UL 153

STANDARD FOR SAFETY

Portable Electric Luminaires

UL Standard for Safety for Portable Electric Luminaires, UL 153

Thirteenth Edition, Dated March 3, 2014

Summary of Topics

These revisions to ANSI/UL 153 dated February 24, 2025 includes the following changes in requirements:

– QR code as an Alternative to Website Address (URL); 198.1.3

– Marking Adjusted to Remove the Word "max"; 199.1

– LED Portable Luminaires with Smaller than 18 AWG Power Supply Cord; 17.3, 17.4, 27.1.1, Table 27.1, 30.3, Table 31.1, 31.2, 31.5, 31.5A, 31.7, Table 35.1, Sections 69A – 69C, and Table 75.1

– Photobiological Safety Assessment for battery-operated portable luminaires with visible light spectrum light source – Supplement SA, SA5.6.1

– Button Batteries or Coin Cell Batteries; 47.4.1 and Appendix A

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

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated September 13, 2024.

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1

UL 153

Standard for Portable Electric Luminaires

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The most recent designation of ANSI/UL 153 as an American National Standard (ANSI) occurred on February 24, 2025. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

Comments or proposals for revisions on any part of the Standard may be submitted to ULSE at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at https://csds.ul.com.

No Text on This Page

CONTENTS

INTRODUCTION

CONSTRUCTION

MECHANICAL CONSTRUCTION – GENERAL

ELECTRICAL CONSTRUCTION – GENERAL

INCANDESCENT UNITS – SUPPLEMENTARY

TUNGSTEN HALOGEN UNITS – SUPPLEMENTARY

FLUORESCENT UNITS – SUPPLEMENTARY

HIGH INTENSITY DISCHARGE UNITS – SUPPLEMENTARY

LED PORTABLE LUMINAIRES WITH SMALLER THAN 18 AWG POWER SUPPLY CORD – SUPPLEMENTARY

SURFACE MOUNTED UNITS – SUPPLEMENTARY

CORD AND CHAIN SUSPENDED UNITS – SUPPLEMENTARY

CLAMP-ON MOUNTED UNITS – SUPPLEMENTARY

PORTABLE CABINET LIGHTS – SUPPLEMENTARY

UNITS FOR USE WITH OFFICE FURNISHINGS – SUPPLEMENTARY

CONVERTIBLE UNITS – SUPPLEMENTARY

INTERCHANGEABLE UNITS – SUPPLEMENTARY REQUIREMENTS

TRACK-STYLE UNITS – SUPPLEMENTARY

PORTABLE LUMINAIRE KIT – SUPPLEMENTARY

PORTABLE LUMINAIRE SUBASSEMBLIES – SUPPLEMENTARY

PORTABLE LUMINAIRE ACCESSORIES – SUPPLEMENTARY

WORK LIGHTS – SUPPLEMENTARY

DAMP LOCATION USE – SUPPLEMENTARY

WET LOCATION USE – SUPPLEMENTARY

PORTABLE HAND LIGHTS – SUPPLEMENTARY

PERFORMANCE

GENERAL – NORMAL TEMPERATURE TEST

GENERAL – ABNORMAL OPERATION TESTS

GENERAL – MECHANICAL TESTS

GENERAL – ELECTRICAL TESTS

INCANDESCENT UNIT TESTS

TUNGSTEN-HALOGEN UNIT TESTS

FLUORESCENT UNIT TESTS

HIGH-INTENSITY-DISCHARGE UNIT TESTS

SURFACE MOUNTED UNIT FOR WALL OR UNDERSHELF MOUNTING TESTS

CORD AND CHAIN SUSPENDED UNIT TESTS

CLAMP-ON UNIT TESTS

TRACK-STYLE UNIT TESTS

PORTABLE LUMINAIRE KIT AND SUBASSEMBLY TEST

WORK LIGHT TESTS

WET LOCATION USE TESTS

PORTABLE HAND LIGHT TESTS

BATTERY TESTS

MARKINGS

INSTRUCTIONS

MANUFACTURING AND PRODUCTION TESTS

SUPPLEMENT SA (Normative) – REQUIREMENTS FOR BATTERY-OPERATED PORTABLE LUMINAIRES

APPENDIX A Standards for Components

APPENDIX B (Informative) Manufacturing and Production Tests

No Text on This Page

INTRODUCTION

1 Scope

1.1 These requirements cover portable luminaires and subassemblies whose primary function is task or ambient illumination. These products are intended for use in accordance with the National Electrical Code, ANSI/NFPA 70.

1.2 These requirements cover portable luminaires intended for connection to a nominal 120-volt, 15- or 20-ampere branch circuit, by means of an attachment plug, a mating connector assembly, or a non-integral power supply.

1.2.1 These requirements also cover portable luminaires intended to receive power through a USB connection, or power over ethernet (POE) using category 5 (CAT5) or similar cables and 8P8C (RJ45) connectors. These portable luminaires do not include and need not be marked to specify their power source.

1.2.2 The requirements in Supplement SA also cover battery-operated portable luminaire intended to be used while disconnected from any external power source.

1.3 Light emitting diode (LED) components and subassemblies integral to a portable luminaire covered by this standard shall comply with the applicable requirements of the Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products, UL 8750.

1.4 These requirements do not cover portable luminaires within the scope of the following standards:

Standard for Electric Signs, UL 48

Standard for Portable Sun/Heat Lamps, UL 482

Standard for Seasonal and Holiday Decorative Products, UL 588[a]

Standard for Luminaires for Use in Hazardous (Classified) Locations, UL 844

Standard for Household and Commercial Furnishings, UL 962[b]

Standard for Electric Aquarium Equipment, UL 1018

Standard for Temporary Lighting Strings, UL 1088

Standard for Relocatable Power Taps, UL 1363[c]

Standard for Flashlights, UL 1576

Standard for Direct Plug-In Nightlights, UL 1786

Standard for Rope Lights, UL 2388

Standard for Horticultural Luminaire Systems, UL 8800

Standard for Portable UV Germicidal Equipment With Uncontained UV Sources, UL 8803

[a] UL 588 and UL 153 can be used for string lights for all-year use that use 18 AWG and larger cord sizes. UL 588 is the only applicable Standard for String lights for all-year use and lighting strings employing cords smaller than 18 AWG. All other seasonal and holiday decorative products, regardless of the size of the cord, are only covered under the scope of UL 588.

[b] UL 962 applies where furnishings have integral illumination intended for aesthetic purposes and with only a modest contribution to ambient illumination levels.

[c] UL 1363 applies for relocatable power taps where illumination is a secondary function of the device.

1.5 Work lights and portable hand lights that include primary or secondary battery packs are within the scope of the Standard for Flashlights and Lanterns, UL 1576.

2 Glossary

2.1 For the purpose of these requirements the following definitions apply.

2.2 ADAPTER – A component of a lighting assembly intended to mate with a base and provide mechanical attachment and electrical connection for interchangeable lighting assemblies.

2.3 ADAPTER FOR TRACK STYLE UNIT – A component of a lighting assembly intended to mate with a track and provide mechanical securement and electrical connection for track-style type units.

2.4 BALLAST – A current limiting device required to start and operate fluorescent lamps.

2.5 BASE – A weighted free standing or wall-mounted, cord-connected support that provides the electrical supply to one or more replaceable or interchangeable lighting assemblies.

2.5.1 BATTERY CELL – The basic manufactured unit of a battery. Provides electrical energy by direct conversion of chemical energy and designed to be charged electrically. Consists of electrodes, separators, electrolyte, container and terminals.

2.6 BATTERY, PRIMARY – A battery that can only be discharged once, not designed to be electrically recharged.

2.7 BATTERY, SECONDARY – A battery intended to be charged and discharged multiple times under prescribed rates of charging and discharging in accordance with the battery manufacturer's recommendations.

2.8 BULB (LAMP) – See 2.25.

2.9 CLASS 2 CIRCUIT – A circuit supplied by an isolating source whose electrical output complies with the requirements of the Standard for Class 2 Power Units, UL 1310, the LPS (limited power source) parameters of the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1 or the Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1, the LVLE (low voltage limited energy) parameters of the Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products, UL 8750, or the Limited Power Source Test of the Standard for Household and Commercial Batteries, UL 2054. Also includes POE and USB power sources.

2.10 CLEARANCE DISTANCE – The shortest distance measured through air between conductive parts.

2.11 COMBUSTION – Burning; or a chemical process (as an oxidation) accompanied by the evolution of light and heat. Examples of combustion are any blackening or disintegration, glowing, flaming or charring of any material or test indicators such as tissue paper, cheesecloth or wood.

2.12 COMPACT FLUORESCENT LAMP – A fluorescent lamp that is formed such that both ends fit into a support that is inserted into a single lampholder.

2.12.1 CONVENIENCE RECEPTACLE – A 15- or 20-amp receptacle suitable for a NEMA-style plug (see 32.1) without a dedicated or defined load and intended for only occasional use. It may be integral with the portable luminaire body or at the end of an attached load-side cord. Load-side connectors or receptacles specifically for interconnected units (per Section 33) are not considered convenience receptacles, regardless of their configuration.

2.13 CONVERTIBLE UNIT – A portable luminaire provided with instructions and a kit that converts the portable luminaire to a fixed luminaire (lighting fixture).

2.14 DECORATIVE PART – A part whose total or partial destruction does not affect intended performance of the portable luminaire.

2.15 DOUBLE INSULATION – An insulation system comprised of basic and supplementary insulation, with the two insulations physically separated and arranged so that they are not simultaneously subjected to the same deteriorating influences (temperature, contaminants, and the like) to the same degree. Each insulation layer (basic and supplementary) is individually able to comply with the spacings and dielectric voltage withstand requirements of this standard.

2.16 END CAP – A cover intended to close the open end of a track.

2.17 EXPOSED PART – A part that is not enclosed to prevent contact.

2.17.1 FREESTANDING PORTABLE LUMINAIRE – A portable luminaire designed to be stable and intended to be operated unattended while on a horizontal surface (e.g., table or floor).

2.18 FRICTION MATERIAL – Rubber or elastomer with or without dimples or ridges. Plastic or metal with or without dimples or ridges is not determined to be a friction material.

2.19 GUARD – That portion of the portable luminaire that prevents inadvertent contact with the lamp. Is able to be integral with the shield.

2.20 HOUSED PART – A part that is prevented from being contacted by a housing that does not meet the requirements for enclosing live parts.

2.20.1 HYGROSCOPIC – A material, including those identified as deliquescent, that absorbs atmospheric moisture at normal room temperatures. Examples include salts of various types, including calcium chloride, magnesium chloride, potassium carbonate, and others.

2.21 INTERCONNECTED UNIT – A luminaire designed to receive and/or provide power to or from another luminaire through a series connection.

2.22 INTERCONNECTING CORD – A conductor running between two luminaires.

2.23 INTERLOCK SWITCH – A switch that de-energizes the lamps when the portable luminaire is opened or when the lamp is replaced.

2.24 ISOLATED SECONDARY CIRCUIT – A circuit derived from an isolated secondary winding of a transformer and that has no direct connection back to the line-connected circuit (other than through grounding means). A secondary circuit that has a direct connection back to the line-connected circuit is determined to be part of the line-connected circuit.

2.25 LAMP – A light source of any configuration (e.g., bulb, tube, LED array or module, etc.), replaceable or not, intended to illuminate the environment where the portable luminaire is located.

2.26 LAMP ADAPTER – A self-ballasted lamp with a replaceable light source.

2.27 LAMP, SELF-BALLASTED – A device provided with a lamp base and incorporating a non-replaceable light source and any additional elements necessary for starting and stabilizing operation of the light source, which cannot be dismantled without being permanently damaged. May be identified as "SBCFL" when the light source is fluorescent or "SBLED" when the light source is LED.

2.28 LAMP CONTAINMENT BARRIER – Any part of a portable luminaire that encloses the lamp.

2.29 LIGHTING ASSEMBLY, INTERCHANGEABLE – An assembly consisting of a lighting unit and an adapter. One or more lighting assemblies is used with a base to make up the portable luminaire for interchangeable lighting assemblies.

2.30 LIGHTING ASSEMBLY, TRACK-STYLE – An assembly consisting of a lighting unit and an adapter. One or more lighting assemblies is used with a track to make up the track-style type unit.

2.31 LIGHTING UNIT, INTERCHANGEABLE – An assembly that includes a lamp enclosure or lamp compartment and any components and parts required for connecting the lamp compartment or enclosure to the adapter for interchangeable lighting assemblies.

2.32 LIGHTING UNIT, TRACK-STYLE – An assembly that includes a lamp enclosure or lamp compartment and any components and parts required for connecting the lamp compartment to the adapter for the track-style type units.

2.33 LINE OF SIGHT – A straight, unbroken, unobstructed, direct line between the eye and an object (for example, the lamp).

2.34 LIVE PART – A metal or other conductive part that has a potential difference during operation with respect to ground or any other conductive part.

2.35 LOW-VOLTAGE CIRCUIT – A circuit involving an open circuit potential within the levels permitted for a Class 2 circuit.

2.36 MANUFACTURER – The organization responsible for producing or distributing the product.

2.37 NORMAL MAINTENANCE AND USE – The cleaning, adjusting, moving, maintaining, and using of the portable luminaire. Includes items such as:

a) Replacing a lamp, starter or fuse;

b) Adjusting an illumination level; and

c) Removal or cleaning of all parts not secured by use of tools.

2.38 ORDINARY TOOL – A tool, such as a flat-blade or cross-head screwdriver, a nut driver, or pliers.

2.38.1 PLANT LUMINAIRE – A portable luminaire with an integral platform or container onto (or into) which a living plant is to be located, primarily for decorative purposes. There is no specific size limitation for a plant luminaire. Luminaires intended to grow plants, vegetables, or herbs on a commercial scale are better identified as "horticultural luminaires" and are not within the scope of this standard.

2.39 PLAY VALUE – A characteristic of products with features that promote a child's interactive exploration and use a child's imagination and ability to pretend to create enjoyable play and incorporates a child's interest to encourage repeat play. Such features may include interactive characteristics similar to those of familiar toys (i.e., stuffed animals, model vehicles with moving parts, buildings, sports equipment, cartoon characters, playhouses, or a “busy box” with lights, sliding or rotating features, or manually actuated music, and similar features), that are attractive to children eight years or less in age. Non-interactive features like decorative displays with pre-set patterns, pictures, or music may be entertaining, but do not necessarily have play value.

2.40 POLYMERIC MATERIAL – A material made of a chemical compound or mixture of compounds formed by polymerization and consisting of repeating structural units. Polymeric materials include thermoplastic, thermosetting, and elastomeric materials. A thermoplastic material is able to be easily softened and resoftened by repeated heating. A thermosetting material cures by chemical reaction when heated and, when cured, is unable to be resoftened by reheating. An elastomeric material is capable of being stretched at room temperature to at least twice its length under low stress and recovers to its original length when released from the stress.

2.41 PORTABLE CABINET LIGHT – A portable lamp intended for installation into an open or enclosed cabinet such as a china hutch, bookcase, bed headboard, or kitchen cabinet.

2.42 PORTABLE CABINET LIGHT, POT STYLE – A portable cabinet light intended for recessed mounting within a cavity above the shelf to which it is secured.

2.43 PORTABLE CABINET LIGHT ACCESSORY – Components such as interconnecting cord sets, dimmers, or switch assemblies intended to be used with portable cabinet luminaires.

2.44 PORTABLE HAND LIGHT ACCESSORY – A component of a hand light such as a lampholder assembly, a lamp guard with or without a hook for hanging, or a handle. These accessories are intended for assembly by the user or for use in other portable hand light applications.

2.45 PORTABLE HAND LIGHTS – A complete assembly consisting of a handle, a lampholder assembly, a guard and a power-supply cord.

2.46 PORTABLE LUMINAIRE – A portable luminaire, also commonly known as a portable lamp, as defined in the scope of the Standard. For purposes of requirements in the Standard, the term “portable luminaire,” “luminaire,” and “unit” are used interchangeably.

2.46.1 POWER OVER ETHERNET (POE) – A wiring system conforming to the Standard for Ethernet, IEEE 802.3, that uses category 5 (CAT5) or similar cables and connectors to concurrently carry power and data, with voltage and power within the Class 2 limits of the National Electric Code, ANSI/NFPA 70. Includes PoE (type 1, 15.4 W max), POE+ (type 2, 30 W max), and 4PPoe / PoE++ (type 3, 60 W max and type 4, 100 W max).

2.47 POWER SUPPLY – An electronic assembly designed to convert and regulate an electrical power source to some defined (range of) output voltage and/or current. Within the context of this standard, this term also applies to assemblies commonly referred to as ballasts, drivers, or other assemblies that perform this function.

2.48 POWER SUPPLY, NON-INTEGRAL – A power supply contained in a separate enclosure from that of the portable luminaire lighting assembly, electrically connected at the supply side to a nominal 120 V branch circuit and at the load side to the lighting assembly at some other voltage. Direct plug-in and through-cord power supplies are common forms of non-integral power supplies. Within the context of this definition, a power supply includes fluorescent ballasts, LED drivers, and other electronic assemblies intended to operate incandescent, electroluminescent, or other lighting source types.

2.49 POWER-SUPPLY CORD FITTER – That portion of the assembly that terminates the power-supply cord at the track, connecting the conductors to the bus bars in the track.

2.50 REACTANCE BALLAST – A ballast, the impedance of which is provided by:

a) Inductive reactance;

b) Capacitive reactance; or

c) Both inductance and capacitive reactance.

2.51 REACTOR (SIMPLE REACTANCE) BALLAST – A reactance type ballast in which the impedance (inductive reactance) is provided by a single coil and core - not a transformer. A reactor ballast usually has one lead in and one lead out.

2.52 SECONDARY CIRCUIT – A circuit that is supplied by an induced voltage from a primary where a primary circuit is that supplied by a branch circuit.

2.53 SHADE – The portion of the portable luminaire within which the lamp is located. The light from the lamp is diffused, deflected, reflected, transmitted through, or absorbed by the shade. The shade may be a functional or supportive part, or a decorative part.

2.54 SIGN – A self-contained, cord or permanently-connected, electrically illuminated product, usually with advertising or other words or symbols, intended to convey information or attract attention in a commercial setting.

2.55 SODALIME GLASS – Window glass which typically has a greenish tint readily discernible by viewing the glass from the edge. It scratches easily as compared to other types of glass. Sodalime glass is not determined to be heat resistant unless it is tempered.

2.56 SUBASSEMBLY – Consists of all the parts to a portable luminaire in an easy to assemble form either for “building” a unit (such as a craft kit) or rewiring a portable luminaire. They are intended to be assembled by a person presumed to possess little or no knowledge or no knowledge of electrical circuitry.

2.57 TEMPORARY – Used only for the amount of time required to complete the job. Not intended for long term use in one location. When the job is complete, the work light is moved to the next work area or stored until the next job.

2.58 TORCHIERE – A portable luminaire supported by the floor having a bowl shaped shade with the concave surface facing upward (open top/closed bottom design) intended to provide indirect light. This includes both opaque and translucent type shades. The lamp (bulb) is typically 5 – 6 feet (1.27 – 1.52 m) above the floor and is hidden from direct view by the concave shade. A floor unit that has an adjustable bowl shaped shade where the concave surface of the shade can be directed upward to an angle greater than 45 degrees from the horizontal is also defined as a torchiere.

2.59 TRACK – An enclosure that houses the bus bars and that houses or is integral with the bus bar support. Track is usually made of extruded material that usually resembles an “H” in cross section, with two vertical members connected by a horizontal member. The bus bar support and bus bars are factory-mounted in the lower half of the “H” and the connection of lighting assemblies is accomplished through the open bottom.

2.60 TUNGSTEN-HALOGEN DOUBLE ENVELOPE LAMP – See 2.62. The lamp also includes an outer integral glass envelope.

2.61 TUNGSTEN-HALOGEN LAMP, SUITABLE FOR USE IN OPEN LUMINAIRE – A lamp that complies with the following:

a) The lamp containment and UV filter requirements of UL 153 and is identified as a “Classified” lamp; or

b) The lamp is single enveloped, complies with the Standard for Incandescent Lamps – Safety Specifications, Part 3: Tungsten Halogen Lamps (non-vehicle), ANSI/IEC C78.60432:3, and the lamp manufacturer declares on the lamp package that the lamp is suitable for use in an open luminaire; or

c) The lamp is provided with an integral outer lamp envelope and the lamp manufacturer does not provide a caution requiring an additional lamp containment barrier or UV filter.

2.62 TUNGSTEN-HALOGEN SINGLE ENVELOPE LAMP – An incandescent lamp with a quartz or glass envelope, filled with a halogen gas, and a tungsten filament.

2.63 ULTRAVIOLET (UV) FILTER – A portion of the portable luminaire that limits ultraviolet (UV) emissions.

2.63.1 Universal Serial Bus (USB) – A wiring system for communication and power transfer between a wide range of digital devices. Several versions exist (USB 1.0, 2.0, 3.0, type C, Power Delivery), all with power levels evaluated under the Limited Power Source (LPS) protocol of the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1 or the Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1, (and similar) standard and conforming to the Class 2 limits of the National Electric Code, ANSI/NFPA 70.

2.64 USER SERVICING – See 2.37.

2.65.1 WATER SHIELD – A part or assembly of parts whose function is to exclude water from some portion of the portable luminaire. A water shield may additionally serve other functions.

2.66 WORK LIGHT – A cord and plug connected light for illumination of work areas such as construction sites, loading docks, and machinery work stations. Work lights are not intended to be hand held during use. Work lights are not intended for use in hazardous locations as defined in the National Electric Code, ANSI/NFPA 70.

3 Organization and Application

3.1 The requirements are organized as follows:

Construction requirements:

Sections 7 – 47 – applicable to all portable luminaires; and

Sections 48 – 142 – applicable to specific type units.

Performance tests:

Sections 143 – 161 – applicable to all portable luminaires; and

Sections 162 – 197 – applicable to specific type units.

Marking requirements:

Section 198 – applicable to all portable luminaires; and

Sections 199 – 216 – applicable to specific type units.

Instruction requirements:

Section 218 – applicable to all portable luminaires; and

Sections 219 – 231 – applicable to specific type units.

Manufacturing and production tests:

Appendix B – applicable to all portable luminaires.

3.2 A portable luminaire is capable of having multiple supplementary requirements that are applicable. For example, a work light, in addition to complying with the general and the work light sections of the standard, shall also be required to comply with the supplementary requirements for tungsten-halogen and wet location type units when these requirements are applicable. Specific unit features which limit the application of the requirement(s) are identified by headings, subheadings, or the text of the paragraph. When a product type reference is not specified, the requirement is applicable to all portable luminaires.

4 Components

4.1 Except as indicated in 4.2, 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.

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

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

b) Is superseded by a requirement in this standard.

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

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

5 Units of Measurement

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

5.2 Unless indicated otherwise, all voltage and current values specified in this standard are rms.

6 Undated References

6.1 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

MECHANICAL CONSTRUCTION – GENERAL

7 General

7.1 These requirements apply to all portable luminaires and shall be used in conjunction with the applicable supplementary requirements in this standard.

8 Assembly and Packaging

8.1 Any portion of a portable luminaire that is detachable, for shipping purposes or otherwise, shall be constructed such that it is only able to be assembled in the intended manner.

Exception: A part that is capable of being detached and assembled without compromising the mechanical or electrical integrity of the unit is capable of being assembled in more than one manner.

8.2 A portable luminaire shall be shipped from the factory in a carton or as an unpackaged complete assembly. Unassembled parts, such as glassware, chains, and similar components, when required elsewhere in the standard to accompany the product, shall be included. Decorative glassware is not required to be mounted in a frame or holder and is able to be separately wrapped to protect it from breakage during shipment.

8.2.1 A portable luminaire designed for use with a non-integral power supply shall comply with (a), (b), or (c) below:

a) The portable luminaire is packaged with a compatible power supply;

b) The power supply is separately shipped and is marked in accordance with Section 199 (markings for non-integral power supply); or

c) The portable luminaire is intended to operate from USB, or POE power sources.

Note: See glossary for defined terms.

8.3 A portable luminaire is not required to be completely mechanically assembled when:

a) All parts required to assemble the product, other than an ordinary tool, are provided with the unit;

b) Splices or electrical connections are not exposed nor require completion in the assembly;

c) The integrity of the strain relief at all wiring terminations is intact (see Strain Relief Test, Section 154);

d) Assembly instructions are provided in accordance with 218.2; and

e) When assembled in accordance with the manufacturer's instructions, the unit complies with the requirements in this standard.

Exception No. 1: A splice or connection is capable of being exposed or incomplete when it consists of interlocking plug/receptacle parts where the means of maintaining polarity and strain relief are inherent to the construction of the interlocking parts.

Exception No. 2: An insulation-piercing or crimp connector is capable of being exposed during the assembly operation when:

a) All live parts of the connector and the conductors are insulated; and

b) The splice is located such that it and the conductors connected to it are unable to inadvertently snagged or grabbed.

8.4 When wires pass through a joint between sections of a portable luminaire that are separable for packing purposes, the wires exposed at the joint prior to assembly shall contain no splices. During assembly, the joint shall either:

a) Be limited, by threads or mechanical interference or similar, to no more than 360 degrees of rotation; or

b) Comply with the Power Supply Cord Twist Test, Section 157.

8.5 When fiberglass sleeving is provided for reducing the risk of cutting or abrasion of wiring between sections of a portable luminaire separable for packing purposes as noted in 8.3 and 8.4, the sleeving shall be secured in place by means other than friction. Unless the assembly is obvious between potential pinch points, the sleeving should not require careful positioning by the user to avoid damage to the wiring.

8.6 When a splice or an electrical connection is located in a section of a portable luminaire that is separable for packing purposes, as noted in 8.3 and 8.4, the unit shall be provided with strain relief to reduce the risk of stress being transmitted to the splice or electrical connection during unpackaging and assembly of the luminaire. The strain relief shall be reliable and not easily defeated by the user. See the Strain Relief Test, Section 154.

8.7 When in any position of adjustment, a spring-loaded or adjustable section of a pole unit shall not transmit stress to a splice or wiring within any section of the unit either during assembly or when completely assembled. For example, the stem of an adjustable height floor unit shall raise and lower without binding or crimping the wiring of the unit.

9 Enclosures

9.1 A portable luminaire shall be constructed so that it has the mechanical strength required to resist the handling to which it is likely to be subjected, without resulting in a risk of fire, electric shock, or injury to persons due to total or partial collapse of any part with resulting reduction of spacings (electrical or thermal), loosening or displacement of parts, or other serious defects.

9.2 Where an enclosure relies on adhesive for compliance with 9.1, the adhesive shall be evaluated and found suitable for the associated temperature, environmental exposure, surface materials, and mechanical forces.

9.3 A portable luminaire shall be constructed so that all user servicing is completed without subjecting any wiring, component, or part to mechanical damage, or reducing electrical spacings.

9.4 A portable luminaire shall be constructed of material such as glass, metal, urea, porcelain, phenolic composition, plastic or wood. Hygroscopic materials are permitted only for portable luminaires supplied by a non-integral class 2 power supply.

9.5 A live part operating above Class 2 circuit limits shall be enclosed in a material with fire containment capability, such as metal, glass, ceramic, porcelain, or a polymeric material that complies with Section 12, during normal maintenance and use.

Exception No. 1: A current-carrying part of a wiring device (such as the screw shell and center contact of a lampholder, and the lampholder contacts, starter holder contacts, and similar components of a fluorescent

lamp) that are normally fitted with a functional component (a lamp, a starter, and similar components during use of the unit is not required to be additionally enclosed.

Exception No. 2: A component, such as a ballast, that has an integral outer housing that has been evaluated as an enclosure is not required to be additionally enclosed.

Exception No. 3: The power-supply cord is not required to be contained within the unit.

Exception No. 4: A wire with minimum 0.030 inch (0.76 mm) thermoplastic insulation is not prohibited from being exposed for 2 inches (50.8 mm) or less when it is securely held in place and is routed in close proximity to a portion of the lamp such that the risk of being inadvertently snagged is minimized.

Exception No. 5: A wire or bundle of wires for a lamp supported lampholder is not prohibited from being exposed when:

a) The exposed wire or bundle of wires is covered with a glass fiber sleeve or thermoplastic tubing that extends from a point inside the enclosure to within 1/2 inch (12.7 mm) of the lampholder, and the sleeving has a wall thickness of at least 0.017 inch (0.42 mm);

b) The hole in the housing through which the nonenclosed wires emerge is not larger than 5/8 inch (15.9 mm) diameter, or has an area of 0.31 square inch (200 mm ^{2}) when other than round in shape; and

c) The wires are provided with a strain relief device at the portable luminaire end, and the device complies with the Strain Relief Test, Section 154.

Exception No. 6: A wire or cord with a minimum 0.030 inch (0.76 mm) thermoplastic insulation and an insulation-piercing or a crimp connector having all live parts of the connector and the conductors insulated are only required to be housed within the unit such that they are unable to be grasped, pulled, or inadvertently snagged. For instance, it meets the intent of the requirement to have a metal base with a felt pad for a bottom cover where the felt pad is secured by an adhesive and the weight of the unit.

Exception No. 7: Wood and other organics are permitted for enclosing combustible parts that are insulated with material rated V2 or better.

10 Metal Thickness for Enclosures

10.1 The thickness of sheet metal used in a portable luminaire shall not be less than specified in Table 10.1.

Exception No. 1: A form of construction that uses metal having a thickness less than specified is able to be used when investigated and found to comply with the applicable tests in Metal Thickness Equivalency Tests, in the Standard for Luminaires, UL 1598.

Exception No. 2: The thickness of metal is not specified for:

a) A decorative part;

b) A reflector part that does not form part of the enclosure; or

c) Any part not required to serve as the enclosure, provide structural integrity, or act as support of a wiring device.

Table 10.1
Thickness of sheet metal

Largest dimension	Conditions of use	Minimum thickness of sheet metal					
		Uncoated		Zinc-coated		Copper, brass, or aluminum	
		Inch	(mm)	Inch	(mm)	Inch	(mm)
Not more than 26 inches (660 mm)	Component Support	0.020	(0.51)	0.023	(0.58)	0.025	(0.64)
		0.016[a]	(0.41)[a]	0.019[a]	(0.48)[a]	0.020[a]	(0.51)[a]
	No Component Support	0.016	(0.41)	0.019	(0.48)	0.020	(0.51)
		0.013[a]	(0.33)[a]	0.016[a]	(0.41)[a]	0.016[a]	(0.41)[a]
Not more than 50 inches (1.27 m)	Component Support	0.026	(0.66)	0.029	(0.74)	0.032	(0.81)
		0.020[a]	(0.51)[a]	0.023[a]	(0.58)[a]	0.025[a]	(0.64)[a]
	No Component Support	0.020	(0.51)	0.023	(0.58)	0.025	(0.64)
		0.016[a]	(0.41)[a]	0.019[a]	(0.48)[a]	0.020[a]	(0.51)[a]
More than 50 inches (1.27 m)	Component Support	0.042	(1.07)	0.045	(1.14)	0.050	(1.27)
		0.031[a]	(0.79)[a]	0.034[a]	(0.86)[a]	0.040[a]	(1.02)[a]
	No Component Support	0.031	(0.79)	0.034	(0.86)	0.040	(1.02)
		0.026[a]	(0.66)[a]	0.029[a]	(0.74)[a]	0.032[a]	(0.81)[a]

[a] Only when the surface involved is curved, ribbed, flanged, or reinforced with additional metal. A surface is determined to be flanged when the two opposite longer sides are bent at right angles to the surface to form 1/2 inch (12.7 mm) or wider flanges.

10.2 Table 10.1 applies to any single surface or single flat sheet. Values for the thickness of sheet steel are based on uncoated material. Rigid members consisting of 1/2 by 1/2 inch (12.7 by 12.7 mm), 90 degree angle strips formed of sheet steel not less than 0.031 inch (0.79 mm) thick, or flat steel bars not less than 3/8 inch (9.5 mm) wide and 1/8 inch (3.2 mm) thick shall be used to reinforce and divide a larger area into sections for which lighter metal is able to be used. Such reinforcement, unless along the greater dimension of the surface, shall also be secured to the adjacent sides of the enclosure. A single sheet of metal having a bent corner that forms an angle of not more than 120 degrees is determined to be reinforced at that corner, and the thickness is based on the length and area of the maximum flat surface involved.

10.3 The minimum thickness of cast metal shall be in accordance with Table 10.2.

Exception: A form of construction that uses metal having a thickness less than specified is able to be used when investigated and found to comply with the applicable tests in Metal Thickness Equivalency Tests, in the Standard for Luminaires, UL 1598.

Table 10.2
Thickness of cast metal

Metal	Minimum thickness, inch (mm)			
	At unreinforced areas		At all other areas[a]	
Die-cast metal	5/64	(2.0)	3/64	(1.2)
Cast malleable iron or permanent mold cast aluminum	3/32	(2.4)	1/16	(1.6)
Other cast metal	1/8	(3.2)	3/32	(2.4)

[a] Applicable for the base of threads, and for surfaces that are curved, ribbed, or otherwise reinforced so as to meet the intent of the requirements, or for a surface of such shape or size that the required mechanical strength is provided.

10.4 Metallic tubing shall not be less than 0.040 inch (1.02 mm) thick when cut threads are employed.

10.5 Unthreaded metallic tubing or metallic tubing having rolled threads shall not be less than 0.025 inch (0.64 mm) thick.

10.6 The thickness of tubing is to be measured with a round-nose micrometer.

10.7 An enclosure, a frame, a guard, a handle, or similar part shall not be sufficiently sharp to constitute a risk of injury to persons in normal maintenance and use.

11 Corrosion Protection

11.1 Each external iron or steel surface of a portable luminaire enclosure or wireway shall be protected from corrosion.

Exception No. 1: Enclosed steel pipe stems are not required to be protected against corrosion.

Exception No. 2: Threaded holes and the cut edges and punched holes of an enclosure, and similar parts, formed of galvanized stock are not required to be protected against corrosion.

Exception No. 3: Cast materials are not required to have corrosion protection.

12 Polymeric Enclosures

12.1 A polymeric material, used as a part or all of the enclosure of a portable luminaire as specified in Enclosures, Section 9, shall have:

a) Mechanical temperature indexes (including impact) as a result of long term aging as described in the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B; and

b) Been evaluated for use in portable luminaires in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

Exception No. 1: A polymeric material used as an enclosure for a dry location unit does not require the volume resistivity test.

Exception No. 2: The distortion under load test is not required when the mold stress relief test is conducted.

Exception No. 3: For units which are not mounted to a surface, the impact test shall include the drop test, and the ball impact test is not required.

Exception No. 4: The mold-stress relief distortion test shall be conducted using the air-oven method only. The test-cell method is not required.

Exception No. 5: The input after mold stress relief distortion, the abnormal conditions test, and the severe conditions test are not required.

Exception No. 6: The mold stress relief distortion test is not required on extruded or protruded materials.

12.2 A polymeric material is relied upon to provide all or a portion of the strain relief, shall comply with the requirements of the Strain Relief Test, Section 154, after the Mold Stress Relief Distortion Test in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

13 Decorative Parts

13.1 A decorative part of polymeric material located near a lamp or other component that generates heat shall:

a) Be present on the portable luminaire when it is temperature tested in accordance with the Normal Temperature Test, Sections 143 – 147; and

b) Not melt or deform in any way that interferes with the normal operation of the unit or results in a risk of fire or electric shock during the temperature test.

13.2 A decorative part is able to be constructed of any material when the failure of the part does not interfere with the performance of the portable luminaire. Hygroscopic materials are permitted only for portable luminaires supplied by a non-integral class 2 power supply.

14 Enclosure Openings

14.1 An opening in a portable luminaire enclosure described in Enclosures, Section 9, shall comply with the requirements for the Accessibility of Live Parts, Section 23.

14.2 An enclosure containing an open core-and-coil device shall not contain open holes or open seams.

Exception No. 1: An opening provided for an automatic starter meets the intent of the requirement when it is no more than 1/8 inch (3.2 mm) diameter larger than the diameter of the starter.

Exception No. 2: Openings provided in through-cord transformers or direct plug-in transformers meet the intent of the requirement when the transformer complies with the Standard for Power Units Other Than Class 2, UL 1012, the Standard for Class 2 Power Units, UL 1310, or the Standards for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1 and Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3.

Exception No. 3: A unit that incorporates an open coil type transformer or power supply is able to have open holes in the enclosure as specified in Table 14.1 when the transformer has been determined to comply with the abnormal test specified in the Standard for Transformers and Motor Transformers for Use in Audio-, Radio-, and Television-Type Appliances, UL 1411, abnormal and short circuit test in the Standards for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1 and Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3, or when a power supply has been investigated to determine compliance with the abnormal, burnout, and short-circuit tests specified in the Standard for Power Units Other Than Class 2, UL 1012, or the Standard for Class 2 Power Units, UL 1310.

Exception No. 4: An enclosure of an open coil ballast or transformer is able to have open holes in its surface when a metal baffle is provided that complies with Figure 14.1 and the following:

a) The distance between the baffle and the outer enclosure, X, shall not exceed 1/4 inch (6.4 mm).

b) The dimensions of the baffle, Y, shall be at least the cross-sectional dimensions of the live part.

c) The distance where the enclosure overlaps the baffle, Z, shall be at least two times the distance between the baffle and the outer enclosure (X).

Exception No. 5: A fluorescent unit that incorporates an open coil type ballast is able to have open holes in the enclosure as specified in Table 14.1 when the ballast complies with the Class P requirements of the Standard for Fluorescent-Lamp Ballasts, UL 935.

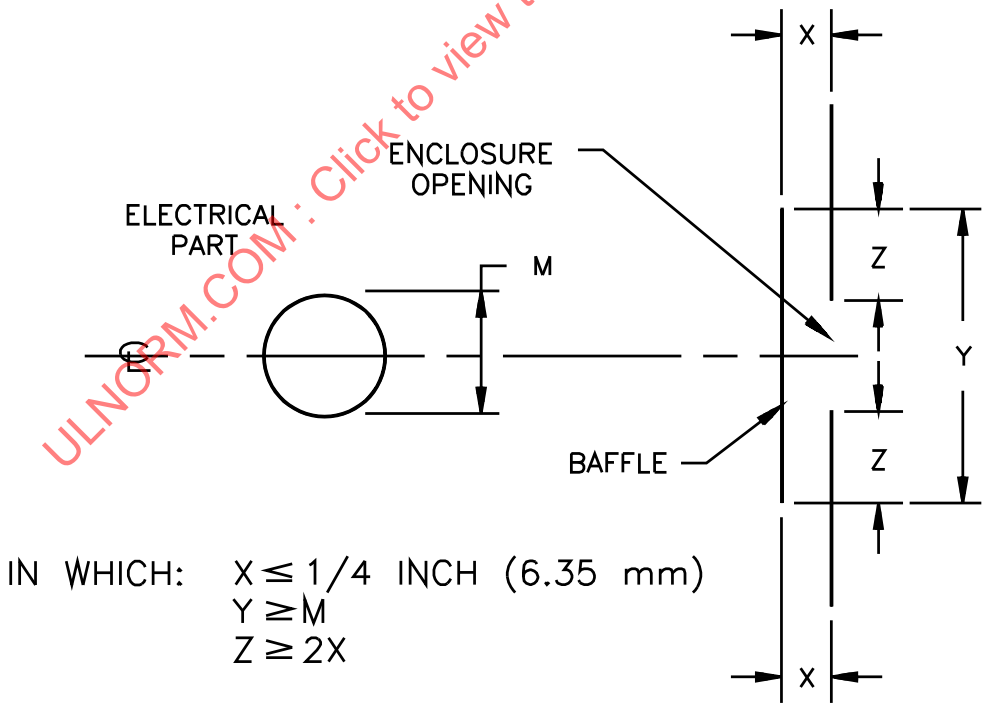
Exception No. 6: A high intensity discharge unit that incorporates an open coil type ballast is able to have open holes in the enclosure as specified in Table 14.1 when the ballast complies with the burnout test requirements of the Standard for High-Intensity-Discharge Lamp Ballasts, UL 1029.

Table 14.1
Maximum size of miscellaneous open holes

Opening shape	Dimension		Maximum area	
	Inch	(mm)	in^2	(cm^2)
Slot[a]	3/8 (width)	(9.6)	1-1/2	(9.68)
Square	1/2 (side)	(12.7)	–	–
Round	1/2 (diameter)	(12.7)	–	–
Irregular	–	–	1-1/2	(9.68)

[a] An open hole between two assembled parts that does not exceed 1/32 inch (0.8 mm) is not required to comply with the area limitation.

Figure 14.1
Relationship of baffle and electrical part to prevent emission



14.3 An enclosure shall not contain any opening that is usable for mounting the portable luminaire.

Exception No. 1: An opening that does not involve access to the enclosure interior is permitted.

Exception No. 2: A keyhole slot is not prohibited from being open when it is in accordance with 71.2.

15 Wireways and Tubing

15.1 A portable luminaire shall be constructed so that when wires are pulled through, or the unit otherwise wired, the covering or insulation on the conductors are not damaged against any surface they are able to contact. Also see Protection of Wiring, Section 30, for additional requirements.

15.2 Wireways shall be free from burrs and fins.

15.3 Tubing that is used as a wireway shall be free from kinks and cracks.

15.4 Screw threads of sheet metal screws and self-tapping screws shall not be exposed for a distance of more than 3/16 inch (4.8 mm) in a wireway.

Exception: The screw threads are not prohibited from being exposed for more than 3/16 inch (4.8 mm) when the wires are held away from or prevented from contacting the screw threads.

16 Shade Construction

16.1 A portable luminaire shall be shipped with a shade unless:

a) The shade functions only as a decorative part and instructions are provided in accordance with 219.1.1;

b) The design is not intended for use with a shade and instructions are provided in accordance with 219.1.2; or

c) The design is not intended for and has no means to readily attach a shade.

16.2 A portable wall, table or floor type luminaire having a shade with one or more of the following features shall comply with the General – Abnormal Operation Tests, Section 149:

a) The adjustable or flexible shade is able to be adjusted against the supporting surface so as to block the air flow to the lamp;

b) There are multiple shades such that one shade directs light onto another; or

c) The shade is able to fold up so as to block the air flow to the lamp.

16.3 A portable luminaire complying with the Temperature Test-Exempt Units requirements of Sections 49 or 63 is able to have a shade constructed of any material.

16.4 A shade shall reliably maintain its dimensions. For example, a breeze shall not be able to blow the cloth of a cloth shade closer to the lamp.

Exception: A shade is not required to reliably maintain its dimensions when the shade is used in accordance with the requirements for the minimum possible dimensions the shade is capable of attaining.

16.5 A dust cover is able to be provided over a shade only when instructions for removal are provided in accordance with 201.3.

Exception: The instructions are able to omitted when the dust cover does not restrict or reduce the required open area of the shade.

17 Strain Relief

17.1 A portable luminaire shall be provided with strain relief so that a pull exerted on the power supply cord is not transmitted directly to a terminal splice, or interior wiring of the unit. See Strain Relief Test, Section 154.

Exception No. 1: Additional strain relief is not required to be provided when the conductors of the supply cord are permanently assembled to a wiring device (such as a switch), lampholder, or similar device by the manufacturer of the wiring device, in such a manner that replacement of the cord requires the disassembly of the device by the removal of a rivet, drive screw, drive pin, or similar component.

Exception No. 2: Additional strain relief is not required to be provided when a lampholder has insulation piercing terminals and is identified as not requiring an additional strain relief device.

17.2 A metal strain-relief clamp or band used with Type SP-2 or lighter general-use, rubber-insulated cord shall be provided with auxiliary insulation over the cord for mechanical protection.

Exception: The auxiliary insulation is able to be omitted for Type SV or SVO cord.

17.3 A clamp of any material (metal or otherwise) shall not be used with Type SPE-2, SPT-2, SVT, or SVTO flexible cords, or a power supply cord for LED portable luminaires covered by the requirements of Sections 69A – 69C.

Exception No. 1: The construction is able to be evaluated for use when the cord is protected by varnished-cloth or similar material under the clamp.

Exception No. 2: A strain-relief bushing of insulation material that has been investigated for the purpose is able to be used.

17.4 Auxiliary insulation is not required for a clamp used for strain relief of thermoplastic-insulated cord heavier than types as indicated in 17.3 when tested in accordance with the Strain Relief Test, Section 154, with no damage to the cord insulation.

17.5 When a knot in a flexible cord serves as strain relief, any surface against which the knot is able to bear or with which it is able to come in contact shall be free from projections, sharp edges, burrs, fins and similar conditions, that are capable of damaging the insulation on the conductors.

18 Portable Luminaires Having Play Value

18.1 A portion of a portable luminaire that has play value for children eight years or less in age and is intended to be removed from the unit and played with (for example a plush doll not integral with the luminaire) shall comply with the Standard Consumer Safety Specification for Toy Safety, ASTM F963. It is not possible to specify the conditions of tests for all constructions; however, the tests shall include evaluation of impact, bite, flexure, torque, tension, compression, sharp point, sharp edge, and small parts.

18.2 The portable luminaire shall not overturn when tested in accordance with the Stability Test, Section 153, with a 15 degree inclined plane.

18.3 A toy or stuffed animal suspended from a unit shall be designed for unexpected, forceful removal and shall comply with the requirements in the Test for Suspended Toys, Section 180.

18.4 The portable luminaire shall be marked in accordance with the requirements in 198.11.

Exception: The marking is able to be modified to indicate that the risks are associated with the luminaire portion and not to the separable portion having play value.

19 Resistance to Liquid Damage

19.1 When a portable luminaire is intended to be used where the deterioration or breakage of a liquid container, seal, or similar component increases the risk of electric shock or liquid spillage, the container, seal, or similar component shall be resistant to deterioration from the liquid intended to be used in contact with that component. The liquid shall be evaluated with respect to its toxic, acid, alkaline, flame and conductive properties. The determination of resistance to deterioration is based upon the material comprising the container, seal, or similar component, its size and shape, the mode of application, and other factors.

19.2 *Deleted*

20 Portable Luminaire Containing Hazardous Substance

20.1 A portable luminaire containing a hazardous substance, such as the mixture of chemicals used as decorative fluid in lava-type lamps, shall be evaluated with respect to ease of ignition, and whether the substance is toxic. The risk of injury shall be assessed on the basis of the amount of the substance or concentration and a one time exposure due to an accidental spill. Inhalation of vapors, contact with skin or eyes, and ingestion are to be considered as probable events. Chemical changes due to exposure to light (UV) and heat (operating temperature) also are to be determined.

20.2 A container of a hazardous substance shall not be adversely affected by the substance. Gaskets, seals, and caps shall not be adversely affected by the substance.

20.3 Soft glass shall not be used as a container of a hazardous substance.

20.4 The unit shall comply with the marking in 198.12.

20A Plant Luminaires

20A.1 General

20A.1.1 A portable luminaire intended to support or contain a plant shall be additionally evaluated for compliance with this section. This intent and the applicability of this section is to be determined by the design of the product, the use instructions, or the claims of the producer.

20A.1.2 For the purpose of this Standard and in the context of clause 1.1, plant hosting is considered a “task”. However, a portable luminaire may provide ambient lighting in addition to this task lighting.

20A.1.3 Portable luminaires intended for commercial-scale plant growth operations are not within the scope of this standard. Portable luminaires subject to the requirements of this section are limited to those intended for a residential setting where the plant is a peripheral and small scale use of the space.

20A.1.4 A portable plant luminaire whose light source may emit hazardous UV, blue, or infrared radiation shall qualify as Risk Group 0 when subjected to the Photobiological Safety Assessment of UL 8800, Standard for Horticultural Lighting Equipment and Systems.

NOTE: Standard incandescent or fluorescent lamps, and LEDs operating only in the visible light spectrum (400 – 700 nm), are not subject to this requirement.

20A.2 Resistance to moisture

20A.2.1 If the intended use of the portable luminaire involves introducing water (or other liquids) in the vicinity of any parts operating above Class 2 voltage limits for wet locations, the portable luminaire shall be evaluated for compliance with the Leakage Current Measurement Test, Section 161.

20A.3 Resistance to chemicals

20A.3.1 User instructions shall be reviewed for all chemical agents (fertilizers, soil or water supplements, or similar) that the manufacturer identifies as eligible for use with the portable luminaire. If the degradation of any portable luminaire materials could result in increased risk of fire or electric shock injury when exposed to these agents, at least one of the following mitigations are required:

a) The material(s) shall be evaluated and determined to be adequately resistant to the degrading effects of the agent(s).

b) The luminaire design and user instructions shall provide sufficient guidance to preclude exposure of the material(s) to the agent(s).

20A.3.2 If either mitigation (a) or (b) from 20A.3.1 is applicable, the instructions shall also provide guidance for detecting early indications of material degradation and steps to either arrest further development (i.e., stop using certain agents) or to halt all use of the portable luminaire.

20A.4 Lamp replacement

20A.4.1 If the portable luminaire has a user-replaceable light source, the user instructions shall provide guidance for acquiring a suitable replacement light source. This is in addition to the lamp replacement markings of Sections 201 – 205, as applicable. The instructions shall include the statement “Replace only with a light source of similar spectral bandwidth emissions”, or similar wording. A statement referring to a specific light source (i.e., catalog number) provided by the producer and designed for the same spectral output is a permitted alternative to this statement.

ELECTRICAL CONSTRUCTION – GENERAL

21 General

21.1 These requirements apply to all portable luminaires and shall be used in conjunction with the applicable supplementary requirements in this standard.

22 Assembly and Packaging

22.1 A portable luminaire shall be completely wired with each electrical component mounted in place and with each splice and connection completed.

Exception No. 1: A detachable power-supply cord is able to be disconnected from the product, as long as it is packaged with the product.

Exception No. 2: A portable luminaire consisting of a wiring harness that snap-fits into a decorative housing is not required to be assembled when such assembly precludes required packaging of the housing for shipping. For example, a ceramic or glass figurine requires packaging material inside and outside to prevent breakage during shipping.

Exception No. 3: Pendant switches (through cord) are able to be shipped unattached with the unit when installation instructions are included to indicate the intended power supply cord is Type SPT-2.

Exception No. 4: Attachment plugs with pin type (insulation piercing) terminals are able to be shipped unattached with the unit when installation instructions are included. See 32.4.

23 Accessibility of Live Parts

23.1 Each part or device that is required by Enclosures, Section 9, to be enclosed shall be located or shielded so that it is not accessible to unintentional contact by persons during normal use, including relamping, replacement of an automatic starter, or other user maintenance services.

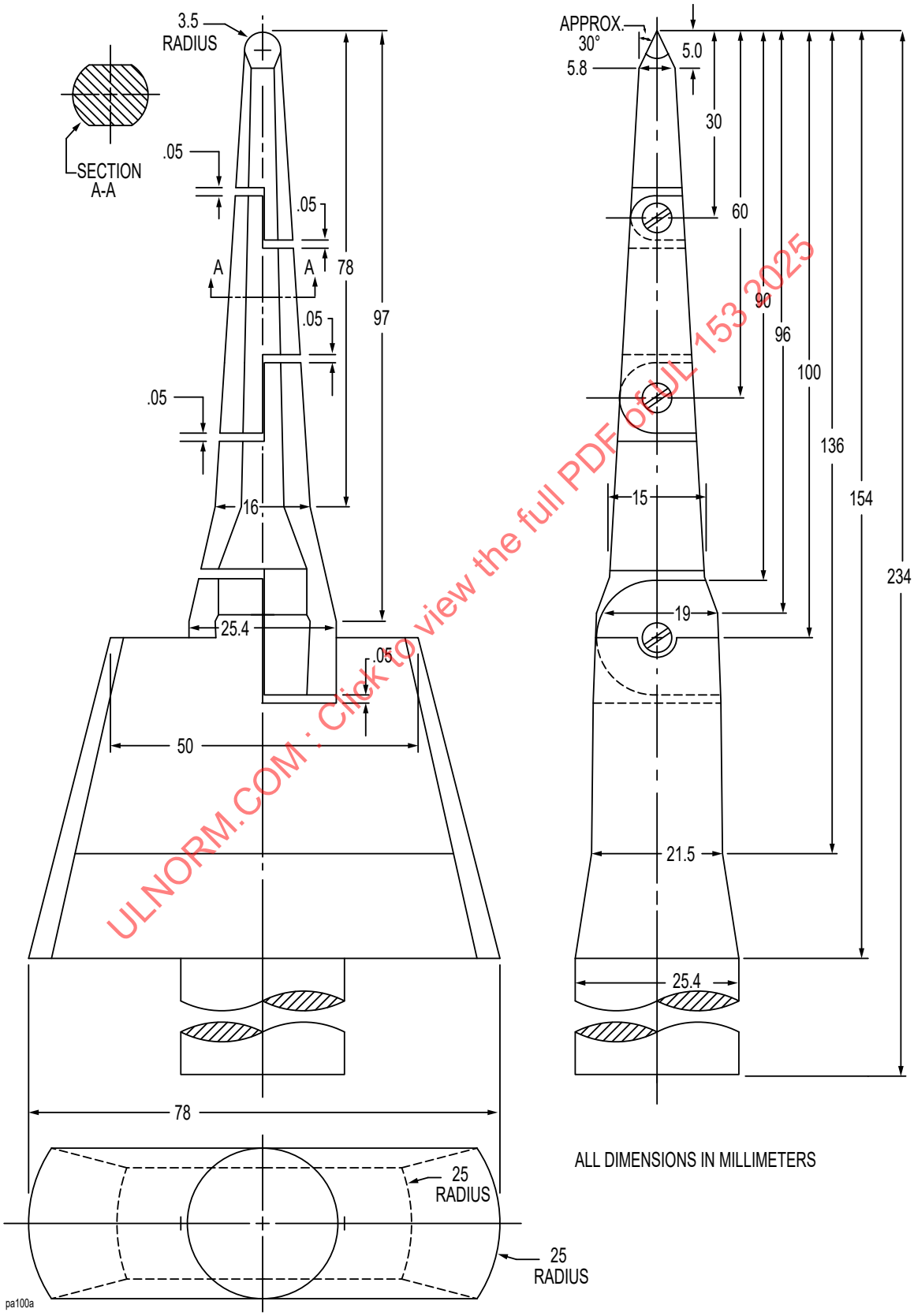
Exception No. 1: An uninsulated live part that operates at a potential of 30 volts rms or less and 42.4 volts peak and is able to be accessible in accordance with Secondary Low Voltage Circuits, Section 38.

Exception No. 2: Wiring that is visible and follows the contour of the portable luminaire is able to be accessible during relamping, when it is not spliced and strain relief is maintained at all wiring terminations.

23.2 A live part is determined to be inaccessible when a probe as illustrated in Figure 23.1 is unable to be manipulated such that it touches any part. The probe is to be articulated into any configuration and rotated or angled to any capable position before, during, or after inserting into the opening.

Figure 23.1

Accessibility probe



23.3 All parts that are removable without the use of tools shall be removed when determining accessibility in accordance with 23.2.

Exception No. 1: A phenolic or metal lampholder shell that is secured by a twist or snap-fit does not require removal.

Exception No. 2: An automatic starter does not require removal.

24 Electrical Spacings

24.1 The spacing between uninsulated live parts of opposite polarity, and between uninsulated live parts and metal that is capable of being grounded shall not be less than 1/4 inch (6.4 mm) through air or 3/8 inch (9.5 mm) over surface. The outer wrap of an open core and coil ballast is determined to be an uninsulated live part with respect to this requirement.

Exception No. 1: The spacing requirements do not apply between uninsulated live parts of a wiring device, such as a lampholder or switch, and dead metal that is part of the wiring device and including mounting screws, rivets, yoke, clamp, or similar components; or for a portable luminaire provided with a grounding means between such live parts and that part of the dead metal surface of the portable luminaire on which the device is mounted in its intended manner. See Figure 24.1.

Exception No. 2: When an isolated dead metal part is interposed between or is in close proximity to:

a) Live parts of opposite polarity;

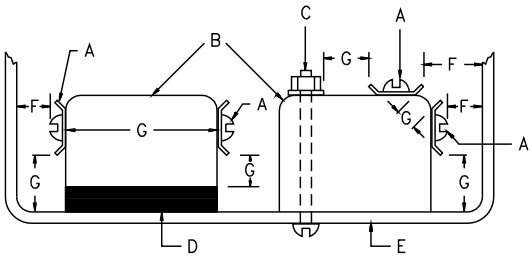
b) A live part and an exposed dead metal part; or

c) A live part and a dead metal part that is able to be grounded, the spacing shall not be less than 3/64 inch (1.2 mm) between the isolated dead metal part and any one of the other parts previously mentioned, provided the total spacing between the isolated dead metal part and the two other parts is not less than 1/4 inch (6.4 mm) through air or 3/8 inch (9.5 mm) over surface.

Exception No. 3: The spacing between uninsulated live parts of a Class 2 circuit and between such parts and dead metal that is grounded in service is not specified.

Figure 24.1

Spacings of components



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A. Uninsulated live parts of wiring device.

B. Insulating material of wiring device.

C. Mounting screw of wiring device.

D. Dead metal part of wiring device.

E. Dead metal parts of portable luminaire.

F. Spacings to which 24.1 applies.

G. Spacings to which 24.1 does not apply. See Exception No. 1 to 24.1.

24.2 As an alternate to 24.1, the Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840, may be used to determine electrical spacing. This only applies to conductive parts that are rigidly held in place and reliably spaced in production such as conductors and components on a printed wiring board. The spacing requirements in UL 840 shall not be used for spacing to a dead metal enclosure, or to uncontrolled components such as wiring device terminals, transformers, and ballasts. Creepage distances shall not be less than clearances. When using the requirements specified in UL 840, the following conditions apply:

a) A portable luminaire marked for wet locations or requiring the humidity conditioning test shall be considered exposed to environmental pollution degree 3 and over voltage category of II.

b) A portable luminaire other than (a) shall be considered exposed to environmental pollution degree 2 and over voltage category of II.

c) The portion of a printed wiring board covered with a potting compound or a conformal coating that complies with the requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluation, UL 746C, shall be considered exposed to environmental pollution degree 1 and over voltage category of II.

24.3 When an uninsulated live part is not rigidly fixed in position by means other than friction between surfaces, or when a movable dead metal part is in proximity to an uninsulated live part, the construction shall be such that the required minimum spacing is maintained.

25 Insulating Materials

25.1 A polymeric material used as an electrical insulator, or as direct or indirect support of a live part, shall comply with the requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

25.2 An insulating lining or barrier of vulcanized fiber or similar materials used where spacing does not otherwise comply with the requirement shall not be less than 1/32 inch (0.8 mm) thick, and shall be so located that it is not adversely affected by arcing, except that vulcanized fiber not less than 1/64 inch (0.4

mm) thick is able to be used in addition to an air spacing of not less than 50 percent of the spacing required for air alone.

Exception: Insulating lining or barrier of vulcanized fiber or similar material in accordance with 25.1 is not required to comply with this requirement.

26 Electrical Ratings

26.1 Each electrical device and insulated conductor shall have a voltage rating at least equal to the voltage applied to it in normal use.

26.2 The maximum ampere rating of a portable luminaire shall not exceed:

a) 12 amperes for a unit provided with an attachment plug with a 15 ampere, 125 volt configuration; or

b) 16 amperes for a unit provided with an attachment plug with a 20 ampere, 125 volt configuration.

26.3 Each electrical device shall have an ampere rating and each insulated conductor shall have an ampacity rating for the maximum current to which it is subjected in normal use.

26.4 The ampere rating of the portable luminaire shall be calculated by adding the ratings of all of the following that are provided on the unit:

a) The ampere rating for each convenience receptacle, marked in accordance with 198.6.2;

b) The ampere rating of each ballast or LED driver;

c) The calculated load of each line voltage incandescent lampholder is to be determined by dividing the marked wattage rating by 120 volts;

d) The ampere rating of each transformer; and

e) The ampere rating of any other line-voltage parts, such as a clock, a motor, and similar parts.

26.5 The ampacity rating of insulated wires and cords with copper conductors shall be as specified in Table 26.1.

Table 26.1
Ampacities of wires and cords with copper conductors

Types of wire and cord[a]	Ampacity			
	18 AWG (0.82 mm^2)	16 AWG (1.3 mm^2)	14 AWG (2.1 mm^2)	12 AWG (3.3 mm^2)
Fixture wires –	6	8	17	23
Flexible cords – As specified in Table 31.1	10	13	18	25
Appliance wiring material	6	8	17	23

[a] Some of the types of wire and cord are not made in each of the sizes shown. For each such type and size, the ampacity shown is inapplicable.

27 Wiring and Conductors

27.1 Conductor size

27.1.1 A conductor of a wire or cord shall be minimum 18 AWG (0.82 mm^2) except where a smaller size is permitted in (a) – (e) below:

a) Internal wiring is permitted to be of any size provided it is adequately protected against overload or abnormal conditions by internal fusing and protected against mechanical damage by the enclosure, barriers, or routing.

b) A conductor in a Class 2 circuit is permitted to be of any size.

c) A permanently attached, completely enclosed, and maximum 6-inch (152-mm) long lead wire for a clock motor or transformer shall be minimum 24 AWG (0.21 mm^2), provided that stalling of the clock motor or any abnormal or overload on the transformer secondary does not result in a risk of fire.

d) Conductors for a series or series/parallel string of non-replaceable lights located within a rigid housing which prevents moving or flexing of the conductors are permitted to be of any size, provided that the portable luminaire complies with the Conductor Short Circuit and Abnormal Operation Test, Section 152.

e) A power supply cord for LED portable luminaires covered by the requirements of Sections 69A – 69C shall employ 20 AWG or 22 AWG conductors.

27.2 Temperature and voltage rating

27.2.1 The flexible cords and fixture wires specified in Table 27.1 shall be considered to have the temperature and voltage ratings as indicated, and shall be subject to the constraints as noted in the footnotes, where applicable.

Table 27.1
Temperature and voltage ratings of wire and cord

Temperature rating	Insulation	300 volts	600 volts
60°C (140°F)	Wire	–	TF, TFF, TW
	Cord[d]	C[a,e], PD[a,e], NISP-1[e], NISP-2, NISPT-1[e], NISPT-2, SJ, SJO, SJOO, SJT, SJTO, SJTOO, SP-1[e], SP-2[g], SPT-1[e], SPT-2[g], SV, SVO, SVOO, SVT, SVTO, SVTOO, Style 20288[e,d]	S, SO, SOO, ST, STO, STOO
75°C (167°F)	Wire	–	RFH-2, RH, RHW, THW, THWN
	Cord[d]	NISP-1[e,b], NISP-2[b], NISPT-1[e,b], NISPT-2[b], SJ[b], SJO[b], SJOO[b], SJT[b], SJTO[b], SJTOO[b], SP-1[e,b], SP-2[b,g], SPT-1[e,b], SPT-2[b,g], SV[b], SVO[b], SVOO[b], SVT[b], SVTO[b], SVTOO[b], Style 20288[b,d,e]	S[b], SO[b], SOO[b], ST[b], STO[b], STOO[b]
90°C (194°F)	Wire[c]	–	FEB, FEPB, PFA, RHH, RHW-2, SA, SIS, TBS, TFN, TFFN, THHN, THHW, THW-2, THWN-2, XHH, XHHW, XHHW-2, Z, ZW

Table 27.1 Continued on Next Page

Table 27.1 Continued

Temperature rating	Insulation	300 volts	600 volts
	Cord[d]	HPD, HPN, HJS, HS, HSO, HSJO, NISP-1[b,e], NISP-2[b], NISPE-1[e], NISPSE-2, NISPE-2, NISPT-1[b,e], NISPT-2[b], SJ[b], SJE, SJEO, SJO[b], SJOO[b], SJT[b], SJTO[b], SJTOO[b], SP-1[b,e], SP-2[b,g], SPE-1[e], SPE-2[g], SPT-1[b,e], SPT-2[b,g], SV[b], SVE, SVE0, SVO[b], SVOO[b], SVT[b], SVTO[b], SVTOO[b], Style 20288[b,d,e]	S[b], SE, SEO, SO[b], SOO[b], ST[b], STO[b], STOO[b]
105°C (221°F)	Cord[c,d]	HPD[a,b], HPN[b], HJS[b], HS[b], HSO[b], HSJO[b], NISP-1[b,e], NISP-2[b], NISPE-1[b,e], NISPSE-2[b], NISPT-1[b,e], NISPT-2[b], SJ[b], SJE[b], SJEO[b], SJO[b], SJOO[b], SJT[b], SJTO[b], SJTOO[b], SP-1[b,e], SP-2[b,g], SPT-1[b,e], SPT-2[b,g], SPE-1[b,e], SPE-2[b,g], SV[b], SVE[b], SVEO[b], SVO[b], SVOO[b], SVT[b], SVTO[b], SVTOO[b], Style 20288[b,d,e]	S[b], SE[b], SEO[b], SO[b], SOO[b], ST[b], STO[b], STOO[b]
150°C (302°F)	Wire	XF, XFF	PF, PFF, PGF, PGFF, PTFF, TFE
200°C (392°F)	Wire	KF-1, KFF-1, SF-1, SFF-1	KF-2, KFF-2, SF-2, SFF-2
250°C (482°F)	Wire	–	PFAH[f], PTF[f]

[a] Not for use in portable luminaires intended to be used in locations that may be affected by moisture, such as a plant luminaire.

[b] Only when surface marked “75°C,” “90°C,” or “105°C,” whichever is applicable.

[c] See 27.2.5 for increased temperature ratings by use of sleeving.

[d] An appliance wiring material complying with Figure 27.1.

[e] Not for use as power supply cord.

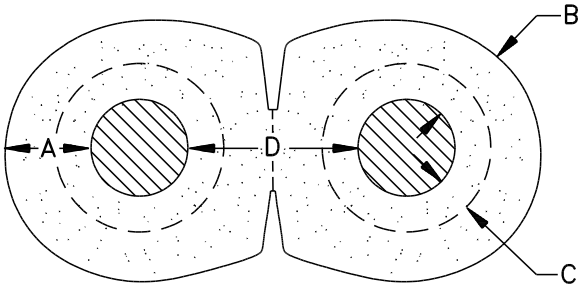
[f] Not for use in wet location luminaires except when wire is totally contained within and water does not enter the unit during the rain and sprinkler tests.

[g] Reference is to minimum voltage, temperature and insulation thickness criteria for power supply cords for LED portable luminaires covered by the requirements of Sections 69A – 69C. Also see 27.1.1(e).

27.2.2 Appliance wiring material (AWM) which is suitable for use as internal wiring and accessible wiring, but not for use as a power supply cord is described in Figure 27.1.

Figure 27.1

Specifications for appliance wiring material



S3527

A – Minimum acceptable average thickness away from tear area and outside point – 0.040 inch (1.02 mm).

B – Minimum acceptable thickness at any point (before separation) – 0.035 inch (0.89 mm).

C – Minimum acceptable thickness at any point after separation – 0.019 inch (0.49 mm).

D –

(1) Minimum acceptable distance between copper conductors – 0.060 inch (1.52 mm).

(2) Stranding shall consist of 36 – 34 AWG (0.013 – 0.020 mm^2) strands.

27.2.3 Wire or cord other than those specified in Table 27.1 is usable when:

a) The insulation of the wire or cord is rated for the maximum temperature involved;

b) The temperature for which the wire or cord is rated is:

1) Identified by a colored thread or a colored stripe as described in 27.2.4; or

2) Printed on the surface of the insulation;

c) The insulation of the wire or cord is:

1) Rated for the maximum voltage involved and not less than 300 volts; and

2) When of rubber or thermoplastic, provided with an overall braid;

Exception: Thermoplastic insulation rated for use at 600 volts or more is not required to be provided with a braid.

27.2.4 With reference to 27.2.3(b)(1) when a colored thread or stripe is used to identify the temperature rating of a wire or cord:

a) For a rubber-insulated wire or cord, green indicates a 75°C (167°F) rating.

b) For a thermoplastic-insulated wire or cord:

1) No identification is required for 80°C (176°F), and when identification is provided, blue is used;

2) Red indicates a 90°C (194°F) rating;

3) Yellow indicates a 105°C (221°F) rating;

4) Brown indicates a 125°C (257°F) rating;

5) Orange indicates a 150°C (302°F) rating; and

6) Black indicates a 200°C (392°F) rating.

27.2.5 Wiring or cord rated minimum 90°C (194°F) is usable at 150°C (302°F) when each individual conductor is provided with sleeving:

a) Consisting of snug fitting:

1) Woven-glass sleeving not less than 0.010 inch (0.25 mm) thick; or

2) Woven-glass tape applied in two or more layers having a total thickness of not less than 0.010 inch; and

b) Extending from the terminals of the lampholder to the point where the wire emerges from the shade or at least 3 inches (76 mm).

28 Splices and Connections

28.1 Stranded conductors of cord or wire intended for connection to a screw terminal shall be twisted and solder-dipped or otherwise treated so as to bind all strands for at least 1/8 inch (3.2 mm) from the end of the stripped conductor prior to connection of the conductor to the terminal so that the strands do not splay during the assembly operation.

28.2 A splice shall be mechanically and electrically secure and, unless a wire connector is used that meets the intent of this requirement shall be soldered. A wire soldered inside an eyelet terminal or similar movement confining part is determined to be mechanically and electrically secure.

28.3 A soldered splice and a splice made with an uninsulated wire connector shall be covered with insulation that has a temperature rating and thickness equivalent to that required on the conductors.

28.4 In determining compliance with 28.3, general-use insulating tape is determined to be rated 80°C (176°F), and usable for 150 volts when wrapped at least once on itself.

28.5 An insulated wire connector shall be rated for the required temperature and voltage of the conductors involved.

28.6 A splice located in an arm or a stem shall not be subject to movement that could create strain on the splice.

28.7 Quick-connect terminals shall be nominally 0.110 (2.80 mm), 0.125 (3.18 mm), 0.187 (4.75 mm), 0.205 (5.21 mm), or 0.250 (6.35 mm) inch wide and shall comply with the Standard for Electrical Quick-Connect Terminals, UL 310. Other sizes of quick-connect terminals shall be investigated with respect to crimp pullout, engagement-disengagement forces of the connector and tab, and temperature rise; all tests shall be conducted in accordance with UL 310.

29 Wiring Attached to Movable or Flexible Parts

29.1 Internal wiring within or attached to a movable or a flexible part shall be stranded, and shall be secured so movement does not cause insulation damage or strain at connections or splices.

30 Protection of Wiring

30.1 A power-supply cord shall exit the portable luminaire through an opening that is free from sharp edges, burrs, and fins that are able to damage the conductor insulation.

30.2 The power-supply cord shall be provided with mechanical means that prevent the cord being pushed inside the enclosure and contacting:

a) A lamp or heated surface, where the surface temperature may exceed the temperature rating of the cord;

b) a sharp edge; or

c) moving part.

30.3 An insulating bushing shall be provided where the flexible cord or wiring enters a pendant lampholder or the base or stem of a portable luminaire, and at the ends of metal tubing where the cord or wiring are pulled during the adjustment of the unit.

Exception No. 1: A smooth, metal bushing is able to be used when Type SPT-2, SJ, SV, or heavier cord is used.

Exception No. 2: An insulating bushing is not required with Integral Type SP-1, SP-2, SPE-1, SPE-2, SPT-1, or SPT-2 cord, a power supply cord for LED portable luminaires covered by the requirements of Sections 69A – 69C, or appliance wiring material complying with Figure 27.1 when:

a) The metal through which the cord passes is not less than 0.042 inch (1.07 mm) thick and the surface is smooth, or the edge of the metal is rolled not less than 120 degrees; or

b) The cord at the point where it passes through the hole is provided with additional insulation that is:

1) Not less than 1/32 inch (0.8 mm) thick;

2) Molded to the cord; and

3) Type SP-1, SP-2, SPE-1, SPE-2, SPT-1, SPT-2 cords, a power supply cord for a LED portable luminaire covered by the requirements of Sections 69A – 69C, or appliance wiring material complying with Figure 27.1.

30.4 Cord or wiring that passes through tubing or contacts the edge of a sheet-metal wall 0.042 inch (1.07 mm) or less thick shall be reliably held away from the edges of the metal or shall be protected by a nonrubber bushing or a grommet or by rolling the edge of the metal not less than 120 degrees.

30.5 When cords or wires pass through or contact the edges of sheet metal thicker than 0.042 inch (1.07 mm), the metal shall be treated by reaming or the equivalent to remove burrs, fins, or sharp edges that are able to damage insulation.

30.6 When the material through which the cord or wiring passes is wood, porcelain, phenolic composition, or other insulating material, not less than 3/64 inch (1.2 mm) thick, a smoothly rounded surface is determined to be equivalent to a bushing.

30.7 Ceramic materials and molded urea, phenolic, and melamine compositions are determined to meet the intent of the requirement for insulating bushings; a bushing of wood or rubber is not usable. Other compositions are able to be used when they have been investigated and found usable for the application.

30.8 A hard-fiber bushing is able to be employed when the bushing is not less than 3/64 inch (1.2 mm) thick.

30.9 An insulated metal grommet is usable in place of an insulating bushing when the insulating material used is not less than 1/32 inch (0.8 mm) thick and completely fills the space between the grommet and the metal in which it is mounted.

30.10 Polymeric sleeving shall not be used for reducing the risk of cutting or abrasion of wiring. Fiberglass sleeving not less than 0.010 inch (0.25 mm) thick is capable of being used.

30.11 A bushing shall be securely held in place.

31 Power-Supply Cords

31.1 A portable luminaire shall be provided with a single power supply cord consisting of one of the types of flexible cords specified in Table 31.1 and an attachment plug rated as required for the application.

Exception: A portable luminaire with a non-integral, direct plug-in type power supply need not have a power supply cord.

Table 31.1
Flexible cord types[b]

Extra hard usage	Hard usage	Not hard usage	
S	SJ	SP-2[c]	SV[a]
SE	SJE	SPE-2[c]	SVE[a]
SEO	SJEO	SPT-2[c]	SVEO
SO	SJO	NISP-2	SVO[a]
SOO	SJOO	NISPE-2	SVOO[a]
ST	SJT	NISPT-2	SVT[a]
STO	SJTO		SVTO[a]
STOO	SJTOO		SVTOO[a]

[a] Individual conductors shall be provided with supplementary insulation or spaced away from metal.

[b] Flexible cords with a “W” or “B” suffix are permitted.

[c] See 27.1.1(e) and Sections 69A – 69C regarding other acceptance criteria for power supply cords for LED portable luminaires employing 20 AWG or 22 AWG conductors.

31.2 A power-supply cord shall not be smaller than 18 AWG (0.82 mm^2).

Exception: A power-supply cord for LED portable luminaires covered by the requirements of Sections 69A – 69C shall employ conductors sized 20 AWG or 22 AWG.

31.3 A power-supply cord shall be at least 5 feet (1.5 m) long measured from the point where the cord emerges from the body of the portable luminaire to the face of the attachment plug or connector.

Exception No. 1: When the intended means of mounting or other features or constructions of any portable luminaire warrants other than the required length of power supply cord, a shorter cord (or no cord) is permitted when instructions are provided in accordance with 218.6. Examples include portable luminaires intended for mounting to machinery, where a longer cord could be subject to mechanical damage, or portable luminaires intended to be mounted to furnishings or cabinets immediately adjacent to a built-in receptacle.

Exception No. 2: For a portable luminaire with a non-integral, through-cord power supply, the power supply cord shall be at least 2 ft (0.61 m) long and the overall length of cord (power supply cord plus power supply output cord) shall be at least 5 ft (1.5 m) long. For a portable luminaire with a non-integral, direct plug-in power supply, the power supply output cord shall be at least 5 ft (1.5 m) long.

Exception No. 3: A portable luminaire provided with a stake, per 131.6, is not required to comply with this requirement when instructions are provided in accordance with 230.2.

31.4 The conductors of the power supply cord shall be identified in accordance with Polarization and Identification, Section 35.

31.5 Integral parallel flexible cord Type SP-1, SPT-1, SPE-1, or appliance wiring material in accordance with Figure 27.1 that is located inside a portable luminaire, the conductors shall be permitted to be separated a maximum of 3 inches (76 mm).

Exception: The flexible cord conductors shall be permitted to be separated more than 3 inches when each conductor is enclosed in supplementary insulation for the temperature involved.

31.5A Integral parallel flexible cord Types SP-2, SPE-2, SPT-2, or a power supply cord for a LED portable luminaire covered by the requirements of Sections 69A – 69C, that is located within a portable luminaire shall be permitted to be separated more than 3 inches.

31.6 Flexible cord types C, HPN, PD, SP-1, SPE-1, SPT-1, and appliance wiring material complying with Figure 27.1 are usable only as internal wiring and shall not be used as power supply cord.

31.7 Integral parallel flexible cord Type SP-2, SPE-2, or SPT-2, or a power supply cord for LED portable luminaires covered by the requirements of Sections 69A – 69C located outside the unit shall be permitted to be separated, but not more than 3 inches (76 mm), providing that the length of separated cord is minimized so as to reduce the risk of being inadvertently snagged.

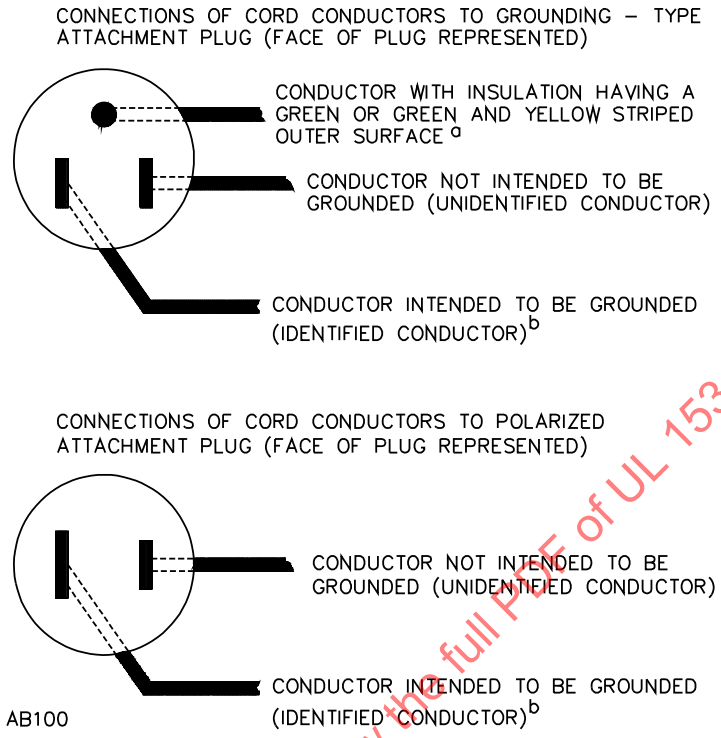
32 Attachment Plugs

32.1 A portable luminaire shall be provided with a polarized attachment plug of the 2-wire, parallel-blade or a 3-wire grounded type, as shown in Figure 32.1. The plug shall be of a 15 or 20 ampere, 125 volt configuration (NEMA Style Nos. 1-15 P, 5-15P, 1-20P, or 5-20P) and shall comply with the requirements in the Standard for Attachment Plugs and Receptacles, UL 498 and/or the Standard for Cord Sets and Power-Supply Cords, UL 817.

Exception: An attachment plug in accordance with Alternate Power-Supply Connections, Section 34, is not required to comply with the requirement.

Figure 32.1

Connections to attachment plug



[a] In the above illustration, the blade to which the green conductor is connected may have a U-shaped or a circular cross section.

[b] Signifies a conductor identified in accordance with Table 35.1.

32.2 The attachment plug shall have electrical ratings as required for the ratings of the portable luminaire. See Electrical Ratings, Section 26.

32.3 For an attachment plug that is assembled to a flexible cord by a manufacturer of the portable luminaire the conductors of the flexible cord shall be fastened securely and in a workmanlike manner to the terminals of the attachment plug. All connections shall be made so that no stray strands of any conductor contacts live parts of opposite polarity or dead metal parts.

32.4 When the intended mounting means of a portable luminaire precludes factory connection of the attachment plug to the flexible cord, a pin-type (screwless) polarized attachment plug (one in which a pin terminal pierces the conductor insulation to establish contact) is able to be provided. Instructions shall be provided in accordance with 218.5.

33 Interconnected Units

33.1 Portable luminaires intended to provide or receive power from another portable luminaire connected in series shall comply with this section.

33.2 *Deleted*

33.3 Interconnected units that do not have a NEMA 15 or 20 A Style plug per 32.1, and are intended to connect to a unit which has overcurrent protection, do not require overcurrent protection.

33.4 Where a power supply, LED driver, ballast or transformer of one portable luminaire powers one or more adjacent units, the adjacent units do not require overcurrent protection.

33.5 The plugs, receptacles, connectors, and cord used for interconnection shall have suitable voltage and current load ratings. Load- and supply-side receptacles and connectors shall have different configurations to prevent inadvertent connection of a supply-side cord set to the load receptacle.

33.5.1 Load-side receptacles and connectors that provide branch-circuit supply to interconnected units shall be wired to provide the same grounding or polarity as the attachment plug.

33.6 The interconnection plugs and receptacles shall comply with Accessibility of Live Parts, Section 23, and Electrical Spacings, Section 24, when inserted and when removed.

Exception: Interconnection plugs and receptacles for secondary low voltage circuits are not required to comply with this requirement.

33.7 Attachment plugs and receptacles shall comply with the requirements in the Standard for Attachment Plugs and Receptacles, UL 498, the Standard for Appliance Couplers for Household and Similar General Purposes – Part 1: General Requirements, UL 60320-1, or the Standard for Cord Sets and Power Supply Cords, UL 817. Connectors shall comply with the following:

a) Connector materials shall be rated for the temperatures to which they are subject during the Normal Temperature Test;

b) Connector materials shall meet the requirements in Polymeric Enclosures, Section 12, and Insulating Materials, Section 25;

c) Connectors shall comply with the 35-pound Strain Relief Test, Section 154, on the interconnecting cord end; and

d) Connectors shall comply with the 50-cycle Overload Test in the Standard for Component Connectors for Use in Data, Signal, Control, and Power Applications, UL 1977.

Exception: Connectors in Class 2 circuits are not required to comply with this requirement.

33.8 *Deleted*

33.9 The ground connection when required by Grounding and Bonding, Section 36, shall make first and break last.

33.10 An interconnected unit shall be provided with markings in accordance with 198.9.

33.11 An interconnected unit shall be provided with instructions in accordance with 218.4.

33.12 An interconnected unit with a shortened power supply cord in accordance with Exception No. 1 of 31.3 shall be marked in accordance with 198.9.1 and instructions in accordance with 218.6.

34 Alternate Power-Supply Connections

34.1 A portable luminaire with a detachable cord is permitted to use an attachment plug of alternative configuration when provided with instructions in accordance with 218.8.

34.2 A proprietary connector provided in place of an attachment plug or an attachment plug and cord shall be investigated and determined usable for the purpose for which it is intended and shall be provided with markings and instructions in accordance with 218.7.

35 Polarization and Identification

35.1 A supply-circuit conductor that is connected to the grounded supply conductor (neutral) shall be marked in accordance with Table 35.1 and shall be connected to the wide blade of a 2-wire attachment plug, or the left-hand blade of a 3-wire attachment plug when looking at the face of the plug with the grounding pin up. See Figure 32.1.

Exception: A Class 2 low voltage plug-in power supply is not required to be provided with a polarized type 2-wire attachment plug.

Table 35.1
Polarity identification of flexible cords

Method of identification	Color combinations	
	Wire intended to be grounded[e] – connected to the screw shell of lampholders	All other wires[e]
Color of braids on individual conductors	Solid white or gray – without tracer	Solid color other than white or gray – without tracer
	Solid white or gray – without tracer[a]	White or gray with tracer in braid[a]
	Color other than white or gray, with tracer in braid	Solid color other than white or gray – without tracer
Color of insulation on individual conductors	Solid white, gray, or blue[b]	Solid color other than white, gray, or blue[b]
Color of separators	White or gray[c]	Color other than white or gray[c]
	Tin or other white metal on all strands of the conductor[d]	No tin or other white metal on the strands of the conductor[d]
Other means	A stripe, ridge, or groove on the exterior surface of the cord[c]	

[a] Only for Types C and PD cords.

[b] Only for cords – other than Types SP-1, SP-2, SPE-1, SPE-2, SPT-1, and SPT-2 cords, a power supply cord for LED portable luminaires covered by the requirements of Sections 69A – 69C, or AWM complying with Figure 27.1 – having no braid on any individual conductor.

[c] Only for Types SP-1, SP-2, SPE-1, SPE-2, SPT-1, and SPT-2 cords, a power supply cord for LED portable luminaires covered by the requirements of Sections 69A – 69C, or appliance wiring material complying with Figure 27.1.

[d] Only for Types SPT-1 and SPT-2 cords, a power supply cord for LED portable luminaires covered by the requirements of Sections 69A – 69C, or appliance wiring material complying with Figure 27.1.

[e] A wire finished to show a green color with or without one or more yellow stripes or tracers shall be used only as an equipment-grounding conductor. See Figure 32.1.

35.2 The screwshell or screwshell contact of each Edison-base lampholder shall be connected to the grounded supply conductor of the supply cord.

35.3 A switch or a fuse or other protective device shall not be connected to the grounded supply conductor of the attachment plug.

Exception: When the switch or protective device simultaneously interrupts both conductors of the supply circuit, it is able to be connected to the grounded supply conductor.

35.4 Any portion of a portable luminaire that is capable of being detached thereby breaking electrical connections – such as a detachable power-supply cord, interlocking connectors, or cord connector– shall be constructed such that it is only able to be assembled in the manner which is required to maintain polarity.

36 Grounding and Bonding

36.1 When a 3-conductor cord-and-plug assembly is provided on a portable luminaire, all conductive parts of a portable luminaire not intended to be electrically live, that are accessible to persons including during any user maintenance and that have the potential to inadvertently become energized shall be grounded by being conductively bonded together to the equipment grounding means.

Exception: Chain links of a swag type unit are not required to be bonded.

36.2 A portable luminaire with any accessible non-current carrying conductive parts and operating with voltage to ground in excess of 150 volts, under any condition of service including open circuit, shall have a grounding type attachment plug.

Exception No. 1: A portable luminaire provided with double insulation between uninsulated parts operating above 150 V to ground and any accessible non-current carrying conductive parts need not comply with this requirement.

Exception No. 2: A portable luminaire provided with a simple reactance ballast or a ballast marked "For use in portable lamps" is not required to comply with this requirement.

36.3 When the reliability of a grounding connection is questioned, it shall be subjected to the Grounding Continuity Test, Section 158.

36.4 A part is determined to be accessible when it is capable of being touched by the probe illustrated in Figure 23.1.

36.5 A conductive part that is required to be grounded or bonded in accordance with 36.1 shall not be coated with vitreous enamel, paint, or similar coating.

Exception No. 1: The surface is able to be coated when it is marked or treated such that there is bare metal contact at the point(s) of bonding.

Exception No. 2: The surface is able to be coated when the means of bonding reliably penetrates or scratches the surface such that there is bare metal contact at the point(s) of bonding.

36.6 The continuity of the grounding or bonding system shall not rely on solder alone or on the dimensional integrity of a thermoplastic material.

Exception: When a material complies with the applicable requirements for Polymeric Decorative Parts, Section 13, and Polymeric Enclosure, Section 12, its integrity is determined reliable for continuity of the grounding or bonding system.

36.7 The grounding terminal of a receptacle provided on a portable luminaire with a metal enclosure shall be bonded to the grounded metal of the unit by one of the following:

a) Riveting, bolting, or welding the metal mounting yoke or strap, when provided, of the receptacle to the metal unit enclosure.

b) A 16 AWG (1.3 mm^2) or larger copper bonding jumper from the receptacle grounding terminal to the unit enclosure, the connection to the lamp enclosure being made by riveting, bolting, or welding.

36.8 A bonding or grounding wire or jumper connector shall be secured by:

a) A machine screw and nut;

b) A machine screw that threads into metal when there are at least two full threads in the metal; or

c) A rivet.

A sheet-metal screw shall not be used to secure a bonding or grounding wire or jumper connector.

36.9 A bonding or grounding wire or jumper connector shall not be terminated by a screw, rivet, or equivalent device that is also used to secure another device or part that is intended to be removed during replacement of any electrical device or component other than the power-supply cord.

Exception: The requirement does not apply to components that are not intended for user replacement and are secured by tamper proof screws that require a special tool to remove.

37 Electronic Circuits

37.1 A printed wiring board, including coatings, when provided shall comply with the requirements in the Standard for Printed-Wiring Boards, UL 796, and shall be classified V-0, V-1, or V-2 in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

Exception: A printed wiring board containing only circuitry not exceeding Class 2 limits is not required to comply with this requirement.

37.2 A resistor, capacitor, inductor, transformer, or other part that is mounted on a printed wiring board to form a printed-wiring assembly shall be secured so that the risk of displacement by any force exerted on it is minimized.

37.3 A circuit involving a capacitor, rectifier, transistor, or similar component is to be subjected to analysis to determine whether there is a risk of fire or electric shock when the component is opened or shorted. The possible effect of one component on another, encapsulation, and similar factors are to be determined. When a risk is determined to exist, the Component Fault Test, Section 151 is to be conducted.

38 Secondary Low Voltage Circuits

38.1 Each secondary circuit exceeding Class 2 limits shall be investigated as though it were a primary circuit with respect to enclosure and accessibility requirements.

Exception: Isolated low-voltage circuits are not required to comply with the accessibility requirements of Accessibility of Live Parts, Section 23.

38.2 A printed wiring assembly and subsequent circuitry used in an isolated, low-voltage circuit exceeding Class 2 limits shall comply with the requirements of Electronic Circuits, Section 37.

38.3 An isolated secondary low-voltage circuit is able to use the frame of the portable luminaire to carry current to one side of the load when hinges or other moveable parts are not used as current-carrying means.

Exception No. 1: A hinge or other moveable part is permitted to be used as a current-carrying means when it complies with the test requirements in Low Voltage Hinged or Moveable Part Cycling Test, Section 160.

Exception No. 2: A Class 2 circuit is able to use the frame of the portable luminaire, including a hinge or other moveable part, to carry current to one side of the load. The frame is able to carry current to both sides of the load providing that one side is insulated or guarded such that external conductive objects, such as jewelry, cannot be inadvertently placed across the Class 2 supply. Insulation employed to comply with this requirement shall comply with the Dielectric Voltage-Withstand Test, Section 159, with a test potential of 500 Vac (or 707 Vdc) applied between the opposing frame pieces.

38.4 A class 2 circuit is permitted to use external surfaces of the portable luminaire to carry current when the portable luminaire complies with the Exposed Class 2 Conductor Abnormal Operation Test, Section 152A.

39 Separation of Secondary Circuit Conductors

39.1 All uninsulated live parts connected to different circuits shall be spaced from one another as though they were parts of opposite polarity, in accordance with the requirements in 24.1 and shall be judged on the basis of the highest voltage involved.

39.2 The wiring in an isolated, low-voltage circuit shall be routed away from the wiring of primary circuits or shall be provided with insulation that is rated for use at the highest of the voltages in the circuits.

39.3 Wires that are part of an isolated low-voltage circuit shall be maintained away from uninsulated live parts of the primary circuit.

40 Separation of Communication Circuit Conductors

40.1 The wiring of communication circuits (telephone jacks) or data conductors that are part of a lighting control system shall be separated by a permanent barrier or a 2 inch (50.8 mm) spacing from the wiring of primary circuits.

41 Component Mounting

41.1 Uninsulated live parts shall be secured to the base or mounting surface so that they are restrained from turning or shifting in position, when such motion results in a reduction of spacing below the minimum required value.

41.2 A joint between metal parts or between fastening arms and supports, shall be strong and rigid and shall not turn when such turning results in movement of a wire or a wiring device after the assembly is completed.

41.3 A switch other than a through-cord switch, a ballast other than a through-cord ballast, a lampholder, convenience receptacle, an attachment-plug receptacle, or similar component shall be mounted securely and shall be restrained from turning.

Exception No. 1: A switch is not required to be restrained from turning when all four of the following conditions are met:

a) The switch is of a plunger or other type that does not tend to rotate when operated. A toggle switch is determined to be subject to forces that tend to turn the switch during normal operation of the switch.

b) The means for mounting the switch prevents the operation of the switch from loosening it.

c) The spacing are not reduced below the minimum required values when the switch rotates.

d) The normal operation of the switch is by mechanical means rather than by direct contact by persons.

Exception No. 2: A lampholder of the type in which the lamp is unable to be replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel, is not required to be restrained from turning when rotation does not reduce spacing below the minimum required values.

Exception No. 3: A lampholder is not required to be restrained from turning when:

a) The means of providing strain relief is not affected by the rotation of the lampholder; and

b) The cord or wiring is not twisted by the rotation (turns freely during rotation).

41.4 The means for preventing the turning or shifting indicated in this section is to consist of more than friction between surfaces. For example:

a) A properly applied lock washer that “cuts” into the surfaces it is placed between;

b) An irregularly shaped opening that prevents rotation by physical fit;

c) A tab that contacts another tab or obstruction that prevents further rotation; or

d) A set screw.

Exception No. 1: A candelabra-base lampholder held in a spring-clip bracket is able to be prevented from rotating by the friction pressure of the spring clip against the mounting surface.

Exception No. 2: The fastening means for securing telescoping parts in an adjustable telescoping arm friction alone is usable when rotation between parts is limited to 360 degrees or less and rotation does not result in damage to conductor insulation.

41.5 A sheet-metal or self-threading screw is able to be used to secure or support a part, such as a ballast, transformer, lampholder, starter holder, or a similar component, that weighs more than 7-1/2 pounds (3.4 kg), to a sheet steel luminaire part. A sheet-metal or self-threading screw in accordance with Security of Screws Test, Section 156, is not prohibited from securing or supporting a part, such as a ballast, transformer, lampholder, starter holder, or a similar component to other than a sheet steel luminaire part.

42 Lampholders

42.1 General

42.1.1 A lampholder with exposed terminals shall have the terminals located behind a permanent barrier or similar construction to comply with the requirements for Enclosures, Section 9, and the requirements for Accessibility of Live Parts, Section 23.

42.1.2 A lamp-supported lampholder shall be provided with stranded wiring.

42.2 Incandescent lampholders

42.2.1 A lampholder, constructed with exposed terminals, that is intended to be provided with a fiber husk and/or outer sleeve (thereby resembling a candle) to prevent inadvertent contact of the terminals shall not be used in a portable luminaire unless evaluated for compliance with 42.2.2 or 42.2.3, as applicable.

Exception: The lampholder is able to be used when live parts are not accessible, as specified in Accessibility of Live Parts, Section 23, when the outer sleeve or outer husk is removed.

42.2.2 The use of a thermoplastic sleeve:

a) Complying with the Polymeric Enclosure, Section 12, requirements;

b) Secured in place; and

c) Not removable without the use of tools;

Meets the intent of the requirement when, with the sleeve in place, the construction complies with the accessibility requirements in Accessibility of Live Parts, Section 23. See 42.2.1.

42.2.3 The use of a fiber husk:

a) Complying with the 1/32 inch (0.8 mm) minimum treated cellulosic fiber for the fiber husk;

b) Secured in place; and

c) Not removable without the use of tools;

Meets the intent of the requirement when, with the sleeve in place, the construction complies with the accessibility requirements in Accessibility of Live Parts, Section 23. See 42.2.1

42.2.4 A porcelain lampholder mounted by means of a screw ring shall be used only with the gasket usually supplied with this type of lampholder.

Exception: The gasket is not required when a lampholder is mounted on and supported by porcelain.

42.2.5 *Deleted*

42.3 Fluorescent lampholders

42.3.1 A portable luminaire with instant-start ballast(s) and incorporating bi-pin lampholders shall:

a) Be constructed with a ballast(s) identified as Type CC, or

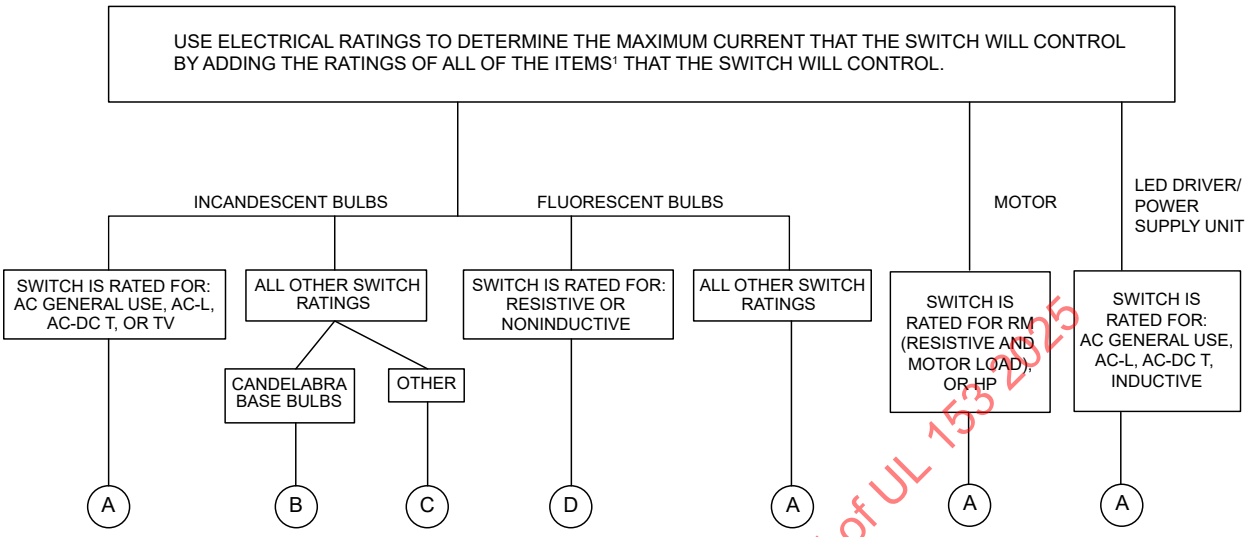
b) Be constructed with lampholders intended for use with instant-start electronic ballasts in accordance with Components, Section 4. Lampholders marked with a circle “I” comply with these requirements.

43 Switches and Dimmers

43.1 A switch for a 120 Vac circuit shall have a current rating for the load it controls in accordance with Figure 43.1.

Figure 43.1

Switch ratings



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[1] Refer to items in 26.4.

a) The switch shall be rated for at least the current it is to control. The current rating for a TV rated switch is indicated as a suffix, for example, TV5 has a 5 ampere rating.

b) The switch shall be rated for at least five times the current it is to control (that is, when it controls a maximum 0.5 ampere load, it shall be rated for minimum 2.5 amperes).

c) The switch shall be rated for at least six times the current it is to control (that is, when it controls a maximum 0.5 ampere load, it shall be rated for minimum 3.0 amperes).

d) The switch shall be rated for at least two times the current it is to control (that is, when it controls a maximum 0.5 ampere load, it shall be rated for minimum 1.0 ampere).

43.2 A switch shall not be connected in the load side of a ballast.

Exception No. 1: A switch is able to be connected in the load side of a reactor ballast.

Exception No. 2: For a plug-in type ballast, a switch is able to be connected in the load side of a ballast when the switch has a voltage and current rating at least equal to the output rating of the ballast under all conditions of use, including normal operation, operation without a lamp, and operation with a deactivated lamp.

43.3 A portable luminaire is not required to be provided with a switch.

43.4 A switch for an isolated secondary circuit shall be rated for the voltage and current of that circuit under normal operation.

43.5 A switch shall not open a required grounding conductor of a portable luminaire.

44 Receptacles

44.1 A convenience receptacle provided on a portable luminaire shall be of the same type and configuration as the attachment plug of the unit, and shall be wired such that it provides the same polarized or grounded supply as the attachment plug of the unit. See Figure 32.1.

44.2 A portable luminaire is permitted to include one or more convenience receptacles. The electrical rating of each receptable shall be marked in accordance with 198.6.2.

44.3 When the face of a receptacle is less than 5/8 inch (15.9 mm) wide or less than 7/8 inch (22.2 mm) long, the face of the receptacle shall project not more than 3/16 inch (4.8 mm) from the part of the mounting surface that is within a rectangle 7/8 inch (22.2 mm) long and 5/8 inch (15.9 mm) wide symmetrically located about the receptacle contacts; and when the mounting surface is conductive, the face of the receptacle shall project not less than 3/32 inch (2.4 mm) from that part of the mounting surface.

44.4 The area surrounding a convenience receptacle shall be free of any projection that prevents full insertion of the blades of an attachment plug having a face diameter of 1-15/16 inches (49.2 mm) and rectangular attachment plug having a face of 1-1/2 by 1-5/8 inch (38.1 by 41.3 mm).

Exception: Projections that prevent the blades of the attachment plug from making electrical contact with the female contacts of the receptacle meet the intent of the requirement.

45 Transformers

45.1 Transformers used in portable luminaires shall comply with the Transformer Short-Circuited Test, Section 150. A transformer known to comply with any of the following standards is considered to comply with this requirement:

a) Standard for Class 2 Power Units, UL 1310;

b) Standard for Transformers and Motor Transformers for Use In Audio-, Radio-, and Television-Type Appliances, UL 1411;

c) Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1 and the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3; or

d) Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1 or the Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1, “limited power source” (LPS) requirements.

46 Motors

46.1 Each motor shall be of a type that is intended for its application and shall operate at its maximum normal load during the Normal Temperature Test, Sections 143 – 147, without resulting in a risk of fire, electric shock, or injury to persons.

46.2 A motor winding shall resist the absorption of moisture.

46.3 Each motor shall be protected from overheating as the result of any condition of load, up to and including stalled rotor.

46.4 The protection against overheating required by 46.3 shall be accomplished by one of the following:

a) Thermal impedance protection complying with the requirements in the Standard for Impedance Protected Motors, UL 1004-2; or

b) Other protection that is found by test to be equivalent to the protection specified in (a).

46A Overcurrent Protection

46A.1 Overcurrent protection, where required, shall either be a circuit breaker, a fuse, or an electronic circuit determined to be reliable when evaluated in accordance with the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, including Requirements for Electronic Controls, Annex H.

46A.2 A fuseholder shall be of a type that prevents insertion of a fuse larger than that required for compliance with this standard.

47 Portable Luminaires with Batteries

47.1 Primary batteries shall be protected from any charging currents by no less than two diodes (or equivalent) or one diode (or equivalent) and a current limiting device (such as a resistor).

47.2 Secondary batteries shall comply with the applicable requirements of the Standard for Household and Commercial Batteries, UL 2054, or the Standard for Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes – Safety Requirements for Portable Sealed Secondary Cells, and for Batteries Made from Them, for Use in Portable Applications – Part 1: Nickel Systems, UL 62133-1.

47.3 Battery cells constructed of lithium metal, lithium alloy or lithium ion shall additionally comply with the applicable requirements of the Standard for Lithium Batteries, UL 1642, or the Standard for Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes – Safety Requirements for Portable Sealed Secondary Cells, and for Batteries Made from Them, for Use in Portable Applications – Part 2: Lithium Systems, UL 62133-2.

47.4 A battery shall be located and mounted within the portable luminaire in a manner that, during replacement or use, prevents misalignment, reverse polarity, damage to connections, loose connections, or access to uninsulated parts that represent a risk of electric shock.

47.4.1 A product or a product accessory, such as a wireless remote control, incorporating one or more button batteries or coin cell batteries having a maximum diameter of 1.25 inches (32 mm) with the

diameter being greater than its height, shall comply with the Standard for Products Incorporating Button Batteries or Coin Cell Batteries, UL 4200A.

Exception: UL 4200A is not applicable to products and product accessories that by virtue of their dedicated purpose and instructions are not intended to be used in locations where they may be accessed by children.

47.5 The output characteristics of the battery charging circuit shall be compatible with the designated secondary battery. The charging circuitry shall not be adjustable by the user.

47.6 The battery and its charging circuit componentry shall comply with the normal temperature test when operated through two consecutive cycles of charging and discharging in accordance with 144.13.

47.7 The charge rate of a secondary battery shall be measured in accordance with 197.1 and shall not exceed the battery manufacturer's recommendations.

47.8 A secondary battery and its charging circuit shall comply with the abnormal tests of Section 197.2.

47.9 A portable luminaire with batteries intended for user replacement shall be marked to identify the appropriate replacement batteries, per the requirements of Portable Luminaires with Batteries, Section 200. Battery cells and batteries that are not accessible with the use of ordinary tools shall be considered not intended for user replacement, and the portable luminaire shall not provide any markings or instructions for the replacement of such cells or inaccessible batteries.

47.10 A portable luminaire with batteries shall be provided with instructions for proper disposal of used batteries, per the requirements of Portable Luminaires with Batteries, 218.9.

INCANDESCENT UNITS – SUPPLEMENTARY

48 General

48.1 The requirements specified in Sections 48 – 53 apply to portable luminaires using incandescent lamps. However, requirements in Sections 50 – 53 (Torchieres) do not apply to portable luminaires marked per 204.3 for use with Self-Ballasted LED lamps only.

48.2 These requirements do not apply to portable luminaires intended for use with tungsten-halogen lamps which are covered by Sections 54 – 59.

Exception: Double enveloped, tungsten-halogen lamps similar in shape to a Type A incandescent lamp, rated 100 watts or less, complying with the requirements of 57.1.2, are able to be evaluated to the Temperature Test-Exempt Units requirements of Section 49.

48.3 These requirements apply to portable luminaires intended for use with xenon filament (not xenon arc) lamps. Xenon lamp portable luminaires are not eligible for the Temperature Test-Exempt program of Section 49. Xenon lamp portable luminaires shall also comply with 55.1.1 and 55.1.2.

48.4 These requirements are supplementary to other applicable requirements in this standard.

49 Temperature Test-Exempt Units

49.1 General

49.1.1 An incandescent portable luminaire that complies with the requirements of this section is not required to be subjected to the Normal Temperature Test – General, Section 143, and Test Method – General, Section 144.

49.1.2 A unit that incorporates the following additional features is not temperature test exempt:

a) Employs a transformer, motor or similar electrical component that is able to generate heat;

b) Employs polymeric materials used as an enclosure, barrier, structural part, or water shield;

c) Employs a closed shade with total lamp wattage greater than 7 W;

d) Employs a shade or decorative part of a material that is able to melt or deform in such a way as to interfere with the normal operation of the lamp; or

e) Is intended for installation in or under a cabinet.

f) Employs a metal shell type medium base lampholder in the base-up position.

49.1.3 A portable incandescent luminaire that complies with the temperature test-exempt requirements of 49.1.1, may also or alternatively be marked in accordance with 203.1.3 or 204.2 for use with a fluorescent or LED self-ballasted lamp or lamp adapter. The lamp replacement marking for the portable luminaire shall not exceed the permitted wattage value for an incandescent lamp as determined by Section 49.

49.2 Determination of temperature test-exempt status

49.2.1 The following steps are to be followed to determine when a portable luminaire complies with the temperature test exempt requirements:

a) Determine shade designation in accordance with 49.3;

b) Determine minimum lamp-to-shade spacings for shade designation, lampholder type and wattage in accordance with 49.4; and

c) Determine minimum wire insulation temperature rating in accordance with 49.5.

49.2.2 A portable luminaire is temperature test exempt when it complies with all the requirements of 49.2.1.

49.2.3 Portable luminaires with shade designs meeting the requirements of 49.6 are temperature test exempt.

49.3 Shade designation

49.3.1 The shade designation required in 49.2.1(a) is to be assigned by determining when there are shade openings above and below the lamp, and when the opening size complies with the minimum area specified in Table 49.1 for the designation. Also see Figure 49.1 for examples.

Table 49.1
Shade opening size for "open" designations

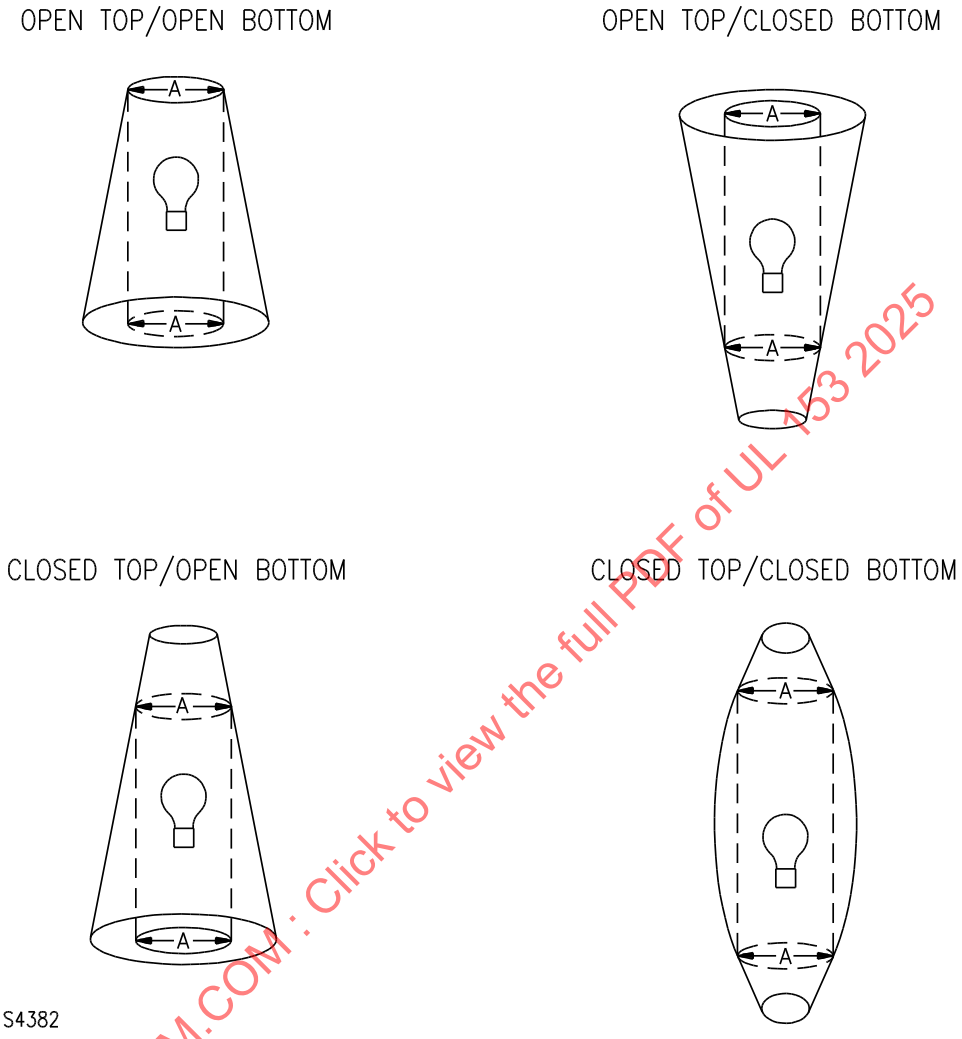
Maximum marked lamp wattage [a]	Minimum opening area		Minimum opening diameter[b]	
	in^2	(cm^2)	in	(mm)
25	7	(45)	3	(76.2)
75	10	(65)	3.5	(88.9)
100	13	(84)	4	(101.6)
150	16	(103)	4.5	(114.3)
200	20	(129)	5	(127.0)
250	24	(155)	5.5	(139.7)
300	29	(187)	6	(152.9)

[a] For a shade with more than one lamp, the lamp wattage is the sum of all lamp wattages. When the marked lamp wattage (or for multiple lamps, the sum of all lamp wattages) is between the value specified, the minimum opening area shall be that for the next highest wattage.

[b] Dimensions specified apply to a circular shade openings corresponding to the minimum opening area specified in column two. For a non-circular opening, the maximum linear dimension may be greater providing the opening area complies with the value specified in column two.

Figure 49.1

Shade configuration



Dimension “A” is the minimum opening area specified in Table 49.1 shade opening size for “open” designations.

49.3.2 The assigned shade designations are:

OPEN TOP / OPEN BOTTOM – A shade has this designation when an opening exists above and below the lamp of the minimum size specified in Table 49.1.

OPEN TOP / CLOSED BOTTOM – A shade has this designation when an opening exists above the lamp of the minimum size specified in Table 49.1. Any opening below the lamp is smaller than that required for the shade to qualify as Open Top / Open Bottom.

CLOSED TOP / OPEN BOTTOM – A shade has this designation when an opening exists below the lamp of the minimum size specified in Table 49.1. Any opening that exists above the lamp is smaller than that required to qualify as Open Top / Open Bottom.

CLOSED TOP / CLOSED BOTTOM – A shade has this designation if when the openings above and below the lamp are smaller than the minimum size specified in Table 49.1. The maximum marked lamp wattage is 7 watts.

49.3.3 Any obstructions to an opening in the shade, including 4 inches (101.6 mm) above and below dimension A in Figure 49.1 for open designations, must be deducted from the area calculation to determine compliance with Table 49.1. The lamp itself, the lampholder (or a maximum 1/2 inch diameter nipple or rod to support the lampholder), or a simple harp or wire to support the shade are not identified as obstructions.

49.3.4 A shade with an obstruction meets the intent of the requirement when the remaining unobstructed area is at least 10 percent greater than the amount required for an otherwise unobstructed shade.

49.4 Lamp-to-shade spacing

49.4.1 Lamp-to-shade spacing required in 49.2.1(b) is to be determined by measuring the minimum distance from any point on the lamp centerline to the nearest point on a shade in accordance with Table 49.2 – Open Top/Open Bottom, Table 49.3 – Open Top/Closed Bottom, or Table 49.4 – Closed Top/Open Bottom, as applicable. See Figure 49.2 for an example of lamp-to-shade spacing measurement.

Table 49.2
Open top / open bottom shade minimum lamp-to-shade spacing

Lampholder type	Marked lamp wattage[a]	Lamp centerline length		Minimum lamp-to-shade spacing	
		Inch	(mm) [b]	Inch	(mm) [c]
Medium	25	2-3/4	(69.8)	1-5/8	(41.2)
	40	3-1/4	(82.5)	2	(50.8)
	60	3-1/4	(82.5)	2-1/2	(63.5)
	75	3-1/4	(82.5)	2-7/8	(73)
	100	3-1/4	(82.5)	3-1/2	(88.9)
	150	3-1/4	(82.5)	4-3/4	(120.6)
	200	3-7/8	(98.4)	6	(152.4)
	250	4-1/2	(114.3)	7-1/4	(184.4)
	300	5	(127)	8-1/2	(215.9)
Intermediate	20	1-3/4	(44.4)	1-1/2	(38.1)
	40	2	(50.8)	2	(50.8)

Table 49.2 Continued on Next Page

Table 49.2 Continued

Lampholder type	Marked lamp wattage[a]	Lamp centerline length		Minimum lamp-to-shade spacing	
		Inch	(mm) [b]	Inch	(mm) [c]
Candelabra	25	2	(50.8)	1-5/8	(41.2)
	40	2	(50.8)	2	(50.8)
	60	2	(50.8)	2-1/2	(63.5)

[a] For a shade with more than one lamp, the minimum spacing is to be measured from each lamp.

[b] See 49.4.4.

[c] See 49.4.1.

Table 49.3
Open top / closed bottom shade minimum lamp-to-shade spacing

Lampholder type	Marked lamp wattage [a]	Lamp centerline length [b]		Minimum lamp-to-shade spacing [c]	
		inch	(mm)	inch	(mm)
Medium	25	2-3/4	(69.8)	2-1/8	(53.9)
	40	3-1/4	(82.5)	2-1/2	(63.5)
	60	3-1/4	(82.5)	3	(76.2)
	75	3-1/4	(82.5)	3-3/8	(85.7)
	100	3-1/4	(82.5)	4	(101.6)
	150	3-1/4	(82.5)	5-1/4	(133.3)
	200	3-7/8	(98.4)	6-1/2	(165.1)
	250	4-1/2	(114.3)	7-3/4	(196.8)
	300	5	(127)	9	(228.6)
Intermediate	20	1-3/4	(44.4)	2	(50.8)
	40	2	(50.8)	2-1/2	(63.5)
Candelabra	25	2	(50.8)	2-1/8	(53.9)
	40	2	(50.8)	2-1/2	(63.5)
	60	2	(50.8)	3	(76.2)

[a] When more than one lamp in shade, the minimum spacing is to be measured from each lamp.

[b] See 49.4.4.

[c] See 49.4.1.

Table 49.4
Closed top / open bottom shade minimum lamp-to-shade spacing

Lampholder type	Marked lamp wattage[a]	Lamp centerline length [b]		Minimum shade height [c]		Minimum lamp-to shade spacing [d]	
		inch	(mm)	inch	(mm)	inch	(mm)
Medium	25	2-3/4	(69.8)	2-1/2	(63.5)	3	(76.2)
				1-1/2	(38.1)	4	(101.6)
	40	3-1/4	(82.5)	12	(304.8)	4	(101.6)
				6	(152.4)	5	(127)
				5	(127)	6	(152.4)
				3-1/2	(127)	7	(177.8)
	60	3-1/4	(82.5)	13	(330.2)	5	(127)
				8-1/2	(215.9)	6	(152.4)
				5-1/2	(139.7)	7	(177.8)
	75	3-1/4	(82.5)	11	(279.4)	6	(152.4)
				8-1/2	(215.9)	7	(177.8)
				7	(177.8)	8	(203.2)
	100	3-1/4	(82.5)	10	(254)	7	(177.8)
				9-1/2	(241.3)	8	(203.2)
				8	(203.2)	9	(228.6)
	150	3-1/4	(82.5)	10-1/2	(266.7)	9	(228.6)
Intermediate	20	1-3/4	(44.4)	5-1/2	(139.7)	2	(50.8)
				2	(50.8)	3	(76.2)
				1-1/2	(38.1)	4	(101.6)
				1	(25.4)	5	(127)
	40	2	(50.8)	11	(279.4)	5	(127)
				8-1/2	(215.9)	6	(152.4)
				6-1/2	(165.1)	7	(177.8)
Candelabra	25	2	(50.8)	6-3/4	(171.4)	2	(50.8)
				5-3/4	(146)	3	(76.2)
				4-3/4	(120.6)	4	(101.6)
				1-3/4	(44.4)	5	(127)
	40	2	(50.8)	10	(254)	4	(101.6)
				7	(177.8)	5	(127)
				5-1/2	(139.7)	6	(152.4)
				4-1/2	(114.3)	7	(177.8)
	60	2	(50.8)	9-3/4	(247.6)	6	(152.4)

[a] When more than one lamp in shade, the minimum spacing and height is to be measured from each lamp.

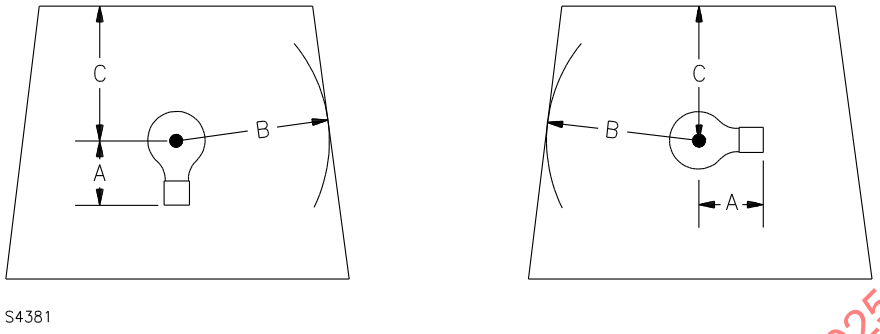
[b] See 49.4.4.

[c] See 49.4.5.

[d] See 49.4.1.

Figure 49.2

Minimum lamp-to-shade spacings



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Dimension “A” is the lamp centerline length, and dimension “B” is the minimum lamp-to-shade spacing measured from the end point of dimension “A” but not below the horizontal. Dimension “C” is the minimum shade height for closed top/open bottom only measured for the highest elevation point along the lamp centerline to the shade. See 49.4.

49.4.2 The lamp-to-shade spacing shall be evaluated with the shade in the position that results in minimum spacings unless the shade is constructed such that it is not able to be repositioned. A shade supported by a harp or one that clips on to a lamp is determined to be adjustable.

Exception No. 1: A shade made of metal, glass, or porcelain is evaluated in only the normal use position.

Exception No. 2: A shade that has been determined to be ignition resistant in accordance with Lamp Shade Ease of Ignition Test, Section 164, and also been evaluated for flame resistance in accordance with the Standard Methods of Fire Tests for Flame Propagation of Textiles and Films, NFPA 701, is evaluated only in the normal use position.

Exception No. 3: A shade that is secured by a lamp harp that is fixed by welding, brazing, or by mechanical means is not required to comply with the above requirement. Shades supported by harps complying with the Lamp Harp Torque Test in Section 163 are evaluated in only the normal use position. Adhesives or sealants shall be evaluated for compliance with the adhesive requirements for the Standard for Polymeric Materials – Use In Electrical Equipment Evaluations, UL 746C.

Exception No. 4: A portable luminaire for use with a lamp rated 150 W or less that is provided with a shade that is adjustable and that complies with the minimum lamp-to-shade spacings in the normal use position for a 150 W rated lamp as specified in the requirements for Temperature Test Exempt Units, Section 49, is evaluated in only the normal use position.

49.4.3 The minimum lamp-to-shade spacing for a Closed shade (maximum 7 W) is 1 inch in any direction from any point on the lamp centerline, where the lamp centerline is 2 inches (50.8 mm) maximum.

49.4.4 The lamp centerline is a straight line extending out perpendicularly from the depressed center contact of the lampholder for the distance specified in Table 49.2 – Table 49.4.

49.4.5 The minimum shade height for an Closed Top/Open Bottom shade (Table 49.4) is the vertical distance measured from the highest elevation point along the lamp centerline to the shade. Lampholder orientation (up, down, horizontal, etc.) affects this measurement. No obstructions are to exist within this distance.

49.5 Wire insulation temperature rating

49.5.1 The minimum wire insulation temperature rating required in 49.2.1(c) shall be:

a) 60°C when spaced greater than 2 inches from any incandescent lamp or lampholder; and

b) In accordance with Table 49.5 when spaced within 2 inches of any incandescent lamp or lampholder.

Table 49.5
Wire insulation temperature rating

Shade type	Lampholder orientation[a]	Minimum wire rating, °C
Open Top/Open Bottom, or	0 – 105 degrees	75[b]
Open Top/Closed Bottom	> 105 degrees	105
Closed Top/Open Bottom	0 – 105 degrees	105
	> 105 degrees	150
Closed Top/Closed Bottom[c]	0 – 180 degrees	105

[a] Base down is 0 degrees, horizontal is 90 degrees, and base up is 180 degrees.

[b] 60° C for marked lamp wattage of 100 W or less

[c] Maximum 7 W marked lamp wattage.

49.6 Other shade designs

49.6.1 A portable luminaire is able to use a shade other than those specified by 49.3 – 49.5 and be temperature test exempt, when the unit has:

a) A glass chimney that follows the contours of the lamp and is used to direct heat upward;

b) A shade is provided and is spaced a minimum of 1/2 inch (12.7 mm) from the chimney on all sides. The shade extends from the bottom of the chimney to at least one lamp height above the lamp, and has a top opening through which the chimney extends; and

c) The wiring to the lampholder is rated 105°C minimum.

49.6.2 The shade in 49.6.1(b) is not required when the unit is rated for maximum 60 W lamp replacement.

50 Incandescent Torchiere

50.1 When a guard is used on an incandescent torchiere style unit to comply with the Tungsten-Halogen Torchiere Abnormal Operation Test of Section 167 and the Tungsten-Halogen Torchiere Vertical Wall Test of Section 168, the guard shall:

a) Be constructed in accordance with 55.3.3;

b) Be secured in accordance with 55.1.4 and 55.3.9; and

c) Comply with the accessibility requirements of 55.3.7(a).

50.2 An incandescent torchiere that has more than 2 lamps in a lamp compartment or has greater than a 150 W lamp replacement rating shall comply with the incandescent torchiere abnormal operation tests of 51.2.

50.3 If the incandescent torchiere portion of the unit emits 90 to 100 percent of its light upward, it shall:

a) Consume not more than 190 W;

b) Not be capable of operating with lamps that total more than 190 W; and

c) Shall be subjected to the Torchiere Input Test, Section 162.

Exception No. 1: The torchiere input test need not be conducted if the incandescent torchiere is provided with an overcurrent device that limits the input power to not greater than 190 W after 1 minute of operation.

Exception No. 2: This requirement only applies to the torchiere portion of the unit, not to other portions such as a sidelight if provided.

50.4 If photometric tests are required to make the determination of the percent of the light upward in 50.3, the test method should be in accordance with Method for Photometric Testing of Indoor Luminaires Using High Intensity Discharge or Incandescent Filament Lamps, IESNA LM-46.

50.5 A polymeric material used as a guard shall comply with the requirements of 55.4.3(d) and 55.4.4.

51 Tests

51.1 Normal temperature test

51.1.1 An incandescent type unit shall be temperature tested in accordance with the Normal Temperature Test – General, Section 143, and Test Method – General, Section 144, except as exempted by Temperature Test-Exempt Units, Section 49.

51.2 Incandescent torchiere abnormal operation tests

51.2.1 An incandescent torchiere style unit having the following features shall be subjected to the Tungsten-Halogen Torchiere Abnormal Operation Test of Section 167 and the Tungsten-Halogen Torchiere Vertical Wall Test of Section 168:

a) Has more than 2 lamps in a lamp compartment; or

b) Has greater than a 150 W lamp replacement rating per lampholder.

Exception: An incandescent torchiere style unit provided with a guard complying with Section 50 and spaced at least 3 inches (76.2 mm) away from the lamp is not required to be subjected to the Incandescent torchiere abnormal operation tests, subsection 51.2.

51.2.2 For the abnormal operations test described in Section 51.2.1, the test procedure described in Section 167 shall be modified as follows:

a) The test shall be conducted three times with a new cheesecloth pad; and

b) The criteria for non-compliance shall only be ignition (flaming) of the cheesecloth.

51.3 Torchiere input test

51.3.1 An incandescent torchiere having a construction which permits the insertion of lamps rated greater than 190 watts total for the torchiere portion of the unit shall be subjected to the Torchiere Input Test, Section 162.

Exception: This test need not be conducted if the incandescent torchiere is provided with an overcurrent device that limits the input power to not greater than 190 W after 1 minute of operation.

52 Markings

52.1 An incandescent type unit shall comply with the marking specified in Incandescent Units, Section 201.

52.2 An incandescent torchiere style unit tested in accordance with 51.2 shall be marked in accordance with the marking specified in 202.3.6.

53 Instructions

53.1 An incandescent type unit shall comply with the instructions specified in Incandescent Units, Section 219.

TUNGSTEN HALOGEN UNITS – SUPPLEMENTARY

54 General

54.1 The requirements specified in Sections 54 – 59 apply to portable luminaires marked per 202.1.1 for use with tungsten-halogen type lamps.

54.2 These requirements are supplementary to other applicable requirements in this standard.

55 Construction – Mechanical

55.1 General

55.1.1 The lampholder voltage for a tungsten-halogen unit employing a lamp with a lamp base configuration shown in Table 55.1 shall be 30 V rms, 42.4 V peak, or less, regardless of the nominal unit's input voltage.

55.1.2 The lampholder voltage for a tungsten-halogen unit employing a lamp with a lamp base configuration shown in Table 55.2 shall be a nominal operating voltage of 120 V.

Table 55.1

Lamp base configuration,30 V rms, 42.4 V peak, or less

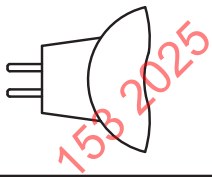
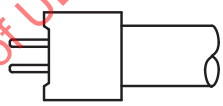
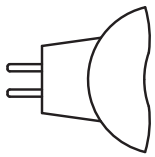
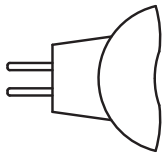
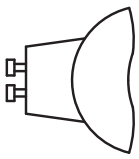
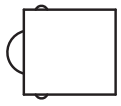
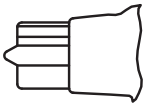
Description	Lamp Base	Lamp Base Physical Shape
Bipin C-C 4 mm (0.157 in)	G4	
Bipin C-C 4 mm (0.157 in)	GU4	
Bipin C-C 5.3 mm (0.209 in)	G5.3	
Bipin C-C 5.3 mm (0.209 in)	GU5.3 GX5.3 GY5.3	
Bipin C-C 6.35 mm (0.250 in)	G6.35 GX6.35 GY6.35	
Bipin C-C 6.35 mm (0.250 in)	GZ6.35	
Bipin C-C 7 mm (0.275 in) Twist and Lock	GU7	
Single Contact Bayonet Candelabra	BA15S	
Wedge	W2.1 x 9.5d	

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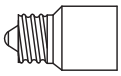
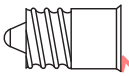
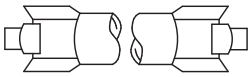
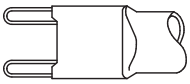
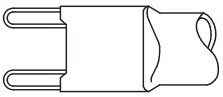
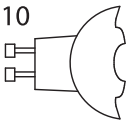
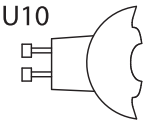
Table 55.2

Lamp base configuration, 120 V nominal

Description	Lamp Base	Lamp Base Physical Shape
Mini-Can Screw	E11	
Candelabra	E12	
Intermediate	E17	
Medium	E26/24	
Medium Skirted	E26/50X39	
Trilite	E26d	
Mogul	E39	
Double-ended	R7S	
Double-ended	RX7S	
Bi-pin C – C 8 mm (0.315 in)	G8	
Bi-pin C – C 9 mm (0.354 in)	G9	
Bi-pin C – C 10 mm (0.394 in) Twist and lock	GZ10 GU10	GZ10  GU10 

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55.1.3 A guard, lamp containment barrier, and UV filter is able to be fabricated as a single part.

55.1.4 A guard, lamp containment barrier, or UV filter shall be secured in position by:

a) A mechanical means that produces an interference fit;

b) A twist and lock means;

c) Spring clips; or

d) Other mechanical means.

55.1.5 An adhesive used to secure a guard, lamp containment barrier, or UV filter shall be investigated in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

55.1.6 Any part required for compliance with the Tungsten Halogen Lamp Adjacent Surfaces and Overlamping Abnormal Operation Test of Section 165, including guards, lamp containment barriers, UV filters, and spacers or similar projections, shall be factory installed and require the use of a tool for removal.

Exception No. 1: A guard for a work light may be shipped unattached in accordance with 126.1.2.

Exception No. 2: A guard for a work light may be attached without the use of tools when it complies with 126.2.5.

55.1.7 A tungsten-halogen torchiere style floor unit that complies with the Heat Flux Density Measurement Test specified in Section 174 shall be shipped from the factory with the tungsten-halogen lamp of the type and wattage for which the unit is designed and rated.

55.2 Guard

55.2.1 A tungsten-halogen type unit shall be provided with a lamp compartment or a guard such that the lamp is inaccessible to inadvertent contact during normal use (see 55.2.2). the evaluation is done for each position that is attainable by an adjustment means.

Exception: A guard is not required for a portable luminaire intended for use with a tungsten-halogen lamp for which the lamp manufacturer does not require a lamp containment barrier.

55.2.2 With respect to 55.2.1, a lamp is determined to be inaccessible to inadvertent contact when a 1-1/2 inch (38 mm) diameter probe of any convenient length with a 3/4 inch (19 mm) radius rounded (hemispherical) end (see Figure 55.1) is unable to be made to contact any part of the lamp with the guard in place as intended. The probe is to be rotated or angled to any position before, during, or after insertion into an opening, and the penetration is to be to any depth attainable by the opening.

Exception No. 1: A floor type unit with a single lamp at least 5 feet (1.5 m) above the floor in its lowest position is required to only have the lamp inaccessible, as determined by the probe, from underneath or from the sides of the unit.

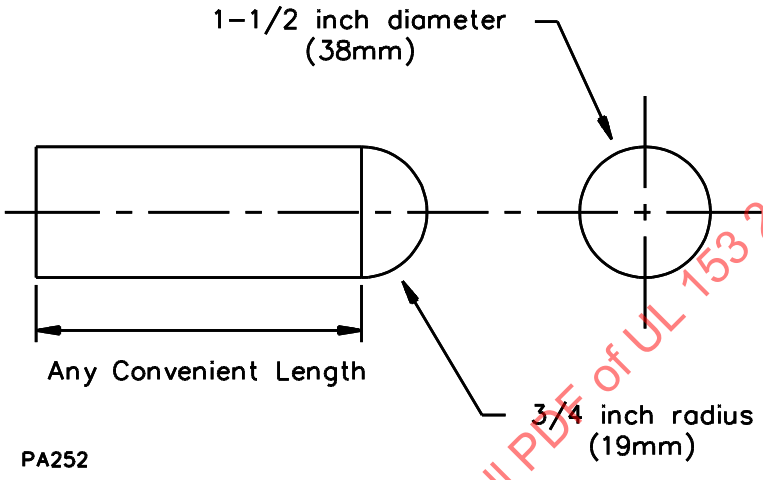
Exception No. 2: A surface-mount unit:

a) With a single lamp; and

b) Marked in accordance with 202.4 to indicate mounting a minimum of 5 feet above the floor is required to only have the lamp inaccessible, as determined by the probe, from underneath or from the sides of the unit.

Figure 55.1

Straight probe



55.2.3 A guard shall be constructed of:

a) Metal, minimum 0.016 inch (0.41 mm) thick;

b) Heat resistant glass such as tempered, annealed or borosilicate glass;

1) Minimum 1/8 inch (3.2 mm) (3.0 mm metric trade size) thick when used with lamps rated 100 W or greater; or

2) Minimum 3/32 inch (2.4 mm) thick when used with lamps rated less than 100 W;

c) Porcelain or ceramic; or

d) A polymeric material, minimum 3/32 inch (2.4 mm) thick.

55.2.4 A guard constructed of a polymeric material shall meet the intent of the requirement for the service temperature involved and, when not flat, comply with the mold stress relief requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

55.3 Guards for torchiere style units

55.3.1 The following requirements apply to the guard over the lamp compartment of a torchiere style floor unit.

55.3.2 A guard shall be provided over the lamp compartment of a torchiere style floor unit.

55.3.3 A guard shall be constructed of:

a) Plated or painted wire nominal 0.06 inch (1.5 mm) diameter wire;

b) Metal, minimum 0.016 inch (0.41 mm) thick;

c) Heat resistant glass such as tempered, annealed, or borosilicate glass:

1) Minimum 1/8 inch (3.2 mm) (3.0 mm metric trade size) thick, when used with lamps rated 100 W or greater; or

2) Minimum 3/32 inch (2.4 mm) thick, when used with lamps rated less than 100 W; or

d) Porcelain or ceramic.

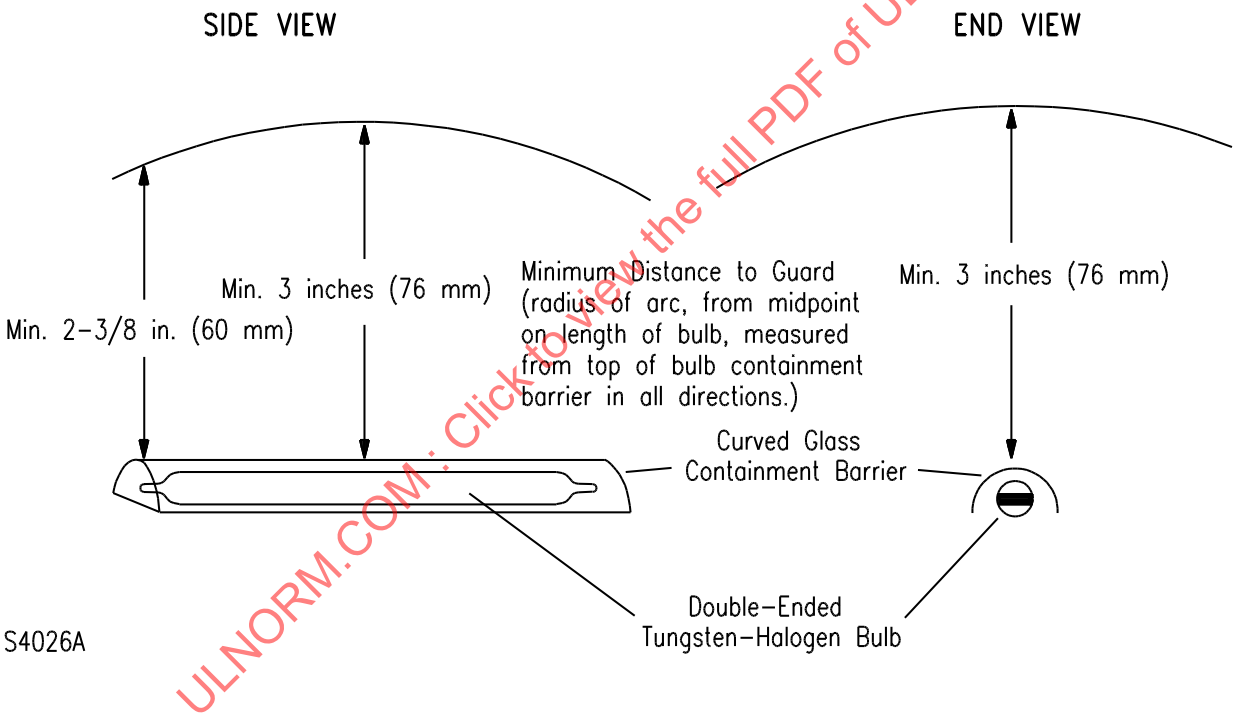
55.3.4 As depicted in Figure 55.2, the minimum guard-to-lamp containment barrier spacing shall be:

a) 3 inches (76 mm) when measured from the center of the lamp containment barrier; and

b) 2-3/8 inches (60 mm) when measured from the ends of the lamp containment barrier.

Figure 55.2

Guard for Torchiere style units



55.3.5 The minimum guard-to-lamp envelope spacing, when there is no independent lamp containment barrier, shall be:

a) 3-1/2 inches (88.9 mm) measured at the center of the lamp containment barrier; and

b) 2-7/8 inches (73 mm) measured at the ends of the lamp containment barrier.

55.3.6 The minimum guard-to-lamp containment barrier spacing of 55.3.4 or guard-to-lamp envelope spacing of 55.3.5 is not required to be met when the torchiere complies with the Heat Flux Density Measurement Test in Section 174.

55.3.7 The guard shall prevent the probes specified below from contacting the lamp containment barrier or the lamp envelope under the following conditions:

a) A 1-1/2 inch (38.1 mm) diameter spherical probe inserted through the guard in any orientation; and

b) A 0.4 inch (10 mm) thick, 1-3/8 inches (35 mm) wide and any convenient length flat plate probe, inserted vertically ±45 degrees through the guard.

55.3.8 The guard shall be installed at the factory.

55.3.9 Any guard that is required to be moved to relamp shall be attached to the unit on one side by means of a hinge, tether, swivel, or similar device.

55.3.10 Any guard that does not require the use of tools to remove it shall have the guard removed during the abnormal operations tests of Sections 165 – 168.

55.3.11 A torchiere design that complies with the abnormal operations tests of Sections 165 – 168 with the guard removed shall be exempt from the requirement in 55.3.10.

55.3.12 A torchiere designed for a single-ended tungsten-halogen lamp shall be exempt from the guard requirements in 55.3.2 when:

a) The lamp is provided with an integral outer envelope for which the lamp manufacturer does not require a lamp containment barrier;

b) The unit complies with the Heat Flux Density Measurement Test in Section 174 and the abnormal operations test of Sections 165 – 168;

c) The lamp is provided with the unit as specified in 55.1.7; and

d) The unit is marked in accordance with 202.1.2 and provided with instructions in accordance with 220.2.

55.4 Lamp containment barrier

55.4.1 A tungsten-halogen type unit shall be provided with a lamp containment barrier (as defined in 2.28) that complies with the requirements in this section, unless:

a) The lamp manufacturer declares on the lamp package that the lamp is suitable for use in an open luminaire; or

b) The portable luminaire is intended to be used with a lamp provided with an integral outer glass envelope, and the lamp manufacturer does not provide a caution requiring an additional lamp containment barrier.

55.4.2 A lamp containment barrier shall not have any holes greater than 1/8 inch (3.2 mm) diagonally or in diameter.

Exception: A lamp containment barrier is able to have open holes greater than 1/8 inch diagonally or in diameter when the openings are not line-of-sight between the lamp and any points outside of the portable luminaire.

55.4.3 A lamp containment barrier shall be constructed of:

a) Metal, minimum 0.016 inch (0.41 mm) thick;

b) Heat resistant glass such as tempered, annealed or borosilicate glass;

1) Minimum 1/8 inch (3.2 mm) (3.0 mm metric trade size) thick when used with lamps rated 100 W or greater; or

2) Minimum 3/32 inch (2.4 mm) thick when used with lamps rated less than 100 W;

c) Porcelain or ceramic; or

d) A polymeric material, minimum 3/32 inch (2.4 mm) thick.

55.4.4 A polymeric lamp containment barrier shall comply with the Polymeric Lamp Containment Barrier Test, Section 172, for the service temperature involved. When not flat, it shall comply with the mold stress relief requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

55.5 Ultraviolet (UV) filter

55.5.1 A portable luminaire intended for use with only double envelope tungsten-halogen type lamps and that is marked in accordance with 202.2.2 is determined to comply with the UV filter requirements in this section.

55.5.2 A portable luminaire that is able to be used with single envelope tungsten-halogen type lamps – lamps not provided with an integral outer glass envelope shall be provided with a UV filter.

Exception No. 1: A portable luminaire in which the light source is located 5 feet (1.5 m) or more above the floor, and the light source is directed only in the upward direction (i.e., torchiere style) is not required to be provided with a UV filter.

Exception No. 2: A surface mounted unit marked in accordance with 202.4 to indicate mounting a minimum of 5 feet above the floor and the light source is directed only in the upward direction is not required to be provided with a UV filter.

55.5.3 A downlight diffuser provided on a portable luminaire that is constructed as described in the Exceptions No. 1 and No. 2 to 55.5.2 shall comply with the UV filter requirements of this section.

55.5.4 A UV filter shall be constructed of:

a) Sodalime glass, or glass with transmission characteristics in accordance with Table 55.3. Either type shall be minimum 1/8 inch (3.2 mm) (3.0 mm metric trade size) thick for over 100 W or 3/32 inch (2.4 mm) thick for 100 watts or less; or

b) A polymeric material with transmission characteristics in accordance with Table 55.3 and minimum 3/32 inch (2.4 mm) thick.

Exception: The filter material is not required to comply with 55.3 if the luminaire complies with ANSI/IESNA RP-27 Series Standards "Recommended Practice for Photobiological Safety for Lamps and Lamp Systems", and complies with the exposure limits specified for general lighting source lamps that are classified "Exempt Group" and do not pose an actinic ultraviolet hazard within 8-hours exposure.

Table 55.3
Ultraviolet transmission characteristics

Wavelength, nanometers	Maximum transmission, percent
350	85
320	40
300	8
290	0.5
less than 280	0.1

55.5.5 A polymeric UV filter shall be:

a) Resistant to UV radiation in compliance with the requirements in the Standard for Polymeric Materials – Use In Electrical Equipment Evaluations, UL 746C;

b) Meet the intent of the requirement for the service temperature;

c) Rated HB minimum; and

d) When not flat, comply with the mold stress relief requirements in UL 746C.

55.5.6 Any open holes in the UV filter shall be provided with a barrier complying with 55.5.4 or constructed of metal to prevent the direct emission of light from the lamp. The evaluation is done for each position that is attainable by an adjustment means.

55.5.7 The portable luminaire shall be marked in accordance with 202.3.2 when not provided with an interlock switch specified in Interlock Switch, 56.2 that de-energizes the lamp when the unit is opened for lamp replacement.

55.6 Flexible or articulated arms

55.6.1 A floor mounted tungsten-halogen torchiere style portable luminaire with a flexible or articulated arm that employs end-stops to limit arm adjustment shall comply with the following:

a) The end-stops shall be factory installed;

b) The end-stops shall not be easily defeatable nor removable without the use of tools; and

c) The unit shall be subjected to the Tungsten-Halogen Torchiere Flexible or Articulated Arm Stop Test described in Section 170.

56 Construction – Electrical

56.1 Switches

56.1.1 A unit provided with double ended lamps shall be provided with a double pole switch that simultaneously opens both conductors. The switch shall be clearly marked with an indication of the off position either adjacent to the switch or on the switch.

Exception No. 1: No switch is required, or a single pole switch is permitted, under any of the following conditions:

a) The lamp is connected to the secondary of an isolating transformer having a secondary rating no more than 30 Vac or 60 Vdc;

b) The lamp requires a tool to gain access for lamp replacement and the portable luminaire is marked per 202.3.1;

c) The user can only make initial contact with the lampholder connected to the grounded (neutral) lampholder and the portable luminaire is marked per 202.3.1; or

d) The lamp is only able to be inserted first into the lampholder connected to the grounded (neutral) lampholder and the portable luminaire is marked per 202.3.1 and 202.3.7.

Exception No. 2: Deleted

Exception No. 3: Deleted

Exception No. 4: Deleted

56.2 Interlock switch

56.2.1 An interlock switch that de-energizes the lamp when a portable luminaire is opened for lamp replacement shall be either:

a) Rated for the load it controls and comply with the Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1; or

b) Comply with the requirements in 56.2.2 and 56.2.3 and the tests in 57.6.

56.2.2 Current-carrying parts shall be copper or copper alloy.

Exception: Stainless steel that is resistant to corrosion is able to be used for other than quick-connect terminals, push-in terminals, solder terminals, and arcing parts of a switch.

56.2.3 Electrical spacings shall comply with Electrical Spacings, Section 24.

56.2.4 A portable luminaire provided with an interlock that de-energizes the lamp when the unit is opened for lamp replacement is not required to be marked as specified in 202.3.2.

56.3 Automatic temperature-regulating or limiting control

56.3.1 An automatic temperature-regulating or limiting control or similar device shall be used only as supplementary protection and, when employed, shall be used in combination with a guard that complies with 55.3.

56.4 Tipover switch

56.4.1 A tungsten-halogen torchiere style floor unit that has a flexible or articulated arm shall be provided with a tipover switch in accordance with 56.4.

56.4.2 When a tipover switch is provided, the Severe Condition Test, 165.3, and the Tungsten-Halogen Torchiere Vertical Wall Test, Section 168, are not required.

Exception: A tungsten-halogen torchiere style unit with a flexible or articulated arm is not exempt from the Tungsten-Halogen Torchiere Vertical Wall Test.

56.4.3 A tipover switch shall de-energize the unit when tipped over in any direction.

56.4.4 A tipover switch used with a tungsten-halogen torchiere shall de-energize the unit when tipped beyond the angle that the unit would right itself.

57 Tests

57.1 Normal temperature test

57.1.1 A tungsten-halogen type unit is to be subjected to the Normal Temperature Test – General, Section 143, and Test Method – General, Section 144, except as provided for in 57.1.2.

57.1.2 A tungsten-halogen type unit that:

a) Uses an Edison base, double envelope tungsten-halogen lamp similar in shape to a Type A incandescent lamp;

b) Is rated 100 watts or less;

c) Complies with the shade dimension requirements of Section 49 for Temperature Test Exempt Units employing a 100 watt lamp and a medium base; and

d) Is marked in accordance with 202.2.2;

is not required to be subjected to the Temperature Test.

57.2 Tungsten-halogen lamp adjacent surfaces and overlamping abnormal operation tests

57.2.1 A tungsten-halogen type unit is to be subjected to the Tungsten-Halogen Lamp Adjacent Surfaces and Overlamping Abnormal Operation Tests in Section 165.

Exception No. 1: These requirements do not apply to portable luminaires intended for use with medium-base type A style double envelope tungsten-halogen lamps.

Exception No. 2: These requirements do not apply to portable luminaires intended for use with medium-base type reflector style double envelope tungsten-halogen lamps which are:

a) Direct replacements for incandescent lamps;

b) Do not require a UV filter or lamp containment; and

c) Are of the PAR 20, PAR 30, and PAR 38 types with wattages not exceeding 150 W.

57.3 Tungsten-halogen torchiere abnormal operation tests

57.3.1 A tungsten-halogen portable floor unit having an open top design with the lamp facing upward, such as a torchiere style, shall not be rated in excess of 190 W and shall comply with the Tungsten-Halogen Torchiere Abnormal Operation Test, Section 167, the Tungsten-Halogen Torchiere Vertical Wall Test, Section 168, and shall be marked in accordance with 202.3.6.

Exception: A unit other than a style having a flexible or articulated arm and provided with a tipover switch in accordance with 56.4 is not required to be subjected to the Tungsten-Halogen Torchiere Vertical Wall Test, Section 168.

57.3.2 If the tungsten-halogen portion of the unit emits 90 to 100 percent of its light upward, it shall:

a) Not be capable of operating with lamps that total more than 190 W; and

b) Shall be subjected to the Torchiere Input Test, Section 162.

Exception No. 1: The torchiere input test need not be conducted if the tungsten-halogen torchiere is provided with an overcurrent device that limits the input power to not greater than 190 W after 1 minute of operation.

Exception No. 2: This requirement only applies to the torchiere portion of the unit, not to other portions such as a sidelight if provided.

57.3.3 If photometric tests are required to make the determination of the percent of the light upward in 57.3.2, the test method should be in accordance with Method for Photometric Testing of Indoor Luminaires Using High Intensity Discharge or Incandescent Filament Lamps, IESNA LM-46.

57.4 Guard, lamp containment barrier & UV filter security tests

57.4.1 A tungsten-halogen type unit provided with a guard, lamp containment barrier and UV filter is to be subjected to the Tungsten-Halogen Lamp Guard, Lamp Containment Barrier and UV Filter Security Test in Section 166.

57.5 Polymeric lamp containment test

57.5.1 A tungsten-halogen type unit provided with a polymeric lamp containment barrier as described in 55.4.4 is to be subjected to the Polymeric Lamp Containment Barrier Test in Section 172.

57.6 Interlock switch tests

57.6.1 An interlock switch shall comply with the Normal Temperature Test – General, Section 143, and Test Method – General, Section 144, Dielectric Voltage-Withstand Test, Section 159, and the Interlock Switch Endurance Test, Section 173.

57.7 Torchiere input test

57.7.1 A tungsten-halogen torchiere having a construction which permits the insertion of lamps rated greater than 190 W total for the torchiere portion of the unit shall be subjected to the Torchiere Input Test, Section 162.

Exception: This test need not be conducted if the tungsten-halogen torchiere is provided with an overcurrent device that limits the input power to not greater than 190 W after 1 minute of operation.

58 Marking

58.1 A tungsten-halogen type unit shall comply with the markings specified in Tungsten Halogen Units, Section 202.

59 Instructions

59.1 A tungsten-halogen type unit shall comply with the instructions specified in Tungsten Halogen Units, Section 220.

Exception: These requirements do not apply to portable luminaires intended for use with medium-base type double envelope tungsten-halogen lamps specified in Exception Nos. 1 and 2 of 57.2.1.

FLUORESCENT UNITS – SUPPLEMENTARY

60 General

60.1 The requirements specified in Section 60 – 64 apply to portable luminaires using fluorescent lamps.

60.2 These requirements are supplementary to other applicable requirements in this standard.

61 Construction – Electrical

61.1 Ballasts

61.1.1 A ballast having an open circuit voltage greater than 1000 volts shall not be used.

61.1.2 A portable luminaire with instant-start ballast(s) and bi-pin lampholders shall use only:

a) Ballast(s) marked as Type CC and that comply with Supplement SD of the Standard for Fluorescent-Lamp Ballasts, UL 935, or

b) Lampholders marked with a circle “I” and that comply with Supplement SD of the Standard for Lampholders, UL 496.

61.2 Lampholder

61.2.1 A lampholder shall have a minimum voltage rating equal to or greater than the ballast marked output voltage rating and/or marked open circuit voltage.

61.2.2 Simple reactance ballasts and Class P ballasts not marked with an output voltage rating and/or open circuit voltage rating shall be used with lampholders rated at least 250 V.

61.2.3 Circuit interrupting lampholders shall be used at each end of each lamp with any ballast that is marked for use with circuit interrupting lampholders for that particular lamp.

Exception: Other configurations shown on the ballast marking or wiring diagram are able to be used.

61.2.4 A portable luminaire shall not use lampholders designed for ferrule-type lamps.

61.3 Wire temperature ratings

61.3.1 The internal wiring of a fluorescent type unit shall meet the requirement for temperatures specified in Table 61.1.

Table 61.1
Wire temperature rating of a portable luminaire employing fluorescent lamps

Position of wiring	Minimum temperature rating of wiring[a]	
	°C	°F
Permanently spaced at least 3 inches (76 mm) from any ballast	60	140
Less than 3 inches from, and not in contact with, any ballast except at the point of entry to the ballast	80[b]	176
In contact with any ballast	90[b]	194

[a] Leads permanently attached to a ballast or an electric-discharge-lamp lampholder are rated for a temperature of at least 75°C (167°F).

[b] Wiring provided with an outer braid is usable for 75°C (167°F) minimum.

62 Tests

62.1 Normal temperature test

62.1.1 A fluorescent type unit shall be temperature tested in accordance with the Normal Temperature Test – General, Section 143, and Test Method – General, Section 144, except as provided by Temperature Test-Exempt Units, Section 63.

62.1.2 A portable luminaire that incorporates features requiring additional evaluation, such as a power factor correction capacitor in series with a simple reactance ballast, a motor, or a polymeric enclosure material, is required to be subjected to a temperature test.

62.2 Abnormal operation shorted starter test

62.2.1 A fluorescent type unit that is provided with other than a manual starter shall be subjected to the Abnormal Operation – Shorted Starter Test as described in Section 175.

Exception: When the ballast is a Class P ballast, the test is not required to be conducted.

63 Temperature Test-Exempt Units

63.1 A fluorescent portable luminaire is not required to be subjected to the Normal Temperature Test – General, Section 143, and Test Method – General, Section 144, when provided with:

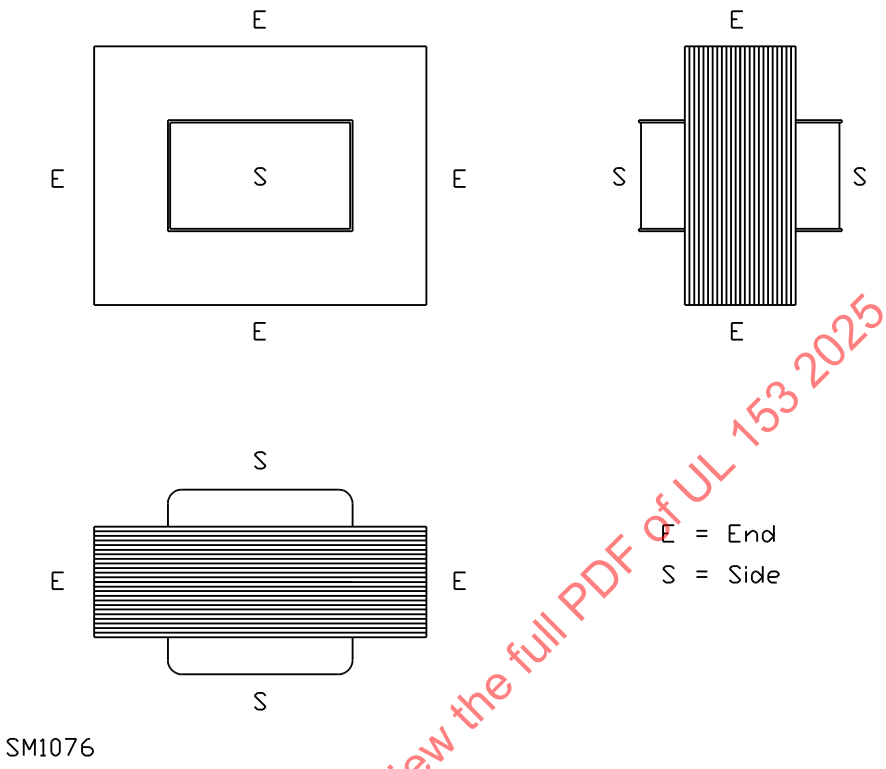
a) A single Class P ballast; or

b) Straight tubular lamps and a single simple reactance type ballast without a power-factor correction capacitor in series; or

c) More than one ballast per (a) or (b) above with the spacing between any two ballasts not less than 1 inch (25 mm) when arranged end-to-end and not less than 4 inches (100 mm) when arranged otherwise. See Figure 63.1.

Figure 63.1

Typical ballast configuration



63.2 Internal wiring for a fluorescent portable luminaire not subjected to a temperature test in accordance with 63.1 shall be:

a) Rated minimum 60°C when permanently spaced at least 3 inches (76 mm) from any ballast;

b) Rated minimum 80°C when within 3 inches (76 mm), and not in contact with any ballast; or

c) Rated minimum 90°C when in contact with any ballast.

63.3 A portable luminaire provided with a GU-24 or GU-24-1 holder and intended for either a fluorescent or LED self-ballasted lamp is not required to be subjected to the Normal Temperature Test – General, Section 143, and Test Method – General, Section 144, providing that:

a) The shade designation is determined in accordance with Section 49.3;

b) The shade complies with the minimum lamp-to-shade spacing in Section 49.4 for the shade designation, using the values in the tables for a 'medium' type lampholder, and where the corresponding value for marked wattage in the tables is equal to or greater than the lamp replacement marking of the fluorescent or LED self-ballasted lamp; and

c) The GU-24 or GU-24-1 holder leads are rated 90°C minimum.

63.4 Integral leads of a ballast or lampholder are determined as usable for 75°C or higher, when so marked.

63.5 Wiring provided with an outer braid is determined usable for 90°C.

64 Marking

64.1 A fluorescent type unit shall comply with the markings specified in Fluorescent Units, Section 203.

HIGH INTENSITY DISCHARGE UNITS – SUPPLEMENTARY

65 General

65.1 The requirements specified in Sections 65 – 69 apply to portable luminaires using high intensity discharge lamps.

65.2 These requirements are supplementary to other applicable requirements in this standard.

66 Construction – Mechanical

66.1 Metal halide lamp containment and UV filter

66.1.1 A portable luminaire for use with a metal halide lamp shall be provided with lamp containment barrier in accordance with the requirement for Lamp Containment Barrier, 55.4.

66.1.2 A portable luminaire for use with a metal halide lamp that is not provided with an integral outer glass envelope shall additionally be provided with a UV filter in accordance with the requirements for Ultraviolet (UV) Filter, 55.5.

67 Construction – Electrical

67.1 Lampholders

67.1.1 A lampholder for a high pressure sodium lamp shall have a minimum pulse voltage rating of 4 kV or at least the pulse voltage output of the lamp igniter, whichever is greater.

67.2 Ballasts

67.2.1 A portable luminaire shall be provided with a ballast rated for the intended lamp and shall be electrically connected in accordance with the diagram or instructions on or with the ballast.

67.3 Capacitors

67.3.1 A portable luminaire having a capacitor as a component separate from the ballast shall incorporate means, such as a bleeder resistor, for the automatic discharge of the capacitor within 1 minute after removal of the lamp from the circuit or after opening of the primary circuit, or both. The voltage (V) at the end of 1 minute across the terminals shall be reduced to a value of 50 volts or less, and the energy stored (J) shall be less than 20 joules as determined by the equation:

$$J = 5 \times 10^{-7} CV^2$$

where:

C is the capacitor rating in microfarads.

67.3.2 To comply with 67.3.1, the maximum resistance value of a bleeder resistor shall be determined by the equation:

$$R = \frac{K}{C}$$

where:

R is the resistance value in megohms;

K is the resistor factor determined from Table 67.1; and

C is the capacitor rating in microfarads.

Table 67.1
Bleeder resistor factor (K)

Voltage		Factor (K)
Peak	rms[a]	
0 – 100	0 – 70	85
101 – 110	71 – 78	76
111 – 120	79 – 85	70
121 – 130	86 – 92	63
131 – 140	93 – 99	55
141 – 150	100 – 106	54
151 – 170	107 – 120	50
171 – 200	121 – 141	44
201 – 240	142 – 169	39
241 – 280	170 – 197	35
281 – 325	198 – 230	32
326 – 375	231 – 265	30
376 – 450	266 – 318	27
451 – 500	319 – 353	26
501 – 700	354 – 495	23
701 – 1000	496 – 707	19

[a] For a transformer type ballast, the voltage value to be applied from this table is the rms voltage rating of the capacitor as specified by the ballast.

67.3.3 The requirement in 67.3.2 is to be met without the use of a bleeder resistor when the capacitor is located in a closed loop of the circuit and when the loop is not opened by removal of the lamp or by the opening of a switch, fuse, or similar device.

67.4 Nonintegral oil-filled capacitors

67.4.1 When an oil-filled capacitor is not integral with the ballast, its characteristics and installation shall comply with the requirements of this section.

67.4.2 A capacitor shall comply with the requirements for capacitors in, the Standard for Capacitors, UL 810, and shall be rated for the voltage to which it is to be connected. Such capacitors relieve an internal fault condition by movement of the terminal end of the capacitor enclosure to break the circuit internally. Movement is initiated by internal pressure during a fault condition, causing expansion of the capacitor body.

67.4.3 A capacitor shall be rated not less than the maximum fault current to which it is subjected, as follows:

a) A value of 5,000 amperes when connected across the ballast primary; that is, when the capacitor is in parallel with the ballast input circuit;

b) A value of 200 amperes when connected in series with a ballast coil; or

c) The maximum current available to the capacitor under capacitor short-circuit condition, as determined by an investigation.

67.4.4 The placement and mounting of a capacitor in a portable luminaire shall be such that a free air space is provided in front of the capacitor end-terminals to enable the capacitor to expand, without obstruction, under a fault condition. This expansion clearance space shall be such that the front enclosure and terminals of the capacitor, with associated wire connectors and supply leads attached, to travel 1/2 inch (12.7 mm) in a direction perpendicular to the mounting surface of the terminals.

Exception: The expansion clearance space is to be less than 1/2 inch (12.7 mm) when an investigation determines that the space required for a particular capacitor is provided.

67.4.5 In addition to the expansion clearance space specified in 67.4.4, an electrical air spacing between any exposed live part of the capacitor, such as exposed terminals and wire connectors, and any uninsulated live part of opposite polarity or uninsulated, grounded dead metal parts shall (after expansion) be:

a) At least 1/16 inch (1.6 mm) when the voltage involved does not exceed 300 volts; or

b) At least 1/8 inch (3.2 mm), when the voltage involved exceeds 300 volts.

68 Tests

68.1 Normal temperature test

68.1.1 A high intensity discharge type unit shall be subjected to the Normal Temperature Test – General, Section 143, and Test Methods – General, Section 144.

68.1.2 The test of one ballast to represent others meets the intent of the requirement with the following exceptions:

a) A metal halide or mercury vapor type is unable to represent a high pressure sodium (HPS) type.

b) A HPS type is unable to represent a metal halide or mercury vapor type.

c) A lower wattage type is unable to represent a higher wattage type.

d) A ballast with one class insulation system is unable to represent a ballast with a different class insulation system.

e) For a ballast of other than the enclosed and potted type with a Class 105 insulation system, a ballast with a bench-test temperature is unable to represent a ballast with a higher bench-test temperature.

f) An unprotected ballast is unable to represent a protected ballast when the protector:

1) Is buried within the ballast and has a temperature rating of less than the rating of the ballast insulation system; or

2) Is located directly on the ballast core or under the wrap of an open coil and has a temperature rating of less than 90°C (194°F) for a Class 105 system, 110°C (230°F) for a Class 130 system, or 150°C (302°F) for a Class 180 system.

68.2 Glass impact test

68.2.1 A unit intended for use with a metal halide lamp without an integral outer envelope and provided with a glass lamp containment barrier is to be subjected to the Glass Impact Test, Section 176.

68.3 Glass thermal shock/containment test

68.3.1 A unit intended for use with a metal halide lamp and provided with a glass lamp containment barrier of other than tempered or borasilicate glass is to be subjected to the Glass Thermal Shock/Containment Test, Section 177.

69 Markings

69.1 A high intensity discharge type unit shall comply with the markings specified in High-Intensity-Discharge Units, Section 205.

LED PORTABLE LUMINAIRES WITH SMALLER THAN 18 AWG POWER SUPPLY CORD – SUPPLEMENTARY

69A General

69A.1 The requirements specified in Sections 69A – 69C apply to LED portable luminaires employing 20 or 22 AWG power supply cord, where the following Portable Luminaire types are excluded:

a) Interconnecting units – as specified in Section 33;

b) Units with Receptacles – as specified in Section 44;

c) Units with facility for Grounding and Bonding – as specified in Section 36;

d) High Intensity Discharge units – as specified in Sections 65 – 69;

e) Units for use with office furnishing – as specified in Sections 90 – 94;

f) Convertible units – as specified in Sections 95 – 99;

g) Interchangeable units – as specified in Sections 100 – 103;

h) Track-style units – as specified in Sections 104 – 109;

i) Portable Work Lights – as specified in Sections 125 – 129;

j) Wet location use – as specified in Sections 130 – 135;

k) Portable Hand lights – as specified in Sections 136 – 142; and

l) Units with supplementary circuit output connectors (for example, a USB-compliant [type A, type B, or USB-C] connector port) and induction power transmitters.

69A.2 These requirements are supplementary to other applicable requirements in this standard.

69A.3 When a LED portable luminaire has a replaceable light source, the relamping marking or relamping information in the instruction sheet shall reference only an appropriately rated LED light source.

69B Construction – Electrical

69B.1 Electrical ratings

69B.1.1 The maximum ampere rating of the LED portable luminaire shall comply with Table 69B.1.

Table 69B.1
Ampacity of cords with copper conductors

Types of wire and cord	Ampacity (A)	
	20 AWG (0.519 mm^2)	22 AWG (0.325 mm^2)
Flexible cords	2	0.5

69B.1.2 The ampacity rating of flexible cords with copper conductors shall be as specified in Table 69B.1.

69B.2 Power supply cord

69B.2.1 A power supply cord shall comply with the requirements of a Portable LED Luminaire Power-Supply Cord in the Standard for Cord Sets and Power Supply Cords, UL 817, where the requirements for two-conductor Type SP-2, SPE-2, or SPT-2 (in accordance with the Standard for Flexible Cords and Cables, UL 62) apply, except that the conductor size is 20 AWG (0.519 mm^2) or 22 AWG (0.325 mm^2).

69B.2.2 The attachment plug of the power supply cord shall be molded onto the flexible cord. The plug shall be of 15 A, 125-V configuration (NEMA 1-15P), polarized as shown in Figure 32.1.

69B.2.3 A Portable LED Luminaire power-supply cord shall be a nondetachable power-supply cord.

69B.3 Wiring and conductors

69B.3.1 Any internal wiring and conductors shall be minimum 22 AWG (0.325 mm^2) as permitted from Exception to 31.2 and shall not be smaller than the power supply cord provided.

69C Power Supply Cord Short Circuit Test

69C.1 The LED portable luminaire shall be tested in accordance with 69C.2 and 69C.3. Compliance criteria is described in 69C.4.

69C.2 Three samples are to be mounted as intended, draped with cheesecloth, and then a short circuit condition is to be introduced to simulate a line to neutral fault. The short should be located in the farthest supply point within the luminaire (e.g, the edison based lampholder) to provide the maximum lead resistance.

69C.3 The test is to be conducted until circuit interruption and resulting thermal stability occurs (usually no more than 10 minutes after circuit interruption).

69C.4 Acceptable results are no ignition of the cheesecloth or polymeric enclosure, and no openings in the enclosure that allows accessibility to uninsulated live parts.

SURFACE MOUNTED UNITS – SUPPLEMENTARY

70 General

70.1 These requirements apply to portable luminaires intended to be mounted to a vertical or horizontal surface.

70.2 These requirements are supplementary to other applicable requirements in this standard.

70.3 Unless otherwise specified, these requirements do not apply to the following mounting means:

a) Cord and chain suspended units– as specified in Sections 74 – 79;

b) Clamp-on mounted units – as specified in Sections 80 – 83;

c) Portable cabinet lights covered in Sections 84 – 89; and

d) Track-style type units covered in Sections 104 – 109.

71 Wall Mounted Units

71.1 General

71.1.1 These requirements apply to portable luminaires intended to be mounted to a wall, or to a similar structural surface.

71.2 Construction – mechanical

71.2.1 A wall mounted unit shall comply with the Mounting Means Test – Surface Mounted Unit, Section 178.

Exception: A wall mounted unit provided with the mounting hardware and within the design limits of Table 71.1 is not required to comply with the Mounting Means Test – Surface Mounted Unit, Section 178.

Table 71.1
Mounting requirements

Maximum weight		Mounting Hardware
Pounds	(kg)	
2-1/4	(1.0)	C, D, or E
4-1/4	(1.9)	D or E

Eligible wall mounted portable luminaires shall comply with (A) or (B):

(A) No projection more than 7-1/2 inches (190 mm) from the vertical wall on which the unit is mounted. Replaceable lamps are not included in the measurement.

(B) Center of gravity no more than 3 inches (76.2 mm) from the vertical wall on which the unit is mounted, under any position of adjustment

Mounting hardware types:

(C) Ring-hanger, keyhole slot(s), or notch(es).

(D) At least two No. 6 Type A sheet metal screws that penetrate the mounting surface by not less than 3/4 inch (19 mm) when installed.

(E) At least two No. 10 – 24 machine screws with mating hollow-wall anchors, or wing or expansion bolts long enough to fully penetrate a 3/4 inch (19 mm) thick wall when installed.

71.2.2 In determining compliance with Table 71.1, the weight of the portable luminaire shall be determined by weighing the complete unit with the exception of the mounting hardware. When the lamp shade is not provided, 1/4 pound (113 g) shall be added for each lampholder to reflect the weight of the shade. When a shelf, bowl, hook or any means of support of any object, other than a shade, is provided, the weight of the intended object shall be included.

71.2.3 A wall mounted unit is able to be provided with a separable bracket used to secure the product to a vertical mounting surface in accordance with 71.2.1.

71.2.4 A wall mounted, cabinet, or undercabinet unit is permitted to be magnetically or adhesively secured to the mounting surface, in lieu of using hardware, provided that it also meets the following conditions:

a) Complies with the Mounting Means Test – Surface Mounted Unit, Section 178;

b) Complies with the Abnormal Operation Test, Section 149, under conditions of mounting means failure; and

c) Complies with the Drop Test, Section 155.

71.3 Construction – electrical

71.3.1 A surface mounted unit shall comply with the requirements for Enclosure, Section 9, and the requirements for Accessibility of Live Parts, Section 23, without dependence on the intended mounting surface or any separable bracket.

71.3.2 The power supply cord shall exit the portable luminaire from a surface other than the one to which it is mounted.

71.3.3 *Deleted*

71.4 Instructions

71.4.1 A surface mounted unit shall be provided with installation instructions as specified in Surface Mounted Units, Section 221.

72 Under-Shelf Mounted Units

72.1 General

72.1.1 These requirements are supplemental to those of Section 71, and apply to portable luminaires intended to be mounted under a shelf, cabinet, or similar structural surface.

72.2 Mounting means

72.2.1 An under-shelf mounted unit shall be provided with a means for mounting in accordance with Wall Mounted Units, Section 71, except Conditions A and B from Table 71.1 are not applicable.

72.3 Construction – electrical

72.3.1 Wiring

72.3.1.1 An interconnecting cord for under-shelf mounted units shall be in accordance with Table 27.1 and rated 105°C minimum.

Exception: For a Class 2 circuit, other types of wire, cord, or appliance wiring material is able to be used when the insulation is rated for the maximum temperature and voltage involved.

72.3.1.2 Low voltage wiring shall have an ampacity rating in accordance with Table 26.1. Overcurrent protection for low voltage wiring is not required.

72.3.2 Insulating barriers for fluorescent lamp components

72.3.2.1 A fluorescent under-shelf unit shall be provided with insulating material not less than 1/32 inch (0.8 mm) thick between a metal enclosure and:

a) The enclosure of a ballast;

b) A splice or fixture-type wire connector; and

c) A dead metal part – including a mounting screw, rivet, yoke, clamp, and similar parts – of an electrical component, such as a lamp holder, switch, or receptacle.

Exception No. 1: Insulating material is not required to be provided when the construction of the component results in a separation of not less than 1/2 inch (12.7 mm) between dead metal parts and live parts of the component.

Exception No. 2: Insulating material is not required to be provided in a unit that is provided with a grounding attachment plug and constructed in accordance with Grounding and Bonding, Section 36.

72.3.3 Grounding

72.3.3 deleted

72.4 Markings

72.4 deleted

73 Appliance Mounted Units

73.1 General

73.1.1 A portable luminaire is permitted to have means for securement to a cord-connected appliance, such as a sewing machine, or to an easily relocated nonelectrical product, such as a picture, music stand, or portable furnishing.

73.2 Instructions

73.2.1 An appliance mounted unit shall comply with the installation instructions specified in 221.2.

CORD AND CHAIN SUSPENDED UNITS – SUPPLEMENTARY

74 General

74.1 The requirements specified in Sections 74 – 79 apply to a portable luminaire that is intended for suspension from the ceiling. Such a lamp is able to be provided with a chain.

74.2 These requirements are supplementary to other applicable requirements in this standard.

74.3 For the purposes of this section, the following definitions apply:

a) “Swag” type unit – A portable luminaire suspended by a chain, wire, cable, or equivalent means.

b) “Hanging” type unit – A portable luminaire suspended by its power supply cord.

75 Construction – Mechanical

75.1 Chains

75.1.1 A swag type unit not intended to be installed directly beneath a ceiling-mounted receptacle and with the power supply cord routed through a chain shall be provided with not more than 15 feet (4.6 m) and not less than 9 feet (2.7 m) of metal chain.

Exception: Less chain is able to be provided when the unit is marked “For use in recreational vehicles only” in accordance with 206.1.

75.1.2 When there are supplementary chain segments attached to an extended arm, a splice compartment, and similar components, the length of the chain is determined to be the length of the principal segment plus the length of the longest supplementary segment, plus the length of any other segment over 12 inches (305 mm) long. When all supplementary segments are the same length and not more than 12 inches (305 mm) long, the length of the chain is determined to be the length of the principal segment plus the length of only one supplementary segment.

75.2 Support hardware

75.2.1 The support hardware for a portable luminaire shall consist of:

a) At least two metal hooks, each with a No. 10-24 threaded hole that engages the bolt threads;

b) Two toggle bolts, each consisting of a No. 10-24 bolt, 2-7/8 inches (73 mm) long with two tapered wings 1 by 5/16 inch (25.4 by 7.9 mm); and

c) Two studs – combination wood screw-machine screw – measuring 1-3/4 inches (44.4 mm) overall and having 1-1/4 inches (31.8 mm) of wood screw threads on one end and at least six No. 10-24 machine screw threads on the other end.

Exception No. 1: A form of support hardware, other than that specified, is able to be supplied when it is investigated in accordance with the Mounting Means Test – Chain and Suspended Units, Section 179, and determined to meet the intent of the requirement for the support of the unit.

Exception No. 2: A hanging type unit is capable of being provided with plastic hooks instead of metal hooks when it is investigated in accordance with the Mounting Means Test – Chain and Suspended Units, Section 179.

75.2.2 In addition to the hardware specified in 75.2.1, a hanging type unit provided with metal hooks shall also be provided with insulators to protect the cord.

75.3 Maximum weight

75.3.1 The weight of a swag type unit, including the shade, glassware, 4 feet (1.2 m) of chain, and any anticipated additional loading shall not exceed 30 pounds (13.6 kg).

Exception: The total weight is able to be more than 30 pounds (13.6 kg) when the unit is tested in accordance with the Mounting Means Test – Chain and Suspended Units, Section 179.

75.3.2 A swag type unit that is provided with a bowl, a shelf, or a hook intended for the support of any object that is not part of the portable luminaire itself, other than the shade, shall be investigated to determine that provision for the support of the additional weight does not result in the total weight exceeding the 30 pounds (13.6 k) specified in 75.3.1. It is not possible to specify the conditions of mechanical loading for all forms of constructions; however, the most severe conditions of anticipated use and abuse shall be evaluated – for example, a bowl is to be filled to capacity with dry sand and additionally filled with water.

Exception: The total weight is able to be more than 30 pounds (13.6 kg) when the unit is tested in accordance with the Mounting Means Test – Chain and Suspended Units, Section 179.

75.3.3 The weight of a hanging type unit (cord suspended), including the shade, glassware, and any anticipated additional loading shall not exceed the cord specifications in Table 75.1.

Table 75.1
Cord loading

Cord type	Maximum total weight of cord load	
	Pounds	(kg)
SP-2[a], SPE-2[a], SPT-2[a], NISP-2, NISPE-2, NISPT-2, SV, SVE, SVEO, SVO, SVOO, SVT, SVTO, SVTOO	2-1/2	(1.1)
SJ, SJE, SJO, SJEO, SJOO, SJT, SJTO, SJTOO, S, SE, SOO, SO, SEO, ST, STOO, STO	10	(4.5)

[a] The weights specified also apply to power supply cord for LED portable luminaires covered by the requirements of Sections 69A – 69C.

75.3.4 A hanging type unit (cord suspended) shall not be provided with a bowl, shelf, or hook intended to support any object that is not part of the hanging lamp.

75.3.5 A hanging unit having play value in accordance with Portable Luminaires Having Play Value, Section 18, shall be tested in accordance with the Test for Suspended Toys, Section 180.

76 Construction – Electrical

76.1 Internal wiring protection

76.1 deleted

76.2 Power-supply cord

76.2.1 The power supply cord for a swag type unit not intended to be installed directly beneath a ceiling-mounted receptacle shall:

a) Be at least 15 feet (4.6 m) long from the point where the cord emerges from the body of the lamp to the face of the attachment plug or connector,

b) If routed through a chain, extend not less than 1 foot (0.3 m) nor more than 6 feet (1.8 m) beyond the end of the chain; and

c) Have insulation rated for no less than 105°C (221°F).

Exception: The cord is able to be less than 15 feet long when the unit is marked "For use in recreational vehicles only" in accordance with 206.1.

76.2.1.1 The cord of a fluorescent, HID, or LED swag-type unit intended to be installed directly beneath a ceiling-mounted receptacle (commonly referred to as a "shop light") shall be provided with a grounding-type attachment plug. The cord shall be protected from mechanical damage by one or more of the following means:

a) The cord is a hard usage (or better) type, as identified in Table 31.1, or

b) The cord is routed through a chain, or

c) The cord exits the enclosure through the top surface, between the two supporting chains, or

d) The cord includes a protective sleeve that covers at least that length of the cord where it will not be located between the two supporting chains when the shop light is installed per the manufacturer's instructions. The sleeving shall be secured in place and be of a material able to provide supplemental mechanical protection for the cord (for example, woven fiberglass, tubing, or similar). Providing cable ties with instructions to secure the cord to one of the supporting chains is an acceptable means of protecting that portion of the cord secured to the chain, without additional sleeving.

Exception: A "shop light" with no accessible conductive parts, or with accessible conductive parts separated from any uninsulated live parts by double insulation, is permitted to use a polarized (ungrounded) attachment plug.

76.2.2 The flexible cord for a hanging type unit shall:

a) Be at least 15 feet (4.6 m) long from the point where the cord emerges from the body of the unit to the face of the attachment plug or connector;

b) Have insulation rated for 105°C (221°F); and

c) Be of a type specified in Table 75.1.

76.3 Lampholders and switches

76.3.1 Dead metal parts of a lampholder or a switch (such as a mounting bracket, nipple, or pull chain) shall comply with the applicable Accessibility, Spacings, and Grounding requirements in the ELECTRICAL CONSTRUCTION – GENERAL portion of this standard.

76.3.2 A lampholder shall have a body and base (or cap) of insulating material. Metal shell lampholders and/or lampholders with exposed terminals shall not be used.

76.3.3 When the insulating body of an incandescent lampholder is provided with an integral metal nipple or tube, the inner end of the nipple or tube shall not extend inward beyond the inner surface of the lampholder body.

76.3.4 A through-cord switch shall be located at least 1-1/2 inches (38 mm) from accessible dead metal of the portable luminaire.

77 Tests

77.1 Mounting means test

77.1.1 A cord and chain suspended unit required to be tested as specified in the Exception 1 to 75.2.1 shall be subjected to the Mounting Means Test – Chain and Suspended Units, Section 179.

77.2 Tests for suspended toys

77.2.1 A cord and chain suspended unit having play value in accordance with Portable Luminaires Having Play Value, Section 18, shall be subjected to the Test for Suspended Toys, Section 180.

78 Markings

78.1 A swag-type unit not provided with the lengths of cord and chain required by 75.1.1 and 76.2.1 shall be provided with markings as specified in Cord and Chain Suspended Units, Section 206.

79 Instructions

79.1 A cord and chain suspended unit shall be provided with instructions as specified in Cord and Chain Suspended Units, Section 222.

CLAMP-ON MOUNTED UNITS – SUPPLEMENTARY

80 General

80.1 These requirements specified in Sections 80 – 83 apply to portable luminaires that are provided with clamps as the mounting means.

80.2 These requirements are supplementary to other applicable requirements in this standard.

81 Construction – Mechanical

81.1 Clamp

81.1.1 A clamp relying on a spring-actuated clip for securement shall hold the portable luminaire to surfaces from 1/16 inch (1.6 mm) thick to 1-1/2 inches (38 mm) thick.

81.1.2 A clamp shall not require the use of tools to adjust the clamp.

Exception: A clamp intended for a specific application (such as mounting to office furnishings) is not required to comply with this requirement.

81.1.3 A thumb screw knob provided to tighten a clamp shall be at least 7/8 inch (22.2 mm) in diameter.

81.1.4 When a spring-actuated clamp employs a friction-type material secured by an adhesive, the adhesive bond shall comply with the requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

Exception No. 1: Molded-in, ultrasonic, or solvent bonded friction materials do not require additional evaluation of the bond.

Exception No. 2: Evaluation of the adhesive bond is not required when the Mounting Means Test – Clamp-On Unit, Section 181, is conducted without the friction material in place.

82 Construction – Electrical

82.1 Power-supply cords

82.1.1 The power supply cord for an incandescent clamp-on unit shall be rated 105°C (221°F) minimum.

82.2 Lampholders and switches

82.2.1 Dead metal parts of a lampholder or a switch (such as a mounting bracket, nipple, or pull chain) shall comply with the applicable Accessibility, Spacings, and Grounding requirements in the ELECTRICAL CONSTRUCTION – GENERAL portion of this standard.

82.2.2 A lampholder shall have a body and base (or cap) of insulating material. Metal shell lampholders and/or lampholders with exposed terminals shall not be used.

82.2.3 When the insulating body of an incandescent lampholder is provided with an integral metal nipple or tube, the inner end of the nipple or tube shall not extend inward beyond the inner surface of the lampholder body.

82.2.4 A through-cord switch shall be located at least 1-1/2 inches (38 mm) from accessible dead metal of the portable luminaire.

83 Tests

83.1 Mounting means test

83.1.1 A clamp relying on a spring-actuated clip for securement shall comply with the Mounting Means Test – Clamp-On Unit, Section 181.

PORTABLE CABINET LIGHTS – SUPPLEMENTARY

84 General

84.1 The requirements specified in Sections 84 – 89 apply to portable luminaires intended for final installation into an open or enclosed cabinet such as a china hutch, bookcase, bed headboard, or kitchen cabinet.

84.2 A portable cabinet light shall be installed so that the line voltage power supply cord is not concealed.

84.3 These requirements are supplementary to other applicable requirements in this standard.

85 Construction – Mechanical

85.1 Mounting means

85.1.1 A pot style portable cabinet light shall have the mounting flange secured by means other than friction alone such as clamping with mechanical stop to limit adjustment, twist and lock, mechanical fasteners, or multiple spring clips that hook over the mounting surface. A strain relief bushing, bent tabs, or raised dimples in combination with a clamp meets the intent of the requirement.

85.1.2 Portable cabinet lights other than pot style shall have a mounting means that complies with 71.2.

86 Construction – Electrical

86.1 Power-supply cords

86.1.1 The power supply cord shall be at least 10 feet (3.05 m) in length, measured from the plug to the entrance into the first portable luminaire or accessory (switch, dimmer, power supply, or similar equipment).

Exception: A shorter cord is permitted when instructions are provided in accordance with 218.6.1.

86.1.2 Means shall be provided to prevent cord contact with the portable cabinet light at a location other than the cord exit, unless the cord is rated for the maximum temperature of any location it may contact.

86.2 Interconnecting cord

86.2.1 A length of 105°C (221°F) flexible cord identified in Table Table 31.1 is to be provided for interconnection between portable cabinet lights operating beyond class 2 circuit limits.

86.2.2 Portable cabinet lights operating within class 2 circuit limits are permitted to be interconnected using any wire, cord, or appliance wiring material whose insulation is rated for the maximum temperature and voltage involved.

86.3 Attachment plugs and receptacles

86.3.1 A portable cabinet light intended for interconnection shall be provided with:

a) A receptacle of the same type and configuration as the attachment plug of the portable unit, as illustrated in Figure 32.1, and marked in accordance with 207.3; or

b) A non-NEMA standard receptacle.

86.4 Lampholders

86.4.1 Lampholders shall have all wiring terminations and connections enclosed within the insulating body of the lampholder.

86.5 Low voltage portable cabinet lights

86.5.1 The cord between a low voltage portable cabinet light and remote mounted low voltage transformer or power supply shall be no less than 18 inches (457.2 mm) long.

86.5.2 Proprietary plugs and receptacles used for secondary circuit or low voltage connections shall not be NEMA Styles 1 – 15, 1 – 15P, 5 – 15, or 5 – 20.

86.5.3 Low voltage wiring shall have an ampacity rating in accordance with Table 26.1. Overcurrent protection for low voltage wiring is not required.

86.6 Portable cabinet light accessories

86.6.1 A portable cabinet light accessory shall make all electrical connections with interconnecting plug and receptacles where the means of maintaining polarity and strain relief are provided. The accessories shall comply with the applicable requirements in Sections 84 – 86 and elsewhere in the standard.

86.6.2 A portable cabinet light accessory incorporating a power supply cord shall comply with 86.1.1 when assembled to the intended mating portable cabinet light.

86.6.3 The portable cabinet light accessory shall be marked in accordance with 207.4 and provided with installation instructions in accordance with Section 224.

87 Tests

87.1 Normal temperature test

87.1.1 A portable cabinet light shall be subjected to the Normal Temperature Test – General, Section 143, Test Method – General, Section 144, and Specific Test Conditions – Portable Cabinet Lights, Section 146.

88 Markings

88.1 A portable cabinet light shall comply with the markings specified in Portable Cabinet Lights, Section 207.

88.2 *Deleted*

89 Instructions

89.1 A portable cabinet light shall comply with the instructions specified in Section 223, Portable Cabinet Lights and, if for installation on a bed headboard, 221.1.2.

UNITS FOR USE WITH OFFICE FURNISHINGS – SUPPLEMENTARY

90 General

90.1 The requirements specified in this section apply to portable luminaires used with office furnishing.

90.2 These requirements are supplementary to other applicable requirements in this standard.

90.3 A portable luminaire intended for use with proprietary mounting systems shall be evaluated based upon the manufacturer's instructions.

91 Construction – Mechanical

91.1 An office furnishing shall not be used to complete any portion of an electrical enclosure.

92 Construction – Electrical

92.1 Power-supply cords

92.1.1 A power supply cord shall be at least hard usage, Type SJ, SJE, SJEO, SJO, SJOO, SJT, SJTO, SJTOO, S, SE, SEO, SO, SOO, ST, STO, or STOO as defined in the Standard for Flexible Cords and Cables, UL 62.

92.1.2 A power supply cord shall not exceed 9 feet (2.74 m) in length as measured from the back surface of the attachment plug to the point of cord entry on the portable luminaire.

92.1.3 A power supply cord shall be 18 AWG minimum, shall contain an equipment grounding conductor, and have a grounding type attachment plug.

Exception: Portable luminaires having a polymeric enclosure and no metal parts accessible during normal use, relamping, or starter replacement is not required to comply with this grounding requirement. Accessible metal parts include ballast mounting screws or metal fasteners that are able to become energized.

92.2 Plugs and receptacles

92.2.1 A plug or receptacle provided for interconnection shall be the grounded type and rated not less than 15 A, 125 V, and shall not be NEMA Styles 1 – 15, 1 – 15P, 5 – 15 or 5 – 20.

Exception: A grounded type plug or receptacle is not required when the portable luminaire complies with the Exception to 92.1.3.

92.2.2 A convenience receptacle shall not be provided in a portable luminaire for use with office furnishings.

92.3 Interconnecting cord

92.3.1 An interconnecting cord shall be the hard usage type rated 105°C in accordance with 92.1.3.

Exception: For a Class 2 circuit, other types of wire, cord, or appliance wiring material is able to be used when the insulation is rated for the maximum temperature and voltage involved.

92.3.2 An office furnishing unit with provision for interconnection and equipped with a 18 AWG power supply cord shall be provided with overcurrent protection rated to protect the cord, plug, and receptacle.

92.3.3 An office furnishing unit with provision for interconnection and equipped with a 16 AWG power supply cord shall either be provided with suitably rated overcurrent protection or shall be marked in accordance with 198.9.4.

92.3.4 Overcurrent protection in the form of fuses shall have a marking in accordance with 198.9.3.

93 Markings

93.1 An office furnishing type unit shall comply with the markings specified in Units for Use with Office Furnishings, Section 208.

94 Instructions

94.1 An office furnishing type unit shall comply with the instructions specified in Units for Use with Office Furnishings, Section 225.

CONVERTIBLE UNITS – SUPPLEMENTARY

95 General

95.1 The requirements specified in Sections 95 – 99 apply to portable luminaires intended to be convertible to fixed units (lighting fixtures).

95.2 These requirements are supplementary to other applicable requirements in this standard.

95.3 A convertible unit shall be mounted in accordance with the instructions provided by the manufacturer and evaluated as a portable luminaire in accordance with the requirements in this standard and as a fixed unit (luminaire) in accordance with the Standard for Luminaires, UL 1598.

95.4 The conversion kits covered in Construction – Mechanical, Section 96, shall be:

a) An integral conversion kit whose only function is to provide the parts to convert the supply connection to a fixed wiring means in accordance with the Standard for Luminaires, UL 1598; or

b) A separately mounted and connected portable luminaire accessory that is convertible to a fixed unit (luminaire). The accessory shall comply with Portable Luminaire Accessories – Supplementary, Sections 121 – 124.

96 Construction – Mechanical

96.1 Swag-to-chandelier conversion kits

96.1.1 A convertible swag type unit shall be provided with a separately packaged conversion kit, consisting of a canopy, crossbar, wire connectors, and all the required mounting hardware to enable the portable luminaire to be converted to a chain-suspended, outlet box-mounted unit.

96.2 Surface mount conversion kits

96.2.1 A convertible surface-mount unit shall be provided with a separately packaged conversion kit, consisting of wire connectors and all the mounting hardware required, to enabled the portable luminaire to be converted to a surface-mount unit.

96.3 Under-shelf mounted conversion kits

96.3.1 A convertible under-shelf mounted unit shall be provided with a separately packaged conversion kit, consisting of wire connectors and all the mounting hardware required, to enable the under-shelf mounted portable luminaires to be converted to a fixed wired unit.

96.3.2 *Deleted*

96.3.3 *Deleted*

97 Construction – Electrical

97.1 Grounding

97.1.1 A convertible unit shall have a grounding conductor in accordance with this standard that complies with the requirements in the Standard for Luminaires, UL 1598, as appropriate.

97.1.2 The grounding conductor provided with a chain suspended (swag) type unit shall either:

a) Be integral with the power supply cord; or

b) Extended at least 12 inches (304.8 mm) beyond the last link of chain.

97.1.3 The grounding conductor of a convertible surface-mounted unit shall either:

a) Be integral with the power supply cord; or

b) Extend at least 12 inches (304.8 mm) from the exit of the power supply cord from the convertible unit.

97.2 General

97.2.1 An under-shelf mounted system that is convertible to a fixed wiring means shall comply with the following:

a) All components of the system shall comply with the Standard for Luminaires, UL 1598; and

b) The interconnected cords shall be provided with a grounding conductor and a grounding means if grounding is required for the luminaire in accordance with UL 1598.

97.3 Polarity

97.3.1 A convertible unit shall be wired so that the conductor connected to the screw-shell or to the identified neutral of the ballast is identified for proper connection to the power supply in accordance with Polarization and Identification, Section 35.

97.4 Power – supply cord

97.4.1 A convertible unit shall be provided with a power supply cord connected to the unit, or provided with a detachable power supply cord as long as it is packaged with the product.

98 Markings

98.1 A convertible unit shall comply with the markings specified in Convertible Units, Section 209.

99 Instructions

99.1 A convertible unit shall comply with the instructions specified in Convertible Units, Section 226.

INTERCHANGEABLE UNITS – SUPPLEMENTARY REQUIREMENTS

100 General

100.1 The requirements specified in Sections 100 – 103 apply to residential units which utilize one or more replaceable or interchangeable lighting assemblies fitted to a base which is to be weighted or configured for pin-up mounting.

100.2 These requirements are supplementary to other applicable requirements in this standard.

100.3 The base, adapter, and lighting assembly shall comply with the applicable requirements of the Standard for Track Lighting Systems, UL 1574.

Exception: A lighting assembly complying with the requirements of UL 1574 is not required to comply with the Normal Temperature Test requirements of Section 143, General, and Section 144, Test Method – General, with respect to shade temperatures when the base for which the lighting assembly is intended is marked in accordance with 210.5.

101 Construction – Mechanical

101.1 Mounting

101.1.1 The base shall not be provided with means for permanent mounting to a building structure. This does not preclude the provision of clips or separable mounting brackets which are intended to be permanently attached to a building structure and to which the base is connected.

Exception: Means for mounting in accordance with Surface Mounted Units – General, Section 70, and Wall Mounted Units, Section 71, is to be provided.

101.1.2 It shall not be required to use a tool to remove the base from clips or separable mounting brackets.

102 Construction – Electrical

102.1 Power-supply cords

102.1.1 The power supply cord and attachment plug cap shall be rated in accordance with Electrical Ratings, 198.6, based on the maximum current rating of the lighting assemblies intended to be applied to the base, in accordance with the marking specified in 210.1.

102.2 Polarization

102.2.1 Polarity shall be maintained electrically through all components (power supply cord, base, adapter and lighting assembly). The screw shell of an Edison-base lampholder and an identified (neutral) conductor of a ballast shall be connected to the grounded (neutral) conductor of the lighting assembly and the base.

102.2.2 The mechanical means required in 102.2.1 for maintaining polarity of the components (for example, a keying ridge or protrusion) shall comply with the Mechanical Means of Polarity Test, Section 182.

102.3 Adapter

102.3.1 The base shall be provided with a fixed number of locations for attachment of adapters.

102.3.2 An adapter shall not be provided with a general purpose receptacle.

103 Markings

103.1 An interchangeable type unit shall comply with the marking specified in Interchangeable Units, Section 210.

TRACK-STYLE UNITS – SUPPLEMENTARY

104 General

104.1 The requirements specified in this section apply to portable luminaires that utilize one or more replaceable or interchangeable lighting assemblies fitted to a track or portion thereof intended to facilitate adjustment.

104.2 These requirements are supplementary to other applicable requirements in this standard.

104.3 A track-style type unit shall comply with the applicable requirements in this standard. The track and adapter shall comply with the applicable requirements in the Standard for Track Lighting Systems, UL 1574. A lighting assembly complying with the applicable requirements in UL 1574 need not be subjected to further evaluation.

105 Construction – Mechanical

105.1 Track

105.1.1 The track shall be provided in fixed, one piece, lengths with a maximum length of 8 feet (2.4 m) and with the power-supply cord fitter and end cap attached.

105.2 Securement of cord and end cap

105.2.1 The power-supply cord fitter and the end cap shall be permanently secured in place.

105.2.2 With respect to 105.2.1, an end cap or power-supply cord fitter is determined to be permanently secured in place when it is secured in such a manner that it is not removable:

a) Without the use of tools; or

b) With ordinary tools such as a flat or cross blade screwdriver, common pliers, or a hex head driver.

Exception: The power-supply cord fitter or end cap is able to be removable (removed) with ordinary tools when the assembly means is not visible after installation.

105.3 Mounting means

105.3.1 Mounting means shall be provided with each track. The mounting means shall consist of:

a) Screws or bolts for mounting the track; or

b) Clips for mounting the track along with screws or bolts for mounting of the clips.

Exception: A different mounting means is to be provided when it complies with the Track Clip Securement Test, Section 183, and is investigated and found to be equivalent to the mounting means described in 105.3.1.

105.3.2 Mounting clips, when provided, shall comply with the Track Clip Securement Test, Section 183.

106 Construction – Electrical

106.1 Power-supply cords

106.1.1 The power-supply cord attachment plug and overcurrent protection shall be sized in accordance with Table 106.1. Overcurrent protection shall be provided in the power-supply cord.

Table 106.1
Size of power-supply cord attachment plug and overcurrent protection

Cord size AWG	Minimum plug rating (Amperes)	Maximum ampere overcurrent
12	20	none
12	15	15
14	15	15
16	10	10
18	7	7

106.2 Polarity

106.2.1 Polarity shall be maintained electrically through all components (power-supply cord, power-supply fitter, track, adapter, and lighting assembly) of a track-style type unit.

106.3 Receptacles

106.3.1 A general purpose receptacle shall not be provided.

107 Tests

107.1 Mechanical means of polarity test

107.1.1 The mechanical means required in 106.2.1 for maintaining polarity of the components in a track-style type unit (for example, a keying ridge or protrusion) shall comply with the Mechanical Means of Polarity Test, Section 182.

107.2 Track clip securement test

107.2.1 Mounting clips and the exception to 106.2.1 shall be evaluated by complying with the Track Clip Securement Test, Section 183.

108 Markings

108.1 A track style unit shall comply with the markings specified in Track-Style Units, Section 211.

109 Instructions

109.1 A track style unit shall comply with the instructions specified in Track-Style Units, Section 227.

PORTABLE LUMINAIRE KIT – SUPPLEMENTARY

110 General

110.1 The requirements specified in Sections 110 – 115 apply to portable luminaire kits. A portable luminaire kit consists of all the parts to a portable luminaire in an easy to assemble form either for "building" a unit such as a craft kit. They are intended to be assembled by a person presumed to possess a little or no knowledge of electrical circuitry. The assembled units shall comply with the applicable requirements elsewhere in this standard independent of any materials not included in the kit. Only ordinary tools shall be required for assembly unless specific tools are provided.

110.2 These requirements are supplementary to other applicable requirements in this standard.

111 Construction – Mechanical

111.1 General

111.1.1 The complete portable luminaire kit shall be packaged in a single carton or container. This does not preclude shipping cartons holding many of the individually packaged products.

111.2 Shade

111.2.1 When a shade is not provided, then instructions detailing shade dimensions shall be provided in accordance with Incandescent Units Shipped without Lampshade, 219.1.

112 Construction – Electrical

112.1 General

112.1.1 A portable luminaire kit shall consist of all electrical parts and screws for mounting components when required and either:

a) The required mechanical support or enclosure parts; and/or

b) Complete instructions for "building" or "finding" parts that meet the intent of the requirement.

112.1.2 The electrical assembly shall be completely factory wired.

Exception: The electrical assembly is not required to be completely factory-wired where the construction of the kit precludes the pulling of the cord, when:

a) The integrity of the strain relief at all factory connections is intact;

b) The means of providing and maintaining strain relief and/or proper polarity are clearly detailed in the instructions; and

c) Splices or electrical connections do not require completion by the user except as permitted elsewhere in the standard.

112.2 Mounting of components

112.2.1 A fluorescent unit subassembly is to include a means for supporting the ballast(s) unless the means of support is integral with the lampholder(s).

112.2.2 A cork or plug mounted on a stem connected to the lampholder is an intended means for mounting the lampholder to a bottle, vase, jar, or similar support.

113 Tests

113.1 Assembly and installation test

113.1.1 The portable luminaire kits required assembly and installation instructions shall be evaluated by conducting the Assembly and Installation Test, Section 184.

114 Markings

114.1 Portable luminaire kits and subassemblies shall comply with the markings specified in Portable Luminaire Kits and Subassemblies, Section 212.

115 Instructions

115.1 A portable luminaire kit and subassembly shall comply with the installation instructions specified in Portable Luminaire Kits and Subassemblies, Section 228.

115.2 All parts provided shall be detailed in the assembly instructions.

PORTABLE LUMINAIRE SUBASSEMBLIES – SUPPLEMENTARY

116 General

116.1 The requirements specified in Sections 116 – 120 apply to portable luminaire subassemblies. Portable luminaire subassemblies are parts of portable luminaries intended for either factory assembly or field assembly for rewiring a unit by persons familiar with the knowledge and hazards of electrical circuitry. Only ordinary tools shall be required for assembly unless specific tools are provided.

116.2 These requirements are supplementary to other applicable requirements in this standard.

117 Construction – Electrical

117.1 General

117.1.1 A portable luminaire subassembly shall consist of all electrical parts (including wire nuts, pre-stripped and tinned wires, and screws for mounting components when required.

117.1.2 The electrical assembly shall be completely factory wired and the lampholder shall have integral leads or an integral shell that encloses the wiring terminations.

Exception: The electrical assembly is not required to be completely factory-wired where the construction of the subassembly precludes the pulling of the cord, when:

a) The integrity of the strain relief at all factory connections is intact; and

b) The means of providing and maintaining strain relief and/or proper polarity are clearly detailed in the instructions.

117.2 Power-supply cord

117.2.1 For a unit rewiring subassembly, the minimum power supply cord length shall be such that when the unit is rewired, the external portion of the cord is at least 5 feet (1.5 m) long.

117.3 Mounting of components

117.3.1 A fluorescent unit subassembly is to include a means for supporting the ballast(s) unless the means of support is integral with the lampholder(s).

118 Assembly and Installation Test

118.1 The portable luminaire subassembly's required assembly and installation instructions shall be evaluated by conducting the Assembly and Installation Test, Section 184.

119 Markings

119.1 A portable luminaire subassembly shall comply with the markings specified in Portable Luminaire Kits and Subassemblies, Section 212.

120 Instructions

120.1 A portable luminaire subassembly shall comply with the installation instructions specified in Portable Luminaire Kits and Subassemblies, Section 228.

120.2 All parts provided shall be detailed in the assembly instructions.

PORTABLE LUMINAIRE ACCESSORIES – SUPPLEMENTARY

121 General

121.1 A portable luminaire accessory consists of components such as interconnecting cord sets, dimmers, and switch assemblies.

121.2 A portable luminaire accessory intended for use as a conversion kit to enable a portable luminaire to be converted to a fixed unit (luminaire) shall comply with the requirements for Convertible Units – Supplementary, Sections 95 – 99.

121.3 These requirements are supplementary to other applicable requirements in this standard.

122 Construction

122.1 The interconnecting means between the portable luminaire accessory and the portable luminaire shall comply with the requirements for Interconnected Units, Section 33.

123 Markings

123.1 The portable luminaire accessory shall comply with the markings specified in Section 213.

124 Instructions

124.1 The portable luminaire accessory shall comply with the installations instructions specified in Section 229.

WORK LIGHTS – SUPPLEMENTARY

125 General

125.1 The requirements specified in Sections 125 – 129 apply to work lights defined in accordance with 2.66.

125.2 These requirements are supplementary to other applicable requirements in this standard.

125.3 A work light with a tungsten halogen lamp shall additionally comply with the requirements in Tungsten Halogen Units, Sections 54 – 59, unless superseded by requirements herein.

125.4 A work light with a high intensity discharge lamp shall additionally comply with the requirements in High Intensity Discharge Units, Sections 65 – 69, unless superseded by requirements herein.

125.5 A work light with a fluorescent lamp shall additionally comply with the requirements in Fluorescent Units, Sections 60 – 64, unless superseded by requirements herein.

125.6 A work light with an LED light source shall additionally comply with the applicable requirements from the Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products, UL 8750, unless superseded by requirements herein.

125.7 A work light marked for outdoor use, in accordance with 214.4, or for wet location use, in accordance with 215.1, shall additionally comply with the requirements in Wet Location Use, Sections 130 – 135, unless superseded by the requirements herein.

125.8 A work light provided with an integral generator shall comply with the wet location requirements and be marked in accordance with 214.4.

125.9 A work light with an integral or separable battery pack is not within the scope of this Standard. See 1.5.

126 Construction – Mechanical

126.1 Assembly

126.1.1 A work light is able to be unassembled when the subassemblies comply with Assembly and Packaging, Section 8.

126.1.2 A guard for a work light, when not factory attached, is to be shipped only as a single unattached subassembly when it is able to be attached by common household tools and is marked in accordance with 214.6.

126.2 Guards

126.2.1 A work light shall be provided with a guard that complies with this section.

Exception No. 1: A guard is not required when the housing surface temperatures do not exceed 150°C (302°F) during the Normal Temperature Test – General, Section 143, Test Method – General, Section 144, and Specific Test Conditions – Work Lights, Section 147.

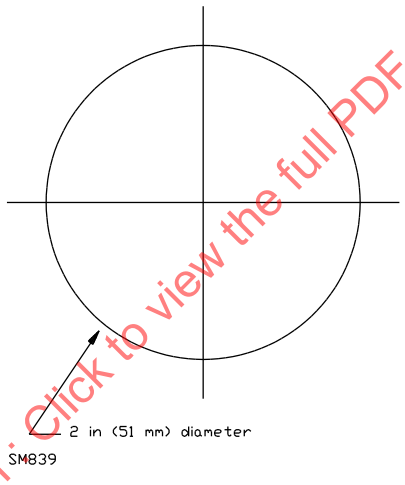
Exception No. 2: A work light provided with an integral generator is not required to be provided with a guard when the lamp compartment is located at least 5 feet (1.5 m) above the ground in its lowest position.

126.2.2 A guard shall be fabricated from nominal 0.06 inch (1.5 mm) minimum diameter plated or painted wire.

126.2.3 For areas other than at the exposed lamp or diffuser, the guard shall prevent a 2 inch (51 mm) diameter sphere from contacting any housing surfaces which require guarding. See Figure 126.1 for sphere probe.

Figure 126.1

Sphere probe for work lights



126.2.4 A guard for the lens or diffuser is not required for a work light complying with Exception No. 1 or Exception No. 2 to 128.2.1.

126.2.5 A work light guard shall be attached so that it either:

a) Requires the use of tools for removal; or

b) Requires two separate actions to disengage the securing means (i.e. push and turn) and complies with the Guard Securement Test in Section 185.

126.3 Handles

126.3.1 A work light with external enclosure surface temperatures exceeding 90°C (194°F) during the Normal Temperature Test – General, Section 143, Test Method – General, Section 144, and Specific Test Conditions – Work Lights, Section 147, shall be provided with a handle for positioning the light. The surface temperature of the handle shall not exceed the limits in Table 144.1, item 1(b).

Exception: A work light is not required to comply with this requirement when it requires a tool for making aiming adjustments.

126.4 Bases and stands

126.4.1 Work lights have the option of being freestanding, clamp on, or employing similar portable mounting means, or being provided with a means for mounting to a tool, machine, wall, or similar object.

126.4.2 A stand that telescopes and extends 5 feet (1.5 m) or more above the ground shall be arranged to prevent sudden collapse when aiming or adjusting the work light. This is to be accomplished by a detent, positive latching or locking feature.

126.4.3 The telescoping portion of a stand shall either have a mechanical stop to prevent separation or have an alignment mark. The product shall be marked in accordance with 214.7 describing the purpose of the alignment mark.

126.4.4 A base or stand that has casters or wheels shall have an integral locking device.

126.4.5 A base or stand of a wet location type unit that has casters or wheels shall have provision for storing the power supply cord.

126.4.6 Stability of a work light shall not rely on a compartment or a base or stand intended to be filled with liquid, sand, or other material by the user or operator.

126.4.7 *Deleted*

127 Construction – Electrical

127.1 Power-supply cords

127.1.1 A work light rated 1800 W or less shall be provided with a junior hard service cord Type SJ, SJO, SJT or equivalent rated for the current in accordance with Table 26.1.

127.1.2 A work light rating exceeding 1800 W shall be provided with a hard service cord Type S, SO, ST or equivalent rated for the current in accordance with Table 26.1.

127.1.3 *Deleted*

127.1.4 A work light power supply cord shall be routed or secured such that normal adjustment of the light does not result in the power supply cord resting on a surface having a temperature greater than the cord rating.

127.1.5 A power supply cord for a work light shall be:

a) Minimum 18 AWG (0.8 mm^2) for a unit without a receptacle;

b) Minimum 18 AWG (0.8 mm^2) for a unit with a receptacle and marked for maximum load per 198.6.2, also see 127.3.2(a); or

c) Minimum 14 AWG (2.1 mm^2) for a unit with a receptacle and not marked for maximum load per 198.6.2, also see 127.3.2(b).

127.2 Grounding type attachment plug

127.2.1 A work light having accessible metal surfaces shall have a grounding type attachment plug.

Exception: For a work light without a receptacle, a grounding-type attachment plug is not required if all accessible metal surfaces are separated by double insulation from uninsulated live parts exceeding class 2 voltage limits.

127.2.2 A work light provided with a receptacle shall have a grounding type attachment plug.

127.3 Receptacles

127.3.1 A work light receptacle shall:

a) Be of the grounding type; and

b) Comply with applicable receptacle requirements in Receptacles, Section 44.

127.3.2 A work light with receptacle(s) shall:

a) Be provided with maximum load markings per 198.6.2; or

b) Additionally comply with the following requirements:

1) Be provided with a power supply cord sized per 127.1.5(c);

2) Have an attachment plug rated for 20A; and

3) Be suitable for a 15A load drawn from the receptacle(s), as determined by the Normal Temperature Test – General, Section 143.

127.3.3 A switch provided to control an integral receptacle shall:

a) Have a minimum 120 Vac voltage rating and a current rating no less than as marked per 198.6.2.

b) Comply with the requirements of

1) The Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1, and is rated for use with other than resistive (Res), AC tungsten filament lamp (L), or AC and DC tungsten filament lamp (T) loads, or

2) The Standard for General-Use Snap Switches, UL 20, as a general-use AC switch; and

c) Be marked (on or adjacent to the switch) “on”/”off” or “I” / “0”, or be provided with an indicator light that illuminates when the switch is on.

127.4 Tipover switches

127.4.1 When a tipover switch is provided, the Severe Condition Test, 165.3 is not required.

127.4.2 A tipover switch shall comply with Switches and Dimmers, Section 43.

127.4.3 A tipover switch shall de-energize the work light when tipped over in any direction.

127.4.4 A tipover switch shall be arranged such that the trip mechanism is not able to be externally defeated or result in nuisance tripping. A plunger activated switch where the weight of the work light activates the light source does not meet the intent of the above requirement.

128 Tests

128.1 Normal temperature test

128.1.1 A work light shall be subjected to the Normal Temperature Test – General, Section 143, Test Method – General, Section 144, and Specific Test Conditions – Work Lights, Section 147.

128.2 Abnormal operation tests

128.2.1 A work light is to be subjected to the following tests in Sections 165 – 173:

a) Severe Condition, 165.2, 165.3, and 165.8;

b) (Tungsten-halogen and HID work lights only:) Tungsten-Halogen Lamp Guard, Lamp Containment Barrier, and UV Filter Security Tests, Section 166; and

c) (Tungsten-halogen and HID work lights only:) Polymeric Lamp Containment Barrier Test, Section 172.

Exception No. 1: The Severe Condition Test is not required when a tipover switch is provided in accordance with Tipover Switches, 127.4.

Exception No. 2: The Severe Condition Test and the Tungsten-Halogen Lamp Guard, Lamp Containment Barrier, and UV Filter Security Tests are not required when the unit complies with 128.3.2 and is marked in accordance with 214.4.

128.3 Stability tests

128.3.1 A work light is to be subjected to the Stability Test, Section 153, at an incline of 8 degrees for any possible use adjustment.

128.3.2 A work light complying with Exception No. 2 of 128.2.1 is to be subjected to the Stability Test, Section 153, at an incline of 33 degrees.

128.3.3 *Deleted*

129 Markings

129.1 A work light shall comply with the markings specified in Work Light, Section 214.

DAMP LOCATION USE – SUPPLEMENTARY

129A General

129A.1 The requirements in Sections 129A – 129D apply to portable luminaires marked “Suitable for damp locations.”

129A.2 These requirements are supplementary to other applicable requirements in this standard.

129B Construction

129B.1 The portable luminaire shall comply with the requirements in Corrosion Protection, Section 131.3, as applicable to wet location products.

129B.2 The screw shell in a screw shell-type lampholder shall not be constructed of unplated aluminum.

129B.3 Nonabsorptive electrical insulation shall be used in the construction of electrical components where it is relied upon to provide electrical spacings or sole support of live electrical parts or to provide electrical insulation. Untreated fiber and similar material shall not be used; while treated cellulosic fiber, phenolic, urea, porcelain, and similar material, are examples of materials that meet the intent of the requirement.

129C Tests

129C.1 Portable luminaires intended for damp locations shall be:

a) Subjected to the Leakage Current Measurement Test, Section 161, and

b) If provided with a polymeric enclosure, comply with the Resistance to Impact test of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, using a preconditioning temperature of 0 ±2°C (32 ± 3.6°F).

Exception: Portable luminaires supplied by a remote Class 2 power unit circuit are not subject to these tests.

129D Markings

129D.1 A damp location type unit shall comply with the markings specified in Damp Location Use, Section 214A. It shall not be provided with any information such as markings, instructions, or illustrations that implies or depicts wet location use.

WET LOCATION USE – SUPPLEMENTARY

130 General

130.1 The requirements specified in Sections 130 – 135 apply to surface-mounted, free standing, or stake mounted units marked "Suitable for wet locations." Such portable luminaires are suitable for locations subject to rain, vehicle washing areas, locations subject to spray of a noncorrosive and nonflammable liquid, and similar conditions.

130.2 These requirements are supplementary to other applicable requirements in this standard.

130.3 The requirements do not cover portable luminaires for use under water (such as in a decorative fountain or a swimming pool) nor in areas that contain flammable or corrosive liquids or gases.

131 Construction – Mechanical

131.1 Enclosure

131.1.1 A portable luminaire shall be constructed to prevent the accumulation of water on live parts, electrical components, or conductors not identified for use in contact with water.

131.1.2 A polymeric material used as an enclosure for wet location use units shall have an ultraviolet light (UV) resistance rating in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

131.2 Water shields

131.2.1 A polymeric water shield, including a silicone rubber boot used over a switch, shall be a UV rated material.

131.2.2 A polymeric water shield that operates at a temperature higher than 65°C (117°F), but not higher than 95°C (171°F), as determined by Normal Temperature Test of Test Method – General, Section 144, and that does not have a recognized temperature rating for the measured temperature shall comply with the Thermal Conditioning Test of Section 187, Polymeric Thermal Conditioning Test.

131.3 Corrosion protection

131.3.1 Copper, aluminum, and alloys of copper and aluminum, stainless steel, and similar materials having inherent resistance to atmospheric corrosion may be used without additional corrosion protection.

131.3.2 All exposed, exterior and interior, surfaces of ferrous metal parts shall be protected by one of the following:

a) A coating of nonferrous metal applied by the hot dip process method;

b) A plating of nonferrous metal applied either by electro-deposition or by chemical means;

c) A coating of vitreous enamel;

d) Baked paint, or similar type of coating; or

e) Air-dry paint that complies with the Paint Adhesion Test of Section 190.

131.3.3 The requirements of 131.3.2 shall not apply to the following:

a) Bearings, sliding surfaces of a hinge or shaft, hinge pins, and similar parts located on the exterior of enclosures where such protection is not practical; and

b) Decorative parts.

131.3.4 Edges, punched holes, and spot-welds in prefinished steel, and hanger locations for painting or plating in ferrous metal, do not require any corrosion protection.

131.3.5 Welds in ferrous metals shall be painted with at least one coat of outdoor paint, and spot-welds in galvanized steel shall be painted with at least one coat of paint.

131.3.6 Vitreous enamels are able to be used as a protective coating for ferrous sheet metal having a minimum thickness of 0.025 inch (0.6 mm).

131.4 Drain openings

131.4.1 A portable luminaire that permits water to enter the unit during the Rain and Sprinkler Tests, Section 186, shall be provided with a drain hole.

131.4.2 Drain holes, if provided, shall be located in the surface likely to prevent the accumulation of water.

131.4.3 Drain holes shall permit the insertion of a 0.125 inch (3.2 mm) diameter rod.

131.5 Gaskets

131.5.1 A gasket or bushing required to prevent water from entering the enclosure shall be secured to prevent its loosening during user maintenance by a clip, clamping ring, adhesion, or other mechanical means.

131.5.2 A gasket shall be made of material as shown in Table 144.1, Items 24 – 29, and shall have a temperature rating suitable for the operating temperature as determined by the Normal Temperature Test of 144.1, or shall withstand the:

a) Gasket Accelerated Aging Test of Section 188, Test Method A, for the gasket or bushing only; or

b) Gasket Accelerated Aging Test of Section 188, Test Method B, with the gasket or bushing installed as intended in the portable luminaire.

131.5.3 The adhesive used to secure a gasket or bushing that is required to prevent water from entering the enclosure, and which is likely to be exposed or not compressed as intended during user maintenance, shall comply with the:

a) Gasket Adhesion Test of Section 189, method A for the gasket adhesive combination only; or

b) Gasket Adhesion Test of Section 189, method B, with the gasket installed in the portable luminaire.

131.6 Mounting stakes

131.6.1 Mounting stakes for wet location type units shall be a minimum 5 inches (12.7 cm) long. Shorter stakes or multiple stakes are permitted when the portable luminaire is provided with a stabilizing plate 3 inches (7.6 cm) minimum in diameter perpendicular to the stake.

131.6.2 Mounting stakes shall be provided with at least one reinforcing angle running the length of the stake.

131.6.3 Mounting stakes shall be:

a) 0.056 inch (1.42 mm) thick minimum zinc coated steel;

b) 0.1 inch (2.5 mm) thick minimum diecast aluminum or zinc, or sheet aluminum; or

c) 0.1 inch (2.5 mm) thick minimum rigid plastic complying with the requirements in Polymeric Enclosures, Section 12.

132 Construction – Electrical

132.1 Power-supply cords

132.1.1 Any cord exposed outside of a portable luminaire shall be type SJ, SJO, SJT, or equivalent and be marked “W” following the type designation. The attachment plug shall also be rated for outdoor use.

132.1.2 *Deleted*

132.2 Grounding type attachment plug

132.2.1 Wet location units having accessible metal surfaces shall have a grounding type attachment plug.

Exception: For a wet location unit without a receptacle, a grounding-type attachment plug is not required if all accessible metal surfaces are separated by double insulation from uninsulated live parts exceeding class 2 voltage limits.

132.3 Receptacles

132.3.1 A portable luminaire provided with a load-side connector or convenience receptacle shall be provided with a water shield that is hinged, tethered, or otherwise permanently attached to the luminaire.

132.3.2 *Deleted*

132.3.3 The attachment plug on a wet location portable luminaire supply cord shall not be provided with a current tap.

132.4 Lampholders

132.4.1 The screw shell in a screw shell-type lampholder shall not be constructed of unplated aluminum.

132.5 Switches

132.5.1 A switch shall be arranged to prevent water from entering the switch or enclosure.

132.6 Electrical insulation

132.6.1 Nonabsorptive electrical insulation shall be used in the construction of electrical components where it is relied upon to provide electrical spacings or sole support of live electrical parts or to provide electrical insulation. Untreated fiber and similar material shall not be used; while treated cellulosic fiber, phenolic, urea, porcelain, and similar material, are examples of materials that meet the intent of the requirement.

133 Tests

133.1 Wet location tests

133.1.1 A wet location type unit shall be subjected to the Wet Location Use Tests, Sections 186 – 190, as applicable.

134 Markings

134.1 A wet location type unit shall comply with the markings specified in Wet Location Use, Section 215.

135 Instructions

135.1 A wet location type unit shall comply with the instructions specified in Wet Location Use, Section 230.

PORTABLE HAND LIGHTS – SUPPLEMENTARY

136 General

136.1 The requirements specified in Sections 136 – 142 apply to portable hand lights and hand light accessories.

136.2 These requirements are supplementary to other applicable requirements in this standard.

136.3 A portable hand light provided with a light source other than an incandescent medium or candelabra base lamp shall additionally comply with the requirements of the applicable Sections of this standard unless superseded by requirements herein.

136.4 A portable hand light marked for wet location use, in accordance with 215.1 shall additionally comply with the requirements in Wet Location Use, Sections 130 – 135.

136.5 A portable hand light with an integral or separable battery pack is not within the scope of this Standard. See 1.5.

137 Construction – Mechanical

137.1 General

137.1.1 The overall length of the assembled portable hand light, when provided with a cord, shall not be less than 6 feet (1.83 m) when measured as described in 137.1.2.

Exception: A portable hand light intended for use with a cord reel need not comply with this requirement when it is provided with a power-supply cord a minimum of 1 foot (30.5 cm) as measured from the hand light fitting to the face of the attachment plug and marked in accordance with 216.9.

137.1.2 The minimum length mentioned in 137.1.1 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.

137.1.3 An edge, a projection, and a corner of an enclosure, frame, guard, handle, or a similar object, shall be smooth and well rounded and not so sharp as to constitute a risk of personal injury.

137.1.4 A polymeric material used as part or all of the enclosure of a portable hand light shall comply with Polymeric Enclosures, Section 12, and have a minimum flame rating of V2.

137.2 Assembly and packaging

137.2.1 A portable hand light is to be fully assembled when packaged and shipped.

Exception: A guard for a portable hand light when not factory attached, is to be shipped only within the same packaging and shall be tethered to the handle and provided with instructions for proper securement.

137.3 Lamp guard

137.3.1 A portable hand light shall be provided with a lamp guard located and secured such that the lamp is inaccessible to inadvertent contact during normal use.

Exception: A lamp guard is not required when the light source remains undamaged during the Drop Test (Section 193) and no accessible surface of the light source exceeds 90°C during the Temperature Test (Section 144).

137.3.2 With respect to 137.3.1, a lamp is determined to be inaccessible to inadvertent contact when a 1-1/2 inch (38 mm) diameter probe of any convenient length with a 3/4 inch (19 mm) radius rounded (hemispherical) end as described in Figure 55.1 is unable to be made to contact any part of the lamp with the guard in place as intended. The probe is to be rotated or angled to any position before, during, or after insertion into an opening, and the penetration is to be to any depth attainable by the opening.

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

137.3.4 A metallic lamp guard (reflector), with or without an insulating coating, shall be used only in conjunction with a three conductor cord and shall be grounded by connection to the grounding conductor.

137.3.5 A lamp guard (reflector) made of non-conductive polymeric material shall be evaluated to the requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and shall be employed on portable hand lights having two-wire cords. A three-wire cord shall only be used with a polymeric guard when other dead metal is used in the construction.

137.3.6 A guard constructed of a polymeric material shall comply with the requirement for the service temperature involved and, shall comply with the mold stress relief requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

137.3.7 A Portable Hand Light guard shall be attached so that it either:

a) Requires the use of tools for removal; or

b) Requires two separate actions to disengage the securing means (i.e. push and turn) and complies with the Guard Securement Test in Section 196.

137.4 Corrosion protection

137.4.1 All ferrous-metal parts, including hinges, bolts, and fasteners, exposed after assembly shall be protected against corrosion by painting, coating or plating. Copper, aluminum, alloys of copper and aluminum, stainless steel and similar materials having inherent resistance to atmospheric corrosion are not required to be provided with additional corrosion protection.

138 Construction – Electrical

138.1 General

138.1.1 A portable hand light not provided with a cord shall be constructed such that no live parts are accessible when extension cord or cord reel are attached by the user.

138.1.2 A soldered connection shall be mechanically secured before soldering unless the conductor in question, when disconnected at its termination, is:

a) Prevented from contacting live parts of opposite polarity;

b) Prevented from contacting accessible dead metal parts or grounded parts;

c) Does not present a risk of fire or shock due to arcing; and

d) Not accessible to contact by the user.

138.2 Assembly

138.2.1 A portable hand light shall be completely wired with each electrical component mounted in place and with each splice and connection completed.

Exception: A detachable power-supply cord is able to be used, as long as it provided with instructions for the selection and use of a suitable extension cord.

138.3 Wiring and conductors

138.3.1 A conductor of a wire or cord shall be 18 AWG (0.82 mm^2) minimum.

138.3.2 Conductors shall be fastened securely to the terminals of the respective hand light component.

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

138.4 Protection of wiring

138.4.1 A power-supply cord shall exit the portable hand light through an opening that is free from sharp edges, burrs, and fins that are able to damage the conductor insulation.

138.4.2 Means shall be provided to keep the flexible cord from being pushed into the hand light through the cord-entry hole, when such displacement:

a) Exposes the cord to mechanical damage or to a temperature higher than that for which the cord is rated;

b) Reduces spacing (such as to a metal strain-relief clamp) below the acceptable minimum values; or

c) Contacts sharp edges.

138.5 Power-supply cords

138.5.1 A portable hand light with a medium base lampholder or a receptacle shall have a Type SJT or heavier flexible cord. Other hand lights are permitted to employ Type SVT, SVTO, SVTOO, SVO, or SVOO flexible cords when marked in accordance with 216.8. Rubber jacketed flexible cords, which are not oil resistant, shall not be used.

138.5.2 The power supply cord shall be continuous from the attachment plug to the handle without splice, connector, or through-cord power supply.

Exception No. 1: A through-cord power supply is permitted to be spliced into the power supply cord within 30 inches (76.2 cm) of the attachment plug.

Exception No. 2: A receptacle fitting is permitted to be spliced into the power supply cord within 24 inches (61 cm) of the handle.

138.5.3 A power-supply cord intended for use on a portable hand light shall be:

a) Minimum 18 AWG (0.8 mm^2) for a unit without a receptacle; or

b) Minimum 18 AWG (0.8 mm^2) for a unit with a receptacle and provided with suitable overcurrent protection; or

c) Minimum 16 AWG (1.3 mm^2) for a unit with a receptacle and marked for maximum load per 216.5, also see 138.9.3(a); or

d) Minimum 14 AWG (2.1 mm^2) for a unit with a receptacle and not marked for maximum load per 216.5, also see 138.9.3(b).

138.5.4 *Deleted*

138.6 Grounding type attachment plug

138.6.1 A portable hand light having accessible metal surfaces shall have a grounding type attachment plug.

Exception: For a portable hand light without a receptacle, a grounding-type attachment plug is not required if all accessible metal surfaces are separated by double insulation from uninsulated live parts exceeding class 2 voltage limits.

138.6.2 A portable hand light provided with a receptacle shall have a grounding type attachment plug.

138.6.3 The grounding conductor of a portable hand light shall be contained within the overall assembly, connected to the grounding terminal and inaccessible while in use.

138.7 Incandescent lampholders

138.7.1 For the medium and candelabra base lampholders, the maximum-depth requirement described in the Standard for Lampholders, UL 496, does not apply to a construction in which the outer enclosure (insulating material) is flared or in which a non-rigid body is employed and extends beyond the specified limit to provide further protection against contact with live parts as long as the said construction does not prevent the bulb from being fully seated in the lampholder.

138.7.2 When the method of mounting a lampholder affects the depth of the lamp cavity, the determination of the lampholders suitability is to be made with the device mounted as intended.

138.7.3 The screwshell or screwshell contact of each lampholder or neutral lead of receptacle outlets shall be connected to the neutral supply conductor of the supply cord.

138.7.4 Metal-shell lampholders with paper liners shall not be used.

138.8 Switches

138.8.1 A switch may be provided to control a receptacle outlet, when the switch:

a) Has a voltage and current rating not less than the load it is intended to control;

b) Complies with the requirements of the Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1, and is rated for use with other than resistive (Res), AC tungsten filament lamp (L), or AC and DC tungsten filament lamp (T) loads;

Exception: A switch that complies with the requirements of the Standard for General-Use Snap Switches, UL 20, for a general-use AC switch is not prohibited from being used.

c) The switch indicates to the user when its associated receptacle is energized. See 216.6; and

Exception: A portable electric hand lamp is not prohibited from being equipped with indicator or pilot lights, such as neon-series-resistor, LED type, or similar items, to show if the receptacle is live, or to indicate that the unit is energized.

d) The receptacle is provided with supplementary overcurrent protection, in accordance with 139.

Exception: Supplementary overcurrent protection is not required for a unit provided with a switch and receptacle rated 15A minimum, and power supply cord and internal wiring rated 14 AWG (2.1 mm^2 minimum.

138.8.2 *Deleted*

138.8.3 *Deleted*

138.8.4 A portable hand light shall not include a through-cord or pendant switch.

138.9 Receptacles

138.9.1 A portable hand light assembled to Type SVT, SVTO, SVTOO, SVO, or SVOO flexible cord shall not have receptacle outlets.

138.9.2 A portable hand light provided with a receptacle shall:

a) Be of the grounding type; and

b) Comply with applicable receptacle requirements in Receptacles, Section 44.

138.9.3 A portable hand light with receptacle(s) shall:

a) Be provided with maximum load markings per 216.5; or

b) Additionally comply with the following requirements:

1) Be provided with a power supply cord sized per 138.5.3(d);

2) Have an attachment plug rated for 20A; and

3) Be suitable for a 15A load drawn from the receptacle(s), as determined by the Normal Temperature Test – General, Section 143.

139 Supplementary Protection

139.1 A portable hand lamp that requires supplementary overcurrent protection in accordance with 138.8.1(d) for a switched receptacle shall have a supplementary overcurrent protective device connected between the power-supply cord and the switched receptacle.

139.2 A supplementary overcurrent protection device shall be capable of clearing a fault current of not less than 1000A and shall comply with the requirements in the Standard for Supplementary Protectors for Use in Electrical Equipment, UL 1077. The supplementary overcurrent protection device shall have been subjected to the Overload Test in UL 1077, tested for motor starting at 6 times the AC full load current rating.

Exception No. 1: A fuse that is capable of clearing a fault current of not less than 1000A and that complies with the requirements in the Standard for Low-Voltage Fuses – Part 14: Supplemental Fuses, UL 248-14, is not prohibited from being used as a supplementary overcurrent protection device.

Exception No. 2: A circuit breaker that complies with the requirements in the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489, and is in accordance with the National Electrical Code, ANSI/NFPA 70 for branch circuit protection, is not prohibited from being used in lieu of a supplementary overcurrent protection device.

139.3 The overcurrent protective device shall be a supplementary protector of the automatic-trip-free, manual-reset type or a replaceable fuse installed in an extractor type fuse holder. A unit that is provided with fuses that are intended to be replaced in the field shall be marked in accordance with the requirements in 216.7.

139.4 A single-pole supplementary protection device shall be connected in the ungrounded (line) conductor of the supply circuit only. A double-pole device shall be connected on both the ungrounded and grounded (neutral) conductors such that when it operates, it opens both ungrounded and grounded conductors.

139.5 A supplementary protection device shall not open during the Temperature Tests in Sections 143, 144, and 148.

139.6 A supplementary protection device shall not be connected in the grounding conductor.

139.7 The ampere rating of the overcurrent protective device of 139.1 shall not be greater than the ampacity of:

a) The configuration of the receptacle it is to protect;

b) That of the power-supply cord; or

c) The switch controlling the receptacle, whichever is lower.

139.8 Thermal cutoff devices, thermal relays, and similar devices, shall not be used as supplementary overcurrent protection devices.

140 Tests

140.1 Normal temperature test

140.1.1 An incandescent type portable hand light shall be temperature tested in accordance with the Normal Temperature Test – General, Section 143, Test Method – General, Section 144, and Specific Test Conditions – Portable Hand Lights, Section 148.

140.1.2 A portable hand light using a light source other than incandescent, shall be subjected to the tests specified in 140.1.1, except that the test lamp restrictions of 148.1.1 and 148.1.3 shall not apply and the test lamps shall be as specified in Section 144.

140.2 Abnormal operation tests

140.2.1 A portable hand light shall be subjected to the Abnormal Operations Tests, Section 191.1 through 191.4.

140.3 Mechanical tests

140.3.1 A portable hand light shall be subjected to the Crush Test, Section 192, Hand Light Guard Securement Test, Section 196, Drop Test, Section 193, Conductor Securement Test, Section 194, and the Strain Relief Test, Section 154.

140.4 Electrical tests

140.4.1 A portable hand light shall be subjected to the Dielectric Voltage-Withstand Test, Section 195.

141 Markings

141.1 A portable hand light shall comply with the markings specified in Section 216.

142 Instructions

142.1 A portable hand light accessory shall comply with the instructions specified in Section 231.

PERFORMANCE

GENERAL – NORMAL TEMPERATURE TEST

143 General

143.1 A portable luminaire shall be subjected to a normal temperature test in accordance with the following:

a) Freestanding and Surface Mounted Units – Shall be tested in accordance with Sections 143 – 145.

b) Portable Cabinet Lights – Shall be tested in accordance with General, Section 143, Test Method – General, Section 144, and Specific Test Conditions – Portable Cabinet Lights, Section 146.

c) Work Lights – Shall be tested in accordance with General, Section 143, Test Method – General, Section 144, and Specific Test Conditions – Work Lights, Section 147.

143.2 A temperature test is not required for portable luminaires that comply with the temperature test exempt requirements for:

a) Incandescent units specified in Temperature Test-Exempt Units, Section 49,

b) Tungsten-halogen units using medium base Type A lamps specified in 57.1.2, and

c) Fluorescent units specified in Temperature Test-Exempt Units, Section 63.

143.3 A portable luminaire that requires evaluation under any other part of this standard requires temperature testing in accordance with the particular part.

143.4 A temperature test conducted with an aluminum shade shall not be used to represent a steel shade. A temperature test conducted with a light colored or reflective shade shall not be used to represent a dark colored or nonreflective shade. A temperature test conducted with a phenolic or porcelain lampholder in the base-up position shall not be used to represent a metal shell lampholder.

144 Test Method – General

144.1 Temperature limits

144.1.1 The temperature limits specified in Table 144.1 are based on an ambient temperature of 25°C (77°F). The temperature test is to be conducted at any ambient temperature between 20 and 30°C (68 and 86°F) and corrected to an ambient of 25°C (77°F).

144.1.2 A polymeric material used as a decorative trim or part shall not melt or deform in such a way as to interfere with the normal operation of the lamp.

Table 144.1
Maximum temperatures

Parts and materials			Temperature °C	Temperature °F
1.	Accessible parts (see also Item 18)			
	A.	Portable luminaire external surfaces (other than lamps or lenses) including shade projections provided as a spacer to comply with abnormal operations tests[g]	90	194
	B.	Operating knobs, handles, and levers intended for momentary contact during adjustment only:[k, n]		
		1. Wood	90	194
		2. Plastic or rubber[h]	85	185
		3. Glass, porcelain, or vitreous enameled material	70	158
		4. Metal	50	122
	C.	Handles or surfaces intended to be grasped for lifting, carrying, or holding:		
		1. Metallic	50	122
		2. Nonmetallic	60	140
2.	Work light and wet location stake mounted surfaces (other than diffuser or exposed lamp) without guard[l, m]		150	302
3.	Capacitors[a]			
	A.	Electrolytic	65	149
	B.	Other types	90	194
4.	Coil of device employing Class 105 insulation system			
		Thermocouple method	90	194
		Resistance method	100	212
5.	Coil of device employing Class 130 insulation system			
		Thermocouple method	110	230
		Resistance method	120	248
6.	Coil of device employing Class 155 insulation systems:			
		Thermocouple method	135	275
		Resistance method	140	284
7.	Coil of device employing Class 180 insulation systems:			
		Thermocouple method	150	302
		Resistance method	165	329
8.	Coil of device employing Class 200 insulation systems:			
		Thermocouple method	170	338
		Resistance method	185	365
9.	Coil of device employing Class 220 insulation systems:			
		Thermocouple method	185	365
		Resistance method	200	392
10.	Coil of device employing Class 250 insulation systems:			
		Thermocouple method	215	419
		Resistance method	230	446
11.	Conductor with rubber or thermoplastic insulation[b]		60	140

Table 144.1 Continued on Next Page

Table 144.1 Continued

Parts and materials		Temperature	
		°C	°F
12.	Fuses[b]	90	194
13.	Enclosure interior surfaces		
	A. Wood	90	194
	B. Insulating material	c	c
14.	Insulating material		
	A. Polymeric	c	c
	B. Varnished cloth	85	185
	C. Fiber[b]	90	194
	D. Wood and similar material	90	194
	E. Laminated phenolic composition[b]	125	257
	F. Phenolic composition	150	302
15.	Sealing compound	d	d
16.	Semiconductor device[b]	100	212
17.	Surfaces that are able to be adjacent to the portable lamp when it is mounted	90	194
18.	Exterior of wall or ceiling mounted lamps except lamps and lenses[f]	90	194
19.	Phenolic lampholder body[b]	150	302
20.	Lampholder with paper liner	150	302
21.	Current carrying parts,[o] including lampholders		
	A. Copper or aluminum	200	392
	B. Nickel plated copper	250	482
	C. Stainless steel, monel, nickel alloy	315[e]	599[e]
22.	Required label materials	i	i
Wet Location Units			
23.	On thermoplastic watersheds[j,b]	65	149
24.	On gaskets of silicone rubber[j]	230	446
25.	On gaskets of EPDM[j]	90	194
26.	On non-thermal setting sealing compound[j]	d	d
27.	On rubber gaskets[j]	70	158
28.	On neoprene gaskets[j]	90	194
29.	On gaskets of cork or other fibrous material[j]	90	194

[a] A capacitor operating at a temperature higher than 65°C (149°F) is to be judged on the basis of its marked temperature rating or, when not marked with a temperature rating, is able to be investigated to determine whether it is usable at a higher temperature.

[b] Does not apply when investigated and found to meet the requirement for a higher temperature.

[c] Polymeric material shall be judged with respect to the temperature specified for the application.

[d] The maximum intended sealing compound temperature, when corrected to 25°C (77°F) ambient temperature, is 15°C (27°F) less than the softening point of the compound as determined by the Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus, ASTM E28.

[e] Applies to screwshell-type lampholders only. The maximum temperature for other lampholders is not specified.

[f] The temperature is able to be higher than 90°C (194°F), and no higher than 150°C (302°F) when the unit is marked as specified in 198.8.

[g] Where the lens is not also serving as a portion of the shade.

Table 144.1 Continued on Next Page

Table 144.1 Continued

Parts and materials	Temperature	
	°C	°F
[h] Includes plastic with a metal plating not more than 0.005 inch (0.13 mm) thick; and metal with a plastic or vinyl covering not less than 0.005 inch (0.13 mm) thick.		
[i] Label materials shall be judged with respect to the temperature intended for the application.		
[j] Applicable only for materials used in wet locations in compliance with 131.5.		
[k] Work light handles are intended for momentary contact during adjustment only.		
[l] Does not apply to work lights complying with Exception No. 2 of 126.2.1.		
[m] When the wet location stake mounted surface exceeds 90°C (194°F), the unit shall be marked in accordance with 215.2.		
[n] For a straight projection measuring 3 inches (7.62 cm) or less and not provided with a ball or similar appendage that invites use as a lever or shade operating handle, the limit shall be 90°C (194°F). The temperature shall be measured 1 inch (2.54 cm) from the farthest projection.		
[o] Does not apply to conductive metals of insulated conductors when the conductors are encased in ceramic or similar inorganic material, or otherwise secured in a manner that maintains electrical spacings as specified in Electrical Spacings, Section 24.		

144.2 Test duration

144.2.1 A portable luminaire is to be operated continuously at rated lamp wattage until constant temperatures are attained. A motor or other component is to be on and operating at maximum load during the temperature test. A temperature is determined to be constant when:

a) The test has been running for a minimum of 7.5 hours; or

b) The test has been running for at least 3 hours; and three successive readings, taken at 30 minute intervals, are within 1°C of one another and are still not rising.

144.3 Temperature measurement by thermocouple

144.3.1 When temperature readings are to be obtained by means of thermocouples, the thermocouples shall consist of wires not larger than 24 AWG (0.21 mm^2). When thermocouples are used in the determination of temperatures in connection with the heating of electrical devices, it is common practice to use thermocouples consisting of 30 AWG (0.05 mm^2) iron and constantan wire, and an instrument specifically designed for accurate determination of the attained temperature; and such equipment is to be used whenever referee temperature measurements are required. The thermocouple wire is to conform with the requirements specified in the Tolerances on Initial Values of EMF versus Temperature tables in the Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, ANSI/ASTM E230/E230M.

144.3.2 A thermocouple junction and the adjacent thermocouple lead wire are to be held securely in thermal contact with the surface of the material of which the temperature is being measured and shall be placed at locations of the hottest accessible parts. Thermocouples are to be secured to surfaces by welding, soldering, fuller's earth and sodium silicate (waterglass), adhesive intended for surface and temperatures, or equivalent as long as solid thermal contact is maintained. Tape is not to be used to secure the thermocouple within 3 inches (76.2 mm) of the thermocouple junction.

144.3.3 When a portable luminaire utilizes a polymeric part such as a thermoplastic enclosure, watershield, lens, diffuser, or similar parts temperatures are to be measured by placing one or more thermocouples in contact with the part in such a manner that the thermocouple is wedged between the part and any metallic material or other source of conducted heat. For a source of radiated or convected heat, thermocouples are to be inserted from the outside surface through holes drilled in the polymeric material, such that the thermocouple tips are located in the plane of the inside surface and are sealed in place with fuller's earth and sodium silicate (waterglass).

144.3.4 Pleated or double-walled fabric or plastic shades shall have the thermocouples attached by slitting the outer covering and attaching the thermocouples to the outside of the shade liner.

144.4 Temperature measurement by change-of-resistance

144.4.1 The temperature of a coil or winding of a ballast or transformer employing a Class 130 or higher insulation system is to be measured by means of the change-of-resistance method. For a potted device, it is usually required to have a portable luminaire made up with test leads brought out before it is potted, as well as having a thermocouple placed on the capacitor (when provided).

144.4.2 At a point on the surface of a coil of a ballast where the temperature is affected by an external source of heat radiation (for example, a lamp), the temperature rise measured by means of thermocouples mounted on the outside of the coil wrap is able to be greater than the indicated maximum when the temperature rise of the coil, as measured by the resistance method, is not greater than specified in Table 144.1. The maximum temperature differential meeting the intent of the requirement for the thermocouple method is 20°C (36°F).

144.4.3 The temperature rise 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 rise 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; and

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.

144.4.4 Usually it is required to de-energize the winding before measuring R. The value of R at the end of the test is to 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 is to be plotted and extrapolated to give the value of R at the end of the test.

144.5 Ambient temperature measurement

144.5.1 The ambient temperature is to be measured by means of a thermocouple immersed in a bath of mineral oil in a glass container, or other means equivalently immune to air turbulence or convection currents.

144.6 Test voltage, current, and wattage

144.6.1 A portable luminaire that uses a lamp rated for other than the voltage it operates at in the product is to be tested in the manner that results in a maximum temperature rise, either at rated voltage or rated wattage. For example, a nominal 120 volt, 60 watt product intended for use with a lamp rated for 130 volts,

60 watts usually operates hotter at rated wattage. Conversely, a nominal 120 volt, 60 watt product intended for use with a lamp rated for 110 volts, 60 watts usually operates hotter at rated voltage.

144.6.2 A portable luminaire provided with a transformer, a ballast, a power supply, or another device that alters the characteristics of the power supply prior to the lamp is to be tested at rated voltage.

144.6.3 For a portable luminaire not otherwise exempt from temperature testing per 143.2, a convenience receptacle shall be resistively loaded to the current rating marked in accordance with 198.6.2. An output connector for an interconnected portable luminaire shall be loaded to the maximum current rating derived from the marking of 198.6.1.

144.6.4 For a portable luminaire marked for use with Self-Ballasted LED lamps only, refer to 144.11A for test voltage and wattage requirements.

144.7 High intensity discharge lamp nominal test conditions

144.7.1 When subjected to a temperature test, a high intensity discharge (HID) type unit shall be provided with a nominal system consisting of a ballast, capacitor, and lamp combination that complies with 144.7. A unit is to be operated at rated frequency and at:

a) A supply voltage rated for the ballast; or

b) The supply voltage required to be determined a nominal system in accordance with 144.7.2.

Exception: A nominal system is not required when the portable luminaire is provided with a self-ballasted lamp.

144.7.2 A nominal system shall be a combination of components such that, when connected to the supply voltage rated for the ballast and measured as specified in 144.7.3, the lamp operates at its marked wattage rating ±5 percent. The capacitance of the capacitor is to be within ±5 percent of the capacitance rated for the ballast.

Exception: A lamp is not required to operate within ±5 percent of its marked rating when operated by a ballast intended to operate the lamp at other than the lamp's marked rating. Such a construction is to be documented by the ballast manufacturer.

144.7.3 To determine whether a ballast, capacitor, and lamp combination is a nominal system, the components are to be installed in a portable luminaire and the unit is to be operated in a 25 ±5°C (77 ±9°F) ambient temperature while connected to a rated supply voltage source. A nominal system exists when the measured lamp wattage after the wattage stabilizes (usually within 15 minutes) is within ±5 percent of the marked rating of the lamp. Otherwise, to be determined a nominal system, the ballast supply voltage is adjusted so that the lamp operates at the marked lamp wattage.

144.8 Incandescent test lamps

144.8.1 An incandescent type unit is to be tested with a test lamp of the wattage and type marked. When intended for a three-way lamp holder, a three-way lamp is to be used and operated at the highest wattage setting whether marked otherwise or not.

144.8.2 When the marked lamp replacement is of a wattage and type other than specified in Table 144.2 and is a candelabra-, intermediate-, or medium-base type, the test is to repeated with a test lamp from Table 144.2 that most closely approaches the marked lamp.

Table 144.2
Commonly available lamps

Medium-base lamps	
Wattage	**Types**
7-1/2, 9	S-11
10, 11	S-14
15	A-15, S-11, T-10
25	A-15, A-19, B-10, B-13, BA-9-1/2, F-15, G-25, G-30, G-40, R-14 T-10
30	A-15, R-20
40	A-15, A-19, A-21, B-10, B-13, BA-9-1/2, C-15, CA-9, F-15, G-16.5, G-25, G-30, G-40, R-14, R-16, T-8, T-10
50	A-19, ER-30, R-20, BR-30
60	A-19, A-21, B-10, B-13, BA-9-1/2, C-15, CA-9, E-17, F-15, F-20, G-25, G-30, G-40, R-20, T-10
70	A-19, T-19
75	A-19, A-21, B-10, B-13, ER-30, PAR-30, PAR-38, R-20, T-10
90	A-19, A-21, BR-40
100	A-19, A-21, A-23, BR-40, F-20, G-30, G-40, PAR-38, R-20
120	BR-40, BRL-38, ER-40
150	A-21, A-23, A-25, BR-40, G-40, P-25, PAR-38, PS-25, T-10
200	A-21, A-23, A-25, BR-40, PS-25, PS-30
250	A-23, G-30, P-25, PAR-38
300	BR-40, PS-25, PS-30, R-40
Medium-base 3-way lamps	
Wattage	**Types**
15-135-150	A-21
30-70-100	A-21
50-100-150	A-21
50-200-250	A-23
100-200-300	PS-25
Intermediate-base lamps	
Wattage	**Types**
6	S-6
7	R-12
10	S-11
15	F-10, T-7, T-8
20	T-6-1/2
25	R-12, R-14, S-11, T-6-1/2, T-8
40	S-11, T-6-1/2
Candelabra-base lamps	
Wattage	**Types**
2	B-10, CA-8
3	S-6

Table 144.2 Continued on Next Page

Table 144.2 Continued

4,7	C-7
6	S-6, T-4-1/2
10	B-12, C-7, G-16-1/2, S-6, S-11
12	B-10
15	B-10, BA-9, C-9-1/2, CA-8, F-10, G-16-1/2, S-11, T-6, T-7, T-8
20	B-10
25	B-10, B-10-1/2, BA-9, C-9-1/2, C-11, CA-10, F-10, G-16-1/2, S-11, ST-9-1/2, T-8
40	B-10, B-10-1/2, BA-9, C-11, CA-10, G-16-1/2, ST-9-1/2
60	B-10, B-10-1/2, BA-9, C-11, CA-10

144.9 Tungsten-halogen test lamps

144.9.1 A tungsten-halogen type unit is to be tested with a test lamp of the wattage and type marked.

144.10 Fluorescent test lamps

144.10.1 A fluorescent type unit is to be tested with a test lamp of the wattage and type marked except as noted in 144.10.2.

144.10.2 A portable luminaire that uses fluorescent lamps with integral starters shall be tested with the lamp(s) that produces maximum heating. This requires a test with the lamp which produces the highest current as well as the lamp which produces the highest wattage.

144.11 High intensity discharge test lamps

144.11.1 A high intensity discharge (HID) unit is to be tested with a test lamp of the wattage and type marked.

144.11A Self-Ballasted LED Lamps

144.11A.1 This section covers portable luminaires intended for use with Self-Ballasted LED lamps (SBLED) only.

144.11A.2 For a portable luminaire with a screw base lampholder, a test lamp from Table 144.2 that most closely approaches the marked SBLED lamp wattage shall be used [e.g., where a maximum 20W SBLED lamp (Medium-Base) is specified, the selected test lamp would be an incandescent type 25W (Type A-15) or 25W (Type A-19)].

144.11A.3 For a portable luminaire with a bi-pin lampholder or double-end lampholder, the test lamp that most closely approaches the marked lamp shall be used (e.g., where a maximum 7W SBLED lamp is specified, the selected test lamp would be a tungsten halogen, 10W).

144.11A.4 The supply voltage shall be adjusted such that the test lamp dissipates 10 ±2 % more power than the highest wattage of marked SBLED Lamp (e.g., for a maximum 20W SBLED lamp, the supply voltage is adjusted so the test lamp dissipates 22 ±0.4W during the temperature test).

Exception: This requirement does not apply when the portable luminaire includes an external power supply unit or LED driver that provides supply to the SBLED lamp – see 144.6.2.

144.12 Shade positions and decorative parts

144.12.1 A portable luminaire that is able to be adjusted to several positions of usage shall be tested in the (each) position that results in a maximum temperature rise. This requires testing in more than one position, such as shade horizontal, 45 degrees below horizontal, and vertically down.

144.12.2 A portable luminaire with multiple shades is to be tested in each position that results in a maximum temperature rise on any surface subject to temperature limits in accordance with Table 144.1. The positions used are to represent reasonable positions of use. No shade is to be placed in a position in which the path of light from the shade is obstructed by another shade. Shades are to be tilted, raised, lowered, rotated, or otherwise adjusted as permitted.

144.12.3 A portable luminaire with a shade that clips onto a lamp or a shade supported by a harp shall be tested in any position allowed by the clip on harp adjustments unless compliance with 49.4.2 is established.

144.12.4 A portable luminaire that is provided with an optional or decorative part is to be tested both with and without the part in place when the temperatures on the unit vary, depending on the presence of the part. For example, a metal shade provided with a plastic baffle that extends up over the shade is to be tested with and without the baffle to determine maximum shade temperatures on the metal shade surface. Actuating or moveable parts are to be positioned in any position of normal use, including closing hinged covers (“barn doors”).

144.13 Portable luminaires with secondary batteries

144.13.1 This test may be conducted independently or in combination with any other required temperature test. A portable luminaire with secondary battery(ies) and battery charging system shall be operated through two complete cycles of charge and discharge. Prior to conducting the initial charge, the battery is to be discharged by operating the product until no visible output is apparent. The battery shall then be charged until full nominal battery voltage is attained, but no less than seven hours, followed by discharge until no visible output is apparent. This charge and discharge cycle shall then be repeated. The surface temperature of the battery shall be continuously monitored during the charge and discharge cycles and shall not exceed the battery manufacturer’s temperature specification nor the maximum permitted temperature of any materials in direct contact with the battery.

145 Specific Test Conditions – Free Standing and Surface Mounted Units

145.1 General

145.1.1 Free standing units shall be tested on a level sheet of 1/2 inch (12.7 mm) thick plywood that extends beyond the lamp at least 2 feet (61 cm) in each direction, and is located at least 3 feet (91.4 cm) away from other horizontal or vertical surfaces.

145.1.2 Portable luminaires intended for attachment to a vertical surface, under a cabinet or shelf, or on a ceiling shall be attached to a sheet of 1/2 inch (12.7 mm) thick plywood that extends beyond the lamp at least 2 feet (61 cm) in each direction. The units shall be attached in the worst case position(s) permitted by the manufacturers' directions.

145.1.3 When a portable luminaire has a flexible or adjustable arm, the bottom of the shade or guard shall be positioned parallel to the mounting surface and located as close as possible to the mounting surface, but not closer than 6 inches (152 mm).

Exception: When the unit is unable to comply with 145.1.3 because the arm is not long enough for the shade or guard to maintain a 6 inch (152 mm) spacing, the bottom portion of the shade or guard is to be positioned as close to the mounting surface as permitted by the construction without guiding or propping.

145.2 Test results

145.2.1 Results of the tests meet the intent of the requirement when:

a) Temperatures do not exceed the applicable values specified in Table 144.1; and

b) Temperatures on the mounting surface do not exceed 90°C (194°F).

146 Specific Test Conditions – Portable Cabinet Lights

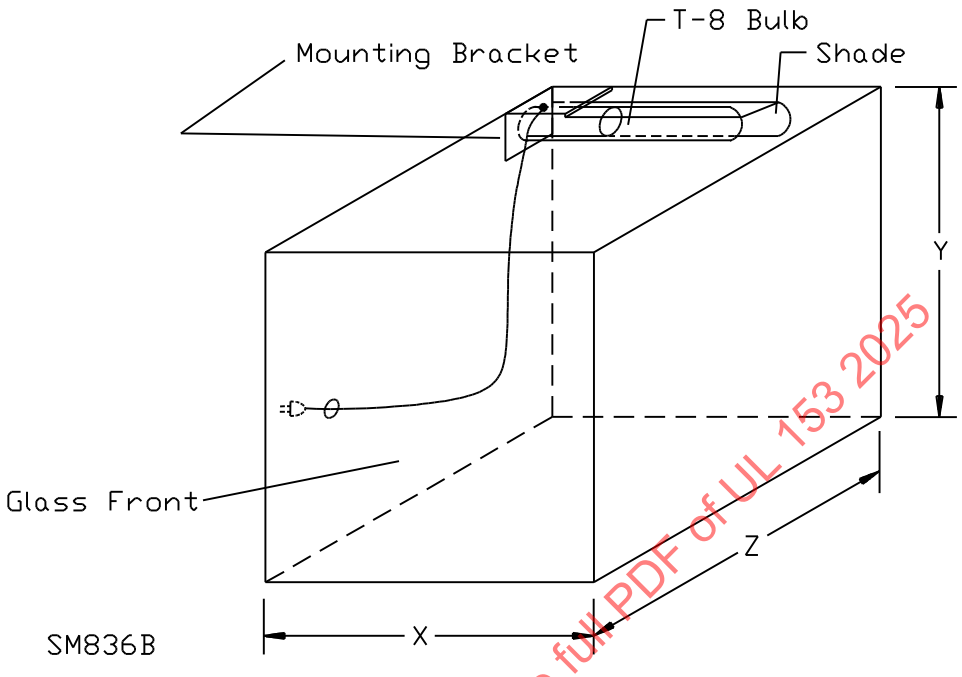
146.1 Other than pot style

146.1.1 The portable cabinet light shall be tested while totally enclosed in a six-sided box having inside dimensions of 12 inches (30 cm) by 12 inches (30 cm) by 12 inches (30 cm). When the length of the portable cabinet light exceeds 12 inches (30 cm), the inside dimension of the test box shall be adjusted to the length of the portable cabinet light. Alternately, the test box is able to have dimensions in accordance with 223.2.1. The test box is to be made of 1/2 inch (12.7 mm) thick plywood or particle board, with a 1/8 inch (3.2 mm) thick glass front. All seams shall be sealed with tape or the equivalent to restrict air exchange.

146.1.2 A portable cabinet light that is completely within the cabinet as shown in Figure 146.1 is to be mounted as close to the sides and top of the test box as the housing or shade provided with the portable cabinet light permits and operated until all temperatures stabilize. If the mounting means accommodates more than one mounting configuration, the test shall be conducted in the condition representing the most severe operation. Alternately, the portable cabinet light is to be mounted in the dimensioned test box as it would be in a cabinet in accordance with the instructions provided with the portable cabinet light and operated as above. The test is to be conducted with the portable cabinet light mounted vertically (lamp base up) and horizontally (side or wall mounted). Portable cabinet lights with adjustable mounting flanges shall be evaluated with the light in representative worst case positions.

Figure 146.1

Portable cabinet light test box



Notes:

a) Inside dimensions of test box X = Y = Z = 12 inches (30.5 cm) or as specified by manufacturer.

b) Seal all openings and seams with tape.

c) Position portable cabinet light as close to sides and top as possible.

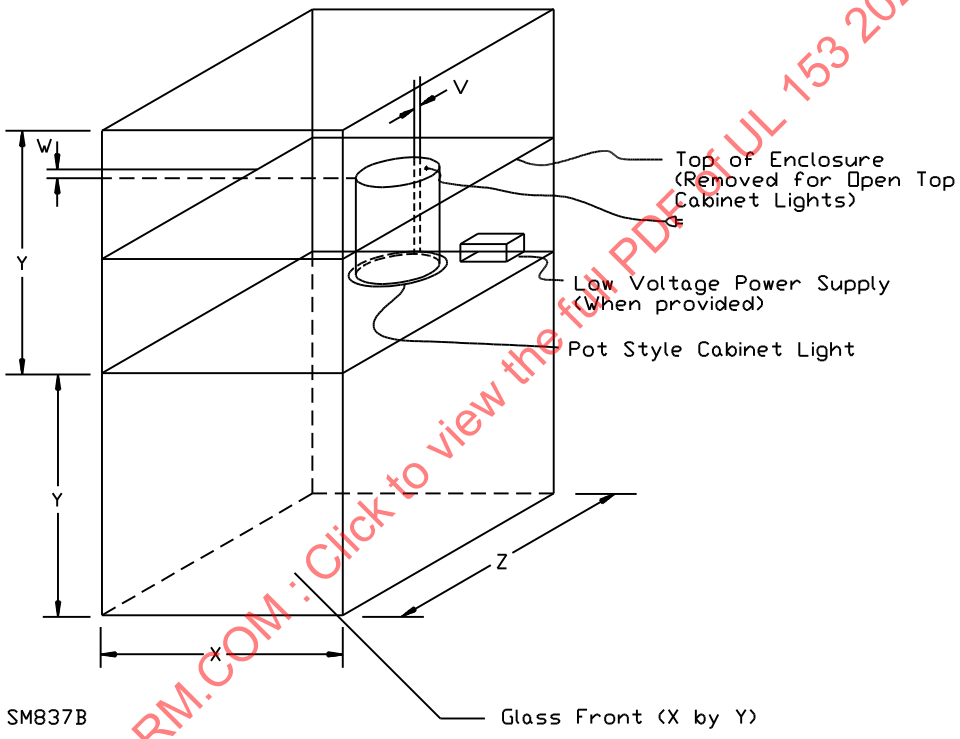
d) Tested with T-8 lamp horizontal and repeated with T-8 lamp vertical, base-up.

146.2 Pot style

146.2.1 A pot style portable cabinet light shall be tested inside the enclosure shown in Figure 146.2. The portable cabinet light shall be centered left to right and with clearances from the pot to the back either provided by the mounting flange or 1/2 inch (12.7 mm), whichever is greater. The clearance from the top of the pot housing to the top of the enclosure is 1/2 inch (12.7 mm). The 1/2 inch (12.7 mm) clearance is measured from the pot housing and does not include tabs, bushings, or brackets. A portable cabinet light with adjustable mounting flanges shall be evaluated with the light in representative worst cast positions. Other mounting configurations shall be evaluated when specified in the manufacturers instructions.

Figure 146.2

Pot style portable cabinet light test box



Notes:

a) Inside dimensions of test box X = Y = Z = 12 inches (30.5 cm).

b) V equals width of pot light mounting flange or 1/2 inch (12.7 mm) spacing from pot light to back of test box, whichever is greater.

c) Low voltage transformer or power supply mounted as close to the back wall as possible.

d) W equals 1/2 inch (12.7 mm) from top of pot light to inside of upper box top.

e) Tested only in position shown.

146.2.2 A pot style portable cabinet light provided with instructions in accordance with 223.2.2 is to be tested with the top of the test enclosure removed with clearances either provided by the mounting flange or 1/2 inch (12.7 mm), whichever is greater. See Figure 146.2.

146.3 Test results

146.3.1 Results of the tests meet the intent of the requirement when:

a) Temperatures do not exceed the applicable values specified in Table 144.1;

b) Temperatures on the mounting surface and test box do not exceed 90°C (194°F);

c) For pot style portable cabinet lights, the maximum temperature on any external surface above the plane of the surface through which the pot style portable cabinet light is mounted shall not exceed 90°C (194°F); and

d) The housings of remotely mounted transformers or power supplies shall not exceed 90°C (194°F).

Exception: The temperature in 146.3.1(c) is able to be greater than 90°C (194°F) and no higher than 150°C (302°F), when the pot style portable cabinet light is intended for closed top cabinets only and is provided with the installation instructions in accordance with 223.2.3.

147 Specific Test Conditions – Work Lights

147.1 General

147.1.1 A work light is to be temperature tested with the light source adjusted to produce maximum temperatures on the test surface. Multiple temperature tests are to be performed, when required.

147.1.2 When a work light is intended for use with more than one base or stand, each unique configuration is to be evaluated.

147.2 Test results

147.2.1 Results of the tests meet the intent of the requirement when:

a) Temperatures do not exceed the applicable values specified in Table 144.1; and

b) Temperatures on the supporting surface under the work light do not exceed 90°C (194°F).

147.2.2 A work light rated less than 150 W shall additionally comply with the 90°C external surface temperature requirements in Table 144.1.

148 Specific Test Conditions – Portable Hand Lights

148.1 General

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

148.1.2 For 148.1.1, the other position of use to consider is the base down position if provided with a hook at the end unless the mounting means allows other fixed use positions.

148.1.3 The lamp or lamps used for testing shall not exceed the maximum permitted by the lamp replacement marking, but shall not be less than 75 W for medium base units. The lamp used shall be that which produces the highest temperatures at significant parts of the portable hand light.

148.1.4 Except when indicated by special marking, the incandescent lamp envelope shall be as specified in Table 148.1.

Table 148.1
Lamp envelopes for medium base lampholders

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

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

148.2 Test results

148.2.1 Results of the tests meet the intent of the requirement when temperatures do not exceed the applicable values specified in Table 144.1.

GENERAL – ABNORMAL OPERATION TESTS

149 Adjustable Position or Multiple Shade Abnormal Operation Test

149.1 General

149.1.1 Adjustable or Flexible Shade Position – A portable wall, table or floor type unit that is able to be adjusted such that the shade rests against the supporting surface so as to block the air flow to the lamp is to be tested as described in 149.2 and 149.3. This test does not apply to clamp-on mounted units with fixed shades or a shade with a limited range of movement such that the shade cannot be positioned against the supporting surface.

149.1.2 Multiple Shades – A portable luminaire that is able to be adjusted such that one shade directs light onto another shade is to be tested as described in 149.2 and 149.4. The test is to be conducted in each position that results in a maximum temperature rise on any shade.

149.1.3 Folding Position – A portable luminaire that is able to fold up so as to block the air flow to the lamp is to be tested as described in 149.2 and 149.5.

149.1.4 Compliance criteria is described in 149.6.

149.2 Test method – general

149.2.1 It is usually required to operate the portable luminaire continuously for 7 hours to determine that the ultimate result has been obtained. It is usually required to repeat the tests with each lamp wattage or type used for the Normal Temperature Test, Sections 143 – 147. A new sample is to be used for each test.

However, with the concurrence of those concerned, the same sample is to be used for another test provided that results are obtained that meet the intent of the requirement.

149.2.2 An automatic temperature-regulating or -limiting control; or other protective device provided as part of the portable luminaire is to be shunted out of the circuit during the test, unless the control has been shown by an investigation to be reliable and unable to be defeated by the user.

149.2.3 The cloth used in the abnormal test is to be bleached cheesecloth, 36 inches (91.4 cm) wide, running 14 – 15 square yards per pound (26 – 28 m^2/kg) and having what is known in the trade as a count of 32 by 28; that is, for any square inch 32 threads in one direction and 28 in the other direction (for any square centimeter, 13 threads in one direction and 11 in the other direction). The cloth is to be loosely draped over the portable luminaire being tested in order to serve as a flame indicator (presence of ash or burnt holes) not as a blanket to trap heat.

149.2.4 The tissue paper used in the abnormal test is to be untreated white paper, nominally 0.001 inches (0.025 mm) thick, commonly used for gift wrapping.

149.3 Test method – adjustable or flexible shade position

149.3.1 A portable luminaire is to be supported on white tissue paper on a Knot-free softwood surface with the shade resting against the same surface. The unit is to be loosely covered with a single layer of cloth and operated continuously.

149.3.2 For the purpose of this test, friction alone is not to be relied upon to prevent positioning of a shade against the supporting surface.

149.4 Test method – multiple shades

149.4.1 A portable luminaire is to be placed on a knot-free softwood surface covered with tissue paper. The shades of a unit are to be adjusted such that the light from a shade(s) is focused on another shade(s). The unit is to be covered with a layer of cloth and operated continuously.

149.5 Test method – folding position

149.5.1 A portable luminaire is to be placed in a folded-up position on a knot-free softwood surface covered with tissue paper. The unit is to be loosely covered with a single layer of cloth and operated continuously.

Exception: When the unit is provided with a switch to de-energize the lamp when the lamp is folded, the test is to be conducted at the most severe position permitted by the switch.

149.5.2 For the purpose of this test, friction alone is not to be relied upon to prevent positioning of a shade against the supporting surface.

149.6 Test results

149.6.1 There shall be no:

a) Emission of flame or molten metal;

b) Combustion, glowing or flaming or disintegration of the material on which the unit is resting or of material placed on or near the unit;

c) Exposure of parts involving a risk of electric shock; or

d) Dielectric breakdown when subjected to the Dielectric Voltage-Withstand Test, Section 159, during any of these tests.

150 Transformer Short-Circuited Test

150.1 General

150.1.1 A portable luminaire using a transformer in accordance with Transformers, Section 45 shall be tested as described in 150.2. Compliance criteria is described in 150.3.

150.2 Test method

150.2.1 The portable luminaire is to be placed in its normal operating position on white tissue paper on a softwood surface, connected to a supply circuit of maximum rated voltage, and operated continuously. It is required to operate the unit continuously for 7 hours to determine that the ultimate result has been obtained.

150.2.2 The portable luminaire is to be operated at all voltage settings with each of the following loads, using a new transformer for each test:

a) The intended lamp;

b) A load that draws 25 percent of the short-circuit current;

c) A load that draws 50 percent of the short-circuit current; and

d) A load that draws 75 percent of the short-circuit current.

150.2.3 The short-circuit current is to be determined by shorting the secondary of the portable luminaire through an ammeter and determining the current after 1 minute of operation of the unit at rated voltage. Any overcurrent-protective device is to be by-passed while the value of the short-circuit current is determined.

150.2.4 The tissue paper used in the abnormal test is to be untreated white paper, nominally 0.001 inches (0.025 mm) thick, commonly used for gift wrapping.

150.3 Test results

150.3.1 There shall be no:

a) Emission of flame or molten metal;

b) Combustion, glowing or flaming or disintegration of the material on which the unit is resting or of material placed on or near the unit;

c) Exposure of parts involving a risk of electric shock;

d) The insulation resistance between exposed metal and live parts normally operating at more than 30 volts shall not be less than 50,000 ohms; or

e) Dielectric breakdown when subjected to the Dielectric Voltage-Withstand Test, Section 159, during any of these tests.

151 Component Fault Test

151.1 General

151.1.1 A circuit employing an electronic component that requires a component fault test in accordance with 37.3 shall be tested in accordance with 151.2. Compliance criteria is described in 151.3.

151.2 Test method

151.2.1 A circuit involving a capacitor, rectifier, transistor, or similar component involving a risk of fire or electric shock shall be subjected to a component fault test, with the component opened or shorted in accordance with 37.3.

151.2.2 For the test described in 151.2.1, only one component and fault condition is to be conducted per each test.

151.2.3 The portable luminaire is to be placed on a knot-free softwood surface covered with tissue paper. Any dead metal is to be connected through a 3 ampere nonrenewable fuse to either:

a) Earth ground when the unit is provided with a grounding type attachment plug; or

b) The neutral conductor when not provided with a grounding type attachment plug.

151.2.4 The unit is to be loosely draped with a single layer of cheese cloth and operated continuously.

151.2.5 It is usually required to operate the unit continuously for 7 hours to determine that the ultimate result has been obtained.

151.2.6 The cloth used in the abnormal test is to be bleached cheesecloth, 36 inches (914 mm) wide, running 14 – 15 square yards per pound (26 – 28 m^2/kg) and having what is known in the trade as a count of 32 by 28; that is, for any square inch 32 threads in one direction and 28 in the other direction (for any square centimeter, 13 threads in one direction and 11 in the other direction). The cloth is to be loosely draped over the portable luminaire being tested in order to serve as a flame indicator (presence of ash or burnt holes), not as a blanket to trap heat.

151.2.7 The tissue paper used in the abnormal test is to be untreated white paper, nominally 0.001 inches (0.025 mm) thick, commonly used for gift wrapping.

151.3 Test results

151.3.1 There shall be no:

a) Emission of flame or molten metal;

b) Combustion, glowing or flaming or disintegration of the material on which the unit is resting or of material placed on or near the unit;

c) Exposure of parts involving a risk of electric shock; or

d) Dielectric breakdown when subjected to the Dielectric Voltage-Withstand Test, Section 159, during any of these tests.

152 Conductor Short Circuit and Abnormal Operation Test

152.1 General

152.1.1 A portable luminaire, which has a series or series/parallel string of non-replaceable lights having internal conductors smaller than 18 AWG (0.82 mm^2), in accordance with 27.1.1(d), shall be tested in accordance with 152.2 and 152.3. Compliance criteria is described in 152.4.

152.2 Test method – short circuit

152.2.1 For the short circuit test, three samples are to be mounted as intended, draped with cheesecloth, and then a short circuit condition is to be introduced to simulate a line to neutral fault. The short should be located in the farthest series string to provide the maximum lead resistance.

152.2.2 The test is to be conducted:

a) Until circuit interruption and resulting thermal stability occurs (usually no more than 10 minutes after circuit interruption);

b) 7 hours, when temperatures and current levels are being monitored and show no changes over 3 consecutive readings, 30 minutes apart; or

c) 72 hours have transpired with no visual change, such as discoloration or distortion.

152.3 Test method – abnormal operation

152.3.1 Three samples are to be mounted as intended, draped with cheesecloth, and then a lamp is to be bypassed in the series string to simulate a shorted lamp. The bypassed lamp is to be located in the closest series string to provide the least lead resistance.

152.3.2 The test is to be conducted:

a) Until circuit interruption and resulting thermal stability occurs (usually no more than 10 minutes after circuit interruption);

b) 7 hours, when temperatures and current levels are being monitored and show no changes over 3 consecutive readings, 30 minutes apart; or

c) 72 hours have transpired with no visual change, such as discoloration or distortion.

152.4 Test results

152.4.1 Acceptable results for the short circuit and the abnormal operation tests are no ignition of the cheesecloth or polymeric enclosure, and no openings in the enclosure that allows accessibility to uninsulated live parts.

152A Exposed Class 2 Conductor Abnormal Operation Test

152A.1 A portable luminaire with an integral or remote class 2 power source and that uses external surfaces to carry current, per 38.4, shall comply with this section.

152A.2 A 22 AWG (0.32 mm^2) tinned solid copper wire shall be connected to short across external surfaces intended to carry current. The wire can be connected to each side of the circuit by any convenient means (alligator clips, solder, etc.) provided that good conduction is established. The luminaire shall then be connected to a rated source of supply and energized.

152A.3 The output from the power unit shall automatically halt within 10 seconds, with no melting of the shorting wire, and shall not re-energize prior to removal of the shorting conductor. This test shall be repeated two additional times, with similar results.

152A.4 The test of 152A.2 shall then be repeated but with the portable luminaire energized prior to applying the shorting conductor. This may require insertion of a separate switch element between the shorting conductor and one side of the circuit. Compliance with 152A.3 shall be observed, for three trials.

GENERAL – MECHANICAL TESTS

153 Stability Test

153.1 General

153.1.1 Freestanding portable luminaires shall not tip over when tested as described in 153.2 and as modified in 153.3 when provided with a flexible or articulated arm, or as modified in 153.4 when provided with provisions for loading.

Exception No. 1: A freestanding portable luminaire that complies with the Normal Temperature Test in Sections 143 – 145 in any position (such as tipped over and/or with restricted air flow around heat-generating parts) and the Drop Test in Section 155 is not required to comply with this requirement.

Exception No. 2: A freestanding portable luminaire supplied by a non-integral, class 2 power supply is not required to comply with this requirement if it complies with the limits of Table 144.1 when subject to the Normal Temperature Test in Sections 143 – 145 in any position, such as tipped over and/or with restricted air flow around heat-generating parts.

153.2 Test method – general

153.2.1 The portable luminaire, complete with glassware or shade provided as a part of the lamp or with a representative cloth-and-wire shade when none is provided, is to be placed on the inclined plane and turned to a position that is most likely to result in tip over. When the shade is supported by an adjustable harp, or clips onto the lamp, it is to be positioned so that the lamp-to-shade spacing is equidistant to the lamp.

153.2.2 The plane is to be inclined at an angle of 8 degrees with the horizontal.

153.2.3 For lamps having toy-like appearance the plane is to be inclined to an angle of 15 degrees.

153.3 Test method – units with flexible or articulated arm

153.3.1 When the portable luminaire has a flexible or articulated arm, the luminaire is to be configured as noted in (a) – (c) below, as applicable, before being placed on the inclined plane as instructed in Test Method – General, Section 153.2:

a) If the connection between the arm and the base (or stem) allows for adjustment of the arm's horizontal extension from the base (or stem), the maximum horizontal distance between the base (or stem) and the furthest extension of the arm shall be established.

b) If the connection allows for vertical adjustment of the arm's angle relative to the horizontal plane, the furthest extension of the arm shall be placed at lowest horizontal position practical, not exceeding 45 degrees below a horizontal line from the point where it connects to the base (or stem).

c) If the unit has more than one flexible or articulated arm, one of the arms is to be adjusted as described above while the other arm or arms are to be extended vertically.

Exception: When the unit is not stable on a flat horizontal surface when configured as described, the configuration shall be adjusted as modestly as possible prior to testing.

153.4 Test method – units having provisions for loading

153.4.1 A portable luminaire having one or more of the following:

a) Off-center shelf;

b) Adjustable shelf; or

c) Other provision for loading;

shall comply with the stability test in this section when loaded as described in 153.4.2.

153.4.2 For the stability test of a portable luminaire as described in 153.4.1, each shelf or other provision for loading is to be:

a) Adjusted to the position that results in least stability; and

b) Loaded with the maximum load specified in the marking required in 198.10; or

c) Loaded with a 15 pound (6.81 kg) weight secured to prevent movement and centered on the highest shelf or rack.

153.5 Test results

153.5.1 *Deleted*

154 Strain Relief Test

154.1 General

154.1.1 All strain reliefs provided on a portable luminaire shall be tested as described in 154.2. Compliance criteria is described in 154.3.

154.2 Test method

154.2.1 The conductors of the flexible cord are to be severed immediately adjacent to the terminals or splices except that the cord is not to be severed when any of the following occur:

a) A knot is used as a strain relief;

b) The construction is of the type described in Exception No. 1 of 17.1; or

c) The construction is of the type described in Exception No. 2 of 17.1.

154.2.2 A 35 pound (16 kg) weight is to be suspended from the cord for 1 minute so that the force is applied in any direction that will most likely result in stressing the cord opening or bushing. When the lamp surface that supports the strain relief is fragile, care is to be taken to properly support that surface during the test. For instance, when the strain relief consists of a knot in the cord bearing against the side of a

ceramic figurine, the surface under the figurine is to be padded such that the pull exerted on the cord is the only strain on the area providing the strain relief.

154.2.3 The strain-relief device required by Exception No. 5 of 9.5 shall comply with the requirements specified in this section except that a weight of 20 pounds (9.1 kg) is to be used.

154.3 Test results

154.3.1 The results of the test do not meet the intent of the requirement when any of the following conditions occur:

a) The insulation or covering on the flexible cord or wiring is cut or torn.

b) The bushing slides through the hole in the chassis or enclosure.

c) A cemented-on bushing slides on the cord.

d) For a cord or wiring that is not severed at the terminals, strain is placed on internal conductors.

e) For a cord or wiring that is severed at the terminals, there is movement of the cord of more than 1/16 inch (1.6 mm) at the points where the connections are made or where the conductors are permanently assembled to the terminals.

155 Drop Test

155.1 General

155.1.1 The Drop Test described in 155.2 is conducted on freestanding units not evaluated for Stability per 153.1, and on wall mounted units with unreliable mounting means, per 71.2.4. Compliance criteria is described in 155.3.

155.2 Test method

155.2.1 One sample of a shelf mounted unit shall be dropped 3 feet (91.4 cm) onto a tissue paper covered nominal 1/2 inch (12.7 mm) thick trade size, knot-free softwood including plywood sheet supported by a concrete floor. The tissue paper is to be untreated white paper, nominally 0.001 inches (0.025 mm) thick, commonly used for gift wrapping. The unit shall be energized for this test. If a detachable supply connector becomes detached when the unit is dropped, it is to be re-attached.

155.2.2 The unit shall remain energized for 1 hour.

155.3 Test results

155.3.1 There shall be no:

a) Emission of flame or molten metal;

b) Combustion of unit or test surface;

c) Exposure of parts involving a risk of electric shock;

d) Exposed edges or sharp parts likely to cause injury (see 9.1);

e) Visible damage to any batteries; or

f) Dielectric breakdown when subjected to the Dielectric Voltage-Withstand Test, Section 159.

156 Security of Screws Test

156.1 General

156.1.1 The following tests described in 156.2 applies to self-threading or sheet-metal screw used to:

a) Mount or support a part that weighs more than 7-1/2 pounds (3.4 kg);

b) Join two or more sheets of material other than sheet steel.

Exception: These tests are not required to be conducted when the screw threads through the sheet material into sheet steel.

156.1.2 Compliance criteria is described in 156.3.

156.2 Test method

156.2.1 A self-threading or sheet metal screw used to join two or more sheets of material other than sheet steel, with a No. 6 or smaller screw shall be subjected to a tightening torque of 20 inch-pounds (2.2 N·m) and a No. 7 or larger screw shall be subjected to a tightening torque of 30 inch-pounds (3.4 N·m).

156.2.2 A self-threading or sheet-metal screw used to mount or support a part that weighs more than 7-1/2 pounds (3.4 kg) shall be subjected to a force equal to four times the weight of the part applied in a direction coincident with the longitudinal axis of the screw.

156.3 Test results

156.3.1 Test results meet the intent of the requirement when the threads of the screw do not strip or pull out of the sheet metal.

157 Power-Supply Cord Twist Test

157.1 General

157.1.1 A portable luminaire with a joint capable of more than 360 degrees of rotation during assembly, per 8.4(b), shall be tested as described in 157.2. Where multiple separable joints are involved, each shall be individually tested. Compliance criteria is described in 157.3.

157.2 Method

157.2.1 The maximum amount of rotation is to be determined by assembling, without tools, the separated tubes until further movement is restricted by the threads or other mechanical interference means. The joint is then to be disassembled.

157.2.2 With the joint unassembled, the power supply cord is to be firmly grasped 1 inch (25 mm) from where it emerges from the separated joint. One tubing through which the cord passes is then to be rotated in one direction the maximum amount determined by 157.2.1, and held there for 10 seconds, while the emerged supply cord is held in a fixed position. After releasing, the other tube is to be rotated the same amount, in the opposite direction, again while firmly holding the emerged supply cord 1 inch (25 mm) from where it emerges.

157.3 Results

157.3.1 The rotation(s) shall not place any stress on the internal connections or splices.

GENERAL – ELECTRICAL TESTS

158 Grounding Continuity Test

158.1 General

158.1.1 The following test described in 158.2 applies to accessible dead metal parts that are required to be grounded in accordance with Grounding and Bonding, Section 36. Compliance criteria is described in 158.3.

158.2 Test method

158.2.1 The impedance between the point of connection of the equipment-grounding means and any other accessible metal part required to be grounded, shall be determined by applying a current of 25 amperes – derived from a 60 hertz source with a no-load voltage not exceeding 6 volts – between the grounding connection and the metal part in question. The resulting impedance is calculated by dividing the value of the measured voltage by the applied current (25 A).

158.2.2 If the unit is provided with a non-detachable power supply cord, the cord/plug shall not be included in the test circuit unless it is reliably established that its presence will not affect the results of this test. In most cases, the use of a nominal 6 inches (152.4 mm) section of power supply cord from the point where the cord emerges from the body of the portable luminaire will not adversely affect the test results.

158.3 Test results

158.3.1 The results meet the intent of the requirement when the impedance between the point of connection of the equipment-grounding means and any other metal part that is required to be grounded does not exceed 0.1 ohm.

159 Dielectric Voltage-Withstand Test

159.1 General

159.1.1 Portable luminaires having accessible dead metal parts or low voltage circuits intended to be isolated from primary circuits shall comply with 159.2. Compliance criteria is described in 159.3.

159.2 Test method

159.2.1 A 1200 volt, 40 – 70 hertz potential shall be applied for 1 minute between:

a) Primary wiring, including connected components, and accessible dead metal parts, including those parts that are accessible only during relamping; and

b) Primary wiring and accessible low-voltage metal parts, including terminals.

Alternatively, the test is permitted to be conducted with a DC potential at 1.414 times the AC potential.

159.2.1.1 A 500 volt, 40 – 70 hertz potential shall be applied for 1 minute between:

a) Concurrently accessible secondary circuit conductive parts operating above the voltage limit for a class 2 circuit; and

b) Accessible secondary circuit conductive parts operating above the voltage limit for a class 2 circuit and dead metal or ground.

Alternatively, the test is permitted to be conducted with a 707 Vdc potential.

159.2.2 When 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. When the output of the test-equipment transformer is 500 volt-amperes or larger, the test potential is 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.

159.3 Test results

159.3.1 The results meet the intent of the requirement when there is no electrical breakdown.

160 Low Voltage Hinged or Movable Part Cycling Test

160.1 General

160.1.1 The following test described in 160.2 applies to low-voltage hinged or movable parts that are used to carry current in accordance with Secondary Low Voltage Circuits, Section 38. Compliance criteria is described in 160.3.

160.2 Test method

160.2.1 A hinge or joint between movable parts used to carry current in accordance with Exception No. 1 of 38.3 shall not have a temperature rise greater than 5°C (9°F) as a result of carrying the maximum normal current after 6000 operations of the hinge or movable part.

160.2.2 The hinge or movable part is to be flexed for 6000 operations through the full range permitted by the construction while the joint is carrying the maximum rated current. The temperature rise is to be measured at the conclusion of the test cycling, with the hinge or movable part shielded from external sources of heat such as transformer and lamp, and is to be measured with the joint in the position causing maximum heating due to increased resistance in the circuit.

160.3 Test results

160.3.1 The results meet the intent of the requirement when the hinge or joint between movable parts used to carry current does not have a temperature rise greater than 5°C (9°F).

161 Leakage Current Measurement Test

161.1 General

161.1.1 The following test described in 161.2 applies to a portable luminaire using insulating material that is able to be adversely affected by moisture under its intended operating conditions such as a plant lamp. Compliance criteria is described in 161.3.

161.2 Test method

161.2.1 The portable luminaire shall be conditioned for 24 hours in moist air having a relative humidity of 88 ±2 percent at a temperature of 32.0 ±2°C (89.6 ±3.6°F). After conditioning, the leakage current shall be measured as described in this section.

161.2.2 Unless otherwise specified, the test is to be conducted with the portable luminaire connected to a source of supply of rated frequency and of maximum rated voltage except that the voltage is to be 120 volts for a lamp rated between 110 and 120 volts.

161.2.3 Leakage current refers to all currents, including capacitively coupled currents, that are able to be conveyed between exposed conductive surfaces of a lamp.

161.2.4 When a conductive surface other than metal is used for the enclosure or part of the enclosure, the leakage current is to be measured using metal foil having an area of 10 by 20 centimeters in contact with the surface. When the surface has an area less than 10 by 20 centimeters, the metal foil is to be the same size as the surface. The metal foil is not to remain in place long enough to affect the temperature of the lamp.

161.2.5 The measurement circuit for leakage current is to be as illustrated in Figure 161.1. The measurement instrument is defined in (a) – (c). The meter that is actually used for a measurement is required to only indicate the same numerical value for a particular measurement as the defined instrument. The meter used is not required to have all the attributes of the defined instrument.

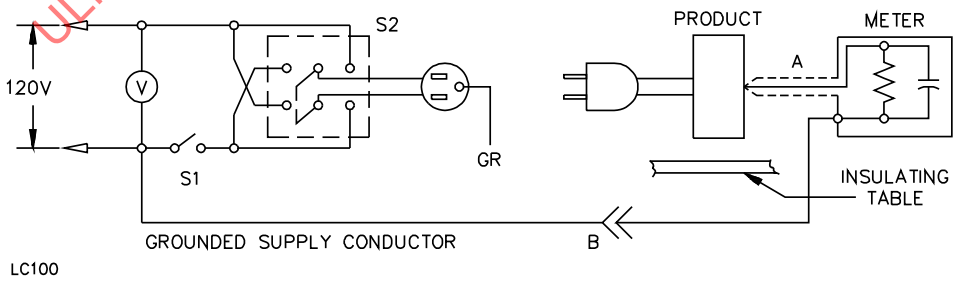
a) The meter is to have an input impedance of 1500 ohms resistive shunted by a capacitance of 0.15 microfarad.

b) The meter is to indicate root mean square values which is 1.11 times the average of the full-wave rectified composite waveform of the current through the resistor.

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

Figure 161.1

Leakage-current measurement circuit



Portable luminaire intended for connection to a 120 volt power supply.

a) Probe with shielded lead.

b) Separated and used as clip when measuring currents from one part of device to another.

161.2.6 Unless the meter is being used to measure leakage from one part of a portable luminaire to another, the meter is to be connected between the accessible parts and the grounded supply conductor (neutral).

161.2.7 The portable luminaire is to be tested for leakage current with the grounding conductor open at the attachment plug. The supply voltage is to be adjusted to the voltage specified in 161.2.2. The test sequence, with reference to the measuring circuit, is to be as follows:

a) With switch S1 open, the portable luminaire is to be connected to the measuring circuit. Leakage current is to be measured using both positions of switch S2 and with the unit switching devices in all their normal operating positions.

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

c) The leakage current is to be monitored until thermal stabilization. Both positions of switch S2 are to be used in determining this measurement. Thermal stabilization is to be obtained by operation as in the Normal Temperature Test, Sections 143 – 147.

161.3 Test results

161.3.1 The results meet the intent of the requirement when the leakage current does not exceed 0.5 milliampere.

161A Input Power Measurement

161A.1 While connected to a source of rated voltage, the current or wattage consumed by a portable luminaire intended for branch circuit connection (120 Vac) with a non-replaceable light source shall be measured across all operational settings. The maximum current (or wattage) consumed shall not exceed the rated input, as marked per 198.6.3, by more than 10%.

INCANDESCENT UNIT TESTS

162 Torchiere Input Test

162.1 General

162.1.1 A portable luminaire of the torchiere type shall be subjected to the test described in 162.2. Compliance criteria are described in 162.3.

162.2 Test method

162.2.1 The unit shall be connected to a 120 volt supply and a wattmeter connected to the input circuit. If the unit has non-torchiere portions such as sidelights, these lamps shall be removed for this test.

162.2.2 The rated lamp of the torchiere portion of the unit shall be removed and replaced with a lamp rated 200 W. If multiple lamps are employed, the total wattage shall be 200 W.

162.2.3 If a 200 W rated lamp is not commercially available in the same type and size that is rated for the unit, the next higher rated lamp that is greater than 200 W shall be used for the test.

162.2.4 The power to the unit shall be turned on. The input voltage shall be adjusted to draw lamp wattage in accordance with 162.2.2 or 162.2.3 as applicable. The input power to unit shall be recorded.

162.3 Test results

162.3.1 The measured power to the unit shall not exceed 190 watts after one minute of operation.

163 Lamp Harp Torque Test

163.1 General

163.1.1 Lamp harps evaluated to Exception No. 3 of 49.4.2 shall be subjected to the following test described in 163.2. Compliance criteria is described in 163.3.

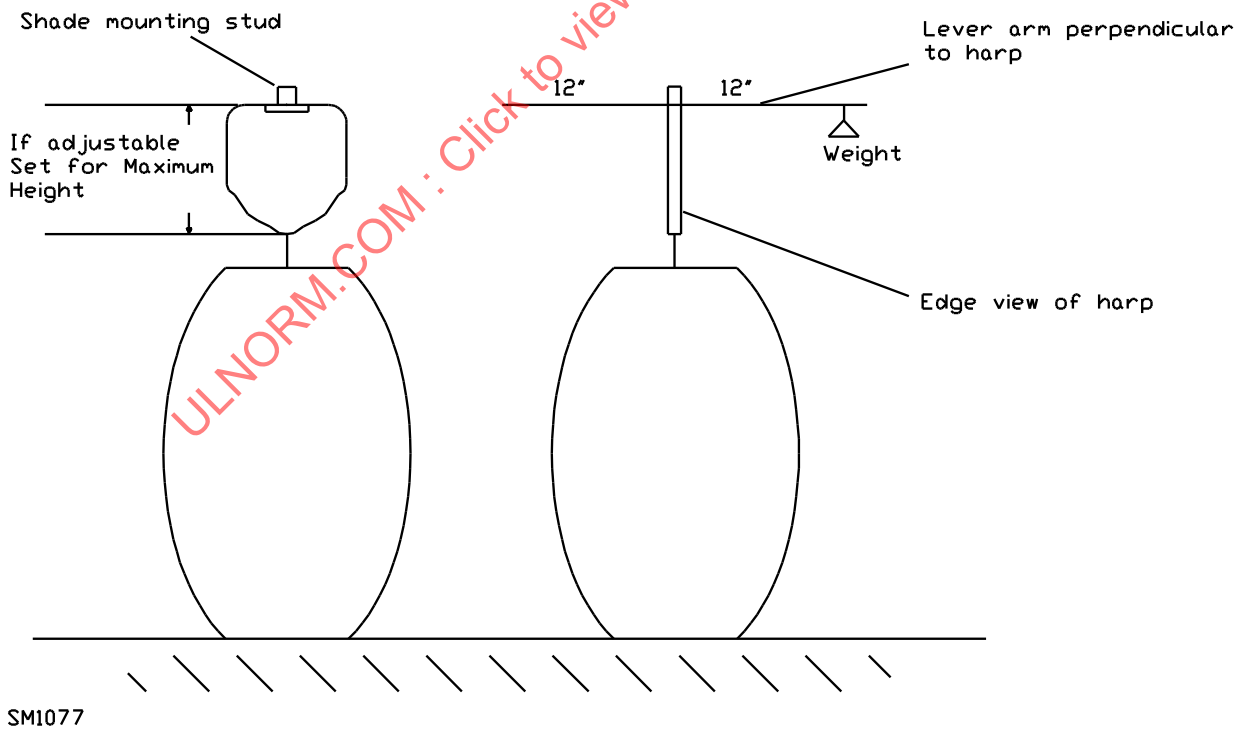
163.2 Test method

163.2.1 The harp shall be supported vertically as intended in service. When adjustable in height, the harp is to be adjusted for the maximum height.

163.2.2 A lever arm, nominal 1/8 inch (3.18 mm) thick by 1 inch (2.54 cm) wide by 24 inches (30.5 cm) long minimum, shall be centered and attached to the harp shade mounting stud and arranged such that when a force is applied, it is perpendicular to the centerline of the harp uprights. The lever arm shall extend enough in the other direction to counterbalance the weight of the lever arm so that the lever arm weight is cancelled from the moment force. See Figure 163.1.

Figure 163.1

Lamp harp torque test



163.2.3 A weight of 2 pounds (0.91 kg) shall be attached to the lever arm at a distance of 12 inches (30.5 cm) from the centerline of the harp mounting stud.

163.3 Test results

163.3.1 The harp shall be subjected to an applied force of 24 inch-pounds (2.70 N·m) for 1 minute. The harp and/or lever arm is not prohibited from bending during the test. The weights and lever arm shall then be removed, and the minimum lamp-to-shade spacing measured in accordance with 49.4.2.

164 Lampshade Ease of Ignition Test

164.1 General

164.1.1 A lampshade evaluated in accordance with Exception No. 2 of 49.4.2 shall be subjected to the following test described in 164.2. Compliance criteria is described in 164.3.

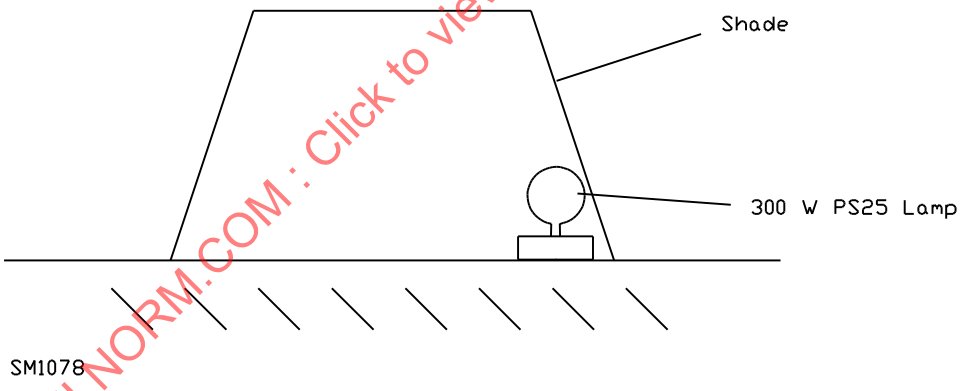
164.2 Test method

164.2.1 Two complete lampshades shall be conditioned for seven days in an air circulating oven at a temperature of 70°C (158°F).

164.2.2 After conditioning, a Type PS25 300 W Lamp is energized for five minutes and then while still energized is placed in direct contact with the interior surface of the shade for a 3 hour time period. See Figure 164.1.

Figure 164.1

Lamp shade ease of ignition test



Interior of shade in contact with energized lamp.

164.3 Test results

164.3.1 No open flaming shall occur. Charring of the material shall be limited to the immediate area of light lamp contact.

TUNGSTEN-HALOGEN UNIT TESTS

165 Tungsten Halogen Lamp Adjacent Surfaces and Overlamping Abnormal Operation Tests

165.1 General

165.1.1 A tungsten-halogen type unit is to be subjected to the tests described in 165.2 for the general conditions and 165.3 – 165.7 for the specific conditions. Compliance criteria is described in 165.8. When a portable luminaire is damaged during any test, a new unit is to be used for subsequent tests.

Exception No. 1: A portable luminaire that complies with the mounting means requirements in Mounting Means Tests, Section 178 or Section 179, is not required to be subjected to the Severe Condition Test, 165.3.

Exception No. 2: The Vertical Surface Test, 165.4, is not required when equivalent operation is obtained during the Normal Temperature Test, Sections 143 – 147.

Exception No. 3: The Supporting Surface Test, 165.5, is not required when equivalent operation is obtained during the Normal Temperature Test, Sections 143 – 147.

Exception No. 4: The Overhead Surface Test, 165.6, is not required when equivalent operation is obtained during the Normal Temperature Test, Sections 143 – 147.

Exception No. 5: The Overlamping Test, 165.7, is not required when equivalent operation is obtained during the Normal Temperature Test, Sections 143 – 147.

165.1.2 A tungsten-halogen unit that:

a) Uses an Edison base, double envelope tungsten-halogen lamp similar in shape to a Type A incandescent lamp;

b) Is rated 100 W or less;

c) Complies with the shade dimension requirements of Section 49 for Temperature Test-Exempt Units employing a 100 W lamp and a medium base; and

d) Is marked in accordance with 202.2.2;

is not required to be subjected to any abnormal operations tests.

165.2 Test method – general

165.2.1 To determine that the ultimate results have been observed, up to 7 hours of continuous operation is required.

165.2.2 To determine that the most severe condition has been evaluated, a portable luminaire is to be tested in several positions. The positions used are not required to be normal positions of use.

165.2.3 An automatic temperature-regulating or limiting control or other protective device provided as a part of the portable luminaire is to be shunted out of the circuit during these tests, unless the control has been shown by an investigation to be reliable and undefeatable by the user.

165.2.4 Any part of the unit that is removable without the use of a tool, including a shade, is to be removed prior to these tests when its removal results in a more severe condition.

165.2.5 The tissue paper used in the abnormal test is to be untreated white paper, nominally 0.001 inches (0.025 mm) thick, commonly used for gift wrapping.

165.2.6 The test surface is to be nominal 1/2 inch thick trade size, knot-free, softwood, and is able to include plywood. The test surface is to be covered with a double layer of white tissue paper.

165.3 Test method – severe condition

165.3.1 A portable luminaire is to be placed in a position representing the most severe condition, regardless of mounting means, on the test surface.

165.3.2 After having been positioned, the portable luminaire is to be operated without further guiding or propping.

165.3.3 For a chain suspended shop-light type portable luminaire using tungsten halogen lamps, the Severe Condition Test shall be conducted with the unit suspended as intended with the tissue covered paper placed up against the bottom of the lamp compartment. The test indicator shall be parallel to the floor to simulate stacked boxes.

165.4 Test method – vertical surface

165.4.1 A portable luminaire is to be operated after being placed or mounted as intended as close as permitted by the lamp construction to a vertical test surface located at a right angle to the support or mounting surface. When a lamp is adjustable, it is to be:

a) Positioned as close to; and

b) Directed toward,

the vertical test surface to the greatest degree permitted by the construction of the portable luminaire.

165.5 Test method – supporting surface

165.5.1 A portable luminaire is to be operated after being placed or mounted as intended on the test surface and operated continuously. Among the abnormal conditions to be evaluated is operation of the lamp:

a) Positioned as close to; and

b) Directed toward,

the supporting surface to the greatest degree permitted by the construction of the unit.

165.6 Test method – overhead surface

165.6.1 A portable luminaire is to be operated after being placed or mounted as intended under a test surface. The height of the surface above the portable luminaire is to be determined by intended use of the unit and is to be as specified in the markings, 202.3.5. Among the conditions of operation to be evaluated is operation of the unit:

a) Positioned as close to; and

b) Directed toward,

the overhead surface to the greatest degree permitted by the construction of the portable luminaire.

165.7 Test method – overlamping

165.7.1 A portable luminaire is to be operated in a position of normal use with the maximum wattage lamp of the same type specified in the lamp replacement marking that physically fits into the unit and is generally available through retail channels. However, when the lamp is energized through a transformer, the test is to be conducted with the highest wattage lamp that does not result in transformer burnout in 7 hours, or does not result in a protective device functioning.

165.8 Test results

165.8.1 There shall be no:

a) Emission of flame or molten metal;

b) Combustion, glowing or flaming or disintegration of the material on which the unit is resting or of material placed on or near the unit;

c) Exposure of parts involving a risk of electric shock; or

d) Dielectric breakdown when subjected to the Dielectric Voltage-Withstand Test, Section 159, during any of these tests.

166 Tungsten-Halogen Lamp Guard, Lamp Containment Barrier, and UV Filter Security Test

166.1 General

166.1.1 A tungsten-halogen type unit is to be subjected to the test described in 166.2. Compliance criteria is described in 166.3.

Exception: A unit that complies with the Mounting Means Tests, Section 178, Mounting Means Test – Surface Mounted Unit, or Section 179, Mounting Means Test – Chain and Suspended Units, is not required to comply with this test.

166.2 Test method

166.2.1 All portable luminaires except floor type units are to be operated until temperatures are stable and then dropped, while plugged in and operating, through a distance of 3 feet (0.9 m) so that the unit strikes the test surface in a position most capable of damaging or altering a guard, lamp containment barrier, or a UV filter of the unit. Operation shall continue for 7 hours or until ultimate results are obtained.

166.2.2 A floor type unit is to be operated until temperatures are stable and then tipped over, while plugged in and operating, so that the unit strikes the test surface in a position most capable of damaging or altering a guard, lamp containment barrier, or a UV filter of the unit. The sample is to be placed on a flat horizontal surface and is to be tipped over by gradually and slowly pushing the top of the portable luminaire beyond the point of instability until it free-falls. Operation shall continue for 7 hours or until ultimate results are obtained.

166.2.3 The test surface is to be nominal 1/2-inch thick trade size, knot-free, softwood or plywood. The test surface is to be covered with a double layer of white tissue paper and completely supported by a concrete floor.

166.2.4 The tissue paper used in the test is to be untreated white paper, nominally 0.001 inches (0.025 mm) thick, commonly used for gift wrapping.

166.2.5 Any part of a portable luminaire that is removable without the use of a tool, including a shade, is to be removed prior to this test when its removal results in a more severe condition.

166.3 Test results

166.3.1 There shall be no:

a) Emission of flame or molten material;

b) Combustion of the material under or near the fallen unit;

c) Detachment of the guard, lamp containment barrier, or UV filter from the unit, or damage to the extent that physical or electrical spacings are reduced or openings occur which increase the risk of fire or personal injury; including deformation of a projection or spacer used to comply with the tungsten-halogen unit tests in Section 165; and

d) Dielectric breakdown when subjected to the Dielectric Voltage-Withstand Test described in Section 159 following the test.

166.3.2 Detachment of the components in item (c) of 166.3.1 is permitted for parts that rely on an interlock switch that when removed disconnect power to the unit.

167 Tungsten-Halogen Torchiere Abnormal Operation Test

167.1 General

167.1.1 One sample of a tungsten-halogen torchiere style floor unit as described in 57.3 shall be subjected to the test described in 167.2. Compliance criteria is described in 167.3.

167.2 Test method

167.2.1 The tungsten-halogen test lamp is to be a Philips brand lamp rated for the maximum wattage marked on the unit at 120 volts. When the portable luminaire is marked for a lamp wattage not produced by Philips, a test lamp by another manufacturer is to be used.

167.2.2 When a dimmer or other lamp-wattage reducing device is provided as a part of the portable luminaire, the device is to be shunted from the circuit for this test. A protective device such as an automatic temperature-regulating or -limiting control is also to be shunted from the circuit, unless the control is evaluated and found reliable.

167.2.3 Any part of a portable luminaire that is removable without the use of a tool is to be removed prior to the test when removal results in a more severe test condition.

167.2.4 The risk of fire indicator is to be double-layered, bleached cheesecloth, running 14 – 15 square yards per pound (26 – 28 m^2/kg) per layer, and having a count of 32 by 28, that is, for any square inch there are 32 threads in one direction and 28 in the other direction (for any square centimeter, there are 13 threads in one direction and 11 threads in the other direction). The cheesecloth is to be wrapped around a 6 inch (15.2 cm) wide, 1/16 inch (1.6 mm) thick mandrel with length equal to the width of the cheesecloth. The mandrel is then removed to form a 10 double layer pad. The overall length of the pad is to be long enough to drape over the edge of the shade at both ends and is not to exceed twice the maximum diameter or diagonal of the shade.

167.2.5 The unit is to be placed in a draft-free room and connected to a variable 120-volt source of supply, adjusted to produce rated lamp wattage. The unit is to be energized for 15 minutes. Without being compressed, the cheesecloth pad is to be placed on top of the unit so that it is centered along the axis of the test lamp. The cheesecloth pad is to follow the contour of the guard, so that it extends over the edge of the shade at both ends, and is as close to the lamp as the torchiere's construction permits.

167.2.6 A unit tested with the guard removed is to have the cheesecloth pad in contact with the lamp containment barrier or the lamp envelope. The probes described in 55.3.7 are to be used to position the pad as close to the lamp envelope as permitted by the torchiere's construction features.

167.2.7 The unit is to be operated until:

a) The cheesecloth ignites (flames);

b) A hole develops in any layer of cheesecloth; or

c) 7 hours has elapsed.

167.2.8 Identification of holes in the cheesecloth is to be made at the conclusion of the test by visual examination, without disturbing the cheesecloth in a manner that displaces any discolored material.

167.2.9 A unit with an automatic temperature regulating or limiting control, that is relied on for supplementary protection, shall be subjected to the test described in this section with the following additional conditions:

a) The test is to be conducted at rated lamp wattage with the cheesecloth pad centered along the axis of the test lamp, as specified in 167.2.5.

b) The test in (a) is then to be repeated with the test pad positioned at 90 degrees with respect to the axis of the test lamp and in any other position that results in a longer time for the control to operate.

c) The test is to be repeated with the cheesecloth in the position of (a) or (b) that resulted in the longest time for the control to operate, with the unit's wattage reduced in 50-watt increments for dimmers that are continuous by changing the input voltage, or selecting a lower step wattage setting for dimmers that are not continuous, until the unit operates for 7 hours without operation of the control device.

The unit complies with the testing requirements when the conditions of 167.3 are met.

167.3 Test results

167.3.1 There shall be no:

a) Ignition (flaming) of the cheesecloth; or

b) Holes in any layer of the cheesecloth.

168 Tungsten-Halogen Torchiere Vertical Wall Test

168.1 General

168.1.1 Following the test specified in Section 165, Tungsten-Halogen Torchiere Abnormal Operation Test, the sample shall be subjected to the test in 168.2. Compliance criteria is described in 168.3.

168.2 Test method

168.2.1 The unit is to be laid on its side in the tipped-over position. With an operable lamp inserted, the unit is to be operated a rated wattage, and placed next to the wall described in 168.2.3.

168.2.2 For a unit with a flexible or articulated arm, the tipped-over position specified in 168.2.1 shall be the position that results in maximum heating of the plywood wall without actuating the tipover switch.

168.2.3 The wall is to consist of 3/4 inch (19.1 mm) thick fir plywood, and is to be covered with one layer of white, basically cotton terry cloth untreated fabric with a polyester content not more than 20 percent, and having a pile wave and a nominal weight of 8 ounces per square yard (270 g/m^2). The wall is to extend at least 12 inches (305 mm) beyond the unit on both sides and 12 inches above the unit.

168.2.4 The unit is to be positioned at a distance from the wall that results in the highest temperatures on the plywood wall during operation.

168.2.5 The unit is to be operated until:

a) There is glowing or flaming of the test indicator as indicated as described in 168.3; or

b) 7 hours has elapsed.

168.2.6 The test is to be discontinued after 2 hours when this duration of testing produces no discoloration of the terry cloth material.

168.3 Test results

168.3.1 There is to be no glowing or flaming of the terry cloth material or the plywood, including charring with cross-checking of the plywood as indicated by separation of the wood fibers in the direction of the grain.

169 Tungsten-Halogen Torchiere Stability Test

169.1 General

169.1.1 A floor mounted tungsten-halogen torchiere style portable luminaire not provided with a tipover switch shall be tested as described in 169.2. Compliance criteria is described in 169.3.

169.2 Test method

169.2.1 The unit is to be placed on a plane inclined at an angle of 12 degrees with the horizontal and turned to any position of use presenting the greatest risk of tip over.

169.3 Test results

169.3.1 The results of the test do not meet the intent of the requirement when the unit tips over.

170 Tungsten-Halogen Torchiere Flexible or Articulated Arm Stop Test

170.1 General

170.1.1 A tungsten-halogen torchiere style floor unit with a flexible or articulated arm that employs an end-stop to limit arm adjustment in accordance with 55.6 shall be tested as described in 170.2. Compliance criteria is described in 170.3.

170.2 Test method

170.2.1 A tungsten-halogen torchiere unit is to be oriented as intended in normal use and have the flexible or articulated arm positioned against the end-stop. A 10 pound (22 kg) weight is to be applied to the end of the arm furthest away from the end-stop for 1 minute.

170.2.2 When the applied weight causes tipover of the unit, the torchiere base or other nonadjustable sections are to be secured to prevent tipover during this test.

170.3 Test results

170.3.1 The end-stop shall not be damaged to the extent that the arm is able to move beyond the normal range.

171 *Reserved for future use*

172 Polymeric Lamp Containment Barrier Test

172.1 General

172.1.1 The test described in 172.2 apply only to that part of a lamp containment barrier (as defined by 2.29) that is of a polymeric material and is located where particles from a ruptured tungsten-halogen lamp drop to and rest. Compliance criteria is described in 172.3.

172.2 Test method

172.2.1 Three barriers are to be supported by their outer edges and oriented as intended during normal operation. A surface located 12 inches (305 mm) below the test samples is to be covered by a layer of dry absorbent cotton that is nominal 1/4 inch (6.4 mm) thick.

172.2.2 During the test, each sample of the lamp containment barrier material is to be heated to and maintained at the maximum operating temperature recorded when tested in accordance with the Normal Temperature Test, Sections 143 – 147.

172.2.3 Three cylindrical arc tube segments as specified in Table 172.1 are to be preheated to 1100°C (2012°F) for a minimum of 15 minutes.

Table 172.1
Quartz arc tube test segments

Lamp wattage	Outside diameter		Wall thickness		Length	
	inch	(mm)	inch	(mm)	inch	(mm)
150 or less	0.55	(14.0)	0.040	(1.0)	1/4	(6.4)
151 to 400	0.85	)21.6)	0.049	(1.24)	1/4	(6.4)
greater than 400	1.0	(25.4)	0.07	(1.9)	1/2	(12.7)

172.2.4 Each arc tube segment is then to be placed on the lamp containment barrier such that the longitudinal axis of the cylinder is perpendicular to the plane of the barrier. The transfer of each arc tube segment from the oven to the surface of the lamp containment barrier shall not exceed 2 seconds.

172.3 Test results

172.3.1 The results meet the intent of the requirement when during the testing of the samples, the dry absorbent cotton located below the test samples is not ignited by:

a) Flaming drops of plastic material; or

b) Any arc tube segment that penetrates the lamp containment barrier material and falls on the cotton.

173 Interlock Switch Endurance Test

173.1 General

173.1.1 The following test described in 173.2 applies to a tungsten-halogen interlock switch that has been evaluated in accordance with 56.2.1(b). Compliance criteria is described in 173.3.

173.2 Test method

173.2.1 A tungsten-halogen type unit provided with an interlock switch shall be connected to a supply circuit of 60 Hz and operated at rated lamp wattage. The switch shall be operated by means of the interlocking mechanism provided in the unit for 500 cycles at a rate of not exceeding 6 cycles per minute. Dead-metal parts of the switch shall be connected to earth ground through a 3A quick-acting plug-type fuse. The switch contacts shall be located in the ungrounded conductor of the supply circuit.

173.3 Test results

173.3.1 When tested in accordance with 173.2, there shall be no electrical or mechanical malfunction of the switch, and the fuse connected to the dead metal does not open.

174 Heat Flux Density Measurement Test

174.1 General

174.1.1 One sample of the tungsten-halogen torchiere unit as described in 55.1.7 shall be subjected to the test described in this section.

174.2 Test method

174.2.1 The tungsten-halogen test lamp shall be identical to the test lamp used for the Tungsten-Halogen Torchiere Abnormal Operation Test, Section 167.

174.2.2 Test lamps (bulbs) shall not have an accumulated operating time history that results in greater than a 5 percent loss in output radiant energy at the time readings are taken. A comparison of heat flux density readings taken at any one conveniently reproducible reference location, such as 6 inches (152 mm) in front of the test lamp on the light beam axis, when the lamp is brand new, and after use in testing, shall be used to establish whether darkening exceeds the specified 5 percent limit.

174.2.3 When a dimmer or other lamp-wattage reducing device is provided as part of the unit, the device is to be shunted from the circuit for this test.

174.2.4 Any part of the unit that is removable without the use of tools is to be removed prior to the test when removal results in a more severe test condition.

174.2.5 The unit is to be placed in a draft-free room and connected to a variable 120-volt source of supply adjusted to produce rated lamp wattage.

174.2.6 When a guard is used to maintain the distance between the lamp and the combustible materials, the shortest distance between the heat source and either probe specified in 55.3.7 is to be measured and recorded. The receiving area of the measuring instrument is to be maintained at the distance from the heat source while measuring the heat flux density. In no case is the receiving area of the measuring instrument to be spaced less than 1/4 inch (6.35 mm) from the heat source.

174.2.7 The measuring instrument used in 174.2.6 is to be one which:

a) Produces an average reading of the total radiant plus convection heat flux density incident on a circular or square flat receiving area of not less than 0.16 in^2 (1 mm^2) or more than 0.032 in^2 (2 mm^2);

b) Has an overall diameter not exceeding 1 inch (25.4 mm);

c) Has a field of view at the receiving surface which encompasses all of the available radiant energy emitting areas of the source under test;

d) Has provision for the determination or compensation of the temperature of the receiving surface at the time of the heat flux density measurement so that the radiant and convective heat flux densities are able to be computed as that transferred relative to a room temperature [25 ±5°C (77 ±10°F)] black receiving body;

e) Has a calibrated response to all radiant energy within the wavelengths of 0.3 to 20 microns; and

f) Is capable of measuring net total heat flux density of 1.0 W/cm^2 within the specified wave length with an error not exceeding 10 percent.

174.2.8 Heat flux density readings shall be taken after 15 minutes of operation or when the lamp and its reflector and/or housing have reached thermal equilibrium, whichever occurs sooner.

174.3 Test results

174.3.1 During conditions of intended operation, and with the light beam directed in a vertical plane, a unit shall not produce a net total heat flux density exceeding 1.0 W/cm^2 at any point beyond the external surface of the lamp or containment barrier.

FLUORESCENT UNIT TESTS

175 Abnormal Operation – Shorted Starter Test

175.1 General

175.1.1 A fluorescent type unit provided with other than a manual starter or a Class P ballast shall be subjected to the following test described in 175.2. Compliance criteria is described in 175.3.

175.2 Test method

175.2.1 The starter is to be shorted and the portable luminaire loosely covered with a single layer of cloth and operated continuously.

175.2.2 To determine that the ultimate results have been observed, up to 7 hours of continuous operation is required.

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

175.3 Test results

175.3.1 There shall be no:

a) Emission of flame or molten metal;

b) Combustion, glowing or flaming or disintegration of the material on which the lamp is resting or of material placed on or near the unit;

c) Exposure of parts involving a risk of electric shock; or

d) Dielectric breakdown when subjected to the Dielectric Voltage-Withstand Test, Section 159.

HIGH-INTENSITY-DISCHARGE UNIT TESTS

176 Glass Impact Test

176.1 General

176.1.1 The following test described in 176.2 is applicable to metal halide lamps without integral outer glass envelopes. Compliance criteria is described in 176.3.

176.2 Test method

176.2.1 A sample of the glass lamp containment barrier installed in a portable luminaire shall withstand 5 foot-pound (6.8 N-m) impact from a 2 inch (50.8 mm) diameter steel ball weighing 1.18 pounds (0.54 kg) applied to the center of the glass lamp containment barrier.

176.2.2 The glass lamp containment barrier is to be subjected to the impact by releasing the steel ball from the height required to produce the desired impact force. The figure containing the glass containment

barrier to be tested is to be supported by a rigid surface [3/4 inch (19.1 mm) thick tongue and groove oak flooring or 3/4 inch thick plywood over a concrete pad].

176.3 Test results

176.3.1 As a result of the test specified in 176.2, the glass shall not shatter or crack.

177 Glass Thermal Shock/Containment Test

177.1 General

177.1.1 The test described in 177.2 is applicable to units with metal halide lamps having a glass material other than tempered or borosilicate glass. Compliance criteria is described in 177.3.

177.2 Test method

177.2.1 Each of three samples of the lamp containment barrier material to be tested is to be supported by its outer edges and oriented as it would be during normal operation. The lamp containment barrier material is to be maintained at a temperature of 25 ±5°C (77 ±9°F).

177.2.2 Three arc tube segments, as specified in Table 172.1, are to be preheated to 1100°C (2012°F) for a minimum of 15 minutes.

177.2.3 Each arc tube segment is then to be removed from the oven and, within 2 seconds, placed on the thinnest part of each lamp containment barrier. Each arc tube segment is to be placed on the barrier such that the longitudinal axis of the cylinder is perpendicular to the plane of the barrier.

177.3 Test results

177.3.1 The results meet the intent for the requirement when none of the samples of the glass lamp containment barrier material shatter or crack.

SURFACE MOUNTED UNIT FOR WALL OR UNDERSHELF MOUNTING TESTS

178 Mounting Means Test – Surface Mounted Unit

178.1 General

178.1.1 A surface mounted unit that is required to be tested as specified in 71.2.1 shall be tested as described in 178.2. Compliance criteria is described in 178.3.

178.2 Test method

178.2.1 Each test is to be conducted using the hardware provided and with the unit mounted in accordance with the instructions provided. An adjustable luminaire is to be adjusted to the position that results in the most severe test.

Exception: When the instructions for a wall-mounted unit do not specify a minimum mounting surface, the tests are to be conducted using 3/8 inch (9.5 mm) trade size plaster board securely attached to studs on 16 inch (406 mm) centers.

178.2.2 A weight of three times the weight of the unit is to be gradually applied at the point of the maximum projection of the portable luminaire and maintained for 1 hour.

178.3 Test results

178.3.1 The test result does not meet the intent of the requirements when:

a) The portable luminaire, separable mounting bracket or screws are pulled from the mounting surface;

b) The portable luminaire becomes detached from the separable mounting bracket; or

c) The portable luminaire is damaged to the extent that internal wiring, splices, a switch or uninsulated live parts are exposed. Wireways or decorative parts are able to be bent.

CORD AND CHAIN SUSPENDED UNIT TESTS

179 Mounting Means Test – Chain and Suspended Units

179.1 General

179.1.1 A portable luminaire constructed in accordance with the Exceptions to 75.2.1, 75.3.1, or 75.3.2 shall be tested as described in 179.2 and either 179.3 when a swag type or 179.4 when a hanging type. Compliance criteria is described in 179.5.

179.2 Test method – general

179.2.1 The weight of the unit is to be determined in accordance with 75.3.2. The portable luminaire is to be mounted in accordance with the manufacturer's instructions on a simulated ceiling.

179.2.2 The simulated ceiling described in 179.2.1 is to be of the following construction:

a) For a plaster, dry wall, or similar ceiling, a 2 by 2 foot (610 by 610 mm), 3/8 inch trade size thick plaster board to be supported on opposite ends by trade size 2 by 4 inch studs.

b) For a wood, acoustical tile, or similar ceiling, one 12 by 12 inch (305 by 305 mm), 3/8 inch trade size thick tile of the material(s) specified in the instructions to be supported on each end by trade size 1 by 2 inch furring strips.

179.3 Test method – swag unit

179.3.1 For a swag type unit, a load consisting of three times the weight of the unit is to be suspended from the mounting means of the unit (in addition to the unit) for a period of 1 hour.

179.4 Test method – hanging unit

179.4.1 For a hanging type unit, the maximum amount of weight that the cord is able to suspend is to be determined in accordance with Table 75.1. The difference between the weight of the portable luminaire and the maximum weight the cord is able to suspend is load “A.” Load “A” is to be suspended from the unit for a period of 1 hour.

179.5 Test results

179.5.1 The results of the test do not meet the intent of the requirements when:

a) The portable luminaire falls or is pulled away from the ceiling.

b) There is damage to the unit exposing live parts or sharp edges which affect the performance of the unit; or

c) Any other situation that results in a risk of fire, electric shock, or injury to persons.

180 Test for Suspended Toys

180.1 General

180.1.1 A portable luminaire with a suspended toy shall be subjected to the test described in 180.2. Compliance criteria is described in 180.3.

180.2 Test method

180.2.1 The unit is to be mounted in accordance with the manufacturer's instructions on a simulated ceiling. The simulated ceiling is to be of the same construction as that described in 179.2.2.

180.2.2 A weight is to be suspended from the toy. The weight is to be gradually increased until the toy becomes separated from the lamp.

180.2.3 The weight of the unit is to be determined in accordance with 75.3.2. When the weight of the lamp plus the weight of the load required to remove the toy exceeds:

a) 30 pounds (13.6 kg) for the mounting means specified in 75.2.1; or

b) The total amount of weight (unit plus load) tested in Mounting Means Test – Chain and Suspended Units, Section 179;

the Mounting Means Test in Section 179 shall be conducted using a load of the weight required to remove the toy.

180.2.4 For a hanging unit, the weight of the luminaire plus the weight of the load required to remove the toy shall not exceed the limits of the cord as specified in Table 75.1.

180.3 Test results

180.3.1 The results of the test do not meet the intent of the requirements when any of the following conditions occur:

a) The unit falls or is pulled away from the ceiling.

b) There is damage to the unit resulting in exposed live parts or sharp edges which affect the performance of the unit; or

c) Any other situation that results in a risk of fire, electric shock, or injury to persons.

CLAMP-ON UNIT TESTS

181 Mounting Means Test – Clamp-On Unit

181.1 General

181.1.1 A clamp-on unit relying on a spring-actuated clip for securement shall be subjected to the test described in 181.2. Compliance criteria is described in 181.3.

181.2 Test method

181.2.1 The test is to be conducted as follows:

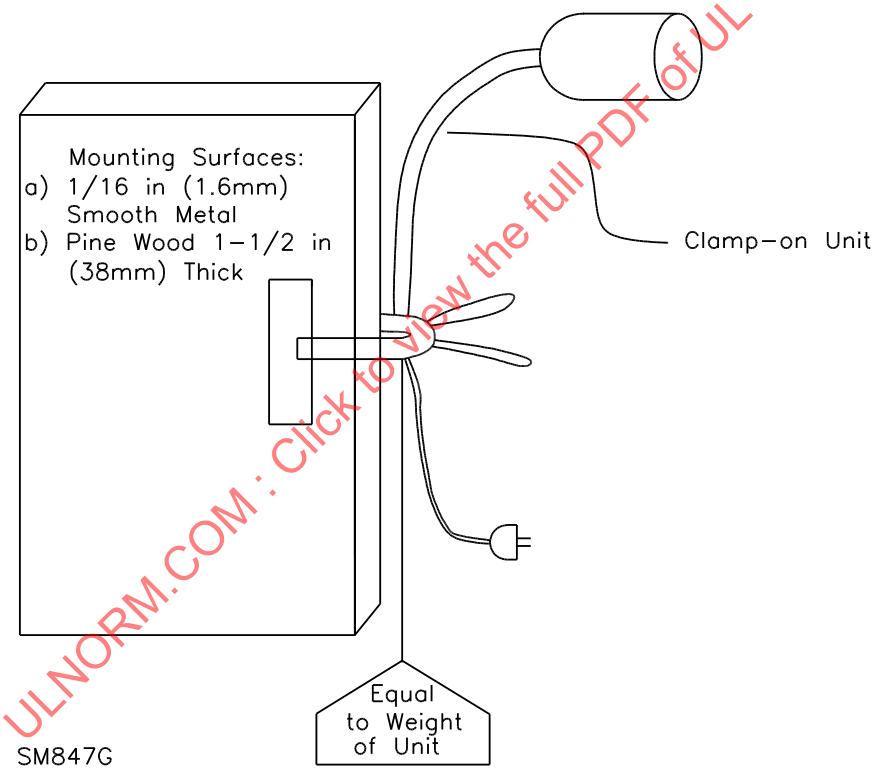
a) The unit is to be clamped to a smooth vertical unpainted metal surface 1/16 inch (1.6 mm) thick. A weight equal to the weight of the unit is to be attached at the point where the clamp is secured to the unit. See Figure 181.1.

b) The test is to be repeated with the unit clamped to a smooth, unpainted pine wood surface 1-1/2 inches (38 mm) thick.

c) For each of the above conditions, the weight is to be applied gradually and maintained for one hour.

Figure 181.1

Clamp-on unit setup



181.2.2 Any friction material not permanently secured to the spring clip is to be removed prior to conducting the tests in 181.2.1.

181.3 Test results

181.3.1 The portable luminaire shall not fall from the mounting surface as a result of the test. Pivoting of the unit is not prohibited.

TRACK-STYLE UNIT TESTS

182 Mechanical Means of Polarity Test

182.1 General

182.1.1 The following test described in 182.2 applies to interchangeable and track-style type units. Compliance criteria is described in 182.3.

182.2 Test method

182.2.1 An ohmmeter is to be connected between the two power-supply cord connectors that supply the unit.

182.2.2 An adapter that is wired to complete the circuit in 182.2.1 when inserted as intended, is to be inserted into the base (interchangeable unit) or bus-bar (track-style type unit) in an attempt to defeat the means of maintaining polarity. When a twist motion is normally used to insert the device, a torque of 15 pound-inches (1.7 N-m) is to be applied for 1 minute.

182.3 Test results

182.3.1 The test results meet the intent of the requirements when:

a) The adapter and base or bus-bar show no damage affecting performance or construction;

b) The ohmmeter shows no evidence that permanent electrical contact was made; and

c) There is no reduction of spacings to values below the minimum spacing values specified in Electrical Spacing, Section 24.

183 Track Clip Securement Test

183.1 General

183.1.1 A mounting clip shall be tested as described in 183.2. Compliance criteria is described in 183.3.

183.2 Test method

183.2.1 A clip is to be mounted to a track as intended. The track is to be:

a) Supported at both ends so that the track is in a horizontal position; and

b) Oriented so that the track is upside-down with the clip at the midpoint of the track.

A 25 pound (11.4 kg) weight is to be suspended from the clip for 5 minutes.

183.2.2 The test described in 183.2.1 is to be repeated with the track:

a) In a position that simulates wall mounting; and

b) Oriented so the longitudinal openings on the track are horizontal.

183.3 Test results

183.3.1 Test results meet the intent of the requirement when:

a) The clip remains in the intended mounting position without evidence of pulling away from the track; and

b) The track is not distorted so that it results in:

1) A reduction of spacings below the minimum required values specified in Electrical Spacings, Section 24; and

2) Uninsulated live parts or internal wiring becoming accessible to contact.

PORTABLE LUMINAIRE KIT AND SUBASSEMBLY TEST

184 Assembly and Installation Test

184.1 General

184.1.1 The following test described in 184.2 applies to a portable luminaire kit and subassembly which requires assembly by the user. Compliance criteria is described in 184.3.

184.2 Test method

184.2.1 The portable luminaire kit and subassembly is to be assembled or installed in accordance with the instructions provided by the manufacturer and evaluated in accordance with this standard. All required tests shall be conducted on the assembled product in accordance with this standard.

184.2.2 When more than one method of assembly is detailed in the instructions, each method shall be evaluated.

184.3 Test results

184.3.1 Test results meet the intent of the requirements when the assembled product complies with all requirements of the standard.

WORK LIGHT TESTS

185 Guard Securement Test

185.1 General

185.1.1 These requirements are applicable to work lights that rely on a securing means in accordance with 126.2.5.

185.2 Test method

185.2.1 A guard shall be subjected to the following forces, in any direction, in an attempt to remove the guard from the unit:

a) A 5 pound (2.27 kg) push force; and

b) For other than a tripod mounted unit, a pull off force equal to 4 times the weight of the unit, or 20 pounds (9.07 kg), whichever is less.

185.2.2 The results meet the intent of the requirement when the guard remains attached to the unit and complies with 126.2.3.

WET LOCATION USE TESTS

186 Rain and Sprinkler Tests

186.1 General

186.1.1 A portable luminaire that is intended to be used in wet locations shall be subjected to the rain test described in 186.2 and 186.3 and the sprinkler test described in 186.2 and 186.4. Compliance criteria is described in 186.5.

Exception: The rain test and sprinkler test are not required when the construction features of the unit are such that it is readily apparent that water does not enter the unit during its intended use.

186.2 Test method – general

186.2.1 A portable luminaire shall be positioned in the most severe position permitted by its base and any adjustment means.

186.2.2 A portable luminaire provided with a gasketed joint in the lamp compartment that is opened for relamping shall have the joint opened and reclosed prior to the rain and sprinkler tests. The unit shall be operated a minimum of 1/2-hour prior to opening the gasketed joint.

186.2.3 A portable luminaire with a load-side connector or convenience receptacle shall have the water shield required by 132.3.1 in place for the duration of the test. For an interconnected unit, the test shall be repeated with a cord set plugged into the connector if the water-excluding features of the water shield are different than those of the mating attachment plug.

186.2.4 The rain and sprinkler tests are to be conducted in the operating sequence illustrated in Table 186.1.

186.2.5 Immediately following the rain or sprinkler test, when there are accessible dead metal parts, the portable luminaire shall be subjected to the Dielectric Voltage-Withstand Test, Section 159.

Table 186.1
Operating sequence

Duration in hours	Lamp	Water
1	On	Off
1/2	Off	On
2	On	On
1/2	Off	On

186.3 Test method – rain test

186.3.1 The rain test apparatus is to consist of three spray heads mounted in a water supply pipe rack as shown in Figure 186.1. Spray heads are to be constructed in accordance with the details shown in Figure 186.2. The portable luminaire is to be set up as in a normal installation when so intended. The enclosure is to be positioned in the focal area of the spray heads so that the greatest quantity of water enters the enclosure. The water pressure is to be maintained at 5 pounds per square inch (34.5 kPa) at each spray head.