

UL 298

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Portable Electric Hand Lamps

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for
Portable Electric Hand Lamps, UL 298

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Revisions: This Standard contains revisions through and including September 16, 1998. 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 September 16, 1998 include a reprinted title page (page 1) for this Standard.

As indicated on the title page (page 1), this UL Standard for Safety has been adopted by the Department of Defense.

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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that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.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.

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1

UL 298

Standard for

Portable Electric Hand Lamps

Prior to the first edition, the requirements for the products covered by this standard were included in the Standard for Cord Sets and Power-Supply Cords, UL 817.

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Second Edition – November, 1980

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Fourth Edition

November 25, 1996

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

The Department of Defense (DoD) has adopted UL 298 on April 23, 1984. The publication of revised pages or a new edition of this standard will not invalidate the DoD adoption.

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 differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, 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 portable electric hand lamps rated 125 V, 300 W or less for use in accordance with the National Electrical Code.

1.2 These requirements cover incandescent Edison-base portable electric hand lamps of the admedium-, medium-, intermediate- and candelabra-base sizes.

1.3 These requirements do not cover portable hand lamps intended for outdoor use, or portable hand lamps for use in hazardous locations or above hazardous locations as defined in the National Electrical Code.

1.4 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this Standard, 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 acceptable level of safety as originally anticipated by the intent of this Standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this Standard cannot be judged to comply with this Standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this Standard.

2 Glossary

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

2.2 **HAND LAMP FITTING** – A device including a lampholder assembly, a lamp guard, with or without a hook for hanging, a handle, and provisions for assembly on a power-supply cord.

2.3 **HANDLE** – A part of insulating material to be grasped by hand in order to direct the light.

2.4 **HOOK FOR HANGING** – A projection attached to, or formed as a part of, a hand lamp fitting (the lamp guard or handle) to be used for hanging.

2.5 **LAMP GUARD** – A protective enclosure for the lamp having provision for lamp replacement.

2.6 **LAMPHOLDER ASSEMBLY** – A lampholder wiring device, to be enclosed in the hand lamp fitting, with provisions for the connection of the power-supply cord conductors and with or without receptacle contacts. Insulating barriers may be included. The lampholder assembly may have a switch to control the lamp.

2.7 **PORTABLE HAND LAMP** – A complete assembly consisting of a hand lamp fitting with a power-supply cord (without a through-cord switch) for connection to a receptacle outlet.

2.8 **POWER-SUPPLY CORD** – A length of flexible cord terminating at one end in an attachment plug to connect with a receptacle outlet. The free end is available for connection to a hand lamp fitting.

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 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.

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

3.4 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.

4 Units of Measurement

4.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

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

6 General

6.1 A portable hand lamp shall employ materials throughout that are acceptable for the particular use.

6.2 The overall length of the assembled portable hand lamp shall not be less than 6 feet (1.83 m) when measured as described in 6.3.

Exception: A portable hand lamp intended for use with a cord reel need not comply with this requirement if it is provided with a power-supply cord a minimum of 1 ft (30.5 cm) as measured from the hand lamp fitting to the face of the attachment plug and marked in accordance with 40.12 and 40.13.

6.3 The minimum length mentioned in 6.2 is to be taken as the overall length of the complete assembly, including the guard and line fitting, but not including the blades of an attachment plug.

6.4 Live parts of a portable hand lamp shall be located or enclosed to provide protection against unintentional contact with live parts. See 6.5.

6.5 Compliance with 6.4 requires that the integrity of the location and the enclosure of live parts be maintained under conditions of normal use and reasonably foreseeable conditions of abnormal use including that described in Dielectric Voltage-Withstand, Section 27.

7 Spacings

7.1 The spacing between uninsulated live parts of opposite polarity, and between uninsulated live parts and accessible metal that may be grounded, shall not be less than 1/4 inch (6.4 mm) through air or 3/8 inch (9.5 mm) over surface.

Exception No. 1: These spacings do not apply between uninsulated live parts of a wiring device, such as a lampholder, and dead metal that is part of the wiring device. See 3.1.

Exception No. 2: A spacing through air or over surface of not less than 3/64 inch (1.2 mm) is acceptable between the screw shell of a lampholder and a grounded dead metal part.

7.2 A barrier or liner of insulating material used to provide spacings shall be of material acceptable for the application and not less than 0.028 inch (0.71 mm) thick, except that a barrier which is securely held in place and not exposed nor otherwise likely to be mechanically damaged after installation may be less than 0.028 inch (0.71 mm) but not less than 0.016 inch (0.41 mm) thick.

8 Enclosure and Other Insulating Materials

8.1 An insulating material acceptable for the particular application shall be used for:

- a) The handle,
- b) The enclosure of the lampholder interior, and
- c) The enclosure of any other live part.

8.2 Insulating materials of a portable hand lamp fitting shall be:

- a) Phenolic (150EC, 302EF),
- b) Urea (100EC, 212EF),
- c) Wood (90EC, 194EF),
- d) Rubber (see Accelerated Aging, Section 23, and Insulation Resistance, Section 25),
- e) PVC materials (see Table 23.1), or
- f) Other materials recognized for use at 90EC (194EF) or higher temperatures.

8.3 The determination of the acceptability of an insulating material shall include consideration of aging characteristics relative to its operating temperatures.

8.4 Insulating materials operating in excess of their recognized temperature limits are not considered to be acceptable with respect to aging characteristics.

Exception: Insulating materials operating in excess of their recognized temperature limits in localized areas adjacent to the screw shell or lamp (for example, the lampholder rim or screw-shell enclosure) shall be subjected to an extended use test. See the Extended Use Test, Section 24.

8.5 A fiber liner around a screw shell that serves solely as a thermal barrier, and does not provide electrical spacings or the overall enclosure of live parts, may operate at a temperature in excess of 90EC (194EF).

8.6 Fiber, including vulcanized fiber, shall not be relied upon to support or to provide the overall enclosure of live parts. See 7.2 and 9.4.

9 Hand Lamp Fittings

9.1 A hand lamp fitting shall provide for connection of the intended power-supply cord and strain relief. See Strain Relief, Section 14, and Strain Relief, Section 20.

9.2 A hand lamp fitting shall have acceptable mechanical strength. See Crushing, Section 22, Abnormal Operation, Section 28, and the Drop Test, Section 29.

9.3 There shall be ample space within a fitting for connection of internal wiring.

9.4 Metal-shell lampholders with paper liners shall not be used. This requirement does not preclude the use of an impregnated-paper liner around the lampholder screw shell as a thermal barrier. See 8.5.

9.5 Parts of a hand lamp fitting, such as switches and lampholder assemblies, shall be prevented from any turning which would apply tension to wiring connections, cause damage to the wiring, reduction of spacings, or otherwise adversely affect the assembly.

9.6 A hand lamp fitting shall have a lamp guard, with or without a hook or equivalent means for temporary support. No part of the assembly shall have a hole, indentation, projection, or other feature that could be used for permanent mounting of the assembly. This does not preclude acceptance of projections formed to provide a finger guard or grip in the handle or needed for the assembly of the lamp guard or other parts.

9.7 If provided, receptacle outlets of a portable hand lamp shall be of the general-purpose 15-A, 125-V, three-wire grounding type. See 39.2 and Figure 9.1.

9.8 When individually packaged, a hand lamp fitting shall be provided with instructions for proper assembly. See 40.8.

9.9 There shall not be more than two receptacle outlets in a portable hand lamp.

9.10 A portable hand lamp assembled to Type SVT, SVTO, SVTOO, SVO, or SVOO flexible cord shall not have receptacle outlets. See the Exception to 13.1.

9.11 There shall be an obstruction on the face of any 15-A, 125-V parallel-slot grounding-type receptacle outlet to prevent grounding-type attachment plugs from being inserted in the outlet with their grounding pins outside the body of the outlet. The obstruction shall be sufficiently large and substantial to necessitate deliberate displacement of the grounding pin or other attachment plug contact members during and as the result of improper mating of the attachment plug with the outlet. See Figure 9.2.

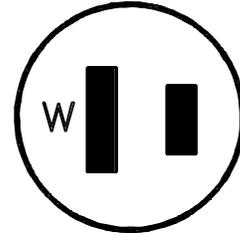
Figure 9.1
15 Ampere general-purpose slot and blade configurations

Figure 9.1 revised September 16, 1998

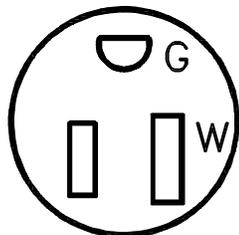
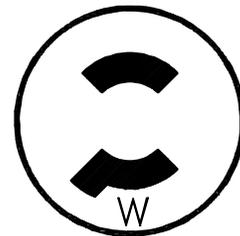
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OUTLET

PLUG

POLARIZED

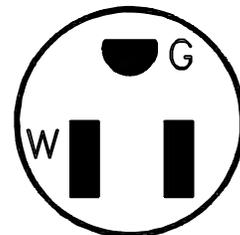


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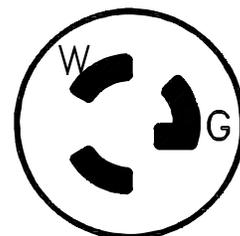
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L5-15R

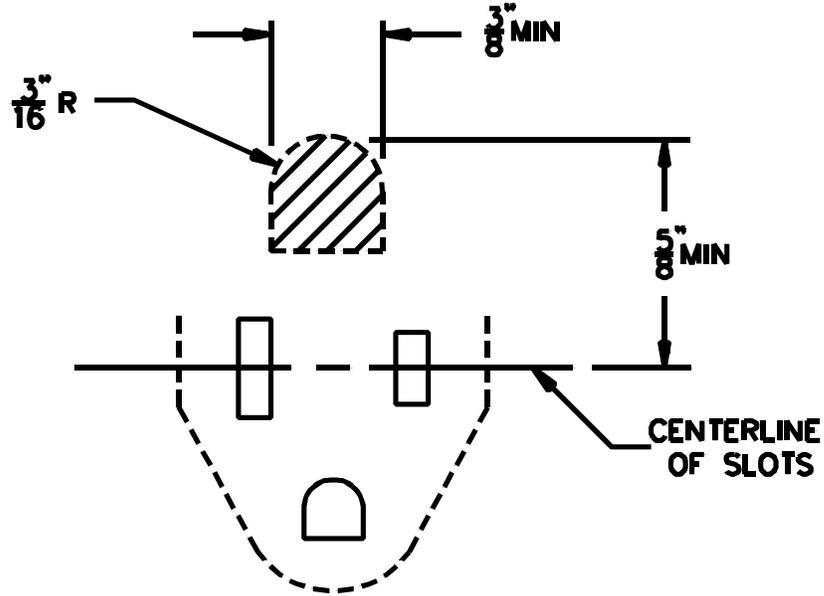
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AA100

Figure 9.2
Face of 15-Ampere, 12-Volt, parallel-slot receptacle outlet showing the smallest acceptable obstruction for the grounding pin on the mating plug

Figure 9.2 revised September 16, 1998



SB1176

inch	$\frac{3}{16}$	$\frac{3}{8}$	$\frac{5}{8}$
mm	4.8	9.5	15.9

9.12 An outlet device that has a parallel-slot, grounding-type, 15-A, 125-V contact configuration, shall be so constructed that the plug-grounding member of the corresponding attachment plug cannot be inserted by hand into any outlet slot to touch the live contact.

10 Lampholder

10.1 The lampholder of a hand lamp fitting shall be acceptable for use with the lamp base.

10.2 The lampholder screw shell shall not be exposed above the rim of the lampholder cavity.

10.3 The minimum depth of a lampholder cavity, measured vertically from the plane of the depressed center contact to the plane of the rim of the insulating enclosure, shall be as indicated in Table 10.1.

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Table 10.1
Depth of lamp cavity

Trade size of lampholder	Depth of lampholder cavity in inches (mm)			
	Minimum		Maximum	
Admedium	1-1/8	(28.6)	1-3/16	(30.2)
Medium	15/16	(23.8)	1	(25.4)
Intermediate	25/32	(19.8)	27/32	(21.4)
Candelabra	5/8	(15.9)	11/16	(17.5)

10.4 The maximum-depth requirement shown in Table 10.1 does not apply to a construction in which the outer enclosure (insulating material) is flared or in which a nonrigid body is employed and extends beyond the specified limit to provide further protection against contact with live parts.

10.5 If the method of mounting a lampholder affects the depth of the lamp cavity, the determination is to be made with the device mounted as intended.

11 Lamp Guard

11.1 A hand lamp fitting shall be provided with a lamp guard of acceptable mechanical strength, that is dimensioned, located, and secured to protect the lamp.

11.2 The lamp guard may be provided with a hook or equivalent means intended for the temporary support of the hand lamp. No means for permanent mounting shall be provided.

11.3 A metallic lamp guard or reflector, with or without an insulating coating, shall be grounded by connection to the grounding conductor. See 16.1, 30.1, and 30.2.

11.4 A lamp guard or reflector made of nonconductive material shall be employed on portable hand lamps having two-wire cords. They may also be used on those having three-wire cords.

12 Switches

12.1 A switch shall not control a receptacle outlet.

12.2 A switch may be provided to control a lampholder outlet.

12.3 A switch provided to control a lampholder outlet shall be acceptable for the control of the maximum size lamp intended to be used in the hand lamp.

12.4 If a switch opens a conductor identified as a grounded conductor, it shall simultaneously open all ungrounded conductors.

12.5 A switch shall not open the grounding conductor of a portable hand lamp.

12.6 A portable hand lamp shall not include a through-cord or pendant switch.

13 Power-Supply Cord

13.1 The power-supply cord shall have Type SJT, its equivalent, or heavier flexible cord. Rubber jacketed flexible cords, which are not oil resistant, shall not be used.

Exception: A portable hand lamp provided with a candelabra- or intermediate-base lampholder outlet and no receptacle may employ Type SVT, SVTO, SVTOO, SVOO flexible cord if it is marked in accordance with 40.7. See also 9.10.

13.2 The flexible cord shall be continuous from line fitting to load fitting without splice, tap or outlet fitting.

13.3 The line fitting shall be an attachment plug of the 2-wire polarized or 3-wire grounding, 15-A, 125-V general-purpose type. See 40.11 and Figure 9.1.

13.4 If a receptacle outlet is provided, the line fitting shall be of the grounding type. See 9.7 and Figure 9.1.

13.5 Conductors shall be fastened securely to the terminals of the hand lamp fittings.

13.6 The insulation on any individual conductor shall be removed only to the extent necessary to make proper connection at a wiring terminal.

14 Strain Relief

14.1 Strain relief shall be provided so that a mechanical stress on the flexible cord is not transmitted directly to binding-screw terminals, splices or internal wiring of a hand lamp fitting. See Strain Relief, Section 20.

14.2 A metal strain-relief clamp or band without auxiliary protection is acceptable with a Type SVO, SVOO, SJT, SJTO, SJTOO, SJO, SJOO, SJEO, SO, SOO, ST, STO, STOO, or SEO cord. A metal strain-relief clamp or band is acceptable with a Type SVT, SVTO, or SVTOO cord only if adequate auxiliary nonconducting mechanical protection is provided over the cord.

14.3 The requirement in 14.1 does not preclude the use of a strain-relief means which is part of a recognized fitting.

14.4 Means shall be provided to keep the flexible cord from being pushed into the hand lamp fitting through the cord-entry hole if such displacement:

- a) May expose the cord to mechanical damage or to a temperature higher than that for which the cord is rated, or
- b) Is likely to reduce spacing (such as to a metal strain-relief clamp) below the acceptable minimum values.

14.5 If a knot in a flexible cord serves as strain relief, the surface against which the knot may bear or with which it may come in contact shall be free from projections, sharp edges, burrs, fins, and the like, that may cause abrasion of the cord jacket or the insulation on the conductors.

15 Terminal Identification and Wiring

15.1 A terminal on a device which is identified for the connection of either a grounded or a grounding conductor shall be correctly connected to the corresponding conductor of the cord.

15.2 The grounding conductor insulation shall be green or green with one or more yellow stripes.

15.3 The grounded conductor shall be solid white or natural gray.

15.4 Corresponding terminals of line and load fittings shall be connected to the same conductor of the cord.

15.5 There shall be a cord conductor attached to each terminal in each fitting and a terminal in each fitting for each conductor.

15.6 The screw shell of the lampholder and the grounded terminal or lead of receptacle outlets shall be connected to the same conductor of the power-supply cord, which shall be identified in accordance with 15.3 as the grounded conductor.

15.7 A soldered connection shall be mechanically secured before soldering unless the conductor in question (when disconnected at its termination) is prevented from contacting live parts of opposite polarity, accessible dead metal parts or grounded parts and in addition cannot be contacted by the user.

16 Grounding

16.1 The grounding member of the attachment-plug, the grounding conductor of the power-supply cord, and accessible dead metal parts of a portable hand lamp, that are likely to become energized, shall be electrically interconnected as determined by testing. See 11.3 and Grounding Path Resistance, Section 30.

16.2 The grounding conductor of a portable hand lamp shall be contained within the overall assembly and shall not be accessible while in use.

17 Protection Against Corrosion

17.1 All ferrous-metal parts except stainless steel shall be protected against corrosion by zinc or cadmium coatings, or by plating, enameling, or painting.

17.2 Brass, copper, or lead-alloy are not acceptable for coating ferrous-metal parts as protection against corrosion.

18 Protection Against Personal Injury

18.1 An edge, a projection, and a corner of an enclosure, frame, guard, handle, or the like, shall be smooth and well rounded and not sufficiently sharp to constitute a risk of personal injury.

PERFORMANCE

GENERAL

19 Conductor Secureness

19.1 If a conductor of a flexible cord is connected by a pressure terminal connection to a part of a portable hand lamp before it is assembled into the hand lamp, the connection shall not break under a pull of 20 lbf (89 N) for 1 minute.

19.2 The pull is to be applied between the part and the conductor before the element has been assembled into the hand lamp. The angle between the part and the conductor is to be the same as in the complete assembled hand lamp. The force is to be gradually applied.

20 Strain Relief

20.1 When subjected to a straight pull of 30 lbf (133 N) between the enclosure and the flexible cord for a period of 1 minute, the assembly of the cord to a hand lamp shall prevent transmission of stress to the internal connections.

20.2 The hand lamp fitting, with the internal connections severed, is to be securely supported by the lampguard or hook.

Exception: If the construction of the lampguard or hook is such that it will not support the 30 lbf (133 N) pull, the handle is to be securely supported in the vertical position by a flat plate. The plate is to have a hole large enough for the supply cord to pass through.

20.3 The 30 lbf (133 N) pull is to be applied in a direction perpendicular to the plane of cord entry by means of a weight.

21 Dielectric Voltage-Withstand – Conductors

21.1 A portable hand lamp shall be capable of withstanding without breakdown, for a period of 1 minute, the application of a 60 Hz essentially sinusoidal potential of 1250 V between any two conductors without the lamp in place.

21.2 The test voltage is to be applied with the lamp removed. The test is to be repeated until each conductor has been tested with respect to every other conductor.

21.3 The test potential is to be supplied from a 500 VA or larger capacity testing transformer the output voltage of which 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 voltage for 1 minute. The increase in the applied potential is to be at a uniform rate and as rapid as is consistent with its value being correctly indicated by the voltmeter.

22 Crushing

22.1 The hand lamp fitting (at room temperature and with the lampguard removed) shall be capable of withstanding for 1 minute a crushing force of 75 lbf (334 N) applied in any direction at right angles to its major axis without creating a risk of fire or electric shock.

22.2 Any testing equipment that can apply a steady crushing force of 75 lbf (334 N) to the fitting may be employed. The crushing force is to be applied gradually. The force is to be applied at the point or points around the periphery of the fitting, in the area of the receptacle, most likely to produce unacceptable results.

22.3 The fitting is to be tested between two parallel flat steel plates measuring nominally 2 by 4 by 1/2 inch (50 by 100 by 13 mm) thick.

22.4 The test is then to be repeated with a previously untested fitting placed on a 1/2 inch (13 mm) thick flat steel plate and the crushing force is to be applied through the face of a 3/8 by 3/8 inch (9.5 by 9.5 mm) steel bar approximately 2 inches (50 mm) long.

23 Accelerated Aging

23.1 Rubber compounds

23.1.1 A molded rubber hand lamp fitting or part shall not show apparent deterioration, such as cracking, discoloration, shrinking, swelling, melting, or warping, and shall not show a greater change in hardness than ten numbers after being tested as described in 23.1.2 and 23.1.3.

23.1.1 revised July 17, 1997

23.1.2 If possible, the molded rubber device is to be used complete. The hardness of the rubber is to be determined as the average of five readings with an appropriate gauge, such as the Rex Hardness Gauge or the Shore Durometer. The device is to be placed for 70 hours in a full-draft circulating-air oven at a temperature of $100 \pm 2^{\circ}\text{C}$ ($212 \pm 3.6^{\circ}\text{F}$). The device is to be allowed to rest at room temperature for four or more hours after removal from the air oven. The hardness is to be determined again as the average of five readings. The difference between the average original hardness reading and the average reading taken after exposure in the air oven is the change in hardness.

23.1.2 revised July 17, 1997

23.1.3 The accelerated-aging test mentioned in 23.1.1 and 23.1.2 is to be made on specimens of each color of rubber and on specimens of each basic rubber compound employed for the device.

23.1.3 revised July 17, 1997

23.2 PVC compounds

23.2.1 A hand lamp fitting having a body or other parts of molded polyvinyl chloride or a copolymer thereof shall not show change in hardness greater than five numbers, cracks, discoloration, or other visible signs of deterioration as the result of exposure, in a full-draft circulating-air oven, to the applicable aging program as outlined in Table 23.1.

Table 23.1
PVC accelerated aging program

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

^a The Extended Use Test, Section 24, is required for portable hand lamps operating at temperatures of 105EC (221EF) or more on PVC materials.

24 Extended Use Test

24.1 The insulating materials referenced in 8.4 shall not crack, crumble, or otherwise become nonfunctional as a result of the flexure inherent in lamp and guard replacement after 60 days of continuous operation at a temperature 10EC (18EF) higher than the highest enclosure temperature measured during the Normal Temperature Test, Section 26, with the hand lamp in the filament-down, base-up position.

25 Insulation Resistance

25.1 When determined as described in 25.2 – 25.6 inclusive, the insulation resistance of rubber and similar material of any color shall not be less than 100 megohms between:

- a) Live parts of opposite polarity,
- b) Live parts and dead metal parts that are exposed to contact by persons or that may be grounded in service, and
- c) Live parts and any surface of insulating material that is exposed to contact by persons or that may be in contact with ground in service.

25.2 In determining compliance with the requirement in 25.1, the insulation resistance is to be measured by a magneto megohm-meter which has an open-circuit output of 500 V, or by equivalent equipment.

25.3 In measuring insulation resistance to the surface of an insulating material, it is necessary to apply an electrode to the insulating material as described in 25.4.

25.4 To provide electrode contact with an exterior surface, a quantity of No. 7 lead drop shot (approximate diameter 0.10 inch or 2.5 mm) is to be placed in a container that is open at the top and, after cord holes and other openings through which the shot could enter are carefully plugged with a high resistance insulating material, the device is to be immersed in the shot so that the shot serves as an electrode in contact with the exterior surface to which the test is to be applied.

25.5 Materials other than rubber and similar material are to be tested if they contain sufficient free carbon to color the material grey or black.

25.6 All rubber parts are to be conditioned for at least 48 hours at room temperature before being subjected to the test mentioned in 25.2.

26 Normal Temperature Test

26.1 The temperatures of a portable hand lamp for use with medium-base lamps shall not exceed the limits specified in 26.7 when tested as described in 26.2 – 26.6 inclusive. Portable hand lamps of other lamp base sizes shall be similarly investigated with respect to their normal operating temperatures using intended lamps.

26.2 A portable hand lamp shall be tested with the hand lamp supported in free air in the orientations most likely to result in the highest enclosure and internal wiring temperature. The portable hand lamp shall be tested in the lamp base up position and any other position that is likely to result in higher temperatures.

26.3 The lamp or lamps used for testing shall not exceed the maximum permitted by the marking on the hand lamp but shall not be less than 75 W. The lamp shall be that which produces the highest temperatures at significant parts of the portable hand lamp.

26.4 Except when indicated by special marking, the incandescent lamp envelope shall be as specified in Table 26.1.

Table 26.1
Lamp envelopes

Lamp wattage	Lamp envelope
75, 100	A-19
150	A-23
200	A-23
300	PS-25

26.5 The portable hand lamp shall be operated continuously at the rated wattage of the test lamp until constant temperatures are obtained.

26.6 Temperature readings are to be obtained by means of thermocouples consisting of wires not larger than No. 28 AWG (0.08 mm²). A temperature is considered to be constant when three successive readings, taken at 15-minute intervals indicate no change. When thermocouples are used in the determination of temperatures in connection with the heating of electrical devices, it is common practice to employ thermocouples consisting of No. 30 AWG (0.05 mm²) iron and constantan wires, and a potentiometer-type of indicating instrument. Such equipment shall be used whenever referee temperature measurements are necessary. The thermocouple wire is to conform with the requirements for special thermocouples as listed in the table of limits of error of thermocouples in the Standard for Temperature Measurement Thermocouples, ANSI MC96.1-1982.

26.7 The following temperature limits are based on a room temperature of 25EC (77EF). The temperature test may be made at any ambient temperature within the range of 10 to 40EC (50 to 104EF) and the variation from 25EC (77EF) added to or subtracted from the observed temperature readings.

- a) The temperature rating of insulated wire or flexible cord.
- b) The temperature rating of insulating materials. A temperature higher than the temperature rating of a recognized material may be judged acceptable upon successful completion of the Extended Use Test, Section 24.
- c) 15EC (59EF) on lampholder screw shells. A temperature higher than 200EC (392EF) may be acceptable if the parts are reinforced by or formed of monel metal, stainless steel, or other metal acceptable for the higher temperature.

26.7 revised November 25, 1996

27 Dielectric Voltage-Withstand

27.1 A portable hand lamp shall be capable of withstanding without breakdown for 1 minute the application of a 60-Hz essentially sinusoidal potential of 2250 V between live parts and dead metal parts, including the metal of an insulated lamp guard. The potential shall be applied while the unit is well heated.

27.2 The test potential is to be supplied from a 500 VA or larger capacity testing transformer whose output is essentially sinusoidal and can be varied. The applied potential is to be increased from zero until the required test voltage is reached, and is to be held at that voltage for 1 minute. The increase in the applied potential is to be at a uniform rate and as rapid as is consistent with its value being correctly indicated by a voltmeter in the output circuit of the test transformer. The requirement for a 500 VA or larger transformer is waived if the high-potential testing equipment used maintains the specified high potential at the portable hand lamp for the duration of the test.

28 Abnormal Operation

28.1 General

28.1.1 A portable electric hand lamp shall not increase the likelihood of a fire or electric shock when subjected to the tests in this section.

28.2 Continuous operation

28.2.1 Two previously untested samples of the hand lamp, including the lamp guard, are to be operated continuously for a minimum of 7 hours while resting reflector face down on a softwood surface which has been covered with a single layer of white tissue paper. The test lamps shall be as indicated in 28.4.2 and 28.4.7 and shall be operated at their rated wattage. A 3-A plug fuse, other than the time-delay type, shall be connected between earth ground and all exposed metal parts of each hand lamp. The grounding conductor, if provided, shall be opened. The results are acceptable if the hand-lamp body does not soften so as to expose live parts, there is no ignition of the tissue paper, and the 3-A grounding fuse remains intact.

28.3 Manual manipulation (following continuous operation)

28.3.1 Samples subjected to the conditioning described in 28.2.1 shall be manually manipulated (by squeezing and twisting the handle) in an attempt to short live parts, expose live parts to external contact, and cause live parts to make contact with exposed dead metal parts. The hand-lamp fitting is to be manipulated in the heated condition immediately after disconnection from the source of supply.

Exception: The test described above need not be performed if the body of the portable electric hand lamp is constructed of rigid thermosetting materials that resist softening and deformation with increased temperature, such as a phenolic compound. If there is any question regarding the acceptability of the material used, the test shall be conducted.

28.4 Mechanical manipulation

28.4.1 Two previously untested samples of the portable hand lamp are to be conditioned for a period of 2 hours by being operated with a test lamp, while hanging vertically in the filament-down, lamp-base up position.

Exception No. 1: As indicated in the Exceptions to 28.4.2.

Exception No. 2: The tests described in 28.4.1 – 28.4.6 need not be performed if both the portable electric hand lamp body and lamp guard are constructed of rigid thermosetting materials that resist softening and deformation with increased temperature, such as a phenolic compound. If there is any questions regarding the acceptability of the materials or construction used, the test shall be conducted.

28.4.2 The test lamps of 28.2.1 and 28.4.1 are to be lamps of the sizes indicated in Table 26.1. One lamp is to be of the maximum wattage rating with which the hand lamp is intended to be used, and the other of the next higher wattage rating than that with which the hand lamp is intended to be used. See 28.4.7.

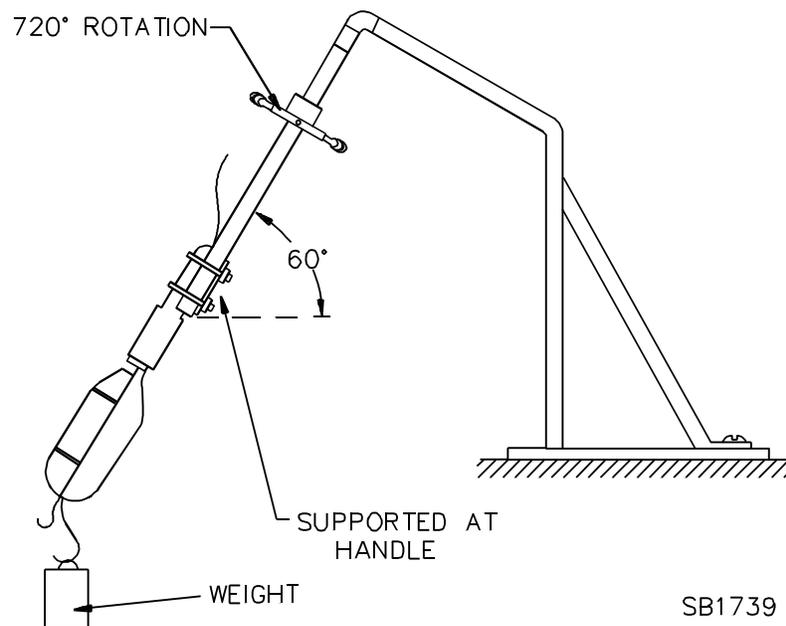
Exception No. 1: If a hand lamp is of the medium-base type and rated 75 W or less, one sample is to be tested with a 100-W test lamp.

Exception No. 2: If a hand lamp is rated 300 W, only one sample is to be tested and a 300-W test lamp is to be used.

Exception No. 3: If a hand lamp is provided with a lamp-guard construction that prevents the use of a test lamp of the next higher wattage rating, only one sample is to be tested using a test lamp of the maximum wattage rating.

28.4.3 Without de-energizing the hand lamps, each complete hand lamp is to be attached to a test fixture as shown in Figure 28.1. The lamp is to be at an angle of 60 degrees with the horizontal with base up. The fixture is to be constructed so that the hand lamp can be smoothly and continuously rotated about its longitudinal axis. The exposed metal parts of the test fixture and hand lamp are to be connected to earth ground through a 3-A plug fuse, other than the time-delay type.

Figure 28.1
Test fixture for mechanical manipulation test



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28.4.4 The hand lamp being tested is to be energized and attached to the test fixture to simulate conditions of normal use (clamps are to be positioned on the gripping area of the handle – to simulate a hand grip). A 20-lb (9.1 kg) weight is to be suspended from the lamp guard at the point farthest from the handle, as shown in Figure 28.1.

28.4.5 While energized, and with the test fixture grounded (grounding conductor of hand lamp, if provided, open), and with the weight in place, the hand lamp is to be smoothly rotated, at a continuous rate, for two complete revolutions (720 degrees) over a 1-minute period.

28.4.6 Exposure, shorting or grounding of live parts, separation of the lamp guard, breakage of the lamp, separation of the lampholder interior from the enclosure or separation of receptacle contacts from the lampholder interior are unacceptable results.

28.4.7 At the manufacturer's request, for hand lamps of the medium-base type requiring 100- or 150-W lamps, Standardized Test Lamps (lamps manufactured under controlled conditions to produce relatively consistent temperatures) of equivalent ratings may be utilized for the tests described in 28.2.1 and 28.4.1 – 28.4.6.

29 Drop Test

29.1 A portable electric hand lamp shall not produce a risk of electric shock when dropped from a height of 6 feet (1.83 m) onto a concrete surface in the manner most likely to produce unacceptable results. The envelope of the lamp may fracture but the integrity of the hand lamp enclosure shall be maintained.

30 Grounding Path Resistance

30.1 In a portable hand lamp, the resistance of the grounding path between the grounding member of the attachment-plug and exposed dead-metal parts required to be grounded, excluding the resistance of the grounding conductor of the flexible cord, shall not exceed 0.1 ohm.

30.2 The grounding path resistance shall be measured by a calibrated ohmmeter. If a referee measurement is needed the following procedure is to be followed: either a direct- or alternating-current of 15 A is to be passed from the grounding terminal to all exposed dead metal parts, and the resulting drop in potential is to be measured between these two points. The resistance in ohms is to be determined by dividing the drop in potential in volts by the current in amperes passing between the two points.

RECEPTACLE OUTLETS

31 General

31.1 The performance of a receptacle outlet device shall be investigated by means of tests on sets of six representative samples as described in Sections 32 – 35.

32 Retention of Attachment Plugs

32.1 Except for a device that has provision for locking the attachment plug in place after the blades have been inserted in the female contacts, the contacts of an outlet device shall be capable of holding an attachment plug so that a pull of from 3 to 15 lbf (13.3 to 66.7 N) will be required to withdraw the plug when the test is performed as indicated in 32.2.

32.2 Each sample is to be subjected to 10 conditioning cycles of insertion and withdrawal of a standard solid-blade attachment plug of a type with which the device is intended for use and which has detent holes in rigidly mounted blades. Following the conditioning cycles, the attachment plug is to be fully reinserted into the device. A pull of 3 lbf (13.3 N) in a direction perpendicular to the plane of the face of the female-contact device and tending to withdraw the attachment plug from the device is then to be applied to the plug for 1 minute. The results are unacceptable if there is any displacement of the attachment plug. The female-contact device is then to be subject to the overload and temperature tests, following which, the entire procedure described above is to be repeated. In the repeated test, the results are unacceptable if the attachment plug is displaced by the 3-lbf (13.3-N) pull, but it is required that the plug be withdrawn when the pull is increased to 15 lbf (66.7 N). If the device is intended to accommodate either a 2- or 3-wire attachment plug, the entire procedure described above is to be performed with a 2-wire plug after which a 3-wire plug inserted into the device is required to be withdrawn by a 15-lbf (66.7-N) pull.

33 Overload

33.1 Each sample of a device that has outlet contacts shall be capable of performing acceptably when subjected to the overload test described in 33.2 – 33.5. There shall not be electrical or mechanical malfunction of the device nor undue burning or pitting of the contacts.

33.2 The device being tested is to be operated manually by inserting and withdrawing an attachment plug with rigidly secured solid blades that are connected by means of a flexible cord to a load. An equipment-grounding blade is to be provided and connected to ground through a fuse. The device is to be caused to make and break a current of 22.5 A for 50 cycles of operation at a rate not more than 10 cycles per minute.

33.3 The potential of the test circuit is to be between 118 – 131 V. The test is to be conducted on direct current.

33.4 Neither the blades nor the contacts are to be adjusted, lubricated, or conditioned otherwise before or during the test.

33.5 The fuse in the grounding conductor is to be a 15-A fuse. The fuse in the test circuit is to be a 25-A fuse. Neither the line fuse or the grounding fuse shall open during the test.

34 Temperature

34.1 The temperature rise of a device having female contacts, measured at the points described in 34.2 shall not be more than 30EC (54EF) when the device is carrying 15 A.

34.2 The temperature measurement mentioned in 34.1 is to be made on the wiring terminals of the device if they are accessible for the mounting of thermocouples. If the wiring terminals are inaccessible, or if the device has no wiring terminals, temperatures are to be measured at points as close to the face of the device as possible on the male blades of an attachment plug inserted in the outlet.

34.3 The temperature test is to be made following the overload test on each sample of the device and is to continue for 4 hours even though stabilized temperatures may be attained in less time. The generation of heat from sources other than the female contacts is to be minimized as much as possible. Each connection to the device being tested is to be made by means of the shortest possible length of No. 14 AWG (2.1 mm²) insulated wire. The contacts of the device being tested are to be connected together by means of an inserted attachment plug. The plug is to have rigidly attached blades, and the terminals of the plug are to be short-circuited by means of the shortest feasible lengths of insulated wire as described above.

34.4 Temperature readings are to be obtained by means of thermocouples consisting of iron and constantan (copper-nickel) wires not larger than No. 28 AWG (0.08 mm²). It is a common practice to employ thermocouples consisting of No. 30 AWG (0.05 mm²) iron and constantan wires with a potentiometer-type indicating instrument. This equipment shall be used if a referee measurement of temperature is necessary.

35 Resistance to Arcing

35.1 If a material other than phenolic, urea, melamine, or cold-molded composition is used in the construction of the receptacle outlet, or in a way that the material is likely to be exposed to arcing while in service, the samples of the device that were subjected to 50 cycles of operation in the overload test described in Overload, Section 33, shall perform acceptably when subjected to an additional 200 cycles of operation to the overload-test conditions following the temperature test, and the repetition (if required – see 32.2) of the Retention of Attachment Plugs, Section 32.

35.2 Alternately, if agreeable to those concerned, a second set of previously untested samples may be subjected to 250 cycles of operation under the overload test conditions, described in Overload, Section 33.

LAMP HOLDERS

36 General

36.1 The performance of a lampholder shall be investigated by means of tests on each of six representative samples. Tests made on the same set of samples shall be conducted in the order indicated.

37 Security of Screw Shell

37.1 A medium-base screw shell shall be secured in a lampholder such that the shell does not turn, pull out, or become loose or distorted enough to adversely affect the assembly when the shell is subjected for 1 minute to a straight pull of 20 lbf (89 N) and to a torque of 20 pound-inches (2.26 N•m).

37.2 Samples are to be tested by means of:

- a) A weight exerting a 20 pound (89 N) force attached to a threaded plug that can be screwed into a female screw shell, and
- b) A similar threaded plug to which a torque of 20 pound-inches (2.26 N•m) can be imparted while the plug engages the screw shell and thrusts against the center contact of the lampholder.

37.3 In conducting the torsion test, the threaded plug is to be made to engage fully with the screw shell being tested. Then, with the lampholder firmly held, the torque is to be applied gradually so that there is no sudden jerk on the screw shell.

MANUFACTURING AND PRODUCTION TESTS

38 Dielectric Voltage-Withstand

38.1 Each portable electric hand lamp shall be capable of withstanding without electrical breakdown, as a routine production-line test, the application of a test potential between any two conductors (including between line conductors and grounding conductor, if provided) using one of the following methods.

- a) A 1250-V a-c (40 – 70-Hz) test potential applied for 1 minute,
- b) A 1500-V a-c (40 – 70-Hz) test potential applied for 1 second,
- c) A 1770-V d-c test potential applied for 1 minute, or
- d) A 2100-V d-c test potential applied for 1 second.

38.2 The test potential may be gradually increased to the required voltage but the full value is to be applied for 1 second or 1 minute as required.

38.3 The test equipment for a-c testing shall include a transformer having an essentially sinusoidal output.

38.4 If the output of the test equipment power-supply 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 being tested is to result.

38.5 If the output of the test-equipment power-supply 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. 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.

38.6 Test equipment other than that described in 38.3 – 38.5 may be used if found to accomplish the intended factory control.

RATING

39 General

39.1 A portable hand lamp without a receptacle outlet shall be rated in maximum wattage, ____ W, 125 V. The maximum wattage shall not exceed 300 W for a medium-base lampholder.

39.2 A portable hand lamp with a receptacle outlet shall have an ampere rating based on the ampacity and length of the cord, but shall not be rated greater than 15 A. Its voltage rating shall be 125 V. See 9.7.

MARKING

40 General

40.1 A portable hand lamp shall be marked where it is plainly visible with:

- a) The name or trademark of the manufacturer or other descriptive marking by which the organization responsible for the product may be identified,
- b) The electrical rating,
- c) The catalog or model number of the product, and
- d) The date or other dating period of manufacture not exceeding any three consecutive months.

Exception: The date of manufacture may be abbreviated or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer, provided that the code:

- 1) *Does not repeat in less than 10 years, and*
- 2) *Does not require reference to the production records of the manufacturer to determine when the product was manufactured.*

Revised 40.1 effective December 5, 1996

40.2 If a manufacturer produces or assembles portable hand lamps at more than one factory, each finished portable hand lamp shall have a distinctive marking, which may be in code, by which it can be identified as the product of a particular factory.

40.3 A portable hand lamp with a receptacle shall have the marking required in 40.1, 40.2, and 40.6 located as follows:

- a) On a wrap around label located on the cord within 6 inches (152 mm) of the handle,
- b) On a flag label attached to the cord within 6 inches of the handle, or
- c) On the hand lamp fitting.

40.4 A portable hand lamp without a receptacle shall have the marking required by 40.1 and 40.2 applied as indicated in 40.3 (a) – (c) or on a tag of tough paper, cloth, or the equivalent, having a hole large enough to accommodate the cord. The tag is not to be slit from the edge of the tag. The cord is to be passed through the hole in the tag prior to assembly of the end fittings on the portable hand lamp.

40.5 If a portable hand lamp employs a receptacle outlet, the receptacle outlet shall not be marked with an electrical rating.

40.6 The portable hand lamp shall have the following marking, or the equivalent, located on or adjacent to (within 6 inches or 152 mm of handle) the lampholder so as to be visible when relamping: "CAUTION – TO REDUCE THE RISK OF ELECTRIC SHOCK AND FIRE – PULL PLUG WHEN RELAMPING – USE ONLY _____ WATT OR SMALLER BULB". The maximum marked wattage shall not exceed 300 W. The marking shall be plain and permanent in letters at least 1/16 inch (1.6 mm) high contrasting with the background by embossing, indent printing or color.

40.7 A portable electric hand lamp made with Type SVT, SVTO, SVTOO, SVO, or SVOO cord shall be marked "For Light Duty Use Only".

40.8 Each portable hand lamp fitting shall be provided with instructions and the necessary hardware for proper assembly. The instructions shall include that information necessary to provide for strain relief, selection of the correct flexible cord (that is cord type, conductor size, length and ampacity relationships), proper wiring including polarity, and proper guard assembly.

Exception: A single set of instructions may be provided in the shipping container of portable hand lamp fittings which are bulk packaged for shipment to an original equipment manufacturer for factory assembly.

40.9 If a hand lamp fitting is required to be assembled to a flexible cord having insulation with a temperature rating higher than 60EC (140EF), the instructions of 40.8 shall include reference to the minimum temperature rating required, along with instructions for determining the temperature rating of the cord.

40.10 A portable hand lamp fitting shall be marked in accordance with the requirements in 40.1 – 40.7 for portable hand lamps. If the marking is intended to be located on a wrap-around or flag label attached to the cord, that label along with instructions for its attachment to the cord shall be provided with the fitting.

Exception No. 1: The electrical rating of a portable hand lamp fitting with a receptacle may be included in the instructions.

Exception No. 2: Where applicable the phrase "For Light Duty Use Only" may be included in the instructions.

Exception No. 3: The marking identifying the manufacturer or organization responsible for the product and the factory identification may be located where plainly visible during the assembly of a portable hand lamp using the fitting.

40.11 Instructions for the use of a polarized attachment plug shall be provided with each portable electric hand lamp employing a 2-wire polarized parallel-blade attachment plug and may be included on a separate sheet or in a separate format in the manufacturer's instructions. The instructions shall be titled IMPORTANT SAFETY INSTRUCTIONS in letters not less than 3/16 inch (4.8 mm) high, and shall precede the following, or the equivalent text, "This product has a polarized plug (one blade is wider than the other). As a safety feature, 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. Never use with an extension cord unless plug can be fully inserted. Do not attempt to defeat this safety feature."

40.12 A portable electric hand lamp intended for use with a cord reel as described in the Exception to 6.2 shall be marked with the following or the equivalent "FOR USE WITH A CORD REEL ONLY."

40.13 The marking in 40.12 shall be plainly visible on the outer surface of the smallest unit container or through the unit packaging. The letters shall be a minimum of 1/4 inch (6.4 mm) high as measured by the characters b, 1, and H, and shall contrast with a solid color background.

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

Attachment Plugs and Receptacles – UL 498
Ballasts, Fluorescent-Lamp – UL 935
Cord Sets and Power-Supply Cords – UL 817
Lampholders, Edison-Base – UL 496
Lampholders, Starters, and Starter Holders for Fluorescent Lamps – UL 542
Marking and Labeling Systems – UL 969
Plastic Materials for Parts in Devices and Appliances, Tests for Flammability of – UL 94
Polymeric Materials – Fabricated Parts – UL 746D
Polymeric Materials – Long Term Property Evaluations – UL 746B
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
Switches, General-Use Snap – UL 20
Switches, Special-Use – UL 1054
Tape, Polyvinyl Chloride Polyethylene and Rubber Insulating – UL 510
Terminals, Electrical Quick-Connect – UL 310
Transformers, Class 2 and Class 3 – UL 1585
Tubing, Extruded Insulating – UL 224
Tubing for Electric Wiring, Flexible Nonmetallic – UL 3
Wire Connectors and Soldering Lugs for Use With Copper Conductors – UL 486A
Wire, Flexible Cord and Fixture – UL 62
Wires and Cables, Rubber-Insulated – UL 44
Wires and Cables, Thermoplastic-Insulated – UL 83

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