



# DLC LUNA Version 1.0 Technical Requirements Tables



The LUNA Technical Requirement Tables contain the complete set of minimum technical specifications that products must meet to be LUNA qualified on the DLC QPL. To provide a comprehensive set of requirements for products seeking qualification under LUNA, this document contains tables from the SSL V5.1 Technical Requirements that are unchanged by the LUNA policy, in addition to the requirements specific to the LUNA Technical Requirements policy. The tables in this document are organized separately from those in the [SSL V5.1 Technical Requirements Tables](#) and the [LUNA V1.0 Technical Requirements](#) policy document, and the numbering of the tables does not correlate between the two documents. Each applicable document (SSL V5.1 Technical Requirements Tables, LUNA Technical Requirements policy, or both) is referenced for each table below. Please review the requirements carefully for the specific product type before submitting a product application. Products listed on the QPL under the LUNA V1.0 qualification meet the requirements listed in this document.

Application submission information may be found on the DLC website.

## Table of Contents

DLC LUNA Categories, General Applications, and Primary Use Designations (PUD)	4
Minimum Light Output and Minimum Efficacy Requirements	4
Light Output and Distribution Requirements by Primary Use Designation	5
Aiming Requirements	5
Shielding Requirements	6
Backlight, Uplight, and Glare (BUG) Ratings Requirements	6
Controllability Requirements	7
DLC Premium	9
Driver ISTMT and Specification Sheet	9
Lumen Maintenance	10
LM-80 Applicability	11
L <sub>70</sub> Evaluation	11
L <sub>90</sub> Evaluation for Premium Products	11
LM-84 and TM-28	12
Tolerances	12
Spectral Quality Requirements	13
TM-30	13
Multiple CCTs	14
Allowances	14
Tolerances	15
Power Factor and Total Harmonic Distortion	17
Multiple LEDs	17
Warranty	18
Safety Certification	18

Single Product / Family Grouping / Product Updates .....	18
Private Label.....	18
Verification of Model Numbers .....	19
Additional Guidance for Products Seeking Qualification under the "Specialty" Primary Use Designation.....	19
Additional Guidance for Reporting Requirements .....	20
Policy Clarifications and Updates.....	21

## DLC LUNA Categories, General Applications, and Primary Use Designations (PUD)

**Table 1:** Categories, General Applications, and Primary Use Designations (PUD). Adapted from [SSL V5.1 Technical Requirements Tables](#), Table 1.

#	Category	General Application	Primary Use Designations (PUD)
1	Outdoor	Low Output	<ul style="list-style-type: none"> <li>• Outdoor Pole/Arm-Mounted Area and Roadway Luminaires</li> <li>• Outdoor Pole/Arm-Mounted Decorative Luminaires</li> <li>• Outdoor Full-Cutoff Wall-Mounted Area Luminaires</li> <li>• Bollards</li> <li>• Fuel Pump Canopy Luminaires</li> <li>• Specialty: Hazardous Area Lighting</li> <li>• Specialty: Hazardous Outdoor Pole/Arm-Mounted Area and Roadway Luminaires</li> <li>• Specialty: Hazardous Wall Mounted Luminaire</li> <li>• Specialty: Canopy Lighting</li> <li>• Specialty: Directional Fuel Pump Canopy Luminaires</li> <li>• Specialty: Transportation</li> </ul>
2		Mid Output	
3		High Output	
4		Very High Output	

Table 1 Notes:

- Luminaires may not qualify for DLC Premium using “Specialty: \_\_\_\_\_” as the Primary Use Designation.

## Minimum Light Output and Minimum Efficacy Requirements

**Table 2:** Efficacy Requirements for DLC Standard and DLC Premium Luminaires. Adapted from [SSL V5.1 Technical Requirements Tables](#), Table 2.

Category	General Application	Minimum Light Output (lm) <sup>1</sup>	Minimum Efficacy (lm/W)	
			DLC Standard	DLC Premium
Outdoor Luminaires	Low Output	250-5,000	105	120
	Mid Output	5,000-10,000	105	120
	High Output	10,000-30,000	105	120
	Very High Output	≥30,000	105	120

<sup>1</sup> Minimum Light Output requirements vary by Primary Use Designation (PUD); please refer to **Table 3 in this document** for specific requirements.

## Light Output and Distribution Requirements by Primary Use Designation

Products tested to meet LUNA distribution requirements shall submit an ANSI/IES LM-63-19 or ANSI/IES LM-63-02 R2008 .ies file containing luminous intensity data tested to ANSI/IES LM-79-19 or IES LM-79-08. Please see the *Additional Reporting Guidelines* section in the [LUNA V1.0 Technical Requirements](#) policy document for more details. ANSI/IES TM-33-18 .xml documents may be submitted in addition to .ies files but are not required at this time.

**Table 3: Primary Use Technical Requirements: Light Output and Distribution.** Adapted from [SSL V5.1 Technical Requirements Tables](#), Table 5

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)	Zone/Spacing Criteria/Beam Angle	ZLD/SC/BA Nominal Requirement	ZLD/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
A	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1,000	0-90°	100%	-1%	≥99%
			80-90°	≤10%	+3%	≤13%
B	Outdoor Pole/Arm-Mounted Decorative Luminaires	1,000	0-90°	≥65%	-3%	≥62%
C	Outdoor Full-Cutoff Wall-Mounted Area Luminaires	300	0-90°	100%	-3%	≥97%
			80-90°	≤10%	+3%	≤13%
E	Bollards	500	90-110°	≤15%	+3%	≤18%
			>110°	0%	+3%	≤3%
G	Fuel Pump Canopy Luminaires	2,000	0-40°	≥40%	-3%	≥37%
			40-70°	≥40%	-3%	≥37%

### Aiming Requirements

LUNA eligible outdoor PUDs shown in **Table 4** shall only include mounting options that will not allow tilt angles beyond +/-10 degrees, in order to align the luminaire parallel with the roadway/pavement surface.

**Table 4: Maximum aiming requirements for LUNA eligible pole/arm mounted PUDs.** Summarized from [LUNA V1.0 Technical Requirements](#), Table 6.

Primary Use Letter	Primary Use Designations Eligible for LUNA Qualification	Maximum allowable tilt angle
A	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	+/- 10 degrees
B	Outdoor Pole/Arm-Mounted Decorative Luminaires	+/- 10 degrees
n/a	Specialty: Hazardous Area Lighting	+/- 10 degrees
	Specialty: Hazardous Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	+/- 10 degrees

Note: Please see the [LUNA V1.0 Technical Requirements](#) policy document, Distribution section for more details

## Shielding Requirements

LUNA eligible outdoor PUDs shown in **Table 5** shall have at least one shield option or accessory available.

**Table 5: Shielding requirements for LUNA Eligible pole/arm mounted PUDs. Summarized from [LUNA V1.0 Technical Requirements](#), Table 6.**

Primary Use Letter	Primary Use Designations Eligible for LUNA Qualification	Shielding requirement
A	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	At least one shield shall be included on specification sheet or supplemental documentation as an available accessory or option (e.g. house side shields (HSS), cul-de-sac shields (CSS), front-side shields (FSS), or glare shields).
B	Outdoor Pole/Arm-Mounted Decorative Luminaires	
n/a	Specialty: Hazardous Area Lighting	
	Specialty: Hazardous Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	

Note: Please see the [LUNA V1.0 Technical Requirements](#) policy document, Distribution section for more details.

## Backlight, Uplight, and Glare (BUG) Ratings Requirements

In addition to the distribution requirements in **Table 3**, all outdoor luminaires shall report the 6-character BUG values. BUG ratings for child products are reported by the applicants. BUG ratings for parent products will be generated by the DLC using tested photometric data, per IES TM-15-11 and Addendum A for IES TM-15-11. **Table 6** provides the maximum allowable U Rating threshold for LUNA eligible PUDs. Applicability to future Specialty Primary Use Designations will be determined on a case-by-case basis.

**Table 6: Uplight Requirements for LUNA Eligible PUDs. Summarized from [LUNA V1.0 Technical Requirements](#), Table 7.**

Primary Use Letter	Primary Use Designations Eligible for LUNA Qualification	Maximum U Rating Threshold
A	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1
B	Outdoor Pole/Arm-Mounted Decorative Luminaires	2
C	Outdoor Full-Cutoff Wall-Mounted Area Luminaires	1
E	Bollards	1
G	Fuel Pump Canopy Luminaires	2
n/a	Specialty: Hazardous Area Lighting	1
	Specialty: Hazardous Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1
	Specialty: Hazardous Wall Mounted Luminaire	1
	Specialty: Canopy Lighting	2
	Specialty: Directional Fuel Pump Canopy Luminaires	2
	Specialty: Transportation	2

Note: Please see the [LUNA V1.0 Technical Requirements](#) policy document, Distribution section for more details.

## Controllability Requirements

**Table 7:** Controllability Requirements for LUNA V1.0. Summarized from [LUNA V1.0 Technical Requirements](#), Table 9. For LUNA, these requirements supersede [SSL V5.1 Technical Requirements Tables](#), Table 6.

Metric	LUNA V1.0 Requirements
<b>Dimming Capability</b>	Continuous dimming capability to $\leq 20\%$ of max output power is required.* In addition, each product must support at least one Communication method for dimming (either wired communication for a single control point, or communication between multiple controls points).
<b>Wired Communication for a Single Control Point</b>	All products must identify all available wired communication options for a single control point.**
<b>Integral Controls</b>	All products must report on the availability of integral controls.***
<b>Communication Between Multiple Control Points</b>	All products must identify any available communication options between multiple control points.****

\* Specialty designation hazardous luminaires are exempt from the dimming requirements.

\*\* Please see **Table 7.1** below for a list of wired communication options for a single control point.

\*\*\* Please see **Table 8** below for a list of integral control capabilities.

\*\*\*\* Please see **Table 9** below for a list of communication options between multiple control points.

**Table 7.1:** Wired communication options for a single control point recognized by LUNA. Summarized from [LUNA V1.0 Technical Requirements](#), Table 9. For LUNA, these requirements supersede [SSL V5.1 Technical Requirements Tables](#), Table 6.

Protocol	Additional types of integral controls
Wired Analog Standard	<ol style="list-style-type: none"> <li>0-10V <a href="#">IEC 60929</a> Annex E</li> <li>0-10V <a href="#">ANSI C137.1-2019</a> (8-Volt)</li> <li>0-10V <a href="#">ANSI C137.1-2019</a> (9-Volt)</li> <li>Forward Phase NEMA SSL 7A-2015 (R2021)</li> </ol>
Wired Digital Standard	<ol style="list-style-type: none"> <li><a href="#">DALI</a></li> <li><a href="#">DALI 2</a></li> <li><a href="#">D4i</a></li> <li><a href="#">DMX512</a></li> </ol>
Other	n/a

**Table 8:** Integral control capabilities and receptacles recognized by LUNA. Summarized from [SSL V5.1 Technical Requirements Tables, Table 6](#) and [LUNA V1.0 Technical Requirements, Table 10](#).

Topic	Additional types of integral controls
Integral control sensors listed in SSL V5.1	Occupancy, Daylight, Multifunction, Traffic, Photocell, Integral Sensor Receptacle, None
Integral control capabilities listed in SSL V5.1	High-end Trim, LLLC, Energy Monitoring, Networked Replacement Lamp, LLLC model name, none
Integral control capabilities beyond those listed in SSL V5.1	Part night dim
	Photocontrol with self-calibrating astronomic time clock
	Low-end trim for vacancy mode
Integral control receptacles for outdoor luminaires	<a href="#">ANSI C136.41-2013</a> (NEMA 5-pin)
	<a href="#">ANSI C136.41-2013</a> (NEMA 7-pin)
	<a href="#">ANSI C136.58-2019</a> (Zhaga Book 18)
	Other

Note: Please see the [LUNA V1.0 Technical Requirements](#) policy document, Controllability section for more details and acceptable terminology.

**Table 9:** Communication Between Multiple Control Points. Summarized from [LUNA V1.0 Technical Requirements, Table 11](#). For LUNA, these requirements supersede [SSL V5.1 Technical Requirements Tables, Table 6](#).

Physical medium	Standard protocol
Wired	<a href="https://www.dali-alliance.org/products">DALI</a> “Registered” at <a href="https://www.dali-alliance.org/products">https://www.dali-alliance.org/products</a>
	<a href="https://www.dali-alliance.org/products">DALI-2</a> “Certified product” at <a href="https://www.dali-alliance.org/products">https://www.dali-alliance.org/products</a>
	<a href="#">DMX512</a>
	<a href="#">BACnet</a>
	<a href="#">LONworks</a>
	<a href="#">Modbus</a>
	Other (describe)
Wireless	Bluetooth Mesh
	<ul style="list-style-type: none"> <li><a href="#">BLE MDP v2</a></li> </ul>
	<ul style="list-style-type: none"> <li><a href="#">BLE SIG Mesh v1.x</a></li> </ul>
	<ul style="list-style-type: none"> <li>BLE Proprietary</li> </ul>

	Cellular
	• 4G
	• 5G
	<a href="#">EnOcean</a>
	<a href="#">Wi-Fi</a>
	Zigbee Certified Product
	<a href="#">Zigbee 3.0</a>
	Zigbee Proprietary
	Other (describe)

Note: Please see the [LUNA V1.0 Technical Requirements](#) policy document, Controllability section, Table 10 for more details and acceptable terminology.

## DLC Premium

DLC Premium is a higher-performance classification for luminaires (retrofit kits and lamps are ineligible for LUNA qualification). The DLC Premium classification is intended to differentiate products that can achieve higher performance that exceeds DLC Standard requirements. If a manufacturer seeks qualification of its product(s) to the DLC Premium classification, it must provide all the necessary testing to demonstrate that the product(s) meet the Premium classification’s requirements in addition to meeting all base Standard requirements, except for lumen maintenance. Products with a Primary Use Designation of “Specialty” are not eligible to qualify for the DLC Premium classification.

**Table 10:** DLC Premium Requirements Summary for LUNA eligible PUDs. Adapted from [SSL V5.1 Technical Requirements Tables](#), Table 7.

Metric	V5.1 DLC Premium Requirements
<b>Efficacy</b>	+15 lumens per watt over V5.1 Standard efficacy requirements.
<b>Driver ISTMT</b>	TMP <sub>ps</sub> ≤ driver operating temp specification for which the driver is designed to last ≥50,000 hours.
<b>Lumen Maintenance</b>	Products seeking qualification in the DLC Premium classification will be required to pass L <sub>90</sub> > 36,000 hours, as evaluated using TM-21. Note new LM-80 / TM-21 guidance.

### Driver ISTMT and Specification Sheet

As part of the DLC Premium application process, manufacturers must provide the following:

1. Test report from a lab that meets the DLC’s Laboratory Requirements for ISTMTs. The report must include the measured temperature from the TMP<sub>ps</sub>.
2. A picture of the TMP<sub>ps</sub> location with an arrow indicating the thermocouple attachment point.

3. Documentation from the driver manufacturer that indicates the maximum case temperature for which the driver is designed to last  $\geq 50,000$  hours, as well as the TMP location it designates for thermal testing.
  - a. Custom and integrated drivers must provide documentation equivalent to that required for drivers from third-party vendors. Manufacturers must supply documentation indicating the maximum acceptable temperature for the driver for 50,000-hour life, as well as the TMP to be used during thermal testing and evaluation.

The luminaire passes the driver ISTMT requirements if the measured temperature at the  $TMP_{ps}$  is less than or equal to the allowable operating temperature for which the driver is designed to last  $\geq 50,000$  hours specified by the power supply manufacturer. Drivers shall be tested *in-situ* under steady-state operating conditions, with case temperature measured at the designated TMP.

One or more additional thermocouples are attached to the power supply/driver at the  $TMP_{ps}$ . For off-the-shelf remote power supplies, manufacturers typically provide a measurement location (case temperature designated by a “dot” adjacent to a  $(t_c)$  symbol) for warranty/lifetime purposes. In situations where the  $TMP_{ps}$  is not designated by the manufacturer, or where power supplies are integrated with the LED package(s), array, or module(s), luminaire manufacturers should identify the  $TMP_{ps}$  to be used for warranty/lifetime purposes. Note that this includes situations where the driver/power supply is not purchased from an outside vendor, and where the driver/power supply is integrated into the luminaire or lamp. Please see [this image](#) for an example of the documentation to identify these types of power supplies.

The thermocouple tolerance shall conform to ASTM E230 Table 1 “Special Limits” ( $\leq 1.1^\circ\text{C}$  or 0.4%, whichever is greater).

UL 1598 testing may be used for the ISTMT report if the lab that conducted the test meets the DLC’s laboratory requirements for ISTMT.

Per the [Premium Requirements](#), custom and integrated drivers must provide equivalent driver spec sheet documentation as drivers from third-party vendors. This also applies to private labeled drivers where the private labeler does not market the private labeled driver and therefore does not have a public-facing driver spec sheet for the driver. Equivalent driver spec sheet documentation must include information on the rated driver performance, including but not limited to: input and output characteristics, the maximum case temperature for which the driver is designed to last  $\geq 50,000$  hours, TMP location, as well as the specific driver model number. Reviewers may ask for additional driver information.

## Lumen Maintenance

The DLC expects that manufacturers provide the most up-to-date LM-80 report available for the LED package/module/array used within the product. It is the submitting manufacturer’s responsibility to ensure they have received the most up-to-date LM-80 report from the LED manufacturer for each application. Additional data that improves the projection accuracy cannot be ignored simply because it shows worse performance. The Lumen Maintenance requirements for DLC Standard and DLC Premium are shown in **Table 11**.

**Table 11:** Lumen Maintenance requirements for DLC Standard and DLC Premium. Adapted from [SSL V5.1 Technical Requirements Tables, Table 8](#).

DLC Standard	DLC Premium
$L_{70} \geq 50,000$ hours	$L_{90} \geq 36,000$ hours

The DLC has two options for demonstrating lumen maintenance compliance.

- **Lumen Maintenance Option 1:** Using component-level performance through the TM-21 protocols, which leverage the LM-80 performance and in-situ temperature of the LED device.
- **Lumen Maintenance Option 2:** Using luminaire-level performance through TM-28 protocols, which leverage the LM-84 test performance. More information is available in the [Application Instructions](#). Due to the length of this type of testing, it is recommended that the submitter reach out to [applications@deisgnlights.org](mailto:applications@deisgnlights.org) to ensure the testing will align with DLC testing and reporting requirements before beginning any testing using the LM-84 method.

## LM-80 Applicability

The DLC refers to current [ENERGY STAR Requirements for Use of LM-80 Data](#) when determining applicability of LM-80 data for submitted products.

### L<sub>70</sub> Evaluation

The DLC relies on the results from the [ENERGY STAR TM-21 Calculator](#) for evaluating compliance with the lumen maintenance requirements, except in the case where LM-80 data sets with uneven intervals are used. In this case, the DLC relies on results from the [ENERGY STAR TM-21 Calculator for Uneven LM-80 Intervals](#) for evaluating compliance with the lumen maintenance requirements. For products that have sufficient LM-80 data to project to 50,000 hours per the TM-21 limits of projection rules, the calculator must show a  $L_{70}$  of 50,000 or more. In the current version of the ENERGY STAR calculator (dated 6-18-2018), this is shown in cell I42 when “70” is entered into cell I35. There are no provisions for shorter projection periods for this  $L_{70}$  requirement; to qualify for Standard there must be sufficient LM-80 data to project to at least 50,000 hours per TM-21 rules.

### L<sub>90</sub> Evaluation for Premium Products

Products applying for DLC Premium must meet lumen maintenance requirement of  $L_{90} \geq 36,000$  hours. The DLC relies on the results from the ENERGY STAR TM-21 Calculator for evaluating compliance with the lumen maintenance requirements, except in the case where LM-80 data sets with uneven intervals are used. In this case, DLC relies on results from the [ENERGY STAR TM-21 Calculator for Uneven LM-80 Intervals](#) for evaluating compliance with the lumen maintenance requirements. The results in the ENERGY STAR TM-21 calculator must show a lumen maintenance value of no less than 36,000 in cell I42, when cell I35 is set to 90, to meet the Premium lumen maintenance requirement. There are no provisions for shorter projection periods for this  $L_{90}$  requirement; to qualify for Premium there must be sufficient LM-80 data to project to at least 36,000 hours per TM-21 rules.

## LM-84 and TM-28

Option 2 is to conduct luminaire-level testing according to the LM-84-14 test standard and apply the TM-28-14 projection methodology. For Option 2, the DLC uses a pass/fail threshold for lumen maintenance compliance. The projection from TM-28 must project to at least 6,000 hours and the lumen maintenance projection at the projection end point must be consistent with an  $L_{70}$  of 50,000 hours. If choosing Option 2 for lumen maintenance determination, please contact the DLC at [info@designlights.org](mailto:info@designlights.org).

## Tolerances

When applying the lumen maintenance in accordance with these protocols, the DLC applies a tolerance of 5% to drive currents tested under LM-80, and a 1.1°C to the temperature measured in ISTMT results.

## Additional Guidance on LM-80 Data Limitations

In general, full LM-80 results are necessary for DLC qualification. However, manufacturers may submit products using an LED package/module/array where limited LM-80 data is available if the following conditions are met:

1. The LED package/module/array is a successor package/module/array to a previous generation package/module/array according to [ENERGY STAR® Requirements for the Use of LM-80 Data](#).
2. The manufacturer provides the complete ( $\geq 6,000$  hours) LM-80 of the previous generation LED package/module/array.
3. The manufacturer provides at least 3,000 hours of LM-80 data of the successor LED package/module/array.
4. The successor package/module/array data demonstrates better performance at 3,000 hours than the previous generation LED package/module/array data at 3,000 hours.
5. The manufacturer provides the remaining 3,000 hour successor LED package/module/array data when available.

## Additional Guidance on LM-80 Tc Locations

Consistent with guidance from ENERGY STAR®, while there may be several acceptable locations to measure the temperature of the LED package/module/array (collectively referred to as the  $TMP_{LED}$ ), the TMP in the ISTMT must match the TMP used during the LM-80. If the ISTMT TMP does not match the LM-80 TMP in the original submission material, DLC staff will look for the applicant to provide one of the following options:

1. Provide an LM-80 of the board or module, where the TMP is monitored/measured at the same TMP used in the ISTMT.
2. Provide an ISTMT measuring the TMP of the hottest LED in the product at the same TMP used in the LM-80.

If neither of the above is possible, and the LED TMP is not accessible, DLC staff will work with the manufacturer to obtain information that explicitly describes the relationship between the board TMP and LED TMP. However, this information will be reviewed on a case by case basis, and may not be sufficient to appropriately verify compliance with the lumen maintenance requirements for all applications.

## Spectral Quality Requirements

The DLC has spectral quality requirements for LUNA. Though the chromaticity requirements vary with DLC LUNA qualification, all other requirements are the same for DLC Standard and DLC Premium. Please see the [V5.1 Technical Requirements](#) policy document for additional details on required testing.

**Table 12: DLC LUNA Spectral Quality Requirements.** Adapted from [SSL V5.1 Technical Requirements Tables, Table 9](#) and [LUNA V1.0 Technical Requirements, Table 8](#).

Metric	DLC LUNA Requirements
<b>Chromaticity (CCT &amp; <math>D_{uv}</math>)</b>	<p>All products must exhibit chromaticity consistent with at least one of the basic, flexible, or extended, nominal, 7-step quadrangle CCTs from 2200K – 3000K.</p> <p>Products tested to meet LUNA spectral quality requirements shall submit an ANSI/IES TM-27-20 or IES TM-27-14 .spd file containing spectral power distribution data in increments of <math>\leq 5\text{nm}</math>. ANSI/IES TM-33-18 .xml documents are also acceptable in addition to .spd files, but are not required at this time.*</p>
<b>Color Rendition</b>	<p><i>All Outdoor products:</i></p> <p><b>Option 1 - ANSI/IES TM-30-18:</b></p> <ul style="list-style-type: none"> <li>• IES <math>R_f \geq 70</math></li> <li>• IES <math>R_g \geq 89</math></li> <li>• <math>-18\% \leq \text{IES } R_{cs,h1} \leq +23\%</math></li> </ul> <p><b>Option 2 - CIE 13.3-1995:</b></p> <ul style="list-style-type: none"> <li>• <math>R_a</math> (CRI) <math>\geq 70</math></li> <li>• Must report <math>R_9</math></li> </ul>
<b>Color Maintenance</b>	<p><i>All Outdoor products:</i></p> <p>Chromaticity shift from 1,000-hour measurement to 6,000-hour measurement must be within a linear distance of 0.007 (<math>\Delta u'v' \leq 0.007</math>) on the CIE 1976 (<math>u', v'</math>) chromaticity diagram.</p>

Note: Please see the LUNA V1.0 Technical Requirements policy document, Spectral Quality section for more details.

### TM-30

IES TM-30-18 is a document approved by the Illuminating Engineering Society (IES) that describes a method for evaluating light source color rendition. The method encompasses several individual measures and graphics that complement one another and provide a comprehensive characterization of how the light will affect the color appearance of objects. The three highest-level components of the system are the Fidelity Index ( $R_f$ ), Gamut Index ( $R_g$ ), and the Color Vector Graphic. With LUNA V1 Technical Requirements, the DLC will accept TM-30 metrics to meet the color rendition requirements. At this time, these metrics are required to be reported, but are not required to meet the color rendition requirements if the CIE 13.3.-1995 requirements option is met. Using the official Excel

version of the TM-30 calculation tool offered with the IES standard is required to list these metrics on the QPL. For more information on IES TM-30, please go to <http://energy.gov/eere/ssl/tm-30-frequently-asked-questions>, or refer to the IES TM-30-18 standard, available [here](#).

## Multiple CCTs

If a product family includes variations in performance other than CCT (including wattage, light output, light distribution, etc.), it must be submitted in accordance with the family grouping policy.

If applying for multiple CCT variations, note that the testing must be conducted on the worst-case variation (likely the lowest CCT); colorimetry data for the highest CCT variation (LM-79 section 12 measurements) from an accredited lab must also be included.

Colorimetry data is required to verify that all additional CCT variations included in a Single Product Application meet the CCT requirement. If the manufacturer cannot provide the reviewer this information, the reviewer can qualify only the model number for which test data has been provided until test data is available for the additional CCT variations.

Products that use more than one CCT of a given LED are eligible. As with the general multiple-LED-types policy, LM-80 and ISTMT testing must be provided that covers both LEDs. If the LEDs are covered by the same LM-80, only the hottest LED overall will need to be tested. Please note, that DLC normally expects that, if other parameters are equal, lower CCT will be hotter than higher CCTs.

LEDs with more than one CCT that are dynamically controlled for purposes of color-tuning must meet the requirements of the [Color Tuning Policy](#). With the LUNA V1.0 Technical Requirements, white-tunable and warm-dimming products are eligible for LUNA but shall not be tunable to chromaticities outside the LUNA chromaticity requirements (i.e., color-tunable products are eligible for LUNA, so long as the product(s) tunable range is limited to between 2200-3000K).

## Allowances

**Table 13** presents allowances to minimum efficacy requirements that apply to products with specific features, in specific categories. Additional information will be incorporated in this section as allowances are defined. To participate in the discussion around the development of these allowances, please contact [info@designlights.org](mailto:info@designlights.org).

**Table 13:** Allowances to efficacy requirements. Summarized from [SSL V5.1 Technical Requirements Tables, Table 10](#), and [LUNA V1.0 Technical Requirements, Tables 5 and 13](#).

Feature	General Application or PUD applicability	Performance Metric	Allowance
CCT	Outdoor	≤ 2700K	-5%
Color Rendition	Outdoor	<b>Option 1 - ANSI/IES TM-30-18:</b> <ul style="list-style-type: none"> <li>• IES <math>R_f \geq 70</math></li> <li>• IES <math>R_g \geq 89</math></li> <li>• <math>-12\% \leq \text{IES } R_{cs,h1} \leq +23\%</math></li> </ul> <b>Option 2 - CIE 13.3-1995:</b> <ul style="list-style-type: none"> <li>• <math>R_a \text{ (CRI)} \geq 80</math> and <math>R_9 \geq 0</math></li> </ul>	-5%
Bollards	Bollards	Bollards that meet all LUNA requirements for distribution, spectrum, and controllability	-25%
Shielded Products	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	Luminaires with internal or external house-side shields (HSS) that reduce house-side lumens by at least 50% compared to an equivalent unshielded product.	-20%
	Outdoor Pole/Arm-Mounted Decorative Luminaires Specialty: Hazardous Area Lighting	Luminaires with internal or external cul-de-sac shields (CSS) that reduce house-side lumens by at least 70% compared to an equivalent unshielded product.	-35%
	Specialty: Hazardous Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	Luminaires with internal or external front-side shields (FSS) that reduce street-side lumens by at least 30% compared to an equivalent unshielded product.	-20%

Notes: Allowances are cumulative, and a product may take advantage of an efficacy allowance in conjunction with the luminaire efficacy tolerance. Please see the [LUNA V1.0 Technical Requirements](#) policy document, Allowances section for more details.

## Tolerances

**Table 14** presents tolerances that apply to all metrics listed in the Technical Requirements Tables. These tolerances are referenced in the [ENERGY STAR® Manufacturer's Guide](#). For zonal lumen tolerances specific to each Primary Use Designation, please refer to **Table 3** in this document.

**Table 14: Tolerances.** Adapted from [SSL V5.1 Technical Requirements Tables, Table 11](#).

Performance Metric	Tolerance
Light Output	±10%
Luminaire Efficacy	-3%
Allowable CCT	Defined by ANSI C78.377-2017†
Minimum Color Rendering	CIE Ra (CRI): -1 Point CIE R9: -1 Point IES Rf: -1 Point IES Rg: -1 Point  IES $R_{cs,h1}$ : +/- 1%
Color Maintenance	$\Delta u'v'$ : + 0.0004 points Data must be consistent with the LM-80 testing and reporting guidelines
Power Factor	-3%
Total Harmonic Distortion	+5%

† ANSI C78.377-2017 also referred to for  $D_{uv}$ ,  $\Delta u'v'$ , and (x,y) chromaticity coordinates tolerances.

For any performance metrics that are measured as a percentage, corresponding tolerances refer to percentage points. For example, a power factor requirement of  $\geq 0.90$  (i.e.  $\geq 90\%$ ) with a -3% tolerance implies a functional requirement of  $\geq 0.87$  (i.e.  $\geq 87\%$ ). For performance metrics that are not measured as a percentage, the tolerance is a percentage of the required value. For example, for a minimum efficacy requirement of 60 lm/W with a -3% tolerance, the functional requirement is 58.2 lm/W (i.e.  $60 - 3\% = 58.2$ ).

Tolerances are intended to account for all testing variation, rounding, and significant digits. The requirement values and tolerances will be interpreted by DLC review staff as exact requirements. While test labs will be expected to follow the requirements of their accreditation and relevant test standards, DLC staff will not employ additional “rounding” to interpret values below the absolute thresholds as passing. For example, if a luminaire is required to have an efficacy of 110 lm/W, then with the efficacy tolerance of -3%, any value for efficacy less than 106.70000... will be interpreted as a failing value. It is an applicant’s responsibility to check all data presented in an application before submission to ensure compliance with the DLC requirements.

### Measured temperature from the ISTMT

According to [ENERGY STAR Manufacturer’s Guide for Qualifying Solid-State Lighting Luminaires – Version 2.1](#), the measured temperature from an ISTMT has a tolerance of  $\leq 1.1^\circ\text{C}$  or 0.4%, whichever is greater due to thermocouple tolerance. This may change the appropriate In-Situ case temperature ( $T_c, ^\circ\text{C}$ ) to enter into the ENERGY STAR TM-21 calculator. For example, a measured In-Situ case temperature of  $86.1^\circ\text{C}$  may be entered as  $85^\circ\text{C}$  to comply with an  $85^\circ\text{C}$  case temperature data set from the LM-80 report.

## Power Factor and Total Harmonic Distortion

In addition to the specific requirements above, all DLC qualified luminaires must have a power factor of  $\geq 0.9$ , and a total harmonic distortion of  $\leq 20\%$ . This applies to every category listed in the above Technical Requirements Tables. Qualified products must meet the requirements in their worst-case loading conditions.

In all cases, testing must be provided at the worst-case performance among a product's different operating modes, as the Technical Requirements for each category are minimum performance requirements. Due to design complexities of SSL luminaires and the many variables that could affect each performance metric with a minimum requirement, it is difficult to prescribe what worst case will be for all situations. It is the manufacturer's responsibility to identify the worst-case operating mode of the product for each performance metric requirement and provide the appropriate test data. The DLC always reserves the right to ask for details of how worst-case was determined, including supporting engineering analysis and test data supporting the selection, as deemed necessary.

The DLC's understanding of the technology has led us to expect certain operating modes and design choices to be the worst-cases. Power factor and THD are commonly seen to be worst case at 277V, while photometrics (specifically efficacy) are commonly worst case at 120V. This is not necessarily true for all luminaire designs, so a manufacturer may submit independent test data for a different operating mode if it is accompanied by a technical rationale and supporting data (independent or in-house) demonstrating that what was tested is in fact the worst-case. If testing is not conducted according to the expectations described above, DLC reviewers will ask for the testing at the expected worst-case operating modes, or a technical rationale with supporting data for an alternate worst-case operating mode for both electricals (power factor and THD) and photometrics.

Alternately, if the voltage inputs for a product include 347V and/or 480V options, manufacturers will be expected to provide a rationale for how worst-case was determined, or test data at all voltages if a rationale cannot be provided for a particular operating mode.

When submitting applications for products using universal drivers, be sure to test at the appropriate operating mode for both photometric and electrical measurements. Please note that the DLC requires the current THD ("THDi" or "ATHD") performance be reported, not voltage THD.

The manufacturer may test only the light engine-electrical component system when conducting power factor and THD tests (for products with light engines that are separable from the housing).

## Multiple LEDs

Products employing multiple types of LEDs are eligible under the following conditions: 1) the types and quantities of the LED packages/modules/arrays are known, and 2) the LEDs are not dynamically controlled, other than for dimming purposes. That is, products where variable numbers of LEDs are dynamically chosen and therefore the precise construction of any given product is not defined are not eligible. Policy development for appropriate evaluation of this type of product is under consideration.

For products using multiple LED types, including color-tunable products, an LM-80, ISTMT, and TM-21 projection will be needed for each type of LED present in the product. As per normal thermal testing rules, ISTMTs must be conducted on the hottest LED of each type. See the Lumen Maintenance section for more details.

## Warranty

The DLC requires a minimum warranty period of 5 years on all products listed on the QPL. The warranty must cover the complete luminaire when applicable. Note that the “luminaire” includes light source, housing, heat sink, power supplies and other electrical components, optics, and any other components of the luminaire. Warranty documentation must clearly explain the terms and conditions associated with the warranty.

Warranties that only cover certain components of the luminaire are not sufficient to meet the requirement. Consumable components that are designed and intended to be replaced as part of regular maintenance and upkeep, such as air filter elements or UV-C lamps, are not subject to the warranty requirements. Warranty statements are reviewed on a case-by-case basis and the DLC reserves the right to seek additional clarification if necessary.

Warranty terms and conditions can vary widely from manufacturer to manufacturer. The DLC explicitly defines a warranty period of 5 years and does not have specific requirements for warranty claim terms other than those listed above. The DLC does not verify or validate a manufacturer’s terms, conditions or process for customer warranty claims. The DLC does not monitor field failure rates of qualified products, or policy warranty redemption or history among manufacturers. Industry stakeholders are urged to review warranty terms and conditions as part of the purchasing decision process.

## Safety Certification

### Single Product / Family Grouping / Product Updates

1. All products are required to submit a compliance certificate from an approved safety certification organization relevant in the United States or Canada. This compliance document shall bear the manufacturer's name and will be proof that the products listed have been investigated by the safety organization and found to be in compliance with the standards listed on the certificate. The name of this document varies by safety organization, however, is commonly referred to as a Certificate of Compliance or Authorization to Mark.
2. During the application process, manufacturers will be required to digitally sign an agreement confirming that the safety documentation they are providing with the application covers ALL models they wish to be listed on the QPL and that the products being sold will bear the proper markings from the safety organization.

Note: If, after qualification, the safety documentation gets updated so that any model number(s) listed on the QPL are no longer covered by the original safety certificate, it is the responsibility of the manufacturer to submit the revised documentation so that the DLC records can be updated accordingly. Failure to do so may result in the product and any associated family members or private labels of the product being delisted.

### Private Label

1. All products are required to submit a compliance certificate from an approved safety certification organization relevant in the United States or Canada. This compliance document shall bear the Original Equipment Manufacturer (OEM) name and will be proof that the products listed have been investigated by the safety organization and found to be in compliance with the standards listed on the certificate. The name of this document varies by safety organization, however, is commonly referred to as a Certificate of Compliance or Authorization to Mark. If the submitted compliance certificate is

different from the one on file from the OEMs submission to the DLC, the OEM must update their records prior to the private label submission being formally processed.

2. In addition to a compliance certificate from the OEM, the private labeler must also submit a compliance certificate from an approved safety certification organization which bears the private labelers name and unique file number.
3. All products are required to submit a Multiple Listing correlation sheet issued by the approved safety organization which cross references the OEM model numbers with private label model numbers.
4. During the application process, manufacturers will be required to digitally sign an agreement confirming that the safety documentation provided covers ALL models they wish to be listed on the QPL and that the products being sold will bear the proper markings from the safety organization.

Note: If the safety documentation gets updated so that any model number(s) listed on the QPL are no longer covered by the original safety certificate, it is the responsibility of the manufacturer to submit the revised documentation so that the DLC records can be updated accordingly. Failure to do so may result in the product and any associated family members being delisted.

## Verification of Model Numbers

The DLC performs a limited review of the safety documentation being submitted by the manufacturer. It is the responsibility of the applicant to verify that ALL of the model numbers that are being submitted for qualification be covered by the safety certification documents. If the model numbers being submitted are found to not have been covered by the safety certification documents that were originally submitted, the models will be removed from the QPL and further action may be taken, if necessary.

## Additional Guidance for Products Seeking Qualification under the "Specialty" Primary Use Designation

This designation has been developed as an additional tool for the DLC and its Member programs to employ in seeking to identify high-quality, energy-saving LED luminaires in commercial and industrial applications for certain niche applications for which the DLC has not yet developed a specific Primary Use Designation.

To prevent the "Specialty" designation from being a loophole to get around requirements in other categories, the DLC will employ a number of principles in evaluating products submitted with this classification, including the following:

1. Products with a Specialty designation must meet the intention of the broader category and general application group under which they are designated. For example, products seeking qualification with a classification of Outdoor-Low Output-Specialty: \_\_\_\_\_ must be intended for use in outdoor applications.
2. Products with a Specialty designation must meet the minimum performance specifications of the broader category under which they are designated. This includes minimum light output, efficacy, chromaticity, color rendition, color maintenance, L<sub>70</sub>, THD, and PF requirements.
3. Products with a Specialty designation must specify the end-use for which they are intended. For example, products that are intended to be used for canopy lighting that seek qualification under the specialty designation must indicate on the application form that their intended use is "Specialty:

Canopy Lighting". DLC staff will monitor terminology and may make minor modifications to descriptor terms to ensure consistency (for example "Specialty: Canopy Lighting vs. "Specialty: Canopy Luminaire"). Changes in descriptor terms will be made in consultation with the applicant.

4. As part of its evaluation for any new Specialty designation, the DLC will make a determination on what dimming requirements will apply to that designation. Additional detail on the application and market for the end-use may be requested of the applicant to assist in making this determination.
5. The DLC retains the right to deny access to the Specialty designation for any product it does not believe meets the intention of the designation. Judgment on eligibility will be at the sole discretion of the DLC program staff.

Seeking qualification of a product using this Primary Use Designation is an acknowledgement of the rules of the program and a confirmation that the applicant agrees to abide by the decisions of the program.

Products with a Specialty designation are not eligible for DLC Premium classification.

Products seeking qualification on the QPL that would like to identify themselves as suitable for Hazardous Locations using the Specialty designations must provide documentation to demonstrate the appropriateness of their products for Hazardous Locations. Refer to the [Testing and Reporting Requirements for Hazardous Location Lighting](#) for additional details.

## Additional Guidance for Reporting Requirements

In addition to designating a Primary Use and meeting Zonal Lumen Density requirements, manufacturers submitting to the DLC must indicate whether their products are capable of dimming. Refer to the [DLC Dimming and Field Adjustable Light Output policy](#) for additional details.

For products that are Color Tunable, manufacturers must indicate which of the following sub-categories applies: White-Tunable and/or Warm-Dimming. For white-tunable products, manufacturers must submit appropriate LM-79 reports according to the [Testing and Reporting Requirements for Color-Tunable Products](#) and report measured CCT (K), power consumption (W), lumen output (LM) and input control signal applied. The DLC may revise the color tunable testing requirements to align with any future industry standards published with full bodied supporting data. For Warm-Dimming products, manufacturers must submit a single LM-79 report performed at the maximum setting of the dimming input control.

Manufacturers submitting products to DLC Premium will also need to indicate whether the product can be ordered with integral controls (occupancy sensors or photo sensors). The DLC will evaluate a manufacturer's claims of integral controls capability by ensuring that these features are clearly identified on the product specification sheet. DLC reviewers may check web listings and other marketing materials and reserve the right to request additional information to demonstrate integral controls capability if product specification sheets are not sufficient.

## Policy Clarifications and Updates

As the DLC processes applications for LUNA V1.0, we may encounter the need for minor corrections, terminology clarifications, and policy interpretations. In order to be as transparent as possible, the LUNA policy documents will be updated as needed, and the changes will be tracked in the table below and on the DLC website. **Table 15** shows the corrections or clarifications made and where they can be found in the document.

**Table 15:** Corrections and clarifications published as needed

Date Updated	Subject	Change Type	Description	Affected Page(s)
11/27/23	Clarifications for LUNA testing requirements	Clarification	Table numbers in reference to the LUNA V1.0 Technical Requirements updated to reflect clarification update.	Throughout
9/7/2022	Clarifications for LUNA testing requirements	Clarification	Table numbers in reference to the LUNA V1.0 Technical Requirements updated to reflect clarification update.	Throughout
4/20/2022	Controllability Requirements Terminology	Policy Change	Changes the name of two of the controllability metrics required for reporting and requires products to support at least one communication method for dimming, either between a single control point or multiple.	24-30
1/12/2022	Dimming Capability	Correction	The minimum dimming level requirement was corrected from <20% to ≤20% of max power	7