STANDARD FOR SAFETY

UL 8752, Organic Light Emitting Diode (OLED) Panels

Standards Council of Canada
Conseil canadien des normes

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UL Standard for Safety for Organic Light Emitting Diode (OLED) Panels, UL 8752

First Edition, Dated June 13, 2012

Summary of Topics

This revision of UL 8752/ULC-S8752 is being issued to update the title page to reaffirm approval as an American National Standard and as a National Standard of Canada. No changes in requirements have been made.

The requirements are substantially in accordance with Proposal(s) on this subject dated February 16, 2018.

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

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Commitment for Amendments

This Standard is issued jointly by Underwriters Laboratories Inc. (UL) and ULC Standards. Amendments to this Standard will be made only after processing according to the Standards writing procedures by UL and ULC Standards.

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In Canada, written comments are to be sent to ULC Standards, 400 – 171 Nepean Street, Ottawa, Ontario KP2 0B4. Proposals should be submitted on a Standards Revision Request Form available from ULC Standards.

This ANSI/UL Standard for Safety consists of the First Edition including revisions through August 3, 2018.

The most recent designation of ANSI/UL 8752 as a Reaffirmed American National Standard (ANS) occurred on August 3, 2018. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), an informative Annex, or the Preface.

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

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ANNEX B (NORMATIVE) – Reference Standards

Preface

This is the common UL and ULC Standard for Organic Light Emitting Diode (OLED) Panels. It is the First edition of both CAN/ULC-S8752 and ANSI/UL 8752.

This Joint Standard was prepared by Underwriters Laboratories Inc., ULC Standards, and the Technical Committee on Solid State Lighting (TCSSL). The standard was formally approved by the UL/ULC Technical Committee on Solid State Lighting (TCSSL). The efforts and support of the Technical Committee are gratefully acknowledged.

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

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.

Annex A and Annex B, both identified as normative, form a mandatory part of this Standard.

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 identical standard between UL and ULC Standards. An identical standard is a standard that is the same in technical content except for conflicts in Codes and Governmental Regulations. Presentation shall be word for word for editorial changes.

Interpretations

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

INTRODUCTION

1 Scope

1.1 These requirements apply to organic lighting emitting diode (OLED) panels intended for task, ambient, or aesthetic illumination, and for portable or permanent installation in accordance with the following standards, and for connection to isolated (non-utility connected) power sources such as generators, batteries, fuel cells, solar cells, and the like, in accordance with the:

In Canada:

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

In the United States:

National Electrical Code (NEC), ANSI/NFPA 70.

1.1 revised September 30, 2013

1.2 The OLED panels covered by this standard are intended to be installed in dry or damp locations only, in one or more of the following configurations:

a) Secured directly to the walls or ceiling of a structure,

b) Integrated into a mechanical frame or structure that is in turn mounted or secured to the walls or ceiling of a structure (for example, a luminaire or sign),

c) Integrated into a mechanical frame or structure that is portable and able to be relocated without special tools or skills (for example, a portable luminaire).

1.3 The OLED panels covered by this standard are intended to be supplied from an electrical power source operating within the voltage and current limits specified in Electrical Construction – General, Section 12. These voltage limits are understood to represent no risk of electric shock injury, and the current limits sufficient to adequately reduce the risk of fire initiation.

Exception: For OLED panels intended to be supplied by a power source beyond the limits of Section 12, see the Supplemental Requirements for Higher Power OLED Panels, Annex A.

1.4 An OLED panel mounted within the frame structure of a fixed or portable luminaire per 1.2 (b) or (c) need not comply with the requirements in this standard where the risk of fire or injury is fully addressed by the applicable luminaire standard.

1.5 These requirements do not address the power sources used to supply an OLED panel. Mechanically integrated assemblies that include both an OLED panel and a power source shall be evaluated for conformance with the applicable luminaire standard. Some power sources suitable for use with OLED panels are identified in Electrical Construction – General, Section 12.

1.6 This standard does not include requirements for the evaluation of OLED panels intended for use in:

In Canada:

a) Hazardous locations as specified in the Canadian Electrical Code, CSA C22.1;

b) General patient care areas or critical patient care areas as defined by Section 24 of the Canadian Electrical Code, CSA C22.1;

c) Emergency systems as defined by Section 46 of the Canadian Electrical Code, CSA C22.1; or

d) Air-handling spaces as defined by Rule 12-010 of the Canadian Electrical Code, CSA C22.1.

In the United States:

a) Hazardous locations as specified in the National Electrical Code (NEC), ANSI/NFPA 70;

b) General patient care areas or critical patient care areas as defined by Article 517 of the National Electrical Code (NEC), ANSI/NFPA 70;

c) Emergency systems as defined by Article 700 of the National Electrical Code (NEC), ANSI/NFPA 70; or

d) Air-handling spaces as defined by Article 300.22(C) of the National Electrical Code (NEC), ANSI/NFPA 70.

1.7 This standard does not include requirements for the assessment of OLED panel compliance with building code seismic requirements.

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.

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

3 Units of Measurement

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

3.2 Unless otherwise indicated, all voltage and current values mentioned in this standard are root-mean-square (rms).

4 Undated References

4.1 See Annex B for a list of publications referenced in this standard. Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

5 Glossary

5.1 For the purposes of this standard, the following definitions apply.

5.2 FIXED LUMINAIRE – A lighting assembly intended for fixed mounting and permanent connection to the facility electrical system.

5.3 OLED – An assembly of organic (carbon-based) electroluminescent semiconductor material situated between two electrodes, at least one of which is transparent. When supplied with an electric current (by applying a voltage across the electrodes), the organic material emits light.

5.4 OLED PANEL – An independently operable unit consisting of one or more OLEDs (of any size) with means for connection to an electrical current source. The panel may incorporate passive electrical components to regulate the current, and may also include a frame and/or means for mounting.

5.5 PORTABLE LUMINAIRE – A complete lighting assembly connected to the electrical supply by a flexible cord and plug assembly, and able to be relocated without the use of specialized tools.

5.6 POWER SOURCE – A device connected between the branch circuit protection device and the OLED panel, intended to supply the desired voltage and/or current to the OLED panel. A power source is typically referred to as transformer, power supply, driver, ballast, or comparable designation.

5.7 RISK OF FIRE – An electrical circuit able to generate sufficient heat to ignite adjacent materials. Consideration shall be given to the heat generated during normal operation, component faults, and damaged conductors or connections.

5.8 RISK OF INJURY – Parts containing characteristics or sufficient mechanical or thermal energy that, when contacted by a person, can cause permanent damage to the body. Examples include sharp parts that can cut the skin or hot parts that can cause second degree burns.

MECHANICAL CONSTRUCTION

6 General

6.1 An OLED panel shall be formed and assembled so that it has the strength to withstand the handling to which it may be subjected during installation and use, without increased risk of fire or injury to persons.

7 Mounting

7.1 An OLED panel intended to be secured directly to the building structure shall be provided with installation instructions, per the Installation and Operation Instructions, Section 27. Mounting hardware shall either be packaged with the panel or the installation instructions shall specify the types of acceptable mounting fasteners and systems to be used.

8 Glass

8.1 OLED panels with glass edges or corners that are accessible during use or maintenance shall be seamed, swiped, fire-polished, or similarly treated to eliminate sharpness.

8.2 Exposed glass surfaces of an OLED panel intended to be secured directly to the building structure, in accordance with 1.2(a), shall comply with the minimum thickness as specified in Table 1. Where the panel includes multiple layers of glass and/or other materials (such as printed circuit boards and organic material layers) secured together to form a laminate structure, the measurement shall consider the overall thickness of the laminate structure when determining compliance with Table 1.

Exception: Exposed glass or glass laminate structures of an OLED panel intended to be secured directly to the building structure that comply with the Glass Breakage Weight Limit Test, Section 23, are permitted to be of lesser thickness.

8.3 An OLED panel intended to be directly mounted to the ceiling, in accordance with 1.2(a), and with an exposed glass surface shall comply with the Static Load Mounting Test, Section 24.

9 Polymeric Materials

9.1 An exterior polymeric material of more than 161 cm^2 (25 in^2) contiguous exposed surface area shall be rated minimum HB flammability.

9.1 revised September 30, 2013

9.2 An OLED panel intended for mounting on a building surface and with a polymeric material of more than 2.3 m^2 (25 ft^2) in contiguous surface area shall comply with the:

In Canada:

Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies, CAN/ULC-S102;

In the United States:

Test for Surface Burning Characteristics of Building Materials, UL 723.

The panel shall have a smoke-developed index of not over 450 and a flame spread index of not over 25, with no evidence of continued progressive combustion.

9.3 Insulated wire and connectors made of polymeric materials shall be rated for the voltage, current, and temperature to which they are subjected.

10 Adhesives

10.1 Where adhesive failure could result in an increased risk of fire or injury, an adhesive used to secure parts of an OLED panel together or to secure the OLED panel to a frame or structural element shall be subjected to the Adhesive Support Test in the:

In Canada:

Standard for Light Emitting Diode (LED) Equipment for Lighting Applications, CAN/CSA-C22.2 No. 250.13;

In the United States:

Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products, UL 8750.

11 Conductor Protection

11.1 Electrical connections shall be protected against mechanical stresses during installation or use by strain relief devices or comparable means. Electrical connections that are subject to movement or mechanical stress shall be subjected to the Conductor Secureness Test, Section 25.

11.2 Means shall be provided to prevent conductors from being displaced when such displacement could result in:

a) Subjecting the conductor to mechanical damage;

b) Exposing the conductor to a temperature higher than that for which it is rated;

c) Damaging internal connections or other components.

11.3 All openings and wireways shall be smooth and free from sharp edges or burrs that could cause abrasion of conductor insulation.

ELECTRICAL CONSTRUCTION

12 General

12.1 An OLED panel shall be marked, per 26.3, for connection to a power source conforming to the voltage limits in Table 2.

12.2 An OLED panel shall be marked, per 26.3, for connection to a power source whose nameplate output current does not exceed 5 A.

12.3 The voltage and current limits of 12.1 and 12.2 shall be provided by a source that is electrically isolated from the branch circuit. Power sources that comply with the following standards are considered to comply with the following requirements:

In Canada:

a) Standard for Power Supplies with Extra-Low-Voltage Class 2 Outputs, CAN/CSA-C22.2 No. 223;

b) Standard for Information Technology Equipment – Safety – Part 1: General Requirements, CAN/CSA-C22.2 No. 60950-1;

c) Standard for General Use Power Supplies, CSA 22.2 No. 107.1;

d) Standard for Low Voltage Transformers – Part 1: General Requirements, CSA C22.2 No. 66.1, and the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, CSA C22.2 No. 66.3;

e) Standard for Extra-Low-Voltage Landscape Lighting Systems, CSA C22.2 No. 250.7;

f) Standard for Low Voltage Lighting Systems, UL 2108; and

g) Standard for Light Emitting Diode (LED) Equipment for Lighting Applications, CAN/CSA-C22.2 No. 250.13.

In the United States:

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

b) Standard for Information Technology Equipment – Safety – Part 1: General, UL 60950-1;

c) Standard for Power Units Other Than Class 2, UL 1012;

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

e) Standard for Low Voltage Landscape Lighting Systems, UL 1838;

f) Standard for Low Voltage Lighting Systems, UL 2108; and

g) Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products, UL 8750.

Other power sources shall be determined to provide a comparable level of isolation as that provided by one of the above standards.

12.4 An OLED panel shall not be grounded.

Exception: Exposed conductive parts of an OLED panel or frame intended to be integrated into a (fixed or portable) luminaire provided with a means for grounding are permitted to be electrically bonded to the luminaire means for grounding.

12.5 An OLED panel shall be provided with no more than one electrical power input for field connection. Additional connections for control circuitry are permitted.

Exception: More than one power input connection is permitted if the circuitry limits total OLED panel power consumption to no more than the marked ratings, per 26.3.

12.5 revised September 30, 2013

13 Current Carrying Parts

13.1 Current-carrying parts not part of the OLED assembly, such as lead wires and control electronics, shall be of corrosion-resistant materials, such as copper, copper alloy, or aluminum.

13.2 Current-carrying parts shall have sufficient ampacity to reduce the risk of fire, as demonstrated by compliance with the Temperature Test, Section 19, and the Abnormal Input Test, Section 20.

13.3 Current-carrying parts shall be reliably secured to prevent turning or shifting in position if such motion may result in damage to an electrical connection or misalignment of electrical contacts.

14 Splices and Connections

14.1 A soldered wire connection shall be made mechanically secure before being soldered, using one or more of the following techniques:

a) A minimum of one full wrap around a terminal;

b) Insertion into a U- or V- shaped slot in a terminal;

c) Twisted together with other conductors;

d) For a lead integral with a component, inserted through an opening of a printed wiring board; or

e) For a lead not integral with a component, passed through an opening of a printed wiring board and bent 90 degrees or covered with epoxy, silicone, or potting compound after soldering.

14.1 revised September 30, 2013

14.2 Push-in terminals, spade-type connectors, and similar means shall be investigated to determine if they provide adequate mechanical security. Quick-connect terminals shall comply with the:

In Canada:

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

In the United States:

Standard for Electrical Quick-Connect Terminals, UL 310.

Mechanical splicing devices shall comply with the:

In Canada:

Standard for Wire Connectors, CAN/CSA-C22.2 No. 65;

In the United States:

Standard for Wire Connectors, UL 486A-486B.

Single and multi-pole connectors secured to conductors or to printed circuit boards shall comply with the:

In Canada:

Standard for Special Use Attachment Plugs, Receptacles, and Connectors, CSA 22.2 No. 182.3;

In the United States:

Standard for Component Connectors for Use in Data, Signal, Control and Power Applications, UL 1977.

15 Segregation from Other Conductors

15.1 An OLED panel integrated into another product (such as a luminaire) shall have all conductive parts of the OLED panel effectively segregated from other conductive parts within the product that operate at higher voltages, by means of insulation, barriers, or maintained spacings.

15.2 Segregation of conductors shall be accomplished by clamping, routing, or an equivalent means that provides a minimum 6.4-mm (0.25-in) separation.

16 Switches and Controls

16.1 A switch or other control device shall have a current and voltage rating not less than that of the load that it controls.

17 Supply Connections

17.1 An OLED panel intended to be secured directly to the building structure shall have provision to connect to a low voltage supply source by one of the following means:

In Canada:

a) Provision for mounting over a standard outlet box, connection to conduit or cable, or other means in accordance with the Canadian Electrical Code, CSA C22.1, Part I;

b) A length of power limited cable such as ELC, LVT, CM, or equivalent, or wiring terminals suitable for connection of such cable;

c) A length of flexible cord permanently connected to the panel or detachable using a mating plug and connector. The supply end of the cord shall not include a plug suitable for direct branch circuit connection; or

d) A length of appliance wiring material identified as suitable for external use in accordance with the Standard for Appliance Wiring Material Products, CSA C22.2 No. 210, permanently connected to the panel or detachable using a mating plug and connector. The supply end of the appliance wiring material shall not include a plug suitable for direct branch circuit connection.

In the United States:

a) Provision for mounting over a standard outlet box, connection to conduit or cable, or other means in accordance with Chapter 3 of the National Electrical Code (NEC), ANSI/NFPA 70;

b) A length of power limited cable such as CL2 or CL3 or equivalent, as specified in Table 725.154(G) of the National Electrical Code (NEC), ANSI/NFPA 70, or wiring terminals suitable for connection of such cable;

c) A length of flexible cord permanently connected to the panel or detachable using a mating plug and connector. The supply end of the cord shall not include a plug suitable for direct branch circuit connection; or

d) A length of appliance wiring material identified as suitable for external use in accordance with the Standard for Appliance Wiring Material, UL 758, permanently connected to the panel or detachable using a mating plug and connector. The supply end of the appliance wiring material shall not include a plug suitable for direct branch circuit connection.

17.2 An OLED panel intended to be mounted within the frame structure of a fixed or portable luminaire shall have provision to connect to a low voltage supply source in conformance to the internal wiring provisions of the applicable luminaire standard.

PERFORMANCE

18 Input Power

18.1 The measured input to an OLED panel in watts shall not exceed the marked rating by more than 10 percent when the unit is operated under conditions of intended use and connected to a rated source of supply. Measurements shall be made no less than 20 minutes after the panel is energized, to allow for stabilization.

19 Temperature Test

19.1 An OLED panel shall not exhibit any visual signs of combustion (including discoloration), and shall not attain a temperature at any point greater than indicated in Table 3, when connected to an appropriately rated source of supply and operated continuously until temperatures are stable, as described in this section.

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19.2 The test is to be conducted at an ambient temperature of 25 ±5°C (77 ±9°F), unless the installation instructions specify a higher ambient in which case the test shall be conducted at the highest specified ambient, ±5°C (±9°F). The ambient temperature is to be measured by means of a thermocouple immersed in a bath of 15 milliliters of mineral oil in a glass container. Final temperatures are to be normalized to 25°C (or the marked maximum ambient), to determine compliance with Table 3.

19.3 A temperature is considered stable when:

a) The test has been running for a minimum of 7.5 hours; or

b) The test has been running for a minimum of 3 hours and three successive readings taken at 15 minute intervals are within 1°C of one another and are not rising.

19.4 Temperature readings are to be obtained by thermocouples made of wires that conform to the requirements specified in the Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, ANSI/ASTM E230/E230M. Thermocouple wires shall be not larger than 24 AWG (0.21 mm^2) and not smaller than 30 AWG (0.05 mm^2), unless smaller wires are deemed necessary to reduce the impact of the thermocouple serving as a heat sink. Where referee temperatures are needed to resolve measurement uncertainty, 30 AWG iron and constantan wires and a potentiometer-type instrument shall be used. The thermocouple junction and adjacent lead wire are to be held in secure thermal contact with the material surface being measured.

19.5 The panel shall be mounted as specified by the manufacturer's installation instructions. If no instructions are provided, the panel shall be supported in a vertical position. A part designed to be adjustable by the user shall be positioned or adjusted to result in maximum heating of the unit or mounting surface.

19.6 When a part to be measured is in contact with a metallic part or another source of conducted heat, the thermocouple shall be wedged between the part and the adjacent source of heat. Where a part to be measured is subject to a source of radiated or convected heat, thermocouples are to be inserted from the outside surface through holes drilled in the material, such that the thermocouple tips are located in the plane of the inside surface and are sealed in place with fuller's earth and sodium silicate (waterglass). Where either of the above two methods are impractical, alternative means of measuring the relevant temperatures are permitted where such methods can be shown to provide consistent and accurate readings that can be calibrated to an appropriate laboratory standard.

20 Abnormal Input Test

20.1 An OLED panel intended for a constant current input shall be connected to a source of supply adjusted to provide 200% of the rated input current. The panel shall be operated continuously in this condition for 7 hours.

20.2 An OLED panel intended for a constant voltage input shall be connected to a source of supply adjusted to provide 110% of the rated input voltage. The panel shall be operated continuously in this condition for 7 hours.

20.3 There shall be no visual evidence of combustion (such as flaming, charring, or significant discoloration) as a result of the tests of 20.1 or 20.2. The tests may be discontinued prior to 7 hours if the panel is no longer operational and in a stable condition. Where the results of either test are uncertain after 7 hours, the panel shall be draped in cheesecloth* and allowed to continue operating for another 7 hours. There shall be no ignition of the cheesecloth.

*untreated cotton cloth running 26 – 28 m^2/kg (14 – 15 yd^2/lb) and for any square inch, a count of 32 threads in one direction and 28 in the other direction.

21 Component Fault Tests

21.1 Accessible, conductive (metallic) surfaces shall not exceed the voltage limits of Table 2 when OLED panel circuitry is subjected to the fault conditions described in 21.4. Because the input to the OLED panel is electrically isolated from the branch circuit (per 12.3), the voltage measurements shall be taken between any two parts that can be simultaneously accessed by users or maintenance personnel (i.e., voltage-to-ground need not be considered).

21.2 An OLED panel shall not exhibit evidence of fire when prepared in accordance with 21.3 and subjected to the fault conditions described in 21.4.

21.3 The OLED panel shall be loosely wrapped in a single layer of cheesecloth.* The wrapped panel shall be placed on a knot-free softwood surface covered with tissue paper, and then operated for no less than 3 hours and no more than 7 hours. The test may be discontinued prior to 7 hours if thermal conditions are stable with no indication of combustion.

*untreated cotton cloth running 26 – 28 m^2/kg (14 – 15 yd^2/lb) and for any square inch, a count of 32 threads in one direction and 28 in the other direction.

21.4 Fault conditions (short or open circuit) shall be imposed on discrete OLED power management and control circuitry components where circuit analysis suggests that such failures may result in higher power (voltage or current) conditions within the panel. Where not represented by these component faults, clearances and creepage distances shall additionally be subject to fault condition (short) assessment.

Exception: Clearances and creepage distances that conform to the:

In Canada:

Standard for Insulation Coordination, CSA C22.2 No. 0.2, need not be subject to these fault conditions. For the assessment per CSA C22.2 No. 0.2, OLED panels shall be considered to operate at overvoltage category I (signal level) and in a pollution degree 2 or 1 environment, based on the specific construction under evaluation.

In the United States:

Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840, need not be subject to these fault conditions. For the assessment per UL 840, OLED panels shall be considered to operate at overvoltage category I (signal level) and in a pollution degree 2 or 1 environment, based on the specific construction under evaluation.

22 Flame Spread and Smoke Developed Test

22.1 Representative samples of OLED panels of greater than 2.3 m^2 (25 ft^2) surface area shall be tested for surface burning characteristics as specified in:

In Canada:

Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies, CAN/ULC-S102.

In the United States:

Standard for Test for Surface Burning Characteristics of Building Materials, UL 723. For the purpose of establishing the flame spread and smoke developed indices, typically a minimum of three tests are to be conducted. Samples are to be positioned in the 7.62-m (25-ft) long fire test chamber specified in the Standard for Test for Surface Burning Characteristics of Building Materials, UL 723. Sufficient panels shall be installed in the test chamber connected end-to-end to form a continuous length of 7.3 m ±12.7 mm (24 ft ±1/2 in) and in a width that spans the test chamber 451 ±6.3 mm (19-3/4 ±1/4 in). The panels are to be centered along the top length of the fire test chamber and rest on the side ledges.

22.2 The system shall have a flame-spread index of not over 25 without evidence of continued progressive combustion and a smoke-developed index of not over 450.

23 Glass Breakage Weight Test

23.1 To determine compliance with the exception to 8.2, the panel shall be weighed and the weight of 65 cm^2 (10 in^2) shall be calculated. The panel shall be placed on a flat surface and the glass shattered with a center punch at a point 30 mm (1.18 in) from the midpoint on the edge of the glass toward the center. The edge shall be defined as the longest dimension on an irregular shape.

23.2 The 10 largest particles shall be weighed together. The total weight shall be less than the calculated weight of 65 cm^2 (10 in^2) of the original specimen.

24 Static Load Mounting Test

24.1 To determine compliance with 8.3, an OLED panel intended to be mounted directly to the ceiling and with an exposed glass surface shall be weighed. An amount of granular material, such as sand, equal to four times the weight of the panel shall be poured onto the panel and distributed evenly. The panel shall then be mounted to distribute the panel weight in a manner representative of the intended mounting means. The panel shall stay in place for at least 1 minute with no visible damage to the panel or mounting hardware.

25 Conductor Secureness Test

25.1 A pulling force of 89 N (20 lb) shall be applied for 1 minute to the conductor in a direction perpendicular to the plane of the entrance to the conductor connection. There shall be no breaking of the conductor or loosening of the conductor connections.

MARKING AND INSTRUCTIONS

26 General

26.1 Markings required in this section shall be legible and permanent, and shall be one of the following:

a) Lettering on a pressure-sensitive label that complies with:

In Canada:

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

In the United States:

Standard for Marking and Labeling Systems, UL 969;

b) Paint stenciled lettering;

c) Ink-stamped machine lettering;

d) Ink-hand-stamped lettering;

e) Indelibly printed lettering;

f) Die-stamped lettering;

g) Embossed lettering;

h) Molded or cast lettering; or

i) Etched lettering in metal or glass.

26.2 An OLED panel shall be marked with all of the following:

a) The company name, trade name, or trademark or other descriptive marking by which the organization responsible for the product may be identified;

b) A distinctive catalog number or the equivalent;

c) The date or other dating period of manufacture of the product not exceeding any three consecutive months:

Exception No. 1: The company's identification is not prohibited from appearing in a traceable code when the product is identified by the brand or trademark owned by a private labeler.

Exception No. 2: The date of manufacture is not prohibited from being abbreviated or is not prohibited from being in a nationally accepted conventional code or in a code affirmed by the manufacturer, when the code:

i) Does not repeat in less than 20 years; and

ii) Does not require reference to the production records of the company to determine when the product was manufactured.

26.3 An OLED panel shall be legibly and permanently marked with its electrical input ratings: Voltage, frequency (Hz or dc), current, and watts. Polarity for the connections shall be clearly indicated.

Exception: An OLED panel intended for use only with one or more specific low voltage power source(s) is permitted to identify the power source by manufacturer and model number, in lieu of the electrical input rating.

26.3 revised September 30, 2013

26.4 An OLED panel intended for mounting directly on a building surface and attaining surface temperatures higher than 90°C, per footnote (c) of Table 3, shall be marked for mounting only on non-combustible surfaces.

27 Installation and Operation Instructions

27.1 The installation and operation instructions shall specify that the OLED panel is to be supplied only by an isolating power source conforming to the output limits as specified in Electrical Construction – General, Section 12.

Exception: For OLED panels intended to be supplied by a power source beyond the limits of Section 12, see the Supplemental Requirements for Higher Power OLED Panels, Annex A.

27.2 An OLED panel intended to be secured directly to the building structure shall be provided with installation instructions that specify the means for both mechanical mounting and electrical connection. If mounting or connection hardware is not provided, the instructions shall specify the type of hardware needed.

27.3 The installation instructions for an OLED panel intended for mounting directly on a building surface and attaining surface temperatures higher than 90°C, per footnote (c) of Table 3, shall state that it is for mounting only on non-combustible surfaces.

TABLES

Table 1
Thickness of glass panels
(Reference: Clause 8.2)

Exposed area of glass		Minimum thickness of glass			
		Flat glass		Curved glass	
cm^2	(in^2)	mm	(in)	mm	(in)
0 – 968	(0 – 150)	2.11	(0.083)	2.11	(0.083)
969 – 3226	(150 – 500)	2.54	(0.100)	2.11	(0.083)
3227 and greater	(501 and greater)	3.56	(0.140)	2.54	(0.100)

Table 2
Voltage Limits
(Reference: Clause 12.1)

Waveform type[a]	Maximum voltage
Sinusoidal ac	30 V rms
Non-sinusoidal ac	42.4 V peak
dc[b, c]	60 V

[a] For a combined ac + dc waveform, the voltage limit shall be the non-sinusoidal ac limit where the dc voltage is no more than 20.8 V, and shall be (33 + 0.45Vdc) where the dc voltage is greater than 20.8 V.

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

[c] dc waveforms interrupted at frequencies between 10 – 200 Hz shall be limited to 24.8 V.

Table 3
Maximum surface temperatures
(Reference: Clause 19.1)

Table 3 revised September 30, 2013

Materials and components parts	°C	(°F)
1. Electrical insulation (conductors, printed wiring boards, etc.)	60[a]	(140)[a]
2. Electronic components (diodes, transistors, capacitors, etc.)	75[a]	(167)[a]
3. Polymeric or cellulosic material	90[b]	(194)[b]
4. Surfaces adjacent to or upon which the panel may be mounted in service	90[c]	(194)[c]
5. Input supply terminals[d]	75[a]	(167)[a]
6. Supply wire connections	60[e]	(140)[e]
7. Fuse clip with rated fuse installed	110	(230)
8. Sealing compound	[f]	[f]

[a] This limitation does not apply to insulating materials or electronic components that have been investigated and found suitable for a higher temperature.

[b] The maximum temperature of a polymeric material, when corrected to a 25°C (77°F) ambient temperature, shall not exceed the generic or relative temperature index specified in the Standard for Evaluation of Properties of Polymeric Materials, CSA C22.2 No. 0.17, or the Standard for Polymeric Material Long-Term Property Evaluations, UL 746B.

[c] 150°C (302°F) for an OLED panel marked for use only on non-combustible surfaces, per 27.3.

[d] The temperature on a wiring terminal or lug is measured at the point most likely to be contacted by the insulation of a conductor installed as in actual service.

[e] Unless the equipment is marked for use with 75°C or 90°C supply wire.

[f] No limit for thermoset material. For other sealing compound materials, the maximum temperature, when corrected to a 25°C (77°F) ambient temperature, is 15°C (27°F) less than the softening point of the compound as determined in the Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus, ASTM E28.