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DRAFT Testing and Reporting Requirements for Direct-Current (DC) and Power-over- Ethernet (PoE) Lamps, Luminaires, and Retrofit Kits

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Products powered by Direct Current (DC) and Power-over-Ethernet (PoE) must comply with the provisions of this document to be eligible for listing on the DLC Solid-State Lighting (SSL) Qualified Products List (QPL). DC/PoE products are defined as SSL lamps, luminaires, and retrofit kits that are powered by a DC voltage and listed as DC or PoE products on the DLC SSL QPL. If DC/PoE lamps, luminaires, and retrofit kits are also capable of being powered by AC voltage and the manufacturer desires to have them listed as suitable for both AC and DC, then the AC listing of the product must have a distinct model number that is different from the DC listed product and it must be separately qualified.

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The DLC intends to list DC/PoE lamps, luminaires, and retrofit kits on the SSL QPL based only on the luminous efficacy of these products as measured at their DC power input. The overall energy consumption of the DC/PoE systems also depends on DC line losses and DC power supply efficiency, in addition to luminaire or lamp efficacy. However, given the variation in system architectures and power losses, the DLC will not publish system-level efficacies. The DLC will provide basic guidance to utilities on how to calculate DC/PoE system efficiency, including losses at the DC Power Supply and the DC lines, to assist them in considering incentive applications.

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Definitions

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1. **DC Power Supply:** For this policy, the term “DC Power Supply” is used to indicate the device(s) that connect AC mains to the lines directly providing DC input power to the DC/PoE product. Though DC/PoE products may be used entirely disconnected from the AC power grid, the primary focus of



28 this policy is grid-connected SSL lighting. A DC Power Supply may be more
29 typically known as any of the following:

- 30 • **AC-to-DC Power Converter**
- 31 • **Power-over-Ethernet Power Sourcing Equipment (PoE PSE)**,
32 also known as a PoE Switch
- 33 • **AC/DC Multi-Directional Inverter**

34 2. **DC-to-DC Driver:** An LED driver, typically integrated into the luminaire,
35 that converts the DC voltage received at the DC luminaire into the DC
36 voltage required to operate the LEDs in the lamp, luminaire, or retrofit kit.
37 Not all DC or PoE lamps, luminaires, or retrofit kits require a DC-to-DC
38 driver.

39 Eligibility

40 The following are eligibility rules for DC/PoE products:

- 41 • DC/PoE products are not eligible to be submitted as Single Product DLC
42 application types. Both single DC/PoE products and DC/PoE product families
43 must submit a Family Grouping Application and be tested in accordance with
44 the requirements of the [family grouping policy](#).
- 45 • DC/PoE products must meet all DLC Technical Requirements for the General
46 Application(s) and Primary Use(s) under which they are submitted, with the
47 exception of THD and Power Factor. These requirements include minimum
48 lumen output, efficacy, Correlated Color Temperature (CCT), Color Rendering
49 Index (CRI), lumen maintenance, and zonal distribution/spacing.
- 50 • DC/PoE products will only be classified as DLC Premium if they meet all [DLC](#)
51 [Premium classification requirements](#). An LED Driver ISTMT is required for
52 DLC Premium submissions of luminaires with an integrated DC-to-DC driver.
53 Additional documentation is required on the driver per the requirements for
54 Premium products.
- 55 • DC/PoE products may also have Color-Tunable, Field-Adjustable, or
56 Dimmable product features, in which case they are also subject to the
57 relevant DLC Testing and Reporting Requirements for those types of
58 products. If products exhibit both performance features, they must comply
59 with both Color-Tunable and Field-Adjustable Product Testing and Reporting
60 Requirements.

61 Testing Methods and Requirements

62 Testing for DC/PoE products or family groups must be provided to cover all areas of
63 investigation as with AC products or family groups. The below requirements apply
64 to the DC/PoE luminaire, lamp, or retrofit kit under consideration, as test reports
65 will not be required on the DC Power Supply.

- 66 1. DC/PoE products or family groupings shall be tested according to the
67 guidelines for electrical instrumentation of DC devices in the latest version of
68 the Illuminating Engineering Society's (IES) LM-79 publication.
 - 69 a. The intent of the LM-79 Test Reports required for DLC submission is
70 measurement of the luminaire efficacy as well as other photometric
71 characteristics under DC power without including DC Power Supply
72 conversion losses or line losses.
 - 73 b. Many DC/PoE products, for example PoE+, utilize multiple pairs of
74 conductors. LM-79 Test Reports shall reflect the combined power
75 analysis of all conductors with the inclusion of DC-to-DC driver
76 losses.
 - 77 c. The test report shall document the number of powered conductor
78 pairs.
 - 79 d. Where the test laboratory is in doubt about the proper
80 interconnection or placement of voltage sensing leads for power
81 measurement, they should consult the manufacturer.
- 82 2. The luminous efficacy according to the LM-79 Test Method shall be provided
83 at up to three voltages:
 - 84 a. The minimum luminaire DC input voltage according to the
85 established system protocol (e.g. minimum of 42.5V for IEEE
86 802.3at Type 2 PoE powered devices), or where no independent
87 protocol exists, the minimum voltage described in the luminaire
88 manufacturer's system requirements.
 - 89 b. The maximum allowable DC voltage of the DC system according to
90 the established system protocol (e.g. maximum of 57V for IEEE
91 802.3at Type 2 PoE powered devices), or where no independent
92 protocol exists, the maximum voltage permitted under the National
93 Electrical Code for the appropriate class of wiring (e.g. NEC
94 maximum of 60V for Class 2), or where the product will not operate
95 under the above maximum voltages, the manufacturer's specified
96 maximum voltage accompanied by a written explanation of the
97 nature of the voltage limitation. If the maximum voltage is less

- 98 than a 5% increase over the minimum voltage in part a), testing at
99 the maximum voltage is not required.
- 100 c. The mean of the maximum and minimum voltages in parts a) and
101 b). If this voltage is less than a 5% increase over the minimum
102 voltage in part a), or if part b) is not required, testing at the mean
103 voltage is not required.
- 104 3. Manufacturers must provide clear instructions to the testing laboratory for
105 how to achieve the full light output state for LM-79 testing. Full light output
106 state is defined as the light output at the nominal product input voltage.
107 Additionally, for dimmable products, any dimming input control signal must
108 be set to the maximum setting. The identical instructions must be provided
109 to the DLC as part of the application review as were provided to the test
110 laboratory.
- 111 4. In-Situ Temperature Measurement Tests (ISTMTs) must be conducted in the
112 most appropriate application as defined by its appropriate safety standard,
113 per its safety certifications (ANSI/UL 1598 or CSA C22.2 No. 250.0-08). TM-
114 21 projections will use this thermal measurement in conjunction with the
115 provided LM-80 data to evaluate lumen maintenance and compliance with
116 L70 requirements. Alternatively, LM-84 and TM-28 projections will be
117 acceptable. Please contact applications@designlights.org if you intend to use
118 this alternative LM-84 approach.

119 Supporting Documentation

120 Applicants shall provide the following supporting documentation with the application
121 submittal. If any of the following information is not clearly documented in the
122 system design or installation guide, product specification sheet, or other supporting
123 technical or marketing materials, the application will be considered incomplete and
124 the DLC reviewer will request additional information.

- 125 • Product Installation, Power Supply, and Wiring documentation covering the
126 following:
 - 127 ○ Sizing of DC Power Supply to products
 - 128 ○ Locating DC Power Supplies
 - 129 ○ Parameters for choosing wiring gauge and type
 - 130 ○ Acceptable limits for wiring length
 - 131 ○ Reference to any standards utilized (e.g. ANSI C137.3)

- 132 ○ Acceptable upper and lower limits for voltage & current in DC wiring or
- 133 cabling
- 134 ○ Explanation for configuration and typical use of DC Power Supply and
- 135 wiring for non-lighting loads such as sensors or switches.
- 136 ○ Range of acceptable input voltages to luminaire, lamp, or retrofit kit
- 137 ● Dimming Control Interface Documentation
- 138 ○ For products with dimming capabilities, a description of the method of
- 139 the input control
- 140 ○ References to any control standards or protocols utilized
- 141 ○ Photos of the control input location

142 Listing on the QPL

143 DC/PoE products will be listed on the SSL QPL according to their lowest efficacy as
144 documented in the LM-79 report(s) specified in Section 2 of the Testing
145 Requirements above. In addition, the highest and lowest tested wattage from the
146 submitted LM-79 test result(s) of the product will be displayed with supplemental
147 fields to indicate the range of power use of the product. All existing QPL fields will
148 apply to DC/PoE products except for Total Harmonic Distortion (THD) and Power
149 Factor (PF). These two fields will be either left blank or "N/A". DC/PoE products will
150 be distinguished from Alternating Current (AC) products on the SSL QPL as follows:

- 151 ● DC/PoE listings on the QPL will prominently feature and point to a
- 152 supplemental guide or pop-up window that provides important information
- 153 for how to use the DC/PoE listing data, which is different from non-DC/PoE
- 154 listing data.
- 155 ● Four new fields will be required for DC/PoE listings and one existing field may
- 156 be modified:
 - 157 ○ **"System Type/Power Supply Type/Voltage Type"** (TBD on exact
 - 158 wording). This new field would apply to all products on the QPL and
 - 159 would be populated with text as "AC", "DC", or "PoE".
 - 160 ○ **"Test Voltage"** (TBD on exact wording). This new field would be
 - 161 needed for DC and PoE products and may also be applied to existing
 - 162 AC products. It would be a numerical value that lists the voltage from
 - 163 the LM-79 test report (e.g. 24 Volts, 300 Volts, etc.) that corresponds
 - 164 to the luminous efficacy listed for that product.
 - 165 ○ **"Voltage Range"** (TBD on exact wording). This new field would be
 - 166 applied to both AC and DC products. It would either be a text value

167 that lists the range of acceptable voltage for the product (e.g. 120-
168 277VAC, 44-57VDC, or be a text field that lists "Class 1" or "Class 2",
169 or alternatively "High Voltage" or "Low Voltage".

170 ○ **"DC Efficacy"** (TBD on exact wording). This new field would list the
171 efficacy of DC/PoE products, which is different from the current
172 "efficacy" field of existing products. The existing "efficacy" field on the
173 DLC's QPL may be changed to "AC efficacy" to clearly differentiate
174 from the "DC efficacy" of DC/PoE products.

175 The DLC will provide basic guidance to utilities on how to calculate DC/PoE system
176 efficiency, including losses at the DC Power Supply and the DC lines, to assist them
177 in considering incentive applications.

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