JOINT CANADA-UNITED STATES
NATIONAL STANDARD

ANSI/CAN/UL 8754:2024

STANDARD FOR SAFETY

Holders, Bases, and Connectors for Solid-State (LED) Light Engines and Arrays

ANSI/UL 8754-2024

SCC FOREWORD

National Standard of Canada

A National Standard of Canada is a standard developed by a Standards Council of Canada (SCC) accredited Standards Development Organization, in compliance with requirements and guidance set out by SCC. More information on National Standards of Canada can be found at www.scc.ca.

SCC is a Crown corporation within the portfolio of Innovation, Science and Economic Development (ISED) Canada. With the goal of enhancing Canada's economic competitiveness and social well-being, SCC leads and facilitates the development and use of national and international standards. SCC also coordinates Canadian participation in standards development, and identifies strategies to advance Canadian standardization efforts.

Accreditation services are provided by SCC to various customers, including product certifiers, testing laboratories, and standards development organizations. A list of SCC programs and accredited bodies is publicly available at www.scc.ca.

UL Standard for Safety for Holders, Bases, and Connectors for Solid-State (LED) Light Engines and Arrays, ANSI/CAN/UL 8754

Second Edition, Dated May 16, 2024

Summary of Topics

This new Second Edition of ANSI/CAN/UL 8754 dated May 16, 2024 incorporates editorial changes including renumbering and reformatting to align with current style.

The requirements are substantially in accordance with Proposal(s) on this subject dated September 1, 2023.

No Text on This Page

ANSI/UL 8754-2024

MAY 16, 2024

ANSI/CAN/UL 8754:2024

Standard for Holders, Bases, and Connectors for Solid-State (LED) Light Engines and Arrays

First Edition – July, 2013

Second Edition

May 16, 2024

This ANSI/CAN/UL Safety Standard consists of the Second Edition.

The most recent designation of ANSI/UL 8754 as an American National Standard (ANSI) occurred on May 16, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface or SCC Foreword.

This Standard has been designated as a National Standard of Canada (NSC) on date May 16, 2024.

No Text on This Page

CONTENTS

No Text on This Page

Preface

This is the Second Edition of ANSI/CAN/UL 8754, Standard for Holders, Bases, and Connectors for Solid-State (LED) Light Engines and Arrays.

ULSE is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL 8754 Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

Annex A, identified as Normative, forms a mandatory part of this Standard.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

This Second Edition joint American National Standard and National Standard of Canada is based on, and now supersedes, the First Edition of UL 8754 and the First Edition of CAN/ULC S8754.

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

Our Standards for Safety are copyrighted by ULSE Inc. Neither a printed nor electronic copy of a Standard should be altered in any way. All of our Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of ULSE Inc.

This Edition of the Standard has been formally approved by the Technical Committee (TC) for Field-Replaceable LED Light Engines, TC 8753.

This list represents the TC 8753 membership when the final text in this Standard was balloted. Since that time, changes in the membership may have occurred.

TC 8753 Membership

Name	Representing	Interest Category	Region
Besmanoff, Barry	Litelab Corp	Supply Chain	USA
Caamano, Juan	UL Solutions	Testing & Standards Org.	USA
Carpenter, Fred	Acuity Brands Lighting Inc	Producer	USA
Chou, Mike	Great Consultant Service (GCS) Co., Ltd.	General Interest	Chinese Taipei
Coric, Milos	UL Standards & Engagement	TC Chair (Non-Voting)	USA
Dinic, Tatjana	Ontario Electrical Safety Authority	Authorities Having Jurisdiction	Ontario

TC 8753 Membership Continued on Next Page

TC 8753 Membership Continued

Name	Representing	Interest Category	Region
Jackson, Pete	City of Bakersfield	Authorities Having Jurisdiction	USA
Mattatall, Robert	Mattatall Signs Limited	Supply Chain	Nova Scotia
May, Mike	DVA MayDay Corp, Dba Deltavation	Producer	USA
Morales, Julio	UL Standards & Engagement	TC Project Manager (Non-Voting)	USA
O'Neill, Joseph	Wilger Testing	General Interest	USA
Rittenhouse, Dennis	University of Waterloo	General Interest	Canada
Savage, Michael	Marion County, FL	Authorities Having Jurisdiction	USA
Schapira, Francisco	Leviton Mfg Co. Inc.	Producer	USA
Stimac, Tom	GE Lighting Solutions L L C	Producer	USA
Sullivan, Brad	Technical Safety BC	Authorities Having Jurisdiction	British Columbia
Venkataramanan, Venkat	University of Toronto	General Interest	British Columbia
Willis, Karen	National Electrical Manufacturers Association (NEMA)	Non-Voting	USA
Woods, Thomas	A A G Stucchi North America INC	Producer	USA
Zhang, Yefeng	Signify	Producer	China

International Classification for Standards (ICS): 29.140.01; 29.140.40; 31.080.10

This Standard is intended to be used for conformity assessment.

The intended primary application of this Standard is stated in its scope. It is important to note that it remains the responsibility of the user of the standard to judge its suitability for this particular application.

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE

1 Scope

1.1 This Standard specifies the requirements applicable to holders, bases and connectors intended for solid-state (LED) light engines and arrays for installation in lighting equipment, provided that they employ a configuration not typically found on incandescent or fluorescent light sources.

1.2 This Standard does not cover lampholders with screw, bayonet or pin-type bases intended to be compatible with incandescent or fluorescent lamps. Such lampholders are covered under CSA C22.2 No. 43 / UL 496.

1.3 This Standard does not cover wire connectors. Such connectors are covered under CSA C22.2 No. 65 / UL 486A-486B or CSA C22.2 No. 2459 / UL 2459.

2 Glossary

2.1 For the purpose of this Standard, the following definitions apply:

2.2 BASE – That part of a lampholder that is used for mounting of the device.

2.3 CURRENT-INTERRUPTING DEVICE – A component (such as a switch or breaker) intended to stop the flow of current in a lampholder circuit.

2.4 ENCLOSURE – That part or parts of a lampholder that:

a) Renders inaccessible all or any parts of the equipment that may otherwise present a risk of electric shock, or

b) Retards propagation of flame caused by electrical disturbances occurring within.

2.5 INSULATION, BASIC – The insulation necessary to provide basic protection against the risk of electric shock. This insulation may be in the form of vulcanized fiber, an inorganic or polymeric material, or an air gap.

2.6 INSULATION, DOUBLE – An insulation system comprised of both basic insulation and supplementary insulation.

2.7 INSULATION, REINFORCED – A single insulation system with such mechanical and electrical qualities that it, in itself, provides the same degree of protection against the risk of electric shock as does double insulation.

NOTE: The term "single insulation system" does not necessitate that the insulation must be in one homogeneous piece. The insulation system may comprise two or more layers that cannot be tested as supplementary or basic insulation.

2.8 INSULATION, SUPPLEMENTARY – An independent insulation provided in addition to the basic insulation to provide protection against the risk of electric shock in case of breakdown of the basic insulation.

2.9 LAMP BASE – The part of a lamp that engages the lampholder and makes contact with the electrical circuits of the lampholder.

2.10 LAMP CONNECTOR – A type of lampholder that provides electrical connection to a lamp but does not provide mechanical support; sometimes known as a lamp-supported lampholder.

2.11 LAMPHOLDER – A wiring device intended for making connection to the electrical circuits of a lamp and, in some cases, providing support.

2.12 LAMPLOCK – A feature intended to keep a lamp from being removed except by a person having a key or special tool.

2.13 LED ARRAY (LED MODULE) – An assembly of one or more LED packages or dies on a printed circuit board or substrate, possibly with optical elements and additional thermal, mechanical, and electrical interfaces that are intended to connect to the load side of an LED driver.

2.14 LED LIGHT ENGINE (LIGHT ENGINE) – An integrated assembly comprised of an LED array (LED module), LED driver, and other optical, thermal, mechanical and electrical components. The device is intended to connect directly to the branch circuit through a custom or industry-standard lamp base. This lamp base shall be of a type not typically found on incandescent or fluorescent light sources.[a]

[a] With permission from IES RP-16, Nomenclature and Definitions for Illuminating Engineering, by the Illuminating Engineering Society of North America.

2.15 LIMITED APPLICATION DEVICE (LAD) – Lampholders that:

a) Are only suitable for connection to low voltage, low energy circuits supplied from a Class 2 or LVLE source; or

b) Are solely used to provide mechanical support to the light engine and its components, and provide no direct support of live parts.

NOTE: The following clauses contain requirements, exceptions or notes applicable to limited application devices: 4.2.3, 4.2.6, 4.5.2, 4.8.5.2, 4.9.10, 4.12.3, 5.1.1, 5.3.1, 5.3.3, 6.2, and 7.3.3.

2.16 LIVE PART – A metal or other conductive part that, during intended use, has an electrical potential difference with respect to earth ground or any other conductive part. By definition, the grounded (or neutral) mains supply conductor is considered to be a live part.

2.17 LOCATION, DAMP – An interior or exterior location that is normally or periodically subject to condensation of moisture, including partially protected locations. The interior of a luminaire or sign intended for wet locations is considered a damp location.

NOTE: Examples of damp locations include partially protected locations under canopies, marquees, roofed open porches, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold storage warehouses.

2.18 LOCATION, DRY – A location not normally subject to dampness. Dry locations include locations subject to temporary dampness, as in the case of a building under construction, provided ventilation is adequate to reduce the likelihood of accumulation of moisture.

2.19 LOCATION, WET – A location in which water or other liquid can drip, splash, or flow on or against a device.

NOTE: Examples include vehicle washing areas, showers, or unprotected locations exposed to weather.

2.20 RATED CURRENT – The current declared by the manufacturer to indicate the highest current for which the device is rated.

2.21 RATED VOLTAGE – The voltage declared by the manufacturer to indicate the highest working voltage for which the device is rated.

2.22 SEALING COMPOUND – An insulating material that may be used to insulate live parts on the underside of a lampholder from the surface to which it is intended to be mounted or used to fill a void for the purpose of reducing clearances.

2.23 SET SCREW – A threaded device for securing a lampholder to its support or for securing leads within a terminal assembly.

2.24 SOLID-STATE LIGHTING ASSEMBLY – An LED light engine or array intended for factory installation into end-product lighting equipment in a manner not intended for servicing by end users (i.e., servicing performed by qualified personnel only).

2.25 SOLID-STATE ASSEMBLY HOLDER – A wiring device that couples a solid-state lighting assembly to the end-product lighting equipment in a manner not intended for servicing by end users (i.e., servicing performed by qualified personnel only). The coupling is either electrical or both electrical and mechanical.

2.26 SYSTEM, DEFINED-FIT – A group of modular components (e.g., lampholders, light engines, associated mounting and thermal control hardware) defined and evaluated as a unique lighting system for use in luminaires and similar equipment (see 4.16).

2.27 TERMINAL – Provision for the connection of supply conductors.

2.28 TERMINAL, INSULATION DISPLACEMENT (PIERCING) – A terminal to which insulated conductors are secured by forcing them through an integral blade assembly, piercing through their insulation in the process.

2.29 TERMINAL, PUSH-IN – A terminal in which the stripped end of a conductor is pushed into the terminal and the clamping pressure is maintained by a spring mechanism without the use of screws.

2.30 TERMINAL, SCREW – A terminal in which the conductor is bent around the screw and clamped directly under the head of the screw when it is tightened.

2.31 UPSET – A process for peening, staking, cross threading, or rounding, for example, a screw's shaft end to prevent it from loosening or being backed out.

2.32 VULCANIZED FIBER – A material normally used as electrical insulation, made by combining layers of chemically jelled paper. "Fish paper" is a designation commonly used in the trade to refer to thin sheets of electrical grade vulcanized fiber.

2.33 WORKING VOLTAGE – The highest voltage to which an electrical component or insulating barrier could be subjected when the equipment is operating under any condition of normal use.

3 General

3.1 Reference publications

3.1.1 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.

3.1.2 Throughout this Standard, and in references to requirements in CSA C22.2 No. 43 / UL 496, the word "lamp" is understood to also comprise solid-state (LED) light engines and arrays.

3.1.3 The following publications are referenced in this Standard:

ASTM D36/D36M, *Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)*

ASTM E28, *Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus*

ASTM E230/E230M, *Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples*

CSA C22.1, *Canadian Electrical Code, Part I, Safety Standard for Electrical Installations*

CSA C22.2 No. 0, *General Requirements – Canadian Electrical Code, Part II*

CSA C22.2 No. 0.1, *General Requirements for Double-Insulated Equipment*

CSA C22.2 No. 0.2, *Standard for Insulation Coordination*

CSA C22.2 No. 0.3, *Test Methods for Electrical Wires and Cables*

CSA C22.2 No. 0.15, *Standard for Adhesive Labels*

CSA C22.2 No. 0.17, *Standard for Evaluation of Properties of Polymeric Materials*

CSA C22.2 No. 18.1, *Metallic Outlet Boxes*

CSA C22.2 No. 34, *Electrode Receptacles, Fittings, and Connectors for Gas Tubes*

CSA C22.2 No. 35, *Standard for Extra-Low-Voltage Control Circuit Cable, Low-Energy Control Cable, and Extra-Low-Voltage Control Cable*

CSA C22.2 No. 37, *Christmas Tree and Other Decorative Lighting Outfits*

CSA C22.2 No. 38, *Thermoset-Insulated Wires and Cables*

CSA C22.2 No. 42, *General Use Receptacles, Attachment Plugs, and Similar Wiring Devices*

CSA C22.2 No. 43, *Lampholders*

CSA C22.2 No. 49, *Standard for Flexible Cords and Cables*

CSA C22.2 No. 65, *Standard for Wire Connectors*

CSA C22.2 No. 75, *Thermoplastic-Insulated Wires and Cables*

CSA C22.2 No. 107.1, *Standard for General Use Power Supplies*

CSA C22.2 No. 127, *Standard for Equipment and Lead Wires*

CSA C22.2 No. 153, *Standard for Electrical Quick-Connect Terminals*

CSA C22.2 No. 158, *Terminal Blocks*

CSA C22.2 No. 182.3, *Standard for Special Use Attachment Plugs, Receptacles, and Connectors*

CSA C22.2 No. 198.1, *Standard for Extruded Insulating Tubing*

CSA C22.2 No. 210, *Standard for Appliance Wiring Material Products*

CSA C22.2 No. 250.13, *Standard for Light Emitting Diode (LED) Equipment for Lighting Applications*

CSA C22.2 No. 256, *Direct Plug-In Nightlights*

CSA C22.2 No. 2459, *Standard for Insulated Multi-pole Splicing Wire Connectors*

NEMA C78.901, *Electric Lamps – Single-Based Fluorescent Lamps – Dimensional and Electrical Characteristics*

NEMA_ANSLG C81.61, *Electrical Lamp Bases – Specifications for Bases (Caps) for Electric Lamps*

NEMA_ANSLG C81.62, *Electric Lampholders*

NEMA_ANSLG C81.63, *Gauges for Electric Lamp Bases and Lampholders*

NFPA 70, *National Electrical Code*

UL 44, *Thermoset-Insulated Wires and Cables*

UL 62, *Flexible Cords and Cables*

UL 83, *Thermoplastic-Insulated Wires and Cables*

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

UL 224, *Extruded Insulating Tubing*

UL 310, *Electrical Quick-Connect Terminals*

UL 486A-486B, *Wire Connectors*

UL 486E, *Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors*

UL 496, *Lampholders*

UL 498, *Attachment Plugs and Receptacles*

UL 514A, *Metallic Outlet Boxes*

UL 588, *Seasonal and Holiday Decorative Products*

UL 746A, *Polymeric Materials – Short Term Property Evaluations*

UL 746B, *Polymeric Materials – Long Term Property Evaluations*

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

UL 746D, *Polymeric Materials – Fabricated Parts*

UL 746E, *Polymeric Materials – Industrial Laminates, Filament Wound Tubing, Vulcanized Fibre, and Materials Used in Printed Wiring Boards*

UL 746F, *Polymeric Materials – Flexible Dielectric Film Materials For Use In Printed-Wiring Boards and Flexible Materials Interconnect Constructions*

UL 758, *Appliance Wiring Material*

UL 796, *Printed Wiring Boards*

UL 840, *Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment*

UL 879, *Electric Sign Components*

UL 969, *Marking and Labeling Systems*

UL 1581, *Reference Standard for Electrical Wires, Cables, and Flexible Cords*

UL 1786, *Direct Plug-In Nightlights*

UL 1993, *Self-Ballasted Lamps and Lamp Adapters*

UL 2097, *Double Insulation Systems for Use in Electronic Equipment*

UL 2459, *Insulated Multi-Pole Splicing Wire Connectors*

UL 8750 *Light Emitting Diode (LED) Equipment for Use in Lighting Products*

UL 8753, *Field-Replaceable Light Emitting Diode (LED) Light Engines*

3.2 Components

3.2.1 Except as indicated in 3.2.2, a component of a product covered by this Standard shall comply with the requirements for that component. See 3.1.3 for a list of standards covering components generally used in products covered by this Standard. A component shall comply with the standard(s) appropriate for the country where the product is to be used.

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

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

b) Is superseded by a requirement in this Standard.

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

3.2.4 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.

3.3 Units of measurement

3.3.1 The values given in SI (metric) units shall be normative. Any other values given shall be for information only.

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

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

4 Construction

4.1 Enclosures

4.1.1 A lampholder enclosure shall have the necessary strength and rigidity to resist the abuses likely to be encountered during normal service. The degree of resistance inherent in the unit shall preclude breaking, warping, or cracking without the required spacings being reduced or parts becoming loosened or displaced.

4.1.2 A lampholder enclosure shall not warp, creep, crack, or distort under conditions of arcing, temperature, and mechanical stress that are likely to occur in service.

4.1.3 Polymeric enclosure materials shall comply with the requirements in 4.2.

4.1.4 An adhesive used to secure the enclosure shall comply with the adhesive support test in CSA C22.2 No. 250.13 / UL 8750. Fusion techniques, such as solvent cementing, ultrasonic welding, electromagnetic induction, and thermal welding are not subject to this test.

4.1.5 Enclosures that are assembled using snap-together components shall comply with the Deflection Test in 5.8.

Exception: This test is not required for snap-together components additionally secured by adhesive or fusion techniques.

4.2 Insulating materials

4.2.1 All polymeric materials used in a lampholder shall comply with 4.2.2 – 4.2.6. When a material is used for more than one purpose, the most stringent requirements shall be applied.

4.2.2 Lampholders employing molded polymeric materials shall comply with the mold stress-relief distortion test specified in Clause 5.2.17 of CSA C22.2 No. 43 / UL 496 as specified for fluorescent lampholders.

4.2.3 A polymeric material used to enclose electrical parts or to provide direct or indirect support of live parts shall have a flame class rating of at least V-2, as determined by CSA C22.2 No. 0.17 / UL 94.

Exception: Polymeric materials used in limited application devices may be classified HB.

4.2.4 A polymeric insulating material used to enclose electrical parts, to provide direct or indirect support of live parts or to provide mechanical support shall possess a minimum electrical relative thermal index (RTI) of 90 °C (194 °F), as determined by CSA C22.2 No. 0.17 / UL 746B.

Exception: A minimum RTI is not specified for polymeric materials used in limited application devices (see 6.3 and Table 4.1).

Table 4.1
Test Plan Summary Using CSA C22.2 No. 43 / UL 496

Test description	Reference	Number and description of samples
Tests for push-in terminals[a]	CSA C22.2 No. 43 / UL 496, Clause 5.1.3	6 samples, if device has such terminals.
Rain test[a]	CSA C22.2 No. 43 / UL 496, Clause 5.2.14	6 samples, if device is marked for wet locations.
Insulation-piercing terminal lampholder temperature test[a]	CSA C22.2 No. 43 / UL 496, Clause 5.2.15	18 samples, if device has such terminals (6 additional samples if device is switched).
Mold Stress-Relief Distortion	CSA C22.2 No. 43 / UL 496, Clause 5.2.17	6 samples, if device employs thermoplastic material.
NOTE: This table is a summary of test samples typically needed. Actual number of samples may vary where agreeable to all parties concerned.		
[a] Not required for a limited application device (LAD). [b] Performed in accordance with the test method for fluorescent lampholders. For limited application devices, the oven temperature shall be maintained at 10 °C (18 °F) above the thermoplastic material's RTI rating.		

4.2.5 The polymeric enclosure of a lampholder marked for wet location use shall comply with the ultraviolet light exposure test specified in CSA C22.2 No. 0.17 / UL 746C.

4.2.6 Polymeric materials used for direct support of live parts, or as electrical insulation, shall have the following performance level classes (PLC), as determined by CSA C22.2 No. 0.17 / UL 746A:

a) A Hot Wire Ignition (HWI) in accordance with CSA C22.2 No. 0.17 / UL 746C,

b) A High-current Arc resistance to Ignition (HAI) in accordance with CSA C22.2 No. 0.17 / UL 746C,

c) A Comparative Tracking Index (CTI) of 2 or less for materials directly exposed to weather, and

d) A Comparative Tracking Index (CTI) of 3 or less for all other materials.

Exception: Does not apply to limited application devices.

4.3 Sealing compound

4.3.1 The depth or thickness of sealing compound over a live nut, screw head, or rivet shall not be less than 1.6 mm (1/16 in). If the underside of the base is not recessed and if in some cases it will be in contact with the surface upon which the lampholder is mounted, the depth or thickness of the sealing compound shall not be less than 3.2 mm (1/8 in).

4.3.2 Sealing compound shall be insulating and shall not soften at a temperature of 15 °C (27 °F) above the relative thermal index (RTI) of the thermoplastic enclosure material in which it is imbedded, but not lower than 105 °C (221 °F). Compliance shall be determined by ASTM E28 or ASTM D36, as applicable to the material.

4.3.3 Sulfur shall not be acceptable as a sealant.

4.4 Mounting

4.4.1 A mounting bracket shall be attached to the lampholder, or at least two securement points shall be employed, such that neither the lampholder nor any lampholder component can rotate during installation or removal of a lamp. A single rivet or screw shall not be considered to prevent rotation unless additional means such as projections, keys, or the like are provided to restrict movement.

4.4.2 A mounting hole tapped to receive a screw shall be acceptable if it contains no fewer than two threads for the screw if in metal, or no fewer than five threads if in insulating material. Spring clips, clamps, or other means that provide equivalent support and restriction of rotation may also be used.

4.4.3 Live screw heads or nuts on the underside of a base designed for surface mounting shall be countersunk not less than 3.2 mm (1/8 in) in the clear, and then covered with a waterproof, insulating, sealing compound that complies with 4.3.2.

NOTE: If such parts are staked, upset, or otherwise secured so they cannot loosen, they may be insulated from the mounting surface by material other than sealing compound or by 12.7 mm (1/2 in) or more air separation from the mounting surface.

4.5 Accessibility of live parts

4.5.1 Accessibility to uninsulated live parts of a lampholder shall be determined while the lampholder is completely assembled and mounted as intended:

a) Without a lamp,

b) With the appropriate lamp inserted, and

c) During the insertion or removal of a lamp.

4.5.2 An uninsulated live part of a lampholder shall not be accessible, as determined by the probe test described in 4.5.3.

Exception No. 1: An uninsulated live part that is not energized when it is accessible need not comply with this requirement.

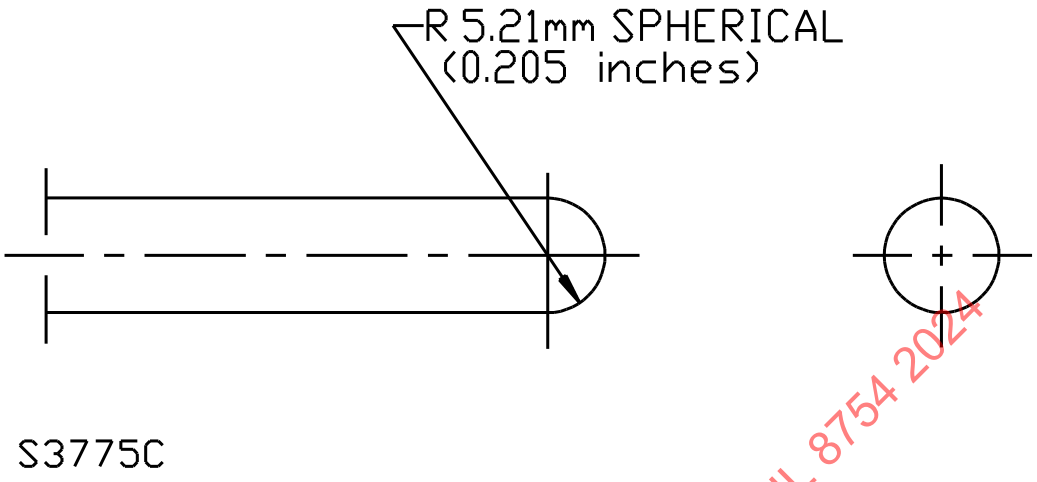
NOTE: A circuit-interrupting device used to disconnect uninsulated live parts from the ungrounded supply shall comply with 4.10.

Exception No. 2: Does not apply to limited application devices.

4.5.3 The rod probe illustrated in Figure 4.1 shall not contact live parts when inserted through any openings in an enclosure, with the probe in every possible position. The probe shall be used as measuring instruments to judge accessibility and not as instruments to judge the strength of the material. Where necessary, an electrical indicator may be used to determine whether contact is made with live parts.

Figure 4.1

Rod Probe



4.6 Corrosion protection

4.6.1 Iron and steel parts and other parts not inherently corrosion-resistant shall be protected against corrosion by painting, enameling, galvanizing, plating, or other equivalent means.

4.7 Current-carrying parts

4.7.1 Current-carrying parts shall be made of:

a) Copper or copper alloy, with or without plating, or

b) Stainless steel.

Aluminum and aluminum alloys shall not be used, either as a part or as plating.

NOTE: When used as lamp contacts, the suitability of these metals to resist damage due to arcing will be determined by the Abnormal Overload Test in 5.4.

4.7.2 All current carrying parts shall be sized to suitably carry rated current. Compliance shall be determined by the Temperature Rise Test in 5.5.

4.7.3 Zinc or cadmium plating shall not be used on terminal parts of a lampholder where the parts will come in contact with branch circuit conductors other than the grounding conductors.

4.7.4 A current-carrying part shall be secured such that it cannot be turned relative to the surface on which it is mounted.

4.7.5 Positive electrical contact shall be maintained at any point at which a connection is made between current-carrying parts.

4.8 Supply connections

4.8.1 General

4.8.1.1 A lampholder shall be capable of being readily wired as intended. If a lampholder is intended for the connection of conductors, wiring terminals or leads shall be provided.

4.8.1.2 A lampholder may employ solder terminals provided that such lampholders are marked in accordance with 7.1.5. The solder terminals may be in the form of a terminal plate with a hole, an eyelet connected to a lampholder contact, or other such termination.

4.8.1.3 Lampholders provided with wiring terminals shall accept wires at least as large as 18 AWG.

4.8.1.4 Lampholders that employ push-in terminals that can accept 14 AWG wires shall reject 12 AWG or larger wires. Compliance shall be determined by the Tests for Push-in Terminals in CSA C22.2 No. 43 / UL 496.

4.8.2 Screw terminals

4.8.2.1 A screw for securing lead wires shall be of the wire-binding type.

4.8.2.2 A terminal plate having a tapped hole for a wire-binding screw shall be of metal not less than 0.76 mm (0.03 in) thick and shall not have fewer than two full threads in the metal.

4.8.2.3 For a binding screw having 32 or more threads per in (25.4 mm), a terminal plate formed from stock not less than 0.76 mm (0.03 in) thick may have the metal extruded at the screw hole to provide two full threads for the binding screw.

4.8.2.4 With reference to the requirement in 4.8.2.2, metal having a thickness of not less than 1.52 mm (0.06 in) shall be considered acceptable for a tapped hole for a screw having 32 threads per in (25.4 mm).

4.8.2.5 A terminal employing a wire-binding screw shall be provided with upturned lugs or the equivalent to hold a wire under the head of the screw.

4.8.2.6 A wire-binding screw shall thread into metal.

4.8.2.7 Thread-cutting screws shall not be used for field connections.

4.8.3 Push-in terminals

4.8.3.1 Push-in terminals shall be suitable for all intended wire sizes and types. Compliance shall be determined by the Security of Leads Test specified in 5.11.

4.8.3.2 Lampholders with push-in terminals shall comply with the marking requirements in 7.1.4.

4.8.4 Set screws

4.8.4.1 Lampholders employing set screws for supply connections shall be specified for use only with solid or tinned stranded wire, and shall comply with the performance requirements specified in CSA C22.2 No. 158 / UL 486E.

4.8.5 Lead wires

4.8.5.1 Lead wires shall be of appliance wiring material, flexible cord, or fixture wire and shall be suitable for the application.

4.8.5.2 Lead wires shall not be less than 18 AWG (0.82 mm^2).

Exception No. 1: Lead wires smaller than 18 AWG (0.82 mm^2) and not smaller than 24 AWG (0.21 mm^2) may be used when the leads are intended to be completely enclosed, not subject to movement in the end-product and the leads are not more than 152 mm (6 in) long.

Exception No. 2: Does not apply to limited application devices.

4.8.5.3 Lead wires intended for connection to branch circuit conductors shall be not less than:

a) 100 mm (4 in) measured from the outside of the lampholder body, and

b) 152 mm (6 in) for a grounding lead wire, if provided.

4.8.5.4 A soldered connection shall be made mechanically and electrically secure before soldering.

4.8.5.5 Lead wires shall be prevented from contacting edges which contain burrs that could damage the lead insulation.

4.8.5.6 Leads shall be securely terminated to the electrical components of the lampholder. Compliance shall be determined by the Security of Leads Test in 5.11.

4.8.6 Quick-connect terminals

4.8.6.1 Quick-connect terminals shall comply with the applicable requirements in CSA C22.2 No. 153 / UL 310.

4.8.7 Polarization

4.8.7.1 A conductor terminal intended for connection of the neutral conductor of the branch circuit shall be substantially white in color or shall be marked "neutral", "W", "N", or "white" adjacent to the terminal.

4.8.7.2 A white terminal plate of a binding-screw terminal that is plainly visible after wiring may serve as the terminal identification specified in 4.8.7.1 if all the line-terminal binding screws are of the same color.

4.8.7.3 If the terminal that would be plated white to comply with the requirement in 4.8.7.1 is not visible, the wire-entrance hole for the connection to that terminal shall be marked with the word "white" or colored white directly adjacent to the lead wire entry hole.

4.8.8 Grounding leads

4.8.8.1 A grounding lead, if provided, shall have insulation that is green, with or without one or more yellow stripes.

4.8.9 Insulation displacement (piercing) terminals

4.8.9.1 Insulation displacement terminals shall be suitable for all intended wire sizes and types. Compliance shall be determined by the Insulation-Piercing Terminal Lampholder Temperature Tests in CSA C22.2 No. 43 / UL 496.

4.8.9.2 Lampholders with insulation displacement terminals shall comply with the marking requirements in 7.1.6.

4.9 Creepage distances and clearances

4.9.1 Creepage distances and clearances shall be measured with and without a lamp installed as intended. If the lampholder employs a current-interrupting device that de-energizes all parts in the absence of a lamp, the spacing shall be measured only with a lamp installed.

Exception: The spacings for a solid-state assembly holder may be measured with its intended solid-state lighting assembly installed.

4.9.2 On a spring contact lampholder, the creepage distances and clearances shall be maintained in any position up to 3.2 mm (1/8 in) from the fully depressed position of the spring.

Exception: The spacings for a solid-state assembly holder may be measured with its intended solid-state lighting assembly installed.

4.9.3 Uninsulated live parts that are supported by friction alone and movable non-current-carrying metal parts in proximity to uninsulated live parts shall maintain the minimum creepage distances and clearances specified under all conditions.

4.9.4 For the purpose of these measurements, the lampholder mounting surface shall be considered to be a grounded, non-current-carrying metal part.

4.9.5 A dead metal screw head, rivet, or the like shall not be considered accessible if, after the device is installed in the intended manner, the dead metal part is located in a maximum 7.1 mm (9/32 in) diameter hole and is recessed not less than 4.8 mm (3/16 in).

4.9.6 A non-current-carrying dead metal part interposed between live parts of opposite polarity or between a live part and a grounded or exposed non-current-carrying metal part shall be considered as reducing the spacing by the dimension of the interposed non-current-carrying metal part.

4.9.7 Minimum spacings between lampholder wiring terminals; such as between these terminals and other uninsulated live parts, or between these terminals and dead-metal parts, shall be in accordance with Table 4.2.

Table 4.2
Minimum Spacings at Lampholder Wiring Terminals

Potential (V)	Shortest distance[a] (mm)
0 – 600	(6.4)
[a] Between terminals and either dead-metal parts or other live parts	

4.9.8 Minimum spacings for other than lampholder wiring terminals; such as between uninsulated live parts of opposite polarity, between an uninsulated live part and a grounded dead-metal part, or between an uninsulated live part and an accessible dead-metal part, shall be in accordance with Table 4.3.

Table 4.3
Minimum Spacings at Other Than Lampholder Wiring Terminals

Location type	Potential (V)	Shortest distance[a] (mm)
Dry or damp	0 – 250	(1.2)
Dry or damp	277	(1.4)
Dry or damp	300	(1.6)
Dry or damp	600	(3.2)
Wet	0 – 600	(4.8)

[a] Intermediate distance values for potentials between 250 V and 600 V in dry or damp locations may be linearly interpolated.

4.9.9 Other than for spacings involving wiring terminals, a dead-metal enclosure, or the lampholder mounting surface; spacings defined in 4.9.8 are alternatively permitted to be in accordance with CSA C22.2 No. 0.2/ UL 840. The following conditions apply:

a) Overvoltage Category II

b) Pollution degree 3, for live parts in wet locations

c) Pollution degree 2, for live parts in dry or damp locations

d) Pollution degree 1, for live parts that are completely encapsulated or potted

4.9.10 Limited application devices need not comply with 4.9.

4.10 Current-interrupting devices

4.10.1 A current-interrupting device (such as a switch or fuse) shall be rated for the voltage and current of the circuit in which it is connected.

4.10.2 A current-interrupting device shall disconnect the ungrounded supply.

4.10.3 A current-interrupting device shall not be connected in the grounded (neutral) conductor unless the device connects and disconnects the grounded conductor and all ungrounded conductors simultaneously.

4.10.4 A lampholder provided with a current interrupting device shall comply with the Switching Mechanism Test of 5.10.

4.11 Lamplocks

4.11.1 A lampholder provided with a special feature, such as a lamplock, shall be so constructed that operation of the feature as in actual service does not damage the enclosure; does not result in the loosening of any of the parts of the complete assembly; and does not expose live parts for persons to contact unintentionally.

4.12 Lampholder configuration

4.12.1 The configuration shall be of a type not typically found on ANSI or IEC-compliant incandescent or fluorescent lampholders. For example: Edison-types (e.g., E12, E17, E26), bayonet-types (e.g., BA15, GU10, GU24, GX53) and fluorescent pin types (e.g., G5, G13) shall not be used.

4.12.2 A lampholder that is part of a defined-fit system shall:

a) Have an electrical and mechanical configuration that complies with all applicable specifications and dimensional gauges for that system, and

b) Be marked with the system's designation on the lampholder body in accordance with 7.1.2.

4.12.3 Lampholders shall be able to withstand the electrical and mechanical stresses particular to their intended use. Compliance shall be determined by the Millivolt Drop (see 5.2), Mechanical Cycling (see 5.3), Abnormal Overload (see 5.4), Temperature Rise (see 5.5) and Loading (see 5.6) tests.

Exception: Limited application devices only need to comply with the Mechanical Cycling (see 5.3) and Loading (see 5.6) tests.

4.13 Grounding

4.13.1 Accessible non-current-carrying (dead) metal parts separated from live parts by only basic insulation shall be bonded to ground if the working voltage of the live parts exceeds 150 V to ground.

4.13.2 In lieu of the grounding requirement in 4.13.1, double insulation is permitted. Double insulated devices shall comply with CSA C22.2 No. 0.1 / UL 2097 and be marked per 7.3.2.

4.13.3 When applying CSA C22.2 No. 0.1 / UL 2097, use the following criteria:

a) Reinforced insulation may be used wherever double insulation is required;

b) When a clearance or a creepage distance is acting as reinforced insulation, the required distance shall be twice the value specified by 4.9.

4.13.4 If a lampholder is provided with a contact surface or an electrical contact for grounding accessible dead metal parts on a light engine, then it shall be arranged such that during device installation, the grounding-conductor contact shall engage before the supply contacts. During disconnection, the supply contacts shall disconnect before the grounding-conductor contacts (ground shall be first to make, last to break).

4.13.5 Devices with grounded, accessible dead metal shall comply with the Grounding Contact Test in 5.7.

4.14 Mass

4.14.1 A lampholder's retention means shall be sufficiently robust to reliably support both a 200 g (0.44 lb) device and withstand loads created by any associated hardware (e.g., spring-loaded heatsink). Compliance shall be determined by the Loading Test in 5.6, using a 500 g (1.1 lb) device mass to represent all loads.

Exception No. 1: Lampholders that form part of a defined-fit system shall be evaluated for the mass specified by their system.

Exception No. 2: Lampholders are not prohibited from being evaluated for the support of greater masses.

Exception No. 3: This requirement does not apply to solid-state assembly holders limited to supporting a total load of 110 g (0.25 lb) or less.

4.15 Environmental considerations

4.15.1 These lampholders may be used in either dry or damp locations unless marked for wet location use.

4.15.2 Lampholders marked for wet location use shall comply with the Rain Test, Clause 5.2.14.5, of CSA C22.2 No. 43 / UL 496.

4.15.3 The inside of a wet location device is considered a damp location as long as there is no water ingress during the Rain Test.

4.16 Defined-fit system

4.16.1 A defined-fit system shall have all of the following characteristics:

a) The system shall be defined in a controlled document or series of controlled documents which shall be publicly available.

b) The document(s) shall identify and define the electrical, mechanical and thermal specifications for the components in the system.

c) The mechanical and electrical configuration of holders shall be unique to the system and intended to disallow (reject) mating with non-system light engines.

d) The mechanical and electrical configuration of light engines shall be unique to the system and intended to disallow (reject) mating with non-system holders.

e) The system shall define measuring techniques and tolerances for checking dimensional specifications, which may be accomplished using controlled gauges.

f) The system shall allow for field-replacement of light engines by end-users (comparable to the lamp in an incandescent luminaire).

g) The system shall define a unique identifier or set of identifiers (e.g., alphanumeric codes, symbols) that allow end-users to verify that a light engine is electrically, mechanically and thermally compatible with a particular end-product luminaire during light engine installation or replacement.

5 Tests

5.1 General

5.1.1 The test plan summary in Table 4.1 and Table 5.1 is a summary of the required tests and the number of samples required for each test. The tests in Table 4.1 shall be performed in accordance with the tabulated CSA C22.2 No. 43 / UL 496 clauses.

Table 5.1
Test Plan Summary

Test description	Reference	Number and description of samples
Millivolt drop test[a,b]	5.2	3 samples.
Mechanical cycling test[b]	5.3	3 samples, same ones used for millivolt drop.
Abnormal overload test[a,b]	5.4	3 samples.
Temperature rise test[a]	5.5	3 samples.
Loading test	5.6	3 samples.
Grounding contact test[a]	5.7	3 samples, if provided with grounding means.
Deflection test[a]	5.8	3 samples.
Humidity conditioning[a]	5.9	3 samples.
Switching mechanism[a]	5.10	3 samples.
Security of leads[a]	5.11	3 samples.
Dimensional conformity test	5.12	Number of samples depends on fit system.
NOTE: This table is a summary of test samples typically needed. Actual number of samples may vary where agreeable to all parties concerned.		
[a] Not required for a limited application device (LAD). [b] Not required for a solid-state assembly holder.		

5.2 Millivolt drop test

5.2.1 The test shall be conducted using the lamp base shorting fixture described in 8.1.

5.2.2 When tested as described in 5.2.3, the drop in potential across the lampholder contacts shall not exceed 200 mV at rated current, when measured across the lampholder's wiring terminals, both before and after the mechanical cycling test in 5.3.

5.2.3 With the lamp base shorting fixture fully inserted into the lampholder, the voltage drop across the lampholder's supply terminals shall be measured. A DC supply, with its output current limited to within 2 % of the lampholder's rating, shall supply the current for this test.

5.3 Mechanical cycling test

5.3.1 After the "as received" millivolt drop test in 5.2, each of the three lampholder samples shall be subjected to 500 cycles of insertion and removal using the lamp base fixture without mechanical malfunction or damage. The samples shall be unpowered for this test.

Exception: For limited application devices, the millivolt drop test is not conducted beforehand.

5.3.2 During each cycle, the lamp base fixture shall be fully inserted into the lampholder in a manner that simulates normal use, with the fixture's contacts fully engaging the lampholder's contacts.

5.3.3 After cycling, the millivolt drop test in 5.2 shall be repeated.

Exception: Not applicable to limited application devices.

5.4 Abnormal overload test

5.4.1 The test shall be conducted using the lamp base overload fixture described in 8.2.

5.4.2 Three samples of the lampholders shall be subjected to the Abnormal Overload Test in CSA C22.2 No. 2459 / UL 2459, and as amended below.

5.4.3 The fixture shall be connected to a suitable load so that, when fully inserted into the lampholder, it causes the lampholder to draw 150 ±5 % of its rated current at rated voltage. The fixture shall then be inserted and removed from the lampholder to make and break the specified current for 50 cycles of operation, at a rate no greater than 10 cycles per min.

5.4.4 The power factor of the load shall be 0.5 ±0.05 leading (capacitive).

5.5 Temperature rise test

5.5.1 The temperature rise on the terminals and internal current-carrying parts of a lampholder shall not exceed 30 °C (86 °F) when carrying rated current. The test shall be conducted on three samples using the lamp base shorting fixtures described in 8.1.

5.5.2 The lampholders shall be wired in series. If the lampholders are provided with wire terminals, they shall be wired with 18 AWG wire, each 456 mm (18 in) long. If the lampholders are provided with wire leads, the leads shall be 152 mm (6 in) long.

5.5.3 With a lamp base shorting fixture fully inserted into each lampholder, a supply source was used to cause rated current to flow through the lampholders. The test current shall be within 2 % of the rated value. Temperatures shall be measured after they have stabilized, when:

a) The test has been running for a minimum of 7.5 h, or

b) The test has been running for a minimum of 3 h, and three successive readings taken at 15-min intervals are within 1 °C (1.8 °F) of one another and are not rising.

5.5.4 The test was conducted on an open bench in a 25 ±5 °C (77 ±9 °F) ambient. The readings were normalized to 25 °C (77 °F) to determine compliance.

5.6 Loading

5.6.1 A lampholder shall support a load equal to its maximum device mass (see 4.14.1) plus four times that mass for 1 min. This force shall be applied perpendicular to the lamp base interface.

NOTE: For example, if the lampholder is being tested for a device mass of 500 g (1.1 lb), then the test mass shall be 2500 g (5.51 lb) (including mass of lamp base).

5.6.2 If the lampholder is articulated, or has more than one mounting configuration, the lampholder shall be articulated or mounted such that the force applied by this test imparts the greatest bending moment (torque) on the lampholder's mounting surface.

5.6.3 With the lampholder securely mounted as intended, a compatible lamp base shall be fully inserted into the lampholder. Enough mass shall then be attached to the lamp base to attain the test mass, in such a manner that the force is applied along the center of the lamp base. This load shall be applied for one min. The test mass shall be within 2 % of the target value.

5.6.4 There shall be no physical damage to the lampholder, nor deflection or deformation during or after loading that reduces electrical spacings.

5.7 Grounding contact test

5.7.1 Three samples of the lampholder shall be subjected to the Grounding Contact – Short-time Withstand Current Test in CSA C22.2 No. 2459 / UL 2459, and as amended below.

5.7.2 For each sample, one conductor shall be secured to the lampholder's ground terminal in the intended manner. The other conductor shall be securely soldered or welded to the accessible non-current-carrying metal parts on the sample. The conductor size used shall be the largest gauge rated for the lampholder, but no smaller than 18 AWG.

5.7.3 The test current shall be within 5 % of the target value.

5.8 Deflection test

5.8.1 The enclosure of a lampholder shall be capable of withstanding a force of 89 ±5 N (20 ±1 lbf), applied using a 12 mm (0.472 in) diameter rod with a hemispherical end, without damage to the enclosure or exposing internal electrical parts.

5.8.2 The holder shall be mounted as intended, with no light engine installed. The force shall be applied along a joint of snap-together parts or to any part of the enclosure, and shall be gradually increased from zero until the specified value is reached and then maintained for a period of 1 min.

5.9 Humidity conditioning (followed by dielectric voltage withstand)

5.9.1 A device having accessible non-current-carrying metal parts shall be exposed for 48 h to moist air having a relative humidity of 93 ±5 % at a temperature of 25 ±2 °C (77 ±3.6 °F). Following the 48-h period and while still exposed to moist air, the device shall be subjected to the dielectric voltage-withstand test.

Exception: Alternatively, conditioning may be conducted in an atmosphere having 88 ± 5% relative humidity at a temperature of 32 ±2 °C (90 ±3.6 °F), or 93 ±5 % relative humidity at a temperature of 28 ±2 °C (82 ±3.6 °F).

5.9.2 The dielectric voltage-withstand test described in 5.9.1 shall be conducted as described in 5.10.3.3 and 5.10.3.4.

5.9.3 There shall be no dielectric breakdown as a result of this test.

5.10 Switching mechanism test

5.10.1 General

5.10.1.1 A lampholder provided with a switching mechanism shall be capable of performing acceptably when subjected to the overload test and the endurance test in accordance with the requirements in 5.10.2 – 5.10.3.

5.10.2 Overload test

5.10.2.1 During the test, there shall be no electrical or mechanical breakdown of the equipment, no undue burning or pitting of contacts and no welding of contacts.

5.10.2.2 With the lampholder connected to a test voltage within 5 % of rated voltage, the device contacts shall be connected in the manner representative of intended use to a tungsten-filament (or equivalent)