices in a decorative outfit shall be kept to a minimum. Each splice shall comply with each of the following items (see 13.1.4):

a) Each splice shall be soldered, welded, or otherwise effectively assembled by means of a connector. A soldered joint shall be mechanically secure before soldering.

b) Each splice shall be enclosed as indicated in Mechanical Assembly, Section 9, Enclosures, Section 10, Accessibility of Live Parts, Section 12, and Spacings, Section 16, and protected such that the splice cannot be subjected to a strain or other mechanical abuse.

17.2 A lead is considered to be mechanically secure when one or more of the following is provided:

a) At least one full wrap around a terminal.

b) At least one right angle bend when passed through an eyelet or opening.

c) Twisting with other conductors.

Exception: When the construction cannot be mechanically secured before soldering, it is permitted to solder the connection without mechanical securement provided both sides of the connection are secured in such a way that the stress on the connection, either during or after manufacturing process, has been shown to be unlikely and the product employing the construction complies with the appropriate Strain Relief test for lampholders described in Section 79.

18 Class 2 Circuits

18.1 A Class 2 circuit shall be derived from the output of:

a) A Class 2 transformer which complies with the applicable requirements in the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1, and the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3; or

b) A Class 2 power unit which complies with the applicable requirements in the Standard for Class 2 Power Units, UL 1310; or

c) A power unit which complies with the applicable requirements for a limited power source (LPS) in the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1; or

d) A power unit which complies with the applicable requirements for a limited power source (LPS) in the Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1; or

e) An LED Driver for non-integral LED lighting strings that complies with the applicable requirements in the Outline of Investigation for Seasonal Use LED Drivers and Non-Integral LED Lighting Strings, UL 2749.

18.2 A product that is provided with a detachable Class 2 power supply shall be marked as described in 125.13.1.

19 Switches

19.1 In addition to the applicable requirements in this standard, a switch employed in a seasonal product shall comply with the applicable requirements in the Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1. A photoelectric switch shall comply with the requirements in the Standard for Nonindustrial Photoelectric Switches for Lighting Control, UL 773A.

Exception: A switch employed in a Class 2 circuit need not comply with the requirements in UL 61058-1 or UL 773A.

19.2 A snap switch provided to control one or more incandescent lamps in a product that does not employ a load fitting shall have a current rating not less than the maximum current it controls and, shall be tungsten-rated, when controlling tungsten-filament lamps.

19.3 The rating of a switch which controls the load fitting of a product shall be tungsten rated equal to the fuse rating.

19.4 In determining the required switch rating for a product without a load fitting, the sum of the marked ratings of any fixed loads shall be used. For a product without a load fitting and with lampholders, the switch shall be sized based on the Input Test, Section 42, with all loads set to draw the maximum current.

19.5 An on/off switch which controls all functions of a product employing a polarized attachment plug or current tap shall be a single-pole switch connected to the ungrounded (hot) supply conductor. An on/off switch which controls all the functions of a product employing a non-polarized attachment plug or current tap shall be a double-pole switch connected such that it disconnects both sides of the line simultaneously.

Exception: An on/off switch located in a Class 2 Circuit need not comply with this requirement.

20 Printed Wiring Boards

20.1 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.

20.2 The temperature rating of a printed wiring board shall be equivalent to the temperature measured during the Temperature Test, Section 43, when corrected to 25°C (77°F) ambient temperature.

21 Bushings

21.1 At the point where a flexible cord passes through an opening in a wall, barrier, or enclosing case, there shall be a bushing or equivalent protection for the cord. A bushing shall be secured in place, and shall have a smooth, rounded surface against which the cord can bear. If the wall or barrier is of metal, an insulating bushing shall be provided. See 11.2.

21.2 If the cord hole is in wood, porcelain, phenolic composition, or another nonconducting material, a smooth, rounded surface is considered to be equivalent to an insulating bushing.

21.3 Ceramic materials and some molded composition are acceptable for insulating bushings. Separate insulating bushings of wood, rubber, or hot-molded shellac and tar compositions are not acceptable. Fiber may be employed if all three of the following conditions are met:

a) The fiber is not to be subjected to a temperature in excess of 90°C (194°F) under normal operating conditions.

b) The bushing is not to be thinner than 3/64 inch (1.2 mm).

c) The fiber is to be formed and secured in place so that it cannot be affected adversely by ordinary conditions of moisture.

22 Lampholders

22.1 General

22.1.1 A midget or miniature Edison-screw or push-in lampholder shall only be used:

a) In a series-connected string or a decorative outfit, tree stand, or similar decorative product employing series-connected lampholders, or

b) In a Class 2 circuit.

22.1.2 A candelabra or intermediate screw lampholder shall only be used in a parallel-connected string or a decorative outfit, tree stand, or similar product, employing parallel-connected lampholders.

22.1.3 A medium screw lampholder shall only be used in a decorative outfit employing parallel-connected lampholders.

22.1.4 Connections between lampholder terminals and leads that are not sealed in place shall be soldered.

Exception: Candelabra-screw lampholders intended for indoor use and lampholders with insulation-piercing terminals need not comply with this requirement.

22.1.5 When assembled to conductors or cord of the type and size intended, the opening in the lampholder through which the conductors or cord are routed shall be free of sharp edges, burrs, or fins.

22.2 Series-connected

22.2.1 General

22.2.1.1 The body of a lampholder shall comply with the Crush Test, Section 83, have a minimum temperature of 90°C and be:

a) A thermoplastic material which complies with the requirements in 10.3.10, and the Oven Test, Section 78; or

b) A thermoset material such as phenolic or urea.

22.2.1.2 The body of a lampholder which is less than 0.15 inch^3 (2500 mm^3) shall meet the requirements in either 22.2.1.2A or 22.2.1.2B.

22.2.1.2A The body of a lampholder shall be molded of a material that has a flammability rating of SC-0 or SC-1 in accordance with the Standard for Tests for Flammability of Small Polymeric Component Materials, UL 1694, when testing is performed on standardized flame bars of 55 (±0.5) × 13.0 (±0.5) mm at a thickness of 0.8 (±0.1) mm or less.

22.2.1.2B For non-replaceable lamps that are not of a molded construction, the lampholder is permitted to consist of a tubing material that has been determined suitable for use in the Standard for Seasonal and Holiday Decorative Products, UL 588, and the tubing shall:

a) Be rated 90°C,

b) Comply with the Tensile Strength requirements in the Standard for Extruded Insulated Tubing, UL 224,

c) If in direct contact with uncoated copper, comply with the Copper Corrosion Test in the Standard for Extruded Insulated Tubing, UL 224, and

d) Be provided with a polymeric material enclosing tubing and the lamp leads. The polymeric material shall be rated 90°C and have a flammability rating of SC-0 or SC-1 in accordance with the Standard for Tests for Flammability of Small Polymeric Component Materials, UL 1694, when testing is performed on standardized flame bars of 55 (±0.5) × 13.0 (±0.5) mm at a thickness of 0.8 (±0.1) mm or less.

22.2.1.2C The lampholder must comply with the Flammability Test for Small Components specified in the Standard for Tests for Flammability of Small Polymeric Component Materials, UL 1694, except that the bottom of the lampholder shall be located 11.8 ±0.39 inch (300 ±10 mm) above the cotton indicator and the flame application time shall be 10 seconds. Total consumption of the component or specimen or ignition of the cotton indicator by flaming particles or drops shall not be allowed.

22.2.1.3 A miniature screw (E10) lampholder shall comply with all of the following:

a) There shall be accommodation for a lamp with a screw base that has 14 threads per inch (0.55 threads per millimeter) and a nominal diameter of 3/8 inch (9.5 mm).

b) The lampholder depth shall be from 17/32 – 19/32 inch (13.5 – 15.1 mm), measured from the plane of the open end to the highest point on the center contact (depressed if flexible).

c) The spacing between parts of opposite polarity and between live and dead metal parts shall not be less than 1/32 inch (0.8 mm).

d) The lamp screw base shall not be contacted by the probe shown in Figure 9.1 while a lamp that complies with the maximum height of the base as indicated in Table 22.1 is fully seated in the lampholder.

Table 22.1
Maximum height of metal base

Base size	Height inches (mm)
Miniature (E10)	17/32 (13.5)
Midget (E5)	23/64 (9.1)

22.2.1.4 A midget screw (E5) lampholder shall comply with all of the following:

a) There shall be accommodation for a lamp with a screw base that has 25.4 threads per inch (1 thread per millimeter) and a nominal diameter of 3/16 inch (4.8 mm).

b) The lampholder depth shall be a minimum 23/64 inch (9.1 mm), measured as described in 22.2.1.3(b).

c) The spacing between parts of opposite polarity and between live and dead metal parts shall not be less than 1/32 inch (0.8 mm).

d) The lamp screw base shall not be contacted by the probe shown in Figure 9.1 while a lamp that complies with the maximum height of the base as indicated in Table 22.1 is fully seated in the lampholder.

22.2.1.5 The spacing between parts of opposite polarity and between live and dead metal parts shall not be less than 1/32 inch (0.8 mm) for a push-in or non-replaceable lampholder. The push-in lamp shall be provided with an adapter which secures the lamp into the lampholder by push-in friction fit, or by a latching mechanism which snap-fits the lamp in place. The adapter shall be constructed of the same material as the lampholder.

22.2.1.6 A screw shell shall be fastened in place to reduce the likelihood of loosening, twisting, or straining against electrical connections. The screw shell of a midget- or miniature-screw lampholder shall comply with the "Go" and "Not Go" gauges made in accordance with the specifications for Gauges for Electric Lamp Bases and Lampholders, ANSI C81.63.

22.2.1.7 Live parts in a series-connected lampholder shall not be exposed before, during, or after insertion of a lamp of the size for which the lampholder is intended. Accessibility of live parts is to be determined by contact with the probe illustrated in Figure 9.1. The probe is to be inserted into any opening in the lampholder or lamp, or the lampholder and lamp assembly.

Exception No. 1: A lampholder located in a Class 2 circuit need not comply with this requirement.

Exception No. 2: A miniature screw lampholder need not comply with this requirement.

22.2.1.8 For a series-connected lampholder, contacts shall be secured in the lampholder body by means other than friction alone so as to reduce the likelihood of their displacement. Compliance shall be determined by the Secureness of Lampholder Contacts Test, Section 80.

22.2.1.9 For a series-connected lampholder employing three leads, connection between two of the leads shall be made mechanically secure before securement in the lampholder body. The lampholder shall be tested for compliance with the Secureness of Lampholder Contacts Test, Section 80.

22.2.1.10 A midget push-in type series- or, series-parallel connected string employing spring-loaded lampholder contacts shall be provided with a minimum of one supplementary protector as indicated in 7.8 in each series-connected circuit. The lampholder shall also comply with the Cascading Lamp Temperature Test, Section 85, Cycling Test, Section 86, Lampholder Millivolt Drop Test, Section 81, and Leakage Current Following Humidity Conditioning, Section 41. In addition, these contacts shall not be used in strings that employ less than 20 lampholders.

22.2.2 Outdoor use

22.2.2.1 The screw shell or contacts of a series-connected lampholder employed in a product intended for outdoor use shall be of copper or of an alloy that contains at least 80 percent copper.

22.2.2.2 A series-connected lampholder intended for outdoor use shall be provided with drain holes, or the equivalent, and shall be designed to reduce the likelihood of accumulation of water in the lampholder cavity.

22.2.2.3 A material used for the body of a series-connected lampholder or a polymeric material described in 22.2.1.2B intended for outdoor use shall be resistant to Ultraviolet (UV) weathering and exposure to water as determined by compliance with the Ultraviolet (UV) Light Exposure and Water Immersion Tests, Section 94.

Exception: Materials that comply with the outdoor use requirements described in the Standard for Safety for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, do not need to be subjected to the tests in Section 94.

22.3 Parallel-connected

22.3.1 Candelabra and intermediate screw lampholders shall comply with the requirements for seasonal lighting lampholders contained in Seasonal-Lighting Lampholders, Supplement SB. Medium screw lampholders shall comply with the requirements for seasonal lighting lampholders contained in Supplement SB where specifically indicated in addition to requirements for general-use medium screw lampholders contained in the Standard for Lampholders, UL 496. Medium screw lampholders employed in products intended for outdoor use shall also comply with the requirements for weatherproof lampholders contained in UL 496.

22.3.2 The screw shell of each Edison-screw parallel-connected lampholder shall be connected to the terminal or lead that is intended to be connected to the grounded (neutral) conductor of the power-supply circuit. The center contact of each Edison-screw parallel-connected lampholder shall be connected to the terminal or lead that is intended to be connected to the ungrounded (hot) conductor of the power-supply circuit.

23 Lamps

23.1 A lamp employed in a seasonal lighting product shall comply with the requirements for Seasonal-Lighting Lamps, Supplement SA.

23.2 A lamp provided with a shunt:

a) Shall be provided only in a series-connected string or a decorative outfit employing 20 or more push-in or midget screw lampholders or 8 or more miniature screw lampholders, and

b) Shall have its suitability determined in conjunction with the requirements for Overcurrent Protection, Section 7, and the Cascade Lamp Burnout Simulation Test, Section 84, and

c) Shall be replaceable.

24 Lamping

24.1 Each string or decorative outfit shall be provided with a number of lamps equal to or greater than the number of lampholders in the string or unit. The string or unit shall be evaluated as indicated in 118.1.

Exception: If a product employs one or more medium screw lampholders, lamp(s) need not be provided.

24.2 Each product employing push-in or midget or miniature screw lampholders with user-replaceable lamps in accordance with 24.1 shall be provided with at least two spare lamps for each type of lamp installed in the product. Each product employing steady-illuminating push-in type lamps without lamp

shunts shall be provided with at least four spare lamps. The spare lamps shall be of the same type as provided in the product, such as steady burning, ballast, or individual-flashing lamps. The number of spare lamps required above shall be provided for each different type of lamp provided in the product.

Exception No. 1: A product employing only one lampholder need only be provided with one spare lamp.

Exception No. 2: A product employing LED lamps need only be provided with two spare lamps.

25 Fuseholders and Fused Attachment Plugs

25.1 In addition to the applicable requirements in this standard, a fuseholder located in the enclosure of a unit shall comply with the Standard for Fuseholders – Part 1: General Requirements, UL 4248-1, and a fused attachment plug or current tap shall comply with the Standard for Attachment Plugs and Receptacles, UL 498, or the Standard for Cord Sets and Power-Supply Cords, UL 817. An in-line fuseholder with insulation-piercing terminals shall also comply with the requirements for In-Line Fuseholders with Insulation-Piercing Terminals for Seasonal Products, Supplement SC.

25.2 The fused attachment plug, current tap, fuseholder, or in-line fuseholder shall be constructed such that there shall not be exposure of live parts during removal or replacement of the fuse(s). In addition, for a fused attachment plug or current tap, there shall not be exposure of live parts with the fuse cover partially open during 0.08 inch (2.03 mm) insertion into a receptacle. Exposure of live parts shall be determined by contact with the accessibility probe illustrated in Figure 9.1.

25.3 The fuse cover of a fuseholder, in-line fuseholder, or fused attachment plug or current tap shall not be detachable from the device as determined by the Fuseholder Cover Test, Section 69.

25.4 A fuseholder, in-line fuseholder, or fused attachment plug or current tap employed in a product intended for outdoor use shall comply with the requirements for Outdoor-Use Products, Section 27.

26 Devices Employing Insulation-Piercing Terminals

26.1 A device employing insulation-piercing terminals shall be for use only with Type XTW, SPT-1, or SPT-2 parallel conductor flexible cord that complies with the Standard for Flexible Cords and Cables, UL 62.

26.2 If a device employs insulation-piercing terminals, it shall comply with the Temperature Tests for Devices Employing Insulation-Piercing Terminals, Section 54.

27 Outdoor-Use Products

27.1 A product, other than a series-connected lighting string, intended for outdoor use shall comply with the Rain Test, Section 89. A series-connected lighting string shall comply with the Rain Test described in Section 90.

27.2 A product intended for outdoor use which employs polymeric materials shall also comply with the Drop Test, Section 59, to be performed using a concrete surface, the Cold Impact Test, Section 61, and the Ultraviolet (UV) Light Exposure and Water Immersion Tests, Section 94.

Exception No. 1: An enclosure fabricated of material evaluated for resistance to ultraviolet light and water exposure and immersion in accordance with the requirements specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, need not be evaluated to Section 94.

Exception No. 2: The lampholders employed in series-connected lighting strings are not required to be subjected to these tests.

27.3 A controller, splice compartment, direct plug-in unit, or similar component, that is intended for outdoor use and is likely to be ground supported, whether a separate product or provided as part of a product, shall also comply with the Standing Water Immersion Test, Section 91.

27.4 An enclosure, controller, splice compartment, or similar component, of a product intended for outdoor use shall be provided with a gasket or similar sealing device, and shall not rely on ultrasonic welds to seal out moisture. The gasket shall comply with the requirements for wet locations in the Standard for Gaskets and Seals, UL 157, and the Gasket Test, Section 92, in addition to the requirements in 27.5 and 27.6.

Exception: Gaskets constructed of neoprene or silicone rubber do not need to be subjected to the gasket test when the material is used within its generic rating described in 27.6.

27.5 A gasket employed in a product intended for outdoor use shall be secured such that the removal of a lamp from the unit or the opening of a panel or a frame for relamping shall not cause the gasket to loosen. Clips or a clamping ring are an acceptable means of securement. A gasket secured by adhesive shall comply with the Gasket Adhesion Test, Section 93.

27.6 A gasket employed in a product intended for outdoor use shall be constructed of an acceptable material. Neoprene rubber is acceptable for a 60°C (140°F) service temperature and silicone is acceptable for a 105°C (221°F) maximum service temperature.

27.7 An enclosure employed in a product intended for outdoor use shall comply with the requirements in 10.3.5 and 10.3.8.

27.8 For an outdoor-use decorative outfit provided with both lampholders and a decorative part such as a shade, diffuser, blow molded figure, or similar decorative cover, the decorative part shall be provided with a minimum 1/4 inch (6.4 mm) diameter drain hole to reduce the likelihood of accumulated water reaching the lampholder.

Exception: A decorative cover employed in a decorative outfit consisting of individual decorative covers provided over a maximum of 2 lamps of a series-connected lighting string, need not be provided with drain holes.

27.9 Lampholders employed in a product intended for outdoor use shall also comply with 22.2.2.1 – 22.2.2.3.

27.10 Non-moisture absorptive electrical insulation shall be used in the construction of electrical components where it is relied upon to provide electrical spacings or direct or indirect support of uninsulated live electrical parts. Untreated electrical grade paper used in transformers and untreated fiber are examples of materials that shall not be used. Vulcanized fiber, phenolic, urea, porcelain, and similar insulators, are examples of acceptable materials.

27.11 For decorative outfits provided with parallel-connected lampholders there shall be a minimum spacing of 1.5 inches (38 mm) between the live parts and the ground. For decorative outfits provided with series-connected lampholders, the lampholders shall not be ground supported.

SERIES-CONNECTED STRINGS

28 General

28.1 Except as provided in 28.3 and 28.4, a series-connected string shall accommodate only one type of lamp with a minimum of 8 miniature-base lamps or 10 push-in or midget-base lamps. Type is defined as the same voltage, current rating, and connection (i.e. push-in, screw-type, or other design).

Exception No. 1: It is acceptable for a series-connected string employing individually flashing lamps to have lamps with different ratings for the steady illuminating and individually flashing lamps.

Exception No. 2: It is acceptable for lamps with different ratings to be used if the strings employ only LED lamps.

Exception No. 3: All of the lamps in the string are replaceable when the lighting string is constructed such that the lamps of one rating physically cannot fit into a lampholder intended for a lamp of another rating, making an electrical connection. In addition, when the lamp adapters are relied upon to prevent insertion of the lamp into the lampholder, it shall be secured to the lamps by an adhesive that complies with the requirements in the Adhesive Test, Section 63.

28.2 The maximum current draw for a series-connected string shall be 0.60 A.

Exception: The maximum current draw for a series- or series-parallel-connected decorative lighting string without a load fitting, and employing a polarized attachment plug can be 1.8 A if the product is marked in accordance with 125.5.2.

28.3 A series-connected string intended for use with individual-flashing lamps that operate by means of a self-contained thermostatically-operated shunting device shall consist of one of the following (see also 28.4):

a) Not less than 18 push-in lampholders in series with 2 midget-screw lampholders.

b) Not less than 18 midget-screw lampholders in series with 2 miniature-screw lampholders.

c) Not less than 35 lamps connected in series with a minimum of half of the lamps in the lighting string being steady-illuminating and one of the following:

1) All of the lamps in the string are not replaceable, or

2) All the lamps in the string are replaceable and the lighting string is constructed such that the individual-flashing lamps cannot fit into the lampholder such that it makes an electrical connection with the lampholder intended for steady-illuminating lamps. In addition, the lamp adapters must be secured to the lamps by an adhesive that complies with the requirements outlined in Section 63, the Adhesive Test.

Exception: When the construction of the lighting string is such that replacement of steady illuminating lamps with individual-flashing lamps is not possible, then no adhesive is required.

3) A minimum of half of the lighting string shall be steady-illuminating lamps and non-replaceable. The remaining lamps shall be permitted to be replaceable. These strings would be required to be provided with the marking described in 125.3.9.

d) Not less than 70 lamps connected in series with a minimum of half of the lamps in the lighting string being steady-illuminating provided that the string additionally comply with the Cascading Lamp Temperature test described in Section 85.

28.4 The two larger size lampholders in each of the series-connected strings described in 28.3 are for the accommodation of current-limiting ballast lamps. Each of these ballast lamps is to be rated for at least 60 V and the two in series, alone, are to limit the current to less than or equal to 0.60 A.

28.5 Series-connected strings employing miniature screw-base lamps are limited to indoor-use only and shall be marked in accordance with 125.1.3.

28.6 Series-connected strings intended for installation on the ribs or internal mechanism of a patio umbrella shall additionally comply with the cycling test described in Section 96, Decorative Lighting String Intended for Use on a Patio Umbrella, when mounted as intended in accordance with the installation instructions.

PARALLEL-CONNECTED STRINGS

29 General

29.1 A parallel-connected string shall employ only intermediate- or candelabra-screw lampholders, shall have at least 7 lampholders, and the total wattage of the lighting string shall not exceed the conductor current as indicated in Table 13.1.

29.2 Each lampholder in a parallel-connected string shall be switchless.

29.3 A lamp employed in a parallel connected string shall have a maximum rating of 7 watts (0.058 A at 120 V).

29.4 The conductors of a parallel-connected string shall terminate in a lampholder or an enclosure which complies with the requirements for polymeric enclosures contained in 10.1.1 – 10.1.4 and 10.3.1 – 10.3.10.

DECORATIVE LIGHTING HARNESSES

30 General

30.1 A decorative-lighting harness shall comply with the requirements for parallel-connected strings except that a maximum of 6 lampholders shall be provided and medium screw lampholders may be employed.

30.2 A decorative-lighting harness shall be provided with lamps, lampholders, an attachment means, wire and overcurrent protection. A decorative-lighting harness may also be provided with a switch, a load fitting, or both.

30.3 A decorative-lighting harness shall not exceed 1.75 A as measured during the Input Test, Section 42, with the maximum marked wattage replacement lamps installed.

30.4 The wire employed in a decorative-lighting harness shall terminate in a lampholder or an enclosure which complies with the requirements for polymeric enclosures contained in 10.1.1 – 10.1.4 and 10.3.1 – 10.3.10.

DECORATIVE OUTFITS

31 General

31.1 A series string employing push-in or midget or miniature base lamps that is used in a decorative outfit, tree stand, or similar product, shall comply with all the requirements applicable to series-connected strings. A parallel string or parallel-connected lampholder that is used in a decorative outfit, tree stand, or similar product, shall comply with all the requirements applicable to parallel strings.

Exception No. 1: Fewer lamps than specified in 29.1 for parallel-connected strings may be employed.

Exception No. 2: Fewer lamps than specified in 28.1 for series-connected strings may be employed if the series-connected lamp or lamps are not provided with shunts. The decorative outfit shall be marked in accordance with 125.3.6.

31.2 A decorative outfit employing a medium base lamp shall comply with all of the following:

a) The lamp shall be located to reduce the likelihood of contact with materials not provided as part of the product, such as curtains, trees, or cloth;

b) The decorative outfit shall have a maximum temperature rise of 65°C (117°F) on any external part of the product that may come in contact with other materials, such as the outside of a blow-molded figure or a ceramic house, as determined by the Temperature Test, Section 43;

c) The decorative outfit shall be marked with its maximum tested replacement lamp wattage as indicated in 125.3.3; and

d) Shall not be provided with a load fitting.

31.3 A lampholder shall comply with the mechanical assembly requirements contained in 9.6.

31.4 A decorative outfit with one or more switched lampholders shall accommodate only candelabra-base or larger lamps and shall be for indoor use only.

31.5 A medium screw lampholder shall only be used in a decorative outfit employing parallel-connected lampholders. A maximum of 6 medium screw lampholders shall be employed and shall not exceed 1.75 A as measured during the Input Test, Section 42, with the maximum marked wattage replacement lamps installed.

31.6 The wire employed in a decorative outfit shall terminate in a lampholder or an enclosure which complies with the requirements for polymeric enclosures contained in 10.1.1 – 10.1.4 and 10.3.1 – 10.3.10.

31.7 For a decorative outfit employing single conductor CXTW wire, with lampholders, wire, or both, secured to and supported by a rigid frame provided with the product, there shall be a maximum of 3 inches (76.2 mm) of cord between each secured lampholder or wire and the space between the suspended wire and the frame shall not exceed 1/2 inch (12.7 mm).

32 Motorized Devices

32.1 A motorized device in the form of a decorative outfit for either indoor or outdoor use or a tree stand for indoor use only shall be rated at 120 V or less. Acceptability is to be determined in accordance with the requirements in 32.2 – 32.4 and all other applicable requirements contained in this standard.

32.2 Receptacle outlets provided on the rotating portion of a tree stand are considered for the connection of push-in, midget-base, miniature-base, candelabra-base, or intermediate-base incandescent lamps and are considered dedicated type and shall be marked according to 125.8.3.

32.3 There shall not be more than three dedicated outlets provided to furnish power to strings or other seasonal products that can be attached to the motorized device.

32.4 A motor employed in a decorative outfit shall comply with the requirements in the Standard for Overheating Protection for Motors, UL 2111.

Exception: A DC-operated motor need not comply with this requirement.

32.5 The flexible cord employed to supply the load fitting shall be the same type and size as that required for the supply connections as specified in Table 6.2.

33 Light Sculptures

33.1 The frame of a light sculpture shall be either a metallic material coated with a polymeric material that complies with the volume resistivity requirements in the Standard for Polymeric Materials – Use In Electrical Equipment Evaluations, UL 746C, or a polymeric material. In both cases the polymeric material shall comply with the requirements in Materials, Section 8. A polymeric frame shall also comply with the Enclosure Mold Stress Relief Test, Section 58, such that stress is not placed on electrical connections or wire as a result of the test.

Exception No. 1: A light sculpture supplied by a Class 2 circuit need not comply with 33.1.

Exception No. 2: A light sculpture intended for outdoor-use that complies with the Rain Test, Section 89 need not be subjected to the volume resistivity requirements in 33.1.

33.2 If the light sculpture folds, such as for storage, or is animated, it shall have sufficient free length of wire to avoid pinching, cutting or abrading of the conductors or insulation.

33.3 Lighting sculptures consisting of more than one section are allowed to be shipped unassembled when the lighting strings are affixed to the individual sections provided that suitable user assembly instructions are included in the instruction manual.

DIRECT PLUG-IN UNITS

34 General

34.1 The mechanical assembly of a direct plug-in unit intended for indoor use shall be considered acceptable if the unit:

a) Complies with the requirements in 34.2 – 34.8, or

b) Complies with the Standard for Class 2 Power Units, UL 1310; or

c) Complies with the requirements for the mechanical assembly of a direct plug-in unit specified in the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1.

34.2 The integral blade assembly of a direct plug-in unit shall comply with the construction requirements in the Standard for Attachment Plugs and Receptacles, UL 498. See 34.8.

34.3 The mechanical assembly of a direct plug-in unit intended for outdoor use shall be considered acceptable if it complies with the requirements for Outdoor-Use Products, Section 27, in addition to the requirements in 34.1.

34.4 The maximum acceptable moment, center of gravity, dimensions, and weight of a direct plug-in unit shall comply with each of the following requirements (see 34.5):

a) The quotient of WY/Z shall not exceed 48 ounces (1361 g).

b) The quotient of WY/S shall not exceed 48 ounces (1361 g).

c) The product of WX shall not exceed 80 ounce-inches (0.56 N·m).

d) The weight of the unit shall not exceed 28 ounces (794 g).

in which:

W is the weight of the unit in ounces (g),

Y is the distance illustrated in Figure 34.1 in inches (mm),

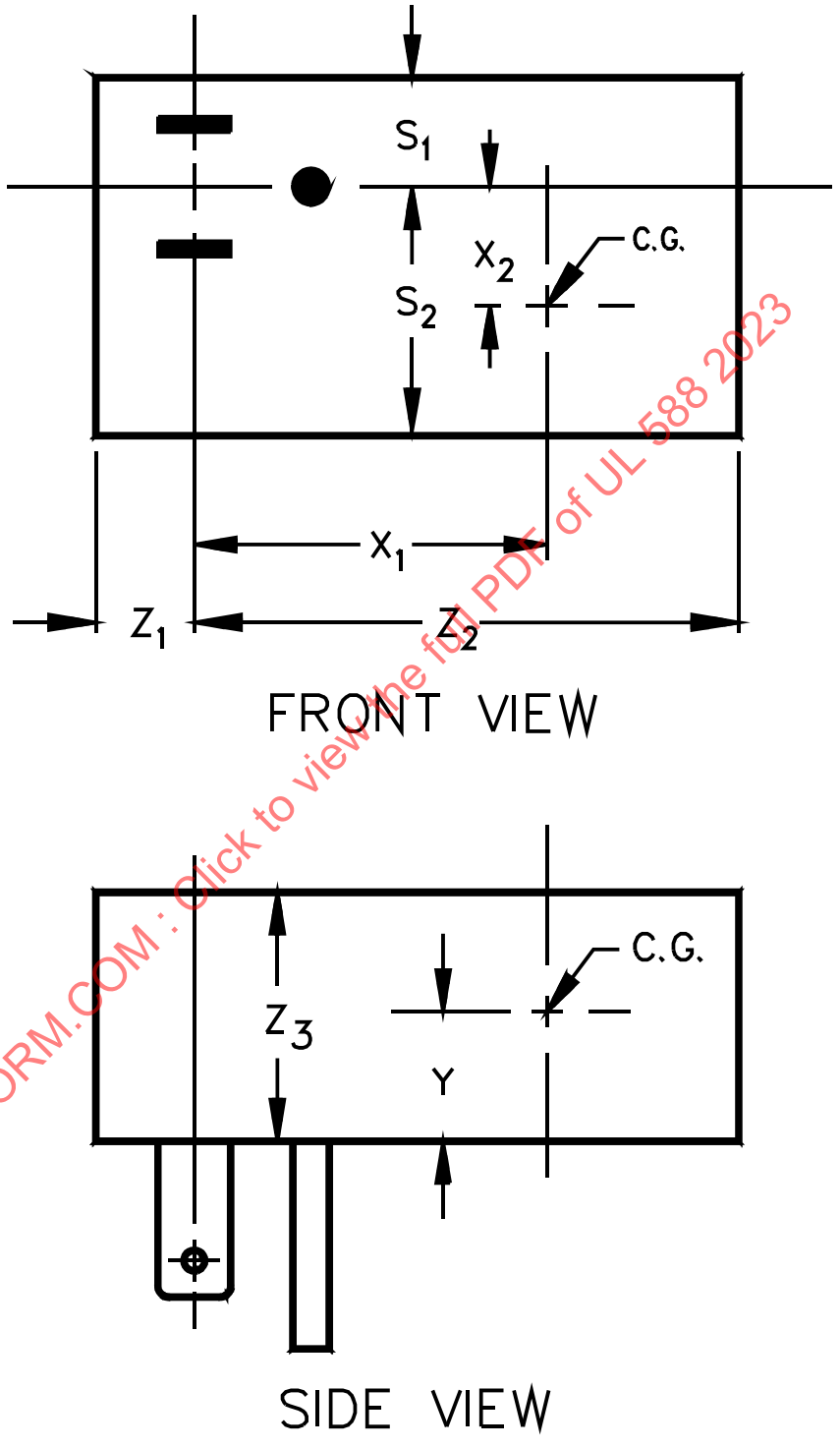
Z is the lesser of the two distances, Z_1 or Z_2, as illustrated in Figure 34.1 in inches (mm),

S is the lesser of the two distances, S_1 or S_2, as illustrated in Figure 34.1 in inches (mm), and

X is the greater of the two distances X_1 or X_2, as illustrated in Figure 34.1 in inches (mm).

Figure 34.1

Dimensions of a direct plug-in unit



C.G. = Center of Gravity

34.5 The values specified in 34.4 shall be determined as follows:

a) For units with an output cord, the cord is to be cut off at the enclosure, or at the strain-relief means if the strain-relief means is outside the enclosure.

b) For units with directly mounted accessories, the values are to be measured with the accessories in place.

c) A mounting tab is not to be included in the measurements of the linear dimensions for the purpose of determining moments unless:

1) The tab and enclosure comply with the Drop Test, Section 59, with one impact on the tab itself, without deformation, and

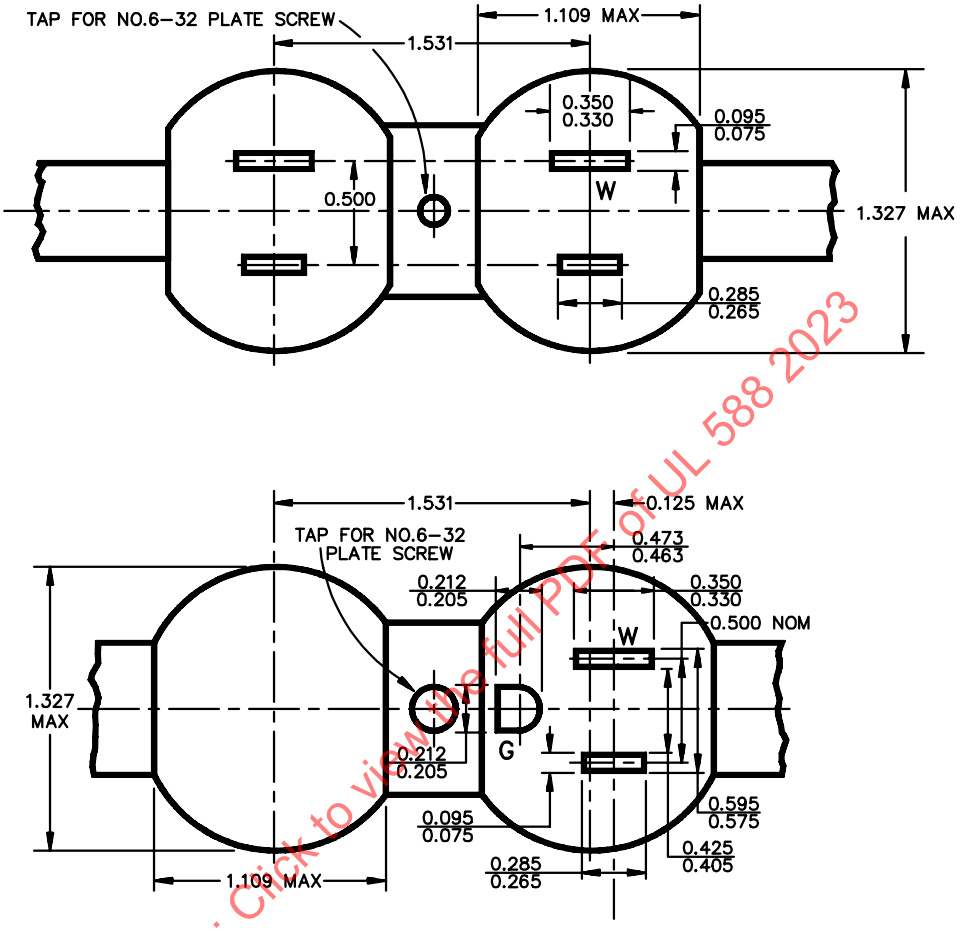
2) For a polymeric-enclosed unit having an integral tab, the tab and enclosure do not distort at temperatures to which the material may be subjected under conditions of normal and abnormal use as determined by the Enclosure Mold Stress Relief Test, Section 58.

34.6 When inserted in a parallel-blade duplex receptacle, no part of a unit, including a mounting tab or output wiring, shall interfere with full insertion of an attachment plug or current tap into the adjacent receptacle. See Figure 34.2.

Exception: A unit that renders the adjacent receptacle completely unusable in any one mounting position need not comply with this requirement.

Figure 34.2

Parallel duplex receptacle



NOTE: All dimensions are in inches.

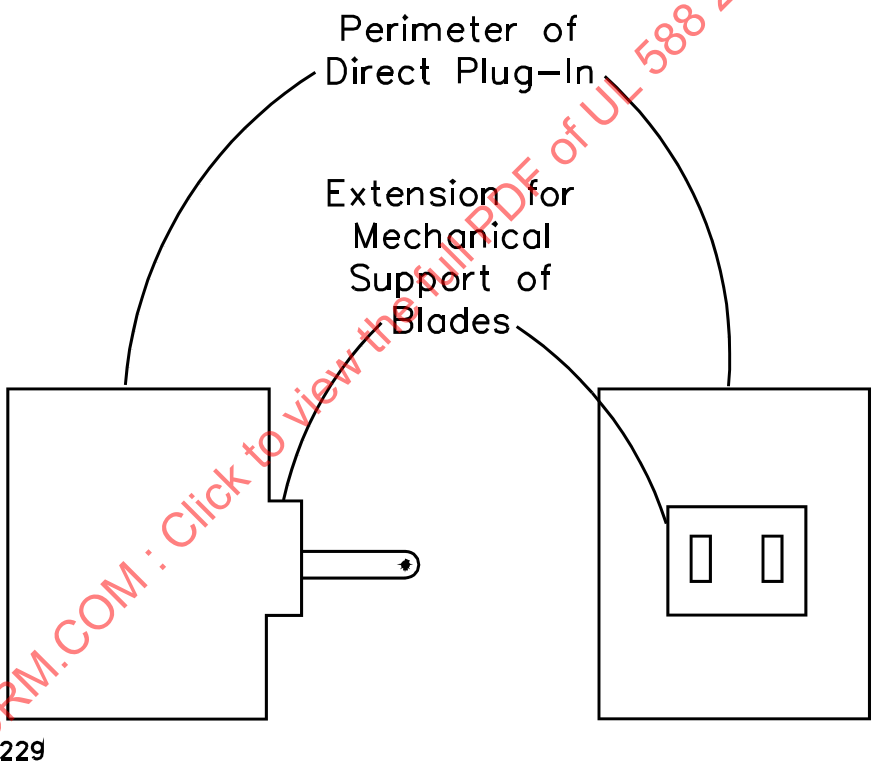
34.7 The enclosure of the direct plug-in unit shall be capable of being gripped for removal from the receptacle to which it is connected, and the perimeter of the face section from which the blades project shall not be less than 5/16 inch (7.9 mm) from any point on either blade.

Exception: For tab-mounted units, the perimeter of the face section may not be less than 1/4 inch (6.4 mm) from any point on either blade.

34.8 With reference to 34.7, an extension from the face for mechanical support of the blades is not to be considered in the measurement provided the extension measures 0.04 inches (1 mm) or less from the face section of the direct plug-in unit. See Figure 34.3.

Figure 34.3

Extension for mechanical support of blades



ORNAMENTS

35 General

35.1 An ornament shall be for indoor use only.

35.2 During or after insertion of the lampholder adapter of an ornament into the lampholder of a series-connected string or decorative outfit, there shall not be exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1.

35.3 An ornament shall be provided with its own mounting means, to accommodate a hook or for direct mounting to a tree, such that the weight of the ornament is not supported only by the lampholder.

35.4 Any exposed wiring as part of an ornament, including the input leads, shall comply with the wiring requirements for series-connected strings contained in Supply Connections, Section 13.

Exception: Any exposed wiring other than the input leads may be appliance wiring material (AWM) with the same insulation thickness and wire gauge as the wire types indicated in Section 13, and temperature and voltage ratings suitable for the intended application.

35.5 Non-exposed internal wiring may be appliance wiring material (AWM) with temperature, current, and voltage ratings suitable for the intended application.

35.6 A lampholder and pigtail adapter employed in an ornament shall comply with the requirements for series-connected lampholders contained in Lampholders, Section 22.

35.7 A motor employed in an ornament shall comply with 32.4.

35.8 An adapter shall be provided with a strain relief such that a pull exerted on the supply cord cannot be transmitted to the adapter contacts. This shall comply with the requirements in Lampholder Strain Relief Tests, Section 79.

BATTERY OPERATED PRODUCTS

36 General

36.1 When a seasonal product utilizes the number and type of batteries shown in Table 36.1, the product shall comply with all the requirements in this standard for Class 2 circuits having more than a 15 W output. When a seasonal product utilizes fewer than the number of batteries shown in Table 36.1, the product shall be evaluated using the requirements for Class 2 circuits having less than a 15 W output. In addition, each of the products described above shall comply with the marking requirements in 125.10 and 125.11.

Table 36.1
Output capabilities of common sizes and types of batteries[c]

Battery				8 A output at 1 minute (batteries in parallel)[b]
Type	Size	Designation[a]	Rated voltage	
Carbon-zinc	N	N	1.5	NA
	AAA	AAA	1.5	NA
	AA	AA	1.5	6
	C	C	1.5	5
	D	D	1.5	3
	F	–	1.5	2
	G	–	1.5	1
	6	6	6.0	1
	9-V transistor	1604	9.0	NA
Alkaline-manganese dioxide	N	L20	1.5	NA
	AAA	L30	1.5	NA
	AA	L40	1.5	2
	C	L70	1.5	2

Table 36.1 Continued on Next Page

Table 36.1 Continued

Battery				8 A output at 1 minute (batteries in parallel)[b]
Type	Size	Designation[a]	Rated voltage	
	D	L90	1.5	1
	9-V transistor	1604A	9.0	2
Nickel-cadmium	N	KR115/XXX	1.2	NA
	AAA	–	1.2	NA
	AA	KR142/XXX	1.2	1
	C	KR257/XXX	1.2	1
	D	KR334/XXX	1.2	1
	9-V transistor	–	8.4	NA

[a] This designation corresponds to that in the Portable Primary Cells and Batteries with Aqueous Electrolyte, General and Specifications, ANSI C18.1M, Part 1.

[b] Denotes minimum number of batteries capable of delivering 8 A DC or more to external resistive load for minimum 1 minute.

[c] The measured power output of a battery not included in the table shall be less than 15 watts as determined by the Power Measurement Test.

PERFORMANCE

GENERAL

37 Cheesecloth Indicators

37.1 Cheesecloth used for tests shall be bleached cheesecloth, running 14 – 15 yd^2/lb (approximately 26 – 28 m^2/kg) and having what is known in the trade as a "count of 32 by 28," that is, for any square inch 32 threads in one direction and 28 threads in the other direction(for any square centimeter, 13 threads in one direction and 11 in the other direction).

37.2 Tests involving cheesecloth are to be made in a draft free location.

38 Test Sequences

38.1 The tests are to be performed in the order presented unless otherwise indicated. If a product employs a component or another product as part of its construction, each part of the product shall comply with its applicable performance requirements. For example, if a series-connected string employs a controller, performance requirements for a series-connected string, controller, cord-connected wiring device, series-connected lampholder, series-connected lamp, and fuseholder shall all be applied.

ALL PRODUCTS EXCEPT ORNAMENTS

39 General

39.1 If a product employs a polymeric enclosure, the Enclosure Mold Stress Relief Test, Section 58, is to be performed before the Strain Relief Test, Section 46. If a product is intended for outdoor use, the Enclosure Mold Stress Relief Test, Section 58, the Drop Test, Section 59, the Impact Test, Section 60, and the Resistance to Crushing Test, Section 62, are to be performed before the Rain Test, Section 89, and the Standing Water Immersion Test, Section 91.

40 Leakage Current Test

40.1 When tested as described in 40.3 – 40.9, the leakage current of a seasonal lighting product shall not be more than 0.5 mA. The leakage current derived from that circuit need not be measured if the potential between the accessible part and ground or any other accessible part, from an insulated (not conductively connected to the line-voltage circuit) low-voltage supply, is less than:

a) 42.4 V peak for an indoor product or where wet contact is not likely to occur, and

b) 21.1 V peak for an outdoor product or where wet contact is likely to occur.

40.2 Leakage current refers to all currents, including capacitively coupled currents, that may be conveyed between exposed conductive surfaces of the product and ground or other exposed conductive surfaces.

40.3 All exposed conductive surfaces of a product shall be tested for leakage current. A conductive surface is considered to be exposed unless it is guarded by an enclosure which reduces the risk of electric shock as determined by Enclosures, Section 10. The leakage currents from these surfaces are to be measured to the grounded (neutral) supply conductor individually as well as collectively, if simultaneously accessible, and from one surface to another, if simultaneously accessible. Surfaces are considered to be simultaneously accessible if they can be readily contacted by one or both hands of a person at the same time.

40.4 If an insulating material, with or without a metalized coating, is used for the enclosure or part of the enclosure, the leakage current is to be measured using a metal foil with an area of 10 by 20 cm (3.9 by 7.9 inches) in contact with accessible surfaces of insulating material. If the accessible surface of insulating material is less than 10 by 20 cm, the metal foil is to be the same size as the surface. The metal foil is not to remain in place long enough to affect the temperature of the product. The accessible parts are to be tested individually, collectively, and from one part to another.

40.5 For a product employing a lampholder, leakage current of the lamp and lampholder assembly, wrapped in foil as described in 40.4, shall be determined. If a product employs multiple lampholders, leakage current shall be determined on one lamp and lampholder assembly.

40.6 The measurement circuit for leakage current is to be as illustrated in Figure 40.1. The measurement instrument is defined in (a) – (c). The meter that is actually used for a measurement need only indicate the same numerical value for the particular measurement as would the defined instrument. The meter used need not have all the attributes of the defined instrument.

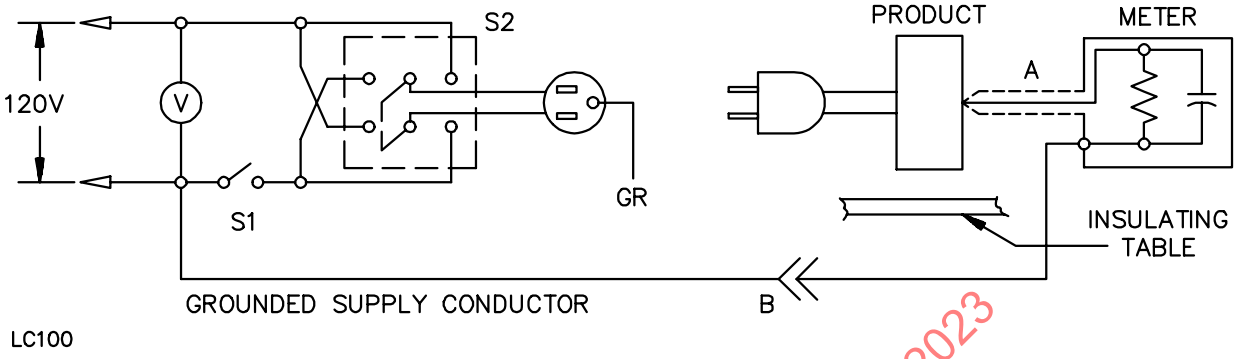
a) The meter shall have an input impedance of 1500 ohms resistive shunted by a capacitance of 0.15 µF.

b) The meter shall indicate 1.11 times the average of the full-wave rectified composite waveform of voltage across the resistor or current through the resistor.

c) Over a frequency range of 0 – 100 kHz, the measurement circuitry shall have a frequency response (ratio of indicated to actual value of current) that is equal to the ratio of the impedance of a 1500 ohm resistor shunted by a 0.15 µF capacitor to 1500 ohms. At an indication of 0.5 mA, the measurement shall have an error of not more than 5 percent at 60 Hz.

Figure 40.1

Leakage-current measurement circuit



LC100

Notes:

A – Probe with shielded lead.

B – Separated and used as clip when measuring currents from one part of the motor-operated device to another.

40.7 Unless the meter is being used to measure leakage current from one part of the product to another, the meter shall be connected between the accessible parts and the grounded supply conductor.

40.8 One product is to be tested for leakage current starting with the as-received condition. The product is considered to be in the as-received condition prior to energization, except as may occur as part of the production-line testing. The supply voltage is to be adjusted to 120 V. The test sequence, with reference to the measuring circuit illustrated in Figure 40.1, is to be as follows:

a) With switch S1 open, the product is to be connected to the measurement circuit. The leakage current is to be measured using both positions of switch S2 with the product switching devices in all their normal operating positions.

b) Switch S1 is then to be closed, energizing the product, and within a period of 5 seconds, the leakage current is to be measured using both positions of switch S2 and with the product switching devices in all their normal operating positions.

c) The leakage current is to be monitored to determine the maximum leakage current from the time of previous measurement until operating temperatures are obtained. Both positions of switch S2 are to be used in determining this measurement.

Exception: Products which have been subjected to the Rain Test, Section 89, need only comply with 40.8(a) and 40.8(b).

40.9 A product is to be carried through the complete Leakage Current Test program as specified in 40.1 without interruption for other tests. With the concurrence of those concerned, the Leakage Current Test may be interrupted for the purpose of conducting other nondestructive tests after the leakage current has stabilized.

41 Leakage Current Following Humidity Conditioning

41.1 A seasonal product shall comply with the requirements for leakage current contained in 40.1 of the Leakage Current Test, Section 40, following exposure for 48 hours to air having relative humidity of 88 ±2 percent at a temperature of 32 ±2°C (90 ±4°F).

41.2 To determine whether a product complies with the requirements in 41.1, one product is to be heated to a temperature just above 34°C (93°F) to reduce the likelihood of condensation of moisture during conditioning. The heated product is to be placed in the humidity chamber and is to remain for 48 hours under the conditions specified in 41.1.

41.3 Following the conditioning, the product is to be tested, without load current flowing, as described in 40.8(a), either in the humidity chamber or immediately after removal of the conditioned product from the humidity chamber. Note that moisture in the air condensing on the conditioned product surfaces after removal from the chamber can invalidate the test results. After the test, without load current flowing, the product is to be energized and tested as described in 40.8 (b) and (c). For each test, the maximum leakage current is to be recorded and the test is to be discontinued when the leakage current stabilizes or decreases.

42 Input Test

42.1 When tested as described in 42.2 and 42.4, the measured input current to the seasonal lighting product at maximum rated voltage shall be within 10 percent of the marked rating with all features on the unit set in the state to draw maximum input current and wattage.

Exception No. 1: For a product employing LED lamps, the measured input current at maximum voltage rating shall not exceed 110 percent of the marked rating.

Exception No. 2: For a lighting string employing individual-flashing lamps, these lamps shall be shorted during the test.

42.2 Measurements for a product which employs dedicated receptacles are to be obtained with all unused receptacles operating at their maximum output rating.

42.3 One product is to be connected to a 120 V, 60 Hz supply source. For a product containing only incandescent lamps, the maximum marked wattage lamps are to be installed. For a controller or direct plug-in unit, the unit is to be adjusted to draw the maximum input current and wattage from the supply source. When a unit is provided with dedicated receptacles, the receptacles are to be connected to a variable resistor and the resistor is then to be adjusted to draw the maximum marked output wattage or current of the receptacles of the unit, whichever is greater. The measured input voltage and current are to be recorded.

42.4 A motorized tree stand is to be tested while loaded with its maximum recommended tree weight.

43 Temperature Test

43.1 A decorative-lighting product which employs candelabra or intermediate base lamps, but which does not employ electronic devices, is to be tested with the lamps operating at an envelope temperature of 90°C (194°F). The input voltage may need to be adjusted above 120 V. A product which employs candelabra or intermediate base lamps and electronic devices is to first be tested at 120 V, with the temperatures measured in the area of the electronic devices only. The test voltage is then to be adjusted to obtain a lamp envelope temperature of 90°C (194°F), with the temperatures measured in the lamp areas only. The determination of the 90°C (194°F) lamp envelope temperature is to be obtained with the

lamp base down in accordance with the Lamp-Envelope Temperature Test, Section SA9, contained in Seasonal-Lighting Lamps, Supplement SA.

43.2 All values in Table 43.1 are based on an assumed ambient (room) temperature of 25°C (77°F), but the test may be conducted at any ambient temperature within the range of 10 – 40°C (50 – 104°F). An observed temperature is to be corrected by addition (if the ambient temperature is lower than 25°C (77°F)) or subtraction (if the ambient temperature is higher than 25°C) of the difference between 25°C and the ambient temperature.

Table 43.1
Maximum acceptable temperature rises

Materials and component parts of the unit	Temperature rises	
	°C	°F
1. Enclosure interior surfaces		
a) Polymeric	d	d
b) Wood and similar material	65	117
c) Phenolic composition[a]	125	225
2. Printed wiring boards	f	f
3. Insulating materials		
a) Polymeric	d	d
b) Fiber	65	117
c) Wood and similar material	65	117
d) Phenolic composition[a]	125	225
4. Softening point of any sealing compound	e	e
5. Insulation Systems		
a)Class 105 insulation systems on coil windings of transformers, relays, solenoids, and similar devices[c]	65	117
b) Class 130 insulation systems on coil windings of transformers, relays, solenoids, and similar devices[c]	85	153
6. Capacitors		
a) Electrolytic[b]	40	72
b) Other types[b]	65	117
7. Fuses[a]	65	117
8. Semiconductor devices[a]	75	135
9. Selenium rectifiers[a]	50	90
10. Conductors with rubber or thermoplastic insulation[a]	35	63
11. Flexible cords with rubber or thermoplastic insulation[g]	35	63
12. Surfaces		
a) Any exterior surface	65	117
b) Any surface that may come in contact with combustible material during normal use	65	117

[a] Does not apply if investigated and accepted for a higher temperature.

[b] A capacitor that operates at a temperature rise of more than 40°C (72°F) for electrolytic capacitors and 65°C (117°F) for all other types may be evaluated on the basis of the capacitor's marked temperature rating.

[c] 10°C (18°F) higher in coil insulation temperature rise if measured by the change-of-resistance method.

Table 43.1 Continued on Next Page

Table 43.1 Continued

Materials and component parts of the unit	Temperature rises	
	°C	°F
[d] The maximum temperature of a polymeric material, when corrected to 25°C (77°F) ambient temperature, shall not exceed the temperature index specified in 10.3.9.		
[e] The maximum sealing compound temperature, when corrected to 25°C (77°F) ambient temperature, is 15°C (27°F) less than the softening point of the compound as determined by the Standard Test Methods for Softening Point of Resins Derived from Naval Stores By Ring-And-Ball Apparatus, ASTM E 28.		
[f] The maximum temperature of a printed wiring board, when corrected to 25°C ambient temperature, shall not exceed the maximum operating temperature as determined in accordance with the Standard for Printed-Wiring Boards, UL 796.		
[g] Does not apply if investigated and accepted for a higher temperature and located within an enclosure, except for a lampholder, attachment plug, cord connector, load fitting, current tap, or fuseholder.		

43.3 Temperatures are to be measured by means of thermocouples consisting of iron and constantan wires not larger than 24 AWG (0.21 mm^2) and not smaller than 30 AWG (0.05 mm^2). If the coil is inaccessible for mounting thermocouples, the coil temperature may be determined by the change-of-resistance method (see 43.20). When thermocouples are used in determining temperatures in electrical equipment, it is common practice to employ thermocouples consisting of 30 AWG iron and constantan wires with a potentiometer-type of indicating instrument. This equipment is to be used whenever a referee measurement of temperature is necessary.

43.4 The thermocouples and related instruments are to be accurate and calibrated in accordance with standard laboratory practice. The thermocouple wire is to conform with the requirements specified in the Tolerances on Initial Values of EMF versus Temperature tables in the Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, ANSI/ASTM E230/E230M.

43.5 The thermocouple method consists of the determination of temperature by the application of thermocouples to the hottest accessible areas of the components. Temperatures on printed wiring boards are to be measured on the foil side.

43.6 A thermocouple junction and adjacent thermocouple lead wire are to be securely held in good thermal contact with the surface of the material whose temperature is being measured. In most cases, acceptable thermal contact results from securely taping or cementing the thermocouple in place but, if a metal surface is involved, brazing or soldering the thermocouple to the metal may be necessary.

43.7 The unit is to be covered with cheesecloth and placed on tissue-paper-wrapped pine board.

Exception: Products employing incandescent lamps need not comply with this requirement.

43.8 Rubber-like and felt materials are to be removed from supporting feet to the extent that they are likely to be worn off in service.

43.9 The product is to be connected to a supply circuit of 120 V and a frequency of 60 Hz. The unit is then to be operated continuously for a minimum of 3 hours, under representative intended service conditions that are likely to produce the highest temperature, until constant temperatures are attained. Constant temperatures are considered to exist when three consecutive readings, taken at 15 minute intervals, are within 1°C (1.8°F) of each other and indicate no further rise above the changes in ambient temperature.

43.10 A decorative lighting string which employs individual flashing lamps shall be tested with the lamps in the circuit and then with the individual flashing lamps shorted.

43.11 A decorative lighting string which employs LED lamps is to be tested with the lamps in the forward position, and then with one of the LED lamps in the reverse bias position.

43.12 A decorative outfit which employs incandescent lamps is to be tested in the position likely to produce maximum temperatures, such as with the lamp and lampholder assembly positioned as described in 43.14.

Exception: A decorative outfit that complies with the Mounting Position Test, Section 44, may be tested in its normal use position. Normal position of use is defined as that which is stable on a flat horizontal surface.

43.13 A decorative lighting string is to be tested with the maximum wattage lamps marked on the replacement label and with the decorative attachments, if provided, assembled to the string in the intended manner.

43.14 A decorative lighting string is to be tested while supported in free air with the lampholders in the base-up filament-down position. See Figure 43.1 and Figure 43.2.

Figure 43.1

Measurement of temperatures of a push-in lampholder

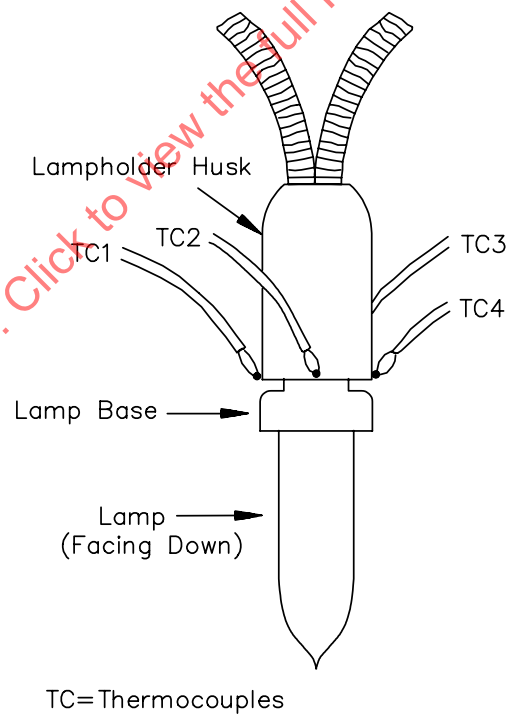
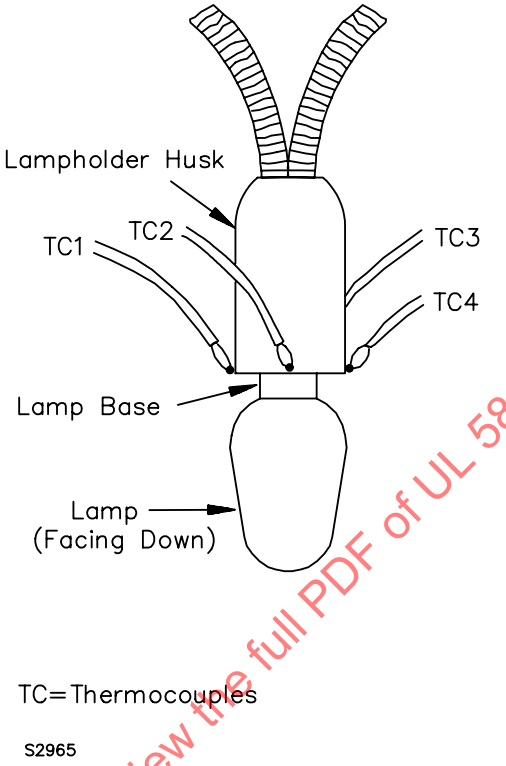


Figure 43.2

Measurement of temperatures of a screw lampholder



43.14.1 For attachment plug and load fitting terminals that are connected to CXTW-S or CXTW-IS conductors, the temperature test shall be performed with all non-conductive threads captured by any terminals including solder-less, crimp, insulation piercing, screw terminal, or any other type. Any non-conductive threads shall not be cut during the insulation stripping process unless they are located integral with the conductor insulation and cannot be separated.

43.15 A tree-top decorative outfit is to be tested with the interior volume of the unit's mounting means completely filled with an equal volume of uncompressed, surgical cotton to simulate its mounting on the top of a tree.

43.16 A wreath-type decorative outfit is to be tested while mounted on a wall in the intended manner.

43.17 A motorized tree stand is to be tested while loaded with its maximum recommended tree weight.

43.18 A controller is to be tested with its setting adjusted to produce the highest temperatures, either with the lamps on in a steady state or flashing at the rate which produces the highest temperature.

43.19 Temperature measurements on products with load fittings or dedicated receptacles are to be obtained with one unused receptacle at a current level equal to the fuse rating. The test may be conducted using a dummy fuse instead of a live fuse. See the Fuseholder Temperature Test, Section 67.

43.20 Features of a product not covered by the conditions of operation described in this section may be tested as necessary to meet the intent of these requirements.

43.21 If the change-of-resistance method is to be used, the product is to be tested as described in 43.9, but with the windings at room temperature at the start of the test. Room ambient temperature and the coil resistance are to be measured both at the start of the test and at its completion. A thermocouple placed on the outside of the coil may be used to assist in the determination of stabilized temperature.

43.22 The temperature rise, Δt, is to be calculated as follows:

$$\Delta t = \frac{R}{r}(k + t_1) - (k + t_2)$$

in which:

Δt is the temperature rise,

R is the resistance of the coil at the end of the test,

r is the resistance of the coil at the beginning of the test,

t_1 is the room temperature (°C) at the beginning of the test,

t_2 is the room temperature (°C) at the end of the test, and

k is 234.5 for copper and 225.0 for electrical conductor grade (EC) aluminum. Values of k for other grades are to be determined.

43.23 If it is necessary to de-energize the winding before measuring R, the value of R at shutdown may be determined by taking several resistance measurements at short intervals, beginning as quickly as possible after the instant of shutdown. A curve of resistance values versus time may be plotted and extrapolated to give the value of R at shutdown.

43.24 A short length of rubber- or thermoplastic-insulated flexible cord exposed to a temperature in excess of its rating, such as at terminals within an enclosure, shall be considered acceptable if supplementary insulation suitable for the temperature and of acceptable dielectric withstand is employed on the individual conductors of the cord for protection against deterioration of the conductor insulation.

44 Mounting Position Test

44.1 A freestanding decorative outfit positioned as indicated in the manufacturer's instructions shall not overturn when resting on an inclined plane.

Exception: A decorative outfit need not be subjected to this test if it was subjected to the Temperature Test, Section 43, while in the position most likely to produce maximum temperatures. See 43.12.

44.2 One decorative outfit, complete with all accessories provided as part of the unit, is to be placed, as intended during normal use, on a plane inclined 8 degrees from the horizontal and then turned to the position most likely to cause the unit to tip over.

45 Dielectric Voltage-Withstand Test

45.1 When tested as described in 45.2 – 45.4, a seasonal lighting product shall withstand without breakdown the application of a 60 Hz essentially sinusoidal potential of 1250 V applied for 1 minute, under all the applicable conditions as follows:

a) For a product employing series-connected lampholders, between live parts and metal foil placed over the lamp, lampholder, and wire assembly and arranged to conform to its shape;

b) For a product employing parallel-connected lampholders:

1) Between live parts of opposite polarity,

2) Between live parts and accessible dead metal parts that are likely to become energized, and

3) Between live parts and metal foil placed over the lamp, lampholder, and wire assembly and arranged to conform to its shape;

c) For a light sculpture or a product employing an enclosure, between live parts and accessible dead metal parts of the enclosure.

45.2 One previously untested product is to be subjected to this test. If the product employs parallel-connected lampholders, the test between live parts of opposite polarity is to be conducted without lamps.

45.3 For a product with a non-metallic enclosure, metal foil is to be placed over the unit assembly and arranged to conform to its shape.

45.4 While in a heated condition following a period of normal operation equal to the length of time needed for temperatures to stabilize during the Temperature Test, Section 43, the product is to be tested by means of a 500 VA or larger capacity transformer whose output voltage is essentially sinusoidal and can be varied. The applied potential is to be increased from zero until the required test level is reached and is to be held at that level for 1 minute. The increase in the applied potential is to be at a uniform rate that is as rapid as is consistent with its value being correctly indicated by a voltmeter.

46 Strain Relief Test

46.1 After being tested as described in 46.2, a seasonal lighting product shall comply with all of the following:

a) There shall not be any damage to any lead connection,

b) There shall not be any breakage of the conductor or insulation,

c) No portion of the conductor shall become exposed outside the enclosure of the product, if employed, and

d) The lead pair or harness of input or output leads shall not be displaced more than 1/16 inch (1.6 mm) from the point of entry into the product.

Exception No. 1: If the leads can be re-attached at the conclusion of the test, the product need not comply with the requirement in (d).

Exception No. 2: A cord connected wiring device or power inlet shall instead comply with the Strain Relief Test, Section 71.

46.2 All wires subject to handling are to be tested. The electrical connections of the input and output leads within the unit are to be removed or severed from their connection point inside the unit. The unit is to be securely supported and its input or output lead assembly, or both, is to be subjected to a pull of 20 lbs (89 N) for a 18 AWG (0.82 mm^2) or larger cord and 8 lbs (36 N) for a 20 AWG (0.52 mm^2) or smaller cord. The pull is to be applied in a direction perpendicular to the plane and repeated in a direction normal to the cord-entry hole by suspending a weight from the input or output leads. The weight may be suspended from a pair or multiple leads if it is unlikely that an individual lead may be pulled. The pull is to be gradually applied to the pair of leads and maintained for a period of one minute.

47 Wire Push-Back Relief Test

47.1 To determine if the enclosure of a seasonal product is provided with a means to prevent external wires from being deliberately pushed into the enclosure, the product shall be subjected to the test described in 47.2. The means shall not be considered acceptable if any of the following occurs:

a) The insulation is subjected to temperatures above its assigned ratings,

b) The wire can come into contact with sharp edges or with moving parts that can damage the conductor insulation,

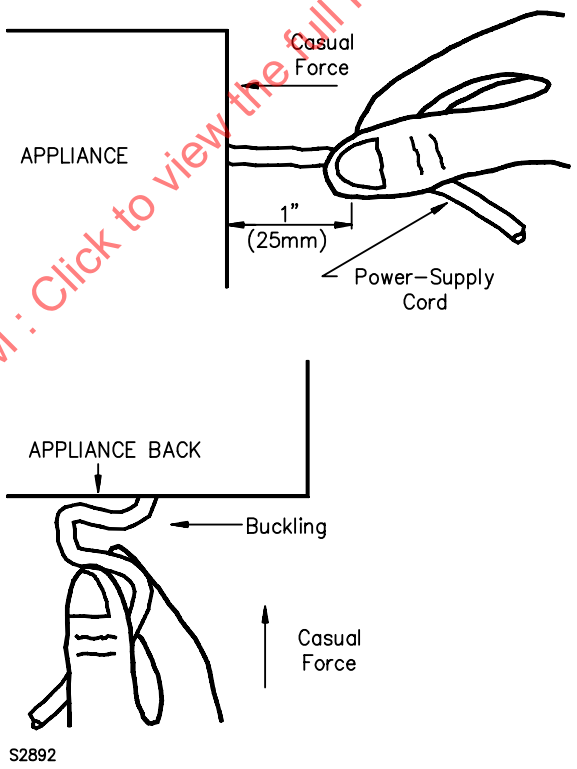
c) The wire displaces parts resulting in a reduction of required spacings, or

d) The wire places stress on internal connections.

47.2 Each wire is to be held by fingers, 1 inch (25 mm) from the point where it emerges from the unit. The wire is then to be pushed back with a casual force as illustrated in Figure 47.1. The force is to be applied until the wire buckles, or until a force of 6 pounds (27 N) is applied.

Figure 47.1

Wire push-back evaluation



48 Abnormal Operation Test

48.1 The breakdown of an electrical component in a seasonal lighting product, as simulated by the test described in 48.2 – 48.9, shall not result in the risk of injury to persons, or the risk of fire or electric shock as determined by the existence of any of the following conditions:

a) Glowing, charring, or flaming of the cheesecloth or tissue paper specified in 48.4;

b) The opening of the 3 A fuse connected to ground specified in 48.5;

c) Emission of flame, sparks, or molten metal from the enclosure;

d) Development of an opening in the overall enclosure that exposes live parts and increases the risk of electric shock (see 12.1); or

e) Loss of structural integrity to such a degree that the equipment collapses or experiences displacement of parts that may:

1) Lead to short-circuiting or grounding of live parts,

2) Affect the function of any safety controls such as thermostats, overload protective devices, waterseals, or strain relief, or

3) Result in the exposure of moving parts increasing the risk of injury to persons.

Exception No. 1: A component located in the following circuits need not be subjected to this test:

a) A Class 2 circuit,

b) A circuit that has been investigated for reliability and determined to be reliable, or

c) A circuit that is not capable of delivering 15 watts of power for one minute or more as determined by the Component Power Measurement Test, Section 49.

Exception No. 2: A resistor, a non-electrolytic capacitor, an inductor, a transformer, an electro-mechanical device, such as a switch or a relay, and an optical isolator that complies with the requirements in the Standard for Optical Isolators, UL 1577, need not be subjected to this test.

48.2 The stalling of an operating mechanism, if employed, and the malfunction of a component such as a diode, a transistor, a thyristor, an electrolytic capacitor, an integrated circuit, an optical isolator, or other electronic component which has not been determined to be reliable by a reliability investigation and which could result in a risk of fire or electric shock, are to be simulated. In order to simulate the malfunction of a component, the circuit between any two terminals of the component is to be opened or shorted. Only one of the two simulated fault conditions is to be imposed at one time. For a multi-terminal device, only two terminals are to be short-circuited at a time. Simulated circuits may be used, but if the tests performed on simulated circuits indicate likely damage to other parts of the equipment to the extent that the safety of the equipment may be affected, the test is to be repeated on the equipment.

48.3 Each simulated fault condition is to be conducted on a separate unit unless it is agreeable to all those concerned that more than one test be conducted on the same unit.

48.4 The unit is to be placed on a softwood surface covered with white tissue paper. A single layer of cheesecloth is to be draped loosely over the entire enclosure.

48.5 The exposed dead-metal parts of the unit are to be connected to ground through a 3 A non-time-delay fuse.

48.6 The unit is to be connected to a 60 Hz, 120 V supply source. The supply circuit is to have a minimum 20 A branch circuit overcurrent protection.

48.7 The test is to be conducted for 7 hours or until at least one of the following results are observed:

a) A risk of fire or electric shock develops,

b) The branch-circuit overcurrent protection opens,

c) The equipment protective device opens,

d) Any other circuit component opens, or

e) A minimum of one hour elapses, circuit conditions stabilize, and there is no further evidence of overheating of parts.

48.8 With reference to of 48.7(e), the overheating of parts may be detected by an indicator such as an odor, smoke, discoloration, cracking of materials, charring, flaming, glowing, arcing, changes in circuit current through the applied fault, or any similar phenomenon.

48.9 If a fault condition is terminated by opening of a circuit component as specified in 48.7(d), the test is to be conducted two more times using new components for each test.

49 Component Power Measurement Test

49.1 To determine if a component or a circuit of a seasonal lighting product is capable of delivering 15 watts of power for one minute [See 48.1, Exception No. 1(c)], the component shall be tested as described in 49.2 – 49.4.

49.2 The unit is to be connected to a 60 Hz, 120 V supply source. One component or circuit of the unit is to be connected to a wattmeter and an adjustable external load resistor as illustrated in Figure 49.1. The external load resistor is to be set for its maximum resistance. A closed shorting switch is to be connected across the unit's protective device, such as a fuse, and the resistor is then to be adjusted to cause a power dissipation of exactly 15 watts as indicated by the meter. The shorting switch across the protective device is then to be opened and the time required for the protective device to open is to be recorded.

49.3 During the test, the supply circuit is to be protected by a 20 A time delay fuse, with characteristics such that the fuse will not open in less than 12 seconds when carrying 40 A.

49.4 The point of measurement of the circuit (see Figure 49.1) is not considered capable of delivering 15 watts for one minute if:

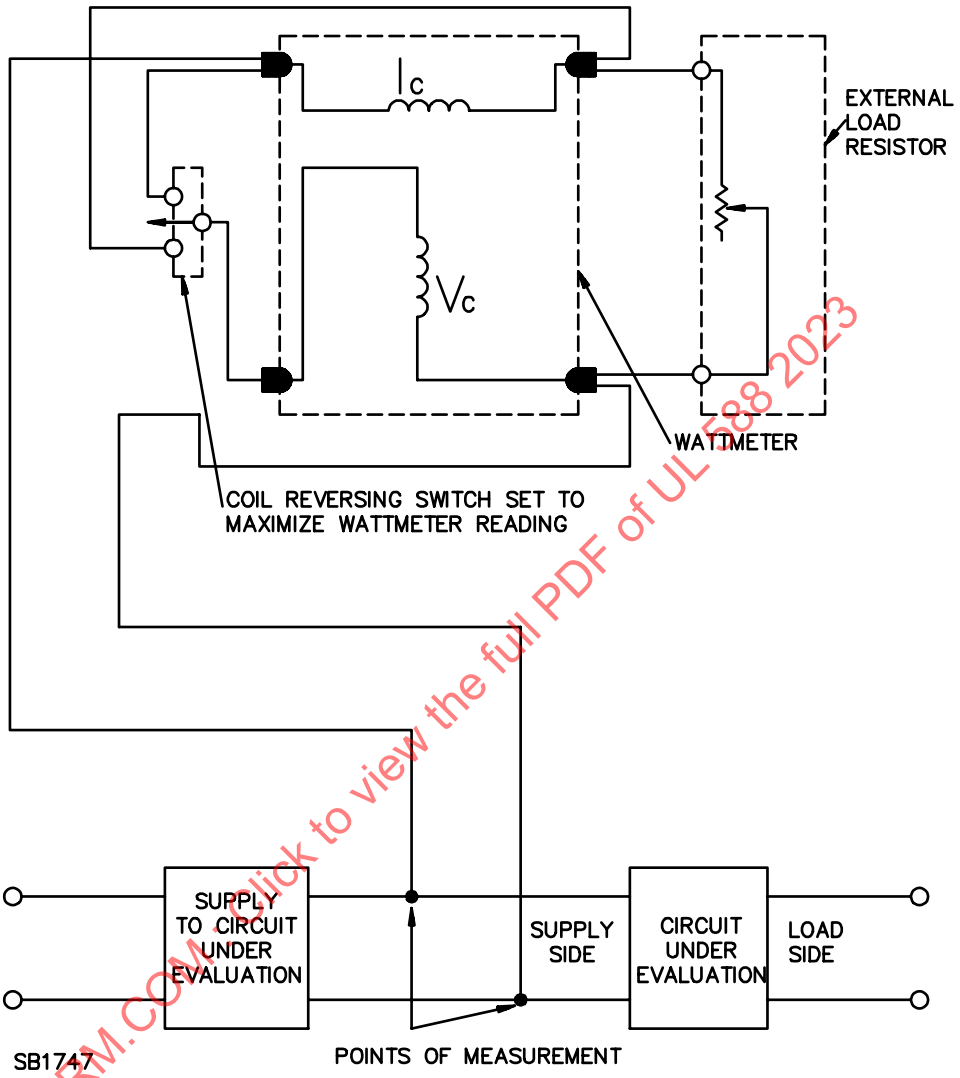
a) The protective device of the unit opens in less than 60 seconds,

b) A circuit component opens in less than one minute, or

c) The current is inherently limited by the circuit.

Figure 49.1

Connection of wattmeter



Note: V_c and I_c are the coil voltage and coil current, respectively, of the wattmeter.

50 Downward Burning Rate Test

50.1 When tested as described in 50.2 – 50.5, the vertical downward burning rate of the material used to make shades, diffusers, or decorative parts of a seasonal lighting product shall not be more than 4 inches (102 mm) per minute.

50.2 If the decorative part consists of a combination of two or more materials sewed or glued together or otherwise affixed to each other in a manner that they are intended to be displayed together and not separately, the burning rate is to be determined on the combination of materials. If the materials are separate or readily separate into individual materials, they shall be tested separately.

50.3 The shade, diffuser, or structural or decorative part is to be supported on a noncombustible surface in a draft-free location with the specimen oriented so as to place one of its major surfaces in a substantially vertical plane.

50.4 The uppermost edge or surface of the specimen is then to be ignited with the use of any convenient open flame such as an ordinary paper book match. In the case of a molded form or figure without an exposed edge, it may become necessary to cut a slit or opening in the desired ignition area to facilitate ignition. Once the material ignites, the ignition flame is to be removed and the vertical downward burning rate is to be determined.

50.5 Usually a vertical downward burning distance of 6 inches (152 mm) is sufficient to determine the burning rate. If the part is less than 6 inches (152 mm) in height, a shorter distance may be used. Where the finished part is too small to determine the vertical downward burning rate, it is necessary to test larger test specimens of the same material and minimum thickness to be used. If repeated attempts do not ignite and sustain combustion, the material is considered to comply with the requirements. In the case of large objects, an upper section, removed from the overall part, may be used in determining the burning rate so as to reduce the amount of combustible material present.

51 Conductivity of Decorative Parts Test

51.1 When tested as described in 51.2, simulated needles, leaves, small twigs, and other loose decorative parts shall not conduct a current in excess of 5 mA.

51.2 Specimens of the material, in the widths employed, are to be spanned between two pairs of copper clamps, the ends of which are to be spaced 1/4 inch (6.4 mm) apart. The assembly is then to be connected in series with an adjustable supply source, an ammeter, and a 1500 ohm resistor. The potential is to be gradually increased from 0 to 120 V while the current flow is monitored and recorded. The current values obtained are to be mathematically converted to represent the equivalent of a 1/4-inch (6.4-mm) width grouping of material.

52 Routine Flexing Test

52.1 A motorized seasonal lighting product in which the current-carrying conductors are routinely flexed during normal operation is to be subjected to the test described in 52.2 and 52.3. As a result of the test, there shall not be any:

a) Opening of circuits or conductors,

b) Exposure of uninsulated conductor strands,

c) Exposure of uninsulated live parts, and

d) Increase in the risk of electric shock as determined by 52.3.

52.2 One previously untested product is to be mounted as intended, and allowed to rotate through a complete cycle of operation for a total of 100,000 cycles. During this test the conductors are to carry a current equivalent to the full load of the animated product.

52.3 After the conditioning described in 52.2, the product shall comply with the Dielectric Voltage-Withstand Test, Section 45. A light sculpture shall also be tested between live parts and the metallic frame, when provided.

53 Slip-Ring Endurance Test

53.1 A seasonal lighting product provided with slip rings intended to transmit power from the base of the rotating part of the product shall be tested as described in the Temperature Test, Section 43, except as indicated in 53.2. As a result of the test, there shall not be visible deterioration of slip rings or brushes and temperatures which exceed the limits for the materials involved shall not be attained.

53.2 In combination with the fixed load of the product, a load which causes the supply cord to carry a maximum current equal to the fuse rating is to be connected to one of the outlets of the rotating table. The product is to be operated for 6000 revolutions of the rotating table while temperatures are measured on the motor, current-carrying parts, adjacent insulation, and similar components.

54 Temperature Tests for Devices Employing Insulation-Piercing Terminals

54.1 General

54.1.1 A device which employs insulation-piercing terminals shall be tested in accordance with 54.1.2 – 54.4.4.

54.1.2 All values for temperature are based on an ambient of 25°C (77°F). The temperature test may be conducted at any ambient temperature within the range of 10 – 40°C (50 – 104°F). An observed temperature is to be corrected by addition (if the ambient temperature is lower than 25°C (77°F)) or subtraction (if the ambient temperature is higher than 25°C) of the difference between 25°C and the ambient temperature.

54.1.3 Temperatures are to be measured by thermocouples consisting of wire not larger than 24 AWG (0.21 mm^2) and not smaller than 30 AWG (0.05 mm^2). For continuous monitoring of the thermocouples, automatic equipment which measures each thermocouple at least once every five minutes is considered acceptable. The thermocouples and the related instrument are to be accurate and calibrated in accordance with standard laboratory practice. The thermocouple wires are to conform with the requirements specified in the Tolerances on Initial Values of EMF versus Temperature tables in the Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, ANSI/ASTM E230/E230M. Thermocouples using iron and constantan 30 AWG (0.05 mm^2) wire are to be used with a potentiometer-type instrument whenever a referee temperature measurement by a thermocouple is necessary.

54.1.4 Thermocouples are to be placed on the wire insulation as close to the terminal connections as possible. They are to be placed in the same location on each device tested.

54.1.5 For each of the tests in 54.2.1 – 54.4.4, the device is to be in the position and under the conditions most likely to cause maximum temperatures to be reached. The tests are to be performed at rated current and rated voltage. The device is to be connected to a supply circuit of 60 Hz and operated at the rated current and voltage of the device. Rated current is considered to be 5 A for 18 AWG (0.82 mm^2) and 20 AWG (0.52 mm^2) cord and 3 A for 22 AWG (0.32 mm^2) cord per the wire gauge intended for the device.

54.1.6 Unless otherwise indicated, each test is to be continued until constant temperatures are attained. A temperature is considered constant if:

a) The test has been running for at least three hours, and

b) Three successive readings, taken at 15 minute intervals, are within 1°C (1.8°F) of each other and are still not rising.

54.2 Temperature test

54.2.1 Throughout the test described in 54.2.2, the temperature of the insulation-piercing terminal connections on each device shall not exceed 60°C (140°F) when normalized to 25°C (77°F).

54.2.2 Each of six previously untested devices which employ insulation-piercing terminals is to be assembled to conductors of the size and type for which they are intended. The devices are to be connected to the rated current and the temperature of the insulation-piercing terminal connections is to be monitored continuously until the temperatures are constant. See 54.1.5.

54.3 Thermal cycling

54.3.1 Throughout the test described in 54.3.2 and 54.3.3, the maximum temperature of the insulation-piercing terminal connections on each device shall not exceed 60°C (140°F) when normalized to 25°C (77°F).

54.3.2 Each of six previously untested devices is to be assembled to conductors of the size and type for which they are intended. The devices are to be connected to the rated current and the temperature of the insulation-piercing terminal connections is to be monitored continuously. See 54.1.5.

54.3.3 The devices are to be cycled for a total of 180 cycles at a rate of 3-1/2 hours on and 1/2 hour off. The temperature of the insulation-piercing terminal connections is to be monitored continuously throughout the 180 cycle period. After the last cycle, the devices are to remain energized until temperatures are constant. The off cycle time may be extended for the convenience of measurement.

54.4 Strain relief/terminal temperature

54.4.1 Throughout the test described in 54.4.2 – 54.4.4, the temperature of the insulation-piercing terminal connections shall not exceed 60°C (140°F) when normalized to 25°C (77°F). As a result of the cord pull, the strain relief shall be considered acceptable if:

a) There is no damage to the lead connection,

b) There is no breakage of the conductor, and

c) No portion of the conductor becomes exposed outside the body of the device.

54.4.2 Each of six previously untested devices is to be assembled to conductors of the size and type for which they are intended. The devices are to be placed in a full draft circulating air oven for 15 days. The oven is to be maintained at a uniform temperature of 70°C (158°F).

54.4.3 The same devices are to be allowed to cool to room temperature. Each device body is to be secured to a vertical surface and the cord subjected to a pull of 20 lbs (89 N) for an 18 AWG (0.82 mm^2) or larger cord and 8 lbs (36 N) for a 20 AWG (0.52 mm^2) or smaller cord. The pull is to be gradually applied in any direction, so as to produce the maximum strain on the connections, and maintained for a period of one minute.

54.4.4 The same devices are then to be connected to the rated load current and the temperature of the insulation-piercing terminal connections are to be monitored continuously. The devices are to be energized for a period of 30 days.

55 Abnormal Tests for Controllers

55.1 General

55.1.1 A controller employed in a seasonal lighting product shall be subjected to the tests described in 55.2.1 – 55.3.2. As a result of each test, there shall not be:

a) Glowing, charring, or flaming of the cheesecloth or tissue paper specified in 55.2.1,

b) Emission of flame, sparks, or molten metal from the enclosure of the unit,

c) Any damage to the enclosure of the controller that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1, or

d) Any damage to the enclosure of the controller that would result in an increase in the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 45.

55.2 Abnormal operation test

55.2.1 One controller is to be tested. The output leads of the controller are to be short circuited to each other while the input to the controller is connected to a 60 Hz, 120 V supply source. The controller is to be placed on a softwood surface covered with tissue paper and draped with a double layer of cheesecloth. The unit is to be connected to a circuit protected by a 20 A branch-circuit overcurrent protective device and energized.

55.2.2 The test is to be conducted for 7 hours or until at least one of the following results are observed:

a) A risk of fire or electric shock develops,

b) The branch-circuit overcurrent protection opens,

c) The equipment protective device opens,

d) Any other circuit component opens, or

e) A minimum of one hour elapses, circuit conditions stabilize, and there is no further evidence of overheating of parts.

55.2.3 With reference to 55.2.2(e), the overheating of parts may be detected by an indicator such as an odor, smoke, discoloration, cracking of materials, charring, flaming, glowing, arcing, changes in circuit current through the applied fault, or any similar phenomenon.

55.3 Overload test

55.3.1 One controller is to be tested. The output terminals of the controller are to be loaded as intended. One of the outputs is then to be shorted to the common terminal while the input to the controller is connected to a 60 Hz, 120 V supply source. The controller is to be placed on a softwood surface covered with tissue paper and draped with a double layer of cheesecloth.

55.3.2 The test is to be conducted for 7 hours or until at least one of the results described in 55.2.2 are observed.

56 Tests for Permanence of Cord Tag

56.1 General

56.1.1 When tested as described in 56.2.1 – 56.3.2, a cord tag containing the markings specified in Sections 124 – 126 shall comply with all of the following:

a) The tag shall resist tearing longer than 1/16 inch (1.6 mm) 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 may render the marking of the tag illegible; and

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

56.2 Test conditions

56.2.1 Each of nine cord tags is to be applied to a cord and conditioned as described in 56.2.2 – 56.2.4, as indicated, before being tested as described in 56.3.1 and 56.3.2. If the tag is applied by an adhesive, the conditioning is to be conducted at least 24 hours after the application of the tag.

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

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

56.2.4 Each of three cord tags is to be tested within 1 minute of being exposed to a humidity of 85 ±5 percent at 32 ±2°C (89.6±3.6°F) for 72 hours.

56.2.5 In addition to the conditioning described in 56.2.2 – 56.2.4, 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 56.2.6 – 56.2.9, as indicated, before being tested as described in 56.3.1 and 56.3.2.

56.2.6 Each of three tags is to be tested after 24 hours of exposure conditioning at 23 ±2°C (73.4 ±3.6°F) and 50 ±5 percent relative humidity, followed by 48 hours of immersion to a depth of not less than 1/8 inch (3.2 mm) in demineralized water at a temperature of 23°C (73.4°F). Testing in accordance with 56.3.1 and 56.3.2 shall be performed within 1 minute of the conditioning.

56.2.7 Each of three tags is to be tested after 24 hours of exposure conditioning at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5 percent relative humidity, followed by 10 days of exposure in an air-circulating oven at a temperature of 60°C (140°F). Testing in accordance with 56.3.1 and 56.3.2 shall be performed 30 minutes after the conditioning.

56.2.8 Each of three tags is to be tested after 24 hours of exposure conditioning at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5 percent relative humidity, followed by 7 hours of exposure in a cold box at a temperature of -10 ±2°C (14.0 ±3.6°F). Testing in accordance with 56.3.1 and 56.3.2 shall be performed within 1 minute of the conditioning.

56.2.9 Each of three tags is to be tested after 24 hours of exposure conditioning at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5 percent 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 the Standard for Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials, ASTM G 23. The tags are to be exposed for 720 hours. The operating cycle is to be 20 minutes consisting of 17 minutes of light exposure only and three minutes of water spray and light, or

b) Xenon-arc, Type B, in accordance with the Standard for Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure Of Nonmetallic Materials, ASTM G 26. The tags are to be exposed for 1000 hours. The operating cycle is to be 120 minutes consisting of 102 minutes of light exposures only and 18 minutes of exposure to water spray and light.

Testing in accordance with 56.3.1 and 56.3.2 shall be performed after 24 hours of exposure at 25 ±5°C (77 ±9°F).

56.3 Test method

56.3.1 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 taut in a vertical plane. A force of 5 lbs (22.2 N) is to be applied for 1 minute to the uppermost corner of the tag farthest from the cord, within 1/4 inch (6.4 mm) 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 56.1.1(d), manipulation, such as straightening of the tag by hand, is permissible.

56.3.2 To determine compliance with 56.1.1(e), each cord tag assembly is to be scraped 10 times across printed areas and edges, with a force of approximately 2 lbs (8.9 N), using the edge of a 5/64 inch (2.0 mm) 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 1.00 inch (25.4 mm) and the edges of the blade shall be rounded to a radius of approximately 1/64 inch (0.4 mm).

PRODUCTS EMPLOYING POLYMERIC ENCLOSURES

57 General

57.1 In addition to the other applicable requirements contained in this Standard, a product which employs a polymeric enclosure shall also comply with the requirements in Sections 58 – 63, in the order presented unless otherwise indicated.

Exception: An ornament which employs a polymeric enclosure shall instead comply with the applicable requirements in either General, Section 102, if electronically operated or General, Section 114, if non-electronically operated.

58 Enclosure Mold Stress Relief Test

58.1 When conditioned as described in 58.2 and 58.3, there shall not be any:

a) Softening of the material, as determined by examination immediately after the conditioning,

b) Shrinkage, warpage, or other distortion of the enclosure material resulting in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1, and

c) Cracking or denting of the enclosure of the unit that would affect the function of any safety controls or constructional features such as thermostats or strain relief, or result in the exposure of moving parts increasing the risk of injury to persons.

58.2 Component parts such as knobs, windows, or inserts that become distorted as a result of the test described in 58.3 may be removed if they interfere with the operation of the unit provided the removal of parts does not result in the inability of the unit to comply with the enclosure requirements in 10.1.1 and the accessibility of live parts requirements in 12.1.

58.3 Each of two previously untested units is to be tested. Each complete, unenergized unit is to be placed in a full-draft circulating air oven for a period of 7 hours at a temperature of 10°C (18°F) above the maximum operating temperature of the enclosure, measured at the hottest location on the inside of the enclosure during the Temperature Test, Section 43, but not less than 70°C (158°F).

59 Drop Test

59.1 After being tested as described in 59.2 and 59.3, a product shall comply with all of the following:

a) There shall not be any visible damage to the enclosure of the unit that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1;

b) There shall not be any cracking or denting of the enclosure of the unit that would affect the function of any safety controls or constructional features such as thermostats, overload protective devices, waterseals, or strain relief, or result in the exposure of moving parts increasing the risk of injury to persons;

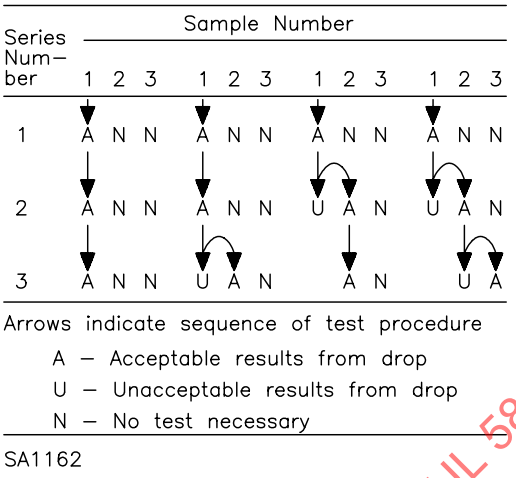
c) There shall not be any damage to the enclosure of the unit that would result in an increase in the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 45.

59.2 Each of three complete, previously untested products is to be subjected to this test. Each unit is to be dropped three consecutive times from a height of 3 ft (0.92 m) to strike a flat hardwood surface in the positions most likely to produce adverse results. Each unit is to be oriented in such a manner so that a different surface of the enclosure of the unit strikes the hardwood surface for each of the three drops. If the product is intended for outdoor use, it is to be dropped onto a concrete surface. Any lamps may be removed from the unit before the test.

Exception: If the manufacturer so elects, fewer units may be tested in accordance with Figure 59.1, where each series consists of three drops of the unit. The overall performance is acceptable upon completion of any one of the procedures represented in the figure. If a unit does not comply on its first series of three drops, the results of the test are unacceptable.

Figure 59.1

Procedure for impact test



59.3 The hardwood surface is to consist of a layer of nominal 1 inch (25 mm) tongue-and-groove oak flooring (actual size 3/4 by 2-1/4 inch or 18 by 57 mm) mounted on two layers of nominal 3/4 inch (19 mm) plywood. The assembly is to rest on a concrete floor or an equivalent non-resilient floor during the test.

60 Impact Test

60.1 After being tested as described in 60.2 and 60.3, a product shall comply with all of the following:

a) There shall not be any visible damage to the enclosure of the unit that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1;

b) There shall not be any cracking or denting of the enclosure of the unit that would affect the function of any safety controls or constructional features such as thermostats, overload protective devices, waterseals, or strain relief, or result in the exposure of moving parts increasing the risk of injury to persons;

c) There shall not be any damage to the enclosure of the unit that would result in an increase in the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 45.

60.2 Each of three previously untested products is to be subjected to a single impact. The impact is to be produced by dropping or swinging a 2-inch (50.8-mm) diameter steel sphere, weighing 1.18 lbs (0.535 kg) from a height which will produce an impact of 5 ft-lbs (6.8 J). The unit is to be rigidly supported and the impact is to be made normal to the most vulnerable spots on the unit enclosure that may be exposed to a blow during intended use. The steel sphere is to strike a different surface of the unit for each impact. For surfaces other than the top of an enclosure, 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 60.1 with respect to the ball drop impact test or to Figure 60.2 for the ball pendulum impact test.

Exception: If the manufacturer so elects, fewer than three units may be used for the tests in accordance with Figure 59.1 wherein each series consists of one impact. The overall performance is acceptable upon completion of any one of the procedures represented in the figure. If a unit does not comply on its first series of three drops, the results of the test are unacceptable.

Figure 60.1

Ball drop impact test

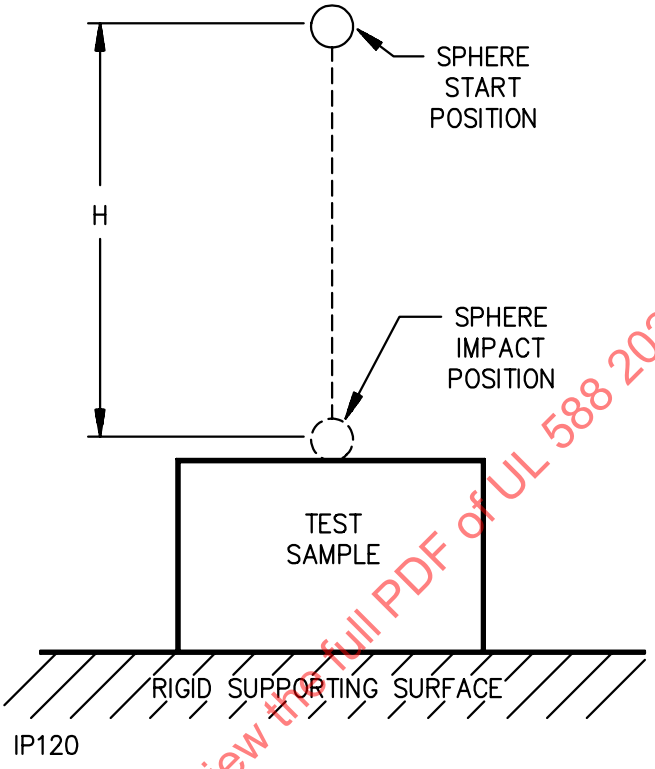
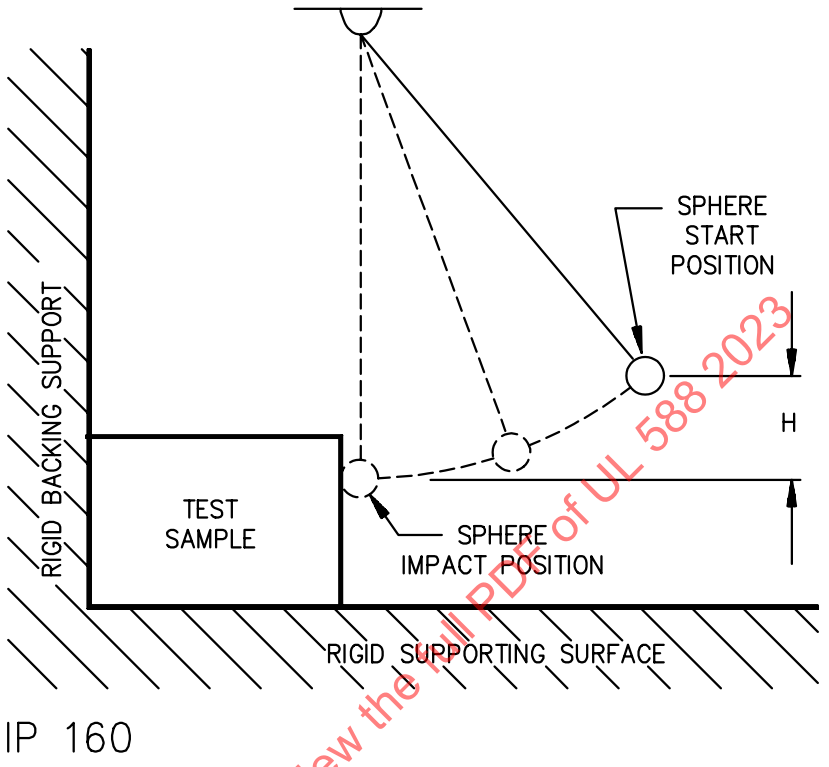


Figure 60.2

Ball pendulum impact test



60.3 With reference to Figure 60.1 and Figure 60.2, 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 test unit when the string is in the vertical position. The supporting surface for the ball drop impact is to be as described in 59.3. 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 3/4 inch (19 mm) plywood over a rigid surface of concrete or an equivalent nonresilient backing surface may be used.

61 Cold Impact Test

61.1 In addition to the Impact Test, Section 60, a product intended for outdoor use shall comply with all of the following after being tested as described in 61.2:

a) There shall not be any visible damage to the enclosure of the unit that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1;

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

c) There shall not be any damage to the enclosure that would result in the increase of the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 45.

61.2 Each of three previously untested products is 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 hours. Within 30 seconds of removal from the chamber the units are to be subjected to the Impact Test, Section 60.

62 Resistance to Crushing Test

62.1 After being tested as described in 62.2, a product shall comply with each of the following:

a) There shall not be any visible damage to the enclosure of the unit that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1;

b) There shall not be any cracking or denting of the enclosure of the unit that would affect the function of any safety controls or constructional features such as thermostats, overload protective devices, waterseals, or strain relief, or result in the exposure of moving parts increasing the risk of injury to persons;

c) There shall not be any damage to the enclosure of the unit that would result in an increase in the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 45.

Exception: A direct plug-in unit which complies with the applicable requirements described in Sections 18 and 34, need not be subjected to this test.

62.2 Each of two previously untested units is to be subjected to a steady crushing force of 75 lbs (334 N) for one minute. The unit is to be mounted between two parallel, flat, maple blocks, each not less than 1/2 inch (12.7 mm) thick. One block is to contain slots into which the blades of the unit, if provided, are to be fully inserted. The crushing force is to be applied gradually in a direction normal to the mounting surface.

63 Adhesive Test

63.1 A product which employs an enclosure or part of an enclosure which is held together by adhesive is to be subjected to this test. After the conditioning described in 63.2, there shall not be breakdown of the adhesive to the extent that parts of the product can be readily separated.

63.2 A product is to be placed in a circulating-air oven for a period of fourteen days at a temperature of 90 ±1.0°C (194 ±1.8°F) or 10°C (18°F) above the maximum operating temperature of the enclosure, whichever is higher. After removal from the oven, the product is to be placed in a humidity chamber that has been adjusted for 88 ±5 percent humidity at 32.0 ±2.0°C (89.6 ±3.6°F) for 7 days. Upon removal from the chamber, the product is to be examined to determine compliance with 63.1.

PRODUCTS EMPLOYING OVERCURRENT PROTECTIVE DEVICES

64 General

64.1 A product or wiring device employing an overcurrent protective device shall comply with the applicable requirements in Sections 65 – 69.

Exception: An in-line fuseholder with insulation-piercing terminals shall instead comply with the requirements for In-Line Fuseholders with Insulation-Piercing Terminals for Seasonal Products, Supplement SC.

65 Calibration Test

65.1 When tested in its holder as described in 65.2, an overcurrent protective device employed in a seasonal lighting product shall open:

a) Within 60 minutes when carrying 135 percent of its rated current, and

b) Within 2 minutes when carrying 200 percent of its rated current.

65.2 Each of six representative overcurrent protective devices is to be subjected to this test. One device in its holder is to be connected in series with a 120 V ac, 60 Hz supply source, a variable resistor, and an ammeter. A switch is to be placed across the overcurrent protective device to short it out of the circuit while the resistor is adjusted to supply a test current equal to 135 percent of the device's rating. The switch is then to be opened and the test current is to be monitored for 60 minutes or until the device opens, causing the current to stop flowing. The test is to be repeated on 2 of the 5 remaining devices. The test is then to be repeated on the three remaining devices at a current equal to 200 percent of the device's rating, for 2 minutes or until the device opens.

66 Fault Current Test

66.1 When an overcurrent protective device and holder employed in a seasonal lighting product is tested as described in 66.2, there shall not be ignition of cotton.

66.2 Each of six representative fuse assemblies is to be subjected to this test. A 120 V ac, 60 Hz supply source is to be connected in series with a calibrated circuit and a 20 A time-delay fuse. The calibrated circuit is to be adjusted to supply a test current of 200 A at a power factor of 0.75 to 0.80 without the assembly under test or the time-delay fuse in the circuit. One fuse is to be inserted into its holder and connected in series with the supply source, the calibrated circuit, and the fuse. Cotton is to be placed around the assembly. If the fuse is located within an attachment plug or current tap, the blades of the device are to be inserted into a receptacle and cotton is to be placed around the body of the device, not in contact with its face. The circuit is to be energized and the test current is to be monitored until the fuse opens, causing the current to stop flowing. The test is to be repeated on 2 of the 5 remaining assemblies. The test is then to be repeated at a current of 1000 A on the three remaining assemblies.

67 Fuseholder Temperature Test

67.1 When tested as described in this section, the temperature rise of an in-line fuseholder or an attachment plug, power inlet, current tap, or product incorporating a fuseholder shall not exceed the following:

a) 85°C (153°F) on the fuse clips;

b) 30°C (54°F) at the wiring terminals or cord connections;

c) The relative thermal index of the surrounding insulating material, minus an assumed ambient of 25°C (77°F); and

d) 60°C (108°F) on any exposed exterior surface.

67.2 The test is to be conducted on a set of six previously untested devices. The test is to be conducted with a live fuse.

Exception: If the live fuse opens at the rated fuse current, in the fuseholder to be tested, twice before temperatures are stabilized as indicated in 67.6, a dummy fuse may be employed for temperature testing in accordance with 67.8 and 67.9. The dummy fuse is to be made from a copper tube, identical to the length of the live fuse and diameter of the contact area of the live fuse.

67.3 The devices are to be wired in a series circuit with the blades of the attachment plug, power inlet, or current tap connected by the shortest possible length of solid copper wire soldered across the blades. For an attachment plug or current tap intended for use with flexible cord, each connection to the fuseholder being tested is to be made by means of a 6 inch (150 mm) or shorter length of the appropriate type of flexible cord that has an ampacity at least equal to that of the device. For a male inlet, Type RH or Type TW lead-in wires no more than 6 inches (150 mm) long are to be connected to the wiring terminals. Wire of

the intended ampacity is to be used regardless of the size of the cord which is intended to be used with the device.

67.4 Temperatures are to be measured by means of thermocouples attached to the fuse clips, the insulating material of the device body in proximity to the fuseholder, and the wiring terminals or cord connections and the exterior exposed surfaces.

Exception: If the wiring terminals or cord connections are not accessible for mounting thermocouples, the thermocouples are to be attached to the blades as close as possible to the face of the device.

67.5 The thermocouples are to consist of 28 – 32 AWG (0.08 – 0.032 mm^2) iron and constantan wires. It is a common practice to employ thermocouples consisting of 30 AWG (0.05 mm^2) iron and constantan wires with a potentiometer type of indicating instrument. This equipment will be used if a referee measurement of temperature is necessary.

67.6 The device is to be connected to a supply circuit of 120 V and a frequency of 60 Hz. The device is then to be operated continuously for a minimum of 3 hours, under representative intended service conditions that are likely to produce the highest temperature, until constant temperatures are attained. Constant temperatures are considered to exist when three consecutive readings, taken at 15 minute intervals, are within 1°C (1.8°F) of each other and indicate no further rise above the changes in ambient temperature.

67.7 Each device is to be tested with the rated fuse intended for use with the device installed and subjected to a test current equal to the maximum fuse ampere rating. The intended ampere rating of the fuse is to be 3 A for a 22 AWG (0.32 mm^2) wire connection and 5 A for 20 or 18 AWG (0.52 or 0.82 mm^2) wire connection. If the device is rated for multiple ranges of wire, it is to be tested at each current level with the corresponding wire sizes. A current tap shall have 15 A of test current through the female contacts and blades in addition to the test current in the fuse circuit specified above.

67.8 If the test is to be conducted with a dummy fuse in accordance with the Exception to 67.2, each device is to be subjected to a test current equal to the intended maximum ampere rating of the intended fuse. The correlation testing described in 67.9 is to be performed on the dummy fuse and the live fuse to determine the temperature correction factor. To represent the heating of a live fuse, the correction factor is to be added to the recorded temperature rise on the wiring terminals, cord connections, surrounding insulating materials, conductors, fuse clips, and exterior surfaces.

67.9 The dummy fuse and live fuse are to be tested in the fuseholder under identical conditions. In order to allow the live fuse to reach temperature stabilization without opening in the fuseholder, it may be necessary to remove the fuse cover, provide ventilation openings in the fuseholder, or both. Any modifications are also to be made to the dummy fuseholder. The difference in measured temperatures between the live fuse and the dummy fuse is the temperature correction factor.

68 Fuseholder Crush Test

68.1 As a result of the test described in 68.2, there shall not be any cracking of the fuseholder or exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1.

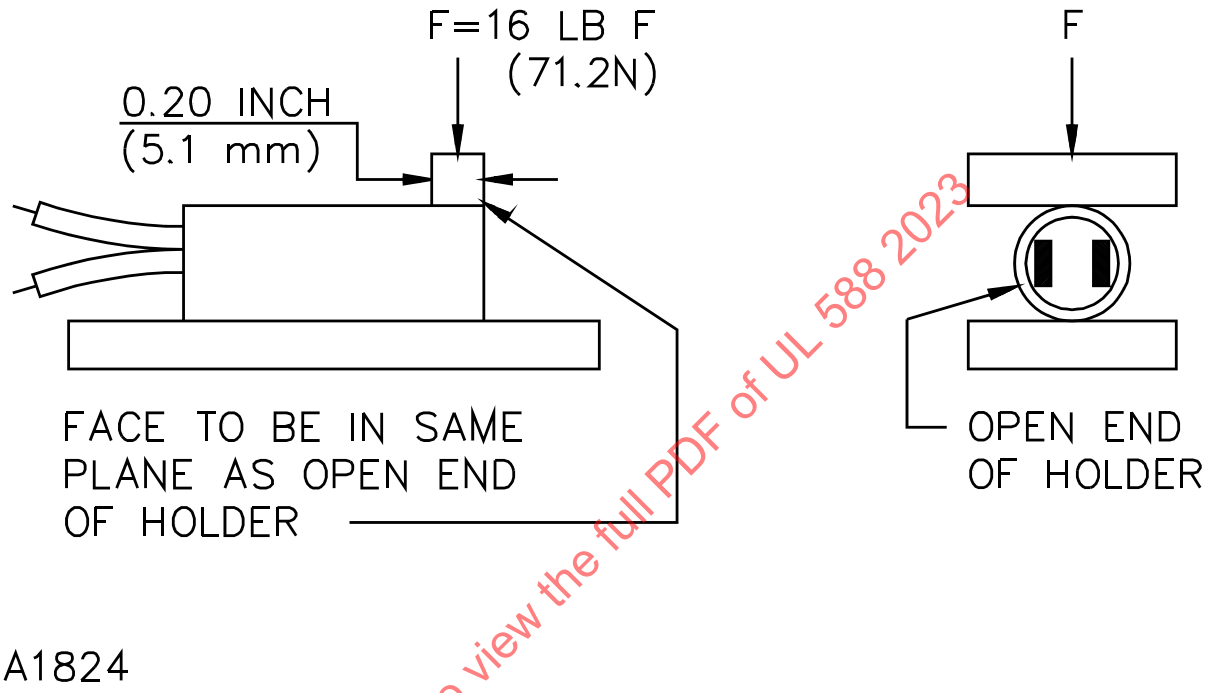
Exception: A fuse incorporated in an attachment plug or current tap need not comply with this requirement.

68.2 Each of three fuseholders is to be tested. Each fuse is to be removed from each fuseholder. The fuseholder is then to be placed between two flat surfaces parallel to each other and parallel to the major axis of the holder. A force of 16 lbs (71.2 N) is to be applied perpendicular to the major axis of the holder and to the plane of the flat surfaces for 1 minute. For holders with open ends for fuse insertion, the force is

to be applied over a distance of 0.20 inch (5.1 mm) as measured from the open end of the holder. See Figure 68.1.

Figure 68.1

Crush test on open-end fuseholder



69 Fuseholder Cover Test

69.1 When subjected to a force of 8 lbs (36 N) applied for 1 minute to an open cover in any direction that the cover may be removed, the open cover of a fuseholder, fused attachment plug, or current tap, or similar device, shall not detach from the body of the device. One fuseholder is to be tested.

PRODUCTS EMPLOYING CORD-CONNECTED WIRING DEVICES OR POWER INLETS

70 General

70.1 In addition to the applicable requirements contained elsewhere in this Standard, a product employing a cord-connected wiring device, such as an attachment plug or cord connector, or a power inlet shall also comply with the applicable requirements in Sections 71 – 76, in the order presented unless otherwise indicated.

71 Strain Relief Test

71.1 The connection of a pair of wires or the conductors of a cord to an attachment plug, a current tap, or a cord connector by a means other than binding-screw terminals shall, except as provided in the Strain Relief Test, Section 46, withstand the straight pull described in 71.2. As a result of the test:

a) Neither conductor of the pair shall become detached from the terminal to which it is connected,

b) There shall not be exposure of live parts as determined by contact with the probe illustrated in Figure 9.1,

c) There shall not be any breakage of the cord, and

d) The leads shall not be displaced more than 1/16 inch (1.6 mm) from the point of entry into the device.

71.2 One device is to be securely supported, such as by the blades in the case of an attachment plug or current tap, and the cord or pair of wires is to be subjected to a straight pull of 30 lbs (133 N) for an assembly with 18 AWG (0.82 mm^2) or larger conductors and 20 lbs (89 N) if the conductors are smaller than 18 AWG. The pull is to be applied by suspending a weight from the cord or wires in a direction normal to the plane of the cord-entry hole. The pull is to be gradually applied and maintained for a period of 1 minute.

72 Reliability of Conductor Connections Test

72.1 If the conductors of the flexible cord or wire are assembled to the blades or contacts of an attachment plug, a current tap, or a cord connector prior to the assembly of the blades or contacts in the device, each connection shall withstand for 1 minute, without breaking, a pull of 20 lbs (89 N) if the conductor is 18 AWG (0.82 mm^2) or larger and a pull of 8 lbs (36 N) if the conductor is smaller than 18 AWG. The pull is to be applied in a direction normal to the plane of the cord-entry hole. As a result of the test, the conductors shall not be displaced more than 1/16 inch (1.6 mm) from the point of entry into the device. The test is to be conducted prior to the assembly of the blades or contacts in the device.

73 Security of Blades Test

73.1 The blades of a wiring device, if they are not rigidly fixed prior to their being connected to the conductors of the cord, or the blades of a power inlet shall be subjected to this test. Each blade, and the parallel blades tested together, shall be capable of withstanding a straight pull of 20 lbs (89 N) for 2 minutes without loosening. For a device of nonrigid construction, where soft, molded material is employed, neither blade shall become displaced more than 3/32 inch (2.4 mm) when measured 2 minutes after removal of the weight.

73.2 One device is to be tested. The device is to be wired in the intended manner and then supported on a horizontal steel plate with the blades projecting downward through a hole having a diameter just large enough for the blades to pass through. The 20 lb (89 N) pull is to be applied by supporting a weight from each blade in succession, and then by the two blades tested together.

74 Security of Input Contacts Test

74.1 As a result of the tests described in 74.2 and 74.3, the blades of a power inlet shall not loosen to a degree such that the power inlet does not comply with the requirements in Spacings, Section 16. After completion of the test, the power inlet shall also comply with the Dielectric Voltage-Withstand Test, Section 45.

74.2 A power inlet is to be rigidly supported in the blades-up position. Each blade, in turn, is to be individually subjected to a force of 30 lbs (133 N) applied gradually along the longitudinal axis of the blade in a direction towards the face of the unit, for 1 minute.

74.3 The same power inlet is to be again positioned as described in 74.2. Both blades are then to be subjected, in combination, to a single applied force of 40 lbs (178 N) for 1 minute.

75 Security of Insulation Test

75.1 Cord and wires employed in a seasonal lighting product shall be secured within the attachment plug, current tap, or cord connector such that the conductor insulation does not slip away from the terminal connections. Unless a knot in the cord or wires inside the plug or other equivalent positive means provides security for the conductor insulation, the assembly shall be capable of withstanding the pull described in 75.2 without detachment of the insulation from the holding means within the device, or baring of the conductors at the entry to the device.

75.2 One device is to be wired as intended with at least a 6-inch (152-mm) length of flexible cord or wires. The insulation on each conductor of the cord or wires is to be slit, parallel to the conductor, for a short distance at a point approximately 1 inch (25.4 mm) from its entry into the device, and all strands of the conductor and the separator (if any) are to be severed at the slit portion. With the device securely held by its blades, a direct pull of 15 lbs (67 N) for 20 AWG (0.52 mm^2) or larger conductors and 10 lbs (45 N) for conductors smaller than 20 AWG is to be applied for 2 minutes at the free end of the cord or wires. The pull is to be applied in a direction normal to the plane of the cord-entry hole.

76 Accessibility Test

76.1 When a product employing a power inlet is tested as described in 76.3, the test probe described in 76.2 shall not contact any blade of the power inlet while the inlet is conductively connected to the cord connector. If the power inlet is removable without the use of a tool, then the test is to be conducted with the power inlet removed from the product.

76.2 The test probe is to be made of 0.06 inch (1.5 mm) thick metal that is 1.38 inches (35 mm) wide and not less than 1.38 inches long.

76.3 The product is to be tested with the detachable power-supply cord supplied with the product. If one is not provided, the cord connector used in this test is to comply with the requirements in the Standard for Attachment Plugs and Receptacles, UL 498. The cord connector is to be inserted as far as possible onto the power inlet blades. The cord connector is then to be withdrawn not more than the distance that is necessary to permit the test probe to be inserted between the power inlet body and the cord connector. The test probe is to be inserted with a maximum force of 4 lbs (17.8 N), until the probe contacts one blade of the power inlet. While the probe is in contact with the blade, the electrical continuity between the contacts of the cord connector and the test probe is to be determined by an ohmmeter or similar instrument. The test is then to be repeated for the other blade of the power inlet.

PRODUCTS EMPLOYING SERIES-CONNECTED LAMPHOLDERS

77 General

77.1 In addition to the applicable requirements contained elsewhere in this standard, a product employing series-connected lampholders shall comply with the requirements in Sections 78 – 84 in the order presented unless otherwise indicated.

78 Oven Test

78.1 As a result of the test described in 78.2, there shall not be exposure of live parts in a lampholder of polymeric composition other than phenolic or urea, as determined by contact with the accessibility probe illustrated in Figure 9.1.

78.2 Each of twelve lampholders, with unenergized lamps installed, is to be suspended by their leads in a circulating-air oven maintained at a uniform temperature of 120.0 ±1.0°C (248.0 ±1.8°F). Twelve additional lampholders, with unenergized lamps installed, are to be placed on their sides in the oven on a

flat surface. The lampholders are to be removed from the oven after 2 hours of heating, and allowed to cool to room temperature. Each lampholder is then to be examined for exposure of live parts.

79 Lampholder Strain Relief Tests

79.1 Lead pull test

79.1.1 The strain relief means provided for the lampholder leads shall perform acceptably as determined by 79.1.2 or 79.1.3, when tested as described in 79.1.4.

79.1.2 For 20 AWG (0.52 mm^2) or larger conductors, the strain relief shall be considered acceptable if:

a) The average of the recorded pull values is at least 27 lbf (120 N),

b) No lampholder or connection sustained damage at less than 24 lbf (107 N), and

c) No portion of the conductor becomes exposed outside the lampholder body.

79.1.3 For conductors smaller than 20 AWG (0.52 mm^2), the strain relief shall be considered acceptable if:

a) The average of the recorded pull values is at least 9 lbf (40 N),

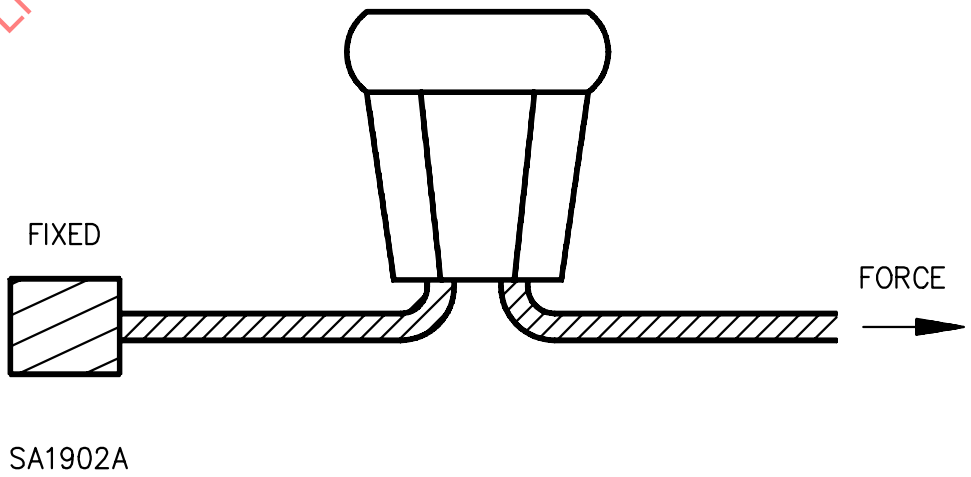
b) No lampholder or connection sustained damage at less than 8 lbf (36 N), and

c) No portion of the conductor becomes exposed outside the lampholder body.

79.1.4 Each of eight previously untested lampholders in the product is to be tested. With the lampholder free, a pull is to be applied to the leads as illustrated in Figure 79.1. Starting at zero, the pull is to be increased uniformly at a rate of approximately 12 lbf/min (53 N/min) until one of the connections or the lampholder body is broken. This pulling force is to be recorded. The pulling force is to be increased to a maximum of 30 lbs (133 N) for 20 AWG (0.52 mm^2) or larger conductors, or 10 lbf (45 N) for conductors smaller than 20 AWG. These maximum forces are to be recorded if there is no damage to the connections or lampholder body. Breakage of the wire on an individual lampholder is to be disregarded.

Figure 79.1

Application of pull



79.2 Secureness of leads test

79.2.1 When tested as described in 79.2.2, the securing means of a lampholder shall be considered acceptable if:

a) There is no damage to the lead connection,

b) There is no breakage of the conductor,

c) No portion of the conductor becomes exposed outside the lampholder body, and

d) The leads are not displaced more than 1/16 (1.6 mm) from the point of entry into the lampholder body.

79.2.2 Each of three previously untested lampholders is to be subjected to this test. The lampholder is to be securely held in a manner that does not additionally support the conductor connection. A pull of 8 lbs (36 N) for a 20 AWG (0.52 mm^2) cord or a pull of 20 lbs (89 N) for an 18 AWG (0.82 mm^2) or larger cord is to be applied gradually to each conductor individually and maintained for 1 minute.

80 Secureness of Lampholder Contacts Test

80.1 As a result of the test described in 80.2 and 80.3, a lampholder contact shall not be displaced more than 1/32 inch (0.8 mm).

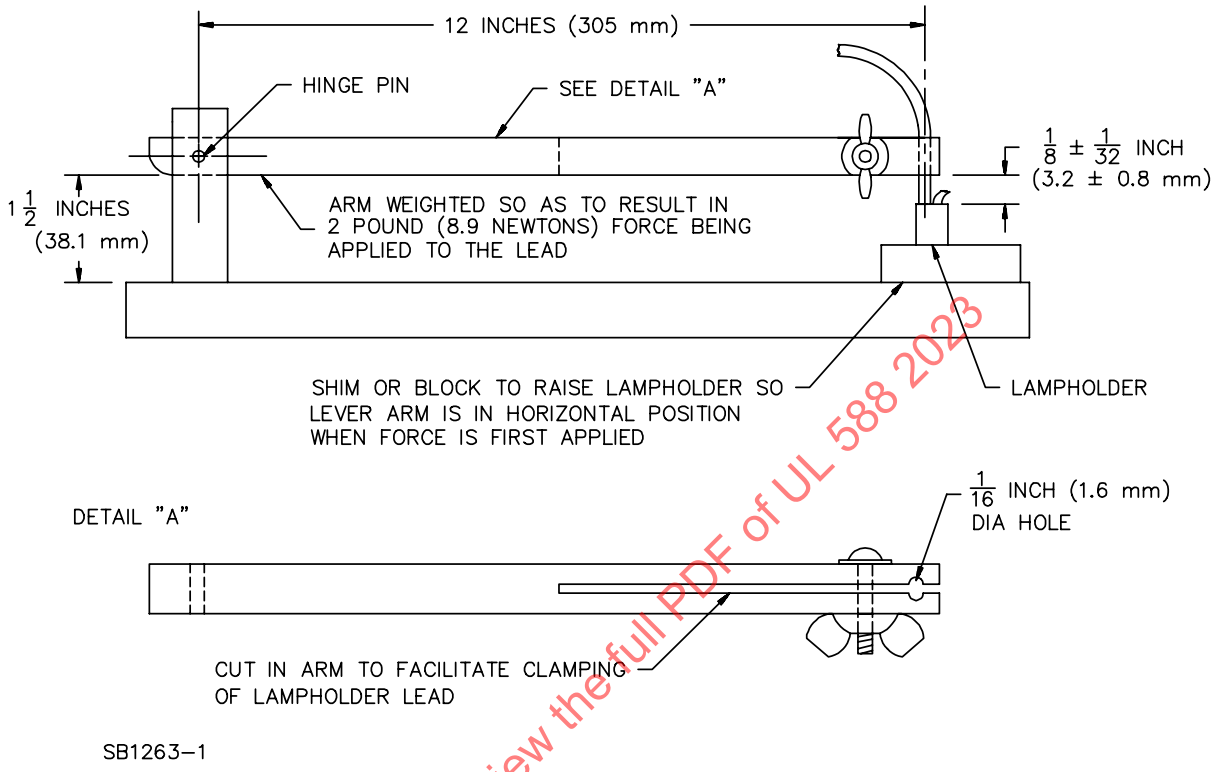
80.2 Each of six previously untested lampholders is to be operated for a period of 7 hours in a position tending to cause the greatest heating of the lampholder. The lampholders are then to be cooled to room temperature.

80.3 Each of six lampholders in the as-received condition and each of six lampholders conditioned as described in 80.2 is to be tested. After removing the lamps from the lampholders, a force of 2 lbs (8.9 N) is to be applied for one minute to the individual wire or cord, 1/8 ±1/32 inch (3.2 ±0.8 mm) from its point of entry into the lampholder body, in a direction tending to force the contacts out of the body. This may be accomplished through the use of a test jig as illustrated in Figure 80.1.

Exception: If a knot in the conductors is provided outside the body of the lampholder as a means of securing the contacts, reducing the likelihood of the attachment of the clamping device 1/8 inch (3.2 mm) from the lampholder body, the clamp is to be secured immediately adjacent to the knot on the side away from the lampholder.

Figure 80.1

Test jig for secureness of lampholder contacts



81 Lampholder Millivolt Drop Test

81.1 When tested as described in 81.2, the drop in potential between the input leads of the lampholder through the lamp-base contacts of a product employing series-connected push-in or midget or miniature screw base lamps, shall not be greater than 200 mV while a current equal to 135 percent of the rating of the overcurrent protective device is flowing.

81.2 One lampholder is to be fitted with a modified lamp base of the intended size and type. For a push-in lampholder, the lamp base is to be modified by removing the envelope and leads from the base. For a screw lampholder, the lamp base is to be modified by removing the envelope and electrical parts from the base. In both cases, a short length of not more than 1 inch (25 mm) of 30 AWG (0.05 mm^2) copper wire is to be assembled to the lamp base to replace the removed parts. The lampholder assembly is then to be connected in series with an ammeter and a variable resistor across any convenient dc supply. The voltage drop is to be measured between the lampholder leads within 1/2 inch (12.7 mm) of the point of entry into the lampholder body.

82 Rope Strength Test

82.1 A non-current carrying polymeric supporting rope which is intended to be twisted with single conductor CXTW wire as described in Exception No. 4(a) of 13.2.4 shall be tested as described in 82.3 and 82.4. The average and minimum as-received breakage pull values of the representative polymeric supporting ropes shall be greater than 28 and 23 lbs (125 and 102 N) respectively, and the average breakage pull value after oven conditioning shall be greater than 60 percent of the as-received value. Prior to testing the representative polymeric supporting ropes shall be separated from the single conductor CXTW wire used in the lighting string.

82.2 A construction as described in Exception 4(b) or Exception 5 of 13.2.4 shall be tested as described in 82.3 and 82.4. The average and minimum as-received breakage pull values of the representative polymeric supporting ropes shall be greater than 56 and 46 lbs (249 and 204 N) respectively, and the average breakage pull value after oven conditioning shall be greater than 60 percent of the as- received value.

82.3 Each of three as-received representative polymeric supporting ropes is to be conditioned in an air-circulating oven for 168 hours maintained at a uniform temperature of 100.0 ±1.0°C (212.0 ±1.8°F). After being removed from the oven, the representative polymeric supporting ropes are to be allowed to cool to room temperature and tested as described in 82.4.

82.4 Each of three as-received and three conditioned representative polymeric supporting ropes are to be tested. Opposing forces spaced 1 inch apart are to be applied to the rope. Starting at zero, the force is to be increased uniformly at a rate of approximately 12 lbf/min (53 N/min) until the rope breaks. The force at which the rope breaks is to be recorded.

83 Crush Test

83.1 A lampholder shall comply with the Fuseholder Crush Test, Section 68, when tested without a lamp.

84 Cascade Lamp Burnout Simulation Test

84.1 The test described in 84.2 and 84.3 is intended to simulate the maximum lamp temperatures that may be attained as a result of lamp-filament burnouts in products employing series-connected lampholders with push-in or midget or miniature screw-base lamps having internal shunts. As a result of the test, there shall not be:

a) Ignition of the lampholder or any decorative features of the product,

b) Melting or distortion of the lampholder that would result in an increase in the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 45,

c) Exposure of live parts either in the lamp assembly under test or in the unenergized lampholder resting on the energized lampholder as determined by contact with the accessibility probe illustrated in Figure 9.1, or

d) Glowing, charring, or flaming of the cotton or cheesecloth specified in 84.2 (f) and (g).

84.2 The test is to be conducted on a previously untested product in the following order:

a) The normal current of the series-connected lamps, with no flashing lamps, is to be determined at 120 V ac.

b) During the determination in (a), the hottest running lamps are to be determined by probing with a thermocouple with any decorative parts in place, if provided.

c) The three hottest lamps are to be selected.

d) With any separable decorative parts removed, a single lampholder is to be connected in series with the overcurrent protective devices provided with the product as indicated in Figure 84.1.

e) One of the lamps selected in (c) is to be inserted into the lampholder.

f) The lampholder and lamp combination is to be positioned horizontally on a supporting surface covered with cotton and then rotated such that the point at which the filament is closest to the bulb envelope is uppermost.

g) A second unenergized lampholder without a lamp is to be rested on the lamp described in (f) so that the outer surface of the unenergized lampholder body adjacent to its internal electrical contact area is touching the lamp envelope as close as possible to the lamp filament. A single layer of cheesecloth is to be draped loosely over the entire assembly. If nonremovable decorative parts are present, the lamp assemblies are to be positioned for maximum transfer of heat between the energized filament and the nonenergized lampholder electrical contact area. Relative position of the lampholders is to be maintained throughout (h) – (j).

h) With the rheostat at its maximum resistance setting, the circuit is to be energized. The current is to be increased to the value determined in (a), and maintained for 5 minutes ±20 seconds. The current is then to be increased to 1.25 times the current determined in (a) and maintained for 3 – 4 minutes.

i) The current is then to be increased in steps equal to 5 percent of the previous value and the current maintained at each increased value for 3 – 4 minutes. This process is to be continued until either the lamp filament or overcurrent protective device clears the circuit. If during any step there is a discernible physical change in any polymeric material, operation is to be continued at that current for an additional 1 – 2 minutes before continuing to the next step.

j) Following (i), if the lamp filament opens and the lamp shunt and overcurrent protective devices are still operational, the current is to be increased in successive steps equal to 10 percent of the overcurrent protective device rating, and the current maintained at each increased value for 3 – 4 minutes. If after any increase there is any discernible physical change in any polymeric material, operation is to be continued at that current for an additional 5 – 6 minutes before continuing to the next step. In order to save time, it is acceptable to omit the lower-current steps, which begin after the filament opens, as long as three consecutive steps are passed through just prior to the clearing of the circuit by the lamp shunt or overcurrent protective device.

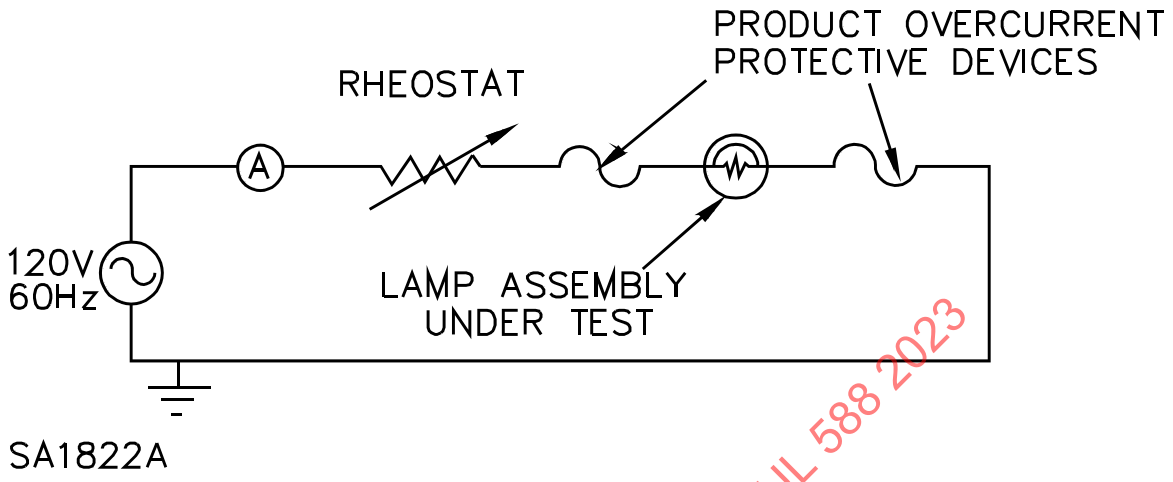
k) Following step (j), the assembly is to be allowed to cool for at least 1 minute. Parts are then to be separated for examination.

Exception No. 1: If a decorative outfit employs a lampholder which is fixed in place, such as a candle set, it shall instead comply with 84.3.

Exception No. 2: A lighting string employing electronic circuits need not comply with the Cascade Lamp Burnout Simulation Test, Section 84, if it is determined that the electronic circuit operates before the internal shunt.

Figure 84.1

Cascade lamp burnout simulation circuit



84.3 The test described in 84.2 is to be repeated with any decorative parts provided in place except that the second unenergized lamp described in 84.2(g) is to be omitted.

PRODUCTS PROVIDED WITH SELF-SHORTING CONTACTS

85 Cascading Lamp Temperature Test

85.1 As a result of the test outlined in 85.2, the maximum measured temperature on the lamp envelope shall not exceed 90 °C prior to the fuse opening.

85.2 The test is to be conducted on a previously untested product in the following order:

a) The tests described in 84.2 (a) – (c).

b) The lampholder assembly combination consisting of each supplementary protector and regular lamp with shunt are to be connected in series with the overcurrent protective devices provided with the product and connected in the circuit as indicated in Figure 84.1.

c) Each lamp and lampholder assembly combination is to be tested in the base-up filament-down position.

d) With the rheostat at its maximum resistance setting, the circuit is to be energized. The current is to be increased in successive steps equal to the value determined in (a), and maintained for 5 minutes for each step until the circuit is to be opened by supplementary protector, lamp shunt, or overcurrent protective device.

e) The envelope temperature is to be measured by thermocouple as described in 43.3.

86 Cycling Test

86.1 After being subjected to the test described in 86.2, the lampholder shall comply with the requirements for the Lampholder Millivolt Drop Test, Section 81.

86.2 Each of six previously untested lampholders with self-shorting contacts is to be subjected to this test. The lampholder is to be cooled to a temperature of -20 ±2°C and maintained at this temperature for a

period of 3 hours. After removal from the chamber, the lamp/base assembly is to be withdrawn and inserted into the lampholder husk loaded with the rated lamp current for 25 cycles. Each of the same six samples is then heated in a circulating-air oven maintained at a uniform temperature of 90 ±2 °C for a period of 3 hours. After removal from the oven, and the lamp/base assembly is to be withdrawn and inserted into the lampholder and loaded with the rated lamp current for 25 cycles. The above steps are to be repeated for 10 times (cycles).

87 Input Test

87.1 For products intended to meet the Exception described in 131.8 when tested in accordance with 87.2, the total current of the series-connected lighting string shall not be more than the maximum current rating of the string.

87.2 The string shall be connected to a 120 Vac, 60 Hz source of supply and operated as intended. The input current shall be recorded. The lamps in the string are to be removed one at a time. The input current of the string shall be recorded after each lamp is removed.

PRODUCTS INTENDED FOR OUTDOOR USE

88 General

88.1 In addition to any other applicable requirements contained in this Standard, a product intended for outdoor use shall also comply with the requirements in Sections 89 – 94, in the order presented unless otherwise indicated. If the product intended for outdoor use employs a polymeric enclosure, the Enclosure Mold Stress Relief Test, Section 58, the Drop Test, Section 59, performed using a concrete surface, and the Cold Impact Test, Section 61, and the Resistance to Crushing Test, Section 62, shall all be performed before the product is subjected to the Rain Test, Section 89, and the Standing Water Immersion Test, Section 91.

89 Rain Test

89.1 When tested as described in 89.2 – 89.5, the construction of a product intended for outdoor use shall not permit the entrance of water into the interior space of the enclosure.

Exception: Water is permitted to enter the interior of a lampholder, attachment plug, current tap, load fitting, or fuseholder employed in the product, provided the device complies with 89.5 (a) and (b), after being tested as described in 89.2 – 89.4.

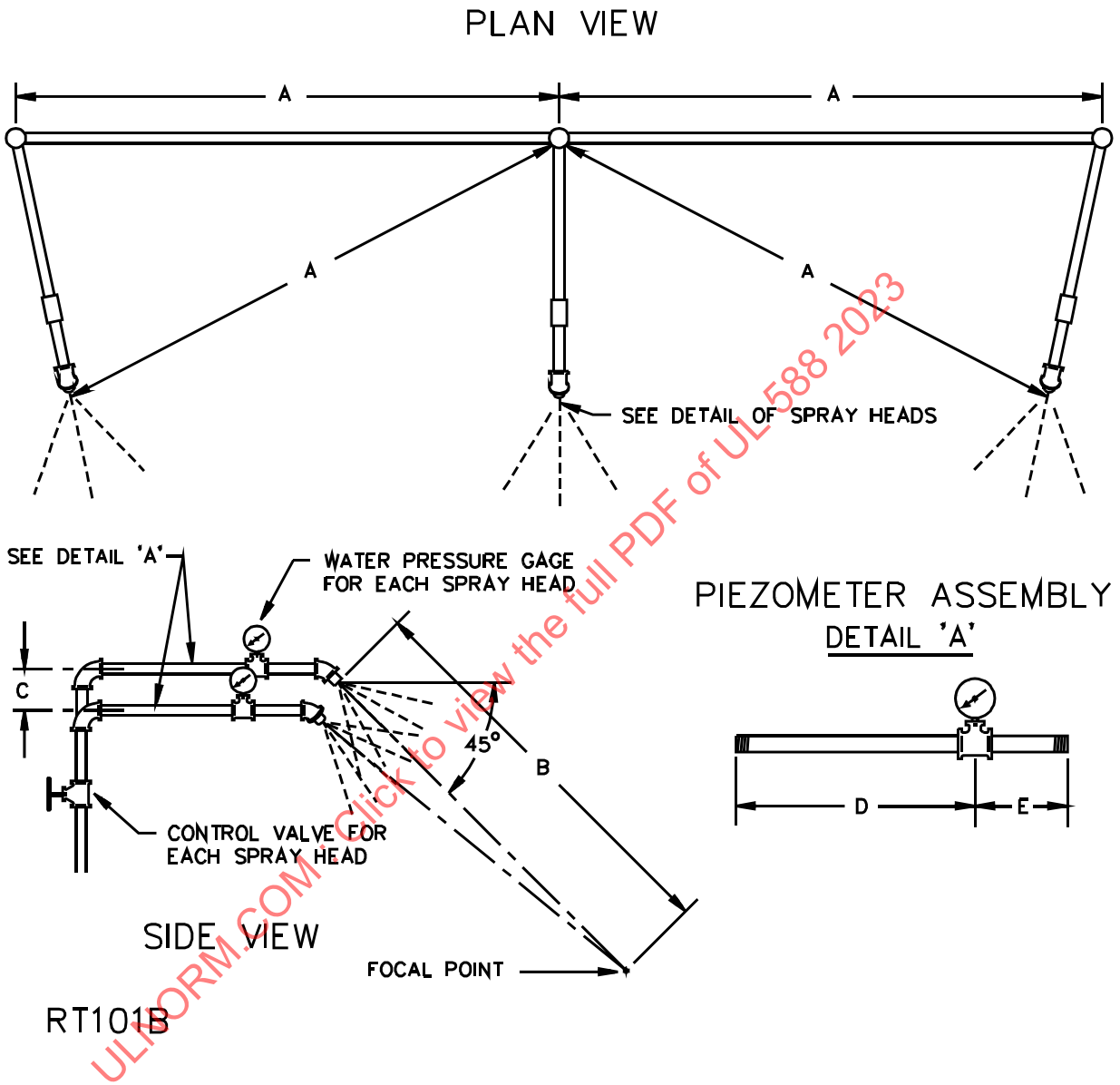
89.2 For all products employing polymeric enclosures, each of four unenergized units is to be tested. One unit is to have been previously subjected to the Enclosure Mold Stress Relief Test, Section 58, one unit is to have been previously subjected to the Drop Test, Section 59, one unit is to have been previously subjected to the Cold Impact Test, Section 61, and one unit is to have been previously subjected to the Resistance to Crushing Test, Section 62. Each unit is to be mounted as specified in the manufacturer's instructions. The unit is to be subjected for one hour to a downward spray of water applied at an angle of 45 degrees to the vertical, in the direction or directions most likely to cause water to enter the unit.

Exception: Series-connected lighting strings shall be subjected to the rain test described in Section 90.

89.3 The water-spray apparatus is to consist of three spray heads mounted as shown in Figure 89.1. The spray heads are to be constructed in accordance with Figure 89.2. The unit is to be positioned in the focal area of the three spray heads such that the greatest quantity of water is likely to enter the unit. If more than one position is likely to cause the entrance of water into the unit, all likely positions are to be tested. The water pressure at each spray head is to be maintained at 5 lb/in^2 (34.5 kPa).

Figure 89.1

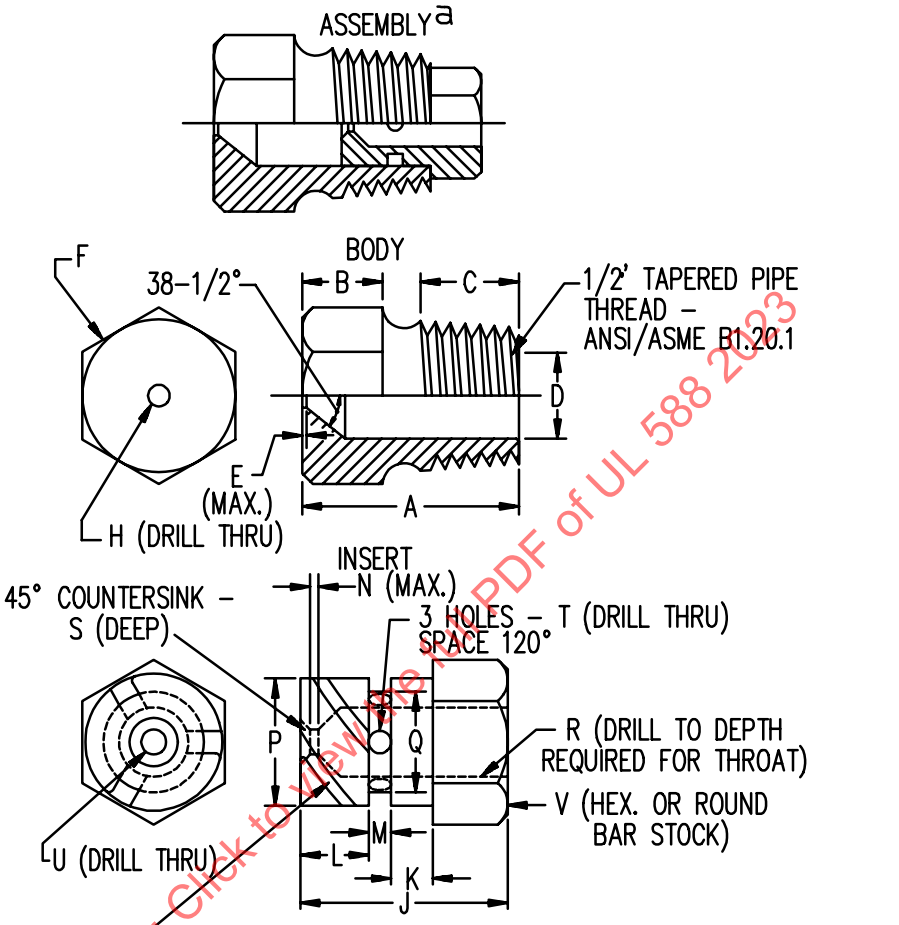
Rain-test spray-head piping



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

Figure 89.2

Spray head



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

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

[b] ANSI B94.11M Drill Size

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

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89.4 The test is to be conducted using water with a resistivity of 2000 ohms-cm. The water resistivity is to be obtained by the addition of sodium chloride (common table salt) to distilled water or tap water. The water temperature is to be 20 – 40°C (68 – 104°F).

89.5 Within five minutes after the completion of the test, the unit shall be maintained in the same orientation as during the application of the rain and also comply with all of the following in the order presented:

a) The Leakage Current Test, Section 40,

b) The Dielectric Voltage-Withstand Test, Section 45 with the dielectric trip current set for a maximum of 150 mA, and

c) A visual inspection to determine that water has not entered the interior space of the enclosure.

Exception: Water is permitted to enter the interior of a lampholder, attachment plug, current tap, load fitting, or fuseholder employed in the product, provided the device complies with (a) and (b).

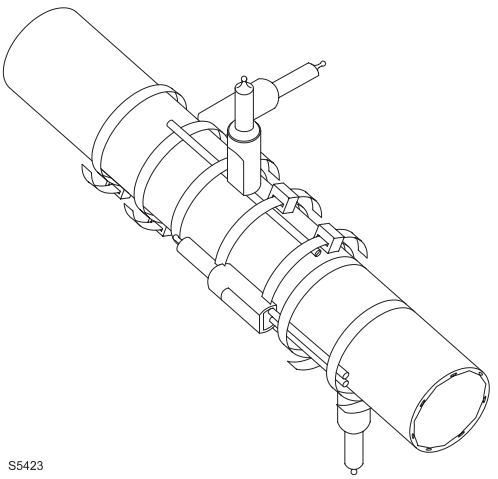
90 Rain Test For Series-Connected Lighting Strings

90.1 The lampholders of a series-connected lighting string intended for outdoor use shall be subjected to the tests described in 90.2 – 90.5.

90.2 Three two-lead lampholders and one three-lead lampholder of a series-connected lighting string shall be secured to the mandrel described in 90.3 using insulated wire positioning devices. These insulated devices shall be placed so that the lampholder is secured as close to the wire exit of the lampholder as possible. The lampholders shall be oriented in the 3, 6, and 12 o'clock positions as shown in Figure 90.1 with the three-lead lampholder at the 6 O'clock position. The remaining lampholder shall be secured so that it is parallel to the mandrel with the wire exit as close to the mandrel as possible. The assembly is to be subjected to the simulated rain test described in 89.2 for one hour to a downward spray of water applied at an angle of 45 degrees to the vertical, in the direction or directions most likely to cause water to enter the unit using the apparatus described in 89.3.

Figure 90.1

Rain test lampholder orientation



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90.3 The mandrel shall be made of 0.1 ±0.01 inch (2.54 ±0.2 mm) thick copper, with an overall length of 36 ±3 inches (915 ±76 mm), and a diameter of 1 ±0.1 inch OD (25.4 ±3 mm). The maximum resistance of the mandrel shall not exceed 0.001 ohms. The mandrel shall be free of oxidation or discoloration.

90.4 The test is to be conducted using water with a resistivity of 2000 ohms-cm. The water resistivity is to be obtained by the addition of sodium chloride (common table salt) to distilled water. The water temperature is to be 20 – 40°C (68 – 104°F).

90.5 Within five minutes after the completion of the test, the unit shall be maintained in the same orientation as during the application of the rain and comply with the Leakage Current Test, Section 40. The tested assembly shall not be moved after the application of the rain. The test equipment shall be moved to the tested sample. The leakage current shall be measured from the mandrel to the grounded (neutral) supply conductor.

91 Standing Water Immersion Test

91.1 When tested as described in 91.2 and 91.3, the construction of a controller intended for outdoor use or any other outdoor-use seasonal product enclosure likely to be ground supported shall not permit the entrance of water into the interior space of the controller and enclosure.

Exception: An attachment plug, current tap, load fitting, lampholder, or an in-line fuseholder need not be subjected to this test.

91.2 Each of four units is to be tested. One unit is to have been previously subjected to the Enclosure Mold Stress Relief Test, Section 58, one unit is to have been previously subjected to the Drop Test, Section 59, one unit is to have been previously subjected to the Cold Impact Test, Section 61, and one unit is to have been previously subjected to the Resistance to Crushing Test, Section 62.

91.3 Each product is to be operated at room temperature for 3-1/2 hours. The product is then to be de-energized and immediately submerged in at least 1 foot (304.8 mm) of water. The temperature of the water before submersion is to be 5°C (41°F) or less. The product is to remain submerged for 4 hours. At the end of four hours, the product is to be removed from the water and subjected to 2 additional cycles of operation and immersion. Between each cycle, the product is to be placed in a dry location at room temperature for approximately 16-1/2 hours. The product is to be inspected immediately after the third immersion for evidence of water entry.

92 Gasket Test

92.1 After the conditioning described in 92.2, a gasket intended to provide a water seal shall have a tensile strength of not less than 60 percent and an elongation of not less than 75 percent of the values determined before conditioning.

92.2 A total of 12 gaskets are needed for this test. Three are to be tested for elongation in the as-received condition and three are to be tested for tensile strength in the as-received condition. Six are to be placed in a circulating-air oven at a temperature 20°C (36°F) above the temperature measured on the gasket during the Temperature Test, Section 43, for 168 hours. Three of the conditioned gaskets are to be tested for elongation and the other three are to be tested for tensile strength. The test methods and apparatus are described in the Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension, ASTM D 412.

93 Gasket Adhesion Test

93.1 When tested as described in 93.2 – 93.4, a gasket secured by adhesive and intended to provide a water seal shall have an adhesion force of not less than 60 percent of the value determined before conditioning.

93.2 A total of 9 representative gaskets are to be tested.

93.3 Three gaskets are to be tested in the as-received condition. Six gaskets are to be placed in a circulating-air oven at a temperature 20°C (36°F) above the temperature measured on the gasket during the Temperature Test, Section 43, for 168 hours.

93.4 The force required to remove the gasket from its mounting surface is the adhesion force and is to be measured by pulling the gasket strip from the test panel at an angle of approximately 90 degrees and a crosshead speed of 0.5 inches/minute (12.7 mm/minute). Three are to be tested in the as-received condition, three are to be tested 1/2 hour after removal from the oven, and three are to be tested 24 hours after removal from the oven.

94 Ultraviolet (UV) Light Exposure and Water Immersion Tests

94.1 General

94.1.1 After being tested as described in 94.2.1 – 94.3.1, the polymeric material employed as an enclosure of a seasonal product intended for outdoor use or as part of an attachment plug, fuseholder, controller, load fitting, lampholder, splice compartment, or similar device employed in a product intended for outdoor use shall comply with both of the following:

a) The flammability classification of the unconditioned material shall not be reduced as a result of the UV conditioning or water immersion described in 94.2.1 – 94.3.1. The flammability classification is to be determined according to the flammability requirements for polymeric enclosures contained in 10.3.10. The portion of the material having the thinnest wall thickness is to be tested. All colors under consideration are to be tested; and

b) The product shall be subjected to the Leakage Current Test, Section 40, the Dielectric Voltage-Withstand Test, Section 45, the Drop Test, Section 59, the Cold Impact Test, Section 61, the Resistance to Crushing Test, Section 62, the Security of Blades Test, Section 73, the Secureness of Lampholder Contacts Test, Section 80, the Crush Test, Section 83, the Rain Test, Section 89, and the Standing Water Immersion Test, Section 91, as applicable.

Exception: Polymeric material molded as a decorative part employed in a seasonal product intended for outdoor use need not be subjected to these tests.

94.1.2 After the UV conditioning, the Drop Test, Section 59, is to be conducted except that the product is to be dropped from a height equal to 70 percent of the initial height and the Cold Impact Test, Section 61, is to be conducted except that the product is to be impacted with a force equal to 70 percent of the initial force. After the immersion conditioning, the Drop Test and the Cold Impact Test are to be conducted at 50 percent of their initial values.

94.2 UV conditioning

94.2.1 Each unit is to be exposed to ultraviolet light and water spray by using either of the following apparatus:

a) Twin enclosed carbon-arc, Type D, in accordance with ASTM G 23, Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials. Exposure Method 1, continuous exposure to light and intermittent exposure to water spray, with a programmed cycle of 20 minutes consisting of a 17 minute light exposure and a 3 minute exposure to water spray with light, is to be used. The apparatus is to operate with a black-panel temperature of 63 ±3°C (145.4 ±5.4°F), or

b) Xenon-arc, Type B, in accordance with ASTM G 26, Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials. Exposure Method 1, continuous exposure to light and intermittent exposure to water spray, with a programmed cycle of 120 minutes consisting of a 102 minute light exposure and an 18 minute exposure to water spray with light, is to be used. The apparatus is to operate with a 6500 W, water-cooled xenon-arc lamp, borosilicate glass inner and outer optical filters, a spectral irradiance of 0.35 W/m^2 nm at 340 nm and a black-panel temperature of 63 ±3°C (145.4 ±5.4°F).

94.2.2 The units are to be mounted vertically on the inside of the cylinder in the ultraviolet-light apparatus, with the width of the unit facing the arcs so that they do not touch each other.

94.2.3 One set of units is to be exposed. For twin enclosed carbon-arc, one set is to be exposed for a total of 720 hours. For xenon-arc, one set is to be exposed for a total of 1000 hours. After the test exposure, the units are to be removed from the test apparatus, examined for signs of deterioration such as crazing or cracking, and retained under conditions of ambient room temperature and atmospheric pressure for not less than 16, nor more than 96 hours, before being subjected to the flammability and physical tests described in 94.1.1. For comparative purposes, units that have not been exposed to ultraviolet light and water are to be subjected to these tests at the same time that the final exposed units are tested.

94.2.4 If a material is to be considered in a range of colors, units representing these ranges are also to be provided. Units in the natural (if used in this color) and in the most heavily pigmented light and dark colors are to be provided and considered representative of the color range, if the test results are essentially the same. An additional set of units is to be provided in the heaviest organic pigment loading, unless the most heavily pigmented light and dark colors include the highest organic pigment level. When certain color pigments (for example, red, yellow, or similar colors) are known to have particularly critical effects, they are also to be provided.

94.3 Water immersion

94.3.1 Using standard test procedures, property values for the material are to be determined both before and after conditioning. Units of the material shall be immersed in distilled or deionized water at 70.0 ±1.0°C (158.0 ±1.8°F) for 7 days. A complete change of water is to be made on each of the first 5 days. Following the water conditioning, the units which are to be subjected to tests described in 94.1.1(b) are to be immersed in distilled or deionized water at 23.0 ±2.0°C (73.4 ±3.6°F) for 1/2 hour immediately prior to testing. Following the immersions, the units to be subjected to flammability tests are to be conditioned in air at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5 percent relative humidity for 2 weeks.

DECORATIVE LIGHTING STRINGS

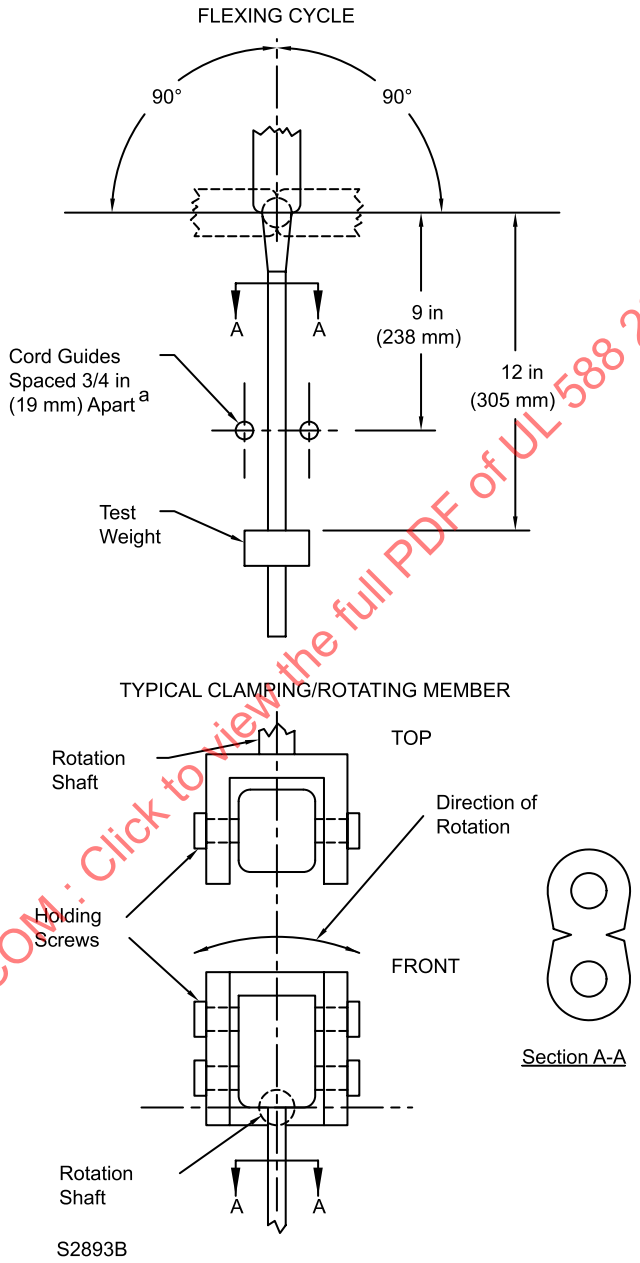
95 Flexing Test

95.1 An enclosure, lampholder, attachment plug, cord connector, load fitting, current tap, splice compartment, or other device connected to wire employed in a decorative-lighting string shall be capable of withstanding a minimum of 750 cycles of flexing when tested as described in 95.2 – 95.5. At the conclusion of the test, the device shall comply with the Dielectric Voltage-Withstand Test, Section 45, and the Temperature Test After Flexing, Section 97. Breakage of the copper or insulation of the conductor is not acceptable unless the conductor breaks at a point other than the interface of the device and conductor.

95.2 Each of six devices is to be assembled to 2-foot (0.6-m) lengths of the intended wire and secured to the flexing apparatus so that the cord assumes the natural bend permitted by the assembly. For a parallel-connected product, three devices are to be mounted with the flat side of the cord parallel to the direction of rotation and three are to be mounted with the flat side of the cord perpendicular to the direction of rotation. For a series-connected product, all six devices are to be connected in any fashion likely to produce the most adverse effects.

95.3 Each device is to be secured in the jaws of the flexing machine so that the point of cord exit is at the center of rotation. The rotating jaws are to be adjusted to rotate to an angle of 90 degrees to each side of the centered position. At the centered position, the cord is to hang vertically and a test weight of 4 oz (113 g) is to be attached to the cord approximately 12 inches (305 mm) from the point of rotation as illustrated in Figure 95.1.

Figure 95.1
Flexing test apparatus



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

95.4 Each device is to be subjected to complete flexing cycles until a conductor in each device opens as determined by a continuously monitoring detection circuit or until 750 cycles is reached. A through-wired device, such as a parallel-connected lampholder employed in a string with a load fitting, is to be operated at a load current equal to the fuse rating. A device used in other than a through-wiring application is to be operated at its own load current. For example, a series-connected lampholder employed in a string is to be tested at the lamp current, while a three-wire lampholder used as the first and last lampholders employed in a string with a load fitting is to be tested at the fuse rating. A flexing cycle consists of rotation of the jaws from the vertical (centered) position until 90 degrees to one side, back past the vertical position until 95 degrees to the other side, and back to the vertical position. The rate of testing is to be 10 cycles per minute.

95.5 The test may be conducted using a dummy fuse instead of a live fuse. See the Fuseholder Temperature Test, Section 67, for the description of a dummy fuse.

96 Decorative Lighting String Intended for Use on a Patio Umbrella

96.1 A series lighting string intended for installation on a patio umbrella shall withstand a minimum of 90 cycles of flexing when tested as described in 96.2. At the conclusion of the test, the device shall comply with the Dielectric Voltage-Withstand Test, Section 45. Breakage of the copper or insulation of the conductor is not acceptable.

96.2 A sample of the lighting string shall be mounted as intended on a patio umbrella provided using the fasteners provided with the product in accordance with the user assembly instructions provided. The umbrella shall be opened and closed for a total of 90 complete cycles to simulate the opening and closing of the umbrella during normal use. During the test, the decorative lighting string shall not be energized. After the test, the Dielectric-Voltage Withstand Test is to be conducted between live parts and dead metal parts.

97 Temperature Test After Flexing

97.1 After being subjected to the Flexing Test, Section 95, and the Dielectric Voltage-Withstand Test, Section 45, each enclosure, lampholder, attachment plug, cord connector, load fitting, current tap, splice compartment, or other device connected to wire employed in a decorative-lighting string shall be tested as described in 97.2 – 97.6. As a result of the test, there shall not be breakage of the wire as determined by the continuity test described in 97.9 and temperature rises shall not exceed the values indicated in Table 43.1.

97.2 The devices previously subjected to the Flexing Test, Section 95, are to be tested.

97.3 Temperatures are to be measured by means of thermocouples consisting of iron and constantan wires not larger than 24 AWG (0.21 mm^2) and not smaller than 30 AWG (0.05 mm^2). When thermocouples are used in determining temperatures in electrical equipment, it is common practice to employ thermocouples consisting of 30 AWG iron and constantan wires with a potentiometer-type of indicating instrument. This equipment is to be used whenever a referee measurement of temperature is necessary.

97.4 The thermocouples and related instruments are to be accurate and calibrated in accordance with standard laboratory practice. The thermocouple wire is to conform with the requirements specified in the Tolerances on Initial Values of EMF versus Temperature tables in the Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, ANSI/ASTM E230/E230M.

97.5 A thermocouple junction and adjacent thermocouple lead wire are to be securely held in good thermal contact with the surface of the material whose temperature is being measured. In most cases, acceptable thermal contact results from securely taping or cementing the thermocouple in place.

97.6 Each device is to be assembled to 2 feet (0.6 m) of wire of the size and type intended to be used with the device. The assembly is then to be connected to a supply circuit of 120 V and a frequency of 60 Hz and operated continuously at rated current for a minimum of 3 hours, under representative intended service conditions that are likely to produce the highest temperature, until constant temperatures are attained. Constant temperatures are considered to exist when three consecutive readings, taken at 15 minute intervals, are within 1°C (1.8°F) of each other and indicate no further rise above the changes in ambient temperature.

97.7 The test may be conducted using a dummy fuse instead of a live fuse. See the Fuseholder Temperature Test, Section 67 for the description of a dummy fuse.

97.8 Temperatures are to be measured on the surface of the lead insulation at the point where the lead exits the device.

97.9 Any indicating device such as an ohmmeter, a battery-and-buzzer combination, or similar continuity testing device, is to be placed across the conductors to determine if continuity is maintained.

97.10 The test may be conducted using a dummy fuse instead of a live fuse. See the Fuseholder Temperature Test, Section 67 for the description of a dummy fuse.

TREE STANDS

98 General

98.1 In addition to any applicable requirements contained elsewhere in the Standard, a tree stand shall comply with the requirements in Sections 99 and 100.

99 Stability Test

99.1 A tree stand with a load representing the maximum size tree intended to be installed shall remain in its intended position while on a plane inclined 8 degrees from the horizontal. The assembly shall not tilt such that it separates from the plane surface on which it rests.

99.2 One tree stand is to be tested. A wooden mast equal in length to at least one-third the maximum recommended tree height is to be attached to the stand in the intended manner, simulating a tree. A weight equal to the maximum recommended tree weight is to be attached to the mast at a distance above the bottom of the mast equal to one-third the maximum recommended tree height. The weighted mast and stand assembly is to be placed on the plane surface.

100 Overflow Test

100.1 When a tree stand provided with a well to hold water, is tested as described in 100.2, liquid overflowing from the reservoir shall not wet uninsulated live parts, splices or other electrical insulation that is likely to be adversely affected by water and shall not have a leakage current in excess of 0.5 mA.

100.2 One tree stand is to be tested. A hard water solution consisting of 1/2 gram of calcium sulphate per liter of distilled water is to be poured into the well of the tree stand through an orifice 3/8 inch (9.5 mm) in diameter. The well is to be filled to capacity and additional water equal to 50 percent of the capacity is to be added. Capacity is defined as filled to the rim of the container. The excess water is to be allowed to overflow. During the overfilling, the lighting load and motor for rotating the tree are to be energized with the supply voltage at 120 V. The leakage current is to be measured between accessible parts and ground. The measuring circuit is to be as indicated in 40.6 using both positions of switch S2. If accessible parts are of insulating material, they are to be covered with foil to provide a contact probe. The unit is then to comply

with the Dielectric Voltage-Withstand Test, Section 45, and a visual inspection to determine if live parts have become wet as a result of the test.

DIRECT PLUG-IN UNITS

101 General

101.1 In addition to the applicable requirements contained elsewhere in the Standard, a direct plug-in unit shall comply with the Security of Blades Test, Section 73, and the Security of Input Contacts Test, Section 74.

ELECTRONICALLY-OPERATED ORNAMENTS

102 General

102.1 An electronically operated ornament shall comply with the Leakage Current Test, Section 103, the Temperature Test at 200 mA (Electronically-Operated), Section 104, the Dielectric Voltage-Withstand Test, Section 105, the Enclosure Mold Stress Relief Test, Section 106, the Strain Relief Test, Section 107, the Drop Test, Section 108, the High Current Abnormal Test, Section 109, the High Current Inrush Test, Section 110, the Series Cascade Burnout Test, Section 111, the Abnormal Operation Test, Section 112, the Adhesive Test, Section 63, the Downward Burning Rate Test, Section 50, the Conductivity of Decorative Parts Test, Section 51, and the Tests for Permanence of Cord Tag, Section 56.

103 Leakage Current Test

103.1 An ornament shall comply with the Leakage Current Test, Section 40, except that the test shall be conducted with the ornament installed in the first lampholder of the representative string and then repeated with the ornament installed in the last lampholder of the representative string.

104 Temperature Test at 200 mA (Electronically-Operated)

104.1 An ornament shall comply with the Temperature Test, Section 43, except that a variable resistor is also to be connected in series with the 120 V ac, 60 Hz supply. The variable resistor is to be adjusted to supply a current of 200 mA to the ornament and the ornament is to be mounted as intended.

105 Dielectric Voltage-Withstand Test

105.1 When tested as described in 105.2 and 105.3, an ornament shall withstand without breakdown the application of a 60 Hz, essentially sinusoidal potential of 1250 V applied for 1 minute between live parts and accessible dead metal parts of the enclosure of the ornament.

105.2 One previously untested ornament is to be subjected to this test. If there is no accessible dead metal, metal foil is to be placed over the ornament assembly and arranged to conform to its shape.

105.3 While in a heated condition following a period of normal operation equal to the length of time needed for temperatures to stabilize during the Temperature Test at 200 mA (Electronically-Operated), Section 104, the ornament is to be tested by means of a 500 VA or larger capacity transformer whose output voltage is essentially sinusoidal and can be varied. The applied potential is to be increased from zero until the required test level is reached and is to be held at that level for 1 minute. The increase in the applied potential is to be at a uniform rate that is as rapid as is consistent with its value being correctly indicated by a voltmeter.

106 Enclosure Mold Stress Relief Test

106.1 When conditioned as described in 106.2, there shall not be any:

a) Softening of the material, as determined by examination immediately after the conditioning,

b) Shrinkage, warpage, or other distortion of the enclosure material resulting in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1, or

c) Cracking or denting of the enclosure of the unit that would affect the function of any safety controls or constructional features such as thermostats or strain relief, or result in the exposure of moving parts increasing the risk of injury to persons.

106.2 One complete, previously untested ornament is to be placed in a full-draft circulating air oven for a period of 7 hours at a temperature 10°C (18°F) above the maximum operating temperature of the enclosure, measured at the hottest location on the inside of the enclosure during the Temperature Test at 200 mA (Electronically-Operated), Section 104, but not lower than 70°C (158°F). After removal from the oven, the ornament is to be examined for any indication of shrinkage, softening of the material or any other deformation of the enclosure material.

107 Strain Relief Test

107.1 As a result of the test described in 107.2 and 107.3:

a) There shall not be damage to either lead connection,

b) There shall not be breakage of the conductor or insulation,

c) No portion of the conductor shall become exposed outside the enclosure of the ornament or adapter, and

d) Neither input lead of the pair shall be displaced more than 1/16 inch (1.6 mm) from the point of entry into the ornament or adapter.

Exception No. 1: If the leads can be re-attached at the conclusion of the test, the ornament or adapter need not comply with the requirement in (d).

Exception No. 2: An ornament which does not employ input leads need not be subjected to this test.

107.2 Each of three ornaments is to be tested. The electrical connections of the input leads to any components within each ornament are to be removed or severed. Each ornament is to be securely supported and its input lead assembly is to be subjected to a pull of 20 lbs (89 N) for a 18 AWG (0.82 mm^2) or larger cord and 8 lbs (36 N) for a 20 AWG (0.52 mm^2) or smaller cord. The pull is to be applied by suspending a weight from the input leads, as a pair. The pull is to be gradually applied to the pair of leads, in any direction, so as to produce the maximum strain on the connections, and maintained for a period of one minute.

107.3 The test in 107.2 is to be repeated on the molded-on input adapter except that the leads are not to be severed or removed inside the adapter.

108 Drop Test

108.1 After being tested as described in 108.2 and 108.3, an ornament shall comply with all of the following:

a) There shall not be any visible damage to the enclosure of the ornament that would result in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1;

b) There shall not be any cracking or denting of the enclosure of the ornament that would affect the function of any safety controls or constructional features such as thermostats or strain relief, or result in the exposure of moving parts increasing the risk of injury to persons;

c) There shall not be any damage to the enclosure of the ornament that would result in an increase in the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section 105.

108.2 Each of three complete ornaments is to be subjected to this test. Each ornament is to be dropped three consecutive time from a height of 6 ft (1.83 m) to strike a flat hardwood surface in the positions most likely to produce adverse results. Each ornament is to be oriented in such a manner so that a different surface of the enclosure of the ornament strikes the hardwood surface for each of the three drops. Any lamps may be removed from the ornament before the test.

Exception: If the manufacturer so elects, fewer ornaments may be tested in accordance with Figure 59.1, where each series consists of three drops of the ornament. The overall performance is acceptable upon completion of any one of the procedures represented in the figure. If an ornament does not comply on its first series of three drops, the results of the test are unacceptable.

108.3 The hardwood surface is to consist of a layer of nominal 1 inch (25 mm) tongue-and-groove oak flooring (actual size 3/4 by 2-1/4 inch or 18 by 57 mm) mounted on two layers of nominal 3/4 inch (19 mm) plywood. The assembly is to rest on a concrete floor or an equivalent non-resilient floor during the test.

109 High Current Abnormal Test

109.1 When tested as described in 109.2, there shall not be:

a) Flaming of the ornament, or charring, glowing, or ignition of the cheesecloth or cotton, or

b) Melting or distortion of the enclosure of the ornament resulting in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1.

109.2 Each of two ornaments is to be subjected to this test. The adapter of the input lead assembly of one of the ornaments is to be inserted into a representative lampholder. The ornament is to be placed on a layer of cotton and covered by cheesecloth. The lampholder assembly is then to be connected in series with a 120 V ac, 60 Hz supply source, a variable resistor, and an ammeter. The resistor is to be adjusted to supply a steady test current of 300 mA to the circuit for 7 hours. The test is then to be repeated at 400 mA for 30 minutes using the second ornament.

110 High Current Inrush Test

110.1 When tested as described in 110.2, there shall not be:

a) Flaming of the ornament, or charring, glowing, or ignition of the cheesecloth or cotton, or

b) Melting or distortion of the enclosure of the ornament resulting in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1.

110.2 Each of three previously untested ornaments is to be subjected to this test. The adapter of the input lead assembly of one of the ornaments is to be inserted into a representative lampholder. The ornament is to be placed on a layer of cotton and covered by cheesecloth. The lampholder assembly is then to be connected in series with a 120 V ac, 60 Hz supply source, a variable resistor, an ammeter, and

a 3 A non-time-delay fuse which complies with the Standard for Low-Voltage Fuses – Part 14: Supplemental Fuses, UL 248-14. A double throw switch is to be placed across the 3 A fuse and the ornament to short them out of the circuit while adjusting the resistor to supply a test current of 6 A to the circuit. The switch is then to be opened and the test current is to be monitored for 7 hours or until the fuse or any component of the ornament opens, causing the current to stop flowing. The test is to be repeated on each of the two remaining ornaments at a current of 8 A and 10 A, respectively.

111 Series Cascade Burnout Test

111.1 When tested as described in 111.3 and 111.4, there shall not be:

a) Flaming of the ornament, or charring, glowing, or ignition of the cheesecloth or cotton, or

b) Melting or distortion of the enclosure of the ornament resulting in the exposure of live parts as determined by contact with the accessibility probe illustrated in Figure 9.1.

111.2 To determine the value of the hot resistance of the lamp shunt, R_H, needed for this test, a lamp from a representative series-connected light string of the type that the ornament is intended to be used with, is to be inserted into a lampholder and connected in series with a 120 V ac, 60 Hz supply source, a variable resistor, and an ammeter. By adjusting the resistor, the current is to be gradually increased until the lamp filament opens, leaving the shunt of the lamp intact. R_H is then to be determined by dividing the measured voltage across the shunted lamp by the current flowing through the lamp shunt.

111.3 Each of three ornaments is to be subjected to this test. The adapter of the input lead assembly of one of the ornaments is to be inserted into a representative lampholder. The ornament is to be placed on a layer of cotton and covered by cheesecloth. The lampholder assembly is then to be inserted into a lampholder and connected in series with a 120 V ac, 60 Hz supply source, an ammeter, a fixed resistance, R_F, a 3 A non-time-delay fuse which complies with the Standard for Low-Voltage Fuses – Part 14: Supplemental Fuses, UL 248-14, and a number of lamps, L, from the representative series-connected string. The number of lamps, L, is to be 1/3 of the total number of lamps in the representative series-connected string. The fixed resistance, R_F, is to be determined as follows:

$$R_F = R_H (N - L)$$

in which:

R_F is the fixed resistance,

R_H is the hot resistance of the lamp shunt,

N is the total number of lamps in the representative series-connected string, and

L is 1/3 the total number of lamps in the representative series-connected string.

111.4 The circuit is to be energized and the test current is to be monitored for 7 hours or until a component, the fuse, or a lamp shunt and filament opens, causing the current to stop flowing. The test is to be repeated on each of the two remaining ornaments.

112 Abnormal Operation Test

112.1 The breakdown of an electrical component in an ornament, as simulated by the test described in 48.2 – 48.9, shall not result in the risk of injury to persons, or the risk of fire or electric shock as determined by the existence of any of the following conditions:

a) Glowing, charring, or flaming of the cheesecloth or tissue paper specified in 48.4;

b) The opening of the 3 A fuse connected to ground specified in 48.5;

c) Emission of flame, sparks, or molten metal from the enclosure;

d) Development of an opening in the overall enclosure that exposes live parts and increases the risk of electric shock (see 12.1); or

e) Loss of structural integrity to such a degree that the equipment collapses or experiences displacement of parts that may:

1) Lead to short-circuiting or grounding of live parts,

2) Affect the function of any safety controls such as thermostats, overload protective devices, waterseals, or strain relief, or

3) Expose moving parts increasing the risk of injury to persons.

Exception No. 1: A component located in the following circuits need not be subjected to this test:

a) A Class 2 circuit,

b) A circuit that has been investigated for reliability and determined to be reliable.

Exception No. 2: A resistor, a non-electrolytic capacitor, an inductor, a transformer, an electro-mechanical device, such as a switch or a relay, and an optical isolator that complies with the Standard for Optical Isolators, UL 1577, need not be subjected to this test.

113 Voltage Drop Test

113.1 When tested in accordance with 113.2, the voltage drop measured shall not be less than the minimum operating voltage of the lamp(s) employed in the lighting string which are being replaced by the ornament.

Exception: The voltage drop test is not required for ornaments that are provided with instructions in accordance with 126.5.2.

113.2 An ornament shall be connected in series with a variable resistor and a 120 V, 60 Hz. source of supply. The variable resistor is to be adjusted to supply a current of 200 mA to the ornament. The voltage across the ornament shall be recorded.

NON-ELECTRONICALLY-OPERATED ORNAMENTS

114 General

114.1 A non-electronically-operated ornament shall comply with the Oven Test, Section 78, the Leakage Current Test, Section 103, the Temperature Test at 200 mA (Non-Electronically-Operated), Section 115, the Lampholder Strain Relief Tests, Section 79, the Secureness of Lampholder Contacts Test, Section 80, the Lampholder Millivolt Drop Test, Section 81, the Crush Test, Section 83, the Cascade Lamp Burnout Simulation Test, Section 116, the Dielectric Voltage-Withstand Test, Section 105, the Adhesive Test, Section 63, the Downward Burning Rate Test, Section 50, the Conductivity of Decorative Parts Test, Section 51, and the Tests for Permanence of Cord Tag, Section 56.

115 Temperature Test at 200 mA (Non-Electronically-Operated)

115.1 A non-electronically-operated ornament shall comply with the Temperature Test, Section 43, except that a variable resistor is also to be connected in series with the 120 V ac, 60 Hz supply. The variable resistor is to be adjusted to supply a current of 200 mA to the ornament and the ornament is to be tested as described in 115.2.

115.2 One complete, previously untested ornament is to be tested while supported in free air with the lampholders in the base-up, filament-down position as indicated in Figure 43.1. The ornament is to be tested with the lamps provided, and is to be inserted in the lampholder in the intended manner.

116 Cascade Lamp Burnout Simulation Test

116.1 When subjected to the Cascade Lamp Burnout Simulation Test, Section 84, with and without the lampholder of the ornament inserted in the ornament in accordance with 84.2(d) and 84.3, the ornament shall comply with the requirements in 84.1.

MANUFACTURING AND PRODUCTION TESTS

117 Production-Line Dielectric Voltage-Withstand Test

117.1 When tested as described in 117.2 – 117.6, a seasonal lighting product shall withstand without electrical breakdown, as a routine production-line test, the application of a 40 – 70 Hz essentially sinusoidal potential of either 1200 V applied for 1 second or 1000 V applied for 1 minute:

a) For a motorized device or a decorative outfit having accessible dead-metal parts that are likely to become energized, between the line-connected wiring, including connected components, and accessible dead metal parts that are likely to become energized.

b) For a parallel-connected string, including all connected components, prior to lamping or a decorative outfit employing a parallel-connected lampholder or lampholders, between live parts of opposite polarity.

117.2 A motorized device may be in a heated or unheated condition for the test. The test is to be conducted when the motorized device is complete (fully assembled) and with the line switch, if provided, in the on position. It is not intended that the motorized device be unwired, modified, or disassembled for the test.

Exception: The test may be performed before final assembly if the test is representative of the conditions for the completed motorized device.

117.3 During the test, both sides of the line-connected circuitry of the motorized device are to be connected together to one terminal of the test equipment. The second test-equipment terminal is to be connected to the accessible dead metal.

117.4 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.

117.5 If the output of the test equipment transformer is 500 VA or larger, the test potential may be indicated by a voltmeter in the primary circuit or in a tertiary winding circuit, by a selector switch marked to indicate the test potential, or by 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 that the manual-reset switch has been reset following a tripout.

117.6 Test equipment other than those described by 117.4 and 117.5 may be used if found to accomplish the intended factory control.

118 Lamping Test

118.1 Each string, decorative outfit, tree stand, or similar seasonal product, that involves a lampholder smaller than the medium-screw size, shall be tested by the manufacturer. Inability of any lamp to light is to be considered unacceptable. The manufacturer may use a means other than lamping that produces results equal to actual lamping.

119 Polarization Continuity Test

119.1 As a routine production-line verification, each parallel-connected string, decorative outfit, tree stand, or similar decorative product, provided with a 2-wire polarized attachment plug shall be tested for electrical continuity between the grounded (neutral) circuit supply conductor of the attachment plug (wider blade) and both the screw shell (side) contact of each parallel-connected lampholder and the wider slot of the load fitting, if employed. Electrical continuity shall also be verified between the ungrounded (hot) circuit supply conductor of the attachment plug (narrow blade) and the overcurrent-protective device. Alternatively, continuity may be verified between the ungrounded (hot) supply circuit conductor of the attachment plug, and:

a) The center contact of each lampholder,

b) The narrow slot of the load fitting, if employed, and

c) The overcurrent-protective device.

119.2 Any indicating device such as an ohmmeter, a battery-and-buzzer combination, or similar continuity testing device, shall be used to determine compliance with the continuity requirements in 119.1.

120 Grounding Continuity Test

120.1 Each product that has a power-supply cord having a grounding conductor shall be tested, as a routine production-line test, to determine that grounding continuity exists between the grounding blade of the attachment plug and the grounding terminal of the load fitting and, when provided, accessible dead metal parts of the product that are likely to become energized.

120.2 A single test is sufficient if the accessible metal selected is conductively connected by design to all other accessible metal.

120.3 Any acceptable indicating device, such as an ohmmeter, a battery-and-buzzer combination, or the like, is permitted to be used to determine whether a product complies with the requirement in 120.1.

RATINGS

121 Details

121.1 A product shall be rated 120 V, 60 Hz.

Exception No. 1: A ornament shall be rated at the replacement lamp voltage(s) for a series-connected string.

Exception No. 2: Battery operated products shall only be provided with a voltage rating.

121.2 A product employing a non-polarized attachment plug shall not have a current rating that exceeds 0.60 A.

Exception: A decorative outfit employing series- or series-parallel-connected lighting strings is able to have a maximum current rating of 1.8 A.

121.3 A product other than a lighting string employing a polarized attachment plug shall not have a current rating that exceeds 3.6 A.

Exception No. 1: The current rating shall be in accordance with Table 13.1.

Exception No. 2: An indoor use lighting sculpture that is constructed such that each string is not connected to the load fitting of another string and is provided with a seasonal use cord set meeting the requirements described in Supplement SB of the Standard for Cord Sets and Power-Supply Cords, UL 817, shall not have a current rating that exceeds 8 A.

Exception No. 3: An outdoor use lighting sculpture that is constructed such that each string is not connected to the load fitting of another string, and is provided with an outdoor seasonal use cord connected wiring device that complies with the requirements described in the Standard for Outdoor Seasonal-Use Cord-Connected Wiring Devices, UL 2438, shall not have a current rating that exceeds 8 A.

121.4 A parallel-connected product without a load fitting and with a current rating that exceeds 1.75 A shall be marked in accordance with 125.5.1.

121.5 A series- or series-parallel-connected decorative lighting string or decorative outfit without a load fitting, employing a polarized attachment plug, and with a current rating that exceeds 0.6 A shall be marked in accordance with 125.5.2.

121.6 A decorative outfit accessory shall not have a current rating exceeding the maximum current rating shown in Table 13.1 for the size of the cord employed.

MARKINGS

122 General

122.1 The height of lettering of the required markings shall be as follows:

a) Upper case letters shall not be less than 1/12 inch (2.1 mm) in height.

b) Lower case letters shall not be less than 1/16 inch (1.6 mm) in height.

c) The words "CAUTION" and "WARNING" shall be in letters not less than 3/16 inch (4.8 mm) in height.

122.2 The required markings shall be legible and shall comply with the following:

a) For tags and labels, the letters shall be black on a white background.

b) For other media, the letters shall be on a high contrast background. Colors such as black on red, black on green, yellow on green, the reverse of any of these combinations, and other low contrast markings are not permitted.

Exception: If a molded or stamped marking is not in a color contrasting with the background color, the letters of the text shall be recessed or raised against their background at least:

a) 0.008 inch (0.2 mm) for those marking contained in 124.1.2 and 124.1.3, and

b) 0.020 inch (0.51 mm) for all other markings.

122.3 A required marking shall be durable, legible, and permanent. A marking shall be considered permanent if it is:

a) Die-stamped into the unit,

b) Molded as part of the unit, or

c) Indelibly stamped or printed on a tag or pressure sensitive adhesive-backed label. An adhesive-backed label shall comply with the requirements in the Standard for Marking and Labeling Systems, UL 969, and be for the temperature, type of surface, and environment, such as indoor or outdoor, for which it is intended.

122.4 If a required marking is located on a tag, the tag shall be a flag-type tag with an adhesive back. The tag is to be wrapped once tightly around and adhered to the power-supply cord. The ends of the tag are to adhere to each other and project as a flag. Cord Tags shall comply with:

a) The requirements in the Standard for Marking and Labeling Systems, UL 969;

b) The Standard for Marking and Labeling Systems – Flag Labels, Flag Tags, Wrap-Around Labels and Related Products, UL 969A; or

c) The Permanence of Cord Tag requirements in Section 56.

122.5 Markings located on a tag as described in 122.4 may continue on the second side of the tag, such that when the first side is read completely, the tag is to be turned over to read the remainder of the marking. At the end of the markings on the first side of the tag, the tag shall be marked: "See other side." Before the remainder of the required markings on the second side of the tag, the tag shall be marked: "Continued from other side."

122.6 For markings located on a tag, the word "CAUTION" may appear only once at the beginning of the marking, followed by a numbered list of the remaining text of each required marking.

123 Product Markings

123.1 A fuseholder, fused attachment plug, fused current tap, or other device which contains a replaceable fuse or fuses, shall be permanently marked on the device with the following: "Use only 125-volt fuse, ____ amp. max." The blank shall be filled in with the ampere value consistent with the rating of the fuse or fuses provided. The marking shall be visible during fuse replacement.

124 Product/Cord Tag Markings

124.1 General

124.1.1 The markings specified in this section shall be located on a tag either:

a) Attached to the product power supply within 6 inches (152.4 mm) of the exit of the attachment plug, current tap, direct plug-in unit, or power inlet, or

b) on the product when not provided with devices indicated in (a).

124.1.2 A seasonal product shall be legibly and permanently marked with:

a) The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product may be identified;

b) A distinctive catalog number;

Exception: When the cord tag contains multiple catalog numbers, the applicable catalog number shall be highlighted by an arrow or equivalent means.

c) The rated input voltage, either as "120 V" or "120 Volts;"

d) The rated input current in "A" or "Amps" and "Watts;"

e) The rated frequency in "Hz" or "Hertz;" and

f) The month and year of manufacture.

Exception No. 1: The date of manufacture may be abbreviated, or in a nationally accepted conventional code, or other dating period of manufacture not exceeding any three consecutive months, or in a code affirmed by the manufacturer, provided that the code:

a) Does not repeat in less than 20 years; and

b) Does not require reference to the production records of the manufacturer to determine when the unit was manufactured.

Exception No. 2: A product intended for sale for only one calendar year, such as an ornament, need only be marked with the year of manufacture.

Exception No. 1: If (a), (b), and (f) are located on a tag attached to the product, the required markings need not comply with 122.2(a).

Exception No. 2: An ornament need not include the markings in (c), (d), and (e).

124.1.3 If a manufacturer produces or assembles a seasonal product at more than one factory, each finished product shall have a distinctive marking, which may be in code, by means of which it may be identified as the product of a particular factory.

Exception: If the required marking is located on a tag attached to the product, the marking need not comply with 122.2(a).

125 Cord Tag Markings

125.1 General

125.1.1 The markings specified in this section shall be located on a tag attached to the product within 6 inches (152.4 mm) of the face of the attachment plug, current tap, direct plug-in unit, or power inlet. For a product that employs two cords or input leads, the tag shall be located on both cords or input leads. For a product that does not employ a cord or input leads, the markings in this section shall instead be located on the product.

125.1.2 A seasonal product shall be marked "For temporary (90 days max) installation and use only" or “This seasonal product is not intended for permanent installation.”

Exception: For an ornament, the marking may instead be located in the instruction manual, on a stuffer sheet, or on the outer surface of the smallest unit package.

125.1.3 A seasonal product intended for indoor use only shall be marked "For indoor use only."

125.1.4 A seasonal product intended for both indoor and outdoor use shall be marked "For indoor and outdoor use."

125.1.5 A seasonal product which contains lamps accessible to the user shall be marked with the word "CAUTION" and the following or the equivalent: "To reduce the likelihood of excessive heat and possible damage, use only decorative lamp accessories packaged with this product."

Exception: For an ornament, the marking may instead be located in the instruction manual, on a stuffer sheet, or on the carton in which the ornament is packaged.

125.1.6 A product rated at the maximum conductor current shown in Table 13.1 shall be marked with the following: "CAUTION – Do not connect to another lighting string, decorative outfit, or seasonal product."

125.2 Products employing replaceable fuses

125.2.1 A seasonal product which employs replaceable fuses shall be marked "Always unplug this product before installing or replacing fuses."

125.3 Products employing lamps

125.3.1 A seasonal product which employs replaceable lamps shall be marked "Always unplug this product before installing or replacing lamps."

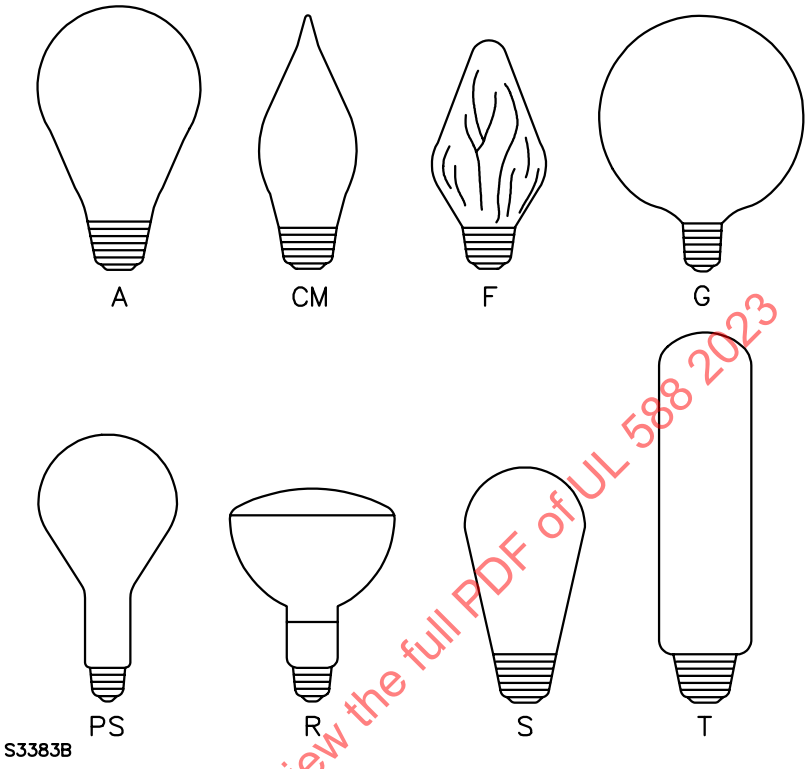
Exception: An ornament shall instead be marked as indicated in 125.9.1.

125.3.2 A seasonal product which employs candelabra- or intermediate-base lamps shall be marked "CAUTION: Replace only with same type ____ Watt Max ____ UL Classified lamps." The first blank shall be filled in with the appropriate wattage of the replacement lamp and the second blank shall be filled in with the type of lamp, either candelabra- or intermediate-base.

125.3.3 A decorative outfit which employs a medium screw lampholder shall be marked with the word "CAUTION" and the following: "(To reduce the) risk of fire(.) use only type ____ lamp(s), ____ watts max(imum)." The first blank shall be filled in with the type designation and a picture of the tested lamp type as illustrated in Figure 125.1 and the second blank shall be filled in with the tested lamp wattage or less. Words or phrases located within parentheses are optional.

Figure 125.1

Lamp types



125.3.4 A seasonal product which employs push-in or midget or miniature screw base lamps employing lamp shunts shall be marked with instructions for the proper method of replacing a burned-out lamp as follows: "CAUTION – To reduce the risk of overheating, replace burned-out lamps promptly. Use ____ volt, ____ watt lamps only." The blanks shall be filled in with the voltage value and wattage of the replacement lamps.

Exception: For an ornament, the wattage marking is not required and it is acceptable to locate the marking instead in the instruction manual, on a stuffer sheet, or on the carton in which the ornament is packaged.

125.3.5 A midget push-in type series, series-parallel connected lighting string that employs a construction that allows the string to operate without the lamps in place shall be marked as follows: "CAUTION – DO NOT OPERATE WITH BULBS MISSING FROM SOCKETS. MISSING BULBS SHOULD BE REPLACED PROMPTLY."

Exception: The marking may instead be located on a stuffer sheet or on the carton in which the lighting string is packaged.

125.3.6 A decorative outfit which employs less than 8 miniature lamps (see Exception No. 2 to 31.1), a decorative outfit or series connected string with less than 20 push-in or midget-screw lampholders, or a series-connected product employing lamps not provided with lamp shunts, shall be marked as follows: "CAUTION – Replace lamps only with ____ volt, ____ watt spare lamps provided with this product." The blanks shall be filled in with the voltage and wattage of the replacement lamps.

125.3.7 A series-connected lighting string which employs non-replaceable lamps shall be marked as follows: "CAUTION – To reduce the risk of fire or electric shock, do not attempt to replace lamps or modify string."

125.3.8 A seasonal product which employs both push-in individually-flashing lamps and steady illuminating lamps in accordance with the exception to 28.3 shall be marked as follows: "CAUTION – This product contains lamps of two different sizes. To reduce the risk of overheating do not replace steady illuminating lamps with flashing lamps. Use ___ volt, ___ watt flashing lamps and ___ volt, ___ watt steady lamps only." The blanks shall be filled in with the voltage and wattage rating of the replacement lamps.

125.3.9 A series-connected lighting string which employs replaceable individual-flashing lamps, and non-replaceable steady illuminating lamps shall be marked as follows: "CAUTION – This product contains two different types of lamps. To reduce the risk of fire or electric shock do not attempt to replace the steady lamps (that are non-replaceable) and or modify string. Replace burned-out individual flashing lamps promptly with individually flashing lamps only. Use ___ volt, ___ watt lamps only. The blanks shall be filled in with the voltage and wattage rating of the replacement lamp.

125.3.10 A seasonal product which employs two different size lamps in accordance with Exception No. 3 in 28.1, shall be marked as follows: "CAUTION – This product contains lamps of two different sizes. To reduce the risk of overheating, replace burned-out lamps promptly. Use ___ volt _____ watt lamps only for the smaller lamps and ___ volt _____ watt lamps only for the larger lamps."

125.3.11 Products employing glass LED lamps shall be marked “CAUTION – RISK OF ELECTRIC SHOCK. Do not use if outer lamp envelope is damaged or broken.”

125.4 Products employing load fittings

125.4.1 A series- or series-parallel-connected decorative-lighting string or a decorative outfit consisting of a string with decorative covers which employs a non-polarized load fitting shall be marked within 3 inches (76.2 mm) of the face of the load fitting with the word “CAUTION” and the following: “This lighting string is rated ___ Watts (___ Amps), do not overload. Connect other lighting strings or decorative outfits end-to-end up to a maximum of 216 Watts (1.8 Amps) total.” Additional instructions shall be provided with the user servicing instructions to further explain the wattage, where to find the wattage rating on the product and where to find the current rating on products that do not contain a wattage rating.

125.4.2 A series- or series-parallel-connected decorative-lighting string or a decorative outfit consisting of a series-connected string with decorative covers, which employs a nonstandard multi-pin connector, shall be marked within 3 inches (76.2 mm) of the face of the load fitting with the word “CAUTION” and the following:

a) “This lighting string is rated ___ Watts (___ Amps), do not overload. Connect end-to-end only lighting strings or decorative outfits of the same model number from the same manufacturer for a maximum total of ___ Watts (___ Amps).” For the second set of blanks the maximum total shall not exceed 216 Watts (1.8 Amps).

b) “Do not replace or modify any connectors on this product, discard 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.”

125.4.3 A lighting string or a decorative outfit consisting of a lighting string with decorative covers that employs a polarized load fitting shall be marked within 3 inches (76.2 mm) of the face of the load fitting with the word “CAUTION” and the following: “This lighting string is rated ___ Watts (___ Amps), do not

overload. Connect other lighting strings or decorative outfits end-to-end up to a maximum of ____ Watts (____ Amps) total." The first blank shall be filled in with the rated wattage of the product. The second blank shall be filled in with the rated amperage of the product. The third blank shall be filled in with the conductor wattage based on 120 V times the maximum conductor current described in Table 13.1. The fourth blank shall be filled in with the maximum total current in Amps described in Table 13.1. Additional instructions shall be provided with the user servicing instructions to further explain the wattage, where to find the wattage rating on the product and where to find the current rating on products that do not contain a wattage rating.

125.4.4 A parallel-connected decorative-outfit provided with one or more load fittings shall be marked, where visible to the user, with the following: "CAUTION – This product is rated _____Watts (_____ Amps) Do not overload. Connect other lighting strings or decorative outfits end-to end up to a maximum of _____Watts (_____ Amps) total. Do not interconnect different types of products." The first blank shall be filled in with the rated wattage of the product. The second blank shall be filled in with the rated amperage of the product. The third blank shall be filled in with the conductor wattage based on 120 V times the maximum conductor current described in Table 13.1. The fourth blank shall be filled in with the maximum total current in Amps described in Table 13.1. The marking shall be located either adjacent to the load fittings or on a tag located within 3 inches (76.2 mm) of the load fittings.

Exception: A decorative outfit consisting of a lighting string with decorative covers need not comply with this requirement.

125.4.5 A series- or series-parallel-connected decorative outfit provided with one or more non-polarized load fittings shall be marked, where visible to the user, with the following: "CAUTION – This lighting string is rated ___ Watts (___ Amps), do not overload. Connect end-to-end a maximum of 216 Watts (1.8 Amps) total. Do not interconnect different types of products." The marking shall be located either adjacent to the load fittings or on a tag located within 3 inches (76.2 mm) of the load fittings. Additional instructions shall be provided with the user servicing instructions to further explain the wattage, where to find the wattage rating on the product and where to find the current rating on products that do not contain a wattage rating.

Exception: A decorative outfit consisting of a lighting string with decorative covers need not comply with this requirement.

125.4.6 A decorative outfit accessory provided with a load fitting shall be marked where readily visible to the user as follows: "CAUTION: Do not overload – Maximum total load shall not exceed ___ Watts (___ Amps)." Additional instructions shall be provided with the user servicing instructions to further explain the wattage, where to find the wattage rating on the product and where to find the current rating on products that do not contain a wattage rating.

125.4.7 A series- or series-parallel-connected decorative outfit provided with one or more polarized load fittings shall be marked, where visible to the user, with the following: “CAUTION – This lighting string is rated ___ Watts (___ Amps), do not overload. Connect end-to-end a maximum of 432 Watts (3.6 Amps) total. Do not interconnect different types of products.” The marking shall be located either adjacent to the load fittings or on a tag located within 3 inches (76.2 mm) of the load fittings. Additional instructions shall be provided with the user servicing instructions to further explain the wattage, where to find the wattage rating on the product and where to find the current rating on products that do not contain a wattage rating.

Exception: A decorative outfit consisting of a lighting string with decorative covers need not comply with this requirement.

125.5 Products without load fittings

125.5.1 A series-connected lighting string with an input current greater than 0.6 A but not exceeding 1.8 A shall be marked with the following: "CAUTION – Do not connect to another lighting string, decorative outfit, or seasonal product."

125.5.2 A series- or series-parallel-connected decorative lighting string or decorative outfit which employs a polarized plug and no load fitting shall be marked with the following: "CAUTION – Do not connect to another lighting string, decorative outfit, or seasonal product."

125.5.3 A series- or series-parallel-connected decorative lighting string or decorative outfit which employs a male screw-base and no load fitting shall be marked with the following: "CAUTION – Connect only to parallel-connected seasonal use products."

125.6 Decorative-lighting strings

125.6.1 A decorative-lighting string shall be marked with the type of string, either series-connected or parallel-connected.

125.7 Decorative outfits

125.7.1 A decorative outfit shall be marked with the word "CAUTION" and the following: "This is an electric product – not a toy! To avoid risk of fire, burns, personal injury and electric shock it should not be played with or placed where small children can reach it."

125.8 Tree stands

125.8.1 A motorized tree stand shall be marked with the recommended tree height and total load weight.

125.8.2 A tree stand not provided with a well to hold water shall be marked: "CAUTION – Use only with an artificial tree. This stand does not contain a well for water."

125.8.3 A motorized tree stand which employs load fittings intended for connection to specific lamp type lighting strings shall be marked adjacent to the load fitting with the following: "Connect only ____ type light strings." The blank shall be filled in with the type of light string, either series-connected or parallel-connected.

125.8.4 A motorized tree stand which employs load fittings not intended for connection to specific lamp type lighting strings shall be marked adjacent to the load fitting with the following: "CAUTION – Do not overload – Max total load shall not exceed ___ A." The blank shall be filled in with the appropriate rating for the cord type and size provided.

125.9 Ornaments

125.9.1 An ornament shall be marked with the following or the equivalent: "Disconnect the lighting string or decorative outfit from the outlet before removing a lamp and replacing it with the ornament."

125.10 Products employing batteries

125.10.1 A battery-operated product investigated for use only with a specific user replaceable battery supply shall be marked: “CAUTION: Replace only with _____type batteries.” The blank is to be filled in with both the appropriate size and type of battery, for example: AA Alkaline, C Carbon Zinc, AAA Ni-Cad, and similar type batteries.

125.10.2 The marking described in 125.10.1 shall be located on the product where it will be visible during replacement of the battery supply, such as in the compartment housing the battery supply, or on the access cover of a battery supply compartment, or near a receptacle intended for connection of an external battery supply by means of a battery cable. If it is not practical to include the markings directly on the surfaces mentioned above because of the size of the battery, battery enclosure, or both, the marking may be provided on a tag. If a tag is used to display the marking, it shall be attached so that it will remain with the product unless or until it is intentionally removed by the user.

125.11 Battery supply polarity identification

125.11.1 Unless the physical configuration of the battery supply and batter-operated products prevents reverse polarity during battery supply installation, the polarity of the connections between a user-replaceable battery supply and a battery-operated product shall be plainly marked on the battery-operated product with:

a) The words “positive” and “negative”,

b) The signs “+” for positive and “−” for negative;

c) The color coding red for a positive lead and black for a negative lead; or

d) A pictorial representation (such as an illustration or a label) illustrating the proper polarity and orientation of the battery supply, as applicable for the type of battery supply involved.

125.12 Bubble lights

125.12.1 A seasonal product containing bubble lights which contain the liquid Methylene Chloride shall be marked as described in SA13.3.

125.13 Class 2 circuits

125.13.1 A product that is provided with a detachable Class 2 power supply shall be marked near the connection, "CAUTION: To reduce the risk of fire and electric shock, use only the power supply Model ___ mfd. by ____ that was provided with this product."

126 Carton/Stuffer Sheet/Product/Cord Tag Markings

126.1 General

126.1.1 The markings specified in this Section shall be located on the product or a tag attached to the product, on the carton in which a product is packaged, or on a stuffer sheet or instruction manual provided with the product.

126.2 Products employing power inlets

126.2.1 A seasonal product which employs a power inlet for use with a cord set or detachable power-supply cord shall include the following instructions:

a) CAUTION – To reduce the risk of electric shock, use only with the power-supply cord provided or with a cord set intended for outdoor use.

b) Do not use a cracked, frayed, or damaged cord. Inspect the cord periodically.

c) Do not abuse cord – Do not carry product by the cord or yank or pull it to disconnect from the outlet.

d) Disconnect the product from the outlet when not in use.

126.3 Products employing skeleton-type lampholders

126.3.1 A seasonal product which employs skeleton-type lampholders shall include the following instructions: "CAUTION" and the following or the equivalent: "To reduce the risk of fire do not deliberately reposition either lampholder contact."

126.4 Decorative-lighting strings

126.4.1 A decorative-lighting string shall include the following instructions: "CAUTION" and the following: "To reduce the risk of fire and electric shock:

a) Do not install on trees having needles, leaves or branch coverings of metal or materials which look like metal, and

b) Do not mount or support strings in a manner that can cut or damage wire insulation."

126.5 Ornaments

126.5.1 An ornament shall include the following instructions: "For use with a series-connected string or decorative outfit which employs ____ voltage push-in type lamps only, and which complies with the requirements in UL 588," or the equivalent. The blank shall be filled in with the voltage or range of voltages of the push-in lamps.

126.5.2 An electronically-operated ornament shall include the following instructions: "Connect no more than three ornaments to each lighting string or decorative outfit."

Exception: This instruction is not required when products have been tested and found to comply with the requirements of the Voltage Drop Test for electronically-operated ornaments or decorative outfits, Section 113.

127 Carton Markings

127.1 General

127.1.1 The markings specified in this Section shall be located on the individual carton or container in which a product is packaged, where readily visible without opening the package. Except as indicated in item (b), the letters shall be printed on a high contrast background as described in 122.2(b). The location of the markings shall comply with one of the following:

a) When packaged in a carton, the marking shall appear on the outside front cover.

b) When packaged in a bag, the marking shall appear on two opposing sides of the bag. If the bag is opaque the letters shall be printed on a high contrast background. If the bag is transparent, the letters shall be printed in black on a white opaque background.

c) When packaged in a bag attached to a piece of cardboard, the marking shall appear on both sides of the cardboard.

d) When packaged in a transparent polymeric covering attached to cardboard, the marking shall appear on the front of the package, on the cardboard.

Exception: The carton or container in which an ornament or a blow-molded figure intended for outdoor-use is packaged need not comply with the requirements in this Section.

127.1.2 The carton or container in which a seasonal product intended for indoor use only is packaged shall be marked with the following or the equivalent: "For Indoor Use Only" or "Indoor Use."

127.1.3 The carton or container in which a seasonal product intended for both indoor and outdoor use is packaged shall be marked with the following or the equivalent: "For Indoor and Outdoor Use," "Indoor and Outdoor Use," or "Indoor and Outdoor."

INSTRUCTION MANUAL

128 General

128.1 A decorative-lighting string, decorative outfit, and ornament shall be provided with legible instructions pertaining to:

a) The risk of fire, electric shock, or injury to persons that may be associated with the use of the product,

b) Operation of the product, and

c) User-maintenance and storage.

128.2 The instructions indicated in Sections 129 – 131 shall be provided as an instruction manual, on a stuffer sheet, or on an outside surface of the smallest unit package of the product.

Exception: Products containing up to 6 strings in the smallest unit package need only be provided with one set of instructions.

128.3 The instruction manual shall include the model or catalog number of the product or products which it covers.

129 Instructions Pertaining to the Risk of Fire, Electric Shock, or Injury to Persons

129.1 General

129.1.1 Instructions pertaining to a risk of fire, electric shock, or injury to persons shall state precautions that should be taken to reduce such risks.

129.1.2 Instructions pertaining to the risk of fire, electric shock, or injury to persons shall be:

a) In the first part of the manual,

b) Before all other instructions, including the operating instructions, and

c) Separate in format from other instructions related to assembly, operation, maintenance, and storage.

129.1.3 The instructions may include illustrations to identify the important safety features specified in 129.2.1.

129.1.4 The height of the lettering in the text and illustrations of the instructions specified in 129.2.1 shall be as follows:

a) Upper case letters shall not be less than 1/12 inch (2.1 mm) in height.

b) Lower case letters shall not be less than 1/16 inch (1.6 mm) in height.

c) The phrases "IMPORTANT SAFETY INSTRUCTIONS," "READ AND FOLLOW ALL SAFETY INSTRUCTIONS," and "SAVE THESE INSTRUCTIONS" shall be in letters not less than 3/16 inch (4.8 mm) in height.

129.1.5 Unless otherwise indicated, the text of the safety instructions shall be verbatim to, or in equally definitive terminology as, 129.2.1, except where specific conflict of the application to a product exists. The items may be numbered. The phrases "READ AND FOLLOW ALL SAFETY INSTRUCTIONS" and "SAVE THESE INSTRUCTIONS" shall be first and last, respectively, in a list of items. Other important safety instruction items considered appropriate by the manufacturer may be inserted.

129.2 Decorative-lighting strings, decorative outfits, and ornaments

129.2.1 The following instructions shall be provided with a decorative-lighting string, decorative outfit, or ornament:

IMPORTANT SAFETY INSTRUCTIONS

When using electrical products, basic precautions should always be followed including the following:

a) "READ AND FOLLOW ALL SAFETY INSTRUCTIONS."

b) "Do not use seasonal products outdoors unless marked suitable for indoor and outdoor use. When products are used in outdoor applications, connect the product to a Ground Fault Circuit Interrupting (GFCI) outlet. If one is not provided, contact a qualified electrician for proper installation."

Exception: An ornament shall instead be marked with the following: "For indoor use only".

c) "This seasonal use product is not intended for permanent installation or use."

d) "Do not mount or place near gas or electric heaters, fireplaces, candles or other similar sources of heat."

e) "Do not secure the wiring of the product with staples or nails, or place on sharp hooks or nails."

f) "Do not let lamps rest on the supply cord or on any wire."

g) "Unplug the product when leaving the house, or when retiring for the night, or if left unattended." The text "or if left unattended" is optional.

h) "This is an electric product – not a toy! To avoid risk of fire, burns, personal injury and electric shock it should not be played with or placed where small children can reach it."

Exception: An ornament shall instead be marked with the following: "This is an electric product – not a toy! It should not be played with or placed where small children can reach it."

i) "Do not use this product for other than its intended use."

j) "Do not hang ornaments or other objects from cord, wire, or light string."

k) "Do not close doors or windows on the product or extension cords as this may damage the wire insulation."

Exception: An ornament need not include this marking.

l) "Do not cover the product with cloth, paper or any material not part of the product when in use."

m) "This product has a polarized plug (one blade is wider than the other) as a feature to reduce the risk of electric shock. This plug will fit in a polarized outlet only one way. If the plug does not fit fully in the outlet, reverse the plug. If it still does not fit, contact a qualified electrician. Do not use with an extension cord unless plug can be fully inserted. Do not alter or replace the plug." It is acceptable to omit this item if the product does not employ a polarized plug.

n) "This product is equipped with push-in type lamps. Do not twist lamps." It is acceptable to omit this item if the product does not contain push-in type lamps.

o) "This product employs overload protection (fuse). A blown fuse indicates an overload or short-circuit situation. If the fuse blows, unplug the product from the outlet. Also unplug any additional strings or products that may be attached to the product. Replace the fuse as per the user servicing instructions (follow product marking for proper fuse rating) and check the product. If the replacement fuse blows, a short-circuit may be present and the product should be discarded." It is acceptable to omit this item for an ornament or if the fuse is not replaceable.

p) "Read and follow all instructions that are on the product or provided with the product."

q) "**SAVE THESE INSTRUCTIONS**"

130 Use and Care Instructions

130.1 The instruction manual shall contain specific instructions concerning the use and care of the product. These instructions shall be preceded by the heading “Use and Care Instructions.” The instructions shall include, but are not limited to, the following:

a) "When the product is placed on a live tree, the tree should be well maintained and fresh. Do not place on live trees in which the needles are brown or break off easily. Keep the tree holder filled with water." This item may be omitted if the product is not intended for placement on a tree or next to a tree.

b) "If the product is placed on a tree, the tree should be well secured and stable." This item may be omitted if the product is not intended for placement on a tree or next to a tree.

c) "Before using or reusing, inspect product carefully. Discard any products that have cut, damaged, or frayed wire insulation or cords, cracks in the lampholders or enclosures, loose connections, or exposed copper wire."

d) "When storing the product, carefully remove the product from wherever it is placed, including trees, branches, or bushes, to avoid any undue strain or stress on the product conductors, connections, and wires."

e) "When not in use, store neatly in a cool, dry location protected from sunlight."

130.2 The markings in 130.1 (a) and (b) may be omitted for those decorative-lighting strings that are obviously not intended for use during the Christmas holiday season, such as a string with Halloween or Easter figures such as pumpkins or eggs.

131 User Servicing Instructions

131.1 The instruction manual shall contain specific instructions concerning user servicing. These instructions shall be preceded by the heading “User Servicing Instructions.” The instructions shall include, but are not limited to, those described in 131.2 – 131.7.

131.2 For products that employ replaceable fuses, the instruction manual shall have specific instructions concerning how to physically replace the fuse. The instructions shall include, but are not limited to the

following statements, or the equivalent, to successfully replace the fuse and shall include illustrations to assist the user:

a) "Grasp plug and remove from the receptacle or other outlet device. Do not unplug by pulling on cord."

b) "Open fuse cover." The manufacturer shall indicate the specific way to open the cover, such as, "Slide open fuse access cover on top of attachment plug towards blades," or "Push on tabs located next to the blades."

c) "Remove fuse carefully." The manufacturer shall indicate the appropriate way to remove the fuse, such as whether to push the fuse from the other side or turn fuseholder over to remove fuse.

d) "Risk of fire. Replace fuse only with ____ Amp, 125 Volt fuse (provided with product)." The blank shall be filled in with the current rating of the fuse. Words located in parenthesis are applicable only if the replacement fuse is provided with the product.

e) "Close fuse cover." The manufacturer shall indicate the specific way to close the cover, such as, "Slide closed the fuse access cover on top of attachment plug," or "Push cover closed so that all tabs latch."

131.3 A product employing a fused attachment plug shall include the following instructions: "Risk of fire. Do not replace attachment plug. Contains a safety device (fuse) that should not be removed. Discard product if the attachment plug is damaged."

131.4 For products that employ series-connected lamps, the instruction manual shall have specific instructions concerning how to physically replace the lamp. The instructions shall include, but are not limited to the following statements, or the equivalent, to successfully replace the lamp and shall include illustrations to assist the user:

a) "Grasp plug and remove from the receptacle or other outlet device. Do not unplug by pulling on cord."

b) The manufacturer shall indicate the specific way to remove the lamp, such as, "Pull lamp and plastic base straight out of lampholder" or "Unscrew lamp counter-clockwise."

c) "Replace lamp with only ____ Volt, _____ Watt _____ type lamp (provided with product)."The blanks shall be filled in with the voltage and wattage of the lamp and type of lamp, such as super bright, regular brightness, energy saving, or LED. Words located in parentheses are applicable only if the replacement lamp is provided with the product.

Typically, super-bright lamps are rated above 0.42 Watts, regular brightness lamps are rated between 0.32 – 0.40 Watts, and energy saving lamps are rated approximately 0.25 Watts.

Exception: For an ornament, the wattage marking is not required.

d) For push-in lamps, the manufacturer shall indicate how to exchange the lamp base on the new lamp with the old one if the new lamp base does not fit.

Exception: For lighting strings that employ individually-flashing lamps the instruction manual shall indicate that the lamp base to the individually-flashing lamps is not intended to be exchanged with another lamp.

Exception: Series-connected strings containing non-replaceable lamps need not have lamp replacement instructions.

131.5 In addition to being located on a tag attached to the product, the appropriate markings specified in 125.3.2 – 125.3.4, as related to the lamp type employed, shall also be included in the relamping information provided in the instruction manual.

131.6 A decorative outfit which employs less than 8 miniature or 10 push-in or midget-screw lampholders (see Exception No. 2 to 31.1), or a series-connected product employing lamps not provided with lamp shunts, shall include the following in the instruction manual: “CAUTION – Risk of fire. This product does not contain lamp shunts, which allow the product to operate if one lamp burns out. Replace lamps only with the spare lamps provided with this product” or “CAUTION – Risk of fire. This product does not contain lamp shunts, which allow the product to operate if one lamp burns out. Do not replace lamps with other than the spare lamps provided with this product.”

Exception: A decorative outfit or series connected lighting string that employs bulbs without internal shunts, but uses external shunts, shall include the following in the instruction manual: “CAUTION – Risk of fire. This product does not contain shunts inside the lamps. Do not replace lamps with other than the spare lamps provided with this product.”

131.7 An ornament shall include the following or the equivalent in the instruction manual: "Disconnect the lighting string or decorative outfit from the outlet before removing a lamp and replacing it with the ornament".

131.8 A midget push-in type series, series-parallel connected lighting string that employs a construction that allows the string to operate without the lamps in place shall not include the following statements or equivalent in the instruction manual or shown on any part(s) of the product and packaging:

a) Picture or drawing depicting lamp(s) removed and the string in the lit condition; or

b) Wording that implies the string can be still energized even with lamp(s) removed.

Exception: A midget push-in type series, series-parallel connected lighting string that employs a shunt device in each socket that complies with Section 87, Input Test.

131.9 A midget push-in type series, series-parallel connected lighting string that employs a construction that allows the string to operate without the lamps in place and uses a "fuse lamp" shall include instructions that identifies the location of the replaceable "fuse lamps" in the lighting strings and instructs the consumer how to properly replace the fuse lamp. In addition, the following shall be included: "WARNING – Risk of fire: This product employs overload protection (fuse lamp) in each series light circuit to provide overload protection in addition to the fuse(s) located in the plug. Do not replace the fuse lamp contained in this set with any other type of lamp, use only spare fuse lamps provided with this product."

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SUPPLEMENT SA – SEASONAL-LIGHTING LAMPS

INTRODUCTION

SA1 Scope

SA1.1 These requirements cover lamps intended for series- or parallel-connection in seasonal products in accordance with this standard.

CONSTRUCTION

SA2 Screw-Base Lamps

SA2.1 General

SA2.1.1 Exposed live metal, including the screw bases of all lamps that are provided with a seasonal lighting product shall be of a type that is contained within, and protected by, insulating material such as the husk of a lampholder. See SA2.1.2.

SA2.1.2 To comply with the requirement in SA2.1.1 the overall base height:

a) Shall not exceed the limit specified in Table SA2.1 for a medium (E26), miniature (E10), or midget (E5) base lamp as measured axially from the bottom of the center contact (including solder) to the upper rim of the screw base, including solder or any conducting material; or

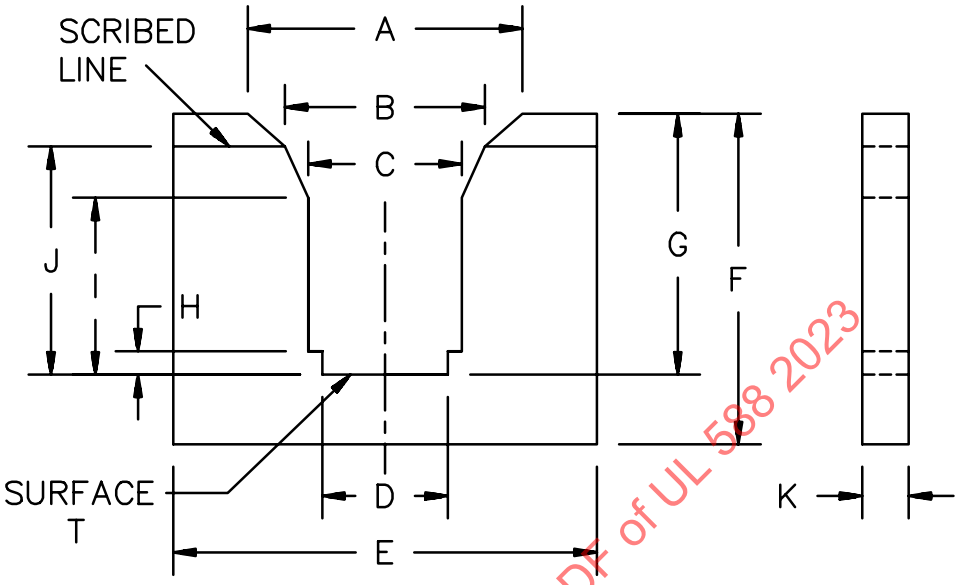
b) Shall be determined by the gauges illustrated in Figure SA2.1 and Figure SA2.2 for a candelabra (E12) or intermediate (E17) base lamp.

Table SA2.1
Maximum height of metal base

Base size	Height	
	inches	(mm)
Medium (E26)	1.0	(25.4)
Miniature (E10)	17/32	(13.5)
Midget (E5)	23/64	(9.1)

Figure SA2.1

Gauge for evaluating exposure of live parts of candelabra screw-base lamps



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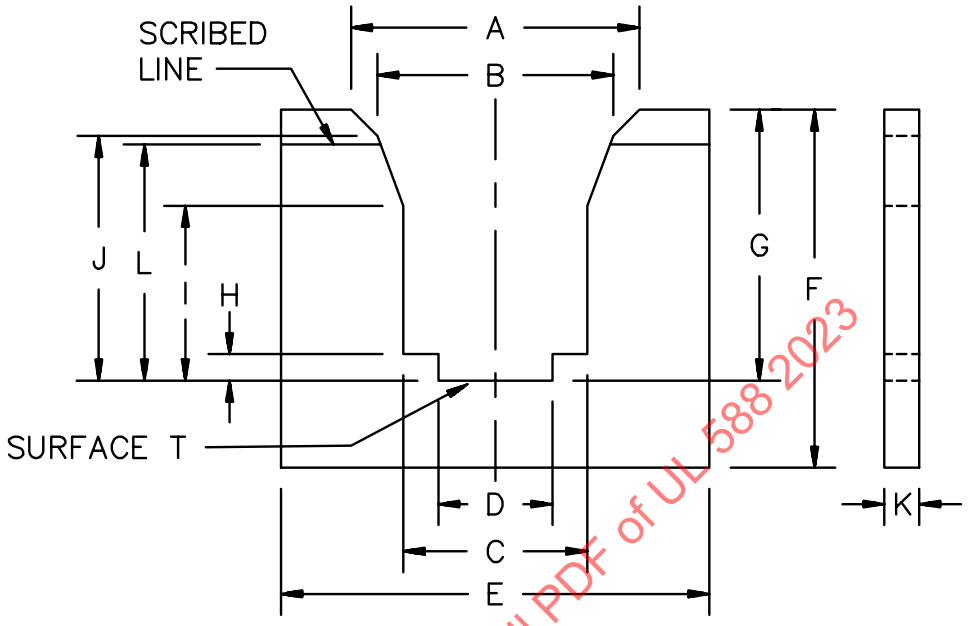
Reference	Dimensions (inches)	Tolerance (inches)	Nearest metric equivalent (millimeters)
A	0.750	-0.001	19.04
B	0.562	-0.001	14.26
C	0.470	-0.0002	11.94
D	0.300	±0.001	7.62
E	1.25	APPROX.	31.8
F	1.0	APPROX.	25.4
G	0.781	+0.001	19.82
H	0.063	+0.001	1.60
I	0.520	+0.001	13.21
J	0.687	+0.001	17.44
K	0.125	APPROX.	3.18

Figure SA2.2

Gauge for evaluating exposure of live parts of intermediate screw-base lamps



SB1793

Reference	Dimensions (inches)	Tolerance (inches)	Nearest metric equivalent (millimeters)
A	0.906	-0.001	23.01
B	0.781	-0.001	19.34
C	0.657	-0.0003	16.69
D	0.415	±0.001	10.54
E	1.50	APPROX.	38.1
F	1.25	APPROX.	31.8
G	0.937	+0.001	23.80
H	0.093	+0.001	2.36
I	0.600	+0.001	15.24
J	0.875	+0.001	22.23
K	0.125	APPROX.	3.18
L	0.844	+0.001	21.44

SA2.2 Lamps intended for parallel connection

SA2.2.1 Candelabra and intermediate screw-base lamps provided with a seasonal lighting product shall comply with the requirements in SA2.2.2 – SA2.2.7.

SA2.2.2 Candelabra and intermediate screw base lamps shall comply with the thread specifications contained in Electrical Lamp Bases, ANSI C81.61. Compliance shall be determined by the Lamp Screw Base Conformity Test, Section SA7.

SA2.2.3 The acceptability of candelabra- and intermediate-screw-base lamps, with respect to envelope shape, envelope eccentricity, height of live parts above the center contact, and height of side solder shall be determined by means of the gauge illustrated in Figure SA2.1 or Figure SA2.2, respectively. In all rotational orientations of the lamp with its major axis coincident with the center line of the gauge, a live part, including side solder or side filament lead, shall not extend above the scribed line.

SA2.2.4 A filament lead in a candelabra-screw-base lamp and in an intermediate base lamp shall not protrude more than 1 mm (0.04 inch) through the center contact solder on the lamp base. The side solder or side filament lead shall not extend more than 1 mm (0.04 inch) from the side of the screw shell.

SA2.2.5 Candelabra- and intermediate-base lamps shall not employ internal filament shunts.

SA2.2.6 The securement of candelabra and intermediate-bases to their lamp envelopes shall withstand the Envelope-to-Base Securement Test, Section SA8.

SA2.2.7 Candelabra- and intermediate-base lamps, under normal operating conditions, shall not have an envelope surface temperature in excess of 90°C (194°F)when subjected to the Lamp-Envelope Temperature Test, Section SA9.

SA2.2.8 The material of the screw shall be copper or an alloy that contains at least 80 percent copper.

SA2.2.9 If a lamp is provided with a polymeric decorative cover, the combination of the lamp with the cover shall comply with the applicable requirements and the decorative cover shall comply with the Downward Burning Rate Test, Section 50.

SA3 Bubble Lights

SA3.1 The lamp and housing portion of a bubble light shall comply with the requirements for Screw-Base Lamps, Section SA2. For a candelabra or intermediate base bubble light, the lamp base with the assembly shall also comply with SA2.2.3. For a bubble light intended for series connection, the lamp shall also comply with the Maximum Lamp Wattage Test, Section SA6.

SA3.2 The housing or any exterior surface of a bubble light shall be constructed of a material which complies with the requirements in Materials, Section 8.

SA3.3 Under normal operating conditions, the housing or exterior surface of a bubble light shall not exceed a temperature of 50°C (122°F) when tested in accordance with the Temperature Test, Section 43.

Exception: If the housing or exterior surface of the bubble light is constructed of a material rated greater than 50°C (122°F) the temperature of the material may exceed 50°C, but shall be consistent with the material rating and, in no case shall the measured temperature be greater than 90°C (194°F).

SA3.4 The identity (or chemical composition) of the liquid contained in the bubble lamp shall be a non-flammable liquid whose chemical as ascertained by the Identification Test, Section SA11, will be consistent with a flammability hazard rating of 0 or 1 in the National Fire Protection Association Standard System for the Identification of the Hazards of Materials for Emergency Response, NFPA 704.

SA3.5 The container which holds the liquid shall not permit liquid to escape the container. Compliance shall be determined as indicated in SA10.2. A supplemental barrier may be employed to comply with this requirement. Polymeric materials used to construct the barrier shall be suitable for the temperatures incurred.

SA3.6 Bubble lights which contain the liquid Methylene Chloride shall be marked as indicated in SA13.3.

SA4 LED Lamps

SA4.1 The housing of an LED lamp shall comply with the requirements in 22.2.1.2.

Exception: LED lamps that are encased in a glass envelope need not comply with 22.2.1.2.

SA4.2 An LED lamp shall not employ internal shunts.

SA4.3 The housing or exterior surface of a LED lamp shall have a minimum temperature rating consistent with the measured temperature of the lampholder when tested in accordance with the Temperature Test, Section 43.

SA4.4 An LED housed within a glass envelope of a screw-type lamp shall comply with the requirements for screw-base lamps and in addition comply with the abnormal operation test described in Section 48.

SA5 Outdoor Use LED Lamps

SA5.1 A polymeric material used for the lamp envelope of an LED lamp intended for outdoor-use shall be resistant to ultraviolet (UV) weathering and exposure to water as determined by the Ultraviolet (UV) Light Exposure and Water Immersion Tests, Section 94.

Exception: A material evaluated for resistance to ultraviolet light in accordance with the requirements specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, need not comply with SA5.1.

PERFORMANCE

LAMPS INTENDED FOR SERIES CONNECTION

SA6 Maximum Lamp Wattage Test

SA6.1 Lamps containing shunts employed in a push-in, or miniature or midget screw lampholder string shall not dissipate a wattage equal to 3.0 times the area of the outside glass bulb surface in square centimeters above the base or 1.1 times the minimum diameter in millimeters of the lamp in the location of the filament, whichever is less, continuously for more than 2 minutes.

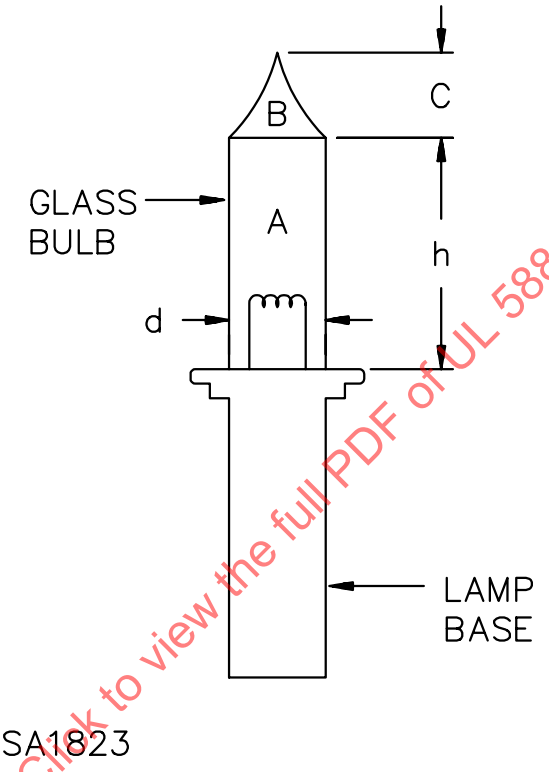
SA6.2 Compliance with SA6.1 is to be determined by inserting the lamp in the intended lampholder connected in series with a variable AC voltage supply in conjunction with a wattmeter. The wattage drawn is to be gradually increased so that the calculated wattage is reached within 60 seconds. Burnout of the filament shall occur within 2 minutes after the specified wattage is achieved. For conventional-type lamps the surface area (see Figure SA6.1) may be calculated as follows:

$$Total\ surface\ area = surface\ area\ A\ plus\ surface\ area\ B$$

$$Surface\ area\ A = 2\pi\frac{d}{2}h$$

$$Surface\ area\ B = \pi\frac{d}{2}\sqrt{\left(\frac{d}{2}\right)^2 + C^2}$$

Figure SA6.1
Determination of surface area of conventional type lamp



SA6.3 For a globe-shaped lamp, the surface area is to be calculated as follows (see Figure SA6.2):

$$Total\ surface\ area = surface\ area\ A\ \ minus\ surface\ area\ B$$

$$Surface\ area\ A = 4\pi\left(\frac{d}{2}\right)^2$$

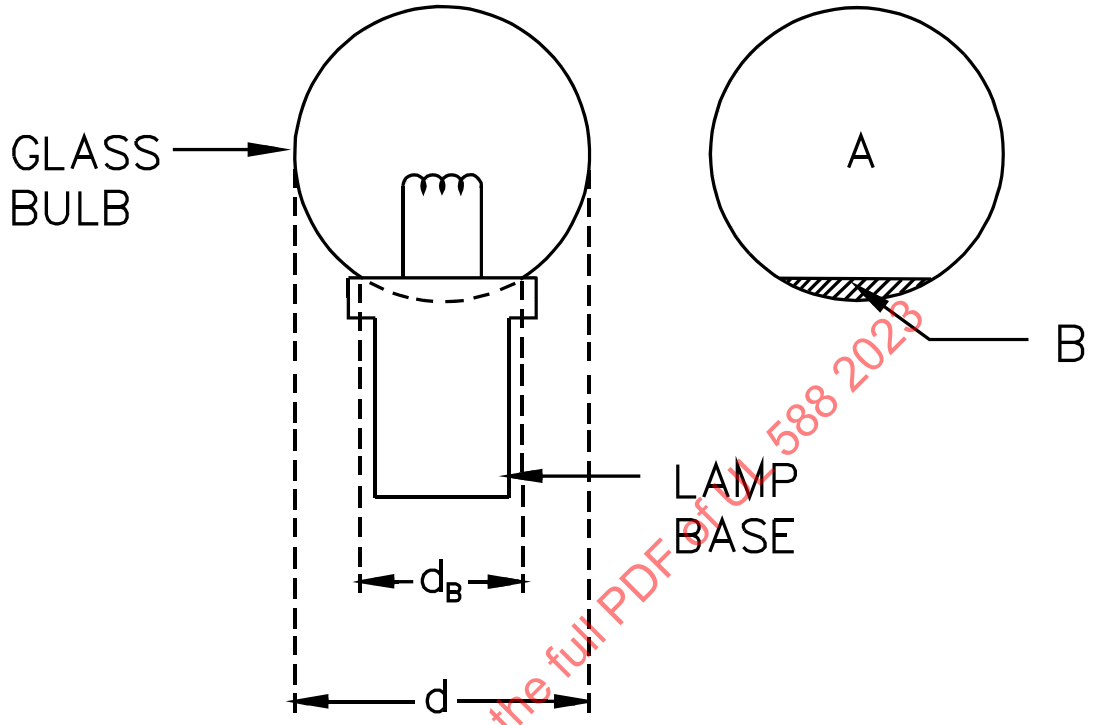
$$Surface\ area\ B = 2\pi\left[\left(\frac{d}{2}\right)^2 - r\left(\frac{d}{2}\right)\right]$$

where:

$$r = \sqrt{\left(\frac{d}{2}\right)^2 - \left(\frac{d_B}{2}\right)^2}$$

Figure SA6.2

Determination of surface area of globe-shaped lamp



LAMPS INTENDED FOR PARALLEL CONNECTION

SA7 Lamp Screw Base Conformity Test

SA7.1 Candelabra and intermediate screw-base lamps shall comply with the "Go" and "Not-Go" gauges shown in Table SA7.1. The gauges shall be made and the lamps shall be tested in accordance with the specifications for Gauges for Electric Lamp Bases and Lampholders, ANSI C81.63. The acceptability of the lamp bases shall be determined using the gauging specifications in the Standards for Electric Lamp Bases, ANSI C81.61.

Table SA7.1
Lamp screw base conformity gauges

Base type	Gauge name	Gauge (standard sheet number)
E12 (Candelabra)	Threaded "Go" Gauge for E12 Candelabra Screw Based Lamps	7006-25C-1
	"Not-Go" Ring Gauge for E12 Candelabra Screw Based Lamps	7006-26B-1
E17 (Intermediate)	Threaded "Go" Gauge for E17 Intermediate Screw Based Lamps	7006-25H-1
	"Not-Go" Ring Gauge for E17 Intermediate Screw Based Lamps	7006-26C-1

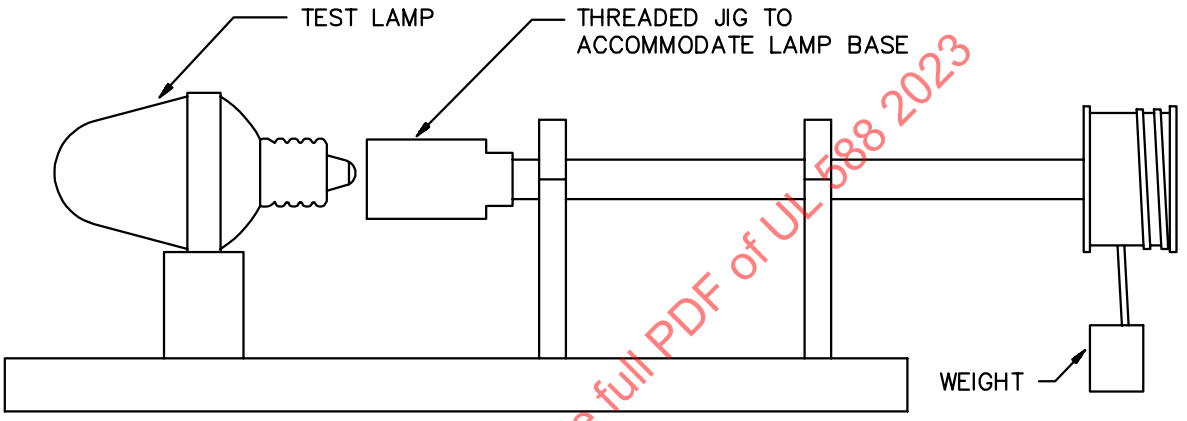
SA7.2 Each of the tests in SA7.1 shall be performed on six previously untested lamp bases.

SA8 Envelope-to-Base Securement Test

SA8.1 Candelabra and intermediate screw bases shall be secured to their envelopes, or to the housing for a bubble light, so that the assembly can withstand for 5 seconds a torque of 5 and 7 pound inches (0.57 and 0.79 N·m) respectively without any indication of separation of the envelope or housing from its base. This determination may be accomplished through the use of a test jig as illustrated in Figure SA8.1. One previously untested lamp is to be tested.

Figure SA8.1

Test jig for lamp-securement torque test



SB1795

SA9 Lamp-Envelope Temperature Test

SA9.1 Compliance with SA2.2.7 shall be determined by visually inspecting the temperature-sensitive stripe described in SA9.4 after being tested as described in SA9.2 – SA9.5. The absence of a distinctive change in the appearance of all or any part of the test stripe, such as a change from dull-opaque to glossy-transparent, is acceptable.

SA9.2 Candelabra- or intermediate-base lamps shall be positioned in lampholders with the lamps oriented so their major axes are essentially vertical with each lamp base down and each lamp is spaced at least 3 inches (76.2 mm) from any adjacent lamp. The test shall be conducted in a substantially draft-free environment, at any ambient temperature within the range of 25 ±3°C (77 ±5.4°F).

SA9.3 If the lamps are provided in various colors, those lamps that, due to color (typically blues and greens) or finish (translucent as opposed to transparent) would be suspected of having a higher envelope temperature are to be tested. If the lamps are provided in various shapes, each lamp shape is to be tested.

SA9.4 A test stripe[a], approximately 1/4 – 1/2 inch (6 – 13 mm) wide of a 93°C (200°F) maximum temperature sensitive liquid is to be painted onto the surface of each lamp (one side only) with the stripe extending from the lower-most part of the glass envelope to its top. When the filament is skewed, the paint is to be applied to the envelope surface closest to the filament.

[a] An acceptable means of providing the stripe is to use the 93°C maximum temperature-sensitive Omegalaq liquid available from Omega Engineering Inc., P.O. Box 4047, Stamford, CT 06907.

SA9.5 The lamps are to be installed in lampholders and then connected to a power supply of 120 V, 60 Hz for 5 minutes, after which they are to be de-energized and then inspected as described in SA9.1.

Exception: The power supply shall be adjusted to the rated voltage of the lamp if this is less than 90 V.

BUBBLE LIGHTS

SA10 General

SA10.1 For a bubble light intended for series connection, the lamp portion of the bubble light shall comply with the Maximum Lamp Wattage Test, Section SA6. For a bubble light intended for parallel connection, the lamp and housing portion of the light shall comply with the applicable requirements in the Lamp Screw Base Conformity Test, Section SA7, and the Envelope-to-Base Securement Test, Section SA8. In addition, the lamp portion of a bubble light intended for parallel connection shall separately comply with the applicable requirements in Sections SA7 – SA9.

SA10.2 The container which holds the liquid shall be subjected to the Crush Test, Section 83, except that a force of 30 lbs (133.4 N) is to be applied and there shall not be any leakage of fluid as a result of the test.

SA11 Identification Test

SA11.1 When tested as described in SA11.2, the identity (or chemical composition) of the liquid contained in a bubble light shall be ascertained. See SA3.4.

SA11.2 QUALITATIVE INFRARED ANALYSIS – An infrared spectrum of the liquid is to be obtained by means of an infrared spectrophotometer, in accordance with the methods described in Infrared Spectroscopy, Section 43 of the Standard for Polymeric Materials – Short Term Property Evaluation, UL 746A. Interpretation of infrared spectral absorbances can aid in the identification of the composition of polymeric compounds. Identification (or chemical composition) is ascertained by comparing a compound's infrared spectra to those of known composition.

GLASS LED LAMPS

SA11A General

SA11A.1 When subjected to a single drop described in 59.1, lamp breakage is considered acceptable provided that for all three lamps, there is no accessibility of live parts or a minimum of 75% of each sample's outer envelope surface area above its base contacts breaks away or becomes permanently separated.

SA11A.2 *Deleted*

PRODUCTION LINE TESTS

SA12 General

SA12.1 Each intermediate and candelabra base lamp shall be subjected to an operation test during production and upon final assembly to determine that each lamp lights at the rated voltage.

MARKINGS

SA13 General

SA13.1 Intermediate and candelabra base lamps shall be legibly and durably marked on the lamp envelope or lamp base with each the following:

a) The manufacturer's name or trademark,

b) The rated voltage, marked as "V" or "Volts," and

c) The rated wattage, marked as "W" or "Watts."

Exception: A bubble light shall be marked on any portion of the assembly which is visible without disassembly.

SA13.2 The carton in which candelabra or intermediate base replacement lamps are packaged shall be marked with the type of lamp, either candelabra base or intermediate base.

SA13.3 A seasonal product containing bubble lights that use methylene chloride shall be marked: “Caution – Vial contains Methylene Chloride. If exposed to the liquid, contact your local poison control hotline.”

SA13.4 Products employing glass lamps complying with this Section shall be marked in accordance with 125.3.11.