Summary of Substantive Changes
between the updates dated September 19, 2013 and May 22, 2014 of
UL 8750, "Light Emitting Diode (LED) Equipment for Use in Lighting Products"
(First edition, dated November 18, 2009)

Presented to the IAPMO Standards Review Committee on July 7, 2013

General: The changes to this standard might have an impact on currently listed products. The substantive changes are:

- Added a definition of the *test reference point* and new testing for LED arrays provided with a manufacturer-identified test reference point (see Sections 3.25.1 and 8.3.18).
- Revised a limiting requirement from specifying Class 2 or LVLE limits to specifying circuits that pose a risk of fire (see Sections 6.1.4, 6.6.1, 7.3.3, 8.5.2.1).
- Added a requirement for the connection of units that are not intended as built-in components (see Section 7.4)
- Added an exception for the compliance with UL 746C of conformal coatings applied to PWBs with Class 2 or LVLE circuits (see Section 7.7)
- Revised and consolidated the spacing requirements of wiring boards (see Sections 7.7 and 7.8 and Tables 7.4 and 7.5).
- Added an exception to the requirement for a transformer coils electrical insulation system to comply with UL 1446 (see Section 7.11).
- Added a provision for using linear regression in situations where optical radiation from the light source is expected to affect the accuracy of a temperature measurement (see Section 8.3.18.1).
- Revised the circuit power limit measurement test procedure and requirements to accommodate circuit power limits in general including both 50-watt and 15-watt circuit measurements (see Section 8.6).

Section 3, Definitions:
Section 3.25, Risk of Fire: Added a 15 W maximum power limit to circuits that do not present a fire risk and the LED array Test Reference Point as follows:
A risk of fire exists in all electrical circuits except:
c) A circuit of 15 W maximum power limit under normal and single fault conditions, as measured in accordance with 8.6.8.3

3.25.1 TEST REFERENCE POINT – A temperature reference point on the enclosure or surface of an LED driver or LED array, defined at the discretion of the manufacturer.

Section 6 Mechanical Construction:
Section 6.1, General: Revised the limiting requirement from specifying Class 2 or LVLE limits to specifying circuits that pose a risk of fire as follows:
6.1.3 Circuits that represent a risk of electric shock or risk of fire shall be provided with an enclosure that complies with 6.2 or 6.3.

~~6.1.4 Circuits that do not involve a risk of electric shock or risk of fire shall not be required to be provided within an enclosure. Circuits operating within Class 2 or LVLE levels need not be enclosed.~~

Section 6.6, Strain Relief: Revised the limiting requirement from specifying Class 2 or LVLE limits to specifying circuits that pose a risk of fire as follows:
6.6.1 For any accessible conductor operating above ~~Class 2 or LVLE limits~~the limits for risk of fire or electric shock, a strain relief and cord pushback means shall be provided that complies with the cord strain pushback relief test requirements of 8.8, where cord or lead wire displacement could result in:

Section 7.3, Internal Wiring: Revised the limiting requirement from specifying Class 2 or LVLE limits to specifying circuits that pose a risk of fire as follows:
7.3.3 The electrical and mechanical connection between a conductor and any circuitry operating above ~~Class 2 or LVLE limits~~the limits for risk of fire or electric shock shall be contained within an enclosure and be inaccessible in accordance with 7.2.

Section 7.4, Supply and Load Connections: Added a requirement for the connection of units that are not intended as built-in components as follows:
7.4.1, General
7.4.1.3 Units that are not intended as built-in components shall have provision for connection to a branch circuit source of supply by field wiring in 7.4.2, integral blade assembly of a direct plug-in unit in 7.4.3, or supply cord and attachment plug assembly in 7.4.3.

7.4.3, Cord-Connected and Direct Plug-In Units
7.4.3.1 A unit shall be provided with either:
a) A cord-connected or direct plug-in power supply or LED driver, with an output cord for mating with the unit, or
b) A power supply cord and ~~integral polarized or grounding-type attachment plug as shown in Figure 7.2~~ attachment plug.

7.4.3.1.1 A unit having an attachment plug or direct plug-in blade configuration shall be polarized or a grounding-type as shown in Figure 7.2.

Exception: A 2-conductor unit is not required to be supplied with a polarized plug when it does not include any single pole switches or fuses and parts that represent a risk of electric shock that may be accessible during operation or service.

Section 7.7, Printed wiring boards: Added an exception for the compliance with UL 746C of conformal coatings applied to PWB's with Class 2 or LVLE circuits and consolidated and moved the spacing requirements for printed wiring boards from section 7.7 and Table 7.4 to section 7.8 and Table 7.5 as follows:
7.7.2 Where a conformal coating is used ~~to qualify for spacing reductions per 7.8.2, the conformal coating~~ to meet the requirements of this standard, it shall comply with the requirements in the Standard

for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and be suitable for use in combination with the printed wiring board.
Exception: Conformal coatings applied to PWBs that contain only Class 2 or LVLE circuits need not comply.

~~*7.7.3 For components mounted along the edge of a printed wiring board, clearances between uninsulated parts of opposite polarity and uninsulated live parts and a dead conductive part that is able to be grounded or a metal part exposed to contact by persons are to take into consideration the possible movement of the component and the printed wiring board itself. When applying the limits in Table 7.4, the printed wiring board is to be positioned, when movement is possible, in the direction that yields the smallest clearance between the parts in question.*~~

Section 7.8, Electrical Spacings: Revised and consolidated the spacing requirements in section 7.7 into section 7.8 and the requirements of 7.8.1 and 7.8.2 into section 7.8.1 as follows:
7.8.1 Minimum spacings ~~*for field-wired branch circuit supply terminals, between uninsulated live parts of opposite polarity, between an uninsulated live part and a grounded dead-metal part, and between an uninsulated live part and an accessible dead-metal part shall be in accordance with Table 7.5*~~ *other than on printed wiring boards or on board-mounted components shall not be less than those shown in Table 7.4, between:*
~~*7.8.2 Minimum spacings for other than field-wired branch circuit supply terminals, between uninsulated live parts of opposite polarity, between an uninsulated live part and a grounded dead-metal part, and between an uninsulated live part and an accessible dead-metal part*~~
a) Uninsulated live parts of opposite polarity,
b) Uninsulated live parts and a grounded dead-metal part, and
c) Uninsulated live parts and an accessible dead-metal part ~~*shall be in accordance with Table 7.6*~~

7.8.3 Minimum spacings on printed wiring boards and for board-mounted components shall be not less than those shown in Table 7.5 between: ~~*uninsulated live parts of opposite polarity, between an uninsulated live part and a grounded dead-metal part, and between an uninsulated live part and an accessible dead-metal part*~~
a) Uninsulated live parts of opposite polarity,
b) Uninsulated live parts and a grounded dead-metal part, and
c) Uninsulated live parts and an accessible dead-metal part ~~*shall be in accordance with Table 7.4*~~*.*

Minimum spacings for components mounted along the edge of a printed wiring board shall take into consideration the possible movement of the component and the printed wiring board itself. When applying the limits in Table 7.5, the printed wiring board is to be positioned, when movement is possible, in the direction that yields the smallest spacings between the parts in question.

~~*Exception No. 1: Other than for wiring terminals or spacings to a dead-metal conductive enclosure, spacings are permitted to be in accordance with the Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840. Overvoltage Category II applies to circuits directly connected to the supply source. Printed wiring boards are presumed to have a minimum CTI of 100 unless known to be greater.*~~

~~*Exception No. 3: Encapsulated parts, inherent spacings of discrete components along with other conductive parts at their point of connection to these discrete components, and circuits supplied by a Class 2 or LVLE source are exempt.*~~

Exception No. 3: Spacings between adjacent PWB traces are permitted to be evaluated based on short circuit tests between the traces. This alternate method is not applicable when the adjacent PWB traces
1) Between electrically isolated circuits, or
2) Between live parts and ground.
Sample preparation shall be per 8.5.1.1 – 8.5.1.3. Compliance shall be determined per 8.5.1.4 criteria.

7.8.3.1 Minimum spacings at other than at field-wired branch circuit supply terminals or between uninsulated live parts and a metal enclosure are permitted to be in accordance with the Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840. Overvoltage Category II applies to circuits directly connected to the supply source. Printed wiring boards are presumed to have a minimum CTI of 100 unless known to be greater.

7.8.3.2 The inherent spacings of discrete components along with other conductive parts at their point of connection to these discrete components, as well as the spacings of circuits supplied by a Class 2 or LVLE source between points of opposite polarity and to dead metal, are exempt from the spacings requirements in this section.

7.11 Coil insulation: Added an exception to the requirement for a transformer coils electrical insulation system to comply with UL 1446 as follows:
7.11.3 Electrical insulation systems
~~*7.11.2.11*~~ *7.11.3.11 A transformer or coil* ~~*insulation system that is relied upon for compliance with this standard and*~~ *that operates above Class 105 (A) temperature limits as indicated in Table 8.1 during the Temperature Test of 8.3 shall incorporate an electrical insulation system that complies with the Standard for Systems of Insulating Materials – General, UL 1446.*

Exception: Under conditions a, b or c below, the integral insulation materials for a transformer or coil need not be evaluated as an electrical insulation system but shall operate within the relative thermal index (RTI) or generic thermal index of the individual insulation material:
a) The transformer or coil windings are wholly connected within Class 2 or LVLE circuits,
b) The coil consists of a single winding with a core that is isolated from ground and all accessible dead metal, or
c) The transformer or coil windings are not relied upon for electrical isolation and the core is isolated from ground and all accessible dead metal.

Section 8.3, Temperature test: Added testing for LED arrays provided with a manufacturer identified Test Reference Point and a provision for using linear regression in situations where optical radiation from the light source is expected to affect the accuracy of a temperature measurement as follows:
8.3.18 When an array (module) is provided with a manufacturer identified Test Reference Point the temperature test shall be performed as follows:
a) The array is attached to the heat sink (if any) provided or recommended by the manufacturer in accordance with the manufacturer's instructions.

b) The assembly is then placed in a still air test oven maintained at an ambient temperature of 40°C (104°F).
c) The array is then operated until temperatures have stabilized.
d) The temperature at the Test Reference Point (see 3.25.1) shall be recorded.
e) The designated temperature for the Test Reference Point shall be calculated using test results in 8.3.1 as follows:
1) For each of the parts noted in Table 8.1, the difference between the maximum temperature allowed per Table 8.1 and the observed temperature is calculated ($\Delta t_1 . . . \Delta t_n$),
2) The smallest value of ($\Delta t_1 . . . \Delta t_n$) is designated as Δt,
3) Δt plus the temperature observed at the Test Reference Point is the maximum designated value allowed for the Test Reference Point. A lesser value may be stated by the manufacturer.

8.3.18.1 In situations where optical radiation from the light source is expected to affect the accuracy of a temperature measurement, with the agreement of all parties involved, linear regression is permitted to be used. A series of temperature measurements shall be taken at 5-second increments immediately after the light source has been de-energized for a total duration of 130 seconds. The data from the first 10 seconds shall be discarded and the remaining 120 seconds of data plotted on a time vs. temperature graph. Using a linear regression formula, the temperature at time zero shall be calculated and recorded to represent the temperature measurement value.

Section 8.5.2, Component Failure Test: Revised the limiting requirement from specifying Class 2 or LVLE limits to specifying circuits that pose a risk of fire as follows: test as follows:
8.5.2.1 A unit shall not exhibit a risk of fire or electric shock when a simulated short circuit is imposed on electrolytic capacitors or semiconductor devices.
Exception No. 1: Circuits in which maximum power levels have been determined to not exceed 50 W need not be evaluated for component failure.
Exception No. 2: Devices supplied by a ~~Class 2 or LVLE~~ source operating within the limits for risk of fire and electric shock need not be subject to this test.

Section 8.6 Circuit Power Limit Measurement Test: Changed the section title and revised the test procedure and requirements to accommodate circuit power limits in general including both 50-watt and 15-watt circuit measurements as follows.
8.6 ~~50-Watt point~~ Circuit power limit measurement test:
8.6.1 ~~To determine the point beyond which any circuit is unable to deliver more than 50 W of available power, a wattmeter and an adjustable external load resistor are to be arranged as illustrated in Figure 8.1. Power limitation is permitted to be accomplished either by the inherent design of the circuit (per 8.6.2), by the opening of a circuit component (per 8.6.3), or by the opening of a protective device (per 8.6.4).~~This test shall be used to determine if the power available to a circuit under any loading condition,including short circuit, measured after one minute of operation exceeds a defined limit. For the purposes of this test, the limit (for example, 15W or 50W) is referred to as PLIMIT.

8.6.2 ~~The external adjustable load resistor is to be initially set for its maximum resistance. The adjustable resistance is then to be reduced gradually to the point of maximum delivery wattage as indicated by a peak reading on the wattmeter.~~ The point in the circuit under evaluation is to be connected to the

measurement circuit as shown in Figure 8.1. The external adjustable load resistor is reduced gradually to the point where PLIMIT is being dissipated. The load shall be re-adjusted as needed to maintain PLIMIT for one minute. If PLIMIT cannot be attained and maintained for one minute under any load condition, the test shall be discontinued.

8.6.3 For a circuit without a designated current limiting device, a circuit component that opens in less than 1 minute at any power delivery level less than ~~50 W~~ PLIMIT and that precludes delivery of ~~50 W~~ PLIMIT for more than one minute is considered to effectively limit the circuit output to less than ~~50 W~~ PLIMIT, if the test can be repeated two additional times on new samples with comparable results.

8.6.4 For a circuit with a designated current limiting device, a closed shorting switch is to be connected across the current limiting device and the adjustable resistance is then to be reduced to result in a power dissipation of exactly ~~50 W~~ PLIMIT as indicated by the meter. The switch across the current limiting device is then to be opened and the time required for the device to open is to be recorded. A current limiting device that opens the circuit in less than 1 minute is considered to effectively limit the circuit output to less than ~~50 W~~ PLIMIT.

8.6.5 If the test is disrupted by the failure of other circuit components (i.e.: capacitor, diode, coil winding, foil trace, etc.) then that test shall be repeated two additional times, with new samples, under the same test condition. Test disruption by opening of the same, or a different, component during these repeated tests is acceptable.

8.6.6 If the supply to the circuit under evaluation consists of other than a single resistor, the test described in this section shall be repeated under any single component fault conditions within the supply circuit likely to result in greater output power availability. The fault condition shall first be applied, and then the variable resistance load shall be adjusted as needed. A new sample shall be used for each component fault.

Exception: Components whose reliability against failure has been deemed acceptable by a separate investigation shall not be faulted. Examples of such components: Optical isolators evaluated to Standard for Optical Isolators, UL 1577; Capacitors evaluated to Standard for Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains, UL 60384-14; etc.

8.6.7 If there is any indication of component overheating during any of the tests described in 8.6.2 – 8.6.6 (i.e.: odor, smoke, discoloration, glowing, cracking, melting, or changes in circuit current through the fault), the test condition shall be repeated as part of the Component Failure Test in 8.5.2.

Tables 7.4, 7.5 and 7.6: The tables were changed, the former spacing requirements in table 7.4 were clarified and consolidated into table 7.5 and the former spacing requirements in tables 7.5 and 7.6 were revised and consolidated into Table 7.4. Table 7.6 was deleted. The table titles were revised as follows:

- *Table ~~7.5~~7.4, ~~Spacings at field-wiring branch circuit supply terminals~~ Spacings other than on printed wiring boards or board-mounted components*
- *Table ~~7.4~~7.5, Spacings on printed wiring boards and for board-mounted components*
- *~~Table 7.6, Spacings other than field-wiring branch circuit supply terminals~~*