

# UL 588

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## Seasonal and Holiday Decorative Products





Underwriters Laboratories Inc. (UL)  
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UL Standard for Safety for Seasonal and Holiday Decorative Products, UL 588

Eighteenth Edition, Dated August 21, 2000

Revisions: This Standard contains revisions through and including July 18, 2003.

**SUMMARY OF TOPICS:**

***This revision of UL 588 is being issued to include the clarification of requirements for Series-Connected Lighting Strings Employing Individual-Flashing Lamps.***

Announcement Bulletin: This Standard contains the announcement bulletin dated March 20, 2001. The announcement bulletin is located at the end of the Standard.

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Text that has been changed in any manner is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

The following table lists the future effective dates with the corresponding item.

Future Effective Dates	References
February 13, 2004	Paragraph 13.2.4

The revised requirements are substantially in accordance with UL's Bulletin on this subject dated April 22, 2003.

The revisions dated July 18, 2003 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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**1**

## **UL 588**

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The most recent designation of ANSI/UL 588 as an American National Standard (ANSI) occurred on July 9, 2003.

This ANSI/UL Standard for Safety, which consists of the Eighteenth Edition with revisions through July 18, 2003, is under continuous maintenance, whereby each revision is ANSI approved upon publication. Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Written comments are to be sent to UL-MEL Standards Department, 1285 Walt Whitman Road, Melville, NY 11747.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

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## FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction which conflict with specific requirements of the Standard cannot be judged to comply with the Standard. A product employing materials or having forms of construction not addressed by this Standard may be examined and tested according to the intent of the requirements and, if found to meet the intent of this Standard, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

## 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.

1.2 These requirements cover factory-assembled seasonal lighting strings with push-in, midget-screw, or miniature-screw lampholders 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, a Christmas tree provided with simulated branches and needles not exceeding 30 inches in height, blow-molded figures or objects, animated figures, tree tops, controllers, tree stands, 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.

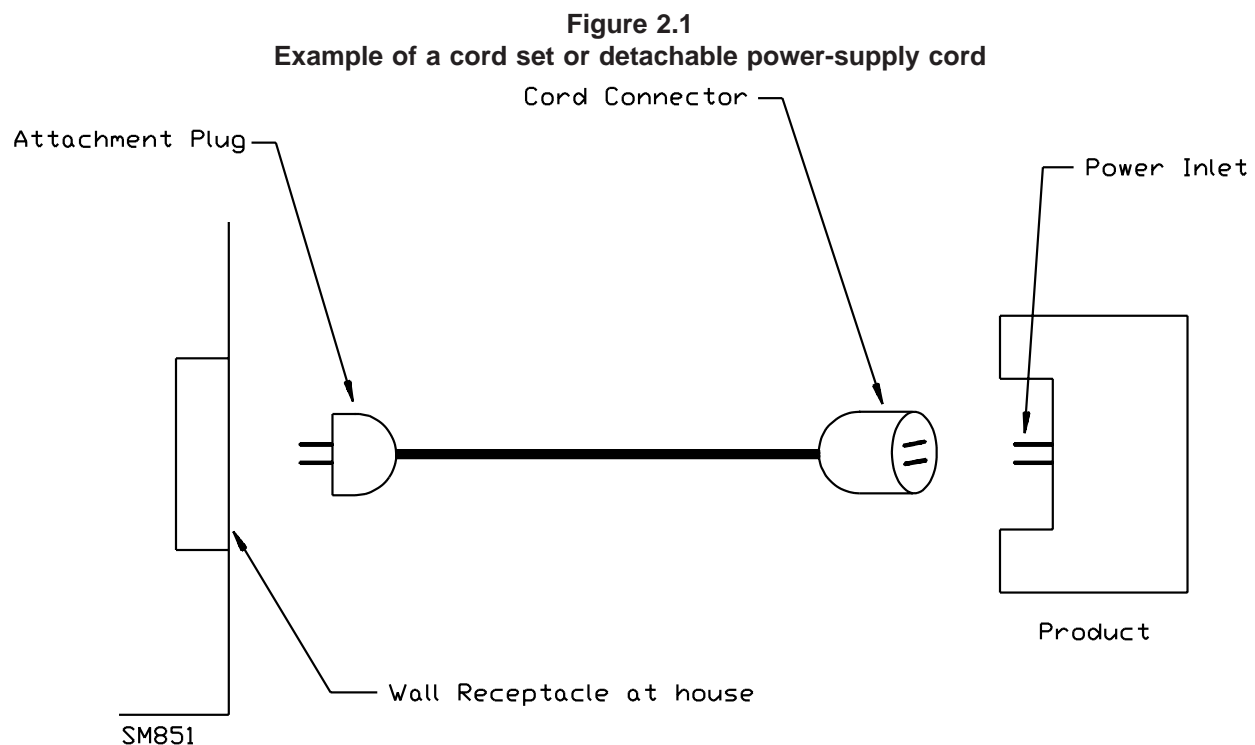
1.5 *Deleted November 21, 2001*

1.5 revised November 21, 2001

## 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. See Figure 2.1.



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 provided with simulated branches and needles not exceeding 30 inches in height, 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 provided with decorative covers over the lamps is 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.

2.17 revised September 25, 2002

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.

2.22A 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.

2.22A added February 14, 2001

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

2.24 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.

2.25 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.

2.26 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.

2.27 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.

2.28 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.

2.29 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.



**2.30 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.

**2.31 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.

2.31 revised June 29, 2001

**2.32 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.

**2.33 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.

2.33 revised June 29, 2001

**2.34 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.

2.34 revised June 29, 2001

**2.35 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.

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

**2.37 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.

**2.38 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.

**2.39 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.

**2.40 ORNAMENT, NON-ELECTRONICALLY-OPERATED** – An ornament provided with a wiring assembly consisting of only a lamp and lampholder on one end and an adapter on the other end. This type of ornament is illuminated only.

2.41 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.

2.42 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.

2.43 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.

2.44 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

No Text on This Page

(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.

**2.45 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.

**2.46 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 Tables 6.1 and 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 <sup>2</sup> )	22 (0.32) <sup>a</sup>	22 (0.32) <sup>a</sup>	20 (0.52) <sup>a</sup>	22 (0.32) <sup>a</sup>
Wire type	CXTW <sup>a</sup>	CXTW <sup>a</sup>	CXTW <sup>a</sup>	CXTW <sup>a</sup>
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 number of strings allowed to be connected together, end-to-end	3	—	6	—
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	7.4, 7.6, 7.15	7.3, 7.7, 7.13	7.6, 7.10, 7.16	7.5, 7.9, 7.14
<sup>a</sup> A motorized product shall employ minimum No. 18 AWG Type SPT-2 wire for the supply connections. See Figures 7.11 – 7.16.				

**Table 6.2**  
**Wire types and overcurrent protection ratings for parallel-connected seasonal lighting products**

	With load fitting		Without load fitting	
Minimum wire size, AWG (mm <sup>2</sup> )	20 (0.52) <sup>a</sup>	18 (0.82) <sup>b</sup>	20 (0.52) <sup>a</sup>	18 (0.82) <sup>b</sup>
Wire type	XTW	SPT-1, SP-2, SPT-2, S, ST, SE, SO, SOO, SJ, SJT, SJE, SJO, SJO	XTW	SPT-1, SP-2, SPT-2, S, ST, SE, SO, SOO, SJ, SJT, SJE, SJO, SJO
Minimum wire temperature	105°C		105°C	
Maximum current rating, Amperes	1.75		3.5	
Fuse rating, Amperes	5		5	
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	7.2, 7.12		7.1, 7.11	
<sup>a</sup> A motorized product shall employ minimum No. 18 AWG Type SPT-2 wire for the supply connections. (See Figures 7.11 – 7.16.				
<sup>b</sup> 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.				

## 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.

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

*Exception No. 2: A product employing a direct plug-in Class 2 power unit which complies with the applicable requirements in the Standard for Class 2 Power Units, UL 1310, need not be provided with integral overcurrent protection.*

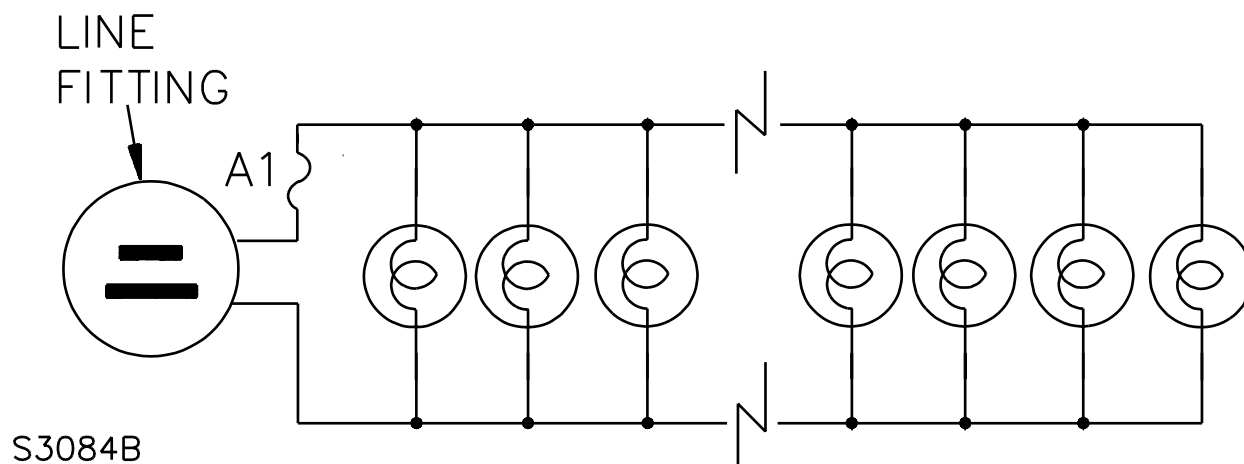
7.2 A product employing a power inlet intended for use with a cord set or a detachable power-supply cord shall be provided with fusing in accordance with this Section:

- 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.

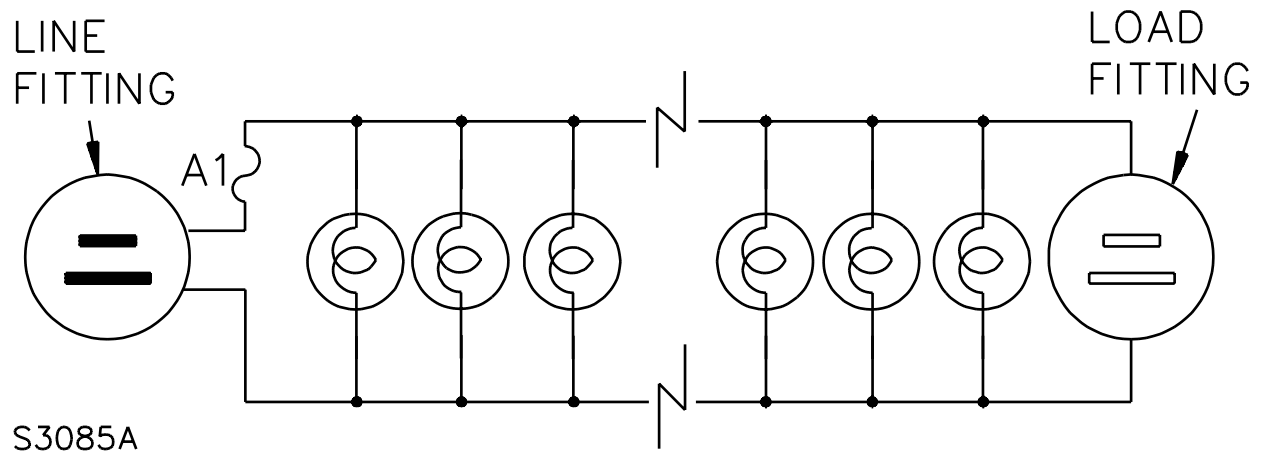
7.3 The overcurrent protection shall be either an integral part of the attachment plug or current tap, or of a through-cord design (in-line fuseholder) located so that there is not more than 6 inches (152 mm) between the face of the attachment plug or current tap and the side of the fuseholder furthest from the attachment plug or current tap. If a through-cord design is employed, a minimum No. 20 AWG (0.52 mm<sup>2</sup>) wire shall be used between the attachment plug or current tap and the fuseholder.

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

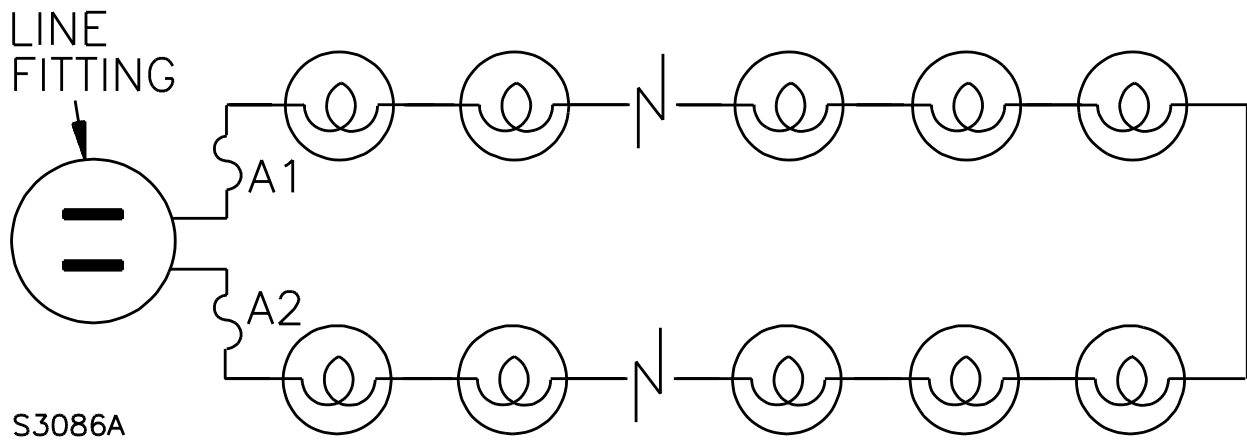
**Figure 7.1**  
**Parallel-connected string with a polarized line fitting and without a load fitting**  
(See note 1)



**Figure 7.2**  
**Parallel-connected string with a polarized line and load fitting**  
(See note 1)

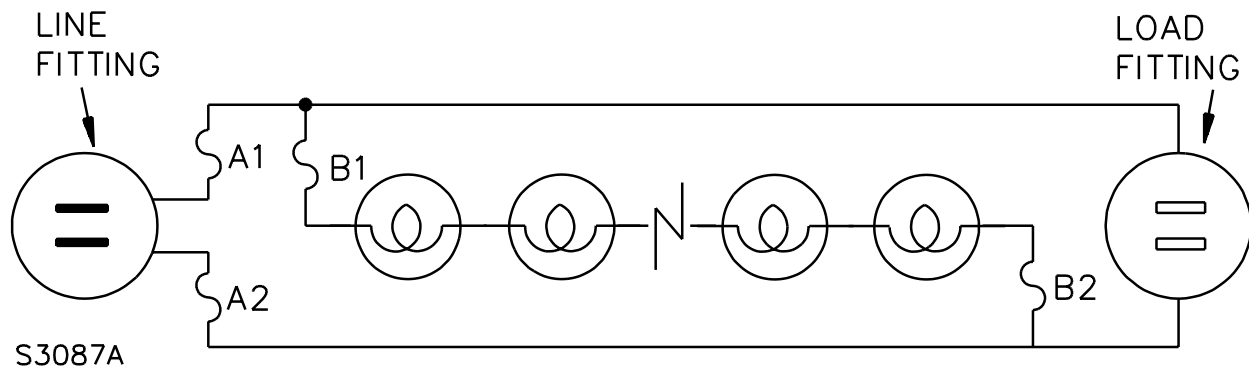


**Figure 7.3**  
**Series-connected string with a non-polarized line fitting and without a load fitting**  
(See note 1)

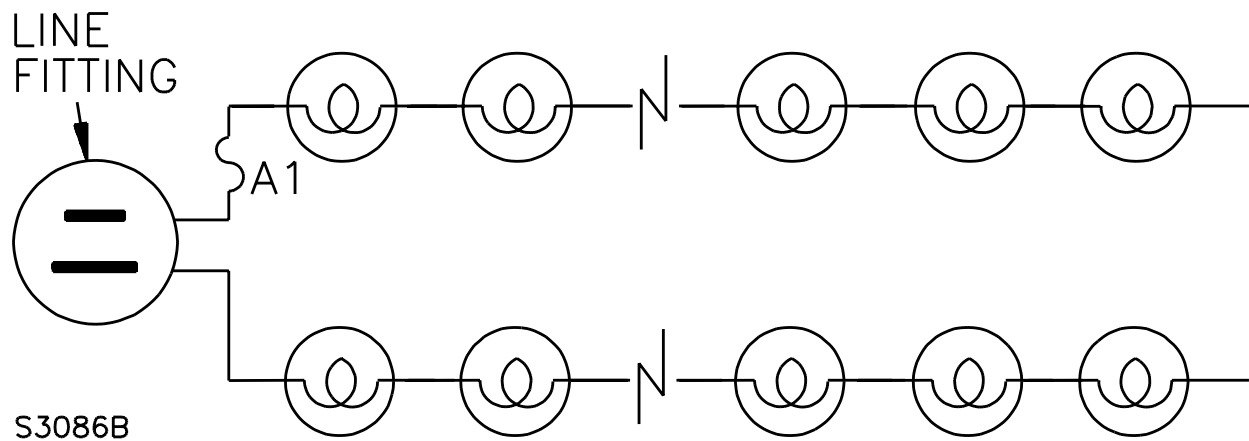




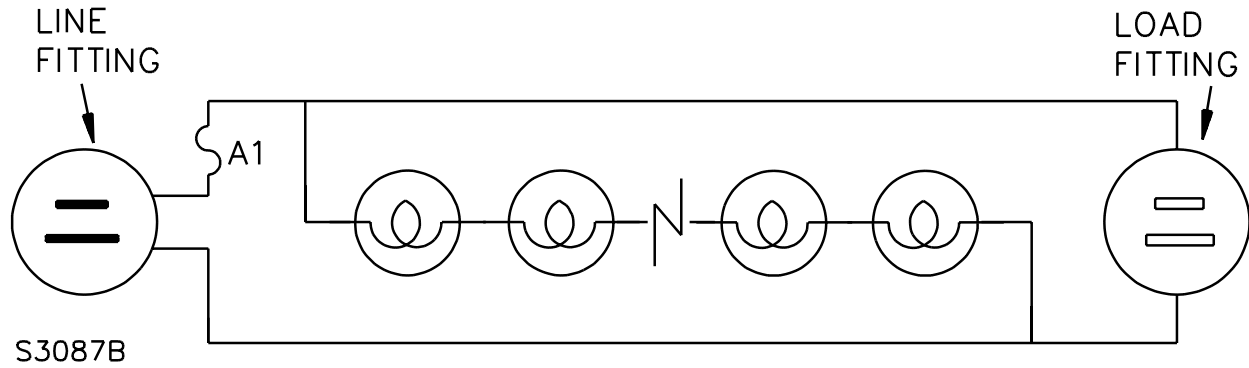
**Figure 7.4**  
**Series-connected string with a non-polarized line and load fitting**  
(See notes 1, 2, 3)



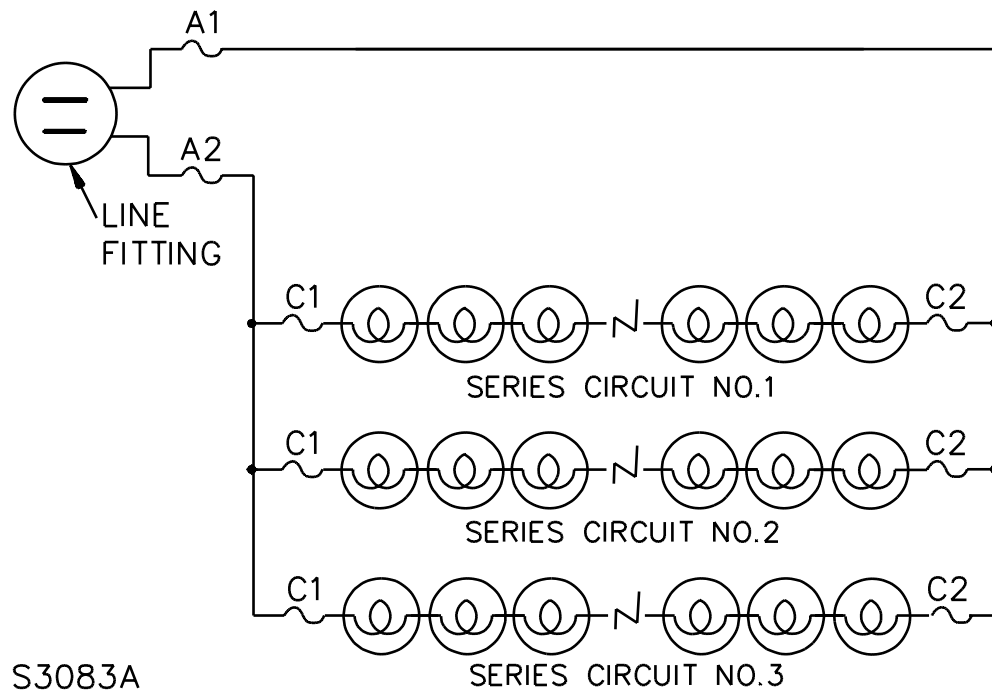
**Figure 7.5**  
**Series-connected string with a polarized line fitting and without a load fitting**  
(See note 1)



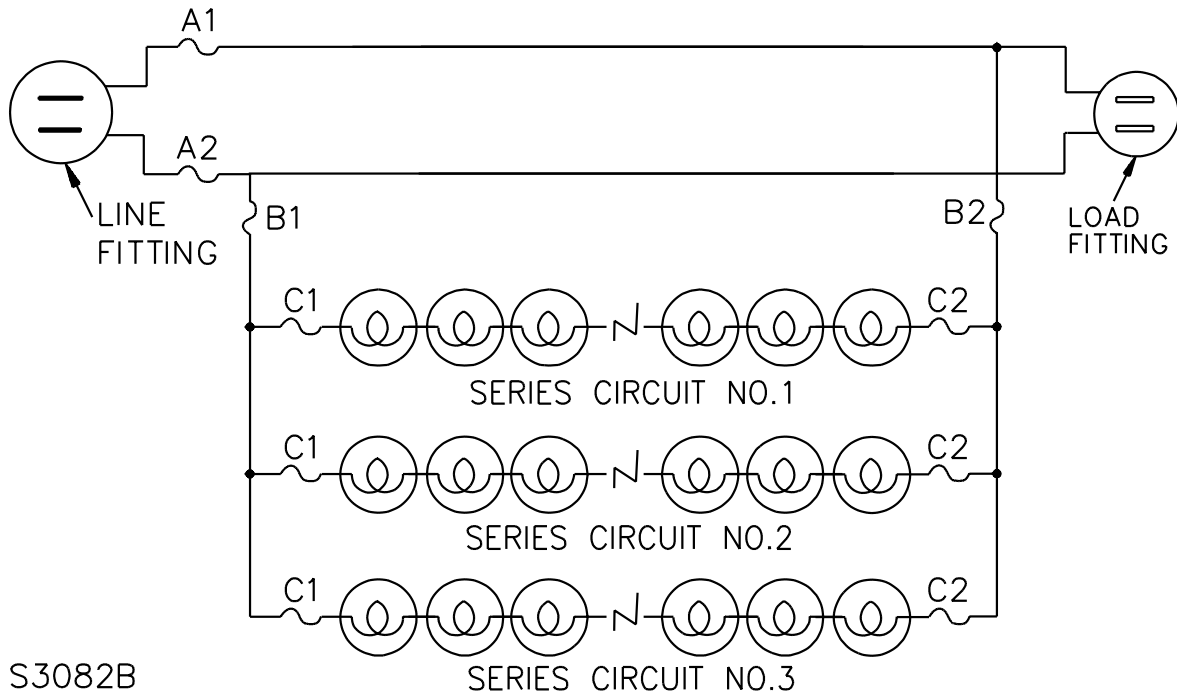
**Figure 7.6**  
**Series-connected string with a polarized line and load fitting**  
(See note 1)



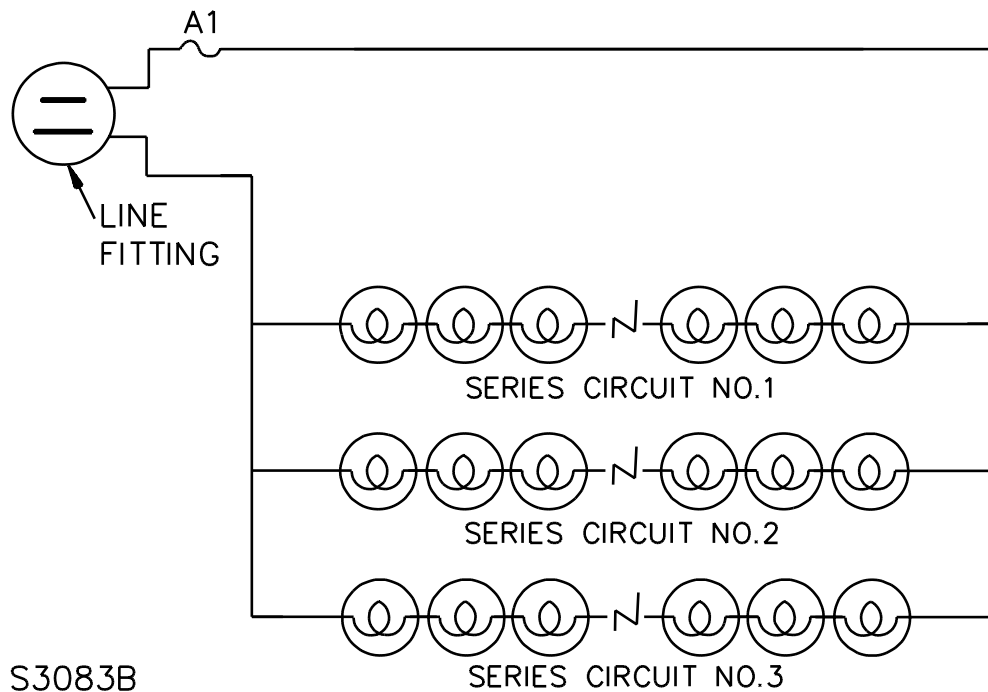
**Figure 7.7**  
**Series-parallel-connected string with a non-polarized line fitting and without a load fitting**  
(See notes 1, 2, 3)



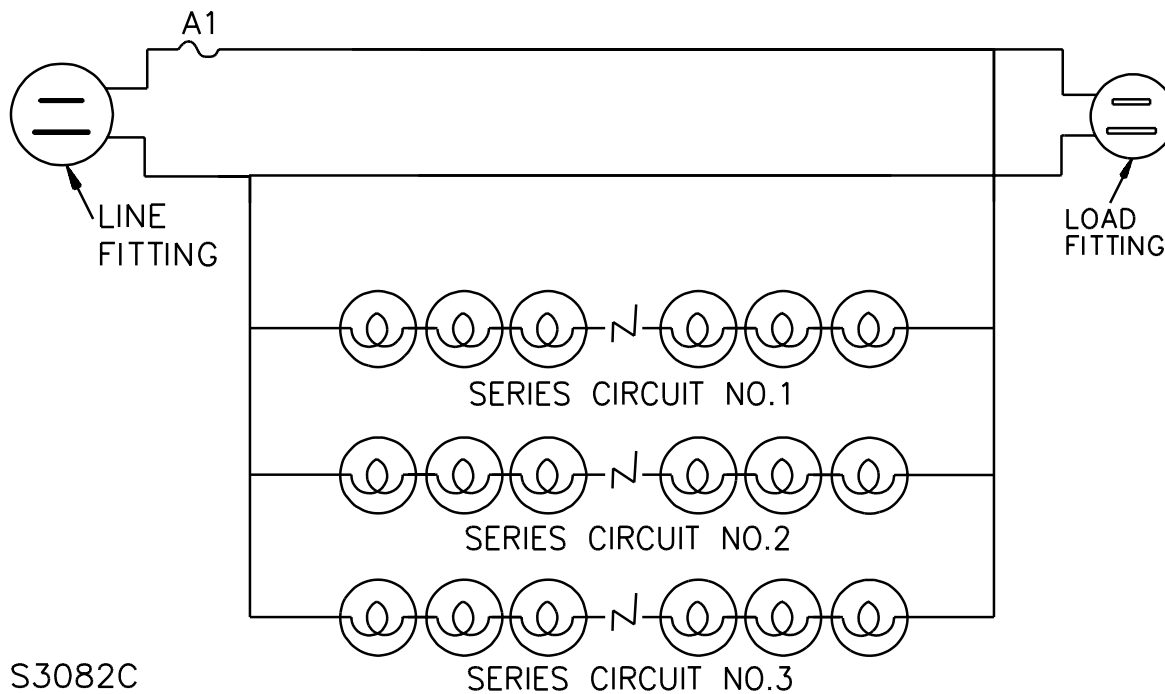
**Figure 7.8**  
**Series-parallel-connected string with a non-polarized line and load fitting**  
(See notes 1, 2, 3)



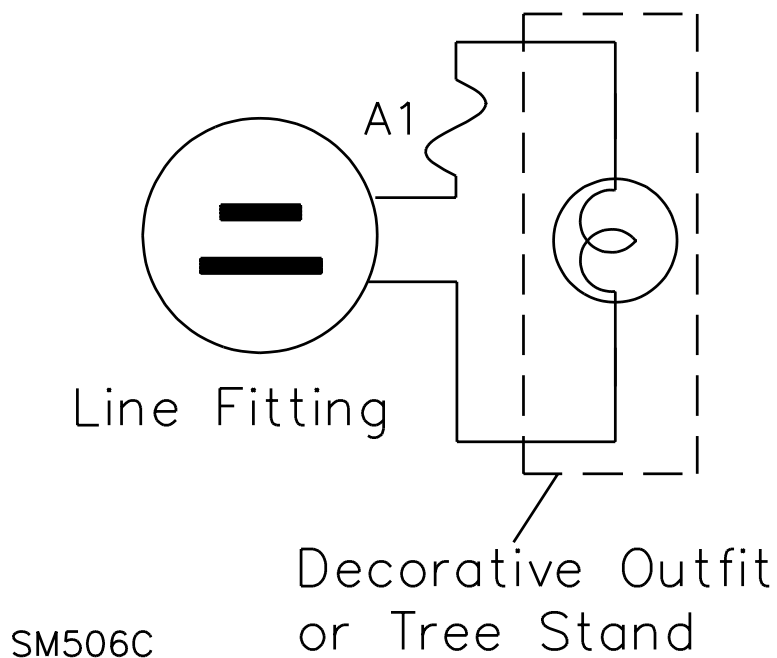
**Figure 7.9**  
**Series-parallel-connected string with a polarized line fitting and without a load fitting**  
(See note 1)



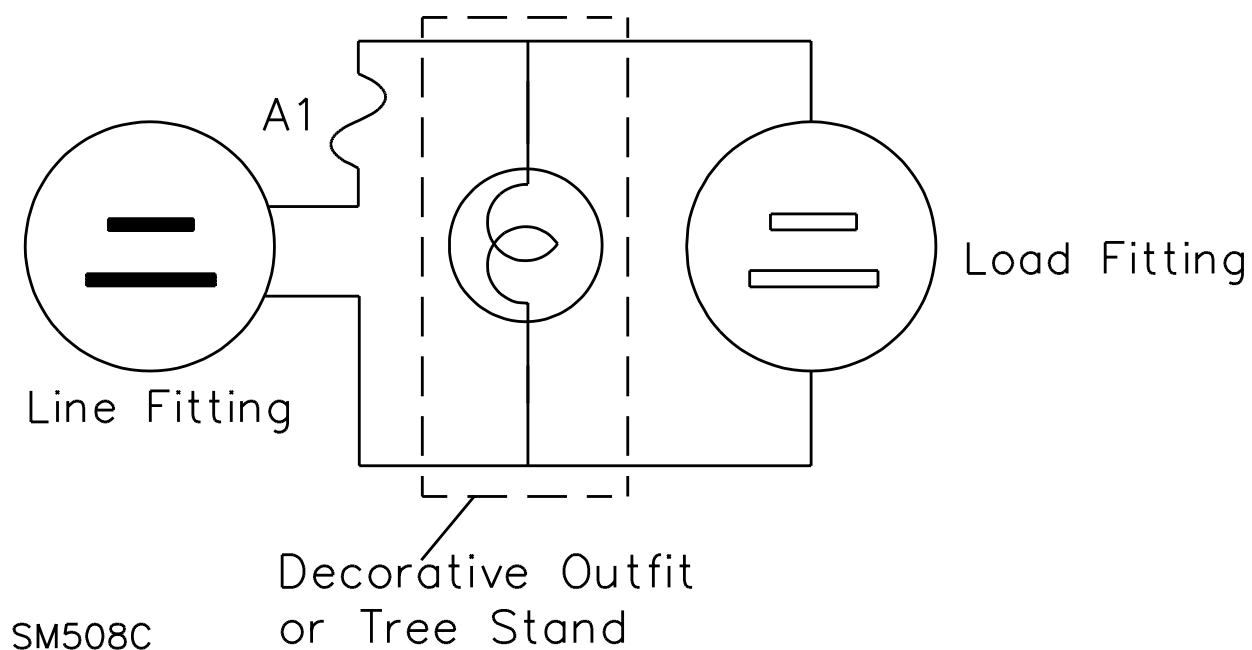
**Figure 7.10**  
**Series-parallel-connected string with a polarized line and load fitting**  
 (See note 1)



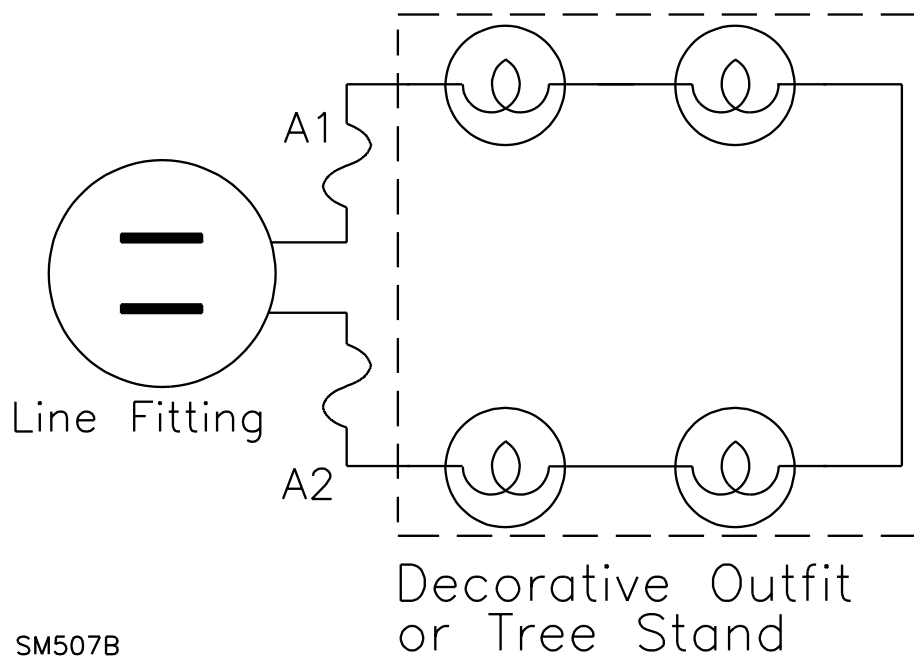
**Figure 7.11**  
**Decorative outfit or tree stand without a load fitting**  
 Decorative lighting harness or parallel-connected string  
 (See notes 1, 4)



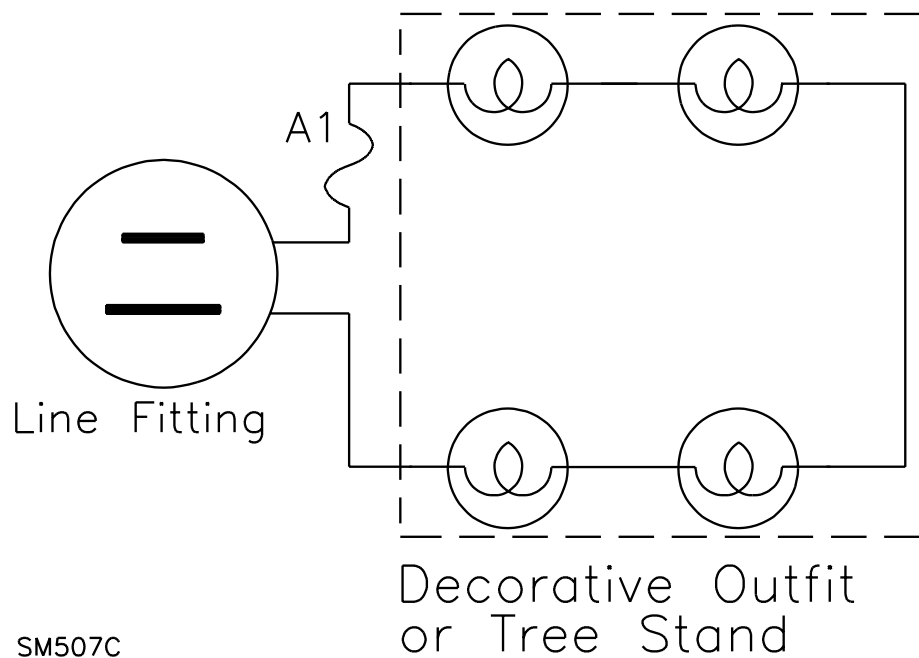
**Figure 7.12**  
**Decorative outfit or tree stand with a load fitting**  
Parallel-connected string  
(See notes 1, 4)



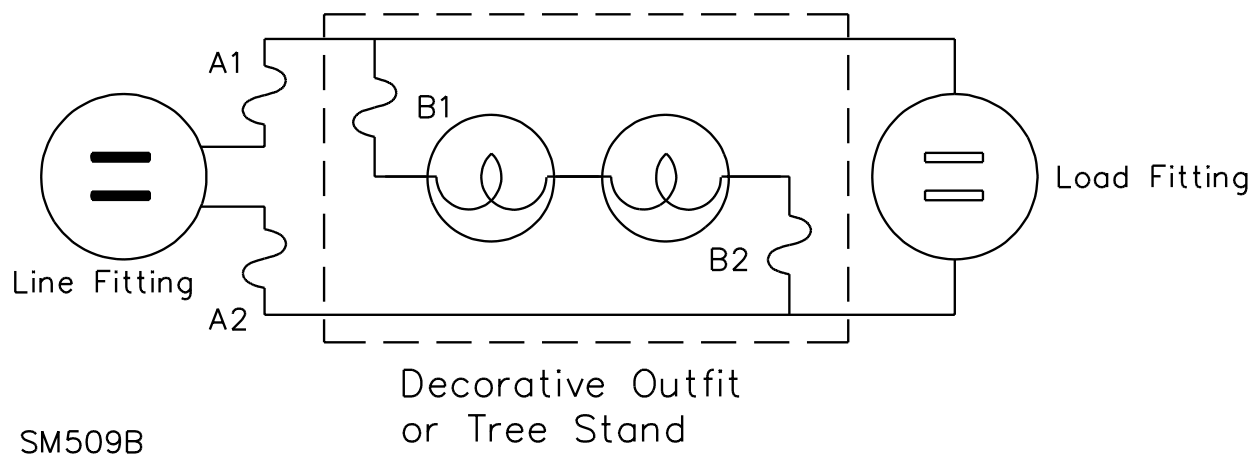
**Figure 7.13**  
**Decorative outfit or tree stand with a non-polarized line fitting without a load fitting**  
Series-connected string  
(See notes 1, 4, 5)



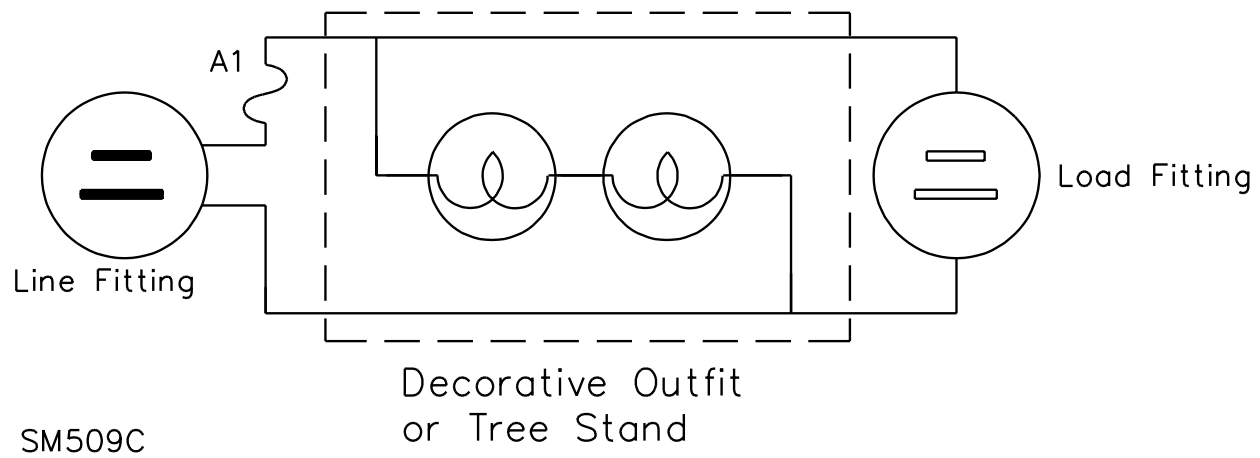
**Figure 7.14**  
**Decorative outfit or tree stand with a polarized line fitting and without a load fitting**  
Series-connected string  
(See notes 1, 4, 5)



**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)



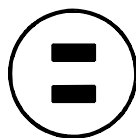
**Figure 7.16**  
**Decorative outfit or tree stand with a polarized line and load fitting**  
Series-connected string  
(See notes 1, 2, 3, 4, 6)



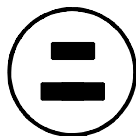
Notes 1 – 6 for Figures 7.1 to 7.16, applicable as indicated in each figure:

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 Tables 6.1 and 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.

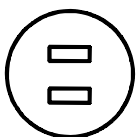
7. The following is a key for Figures 7.1 – 7.16:



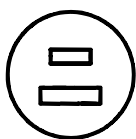
Non-polarized  
Line Fitting



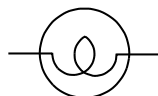
Polarized  
Line Fitting



Non-polarized  
Load Fitting



Polarized  
Load Fitting



Lamp or Load



Used to Indicate Extended  
Length or Repetition  
of Like Construction



Overcurrent Protection

S3711

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: Fuses provided with a series- or series-parallel lighting string provided with a polarized line fitting need not be replaceable.*

7.5 revised November 21, 2001

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.



## 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.*

Revised 9.1 effective January 1, 2001

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.

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.

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.

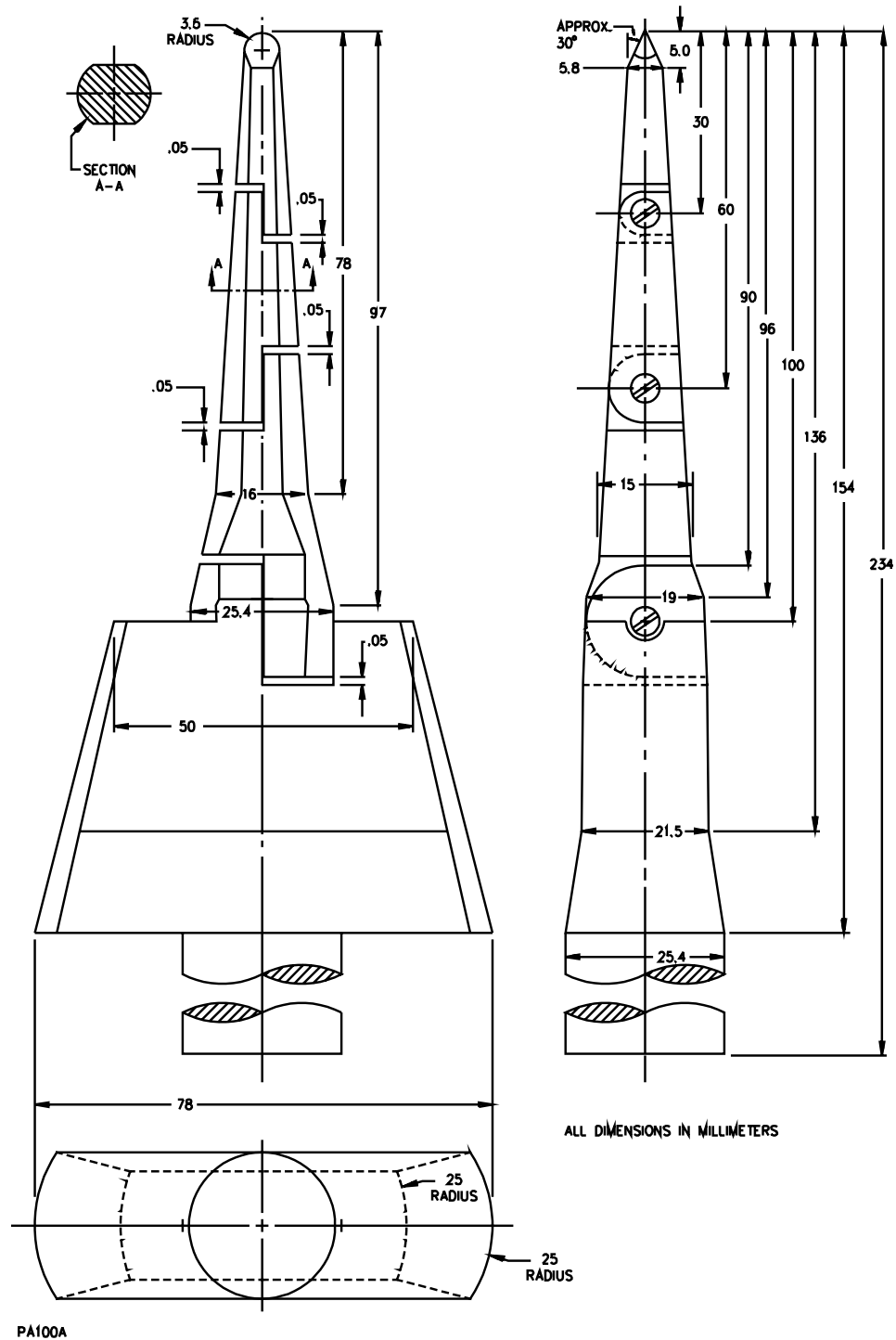
10.1.2 The enclosure of a controller, direct plug-in unit, or electronically-operated ornament shall be constructed of a polymeric material which complies with 10.3.1– 10.3.10.

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.*

Revised 10.1.3 effective January 1, 2001

**Figure 9.1**  
**Accessibility probe**



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.

10.3.3 revised November 21, 2001

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 89, 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<sup>3</sup>(2500 mm<sup>3</sup>) 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<sup>3</sup>(2500 mm<sup>3</sup>) 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<sup>3</sup>(2500 mm<sup>3</sup>) in volume, it shall be subjected to the Flammability Test for Small Components specified in the Standard for Test 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.*

Effective date for 10.3.10 changed from January 2, 2002 to January 2, 2003

**Table 10.1**  
**Material flammability requirements**

<b>Material and application<sup>a</sup></b>	<b>Minimum required flammability rating<sup>b</sup></b>	<b>Minimum HWI (PLC)<sup>d</sup></b>	<b>Minimum HAI (PLC)<sup>d</sup></b>
Polymeric materials used as a non-decorative part of the enclosure for all products <sup>c</sup>	V-1	3	3
	V-0	not required	not required
Polymeric materials used as a non-decorative part of the enclosure for a product which employs a Class 2 circuit with a maximum available power of 15 Watts <sup>f</sup>	e	not required	not required

Table 10.1 Continued on Next Page

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Table 10.1 Continued

Material and application <sup>a</sup>	Minimum required flammability rating <sup>b</sup>	Minimum HWI (PLC) <sup>d</sup>	Minimum HAI (PLC) <sup>d</sup>
<sup>a</sup> A decorative part of a product shall comply with the requirements in Materials, Section 8. <sup>b</sup> Alternative end product flammability tests may be performed in accordance with the Exception to 10.3.10. <sup>c</sup> Refer to Seasonal-Lighting Lampholders, Supplement SB, for parallel-connected lampholders. <sup>d</sup> The HWI and HAI performance level categories (PLC) are described in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A. <sup>e</sup> 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. <sup>f</sup> Maximum available power as measured in 49.2 – 49.4.			

## 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.

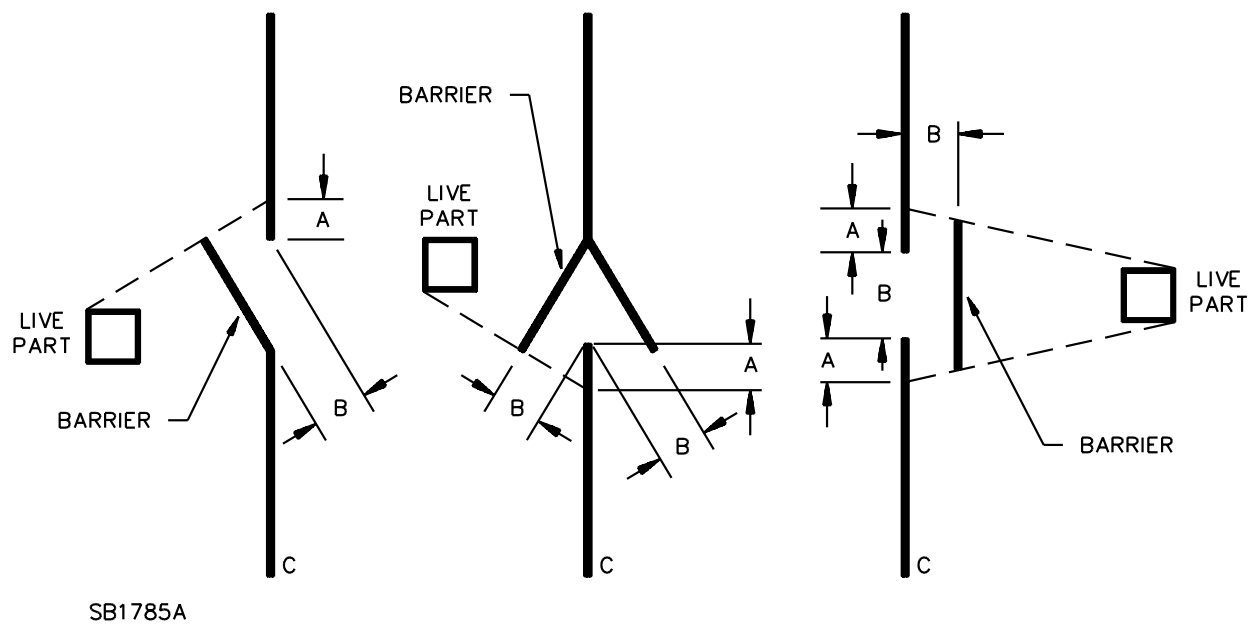
11.6 The barrier specified in 11.4 shall be of such dimensions and located such that a straight line drawn from any live part or arcing part, past the edge of the barrier, will intersect the enclosure a minimum of 0.25 inch (6.4 mm) from the edge of the opening. A live part shall not be located below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

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**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  $\mu$ F, 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 flow for a seasonal product**

Wire size, AWG (mm <sup>2</sup> )	Maximum conductor current of a fully loaded seasonal product, amperes
18 (0.82)	3.5 <sup>a</sup>
20 (0.52)	3.5 <sup>a</sup>
22 (0.32)	1.8
<sup>a</sup> The maximum conductor current flow for a series connected light string which employs polarized line and load fittings is 3.6 A.	

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 Tables 6.1 and 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.*

Added 13.1.8 effective January 1, 2001

## 13.2 Cords

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

13.2.2 In a decorative outfit with one or more medium-screw lampholders, the minimum cord size shall be No. 20 AWG (0.52 mm<sup>2</sup>).

13.2.3 The flexible cord employed in an indoor-use parallel-connected seasonal product shall be a minimum No. 20 AWG (0.52 mm<sup>2</sup>), Type XTW, parallel conductor cord or a minimum No. 18 AWG (0.82 mm<sup>2</sup>) 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".

Revised 13.2.3 effective January 1, 2001

13.2.4 The wire employed in a series-connected seasonal product shall be a minimum No. 22 AWG (0.32 mm<sup>2</sup>) Type CXTW twisted conductor, with a minimum insulation temperature of 105°C (221°F). Type CXTW wire is suitable for both indoor and outdoor use.

*Exception No. 1: A decorative outfit employing lampholders, wire, or both, secured to and supported by a frame provided with the product can employ single-conductor Type CXTW wire as indicated in 31.8.*

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

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

*Exception No. 4: Single conductor CXTW wire may be employed if the wire is twisted with a non-current carrying polymeric supporting rope which is rated for at least 105°C and complies with the Rope Strength Test, Section 81A. The diameter of the support rope shall have a minimum diameter equivalent to the CXTW wire. If the seasonal product is for outdoor-use, then the non-current carrying polymeric rope shall also comply with the requirements in 89.2.*

Revised 13.2.4 effective February 13, 2004

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.

Revised 13.2.5 effective January 1, 2001

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.

Revised 13.2.6 effective January 1, 2001

13.2.7 The power-supply cord of a motorized product shall be minimum No. 18 AWG (0.82 mm<sup>2</sup>), 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 No. 18 AWG (0.82 mm<sup>2</sup>), 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 15 Watts as measured in 49.2 – 49.4, shall be suitable for the current but not less than No. 24 AWG (0.21 mm<sup>2</sup>), with a minimum of 1/64-inch (0.4-mm) thick insulation and 105°C (221°F) insulation rating.

### 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.

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.

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.

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.*

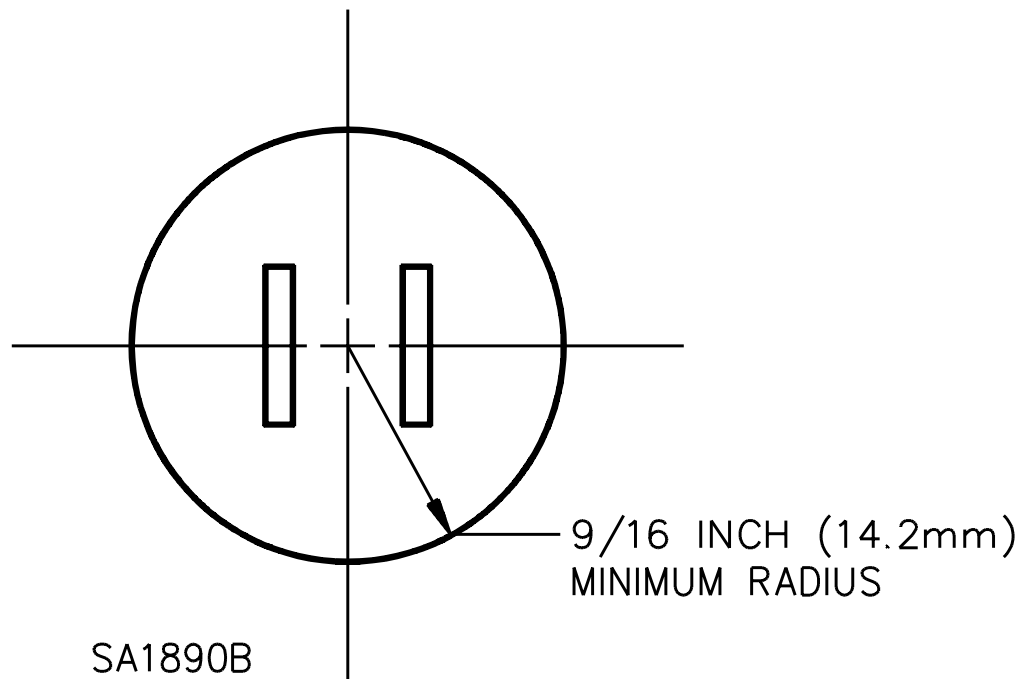
Revised 13.3.5 effective January 1, 2001

13.3.6 An attachment plug, a power inlet, or a load fitting employed in a seasonal product shall be rated a minimum of 5 A for use with Nos. 18 AWG (0.82 mm<sup>2</sup>) or 20 AWG (0.52 mm<sup>2</sup>) wire and a minimum of 3 A for use with No. 22 AWG (0.32 mm<sup>2</sup>) wire. A current tap shall be rated 15 A.

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.

**Figure 13.1**  
**Slot location and face size**

Revised Figure 13.1 effective January 1, 2001

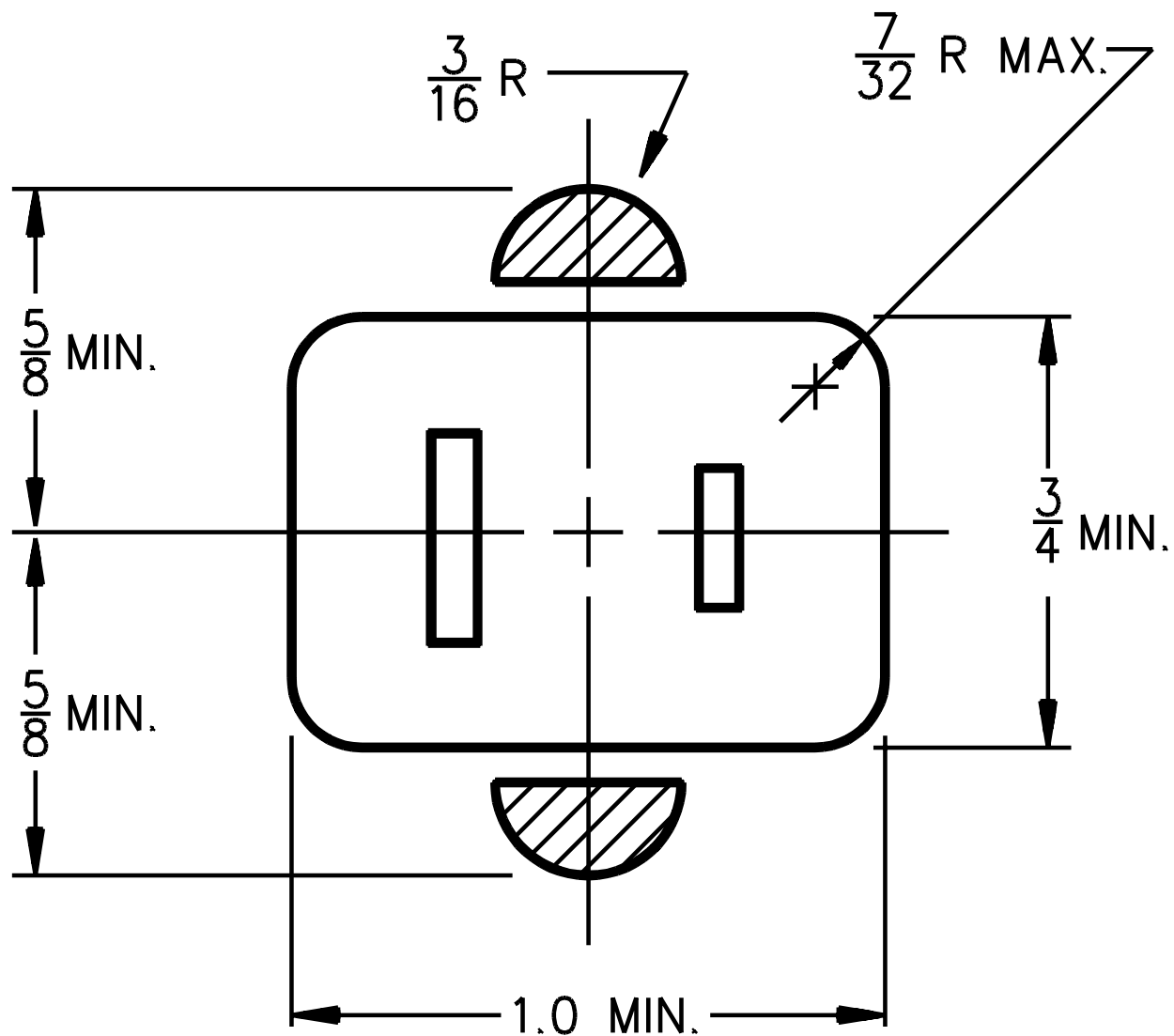


13.3.8 If a seasonal lighting product employs a power inlet intended for use with a cord set or detachable power-supply cord, the connecting means to the power supply of the product shall be constructed such that, when the cord connector of a cord set or detachable power-supply cord is inserted, the 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.



Figure 13.2  
Face dimensions  
All dimensions are in inches



CONTACT  
SLOTS CENTERED

SA1265

inch	$\frac{3}{16}$	$\frac{7}{32}$	$\frac{5}{8}$	$\frac{3}{4}$	1
mm	4.8	5.6	15.9	19.0	25.4

### 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 117.4.3 shall employ a polarized line and load fitting.*

*Exception No. 2: A series-connected string marked in accordance with 117.5.2 shall employ a polarized attachment plug.*

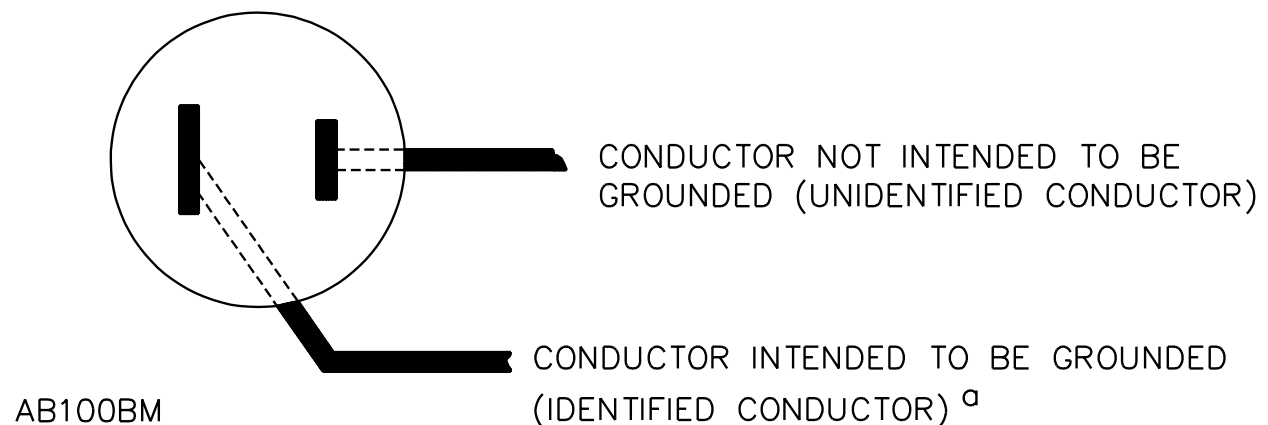
13.4.2 A non-polarized configuration shall not be employed on a product with an input current greater than 0.6 A.

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**

CONNECTIONS OF CORD CONDUCTORS TO POLARIZED  
ATTACHMENT PLUG (FACE OF PLUG REPRESENTED)



Note: <sup>a</sup> Signifies a conductor identified in accordance with Table 13.3.

**Table 13.3**  
**Polarity identification of flexible cords**

Revised Table 13.3 effective January 1, 2001

Method of identification	Acceptable combinations	
	Wire intended to be grounded	All other wires
Color of insulation on individual conductors for jacketed cord <sup>a</sup>	Solid white or natural gray	Solid color other than white or natural gray
	Light blue	Solid color other than light blue, white, or natural gray
Other means for parallel conductor construction	Tin or other white metal on all strands of the conductor <sup>b</sup>	No tin or other white metal on the strands of the conductor <sup>b</sup>
	A stripe, ridge, or groove on the exterior surface of the cord <sup>c</sup>	Without a stripe, ridge or groove on the exterior surface of the cord <sup>c</sup>
<sup>a</sup> 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. <sup>b</sup> Only for Types XTW, SPT-1 and SPT-2 cords with transparent insulation. <sup>c</sup> 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 No. 20 AWG (0.52 mm<sup>2</sup>) or larger wire.

*Exception: A series- or series-parallel-connected decorative lighting string or decorative outfit without a load fitting, employing Type CXTW No. 22 AWG (0.32 mm<sup>2</sup>) wire, and marked in accordance with 117.5.2 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.

## 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.

## 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 Strain Relief Test, Section 46.

*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 101. 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 Special-Use Switches, UL 1054.*

**Table 16.1**  
**Spacings**

Potential involved, volts rms <sup>a</sup>	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)

<sup>a</sup> 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.

## **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 Class 2 and Class 3 Transformers, UL 1585, or
- b) A Class 2 power unit which complies with the applicable requirements in the Standard for Class 2 Power Units, UL 1310.

## 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 Special-Use Switches, UL 1054.

*Exception: A switch employed in a Class 2 circuit where the available power does not exceed 15 watts, need not comply with the requirements in UL 1054.*

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 push-in, midget, or miniature screw lampholder shall comply with the Crush Test, Section 82, 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.

Revised 22.2.1.1 effective February 14, 2003

22.2.1.1.1 The body of a push-in lampholder which is less than 0.15 inch<sup>3</sup> (2500 mm<sup>3</sup>) 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) x 13.0 (±0.5) mm at a thickness of 0.8 (±0.1) mm or less. In addition, the lampholder must comply with the Flammability Test for Small Components specified in 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.

Revised 22.2.1.1.1 effective January 2, 2003

22.2.1.2 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)

22.2.1.3 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 22.2.1.2(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.

22.2.1.4 For a push-in lampholder, 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). The 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.

22.2.1.5 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.

22.2.1.6 There shall not be exposure of a live part in a series-connected push-in or midget or miniature screw lampholder 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: A lampholder located in a Class 2 circuit need not comply with this requirement.*

22.2.1.7 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.

22.2.1.8 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.

Added 22.2.1.8 effective January 1, 2001

## 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 polymeric material used for the body of a series-connected lampholder 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 89.

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## 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 Edison-Base 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 83, and
- c) Shall be replaceable.

Revised 23.2 effective February 14, 2003

## 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 111.1.

*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.*

24.2 revised February 13, 2003

## 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, UL 512, 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 Cord and Fixture Wire, UL 62.

Revised 26.1 effective January 1, 2001

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 intended for outdoor use shall comply with the Rain Test, Section 85.

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 89.

*Exception: 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 89.*

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 86.

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 87, in addition to the requirements in 27.5 and 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 88.

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.*

27.8 revised November 21, 2001

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.

## SERIES-CONNECTED STRINGS

### 28 General

28.1 Except as provided in 28.3 and 28.4, a series-connected string shall accommodate only one size of lamp with a minimum of 8 miniature-base lamps or 10 push-in or midget-base lamps.

28.1 revised February 15, 2002

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 117.5.2.*



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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 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) The lighting string is constructed such that the individual-flashing lamps cannot fit into the lampholders 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.

28.3 revised July 18, 2003

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 117.1.3.

## PARALLEL-CONNECTED STRINGS

**29 General**

29.1 A parallel-connected string shall employ only intermediate- or candelabra-screw lampholders and shall have at least 7 lampholders but not more than the number indicated in Table 29.1.

**Table 29.1**  
**Maximum acceptable number of lampholders in a string**

Lampholder type	Wire size AWG (mm <sup>2</sup> )	Maximum acceptable number of lampholders	
		With cord connector	Without cord connector
Candelabra- or intermediate-screw	20 (0.52)	30	60
	18 (0.82)	30	60

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.

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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 117.3.5.*

31.2 The maximum current draw of a decorative outfit, as determined during the Input Test, Section 42, with the maximum marked wattage lamps installed, shall be:

- a) 1.75 A for a parallel-connected decorative outfit employing 20 AWG (0.52 mm<sup>2</sup>) or larger cord and a polarized plug.

*Exception: A decorative outfit without a load fitting marked in accordance with 117.5.1 is able to have a maximum current draw of 3.5 A.*

- b) 0.60 A for a series-connected decorative outfit employing 22 AWG (0.32 mm<sup>2</sup>) or larger cord and a non-polarized plug.

*Exception No. 1: The maximum current draw for a series- or series-parallel-connected decorative outfit without a load fitting, and employing a polarized attachment plug can be 1.8 A if the product is marked in accordance with 117.5.2.*

*Exception No. 2: The maximum current draw for a decorative outfit employing up to 3 series- or series-parallel connected strings, each employing 22 AWG (0.32 mm<sup>2</sup>) or larger cord, the same type and rated lamp, and one string not containing a load fitting is able to be 1.8 A.*

31.3 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; and
- c) The decorative outfit shall be marked with its maximum tested replacement lamp wattage as indicated in 117.3.3.

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

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

31.6 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.

31.7 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.

31.8 For a decorative outfit employing single conductor CXTW wire, with lampholders, wire, or both, secured to and supported by a frame provided with the product, there shall be a maximum of 3 inches (76.2 mm) of cord between each secured lampholder. The lampholders, wire, or both, shall be secured to the frame such that 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 117.8.3.

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.*

### 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 85 need not be subjected to the volume resistivity requirements in 33.1.*

33.1 revised February 14, 2001

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.

### 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.

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).*

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.*

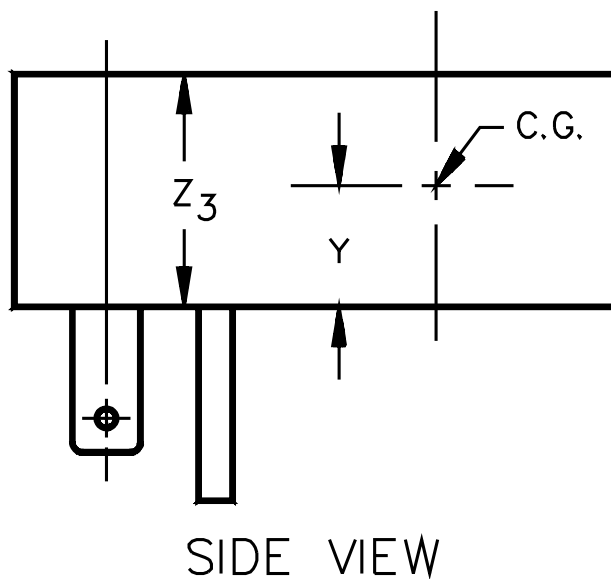
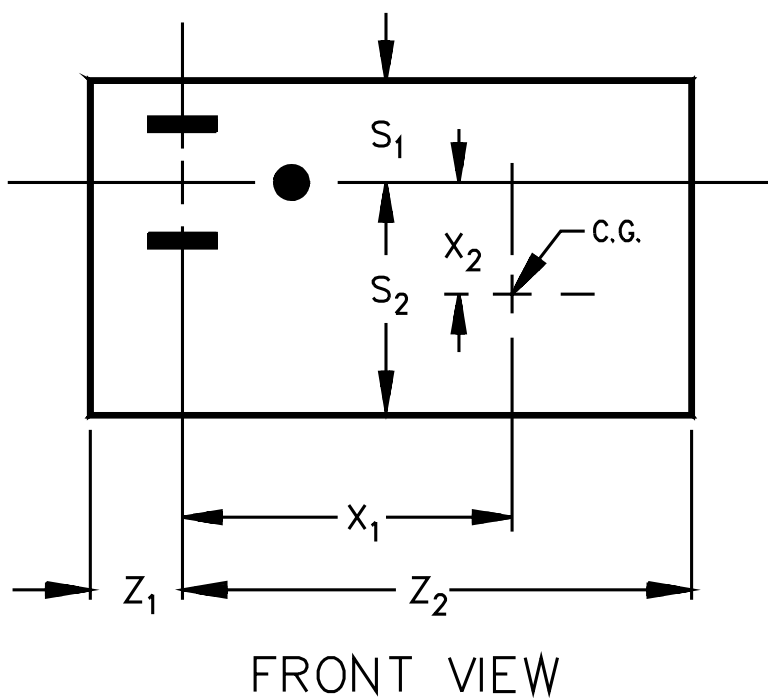
34.7 The enclosure of the direct plug-in unit shall be capable of being gripped for removal from the receptacle to which it is connected, and the perimeter of the face section from which the blades project shall not be less than 5/16 inch (7.9 mm) from any point on either blade.

*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.

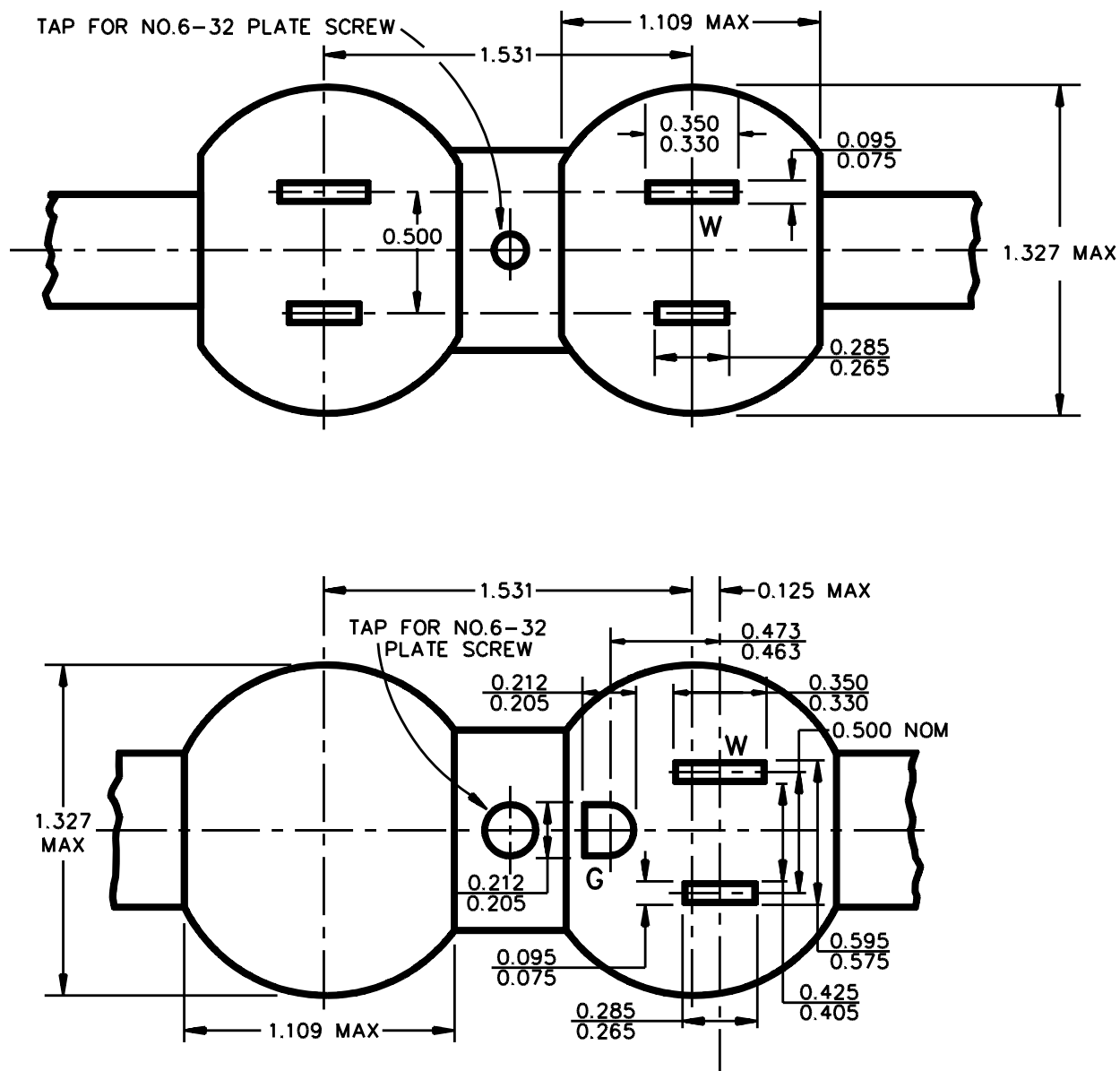


Figure 34.1  
Dimensions of a direct plug-in unit



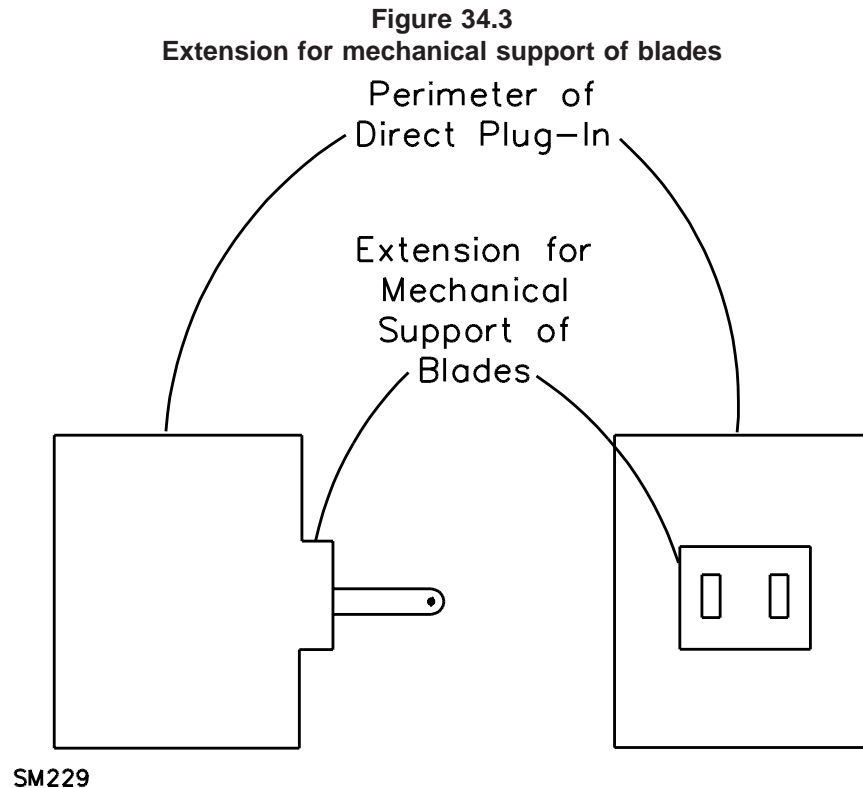
C.G. = Center of Gravity

Figure 34.2  
Parallel duplex receptacle



S2863A

NOTE: All dimensions are in inches.



## 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 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.

## BATTERY OPERATED PRODUCTS

### 36 General

Added Section 36 effective January 1, 2001

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 117.10 and 117.11.

**Table 36.1**  
**Output capabilities of common sizes and types of batteries**

Type	Battery		Rated voltage	8 A output at 1 minute (batteries in parallel) <sup>b</sup>
	Size	Designation <sup>a</sup>		
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
	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
<sup>a</sup> This designation corresponds to that in the Portable Primary Cells and Batteries with Aqueous Electrolyte, General and Specifications, ANSI C18.1M, Part 1.				
<sup>b</sup> Denotes minimum number of batteries capable of delivering 8 A DC or more to external resistive load for minimum 1 minute.				

## PERFORMANCE

### GENERAL

#### 37 Cheesecloth Indicators

37.1 Cheesecloth used for tests shall be bleached cheesecloth, running 14 – 15 yd<sup>2</sup>/lb (approximately 26 – 28 m<sup>2</sup>/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 85, and the Standing Water Immersion Test, Section 86.

#### 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.

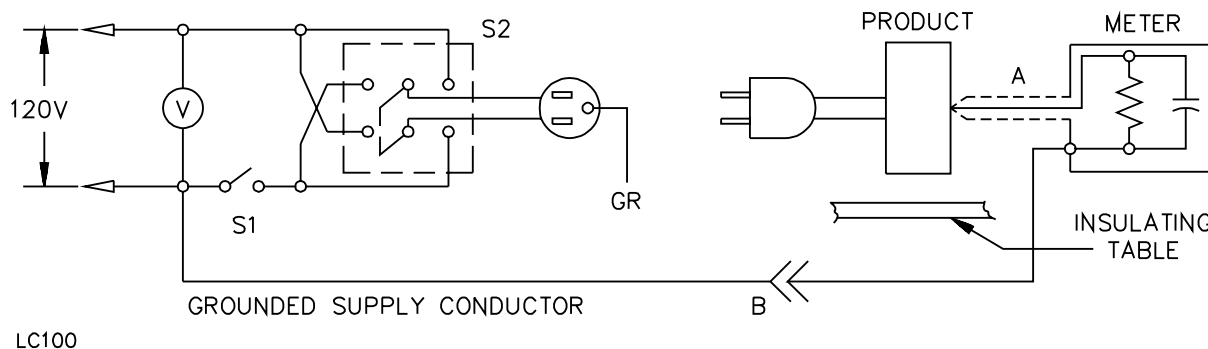
40.5 For a product employing a lampholder, leakage current of the lamp and lampholder assembly, wrapped in foil as described in 40.4, shall be determined. If a product employs multiple lampholders, leakage current shall be determined on one lamp and lampholder assembly.

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  $\mu$ F.
- 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  $\mu$ F 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.

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.

**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.

40.8 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:

- 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.
- 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.
- 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 85, 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  $88 \pm 2$  percent at a temperature of  $32 \pm 2^\circ\text{C}$  ( $90 \pm 4^\circ\text{F}$ ).

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  $34^\circ\text{C}$  ( $93^\circ\text{F}$ ) 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: For a product employing LED lamps, the measured input current at maximum voltage rating shall not exceed 110 percent of the marked rating.*

42.1 revised February 13, 2003

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 SA7, 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.

43.3 Temperatures are to be measured by means of thermocouples consisting of iron and constantan wires not larger than No. 24 AWG (0.21 mm<sup>2</sup>) and not smaller than No. 30 AWG (0.05 mm<sup>2</sup>). If the coil is inaccessible for mounting thermocouples, the coil temperature may be determined by the change-of-resistance method (see 43.19). When thermocouples are used in determining temperatures in electrical equipment, it is common practice to employ thermocouples consisting of No. 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 Initial Calibration Tolerances for Thermocouples table in Temperature Measurement Thermocouples, ANSI/ISA MC96.1.

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.*

**Table 43.1**  
**Maximum acceptable temperature rises**

Materials and component parts of the unit	Temperature rises	
	°C	°F
1. Enclosure interior surfaces	d	d
a) Polymeric	65	117
b) Wood and similar material	125	225
c) Phenolic composition <sup>a</sup>		
2. Printed wiring boards	f	f
3. Insulating materials	d	d
a) Polymeric	65	117
b) Fiber	65	117
c) Wood and similar material	125	225
d) Phenolic composition <sup>a</sup>		
4. Softening point of any sealing compound	e	e
5. Insulation Systems	65	117
a) Class 105 insulation systems on coil windings of transformers, relays, solenoids, and similar devices <sup>c</sup>	85	153
b) Class 130 insulation systems on coil windings of transformers, relays, solenoids, and similar devices <sup>c</sup>		
6. Capacitors	40	72
a) Electrolytic <sup>b</sup>	65	117
b) Other types <sup>b</sup>		
7. Fuses <sup>a</sup>	65	117

Table 43.1 Continued on Next Page

Table 43.1 Continued

Materials and component parts of the unit	Temperature rises	
	°C	°F
8. Semiconductor devices <sup>a</sup>	75	135
9. Selenium rectifiers <sup>a</sup>	50	90
10. Conductors with rubber or thermoplastic insulation <sup>a</sup>	35	63
11. Flexible cords with rubber or thermoplastic insulation <sup>g</sup>	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
<sup>a</sup> Does not apply if investigated and accepted for a higher temperature. <sup>b</sup> 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. <sup>c</sup> 10°C (18°F) higher in coil insulation temperature rise if measured by the change-of-resistance method. <sup>d</sup> 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. <sup>e</sup> 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. <sup>f</sup> 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. <sup>g</sup> 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.		

43.8 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 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, 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 SA7, contained in Seasonal-Lighting Lamps, Supplement SA.

43.10A 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.

43.10A added February 14, 2001

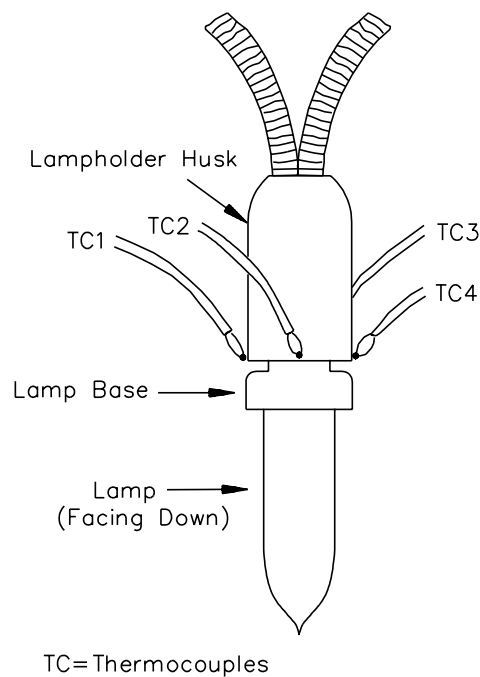
43.11 A decorative outfit which employs incandescent lamps is to be tested in the position likely to produce maximum temperatures, such as with the lamp and lampholder assembly positioned as described in 43.13.

*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.*

43.12 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.

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

**Figure 43.1**  
**Measurement of temperatures of a push-in lampholder**



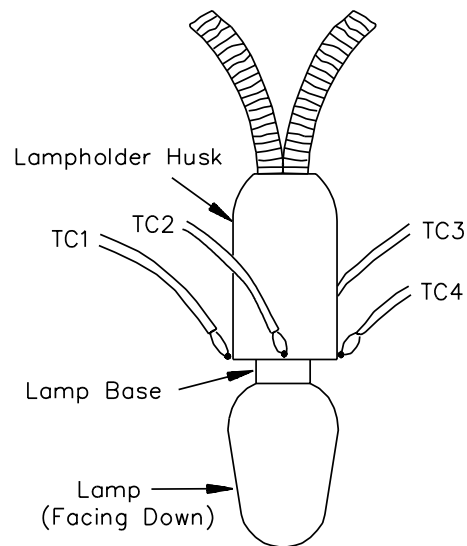
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43.14 A tree-top decorative outfit is to be tested with the interior volume of the unit's mounting means completely filled with an equal volume of uncompressed, surgical cotton to simulate its mounting on the top of a tree.

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

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**Figure 43.2**  
**Measurement of temperatures of a screw lampholder**



TC= Thermocouples

S2965

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

43.17 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.

43.18 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.

43.19 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.

43.20 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.

43.21 The temperature rise,  $\Delta t$ , is to be calculated as follows:

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

*in which:*

*$\Delta t$  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.*

43.22 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.

43.23 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 43.11.*

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 No. 18 AWG (0.82 mm<sup>2</sup>) or larger cord and 8 lbs (36 N) for a No. 20 AWG (0.52 mm<sup>2</sup>) 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.

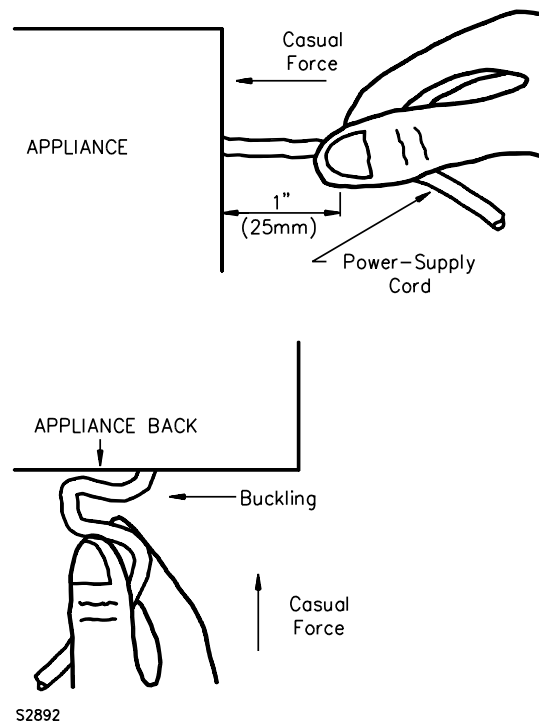
## 47 Wire Push-Back Relief Test

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 derived from the output of:

1) A Class 2 transformer which complies with the applicable requirements in the Standard for Class 2 and Class 3 Transformers, UL 1585, or

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

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.

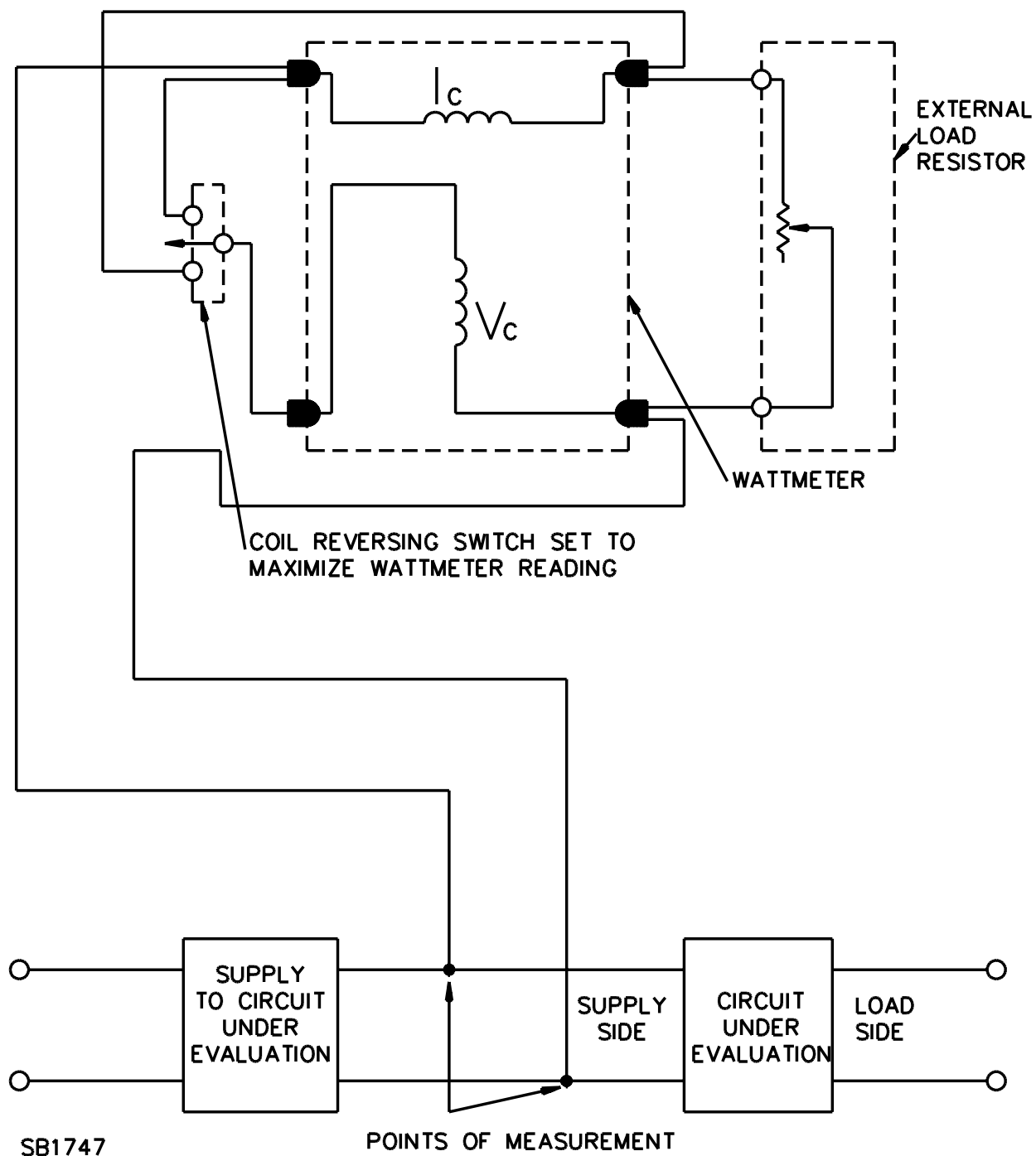
49.2 The unit is to be connected to a 60 Hz, 120 V supply source. One component or circuit of the unit is to be connected to a wattmeter and an adjustable external load resistor as illustrated in Figure 49.1. The external load resistor is to be set for its maximum resistance. A closed shorting switch 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.

50.2 revised February 14, 2001

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 No. 24 AWG ( $0.21 \text{ mm}^2$ ) and not smaller than No. 30 AWG ( $0.05 \text{ mm}^2$ ). 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 Initial Calibration Tolerances for Thermocouples table in Temperature Measurement Thermocouples, ANSI/ISA MC96.1. Thermocouples using iron and constantan No. 30 AWG ( $0.05 \text{ mm}^2$ ) 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 Nos. 18 AWG ( $0.82 \text{ mm}^2$ ) and 20 AWG ( $0.52 \text{ mm}^2$ ) cord and 3 A for No. 22 AWG ( $0.32 \text{ mm}^2$ ) 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  $1^\circ\text{C}$  ( $1.8^\circ\text{F}$ ) 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  $60^\circ\text{C}$  ( $140^\circ\text{F}$ ) when normalized to  $25^\circ\text{C}$  ( $77^\circ\text{F}$ ).

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<sup>2</sup>) or larger cord and 8 lbs (36 N) for a 20 AWG (0.52 mm<sup>2</sup>) 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 116 – 118 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  $60 \pm 1^{\circ}\text{C}$  ( $140 \pm 1.8^{\circ}\text{F}$ ) circulating-air oven for 240 hours. The cord tags are then to be conditioned at a room temperature of  $23 \pm 2^{\circ}\text{C}$  ( $73.4 \pm 3.6^{\circ}\text{F}$ ) and 50  $\pm 5$  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  $\pm 5$  percent at  $32 \pm 2^{\circ}\text{C}$  ( $89.6 \pm 3.6^{\circ}\text{F}$ ) 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  $23 \pm 2^{\circ}\text{C}$  ( $73.4 \pm 3.6^{\circ}\text{F}$ ) and  $50 \pm 5$  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  $23^{\circ}\text{C}$  ( $73.4^{\circ}\text{F}$ ). 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  $23.0 \pm 2.0^{\circ}\text{C}$  ( $73.4 \pm 3.6^{\circ}\text{F}$ ) and  $50 \pm 5$  percent relative humidity, followed by 10 days of exposure in an air-circulating oven at a temperature of  $60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ ). 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  $23.0 \pm 2.0^{\circ}\text{C}$  ( $73.4 \pm 3.6^{\circ}\text{F}$ ) and  $50 \pm 5$  percent relative humidity, followed by 7 hours of exposure in a cold box at a temperature of  $-10 \pm 2^{\circ}\text{C}$  ( $14.0 \pm 3.6^{\circ}\text{F}$ ). 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  $23.0 \pm 2.0^{\circ}\text{C}$  ( $73.4 \pm 3.6^{\circ}\text{F}$ ) and  $50 \pm 5$  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  $25 \pm 5^{\circ}\text{C}$  ( $77 \pm 9^{\circ}\text{F}$ ).

### 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 tautly 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 96, if electronically operated or General, Section 107, 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.*

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.

**Figure 59.1**  
**Procedure for impact test**

Series Num- ber	Sample Number								
	1	2	3	1	2	3	1	2	3
1	↓ A	N	N	↓ A	N	N	↓ A	N	N
2	↓ A	N	N	↓ A	N	N	↓ U	↓ A	N
3	↓ A	N	N	↓ U	↓ A	N	↓ A	N	↓ U

Arrows indicate sequence of test procedure

A – Acceptable results from drop

U – Unacceptable results from drop

N – No test necessary

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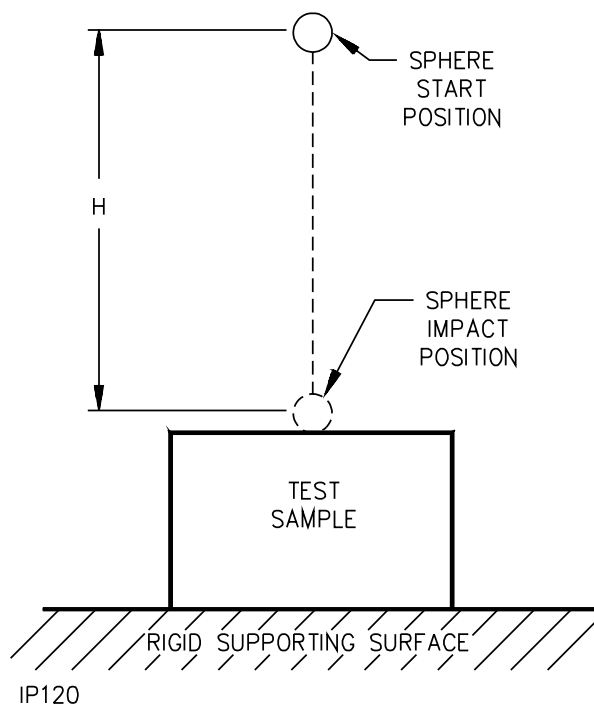
60.2 Each of three previously untested products is to be subjected to a single impact. The impact is to be produced by dropping or swinging a 2-inch (50.8-mm) diameter steel sphere, weighing 1.18 lbs (0.535 kg) from a height which will produce an impact of 5 ft-lbs (6.8 J). The unit is to be rigidly 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.*

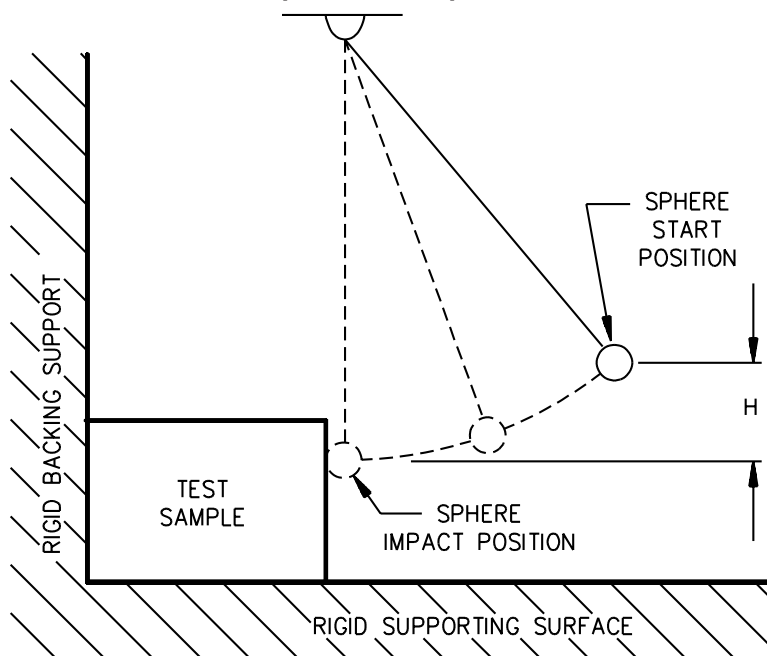
60.3 With reference to Figures 60.1 and 60.2, the "H" designation represents the vertical distance the sphere must travel to produce the desired impact. For the pendulum impact, the sphere is to contact the test unit when the string is in the vertical position. The supporting surface for the ball drop 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.



**Figure 60.1**  
**Ball drop impact test**



**Figure 60.2**  
**Ball pendulum impact test**



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## 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  $-35.0 \pm 2.0^{\circ}\text{C}$  ( $-31.0 \pm 3.6^{\circ}\text{F}$ ) 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.

61.2 revised February 14, 2001

## 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 Standard for Class 2 Power Units, UL 1310, 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  $90 \pm 1.0^{\circ}\text{C}$  ( $194 \pm 1.8^{\circ}\text{F}$ ) or  $10^{\circ}\text{C}$  ( $18^{\circ}\text{F}$ ) 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  $88 \pm 5$  percent humidity at  $32.0 \pm 2.0^{\circ}\text{C}$  ( $89.6 \pm 3.6^{\circ}\text{F}$ ) 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 Nos. 28 – 32 AWG (0.08 – 0.032 mm<sup>2</sup>) iron and constantan wires. It is a common practice to employ thermocouples consisting of No. 30 AWG (0.05 mm<sup>2</sup>) 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 No. 22 AWG (0.32 mm<sup>2</sup>) wire connection and 5 A for Nos. 20 or 18 AWG (0.52 or 0.82 mm<sup>2</sup>) 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.

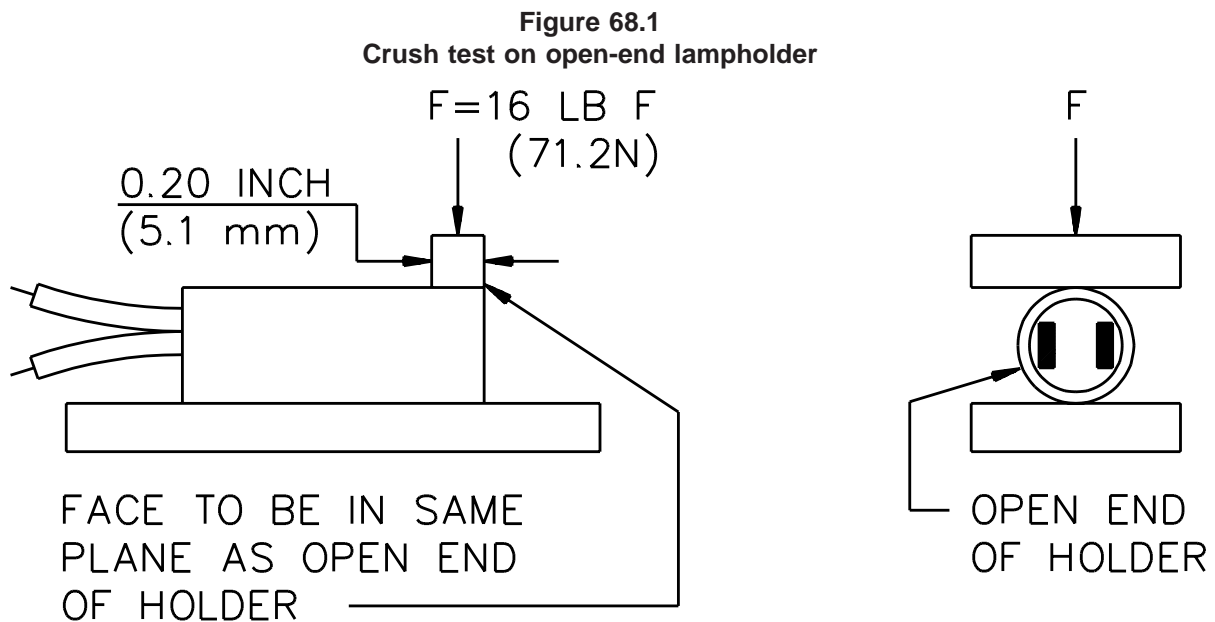
67.9 The dummy fuse and live fuse are to be tested in the fuseholder under identical conditions. In order to allow the live fuse to reach temperature stabilization without opening in the fuseholder, it may be necessary to remove the fuse cover, provide ventilation openings in the fuseholder, or both. 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 66.2, 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.



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## 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 No. 18 AWG (0.82 mm<sup>2</sup>) or larger conductors and 20 lbs (89 N) if the conductors are smaller than No. 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 No. 18 AWG (0.82 mm<sup>2</sup>) or larger and a pull of 8 lbs (36 N) if the conductor is smaller than No. 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 No. 20 AWG (0.52 mm<sup>2</sup>) or larger conductors and 10 lbs (45 N) for conductors smaller than No. 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 – 83 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  $120.0 \pm 1.0^{\circ}\text{C}$  ( $248.0 \pm 1.8^{\circ}\text{F}$ ). 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 No. 20 AWG (0.52 mm<sup>2</sup>) 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 No. 20 AWG (0.52 mm<sup>2</sup>), 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.

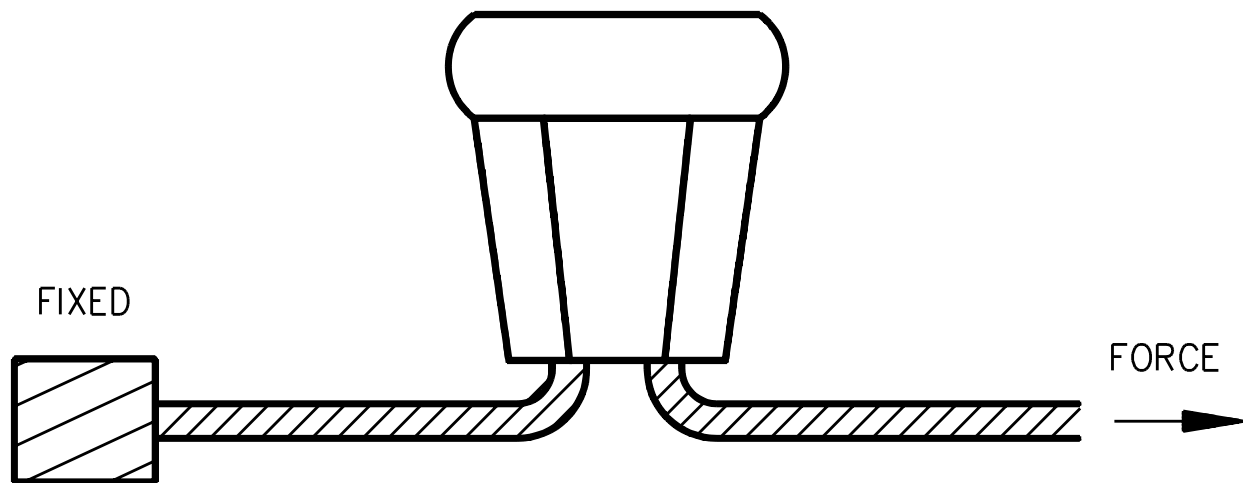
79.1.4 Each of eight previously untested lampholders in the product is to be tested. With the lampholder free, a pull is to be applied to the leads as illustrated in Figure 79.1. Starting at zero, the pull is to be increased uniformly at a rate of approximately 12 lbf/min (53 N/min) until one of the 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 No. 20 AWG (0.52 mm<sup>2</sup>) or larger conductors, or 10 lbf (45 N) for conductors smaller than No. 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.

### 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.

Figure 79.1  
Application of pull



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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<sup>2</sup>) cord or a pull of 20 lbs (89 N) for an 18 AWG (0.82 mm<sup>2</sup>) or larger cord is to be applied gradually to each conductor individually and maintained for 1 minute.

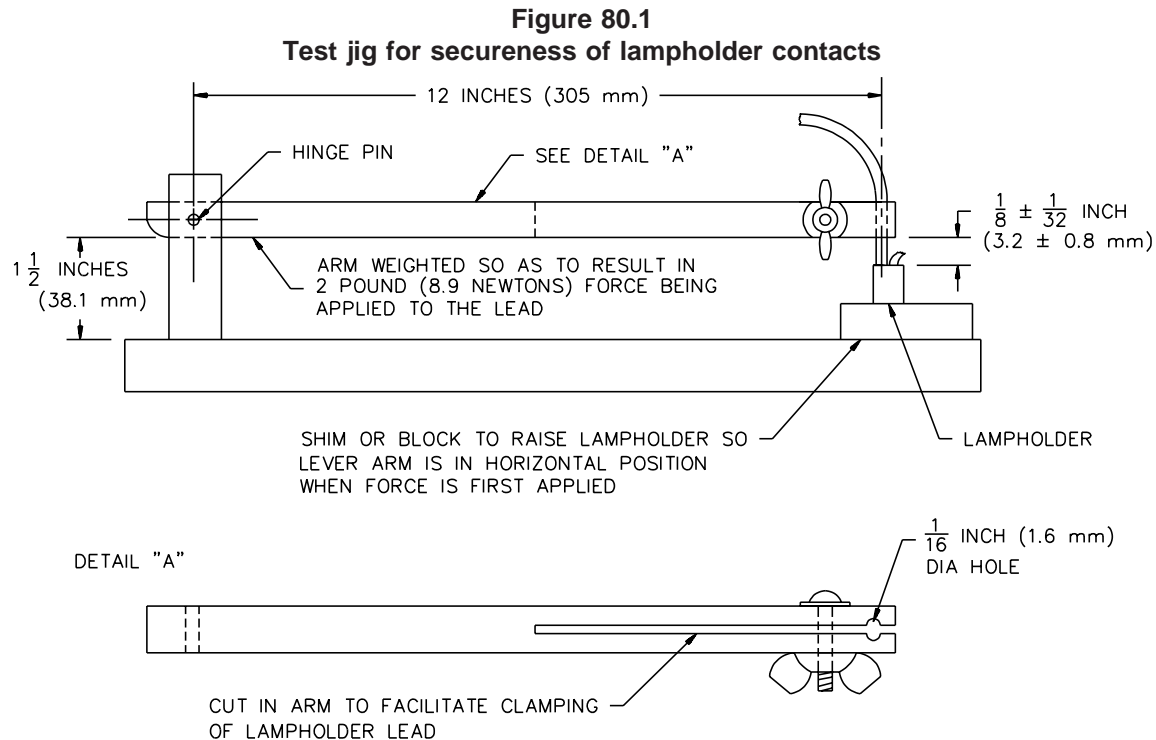
## 80 Secureness of Lampholder Contacts Test

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.*



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## 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 No. 30 AWG (0.05 mm<sup>2</sup>) 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.

## 81A Rope Strength Test

81A added February 14, 2001

81A.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 of 13.2.4 shall be tested as described in 81A.2 and 81A.3. The average and minimum as-received breakage pull values of the representative polymeric supporting ropes shall be greater than 28 and 23 lbs 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.

81A.2 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  $100.0 \pm 1.0^{\circ}\text{C}$  ( $212.0 \pm 1.8^{\circ}\text{F}$ ). 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 81A.3.

81A.3 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.

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## 82 Crush Test

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

## 83 Cascade Lamp Burnout Simulation Test

83.1 The test described in 83.2 and 83.3 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 83.2 (f) and (g).

83.2 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 83.1.
- 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  $\pm 20$  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, the lower-current steps, which begin after the filament opens, may be omitted 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 83.3.*

*Exception No. 2: A lighting employing electronic circuits need not comply with the Cascade Lamp Burnout Test, Section 83, if it is determined that the electronic circuit operates before the internal shunt.*

83.2 revised February 14, 2001

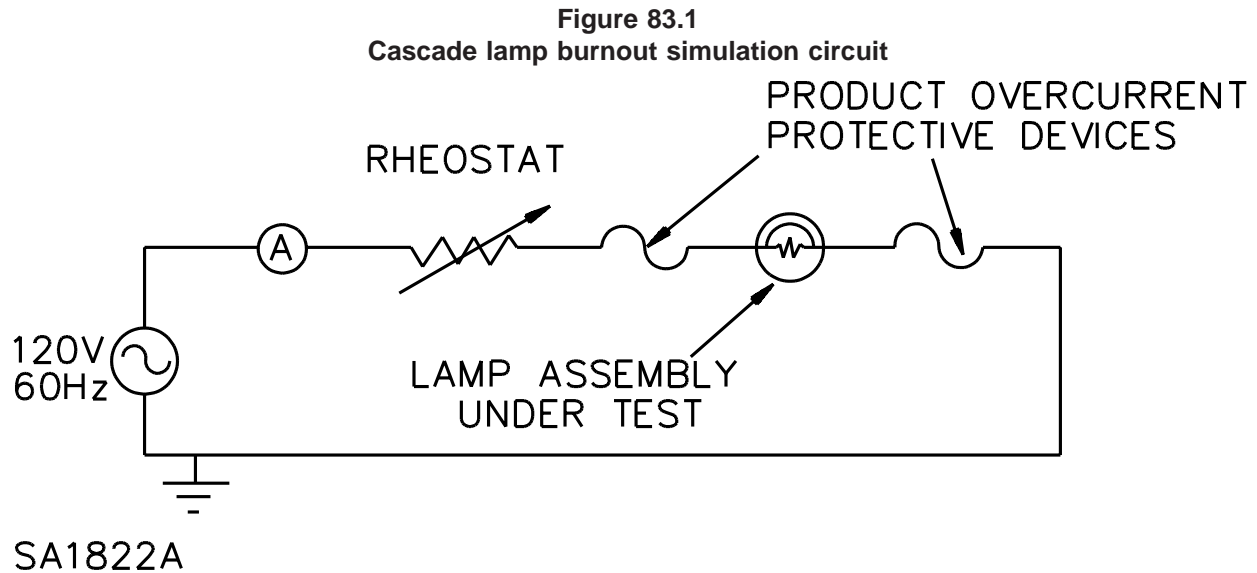
83.3 The test described in 83.2 is to be repeated with any decorative parts provided in place except that the second unenergized lamp described in 83.2(g) is to be omitted.

## PRODUCTS INTENDED FOR OUTDOOR USE

### 84 General

84.1 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 85– 89, 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 85, and the Standing Water Immersion Test, Section 86.





## 85 Rain Test

85.1 When tested as described in 85.2 – 85.5, 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 85.5 (a) and (b), after being tested as described in 85.2 – 85.4.*

85.2 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.

85.3 The water-spray apparatus is to consist of three spray heads mounted as shown in Figure 85.1. The spray heads are to be constructed in accordance with Figure 85.2. 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<sup>2</sup> (34.5 kPa).

85.4 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).

85.5 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, 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).*

85.5 revised February 14, 2001

## **86 Standing Water Immersion Test**

86.1 When tested as described in 86.2 and 86.3, 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.*

86.2 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.

86.3 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.

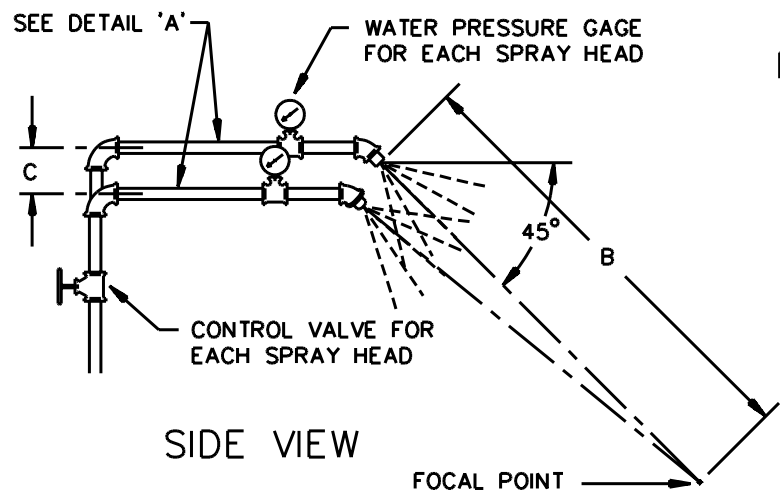
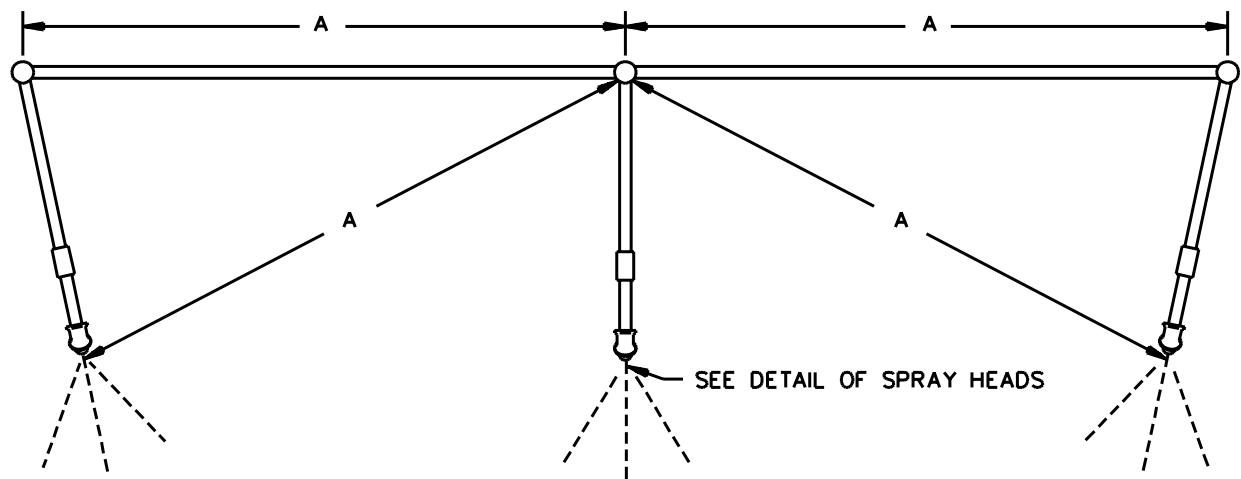
## 87 Gasket Test

87.1 After the conditioning described in 85.2, 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.

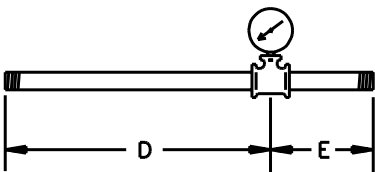
87.2 A total of 12 gaskets are needed for this test. Three are to be tested for elongation in the as-received condition and three are to be tested for tensile strength in the as-received condition. Six are to be placed in a circulating-air oven at a temperature 20°C (36°F) above the temperature measured 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.

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Figure 85.1  
Rain-test spray-head piping  
PLAN VIEW



PIEZOMETER ASSEMBLY  
DETAIL 'A'



RT101B

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



## 88 Gasket Adhesion Test

88.1 When tested as described in 88.2 – 88.4, 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.

88.2 A total of 9 representative gaskets are to be tested.

88.3 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.

88.4 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.

## 89 Ultraviolet (UV) Light Exposure and Water Immersion Tests

### 89.1 General

89.1.1 After being tested as described in 89.2.1 – 89.3.1, 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 89.2.1– 89.3.1. 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 82, the Rain Test, Section 85, and the Standing Water Immersion Test, Section 86, 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.*

89.1.2 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.

## 89.2 UV conditioning

89.2.1 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  $63 \pm 3^{\circ}\text{C}$  ( $145.4 \pm 5.4^{\circ}\text{F}$ ), 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  $0.35 \text{ W/m}^2 \text{ nm}$  at 340 nm and a black-panel temperature of  $63 \pm 3^{\circ}\text{C}$  ( $145.4 \pm 5.4^{\circ}\text{F}$ ).

89.2.2 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.

89.2.3 Two sets of units are to be exposed. For twin enclosed carbon-arc, one set is to be exposed for a total of 360 hours and the second set for a total of 720 hours. For xenon-arc, one set is to be exposed for a total of 500 hours and the second set 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 89.1.1. 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.

89.2.4 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.



### 89.3 Water immersion

89.3.1 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  $70.0 \pm 1.0^{\circ}\text{C}$  ( $158.0 \pm 1.8^{\circ}\text{F}$ ) 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 89.1.1(b) are to be immersed in distilled or deionized water at  $23.0 \pm 2.0^{\circ}\text{C}$  ( $73.4 \pm 3.6^{\circ}\text{F}$ ) 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  $23.0 \pm 2.0^{\circ}\text{C}$  ( $73.4 \pm 3.6^{\circ}\text{F}$ ) and 50  $\pm$  5 percent relative humidity for 2 weeks.

## DECORATIVE LIGHTING STRINGS

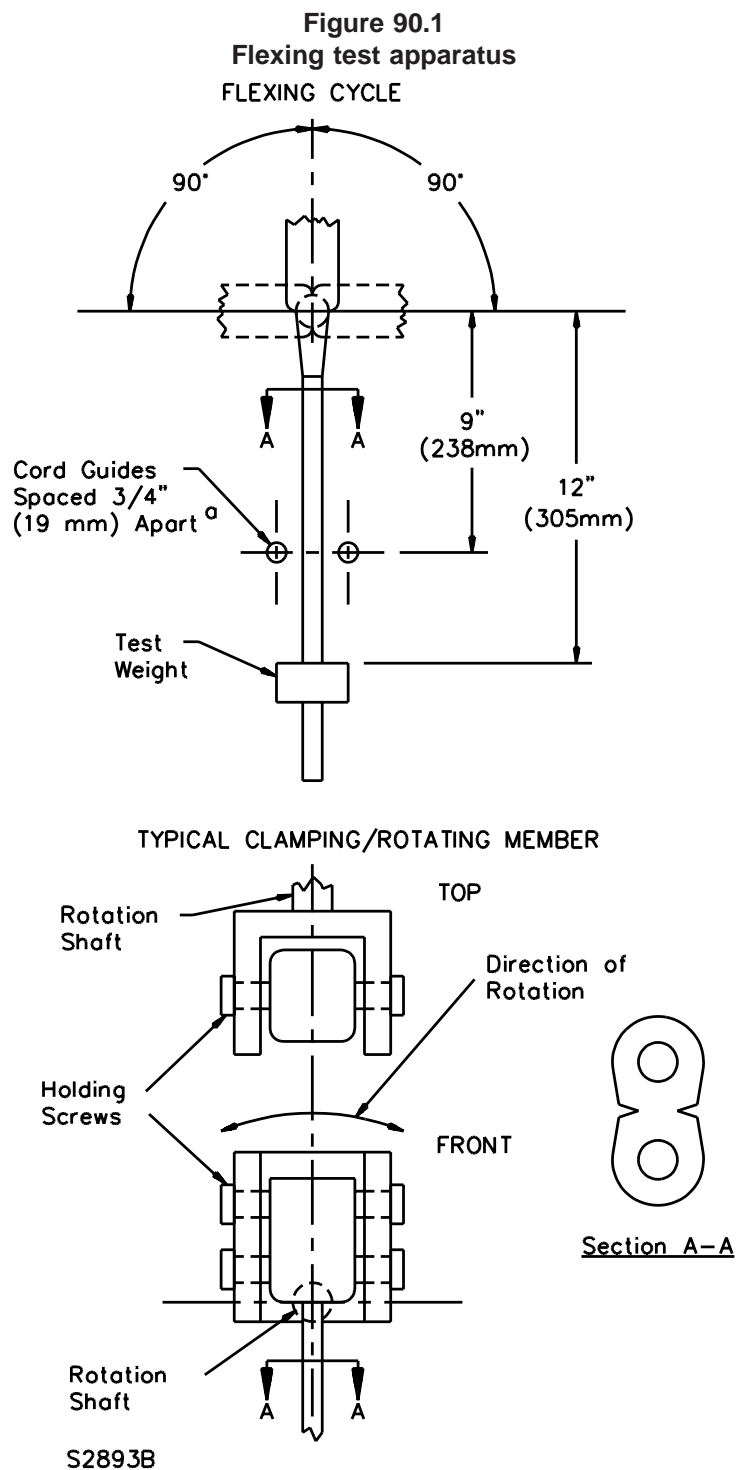
### 90 Flexing Test

90.1 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 90.2 – 90.5. 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 91. 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.

90.2 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.

90.3 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 90.1.

90.4 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 90 degrees to the other side, and back to the vertical position. The rate of testing is to be 10 cycles per minute.



Note: <sup>a</sup> 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.

90.5 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.

## **91 Temperature Test After Flexing**

91.1 After being subjected to the Flexing Test, Section 90, 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 91.2– 91.6. As a result of the test, there shall not be breakage of the wire as determined by the continuity test described in 91.9 and temperature rises shall not exceed the values indicated in Table 43.1.

91.2 The devices previously subjected to the Flexing Test, Section 90, are to be tested.

91.3 Temperatures are to be measured by means of thermocouples consisting of iron and constantan wires not larger than No. 24 AWG ( $0.21 \text{ mm}^2$ ) and not smaller than No. 30 AWG ( $0.05 \text{ mm}^2$ ). When thermocouples are used in determining temperatures in electrical equipment, it is common practice to employ thermocouples consisting of No. 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.

91.4 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 Initial Calibration Tolerances for Thermocouples table in Temperature Measurement Thermocouples, ANSI/ISA MC96.1.

91.5 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.

91.6 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  $1^\circ\text{C}$  ( $1.8^\circ\text{F}$ ) of each other and indicate no further rise above the changes in ambient temperature.

91.7 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.

91.8 Temperatures are to be measured on the surface of the lead insulation at the point where the lead exits the device.

91.9 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.

91.10 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

### 92 General

92.1 In addition to any applicable requirements contained elsewhere in the Standard, a tree stand shall comply with the requirements in Sections 93 and 94.

### 93 Stability Test

93.1 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.

93.2 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.

### 94 Overflow Test

94.1 When a tree stand provided with a well to hold water, is tested as described in 94.2, 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.

94.2 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

### 95 General

95.1 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

### 96 General

96.1 An electronically operated ornament shall comply with the Leakage Current Test, Section 97, the Temperature Test at 200 mA (Electronically-Operated), Section 98, the Dielectric Voltage-Withstand Test, Section 99, the Enclosure Mold Stress Relief Test, Section 100, the Strain Relief Test, Section 101, the Drop Test, Section 102, the High Current Abnormal Test, Section 103, the High Current Inrush Test, Section 104, the Series Cascade Burnout Test, Section 105, the Abnormal Operation Test, Section 106, 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.

### 97 Leakage Current Test

97.1 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.

### 98 Temperature Test at 200 mA (Electronically-Operated)

98.1 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.

### 99 Dielectric Voltage-Withstand Test

99.1 When tested as described in 99.2 and 99.3, 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.

99.2 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.

99.3 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, Section 98, 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.

## 100 Enclosure Mold Stress Relief Test

100.1 When conditioned as described in 100.2, 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.

100.2 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, Section 98, 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.

## 101 Strain Relief Test

101.1 As a result of the test described in 101.2 and 101.3:

- 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.*

101.2 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 No. 18 AWG (0.82 mm<sup>2</sup>) or larger cord and 8 lbs (36 N) for a No. 20 AWG (0.52 mm<sup>2</sup>) 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.

101.3 The test in 101.2 is to be repeated on the molded-on input adapter except that the leads are not to be severed or removed inside the adapter.

## 102 Drop Test

102.1 After being tested as described in 102.2 and 102.3, 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 99.

102.2 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.*

102.3 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.

### 103 High Current Abnormal Test

103.1 When tested as described in 103.2, 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.

103.2 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.

### 104 High Current Inrush Test

104.1 When tested as described in 104.2, 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.

104.2 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.



## 105 Series Cascade Burnout Test

105.1 When tested as described in 105.3 and 105.4, 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.

105.2 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.

105.3 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.*

105.4 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.

## 106 Abnormal Operation Test

106.1 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 derived from the output of:*
  - 1) A Class 2 transformer which complies with the applicable requirements in the Standard for Class 2 and Class 3 Transformers, UL 1585, or*
  - 2) A Class 2 power unit which complies with the applicable requirements in the Standard for Class 2 Power Units, UL 1310, or*
- 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.*

## NON-ELECTRONICALLY-OPERATED ORNAMENTS

### 107 General

107.1 A non-electronically-operated ornament shall comply with the Oven Test, Section 78, the Leakage Current Test, Section 97, the Temperature Test at 200 mA (Non-Electronically-Operated), Section 108, 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 82, the Cascade Lamp Burnout Simulation Test, Section 109, the Dielectric Voltage-Withstand Test, Section 99, 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.

### 108 Temperature Test at 200 mA (Non-Electronically-Operated)

108.1 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 108.2.

108.2 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.

### 109 Cascade Lamp Burnout Simulation Test

109.1 When subjected to the Cascade Lamp Burnout Simulation Test, Section 83, with and without the lampholder of the ornament inserted in the ornament in accordance with 83.2(d) and 83.3, the ornament shall comply with the requirements in 83.1.

## MANUFACTURING AND PRODUCTION TESTS

### 110 Production-Line Dielectric Voltage-Withstand Test

110.1 When tested as described in 110.2 – 110.6, 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.

110.2 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.*

110.3 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.

110.4 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.

110.5 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.

110.6 Test equipment other than those described by 110.4 and 110.5 may be used if found to accomplish the intended factory control.

## **111 Lamping Test**

111.1 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.

## **112 Polarization Continuity Test**

112.1 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.

112.2 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 112.1.

## RATINGS

### 113 Details

113.1 A product shall be rated 120 V, 60 Hz.

*Exception: A ornament shall be rated at the replacement lamp voltage(s) for a series-connected string.*

113.2 A product employing a non-polarized attachment plug shall not have a current rating that exceeds 0.60 A.

*Exception: A decorative outfit employing up to 3 series- or series-parallel-connected lights is able to have a maximum current rating of 1.8 A.*

113.3 A product employing a polarized attachment plug shall not have a current rating that exceeds 3.5 A.

113.4 A parallel-connected product without a load fitting and with a current rating that exceeds 1.75 A shall be marked in accordance with 117.5.1.

113.5 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 117.5.2.

## MARKINGS

### 114 General

114.1 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.

114.2 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 116.1.2 and 116.1.3, and
- b) 0.020 inch (0.51 mm) for all other markings.

114.3 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.

114.4 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.

114.5 Markings located on a tag as described in 114.4 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."

114.6 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.

## **115 Product Markings**

115.1 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.

## **116 Product/Cord Tag Markings**

### **116.1 General**

116.1.1 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, or on the product.

116.1.2 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;"

- 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 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 114.2(a).*

*Exception No. 2: An ornament need not include the markings in (c), (d), and (e).*

116.1.3 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 114.2(a).*

## **117 Cord Tag Markings**

### **117.1 General**

117.1.1 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.

Revised 117.1.1 effective January 1, 2001 for products which contain two cords or input leads and July 17, 2000 for all other products.

117.1.2 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.*

117.1.3 A seasonal product intended for indoor use only shall be marked "For indoor use only."

117.1.4 A seasonal product intended for both indoor and outdoor use shall be marked "For indoor and outdoor use."

117.1.5 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.*

## **117.2 Products employing replaceable fuses**

117.2.1 A seasonal product which employs replaceable fuses shall be marked "Always unplug this product before installing or replacing fuses."

## **117.3 Products employing lamps**

117.3.1 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 117.9.1.*

117.3.2 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.

117.3.3 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 117.1 and the second blank shall be filled in with the tested lamp wattage or less. Words or phrases located within parentheses are optional.

117.3.4 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 lamps only." The blank shall be filled in with the voltage value of the replacement lamps.

*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.*

117.3.5 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 spare lamps provided with this product." The blank shall be filled in with the voltage of the replacement lamps.

Revised 117.3.5 effective February 14, 2003



117.3.6 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."

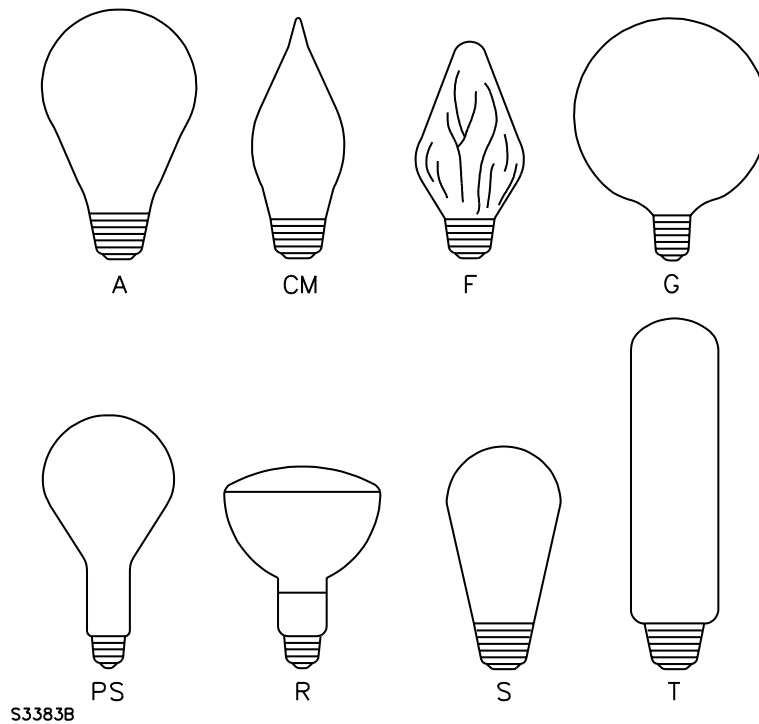
117.3.6 added June 29, 2001

117.3.7 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 lamps only."

117.3.7 added September 25, 2002

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**Figure 117.1**  
**Lamp types**



#### 117.4 Products employing load fittings

117.4.1 If a load fitting is included as part of a parallel-connected decorative-lighting string, the product shall be marked within 3 inches of the face of the load fitting with the following: "CAUTION – Do not overload. This product contains \_\_\_\_ lamps. Do not connect together more than sixty (60) lamps total." The blank shall be filled in with the number of lamps equal to the number of lampholders in the string or decorative outfit.

117.4.2 A series- or series-parallel-connected decorative-lighting string 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: "Do not overload. Connect end-to-end a maximum of three (3) lighting strings or decorative outfits of the same type."

117.4.3 A series- or series-parallel connected string which employs a polarized load fitting shall be marked "Do not overload. Connect end-to-end a maximum of six (6) lighting strings or decorative outfits of the same type."

117.4.4 A parallel-connected decorative-outfit provided with one or more load fittings shall be marked, where visible to the user, with the following: "CAUTION – Do not overload:

- a) Connect a maximum of three (3) series- or series-parallel-connected lighting strings or decorative outfits; or
- b) Connect a maximum of thirty (30) candelabra and intermediate base lamps; or

- c) Connect a maximum of one (1) motorized decorative outfit.

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.

117.4.5 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 – Do not overload: Connect end-to-end a maximum of three (3) series- or series-parallel-connected lighting strings or decorative outfits. 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.

117.4.5 revised November 21, 2001

117.4.6 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 - Do not overload: Connect end-to-end a maximum of six (6) series- or series-parallel-connected lighting strings or decorative outfits. 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.

117.4.6 added November 21, 2001

## **117.5 Products without load fittings**

117.5.1 A product with an input current in excess of 1.75 A or which employs more than 30 parallel-connected lampholders, shall be marked with the following: "CAUTION – Do not connect to another lighting string, decorative outfit, or seasonal product."

117.5.2 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."

117.5.3 A series- or series-parallel-connected decorative outfit which employs up to three (3) light strings connected end-to-end shall be marked with the following: "CAUTION — Do not connect to another lighting string, decorative outfit, or seasonal product."

## **117.6 Decorative-lighting strings**

117.6.1 A decorative-lighting string shall be marked with the type of string, either series-connected or parallel-connected.

**117.7 Decorative outfits**

117.7.1 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."

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## 117.8 Tree stands

117.8.1 A motorized tree stand shall be marked with the recommended tree height and total load weight.

117.8.2 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."

117.8.3 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.

## 117.9 Ornaments

117.9.1 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."

## 117.10 Products employing batteries

Added SubSection 117.10 effective January 1, 2001

117.10.1 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.

117.10.2 The marking described in 117.10.1 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.

## 117.11 Battery supply polarity identification

Added SubSection 117.11 effective January 1, 2001

117.11.1 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 on a label) illustrating the proper polarity and orientation of the battery supply, as applicable for the type of battery supply involved.

**117.12 Bubble lights**

Added SubSection 117.12 effective January 1, 2001

117.12.1 A seasonal product containing bubble lights which contain the liquid Methylene Chloride shall be marked as described in SA11.3.

**118 Carton/Stuffer Sheet/Product/Cord Tag Markings****118.1 General**

118.1.1 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.

**118.2 Products employing power inlets**

118.2.1 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.

**118.3 Products employing skeleton-type lampholders**

118.3.1 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."

Revised 118.3.1 effective January 1, 2001



## 118.4 Decorative-lighting strings

118.4.1 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."

## 118.5 Ornaments

118.5.1 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.

118.5.2 An electronically-operated ornament shall include the following instructions: "Connect no more than three ornaments to each lighting string or decorative outfit."

## 119 Carton Markings

### 119.1 General

119.1.1 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 114.2(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.*

119.1.1 revised February 14, 2001

119.1.2 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."

119.1.3 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**

### **120 General**

120.1 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.

120.2 The instructions indicated in Sections 121 – 123 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.*

120.2 revised November 21, 2001

120.3 The instruction manual shall include the model or catalog number of the product or products which it covers.

### **121 Instructions Pertaining to the Risk of Fire, Electric Shock, or Injury to Persons**

#### **121.1 General**

121.1.1 Instructions pertaining to a risk of fire, electric shock, or injury to persons shall state precautions that should be taken to reduce such risks.

121.1.2 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.

121.1.3 The instructions may include illustrations to identify the important safety features specified in 121.2.1.

121.1.4 The height of the lettering in the text and illustrations of the instructions specified in 121.2.1 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.

No Text on This Page

121.1.5 Unless otherwise indicated, the text of the safety instructions shall be verbatim to, or in equally definitive terminology as, 121.2.1, 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.

## **121.2 Decorative-lighting strings, decorative outfits, and ornaments**

121.2.1 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, when retiring for the night, or if left unattended."
- 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! I 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." This item may be omitted if the product does not employ a polarized plug.
- n) "This product is equipped with push-in type lamps. Do not twist lamps." This item may be omitted 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." This item may be omitted 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"**

## 122 Use and Care Instructions

122.1 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."

Revised 122.1 effective January 1, 2001

122.2 The markings in 122.1 (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.

### 123 User Servicing Instructions

123.1 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 123.2 – 123.7.

123.1 revised and separated into 123.1 and 123.2 effective January 1, 2001

123.2 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, 120 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."

123.2 revised and relocated from 123.1 effective January 1, 2001

123.3 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."

123.4 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 \_\_\_\_ type lamp (provided with product)." The first blank shall be filled in with the voltage of the lamp and the second blank shall be filled in with the type of lamp, such as super bright or regular brightness. Words located in parenthesis are applicable only if the replacement lamp is provided with the product.

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.*

123.4 revised September 25, 2002

123.5 In addition to being located on a tag attached to the product, the appropriate markings specified in 117.3.2 – 117.3.4, as related to the lamp type employed, shall also be included in the relamping information provided in the instruction manual.

123.6 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 in order to allow the product to operate if one lamp burns out. Do not replace lamps with other than the spare lamps provided with this product."

123.7 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".



**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 Figures SA2.1 and 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)

## **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 SA5.

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 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 SA6.

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 SA7.

## **SA3 Bubble Lights**

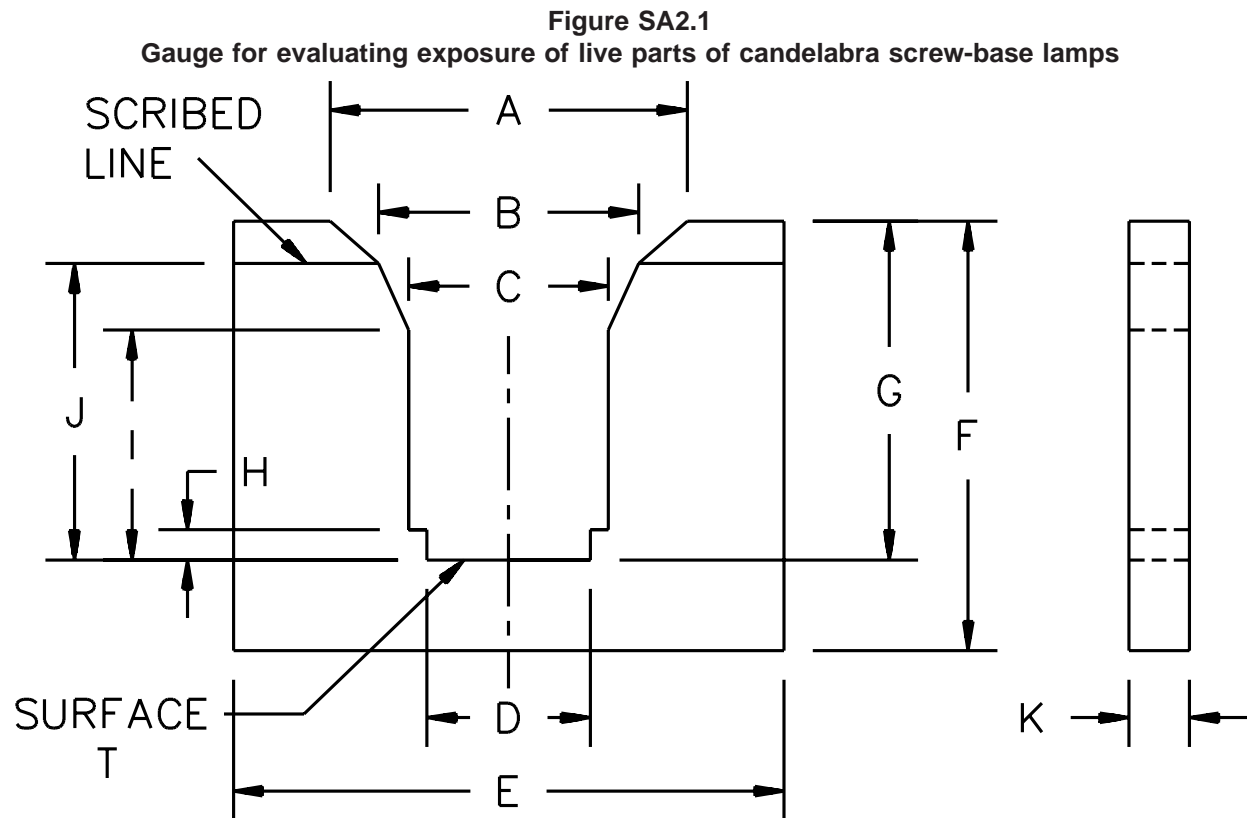
SA3.1 The lamp and housing portion of a bubble light shall comply with the requirements for Screw-Base Lamps, Section SA2. For a candelabra or intermediate base bubble light, the lamp base with the assembly shall also comply with SA2.2.3. For a bubble light intended for series connection, the lamp shall also comply with the Maximum Lamp Wattage Test, Section SA4.

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.

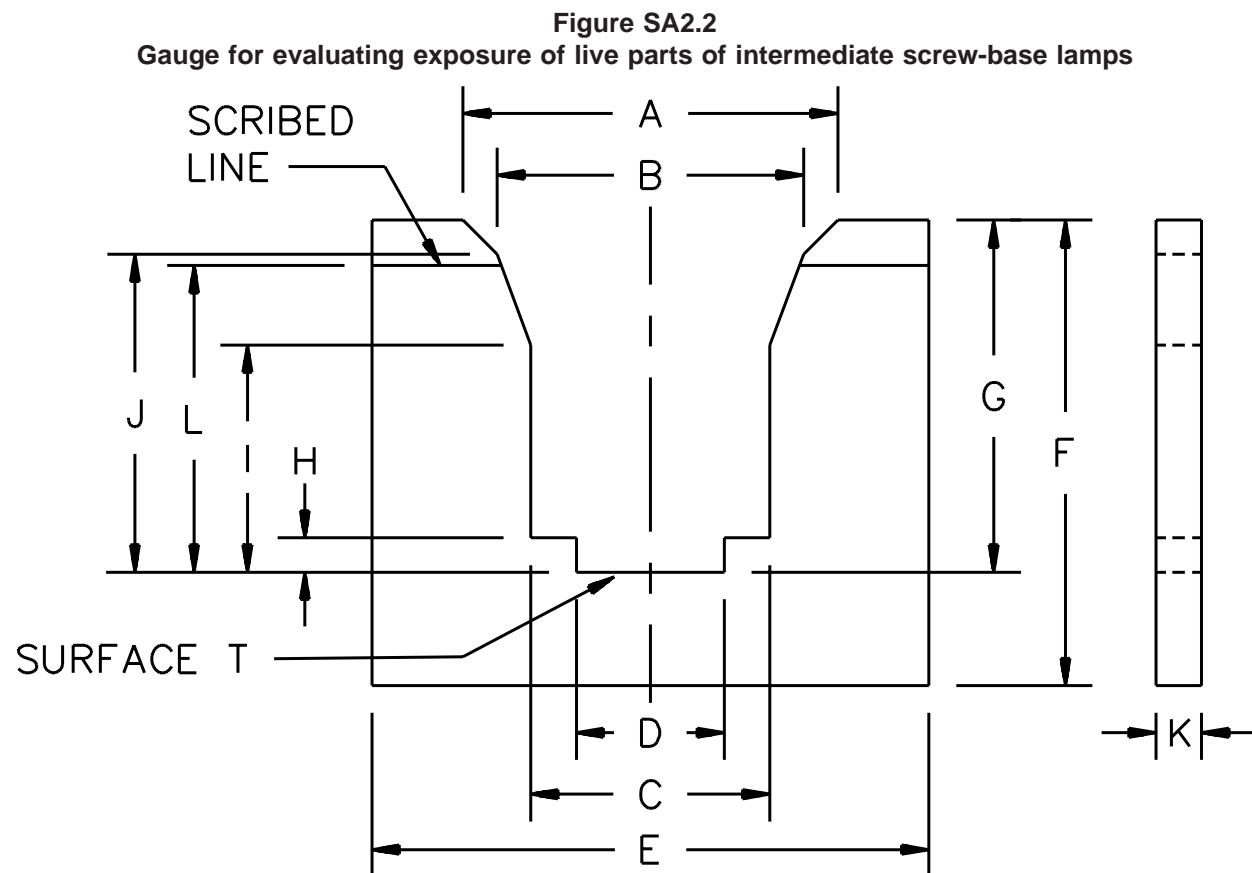
*Exception: If the housing or exterior surface of the bubble light is constructed of a material rated greater than 50°C (122°F) the temperature of the material may exceed 50°C, but shall be consistent with the material rating and, in no case shall the measured temperature be greater than 90°C (194°F).*

SA3.4 The liquid contained in the bubble lamp shall be a non-flammable liquid whose chemical composition has been identified by the Identification Test, Section SA9. A non-flammable liquid is indicated by a flammability rating of 1 in the Standard for the Identification of the Fire Hazards of Materials for Emergency Response, NFPA 704.



SB1794

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



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

SA3.5 The container which holds the liquid shall not permit liquid to escape the container. Compliance shall be determined as indicated in SA8.2. 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 SA11.3.

Added SA3.6 effective January 1, 2001

### **SA3A LED Lamps**

SA3A added February 14, 2001

SA3A.1 The housing of an LED lamp shall comply with the requirements in 22.2.1.1.1.

SA3A.2 An LED lamp shall not employ internal shunts.

SA3A.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 41.

### **SA3B Outdoor Use LED Lamps**

Added SA3B effective February 14, 2003

SA3B.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 87.

*Exception: A material evaluated for resistance to ultraviolet light in accordance with the requirements specified in the Standard for Polymeric Materials-Use in Equipment Evaluations, UL 746C, need not comply with SA3B.1.*

## **PERFORMANCE**

### **LAMPS INTENDED FOR SERIES CONNECTION**

#### **SA4 Maximum Lamp Wattage Test**

SA4.1 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.

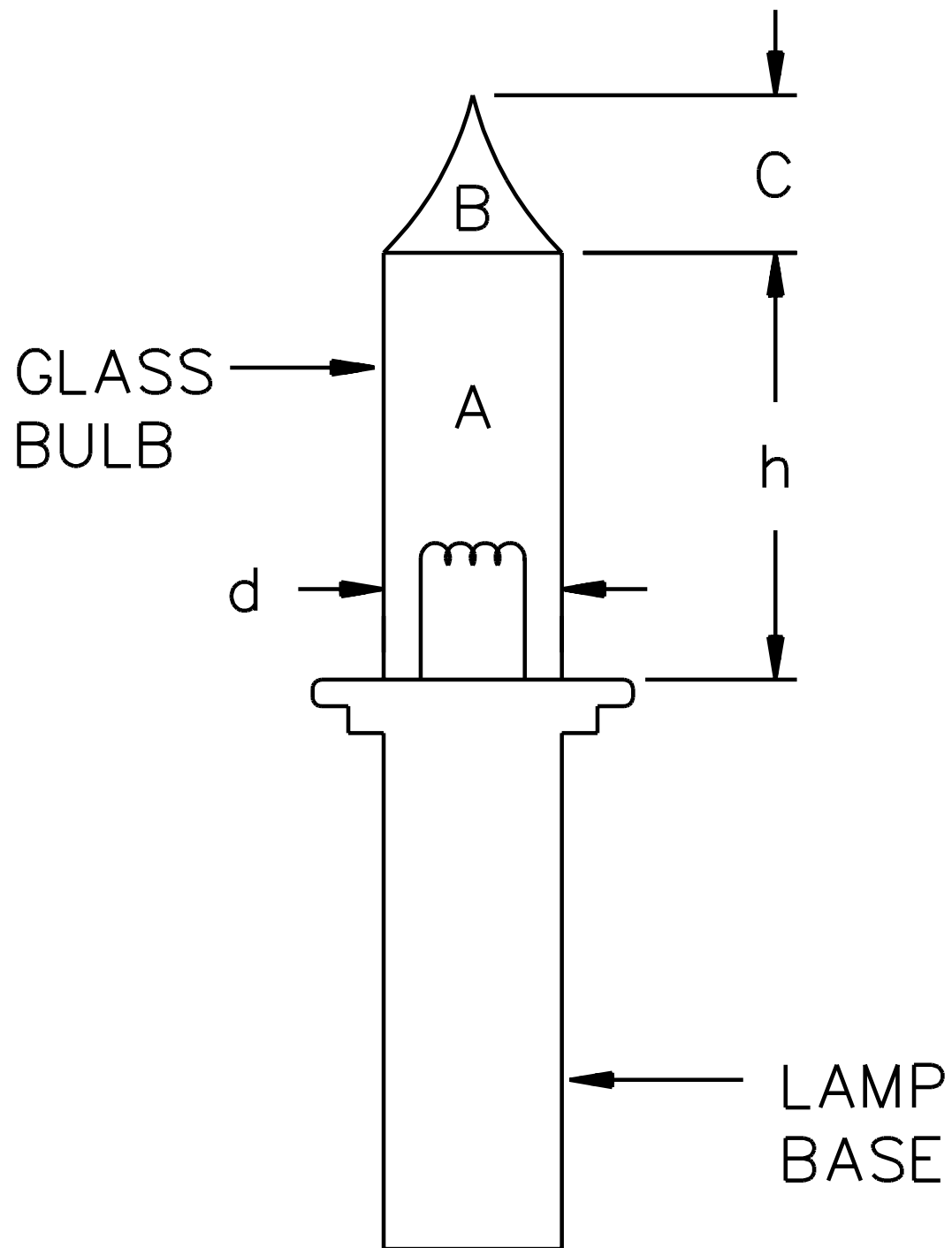
SA4.2 Compliance with SA4.1 is to be determined by inserting the lamp in the intended lampholder connected in series with a variable AC voltage supply in conjunction with a wattmeter. The wattage drawn is to be gradually increased so that the calculated wattage is reached within 60 seconds. Burnout of the filament shall occur within 2 minutes after the specified wattage is achieved. For conventional-type lamps the surface area (see Figure SA4.1) may be calculated as follows:

*Total surface area = surface area A plus surface area B*

$$\text{Surface area } A = 2 \pi \frac{d}{2} h$$

$$\text{Surface area } B = \pi \frac{d}{2} \sqrt{\left(\frac{d}{2}\right)^2 + C^2}$$

Figure SA4.1  
Determination of surface area of conventional type lamp



SA1823

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SA4.3 For a globe-shaped lamp, the surface area is to be calculated as follows (see Figure SA4.2):

*Total surface area = surface area A minus surface area B*

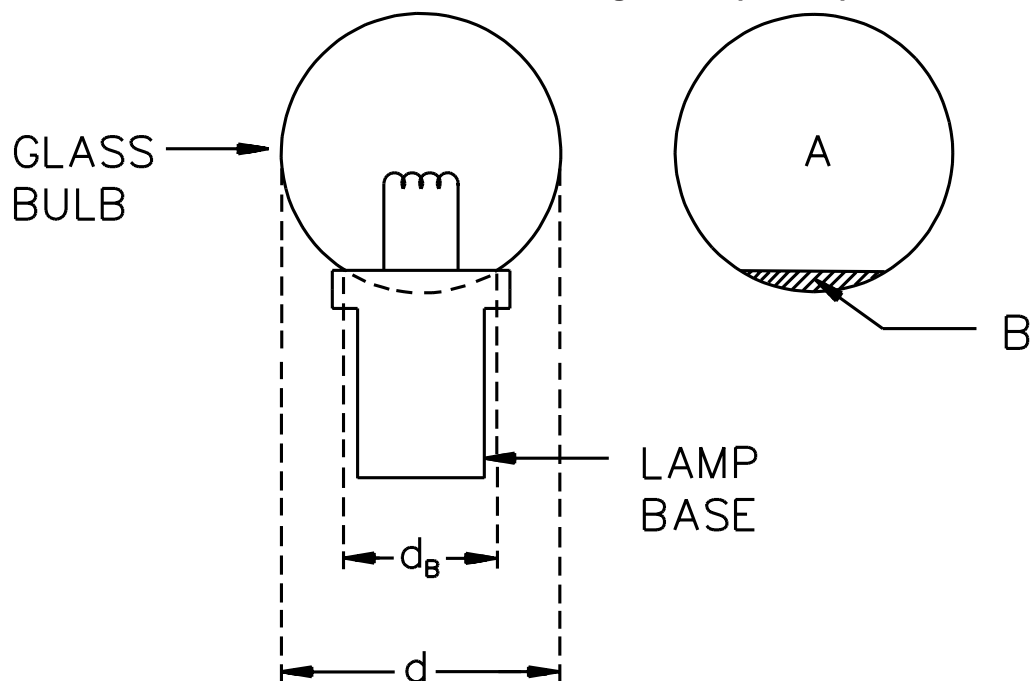
$$\text{Surface area } A = 4 \pi \left( \frac{d}{2} \right)^2$$

$$\text{Surface area } B = 2 \pi \left[ \left( \frac{d}{2} \right)^2 - r \left( \frac{d}{2} \right) \right]$$

where:

$$r = \sqrt{\left( \frac{d}{2} \right)^2 - \left( \frac{d_B}{2} \right)^2}$$

Figure SA4.2  
Determination of surface area of globe-shaped lamp



S3722

#### LAMPS INTENDED FOR PARALLEL CONNECTION

##### SA5 Lamp Screw Base Conformity Test

SA5.1 Candelabra and intermediate screw-base lamps shall comply with the "Go" and "Not-Go" gauges shown in Table SA5.1. 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.

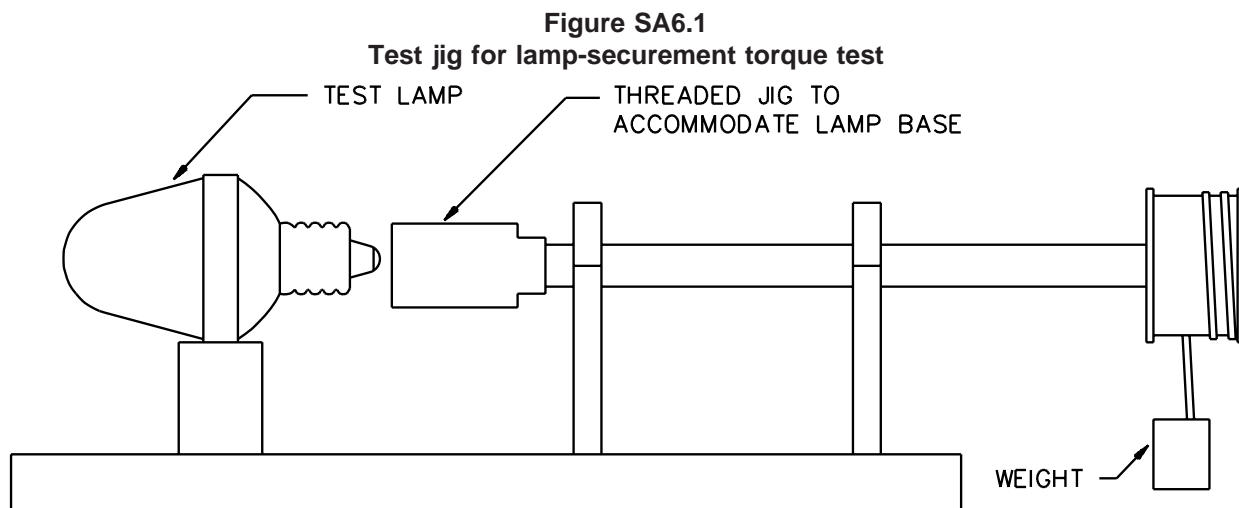
**Table SA5.1**  
**Lamp screw base conformity gauges**

Base type	Gauge name	Gauge (standard sheet number)
E12 (Candelabra)	Threaded "Go" Gauge for E12 Candelabra Screw Based Lamps	3-130-1
	"Not-Go" Ring Gauge for E12 Candelabra Screw Based Lamps	3-132-1
E17 (Intermediate)	Threaded "Go" Gauge for E17 Intermediate Screw Based Lamps	3-144-1
	"Not-Go" Ring Gauge for E17 Intermediate Screw Based Lamps	3-145-1

SA5.2 Each of the tests in SA5.1 shall be performed on six previously untested lamp bases.

### SA6 Envelope-to-Base Securement Test

SA6.1 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 SA6.1. One previously untested lamp is to be tested.



SB1795

## SA7 Lamp-Envelope Temperature Test

SA7.1 Compliance with SA2.2.7 shall be determined by visually inspecting the temperature-sensitive stripe described in SA7.4 after being tested as described in SA7.2 – SA7.5. 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.

SA7.2 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  $25 \pm 3^{\circ}\text{C}$  ( $77 \pm 5.4^{\circ}\text{F}$ ).

SA7.3 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.

SA7.4 A test stripe<sup>a</sup>, approximately 1/4 – 1/2 inch (6 – 13 mm) wide of a  $97^{\circ}\text{C}$  ( $207^{\circ}\text{F}$ ) 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.

<sup>a</sup> An acceptable means of providing the stripe is to use the  $97^{\circ}\text{C}$  maximum temperature-sensitive Omegalaq liquid available from Omega Engineering Inc., P.O. Box 4047, Stamford, CT 06907.

SA7.5 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 SA7.1.

*Exception: The power supply shall be adjusted to the rated voltage of the lamp if this is less than 90 V.*

## BUBBLE LIGHTS

### SA8 General

SA8.1 For a bubble light intended for series connection, the lamp portion of the bubble light shall comply with the Maximum Lamp Wattage Test, Section SA4. 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 SA5, and the Envelope-to-Base Securement Test, Section SA6. In addition, the lamp portion of a bubble light intended for parallel connection shall separately comply with the applicable requirements in Sections SA5 – SA7.

SA8.2 The container which holds the liquid shall be subjected to the Crush Test, Section 80, 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.

**SA9 Identification Test**

SA9.1 When tested as described in SA9.2, the liquid contained in a bubble light shall be identified as a non-flammable liquid. See SA3.4.

SA9.2 One ounce (28.4 g) of the liquid is to be subjected to a spectrographic analysis to determine compliance with SA9.1.

**PRODUCTION LINE TESTS****SA10 General**

SA10.1 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****SA11 General**

SA11.1 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.*

SA11.2 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.

SA11.3 A seasonal product containing bubble lights shall be marked: "Caution – Vial contains Methylene Chloride. If exposed to the liquid, contact your local poison control hotline."

Added SA11.3 effective January 1, 2001

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## SUPPLEMENT SB - SEASONAL-LIGHTING LAMPHOLDERS

### INTRODUCTION

#### SB1 Scope

SB1.1 These requirements cover E12 (candelabra), E17 (intermediate), and E26 (medium) Edison-screw, seasonal lighting lampholders to be used in seasonal-lighting products covered by the Standard for Seasonal and Holiday Decorative Products, UL 588.

#### SB2 Glossary

SB2.1 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.

### CONSTRUCTION

#### SB3 General

SB3.1 The requirements in this section apply to E12 (candelabra) and E17 (intermediate) screw seasonal lighting lampholders.

SB3.2 The requirements in this section apply to E26 (medium) screw seasonal lighting lampholders only where specifically indicated. E26 (medium) screw seasonal lighting lampholders shall also comply with requirements contained in the Standard for Edison-Base Lampholders, UL 496. E26 (medium) screw seasonal lighting lampholders employed in products intended for outdoor use shall also comply with the requirements for weatherproof lampholders in UL 496.

SB3.3 A seasonal lighting lampholder shall be evaluated for the wattage and temperature ratings, lamp type, and cord type specified by the manufacturer, but shall not be rated less than 7 watts, with a minimum temperature rating of 90°C (194°F).

SB3.4 A seasonal lighting lampholder shall comply with the thread specifications for Lampholders for Electric Lamps, ANSI C81.62. Compliance shall be determined by the Screwthread Conformity Test, Section SB13.

SB3.5 A seasonal lighting lampholder shall provide lead securement which complies with the requirements in the Secureness of Leads Test, Section SB15, and the Lead Pull Test, Section SB16.

*Exception: A lampholder intended for use with Type XTW, SPT-1, or SPT-2 parallel conductor flexible cord need not be subjected to the Lead Pull Test.*

Revised SB3.5 effective January 1, 2001

SB3.6 Uninsulated live parts of a seasonal lighting lampholder, including an E26 (medium) screw lampholder, shall not be accessible as determined by contact with the accessibility probe illustrated in Figure SB3.1.

[illegible]



**SB4 Depth of Lamp Base Cavity**

SB4.1 The lamp base cavity dimensions for a seasonal lighting lampholder shall be in accordance with Table SB4.1.

**Table SB4.1**  
**Acceptable lampholder dimensions**

Type of lampholder	Mouth diameter		Depth of lamp base cavity <sup>a</sup>			
	inches	inches	Minimum acceptable		Maximum acceptable	
			inches	(mm)	inches	(mm)
Intermediate-screw	≤25/32	(19.8)	27/32	(21.4)	28/32	(22.2)
	>25/32, ≤26/32	(>19.8, ≤20.6)	27/32	(21.4)	57/64	(22.6)
	>26/32, ≤27/32	(>20.6, ≤21.4)	27/32	(21.4)	29/32	(23.0)
	>27/32, ≤28/32	(>21.4, ≤22.2)	55/64	(21.8)	59/64	(23.4)
	>28/32, ≤29/32 <sup>b</sup>	(>22.2, ≤23.0) <sup>b</sup>	28/32	(22.2)	30/32	(23.8)
Candelabra-screw	≤20/32	(15.9)	22/32	(17.5)	23/32	(18.3)
	>20/32, ≤21/32	(>15.9, ≤16.7)	22/32	(17.5)	47/64	(18.7)
	>21/32, ≤22/32	(>16.7, ≤17.5)	22/32	(17.5)	24/32	(19.1)
	>22/32, ≤23/32	(>17.5, ≤18.3)	45/64	(17.9)	49/64	(19.4)
	>23/32, ≤24/32 <sup>b</sup>	(>18.3, ≤19.1) <sup>b</sup>	23/32	(18.3)	25/32	(19.8)
<sup>a</sup> The specified depth is to exist at any one set of corresponding points within the indicated range of mouth diameters with a fully depressed center contact. <sup>b</sup> If the mouth of a lampholder is flared beyond the mouth diameter indicated above, the depth of the lampholder is to be disregarded at any point at which the diameter is greater than the maximum indicated.						

**SB5 Body Material**

SB5.1 The body of a seasonal lighting lampholder shall be either of the following:

- a) A thermoplastic material having a minimum flammability rating of V-1 with 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, or V-0, and a minimum temperature rating of 90°C. The HWI and HAI performance level categories (PLC) are described in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

*Exception: Polymeric materials may comply with either of the following end product flame tests if they have a minimum HWI PLC of 3 and a minimum HAI PLC of 3:*

- a) If the component material is greater than 0.15 inch<sup>3</sup> (2500 mm<sup>3</sup>) in volume, the flame tests contained in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, may be performed. Specifically, products required to comply with the V-0 or V-1 flame rating shall be subjected to the 12-mm or 3/4-inch 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<sup>3</sup> (2500 mm<sup>3</sup>), it shall be subjected to the 12 mm Flammability Test for Small Polymeric Component Material, Section 4, 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.*

b) A thermoset material such as phenolic or urea.

SB5.2 The body of a seasonal lighting lampholder, including E26 (medium) screw lampholders, shall not be constructed of porcelain.

## **SB6 Metal Screw Shells**

SB6.1 The screw shell of a seasonal lighting lampholder intended for outdoor use shall be of copper or an alloy that contains at least 80 percent copper.

SB6.2 The screw shell thickness of a seasonal lighting lampholder shall comply with Table SB6.1.

**Table SB6.1**  
**Minimum thickness of screw shell in inches (mm)**

Trade size of lampholder and nominal diameter in inches	Copper or copper-alloy screw shell	Aluminum or aluminum-alloy <sup>a</sup> screw shell	Corrosion-resistant steel (stainless) screw shell
Medium – 1	0.012 (0.30)	0.015 (0.38)	b
Intermediate– 21/32	0.010 (0.25)	0.013 (0.33)	b
Candelabra – 1/2	0.010 (0.25)	0.013 (0.33)	b
<sup>a</sup> An aluminum alloy is acceptable for the screw shells of lampholders except the weatherproof type and those employed in wet locations, such as outdoor types of lighting strings and decorative outfits. An aluminum alloy for use in a screw shell is required to be a wrought alloy employing manganese, magnesium, or both, as the principal alloying material (with the possible addition of chromium) and not containing more than 1.5 percent of iron and silicon combined and not more than 1 percent of all other usual impurities of aluminum (including a maximum of 0.25 percent of copper). <sup>b</sup> Corrosion-resistant steel (stainless) is acceptable if the results of an appropriate investigation indicate that the material is intended for the particular application.			

SB6.3 The screw shell of a seasonal lighting lampholder shall be secured in place to reduce the likelihood of loosening, twisting or straining of electrical connections. Compliance shall be determined by the Mechanical Strength of Lampholder Threads Tests, Section SB14.

**SB7 Skeleton-Type Lampholders**

SB7.1 A skeleton-type seasonal lighting lampholder shall be provided with a means other than the screw shell contact(s), such as molded threads, to retain a lamp.

SB7.2 The lamp retaining means shall provide support for the lamp and shall provide lamp retention. Compliance is determined by the Mechanical Strength of Lampholder Threads Tests, Section SB14.

SB7.3 Lampholder contacts shall be completely formed prior to assembly into the lampholder body.

*Exception No. 1: For an automatic assembly process, the side and center contacts may be formed during or after installation into the lampholder body provided the automatic assembly equipment rejects the lampholder whenever proper forming and placement of each contact cannot be confirmed.*

*Exception No. 2: The side and center contacts may be formed during or after installation into the lampholder body if they are of such dimensions that, when repositioned, they cannot:*

- a) Contact each other; or*
- b) Cause a short circuit when a lamp is installed.*

SB7.4 The side and center contacts shall be supported, restrained, or constructed such that when subjected to a 3 lbf (13.3 N) applied in any direction, they cannot become positioned:

- a) To contact each other; and
- b) Such that a lamp screw base causes a short circuit when a lamp is installed.

SB7.5 In order to comply with SB7.4, a seasonal lighting lampholder may be provided with:

- a) A minimum 0.028 inch (0.71 mm) thick insulating barrier interposed between the center and side contacts wherever they can be displaced into contact,
- b) Contacts having both ends held captive or embedded in the body or side walls of the lampholder so that insertion of a lamp cannot move the contact from its required position, or
- c) Contacts retained by clips, barbs, posts or similar devices molded into the body of the lampholder which restrain the contacts from being dislodged.

## **SB8 Insulation-Piercing Terminals**

SB8.1 A seasonal lighting lampholder employing insulation-piercing terminals shall be specified for use only with Type XTW, SPT-1, or SPT-2 parallel conductor flexible cords that comply with the Standard for Flexible Cord and Fixture Wire, UL 62.

Revised SB8.1 effective January 1, 2001

SB8.2 If a seasonal lighting lampholder employs insulation-piercing terminals, it shall comply with the Temperature Tests for Seasonal Lampholders with Insulation-Piercing Terminals, Section SB18.

## **SB9 Outdoor-Use Lampholders**

SB9.1 The screw shell of a lampholder intended for outdoor use shall comply with SB6.1.

SB9.2 A 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.

*Exception: A lampholder intended for outdoor use need not be provided with drain holes if the lampholder is provided with a gasket and is sealed to prevent water from entering the lampholder cavity and complies with the requirements in the Rain Test, Section SB20. When a gasket is provided, it shall comply with the requirements in the Standard for Gaskets and Seals, UL 157, and the Gasket Test, Section 87. When the gasket is secured by adhesive, the adhesive shall comply with the requirements for adhesives in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and with the Gasket Adhesion Test, Section 88.*

SB9.3 A polymeric material used for the body of a lampholder intended for outdoor use shall be acceptably resistant to Ultraviolet (UV) weathering and exposure to water as determined by compliance with the Ultraviolet (UV) Light Exposure and Water Immersion Tests, Section SB23.

*Exception: The body of a lampholder 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 SB23.*

## PERFORMANCE

### ALL LAMPHOLDERS

#### SB10 General

SB10.1 A seasonal lighting lampholder shall be tested in accordance with Sections SB11– SB23.

#### SB11 Dielectric Voltage-Withstand Test

SB11.1 When tested as described in SB11.2 and SB11.3, a seasonal lighting lampholder shall withstand without breakdown the application of a 60 Hz essentially sinusoidal potential of 1250 V applied for 1 minute, between the screw shell contact and the center contact of the lampholder and between live parts and the lampholder and lamp assembly covered in foil.

SB11.2 Each of five lampholders is to be subjected to this test. The test is to be conducted without lamps installed in the lampholders.

SB11.3 Each lampholder 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.

#### SB12 Mold Stress Relief Test

SB12.1 When conditioned as described in SB12.2, 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 lampholder, as determined by the Screwthread Conformity Test, Section SB13, and
- c) Exposure of live parts as determined by SB12.2.

*Exception: A lampholder molded of rigid thermoset materials need not be subjected to this test.*

SB12.2 Each of fifteen lampholders is to be placed in a full-draft circulating air oven maintained at a uniform temperature of 10°C (18°F) above the lampholder temperature rating. The lampholders are to remain in the oven for seven hours. After removal from the oven, three lampholders are to be immediately examined for softening of the material. The 12 remaining lampholders are to be allowed to cool to room temperature and examined for exposure of live parts as determined by contact with the accessibility probe illustrated in Figure SB3.1. The 12 lampholders are then to be subjected to the Screwthread Conformity Test, Section SB13.

### SB13 Screwthread Conformity Test

SB13.1 A seasonal lighting lampholder shall comply with the "Go" and "Not-Go" gauges indicated in Table SB13.1. The gauges shall be made in accordance with the specifications for Gauges for Electric Lamp Bases and Lampholders, ANSI C81.63. During the test, a lampholder shall comply with both of the following:

- a) There shall not be any deformation of the screwthreads of the lampholder, and
- b) The "Go" gauge shall screw into the lampholder and shall turn smoothly. When the gauge is fully inserted, the screw shell and screwthreads of a metal screw shell type lampholder or the side contact and screwthreads of a skeleton-type lampholder shall be located at or above the horizontal surface  $y_1$  of the gauge (see Figure SB13.1), but shall not be above surface  $y_2$ . To verify the inside dimension of the screwthreads, surface  $t$  of the "Not-Go" gauge (see Figure SB13.2) shall not be below the lampholder screwthreads when inserted.

**Table SB13.1**  
**Screwthread conformity gauges**

Base type	Gauge name	Gauge (standard sheet number)	Max torque N·m (lb-inch)	Insertion force N (lbs)
E12  (Candelabra)	Threaded "Go" Gauge for E12 Candelabra Screw Lampholders	3-136-2	0.34 (3)	n/a
	"Not-Go" Plug Gauge for E12 Candelabra Screw Lampholders	3-137-2	n/a	Weight of gauge
E17  (Intermediate)	Threaded "Go" Gauge for E17 Intermediate Screw Lampholders	3-149-1	0.45 (4)	n/a
	"Not-Go" plug Gauge for E17 Intermediate Screw Lampholders	3-150-1	n/a	Weight of gauge

SB13.2 Each of twelve previously untested lampholders and each of twelve lampholders which have been conditioned as described in SB12.2 is to be tested as described in SB13.4 and SB13.5. There shall not be any shrinkage, warpage, or other distortion of the lampholder as a result of the conditioning described in the Mold Stress Relief Test, Section SB12.

*Exception: For lampholders molded of rigid thermoset materials a total of 12 lampholders are to be used. Six previously untested lampholders are to be tested as described in SB13.4 and six previously untested lampholders are to be tested as described in SB13.5.*

SB13.3 In addition to the tests described in SB13.4 and SB13.5, a skeleton-type lampholder shall also be tested as described in either (a) or (b):

- a) Each of six previously untested lampholders and each of six lampholders which have been conditioned as described in SB12.2 is to be tested. A lamp which complies with the requirements for Seasonal-Lighting Lamps, Supplement SA, in the Standard for Seasonal and Holiday Decorative Products, UL 588, and is of the type intended to be installed in each lampholder, is to be inserted into and removed from each lampholder. This cycle is to be repeated 24 times for a total of 25 cycles. The lampholders are then to be tested as described in SB13.5.

Figure SB13.1  
"Go" gauge

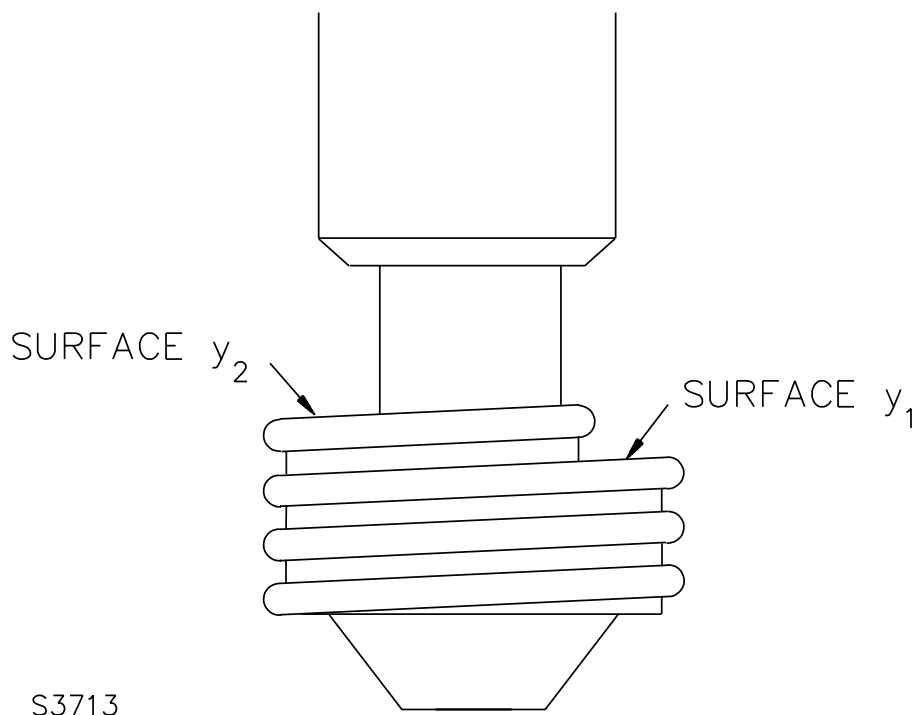
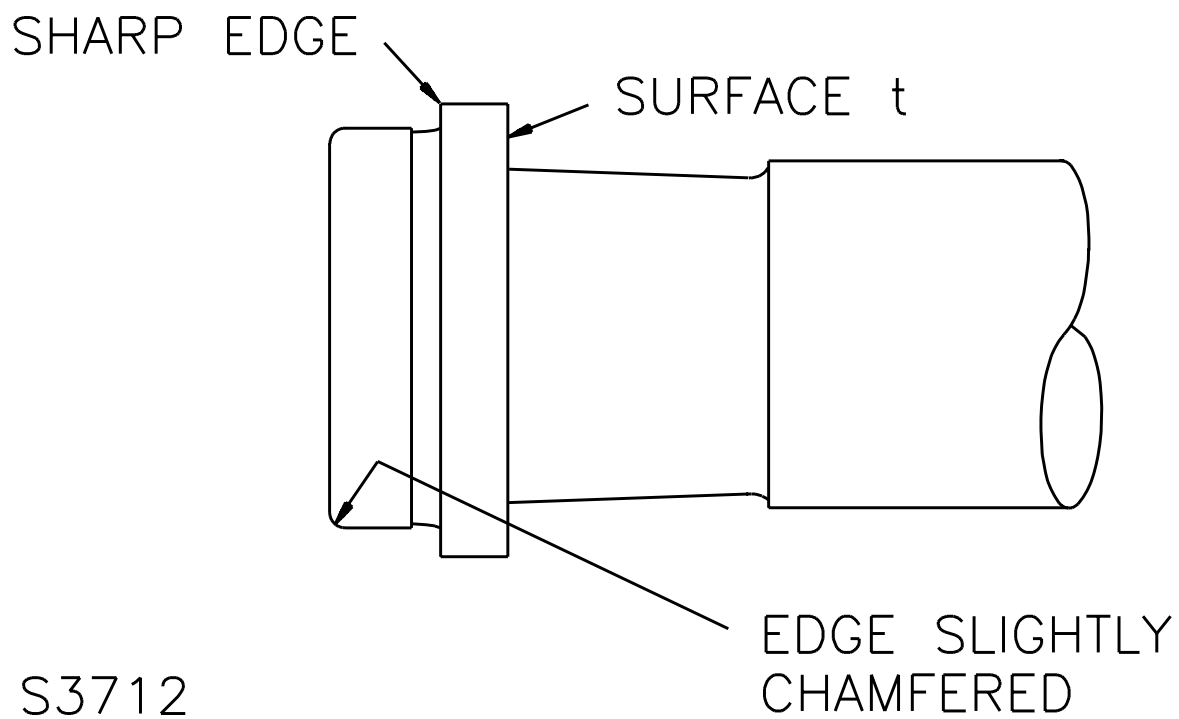


Figure SB13.2  
"Not-Go" gauge



b) Twenty-four additional lampholders are to be tested. The tests described in SB13.4 and SB13.5 are to be repeated with the side contact removed from the lampholder. Six previously untested lampholders and six lampholders which have been conditioned as described in SB12.2 are to be tested with each gauge.

SB13.4 Each of six previously untested lampholders and each of six of the conditioned lampholders is to be tested with the "Go" gauge. The threaded "Go" gauge is to be installed into each lampholder until contact is made with the center contact, if it is a rigid type, or until a flexible center contact is fully depressed. The torque needed to install the threaded gauge is not to exceed the value shown in Table SB13.1. The installation and removal of the "Go" gauge is then to be repeated on the same lampholders. The same lampholders are then to be tested with the "Not Go" gauge. The "Not Go" gauge is to be installed into each lampholder with an insertion force equal to the weight of the gauge.

SB13.5 Each of six previously untested lampholders and each of the remaining six conditioned lampholders is to be tested with the "Not Go" gauge. The "Not Go" gauge is to be installed into each lampholder with an insertion force equal to the weight of the gauge.

## **SB14 Mechanical Strength of Lampholder Threads Tests**

### **SB14.1 Pull test**

SB14.1.1 When tested as described in SB14.1.2, a seasonal lighting lampholder shall not be considered acceptable if:

- a) The threaded gauge pulls out, or
- b) The lampholder becomes damaged or distorted, adversely affecting the installation of a lamp in the lampholder as determined by reinserting the "Go" gauge.

SB14.1.2 Each of six previously untested lampholders is to be subjected to this test. A straight pull is to be applied to each lampholder for one minute by means of a weight attached to the threaded gauge described in SB13.1. The gauge is to be fully installed in the lampholder. The pull force applied is to be as indicated in Table SB14.1 and is to include the weight of the gauge.

**Table SB14.1**  
**Test values for screwshell pull and torque test for seasonal-lighting lampholders**

Type	Pull force N (lbf)		Torque N·m (lb-in)	
E12 (Candelabra)	41	(9.2)	1.2	(10.6)
E17 (Intermediate)	58.2	(13.1)	1.7	(15.0)



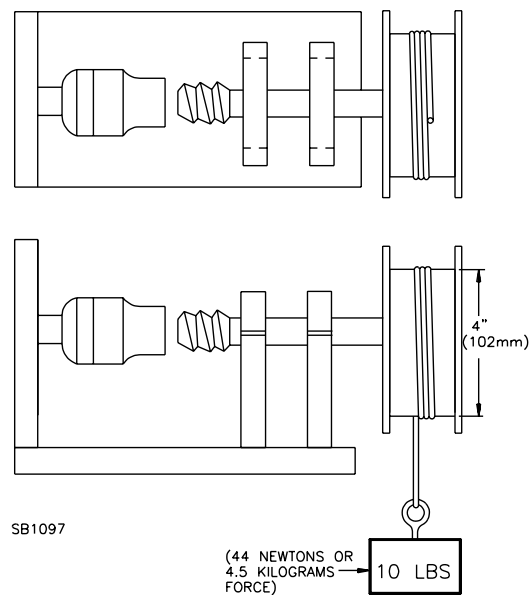
**SB14.2 Torque test**

SB14.2.1 When tested as described in SB14.2.2, a seasonal lighting lampholder shall not be considered acceptable if:

- a) The screw shell turns, strips, pulls out;
- b) Molded threads strip;
- c) The gauge pulls out; or
- d) The lampholder becomes damaged or distorted, adversely affecting the installation of a lamp in the lampholder as determined by reinserting the "Go" gauge.

SB14.2.2 Each of six previously untested lampholders is to be subjected to this test. A torque is to be applied to each lampholder for 1 minute by means of the threaded gauge described in SB13.1. The gauge is to be fully installed in the lampholder. The torque applied is to be as indicated in Table SB14.1. A device for performing the torque test is illustrated in Figure SB14.1.

**Figure SB14.1**  
**Set-up of torsion test of lampholder**



Dimensions in inches (mm)

**SB15 Secureness of Leads Test**

SB15.1 When tested as described in SB15.2, the securing means 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 lampholder body.
- d) The lead is not displaced more than 1/16 inch (1.6 mm) from the point of entry into the lampholder.

SB15.2 Each of six previously untested lampholders is to be subjected to this test. A force of 8 lbs (36 N) for a 20 AWG (0.52 mm<sup>2</sup>) cord or a force of 20 lbs (89 N) for an 18 AWG (0.82 mm<sup>2</sup>) or larger cord is to be applied to each lead for 1 minute. The specified weight is to be suspended from each lead, one at a time, and supported by the lampholder so that the securing means will be stressed from any angle that the construction of the lampholder permits. If two or more conductor flexible cord is employed, the conductors are to be tested together with a force of 16 lbs (71 N) for a 20 AWG (0.52 mm<sup>2</sup>) cord and a force of 30 lbs (133 N) for an 18 AWG (0.82 mm<sup>2</sup>) or larger cord.

**SB16 Lead Pull Test**

SB16.1 When tested as described in SB16.3, the strain relief means provided for the lampholder leads shall perform acceptably as determined by SB16.2.

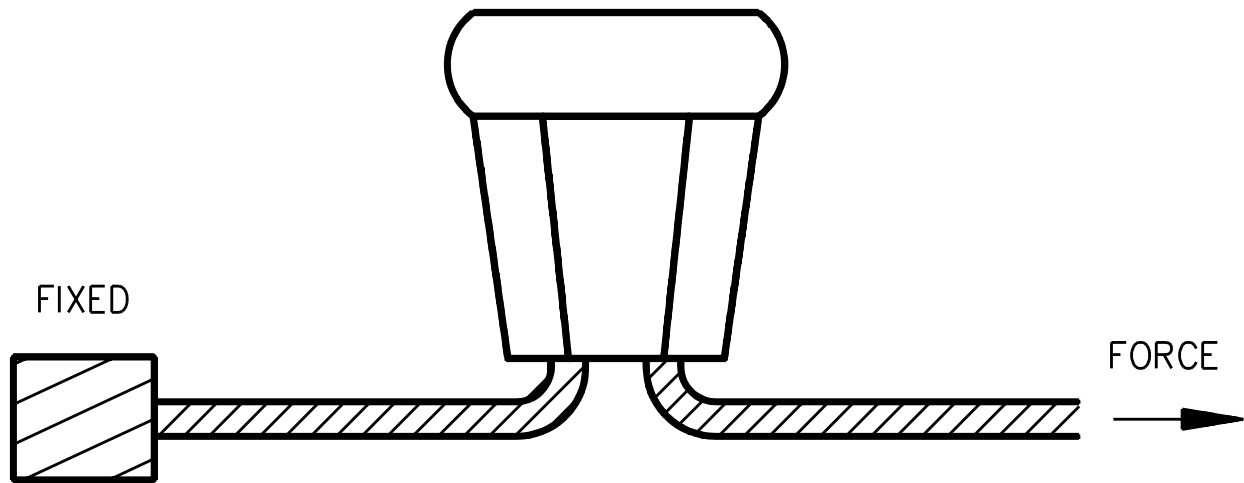
*Exception: A lampholder intended for use with two or more conductor flexible cord need not be subjected to this test.*

SB16.2 For No. 20 AWG (0.52 mm<sup>2</sup>) 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),
- c) No portion of the conductor becomes exposed outside the lampholder body, and
- d) No breakage of the conductor.

SB16.3 Each of eight previously untested lampholders, unless supplied with leads, is to be assembled to conductors of the size and type for which they are intended. With one of the lampholder leads fixed, a pull is to be applied to the other lead as illustrated in Figure SB16.1. 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 lbf (133 N) for No. 20 AWG (0.52 mm<sup>2</sup>) or larger conductors. 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 SB16.1  
Application of pull

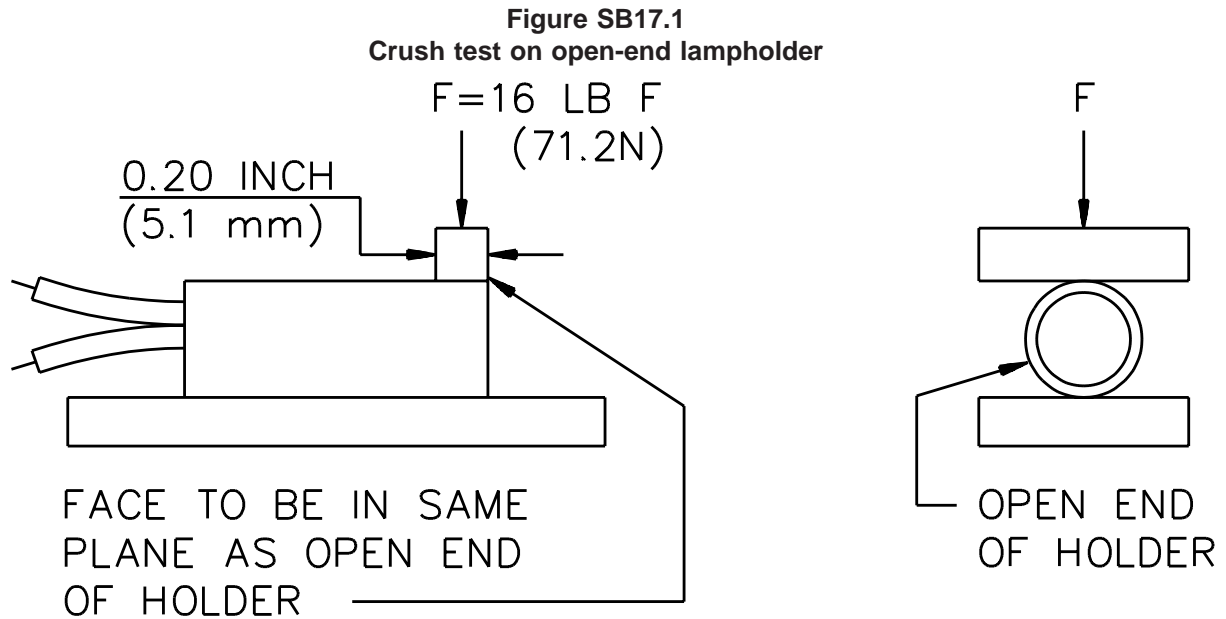


SA1902A

#### SB17 Crush Test

SB17.1 A lampholder shall be capable of withstanding a crushing force of 16 lbs (71 N) for 1 minute without cracking or without exposure of live parts. Live parts are considered to be exposed if they can be contacted by the probe illustrated in Figure SB3.1.

SB17.2 Each of six previously untested lampholders is to be subjected to this test. The lampholder (without a lamp) is to be placed between two flat surfaces parallel to each other and parallel to the major axis of the holder. The 16 lbf (71 N) is to be applied perpendicular to the major axis of the holder and to the plane of the flat surfaces. For lampholders with open ends for lamp insertion, the force is to be applied through a distance of 0.20 inch (5.1 mm) as measured from the open end of the lampholder. See Figure SB17.1.



SA1824A

## SB18 Temperature Tests for Seasonal Lampholders with Insulation-Piercing Terminals

### SB18.1 General

SB18.1.1 A seasonal lighting lampholder which employs insulation-piercing terminals shall be tested in accordance with SB18.1.2 – SB18.4.4.

SB18.1.2 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).

SB18.1.3 Temperatures are to be measured by thermocouples consisting of wire not larger than No. 24 AWG (0.21 mm<sup>2</sup>) and not smaller than No. 30 AWG (0.05 mm<sup>2</sup>). 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 Initial Calibration Tolerances for Thermocouples table in Temperature Measurement Thermocouples, ANSI/ISA MC96.1. Thermocouples using iron and constantan No. 30 AWG (0.05 mm<sup>2</sup>) wire are to be used with a potentiometer-type instrument whenever a referee temperature measurement by a thermocouple is necessary.

SB18.1.4 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 lampholder tested.

SB18.1.5 For each of the tests in SB18.2.1 – SB18.4.4, the lampholder 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 with an incandescent lamp of the rated type and wattage, installed as intended, and operating at an envelope temperature of 90°C (194°F). 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 SA7. The lampholder is to be connected to a supply circuit of 60 Hz and the conductors operated at 3 A for a No. 22 AWG (0.32 mm<sup>2</sup>) and 5 A for No. 20 AWG (0.52 mm<sup>2</sup>) or larger wire if the conductors do not terminate in the lampholder.

SB18.1.6 Unless otherwise indicated, each test is to be continued for a minimum of 3 hours 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.

### **SB18.2 Temperature test**

SB18.2.1 Throughout the test described in SB18.2.2, the temperature of the insulation-piercing terminal connections on each lampholder shall not exceed 60°C (140°F) when normalized to 25°C (77°F).

SB18.2.2 Each of six previously untested lampholders is to be assembled to conductors of the size and type for which they are intended. The lampholders are to be connected to the rated load and the temperature of the insulation-piercing terminal connections is to be monitored continuously until the temperatures are constant.

### **SB18.3 Thermal cycling**

SB18.3.1 Throughout the test described in SB18.3.2 and SB18.3.3, the maximum temperature of the insulation-piercing terminal connections on each lampholder shall not exceed 60°C (140°F) when normalized to 25°C (77°F).

SB18.3.2 Each of six previously untested lampholders is to be assembled to conductors of the size and type for which they are intended. The lampholders are to be connected to the rated load and the temperature of the insulation-piercing terminal connections is to be monitored continuously.

SB18.3.3 The lampholders 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 lampholders are to remain energized until temperatures are constant. The off cycle time may be extended for the convenience of measurement.

**SB18.4 Strain relief/terminal temperature**

SB18.4.1 Throughout the test described in SB18.4.2 – SB18.4.4, 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 lampholder body.
- d) The lead is not displaced more than 1/16 inch (1.6 mm) from the point of entry into the lampholder.

SB18.4.2 Each of six previously untested lampholders is to be assembled to conductors of the size and type for which they are intended. The lampholders 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).

SB18.4.3 The same lampholders are to be allowed to cool to room temperature. Each lampholder 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<sup>2</sup>) or larger cord and 8 lbs (36 N) for a 20 AWG (0.52 mm<sup>2</sup>) 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.

SB18.4.4 The same lampholders are then to be connected to the rated load and the temperature of the insulation-piercing terminal connections are to be monitored continuously. The lampholders are to be energized for a period of 30 days.

**OUTDOOR-USE LAMPHOLDERS****SB19 General**

SB19.1 A lampholder intended for outdoor use shall comply with the tests described in Sections SB20 – SB23, with the intended conductors assembled to the lampholder.

**SB20 Rain Test**

SB20.1 When tested as described in SB20.2 – SB20.4, the construction of a lampholder intended for outdoor use shall not permit the accumulation of water into the interior space of the lampholder as determined by SB20.5.

SB20.2 Ten unenergized lampholders are to be tested. The intended lamp is to be inserted in the lampholder. The lampholder and lamp assembly 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 lampholder.

SB20.3 The water-spray apparatus is to consist of three spray heads mounted as shown in Figure SB20.1. The spray heads are to be constructed in accordance with Figure SB20.2. The lampholder assembly 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 lampholder. The water pressure at each spray head is to be maintained at 5 lb/in<sup>2</sup> (34.5 kPa).

SB20.4 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).

SB20.5 In order to determine compliance with SB20.1, within five minutes after the completion of the test, 5 lampholders are each to be individually subjected to the Leakage Current Test, Section SB21, and 5 lampholders are to be subjected to the Dielectric Voltage-Withstand Test, Section SB11.

**SB21 Leakage Current Test**

SB21.1 When tested as described in SB21.3 – SB21.8, the leakage current of an individual seasonal lighting lampholder with its intended lamp installed 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:

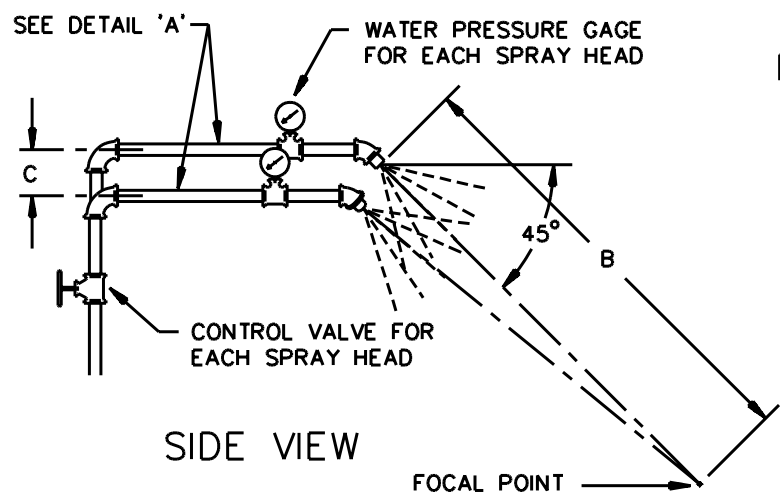
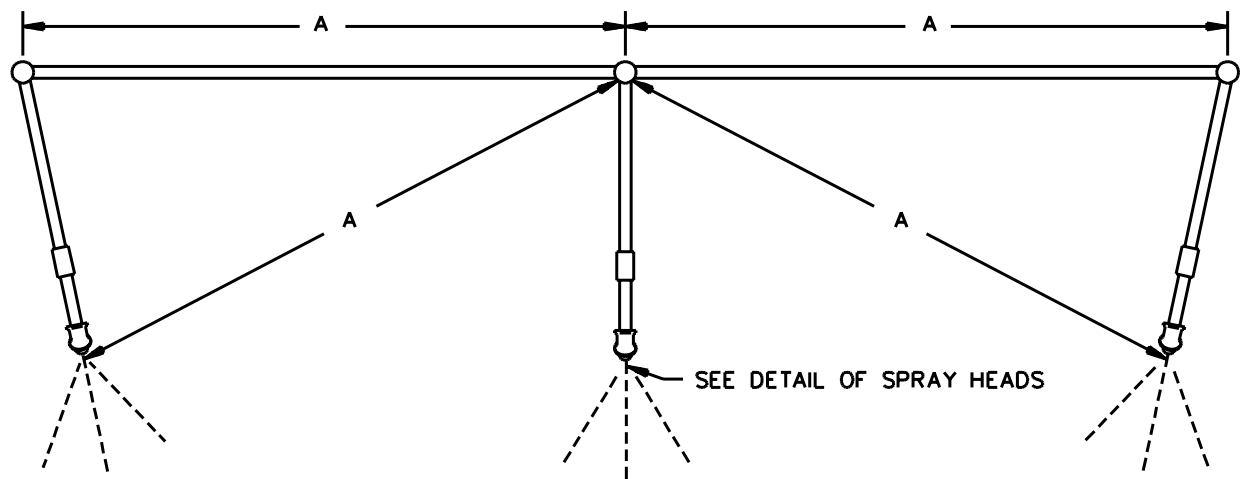
- a) 42.4 V peak for an indoor lampholder or where wet contact is not likely to occur, or
- b) 21.1 V peak for an outdoor lampholder or where wet contact is likely to occur.

SB21.2 Leakage current refers to all currents, including capacitively coupled currents, that may be conveyed between exposed conductive surfaces of the lampholder and ground or other exposed conductive surfaces.

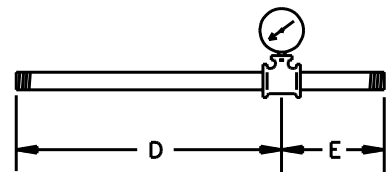
SB21.3 All exposed conductive surfaces of a lampholder shall be tested for leakage current. The leakage current from these surfaces are to be measured to the grounded (neutral) supply conductor individually.

SB21.4 If an insulating material, with or without a metalized coating, is used for the lampholder or part of the lampholder, 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 and the installed lamp 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.

Figure SB20.1  
Rain-test spray-head piping  
PLAN VIEW



PIEZOMETER ASSEMBLY  
DETAIL 'A'



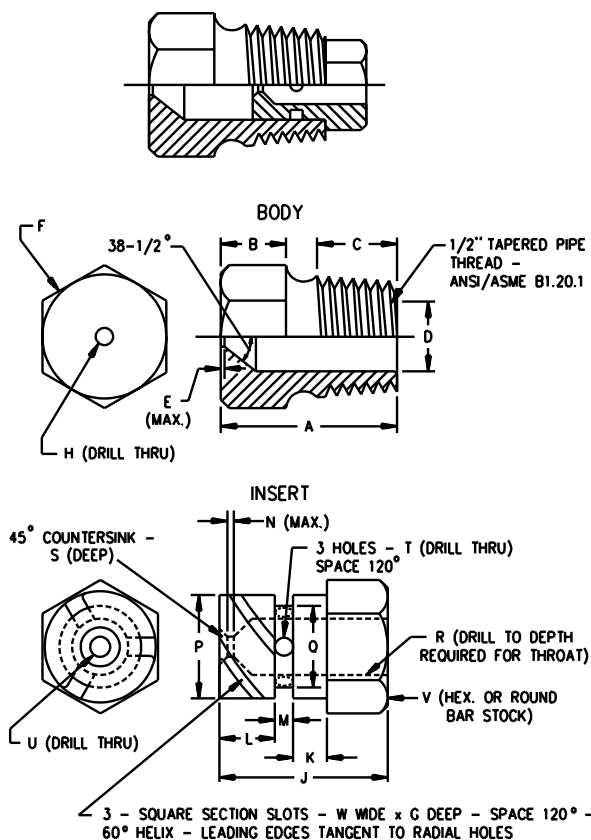
RT101B

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



**Figure SB20.2**  
**Spray head**

ASSEMBLY<sup>a</sup>



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) <sup>b</sup>
H	5.0	(No.9) <sup>b</sup>	U	2.50	(No. 40) <sup>b</sup>
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			

<sup>a</sup> Nylon Rain-Test Spray Heads are available from Underwriters Laboratories

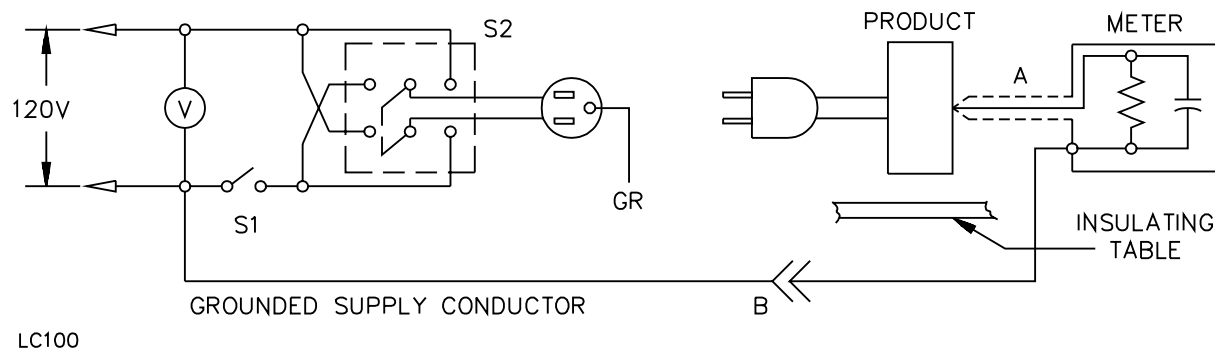
<sup>b</sup> ANSI B94.11M Drill Size

<sup>c</sup> Optional - To serve as a wrench grip.

SB21.5 The measurement circuit for leakage current is to be as illustrated in Figure SB21.1. 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  $\mu$ .
- 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  $\mu$  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 SB21.1**  
**Leakage-current measurement circuit**



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.

SB21.6 The meter shall be connected between the accessible parts and the grounded supply conductor.

SB21.7 One lampholder and lamp assembly is to be tested at a time for leakage current. The supply voltage is to be adjusted to 120 V. The test sequence, with reference to the measuring circuit illustrated in Figure SB21.1, is to be as follows:

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

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

SB21.8 A lampholder and lamp assembly is to be carried through the complete Leakage Current Test program as specified in SB21.1 without interruption for other tests.

## **SB22 Leakage Current Following Humidity Conditioning**

SB22.1 An individual seasonal-lighting lampholder with its intended lamp installed shall comply with the requirements for leakage current contained in SB21.1 of the Leakage Current Test, Section SB21, following exposure for 48 hours to air having a relative humidity of  $88 \pm 2$  percent at a temperature of  $32 \pm 2^\circ\text{C}$  ( $90 \pm 4^\circ\text{F}$ ).

SB22.2 To determine whether a lampholder complies with the requirements in SB22.1, one lampholder is to be heated to a temperature just above  $34^\circ\text{C}$  ( $93^\circ\text{F}$ ) to reduce the likelihood of condensation of moisture during conditioning. The heated lampholder is to be placed in the humidity chamber and is to remain for 48 hours under the conditions specified in SB22.1.

SB22.3 Following the conditioning, the lampholder is to be tested, without load current flowing, as described in SB21.7(a), either in the humidity chamber or immediately after removal of the conditioned lampholder 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 lampholder is then to be energized and tested as described in SB21.7 (b). 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.

## **SB23 Ultraviolet (UV) Light Exposure and Water Immersion Tests**

### **SB23.1 General**

SB23.1.1 After being tested as described in SB23.2.1 – SB23.3.1, the polymeric material used for the body of a lampholder 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 SB23.2.1– SB23.3.1. The flammability classification is to be determined according to the flammability requirements for lampholder body material contained in SB5.1. 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 lampholder shall be subjected to the Screwthread Conformity Test, Section SB13, the Mechanical Strength of Lampholder Threads Tests, Section SB14, the Crush Test, Section SB17, and the Rain Test, Section SB20.

## SB23.2 UV conditioning

SB23.2.1 Each lampholder 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  $63 \pm 3^{\circ}\text{C}$  ( $145.4 \pm 5.4^{\circ}\text{F}$ ), 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  $0.35 \text{ W/m}^2 \text{ nm}$  at 340 nm and a black-panel temperature of  $63 \pm 3^{\circ}\text{C}$  ( $145.4 \pm 5.4^{\circ}\text{F}$ ).

SB23.2.2 The lampholders are to be mounted vertically on the inside of the cylinder in the ultraviolet-light apparatus, with the width of the lampholder facing the arcs, and so that they do not touch each other.

SB23.2.3 Two sets of lampholders are to be exposed. For twin enclosed carbon-arc, one set is to be exposed for a total of 360 hours and the second set for a total of 720 hours. For xenon-arc, one set is to be exposed for a total of 500 hours and the second set for a total of 1000 hours. After the test exposure, the lampholders 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 flammability and physical tests specified in SB23.1.1. For comparative purposes, lampholders 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 lampholders are tested.

SB23.2.4 If a material is to be considered in a range of colors, lampholders representing these ranges are also to be provided. Lampholders 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 lampholders 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.

### SB23.3 Water immersion

SB23.3.1 Using standard test procedures, property values for the material are to be determined both before and after conditioning. Lampholders of the material shall be immersed in distilled or deionized water at  $70.0 \pm 1.0^{\circ}\text{C}$  ( $158.0 \pm 1.8^{\circ}\text{F}$ ) for 7 days. A complete change of water is to be made on each of the first 5 days. Following the water conditioning, the lampholders which are to be subjected to the tests described in SB23.1.1(b) are to be immersed in distilled or deionized water at  $23.0 \pm 2.0^{\circ}\text{C}$  ( $73.4 \pm 3.6^{\circ}\text{F}$ ) for 1/2 hour immediately prior to testing. Following the immersions, the lampholders to be subjected to flammability tests are to be conditioned in air at  $23.0 \pm 2.0^{\circ}\text{C}$  ( $73.4 \pm 3.6^{\circ}\text{F}$ ) and 50  $\pm$  5 percent relative humidity for 2 weeks.

## MARKINGS

### SB24 General

SB24.1 Each lampholder intended for seasonal use shall be marked with the following:

- a) The manufacturer's name or trademark, and
- b) The catalogue or model number of the product.

*Exception: If both the lampholder and the complete product in which it is employed are manufactured at the same location, the lampholder need not comply with this requirement.*

SB24.2 A lampholder intended for seasonal use which complies with the construction and performance requirements for indoor seasonal lighting lampholders contained in Sections SB3 – SB18, shall be marked as follows: "Suitable for Use in Indoor Seasonal Lighting Products."

SB24.3 A lampholder intended for seasonal use which complies with the construction and performance requirements for indoor and outdoor seasonal lighting lampholders contained in Sections SB3 – SB23, shall be marked as follows: "Suitable for Use in Indoor and Outdoor Seasonal Lighting Products."

SB24.4 The markings in SB24.2 and SB24.3 may appear on:

- a) The product,
- b) On the smallest unit carton, or
- c) On a stuffer sheet contained in each carton.

Lampholders employing these markings shall be bulk-packaged for factory assembly only.

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## **SUPPLEMENT SC - IN-LINE FUSEHOLDERS WITH INSULATION-PIERCING TERMINALS FOR SEASONAL PRODUCTS**

### **INTRODUCTION**

#### **SC1 Scope**

SC1.1 These requirements cover in-line fuseholders with insulation-piercing terminals intended for use in seasonal products in accordance with this standard.

### **CONSTRUCTION**

#### **SC2 General**

SC2.1 An in-line fuseholder with insulation-piercing terminals shall comply with the construction requirements contained in this Standard, including requirements for Fuseholders and Fused Attachment Plugs, Section 25, Devices Employing Insulation-Piercing Terminals, Section 26. An outdoor-use in-line fuseholder shall also comply with the requirements for Outdoor-Use Products, Section 27.

### **PERFORMANCE**

#### **SC3 General**

SC3.1 An in-line fuseholder with insulation-piercing terminals shall be subjected to the tests in Sections SC4 – SC22, in the order presented.

#### **SC4 Temperature Tests for Devices Employing Insulation-Piercing Terminals**

SC4.1 An in-line fuseholder shall comply with the Temperature Tests for Devices Employing Insulation-Piercing Terminals, Section 54.

#### **SC5 Drop Test**

SC5.1 An in-line fuseholder shall comply with the Drop Test, Section 59, except that the fuseholder is to be dropped from a height of 12 feet (3.7 m). As a result of the test, in addition to the requirements in 59.1, the fuseholder latching mechanism or access cover shall remain closed and intact.

**SC6 Temperature Test**

SC6.1 An in-line fuseholder shall comply with the Fuseholder Temperature Test, Section 67, except as indicated in SC6.2. Three fuseholders are to be tested.

SC6.2 The test is to be conducted as follows:

- a) The test is to be conducted on each of the in-line fuseholders in the as-received condition.
- b) The cover of each fuseholder is to be opened and closed five times and the Fuseholder Temperature Test, Section 67, is to be repeated.
- c) At the end of the test the cover of each fuseholder is to be opened and closed an additional five times and the Fuseholder Temperature Test is to be repeated again.

**SC7 Dielectric Voltage-Withstand Test**

SC7.1 When tested as described in SC7.2, an in-line fuseholder shall withstand without breakdown the application of a 60 Hz essentially sinusoidal potential of 1250 V applied for 1 minute, between the fuseholder leads of opposite polarity.

SC7.2 Three in-line fuseholders are to be tested. Each fuseholder, while in a heated condition following the Temperature Test, Section SC6, 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.

**SC8 Calibration Test**

SC8.1 An in-line fuseholder shall comply with the Calibration Test, Section 65.

**SC9 Fault Current Test**

SC9.1 An in-line fuseholder shall comply with the Fault Current Test, Section 66, except that the in-line fuseholder is to be placed on a metal plate which is connected to ground through a 30 A non-renewable fuse. Three fuseholders are to be tested.



**SC10 Dielectric Voltage-Withstand Test (Repeated)**

SC10.1 After being subjected to the Fault Current Test, Section SC9, an in-line fuseholder shall comply with the Dielectric Voltage-Withstand Test, Section SC7.

**SC11 Crush Test**

SC11.1 An in-line fuseholder shall comply with the Fuseholder Crush Test, Section 68. One fuseholder is to be tested.

**SC12 Abnormal Pin Protrusion Test**

SC12.1 After being tested according to either of the methods described in SC12.2, an in-line fuseholder shall comply with the following:

- a) There shall not be continuity established between the two conductors as a result of wire penetration as determined by the continuity test described in SC12.3, and
- b) There shall not be an increase in the risk of electric shock as determined by compliance with the Dielectric Voltage-Withstand Test, Section SC7, except that the test is to be conducted with 2500 V for the method described in SC12.2(a) and with 5000 V for the method described in SC12.2(b).

SC12.2 One fuseholder is to be tested in accordance with either of the following:

- a) A short length of parallel conductor wire of the size and type intended to be used with the in-line fuseholder is to be placed on the edge of a supporting surface. The in-line fuseholder is to be placed above the wire with the insulation-piercing terminals positioned so as to penetrate into the web of the wire insulation. The in-line fuseholder is then to be manually pressed as hard as possible against the wire using thumb pressure. A hammer is then to be used to strike each end of the in-line fuseholder five times directly above each wire piercing terminal. The cut ends of the wire are to be separated before the in-line fuseholder is subjected to the Dielectric Voltage-Withstand Test, Section SC7; or
- b) The in-line fuseholder is to be assembled to a short length of parallel conductor wire of the size and type intended to be used with the in-line fuseholder. The in-line fuseholder is to be closed manually and manipulated such that the insulation-piercing terminals are positioned to penetrate the web of the wire insulation. The in-line fuseholder is then to be manually pressed as hard as possible against the wire using thumb pressure until the in-line fuseholder is securely latched in the closed position. After the wire has been penetrated and the in-line fuseholder latched, the cut ends of the wire are to be separated before the fuseholder is subjected to the Dielectric Voltage-Withstand Test, Section SC7.

SC12.3 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 the insulation-piercing terminals of the fuseholder contacted both conductors at any time during the test.

**SC13 Flexing Test**

SC13.1 An in-line fuseholder shall comply with the Flexing Test, Section 90. Six fuseholders are to be tested.

**SC14 Dielectric Voltage-Withstand Test (Repeated)**

SC14.1 After being subjected to the Flexing Test, Section SC13, an in-line fuseholder shall comply with the Dielectric Voltage-Withstand Test, Section SC7.

**SC15 Temperature Test After Flexing**

SC15.1 After being subjected to the Flexing Test, Section SC13, and the Dielectric Voltage-Withstand Test (Repeated), Section SC14, an in-line fuseholder shall be tested as described in SC15.2 – SC15.6. As a result of the test, there shall be not breakage of the wire as determined by the continuity test described in SC15.7 and temperature rises shall not exceed the values indicated in Table 43.1.

SC15.2 The in-line fuseholders previously subjected to the Flexing Test, Section SC13, are to be tested.

SC15.3 Temperatures are to be measured by means of thermocouples consisting of iron and constantan wires not larger than No. 24 AWG (0.21 mm<sup>2</sup>) and not smaller than No. 30 AWG (0.05 mm<sup>2</sup>). When thermocouples are used in determining temperatures in electrical equipment, it is common practice to employ thermocouples consisting of No. 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.

SC15.4 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 Initial Calibration Tolerances for Thermocouples table in Temperature Measurement Thermocouples, ANSI/ISA MC96.1.

SC15.5 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.

SC15.6 The in-line fuseholder is to be assembled to 4 feet (1.2 m) of wire of the size and type intended to be used with the in-line fuseholder. The in-line fuseholder assembly is then to be connected to a supply circuit of 120 V and a frequency of 60 Hz and operated continuously at a current level of 3 A for No. 22 AWG (0.32 mm<sup>2</sup>) wire or 5 A for No. 20 AWG (0.52 mm<sup>2</sup>) or larger wire 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. The in-line fuseholder is to remain closed during the test. Temperatures are to be measured on the wire 1/8 inch (3.2 mm) from each of the insulation-piercing terminals.

SC15.7 Any indicating device such as an ohmmeter, a battery-and-buzzer combination, or similar continuity testing device, is to be placed across the ungrounded conductor to determine if continuity was maintained.

### **SC16 Opening Force Test**

SC16.1 When subjected to the test described in SC16.2 – SC16.4, an in-line fuseholder with a latching mechanism shall be considered acceptable if the average latch-force is not less than 7.5 lbs (33.4 N) and the average tab-force is not less than 13 lbs (57.8 N).

SC16.2 Each of sixteen in-line fuseholders is to be tested. Each in-line fuseholder is to be assembled to wire of the size and type intended to be used with the in-line fuseholder.

SC16.3 Each of eight of the in-line fuseholders is to be tested by applying a force to the latch of the in-line fuseholder (the D-shaped protrusion located on the wire-side of the in-line fuseholder). The force is to be applied in a direction perpendicular to the latch, and increased until the latch opens. The latch-force at which the latch opens is to be recorded.

SC16.4 Each of the remaining eight in-line fuseholders is to be tested by applying a force to the tab of the in-line fuseholder. One side of each in-line fuseholder is to be initially opened for this test. The force is then to be applied to the tab, at the area below the latch, and increased until the latch opens. The tab-force at which the latch opens is to be recorded.

### **SC17 Strain Relief Test**

SC17.1 An in-line fuseholder shall comply with the Strain Relief Test, Section 71.

### **SC18 Reliability of Conductor Connections Test**

SC18.1 An in-line fuseholder shall comply with the Reliability of Conductor Connections Test, Section 72.

### **SC19 Security of Insulation Test**

SC19.1 An in-line fuseholder shall comply with the Security of Insulation Test, Section 75.

**SC20 Fuseholder Cover Test**

SC20.1 An in-line fuseholder shall comply with the Fuseholder Cover Test, Section 69.

**SC21 Outdoor-Use In-Line Fuseholders**

SC21.1 An in-line fuseholder intended for outdoor use shall also comply with the Rain Test, Section 85, the Gasket Test, Section 87, the Gasket Adhesion Test, Section 88, and the Ultraviolet (UV) Light Exposure and Water Immersion Tests, Section 89.

**SC22 Tests for Permanence of Cord Tag**

SC22.1 A cord tag containing the markings specified in Section SC26 and provided with an in-line fuseholder shall comply with the Tests For Permanence of Cord Tag, Section 56.

**MANUFACTURING AND PRODUCTION-LINE TESTS****SC23 Opening Force Test**

SC23.1 As a quarterly production-line test, 20 in-line fuseholders are to be subjected to the Opening Force Test, Section SC16.

**SC24 Open/Close Test**

SC24.1 As a quarterly production-line test, when tested as described in SC24.3, an in-line fuseholder shall withstand without breakdown the application of a 60 Hz essentially sinusoidal potential of 2500 V applied for 1 minute, between parts of opposite polarity after being conditioned as described in SC24.2.

SC24.2 Each of five in-line fuseholders is to be tested. Each fuseholder is to be assembled to a length of wire of the size and type intended to be used with the fuseholder. Each fuseholder is then to be subjected to five cycles of opening the fuseholder cover, removing the fuse, replacing the fuse, and closing the fuseholder cover.

SC24.3 The cut ends of the wire are to be separated and the in-line fuseholder 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.

**SC25 Abnormal Pin Protrusion Test**

SC25.1 As a quarterly production-line test, 5 in-line fuseholders are to be subjected to the Abnormal Pin Protrusion Test, Section SC12.

**MARKINGS****SC26 General**

SC26.1 The markings contained in this section shall comply with the marking requirements in General, Section 114.

SC26.2 A in-line fuseholder containing replaceable fuse(s) shall be permanently marked on the product as follows: "Use only 125-volt fuse, \_\_\_\_ amp. max." The blank shall be filled in with the ampere value and shall be consistent with the rating of the fuse(s) provided. The marking shall be visible during fuse replacement.

SC26.3 A warning tag which complies with the Tests for Permanence of Cord Tags, Section SC22, shall be provided with the in-line fuseholder. The tag shall be located within 6 inches (152.4 mm) of the fuseholder and shall be marked on one side as follows:

**IMPORTANT SAFETY INSTRUCTIONS**

WARNING – To reduce the risk of fire or electric shock securely fasten the latches of the fuseholder. Close the fuseholder completely before plugging in the lighting string or decorative outfit.

WARNING – After replacing the fuse, be sure the cord is flat in the cover channel before closing and latching the fuseholder.

SC26.4 The other side of the warning tag mentioned in SC26.3 shall include a pictorial warning depicting a user physically securing the fuseholder closed. A pictorial of an unacceptable fastening of the fuseholder with slash mark in red overlaying the unacceptable pictorial shall be provided adjacent to this illustration.

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## APPENDIX A

### Standards for Components

Standards under which components of the products covered by this standard are evaluated include the following:

Title of Standard – UL Standard Designation

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Attachment Plugs and Receptacles – UL 498

Cord Sets and Power-Supply Cords – UL 817

Flexible Cord and Fixture Wire – UL 62

Fuseholders – UL 512

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

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

Gaskets and Seals – UL 157

Lampholders, Edison-Base – UL 496

Marking and Labeling Systems – UL 969

Motors, Overheating Protection for – UL 2111

Optical Isolators – UL 1577

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

Polymeric Materials – Short Term Property Evaluations– UL 746A

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

Power Units, Class 2 – UL 1310

Printed-Wiring Boards – UL 796

Small Polymeric Component Materials, Tests for Flammability of – UL 1694

Switches, General-Use Snap – UL 20

Switches, Special-Use – UL 1054

Transformers, Class 2 and Class 3 – UL 1585

Transformers, Specialty – UL 506

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**February 13, 2003**  
**Superseded requirements for**  
**the Standard for**  
**Seasonal and Holiday Decorative Products**

**UL 588, Eighteenth Edition**

The requirements shown are the current requirements that have been superseded by requirements in revisions issued for this Standard. To retain the current requirements, do not discard the following requirements until the future effective dates are reached.

13.2.4 (13.2.4) The wire employed in a series-connected seasonal product shall be a minimum No. 22 AWG (0.32 mm<sup>2</sup>) Type CXTW twisted conductor, with a minimum insulation temperature of 105°C (221°F). Type CXTW wire is suitable for both indoor and outdoor use.

*Exception No. 1: A decorative outfit employing lampholders, wire, or both, secured to and supported by a frame provided with the product can employ single-conductor Type CXTW wire as indicated in 31.8.*

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

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

*Exception No. 4: Single conductor CXTW wire may be employed if the wire is twisted with a non-current carrying polymeric supporting rope which is rated for at least 105°C and complies with the Rope Strength Test, Section 81A. If the seasonal product is for outdoor-use, then the non-current carrying polymeric rope shall also comply with the requirements in 87.2.*

13.2.4 effective until February 13, 2004

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Subject 746A (746B, 746C, 746D, 94, 588)  
(In reply, refer to Subject 746.)

1285 Walt Whitman Road  
Melville, NY 11747-3081  
March 20, 2001



**TO: Industry Representatives on the Industry Advisory Group of UL for  
Plastic Materials  
Electrical Council of Underwriters Laboratories Inc.  
Fire Council of Underwriters Laboratories Inc.  
Subscribers to UL's Standards Service for:  
Polymeric Materials – Short Term Property Evaluations, UL 746A  
Polymeric Materials – Long Term Property Evaluations, UL 746B  
Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C  
Polymeric Materials – Fabricated Parts, UL 746D  
Tests for Flammability of Plastic Materials, UL 94  
Seasonal and Holiday Decorative Products, UL 588  
Listing Service for  
Decorative Lighting Strings, Category DGZZ**

**SUBJECT: New Recognition Service for Polymeric Materials For Use In Seasonal & Holiday  
Decorative Products (QMT02)**

***This bulletin replaces UL's Subject 746A (746B, 746C, 746D, 94, 588) bulletin dated March 8, 2001 referencing the same subject. The reference to Listing Service for Seasonal and Holiday Decorative Products, Category DGVF in the March 8, 2001 bulletin has been changed to Listing Service for Decorative Lighting Strings, Category DGZZ.***

Underwriters Laboratories Inc., (UL) announces a willingness to accept submittals for Recognition under the newly established category of Polymeric Materials For Use In Seasonal & Holiday Decorative Products (QMT02). Effective January 2, 2003, the use of materials Recognized under this category will become a requirement for products Listed in accordance with the Standard for Seasonal & Holiday Decorative Products, UL 588.

The following are the minimum requirements for inclusion in QMT02;

**1) Flammability**

a) All materials shall attain a flammability rating of V-0 or V-1 (minimum thickness 0.8 mm or less) in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. Testing will be conducted at both the minimum thickness of the Recognized polymeric material as well as at 3.0 (+0.2) mm, and

b) All materials shall attain 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. Testing will be performed on standardized flame bars of 55 ( $\pm 5$ ) x 13.0 ( $\pm 0.5$ ) mm at a thickness of 0.8 ( $\pm 0.1$ ) mm or less. No other sample dimensions will be applicable. (Note: These are standard UL 94 Vertical flame bars cut roughly in half.)

## **2) Resistance to Ignition**

a) For materials which attain a flammability rating of SC-0, no minimum ratings are established with respect to Resistance to Ignition.

b) For materials which attain a flammability rating of SC-1, a minimum Performance Level Category (PLC) of 3 shall be established at the material's Recognized minimum thickness for Hot Wire Ignition (HWI) and High Current Arc Ignition (HAI) in accordance with the Standard for Polymeric Materials - Short Term Evaluations, UL 746A.

## **3) Relative Thermal Index (RTI)**

A minimum RTI of 90 °C (established for all properties in accordance with the Standard for Polymeric Materials - Long Term Property Evaluations, UL 746B) will be required. This coincides with current requirements for the Standard for Seasonal & Holiday Decorative Products, UL 588, effective February 14, 2003.

## **4) Specific Gravity**

The Specific Gravity, measured in accordance with the Standard for Polymeric Materials - Short Term Property Evaluations, UL 746A, will be verified to confirm that the material is within the declared normal tolerances (established by the manufacturer as part of the Recognition). The tolerance will be published on the Recognition ("Yellow") Card.

## **5) Identification Tests**

In order to ensure continuity in the product's formulation, additional polymer identification testing (IR, TGA, DSC, SG, etc.) will be determined by UL and incorporated into the New Work testing and UL's Follow-Up Test Program.

Attached as Appendix A is a copy of the Guide Information. A sample Recognition Card is attached as Appendix B. The Guide Card/Recognition Card also has the provision for noting when a material has been investigated and found acceptable for "Suitability for Outdoor Use."

The UL Recognized Component Mark will be a MANDATORY part of the required Markings for products Recognized under this category. The Recognized Component Mark, along with the Recognized Company name and material designation, will be required on the smallest unit container.

Subscribers interested in submitting products under the QMTO2 Recognition Service should contact Mr. Dan O'Shea at UL's Melville office. His contact information is shown below. UL will then send you a Product Information Form for each material to be submitted which will convey additional information about sample requirements, etc., and will ask you the questions necessary for the UL staff to commence an investigation.

Questions regarding the new program requirements for Recognized Polymeric Materials For Use In Seasonal & Holiday Decorative Products (QMT02), should be directed to Mr. Dan O'Shea. Questions regarding the Standard for Seasonal and Holiday Decorative Products, UL 588, should be directed to Mr. Anthony Tassone (631-271-6200, Ext. 22943).

## UNDERWRITERS LABORATORIES INC.

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APPENDIX A**PROPOSED GUIDE CARD****[Plastics – Component] Polymeric Materials for Use in Seasonal and Holiday Decorative Products – Component**

The materials covered under this category are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. THE FINAL ACCEPTANCE OF THE COMPONENT IS DEPENDENT UPON ITS INSTALLATION AND USE IN COMPLETE EQUIPMENT SUBMITTED TO UNDERWRITERS LABORATORIES INC.

**USE**

This category covers polymeric materials intended for use in seasonal and holiday decorative products and accessories.

**FLAMMABILITY**

Materials have been classified based on burning tests conducted in accordance with "UL 1694, Tests for Flammability of Small Polymeric Component Materials." By small-scale tests on standardized samples, materials are classified as SC-0 or SC-1.

**RELATIVE TEMPERATURE INDEX (RTI)**

In accordance with UL 746B, "Polymeric Materials – Long Term Property Evaluations," RTI is the maximum service temperature for a material, where a class of critical property will not be unacceptably compromised through chemical thermal degradation, over the reasonable life of an electrical product, relative to a reference material having a confirmed, acceptable corresponding performance defined RTI.

**SPECIFIC GRAVITY**

The relative density range of the individual Recognition determined in accordance with UL 746A, "Polymeric Materials – Short Term Property Evaluations."

**SUITABILITY FOR OUTDOOR USE (f1, f2)**

Where indicated, the effect of exposure to ultraviolet light and water on property retention has been evaluated in accordance with UL 746C, "Polymeric Materials – Use in Electrical Equipment Evaluations."

**PERFORMANCE LEVEL CATEGORIES (PLC)**

In order to avoid an excessive level of implied precision and bias, material performances for several tests are recorded as Performance Level Categories (PLC), based on the mean test results (rather than recording the exact numerical results), as indicated in the table following the test description.

**Hot Wire Ignition (HWI)**

Performance is expressed as the mean number of seconds needed either to ignite standard specimens or to burn through the specimens without ignition. The specimens are wrapped with resistance wire that dissipates a specified level of electrical energy in accordance with UL 746A.

<b>HWI Range Mean Ign Time (in sec)</b>	<b>Assigned PLC</b>
120 and longer	0
60 through 119	1
30 through 59	2
15 through 29	3

### **High Current Arc Ignition (HAI)**

Performance is expressed as the number of arc rupture exposures (standardized as to electrode type and shape and electric circuit) which are necessary to ignite a material when they are applied at a standard rate on the surface of the material in accordance with UL 746A.

<b>HAI Range Mean No. of Arc to Cause Ign</b>	<b>Assigned PLC</b>
120 and greater	0
60 through 119	1
30 through 59	2
15 through 29	3

### **REQUIREMENTS**

Minimum requirements for products covered under this category are in accordance with UL 588, "Seasonal and Holiday Decorative Products."

### **UL MARKING**

Products Recognized under UL's Component Program are identified by markings consisting of the manufacturer's identification and catalog, model or other product designation. In addition, component products which are produced under the UL Component Recognition Program will also bear the Recognized Component Mark\*.

The Listing or Classification Mark of Underwriters Laboratories Inc. is not authorized for use on, or in connection with, Recognized Components. Only those components which actually bear the "Marking" should be considered as being covered under the Component Recognition Program.

\* The actual symbol will be shown on the guidecard.

APPENDIX B**Proposed ModelCard (QMT02)**

Polymeric Materials For Use In Seasonal &amp; Holiday Decorative Products – Component

UNDERWRITERS LABORATORIES INC  
333 PFINGSTEN RD  
NORTHBROOK, IL 60062

Date

E99999 (MEL)

RTI  
Mech

Material Deg	Color	Min Thk (mm)	Flame Class	Elec	W/Imp	W/O Imp	HWI	HAI	Specific Gravity
<b>Polypropylene (PP), furnished in the form of pellets or sheets.</b>									
<i>(Report Date: 01/03/2001)</i>									
PP-ABC	All	0.75	SC-1	90	90	90	3	3	0.902 – 0.918
DEF-SC0 (f1)	GN	0.75	SC-0	105	105	105	–	–	0.980 – 0.996
<b>Polyvinylchloride (PVC), furnished in the form of pellets</b>									
<i>(Report Date: 01/04/2001)</i>									
123-FR (f2)	GN, WT	0.5	SC-0	120	110	125	0	0	1.772 – 1.811
UV-456 (f1)	All	0.4	SC-1	120	95	115	2	3	1.320 – 1.359

(f1) Suitable for outdoor use with respect to exposure to Ultraviolet Light, Water Exposure and Immersion in accordance with UL 746C.

(f2) – Subjected to one or more of the following tests: Ultraviolet light, water exposure or immersion in accordance with UL 746C where the acceptability for outdoor use is to be determined by UL, Inc.

Marking: Company name or trade name, material designation, and the Recognition Mark, , on container, wrapper or molded on finished part.

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Cutoff

See General Information Preceding These Recognitions

Small-scale flame test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices, sub-assemblies and equipment, where the acceptability of the combination is determined by ULI.