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Self-Ballasted Lamps and Lamp Adapters

Underwriters Laboratories Inc. (UL)
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UL Standard for Safety
for
Self-Ballasted Lamps and Lamp Adapters, UL 1993

First Edition, Dated September 24, 1993

Revisions: This Standard contains revisions through and including May 26, 1999. UL is in the process of converting its Standards for Safety to the Standard Generalized Markup Language (SGML). SGML – an international standard (ISO 8879-1986) – is a descriptive markup language that describes a document's structure and purpose, rather than its physical appearance on the page. Significant benefits that will result from UL's use of SGML are increased productivity, reduced turnaround times, and data and information consistency, reusability, shareability, and portability. The changes noted in these revised pages are needed to modify the format and layout of this Standard to allow it to be converted to SGML. These editorial changes are now in effect.

A change is indicated by a note following the affected item. The note is preceded and followed by an asterisk.

The revisions dated May 26, 1999 include a reprinted title page (page 1) for this Standard.

The revisions dated May 26, 1999 were issued to remove the "94" prefix from the flammability classifications. This type of flame classification has become familiar globally, therefore there is no need to retain the "94" designation.

The master for this Standard at UL's Northbrook Office is the official document insofar as it relates to a UL service and the compliance of a product with respect to the requirements for that product and service, or if there are questions regarding the accuracy of this 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that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.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, Recognition and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

This Standard consists of pages dated as shown in the following checklist:

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UL 1993

Standard for

Self-Ballasted Lamps and Lamp Adapters

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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

Section 1 effective March 31, 1995

1.1 These requirements cover fluorescent self-ballasted lamps and fluorescent lamp adapters rated 120 volts nominal for use with Edison-base lampholders in incandescent lighting fixtures and portable electric lamps. These products are intended for use in accordance with the National Electrical Code, ANSI/NFPA 70.

1.1 revised September 25, 1996

1.2 These devices incorporate resistance, reactance, or electronic (solid state) type ballasts.

1.3 These requirements do not cover medium-to-medium base (E26) fittings that incorporate controls such as photocells, motion detectors, radio controls, or dimmers.

1.4 These devices are not intended for use with emergency exit fixtures or emergency exit lights.

1.5 A product having features, characteristics, components, materials, or systems new or different from those in use when the Standard was developed, and that involves a risk of fire, electric shock, or injury to persons, shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the level of safety for the user of the product as originally anticipated by the intent of this Standard.

2 Glossary

Section 2 effective March 31, 1995

2.1 For the purposes of these requirements the following definitions apply. See Figure 2.1 for the definitions in 2.3, 2.4 and 2.13.

2.2 The term "device" is used to denote fluorescent self-ballasted lamps and fluorescent lamp adapters covered by this standard. The name of the device is used if a requirement applies to only one of them.

2.3 DEVICE BASE – The Edison screw base that connects the device to an Edison screw lampholder in a lighting fixture or portable electric lamp.

2.4 DEVICE LAMPHOLDER – The lampholder provided for the replaceable fluorescent light source.

2.5 DEVICE LAMPHOLDER KEYING – A lampholder design that can accommodate only matching lamp bases.

2.6 ELECTRONIC BALLAST – A ballast, generally involving high frequency switching that is controlled by active components (transistors, thyristors, and the like), and with the lamp ballasting impedance provided by a series capacitive or inductive reactance appropriate for the high switching frequency.

2.7 LAMP ADAPTER – An adapter that has a replaceable light source, may have a replaceable starting device, and incorporates and permanently encloses all other elements that are necessary for operation.

2.8 LAMP CONNECTOR – A set of contacts attached to flexible conductors which provide a removable means for electrical connection to a lamp but does not provide mechanical support.

2.9 LIVE PART – Any conductive part where the measured voltage is greater than 30 V rms or 42.4 V peak (between parts of opposite polarity) to ground.

2.10 LOCATION –

a) DAMP LOCATION – An exterior or interior location that is normally or periodically subject to condensation of moisture in, on, or adjacent to, electrical equipment, and includes partially protected locations under canopies, marquees, roofed open porches, and similar locations.

b) DRY LOCATION – A location not normally subject to dampness, but may include a location subject to temporary dampness as in the case of a building under construction, provided ventilation is adequate to prevent an accumulation of moisture.

c) WET LOCATION – A location in which uncontrolled liquids may drip, splash, or flow on or against electrical equipment.

2.11 POWER CAPACITOR – A capacitor used with a magnetic ballast that is connected:

a) In series with a lamp or lamps and provides the ballast impedance for the lamp current, or

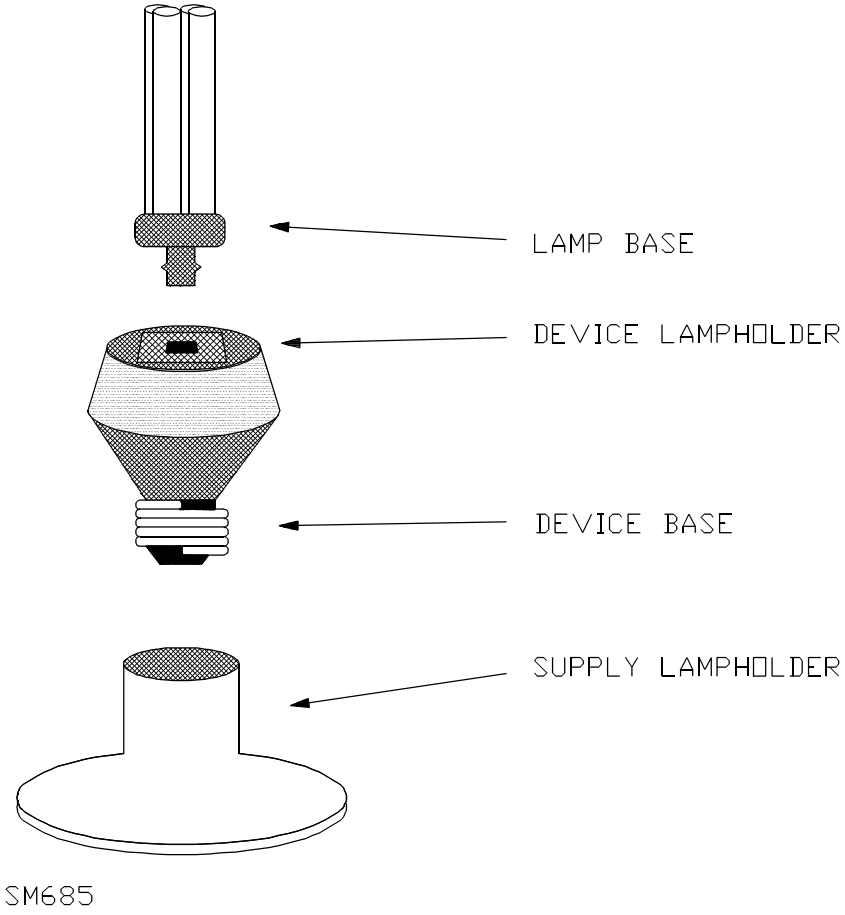
b) For power-factor correction across the input leads of the ballast or across an extension of the primary winding.

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

2.13 SUPPLY LAMPHOLDER – The Edison-base lampholder of an incandescent lighting fixture or portable electric lamp that can accommodate and supply power to a self-ballasted lamp or lamp adapter.

2.14 TYPE TEST – Testing of a representative sample of the device with the objective of determining if the device, as designed and manufactured, can meet the requirements of this standard.

Figure 2.1
Sample device



3 General

Section 3 effective March 31, 1995

3.1 Components

3.1.1 Except as indicated in 3.1.2, 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.

3.1.2 A component need not comply with a specific requirement that:

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

b) Is superseded by a requirement in this standard.

3.1.3 A component shall be used in accordance with its recognized ratings established for the intended conditions of use.

3.1.4 Specific components are recognized as being 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 for which they have been recognized.

3.2 Units of measurement

3.2.1 If a unit of measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value in International System (SI) units is the requirement.

3.2.2 All values of voltage and current are root mean square (rms) values unless otherwise noted.

3.3 References

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

4 Assembly and Packaging

Section 4 effective March 31, 1995

4.1 A device shall be completely assembled and wired with each electrical component mounted in place and with each splice and connection completed when shipped from the factory. The lamp may be packaged separately in the case of a lamp adapter.

CONSTRUCTION

5 Enclosure

Section 5 effective March 31, 1995

5.1 An enclosure shall be provided to reduce the risk of propagation of fire from within, and the risk of electric shock from unintentional contact with uninsulated live parts of a completely assembled device.

5.2 An enclosure shall be of metal or of a polymeric material that complies with Section 10, Polymeric Materials.

5.3 A metal enclosure shall comply with the minimum thickness specified in Table 5.1.

Table 5.1
Thickness of metal enclosures

Metal	Minimum thickness, mm (inch)
Die-cast metal	1.2 (0.047)
Uncoated sheet steel	0.66[a] (0.026)
Nonferrous sheet metal	0.81 (0.032)

[a] Uncoated sheet steel with a minimum of 0.51 mm (0.020 inch) is acceptable if the ballast part of the device is filled with potting compound.

Table 5.1 revised September 25, 1996

5.4 An enclosure constructed of iron or steel shall be protected against corrosion by plating, painting, or the equivalent on both inside and outside surfaces.

5.5 An enclosure shall not have openings wider than 2 mm (0.078 inch), unless they do not permit a 2 mm (0.078 inch) diameter rod of any length to contact live parts.

Exception: The uninsulated live parts of a lampholder into which a lamp connects are not required to comply.

5.5 revised September 25, 1996

5.5.1 The enclosure openings in a lamp adapter shall be evaluated with the lamp removed.

5.5.1 added September 25, 1996

5.6 A hole in an enclosure through which wires emerge to connect with a lamp connector shall be:

a) Close fitting to the emerging leads,

b) Free of burrs, sharp edges, and the like, that may abrade the insulation, and

c) Provided with strain-relief means that complies with the Strain Relief Test For Circular Fluorescent Lamps, Section 21.

6 Lamp Bases and Lampholders

Section 6 effective March 31, 1995

6.1 A device lampholder or device base shall comply with the appropriate requirements of the Standard for Edison-Base Lampholders, UL 496, and the Standard for Lampholders, Starters, and Starter Holders for Fluorescent Lamps, UL 542.

6.2 A device lampholder of a fluorescent lamp adapter is to be tested as specified in 13.9 with the lamp or lamps that the device is intended to accommodate. The lampholder shall be keyed to accommodate a specific lamp or lamps or comply with 6.3. The lampholder keying shall comply with Lamp Caps and Holders Together With Gauges for the Control of Interchangeability and Safety, IEC Publication 61-2.

6.2 revised September 25, 1996

6.3 A device lampholder not complying with 6.2 shall comply with Section 15, Lamp Starting and Operating Measurements.

7 Current-Carrying Parts

7.1 An insulated conductor shall have insulation rated for the voltage, temperature, and conditions of intended use.

7.1 effective March 31, 1995

7.2 The insulation of a conductor shall resist moisture absorption.

7.2 effective March 31, 1995

7.3 Where loosening or breaking of electrical connections involves a risk of fire or electric shock, the connections shall be soldered, welded, or otherwise securely connected. A soldered joint shall be mechanically secure before soldering.

Exception: A surface mount component with a maximum dimension of 13 mm (0.5 inch) need not comply with this requirement.

7.3 effective March 31, 1995

7.4 A wire 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, except on printed-wiring boards where components are properly inserted and soldered or mechanically secured by design.

c) It is twisted with other conductors.

7.4 revised June 2, 1995

7.5 Iron or steel, plain or plated, shall not be used for current-carrying parts.

Exception No. 1: A wire integral to the lamp light source need not comply with this requirement.

Exception No. 2: Iron and steel parts used for the containment of electromagnetic or electrostatic fields need not comply with this requirement.

7.5 revised June 2, 1995

7.6 An uninsulated live part shall be permanently mounted and secured to reduce the likelihood of turning or shifting position if such motion may result in a reduction of spacings below minimum acceptable values.

7.6 effective March 31, 1995

7.7 An accessible wire between a lamp connector for a circular lamp and the device enclosure shall:

a) Be continuous length (no splices) of stranded wire,

b) Incorporate a conductor of No. 20 AWG (0.52 mm^2) or larger; and

c) Have insulation 0.8 mm (1/32 inch) thick or greater.

7.7 revised September 25, 1996

7.8 A printed wiring board shall have a flammability rating of at least V-2.

7.8 revised May 26, 1999

8 Ballasts and Capacitors

Section 8 effective March 31, 1995

8.1 A ballast shall comply with the requirements of the Standard for Fluorescent-Lamp Ballasts, UL 935, and have Class P thermal protection.

8.1 revised and separated into 8.1 and 8.1.1 September 25, 1996

8.1.1 A ballast evaluated in the device shall:

a) Comply with the construction requirements of UL 935, the Standard for Fluorescent Lamp Ballasts;

b) Be subjected to the Abnormal-Temperature Test and Fault-Condition Test-Class P Thermally Protected Ballasts described in UL 935 with the device installed base down at a 40EC (104EF) ambient temperature, or installed in the test fixture described in the Normal Temperature Test, Section 17, at a 25EC (77EF) ambient temperature; and

c) Be measured for the maximum surface ballast temperature by a thermocouple on the outer surface of the device.

8.1 revised and separated into 8.1 and 8.1.1 September 25, 1996

8.1.2 A fusing resistor used for thermal protection shall comply with the Standard for Fusing Resistors and Temperature-Limited Resistors, UL 1412.

8.1.2 added effective March 25, 1998

8.1.3 A ballast operating above Class 105 temperature limits shall have an insulation system complying with the Standard for Systems of Insulating Materials — General, UL 1446.

Exception: A ballast completely enclosed in a polymeric enclosure complying with Section 10, Polymeric Materials, and with no accessible dead metal parts that are capable of being energized is not required to comply with UL 1446.

8.1.3 added September 25, 1996

8.2 A power capacitor shall comply with the applicable requirements specified in UL 935.

9 Spacings

Section 9 effective March 31, 1995

9.1 Spacings through air (clearance) and over surface of insulating material (creepage distance) between:

a) Uninsulated live parts of opposite polarity, and

b) An uninsulated live part and a dead metal part exposed to contact by persons,

shall be at least as described in 9.2 – 9.4.

Exception: Alternate spacing requirements may be applied as specified in 9.6 – 9.8.

9.2 A dead metal part, such as the head of a screw or rivet, is not considered to be exposed to contact if it is recessed to clear the surface by at least 5 mm (0.197 inch) in a hole not more than 7 mm (0.275 inch) in diameter.

9.3 Spacings described in 9.1 in a device intended for dry locations shall not be less than the values specified in Table 9.1.

Table 9.1
Dry locations

Potential, volts	Minimum spacings,mm (inch)	
	Through air	Over surface
less than 130 (176)[a]	3.2 (1/8)	6.4 (1/4)
131 — 250 (177 — 353)[a]	6.4 (1/4)	9.5 (3/8)
251 — 600 (354 — 846)[a]	9.5 (3/8)	9.5 (3/8)

[a] The figures in parenthesis are peak voltages. When evaluating the voltage of a circuit that produces other than sinusoidal waveform, both rms and peak values are evaluated and the requirement for the larger spacings is to be applied.

Table 9.1 revised September 25, 1996

9.4 Spacings described in 9.1 in a device intended for damp and wet locations, shall not be less than the values specified in Table 9.2

Table 9.2
Damp and wet locations

Potential, volts	Minimum spacings,mm (inch)	
	Through air	Over surface
less than 1000 (1410)[a]	9.5 (3/8)	12.7 (1/2)

[a] The figures in parenthesis are peak voltages. When evaluating the voltage of a circuit that produces other than an essentially sinusoidal waveform, both rms and peak values are considered and the requirement for the larger spacings is to be applied.

9.5 Spacings for the ballast shall comply with the requirements of the Standard for Fluorescent Lighting Ballasts, UL 935.

9.6 As an alternative to the spacing requirements specified in 9.3 – 9.5, the clearance and the creepage distance between conductive parts, that are rigidly held in place and reliably spaced in production, may be evaluated for compliance with the Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840. The spacings requirements in UL 840 shall not be applied to spacings to an exposed dead metal enclosure. Creepage distances shall not be less than clearances.

9.7 When applying the requirements specified in UL 840 to determine clearances, the device can be considered as operating on supply circuits having an over-voltage category of II.

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9.8 When applying the requirements specified in UL 840 to determine environmental pollution, the device can be evaluated with different environmental pollution degrees. The following conditions apply:

a) A device marked for damp or wet use shall be exposed to environmental pollution degree 3.

b) A device intended for dry locations shall be exposed to environmental pollution degree 2.

c) The portion of a printed wiring board covered with a potting compound or a conformal coating that complies with the requirements in Conformal-Coating Tests, Section 32, shall be exposed to environmental pollution degree 1.

10 Polymeric Materials

10.1 A polymeric material used to enclose electrical parts, or used to provide direct or indirect support of live parts shall comply with the requirements for portable equipment specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and with the requirements in 10.2 – 10.6 of this standard.

10.1 effective March 31, 1995

10.2 A polymeric material used to enclose electrical parts shall have a Relative Thermal Index (RTI) including electrical and mechanical with impact properties of at least the temperature measured during the Temperature Test, Section 17, unless the measured temperature is less than 65EC (150EF).

10.2 effective March 31, 1995

10.3 A polymeric enclosure shall have a flammability rating of at least V-1.

10.3 revised May 26, 1999

10.4 A polymeric enclosure of a device marked for wet location use shall comply with the Ultraviolet Light Exposure Test specified in the Standard for Polymeric Materials - Use in Electrical Equipment Evaluations, UL 746C.

10.4 revised June 2, 1995

10.5 With respect to UL 746C, the following applies:

a) The Abnormal Operation and Severe Conditions Tests need not be conducted;

b) Mold-Stress Relief Distortion shall be conducted by the air oven method and not the test cell method;

c) The Input After Mold-Stress Relief Distortion Test need not be conducted; and

d) The Volume Resistivity Test need not be conducted.

10.5 effective March 31, 1995

10.6 With respect to the Electrical/Mechanical Properties Table in UL 746C, the material need only comply with the following:

a) Comparative Tracking Index (CTI);

b) High Current Arc Resistance to Ignition (HAI);

c) Hot Wire Ignition (HWI); and

d) Relative Thermal Index (RTI).

10.6 effective March 31, 1995

11 Weight, Size, and Moment

Section 11 effective March 31, 1995

11.1 A device shall have weight, size, and moment limitations as specified in Table 11.1.

Table 11.1
Weight, size, and moment limitations

Device base	Maximum weight,[a,c] kg (pounds)	Maximum dimension, mm (inches)	Maximum moment,[a,b] N•m (inch-pounds)
E12 (Candelabra)	0.50 (1.15)	100 (3.92)	0.60 (5.54)
E17 (Intermediate)	0.75 (1.63)	143 (5.56)	0.09 (7.85)
E26 (Medium)	1.15 (2.5)	216 (8-1/2)[d,e]	1.35[c] (12)
E39 (Mogul)	1.70 (3.75)	324 (12.75)	2.05 (18)

[a] For weight and moment measurements, lamp adapters are to be provided with lamps.

[b] The moment is the weight of a device multiplied by the distance between the center contact of the device lamp base and the center of gravity of the device.

[c] Includes the weight of any glassware and/or shade provided with the device. See 11.3.

[d] Excludes lamp or lamp supports if instructions indicate that they should not be in place until after the device is installed and the maximum dimension of the completely assembled unit is less than 317 mm (12-1/2 inches).

[e] The maximum dimension is 317 mm if the device is provided with a slip-ring lamp base that reduces the likelihood of over-torquing by slipping at less than 1.13 N•m (10 in-lbf).

11.2 A device that is constructed so that alignment with the existing incandescent lighting fixture or portable electric lamp requires an adjustment greater than ±20 degrees shall be provided with adjustment of the device base with relation to the remainder of the device. Examples include:

a) Rectangular-shaped devices in which the device is to be parallel with existing walls when installed in a ceiling-type fixture; and

b) Devices incorporating a ballast compartment or lamp support arms that may have to be rotated more than 20 degrees to properly clear harps in portable electric lamps.

11.2 revised September 25, 1996

11.3 A device intended to be used with a shade or glassware shall be provided with the accessory.

11.4 A lamp adapter shall be provided with a positive means to retain the lamp or lamps in place in any possible mounting orientation, such as by clips, retaining springs, or the equivalent. A securing means relying solely on the electrical contacts of the lampholder does not meet this requirement.

11.4 revised September 25, 1996

11.5 When the integrity of the lamp securing means cannot be determined, the lamp adapter shall comply with the minimum retention force values specified in ANSI C81.62, the Standard for Lampholders for Electric Lamps, and ANSI C81.63, the Standard for Gauges for Electric Lamp Bases and Lampholders, using the appropriate plug gauge for the intended lamp type.

11.5 added September 25, 1996

12 Environmental Considerations

Section 12 effective March 31, 1995

12.1 A device not subjected to additional testing for environmental conditions is intended for use only in dry locations and is to be marked in accordance with 27.8(a). This device shall not be provided with any information such as markings, instructions, or illustrations either on the carton or with the device that implies or depicts a damp or wet location use.

12.2 A device intended for use in damp locations, such as within an enclosed outdoor fixture, shall be subjected to the Humidity Test, Section 23 and be marked as specified in 27.8(b).

12.3 A device intended for use in wet locations shall be subjected to the Water Spray Test, Section 24; the Cold Impact Test, Section 25; and be marked as specified in 27.8(c).

12.3 revised September 25, 1996

PERFORMANCE

13 General

Section 13 effective March 31, 1995

13.1 A device is to be subjected to the applicable tests described in Sections 14 – 23.

13.2 The requirements in Sections 14 – 23 involve type testing to determine that a representative sampling of production complies with the requirements of this standard.

13.3 All tests are to be conducted with the device connected to a supply circuit of rated frequency. The supply voltage is to be the maximum voltage but not less than 120 volts.

Exception No. 1: A device rated 50 – 60 hertz need only be tested at 60 hertz unless testing at 50 hertz represents a more severe condition.

Exception No. 2: A device without a frequency rating is to be tested at 60 hertz.

13.4 The voltage in other than the supply circuit is to be measured using a voltmeter or voltmeter-multiplier combination having a resistance of not less than 10,000 ohms per volt. Meters having higher input impedances are to be used if it is warranted by the impedance of the circuit under test. A voltmeter for measuring a supply circuit is not specified.

13.5 For determining values of voltage, a true rms indicating meter having a frequency response at least three times the frequency involved and having an adequate crest factor (ratio of peak to rms) is to be used. If applicable, consideration should be given to the d-c component of the waveshape. If a referee rms-voltage measurement is necessary, a meter with an input impedance of 10 megohms shunted by 30 picofarads of capacitance is to be used.

13.6 If it is necessary to determine peak-voltage value, an oscilloscope with a high-impedance (10 megohms minimum) input probe is to be used.

13.7 Prior to making the measurements in Sections 14 – 16, it may be necessary to make preliminary measurements using an oscilloscope to determine the nature of the available currents. An ac/dc meter is to be used for measuring dc.

13.8 A device and lamp or lamps are to be aged for 100 hours while connected to a supply of nominal rated voltage. After aging 100 hours, the unit shall be connected to a regulated source of supply at rated voltage and operated for 30 minutes, or until the wattage stabilizes, whichever occurs first prior to conducting any tests in Section 14, Input Measurements Test.

13.9 Where more than one fluorescent lamp has a common base, for example a G-23 base for 5, 7, and 9 watt twin tube lamps, and a G-24q-1 base for 10 and 13 watt quad lamps, tests on lamp adaptors are to be conducted with the lamps that will result in the most severe condition. See Lamp Caps and Holders Together With Gauges for the Control of Interchangeability and Safety, IEC Publication 61, for lamp base types. See also 6.2.

13.9 revised September 25, 1996

14 Input Measurements Test

Section 14 effective March 31, 1995

14.1 With the ballast energized at the input voltage and frequency in accordance with 13.3, 13.7, and 13.8, the input current shall not be more than 110 percent of the marked rating, and the input wattage shall not be more than 110 percent of the marked rating plus 0.5 watt with the device in the base up position controlling:

a) A lamp or lamps which the device lampholder can accommodate; and

b) No lamp in the case of a lamp adapter.

14.1 revised September 25, 1996

14.2 For a device with a marked power factor rating, the power factor is to be calculated.

$$P.F. = \frac{input\ wattage}{(input\ voltage)\ x\ (input\ current)}$$

The input wattage, voltage, and current are measured as in 14.1. The calculated power factor shall be equal to or greater than the marked rating. See 27.7 for additional marking requirements.

15 Lamp Starting and Operating Measurements

15.1 Lamp adapters with the lamp adapter energized at the input voltage and frequency as specified in 13.3, and with device lampholders not keyed in accordance with IEC Publication 61-2 (Lamp Caps and Holders Together with Gauges for the Control of Interchangeability and Safety), shall be in accordance with the lamp manufacturer's specifications. The measurements shall be carried out for each lamp type that can be accommodated by the device lampholder. The measured lamp voltage and current shall not differ by more than 10 percent from the rated value.

15.1 revised September 25, 1996

16 Leakage-Current Test

Section 16 effective March 31, 1995

16.1 A device with an exposed dead metal part shall comply with the leakage current requirements in the Standard for Fluorescent-Lamp Ballasts, UL 935. The measurement is to be made from any accessible dead metal part of the enclosure of the device.

17 Temperature Test

17.1 A device shall be tested as described in 17.2 – 17.12. The maximum temperatures shall not exceed those specified in Table 17.1 when corrected to a room ambient temperature of 25EC.

17.1 revised September 25, 1996

Table 17.1
Maximum acceptable temperature

Materials and components	EC	EF
A. COMPONENTS		
1. Capacitor	a,b	a,b
2. Fuses	90	194
3. Coil insulation systems[e]		
Class 105 insulation systems:		
Thermocouple method	90	194
Resistance method	95	203
Class 130 insulation systems:		
Thermocouple method	110	230
Resistance method	120	248
Class 155 insulation systems:		
Thermocouple method	135	275
Resistance method	140	284
Class 180 insulation systems:		
Thermocouple method	150	302
Resistance method	165	329
4. Potting compound	c	c
5. Printed-wiring boards	a	a
6. Internal wiring	a	a
7. Soldered joint of a resistance ballast	150	302
8. *Deleted*		
9. Lamp base without an integral starter	150	302
B. ELECTRICAL INSULATION		
1. Vulcanized fiber employed as electrical insulation for other than coil systems	90[d]	194
C. SURFACES		
1. Any outer polymeric surface	a	a

(Continued)

Table 17.1 (Cont'd)

[a] The rated temperature of the material or component is to be used.

[b] For a self-ballasted lamp, the rated temperature of the component is not prohibited from being adjusted to correspond with the maximum expected life of the lamp light source.

[c] Unless the material is thermosetting, the maximum potting compound temperature, when corrected to a 40EC (104EF) ambient temperature, is 15EC (27EF) less than the softening point of the compound as determined by the Test Method for Softening Point by Ring-and-Ball Apparatus, ASTM E28-67.

[d] For vulcanized fiber that has been investigated for use at a higher temperature, the higher temperature applies instead of the maximum temperature.

[e] For ballasts intended to comply with the exception to 8.1.3, the maximum acceptable coil temperature shall be the lowest temperature rating of any insulating material or component used in the ballast.

Table 17.1 revised September 25, 1996

17.2 A device shall be tested as follows:

a) If the device is capable of being installed in the smaller test fixture shown in Figure 17.1, it shall have temperatures measured with the device mounted in the test fixture which simulates operation in a typical recessed fixture. The device is to be tested base up.

b) A device that will not fit in the smaller test fixture shown in Figure 17.1 but can be installed in the larger test fixture shall be tested in such a test fixture. The device is to be tested base up.

c) A device exceeding the diameter of the test fixture, shall have temperatures measured with the device mounted on a draft-free bench. The device is tested with both a base up and base down orientation, unless it is obvious that one orientation would result in less severe heating.

17.2 effective March 31, 1995

Figure 17.1
Test box

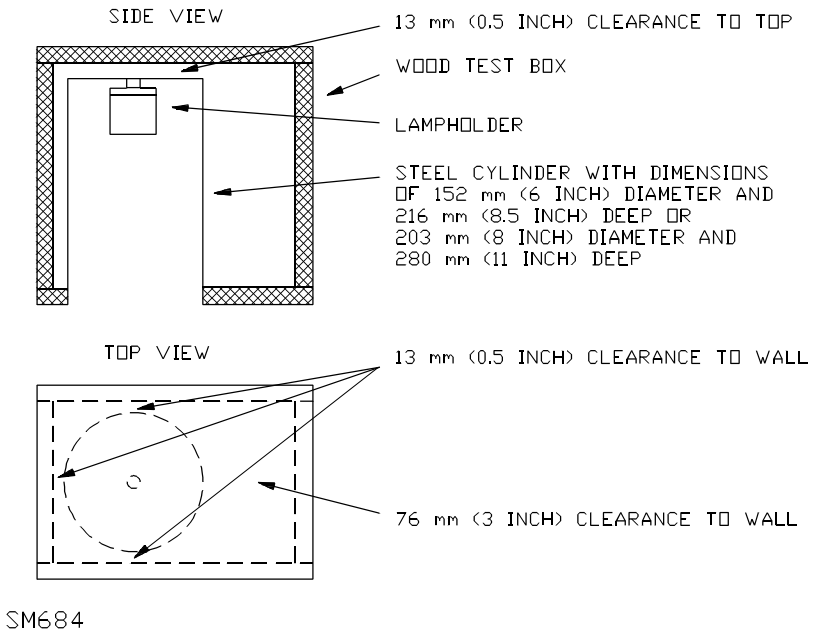


Figure 17.1 effective March 31, 1995

17.3 The test fixture consists of a steel or aluminum cylinder, closed at the top. The smaller cylinder is 152 mm (6 inches) in diameter and 216 mm (8.5 inches) deep while the larger cylinder is 203 mm (8 inches) in diameter and 280 mm (11 inches) deep. The cylinders are fabricated of steel, having a thickness between 0.76 and 1.27 mm (0.03 and 0.05 inch). The cylinders are painted white on all sides. Each cylinder is installed in a rectangular test box having four sides, a top, and bottom. The cylinder is flush to the test box bottom and the wood bottom has an opening the size of the cylinder diameter. The test box sides are constructed of plywood, grade C-D or better, and 10 mm (0.39 inch) thick, minimum. A thickness known as 1/2 inch trade size may be used. Three sides and the top are 13 mm (0.5 inch) from the nearest part of the cylinder. The fourth side is 76 mm (3 inch) from the nearest part of the cylinder. The supply lampholder is porcelain coated and has a cast metal cap bearing against the cylinder top.

17.3 revised September 25, 1996

17.4 If a device is marked as described in 27.9, the open bottom of the test fixture is to remain open for the temperature test, otherwise the device shall be tested with a 3 mm (0.125 inch) thick lens applied to the test fixture opening.

17.4 effective March 31, 1995

17.5 A lamp adapter is to be operated with the wattage and type of lamp or lamps that will fit. It may be necessary to conduct more than one temperature test using different wattage and type lamps in order to determine the most severe temperatures.

17.5 effective March 31, 1995

17.6 During the test, a device is to be energized at an input voltage and frequency in accordance with 13.3. A device intended for use on dimmer circuits shall be subjected to the dimmer tests described in Section 22.

17.6 effective March 31, 1995

17.7 Thermocouples are to consist of wires not larger than No. 24 AWG (0.21 mm^2) and not smaller than No. 30 AWG (0.05 mm^2). It is standard practice to employ thermocouples consisting of No. 30 AWG iron and constantan wires and a potentiometer-type or electronic instrument; and such equipment is to be used whenever referee temperature measurements by thermocouples are necessary. The thermocouple wires are to conform with the requirements for special thermocouples as listed in the table of limits of error of thermocouples, Temperature-Measurement Thermocouples, ANSI MC96.1.

Exception: Thermocouples consisting of chromel-alumel (Type K) or copper - constantan (Type T) wires need not comply, if it is determined that high frequency ballast operation results in eddy current heating of iron and constantan thermocouples.

17.7 revised September 25, 1996

17.8 A thermocouple junction and the adjacent thermocouple lead wire are to be securely held in thermal contact with the surface of the material of which the temperature is being measured. In most cases, adequate thermal contact will result from securely cementing the thermocouple in place. If a metal surface is involved, brazing or soldering the thermocouple to the metal may be necessary.

17.8 effective March 31, 1995

17.9 The temperature on a winding may be measured by the thermocouple method or by the change-of-resistance method (comparing the resistance of the winding at the temperature to be measured with its resistance at a known temperature) using the formula specified in 17.11.

17.9 effective March 31, 1995

17.10 The test is to be continued until constant temperatures are obtained. A temperature is considered to be constant if:

a) The test has been running for at least 3 hours, and

b) Three successive readings, taken at 15-minute intervals, are within 1EC of one another and are still not rising.

17.10 effective March 31, 1995

17.11 The temperature of a winding is to be calculated by the following formula:

$$T_H = \frac{R_H}{R_c}[k + T_1] - [k + T_2]$$

in which:

T_1 *is the temperature of the coil in degrees C when* R_c *is measured;*

T_H *is the temperature of the coil in degrees C at the end of the test;*

R_H *is the resistance of the coil at the end of the test;*

R_c *is the resistance of the coil at the beginning of the test;*

T_2 *is the room temperature at the end of the test in degrees C;*

k is 234.5 for copper or 225.0 for electrical conductor grade (EC) aluminum. Values of the constant for other grades must be determined.

17.11 revised September 25, 1996

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

17.12 effective March 31, 1995

18 Dielectric Voltage-Withstand Test

Section 18 effective March 31, 1995

18.1 A device with accessible dead metal parts shall withstand for 1 minute, without breakdown, the application of a test potential of 1240 volts between all live parts and all accessible dead metal parts. The test shall be performed while the device is hot from normal operation.

18.2 The dielectric voltage-withstand test is to be conducted using test equipment having a 500 volt-ampere or larger transformer, the output voltage of which can be varied. The applied potential is to be increased from zero until the required test value is reached, and is to be held at that value for 1 minute. The increase in the applied potential is to be at a substantially uniform rate and as rapidly as consistent with its value being correctly indicated by a voltmeter.

18.3 The sensitivity of the test equipment shall be such that when a 120,000 ohms minimum calibrating resistor is connected across the output, the equipment indicates acceptable performance for any output voltage less than the specified test voltage, and indicates unacceptable performance for any output voltage equal to or greater than the specified test voltage.

19 Harmonic Distortion Test

Section 19 effective March 31, 1995

19.1 A device rated for a harmonic factor (HF) or total harmonic distortion (THD) of the supply current is to be tested as described in 19.2 and 19.3. With the device base up and energized at the input voltage and frequency in accordance with 13.3, HF or THD shall not be more than the manufacturer's specified rating made for the device by 10 percent when controlling a lamp or lamps that the device lampholder is intended to accommodate.

19.1 revised September 25, 1996

19.2 The supply for the test is to be generated by an electronic power supply having a voltage distortion of less 0.5 percent. Since the source (supply) voltage will affect the magnitude of the harmonics, for measuring purposes, the supply impedance shall be 0.08 ohm. For some electronic supplies it may be necessary to add resistance to obtain the specified supply impedance.

19.3 The magnitude of the various harmonics of the supply frequency is to be recorded to the thirty-third (33) harmonic. The harmonic factor is the ratio of the harmonic content to the rms value of the fundamental. The harmonic factor (HF) is to be calculated as follows:

$$HF = \frac{\sqrt{I_2^2 + I_3^2 + I_4^2 + \ldots}}{I_1}$$

The total harmonic distortion (THD) is to be calculated as follows:

$$THD = \frac{\sqrt{I_2^2 + I_3^2 + I_4^2 + \ldots}}{\sqrt{I_1^2 + I_2^2 + I_3^2 + I_4^2 + \ldots}}$$

in which:

I_1 = 100 percent at the fundamental frequency;

I_2 = magnitude, in percent of the fundamental, of the second harmonic;

I_3 = magnitude, in percent of the fundamental, of the third harmonic.

19.3 revised September 25, 1996

20 Drop Test

Section 20 effective March 31, 1995

20.1 A device is to be subjected to the tests described in 20.2 and 20.3. There shall be no damage to the enclosure making uninsulated live parts or internal wiring accessible to contact or defeating the mechanical protection of internal parts of the equipment afforded by the enclosure.

20.1 revised September 25, 1996

20.2 A device is to be subjected to the impact test described in (a) and (b):

a) A device is to be dropped 0.91 m (3 ft) striking a hardwood surface in the position most likely to produce adverse results. The hardwood surface is to consist of a layer of nominal 25 mm (1 in) thick tongue-and-groove oak flooring mounted on two layers of nominal 19 mm (3/4 in) thick plywood. The assembly is to rest on a concrete floor or an equivalent nonresilient floor during the test.

b) A device is to be dropped three times so that, in each drop, the sample strikes the surface in a position different from those in the other two drops.

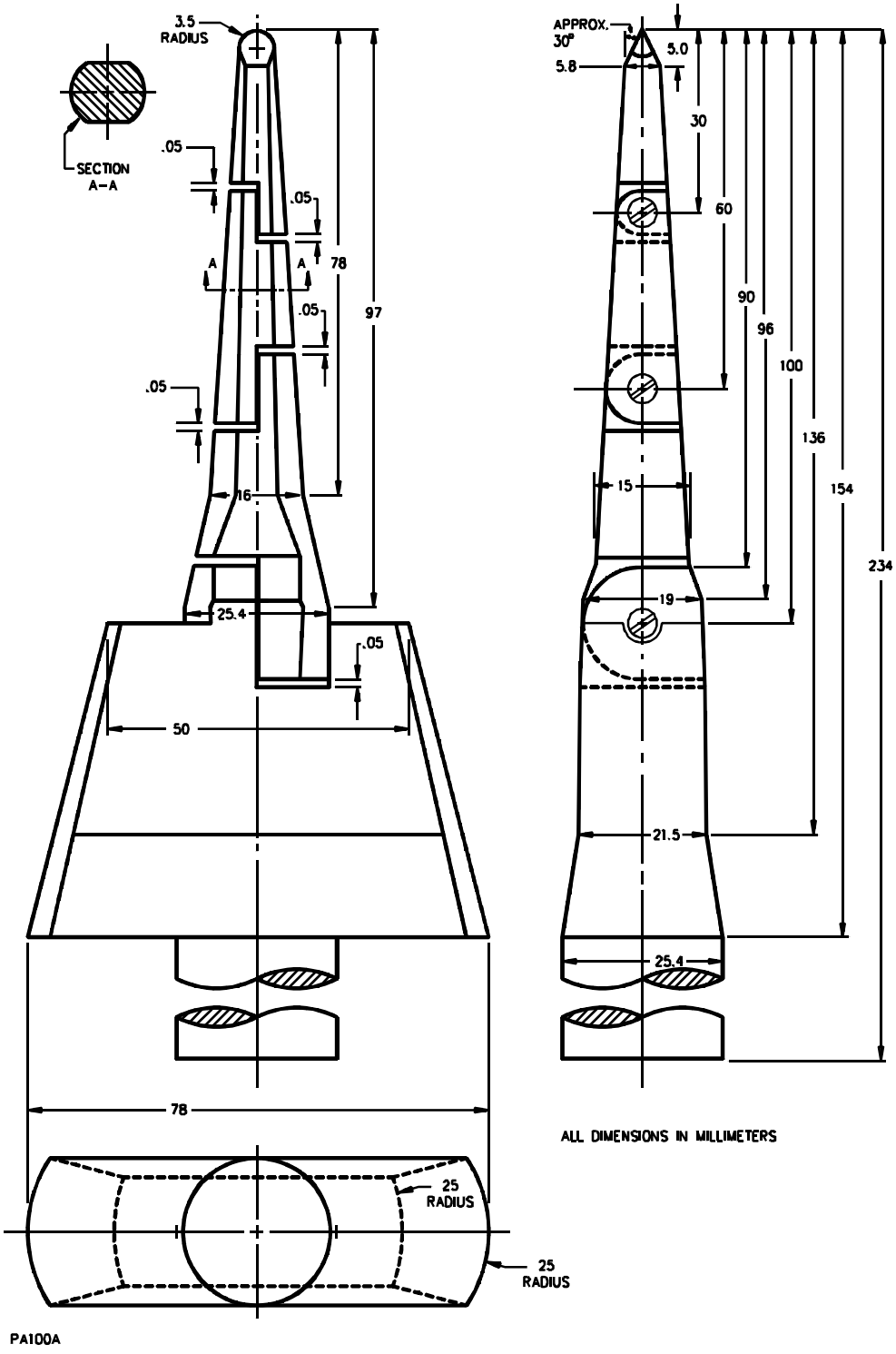
20.3 A device having a metal enclosure shall subsequently be subjected to the Dielectric Voltage-Withstand Test in Section 18. There shall be no breakdown as a result of the Dielectric Voltage-Withstand Test. There shall be no damage to the enclosure making uninsulated live parts or internal wiring accessible to contact, which is determined using the test probe in Figure 20.1, or defeating the mechanical protection of internal parts of the equipment afforded by the enclosure.

20.3 revised September 25, 1996

20.4 Accessiblity criteria is not applied for broken lamps.

20.5 A device intended for use in wet locations shall be subjected to the Cold Impact Test, Section 25.

Figure 20.1
Accessibility probe



21 Strain Relief Test For Circular Fluorescent Lamps

Section 21 effective March 31, 1995

21.1 The strain-relief means provided for lamp connector lead wires exiting the device enclosure is to be tested as described in 21.2. There shall be no movement of any lead greater than 1.6 mm (1/16 inch).

21.2 To determine the acceptability of the means for strain relief, each individual lead wire is to be subjected to a perpendicular force of 22 N (5 pounds) for 1 minute.

21.2 revised September 25, 1996

22 Tests on Dimmer Circuits

Section 22 effective March 31, 1995

22.1 General

22.1.1 A device which may be used on dimmer circuits shall be subjected to the Normal Test specified in 22.2.1. A device not intended for use on dimmer circuits shall be marked in accordance with 27.5 and be subjected to the Abnormal Test specified in 22.3.1.

22.2 Normal test

22.2.1 A device intended for use on dimmer circuits shall be subjected to the Temperature Test, Section 17, while operating from the sources of supply indicated in 22.4.1 and 22.5.1. The device shall comply with the temperature limits specified in Table 17.1.

22.3 Abnormal test

22.3.1 A device not intended for use on dimmer circuits shall be operated while connected to the sources of supply indicated in 22.4.1 and 22.5.1. The device shall be operated in a 25EC (77EF) ambient while oriented base down. A single layer of cheesecloth shall be draped around the device excluding the light source during the test. The device shall be operated for 7 1/2 hours. The cheesecloth shall not flame, glow, or char. There shall be no damage to the enclosure that would allow live parts to be contacted by the test probe in Figure 20.1. The device shall comply with the Dielectric Voltage-Withstand Test, Section 18.

22.3.2 The cheesecloth specified in 22.3.1 is to be bleached cheesecloth, 914 mm (36 inches) wide, running 26 – 28 square meters per kilogram (14 – 15 yd^2/lb) and having what is known in trade as a count 32 by 28; that is, for any square centimeter 13 threads in one direction and 11 in the other direction (for any square inch, 32 threads in one direction and 28 in the other direction). The cloth is to be loosely draped over the device being tested in order to serve as a flame indicator (presence of ash or burnt holes) but is not to be used as a blanket to trap heat.

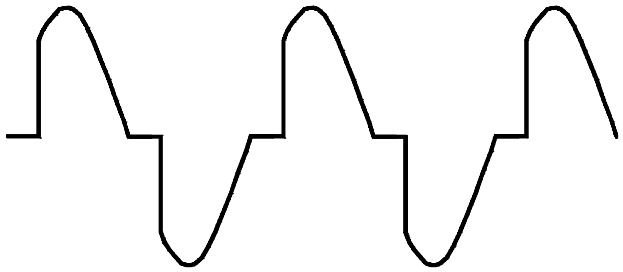
22.4 Half-wave rectified supply

22.4.1 A source of supply as specified in 13.3 is to be operated with a single, appropriately rated, semiconductor diode in series with the ungrounded conductor of the supply.

22.5 Adjustable dimmer supply

22.5.1 A source of supply as specified in 13.3 is to be operated with an adjustable dimmer electrically wired in series. The dimmer is to be an adjustable phase-cut type that does not contain any components in its output circuitry for waveform smoothing and should produce an output waveform with a variable conduction angle similar to that depicted in Figure 22.1. The dimmer is to be adjusted to cause the maximum heating of the device.

Figure 22.1
Phase-cut type dimmer
output waveform



SM664

23 Humidity Test

Section 23 effective March 31, 1995

23.1 A device intended for use in damp or wet locations and having accessible dead metal parts is to be exposed for 48 hours to moist air having a relative humidity of 93 ±2 percent at a temperature of 25.0 ±2.0EC (77 ±3.6EF). Following the 48-hour period and while still exposed to moist air, the device shall comply with the requirements for dielectric voltage-withstand between current-carrying parts and accessible dead metal parts in accordance with Section 18 and operate normally. See 12.2.

24 Water Spray Test

24.1 A device intended for use in wet locations shall be subjected to the test described in 24.2 and 24.3. Water shall not enter the ballast or device lampholder compartments.

Exception: A device constructed so that it is sealed to exclude water need not be subjected to this test.

24.1 revised September 25, 1996

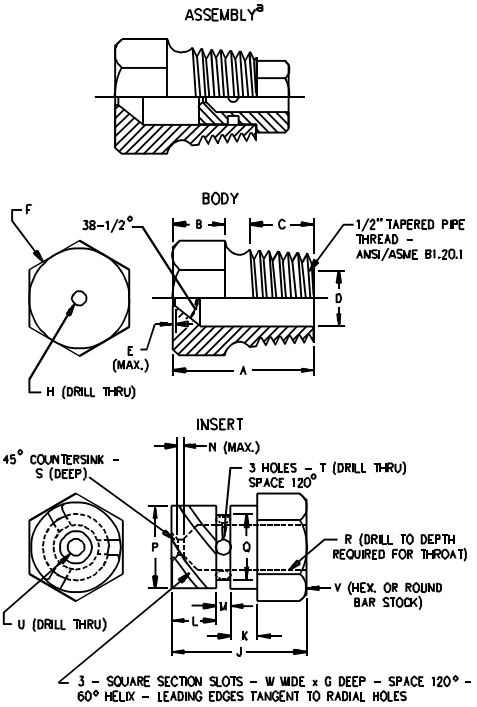
24.2 A device is to be tested by mounting base up as in intended service, and then applying a water spray as described in 24.3 for 1 hour.

24.2 effective March 31, 1995

24.3 The water spray test apparatus is to consist of three spray heads constructed in accordance with the details specified in Figure 24.1 and mounted in a water supply pipe rack as illustrated in Figure 24.2. The water pressure is to be maintained at each spray head at approximately 34.5 kPa (5 psi). The distance between the center nozzle and the device is to be approximately 1.4 m (55 inches). The device is to be brought into the focal area of the three spray heads in such a position and under such conditions that water will be most likely to enter, except that consideration is to be given to the normal mounting position.

24.3 effective March 31, 1995

Figure 24.1
Spray head assembly



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

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

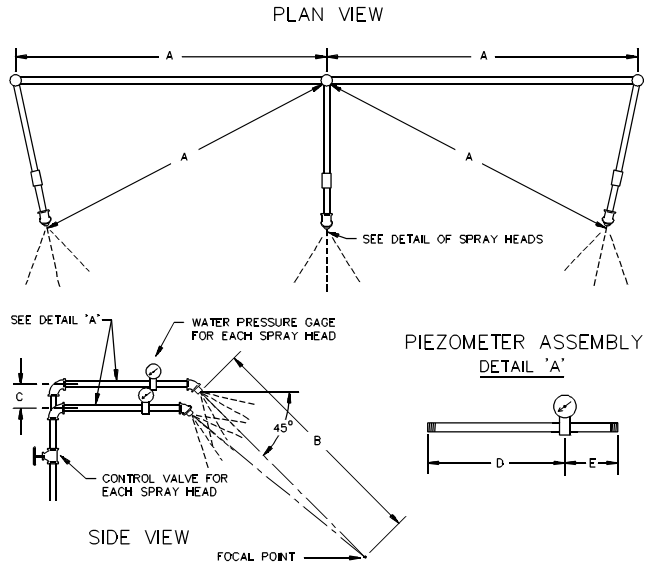
[b] ANSI B94.11M Drill Size

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

RT100F

Figure 24.1 revised May 26, 1999

Figure 24.2
Spray head pipe rack



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

RT101F

Figure 24.2 revised May 26, 1999

25 Cold Impact Test

Section 25 effective March 31, 1995

25.1 The cold impact test (minus 35 degree C) shall be conducted as described in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. See 12.3.

Exception No. 1: A device intended for use only in dry locations and marked as specified in 27.8(a) need not be subjected to this test.

Exception No. 2: A device intended for use in damp locations and marked as specified in 27.8(b) need not be subjected to this test.

MANUFACTURING AND PRODUCTION TESTS

26 Dielectric Voltage-Withstand Test

Section 26 effective March 31, 1995

26.1 Each device shall withstand without electrical breakdown, as a routine production-line test, the application of a potential between current-carrying parts of the supply circuit and accessible dead metal as indicated in Table 26.1.

Exception: Devices having no accessible metal parts, other than the screw shell of the device lamp base, need not be tested.

26.1 revised September 25, 1996

Table 26.1
Production-line test conditions

Condition	Application time, seconds	Applied potential	
		40 — 70 hertz	DC
A	60	1240	1754
B	1	1488	2104

26.2 The production-line test is to be in accordance with either condition A or B of Table 26.1.

26.3 The device may be in a heated or unheated condition for the test.

26.4 The test is to be conducted when the device is fully assembled. It is not intended that the product be unwired, modified, or disassembled for the test.

Exception: The test may be performed before final assembly if the test represents the completed product.

26.5 A device employing a solid-state component that is not relied upon to reduce a risk of electric shock and that can be damaged by the dielectric potential may be tested before the component is electrically connected provided that a random sampling of each day's production is tested at the potential specified in Table 26.1. The circuitry may be rearranged for the purpose of the test to reduce the likelihood of solid-state component damage while retaining representative dielectric stress of the circuit.

26.6 The test equipment shall include a transformer having an essentially sinusoidal output, a means of indicating the test potential, an audible or visual indicator of electrical breakdown, and either a manually reset device to restore the equipment after electrical breakdown or an automatic reject feature of any unacceptable unit.

26.7 If the output of the test equipment transformer is less than 500 volt-amperes, the equipment shall include a voltmeter in the output circuit to directly indicate the test potential.

26.8 If the output of the test equipment transformer is 500 volt-amperes or larger, the test potential may be indicated:

a) By a voltmeter in the primary circuit or in a tertiary-winding circuit,

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

c) For equipment having a single test-potential output, by a marking in a readily visible location to indicate the test potential. When marking is used without an indicating voltmeter, the equipment shall include a positive means, such as an indicator lamp, to indicate that the manually reset switch has been reset following a dielectric breakdown.

26.9 Test equipment other than that described by 26.6 – 26.8 may be used if found to accomplish the intended factory control.

MARKINGS

27 Device Markings

27.1 Devices covered by this standard shall be legibly and permanently marked with:

a) The manufacturer's name, trade name, or trademark or other descriptive marking by which the organization responsible for the product may be identified;

b) A distinctive catalog number or the equivalent;

c) An electrical rating including input voltage, frequency, wattage, and current; and

d) The date or other dating period of manufacture not exceeding any three consecutive months. The date code marking may appear on the surface of the device or the lamp base screw shell.

Exception No. 1: The frequency may be omitted if the ballast is an electronic circuit that operates regardless of the input frequency within a range from 50 to 60 Hz.

Exception No. 2: If the product is marked with the input wattage and the power factor is 0.9 or greater, the current may be omitted.

Exception No. 3: The manufacturer's identification may be in a traceable code if the device is identified by the brand or trademark owned by a private labeler.

Exception No. 4: The date of manufacture may be abbreviated; or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer, if the code:

a) Does not repeat in less than 10 years; and

b) Does not require reference to the production records of the manufacturer to determine when the product was manufactured.

Exception No. 5: The wattage rating need not be marked on an adapter.

27.1 revised June 2, 1995

27.2 All markings shall have lettering in which:

a) The precautionary signal word is at least 2.75 mm (7/64 inch) high;

b) The text is at least 1.5 mm (1/16 inch) high and contrasting in color to the background; and

c) If molded or stamped in a material, the text is at least 2.0 mm (5/64 inch) high and, if not contrasting in color, a depth or raised height of at least 0.5 mm (0.02 inch).

27.2 effective March 31, 1995

27.3 If a manufacturer produces or assembles devices at more than one factory, each finished device shall have a distinctive marking – which may be in code – by means of which it can be identified as the product of a particular factory.

27.3 effective March 31, 1995

27.4 A lamp adapter shall be marked with a rating for each replacement lamp or lamps in watts.

27.4 effective March 31, 1995

27.5 A device that is not intended to be used on a dimming circuit shall be marked "Not for use with dimmers."

27.5 effective March 31, 1995

27.6 If a device is marked with a harmonic distortion factor or total harmonic distortion, the amount shall not exceed the values measured as described in Harmonic Distortion Test, Section 19.

27.6 effective March 31, 1995

27.7 A device may be marked with the power factor rating if tested in accordance with 14.2. A device may be alternately marked "high power factor" or "hpf" if the calculated power factor is 0.9 or greater.

27.7 effective March 31, 1995

27.8 A device shall be marked where readily visible to the user with the signal word "CAUTION" and the following or equivalent, as applicable:

a) A device intended for use only in dry locations shall be marked: "Risk of Electric Shock – Use In Dry Locations Only."

b) A device intended for use in damp locations and subjected to the Humidity Test, Section 23 may be marked: "Risk of Electric shock – Do Not Use Where Directly Exposed To Water."

c) A device intended for use in wet locations and subjected to the Water Spray Test, Section 24; the Humidity Test, Section 23; and the Cold Impact Test, Section 25; may be marked: "Risk of Electric Shock – When Exposed to Water Use This End Up" with an arrow pointing toward the device base.

27.8 effective March 31, 1995

27.9 There shall be a marking to indicate "Not for use in totally enclosed recessed fixtures," unless the device is tested with the lens described in 17.4.

27.9 effective March 31, 1995

28 Instructions

28.1 A device shall be provided with the instructions specified in 28.2 – 28.4 on an information sheet packaged with the device or on the packaging for the device.

28.1 revised September 25, 1996

28.2 Instructions shall include the statement: "Added weight of the device may cause instability of a free-standing portable lamp. Use only with portable table lamps in which the distance from the bottom of the base to the top of the lampholder does not exceed three (3) times minimum base width. Use only with portable table lamps which are provided with lamp shades, "or the equivalent.

Exception No. 1: A device constructed for use only in recessed fixtures, such as a PAR or R lamp type adapter, need not comply with this requirement.

Exception No. 2: Devices weighing less than 200 g (0.44 lbs) need not comply with this requirement.

28.2 effective March 31, 1995

28.3 A device employing a lamp that extends outside the harp of a portable lamp shall be marked in the installation instructions with the following or equivalent: "Use only with a portable table lamp that is provided with a shade."

Exception: A device marked in the installation instructions as specified in 28.2 need not comply with this requirement.

28.3 revised June 2, 1995

28.4 The instructions shall include the statement, "This device is not intended for use with emergency exit fixtures or emergency exit lights."

28.4 effective March 31, 1995

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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

Capacitors – UL 810
Capacitors, Across-the-Line, Antenna-Coupling, and Line-By-Pass, for Radio- and Television-Type Appliances – UL 1414
Flexible Cord and Fixture Wire – UL 62
Fluorescent-Lamp Ballasts – UL 935
Lampholders, Edison-Base – UL 496
Lampholders, Starters, and Starter Holders for Fluorescent Lamps – UL 542
Plastic Materials for Parts in Devices and Appliances, Tests for Flammability of – UL 94
Polymeric Materials – Long Term Property Evaluations – UL 746B
Polymeric Materials – Use in Electrical Equipment Evaluations – UL 746C
Printed-Wiring Boards, Electrical – UL 796
Systems of Insulating Materials – UL 1446

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