ANSI/CAN/UL 8800:2025

JOINT CANADA-UNITED STATES NATIONAL STANDARD

STANDARD FOR SAFETY

Horticultural Lighting Equipment And Systems

ANSI/UL 8800-2025

SCC FOREWORD

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UL Standard for Safety for Horticultural Lighting Equipment And Systems, ANSI/CAN/UL 8800

First Edition, Dated August 30, 2019

Summary of Topics

This revision of ANSI/CAN/UL 8800 dated March 18, 2025 includes the following changes in requirements:

– Horticultural Luminaires for Non-Residential Use Only; 5.5, Section 15A, 19.4.4

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 requirements are substantially in accordance with Proposal(s) on this subject dated November 29, 2024.

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ANSI/CAN/UL 8800:2025

Standard for Horticultural Lighting Equipment And Systems

First Edition

August 30, 2019

This ANSI/CAN/UL Safety Standard consists of the First Edition including revisions through March 18, 2025.

The most recent designation of ANSI/UL 8800 as an American National Standard (ANSI) occurred on March 18, 2025. 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 March 18, 2025.

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Preface

This is the First Edition of the ANSI/CAN/UL 8800, Standard for Safety Horticultural Lighting Equipment And Systems.

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 8800 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.

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.

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.

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This Edition of the Standard has been formally approved by the Technical Committee (TC) on Horticultural Lighting Equipment And Systems, TC 8800.

This list represents the TC 8800 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

TC 8800 Membership

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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

INTRODUCTION

1 Scope

1.1 The requirements contained in this Standard apply to lighting equipment intended for use in a horticultural environment and installed in accordance with the U.S. National Electrical Code (NEC), ANSI/NFPA 70 and the Canadian Electrical Code, Part I (CEC), CSA C22.1.

1.2 Equipment covered by this Standard is intended for horticultural lighting purposes and includes: horticultural luminaires, hardware and horticultural systems intended for use in a plant growth environment.

1.3 Lighting equipment that provides broadband white light such as light for general illumination, or whose primary purpose when applied to plantings is aesthetic and/or sustaining plant life is not considered horticultural lighting.

1.4 The photobiological safety assessment within this standard evaluates the light output characteristic of a single horticultural luminaire. Applicable cautionary or warning markings are then required on the product and in the installation and operating instructions. Increased exposure risk to facility personnel may be present depending upon the number of horticultural luminaires and their placement and/or positioning within the plant growth facility.

1.5 It is the responsibility of the plant growth facility to address the risks specified in 1.4 at the facility level and to ensure that people entering the plant growth areas while the lights are on, are aware of these risks and that appropriate safeguards are in place.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this Standard shall comply with the requirements for that component.

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.

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

3 Units of Measurement

3.1 The values given in SI (metric) units shall be normative. Any other values shall be for information purposes only. See Annex A for metric conversion multipliers.

3.2 Temperatures are given in degrees Celsius only.

3.3 Unless indicated otherwise, all voltage and current values specified in this Standard are root-mean-square (rms).

4 Normative References

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

4.2 The following standards are referenced in this Standard, portions of these referenced standards may be essential for compliance.

ASTM Standards

ASTM G 151, *Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources*
ASTM G 153, *Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials*
ASTM D 1000, *Standard Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications*
ASTM D 5374, *Test Methods for Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation*
ASTM D 5423, *Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation*

UL Standards

UL 73, *Motor-Operated Appliances*
UL 496, *Lampholders*
UL 498, *Attachment Plugs and Receptacles*
UL 507, *Electric Fans*
UL 746B, *Polymeric Materials – Long Term Property Evaluations*
UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*
UL 746E, *Polymeric Materials – Industrial Laminates, Filament Wound Tubing, Vulcanized Fibre, and Materials Used In Printed Wiring Boards*
UL 817, *Cord Sets and Power-Supply Cords*
UL 962, *Household and Commercial Furnishings*
UL 1598, *Luminaires*
UL 1951, *Electric Plumbing Accessories*
UL 1977, *Component Connectors for Use in Data, Signal, Control and Power Applications*
UL 1993, *Self-Ballasted Lamps and Lamp Adapters*
UL 2108, *Low Voltage Lighting Systems*
UL 2238, *Cable Assemblies and Fittings for Industrial Control and Signal Distribution*
UL 8750, *Light Emitting Diode (LED) Equipment for Use in Lighting Products*
UL 60335-1, *Safety of Household and Similar Electrical Appliances, Part 1: General Requirements*
UL 60335-2-24, *Household and Similar Electrical Appliances – Safety – Part 2-24: Particular Requirements for Refrigerating Appliances, Ice-Cream Appliances and Ice-Makers*

CSA Group Standards

CSA C22.1, *Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations*
CSA C22.2 No. 0, *General Requirements – Canadian Electrical Code, Part II*
CSA C22.2 No. 0.17, *Evaluation of Properties of Polymeric Materials*
CSA C22.2 No. 21, *Cord Sets and Power Supply Cords*
CSA C22.2 No. 42, *General Use Receptacles, Attachment Plugs and Similar Wiring Devices*
CSA C22.2 No. 43, *Lampholders*
CSA C22.2 No. 113, *Fans and Ventilators*
CSA C22.2 No. 68, *Motor Operated Appliances (Household and Commercial)*
CSA C22.2 No. 182.3, *Special Use Attachment Plugs, Receptacles, and Connectors*
CSA C22.2 No. 250.0, *Luminaires*

CSA C22.2 No. 250.2, *Lighting Systems*
CSA C22.2 No. 250.13, *Light Emitting Diode (LED) Equipment For Lighting Applications*
CSA C22.2 No. 1993, *Self-Ballasted Lamps and Lamp Adapters*
CAN/CSA C22.2 No. 60335-1, *Household and Similar Electrical Appliances – Safety – Part 1: General Requirements*
CAN/CSA C22.2 No. 60335-2-24, *Household and Similar Electrical Appliances – Safety – Part 2-24: Particular Requirements for Refrigerating Appliances, Ice-Cream Appliances and Ice-Makers*

IEC Standards

IEC 60598-1, *Luminaires – Part 1: General Requirements and Tests*
IEC 61032, *Protection of Persons and Equipment by Enclosures – Probes for Verification*
IEC 62471, *Photobiological Safety of Lamps and Lamp Systems*
IEC/TR 62471-2, *Photobiological Safety of Lamps and Lamp Systems – Part 2: Guidance on Manufacturing Requirements Relating to Non-Laser Optical Radiation Safety*

NFPA Standards

NFPA 70, *National Electrical Code (NEC)*

5 Glossary

5.1 For the purpose of this Standard, the following definitions apply.

5.2 CONFORMAL COATING – A protective covering applied on a printed wiring board to increase the dielectric voltage-withstand capability between conductors and to protect against environmental conditions. A conformal coating is not suitable as electrical insulation or as an electrical enclosure without additional evaluation.

5.3 HORTICULTURAL LUMINAIRE – A horticultural luminaire identified as such and intended to emit light at wavelengths that are intended for growing flowers, vegetables, and other plants. Horticultural luminaires may also supplement general illumination within the horticultural environment.

5.4 HORTICULTURAL SYSTEM – A prefabricated chamber, cabinet, or open frame structure of which identified for the purpose outfitted with electrical infrastructure for the active optimization of plant growth. These systems may incorporate pre-installed materials and equipment which, after installation, may be concealed and may not be accessible for inspection at the final installation site. They may additionally include lighting, shutters, controls, control panels, plumbing components (such as pump motors, solenoid valves, water reservoirs), and cooling and heating components, as part of the plant growth management control horticultural system. A horticultural system may include hydroponic, aeroponic, aquaponic and other forms of irrigation methods. Passive growing structures, such as greenhouses or tent like coverings, are not considered horticultural lighting structures in the context of this Standard.

5.5 NON-RESIDENTIAL (HORTICULTURAL) LUMINAIRE – A horticultural luminaire that is not intended for installation in a dwelling.

NOTE: Dwelling refers to the defined term from NFPA 70.

6 Organization and Application

6.1 The standard is organized as follows:

a) Part I – Horticultural luminaires

b) Part II – Horticultural Systems.

PART I – HORTICULTURAL LUMINAIRES

CONSTRUCTION

7 General

7.1 A horticultural luminaire shall be capable of being installed in accordance with U.S. and Canadian Electrical Installation Codes as noted in 1.1, be provided with electrical insulation and enclosure(s) suitable for the intended grow environment, and safeguard against risk of shock, risk of fire, risk of personal injury, and to safeguard persons against exposure to optical radiation hazard under normal operating conditions.

8 Mechanical Construction

8.1 General requirements

8.1.1 A horticultural luminaire shall comply with the requirements in UL 1598 or CSA C22.2 No. 250.0, for "Mechanical construction," "Mounting means," "Open holes and openings," "Accessibility of supply connections," and, as applicable, the additional requirements in this section of the Standard.

8.2 UV protection of polymeric materials

8.2.1 A polymeric material such as an enclosure, barrier, baffle, or water shield exposed to the sun shall not degrade such that it no longer performs its intended function. Compliance shall be determined in accordance with either the UV Exposure Conditioning Test of UL 1598 or CSA C22.2 No 250.0, or the Ultraviolet Light Exposure Test of UL 746C or CSA C22.2 No. 0.17.

9 Electrical Construction

9.1 General requirements

9.1.1 A horticultural luminaire shall comply with the requirements in UL 1598 or CSA C22.2 No. 250.0, for "Electrical construction," the supplementary requirements for flexible cords on luminaires, and, as applicable, the additional requirements in this section of the Standard.

9.2 UV protection of polymeric materials

9.2.1 Polymeric electrical insulating material of wiring, a component or a device, such as a conductor, cord, lampholder body, connectors body, attachment plug body, or the like, directly exposed to the sun shall not degrade such that it no longer performs its intended insulating function. Compliance shall be determined in accordance with either the UV Exposure Conditioning Test of UL 1598 or CSA C22.2 No. 250.0, or UL 746C or CSA C22.2 No. 0.17.

9.3 Supply connections

9.3.1 A horticultural luminaire having metal parts or metallized polymeric parts that are accessible during user maintenance, or component replacement without the use of tools, and that can involve the risk of shock, shall be provided with a means of connection to a single branch circuit and shall have provisions for grounding in accordance with UL 1598 or CSA C22.2 No. 250.0, using one of the following methods:

a) Provisions for connection of conduit or other permanent wiring method as indicated in UL 1598 or CSA C22.2 No. 250.0;

b) A length of a flexible cord;

c) A length of flexible cord with an assembled-on plug having a NEMA configuration;

d) A power supply cord (length of flexible cord with a molded-on plug) having a NEMA configuration; or

e) Provisions for a proprietary wiring system (harness) and the markings in accordance with 19.1.2.

9.3.2 A proprietary wiring system (harness) shall comply with the requirements in UL 817 or CSA C22.2 No. 21, and other applicable requirements in this Standard.

9.3.3 A horticultural luminaire with provisions for connection to the branch circuit using one of the methods in 9.3.1 (c) through (e), shall comply with the leakage current measurement test of UL 8750 or CSA C22.2 No. 250.13.

9.4 Connections to a remote power source

9.4.1 A horticultural luminaire intended for connection to a remote power source shall be provided with a means of connection to the remote power source (LED driver, fluorescent ballast, or HID ballast) using one of the following methods:

a) Provisions for connection of conduit or other permanent wiring method as indicated in UL 1598 or CSA C22.2 No. 250.0;

b) A length of a flexible cord;

c) A length of flexible cord with an assembled-on plug having a non-NEMA configuration;

d) A power supply cord (length of flexible cord with a molded-on plug having a non-NEMA configuration); or

e) Provisions for a proprietary wiring system (harness).

9.4.2 A proprietary wiring system (harness) shall comply with the applicable requirements in UL 817 or CSA C22.2 No. 21, and other applicable requirements in this Standard.

9.4.3 Plugs and connectors on the output side of a remote power unit shall have a configuration different than one used for supply connections in 9.3.

9.5 Flexible cord

9.5.1 Flexible cord may be used for the purpose of connecting a horticultural luminaire to the branch circuit, for the purpose of interconnecting horticultural luminaires, or for connecting a horticultural luminaire to a remote power source (e.g. LED driver, fluorescent ballast, or HID ballast).

9.5.2 Flexible cord used in accordance with 9.3 and 9.4 shall be:

a) At least of the hard-usage type as defined in UL 1598 or CSA C22.2 No. 250.0;

b) No less than 18 AWG (0.82 mm^2) and sized suitable for the current associated with its application taking into account manufacturer instructions for connection of interconnection cords and additional loads;

c) Rated for a voltage, current and temperature suitable for the application; and

d) Rated "water resistant" for lighting equipment having a "wet location", or "indoor wet location" or "IP" rating for protection against water ingress and "UV resistant" if exposed to the sun or to a light source having UV radiation output characteristics.

9.5.3 For additional consideration for the use of flexible cord, see required installation instructions in Installation and Operating Instructions, Section 20.

9.6 Attachment plugs, mating receptacles, and connectors

9.6.1 Attachment plugs, mating receptacles, and connectors shall be rated for the use, temperature, environmental condition, voltage, and current encountered during operation as described in the manufacturer's installation instructions.

9.6.2 Attachment plugs, mating receptacles, and connectors identified for horticultural use shall comply with the requirements in UL 498 or CSA C22.2 No. 42; or UL 1977 or UL 2238 or CSA 182.3 or CSA C22.2 No 42, if assembled-on; or UL 817 or CSA C22.2 No. 21, if molded-on. They shall additionally comply with applicable requirements in this Standard based on their intended use and application as described in the manufacturer's installation instructions.

9.6.3 The ground connection on attachment plugs and mating receptacles shall make first and break last.

10 LED horticultural luminaires

10.1 General

10.1.1 A horticultural luminaire having an LED light source shall additionally comply with the requirements in this section of the Standard.

10.2 Printed wiring boards

10.2.1 A printed wiring board shall comply with the requirements in UL 8750 or CSA C22.2 No. 250.13.

10.3 LED drivers, LED arrays (modules), LED control modules, LED packages, and LED self-ballasted lamps

10.3.1 An LED driver, LED array (module), LED control module, and LED package shall comply with the requirements in UL 8750 or CSA C22.2 No. 250.13, and any additional applicable requirements in this Standard as determined by their use and application and information contained in the manufacturer's installation instructions.

10.3.2 A LED self-ballasted lamp shall comply with the requirements in UL 1993 or CSA C22.2 No. 1993, and any additional applicable requirements in this Standard.

11 Fluorescent horticultural luminaires

11.1 General

11.1.1 A horticultural luminaire having a fluorescent light source shall additionally comply with "Fluorescent luminaires – supplementary requirements" in UL 1598 or CSA C22.2 No. 250.0.

12 HID horticultural luminaires

12.1 General

12.1.1 A horticultural luminaire having an HID light source shall additionally comply with the "HID luminaires – supplementary requirements" in UL 1598 or CSA C22.2 No. 250.0, and the additional requirements in this section of the Standard.

12.2 Metal halide (MH) lamps

12.2.1 A horticultural luminaire using Metal Halide (MH) lamps other than an ANSI "O" rated lamp, having a manufacturer's declared "open" rating will require additional supporting documentation from the lamp manufacturer as evidence of its "open" rating, or the horticultural luminaire shall be provided with a lamp containment barrier in accordance with the requirements in UL 1598 or CSA C22.2 No. 250.0.

12.3 Lampholders

12.3.1 A lampholder shall comply with the requirements in UL 496 or CSA C22.2 No. 43, and any applicable requirements in this Standard.

12.3.2 A lampholder intended to be used with a lamp that requires high-voltage starting pulses shall have a pulse rating suitable for the lamp starting voltage.

12.3.3 The insulation on the lampholder conductors and the conductors of the output circuit of a ballast that requires high-voltage starting pulses shall be rated a minimum of 600 V.

12.4 Accessibility of double-ended lamp terminals

12.4.1 Lamp terminals of a double-ended lamp shall not be accessible during relamping unless:

a) All ungrounded circuit conductors to the lamp are disconnected by an interlock switch before the parts become accessible;

b) The supply circuit to the lamp has one grounded conductor, the lamp terminals can only make initial contact with the grounded lampholder terminal and the lighting equipment is marked in accordance with 19.2.6; or

c) The supply circuit to the lamp has one grounded conductor, and the lighting equipment is marked in accordance with 19.2.6.

12.4.2 An interlock switch shall comply with the interlock switch endurance test in UL 1598 or CSA C22.2 No. 250.0.

13 Environmental Ratings

13.1 Damp and wet locations

13.1.1 A horticultural luminaire shall be rated suitable for a "damp" or "wet" location environment in accordance with the requirements in UL 1598 or CSA C22.2 No. 250.0. The determination for a "damp" or "wet" rating shall be based on the recommended installation environments in the manufacturer's installation instructions.

Exception: A horticultural luminaire is permitted to be marked "Suitable for Indoor Wet Locations" in accordance with Table B.1 when:

a) The construction complies with the "wet" location requirements as specified in 13.1.1;

Exception: Exposed polymeric materials specified in 8.2.1 and 9.2.1, are not required to be tested for exposure to ultraviolet light;

b) The luminaire's light source does not emit ultraviolet light; and

c) The manufacturer's installation instruction clearly indicate that the luminaire shall not be installed where exposed to direct sunlight (e.g.: within a greenhouse) or where exposed to electrically powered UV sources.

13.2 Exposure to dust and water (IP Codes)

13.2.1 A luminaire intended for use in an environment where it is exposed to excessive dust and water and is marked with an ingress protection code (IP code), shall be evaluated with the applicable tests for ingress of dust, solid objects and moisture of IEC 60598-1. The IP code marking on the horticultural luminaire shall be in format S24 – L2, in accordance with the marking requirements in UL 1598 and CSA C22.2 No. 250.0.

13.2.2 When evaluated in accordance with 13.2.1, a horticultural luminaire shall have a minimum rating of IP54 (protection for dust and water splashing).

14 Conformal Coatings

14.1 Conformal coatings serving as a protective covering applied on a printed-wiring board used to increase the dielectric voltage-withstand capability between conductors, between conductors and accessible dead metal parts and/or to protect against environmental conditions shall be evaluated in accordance with the UL 746E or the printed circuit board requirements in Annex F of CSA C22.2 No. 250.0.

PROTECTION AGAINST INJURY TO PERSONS

15 Photobiological Safety Assessment

15.1 A light source shall not pose a risk of optical injury to persons due to exposure necessary for the normal operation, maintenance and servicing of the equipment.

15.2 In order to determine compliance, a light source shall be subjected to a photobiological safety assessment across the wavelength range from 280 nm through 1400 nm in accordance with the requirements in IEC 62471. The assessment is to determine the level of optical radiation emitted, if any, within the following spectral bands. The measurement distance from the light source to the measuring instrument shall be set at 20 cm (7.9 in) as recommended in IEC 62471 for a non-GLS (general lighting services) light source.

a) Ultraviolet hazard – 280 nm to 400 nm;

b) Retinal blue light hazard – 300 nm to 400 nm;

c) Retinal blue light or thermal hazard – 400 nm to 780 nm;

d) Cornea/lens infrared hazard – 780 nm to 1400 nm; and

e) Retinal thermal. weak visual stimulus hazard – 780 nm to 1400 nm.

15.3 The assigned risk group classification for the lighting equipment resulting from the photobiological safety assessment shall be Risk Group 0 (Exempt), Risk Group 1, or Risk Group 2.

15.4 Lighting equipment having a light source classified as Risk Group 3 is not permitted.

15.5 A horticultural luminaire having a user-replaceable light source, such as a fluorescent or HID lamp, is not required to comply with 15.1 and 15.2 providing the lighting equipment is marked in accordance with 19.4.3 and repeated in the installation instructions.

15A Photobiological Safety Assessment – Non-residential Luminaires Only

15A.1 This assessment serves as an alternative to criteria in Section 15, Photobiological Safety Assessment, for non-residential equipment that are intended exclusively for installation at a mounting height of at least 2.1 m (6.89 ft) above the finished floor, and when marked per 19.4.4.

15A.2 The assessment described in Section 15, Photobiological Safety Assessment, shall be conducted, as modified in 15A.3.

15A.3 In lieu of the measurement distance described in 15.2, the measurement distance from the light source used for this assessment is determined by subtracting 1.9 m (6.23 ft) from the minimum mounting height declared by the equipment manufacturer. The mounting height is the shortest distance from the lowest part of a unit to the finished floor.

Example: If the equipment is intended by the manufacturer for installation at a minimum mounting height of 2.5 m (8.2 ft), then the assessment distance from the light source to the measuring instrument shall be 0.6 m (1.97 ft).

PERFORMANCE

16 General

16.1 A horticultural luminaire shall comply with the applicable performance and test requirements in UL 1598 or CSA C22.2 No. 250.0, and the following tests in this section of the Standard.

17 Normal Temperature Test

17.1 A horticultural luminaire and any remote power source shall be subjected to testing in accordance with UL 1598 or CSA C22.2 No. 250.0, and the additional test requirements in this section of the Standard.

17.2 During the test, the horticultural luminaire shall be installed to represent the highest heat producing condition based on the recommended installation practices contained within the installation instructions provided by the horticultural luminaire manufacturer (see Installation and Operating Instructions, Section 20). This shall include considerations regarding the maximum recommended temperature of the installed environment, the recommended minimum distances between adjacent horticultural luminaires, and the recommended minimum distances to combustible surfaces including walls and ceilings.

18 Abnormal Temperature Test

18.1 A luminaire with integral active cooling means, such as a fan, shall comply with all of the following conditions when tested as described in 18.2 to 18.4:

a) A fuse equal to the branch circuit overcurrent protector specified for the equipment shall not open.

b) There shall be no emission of flame from the enclosure.

c) There shall be no glowing, charring, or ignition of the cheesecloth or tissue paper.

d) The 3 A fuse connected in series with the luminaire bonding circuit shall not open.

e) At the conclusion of the test, the unit shall not exhibit a risk of electric shock, fire, or injury hazards.

18.2 The unit shall be installed in accordance with the Normal Temperature Test, Section 17, 300 mm (11.8 inches) above a knot-free pine board covered by a layer of white tissue paper, or at the minimum distance as marked on the product. The entire enclosure shall be covered by a single layer of cheesecloth. The fan motor shall have its rotor locked in a fixed position by a secure means. If the unit has more than one identical fan, the most temperature onerous fan shall be locked, or the test shall be repeated for each fan.

18.3 A 3 A fuse shall be connected between ground and an equipment bonding circuit lead, bonding terminal, or accessible non-current-carrying metal enclosure of the unit being tested. The luminaire shall be connected to the output of its intended power source equipment or to a power supply with equivalent output, at rated voltage and frequency.

18.4 The unit shall be operated with the motor in a locked rotor state for 7 h or until there is interruption due to component failure, operation of a protective device, or any evidence of combustion, whichever comes first. If the test is interrupted by the opening of an internal protective component, the test shall be repeated two more times with a replacement protective component.

18.5 If a protective device in the unit (for example, a thermal or current cut-out of the one-shot or cycling type, or safety-related electronic circuit) operates during the test, the highest temperatures reached should be taken as the final temperatures and the test can be terminated. Test results shall be acceptable if the conditions specified in 18.1 (a) through (e) are satisfied and the thermal protection:

a) Operates within 3 h and the temperature of any part of the luminaire that may contact a mounting surface does not exceed 160 °C; or

b) Does not operate within 3 h, the test is continued for 7 h, and the temperature of any part of the unit that may contact a mounting surface does not exceed 90 °C.

MARKING AND INSTRUCTIONS

19 Markings

Advisory Note: In Canada, there are two official languages. Therefore, it is necessary to have CAUTION, WARNING, and DANGER instructions and markings in both English and French. Appendix B lists acceptable French translations of the CAUTION, WARNING, and DANGER instructions and markings specified in this Standard. When a product is not intended for use in Canada, instructions and markings may be provided in English only.

19.1 General

19.1.1 A horticultural luminaire shall comply with the marking requirements in UL 1598 or CSA C22.2 No. 250.0, and the marking requirements contained in this section of this Standard. Where a marking format such as S16-L1 is stated, the format refers to marking size and marking location in accordance with the marking format table in UL 1598 or CSA C22.2 No. 250.0.

19.1.2 A horticultural luminaire with provisions for a proprietary wiring system (harness) shall be marked "PROPRIETARY WIRING SYSTEM [Name, Part Number, Cautionary Marking]" in marking format S16-L2 or within the installation instructions.

19.2 HID horticultural luminaire markings

19.2.1 A horticultural luminaire using an HID lamp having an ANSI designation shall be marked with: "RELAMP WITH ___WATT ____TYPE LAMP" in marking format S16-L1. The blank space for lamp type should indicate the ANSI lamp designation and MH or HPS.

19.2.2 A horticultural luminaire using an HID lamp that does not have an ANSI designation shall be marked with: "RELAMP WITH ___WATT ____TYPE LAMP" in marking format S16-L1. The blank space for lamp type should indicate either MH or HPS.

19.2.3 A horticultural luminaire using a Metal-Halide (MH) lamp with an integral lamp containment barrier that does not have an ANSI lamp designation shall be marked with: "RELAMP WITH ___WATT ___TYPE LAMP" model ___, manufactured by ___" in marking format S16-L1.

19.2.4 A horticultural luminaire using an HID lamp and designed for use with a remote ballast and a lamp having an ANSI designation, shall be marked with: "USE BALLAST FOR _____ WATT _____TYPE LAMP" in marking format S16-L1. The blank space for lamp type should indicate the ANSI lamp designation and MH or HPS.

19.2.5 A horticultural luminaire using an HID lamp and designed for use with a remote ballast and a lamp not having an ANSI designation shall be marked with: "USE BALLAST FOR _____ WATT _____ VOLT _____ TYPE LAMP" in marking format S16-L1. The blank space for lamp type should indicate either MH or HPS.

19.2.6 A horticultural luminaire having double-ended HID lamps and complying with the requirements in 12.4.1(b) shall be marked adjacent to the lampholder connected to the grounded supply connection with: **"CAUTION – RISK OF SHOCK. DISCONNECT POWER BEFORE RELAMPING."** in marking format S16-L1.

19.2.7 A horticultural luminaire having double-ended HID lamps and complying with the requirements in 12.4.1(c) shall be marked adjacent to the lampholder connected to the grounded supply connection with: **"CAUTION – RISK OF SHOCK. DISCONNECT POWER BEFORE RELAMPING. INSERT IN THIS LAMPHOLDER FIRST."** in marking format S16-L1.

19.3 LED horticultural luminaire markings

19.3.1 A horticultural luminaire having an LED light source and an integral LED driver shall be marked with the input rating in volts, frequency in hertz, and total amperes or watts, in accordance with UL 1598 or CSA C22.2 No. 250.0.

19.3.2 A horticultural luminaire having an LED light source and intended for connection to a remote LED driver with a constant voltage output shall include the following marking information on the horticultural luminaire in the format S16-L3: constant voltage – voltage, nature of the supply (AC or DC), frequency (for AC rating only), and current or wattage.

19.3.3 A horticultural luminaire having an LED light source and intended for connection to a remote LED driver with a constant current output shall include the following marking information on the horticultural luminaire in the format S16-L3: constant current – current, nature of the supply (AC or DC), frequency (for AC rating only), and voltage or wattage.

19.4 Photobiological safety assessment markings

19.4.1 Lighting equipment having a light source classified as Risk Group 0 (Exempt) for all spectral bands tabulated in Photobiological Safety Assessment, Section 15, does not require any photobiological safety markings on the lighting equipment or within the installation and operating instructions.

19.4.2 Lighting equipment having a light source classified as Risk Group 1 or Risk Group 2 for one or more of the spectral bands tabulated in Photobiological Safety Assessment, Section 15, shall be provided with markings on the lighting equipment and repeated within the installation and operating instructions in accordance with labeling requirements in Figure 19.2 and Figure 19.3.

19.4.2A The product and instruction markings shall be provided verbatim in format S16 as defined in the Marking Section of UL 1598 or CSA C22.2 No. 250, and shall be in a location as following:

a) Product markings – Layout in accordance with 19.4.2B and Figure 19.2, provided on the product where visible after the horticultural luminaire is installed.

b) Instruction markings – Layout in accordance with 19.4.2B and Figure 19.3, provided on any instruction sheet packed with the product.

19.4.2B The product and instruction markings in 19.4.2 shall be presented in bold block print with a black-bordered two-section box on a yellow background, as follows:

a) The risk group classification in the upper box; and

b) The required labeling, information and guidance text in the lower box.

See Figure 19.2 and Figure 19.3 for graphical examples of the required verbiage and format.

19.4.3 Lighting equipment having a user-replaceable light source, such as a fluorescent or HID lamp that has not been evaluated to the requirements in Photobiological Safety Assessment, Section 15, shall be marked as shown in Figure 19.1. The marking shall appear on the lighting equipment in a location where visible after the equipment is installed and repeated in the installation and operating instructions. The marking shall be provided verbatim in format S16 as defined in the Marking Section of UL 1598 or CSA C22.2 No. 250.0. The marking shall appear within a black-bordered box on a yellow background.

Figure 19.1
Markings

WARNING – POSSIBLE RISK OF INJURY TO EYES AND SKIN
• Hazardous optical radiation may be emitted from the light source. Do not stare at operating lamp. May be harmful to the eyes. • UV may be emitted from the light source. Eye or skin irritation may result from exposure. Use appropriate shielding. • IR may be emitted from the light source. Do not stare at operating lamp.

Figure 19.2
Product Markings by Risk Group Classification

Ultraviolet hazard	**RISK GROUP 1**	**RISK GROUP 2**
	NOTICE – UV EMITTED FROM THIS PRODUCT.	**CAUTION – UV EMITTED FROM THIS PRODUCT.**
Retinal blue light hazard		**RISK GROUP 2**
	NONE	**CAUTION – POSSIBLY HAZARDOUS OPTICAL RADIATION EMITTED FROM THIS PRODUCT.**
Retinal blue light or thermal hazard		**RISK GROUP 2**
	NONE	**CAUTION – POSSIBLY HAZARDOUS OPTICAL RADIATION EMITTED FROM THIS PRODUCT.**
Cornea/lens infrared hazard	**RISK GROUP 1**	**RISK GROUP 2**
	NOTICE – IR EMITTED FROM THIS PRODUCT.	**CAUTION – IR EMITTED FROM THIS PRODUCT.**
Retinal thermal, weak visual stimulus hazard	**RISK GROUP 1**	**RISK GROUP 2**
	WARNING – IR EMITTED FROM THIS PRODUCT.	**WARNING – IR EMITTED FROM THIS PRODUCT.**

Figure 19.3
Instruction Markings by Risk Group Classification

Ultraviolet hazard	RISK GROUP 1	RISK GROUP 2
	NOTICE – UV EMITTED FROM THIS PRODUCT. MINIMIZE EXPOSURE TO EYES AND SKIN. USE APPROPRIATE SHIELDING.	CAUTION – UV EMITTED FROM THIS PRODUCT. EYE OR SKIN IRRITATION MAY RESULT FROM EXPOSURE. USE APPROPRIATE SHIELDING.
Retinal blue light hazard	NONE	RISK GROUP 2
		CAUTION – POSSIBLY HAZARDOUS OPTICAL RADIATION EMITTED FROM THIS PRODUCT. DO NOT STARE AT OPERATING LAMP. MAY BE HARMFUL TO THE EYES.
Retinal blue light or thermal hazard	NONE	RISK GROUP 2
		CAUTION – POSSIBLY HAZARDOUS OPTICAL RADIATION EMITTED FROM THIS PRODUCT. DO NOT STARE AT OPERATING LAMP. MAY BE HARMFUL TO THE EYES.
Cornea/lens infrared hazard	RISK GROUP 1	RISK GROUP 2
	NOTICE – IR EMITTED FROM THIS PRODUCT. USE APPROPRIATE SHIELDING OR EYE PROTECTION.	CAUTION – IR EMITTED FROM THIS PRODUCT. AVOID EYE EXPOSURE. USE APPROPRIATE SHIELDING OR EYE PROTECTION.
Retinal thermal, weak visual stimulus hazard	RISK GROUP 1	RISK GROUP 2
	WARNING – IR EMITTED FROM THIS PRODUCT. DO NOT STARE AT OPERATING LAMP.	WARNING – IR EMITTED FROM THIS PRODUCT. DO NOT STARE AT OPERATING LAMP.

19.4.4 Horticultural luminaires evaluated using the requirements in Section 15A, Photobiological Safety Assessment – Non-residential Luminaires Only, shall be marked "CAUTION – RISK OF PERSONAL INJURY. DO NOT INSTALL THIS EQUIPMENT IN A DWELLING" and "MOUNT THIS EQUIPMENT AT LEAST _____ [M] [FEET] ABOVE THE FLOOR". The blank space shall indicate the minimum mounting height above the finished floor declared by the manufacturer. These markings shall be provided both on the product (format S16-L2) and in the installation instructions (format S16-L5).

20 Installation and Operating Instructions

20.1 Installation and operating instructions shall be provided and shall contain specific information for proper installation, mounting, wiring, use, and servicing the lighting equipment based on its intended use and design. In addition, the following specific information shall be included:

a) Instructions for the minimum required distances between adjacent lighting equipment and between the lighting equipment and combustible materials such as walls, ceilings, movable partitions, and the like; and between lighting equipment and other heat generating equipment (providing these installation limitations are needed to prevent overheating of lighting equipment, other equipment, or combustible materials within the installation environment);

b) Instructions for the maximum temperature of the installed environment (ambient temperature) that will ensure safe operation of the lighting equipment and at least one example of how to control the temperature within the installed environment (example: a mechanical ventilation or cooling system is required to maintain the temperature within the growing space below __°F when the horticultural luminaire is in operation);

c) Instructions specifying the method for connecting the lighting equipment to the branch circuit or to a remote power unit or both;

d) For lighting equipment with cords or wiring harnesses, instructions shall include information to guide the installation such that cords:

1) Are not concealed or extended through a wall, floor, ceiling, or other parts of the building structure;

2) Are not located above a suspended ceiling or dropped ceiling;

3) Are not permanently affixed to the building structure;

4) Are routed so that they are not subject to strain and are protected from physical damage;

5) Are visible over their entire length; and

6) Are used within their rated ampacity as determined for the maximum temperature of the installed environment specified in the instructions.

e) Instructions repeating photobiological safety, cautionary and warning markings if applicable in accordance with Photobiological Safety Assessment Markings, Section 19.4. For horticultural luminaires requiring these markings, the installation and operating instructions shall include the following additional information:

"These photobiological safety markings are based on testing of the light output characteristic of a single horticultural luminaire. Increased exposure risk to facility personnel may be present depending upon the number of horticultural luminaires and their placement and/or positioning within the plant growth facility."

"It is the responsibility of the plant growth facility to address these risks at the facility level and to ensure that people entering the plant growth areas while the lights are on, are aware of these risks and that appropriate safeguards are in place."

f) Instructions for the intended installation environment (damp locations, indoor wet locations, wet locations), and dust and water ingress ratings for equipment having an IP rating.

PART II – HORTICULTURAL SYSTEMS

GENERAL

21 General Requirements

21.1 A horticultural system shall comply with the relevant mechanical and electrical construction, performance, marking and installation instruction requirements in UL 1951 or CSA C22.2 No. 68.

21.2 The overall mechanical strength of a rack horticultural system including shelves shall comply with the relevant requirements in UL 962 or CSA C22.2 No. 68 with respect to structural strength.

21.3 Luminaires and associated power units (i.e. ballasts, LED drivers, lighting controls) shall comply with the requirements in Part I of this Standard.

21.4 A motor operated mechanical assembly shall comply with the relevant requirements in UL 73 or CSA C22.2 No. 68, with respect to the risk of electric shock, fire, and casualty hazards.

21.5 A fan shall comply with the relevant mechanical and electrical construction, performance and marking requirements in UL 507 or CSA C22.2 No. 113.

21.6 The refrigeration portion of a horticultural system shall comply with the applicable construction, performance and marking requirements in UL 60335-1 and UL 60335-2-24 or CAN/CSA-C22.2 No. 60335-1 and CAN/CSA-C22.2 No. 60335-2-24.

SUPPLEMENT SA (NORMATIVE) – REQUIREMENTS FOR COATINGS SERVING AN ELECTRICAL AND/OR FIRE ENCLOSURE FUNCTION FOR LED ARRAYS

SA1 Scope

SA1.1 These requirements apply to polymeric coating material applied over the exposed surface of a LED array and its related components, for which the coating serves as an environmental protection barrier and as an enclosure to protect against the risk of electric shock and/or the risk of fire.

SA2 Glossary

SA2.1 For the purpose of this Supplement, the following definitions apply.

SA2.2 RISK OF ELECTRIC SHOCK – A risk of electric shock exists between any two conductive parts or between a conductive part and earth ground if the continuous current flow between the two points exceeds the leakage current limits determined by the Leakage Current Measurement Test, in UL 8750, and if the open circuit voltage exceeds the limits specified in Table SA2.1:

Table SA2.1
Voltage Limits

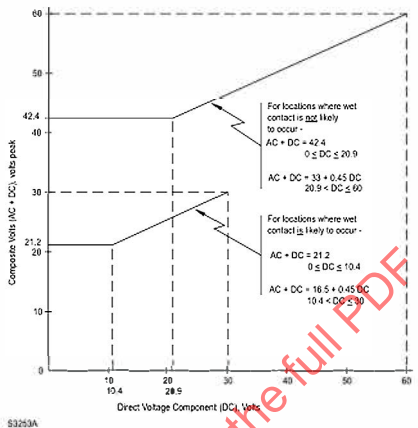
Waveform type[a]	Maximum voltage	
	Damp locations	Indoor Wet/Wet locations
Sinusoidal ac	30 V rms	15 V rms
Non-sinusoidal ac	42.4 V peak	21.2 V peak
dc[b,c]	60 V	30 V

[a] The voltage limits for a composite AC + DC waveform (V peak) shall be per Figure SA2.1 based on the Direct Voltage component (V DC) of the waveform. The graph line for locations where wet contact is not likely to occur refers to Dry and Damp locations. The graph line for locations where wet contact is likely to occur refers to indoor wet or wet locations.

[b] If the peak-to-peak ripple voltage on a dc waveform exceeds 10 percent of the dc voltage, the waveform shall be considered a composite waveform per footnote a above.

[c] DC waveforms interrupted at frequencies between 10 – 200 Hz shall be limited to 24.8 V in dry and damp locations, and 12.4 V in indoor wet or wet locations.

Figure SA2.1
Maximum Voltage



SA2.3 RISK OF FIRE – A risk of fire exists in all electrical circuits except:

a) A Class 2 circuit (refer to definition in UL 8750);

b) An LVLE circuit (refer to definition in UL 8750); or

c) A circuit of 15 W maximum power limit under normal and single fault conditions, as measured in accordance with UL 8750.

SA3 Construction

SA3.1 A polymeric coating material used for the purpose specified in SA1.1 shall:

a) Comply with the requirements for conformal coatings in accordance with UL 746E, and have the following ratings and conditions of use as specified in (1) – (3), and (4) or 5) below:

1) Have an assigned thermal index rating (TI) suitable for the actual use temperatures measured on the coating during the Normal Temperature Test, Section 17, of the luminaire;

2) Be "indoor" or "outdoor" rated for "damp" location rated luminaires and "outdoor" rated for "indoor wet" location, "wet" location and/or "IP" rated luminaire;

3) Be applied within the coating's rated minimum thickness; and

4) Be rated for the printed wiring board type (e.g. ANSI FR4, metal-base type, etc.). When applied over a metal backed printed wiring board, the coating shall be applied to a compatible laminate, and metal base thickness covered by coating evaluation.

5) As an alternate to (4) above, when applied over a metal-base printed wiring board, using a laminate other than the one(s) covered by the coating evaluation, the following additional tests shall be performed.

i) Humidity Conditioning Test in SA4.5;

ii) Steady Force Test – 30 N in SA4.6;

iii) Cold Conditioning Test in SA4.7; and

iv) Thermal Aging Test in SA4.8;

b) Have a minimum hot-wire ignition rating (HWI) of 15 s or comply with the Glow-Wire End-Product Test in SA4.9;

c) Have a minimum high-current arc resistance to ignition rating (HAI) of 15 arcs or comply with the End-Product Arc Resistance Test in SA4.10;

d) Be resistant to UV radiation when the material is exposed to the sun or to UV from the light source. The material shall be UV rated, or comply with the UV exposure test in SA4.11;

Exception: The requirements in (d) do not apply when the horticultural luminaires complies with the Exception to 13.1.1.

e) Comply with the Dielectric Voltage Withstand Test in SA4.1;

f) Comply with the Barrier Strength Test in SA4.2;

g) Comply with the Polymeric Impact Test in SA4.3, except not required for luminaires having downward facing LED array;

h) Comply with the Adhesion And Abrasion Test in SA4.4; and

i) Have a relative thermal index (RTI), or generic thermal index as specified in UL 746B, that is equal to or greater than the temperature measured on the coating during the temperature test.

SA4 Performance

SA4.1 Dielectric voltage withstand test

SA4.1.1 One sample of the fully populated and coated LED array shall withstand without breakdown, the test potential specified in Table SA4.1, using the test equipment specified in SA4.1.2 where V is the maximum AC (rms) voltage between the parts under test. The test may be conducted using a DC potential at 1.414 times the AC potential.

Table SA4.1
Dielectric Voltage Withstand Potential

Test potential, V ac	Circuit location
2V + 1000	Between primary circuits and accessible dead conductive parts Between secondary circuits operating at greater than 70 V peak and accessible dead conductive parts Between the primary and secondary windings of a transformer that are relied upon for separating circuits that are required to be isolated Between printed wiring board traces or other parts operating at different potentials
500 V	Between a secondary circuit operating at no more than 70 V peak and accessible dead conductive parts

SA4.1.2 The dielectric withstand test equipment shall employ a transformer of 500-VA or larger capacity and have a variable output voltage that is essentially sinusoidal or continuous direct current. The applied potential shall be increased from zero at a substantially uniform rate until the required test level is reached and shall be held at that level for 1 minute.

Exception: A 500-VA or larger capacity transformer is not required if the transformer is provided with a voltmeter to directly measure the applied output potential

SA4.1.3 The test shall be conducted between the supply connections to the LED array and foil fitted tightly to the front side of the LED array.

SA4.2 Barrier strength test

SA4.2.1 One sample luminaire with the fully populated and coated LED array mounted as intended shall be tested.

SA4.2.2 A force of 44.5 N (10 lb) over an area of 6.45 cm^2 (1 in^2) shall be applied to the LED array for 1 min, at a location on the printed wiring board where the most damage to the board and components mounted on the printed wiring board are likely to occur.

SA4.2.3 The application of the force shall not result in:

a) Permanent distortion of the LED array;

b) Temporary or permanent reduction of electrical spacings; or

c) Breaking or cracking of the LED array and components mounted on the printed wiring board.

SA4.3 Polymeric impact test

SA4.3.1 Where required by SA3.1(g), one sample of the luminaire with the fully populated and coated LED array mounted as intended shall be held in place and the LED array shall be subjected to a single 7 J (5 ft·lb) impact, using the impact test apparatus specified in UL 1598 or CSA C22.2 No. 250.0, falling through a vertical height of 1.29 m (4.24 ft), on surfaces being tested. The test sample shall be conditioned by placing it in a conditioning environment in accordance with Table SA4.2 for at least 3 h prior to the test.

Table SA4.2
Sample Conditioning

Location marking	Preconditioning temperature
Damp/Indoor Wet	0.0 ±2.0 °C
Wet	−35 ±2.0 °C

SA4.3.2 The application of the impact force shall not result in:

a) Temporary or permanent reduction of electrical spacings;

b) Visible signs of breaking or cracking of, or other physical damage to the LED array including components mounted on the printed wiring board; or

c) A non-conformance following a repeated Dielectric Voltage Withstand Test in SA4.1.

SA4.4 Adhesion and abrasion test

SA4.4.1 One sample of the fully populated and coated LED array shall be conditioned in the following sequence prior to conducting the adhesion and abrasion tests in SA4.4.2 – SA4.4.6.

a) The LED array shall be flexed 4 times so that the midpoint of the LED array is displaced from the line joining the two shortest edges of the LED array a distance equal to 5 percent of the length of the printed wiring board, to simulate conditions that can be expected under normal handling.

Exception: Metal-backed or ceramic printed wiring boards mounted on a flat and rigid surface of a luminaire are not subject to this test.

b) The LED array shall be conditioned at 90 ±1 °C for 96 h.

c) The LED array shall be conditioned at 23 ±1 °C and 96 ±2 percent relative humidity for 96 h.

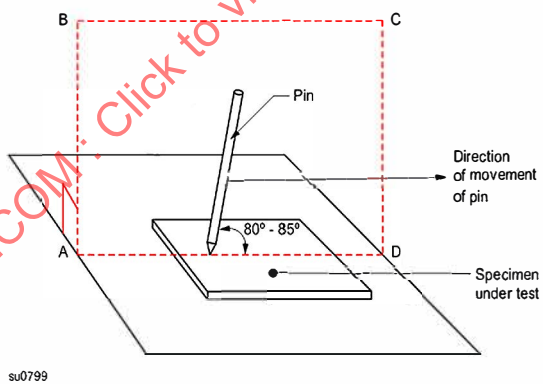
SA4.4.2 The conditioned sample shall be investigated for adhesion of the coating to the LED array by pressing a strip of pressure-sensitive celluloid tape 12.7 mm (0.5 in) wide and 50 mm (2 in) long firmly onto the surface of a conductor pattern, eliminating all air bubbles, and then removing it by manually gripping one end and rapidly pulling it off at an angle of approximately 90°. There shall be no evidence of removal of the protective coating as shown by particles adhering to the tape. The tape used for this test shall have an adhesion of 400 ±60 N/m (27 ±4 lb/ft), as determined by ASTM D 1000.

SA4.4.3 Using the same sample used in SA4.4.2 and the apparatus in SA4.4.6, scratches shall be made across conducting parts on the board.

SA4.4.4 Scratches shall be made by drawing the pin along the surface in a plane perpendicular to the conductor edges at a speed of 20 ±5 mm/s (0.8 ±0.2 in/s), as shown in Figure SA4.1. The pin shall be so loaded that the force exerted along its axis is 10 ±0.5 N (2.25 ±0.1 lb) from the edge of the sample.

Figure SA4.1

Abrasion Resistance Test Apparatus for PCB Conformation Coatings



SA4.4.5 After each test in SA4.4.2 and SA4.4.4, the coating layer shall neither have loosened nor have been pierced, as determined by visual inspection, and the sample shall be subject to the Dielectric Voltage Withstand Test in SA4.1.

SA4.4.6 The test apparatus shall be as shown in Figure SA4.1. The pin shall be made of hardened steel. The end of the pin shall have the form of a cone with a top angle of 40°, and its tip shall be rounded and polished, with a radius of 0.25 ±0.02 mm (0.010 ±0.001 in).

SA4.5 Humidity conditioning test

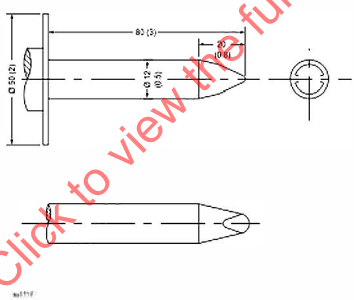
SA4.5.1 Three samples of the fully populated and coated LED array shall be conditioned for 168 hours to moist air having a relative humidity of 88 ±2 percent at a temperature of 32.0 ±2.0 °C (89.6 ±3.6 °F). After the test, the conditioned samples shall be subjected to the Dielectric Voltage Withstand Test in SA4.1.

SA4.6 Steady force test – 30 N

SA4.6.1 The test shall be conducted on three samples of the fully populated and coated LED array.

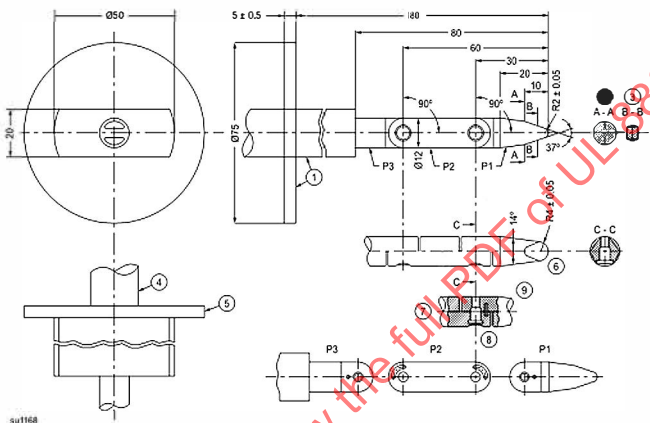
SA4.6.2 Using the test finger shown in Figure SA4.2, the coating shall be subjected to the test in SA4.6.3 and SA4.6.4.

Figure SA4.2
Finger Probe



NOTES:
This test finger is test probe 11 of Figure 7 in IEC 61032. Dimensions are in millimeters (inches).
See Figure SA4.3 for probe tip dimensional requirements that are not specified in this figure.

Figure SA4.3
Jointed Test Finger



Key

1 insulating material	6 spherical
2 section AA	7 detail x (example)
3 section BB	8 side view
4 handle	9 chamfer all edges
5 stop plate	

Dimensions in millimetres

NOTES:

Tolerances on dimensions without specific tolerance:

– on angles:	0–10'
– on linear dimensions:	
up to 25 mm:	0–0.05 mm
over 25 mm:	±0.2 mm
Material of finger:	heat-treated steel, etc.

Both joints of this finger may be bent through an angle of (90 +100)°, but in one plane only.

Using the pin and groove solution is only one of the possible approaches in order to limit the bending angle to 90°. For this reason, dimensions and tolerances of these details are not given in the drawing. The actual design shall ensure a (90 +100)° bending angle.

This test finger is the same as test probe B of IEC 61032. Figure 2.

The jointed test figure is only referenced in note b of Figure SA4.2. Figure SA4.3 is being included as it contains probe tip dimensional requirements that are not specified in Figure SA4.2.

SA4.6.3 The LED array shall be placed on a hard, flat surface and restrained from movement during the test.

SA4.6.4 The test finger shall be placed at 45 degrees from the horizontal and in contact with the top, flat surface of the coating . A steady force of 30 ±3N for a period of 5 seconds is applied along the longitudinal axis of the finger probe. During the test the finger probe is to be restrained from moving in any direction other than along its longitudinal axis.

SA4.6.5 After the test, the samples shall be inspected and there shall be no visible signs of damage to the coating and, each sample shall comply with a repeated Dielectric Voltage Withstand Test in SA4.1.

SA4.7 Cold conditioning test

SA4.7.1 For a damp location or indoor wet location rated luminaire, three samples of the fully populated coated LED array shall be subjected to cold conditioning for 24 hours at 0.0 ±1.0 °C (32.0 ±1.8 °F). After the test, each sample shall be subjected to the Steady Force Test – 30 N in SA4.6.

SA4.7.2 For wet location rated luminaires, three samples of the fully populated and coated LED array shall be subjected to cold conditioning for 24 hours at minus 35.0 ±2 °C (minus 31.0 ±3.6 °F). After the test, each sample shall be subjected to the Steady Force Test – 30 N in SA4.6.

SA4.8 Thermal aging test

SA4.8.1 The test shall be conducted on three samples of the fully populated and coated LED array.

SA4.8.2 The samples shall be aged in a full-draft oven at a temperature and time chosen from the graph in Figure SA4.4 using the index line that corresponds to the maximum surface temperature on the coating measured during the Normal Temperature Test, Section 17. Interpolation is permitted for maximum temperatures that fall between the index lines in the graph. All samples shall be conditioned for 1000 hours unless otherwise agreed by all concerned. The coated LED array shall not be subjected to conditioning less than 300 hours.

Figure SA4.4

Oven Conditioning Time Versus Oven Temperature for Temperature Index for Insulating Materials