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Self-Ballasted Lamps and Lamp Adapters

May 17, 2024

ANSI/UL 1993-2024

Standard for Safety for Self-Ballasted Lamps and Lamp Adapters

Fourth Edition, Dated May 17, 2024

Summary of Topics

This new Fourth Edition dated May 17, 2024 includes the following changes in requirements:

– Flammability rating of polymeric lamp bases
– Additional instructions for Type A LED lamps
– Revision to A8.8 Drop Impact Test
–Alternate wattage limit for high-lumen lamps
– Revisions to production line test conditions
– Lamps for use in elevated ambient temperatures
– Merging of duplicate rigidity after drop test methods
– Protective functions during the temperature test
– Wireless control circuits
– LED Lamps – Current Cascade Abnormal
– Edison screw base length
– Correction of footnote b in Table 5.2
– Corrections to various errors
– Updates to ANCE references – 2.1
– 4.5.1.2: Add the reference – NMX-J-198-ANCE-2015
– 5.3.1: Add the publication year to the reference NMX-565/2-11-ANCE
– 5.3.3: Add the reference NMX-J-565/3-ANCE-2006
– Table 5.2 – Add a note; updates to footnote b and footnote c
– 5.4.5: update reference to: NMX-J-024-ANCE-2018
– 6.1.1, Delete all references to NMX-J-325-ANCE
– 6.4.5: update reference to: NMX-J-578-ANCE-2006
– B3.8 (b): add NMX-J-591/1-ANCE-2007 & NMX-J-591/2-6-ANCE-2020
– C4.5.2: Add the reference NMX-J-295/2-ANCE-2010
– Correction: Add reference to UL 2054, in Section 2, Reference Publications
– Updates to E2 Reference Publications and E5 Markings and Instructions in Annex E for Special use lamps.

Commitment for Amendments

This standard is issued jointly by the Association of Standardization and Certification (ANCE), the Canadian Standards Association (operating as “CSA Group”), and ULSE Inc. (ULSE). Comments or proposals for revisions on any part of the standard may be submitted to ANCE, CSA Group, or ULSE at anytime. Revisions to this Standard will be made only after processing according to the standards development procedures of ANCE, CSA Group, and ULSE. CSA Group and ULSE will issue revisions to this Standard by means of a new edition or revised or additional pages bearing their date of issue. ANCE will incorporate the same revisions into a new edition of the standard bearing the same date of issue as the CSA Group and ULSE pages.

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This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

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This ANSI/UL Standard for Safety consists of the Sixth Edition. The most recent designation of ANSI/UL 1993 as an American National Standard (ANSI) occurred on May 17, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

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

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NOTE – The user’s attention is called to the possibility that compliance with this Standard may require use of an invention covered by patent rights. By publication of this Standard, no position is taken with respect to the validity of this claim or of any patent rights in connection there with. The patent holder has, however, filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from ULSE.

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Preface

This is the harmonized ANCE, CSA Group, and ULSE standard for Self-Ballasted Lamps and Lamp Adapters. It is the fourth edition of NMX-J-578/1-ANCE, the fourth edition of CSA C22.2 No. 1993, and the sixth edition of UL 1993. This edition of NMX-J-578/1-ANCE supersedes the previous edition published in 2017. This edition of CSA C22.2 No. 1993 supersedes the previous edition published in 2017. This edition of UL 1993 supersedes the previous edition published in 2017.

This harmonized standard was prepared by the Association of Standardization and Certification (ANCE), CSA Group, and ULSE. The efforts and support of the Technical Harmonization Committee for Self-Ballasted Lamps, of the Council of the Harmonization of Electrotechnical Standards for the Nations of the Americas (CANENA), are gratefully acknowledged.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

The present Mexican standard was developed by the CT 34 – Iluminación from the Comite de Normalizacion de la Asociacion de Normalizacion y Certificacion, A.C., CONANCE, with the collaboration of the lamps and ballasts manufacturers and users.

This standard was reviewed by the CSA Integrated Committee on Lighting Products, under the jurisdiction of the CSA Technical Committee on Consumer and Commercial Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee. This standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this Standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

Level of Harmonization

This standard is published as an equivalent standard for CSA Group and ULSE and a proposed equivalent standard for ANCE.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

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1 Scope

1.1 These requirements are intended to cover both self-ballasted lamps and self-ballasted lamp adapters rated 120 to 347 V AC nominal for connection to screw-base, pin-base, or recessed single contact (RSC or R7) lampholders. These devices are intended for use in accordance with the National Electrical Code, NFPA 70, and the Canadian Electrical Code, Part I, CSA C22.1, in non-hazardous locations, and the Instalaciones Eléctricas (utilización), NOM-001-SEDE.

1.2 These devices incorporate resistance, reactance, or electronic (solid-state) type ballasts or power supplies. These devices employ various lamp technologies including, but not limited to, incandescent, fluorescent, high-intensity discharge lamps, light-emitting diodes.

1.3 These requirements also include Supplemental Requirements for Light-Emitting Diodes (LED), Annex A, for:

a) Self-contained LED lamps, rated 120 to 347 V AC nominal for connection to screw-, pin-base, and recessed single contact (RSC or R7) lampholders,

b) Lamps for replacement of an ANSI standardized fluorescent lamp, and consisting of light-emitting-diode (LED) lamp technologies, with control circuitry, and a driver or power supply. The LED driver and control circuitry will be either integral with the lamp or remote from the lamp, and

c) Component LED lamps, with or without control circuitry, an ANSI base other than bases mentioned in (a), for connection to LED driver having a low voltage output, such as replacement for tungsten-halogen, MR11 and MR16 shaped lamps.

1.4 This standard does not apply to medium-to-medium base (E26) fittings that incorporate controls such as photocells, motion detectors, radio controls, or dimmers covered by other standards.

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

1.6 Self-ballasted lamps that emit electromagnetic energy (light) outside the 400 – 700 nm range shall additionally comply with Annex E.

2 Reference Publications

2.1 Normative references

2.1.1 For undated references to standards, such reference shall be considered to refer to the latest edition and all revisions to that edition up to the time when this Standard was approved. For dated references to standards, such reference shall be considered to refer to the dated edition and all revisions published to that edition up to the time the standard was approved.

ANSI C78.24, *Electric Lamps: Two-inch (51-mm) Integral-Reflector Lamps with Front Covers and GU5.3 of GX5.3 Bases*

ANSI C81.61, *Specifications for Bases (Caps) for Electric Lamps*

ANSI C81.62, *Electric Lampholders*

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

ASTM B858-06, *Standard Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys*

ASTM D36/D36M, *Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and -Ball Apparatus*

ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester*

ASTM D93, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*

ASTM D1000, *Standard Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications*

ASTM D1525, *Standard Test Methods for Vicat Softening Temperature of Plastics*

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

C22.1-21, *Canadian Electrical Code, Part I, Safety Standard for Electrical Installations*

CSA-C22.2 No. 0:20, *General Requirements – Canadian Electrical Code, Part II*

CSA C22.2 No. 0.1:19, *General Requirements for Double-Insulated Equipment*

C22.2 No. 0.15-15 (R2020), *Adhesive labels*

CSA C22.2 No. 0.17:22, *Evaluation of Properties of Polymeric Materials*

CSA C22.2 No. 43-17(R2022), *Lampholders*

CSA C22.2 No. 66.1-06 (R2020), *Low Voltage Transformers – Part 1: General Requirements*

CSA C22.2 No. 74-16 (R2020), *Equipment for use with electric discharge lamps*

CSA C22.2 No. 248.14-00 (R2019), *Low Voltage Fuses – Part 14: Supplemental Fuses*

CSA C22.2 No. 250.0:21, *Luminaires*

CSA C22.2 No. 250.13:22, *Light Emitting Diode (LED) Equipment for Lighting Applications*

CSA C22.2 No. 256-14 (R2019), *Direct Plug-In Nightlights*

CSA C22.2 No. 60065:16 (R2020), *Audio, Video and Similar Electronic Apparatus – Safety Requirements*

CSA C22.2 No. 60950-1-07 (R2021), *Information Technology Equipment – Safety – Part 1: General Requirements*

CSA E60384-14:14 (R2018), *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

IEC 60081, *Double-Capped Fluorescent Lamps – Performance Specifications*

IEEE C62.41, *IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits*

ISA MC96.1, *Temperature Measurement Thermocouples*

NEMA C82.3, *Electric Lamps – Reference Ballasts for Fluorescent Lamps*

NEMA C78.375A, *Electric Lamps – Fluorescent Lamps – Guide for Electrical Measures*

NEMA C78.40, *Electric Lamps – Specifications for Mercury Lamps*

NEMA C78.42, *Electric Lamps – High-Pressure Sodium Lamps*

NEMA C78.43, *Electric lamps: Single-Ended Metal Halide Lamps*

NEMA C78.81, *Electric Lamps – Double-Capped Fluorescent Lamps – Dimensional and Electrical Characteristics*

NEMA C78.389, *Electric Lamps – High Intensity Discharge Methods of Measuring Characteristics*

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

NEMA C82.5, *Lamp Ballasts – High-Intensity Discharge and Low-Pressure Sodium Lamps*

NFPA 70, *National Electrical Code (NEC)*

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*

NMX-J-024-ANCE-2018, *Iluminación – Portalámparas roscados tipo Edison – Especificaciones y métodos de prueba*

NMX-J-578-ANCE-2006, *Iluminación – Lámparas fluorescentes compactas autobalastradas – Seguridad y métodos de prueba*

NMX-J-198-ANCE-2015, *Iluminación – Controladores para lámparas fluorescentes – Métodos de prueba*

NMX-J-295/2-ANCE-2010, *Iluminación – Lámparas fluorescentes de doble base para alumbrado general – Especificaciones y métodos de prueba*

NMX-J-513-ANCE-2012, *Iluminación – Controladores de alta frecuencia para lámparas fluorescentes – Especificaciones*

NMX-565/2-11-ANCE-2005, *Prueba de riesgo de incendio – Parte 2-11: Métodos de prueba basados en hilo incandescente/caliente – Método de prueba de inflamabilidad de hilo incandescente para productos finales*

NMX-J-565/3-ANCE-2006, *Requisitos de seguridad – Inflamabilidad de materiales plásticos para partes en dispositivos y aparatos – Métodos de pruebas*

NMX-J-565/7-ANCE-2007, *Requisitos de seguridad – Resistencia a la ignición por arco de alta corriente – Método de prueba*

NMX-J-574-ANCE-2005, *Método para determinar los índices de prueba y de resistencia a la formación de caminos conductores en materiales aislantes sólidos*

NMX-J-591/1-ANCE-2007, *Dispositivos eléctricos de control automático para uso doméstico y similar Parte 1: Requisitos generales*

NMX-J-591/2-6-ANCE-2020, *Controles eléctricos automáticos – Parte 2-6: Requisitos particulares para controles de detección de presión eléctricos automáticos incluyendo requisitos mecánicos*

NOM-001-SEDE-2012, *Instalaciones Eléctricas (utilización)*

NOM-058-SCFI-2017, *Controladores para fuentes luminosas artificiales, con propósitos de iluminación en general-Especificaciones de seguridad y métodos de prueba*

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

UL 101, *Leakage Current for Utilization Equipment*

UL 248-14, Low-Voltage Fuses – Part 14: Supplemental Fuses

UL 496, *Lampholders*

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

UL 796, *Printed Wiring Boards*

UL 796F, *Flexible Materials Interconnect Constructions*

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

UL 935, *Fluorescent-Lamp Ballasts*

UL 969, *Marking and Labeling Systems*

UL 1029, *High-Intensity-Discharge Lamp Ballasts*

UL 1310, *Class 2 Power Units*

UL 1412, *Fusing Resistors and Temperature-Limited Resistors for Radio- and Television-Type Appliances*

UL 1446, *Systems of Insulating Materials – General*

UL 1577, *Optical Isolators*

UL 1598, *Luminaires*

UL 1694, *Tests for Flammability of Small Polymeric Component Materials*

UL 2054, *Household and Commercial Batteries*

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

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

UL 60384-14, *Fixed Capacitors for Use in Electronic Equipment – Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains*

UL 60730-1, *Automatic Electrical Controls – Part 1: General Requirements*

UL 60730-2-6, *Automatic Electrical Controls – Part 2-6: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements*

UL 60950-1, *Information Technology Equipment – Safety – Part 1: General Requirements*

2.2 Informative references

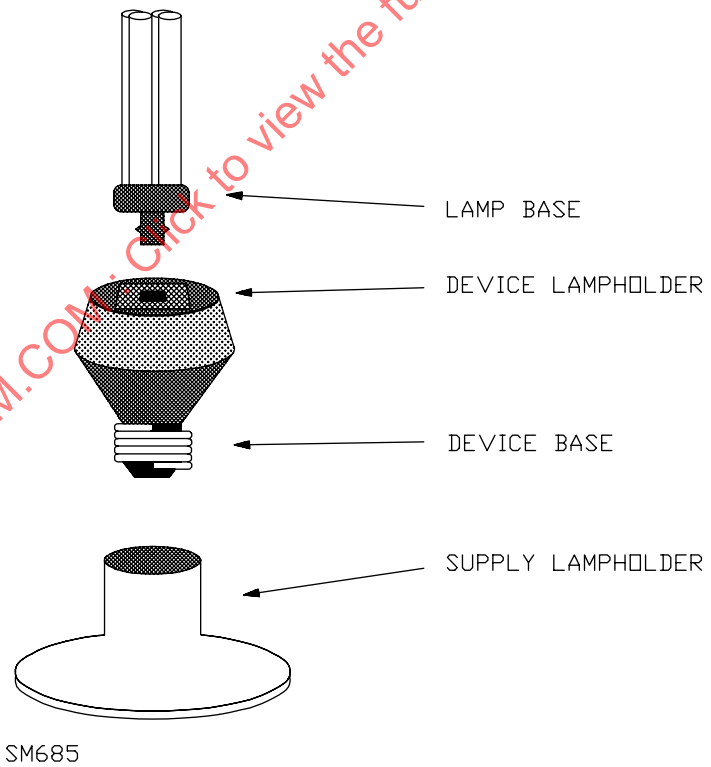
2.2.1 See Annex G for a list of component standards.

3 Definitions

3.1 The following terms and definitions apply in this Standard. See Figure 3.1 for illustrations of the definitions in 3.4, 3.5, and 3.21.

Figure 3.1

Example of Terminology for Lamp Adapters



3.2 ACCESSIBLE NON-CURRENT-CARRYING CONDUCTIVE (METAL) PART – a conductive part without basic insulation that, under normal operating conditions, carries no electrical current. A grounded dead conductive part may carry leakage current.

3.3 DEVICE – a self-ballasted lamp or lamp adapter. The specific name is used when it applies to only one of the devices.

3.4 DEVICE BASE – a screw-base or other ANSI base that connects the device to a mating lampholder for outlet boxes or to lampholders provided in luminaires, portable luminaires, or signs.

3.5 DEVICE LAMPHOLDER – a lampholder provided for the replaceable light source.

3.6 DEVICE LAMPHOLDER KEYING – a lampholder design that can accommodate only matching lamp bases.

3.7 DIMMER, STANDARD – a dimmer or control that modifies the amplitude or waveshape of the lamp's power source in order to reduce light output or energy consumption. This includes the 2-wire triac-based dimmers typically used to dim incandescent lamps.

3.8 DOUBLE INSULATION – an insulation system comprised of both basic insulation and supplementary insulation.

3.9 ELECTRONIC BALLAST – a ballast, generally involving high-frequency switching that is controlled by active components (transistors, thyristors, and the like), and with the lamp ballasting impedance provided by a series capacitive or inductive reactance appropriate for the high switching frequency. "Ballast" also refers to other drivers or supplies that operate lamp technologies other than fluorescent.

3.10 ENCLOSURE – a material provided to enclose parts and components that can involve the risk of fire or electric shock hazard.

3.11 LAMP ADAPTER –

In Canada and the United States, a self-ballasted lamp with a replaceable light source.

In Mexico, a device with an Edison screwbase provided with its controller and lampholder for the replaceable light source.

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

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

3.14 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. The grounded (or neutral) supply conductor is considered to be a live part.

3.15 LIVE PART, HAZARDOUS – a conductive part without basic insulation, where a risk of electric shock exists.

3.16 LOCATION, DAMP – an exterior or interior location that is normally or periodically subject to condensation of moisture in, on, or adjacent to electrical equipment, including partially protected locations. The interior of a luminaire or sign intended for wet locations is considered a damp location.

Note 1: Examples of such 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.

Note 2: Devices intended for damp locations may also be used in dry locations.

3.17 LOCATION, DRY – a location not normally subject to dampness, but could include a location subject to temporary dampness.

Note: For example, a building under construction.

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

Note 1: For example, vehicle washing areas, showers, or unprotected locations exposed to weather.

Note 2: Devices intended for wet locations may also be used in dry and damp locations.

3.19 LUMINAIRE, RECESSED – a luminaire that is designed to be either wholly or partially recessed in a mounting surface.

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

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

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

3.21 SUPPLY LAMPHOLDER – a lampholder of a luminaire or portable luminaire or sign that can accommodate and supply power to a self-ballasted lamp or lamp adapter.

3.22 TYPE TEST – testing of a representative sample of the device with the objective of determining if the device, as designed and manufactured, can meet the requirements of this Standard.

4 General Requirements

4.1 Components

4.1.1 Except as indicated in 4.1.2, a component of a product covered by this Standard shall comply with the requirements for that component. See Annex G for a list of standards covering components generally used in the products covered by this Standard. A component shall comply with the ANCE, CSA, or UL standards as appropriate for the country where the product is to be used.

In Mexico, the requirements of 4.1 do not apply.

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

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

b) Is superseded by a requirement in this Standard.

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

4.1.4 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.

4.2 Application of requirements

4.2.1 The requirements of the national installation codes and other practices of Canada, Mexico, and the United States have been addressed in the requirements of this Standard.

4.2.2 A product intended to be used in Canada, Mexico, and the United States shall comply with the requirements of this Standard for those countries.

4.2.3 A product to be used only in Canada, Mexico, or the United States shall comply with the common requirements of this Standard and the applicable country-specific requirements, where so noted.

4.2.4 In Canada, general requirements applicable to these products are provided in CSA-C22.2 No. 0.

4.3 Units of measurement

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

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

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

4.3.4 Temperatures are given in Celsius only.

4.4 Assembly and packaging

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

4.5 Principles

4.5.1 Risk of electric shock

4.5.1.1 Risk of electric shock can occur due to a number of factors, including:

a) Voltage between conductive parts,

b) Current available,

c) Whether the current is pulsed or continuous,

d) Frequency of voltage and current,

e) Pathway through the human body, and

f) Skin resistance.

4.5.1.2 Risk of electric shock is usually defined only in terms of electrical voltage, current, and frequency. Throughout this Standard, voltage between parts greater than 30 V_{rms}, 42.4 V_{peak} (and DC) – half of these limits for wet locations – is considered to be a risk of electric shock. When the current available is greater than 0.5 mA_{rms} for perception and greater than 5.0 mA_{rms} for let-go, for direct current and alternating current up to 1 kHz, the current is considered to be a risk of electric shock. A passive network connected across the meter input terminals of a measuring instrument compensates for the pathway body impedance

and frequency. The test method and meter network are described in UL 101 or CSA C22.2 No. 0 or NMX-J-198-ANCE-2015.

4.5.2 Risk of fire

4.5.2.1 The risk of fire can occur when electrical energy is converted to heat, and the heat is entrapped. It is difficult to define the energy level in terms of electrical parameters alone because the degree of entrapped heat will determine whether or not there would be combustion. In addition, risk of fire can be abated by a suitable enclosure (fire can be confined by the enclosure).

4.5.2.2 There are several possible indicators that are used while conducting a given test. Throughout this Standard, the check for fire hazard is either by a specific temperature limit or a change of an indicator. For example, one fire indicator is a layer of cheesecloth, and its change of state occurs when it ignites and causes combustion.

4.5.2.3 Throughout this Standard, an energy level of 15 VA is considered to be a sufficient level to support a fire. A circuit having less than 15 VA of available power, as determined by the test method described in 8.20 is considered not to be a fire-hazardous circuit.

4.5.2.4 Throughout this Standard, a suitable enclosure is described in 5.1 and 5.3.

5 Mechanical Construction

5.1 Enclosures

5.1.1 Enclosures shall have the strength and rigidity to resist the abuses to which they are subjected, without increasing the risk of fire, electric shock, or injury to persons due to a reduction of the required spacing for live parts or the loosening or displacement of live parts.

5.1.2 An enclosure shall be of metal or of a polymeric material that complies with 5.3.

5.1.3 A metal enclosure shall comply with the minimum thickness specified in Table 5.1. Alternatively, the suitability of the metal forming an Edison, G5 or G13 lamp base is determined by the applicable requirements and mechanical tests in UL 496 or CSA C22.2 No. 43 and 6.1.8.

Table 5.1
Thickness of Metal Enclosures

Metal	Minimum thickness, mm (in)	
Cast metal	1.2	(0.047)
Uncoated sheet steel	0.66[a]	(0.026)
Nonferrous sheet metal	0.81	(0.032)

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

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

5.2 Openings

5.2.1 An enclosure shall not have openings wider than 2 mm (0.078 in), unless they do not permit a 2 mm (0.078 in) diameter rod of any length to contact live parts. The uninsulated live parts of a lampholder into which a lamp connects are not required to comply.

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

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

a) Close-fitting to the emerging lead wires,

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

c) Provided with a strain-relief means that complies with the strain relief test for lamp connectors of 8.12.

5.3 Polymeric materials

5.3.1 In Canada, a polymeric material shall comply with the requirements in CSA-C22.2 No. 0.17 and with the requirements of 5.3.2 to 5.3.4 and 5.3.6 when the material is used to:

a) Enclose electrical parts,

b) Provide direct or indirect support of live parts, or

c) Both.

In Mexico, the parts of insulating material that contain live parts and external parts of insulating material that provide protection against electrical shock shall be subjected to the glow-wire test in accordance with NMX-J-565/2-11-ANCE-2005 and to the following:

c) The test specimen shall be an end product. If it is necessary to take a part from the lamp in order to perform the test, care shall be taken to assure that the test conditions are not significantly different from that which occurs in normal use conditions;

d) The temperature in the tip of the glow-wire shall be 650 °C.

In the United States, a polymeric material shall comply with the requirements for portable equipment specified in UL 746C and with the requirements of 5.3.2 to 5.3.6 when the material is used to:

e) Enclose electrical parts,

f) Provide direct or indirect support of live parts, or

g) Both.

5.3.2 A polymeric material used to enclose electrical parts shall have a Relative Thermal Index (RTI), including electrical and mechanical, with impact properties of at least the temperature measured during the temperature test of 8.5, unless the measured temperature is less than 65 °C.

5.3.3 A polymeric material used as an enclosure shall have a flammability rating of 5-VA, 5-VB, or V-0 in accordance with UL 94 or CSA-C22.2 No. 0.17 or NMX-J-565/3-ANCE-2006. Polymeric materials used solely to enclose electrical parts that are not part of a fire-hazardous circuit may have a minimum flammability rating of HB.

5.3.4 A polymeric material used as an enclosure of a device marked for wet location use shall comply with the ultraviolet light exposure test specified in UL 746C or CSA-C22.2 No. 0.17.

5.3.5 With respect to UL 746C, the following tests are not required to be conducted:

a) The abnormal operation and severe conditions test,

b) The input after mold-stress relief distortion test, and

c) The volume resistivity test.

5.3.6 A device shall comply with the mold-stress relief distortion test of 8.9.

5.3.7 A polymeric material used for direct support as electrical insulation shall be able to withstand the hot wire ignition (HWI), the comparative tracking index test (CTI), and the high current arc ignition (HAI) to a level of at least the values in accordance with Table 5.2.

Table 5.2
Ratings of Polymeric Materials

Test	Environmental rating	Minimum potential	PLC[e]
CTI[b]	Dry location	≥100 volts	4 or less
	Damp location	≥175 volts	3 or less
	Wet location	≥250 volts	2 or less
Test	**Flammability classification[a]**	**Minimum time**	**PLC[e]**
HWI[c]	V-0, VTM-0	≥7 seconds	4 or less
	5-VA or 5-VB only	≥15 seconds	3 or less
Test	**Flammability classification[a]**	**Minimum time**	**PLC[e]**
HAI[d]	V-0, VTM-0	≥15 seconds	3 or less
	5-VA or 5-VB only	≥30 seconds	2 or less

NOTE – Enclosures of phenolic, urea, or other thermoset materials are acceptable as legacy materials. Thermoplastic materials shall comply with this table.

[a] Flammability classification determined by prior classification or the end product shall be evaluated to the 12 mm flame test in accordance with UL 746C or CSA-C22.2 No. 0.17 or NMX-J-565/2-11-ANCE-2005. Subsequently, the HWI and HAI requirements are determined as a function of the flammability classification.

[b] Determined by prior classification or by the end-product tested in accordance with UL 746C or CSA-C22.2 No. 0.17 or NMX-J-574-ANCE-2005.

[c] Determined by prior classification or by the end-product tested in accordance with UL 746C or CSA-C22.2 No. 0.17 or NMX-565/2-11-ANCE-2005.

[d] Determined by prior classification or by the end-product tested in accordance with UL 746C or CSA-C22.2 No. 0.17 or by the high current arc resistance to ignition in accordance with NMX-J-565/7-ANCE-2007.

[e] For materials with other than VTM flammability classifications, the performance level class (PLC) for material shall be evaluated using the specimen thickness employed in the end product. PLCs have been established in order to give a consistent numbering for improved performance (PLC=0 is best; PLC=5 is poorest) and avoid an excessive level of implied precision. Material performances for several tests and recorded as PLC values are based on the mean test results rather than recording the exact numerical results.

5.4 Weight and moment

5.4.1 A device shall have weight and moment limitations as specified in Table 5.3.

Table 5.3
Weight and Moment Limitations

Device base	Maximum weight[a,c] kg (lbs)	Maximum moment[a,b] N·m (in-lbs)
E12 (Candelabra)	0.50 (1.15)	0.60 (5.54)
E17 (Intermediate)	0.75 (1.63)	0.90 (7.85)
E26 (Medium), GU10, GU24	1.15 (2.5)	1.35[c] (12)
E39 (Mogul)	1.70 (3.75)	2.05 (18)

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

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

[c] Includes the weight of any glassware and/or shade provided with the device. See 5.4.3.

5.4.2 A device that is constructed so that the alignment with the existing incandescent luminaire or portable luminaire requires an adjustment greater than ±20° shall be provided with adjustment of the device base with relation to the remainder of the device. Examples include:

a) A rectangular-shaped device in which the device is to be parallel with existing walls when installed in a ceiling surface luminaire, and

b) A device incorporating a ballast compartment or lamp support arms that will in some cases have to be rotated more than 20° to properly clear harps in portable luminaires.

5.4.3 A device intended to be used with a shade, glassware, or diffuser shall be provided with that accessory.

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

5.4.5 When the integrity of the lamp securing means of a lamp adapter cannot be determined, the device lampholder shall comply with the minimum retention force values specified in ANSI C81.62 or NMX-J-024-ANCE-2018, using the appropriate plug gauge specified in ANSI C81.63 for the intended lamp type.

5.5 Movable joints

5.5.1 Electrical conductors located in circuits considered a risk of fire or electric shock that are subject to movement shall be of the stranded type. The conductors shall be of sufficient length and suitably protected so that any movement does not stress electrical connections or cause conductors to bear against any sharp edges.

5.5.2 Any joint that allows movement while the lamp is installed in its lampholder(s) shall be constructed so that repeated adjustments do not have a detrimental effect on lamp components. Compliance shall be determined by the joint endurance test in 8.23.

5.5.3 Any rotational stops shall be sufficiently robust to withstand lamp insertion and repeated adjustments without damage. Compliance shall be determined by the joint torsion test in 8.2.3.

5.5.4 5.5.2 and 5.5.3 do not apply if:

a) The electrical circuits involved are not considered a risk of fire or electric shock; and

b) Any conductor damage or breakage would not reduce electrical spacings between normally isolated circuits.

6 Electrical Construction

6.1 Lamp bases and lampholders

6.1.1 A device lampholder and device base shall comply with the requirements of CSA C22.2 No. 43 and UL 496. See also 6.1.5. The screw base metal shell, including double contact types (3-way), shall comply with the material, thickness, and dimensional construction requirements. The screw base metal shall be subjected to the pull, torque, and go/not-go tests. A device screw base intended to lock in place and be non-removable shall be provided with a ratcheting mechanism, or the equivalent, so that the lampholder in which it is installed is not damaged. A skeleton type of construction shall not be used on a device screw base.

In Mexico, a device lampholder and device base shall comply with the requirements of NMX-J-024-ANCE-2018.

6.1.2 A screwshell metal of a device base intended for damp or wet locations shall comply with Table 6.1:

Table 6.1
Acceptable Screw Metals vs. Lamp Environmental Rating

Metal composition	Dry locations	Damp locations	Wet locations
Copper alloy, any	Yes	No	No
Unplated Aluminum	Yes	Yes	No
Copper alloy, ≥ 80 % copper content	Yes	Yes	Yes
Copper alloy, compliant with the test in 8.21	Yes	Yes	Yes
Nickel alloy	Yes	Yes	Yes
Stainless Steel	Yes	Yes	Yes
Aluminum or copper alloy electroplated with nickel alloy covering all surfaces (after forming and trimming)	Yes	Yes	Yes

6.1.3 In Canada and the United States, a device lampholder of a fluorescent lamp adapter shall be tested with the lamp or lamps that the device is intended to accommodate. The lampholder shall be keyed to accommodate a specific lamp or lamps or comply with 6.1.4. The lampholder keying shall comply with ANSI C81.61, ANSI C81.62, and ANSI C81.63.

In Mexico, a device lampholder of a fluorescent lamp adapter shall be tested with the lamp or lamps that the device is intended to accommodate. The lampholder shall be keyed to accommodate a specific lamp or lamps or comply with 6.1.4. The lampholder keying shall comply with NMX-J-024-ANCE-2018.

6.1.4 A device which does not comply with 6.1.3 shall comply with the lamp starting and operating measurements of 8.3.

6.1.5 In addition to the requirements referenced in 6.1.1, the flammability rating of polymeric materials used to form the lamp base body shall comply with 5.3.3 if the materials form part of the device's enclosure. This does not apply to contact insulators on Edison lamp bases.

6.1.6 The length of an Edison screw base, measured vertically from the plane of the eyelet contact (contact plate) to the plane of its furthest accessible conductive point as shown in Figure 6.1, shall not be greater than the maximum length indicated in Table 6.2.

Figure 6.1

Edison Screw Bases – Maximum Length

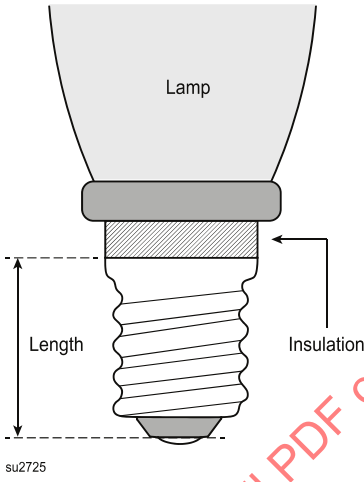


Table 6.2
Edison Screw Bases – Maximum Length

Designation	Max. length (mm)
E39 (Mogul)	42.9
E29 (Admedium)	30.2
E26 (Medium)	25.4
E17 (Intermediate)	21.4
E12 (Candelabra)	17.5
E11 (Mini-candelabra)	15.9

6.1.7 Any insulation used to prevent contact with part of the screw base shall be secured to minimize the likelihood of displacement due to incidental contact by users. The suitability of the securement means shall be determined by performing the Base Insulation Displacement test in 8.11 prior to making the measurements specified in 6.1.6.

6.1.8 G5 and G13 lamp bases functioning as fire or electrical enclosures and formed from metal thinner than specified in Table 5.1 shall comply with either of the Pin Strength tests described in ANSI C81.61 standard sheets 1-310 or 1-406, respectively.

6.2 Current-carrying parts

6.2.1 A wire shall have insulation rated for the voltage, temperature, and conditions of intended use.

6.2.2 Where loosening or breaking of electrical connections involves a risk of fire or electric shock, the connections shall be soldered, welded, or otherwise securely connected. A soldered joint shall be mechanically secure before soldering. A surface mount component not exceeding a maximum dimension