



UL 1472

STANDARD FOR SAFETY

Solid-State Dimming Controls

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UL Standard for Safety for Solid-State Dimming Controls, UL 1472

Second Edition, Dated September 25, 2015

Summary of Topics

This second edition of ANSI/UL 1472 includes the following:

- 1. Addition of requirements for field replaceable actuator assemblies***
- 2. Revising and adding requirements with respect to wall-box dimmer switches for use with LED lamp with integral driver light source***
- 3. Addition of requirements for ground leakage current***

As noted in the Commitment for Amendments statement located on the back side of the title page, UL and CSA are committed to updating this harmonized standard jointly.

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The revised requirements are substantially in accordance with Proposal(s) on this subject dated June 20, 2014 and February 6, 2015.

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CSA-C22.2 No. 184.1
Second Edition

Underwriters Laboratories Inc.
UL 1472
Second Edition



**CSA
Group**



Solid-State Dimming Controls

September 25, 2015



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This standard is issued jointly by the Canadian Standards Association (operating as CSA Group) and Underwriters Laboratories Incorporated (UL). Comments or proposals for revisions on any part of the standard may be submitted to CSA Group or UL at any time. Revisions to this standard will be made only after processing according to the standards development procedures of CSA Group and UL. CSA Group and UL will issue revisions to this Standard by means of a new edition or revised or additional pages bearing their date of issue.

This ANSI/UL Standard for Safety consists of the Second edition.

The most recent designation of ANSI/UL 1472 as an American National Standard (ANSI) occurred on September 24, 2015. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

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ANNEX A

Standards for Components

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ANNEX B

French translations and markings

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Preface

This is the common UL and CSA Standard for Solid-State Dimming Controls. It is the second edition of both CSA-C22.2 No. 184 and UL 1472.

This common Standard was prepared by a Task Force comprised of members representing CSA, UL, NEMA (National Electrical Manufacturers Association) and the EFC (Electro-Federation of Canada).

This standard includes all items presently covered in C22.2 No. 184-M1988 except the following:

- a) Lighting controls without integral switching (disconnecting control).
- b) Devices used as table mounted unit to which a portable luminaire can be temporarily connected.
- c) Devices installed in lampholders.
- d) Devices permanently installed in the supply line of a lamp.
- e) Direct plug-in devices.

The above will be accommodated either in a new edition of C22.2 No. 184, or in future revisions 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 for UL and CSA.

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 except 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.

CSA Group Effective Date

The effective date for CSA Group will be announced through a *CSA Informs* or *CSA Group Certification Notice*.

UL Effective Date

A UL effective date is one established by UL LLC and is not part of the ANSI approved standard.

SDO Forewords

The UL Foreword is no longer located within the UL Standard. The CSA Foreword is included as an SDO-specific page in the CSA version of this co-published standard. The current version of the UL Foreword is located on ULStandardsInfoNet at: <http://ulstandardsinfo.net.ul.com/ulforeword.html>.

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Solid-State Dimming Controls

1 Scope

1.1 These requirements cover permanently installed devices, hereafter referred to as dimmers, that employ a dimming function intended for control of lighting loads of the magnetic ballast, transformer, electronic ballast, self-ballasted lamp, tungsten-filament type, or light-emitting-diode (LED), and are intended to be installed in a wallbox or are provided with an enclosure for flush or surface mounting in accordance with the Canadian Electric Code, Part 1 (CEC), and the National Electrical Code (NEC), ANSI/NFPA 70.

1.2 These requirements cover dimmers, other than touch dimmers, rated 600 volts ac or less, for installation on a 20-ampere or less branch circuit.

1.3 These requirements cover touch dimmers rated 120 volts ac or less for installation on a 20-ampere or less branch circuit.

1.4 These requirements cover dimmers, including touch dimmers, and electronic switches, having a minimum power rating of 300 watts incandescent or 300 volt-amperes in increments of 50 watts or 50 volt-amperes.

1.5 Devices may have additional current ratings based upon the additional lighting loads as specified by the manufacturer.

1.6 A device incorporating other functions (for example, speed control) in addition to a dimming function is investigated on the basis of compliance with the applicable requirements for the dimming function in this Standard as well as requirements for the other functions in the applicable standards.

1.7 These requirements do not cover dimmers that use only a resistor or a transformer to perform the dimming function.

1.8 These requirements do not cover modular, cabinet or console type constructions.

1.9 These requirements do not cover dimmers intended primarily for use in theaters. Dimmers for use in theaters are covered by the Standard for Industrial Control Equipment, UL 508/CSA C22.2 No. 14.

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2 Definitions

2.1 The following definitions apply in this Standard.

Actuating member – Part of the operating mechanism that is used for the dimming control functions. This member may also be used to operate the air-gap switch.

CFL – Compact Fluorescent Lamp.

CCFL – Cold Cathode Fluorescent Lamp.

Dimmer – A device intended to change lighting to various intensities. For the purposes of these requirements, the term “dimmer” refers to all products covered by this Standard.

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.

Electronic switch – A solid-state device that performs strictly an on-off function and meets the requirements of this standard including the air-gap switch requirement.

Grounding/bonding conductor – A conductor that is defined in the National Electrical Code (NEC) as an Equipment Grounding Conductor, and a conductor that is defined in the Canadian Electrical Code (CE Code), Part I, as a Bonding Conductor.

Lamp, self-ballasted – A device such as a CFL, CCFL, LED, etc. that is provided with a lamp base and incorporating a nonreplaceable light source and any additional elements such as an electronic ballast necessary for starting and stabilizing operation of the light source, which cannot be dismantled without being permanently damaged.

Off position – The air-gap switch is in the open position.

Opposite polarity – A difference of potential between two points where shorting of these two points would result in a condition involving overload, rupturing of printed wiring board tracks, components, fuses, or the like.

Touch dimmer – A device using circuitry for touch actuation in accordance with Clauses 4.9 and 5.13. Examples of such circuitry are non-isolated sensing or conductively connected dead metal.

Type I dimmer – A dimmer in which the air-gap switch is used to energize preset lighting levels.

Type II dimmer – UL A dimmer with an air-gap switch that opens and closes the load circuit at the minimum output voltage setting only.

Type IIa dimmer – A dimmer with an air-gap switch that opens and closes the load circuit at the maximum output voltage setting only.

Type III dimmer – A dimmer incorporating solid-state components providing preestablished rectified output settings.

Type IV dimmer – A dimmer not covered by Types I – III.

3 General requirements

3.1 Components

3.1.1 Except as indicated in Clause 3.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Annex A for a list of Standards covering components generally used in the products covered by this Standard. A component shall comply with both the Underwriters Laboratories Inc. and Canadian Standards Association Standards for the component.

3.1.2 A component need not comply with a specific requirement that:

- a) involves a feature or characteristic not needed in the application of the component in the product covered by this Standard, or
- b) is superseded by a requirement in this Standard.

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

3.1.4 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.

3.2 Normative references

3.2.1 Where reference is made to other publications, such reference shall be considered to refer to the latest edition and all amendments published to that edition up to the time when this Standard was published:

UL Standards

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

Standard for Wire Connectors,
UL 486A-486B

Standard for Equipment Wiring Terminals for Use With Aluminum and/or Copper Conductors,
UL 486E

Standard for Metallic Outlet Boxes,
UL 514A

Standard for Nonmetallic Outlet Boxes, Flush Device Boxes, and Covers,
UL 514C

Standard for Polymeric Materials – Long Term Property Evaluations,
UL 746B

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

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

Standard for Across-the-Line, Antenna-Coupling, and Line-By-Pass Capacitors for Radio-and-Television-Type Appliances,
UL 1414

CSA Standards

C22.1-15,
Canadian Electrical Code, Part 1

C22.2 No. 0.17,
Evaluation of Properties of Polymeric Materials

C22.2 No. 18-92,
Outlet Boxes, Conduit Boxes and Fittings

C22.2 No. 65-13,
Wire Connectors

3.2.2 This Standard refers to the following publications and where such reference is made it shall be to the edition listed below.

ANSI Standards

ANSI MC96.1-1982,
Temperature Measurement Thermocouples

ANSI/NFPA 70,
National Electrical Code (NEC)

3.3 Units of measurement

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

4 Construction

4.1 Polymeric materials

4.1.1 A polymeric material used for electrical insulation or as an enclosure part shall have a flammability class rating of 5VA, 5VB, V-0, V-1, or V-2 in accordance with UL 94 and C22.2 No. 0.17. The flammability class rating shall be investigated at the nominal minimum thickness of a polymeric material used within 0.8 mm (1/32 inch) of uninsulated live parts.

Exception No. 1: A polymeric material that complies with either the 12 mm or 3/4 inch flame flammability test described in UL 746C and C22.2 No. 17, need not have a flammability class rating.

Exception No. 2: If the polymeric material is not used in place of the spacings specified in Table 4, a polymeric material used in a rear housing totally contained within the volume of the outlet box may have a minimum flammability class rating of HB.

4.1.2 A polymeric material used for electrical insulation or as an enclosure part shall have a performance level category (PLC), determined in accordance with UL 746C, that complies with the requirements specified in Table 1 for electrical insulation or Table 2 for enclosure parts, respectively.

Exception No. 1: A polymeric material that complies with the requirements in UL 746C is considered to comply with both Table 1 and Table 2.

Exception No. 2: If the spacings to a polymeric material used as an enclosure part are not greater than the through-air and over-surface spacings specified in Table 4, the polymeric material shall comply with both Table 1 and Table 2.

Exception No. 3: If the polymeric material is not used in place of the spacings specified in Table 4, a polymeric material that does not contact uninsulated live parts and that is used as a rear housing totally contained within the volume of the outlet box need not comply with the performance level categories.

4.1.3 A polymeric material used as electrical insulation or as an enclosure part shall have the minimum relative thermal index (RTI) rating specified in Table 3. Higher ratings may be required in a specific application based on the results obtained for the temperature test, Clause 5.5.

4.1.4 A thermoplastic part shall comply with the mold stress-relief test, Clause 5.12.

4.2 Actuating member

4.2.1 An actuating member shall have the strength necessary to resist the abuses to which it is likely to be subjected in its intended use, and shall be securely attached to the operating mechanism that it is intended to control.

4.2.2 An actuating member of conductive material shall be insulated from live parts.

4.2.3 A dimmer provided with a field replaceable actuator assembly shall not permit contact to be made between the probe shown in Figure 2 and any live part when the actuator assembly is removed. Compliance is checked by inspection and if necessary, the field replaceable actuator assembly test, Clause 5.15.

4.2.4 A dimmer provided with a field replaceable actuator assembly that remains operational (capable of switching the load “on” or changing the light output) without the actuator assembly installed, shall also comply with the limited short-circuit test with the actuator assembly removed. See Clause 5.10.6.

Exception: A dimmer provided with cosmetic or decorative type actuator, such as a knob attached to the stem of a dimmer, or a decorative type actuator that, when removed, renders the dimmer inoperable, is not required to comply with the short circuit test with the cosmetic or decorative actuator feature removed.

4.3 Spacings

4.3.1 The minimum through-air and over-surface spacings maintained between uninsulated live parts of opposite polarity, and between an uninsulated live part and a grounded or dead metal part, other than a metallic flush cover plate that is intended to be grounded or exposed to contact when the dimmer is installed in the intended manner, shall be as specified in Table 4. Spacings are to be investigated with 12 AWG (3.3 mm²) wire connected to the field wiring terminals.

Exception No. 1: When a printed-wiring board is conformally coated with a material that complies with the conformal-coating test requirements specified in UL 746C and CSA C22.2 No. 017, the spacings between uninsulated live parts of opposite polarity on a printed-wiring board may be less than specified in Table 4.

Exception No. 2: Spacings between uninsulated live parts of opposite polarity on a printed-wiring board may be less than specified in Table 4, when the printed-wiring board complies with the clearances and creepage requirements specified in UL 840 for overvoltage category 3 and:

- a) for pollution degree 1 for conformal coated printed-wiring boards; or*
- b) for pollution degree 2 for uncoated printed-wiring boards.*

4.3.2 A minimum spacing of 3.2 mm (1/8 inch) through-air shall be maintained between uninsulated live parts and a metallic flush cover plate.

4.3.3 An insulating liner or barrier used in place of required spacings may be used if it complies with Clauses 4.1.1 and 4.1.2. Electrical grade paper not less than 0.33 mm (0.013 inch) thick or mica not less than 1.65 mm (0.065 inch) thick may be used in conjunction with a through-air spacing of not less than 50 percent of the through-air spacing specified in Table 4 without additional investigation.

4.4 Means for mounting

4.4.1 A flush-type dimmer shall be provided with means for mounting in a flush-device box complying with UL 514A or UL 514C, and C22.2 No. 18, or means for mounting on a cover plate for flush-mounted wiring devices complying with UL 514D and C22.2 No. 42.1.

4.4.2 A screw provided for use in mounting a dimmer to an outlet box shall not project more than 22 mm (7/8 inch) beyond the strap or cover, and shall have a flat or blunt end. The end of the screw shall not have burrs, fins, or sharp edges that may damage insulation on wiring.

Exception: Thread-cleaning slots or grooves at the end of a screw may be used.

4.5 Current-carrying parts

4.5.1 General

4.5.1.1 A dimmer shall be provided with the means for the connection of conductors that have an ampacity at least equal to the maximum current rating of the dimmer.

4.5.1.2 The means for connection of conductors in the field shall be one of the following:

- a) a wire-binding screw with a means to retain the conductor under the screw head;
- b) pressure wire connectors that comply with UL 486A, UL 486B, or UL 486E, and C22.2 No. 65;
- c) wire leads as described in Clause 4.5.4; or
- d) an equivalent means.

4.5.2 Live parts

4.5.2.1 Uninsulated live parts shall be so secured in place by means other than friction between surfaces that displacement would not adversely affect performance, and that there is no likelihood of a reduction in spacings to values less than the minimum spacings specified in Spacings, Clause 4.3.

4.5.2.2 An uninsulated live part mounted on insulating material shall be recessed in the insulating material so that wiring cannot touch the live part.

Exception: A wiring terminal need not be so recessed.

4.5.2.3 A back wiring terminal, used on a dimmer intended for installation in a flush-device box, shall be provided with a guarding means that provides the minimum spacing specified in Table 4 between the terminal and the enclosure or wiring, other than the wiring intended for connection to the terminal.