DLC Technical Requirements for LED Lighting: SSL V6.0 & LUNA V2.0

Draft 2

Released for comment July 28, 2025

This version of the DLC Technical Requirements for LED Lighting contains proposed additions, revisions, corrections, and clarifications made to the V5.1 Technical Requirements, all standalone SSL Technical Requirement policies, and LUNA V1.0 Technical Requirements. The DLC encourages commenters to read this draft and welcomes all feedback.

Dear DLC Members and Stakeholders:

The DesignLights Consortium (DLC) appreciates the opportunity to work alongside stakeholders to support the continued evolution of high-performing, energy efficient lighting solutions. Through these collaborations, together we have the ability to provide decision makers with data and resources on quality lighting, controls, and integrated building systems to reduce energy, carbon, and light pollution. Over the past 10 years, the DLC Technical Requirements and Qualified Products Lists (QPLs) have helped enable energy efficiency programs to achieve over 1,000 TWh of lighting savings.

SSL Version 5.1 released in 2020, was the last major update to the SSL requirements, and was focused on improving the quality of light and controllability of listed products. The DLC Technical Requirements for LED Lighting: Solid State Lighting Version 6.0 (SSL V6.0) and LUNA Version 2.0 (LUNA V2.0), introduces a combined set of technical requirements, streamlining what were previously two separate documents.

Goals of the Technical Requirements for LED Lighting

The goals of SSL V6.0 & LUNA V2.0 focus on improvements to performance for non-residential luminaires, retrofit kits, and lamps, emphasizing lighting products that are energy efficient, controllable, and high quality, as aligned with the DLC mission.

Advance energy efficiency and support decarbonization through increased efficacy thresholds and controls requirements.

Strengthen the SSL QPL by expanding eligibility to support sustainability, lighting innovation, and flexible installation practices.

Drive greater adoption of controls through compatibility-based product selection from SSL and NLC QPLs.

Mitigate light pollution by creating more responsible outdoor lighting options.

SSL V6.0 also advances the goals of the DLC Premium classification, which allows QPL users to identify light fixtures and retrofit kits that maximize energy savings and product life without sacrificing light quality. Modern LED luminaires serve as a pathway to connected lighting, which enables deeper

integration with building systems for maximum energy savings and flexible energy use. With higher efficacy thresholds and enhanced controllability, these Premium classified LED products facilitate increased energy savings opportunities. Ultimately, these features combine to deliver a high-quality lighting solution that supports sustainability goals, enhances visual performance, and lowers total cost of ownership.

Draft 1 of the Technical Requirements for LED Lighting - SSL V6.0 and LUNA V2.0 received comments from a wide range of disciplines across the lighting and controls industries. The responses to draft 1 provided excellent insights and recommendations. Based on the feedback and additional stakeholder outreach, we are pleased to issue Draft 2 for comments.

Based on comments from draft 1, continued discussions with stakeholders and uncertainty regarding the future status of the EnergyStar downlight QPL, requirements for downlights and E26 medium base general-purpose lamps will no longer be included in this revision. We are actively monitoring the situation and may revisit this decision in a future update if needed.

The DLC invites commenters to provide feedback on this second draft during a six-week public comment period beginning on Monday, July 28, 2025, and ending on Friday, September 5, 2025. Please submit all feedback using the comment form linked below to comments@designlights.org. This comment period is expected to be the last one before the final release of the technical requirements, which is planned for Monday, November 3, 2025, to support product application acceptance and qualification to SSL V6.0 and LUNA V2.0 on January 5, 2026.

View Proposed Requirements for SSL V6.0 and LUNA V2.0 Draft 2

Download the SSL V6.0 and LUNA V2.0 Draft 2 Comment Form

Draft 2 Release Webinar

The DLC will host an informational webinar on Wednesday, August 6, 2025, at 3:00 PM Eastern Time. The webinar will focus on the technical requirements, emphasize the main changes since draft 1, and will include a Q&A session.

Click here to register for the 8/6 Draft 2 Release Webinar

Please submit all questions and comment forms to comments@designlights.org. We look forward to engaging with you to increase the value of the Technical Requirements and the QPL. A redlined version of Draft 2 is available on request by emailing comments@designlights.org.

Best regards,

The DLC Team

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1 Introduction

The DesignLights Consortium (DLC) is a nonprofit organization committed to accelerating the transition to energy efficient lighting and controls. Through rigorous qualification programs and stakeholder engagement, the DLC supports policies and programs that reduce energy use, carbon emissions, and light pollution, that ultimately promote quality lighting and a more sustainable world. Over the past 10 years, the DLC Technical Requirements and Qualified Products Lists (QPLs) have helped enable energy efficiency programs to achieve over 1,000 TWh of lighting savings. This was possible through collaboration with all of our stakeholders including manufacturers, efficiency program administrators, and users of the QPLs who support the continued evolution of high-performing, energy efficient, non-residential[1] LED lighting solutions.

SSL Version 5.1 released in 2020, was the last major update to the SSL requirements, and focused on improving the quality of light and controllability of listed products. The DLC Technical Requirements for LED Lighting: SSL V6.0 & LUNA V2.0, introduces a combined set of technical requirements, streamlining what were previously two separate documents. The purpose of this document is to define the technical requirements for LED lighting products qualification on the DLC's Solid-State Lighting and LUNA Qualified Products Lists.

Beyond energy savings, the LUNA QPL is designed to mitigate and reduce light pollution by providing a dark sky solution for users of the QPL. The aim is not only to improve clarity and usability of the requirements, but also to reflect how LED lighting technology, and the needs of our shared market, continue to evolve.

Released for its second draft public comment period, the technical requirements reflect over five years of dialogue and input since the launch of SSL V5.1. It includes several key updates:

- A major revision to the DLC Premium classification, expanding beyond efficacy and quality to further enable incentives for advanced controls and integrated lighting systems.
- Clear criteria and improved documentation for manufacturers and specifiers.
- Alignment with technology advances in efficacy, quality of light, and system flexibility.

Today's modern luminaires serve as more than sources of light—they are enablers of connected, intelligent building systems. The V6.0 technical requirements encourage adoption of these capabilities in a way that benefits everyone: manufacturers, building owners, and end-users.

The DLC invites LED and controls product manufacturers and all stakeholders to review this draft and share feedback. Please provide comments not only on the technical content, but also on the

[1] Non-residential, in this case, includes commercial, industrial, multifamily, and municipal sectors. Schools, universities, and hospitals are also taken into account.

organization and navigability of the document itself. Stakeholder insights are critical to shaping a resource that is both technically robust and user-friendly.

This public comment period will remain open for six weeks, and the DLC welcomes all input that helps refine these requirements to better serve the industry and its goals.

1.1 Goals of the Technical Requirements

Advance energy efficiency and support decarbonization through increased efficacy thresholds and controls requirements.

Strengthen the SSL QPL by expanding eligibility to support sustainability, lighting innovation, and flexible installation practices.

Drive greater adoption of controls through compatibility-based product selection from SSL and NLC QPLs.

Mitigate light pollution by creating more responsible outdoor lighting options.

1.2 What's Changed from SSL V5.1 and LUNA V1.0?

The DLC completed the last major update to the SSL Technical Requirements (V5.1) in 2020, and lighting technology has advanced considerably since then. The proposed changes include an efficacy increase, but also extend beyond lumens per watt to consider lighting's impact on all people and the environment. Several policies that were previously published separately have also been merged into this document to centralize information and avoid confusion. The SSL V6.0 & LUNA V2.0 Technical Requirements focus on higher performance, improved lighting controls information, reducing light pollution, and increasing assurance of product longevity. Updates include:

- Increased efficacy thresholds (average +14%) across all DLC-qualified product types to provide the right amount of light for less energy.
- Verified, required minimum driver lifetime for all DLC Standard and Premium products to ensure the power supply lasts as long as the LED chips, increasing confidence in product longevity.
- Clarified definitions for on-site field adjustable capabilities such as color temperature, light distribution, or other variables, so that people can easily understand what they are getting from QPL-listed products. This distinction also helps utilities easily incentivize these products to make their energy efficiency programs more effective.
- Amended the maximum Unified Glare Rating (UGR) thresholds to apply only to Premium requirements for troffers.

- Simplified LUNA (the dark sky solution) requirements through the integration of SSL V6.0 and LUNA V2.0.
- Created opportunities to qualify non-white light LED products, such as 1800K, 2000K, and Amber LED products for QPL listing.
- Included new option to report color maintenance using standardized ANSI/IES TM-35-19 color maintenance data to support transitioning away from custom requirements in V5.1.
- Developed requirements for sea turtle lighting products that address specific needs for outdoor lighting near coastlines.

See **Table 1** below for a more detailed summary of the proposed changes.

1.3 Invitation to Share Feedback

Please review this document, provide your feedback on the proposed requirements, the document structure, and answer the key questions at the end of the respective sections. Each section of the document contains a rationale explaining the reason for the change, a summary of the change from previous versions (V5.1 or V6 Draft 1), a specific description of requirements for each product type, and key questions at the end of these sections to obtain feedback from readers. Draft 2 also indicates topic sections that have not changed from V5.1.

1.3.1 How to Submit Feedback

Use the Comment Form and email to comments@designlights.org when complete. The information in Table 1 provides readers with an overview of the proposed changes in this draft.

1.4 Detailed Summary of Proposed Changes

Table 1: High-Level Summary of Proposed Changes in SSL V6.0 and LUNA V2.0 Draft 2

Topic Area	Proposed change(s) from SSL V5.1 & LUNA V1.0 to V6.0 draft 1	Proposed change(s) from SSL V6.0 & LUNA V2.0 draft 1 to draft 2
Eligibility	New product eligibility includes: • **Non-white Light (NWL) LED Luminaires, Retrofit Kits, and Lamps** (1800K, 2000K) • **Amber LED Luminaires, Retrofit Kits, and** Lamps that support appropriate illumination in outdoor environments, indoor healthcare, industrial, and cleanroom environments • **LUNA V2.0 Technical Requirements** • **Differentiated Linear Ambient PUDs** • **Color-Tunable Products**	• Outdoor **Non-white Light (NWL) LED Luminaires, Retrofit Kits, and Lamps** may be listed to SSL V6.0 without listing to LUNA V2.0 (Turtle Lighting PUDs must still co-list to both SSL V6.0 and LUNA V2.0) • Updated definitions for **Amber LED Luminaires, Retrofit Kits, and** Lamps, and clarified that they are for product performance (e.g., for the lamp, retrofit kit, or luminaire) • Added tolerances for Amber LED metrics (dominant wavelength, FWHM described below)

Topic Area	Proposed change(s) from SSL V5.1 & LUNA V1.0 to V6.0 draft 1	Proposed change(s) from SSL V6.0 & LUNA V2.0 draft 1 to draft 2
		• Proposing size and distribution distinctions for **Differentiated Linear Ambient PUDs** • Added PUDs for mogul screw-base and medium screw-base omnidirectional and directional LED lamps for HID Replacements that allow bare lamp testing and reporting
Efficacy and Light Output	• Increase efficacy thresholds for Standard and **DLC Premium** and introduce outdoor efficacy thresholds by Primary Use Designation (PUD) rather than using a single General Application efficacy threshold for all outdoor products • Update **Efficacy Allowances** V6 efficacy thresholds to continue supporting higher-quality performance	• Adjusted (lowered) **Efficacy Requirements** for some outdoor PUDs and mogul screw-base lamps • New proposed bare-lamp **Efficacy Requirements** and **Light Output Requirements** for medium screw-base lamps for HID replacements and for mogul screw-base lamps for HID replacements • New **Efficacy Requirements** for high bay and low bay hazardous PUDs • **Efficacy Allowances** for UGR now also apply to linear ambient, high bay, and low bay luminaires in addition to troffers (same as V5.1) • Lowered minimum light output for some PUDs to enable NWL products to be listed
Controllability & **Field Adjustable Products**	• **Controls Categories** support the development and adoption of controlled LED solutions • Introduce the ability to link compatible SSL and NLC-listed products on their respective QPLs • Clarify definitions of **Field Adjustable Products** and controlled products • Support increased energy savings and installation flexibility by expanding options for **Field Adjustable Products** • Enhance baseline controllability requirements by proposing minimum Dimming Requirements and removing stepped dim eligibility for outdoor products	• Simplified and clarified proposed **Controls Categories** • Updated the definition of **Controls Ready (Controls Category 2)** for clarity • Clarified **Controls Ready (Controls Category 2)** compatibility expectations with **Controls Ready Receptacle Types** • **Table 16** explicitly allows non-control portions of model numbers to be wildcarded in certain circumstances • Updated DALI Alliance controls options • Added Driver Type: “Integrated Driver + Controller” in Driver and Controller Types to **Table 20** • Refined **Definition for Field Adjustable** for clarity

Topic Area	Proposed change(s) from SSL V5.1 & LUNA V1.0 to V6.0 draft 1	Proposed change(s) from SSL V6.0 & LUNA V2.0 draft 1 to draft 2
		• Removed proposed requirement to ship FALO products at the lowest output setting • Removed proposed requirement to ship indoor FACT products at lowest CCT setting
Quality of Light	• Support responsible outdoor lighting that mitigates light pollution by proposing maximum CCT limits and introducing low CCT and Amber LED product eligibility in **Table 10** • Introduce required reporting of CS4 and CS7 color maintenance values per ANSI/IES TM-35-19, as proposed in **Table 10** • Removed maximum UGR thresholds for linear ambient, high-bay, and low-bay luminaires and integrated retrofit kits	• The CS4 and CS7 reporting requirements are optional for reporting in **Table 10** • Added requirement for SPDX documents and SPD image to be posted on QPL for all Amber parent products to support additional use cases (e.g., ordinance requirements, semiconductor facilities, etc.) in **Table 10**
DLC Premium	**DLC Premium** requirements changes focus on: • Increasing the efficacy levels over Standard listings • Limiting eligibility to specific control categories	• Removed the proposal that all Premium listings require digital drivers from **Table 26**
Lumen Maintenance and Driver Lifetime	• **Driver Lifetime** is proposed to become a requirement for all listings (Standard and Premium), rather than just Premium, to ensure the lifetime of listed products provides persistent energy savings. • **Table 24** outlines the requirements for the Amber LED product	• Proposes a distinct and increased driver lifetime threshold (above Standard) for all Premium listings in **Table 24**
Sustainability	• Supports the use of sustainable lifecycle practices through the option to report Sustainability Certifications	• Removed the following certifications from **Table 25** for simplicity: Health Product Declaration, Living Product Challenge, Certified Wood, SCS Global Services, Electronic Product Environmental Assessment Tool (EPEAT), and Climate Neutral • TÜV Rheinland Green Product Mark was added • Added more information about documentation and reporting requirements, and QPL listing

Topic Area	Proposed change(s) from SSL V5.1 & LUNA V1.0 to V6.0 draft 1	Proposed change(s) from SSL V6.0 & LUNA V2.0 draft 1 to draft 2
LUNA V2.0 Technical Requirements	The **LUNA V2.0 Technical Requirements** include proposals to: • Minimize testing burden • Remove LUNA-specific control requirements and align with SSL V6.0 control requirements. • Allow more product types to qualify. • Add new LUNA-specific options for outdoor lighting in sensitive environments are also proposed, including pc-Amber and de-Amber LEDs, Amber-filtered LEDs, lower CCTs, and Turtle Lighting product types	• Updated requirements for mogul screw-base and medium screw-base HID replacement lamp PUDs to allow bare-lamp submissions in **Table 29** • Added S/P ratio reporting and display on QPL for LUNA parent products to facilitate better information on sky glow reduction in **Table 30** • Increased maximum light output for LUNA Turtle Lighting PUDs in **Table 31**

General Improvements for QPL Users and Qualifying Manufacturers	• Combined all SSL-specific standalone policies to create a single, comprehensive Technical Requirements policy
	• **Required Reporting of Non-Performance Information** that helps identify the intended end-use of the product, including:
	  ○ **Form Factor**
	  ○ **Physical Dimensions**
	  ○ Mounting Options
	  ○ **Environmental Protection Ratings**
	  ○ **Required Product Images**
	• **Product Specification Sheets**
	• A pathway for reporting **Alternately Sourced Equivalent Components**, including alternate LEDs and drivers, is proposed to address the concerns of manufacturers and QPL users regarding variations of listed products.
		• The **Testing Guidance** section now contains the minimum testing requirements for demonstrating compliance by topic
		• Expanded choices for **Form Factor** and **Environmental Protection Ratings**
		• **Required Product Images** expanded to allow photorealistic renderings
		• Clarifications regarding proposals for images and product specification sheets
		• Removed mounting options as required reporting

Downlights and Downlight Retrofit Kits	• Requested feedback on including these products in the technical requirements	• Removed from this version of the technical requirements
Medium screw-base (E26) General Purpose Lamps	• Requested feedback on including these products in the technical requirements	• Removed from this version of the technical requirements

1.5 Definitions

Unless otherwise noted, the terms in this policy directly reference the definitions from the Illuminating Engineering Society (IES) *ANSI/IES LS-1-22: Nomenclature and Definitions for Illuminating Engineering*, and, where applicable, the e-ILV by the International Commission on Illumination (CIE).

To facilitate understanding of terms and nomenclature used throughout the SSL Technical Requirements, the DLC has developed a standalone online resource referred to as "The DLC Glossary". The DLC Glossary can be found on the DLC website at https://designlights.org/glossary. This resource is not intended to be a comprehensive resource for the lighting industry, but rather a DLC-specific resource intended to define terms with implications for DLC qualification. The following definitions include new terminology used in SSL V6.0 and LUNA V2.0.

Dominant wavelength – Methodology of determining the principle wavelength of a light source's hue in chromaticity space. It is calculated by projecting a straight line from the chromaticity coordinates of an equal energy spectrum through the light source's chromaticity coordinates to the spectrum locus.

Non-white light (NWL) – Product types with 1800 K, 2000K, and Amber LEDs are considered non-white light LED types by the DLC. 1800 K and 2000 K quadrangles are standardized in ANSI/NEMA C78.377-2024.

Amber LEDs – There are no current consensus standards for Amber LEDs for general illumination, so the DLC is defining them for its use in SSL V6.0 and LUNA V2.0. Requirements for these LED types are given in **Amber LED Luminaires, Retrofit** Kits, and Lamps**.**

- **Direct-emission (de-) Amber LED** – Aluminum indium gallium phosphide (AlInGaP) LED.
- **Phosphor-converted (pc-) Amber LED** – Indium gallium nitride (InGaN) LED paired with a reddish phosphor that completely, or nearly completely, down-converts the short wavelength radiation into longer wavelength broadband light.
- **Filtered-Amber LED** – White LED (2200 K– 5000 K) lamp/retrofit kit or luminaire with an amber filtered lens or optic that reduces the short wavelength radiation.

Field Adjustable – A feature of a luminaire, lamp, or retrofit kit that is intended to be changed at the time of installation and not over the course of normal operation.

Lighting Controller – A device that governs the output of a light source by integrating an LED driver and sensors such as occupancy and daylight into a communication network that may be wired (such as DALI2) or wireless (such as Zigbee or Bluetooth).

Scotopic/Photopic (S/P) ratio – the ratio of the luminous output of a source evaluated according to the CIE scotopic spectral luminous efficiency, V'(λ), divided by the luminous output evaluated according to the CIE photopic spectral luminous efficiency, V(λ) (per CIE e-ILV).

Traffic color compliant – having a chromaticity outside of ITE Yellow (Amber) (per SAE J578 APR2020). This definition is included in the Hawaii and Maui County Code criteria used in LUNA V2.0 (<=2% blue and "traffic color compliant").

Tunable – a feature of a luminaire, lamp, or retrofit kit that is intended to be changed over the course of normal operation.

Turtle Lighting – Outdoor luminaires used in coastal areas where nesting sea turtles are present. They are typically constrained to using long-wavelength, direct-emission LEDs, having zero direct-uplight emissions, and a limit on total light output, high-angle light, and/or illumination levels. Table 31

1.6 Abbreviations

AC – Alternating Current

ANSI – American National Standards Institute

ASHRAE – American Society of Heating, Refrigerating, and Air-Conditioning Engineers

BA – Beam Angle

BSR – Board of Standards Review

BUG – Backlight, Uplight, Glare

CCT – Correlated Color Temperature

CFL – Compact Fluorescent Lamp

CIE – International Commission on Illumination

CRI – Color Rendering Index

CSA – Canadian Standards Association

CSS – Cul-de-sac Side Shield

DC – Direct Current

e-ILV – International Lighting Vocabulary

FACT – Field Adjustable Color Temperature

FALD – Field Adjustable Light Distribution

FALO – Field Adjustable Light Output

FSS – Front Side Shield

HSS – House Side Shield

IEC – International Electrotechnical Commission

IES – Illuminating Engineering Society

ISO – International Organization for Standardization

ISTMT – In-Situ Temperature Measurement Testing

LED – Light Emitting Diode

LEED – Leadership in Energy and Environmental Design

LLLC – Luminaire Level Lighting Control

LM – Lighting Measurement

LP – Lighting Practice
LS – Lighting Standard
LSS – Left Side Shield
LUNA – Light Usage for Night Applications
NEMA – National Electrical Manufacturers Association
NLC – Networked Lighting Control
NWL – Non-White Light
OEM – Original Equipment Manufacturer
OSHA – Occupational Safety and Health Administration
PF – Power Factor
PL – Private Label
PoE – Power Over Ethernet
PUD – Primary Use Designation
QPL – Qualified Products List
RSS – Right Side Shield
SC – Spacing Criteria
SPD – Spectral Power Distribution
SSL – Solid-State Lighting
THD – Total Harmonic Distortion
TM – Technical Memorandum
TMP – Temperature Measurement Point
UGR – Unified Glare Rating
UL – Underwriters Laboratory
ZLD – Zonal Lumen Distribution

2 Eligibility

2.1 Rationale for Update

The eligible product types for DLC QPLs are intended to represent the market while also accommodating different efficiency program incentive structures. SSL V6.0 proposes new eligibility pathways that address both market demands and program needs.

Due to the importance of downlights to DLC members and concerns over uncertainties in federal funding, Draft 1 requested feedback on a proposal to qualify downlights and downlight retrofit kits which are currently covered by ENERGY STAR. Draft 1 also requested feedback on a proposal to qualify medium screw-base (E26) lamps previously covered by ENERGY STAR as DLC members indicated these lamps could still be incentivized. Draft 2 does not contain either of these proposals.

At this point, the ENERGY STAR downlight program is still operating so the DLC will maintain its policy of preventing overlaps between the DLC and ENERGY STAR QPLs. However, the DLC will continue to monitor federal funding and may move to support DLC members should the situation change. The proposal to qualify medium screw-base lamps has been retracted as a result of concerns communicated during the Draft 1 public comment period.

2.2 Changes in SSL V6.0

Changes from SSL V5.1

- New product types for Amber LED products and turtle lighting
- Deprecated “cutoff” terminology updated to “zero-uplight”
- High-volume specialty PUDs converted to regular PUDs
- New qualification pathways for cove lighting
- New Linear Ambient PUD called “Linear Ambient Strip Luminaires”

Changes from Draft 1 to Draft 2

- Omnidirectional and directional medium screw-base (E26) LED replacements for HID lamps (with bare lamp performance and testing criteria) added to Table 2
- Omnidirectional and directional mogul screw-base (E39/E40) LED replacements for HID lamps (with bare lamp performance and testing criteria) added to Table 2
- Modified filtered-Amber LED definition to expand use cases
- Modified Amber LED definitions to address luminaire applicability and address ANSI C78 working group activities
- New technical distinctions for Linear Ambient Strip Luminaire PUD

201 New or modified Primary Use Designations (PUDs) are shown in bold text in **Table 2** below. See the
202 **Efficacy and Light Output** and **Quality of Light** sections for performance requirements specific to PUDs.

203 ***Table 2: Categories, General Applications, and Primary Use Designations (PUD)***

#	Category	General Application	Primary Use Designation (PUD)
1	Outdoor	Low Output	• Outdoor Pole/Arm-Mounted Area and Roadway Luminaires • Outdoor Pole/Arm-Mounted Decorative Luminaires • **Outdoor Zero-Uplight Wall-Mounted Area Luminaires** • **Outdoor Uplight-Emitting Wall-Mounted Area Luminaires** • **Turtle Lighting Zero-Uplight Pole/Arm-Mounted Area and Roadway Luminaires (Low Output Only)** • **Turtle Lighting Zero-Uplight Wall-Mounted Area Luminaires (Low Output Only)** • **Turtle Lighting Zero-Uplight Bollards (Low Output Only)** • Bollards • Parking Garage Luminaires • Fuel Pump Canopy Luminaires • **Architectural Flood and Spot Luminaires** • Stairwell and Passageway Luminaires • **Hazardous Environment Area Luminaires** • **Sports Lighting** • Specialty: _____
2		Mid Output	
3		High Output	
4		Very High Output	
5	Indoor	Interior Directional	• Wall Wash Luminaires • Track or Mono-Point Luminaires • Specialty: _____
6		Case Lighting	• Display Case Luminaires • Horizontal Refrigerated Case Luminaires • Vertical Refrigerated Case Luminaires • Specialty: _____
7		Troffer	• 2x2 Luminaires for Ambient Lighting of Interior Commercial Spaces • 1x4 Luminaires for Ambient Lighting of Interior Commercial Spaces • 2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces • Specialty: _____
8		Linear Ambient	• Direct Linear Ambient Luminaires • **Linear Ambient Strip Luminaires** • Linear Ambient Luminaires w/ Indirect component • Specialty: _____
9		High-Bay	• High-Bay Luminaires • High-Bay Aisle Luminaires • **Hazardous Environment High-Bay Luminaires** • **Indirect High-Bay Luminaires** • Specialty: _____
10		Low-Bay	• Low-Bay Luminaires • **Hazardous Environment Low-Bay Luminaires** • Specialty: _____

#	Category	General Application	Primary Use Designation (PUD)
11	Outdoor Retrofit Kit	Low Output	• Retrofit Kits for Outdoor Pole/Arm-Mounted Area and Roadway Luminaires • Retrofit Kits for Outdoor Pole/Arm-Mounted Decorative Luminaires • Retrofit Kits for Large Outdoor Pole/Arm-Mounted Area and Roadway Luminaires • Retrofit Kits for Outdoor Zero-Uplight Wall-Mounted Area Luminaires • Retrofit Kits for Parking Garage Luminaires • Retrofit Kits for Fuel Pump Canopy Luminaires
12		Mid Output	
13		High Output	
14		Very High Output	
15	Indoor Retrofit Kit	Troffer	• Linear Retrofit Kits for 2x2 Luminaires • Integrated Retrofit Kits for 2x2 Luminaires • Linear Retrofit Kits for 1x4 Luminaires • Integrated Retrofit Kits for 1x4 Luminaires • Linear Retrofit Kits for 2x4 Luminaires • Integrated Retrofit Kits for 2x4 Luminaires
16		Linear Ambient	• Retrofit Kits for Direct Linear Ambient Luminaires
17		High-Bay	• Retrofit Kits for High-Bay Luminaires
18		Low-Bay	• Retrofit Kits for Low-Bay Luminaires
11	**Solar Powered Outdoor Luminaires**	Low Output	• **Outdoor Pole/Arm-Mounted Area and Roadway Luminaires** • **Outdoor Pole/Arm-Mounted Decorative Luminaires** • **Outdoor Zero-Uplight Wall-Mounted Area Luminaires** • **Outdoor Uplight-Emitting Wall-Mounted Area Luminaires** • **Turtle Lighting Zero-Uplight Pole/Arm-Mounted Area and Roadway Luminaires (Low Output)** • **Turtle Lighting Zero-Uplight Wall-Mounted Area Luminaires (Low Output Only)** • **Turtle Lighting Zero-Uplight Bollards (Low Output Only)** • **Bollards** • **Fuel Pump Canopy Luminaires** • **Architectural Flood and Spot Luminaires** • **Stairwell and Passageway Luminaires** • **Specialty: _____**
12		Mid Output	
13		High Output	
14		Very High Output	
19	Linear Replacement Lamps	2’ T8 Lamps	• Replacement Lamps ("Plug and Play") (UL Type A) • Internal Driver/Line Voltage (UL Type B) Lamps • 1-Lamp External Driver (UL Type C) Lamps • 2-lamp External Driver (UL Type C) Lamps • 3-lamp External Driver (UL Type C) Lamps • 4-lamp External Driver (UL Type C) Lamps • Dual Mode Internal Driver (UL Type A or B)
20		4’ T8 Lamps	
21		4’ T5 Lamps	
22		3’ T8 Lamps	• Replacement Lamps ("Plug and Play") (UL Type A) • Internal Driver/Line Voltage (UL Type B) Lamps • 1-Lamp External Driver (UL Type C) Lamps • 2-lamp External Driver (UL Type C) Lamps • Dual Mode Internal Driver (UL Type A or B)
23		8’ T8 Lamps	
24		4’ T5HO Lamps	• Replacement Lamps ("Plug and Play") (UL Type A) • Internal Driver/Line Voltage (UL Type B) Lamps • 1-Lamp External Driver (UL Type C) Lamps • 2-Lamp External Driver (UL Type C) Lamps • 3-lamp External Driver (UL Type C) Lamps • 4-lamp External Driver (UL Type C) Lamps • 6-lamp External Driver (UL Type C) Lamps • Dual Mode Internal Driver (UL Type A or B)

#	Category	General Application	Primary Use Designation (PUD)
25		U-Bend Lamps	• Replacement Lamps ("Plug and Play") (UL Type A) • Internal Driver/Line Voltage Lamp-Style Retrofit Kits (UL Type B) • 1-Lamp External Driver (UL Type C) Lamps • 2-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) • 3-lamp External Driver Lamp-Style Retrofit Kits (UL Type C) • Dual Mode Internal Driver (UL Type A or B)
26	Mogul Screw-Base (E39/E40) Replacements for HID Lamps	Outdoor – Low Output	• Replacement Lamps for Outdoor Pole/Arm-Mounted Area and Roadway Luminaires (UL Type B) • Replacement Lamps for Outdoor Pole/Arm-Mounted Decorative Luminaires (UL Type B) • Replacement Lamps for Outdoor Zero-Uplight Wall-Mounted Area Luminaires (UL Type B) • Replacement Lamps for Parking Garage Luminaires (UL Type B) • Replacement Lamps for Fuel Pump Canopy Luminaires (UL Type B) • Replacement Lamps for Outdoor Pole/Arm-Mounted Area and Roadway Luminaires (UL Type C) • Replacement Lamps for Outdoor Pole/Arm-Mounted Decorative Luminaires (UL Type C) • Replacement Lamps for Outdoor Zero-Uplight Wall-Mounted Area Luminaires (UL Type C) • Replacement Lamps for Parking Garage Luminaires (UL Type C) • Replacement Lamps for Fuel Pump Canopy Luminaires (UL Type C)
27		Outdoor – Mid Output	
28		Outdoor – High Output	
29		Outdoor – Very High Output	
30		High-Bay	• Replacement Lamps for High-Bay Luminaires (UL Type B) • Replacement Lamps for High-Bay Luminaires (UL Type C)
31		Low-Bay	• Replacement Lamps for Low-Bay Luminaires (UL Type B) • Replacement Lamps for Low-Bay Luminaires (UL Type C)
32		Omnidirectional lamps	• **Omnidirectional Replacement Lamps (UL Type B)**
33		Directional lamps	• **Directional Replacement Lamps (UL Type B)**
34	Medium Screw-Base (E26) Replacements for HID Lamps	Omnidirectional Lamps	• Omnidirectional Replacement Lamps (UL Type B)
35		Directional Lamps	• **Directional Replacement Lamps (UL Type B)**
36	Four Pin-Base Replacement Lamps for CFLs	Vertically Mounted Lamps	• Replacement Lamps ("Plug and Play") (UL Type A)
37		Horizontally Mounted Lamps	
38		2G11 Base Lamps	• Replacement Lamps ("Plug and Play") (UL Type A) • Internal Driver/Line Voltage (UL Type B) Lamps • 1-lamp External Driver (UL Type C) Lamps • 2-lamp External Driver (UL Type C) Lamps • 3-lamp External Driver (UL Type C) Lamps • Dual Mode Internal Driver (UL Type A or B)

Table 2 Notes:

1. Retrofit Kits, certain Mogul Screw-base Replacement Lamps, and G24q-base Four-Pin Replacement Lamps must be tested in reference luminaires, per the policies for those products. Please refer to the **Lamps and Reference Housings** for more detailed information. Medium screw-base replacement lamps for HID have bare-lamp testing requirements and thresholds. Omnidirectional and directional mogul screw-base replacement lamps for HID also have bare-lamp testing requirements and thresholds.
2. Turtle Lighting PUDs must meet both SSL V6.0 and LUNA V2.0 requirements and are only listed when qualified to both sets of requirements. More information on Turtle Lighting PUD requirements is given in **Table 31.**

For further guidance on qualifying products in the Outdoor Solar Luminaire category, please refer to the **Solar Powered Outdoor Luminaires** section.

Retrofit Kits are evaluated in specific PUDs only, and not as a general kit intended for unknown end-use applications

2.3 Eligibility Guidance for the "Specialty" Primary Use Designation

Products with a Specialty designation are not eligible for DLC Premium qualification. The same model number cannot be used for both a specialty and non-specialty product.

Principles for evaluating products submitted with the Specialty designation:

1. Products must meet the intended use of the broader category and general application group under which they are designated. For example, products seeking qualification with a designation of Outdoor Low Output-Specialty: _____ must be intended for use in outdoor applications.
2. Products must meet the minimum performance requirements of the broader category under which they are designated.
3. Products must report distribution data but are not required to meet specific distribution criteria.
4. Products 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 monitor terminology and may make minor modifications to descriptor terms to ensure consistency (for example, "Specialty: Canopy Lighting vs. "Specialty: Canopy Luminaire"). Changes to descriptor terms will be made in consultation with the applicant.
5. As part of the evaluation of any new Specialty designation, the DLC will determine what dimming requirements apply to that designation. Additional details on the application and market for the end-use may be requested.
6. The DLC retains the right to deny the Specialty designation for any product that it does not believe meets the intended use of the designation. Judgment on eligibility will be at the sole discretion of the DLC program staff.

2.4 Eligibility for Hazardous Environment Products

Products labeled as suitable for hazardous environments must provide documentation that proves their appropriateness for hazardous locations. This documentation must clearly indicate that the model numbers in question are certified to the UL844 standard and specify the Class and Division for which the products are certified. In cases where questions arise, the DLC will require that the documentation from the relevant safety organization explicitly identifies both the model numbers and the certification to the UL 844 standard.

2.5 Updates and Additions to Eligible PUDs

2.5.1 Converted Specialty PUDs

SSL V6.0 proposes the conversion of five specialty PUDs to regular PUDs. Distribution thresholds for converted specialty PUDs are proposed in Draft 2. See the **Efficacy and Light Output** and **Quality of Light** sections for more details specific to these PUDs.

- **Sports Lighting:** Directional outdoor area luminaires intended for lighting the active areas of sporting event spaces (e.g., stadiums, fields, courts).
- **Hazardous Environment High-Bay Luminaires:** Suspended, recessed, or surface-mounted luminaires specific to indoor high ceiling spaces (intended for ceilings ≥25') intended for use in hazardous locations as defined in UL 844. (e.g., extreme temperatures, vibrations, volatile substances, etc.).
- **Hazardous Environment Area Luminaires:** Non-directional outdoor luminaires that provide illumination of general spaces intended for use in hazardous locations as defined in UL 844 (e.g., extreme temperatures, vibrations, volatile substances, etc.).
- **Indirect High-Bay Luminaires:** Suspended luminaires specific for indoor, high ceiling spaces (intended for ceilings ≥25') where the luminaire is designed to point at the ceiling or wall but not the floor.
- **Hazardous Environment Low-Bay Luminaires:** Suspended, recessed, or surface-mounted luminaires specific for indoor ceiling spaces (intended for <25') intended for use in hazardous locations as defined in UL 844 (e.g., extreme temperatures, vibrations, volatile substances, etc.).

2.5.2 Differentiated Linear Ambient PUDs

SSL V6.0 differentiates strip lighting from other linear ambient products and adds a new eligibility pathway for cove lighting products under Direct Linear Ambient or Linear Ambient with Indirect Component PUDs. Distribution types are based on the CIE Luminaire Classification System. Draft 2 revises the definition for Linear Ambient Strip Luminaires with the differences from Draft 1 highlighted in italic bold.

- **(New PUD) Linear Ambient Strip Luminaires:** Suspended, surface-mounted, pendant, or recessed luminaires, no wider than ***6", designed to provide ambient lighting in indoor spaces. Products may have any distribution pattern*** and may be designed to be installed end-to-end to create long chains. Utilitarian "strip" or "shop" style fixtures are eligible under this category. Products intended for cove lighting or marketed as "decorative" or "architectural" are not eligible under this category.
- **(Updated Definition) Direct Linear Ambient Luminaires:** Suspended, surface-mounted, pendant, or recessed luminaires, no wider than 12", designed to provide direct lighting (where 50% or more of the light distribution is directed downward) in indoor spaces. Products may be designed to be installed end-to-end to create long chains, and may be described as direct, semi-direct, or general diffuse, depending on intended lighting distribution. Utilitarian "strip" style fixtures are NOT eligible under this category. Products intended for cove lighting or marketed as "decorative" or "architectural" are eligible under this category.

- **(Updated Definition) Linear Ambient Luminaires w/ Indirect Component:** Suspended, surface-mounted, pendant, or recessed luminaires, no wider than 12”, designed to provide ambient lighting (where more than 50% of the light distribution is directed upward) in indoor spaces, including an indirect distribution. Products may be designed to be installed end-to-end to create long chains, and may be described as indirect, semi-direct, semi-indirect, direct-indirect, indirect-direct, or general diffuse, depending on intended lighting distribution. Utilitarian “strip” style fixtures are not eligible under this category. Products intended for cove lighting or marketed as “decorative” or “architectural” are eligible under this category.

2.5.3 Non-white Light (NWL) LED Luminaires, Retrofit Kits, and Lamps

SSL V6.0 allows indoor and outdoor lamps, retrofit kits and luminaires to include LEDs with nominal CCTs of 1800 K and 2000 K, described by chromaticity quadrangles in ANSI/NEMA C78.377-2024. These nominal CCTs are defined as non-white light (NWL) by the DLC. (White light is considered by the DLC to include nominal CCTs of 2200 K to 6500 K). NWL also includes Amber LED luminaires, retrofit kits and lamps.

2.5.3.1 Amber LED Luminaires, Retrofit Kits, and Lamps

SSL V6.0 includes several new PUD types and eligible Amber LED lighting products (see **Definitions**). An ANSI C78 working group is concurrently developing a new chromaticity standard for NWL LEDs (BSR C78.378-202x), which will include LED nomenclature and specifications for amber LEDs. If the definitions conflict with DLC's definitions or requirements, the DLC will consider modifying or augmenting the following requirements to address any inconsistencies.

Eligibility for Amber LED products with regard to efficacy, quality of light, and distribution is expanded in subsequent sections. To assist stakeholders in understanding product color performance for Amber LED lighting products, all Amber parent products will include a downloadable SPDX document and an SPD plot. The following criteria related to Amber LEDs are defined by the DLC and are informed by the nomenclature used in Esposito and Radetsky (2023). Tolerances for dominant wavelength and FWHM bandwidth are given in **Table 35**.

- de-Amber: Aluminum indium gallium phosphide (AlInGaP) LED. Chromaticity of the lamp/retrofit kit or luminaire shall be outside of C78.377-2024 quadrangles and narrowband SPD with a dominant wavelength between 590 – 605 nm and a full width at half maximum (FWHM) of 20 nm or less, with no more than 0.01% total optical radiation between 380 nm and 560 nm.
- pc-Amber: phosphor-converted (pc-) Indium gallium nitride (InGaN) LED. Chromaticity of the lamp/retrofit kit or luminaire shall be outside of C78.377-2024 chromaticity quadrangles and broadband SPD with a dominant wavelength between 590 – 605 nm, a FWHM of no more than 80 nm and a secondary peak of short wavelength radiant power in the blue range (no more than 1% optical radiation below 500 nm).
- Filtered Amber: white LED (2200 K– 5000 K) lamp/retrofit kit or luminaire with an amber filtered lens or optic that reduces the short wavelength radiation to no more than 2% of the total optical radiation (defined as being between 400 - 500 nm divided by the sum of the optical radiation

between 400 – 700 nm). One use case is in Hawaii and Maui Counties. In their code, the percent (%) blue is defined as the sum of the optical radiation between 400-500 nm divided by the sum of the optical radiation between 400 – 700 nm, and the maximum % blue is 2%.

    - Other use cases include outdoor lighting for sensitive areas, semiconductor manufacturing, observatory-adjacent lighting, and other specialized commercial and industrial lighting applications.

- Traffic color compliant is defined as chromaticity outside of ITE Yellow (Amber) (per SAE J578 APR2020). This definition is included in the Hawaii and Maui County Code criteria (<=2% blue and "traffic color compliant"). This metric will be calculated for all outdoor Amber LED parent products based on the submitted SPDX document.

Turtle Lighting products, which require de-Amber LEDs, have their performance requirements described in **Table 31**.

2.5.4 Omnidirectional and Directional HID Replacement Lamps

SSL V6.0 Draft 2 introduces four new HID replacement lamp PUDs that include bare-lamp testing and reporting requirements. They consist of two base types (mogul screw-base (E39/E40) and medium screw-base (E26)) and two form factors (omnidirectional and directional).

In Draft 2, the DLC has added *mogul* screw-base Omnidirectional and Directional General Application choices for Mogul Screw-Base (E39/E40) Replacements for HID Lamps (and related Type B lamps) that allow manufacturers to use bare-lamp testing to meet the proposed bare-lamp efficacy, light output, and distribution threshold requirements in Draft 2.

Manufacturers wishing to list *medium* screw-base HID replacement lamps will also have a bare-lamp testing and reporting pathway in SSL V6.0 Draft 2. They will use the Omnidirectional and Directional General Application choices for Medium Screw-Base (E26) Replacements for HID Lamps (and related Type B lamps). Bare-lamp efficacy, light output, and distribution threshold requirements are proposed in Draft 2.

Manufacturers who wish to update their existing mogul screw-base replacement lamps under PUDs that require in-luminaire testing and thresholds may continue to use the existing Indoor and Outdoor General Application and PUD choices (e.g., Outdoor: Low Output, Low-Bay, etc.) to leverage existing test data, but it is important to note that the in-luminaire efficacy thresholds have increased in SSL V6.0.

2.6 Key Questions Regarding Proposed Eligibility Changes

1. What feedback do you have regarding the proposed definitions, clarifications and tolerances added for the Amber LED definitions?
2. Are the proposed distinctions between the new Linear Ambient Strip PUD and other Linear Ambient PUDs sufficient to:
    a. Distinguish intended use?
    b. Support a lower incentive tier for utilitarian products?

3 Required Reporting of Non-Performance Information

3.1 Rationale for Update

To streamline the process for DLC members during incentive application processing, Draft 2 proposes mandatory reporting of product features that help identify intended end-uses. DLC Member programs may require more specific product information than what is found in DLC Primary Use Designation definitions (PUDs). Providing this additional information will help ensure that selected products meet program requirements without creating new PUDs with more specific requirements.

3.2 Changes in SSL V6.0

Changes from SSL V5.1

- New requirement for reported information:
  - **Form Factor**
  - **Physical Dimensions**
  - **Environmental Protection**
- Product images moving from optional to required
- Specification sheets will be displayed on the QPL

Changes from Draft 1 to Draft 2

- Additional form factors with defined dimensional ratios
- Additional environmental protection rating options
- Product image requirements will allow photorealistic renderings

3.3 Form Factor

Form factor descriptors are proposed in **Table 3** and are intended to support common understanding of product types. SSL V6.0 Draft 2 proposes that form factors will be assigned during the submission process based on the definitions below.

380 ***Table 3: Form Factor Descriptors***

Form Factor	Description
Rectangular	A four-sided shape where the length and width are unequal, and the length-to-width ratio is ≥ 4:1
Square	A four-sided shape where the length and width are roughly equal, with a tolerance of ±20%.
Linear	An elongated shape and a length-to-width ratio 4:1.
Circular	A product with a circular face and uniform diameter, symmetrical along both axes and viewed as a full circle from the front.
Oval/Elliptical	A product with an elongated circular shape, featuring a longer and shorter axis that are symmetrical, resulting in a smooth, stretched outline. The length-to-width ratio is greater than 1:1
Cylindrical	A product with a circular cross-section and a length at least twice its diameter, forming a tubular shape that is symmetrical along its central axis.
Integrated-Style Retrofit Kit	A product that includes all necessary components to replace existing luminaire internals with a new, self-contained light source and driver assembly designed to fit within the existing housing.
Linear-Style Retrofit Kit	A product that replaces only the existing lamps and drivers but not the existing housing and optical elements.
Cobrahead	A roadway luminaire with a curved, elongated housing and a downward-facing optical opening, typically designed for mounting on horizontal arms in street and area lighting applications
Screw-Base	Products with any type of screw-base qualify for this form factor only.
Pin-Base	Products with any type of pin-base qualify for this form factor only.
Non-Conforming	Non-conforming products are integrated LED fixtures that do not fit established form factor categories. These may incorporate elements above established form factors or exhibit entirely unique geometries—commonly found in decorative or specialty designs. Submitters must provide a secondary descriptive term (e.g., “star” or “crescent”) to characterize the shape. This secondary descriptor must be unique from the above established form factors.

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3.4 Physical Dimensions

Submitters must report a single set of physical dimensions for each differing form factor that excludes any additional mounting hardware options beyond the standard housing. The dimensions should be provided in terms of length, width, and height, using either standard or metric units, and must be expressed to two decimal points. The reported dimensions must correspond with the information listed on the specification sheet. For round, oval/elliptical, or cylindrical products, report the diameter(s) along with the height or depth.

3.5 Environmental Protection Ratings

Submitters are required to report on the availability of environmental and mechanical protection options relevant to each wildcarded listing. These represent various ratings that indicate that the product will perform safely in applications subject to harsh weather, physical impacts, vibrations, and corrosive environments. All options listed in the submitted specification sheet must be included in reporting, but products are not obligated to have a specific environmental rating. Additionally, submitters do not need to enhance specification sheets if they do not want to report a rating and are not required to provide testing information, except for the requirements related to **Eligibility for Hazardous Environment Products**.

The DLC will verify that the submitted information is present on the specification sheet. All ratings are expected to be displayed on the SSL and LUNA QPLs. If a rating does not exist or is not included on the specification sheet, the listing will indicate null. Submitters may update the environmental ratings options at any time, with an updated specification sheet indicating the environmental ratings.

An exception to this optional reporting of environmental ratings is the UL environmental rating, which is a rating mandated by the National Electric Code (NEC), NFPA 70. This rating must be included in the application but does not need to be included on the specification sheet. In situations where a manufacturer elects not to include this rating on the specification sheet, it will be reviewed against the safety documentation.

Table 4: Environmental Ratings

Rating Type	Description	QPL Listing	Method of Evaluation
UL Environmental Rating	The Dry, Damp, or Wet Location rating system will be observed as defined in UL 1598.	Dry, Damp, or Wet Location	Applications reviewers will verify that the selected options appear on the specification sheet
Ingress Protection (IP) Rating	The two-digit identification system as defined in IEC 60529 will be used, with 0-6 for intrusion protection and 0-9 used for moisture protection.	IPXY (ex: IP65)	
Impact Protection (IK) Rating	The IK01 – IK10 system will be used as defined in IEC 62262.	IKXX (ex: IK10)	
NEMA Enclosure Type	The NEMA enclosure type system will be used as defined in NEMA 250-2020, Enclosures for Electrical Equipment.	NEMA Type X(Y) (ex: NEMA Type 5)	
Salt-Fog Corrosion	Salt fog resistance shall be determined using the accelerated corrosion test method specified in ASTM B117 or ISO 9227.	Ex: Salt Fog: ASTM B117, 1000 hrs, no red rust or Corrosion Resistance: ISO 9227, 720 hrs NSS	
Vibration	Luminaires shall be tested for mechanical durability in accordance with ANSI C136.31-2023	1.5G, 3G	
NSF/ANSI Food Zone	Food zone suitability shall be determined in accordance with NSF/ANSI 2 or NSF/ANSI 169. Equipment shall be evaluated and certified for use in Food Contact, Splash, or Non-Food Zones, as defined by these standards. Compliance shall be documented and reflect the intended zone classification.	Food Zone, Splash Zone, Non-Food Zone	

3.6 Required Product Images

All listed products are required to provide an image of the qualifying product. This may be an image of the product or a representative image from the product family. The following file requirements and image style guidelines are proposed for all product images.

3.6.1 File Requirements

- The image file must be in TIFF, GIF, PNG, or JPG format.
- The dimensions of the image must be at least 500 x 500 pixels.
- The image must be square (width and height of image must be equal).
- The resolution of the image must be at least 72 ppi (pixels per inch).
- There are no requirements for image file name format or limitations on length of image file name.

3.6.1.1 Image Style Guidelines

- The image must be a photograph or photorealistic rendering; drawings or illustrations of products are not allowed.
- The product image should be the product's professional image or image commonly used for marketing purposes, if available.
- The product image must have realistic color; greyscale images are not allowed. Minimal photo editing necessary to produce a clean, professional image is not considered digital alteration (e.g., removing the background, glare, shadows, etc.).
- The background of the image should be white in most circumstances. If a white background inhibits the ability to clearly see the product in the image, the background must be a single shade from within the greyscale range. The product must have smooth edges if the background has been digitally removed.
- The image must not contain confusing or gratuitous objects (for example, hands, signage, items that are not the product, etc.).
- The image must not contain additional graphics, inset images, or overlaid text.
- The photo should be professionally lit whenever possible and shot in proper focus. Products must occupy the majority of the available space in the image frame (≥ 85%) and must be framed such that the image clearly conveys the general form of the product. Exceptions will be made for products whose form factor does not allow for the entire product to be in frame or for the product to occupy 85% of the frame.
- Each qualified product can be represented by only one image, including products where aesthetic options are represented in the model number via bracketing or wildcarding. A disclaimer will note that product images may be representative of a single SKU represented by a broader model number.

3.7 Product Specification Sheets

Specification sheets will be publicly displayed on the QPL. Manufacturers may update the specification sheet after initial qualification. Documentation and testing requirements will depend on the type of product change, representing all product variations submitted. The DLC proposes that manufacturers can select one of two submission pathways for providing specification sheets and are not required to use the same pathway for all products:

1. **DLC Hosted Document:** Submitters may upload the specification sheet they wish to display through the DLC's application portal. The DLC will host this document, and submitters may use the DLC portal to update their specification sheets to reflect product changes.
2. **Externally Hosted Document:** Submitters may provide a link to a specification sheet hosted on their own product website. This must be a link to the specification sheet document itself rather than a product web page. The DLC will periodically check that links remain operational and will notify submitters if their spec sheet link is no longer correct. Specification sheets may be updated to reflect product modifications, but submitters will be responsible for ensuring that the DLC has the correct link.

The DLC reserves the right to periodically review updated specification sheets to ensure product integrity.

3.7.1 Specification Sheet Document Requirements:

The DLC does not dictate the style or layout of specification sheets. The following information is needed for the DLC to accurately review and link to specification sheets on the QPL.

- Must be in PDF format
- Must include the following:
  - A photograph or photorealistic rendering clearly showing the product
  - Manufacturer name or Brand name
  - Product model number information
  - Dimming capability with language that follows the **dimming requirements**
  - Other product or program-specific requirements as applicable:
    - **3.3 Form Factor**
    - **3.4 Physical Dimensions**
    - **3.5 Environmental Protection Ratings**
    - **6.4 Controls Ready (Controls Category 2)**
    - **6.5 Controls Options Tables**
    - **6.6 Dimming Requirements**
    - **6.7 Integral Controls**
    - **7.5 Field Adjustable Color Temperature (FACT)**
    - **7.6 Field Adjustable Light Output (FALO)**
    - **7.7 Field Adjustable Light Distribution (FALD)**
    - **8.6 Supporting Documentation**
    - **10.3.1 Reporting and Documentation Requirements: Sustainability**
    - **14.3 Special Considerations for Solar Powered Outdoor Luminaires**
    - **15.4 LUNA Light Distribution Requirements**
    - **16.2 Testing and Reporting Requirements for Retrofit Kits**
    - **19.3 Testing and Reporting Requirements for Alternately Sourced Components**
    - **20.4.1 Documentation Requirements for LUNA Efficacy Allowances**
    - **24.2 Luminaire Level Tests**
    - **25.3.7 Minimum Testing Requirements: LUNA Light Output and Distribution**
    - **26.3 ANSI/IES LM-79 (–19 and -24 versions)**

3.8 Key Questions Regarding Proposed Required Reporting of Non-Performance Information

1. The list of form factor descriptors was updated for Draft 2.
    a. Are there any other form factor options needed to describe the range of products eligible for qualification?
    b. Are the provided form factor ratios accurate?
    c. The list of environmental protection ratings was updated for Draft 2. Are there other environmental ratings necessary to discern the intended end use of products?

4 Efficacy and Light Output

4.1 Rationale for Update

As part of the DLC's mission to save energy and reduce carbon emissions, efficacy thresholds are periodically increased to keep pace with technological advancements, ensuring that DLC qualified products continue to represent the most efficient products on the market. The proposed efficacy thresholds in SSL V6.0 and LUNA V2.0 Draft 2 are determined based on efficacy trends among DLC-listed product types, DOE market projections, and other sources.

Luminaires with pc- and de-Amber LEDs typically have lower efficacies than luminaires within the ANSI C78.377-2024 1800 K – 6500 K CCT Quadrangles, and the proposed Amber LED luminaire efficacies are intended to represent the upper 50% of luminaire performance based on a market characterization conducted by the DLC. Furthermore, greater allowances are proposed for 1800 K – 2000 K LEDs, another non-white light (NWL) LED technology, to better support product performance of these product types.

4.2 Changes in SSL V6.0

Changes from SSL V5.1

- Increased standard efficacy thresholds for individual product categories or PUDs as appropriate
- Increased premium efficacy thresholds in relation to standard efficacy thresholds
- New luminaire efficacy thresholds for Amber LED luminaires

Changes from Draft 1 to Draft 2

- Lowered efficacy thresholds for some outdoor PUDs, Hazardous Environment High Bay and Low Bay luminaires and Mogul Base lamps
- New proposed efficacy and light output thresholds for medium screw base lamps for HID replacements (bare lamp)
- New proposed efficacy and light output thresholds for mogul screw base lamps for HID replacements (bare lamp)

4.3 Efficacy Requirements

Table 5 shows proposed efficacy requirements for DLC Standard and Premium luminaires and retrofit kits within standardized CCT quadrangles (1800 K-6500 K CCT as applicable). **Table 6** shows proposed minimum efficacy requirements for lamps (in-luminaire and bare-lamp, as applicable) within standardized CCT quadrangles. Turtle Lighting PUDs are excluded from **Table 5** and **Table 6** as they are required to use de-Amber LEDs.

Efficacy thresholds for Amber LED products are set based on Amber LED technology and apply to any product type eligible for qualification with the associated Amber technology. See **Table 7** for efficacy thresholds that apply to Amber LED products. Lamps and NWL (Amber, 1800 K, and 2000 K) luminaires are not eligible for DLC Premium.

Efficacy allowances and tolerances may apply for some product types. For information on efficacy allowances, see **Efficacy Allowances**, and for information on tolerances, see **Tolerances**. All efficacy values are tested according to ANSI/IES LM-79, and all tested and reported values are displayed on the QPL. For minimum testing requirements, see **Testing Guidance**.

Table 5: Efficacy Requirements for Luminaires and Retrofit Kits Within Standardized CCT Quadrangles (1800 K – 6500 K as applicable[2]) [DLC Standard and DLC Premium Qualifications]

Category	General Application	Primary Use Designation	DLC Standard Minimum Efficacy (lm/W)	DLC Premium Minimum Efficacy (lm/W)
Outdoor Luminaires and Solar Powered Outdoor Luminaires	All	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	125	145
		Outdoor Pole/Arm-Mounted Decorative Luminaires	115	135
		Outdoor Zero-Uplight Wall-Mounted Area Luminaires	125	145
		Outdoor Uplight-Emitting Wall-Mounted Area Luminaires	125	145
		Bollards	115	135
		Parking Garage Luminaires	115	135
		Fuel Pump Canopy Luminaires	125	145
		Architectural Flood and Spot Luminaires	125	145
		Stairwell and Passageway	125	145

[2] For applicable CCT ranges, please refer to the Spectral Quality requirements subsections (**Spectral** Quality Requirements, **Premium** Eligibility and Requirements, and **LUNA** Spectral Quality Requirements) of SSL V6.0 Draft 2. For applicable efficacy allowances, please refer to the **Efficacy Allowances** section of SSL V6.0 Draft 2.

Category	General Application	Primary Use Designation	DLC Standard Minimum Efficacy (lm/W)	DLC Premium Minimum Efficacy (lm/W)
		Sports Lighting	115	135
		Hazardous Environment Area Luminaires	115	135
Indoor Luminaires	Interior Directional	All	95	115
	Case Lighting		110	130
	Troffer		120	140
	Linear Ambient		125	145
	High-Bay	All except Hazardous Environment High Bay Luminaires	140	160
		Hazardous Environment High Bay Luminaires	135	155
	Low-Bay	All except Hazardous Environment Low Bay Luminaires	130	150
		Hazardous Environment Low Bay Luminaires	125	145

Category	General Application	Primary Use Designation	DLC Standard Minimum Efficacy (lm/W)	DLC Premium Minimum Efficacy (lm/W)
Outdoor Retrofit Kits	All	Retrofit Kits for Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	125	145
		Retrofit Kits for Outdoor Pole/Arm-Mounted Decorative Luminaires	115	135
		Retrofit Kits for Large Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	125	145
		Retrofit Kits for Outdoor Wall-Mounted Area Luminaires	125	145
		Retrofit Kits for Parking Garage Luminaires	115	135
		Retrofit Kits for Fuel Pump Canopy Luminaires	125	145
Indoor Retrofit Kits	Troffer	All	120	140*
	Linear Ambient		125	145
	High-Bay		140	160
	Low-Bay		130	150

538 *Linear-style retrofit kits for 2x2, 1x4, and 2x4 luminaires are not eligible for DLC Premium

Table 6: Standard Efficacy Requirements for Lamps Within Standardized CCT Quadrangles (1800 K – 6500 K as applicable[3]) [In-Luminaire and Bare-Lamp]*

Category	General Application	DLC Standard Minimum Efficacy (lm/W)	
		In-Luminaire	Bare-Lamp
Linear Replacement Lamps	2’ T8 Lamps	N/A	130
	3’ T8 Lamps		130
	4’ T8 Lamps		130
	4’ T5 Lamps		130
	4’ T5HO Lamps		130
	8’ T8 Lamps		130
	U-Bend Lamps		130
Mogul Screw-Base (E39/E40) Replacements for HID Lamps	Outdoor: Low Output	115	N/A
	Outdoor: Mid Output	115	
	Outdoor: High Output	115	
	Outdoor: Very High Output	115	
	High-Bay	140	
	Low-Bay	130	
	Omnidirectional	N/A	150
	Directional		145
Medium Screw-Base (E26) Replacements for HID Lamps	Omnidirectional	N/A	130
	Directional		130
Four Pin-Base Replacement Lamps for CFLs	Vertically-Mounted Lamps	80	90
	Horizontally-Mounted Lamps	80	90
	2G11 Base Lamps	N/A	125

* Lamps are not eligible for DLC Premium qualification.

Table 7: Efficacy Requirements for all Amber LED Products

Amber LED Technology	DLC Standard Minimum Efficacy (lm/W)
de-Amber	30
pc-Amber	70

[3] For applicable CCT ranges, please refer to the Spectral Quality requirements subsections (**Spectral** Quality Requirements, **Premium** Eligibility and Requirements, and **LUNA** Spectral Quality Requirements) of SSL V6.0 Draft 2. For applicable efficacy allowances, please refer to the **Efficacy Allowances** section of SSL V6.0 Draft 2.

Filtered Amber	95

4.4 Light Output Requirements

Table 8 and **Table 9** describe the light output ranges that qualify for each General Application. See **Table 12** for more detail on minimum and maximum light outputs and distributions for each PUD. All light output values are tested according to ANSI/IES LM-79, and all tested and reported values are displayed on the QPL. For minimum testing requirements, see **Testing Guidance.**

Table 8: Light Output Requirements for Luminaires and Retrofit Kits

Category	General Application	Light Output Range (lm)
Outdoor Luminaires and Solar Powered Outdoor Luminaires	Low Output	150-5,000
	Mid Output	5,000-10,000
	High Output	10,000-30,000
	Very High Output	≥30,000
Indoor Luminaires	Interior Directional	≥250
	Case Lighting	≥50 lm/ft
	Troffer	≥1,500
	Linear Ambient	≥375 lm/ft
	High-Bay	≥10,000
	Low-Bay	5,000-10,000
Outdoor Retrofit Kits	Low Output	150-5,000
	Mid Output	5,000-10,000
	High Output	≥10,000
	Very High Output	≥30,000
Indoor Retrofit Kits	Troffer	≥1,500
	Linear Ambient	≥375 lm/ft
	High-Bay	≥10,000
	Low-Bay	5,000-10,000

550 ***Table 9: Light Output Requirements for Lamps***

Category	General Application	Light Output Range (lm)	
		In-Luminaire	Bare-Lamp
Linear Replacement Lamps	2’ T8 Lamps	N/A	≥800
	3’ T8 Lamps		≥1,200
	4’ T8 Lamps		≥1,600
	4’ T5 Lamps		≥1,600
	4’ T5HO Lamps		≥3,200
	8’ T8 Lamps		≥3,200
	U-Bend Lamps		≥1,400
Mogul Screw-Base (E39/E40) Replacements for HID Lamps	Outdoor: Low Output	250-5,000	N/A
	Outdoor: Mid Output	5,000-10,000	
	Outdoor: High Output	10,000-30,000	
	Outdoor: Very High Output	≥30,000	
	High-Bay	≥10,000	
	Low-Bay	5,000-10,000	
	Omnidirectional	N/A	≥2000
	Directional	N/A	≥2000
Medium Screw-Base (E26) Replacements for HID Lamps	Omnidirectional	N/A	≥1000
	Directional	N/A	≥2000
Four Pin-Base Replacement Lamps for CFLs	Vertically-Mounted Lamps	1 lamp: ≥575	≥675
	Horizontally-Mounted Lamps	2 lamps: ≥800	≥675
	2G11 Base Lamps	N/A	≥1,900

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4.5 Key Questions Regarding Efficacy and Light Output Proposals

1. What feedback do you have on the efficacy thresholds proposed here? Are there any PUDs or general applications that are impacted more than the others?
2. The DLC has proposed (bare-lamp) mogul screw-base omnidirectional and directional lamps in Draft 2 to simplify the application and testing process. What is your feedback, if any, on the efficacy and output thresholds for (bare lamp) medium screw-base and mogul screw-base replacements for HID lamp PUDs proposed here?
3. The DLC is considering accepting orange and orange-red LED products in V6. These products have a dominant wavelength that is longer than 605 nm. Is a minimum luminaire efficacy of 40 lumens per watt acceptable for luminaires with this LED type?

5 Quality of Light

5.1 Rationale for Update

Quality of light encompasses the characteristics of lighting that include spectrum and distribution and color maintenance, as well as application considerations like uniformity, discomfort from glare, light trespass, light pollution, and more.

Under SSL V6.0 and LUNA V2.0 Draft 2, a product's quality of light is evaluated by its spectral quality, light distribution, and discomfort from glare.

To reduce and limit light pollution, the DLC is proposing to limit outdoor luminaires, lamps and retrofit kits to a maximum CCT of 5000 K (DOE, Esposito and Radetsky, 2023). On average, products with a CCT of 6500 K will produce 23 percent more sky glow than products with a CCT of 5000 K.

Additionally, the DLC proposes changes to the nomenclature and requirements for some PUDs shown in **Table 12** to update nomenclature from using deprecated terminology and to better support mitigating light pollution**.**

Lastly, Draft 2 proposes to allow optional standardized color maintenance reporting values in addition to the color maintenance requirements introduced in SSL V5.1, to begin to transition away from custom color maintenance processes that were specific to the DLC.

5.2 Changes in SSL V6.0

Changes from SSL V5.1

SSL V6.0 and LUNA V2.0 Draft 2 proposes the following changes from SSL V5.1:

- Limit eligible CCTs for outdoor luminaires, lamps, and retrofit kits to 5000 K or lower, except for sports lighting, fuel pump canopy luminaires and retrofit kits which can be up to 5700 K
- Introduce eligibility details for newly defined 1800 K and 2000 K CCTs
- Introduce eligibility details for Amber LED products, i.e., PC-Amber, de-Amber, filtered Amber
- Introduce color maintenance reporting per ANSI/IES TM-35
- Align with industry standard nomenclature and use the terminology "Zero-Uplight" instead of "Full Cutoff" and "Uplight-Emitting" instead of "non-Cutoff and semi-Cutoff".

Changes from Draft 1 to Draft 2

- All outdoor PUDs, except for Turtle Lighting PUDs, can be listed with pc-Amber, de-Amber or filtered-Amber LEDs with or without co-listing to LUNA.
- CS4 and CS7 values are optional to report for all products

5.3 Spectral Quality Requirements

The Spectral Quality Testing and Reporting Requirements for all SSL Standard products are as shown in **Table 10**. DLC Premium spectral quality requirements are described in the **DLC Premium** requirement section of the Technical Requirements. For information on minimum required testing, see **Minimum Testing Requirements: DLC Standard Spectral Quality**.

Table 10: Testing and Reporting Requirements for Spectral Quality (DLC Standard)

Metric and/or Application	Applicable Products	SSL V6.0 & LUNA V2.0 Draft 2 Standard Requirements	QPL Listing	Method of Measurement/ Evaluation
Chromaticity (CCT & D_{uv})	Chromaticity consistent with at least one of the basic, flexible, or extended, nominal 7-step quadrangle CCTs detailed below:		CCT and D_{uv} for parent products from LM-79 test reports listed as Tested Data. Nominal CCT for child products listed as Reported Data.	ANSI/IES LM-79 *ANSI C78.377-2024*
	All indoor products	1800 K – 6500 K		
	All outdoor products, except Sports Lighting and Fuel Pump Canopy	1800 K – 5000 K		
	Sports Lighting and Fuel Pump Canopy	1800 K – 5700 K		
	Non-Amber LUNA outdoor products	1800 K – 3000 K		
Chromaticity (Spectral Compliance Information)	All Amber LED products	Chromaticity consistent with technology specific definitions proposed in the Amber LED Luminaires, Retrofit Kits, and Lamps section	Nomenclature for **Amber LED Luminaires, Retrofit Kits, and** Lamps (de-Amber, pc-Amber, filtered-Amber) for parent and child products. Amber parent products will also display:	ANSI/IES LM-79 ANSI/IES TM-27 .spdx

<table>
<tr><th>Metric and/or Application</th><th>Applicable Products</th><th>SSL V6.0 & LUNA V2.0 Draft 2 Standard Requirements</th><th>QPL Listing</th><th>Method of Measurement/ Evaluation</th></tr>
<tr><td></td><td></td><td></td><td>.SPDX document, and SPD plot as well as:
Dominant wavelength, Chromaticity coordinates from LM-79 report listed as Test Data.</td><td></td></tr>
<tr><td rowspan="4">Color Rendition</td><td colspan="2">Products are required to report data in terms of Option 1 and Option 2 but are only required to meet either Option 1 or Option 2 when thresholds are stipulated.</td><td rowspan="4">All color rendition metrics for parent products from LM-79 test reports listed as Tested Data.

All color rendition metrics for child products listed as Reported Data.</td><td rowspan="4">ANSI/IES LM-79
ANSI/IES TM-30
CIE 13.3-1995</td></tr>
<tr><td>All Indoor products, except high-bay, and NWL:</td><td>Option 1 - ANSI/IES TM-30:
IES $R_f \geq 70$
IES $R_g \geq 89$
$-12\% \leq$ IES $R_{cs,h1} \leq +23\%$
Option 2 - CIE 13.3-1995:
R_a (CRI) ≥ 80
$R_9 \geq 0$</td></tr>
<tr><td>All Outdoor and high-bay products, except NWL:</td><td>Option 1 - ANSI/IES TM-30:
IES $R_f \geq 70$
IES $R_g \geq 89$
$-18\% \leq$ IES $R_{cs,h1} \leq +23\%$
Option 2 - CIE 13.3-1995:
R_a (CRI) ≥ 70
$R_9 \geq -40$ (high-bay only) Outdoor must report R_9</td></tr>
<tr><td>All NWL products:</td><td>ANSI/IES TM-30:
IES R_f
IES R_g
IES $R_{cs,h1}$
CIE 13.3-1995:
R_a (CRI)
R_9</td></tr>
</table>

Metric and/or Application	Applicable Products	SSL V6.0 & LUNA V2.0 Draft 2 Standard Requirements	QPL Listing	Method of Measurement/ Evaluation
Color Maintenance	All Indoor products, except high-bay and NWL:	Chromaticity shift from ≈1,000-hour measurement to ≈6,000-hour measurement shall be within a linear distance of 0.004 ($\Delta u'v' \leq 0.004$) on the CIE 1976 (u', v') chromaticity diagram. Optional reporting of CS4 and CS7 values per ANSI/IES TM-35-19. No thresholds are proposed.	V6.0 Draft 2 proposes to display CS4 and CS7 values for all products when reported.	ANSI/IES LM-80, and/or IES LM-84-14 and ANSI/IES TM-35-19
	All Outdoor and high-bay products, except NWL:	Chromaticity shift from ≈1,000-hour measurement to ≈6,000-hour measurement shall be within a linear distance of 0.007 ($\Delta u'v' \leq 0.007$) on the CIE 1976 (u', v') chromaticity diagram. Optional reporting of CS4 and CS7 values per ANSI/IES TM-35-19. No thresholds are proposed.		
	All NWL products:	Chromaticity shift on the CIE 1976 (u', v') chromaticity diagram from ≈1,000-hour measurement to ≈6,000-hour measurement shall be reported to the DLC. Optional reporting of CS4 and CS7 values per ANSI/IES TM-35-19. No thresholds are proposed.		

5.4 Light Output and Distribution Requirements by Primary Use Designation

The light distribution testing and reporting requirements for all SSL products are shown in **Table 11** below for the DLC Standard qualification. The “QPL Listing” column describes the information that appears as publicly available on the Qualified Products List, if applicable. The “Method of Evaluation” column describes how the products will be evaluated for qualification, whether by compliance with industry standards, manufacturer claims, or other DLC verification methodology. For information on minimum required testing, see **Minimum Testing Requirements: DLC Standard Light Output and Distribution**.

610 ***Table 11: Testing and Reporting Requirements for Light Distribution (DLC Standard)***

Metric and/or Data Set	V6.0 Requirements			Method of Evaluation
	Threshold	Reported	QPL Listing	
Zonal Lumen Distributions (ZLD) & Spacing Criteria (SC) *All products except linear replacement lamps*	Per **Table 12**	No separate ZLD and SC reporting required	ZLD and SC information will not be published on the QPL	ANSI/IES LM-79 values produced by photometric analysis from tested .ies files
Beam Angle *Linear replacement lamps and 2G11 lamps only*	≥140˚	Bare-lamp beam angle for each product	Beam angles are reported by the applicants and listed under the Reported Data section. Beam angles for parent products[4] will be verified by the DLC using LM-79 test reports and listed as Tested Data.	ANSI/IES LM-79 Beam angle per LS-01-22
Beam Angle *Omnidirectional medium screw-base and mogul screw-base replacement lamps*	≥180˚	Bare-lamp beam angle for each product	Beam angles are reported by the applicants and listed under the Reported Data section. Beam angles for parent products[3] will be verified by the DLC using LM-79 test reports and listed as Tested Data.	ANSI/IES LM-79 Beam angle per LS-01-22
Beam Angle *Directional medium screw-base and mogul screw-base replacement lamps*	≥115˚	Bare-lamp beam angle for each product	Beam angles are reported by the applicants and listed under the Reported Data section. Beam angles for parent products[3] will be verified by the DLC using LM-79 test reports and listed as Tested Data.	ANSI/IES LM-79 Beam angle per LS-01-22
Backlight, Uplight, and Glare (BUG) *Outdoor luminaires only*	None	BUG ratings for each product	BUG ratings for child products are reported by the applicants and listed under the Reported Data section. BUG ratings for parent products will be generated by the DLC using tested photometric data and listed as Tested Data	BUG ratings generated per ANSI/IES TM-15-20 and Annex A using luminaire photometric data

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[4] Please reference parent product definition in the **Definitions** section of this document.

612 The light output and distribution requirements for all SSL products are described in **Table 12**.

613 ***Table 12: Primary Use Designation Technical Requirements: Light Output and Distribution***

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)*	Zonal Lumens (ZL)/Spacing Criteria (SC)/Beam Angle (BA)*	ZL/SC/BA Nominal Requirement*	ZL/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
A	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1,000	ZL: 0-90°	100%	-1%	≥99%
			ZL: 80-90°	≤10%	+3%	≤13%
B	Outdoor Pole/Arm-Mounted Decorative Luminaires	1,000	ZL: 0-90°	≥65%	-3%	≥62%
C	Outdoor Zero-Uplight Wall-Mounted Area Luminaires	300	ZL: 0-90°	100%	0%	100%
			ZL: 80-90°	≤5%	+3%	≤8%
D	Outdoor Uplight Emitting Wall-Mounted Area Luminaires	300	ZL: 80-90°	≤10%	+3%	≤13%
			ZL: >90°	≤20%	+3%	≤23%
E	Bollards	150	ZL: 90-110°	≤15%	+3%	≤18%
			ZL: >110°	0%	+3%	≤3%
F	Parking Garage Luminaires	2,000	ZL: 60-80°	≥30%	-3%	≥27%
			ZL: 70-80°	≤25%	+3%	≤28%
G	Fuel Pump Canopy Luminaires	2,000	ZL: 0-40°	≥40%	-3%	≥37%
			ZL: 40-70°	≥40%	-3%	≥37%
I	Architectural Flood and Spot Luminaires	250	ZL: 0-90°	≥85%	-3%	≥82%
J	Stairwell and Passageway Luminaires	750	ZL: 0-90°	≥85%‡	-3%	≥82%
BA	Hazardous Environment Area Luminaires	1,000	ZL: 30-60º	≥40%	-10%	≥30%
			ZL: >90º	≥20%	+3%	≥23%
BB	Sports Lighting	1,000	ZL: 0-90º	100%	1%	≥99%
K	Wall-wash Luminaires	575	ZL: 0-90°	≥60%‡‡	-3%	≥57%
L	Track or Mono-Point Directional Luminaires	250	ZL: 0-90°	≥85%	-3%	≥82%

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)*	Zonal Lumens (ZL)/Spacing Criteria (SC)/Beam Angle (BA)*	ZL/SC/BA Nominal Requirement*	ZL/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
M	Vertical Refrigerated Case Luminaires-center	100 lm/ft	ZL: 10-90°†	≥95%†	-3%	≥92%
N	Vertical Refrigerated Case Luminaires-end	50 lm/ft	ZL: 10-90°‡‡	≥95%‡‡	-5%	≥90%
O	Horizontal Refrigerated Case Luminaires	100 lm/ft	ZL: 0-90°	≥95%	-3%	≥92%
P	Display Case Luminaires	50 lm/ft	ZL: 0-80°	≥95%	-5%	≥90%
Q	2x2 Luminaires for Ambient Lighting of Interior Commercial Spaces	2,000	SC: 0-180°	1.0-2.0	±0.1	0.90-02.1
			SC: 90-270°	1.0-2.0	±0.1	0.90-2.1
			ZL: 0-60°	≥75%	-3%	≥72%
R	1x4 Luminaires for Ambient Lighting of Interior Commercial Spaces	1,500	SC: 0-180°	1.0-2.0	±0.1	0.9-2.1
			SC: 90-270°	1.0-2.0	±0.1	0.9-2.1
			ZL: 0-60°	≥75%	-3%	≥72%
S	2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces	3,000	SC:0-180°	1.0-2.0	±0.1	0.9-2.1
			SC:90-270°	1.0-2.0	±0.1	0.9-2.1
			ZL:0-60°	≥75%	-3%	≥72%
T	Linear Ambient Luminaires (Indirect Component)	500 lm/ft	ZL: 90-150°	≥35%	-3%	≥32%
U	Direct Linear Ambient Luminaires	375 lm/ft	ZL: 0-60°	≥40%	-3%	≥37%
BC	Linear Ambient Strip Luminaires	375 lm/ft	ZL: 0-60°	≥40%	-3%	≥37%
V	High-Bay Luminaires	10,000	ZL: 20-50°	≥30%	-10%	≥20%

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)*	Zonal Lumens (ZL)/Spacing Criteria (SC)/Beam Angle (BA)*	ZL/SC/BA Nominal Requirement*	ZL/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
W	High-Bay Aisle Luminaires	10,000	ZL: 20-50°	≥50%	-10%	≥40%
			ZL: 0-20°	≥30%	-10%	≥20%
BD	Hazardous Environment High-Bay Luminaires	10,000	ZL: 20-50º	≥30%	-10%	≥20%
BE	Indirect High-Bay Luminaires	10,000	ZL: 90-180º	>90%	-3%	≥87%
X	Low-Bay Luminaires	5,000	ZL: 20-50°	≥30%	-10%	≥20%
BF	Hazardous Environment Low-Bay Luminaires	5,000	ZL: 20-50º	≥30%	-10%	≥20%
Y	Retrofit Kits for Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1,000	ZL: 0-90°	100%	-1%	≥99%
			ZL: 80-90°	≤10%	3%	≤13%
Z	Retrofit Kits for Outdoor Pole/Arm-Mounted Decorative Luminaires	1,000	ZL: 0-90°	≥65%	-3%	≥62%
AA	Retrofit Kits for Large Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1,000	ZL: 0-90°	100%	-1%	≥99%
			ZL: 80-90°	≤10%	3%	≤13%
AB	Retrofit Kits for Zero-Uplight Outdoor Wall-Mounted Area Luminaires	300	ZL: 0-90°	100%	-3%	≥97%
			ZL: 80-90°	≤10%	3%	≤13%
AC	Retrofit Kits for Parking Garage Luminaires	2,000	ZL: 60-80°	≥30%	-3%	≥27%
			ZL: 70-80°	≤25%	+3%	≤28%

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)*	Zonal Lumens (ZL)/Spacing Criteria (SC)/Beam Angle (BA)*	ZL/SC/BA Nominal Requirement*	ZL/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
AD	Retrofit Kits for Fuel Pump Canopy Luminaires	2,000	ZL: 0-40°	≥40%	-3%	≥37%
			ZL: 40-70°	≥40%	-3%	≥37%
AE	Retrofit Kits for 2x2 Luminaires for Ambient Lighting of Interior Commercial Spaces (all Primary Use Designations)	2,000	SC:0-180°	1.0-2.0	±0.1	0.90-2.1
			SC:90-270°	1.0-2.0	±0.1	0.90-2.1
			ZL:0-60°	≥75%	-3%	≥72%
AF	Retrofit Kits for 1x4 Luminaires for Ambient Lighting of Interior Commercial Spaces (all Primary Use Designations)	1,500	SC:0-180°	1.0-2.0	±0.1	0.90-2.1
			SC:90-270°	1.0-2.0	±0.1	0.90-2.1
			ZL:0-60°	≥75%	-3%	≥72%
AG	Retrofit Kits for 2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces (all Primary Use Designations)	3,000	SC:0-180°	1.0-2.0	±0.1	0.90-2.1
			SC:90-270°	1.0-2.0	±0.1	0.90-2.1
			ZL:0-60°	≥75%	-3%	≥72%
AH	Retrofit Kits for Direct Linear Ambient Luminaires	375 lm/ft	ZL: 0-60°	≥40%	-3%	≥37%
AI	Retrofit Kits for High-Bay Luminaires	10,000	ZL: 20-50°	≥30%	-10%	≥20%
AJ	Retrofit Kits for Low-Bay Luminaires	5,000 (<10,000)	ZL: 20-50°	≥30%	-10%	≥20%

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)*	Zonal Lumens (ZL)/Spacing Criteria (SC)/Beam Angle (BA)*	ZL/SC/BA Nominal Requirement*	ZL/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
AK	Four-Foot Linear Replacement Lamps (T8, T5: all Primary Use Designations)	1,600	Beam Angle	≥140°	-5°	≥135°
AL	Four-Foot Linear Replacement Lamps (T5HO: all Primary Use Designations)	3,200	Beam Angle	≥140°	-5°	≥135°
AM	Two-Foot Linear Replacement Lamps (all Primary Use Designations)	800	Beam Angle	≥140°	-5°	≥135°
AN	U-Bend Replacement Lamps (all Primary Use Designations)	1,400	Beam Angle	≥140°	-5°	≥135°
AO	Three-Foot Linear Replacement Lamps (all Primary Use Designations)	1,200	Beam Angle	≥140°	-5°	≥135°
AP	Eight-Foot Linear Replacement Lamps (all Primary Use Designations)	3,200	Beam Angle	≥140°	-5°	≥135°
AQ	Mogul Screw-Base Replacements for HID Lamps in Outdoor Pole/Arm-mounted Area and Roadway Luminaires	In luminaire: 1,000	ZL: 0-90°	≥100%	-1%	≥99%
			ZL: 80-90°	≤10%	3%	≤13%

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)*	Zonal Lumens (ZL)/Spacing Criteria (SC)/Beam Angle (BA)*	ZL/SC/BA Nominal Requirement*	ZL/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
AR	Mogul Screw-Base Replacements for HID Lamps in Outdoor Pole/Arm-mounted Decorative Luminaires	In luminaire: 1,000	ZL: 0-90°	≥65%	-3%	≥62%
AS	Mogul Screw-Base Replacements for HID Lamps in Outdoor Zero-Uplight Wall-mounted Area Luminaires	In luminaire: 300	ZL: 0-90°	100%	0%	100%
			ZL: 80-90°	≤10%	3%	≤13%
AT	Mogul Screw-Base Replacements for HID Lamps in Parking Garage Luminaires	In luminaire: 2,000	ZL: 60-80°	≥30%	-3%	≥27%
			ZL: 70-80°	≤25%	+3%	≤28%
AU	Mogul Screw-Base Replacements for HID Lamps in Fuel Pump Canopy Luminaires	In luminaire: 2,000	ZL: 0-40°	≥40%	-3%	≥37%
			ZL: 40-70°	≥40%	-3%	≥37%
AV	Mogul Screw-Base Replacements for HID Lamps in High-Bay Luminaires (Commercial and Industrial)	In luminaire: 10,000	ZL: 20-50°	≥30%	-10%	≥20%
AW	Mogul Screw-Base Replacements for HID Lamps in Low-Bay Luminaires (Commercial and Industrial)	In luminaire: 5,000	ZL: 20-50°	≥30%	-10%	≥20%

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)*		Zonal Lumens (ZL)/Spacing Criteria (SC)/Beam Angle (BA)*	ZL/SC/BA Nominal Requirement*	ZL/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
AX	Vertically Mounted Four Pin-Base Replacement Lamps for CFLs	In luminaire: 575 (1-lamp configur-ation)	Bare lamp: 675	ZL:0-60°	≥75%	-3%	≥72%
AY	Horizontally Mounted Four Pin-Base Replacement Lamps for CFLs	In luminaire: 800 (2-lamp configur-ation)	Bare lamp: 675	ZL:0-60°	≥75%	-3%	≥72%
AZ	2G11 Base Replacement Lamps for CFLs	1,900		Beam Angle	≥140°	-5°	≥135°
BG	Turtle Lighting Zero-Uplight Pole/Arm-Mounted Area and Roadway Luminaires	250		ZL: 0-90°	100%	0%	100%
BH	Turtle Lighting Zero-Uplight Wall-mounted Area Luminaires	250		ZL: 0-90°	100%	0%	100%
BI	Turtle Lighting Zero-Uplight Bollards	150		ZL: 0-90°	100%	0%	100%
BJ	Omnidirectional Mogul Screw-Base Replacements for HID Lamps	Bare lamp: 2000		Beam Angle	≥180°	-5°	≥175°
BK	Directional Mogul Screw-Base Replacements for HID Lamps	Bare lamp: 2000		Beam Angle	≥115°	-5°	≥110°

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)*	Zonal Lumens (ZL)/Spacing Criteria (SC)/Beam Angle (BA)*	ZL/SC/BA Nominal Requirement*	ZL/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
BL	Omnidirectional Medium Screw-Base Replacements for HID Lamps	Bare lamp: 1000	Beam Angle	≥180°	-5°	≥175°
BM	Directional Medium Screw-Base Replacements for HID Lamps	Bare lamp: 2000	Beam Angle	≥115°	-5°	≥110°

† Bilateral, symmetric light distribution on two hemispheres

‡‡ ≥60% of the lumens must be produced in the "forward" hemisphere, toward the wall (i.e., one-sided, single hemisphere light distribution)

‡ Bilateral for surface-mounted units, single hemisphere for corner-mounted units

*All distribution values are tested according to ANSI/IES LM-79, and all tested and reported values are displayed on the QPL. For minimum testing requirements, see **25.3.5 Minimum Testing Requirements: DLC Standard Light Output and Distribution**.

5.4.1 BUG (Backlight, Uplight, and Glare) Ratings

SSL products in the Outdoor Luminaire and Retrofit Kits category shall report the 6-character BUG ratings. Applicability to future Specialty Primary Use Designations will be determined on a case-by-case basis. The following Outdoor Low, Mid, High or Very High Output Primary Use Designations are exempt from SSL V6.0 BUG rating reporting requirements:

- Architectural Flood and Spot Luminaires
- Specialty: Wall Grazing/Slicing
- Specialty: Hazardous Environment Flood and Spot Luminaires
- Specialty: Soffit Lighting
- Specialty: Natatorium Lighting
- Specialty: Tunnel Lighting
- Sports Lighting

The nomenclature of BUG Ratings is similar to the example: **B2 U0 G2**. In addition, for products tested for distribution , tested BUG ratings will be generated by the DLC reviewer using the photometric data (.ies file) and listed under the Tested Data section of the QPL.

5.5 Flood and Spot Luminaires and Sports Lighting

For Architectural Flood and Spot, and Sports Lighting, manufacturers must declare the NEMA Beam Classification of their luminaire in the 0-180° and 90-270° planes as described in **Table 13**.

Table 13: NEMA Beam Classification

NEMA Beam Classification	Beam Spread Range	Method of Evaluation
1	10-18°	Luminaire photometric data (tested .ies files)
2	18-29°	
3	29-46°	
4	46-70°	
5	70-100°	
6	100-130°	
7	≥130°	

5.6 Interactions with Other DLC Policies: Field Adjustable Light Distribution (FALD)

For FALD products, additional clarifications on meeting light distribution and discomfort glare requirements are provided below.

- Testing and reporting requirements for zonal lumen distributions (ZLD) and spacing criteria (SC) are applicable to FALD products. The DLC review process will verify the ZLD requirements per the ZLD and SC measurements at the light distribution setting designated by the manufacturer per the **Field Adjustable Light Distribution (FALD)** Testing and Reporting Requirements.
- Testing and reporting requirements for BUG ratings are applicable to FALD products in the Outdoor Luminaire category, except for the PUDs that are exempted from reporting BUG Ratings (see section **5.4.1 BUG (Backlight, Uplight, and Glare) Ratings**5.4.1 above). This data will be displayed in the product detail page of the SSL QPL.
    - Tested BUG ratings will be listed on the SSL QPL under the Tested Data section.
    - Reported BUG ratings will be listed as Reported Data on the SSL QPL.
- Testing and reporting requirements for UGR are applicable to FALD products in the applicable categories seeking Premium qualification. The UGR values shall meet the threshold at the light distribution setting designated, per the FALD Testing and Reporting Requirements, for meeting the ZLD requirements of the PUD, for which the product is seeking qualification.
- Testing and reporting requirements for UGR are applicable to FALD products seeking efficacy allowances. FALD products are eligible for efficacy allowances related to UGR under V6.0.

5.7 Key Questions Regarding Quality of Light Proposals

1. In Draft 2, the DLC is proposing a maximum CCT of 6500 K for lamps and luminaires in indoor categories and luminaires and 5000 K for lamps (tested in-luminaire in outdoor product types) and outdoor luminaires with exceptions for Sports Lighting and Fuel Pump Canopy PUDs. What is your feedback on this proposal?
    a. Should the DLC consider capping CCT to 5000 K for all lamps?

2. What is your feedback on the proposed Draft 2 distribution requirements for the omnidirectional and directional screw-base replacement lamps?
3. What is your feedback on the proposed Draft 2 distribution requirements for the new PUD luminaires which used to be Specialty (Hazardous Environment Area, Sports Lighting, Linear Ambient Strip, Hazardous Environment High Bay, Indirect High-Bay, and Hazardous Environment Low Bay)?
4. What is your feedback on eliminating beam angle requirements for Flood and Spot Luminaires and Sports Lighting Luminaires? This would remove this information from QPL downloads.

6 Controllability

6.1 Rationale for Update

To better support expansion of energy efficiency incentive programs for luminaires with integral controls and controls ready luminaires, SSL V6.0 and LUNA V2.0 Draft 2 proposes the addition of Controls Categories to associate products with specific controls options. Controls categories are designed to align with energy savings claims associated with specific lighting control strategies which are detailed in various Technical Resource Manuals (TRMs) and program policies. As TRMs govern many energy efficiency programs,[5] Controls Categories will simplify incentive program application and review processes and lower barriers to the adoption of advanced lighting by directly connecting product model number variations to lighting control strategies.

6.2 Changes in SSL V6.0

Changes from SSL V5.1

- Removed existing controls information fields and replaced them with the Controls Categories and Controls Options Tables scheme.

Changes from Draft 1 to Draft 2

- Simplified and clarified Controls Categories
- Updated the definition of 'Controls Ready'
- Updated table 19 to explicitly allow wildcarding of model number segments for non-driver and non-integral controls option that fall in between driver and integral controls options codes.
- Clarified Controls Ready compatibility expectations.
- Added Dimming Capability to Controls Options Table
- Updated DALI Alliance controls options
- Added Driver Type: Integrated Driver + Controller

6.3 Controls Categories

SSL V6.0 Draft 2 proposes the following means for organizing listed products by their control capabilities. **Table 14** details the controls categories for all products.

[5] See the DLC Report Lighting Controls and Technical Reference Manuals: Updates to Enhance Energy Savings for more information.

700 ***Table 14: Controls Categories***

ALL PRODUCTS		
Category	**Name**	**Description**
1	No Integral Controls	A luminaire, lamp, or retrofit kit with no integral control capabilities.
2	Controls Ready Product	A luminaire, lamp, or retrofit kit with controls ready capabilities as defined in **Controls Ready (Controls Category 2).**
3	Product with One Integral Sensor Function*	A non-networked luminaire, lamp, or retrofit kit, or a networked luminaire, lamp, or retrofit kit without an NLC QPL listing, with one integral sensor function installed at the factory.
4	Product with Two or more Integral Sensor Functions*	A non-networked luminaire, lamp, or retrofit kit, or a networked luminaire, lamp, or retrofit kit without an NLC QPL listing, with two or more integral sensor functions installed at the factory. The sensor functions may be accomplished with a single device or multiple devices.
5	Product with Networked Controller	A luminaire, lamp, or retrofit kit with an integral networked controller installed at the factory. The networked controller must operate as part of an NLC QPL listed control system.
6	Product with Networked Controller and Two or More Integral Sensor Functions (LLLC)	A luminaire, lamp, or retrofit kit with an integral networked controller and two or more sensor functions installed at the factory. The sensor functions may be accomplished with a single device or multiple devices. The networked controller must operate as part of an NLC QPL listed control system.

701 * Examples include: occupancy sensing, daylight responsive dimming, dusk/dawn photocell sensing, part-night dimming

702 6.3.1 Driver and Controller Types

703 Draft 2 introduces two new reported fields, collected in the application process as noted in the Product
704 and Controls Options tables below that describe the relevant methods of communication with listed
705 products.

706 6.3.1.1 Driver Type/Communication Method

707 The Driver Type/Communication Method establishes the method by which a driver communicates with
708 a lighting controller, whether the controller is remote mounted or integral to the luminaire, lamp, or

retrofit kit. This method is always wired and may take place between a luminaire driver and a remote mounted controller (e.g., a wallbox dimmer), within a luminaire between an integral controller and the driver, or, in the case of a combined driver/controller, within the same luminaire component. This method aligns with the *Communication between devices within the lighting control system (control system intercommunication)* communication method category described in BSR/IES LP-6-25), also known as the back-end communication method.

6.3.1.2 Integral Controller Type/Communication Method

The Integral Controller Type/Communication Method establishes the method by which an integral controller or sensor communicates with a remote mounted control device or system. This method may be wired or wireless. This method aligns with the *Communication between the lighting controller and luminaires (lighting control protocol)* communication method category described in BSR/IES LP-6-25, also known as the front-end communication method.

6.4 Controls Ready (Controls Category 2)

SSL V6.0 Draft 2 proposes to define Controls Ready luminaires, lamps, or retrofit kits as those on which controls can be installed in the field without modifying the luminaire, lamp, or retrofit kit or using additional materials and, capable of supporting the functionality of the control and are purchased separately from the luminaire, lamp, or retrofit kit. For luminaires that ship with both an integral device and a controls ready receptacle, the controls category shall be set according to the capabilities of the integral device. The following are some examples of luminaires, lamps, or retrofit kits that do and do not qualify as Controls Ready:

- Qualifies as Controls Ready:
  - An outdoor area light with a NEMA 5-pin twist lock connector installed at the factory.
  - An indoor troffer with a Zhaga Book 18 socket installed at the factory.
- Does Not Qualify as Controls Ready:
  - A luminaire with an available knockout for field mounting a sensor or controller. Requires modifying the luminaire (removing the knockout) and additional materials (wire nuts, electrical tape, etc.)
  - A luminaire that ships from the factory with a knockout mounted sensor that is demounted for packing purposes (this would be considered an integral sensor).

Controls Ready receptacles are defined in **Table 15.** These features will not be evaluated against any standards and will be treated as manufacturer-reported assertions validated with references on the product specification sheet or supplemental literature.

6.4.1 Controls Ready Receptacle Types

The receptacle types shown in **Table 15** are intended to indicate mechanical fit only, not full interoperability. The DLC will rely on individual manufacturers to indicate which controls ready accessories are both mechanically and electrically compatible with associated controls ready luminaires.

Draft 2 proposes to exclude luminaires with 3-pin Twistlock – NEMA/ANSI C136.10 Compliant receptacles from listing due to their inability to dim via a signal from the twistlock device. The 3-pin

747 Twistlock receptacle type is included in **Table 15** for completeness and to positively show on the QPL
748 that a product variant of an otherwise qualified luminaire with a 3-pin Twistlock Controls Option Code is
749 *not* qualified.

750 ***Table 15: Controls Ready Receptacle Types***

Receptacle Type	Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
None	No controls ready receptacle is present on the luminaire.	N/A
3 Pin Twistlock – NEMA/ANSI C136.10 Compliant	A receptacle with 3 conducting pins that is installed at the factory and meets the NEMA/ANSI C136.10 standard. Please note that luminaires with 3-pin receptacles are NOT eligible for listing. This option is included here for completeness and to clearly communicate when specific controls options are not eligible.	N/A Please note that luminaires with 3-pin receptacles are NOT eligible for listing
5 Pin Twistlock – NEMA/ANSI C136.41 Compliant	A receptacle with 5 conducting pins that is installed at the factory and meets the NEMA/ANSI C136.41 standard.	NEMA 5-pin NEMA/ANSI 5-pin NEMA 5-pin Twistlock NEMA/ANSI 5-pin Twistlock
7 Pin Twistlock – NEMA/ANSI C136.41 Compliant	A receptacle with 7 conducting pins that is installed at the factory and meets the NEMA/ANSI C136.41 standard.	NEMA 7-pin NEMA/ANSI 7-pin NEMA 7-pin Twistlock NEMA/ANSI 7-pin Twistlock
3.5mm Phono Jack	A receptacle with 3, 4, or 5 contact points that is similar in shape or size to standard headphone jacks for consumer use.	3.5mm Phono Jack 1/8” Phono Jack AUX Port
USB-C Port	A receptacle that is installed at the factory and meets the USB-C requirements for physical characteristics as specified in the IEC 62680-1-3 standard. The electrical characteristics of the receptacle may be proprietary.	USB-C USB Type-C
Zhaga Book 18	A receptacle installed at the factory that meets Zhaga Book 18 requirements. Designed for outdoor installations.	Zhaga Book 18
Zhaga Book 20	A receptacle installed at the factory that meets the Zhaga Book 20 requirements. Designed for indoor installations.	Zhaga Book 20
Other	Other receptacle type as specified by the luminaire manufacturer.	N/A

6.5 Controls Options Tables

Controls Options Tables contain information on all available controls options included in the model number and listed on the specification sheet for a luminaire. These tables are collected during the application submittal process and where one table may apply to multiple Product IDs within the same family. Not every control option needs to apply to every Product ID in a family.

Table 16 shows the details of the controls information Draft 2 proposes to collect in the Controls Options Tables for **All** products.

Table 16: Controls Options Table Details

ALL PRODUCTS		
Controls Information	**Description**	**Available Options**
Controls Option Code	A text string that represents the controls options available for each driver and integral control variation within a model number. Each Controls Options Code must be orderable and shown on the spec sheet. Non-controls portions of model numbers that fall in between controls portions of model numbers codes may utilize wildcards in controls options codes.	As displayed on the specification sheet. For products without controls options use "None".
Driver Type / Communication Method	The type (communication method) of driver that is installed in the product or ordered with the product in the case of remote-mounted drivers. Available options must be indicated on the spec sheet, but an exact match is not required.	• Wired - 0-10 V ANSI C137.1-2022 • Wired – BACnet • Wired - D4i • Wired - DALI version-1 • Wired - DALI-2 • Wired – DMX512 • Wired – Modbus • Wired - KNX • Wired - Other Digital • Wired - Other Digital (Proprietary) • Wired - Other Analog • Wired - Other Analog (Proprietary) • Wired - Phase Cut • Wired - RJ45 (Proprietary) • Wired – Dimmable Fluorescent Ballast (Type A Lamps) • Integrated Driver and Controller

ALL PRODUCTS		
Controls Information	**Description**	**Available Options**
Dimming Capability	The type of dimming the driver associated with this option code is capable of performing.	• Continuous • Stepped • Not Dimmable
Minimum Dimming Level	The lowest level a driver is capable of dimming to expressed as a percentage of total output.	• Minimum Dimming Level (e.g., 10%)
Integral Controller Type / Communication Method	The type (communication method) of integral controller that is installed in the product. Available options must be indicated on the spec sheet, but an exact match is not required.	• None • Wired – BACnet • Wired - D4i • Wired - DALI version-1 • Wired - DALI-2 • Wired – DMX512 • Wired – Modbus • Wired - Other Digital • Wired - Other Digital (Proprietary) • Wired - Other Analog • Wired - Other Analog (Proprietary) • Wired – PoE (IEE 802.3bt) • Wired - RJ45 (Proprietary) • Wireless – 4G • Wireless - 5G • Wireless - Bluetooth NLC • Wireless - Bluetooth (Proprietary) • Wireless - DALI+ • Wireless – EnOcean • Wireless - Infrared Remote • Wireless – Other • Wireless - Other (Proprietary) • Wireless - Wi-Fi • Wireless – Zigbee • Wireless - Zigbee (Proprietary)

ALL PRODUCTS		
Controls Information	**Description**	**Available Options**
Controls Ready Top or Side Receptacle Type	The type of controls ready receptacle, installed at the factory, which is present on the top or side of the product when mounted in operating orientation. Available options must be indicated on the spec sheet or supplemental materials, but an exact match is not required.	• None • 7 Pin Twistlock – NEMA/ANSI C136.41 Compliant • 5 Pin Twistlock – NEMA/ANSI C136.41 Compliant • 3 Pin Twistlock – NEMA/ANSI C136.10 Compliant[6] • Zhaga Book 18 • Zhaga Book 20 • USB C • 3.5mm Phono Jack • Other:___
Controls Ready Bottom or Side Receptacle Type	The type of controls ready receptacle, installed at the factory, which is present on the bottom or side of the product when mounted in operating orientation. Available options must be indicated on the spec sheet or supplemental materials, but an exact match is not required.	• None • 7 Pin Twistlock – NEMA/ANSI C136.41 Compliant • 5 Pin Twistlock – NEMA/ANSI C136.41 Compliant • 3 Pin Twistlock – NEMA/ANSI C136.10 Compliant[6] • Zhaga Book 18 • Zhaga Book 20 • USB C • 3.5mm Phono Jack • Other:___
Integral Sensor Function	The lighting control strategy function of the integral sensor installed at the factory. Available options must be indicated on the spec sheet or supplemental materials, but an exact match is not required.	• None • Occupancy Only • Daylight Only • Photocell Only • Part Night Dim Only • Occupancy + Daylight • Occupancy + Photocell • Photocell + Part Night Dim • Occupancy + Photocell + Part Night Dim • Traffic • Traffic + Photocell • Traffic + Photocell + Part Night Dim

[6] Please note that product variations with 3 pin Twistlock receptacles are not eligible for V6.0 qualification. Option is shown here for data integrity.

ALL PRODUCTS		
Controls Information	**Description**	**Available Options**
Integral Sensor Technology	The type of sensing technology that the integral sensor installed at the factory uses. Available options must be indicated on the spec sheet or supplemental materials, but an exact match is not required.	• None • Passive Infrared (PIR) • Ultrasonic • Dual-Tech • Microphonic • Microwave • Millimeter Wave • Camera • Bluetooth Beacon • Other
Integral Sensor Maximum Mounting Height (ft)	The manufacturer provided maximum mounting height for effective operation of the sensor.	One- or two-digit integer. Value to be submitted in feet. Both feet and meters will be displayed on the QPL.
NLC QPL Product ID	The NLC QPL Product ID of the networked lighting control system that the integral control product communicates with.	N/A
Controls Ready Accessory Model Numbers	Model numbers for the controls ready accessories provided by the manufacturer that are compatible with the listed product. This field is optional for manufacturers to report.	N/A

6.6 Dimming Requirements

The proposed dimming requirements in Draft 2 enhance the controllability of qualified lighting products across all categories in order to increase potential energy savings while improving quality of light, comfort, and well-being for end users of the occupied spaces. The policies will ensure that products listed on the SSL QPL have the capability to be dimmed. SSL QPL products designated as dimmable may require the installation of additional components and/or building infrastructure to enable dimming. The DLC does not set requirements regarding how qualified dimmable products are installed and/or used in the field.

The DLC does *not* issue requirements around utilization of a specific dimming control protocols (0-10V, DALI, etc.) for the dimming capability requirement. *The ability to dim is the focus of this requirement.*

Table 18 shows the dimming requirements for all Standard products.

771 ***Table 17: Standard Dimming Requirements***

Metric	Standard Dimming Requirements	QPL Listing	Method of Evaluation[7]
Dimming	*Indoor luminaires and retrofit kits (excluding case lighting and Specialty primary uses intended for hazardous location):* **Continuous dimming to minimum dimming level of 20% or lower capability required**	1. Dimming capability (continuous, stepped, none) 2. Minimum Dimming Level (e.g., 10%)	Product specification sheet shall clearly identify dimming capability
	Outdoor luminaires, retrofit kits, and screw-base replacement lamps for outdoor applications (excluding specialty sports lighting, specialty tunnel, and Specialty primary uses designated for hazardous locations): **Continuous to minimum dimming level of 20% or lower or stepped dimming capability required**		
	Lamps, unless noted above: **Continuous dimming to minimum dimming level of 20% or lower capability required**		
	All other products: **Required reporting of dimming capability**		

772

773 ## 6.6.1 Special Controllability Considerations for Dimmable Linear Lamps

774 As stated in **Table 17**, all qualified lamps must be continuously dimmable. Because lamps are most often
775 used in retrofit installations, there are special considerations needed to ensure end users are able to dim
776 lamps as desired. The following considerations apply to each UL Type of linear replacement lamps,
777 mogul-screw base lamps, medium-screw base lamps, and pin-based replacement lamps, as appropriate:

[7] Controllability capabilities are based on manufacturer claims; performance is not verified by the DLC.

UL Type A:

- Type A linear lamps, with the exceptions noted below, capable of wired dimming solely via input from the existing ballast should note the minimum dimming level and select the "Wired – Dimmable Fluorescent Ballast" option in the "Driver Type" and "None" in the "Integral Sensor Type" columns, as wired control signals are received by the ballast and not the lamp itself. All other fields should be filled in as applicable.
    - Due to the lack of dimmable ballasts available in the marketplace for eight-foot T8 fluorescent lamps, Type A lamps in the T8 eight-foot general application that claim wired dimming capability utilizing the direct input from the ballast to achieve dimming will be rejected. Therefore, these lamp types that claim to be dimmable via a wired protocol must provide a wiring diagram in the product specification sheet, installation instructions, or separate document showing the electrical circuit of the lamp connecting to mains power via the ballast, including the location of the input signal from an external control source to the lamp.
    - Any Type A lamps which do not solely utilize the ballast input to achieve dimming capability through a wired protocol (i.e., the dimming control wires connect directly to the lamp), must report the specific wired communication protocol and provide a wiring diagram.
    - For the two exceptions above, if an external device is used between the dimming control user interface and Type A lamp, then these lamps must report the communication method between the lamp and external device as the Driver Type and the communication method between the dimming control user interface and the external device as the Integral Controller Type. The wiring diagram noted above will be evaluated by reviewers to determine if an external device is required to achieve the specific communication protocol.

UL Type B:

- In addition to reporting minimum dimming level, presence of integral controls, and communication methods, Type B lamps that claim to be dimmable via a wired protocol with 0-10V, DALI, and DMX512 must provide a wiring diagram in the product specification sheet, installation instructions, or separate document showing the electrical circuit of the lamp connecting to mains power, including the location of the input signal from an external control source to the lamp or lamp holder for 0-10V, DALI or DMX512 control.
- Type B lamps listed for operations with 0-10V, DALI, or DMX512 communication control must be able to achieve this dimming capability without an external signal converter and the low voltage control wires must connect directly to the lamp or lamp holders.

UL Type A/B Dual Mode:

- Type A/B must be dimmable in both modes of operation and stated as such on the product specification sheet.
- All requirements from UL Type A above apply to UL Type A/B Dual Mode. All products will have a note on the QPL that says: "When operated as Type A, dimmable depending on ballast capability"

- Similarly, Dual Mode Lamps must supply documentation as noted in the Type B section above and will be listed on the QPL as described for Type B lamps. If the Type B lamp accomplishes dimming with an external accessory, it will include a note that is specific to Type B operation.

UL Type C:

- Type C lamps must meet all V6.0 Controllability requirements with no further considerations.

6.7 Integral Controls

Reporting of integral control function, technology, and maximum mounting height is required for all products.

Integral sensor functions are defined in **Table 18**. These integral control functions will not be evaluated against any standards and are treated as manufacturer-reported assertions validated with references on the product specification sheet or supplemental literature.

829 ***Table 18: V6.0 Integral Sensor Functions***

Integral Sensor Functions	Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
Occupancy Only	A control device that detects occupant presence and automatically turns luminaires and/or other equipment on and, after a preset delay during which no presence is detected, turns them off. Also called a motion detector.	Occupancy, Vacancy, Motion, Exterior Motion
Daylight Only	Sensors that can automatically affect the operation of lighting or other equipment through dimming based on the amount of daylight and/or ambient light that is present in a space or area.	Daylight, Daylight Harvesting, Daylight Dimming, Daylight Response, Photosensor, Ambient Light
Photocell Only	A sensor that can automatically affect the operation of lighting or other equipment based on the amount of daylight and/or ambient light that is present in an exterior environment.	Photocell, Photo, PCR, Dusk-to-Dawn
Occupancy + Daylight	A control device that detects occupant presence and automatically turns luminaires and/or other equipment on and, after a preset delay during which no presence is detected, turns them off in addition to automatically raising or lowering the dimming levels of lighting or other equipment based on the amount of daylight and/or ambient light that is present in a space or area.	Must include terms from both of the following lists: Occupancy Terms: Occupancy, Vacancy, Motion, Exterior Motion Daylight Terms: Daylight, Daylight Harvesting, Daylight Dimming, Daylight Response, Photosensor, Ambient Light
Occupancy + Photocell	A control device that detects occupant presence and automatically turns luminaires and/or other equipment on and, after a preset delay during which no presence is detected, turns them off in addition to automatically affecting the operation of lighting or other equipment based on the amount of daylight and/or ambient light that is present in an exterior environment.	Must include terms from both of the following lists: Occupancy Terms: Occupancy, Vacancy, Motion, Exterior Motion Photocell Terms: Photocell, Photo, PCR, Dusk-to-Dawn
Traffic	A sensor that can automatically affect the operation of lighting or other equipment based upon detecting the presence or absence of moving vehicles in an area.	Traffic, Adaptive Traffic

830

831 Integral sensor technologies are defined in **Table 19**. Integral sensor technologies will not be evaluated
832 against any standards and are treated as manufacturer-reported assertions validated with references on
833 the product specification sheet or supplemental literature.

834 ***Table 19: V6.0 Integral Sensor Technologies***

Integral Sensor Technologies	Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
Passive Infrared	Presence sensors that detect the movement of heat emitted by people in motion. Detection requires line of sight; and does not function behind obstacles or through glass. Sensors typically have distance ratings for effectiveness at detecting major and minor motion.	Passive Infrared, PIR
Ultrasonic	Presence sensors that emit high frequency acoustic waves and then monitor the pattern of reflections in a space. When the pattern is interrupted the sensor registers movement. Ultrasonic sensors do not require a direct line of sight to function.	Ultrasonic
Microwave	Presence sensors that emit extremely low power electromagnetic radiation in the 300 MHz to 300 GHz range and then monitor the pattern of reflections in a space. When the pattern is interrupted the sensor registers movement. Microwave sensors do not require a direct line of sight to function and can sometimes 'see' through walls. Thus, proper adjustment of sensitivity settings is crucial to avoiding false activations.	Microwave
Millimeter Wave	Presence sensors that emit electromagnetic radiation in the 30 to 300 GHz range. Unlike ultrasonic and microwave sensors, millimeter wave radar sensors are able to detect movement, acceleration, and angles as small as a fraction of a millimeter and are sometimes capable of detecting multiple people in a space.	Millimeter Wave, mmWave
Camera	Presence sensors that utilize captured images, whether high or low resolution, and image processing software to determine human proximity.	N/A
Dual Technology	Presence sensors that utilize two, or more, technologies to increase detection reliability.	Dual-Technology, Dual-Tech, Dual Technology, Dual Tech
Other	Presence sensors that utilize another technology not listed above.	N/A

835 ### 6.7.1 Control Communication

836 Reporting of the Driver Type/Communication Method and Integral Controller Type/Communication
837 Method for all products is required. Luminaires without integral controls would have "None" in the
838 Integral Controller Type. In the case of a luminaire with a driver and integral occupancy sensor, the

839 occupancy sensor is considered the 'integral controller' and the method used to communicate with the
840 occupancy sensor shall be listed as the Integral Controller Type/Communication Method.

841 Driver Type and Integral Controller Type are defined in **Table 20**. These types will not be evaluated
842 against any standards and will be treated as manufacturer-reported assertions validated with references
843 on the product specification sheet or supplemental literature.

844 ***Table 20: Driver and Integral Controller Type Descriptions***

Driver and Integral Controller Types		Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
WIRED	0-10 V IEC 60929 Annex E	Wired analog low-voltage control that varies DC voltage between 0 and 10 volts (or 1 and 10 volts) to produce varying light output.	0-10 V, 1-10 V
	BACnet	A communication protocol for building automation and control networks that uses the ASHRAE, ANSI, and ISO 16484-5 standards protocol.	BACnet
	D4i	An extension of the DALI-2 standard intended for use within luminaires. D4i control devices include requirements for power and control, to simplify selection of up to 2 devices for use on a D4i luminaire.	D4i
	DALI version-1	A standard Protocol for bi-directional, digital communication between lighting control devices. Developed and maintained by the Dali Alliance. The US standard is C137.4 and maintained by NEMA.	DALI, DALI version-1, Digital Addressable Lighting Interface ANSI/NEMA C137.4
	DALI-2	DALI-2 is the certification program based on the latest version of the DALI protocol. DALI-2 certification is created and maintained by the DALI Alliance. The US standard is C137.4 and maintained by NEMA.	DALI-2 ANSI/NEMA C137.4
	DMX512	Lighting control protocol initially created for use in theatrical installations but in common use in architectural lighting installations where color changing or tuning effects are desired. It describes a	DMX512, Digital Multiplex

Driver and Integral Controller Types		Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
		method of digital data transmission between a controller and a dimmer or relay panel, or to DMX512-compatible luminaires. Wiring is Class 2 and is required to be a daisy-chain configuration.	
	DMX512 RDM	A revision to the DMX512 standard to include bidirectional communication and enable remote management of devices.	DMX512 RDM
	Modbus	A client/server data communications protocol developed and maintained by the Modbus Organization. Commonly used in industrial applications.	Modbus
	KNX	A peer-to-peer communication standard used for building automation. Developed and maintained by knx.org	KNX
	Other Analog	An open wired analog communication protocol as specified by the manufacturer.	N/A
	Other Analog (Proprietary)	A closed wired analog communication protocol as specified by the manufacturer.	N/A
	Other Digital	An open wired digital communication protocol as specified by the manufacturer.	N/A
	Other Digital (Proprietary)	A closed wired digital communication protocol as specified by the manufacturer.	N/A
	Phase-cut	Modification, or cutting, of the leading or trailing edge of the AC mains sinusoidal waveform to produce varying light output.	Phase-cut, phase, forward phase, leading edge, reverse phase, trailing edge, TRIAC, magnetic low-voltage (MLV), electronic low-voltage (ELV)
	RJ45 (Proprietary)	A manufacturer specific communication method that uses RJ45 (ethernet) connectors.	RJ45, Cat 5, Cat 6, Cat 7
	Integrated Driver + Controller	A driver and networked controller device where both functions are contained within the same luminaire component housing.	Integrated Driver + Controller

Driver and Integral Controller Types		Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
WIRELESS	4G Cellular	Fourth Generation cellular network designed to support all-IP communications and broadband services. Developed by the International Telecommunication Union.	4G, 4G LTE
	5G Cellular	Fifth Generation cellular network designed to support all-IP communications and broadband services. Developed by the International Telecommunication Union.	5G
	Bluetooth (Proprietary)	Wireless digital communication protocol developed and maintained by the Bluetooth Special Interest Group (SIG). Uses short-range RF to communicate with other nearby Bluetooth-enabled devices.	Bluetooth, Bluetooth Low Energy, BLE, BLE Mesh
	Bluetooth NLC	Wireless digital communication protocol developed and maintained by the Bluetooth Special Interest Group (SIG) specifically for Networked Lighting Control systems. Uses short-range RF to communicate with other nearby Bluetooth-enabled devices.	Bluetooth NLC
	DALI+	DALI+ is the certification program for the wireless or IP-based version of DALI. DALI+ with Thread is the first implementation, using Thread's low-power IP-based, wireless mesh networking protocol. The US standard is C137.4 and maintained by NEMA.	DALI+ with Thread
	EnOcean	Wireless digital communication protocol developed and maintained by the EnOcean Alliance based on the ISO/IEC 14543-3-10/11 standard. Geared to wireless sensors and wireless sensor networks with ultra-low power consumption that utilize energy harvesting technology.	EnOcean, Enocean

Driver and Integral Controller Types		Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
	Infrared Remote	Usually limited to one-way communication	IR, Infrared Remote
	Other	An open wireless communication protocol as specified by the manufacturer.	N/A
	Other (Proprietary)	A closed wireless communication protocol as specified by the manufacturer.	N/A
	Wi-Fi	A wireless protocol similar to the protocols that computers use and is a very robust wireless option. It also functions similarly to PoE in that it assigns IP addresses to each device and luminaire and is dependent on the user interface for granularity of dimming range.	Wi-Fi, Wireless Internet
	ZigBee	Low-power wireless protocol. It uses an IP address for devices, has a parallel full-duplex communication, and uses short- to medium-range RF to communicate. Networked Lighting Control systems with this designation should allow third-party devices.	ZigBee, ZigBee HA, ZigBee 3.0
	Zigbee (proprietary)	Low-power wireless protocol. It uses an IP address for devices, has a parallel full-duplex communication, and uses short- to medium-range RF to communicate. Networked Lighting Control systems with this designation typically do not allow third-party devices.	ZigBee, ZigBee HA, ZigBee 3.0

6.7.2 Documentation Requirements

Given the rapidly evolving technical capabilities included in the controllability requirements, the DLC review staff will not evaluate any controllability claims against actual performance. Reviewers of product applications will rely on manufacturer claims represented directly on the product specification sheet or supplemental controls documentation (where applicable). Documentation shall have explicit declaration of a capability, along with any ordering information (i.e., model number or ordering code variants) that are associated with the specific capability or attribute.

The DLC will monitor its stakeholders' experience with QPL controllability information and intends to use surveillance testing procedures to address any concerns about controllability performance claims not matching QPL or market available data.

6.8 Key Questions Regarding Controllability Proposals

1. Are there any acceptable terms you feel are missing from tables 19, 20, or 21?

7 Field Adjustable Products

7.1 Rationale for Update

To better align with industry standards and differentiate between field adjustable and controllable products, the SSL V6.0 Draft 2 proposes revising the definition of "field adjustable" and reorganizing how field adjustable product attributes are presented on the QPL.

To conserve energy and promote lower light output and color temperature products in outdoor settings, the DLC is proposing that qualified field adjustable color temperature (FACT) products with selectable switches be shipped with these switches set to the lowest CCT. This requirement aims for consistency across all qualified products.

7.2 Changes in SSL V6.0

Changes from SSL V5.1

- Redefined Field Adjustable Light Output and added Field Adjustable Color Temperature to better differentiate Field Adjustable products from dimmable and color-tuning products.

Changes from Draft 1 to Draft 2

- Refined definition of field adjustable for clarity.
- Removed proposed requirement to ship FALO products at lowest output setting.

7.3 Definition for Field Adjustable

Field Adjustable is defined as products that enable the user to make adjustments to the CCT and/or output and/or distribution, through either physical or electronic means, while the user is physically located at the luminaire *at the time of installation*. Field adjustable parameters are not intended to be changed in the normal course of luminaire operation. The capability of a driver to make precise output adjustments, typically performed at the factory or distribution warehouse, and not available to the installer is not considered field adjustable.

By contrast, dimmable products enable the user to make adjustments to the light output of a luminaire, through physical or electronic means, while the user is located at a distance from the luminaire *after the time of installation*. Dimming adjustments commonly are made repeatedly in the normal course of luminaire operation.

Field Adjustable products will be clearly marked as Field Adjustable in search results on the SSL QPL, and details of Field Adjustable product features will be displayed together on QPL Product Detail Pages.

7.4 Eligible Field Adjustable Products

The DLC recognizes three types of field adjustable products: Field Adjustable Color Temperature (FACT), Field Adjustable Light Output (FALO), and Field Adjustable Light Distribution (FALD). In SSL V5.1, products with Field Adjustable Color Temperature were covered under the color tuning policy. To better align with the market, SSL V6.0 is moving Field Adjustable Color Temperature to the Field Adjustable policy.

7.5 Field Adjustable Color Temperature (FACT)

Products that are capable of Field Adjustable Color Temperature (FACT) enable the user to make adjustments to the Correlated Color Temperature (CCT), through either physical or electronic means, while the user is physically located at the luminaire at the time of installation. Field adjustable parameters are not intended to be changed in the normal course of luminaire operation. Draft 2 proposes that the default FACT setting for outdoor products shall be the lowest CCT setting. **Table 21** details the reported data requirements for FACT products.

FACT products shall follow the testing requirements detailed in the Color-Tunable Products section.

To minimize environmental impact in outdoor applications, Draft 2 proposes to require that the default CCT setting at which the outdoor product is shipped shall match CCT Setting 1, or the lowest CCT setting available.

903 ***Table 21: Field Adjustable Color Temperature Reported Data***

Field	Definition	Acceptable Terms denoting CCT on the Product Spec Sheet or Supplemental Literature
Default CCT Setting	The setting at which the product emerges from production and is shipped with no adjustments to CCT. For outdoor products, SSL V6.0 Draft 2 proposes that the Default CCT Setting shall match CCT Setting 1. For all other products, the Default CCT Setting shall be selected at the manufacturer's discretion.	xxxxK xxxx K x K x.x K
CCT Setting 1	The CCT of the luminaire at the lowest setting.	xxxxK xxxx K x K x.x K
CCT Setting 2	The CCT of the luminaire at the second lowest setting.	xxxxK xxxx K x K x.x K
CCT Setting 3	The CCT of the luminaire at the third lowest setting.	xxxxK xxxx K x K x.x K
CCT Setting 4	The CCT of the luminaire at the fourth lowest setting, if necessary.	xxxxK xxxx K x K x.x K
CCT Setting 5	The CCT of the luminaire at the fifth lowest setting, if necessary.	xxxxK xxxx K x K x.x K

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7.6 Field Adjustable Light Output (FALO)

Field Adjustable Light Output (FALO) products are lamps, luminaires, or retrofit kits that are capable of being adjusted to decrease or increase lumen output and wattage from the default setting, through either physical or electronic means, while the user is physically located at the individual luminaire. The default setting is defined as the setting at which the product emerges from production and is shipped with no adjustments to lumen output. The field adjustable set point is fixed by the manufacturer, distributor, installer, or commissioning agent before or during installation or commissioning, via a control that is made discrete to that purpose (i.e., not part of a regular occupant- or sensor-facing control system). Typically, field adjustable light output settings are not occupant-interfacing and are not intended to be changed in the normal course of luminaire operation. This capability is reported separately from the required dimming capability.

Draft 2 proposes that all FALO products shall be capable of responding to an internal signal (field adjustable selection) and an external dimming signal. When FALO is accomplished with a removable device that connects to the driver dimming connection, the manufacturer shall clarify what steps are needed to enable an external dimming connection.

Table 22 details the reported data requirements for FALO products.

Table 22: Field Adjustable Light Output and Wattage Reported Data

Field	Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
Default Lumen Output	The setting at which the product is shipped with no adjustments to lumen output.	xxxxx lm xxxxx lumens
Lumen Output Setting 1	The lumen output of the luminaire at the lowest setting.	xxxxx lm xxxxx lumens
Lumen Output Setting 2	The lumen output of the luminaire at the second-lowest setting.	xxxxx lm xxxxx lumens
Lumen Output Setting 3	The lumen output of the luminaire at the third lowest setting.	xxxxx lm xxxxx lumens
Lumen Output Setting 4	The lumen output of the luminaire at the fourth lowest setting, if necessary.	xxxxx lm xxxxx lumens
Lumen Output Setting 5 (Highest)	The lumen output of the luminaire at the fifth lowest setting, if necessary.	xxxxx lm xxxxx lumens
Default Wattage	The setting at which the product is shipped with no adjustments to lumen output.	xxxx W xxxx Watts
Wattage Setting 1 (Lowest)	The power demand of the luminaire at the lowest setting.	xxxx W xxxx Watts
Wattage Setting 2	The power demand of the luminaire at the second lowest setting.	xxxx W xxxx Watts
Wattage Setting 3	The power demand of the luminaire at the third lowest setting.	xxxx W xxxx Watts
Wattage Setting 4	The power demand of the luminaire at the fourth lowest setting, if necessary.	xxxx W xxxx Watts
Wattage Setting 5 (Highest)	The power demand of the luminaire at the fifth lowest setting, if necessary.	xxxx W xxxx Watts

7.7 Field Adjustable Light Distribution (FALD)

Field adjustable light distribution (FALD) products are lamps, luminaires, or retrofit kits whose light distribution can be intentionally adjusted from the default factory “as-shipped” configuration, through either physical or electronic means, only while the user is physically located at the individual luminaire. Light distribution is considered adjusted when the light intensity in one direction changes relative to the intensity in any other direction. Typically, field adjustable light distribution settings are not occupant interfacing and are not intended to be changed in the normal course of luminaire operation. **Table 23** details the reported data requirements for FALD products.

FALD products eligible for listing on the SSL QPL fall into one or both of two types based on the method used to intentionally adjust their light distribution:

1. **Integral Field Adjustable Light Distribution Products:** Products where the distribution can be adjusted by electrical or mechanical means without the addition, removal, or replacement of any parts or accessories. The adjustment must be integral to the product. For example, a luminaire with aimable light bars to direct the light at different angles would fall under this category.
2. Products within the following Primary Use Designations that are "aimable" but restrict tilt to ≤ 10 degrees to "level" the intensity distribution with the pavement are NOT required to list as FALD:
3. Outdoor Pole/Arm-Mounted Area and Roadway Luminaires
4. Outdoor Pole/Arm-Mounted Decorative Luminaires
5. Hazardous Environment Area Lighting
6. Specialty: Hazardous Environment Outdoor Pole/Arm-Mounted Area and Roadway Luminaires
7. The DLC will rely on manufacturers and submitters to appropriately indicate whether their product has FALD capabilities. However, the DLC reserves the right to ask for additional information to clarify product capabilities related to tilting, aiming, and/or leveling.
8. **Standard Component Field Adjustable Light Distribution Products:** Products where the distribution is adjusted by adding or removing parts that are included with the product as sold under a single model number. These interchangeable components that come as standard with a single model number are defined as "Standard Components" for this policy. An example of this type of FALD product is a luminaire that is shipped standard with three reflectors under a single model number, and for which the installer chooses one of the reflectors during the installation and stores or discards the other two reflectors.
9. Products where the distribution is adjusted by adding parts that do not come standard with every order—termed "optional components" in this policy—are not considered FALD products and must be submitted under separate applications with separate model numbers for each component combination.

The testing and listing requirements are identical for the two FALD types above, as described in the Eligibility, Testing and Reporting, and Listing sections below. SSL QPL applications for FALD products will be required to specify which of the two types above, or both, apply to the product.

960 ***Table 23: Field Adjustable Light Distribution Reported Data***

Field	Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
Field Adjustable Distribution Type		Degree Range IES Distribution Types (Outdoor only) NEMA Flood Types (Outdoor only)
Distribution Setting Default	The setting at which the product emerges from production and is shipped with no adjustments to distribution settings.	xxx ° xxx degrees Type x NEMA x
Distribution Setting 1	The distribution of the luminaire at the narrowest or most concentrated setting.	xxx ° xxx degrees Type x NEMA x
Distribution Setting 2	The distribution of the luminaire at the second narrowest or most concentrated setting.	xxx ° xxx degrees Type x NEMA x
Distribution Setting 3	The distribution of the luminaire at the third narrowest or most concentrated setting.	xxx ° xxx degrees Type x NEMA x
Distribution Setting 4	The distribution of the luminaire at the fourth narrowest or most concentrated setting, if necessary.	xxx ° xxx degrees Type x NEMA x
Distribution Setting 5 (Highest)	The distribution of the luminaire at the fifth narrowest or most concentrated setting, if necessary.	xxx ° xxx degrees Type x NEMA x

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962 ## 7.8 Key Questions for Field Adjustable Products

963 1. Draft 2 proposes that the Default CCT Setting for outdoor LED products with field adjustable color
964 temperature (FACT) shall be at the lowest CCT (CCT Setting 1). Draft 1 proposed this requirement for
965 all products. What is your feedback, if any, on changing this requirement?

8 Color-Tunable Products

8.1 Rationale for Update

To support the increasing demand for color tuning capabilities, SSL V6.0 Draft 2 classifies Color-Tunable products as either CCT-tunable, Warm-dimming or Full Color-Tunable.

Additionally, it proposes that Field Adjustable Color Temperature (FACT) products are eligible for listing under the Field Adjustable Color Temperature subsection, complying with the same testing and reporting requirements as CCT-Tunable products.

8.2 Changes in SSL V6.0

Changes from SSL V5.1

- Redefines “white tunable” as “CCT tunable”
- Introduces eligibility for Full color-tunable products
- Aligns FACT testing and reporting requirements with CCT tunable

Changes from Draft 1 to Draft 2

- No changes from Draft 1 to Draft 2

8.3 Definitions of Color-Tunable Products

Color-Tunable products are defined as products whose output spectra can be adjusted via an input control of any type and is intended to be tuned over the course of normal operation (i.e., not configured at installation and left unchanged). Products supplying colored and white light (i.e., those capable of generating color points with D_{uv} magnitudes beyond the limits of the ANSI/NEMA C78.377-2024 specification, also known as Full Color-Tunable) are proposed to be eligible under SSL V6.0 and will only be evaluated against qualifying thresholds as if they are CCT-Tunable at this time. CCT-Tunable products must utilize a control interface, or multiple interface options clearly described in the product literature that allow for at least two CCT settings. These may be continuously variable inputs such as a 0-10 V DC signal, an established protocol such as DALI or DMX512, a proprietary control signal, setting options described in terms of CCT such as 3000 K or 5000 K, or simple descriptive terms such as 'Night' or 'Day'.

Three types of products are eligible for listing as Color-Tunable:

CCT-Tunable products have a control signal specifically for adjusting CCT while maintaining nominally constant lumen output. These products may include a second, independent dimming control. CCT-Tunable products generally include products that combine the output of 2 LED primaries, and products with 3 or more white and/or RGB LED primaries, so long as they only produce light in standardized

quadrangles as defined in ANSI/NEMA C78.377-2024 as characterized above in response to their control signal.

For a CCT-tunable product, standard or premium, to exhibit constant lumen output, the light output must not vary more than 20% between any CCT measurement across the full range of the CCT adjustment control signal. This will be verified by testing at the minimum, maximum, and intermediate CCT control input, as well as the reported lumen output values for each ANSI CCT Quadrangle during the application submission process. Products where the light output varies by more than 20% between CCT measurements (excluding light output changes resulting from a separate dimming control signal) are not eligible at this time.

Warm-Dimming products have a single input that controls both color temperature and lumen output, lowering the values of both concurrently, most typically to mimic the color temperature shift of incandescent dimming. Products that require an external control system to coordinate dimming and warming color temperature are not eligible.

Full Color-Tunable products have a control signal specifically for adjusting spectral output while maintaining nominally constant lumen output. These products may include a second, independent dimming control. Full Color-Tunable products include products that combine the output of 3 or more white and/or monochromatic LED primaries or CM-LEDs and are capable of producing light in the standardized quadrangles as defined in ANSI/NEMA C78.377-2024 and color points with D_{uv} magnitudes beyond the limits of the ANSI Extended specification as characterized above in response to their control signal.

8.4 CCT-Tunable and Full Color-Tunable Eligibility

In addition to meeting all applicable SSL Technical Requirement the following are eligibility rules for CCT-Tunable and Full Color-Tunable products:

CCT-Tunable and Full Color-Tunable products must meet the DLC Technical Requirements at all values of the color control signal for the General Application(s) and Primary Use(s) for which they are submitted, except for chromaticity, as described below.

The chromaticity limits described in **Table 10** do not apply to full color-tunable products. However, full color-tunable products must align with the Duv limits of the ANSI/NEMA C78.377-2024 binning structure for threshold purposes of passing and failure when demonstrating compliance at any given CCT. Tested chromaticity data for white-tunable products must comply with the proposed chromaticity requirements in **Table 10**, i.e., CCT-tunable and warm-dimming products must be consistent with the ANSI/NEMA C78.377-2024 binning and Duv limits proposed.

The evaluation of the tested CCT against the reported CCT is reviewed for all Full LM-79/Color Reports, including but not limited to, testing for minimum and maximum CCT values as well as the worst-case efficacy product for all color-tunable product types.

Products must be capable of producing light at CCTs in alignment with existing maximum CCT limits for DLC qualified products. However, no maximum or minimum CCT range is required for color tuning eligibility in general. **Efficacy Allowances for DLC Standard and Premium** apply.

Products will only be classified as DLC Premium if they meet all DLC Premium qualification (except chromaticity as described above) requirements at all values of the color control settings. Additional documentation may be required.

Products may also have field adjustable lumen output characteristics, in which case they are also subject to the **Field Adjustable Products** Testing and Reporting Requirements. For information on minimum required testing, see **Minimum Testing Requirements: CCT-Tunable, Full Color-Tunable, and FACT Products**.

8.5 Warm-Dimming Eligibility

The following are eligibility rules for Warm-Dimming products:

Warm-Dimming products must meet all DLC Technical Requirements, including CCT, for the General Application(s) and Primary Use(s) for which they are submitted, as measured at the maximum output for the product. The requirements include minimum lumen output, efficacy, CRI, CCT, lumen maintenance, THD, Power Factor, and zonal distribution/spacing criteria requirements. Standard DLC allowances apply as outlined in **Table 33** of the SSL Technical Requirements Version 6.0.

Warm-Dimming products do not need to meet DLC Technical Requirements at other input control settings, i.e., when they are dimmed below full output.

Warm-Dimming products will only be classified as DLC Premium if they meet all DLC Premium qualification requirements at the maximum input control setting.

Warm-Dimming products may also have field adjustable lumen output under the Field Adjustable Product Testing and Reporting Requirements and thus be listed under both. If products exhibit both performance features, they must comply with both sets of requirements. For information on minimum required testing, see **Minimum Testing Requirements: Warm-Dimming Products**.

8.6 Supporting Documentation for Color-Tunable Products

8.6.1 Control Interface Documentation:

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

- Description of the method of the input control, show photos of control input location and control input mechanism

- Reference to any control standards or protocols utilized
- Clear instructions for how to achieve the settings required in the testing section. Identical instructions must be provided to the test laboratory for testing and to the DLC during the application review.

8.7 Listing on the QPL

Products will be identifiable on the QPL with either “CCT-Tunable”, “Full Color-tunable”, or “Warm-Dimming” values under a “Color Tuning” field. FACT products will be identifiable on the QPL as “FACT” or “Field adjustable Color Temperature” with the same information as white tunable products as described below.

White-Tunable products will be listed on the QPL at the least efficacious setting, with the corresponding product performance characteristics from that LM-79 test: Light Output, Power Consumption, Efficacy, THD, Power Factor, CRI, CCT, Zonal Lumens, Spacing Criteria. In addition, the QPL will display the Minimum Wattage, Maximum Wattage, Minimum CCT, Maximum CCT, Minimum Light Output, and Maximum Light Output as separate fields.

Warm-Dimming products will be listed on the QPL at the full output setting, with the product performance characteristics from that LM-79 test: Lumen Output, Power Consumption, Efficacy, THD, Power Factor, CRI, Maximum CCT, Minimum CCT, Zonal Lumens, Spacing Criteria. Warm-Dimming products will be listed with only the CCT value corresponding to the full output setting.

9 Lumen Maintenance and Driver Lifetime

9.1 Rationale for Update

Maintaining the expected performance over a product's lifetime is critical for energy-efficiency programs and end users. Drivers are one of the leading failure points for LED luminaires and Draft 2 proposes that all SSL QPL products meet a minimum lifetime requirement whereas only Premium listings were required to meet a driver lifetime requirement under V5.1. Draft 2 also proposes a longer driver lifetime requirement for Premium to better support sustained savings from Premium listings.

Based on product performance data, the DLC is also proposing a lower L_{70} criterion for non-white light NWL (Amber, 1800 K, 2000 K) than for white light luminaires, and that these product types are not eligible for DLC Premium.

To encourage the use of the latest industry standards, Draft 2 proposes an optional pathway for reporting In-Situ Temperature Measurement Testing (ISTMT).

9.2 Changes in SSL V6.0

Changes from SSL V5.1

- Driver lifetime requirements must be met by all qualified products (Standard and Premium), not just Premium
- Distinct lumen maintenance (L_{70}) threshold proposed for all NWL products
- Allows optional reporting of ISTMT in accordance with ANSI/IES LM-98-24

Changes from Draft 1 to Draft 2

- A distinct and increased driver lifetime threshold is proposed for all Premium products

9.3 Lumen Maintenance

The DLC expects manufacturers to provide the most up-to-date ANSI/IES 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 24**.

The DLC has two options for demonstrating lumen maintenance compliance.

1. **Lumen Maintenance Option 1:** Using component-level performance through the ANSI/IES TM-21 protocols, which leverage the LM-80 performance and in-situ temperature of the LED device.

2. **Lumen Maintenance Option 2:** Using luminaire-level performance through ANSI/IES TM-28 protocols, which leverage the ANSI/IES 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@designlights.org to ensure the testing will align with DLC Testing and Reporting Requirements before beginning any testing using the LM-84 method.

9.4 Driver Lifetime

The Driver Lifetime requirements for DLC Standard and DLC Premium are shown in **Table 24**.

To demonstrate compliance with the driver lifetime requirements manufacturers must provide the following for all DLC Standard and DLC Premium listings, other than Type A and Type B lamps, which are exempt from this proposed requirement:

1. A test report from a lab that meets the DLC's Laboratory Requirements for ISTMTs. The report must include the measured temperature from the TMP_{ps}. The DLC encourages the use of the latest industry standards and allows reporting of ISTMT reports in accordance with LM-98-24.
2. 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.
3. A picture of the TMP_{ps} location with an arrow indicating the thermocouple attachment point.
4. Documentation from the driver manufacturer that indicates the maximum case temperature for which the driver is designed to last, as well as the TMP location it designates for thermal testing.
5. 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 to meet driver lifetime requirements, as well as the TMP to be used during thermal testing and evaluation.

The luminaire passes the driver lifetime 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 equal to or greater than the lifetime threshold as 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.

The thermocouple tolerance shall conform to ASTM E230 Table 1 "Special Limits" (≤1.1°C or 0.4%, whichever is greater).

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 ≥36,000 or ≥50,000 hours, and the specific driver model number. Reviewers may ask for additional driver information.

Table 24: Lumen Maintenance and Driver Lifetime Requirements for DLC Standard and DLC Premium

Metric	Applicable Product(s)	DLC Standard	DLC Premium	Method of Evaluation
Lumen Maintenance	All 2200 K – 6500 K products	L_{70} ≥ 50,000 hours	(In addition to L_{70} thresholds) L90 ≥ 36,000 hours	LM-80/TM-21 ISTMT/LM-98-24 report OR LM-84/TM-28
	All NWL products	L_{70} ≥ 36,000 hours	Not eligible	
Driver Lifetime	All products	≥ 50,000 hours	≥ 100,000 hours	Driver spec sheet Driver ISTMT

9.5 Key Questions Regarding Lifetime Requirement Proposals

1. To better support sustained savings from Premium listings, Draft 2 proposes a Premium driver lifetime threshold of 100,000 hours. What feedback, if any, do you have with this proposal?
2. In addition to V5.1's ISTMT pathways, the DLC is considering accepting ISTMT results from manufacturer created benchtop reports. What concerns, if any, do you have with accepting benchtop ISTMT results?

10 Sustainability

10.1 Rationale for Update

Environmental considerations, such as carbon reduction and material health, extend beyond energy efficiency. The SSL V5.1 metrics and QPL data focus on a product's use phase, assessing impacts like energy consumption, light pollution, and other environmental factors from installation to removal. To support demand for sustainable lifecycle practices in the lighting industry, Draft 2 proposes incorporating optionally reported data that informs impacts from additional lifecycle stages, offering a comprehensive view of a product's total environmental impact. This includes any aspects in a lifecycle assessment (LCA) beyond the use phase. By encouraging manufacturers to gather lifecycle data, the DLC aims to support broader sustainability efforts in lighting and showcase opportunities beyond energy savings alone.

10.2 Changes in SSL V6.0

Changes from SSL V5.1

- SSL V6.0 introduces Sustainability as an entirely new section.

Changes from Draft 1 to Draft 2

- The following certifications were removed for simplicity: Health Product Declaration, Living Product Challenge, Certified Wood, SCS Global Services, Electronic Product Environmental Assessment Tool (EPEAT), Climate Neutral
- TÜV Rheinland Green Product Mark was added
- More information about documentation and reporting requirements and QPL listing was added

10.3 Sustainability Reporting Options

SSL V6.0 and LUNA V2.0 Draft 2 proposes to add an optional reported field for third-party verified green labels, certifications, and environmental product declarations (EPDs). Sustainable certifications and documents available for reporting are listed in **Table 25**, along with materials required for verification in the "Method of Evaluation" column. The DLC reserves the right to request additional documentation for verification as needed.

1190 ***Table 25: Optionally Reported Sustainability Fields***

Certification Body or Organization	Certification Level	Method of Evaluation
Environmental Product Declaration (EPD)	ISO 14025 compliant	EPD Document (Must be registered with an EPD program operator)
Declare	Declared	Declare Label
	Red List Approved	
	Red List Free	
Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS)	RoHS Compliant	Product documentation with RoHS label or RoHS Declaration of Conformity
	RoHS 2	
	RoHS 3	
Lighting for Good	Fair	Product Documentation with Lighting for Good Label
	Good	
	Best	
Cradle to Cradle	Bronze	Product Documentation with C2C Label or C2C Certification Document
	Silver	
	Gold	
	Platinum	
UL GREENGUARD	GREENGUARD Certified	Product Documentation with GREENGUARD Label or GREENGUARD Certification Document
	GREENGUARD Gold	
TÜV Rheinland	Green Product Mark	Product Documentation with Green Product Mark or Green Product Mark Certificate

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1192 10.3.1 Reporting and Documentation Requirements: Sustainability

1193 For all certifications that allow product documentation with a label as a verification method in the
1194 Method of Evaluation Column above, the provided specification sheet or supporting documentation (as
1195 indicated by the submitter) will be reviewed for the label or logo that confirms compliance with the
1196 associated certification. If a different method of evaluation is used, sensitive information may be
1197 redacted, and the DLC reserves the right to request additional information as needed. In addition,
1198 submitters will be asked to indicate the expiration date of the reported certification if applicable. Once
1199 this date is reached, submitters will be notified and asked to update their listing.

10.3.2 QPL Listing: Sustainability

The name of all reported certifications and certification levels will appear on the QPL. This will not include any information contained in the documents provided for review or links to online databases. If the expiration date of a certification is reached and the listing has not been updated, the QPL will indicate [Expired] next to the certification name until the information is updated. If the certification status is not updated within one year, the certification name and level will be removed from the QPL listing.

10.4 Key Questions Regarding Proposed Sustainability Reporting

1. Do you have any suggested edits to the certifications listed in **Table 25**?
2. Do you have any concerns with reporting the expiration date of reported certifications?

11 Safety

11.1 Changes in SSL V6.0

Requirements in this section are unchanged from SSL V5.1.

11.2 Original Equipment Manufacturer (OEM) Safety Certification Testing and Reporting Requirements

The DLC relies on the submitting manufacturer and safety organization issuing the safety certification to determine the appropriate standard for which to evaluate the product. Products must be certified to the applicable safety standard by a safety certification organization relevant in the United States or Canada. In the United States, this means **a safety certification body recognized by OSHA**. In Canada, this means **a certification body recognized by the Standards Council of Canada**. The scope of accreditation must include certifying lighting products.

The DLC will perform a limited review of the safety documentation submitted by the manufacturer. It is the responsibility of the applicant to verify that ALL of the model numbers submitted for qualification are covered by the safety certification documents. If the submitted model numbers 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.

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 to the DLC 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.

- **Compliance Certificate**
  All products are required to submit a compliance certificate from an approved safety certification organization relevant in the United States or Canada (see Testing Requirements below). 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, it is commonly referred to as a Certificate of Compliance or Authorization to Mark. Examples of appropriate documents for specific safety organizations are below:
  - Intertek – Authorization to Mark
  - UL – Certificate of Compliance or Notice of Authorization
  - CSA – Certificate of Compliance.

12 Power Quality

12.1 Changes in SSL V6.0

Requirements in this section are unchanged from SSL V5.1.

12.2 Power Factor and Total Harmonic Distortion (THD)

All DLC-qualified luminaires (Standard, Premium, LUNA, etc.) must have a power factor of ≥0.9 and a THD of ≤20%. Qualifying products must meet the requirements in their worst-case loading conditions. For information on minimum required testing, see **Minimum Testing Requirements: Power Quality**.

13 DLC Premium

13.1 Rationale for Update

Modern LED luminaires serve as a gateway to connected lighting which enables deeper integration with building systems for maximum energy savings and flexible energy use. As utility customers demand more electricity, luminaires enabling connected lighting grow in importance. As such, the Premium classification has transformed to focus on the advancement of connected lighting along with efficacy, lifetime, and quality of light. LED fixtures combining higher efficacy with advanced controls capabilities deliver more light per Watt of energy, which translates into lower energy consumption and greater operational savings over time.

The Premium classification ensures that products meet the most rigorous standards for efficacy, controllability, and performance, providing both enhanced energy efficiency and long-term reliability. These criteria include improved lumen maintenance, thermal management, and driver durability, all of which contribute to reduced maintenance costs and extended fixture lifespans.

In addition, advanced color control requirements help minimize visual inconsistencies between fixtures, ensuring a uniform and professional lighting appearance throughout a space. Reduced discomfort from glare, especially from recessed troffers, enhances the occupant experience by creating more comfortable and visually balanced environments—ideal for commercial and industrial settings.

Ultimately, these features combine to deliver a high-quality lighting solution that supports sustainability goals, enhances visual performance, and lowers total cost of ownership.

In response to feedback on DLC's tabular UGR requirements, SSL V6.0 Draft 2 will maintain maximum UGR requirements for Troffer PUDs, as they can be effectively modeled this way. However, it proposes removing UGR requirements for Linear Ambient, High-bay, and Low-bay PUDs.

13.2 Changes in SSL V6.0

Changes from SSL V5.1

- Increases efficacy thresholds to 20 lm/W over standard thresholds
- Establishes more stringent controllability requirements including:
    - Continuous dimming down to at least 10% for all products
    - Must be listed as Controls Category 2, 5, or 6
        - 2 – Controls Ready Luminaire Only
        - 5 – Luminaire with Networked Controller
        - 6 – Luminaire Level Lighting Control (LLLC)
- Removes the UGR requirement for Linear Ambient, High-Bay, and Low-Bay product types

Changes from Draft 1 to Draft 2

- Removes requirement for digital drivers for DLC Premium

13.3 Premium Eligibility and Requirements

Products submitted for DLC Premium qualification must meet more stringent efficacy, quality of light, and controllability requirements as outlined in **Table 26**.

The following product types are not eligible to qualify for the DLC Premium qualification:

- Replacement lamps
- Linear-Style Retrofit Kits for 2x2, 1x4, and 2x4 Luminaires
- Products with a Primary Use designated as “Specialty”
- NWL products: de-Amber, pc-Amber, filtered-Amber, and 1800 K – 2000 K
- DLC Premium products are eligible for LUNA qualification. See the **LUNA V2.0 Technical Requirements**.

13.3.1 UGR Requirements for Indoor Products

Performance requirements related to discomfort from glare in SSL V6.0 are calculated with the Unified Glare Rating (UGR) metric and only apply to products seeking **DLC Premium** qualification that meet the given UGR thresholds in **Table 26** and/or to products seeking **Efficacy Allowances** that meet the given UGR thresholds in **Table 33**. The Unified Glare Rating (UGR) defined in CIE 117-1995 is a metric for evaluating discomfort from the glare performance of certain products in the indoor category. UGR for an array of one type of luminaires in a set of reference conditions can be determined using the procedure described in CIE 190-2010. This is known as the tabular method and is widely used in Europe and other regions. In SSL V6.0 Draft 2, the DLC is proposing to continue with maximum UGR requirements for Troffer PUDs, and remove the UGR requirement for Linear Ambient, High-Bay, and Low-Bay product types.

For SSL products seeking Premium qualification, the testing and reporting requirements are listed in **Table 26.**

1305 ***Table 26: DLC Premium Testing and Reporting Requirements***

Metric	Applicable Product(s)	SSL V6.0 & LUNA V2.0 Draft 2 Premium Requirements*	Method of Evaluation
Efficacy	All Products	**+20 lumens per watt** over V6.0 Standard efficacy requirements	Same as V6.0 Standard
Chromaticity (CCT & D_{uv})	All Indoor products, except High-Bay	Products shall exhibit chromaticity consistent with at least one of the basic, flexible, or extended, nominal **4-step quadrangle** CCTs from 2200 K-6500 K	Same as V6.0 Standard
	All other products	Same as V6.0 Standard	
Discomfort Glare	Troffer (Luminaire and Integrated Retrofit Kits only) Note: Linear-Style Retrofit Kits for 2x2, 1x4, and 2x4 Luminaires are not eligible for Premium qualification under V6.0.	**Corrected UGR < 22.0**	Corrected UGR values generated per CIE 190-2010 at the reference condition below. Room dimension: X = 4H, Y = 8H Spacing to height ratio (S/H): 1 Reflectances: 70/50/20%
Controllability	All products	1. Be capable of continuous dimming down to at least 10%. 2. Meet requirements for the following controls categories: a. 2 - Controls Ready Luminaire Only b. 5 - Luminaire w/ Networked Controller c. 6 - Luminaire Level Lighting Control (LLLC)	Same as V6.0 Standard
Lumen Maintenance	All products	$L_{90} \geq$ 36,000 hours	Same as V6.0 Standard
Driver Lifetime	All products	≥ 100,000 hours	

1306 * For any metric not listed above, V6.0 Standard requirements apply.

For information on minimum required testing, see **Minimum Testing Requirements: DLC Premium Spectral Quality** and **Minimum Testing Requirements: DLC Premium Light Output and Distribution**.

13.3.2 Interactions with other DLC Requirements

For FALD products applying for Premium qualification, the product's UGR value must not exceed the maximum allowable threshold for the designated light distribution setting, as specified in **Table 23**. The product must also meet the ZLD criteria for the PUD in **Table 12**.

13.4 Key Questions Regarding Premium Proposals

1. To better support sustained savings from Premium listings, Draft 2 proposes a Premium driver lifetime threshold of 100,000 hours. What feedback, if any, do you have with this proposal?
2. What is your feedback, if any, on allowing Linear-Style Retrofit Kits for 2x2, 1x4, and 2x4 Luminaires to be eligible for Premium qualification, if they meet the UGR threshold requirements for Troffers in **Table 26**?

14 Solar Powered Outdoor Luminaires

14.1 Rationale for Update

Solar Powered Outdoor Luminaires offer significant potential for decarbonization and resilience, as they rely primarily or entirely on solar energy. However, the complexity of component selection and the lack of industry-standardized reporting on key product characteristics provide barriers to the implementation of this technology. By listing solar powered luminaires on the QPL, the DLC aims to reduce these barriers by gathering and displaying the most critical data needed for system understanding and validation. This proposal is also intended to support greater standardization in how manufacturers present performance data on their spec sheets.

14.2 Changes in SSL V6.0

Changes from SSL V5.1

- SSL V6.0 introduces Solar Powered Outdoor Luminaires as an entirely new section.

Changes from Draft 1 to Draft 2

- Changed term Separate Components to Split-Type (defined below)
- Added acceptable terms for specification sheet review

14.3 Special Considerations for Solar Powered Outdoor Luminaires

Luminaires that utilize photovoltaic cells to either supplement or fully provide input power are eligible for DLC qualification under the Outdoor Solar Powered Luminaire Category. DLC qualification for solar powered luminaires applies only to the luminaire component of the product or system. The DLC does not certify solar panels, batteries, or other components of the product. All requirements and thresholds designated for Outdoor Luminaires in this document apply to products in the Outdoor Solar Powered Luminaire category as well. Solar Powered Outdoor Luminaires must either include a photocell or be controls ready if sold as a standalone luminaire. Therefore, outdoor solar luminaires are not eligible for Controls Category 1 in **Table 14**.

Additional reported information is required for products qualified under this category as described in **Table 27**. The “Acceptable Terms” column lists terms that must be present on the product specification sheet or supplemental documentation if a corresponding option is selected.

1346 ***Table 27: Additional Reported Fields Required for Solar Powered Outdoor Luminaires***

Reported Field	Options*	Definition	Acceptable Terms
Configuration	Integrated	The solar panel, battery, and luminaire are installed as one unit. Generally, the solar panel is embedded in the top of the luminaire.	Integrated, All-in-one, self-contained
	Split-Type	The solar panel and battery are mounted separately from the luminaire, but all components are marketed as one product	Split-type, Split-component, Two-piece, All-in-two Pole-integral Pole integrated
	Luminaire Only	The luminaire is sold separately from any battery or solar panel components, but is designed to be integrated into a solar luminaire system	Solar-ready, Solar compatible
Grid Connection	Off Grid	The luminaire receives 100% of its energy from a solar panel	Off grid, Standalone, Autonomous, Grid free
	Hybrid	The luminaire is designed to receive energy from both a solar panel and the electric grid	Hybrid, Dual input, Grid assisted, Grid connected, Grid tied

Reported Field	Options*	Definition	Acceptable Terms
PV Wattage	Value in Watts	Only applicable for products with “Integrated” or “Split-Type” indicated in the Configuration field	N/A
Recommended Install Height	Range in Feet	Only applicable for products with “Integrated” or “Split-Type” indicated in the Configuration field	N/A
Battery Type	Lithium Iron Phosphate ($LiFePO_4$)	Only applicable for products with “Integrated” or “Split-Type” indicated in the Configuration field	Lithium iron phosphate, Lithium ferro phosphate, $LiFePO_4$, LFP
	Lead Acid		Lead acid, Gel
	Nickel-Metal Hydride (NiMH)		Nickel-metal hydride, NiMH
	Lithium Nickel Manganese Cobalt Oxide (NMC)		Lithium nickel manganese cobalt oxide, NMC, NCM, Lithium-ion, Li-ion, Ternary lithium
	Lead Crystal®		Lead crystal, Silicon dioxide, SiO_2
Battery Capacity	Value in Amp-Hours	Only applicable for products with “Integrated” or “Split-Type” indicated in the Configuration field	N/A

Reported Field	Options*	Definition	Acceptable Terms
Battery Lifetime	Value in Years	Time until battery degenerates to 80% capacity Only applicable for products with “Integrated” or “Split-Type” indicated in the Configuration field	N/A
Solar Panel Lifetime	Value in Years	Time until the panel generates 80% of initial capacity Only applicable for products with “Integrated” or “Split-Type” indicated in the Configuration field	N/A

*All reported options and values in this table will be displayed on the QPL

14.3.1 Testing Requirements: Solar Powered Outdoor Luminaires

Luminaires where solar panels fully provide input power (off grid) will be treated as a DC product and should be tested in accordance with the **Direct-Current (DC) and Power over Ethernet (PoE)** Policy. Luminaires that receive supplemental energy from the grid (hybrid) will be reviewed via benchtop electrical testing to determine if the luminaire is less efficient when powered by the solar panel (DC) or the grid (AC). If the luminaire is less efficient when powered by DC it must be tested and listed according to the DC/POE Policy with no AC input into the luminaire during any testing or rating performance. If the luminaire is less efficient when powered by AC, it must be tested and listed as an AC product according to the V6.0 Technical Requirements with no DC input into the luminaire during any testing or rating performance.

14.4 Key Questions: Solar Powered Outdoor Luminaires

1. Do you have any suggested edits or additions to the reported information listed here, including edits to acceptable terms?

15 LUNA V2.0 Technical Requirements

15.1 Introduction

Version 2.0 of the LUNA Technical Requirements continues the DLC's mission to address the growing issue of light pollution. Light pollution disrupts the circadian rhythms of humans and animals; disorients turtles, birds, and insects; and separates people from the night sky. Amber LED and low CCT (i.e., 1800 K – 2000 K) LED products are now eligible due to their ability to further reduce sky glow and minimize impacts to wildlife compared to white LED luminaires, if uplight and over-lighting are also minimized.

BUG ratings (as defined by Annex A in the ANSI/IES TM-15-20 Luminaire Classification System for Outdoor Luminaires) continue to be adopted and are referenced by many national, state, and/or local ordinances, regulations, and policies. They are also required by both primary and secondary references such as the Department of Defense (DOD) Unified Facilities Criteria (UFC), LEED v4.1, LEED for Cities and Communities, and the WELL Community Standard. BUG rating data published on the DLC SSL QPL product detail page supports compliance with these regulations.

Controllability is also a priority for LUNA. Sky glow and light trespass can also be reduced with high-end trim, enabling designers to meet design requirements without over-lighting. In addition, light pollution can be reduced by dimming down as far and as frequently as appropriate, based on lower volumes of traffic and pedestrian conflict at some times of the night. Reducing light output to reduce light pollution also saves energy by delivering precisely the illumination when and where it is needed. Continuous dimming also facilitates compliance with energy code requirements for light level reduction, including recent versions of ASHRAE 90.1, IECC, and California's Title 24.

15.2 Rationale for Update

LUNA V2.0 provides new and additional, product types to be eligible for DLC LUNA qualification, including non-white light (NWL) luminaires, lamps, and retrofit kits that may be suitable for sensitive environments. The list of lamps, retrofit kits, and luminaires eligible for LUNA V2.0 is given in **Table 29**.

Three new turtle lighting PUDs with de-Amber LEDs are also proposed in LUNA V2.0. These are intended for coastal installations where sea turtle hatchlings are known to nest. While de-Amber lighting is still disorientating to sea turtles, it is one of the least disorientating options as long as distribution, light output, and mounting height are controlled. No additional direct-emission long-wavelength LED types (e.g., de-Orange or de-Red) are proposed in LUNA V2.0 Draft 2.

To support national, state, and/or local ordinances, regulations, and policies around light pollution, Draft 2 continues to use Uplight (U) Ratings to set maximum limits on uplight emitted directly by the luminaire. Turtle Lighting PUDs also have an additional Glare (G) Rating maximum threshold requirement to minimize high-angle light.

Finally, LUNA controllability requirements have been simplified and align with SSL V6.0 requirements.

15.3 Changes in SSL V6.0

Changes from SSL V5.1

- Eligibility for Amber and low CCT (1800 K – 2000 K) LED products to qualify to LUNA
- Eligibility for filtered-Amber LED products (e.g., white LEDs with an Amber filter or lens)
- New Turtle Lighting PUDs.
- Eligibility for lamps and outdoor retrofit kits
- Eligibility for luminaires with field adjustable color temperature (FACT) luminaires with CCTs above 3000 K can qualify to LUNA.
- No additional controllability requirements for LUNA

Changes from Draft 1 to Draft 2

- The Scotopic (S)/Photopic (P) ratio will be calculated from the parent product SPDX file using the LUNA Pre-submission tool and displayed on the QPL.
- Increased maximum lumens for some Turtle Lighting PUDs.
- Filtered-Amber LED products have an expanded definition and no longer have to meet the “traffic color compliance” language. Medium screw-base omnidirectional and directional replacement lamps (UL Type B) are LUNA eligible
- Requirements for mogul screw-base replacement lamps have changed from in-luminaire to bare lamp omnidirectional and directional replacement lamp listing.

15.4 LUNA Light Distribution Requirements

The following section outlines the LUNA 2.0 requirements for light distribution. **Table 28** includes columns for the metric or application, its associated requirements, and QPL Listing. The “Method of Evaluation” column describes how products will be evaluated for qualification, whether by compliance with industry standards, manufacturer claims, or other DLC verification methodology. For information on minimum required testing, see **Minimum Testing Requirements: LUNA Light Output and Distribution**.

Luminaires with internal or external auxiliary shielding and/or performance optics may improve the quality of the light distribution, as light is only delivered where it is intended, rather than potentially causing light trespass on neighboring locations. Manufacturers may offer a variety of shielding options such as house-side shields (HSS), cul-de-sac shields (CSS), front-side shields (FSS), left- and right- shields, and glare shields. The DLC acknowledges that luminaire efficacy will be reduced with a shield mounted on the luminaire and is using a LUNA shielding efficacy allowance (specified in **Table 34**) to encourage well-shielded products to be listed on the QPL.

Table 29 lists the PUDs that are eligible for LUNA V2.0 and their respective Primary Use Letters, maximum U-Rating thresholds and light output.

Table 28: LUNA V2.0 Distribution Requirements

Metric / Application	LUNA V2.0 Requirements	QPL Listing	Method of Evaluation
Uplight Rating (from the IES BUG system)	Products must have a U-Rating of 0, 1, or 2, depending on Primary Use Designation indicated in **Table 29**. ANSI/IES LM-63 .ies files (and optionally ANSI/IES TM-33-18 or -23 .xml documents‡) containing luminous intensity distribution data must be submitted for a representative LUNA qualifying product for each unique distribution pattern included in the application. See additional details below.	BUG ratings for parent products will be generated by the DLC using tested photometric data and will be listed under the Tested Data section. BUG ratings for child products are reported by the applicant and listed under the Reported Data section.	ANSI/IES LM-79 per the *Additional Reporting Guidelines.* BUG ratings generated per ANSI/IES TM-15-20 Annex A using luminaire photometric data (.ies files). Note: for LUNA qualification, LM-79/distribution testing must be provided on a LUNA-qualifying product (highest light output at highest LUNA-eligible CCT).
Polar plot image	Using the LUNA pre-submission tool, the submitter will create a .png polar plot image for the representative LUNA qualifying product for each unique distribution pattern included in the application.	For each distribution parent product, images from the LUNA pre-submission tool will be listed under the Tested Data section.	Submitted polar plot images generated by the LUNA pre-submission tool from the submitted .ies or .xml files.

Metric / Application	LUNA V2.0 Requirements	QPL Listing	Method of Evaluation
Aiming	Products may only include mounting options that will not allow tilt angles beyond +/- 10 degrees, in order to level the luminaire parallel with the roadway surface (see **Figure 1**).	Model number will include allowed mounting options. Products with mounting accessories are eligible for LUNA and will be listed on the QPL with the mounting accessories that meet all of the technical requirements. Eligible mounting accessories will be listed in parentheses on the QPL.	Specification sheet, supplemental documentation, or installation instructions must include photos or illustrations of mounting options or accessories with allowable tilt angles (and degree values), or fixed mounting options clearly documented, as per **Figure 2**.
Shielding	Shielding as an available accessory or option must be included on specification sheets or supplemental documentation (e.g., house side shields (HSS), cul-de-sac shields (CSS), front-side shields (FSS), or glare shields) for pole/arm-mounted area/roadway/ decorative PUDs (Primary Use letters A and B), and specialty hazardous environment pole/arm-mounted area and roadway PUDs.	Specific product configurations without shielding will be listed on the QPL per the LUNA requirements as long as a shield is available as an accessory or option. For those who voluntarily choose to list their shielded products and are seeking efficacy allowances, within each given shielding subgroup, shielded products with the lowest efficacy will be listed as worst-case efficacy parent products on the QPL. Shielded products with the highest house-side lumens for products with a HSS or CSS, or street-side lumens for products with a FSS, will be listed as worst-case distribution parent products on the QPL.	Specification sheet or supplemental documentation review to determine that at least one shielding accessory or option is available.

ǂ .ies files may be submitted alone without also submitting ANSI/IES TM-33 .xml documents. If .xml documents are submitted, .ies files must also be submitted so that Photometric Toolbox can be used by DLC reviewers for evaluation. See the **LUNA Testing and Reporting Requirements** for more information.

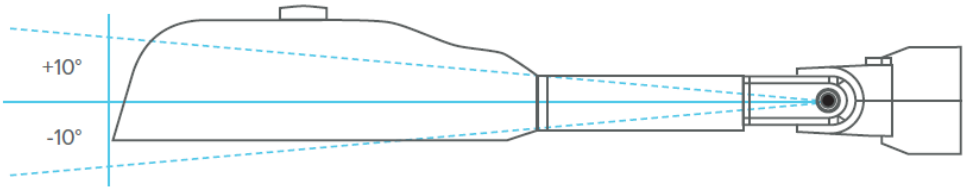

Figure 1: *Acceptable maximum mounting bracket tilt angle for LUNA qualification.*

Table 29: PUDs eligible for LUNA V2.0 qualification and respective U Rating thresholds

Primary Use Letter	Primary Use Designations (PUDs) Eligible for LUNA Qualification	Maximum U Rating Threshold	Maximum Light Output (lumens)
A	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1	N/A
B	Outdoor Pole/Arm-Mounted Decorative Luminaires	2	N/A
C	Outdoor Zero-Uplight Wall-Mounted Area Luminaires	1	N/A
E	Bollards	1	N/A
G	Fuel Pump Canopy Luminaires	2	N/A
Y	Retrofit Kits for Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1	10,000
Z	Retrofit Kits for Outdoor Pole/Arm-Mounted Decorative Luminaires	2	10,000
AA	Retrofit Kits for Large Outdoor Pole/Arm Mounted Area and Roadway Luminaires	1	10,000
AB	Retrofit Kits for Zero-Uplight Outdoor Wall Mounted Area Luminaires	1	10,000
AD	Retrofit Kits for Fuel Pump Canopy Luminaires	2	10,000
BJ	Omnidirectional Mogul Screw-Base Replacements for HID Lamps (Type B)	N/A	10,000 (bare lamp)

BK	Directional Mogul Screw-Base Replacements for HID Lamps (UL Type B)	N/A	10,000 (bare lamp)
BL	Omnidirectional Medium Screw-Base Replacements for HID Lamps (UL Type B)	N/A	10,000 (bare lamp)
BM	Directional Medium Screw-Base Replacements for HID Lamps (UL Type B)	N/A	10,000 (bare lamp)
BG	Turtle Lighting Zero-Uplight Pole/Arm-Mounted Area and Roadway Luminaires	0	5000
BH	Turtle Lighting Zero-Uplight Wall-Mounted Area Luminaires	0	1500
BI	Turtle Lighting Zero-Uplight Bollards	0	1000
BA	Hazardous Environment Area Luminaires	1	N/A
N/A	Specialty: Hazardous Environment Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1	N/A
	Specialty: Hazardous Environment Wall Mounted Luminaire	1	N/A
	Specialty: Canopy Lighting	2	N/A
	Specialty: Directional Fuel Pump Canopy Luminaires	2	N/A
	Specialty: Transportation	2	N/A

15.4.1 Distribution interactions with other DLC policies: Field Adjustable Light Distribution (FALD) and Field Adjustable Light Output (FALO)

Field adjustable light distribution (FALD) products may be eligible for LUNA qualification.

- Products that are “aimable” but restrict tilt to ≤ 10 degrees to “level” the intensity distribution with the pavement are eligible for LUNA. “Aimable” products can be listed with the FALD designation or without the FALD designation at the manufacturer’s discretion.

- Products whose light distribution is intentionally adjusted via changes to components of the luminaire, and adjustment does not change the U Rating, are eligible for LUNA. For example, products with field adjustable optics that change the distribution classification from a Type 2 to a Type 3 are eligible, as long as the U Rating in both adjustable settings is equal to or less than the maximum U Rating criteria for that PUD. Judgement whether a product's light distribution adjustment impacts the U rating is at the discretion of the DLC. The DLC reserves the right to ask for additional technical information, including LM-79/distribution reports, as needed for verification.
- Please note that this may require the separation of models that were otherwise able to be combined on the SSL QPL, to clearly delineate those that are qualified under LUNA and those that are not.

Field adjustable light output (FALO) products are eligible for LUNA qualification as long as lamps, retrofit kits or luminaires with selectable wattage/lumen output are shipped at the lowest wattage or output setting.

15.5 LUNA Spectral Quality Requirements

The spectral quality requirements for LUNA products that extend beyond SSL V6.0 requirements are outlined in **Table 30**. The "QPL Listing" column describes the information that will appear as publicly available on the QPL listing, if applicable. The "Method of Evaluation" column describes how products will be evaluated for qualification, whether by compliance with industry standards, manufacturer documentation, or other DLC verification methodology. For information on minimum required testing, see **Minimum Testing Requirements: LUNA Spectral Quality**.

1466 ***Table 30: LUNA V2.0 Spectral Quality Requirements***

Metric and/or Application	Applicable Products	LUNA V2.0 Spectral Quality Requirements	QPL Listing	Method of Measurement/ Evaluation
Chromaticity (CCT & D_{uv})	Non-Amber LUNA products (luminaires, replacement lamps, and retrofit kits)	LUNA products shall exhibit chromaticity consistent with at least one of the basic, flexible, or extended, nominal 7-step quadrangle CCTs from 1800 K - 3000 K.	.SPDX data ‡, S/P ratio, CCT and D_{uv} for parent products listed as Tested Data. Nominal CCT for child products listed as Reported Data.	ANSI/IES LM-79 (per **Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports**) ANSI/IES TM-27-20 or IES TM-27-14 Optionally: ANSI/IES TM-33-18 (or -23) S/P Ratio calculated per the 2-degree scotopic and photopic luminous efficiency functions in ANSI/IES LS-02-20. Note: For LUNA qualification, LM-79/color testing must be provided on a LUNA-qualifying product.
Chromaticity (Spectral Compliance Information)	LUNA Amber products (luminaires, lamps, and retrofit kits	Chromaticity consistent with technology-specific definitions proposed in the Amber LED Luminaires, Retrofit Kits, and Lamps section	Nomenclature for **Amber LED Luminaires, Retrofit Kits, and Lamps** (de-Amber, pc-Amber, filtered-Amber) for parent and child products. LUNA Amber	ANSI/IES LM-79 ANSI/IES TM-27-20 or IES TM-27-14 Optionally: ANSI/IES TM-33-18

			parents will also display: .SPDX document, as well as the S/P ratio, % blue, traffic color compliance, and Hawaii code compliance which will be listed using outputs from the LUNA pre-submission tool.	
SPDX document	All LUNA parent products	LUNA qualifying products tested to meet LUNA spectral quality requirements must submit an ANSI/IES TM-27 .spdx document containing spectral power distribution data in increments of ≤5nm. ANSI/IES TM-33 (-18 or -23) .xml documents are also acceptable in addition to .spdx files, but are not required at this time.[+]	LUNA parent products will display the .SPDX document under the Tested data section.	ANSI/IES TM-27-20 or IES TM-27-14 Optionally: ANSI/IES TM-33-18
SPD image	All LUNA parent products	Using the LUNA pre-submission tool, the submitter will create a .png SPD image for the representative LUNA qualifying products included in the application.	For each color parent product, images from the LUNA pre-submission tool will be listed under the Tested Data section.	ANSI/IES TM-27-20 or IES TM-27-14 Optionally: ANSI/IES TM-33-18 Submitted SPD images generated by the LUNA pre-submission tool from the submitted .spdx files.

‡ Submitted ANSI/IES TM-27-20 (or IES TM-27-14) will be available for download on the QPL. Please ensure submitted .spdx files do not contain information inappropriate for QPL display.

15.5.1 Spectral Quality Interactions with Other DLC Policies: FACT, CCT-Tunable, and Full Color-Tunable

Field adjustable color temperature (FACT) products are eligible for LUNA V2.0 if the maximum LUNA CCT threshold (i.e., 3000 K for luminaires and 2700 K for lamps and retrofit kits) is within the minimum or maximum CCT of the product's CCT adjustable range.

Per the proposed FACT policy, outdoor products with adjustable CCTs must be shipped at the lowest CCT. To qualify for LUNA V2.0, the lowest CCT must be at or below 3000 K. For these luminaires, only the CCT setting(s) at 3000 K (or lower) will be eligible for LUNA and will be shown on the LUNA QPL.

CCT-tunable and warm-dimming products are eligible for LUNA V2.0 if the maximum CCT in the product's range is within or at the maximum LUNA CCT threshold (i.e., 3000 K for luminaires and 2700 K for lamps and retrofit kits).

Full Color-Tunable products are not eligible for LUNA V2.0.

15.6 LUNA Controllability Requirements

In Version 2.0, the DLC is no longer proposing additional controllability requirements for LUNA. Instead, products seeking qualification to SSL V6.0 as Standard and LUNA V2.0 must meet the same SSL V6.0 controllability requirements for Standard. Similarly, products seeking qualification to SSL V6.0 as Premium and LUNA V2.0 must meet the same SSL V6.0 controllability requirements for Premium.

15.7 LUNA Turtle Lighting PUD Requirements

The de-Amber LED requirements for Turtle Lighting luminaires build on other de-Amber requirements in in SSL V6.0 and LUNA V2.0. Requirements for de-Amber LED thresholds for luminaire efficacy and lumen maintenance are provided in **Table 7** and **Table 24**, respectively. **Table 30** provides the spectral requirements for all LUNA products, including de-Amber. **Table 31** provides the requirements for the three new Turtle Lighting PUDs. Turtle lighting PUDs will also have to meet the LUNA V2.0 distribution requirements in **Table 28**. Filtered-Amber LED luminaires are not allowed for turtle lighting PUDs because the filter could be removed.

Table 31: Turtle Lighting PUD Requirements: Light Output and Distribution

Primary Use Letter	Primary Use Designation	Maximum Light Output (lm)	Amber LED type	Maximum U Rating	Maximum G Rating
BG	Turtle Lighting Zero-Uplight Pole/Arm-Mounted Area and Roadway Luminaires	8000	de-Amber	U0	G1
BH	Turtle Lighting Zero-Uplight Wall-mounted Area Luminaires	2500	de-Amber	U0	G0
BI	Turtle Lighting Zero-Uplight Bollards	1000	de-Amber	U0	G0

15.8 LUNA Testing and Reporting Requirements

LUNA Version 2.0 testing and reporting will now align with SSL V6.0 testing and reporting.

15.8.1 LM-79 Testing

See the **Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports** section for more details on SSL V6.0 requirements.

15.8.2 LM-79 Reporting

Distribution: Distribution reports and photometric files must conform with SSL V6.0 reporting. The DLC encourages manufacturers to submit ANSI/IES TM-33-18 or -23 .xml documents for LUNA Version 2.0, although it is not required.

Spectral Quality: Manufacturers must submit a color report and an ANSI/IES TM-27-20 or IES TM-27-14 .spdx file and may additionally, and optionally, submit an ANSI/IES TM-33-18 -23 .xml document for all new applications under LUNA Version 2.0.

From a file format perspective, the DLC encourages adoption and use of ANSI/IES TM-33-18 -23 .xml documents, in addition to .ies and .spdx file formats, for the following reasons:

- Combines spectral and luminous intensity data
- Includes many commonly used metrics (e.g., color rendition metrics)
- Allows for calculation of alternative field-application metrics (e.g., to support metrics beyond lumens)

The DLC realizes that photometric testing and illumination-engineering software does not currently support ANSI/IES TM-33-18 or -23 export/import and is providing reporting alternatives in LUNA Version

2.0. File types .ies and .spdx are required in LUNA Version 2.0, and ANSI/IES TM-33-18 or -23 .xml documents are optional.

As detailed above, any required LM-79/color or LM-79/distribution testing on requirements specific to the LUNA technical requirements must be conducted on LUNA-qualifying products for family groups, including LUNA and non-LUNA products. Distribution and color testing using non-LUNA products is insufficient to meet the LUNA V2.0 Technical Requirements.

15.9 LUNA Testing and Reporting Requirements

LUNA Version 2.0 testing and reporting will now align with SSL V6.0 testing and reporting.

15.9.1 LM-79 Testing

See the **Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports** section for more details on V6.0 requirements.

15.9.2 LM-79 Reporting

Distribution: Distribution reports and photometric files must conform with SSL V6.0 reporting. The DLC encourages manufacturers to submit ANSI/IES TM-33-18 or -23 .xml documents for LUNA Version 2.0, although it is not required.

Spectral Quality: Manufacturers must submit a color report and an ANSI/IES TM-27-20 or IES TM-27-14 .spdx file and may additionally, and optionally, submit an ANSI/IES TM-33-18 -23 .xml document for all new applications under LUNA Version 2.0.

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- Combines spectral and luminous intensity data
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- Allows for calculation of alternative field-application metrics (e.g., to support metrics beyond lumens)

The DLC realizes that photometric testing and illumination-engineering software does not currently support ANSI/IES TM-33-18 or -23 export/import and is providing reporting alternatives in LUNA Version 2.0. File types .ies and .spdx are required in LUNA Version 2.0, and ANSI/IES TM-33-18 or -23 .xml documents are optional.

As detailed above, any required LM-79/color or LM-79/distribution testing on requirements specific to the LUNA technical requirements must be conducted on LUNA-qualifying products for family groups, including LUNA and non-LUNA products. Distribution and color testing using non-LUNA products is insufficient to meet the LUNA V2.0 Technical Requirements.

15.10 Key Questions: LUNA V2.0

1. LUNA V2 Draft 2 proposes calculating and displaying the S/P Ratio for all LUNA parent products from the submitted SPDX file. In lieu of a DLC calculation using the LUNA pre-submission tool, is this metric easily reported by test labs in their LM-79 color report?
2. What is your feedback, if any, on allowing medium screw-base and mogul screw-base HID replacement lamps to qualify to LUNA (with conditions given in **Table 29**) without being tested in a representative luminaire housing? These products do not have a maximum U Rating threshold as the other PUDs do.
3. LUNA V2 Draft 2 is proposing to allow luminaires with field adjustable CCTs above 3000 K, as long as the luminaire is shipped at the lowest CCT. Is it acceptable to include a lock-out or tamper-evident seal and a clear label of LUNA-qualified setting(s) for LUNA-qualified products to minimize changes to higher CCTs in the field?
4. What is your feedback, if any, on changing the maximum CCT to 4000 K instead of 5000 K for LUNA listed field adjustable CCT (FACT) luminaires?
5. What is your feedback, if any, on requiring LUNA-qualified FALO products with selectable wattage switches to ship from the factory at the lowest wattage or lumen output setting available?
6. Draft 2 increases the maximum light output for all Turtle Lighting PUDs except for bollards. What is your feedback, if any, on these increases?
7. In Draft 2, de-orange and de-orange/red LED are not eligible for Turtle Lighting PUDs due to a lack of published efficacy and lumen maintenance data.
    a. What is your feedback on using 40 lumens per watt as a minimum efficacy threshold for de-orange and de-orange/red LED luminaires used in Turtle Lighting luminaires? If possible, please share data alongside your comments to inform potential thresholds.
    b. What is your feedback on using 36,000 hours as a minimum L70 threshold for de-orange and de-orange/red LED luminaires used in Turtle Lighting luminaires? If possible, please share data alongside your comments to inform potential thresholds.
8. What is your feedback on increasing the G Rating to G2 for Turtle Lighting Zero-Uplight Pole/Arm-Mounted Area and Roadway Luminaires with luminaire lumens above 5000 lumens? Currently, the G Rating is set to G1, as limiting high-angle light is very important in the field.

16 Retrofit Kits

16.1 Changes in SSL V6.0

Requirements in this section are unchanged from SSL V5.1.

16.2 Testing and Reporting Requirements for Retrofit Kits

Manufacturers have two options for testing retrofit kits.

- **Option A**: testing in Approved Housings
- **Option B**: testing in a manufacturer-selected housing

16.2.1 Option A: Testing in Approved Housings (General Purpose)

Option A is intended for retrofit kits that are designed to retrofit typical incumbent luminaires. The testing and reporting requirements described below are intended to subject retrofit kits to conditions in typical fixtures in order to assure confidence in performance.

For this option, the DLC specifies typical fixture housings for the testing of retrofit products, referred to as Approved Housings. This is done to provide test results under common conditions in which the retrofit kits may be installed. In providing this list of typical fixture housings, the DLC does not endorse or exclude any particular make or model frame for use in energy efficiency programs. In selecting a fixture for testing, the manufacturer shall consider the purpose of subjecting the tested kit to typical confinement for thermal endurance.

Retrofit kits tested in an approved housing are considered qualified when installed in any housing of the same end-use. For example, a shoe-box style retrofit kit tested in the Lithonia KAD Contour Series approved housing would be considered qualified (should it meet all Technical Requirements) when installed in any application applicable to the “Retrofit Kits for Outdoor Pole/Arm-Mounted Area and Roadway Luminaires” Primary Use designation. If a retrofit kit can be used in multiple Primary Uses, manufacturers will need to provide testing in a housing applicable to each Primary Use in order to be considered qualified in those end-uses. Products tested according to Option A will be designated as "General Purpose" on the QPL.

- **Required Tests and Reports**
  All DLC QPL testing and reporting requirements that apply to new fixtures shall also apply to any retrofit kit application e.g.: LM-79, ISTMT, IES file, TM-21 projection etc. (Note that for lumen maintenance testing, the source manufacturer is responsible for the LM-80 test of the LED package, array, or module. A report resulting from this test must be passed on to the DLC by the applicant, as specified in the application instructions.)

- **Fixture Level Tests**
  Retrofit kits must be tested (LM-79, ISTMT, LM-80, LM-84) in a fully functional manufacturer-selected reference fixture from the approved list, with the kit properly installed per manufacturer's instructions.

As noted, the DLC does not endorse or exclude any particular make or model of reference fixture. The options listed are intended to illustrate common fixtures of that type. Manufacturers may test in alternative fixtures to those listed, with pre-approval from the DLC.

Applicants shall test and report fixture performance under the following restrictions and conditions:

- Alternative fixtures must be commonly used in the application category intended to be applied for. Documentation may be required to demonstrate fixtures' appropriate use if questions arise.
- Alternative fixtures must provide similar thermal environments to those listed under each category below. Particularly, alternative fixtures may not be significantly different in internal volume or construction materials. Note: pre-approved equivalent requests will only be evaluated against the approved fixtures listed below. Evaluation will not be made against the list of approved housings.

To request that a fixture be considered as an approved housing for testing purposes, please send the spec sheet for the fixture to **applications@designlights.org**, along with a spec sheet for the retrofit kit product. DLC review staff may need additional details, depending on the request and details available on the spec sheet.

16.2.2 Option B: Testing in Manufacturer-Selected Housing (Luminaire Specific)

The DLC understands that not all retrofit kits are designed for the typical housings described above in Option A testing. If a retrofit kit is designed for a specific housing that is not represented by the approved housings listed above, and does not meet the conditions of the pre-approved equivalent process, manufacturers may select a different housing that is appropriate and representative of the housing the retrofit kit would be installed in the field.

Products tested via Option B are only considered qualified when installed in the specific housing used for testing. Additional testing in each housing will be required if manufacturers would like to have a retrofit kit considered qualified when installed in multiple housings under Option B. If a housing has multiple variations (e.g., lenses), testing must be conducted with the variation that results in the worst-case condition. The spec sheet for the housing used for testing will be reviewed during the Initial Review process to ensure the housing is still within the intended use of the currently available retrofit kit Primary Use designations.

The DLC will determine if a retrofit kit is designed for a specific housing by reviewing the marketing material (i.e., product specification sheet) associated with the retrofit kit. Product specification sheets must clearly indicate for which specific housing the retrofit kit is intended. The DLC review process may include checking web listing and other marketing materials and reserve the right to request additional information to demonstrate the retrofit kit is only designed for a specific housing if product specification sheets are not sufficient.

Products tested according to Option B will be designated as “Luminaire Specific” on the QPL, with the housing used for testing listed in the Notes field.

Manufacturers shall test and report fixture performance under the following restrictions and conditions:

- **Required Tests and Reports**
  All DLC QPL testing and reporting requirements that apply to new fixtures shall also apply to any retrofit kit application e.g., LM-79, ISTMT, IES file, TM-21 projection etc. (Note that for lumen maintenance testing, the source manufacturer is responsible for the LM-80 test of the LED package, array, or module. A report resulting from this test must be passed on to the DLC by the applicant, as specified in the application instructions.)
- **Fixture Level Tests**
  Retrofit kits must be tested (LM-79, ISTMT, LM-80, LM-84) in a fully functional manufacturer-selected reference fixture with the kit properly installed per manufacturer’s instructions.

16.3 Special Considerations for Unique Retrofit Kit Scenarios

For scenarios where the same product can be sold as a retrofit kit and a luminaire:

- The exact same product must be able to be deployed as both a stand-alone luminaire and as a retrofit kit. The same product can be installed in either an existing host housing (i.e., as a retrofit kit) or directly in the space without a host housing (i.e., as a luminaire).
- The product (or related group of products) can be submitted as a family in a single level 2 application, with the product(s) seeking qualification both in the appropriate luminaire primary use designation (PUD) as well as in the appropriate retrofit kit PUD.
- Note that to be considered for qualification in both PUDs, the product(s) must appear on the application form twice, one line corresponding to the luminaire PUD and the other corresponding to the retrofit kit PUD. If the product(s) pass review, they will appear on the QPL under two listings and with different Product IDs, corresponding to each PUD.
- All testing must be conducted with the product as a retrofit kit installed in one of the approved housings (Option A within the retrofit kits policy) as this installation method will commonly result in a higher temperature for the product and less efficient performance thus worst-case condition for testing.
- Products intended for luminaire-specific housings (Option B within the retrofit kits policy) will need to ensure compliance with the provisions of that pathway and test in the target reference housing as described in the option B section above.

17 Modular Products with External Power Supplies

17.1 Changes in SSL V6.0

Requirements in this section are unchanged from SSL V5.1.

17.2 Modular Products with External Power Supplies

The DLC understands that most refrigerated and display case lighting products are sold as systems with multiple units attached to a power supply. Occasionally, this system architecture has also been seen on other product types as well. DLC does not consider these types of products as DC or PoE products. For these products, there is no provision for qualifying a product to the DLC QPL with an unspecified or field-specified driver. Qualifications and listings are always driver-specific. If a specific driver is not sold with the product, model numbers will include tested driver information on the QPL, and tested performance shall be measured and reported with a driver that the listed product is intended to be used within the field.

The DLC lists these products, when qualified, with module-level performance data for light output characteristics. Individual modules connected alone on the same power supply used in the system are understood to not perform the same as they would when the total system is connected to the power supply because of efficiency variance based on the load on the power supply. Therefore, DLC evaluates and lists metrics where driver loading plays a meaningful role (i.e., efficacy and power quality metrics) at the system-level, including appropriately loaded power supplies. For information on minimum required testing, see **Minimum Testing Requirements: Modular Products**.

For listing purposes, DLC will also include a note in the “Notes” field on the QPL for end users to describe the minimum system size necessary to meet DLC requirements, as based on the information provided in the application materials.

18 Direct-Current (DC) and Power over Ethernet (PoE)

18.1 Rationale for Update

DC and PoE systems have the potential to reduce electrical losses from AC to DC conversions, integrate directly with DC generation sources such as solar and batteries, reduce installation costs, and connect more readily to IT infrastructure for advanced lighting control. These Requirements for DC and PoE Products enable high quality DC and PoE lighting products to be qualified and listed on the DLC SSL QPL.

In addition to meeting all applicable DLC Standard, Premium, or LUNA Technical Requirements, products powered by Direct Current (DC) and Power over Ethernet (PoE) must comply with the provisions of this subsection to be eligible for listing on the DLC SSL QPL.

DC/PoE products are defined as SSL lamps, luminaires, and retrofit kits that are powered by DC voltage. PoE products are a specific subset of DC products that comply with the IEEE 802.3 Standards for carrying both power and communication signals on Ethernet cables. Qualified products will be 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 Alternating Current (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 and listed.

The DLC lists 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 source efficiency, in addition to luminaire or lamp efficacy. However, given the variation in system architectures and power losses, the DLC does not publish system-level efficacies for DC/PoE SSL products.

18.2 Changes in SSL V6.0

Requirements in this section are unchanged from SSL V5.1.

18.3 Testing Methods and Requirements

Testing for DC/PoE products must be provided to cover all areas of investigation, as is required for AC family groups. Per the eligibility criteria above, **all DC/PoE products must be submitted as a Level 2 application**, regardless of the number of products submitted. The below requirements apply to the DC/PoE luminaire, lamp, or retrofit kit under consideration, as test reports will not be required on the DC Power Source.

1. The DC/PoE product or group of products shall be tested according to the guidelines for electrical instrumentation of DC devices in the Illuminating Engineering Society's (IES) ANSI/IES LM-79-19 or -24 standard.
2. The intent of the LM-79 test reports required for DLC submission is measurement of the luminaire efficacy as well as other photometric characteristics under DC power without including DC Power Source conversion losses or line losses.
3. Many DC/PoE products utilize cables with multiple conductors. LM-79 test reports shall be based on the sum of all power delivered to the product across all connected conductors. The test report shall document the number of powered conductors, and pair-wise grouping if applicable.
4. Voltage and current measurements shall be made at the point of entry to the luminaire or retrofit kit, or at the input terminals to the driver in the case of UL Type C replacement lamps. For luminaires and retrofit kits, these measurements shall include any DC-to-DC driver circuitry that is included and shipped under the same model number as the luminaire or retrofit kit but exclude drivers that need to be ordered separately under a different model number. For UL Type C replacement lamps, these measurements shall include the remote DC-to-DC driver circuitry. If the test laboratory is in doubt about the proper interconnection or placement of voltage sensing leads for power measurement, they should consult the manufacturer.
5. Test laboratories should connect measurement equipment in such a manner that creates minimal disruptions to data communication if the DC power connection carries both data and power. Manufacturers should, if necessary, provide testing labs with instructions for achieving a state of full light output without the consumption of unnecessary communication power.
6. Any removable accessories not required to achieve full light output, such as removable photosensors or occupancy sensors, shall be removed during LM-79 testing. Any accessories with controllable power states that are not required to achieve full light output, such as cameras, microphones or external luminaire power connections, shall be disabled/powered down during LM-79 testing.
7. The luminous efficacy according to the LM-79 Test Method shall be provided at the DC input voltage that results in the worst-case luminous efficacy. The tested voltage must result in the worst luminous efficacy across the product's operating input voltage range and, if applicable, within the input voltage range of the established system protocol (e.g., IEEE 802.3at or IEEE 802.3bt).
8. For any application where the LM-79 test voltage submitted as worst-case is not the lowest voltage in the operating input voltage range, the manufacturer must submit a written justification explaining why their product performs at lower luminous efficacy at the higher input voltage. A tolerance of the greater of 1% or 1 Volt will apply to the test voltage reported on the LM-79 test report. For example, a manufacturer submitting a product listed with an input voltage operating range of 24 – 30 VDC must either submit a test between 23 V and 25 V, or test at another voltage between 23 V and 31 V and include a justification of why 24 V is not the worst-case luminous efficacy for that product. Justifications should explicitly reference any component or design features that affect performance across voltage range, such as constant-current drivers. For products with a minimum operating input voltage greater than the minimum of the nominal range, the operating input voltage range should be included in the written justification.

9. Input voltage ranges for PoE products are specified in the IEEE 802.3 standards for each Powered Device Type and Class. However, because minimum input voltages across Type and Class vary by only a few volts and products may operate across multiple Classes, PoE products shall be tested at 45 V or the minimum input voltage for their Type and Class as listed in
10. **Table** 32 below if greater than 45 V. PoE products must either be submitted with a test within 1 V of 45 or their minimum input voltage from
11. **Table** 32, or be submitted with a test at another voltage within the IEEE 802.3 input voltage range and a justification of why that voltage produces the worst-case luminous efficacy for that product.

Table 32: Minimum Powered Device Input Voltage*

Powered Device Assigned Class	Power Sourcing Equipment Type			
	Type 1	Type 2	Type 3	Type 4
Class 1	42.9	49.0	49.0	51.1
Class 2	42.1	48.3	48.3	50.4
Class 3	39.9	46.5	46.5	48.7
Class 4	__	42.5	42.5	44.9
Class 5	__	__	44.4	46.6
Class 6	__	__	42.5	44.9
Class 7	__	__	__	44.9
Class 8	__	__	__	43.0

***Manufacturers submitting a product without either an LM-79 test at the lowest voltage, or a written justification will be required to submit a new test.

18.4 Listing on the QPL

Six fields specific to DC/PoE listings are maintained under V6.0, two of which are exclusively applicable to PoE:

- **"System Type"**. This field applies to all products on the QPL and is populated with text as "AC", "DC", or "PoE".
- **"Test Voltage"**. This new field is required for DC and PoE products and may also be applied to existing AC products. It is a numerical value that lists the voltage from the LM-79 test report (e.g., 24 Volts, 380 Volts, etc.) that corresponds to the worst-case luminous efficacy listed for that product.
- **"Voltage Range"**. This new field applies to both AC and DC products and lists the nominal input voltage range for the product (e.g., 120-277VAC, 44-57VDC).

- **“DC Efficacy”**. This new field lists the worst-case efficacy of DC/PoE products, which is different from the current “Efficacy” field for existing products. The existing “Efficacy” field on DLC QPL has been changed to “AC Efficacy” to clearly differentiate from the “DC Efficacy” of DC/PoE products.
- **“PoE Type/Class”**. This new field is only applicable to PoE products and lists the Type and Class of PoE utilized.
- **“PoE Connection”**. This new field is exclusively for PoE products to indicate whether the product connects directly or indirectly to the PoE network; for example, whether a luminaire connects directly to the PoE network, or indirectly through another luminaire or driver that is connected to the PoE network

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19 Alternately Sourced Equivalent Components

19.1 Rationale for Update

The DLC has received feedback about supply chain challenges from qualifying manufacturers who have requested that the DLC develop an alternate (dual or multiple) sourcing policy to support listing a single product to the QPL that may be manufactured with alternate, equivalent components, such as drivers or LEDs, as needed.

19.2 Changes in SSL V6.0

Changes from SSL V5.1

- Requirements for alternately sourced equivalent components are entirely new since SSL V5.1

Changes from Draft 1 to Draft 2

- None

19.3 Testing and Reporting Requirements for Alternately Sourced Components

To ensure DLC listed products maintain their performance when using alternate LED and/or drivers, these alternately sourced equivalent drivers and LEDs are only eligible when these components do not significantly change the performance of the qualifying product. That is, the tested and reported data for the qualifying products must be equivalent regardless of which component is being used. Draft 2 proposes a pathway for manufacturers to report equivalent, alternately sourced components that are being used as described below.

Manufacturers must attest that alternate components, such as alternate drivers and LEDs, do not change the performance characteristics of the qualifying products beyond the acceptable tolerances specific to an original subcomponent as defined in **Table 35**. If manufacturers report that alternate sourcing is occurring, then specification sheets for all alternate components must be provided.

All alternate LEDs and alternate drivers must demonstrate subcomponent-level lumen maintenance and driver lifetime requirements are met as described in this Technical Requirements document.

LM-79 testing and power quality testing (i.e., PF and THD) must be conducted on the worst-case variation, considering all alternate components.

The DLC reserves the right to request additional information as appropriate.

19.4 Key Questions Regarding Alternately Sourced Equivalent Components Proposals

1. In addition to V5.1's ISTMT pathways, the DLC is considering accepting ISTMT results from manufacturer created benchtop reports. What concerns, if any, do you have with accepting benchtop ISTMT results?
2. What feedback, if any, do you have regarding the reporting of alternate components?

20 Efficacy Allowances

20.1 Rationale for Update

As with previous revisions of the DLC Technical Requirements, the SSL V6.0 and LUNA 2.0 revision includes increases in efficacy thresholds. The DLC recognizes that quality must go hand-in-hand with efficacy if long-term energy savings are to be realized. The DLC also recognizes the risk that some products may achieve higher efficacy at the expense of quality, which can leave customers unsatisfied and/or can negatively impact human health or well-being. The DLC is incorporating quality requirements to ensure that the QPL includes a balance of products that provide good quality of light, while at the same time saving energy through high efficacy and controllability.

The DLC efficacy requirements are not intended to drive market development or customer choice away from features that contribute to the overall quality of light or the quality of the lighting for a particular space. As such, the DLC will grant allowances to efficacy requirements, applicable to both tested and reported performance values, to offset potential efficacy tradeoffs due to these enhanced quality features.

Additional allowances specific to LUNA qualified products include allowances for shielded luminaires and bollards. These allowances are provided to encourage shielded luminaires to be listed and to account for the decreased efficacy due to optics and baffles, respectively. Auxiliary shielding may increase the quality of the light distribution of a luminaire, as light is only delivered where it is intended and does not cause light trespass on neighboring locations. However, the application of shields often results in lower luminaire efficacy, and in many cases, shielded products cannot meet the DLC's minimum efficacy requirements. Based on DLC outreach, comments from lighting designers indicated that shielded photometry is used when available.

20.2 Changes in SSL V6.0

Changes from SSL V5.1

- Higher allowances for 2700 K or lower CCTs (described in **Table 33**)

Changes from Draft 1 to Draft 2

- An efficacy allowance for UGR now applies to linear ambient, high bay, and low bay luminaires in addition to troffers (same allowances as SSL V5.1)

20.3 Efficacy Allowances for DLC Standard and Premium

The efficacy allowances included in Draft 2 are summarized **Table 33**. Efficacy allowances are provided for products with improved color rendition, products with CCT ≤ 2700 K, and certain indoor luminaire and integrated retrofit kit PUDs with low UGR values.

Efficacy allowances are cumulative up to a maximum allowance of 15%, except for NWL products, which may have a cumulative allowance up to 25%. Additionally, a product may take advantage of an efficacy allowance in conjunction with the luminaire efficacy tolerance, as stated in **Table 35**.

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Feature	Category / General Application	Performance Metric	Allowance under V6.0	Method of Evaluation
Low CCT	All Products Within Standardized CCT Quadrangles	≤ 2700 K	-8%	Same as V6.0 Standard
		≤ 2200 K	-10%	
		≤ 2000 K	-20%	
		≤ 1800 K	-25%	
High Color Rendition	All Indoor Products Excluding High-Bay	**Option 1 - ANSI/IES TM-30:** • IES R_f ≥ 75 • IES R_g ≥ 92 • -7% ≤ IES $R_{cs,h1}$ ≤ +19% **Option 2 - CIE 13.3-1995:** • R_a (CRI) ≥ 90 and R_9 ≥ 50	-5%	Same as V6.0 Standard
		ANSI/IES TM-30: • IES R_f ≥ 78 • IES R_g ≥ 95 • -1% ≤ IES $R_{cs,h1}$ ≤ +15%	-10%	
	All Outdoor Products and High-Bay	**Option 1 - ANSI/IES TM-30:** • IES R_f ≥ 70 • IES R_g ≥ 89 • -12% ≤ IES $R_{cs,h1}$ ≤ +23% **Option 2 - CIE 13.3-1995:** • R_a (CRI) ≥ 80 and R_9 ≥ 0	-5%	
Enhanced Discomfort Glare Control	Troffer, (Luminaires and Integrated Retrofit Kits only)	**Corrected UGR < 16.0**	-10%	Corrected UGR values generated per CIE 190-2010 at the reference condition below. • Room dimension: X = 4H, Y = 8H • Spacing to height ratio (S/H): 1 Reflectances: 70/50/20%
	Linear Ambient, (Luminaires and Retrofit Kits only)	**Corrected UGR < 16.0**	-10%	
	Low Bay (Luminaires and Retrofit Kits only)	**Corrected UGR < 19.0**	-10%	
	High Bay, (Luminaires and Retrofit Kits only)	**Corrected UGR < 22.0**	-10%	

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20.3.1 Testing Requirements for Efficacy Allowances

For information on minimum required testing, see **Minimum Testing Requirements: Spectral Quality for Efficacy Allowances** and **Minimum Testing Requirements: Discomfort Glare Efficacy Allowances**.

20.3.2 Interactions with other DLC Policies: Field Adjustable Light Distribution

Field Adjustable Light Distribution (FALD) products are eligible for efficacy allowances, including allowances related to discomfort glare per the PUD performance metric requirements given in **Table 33**. The **Minimum Testing Requirements: Light Output and Distribution** for UGR are applicable to FALD products.

20.4 Efficacy Allowances for LUNA Qualified Products

Additional efficacy allowances that apply to products qualified under LUNA V2.0 are summarized in **Table 34**. These allowances may be added to other spectral quality allowances provided under SSL V6.0 for a maximum allowance of 45%.

The DLC is providing efficacy allowances for all LUNA qualified bollards, as well as area lighting, roadway lighting, and pole- or arm-mounted decorative lighting with house-side shields (HSS), cul-de-sac shields (CSS), and front-side shields (FSS) that reduce house-side (for HSS and CSS) or street-side (for FSS) lumens by the percentage specified in **Table 34**. Although manufacturers must demonstrate that at least one shield option or accessory is available for LUNA qualification, listing additional specific LUNA qualified products with shields is voluntary.

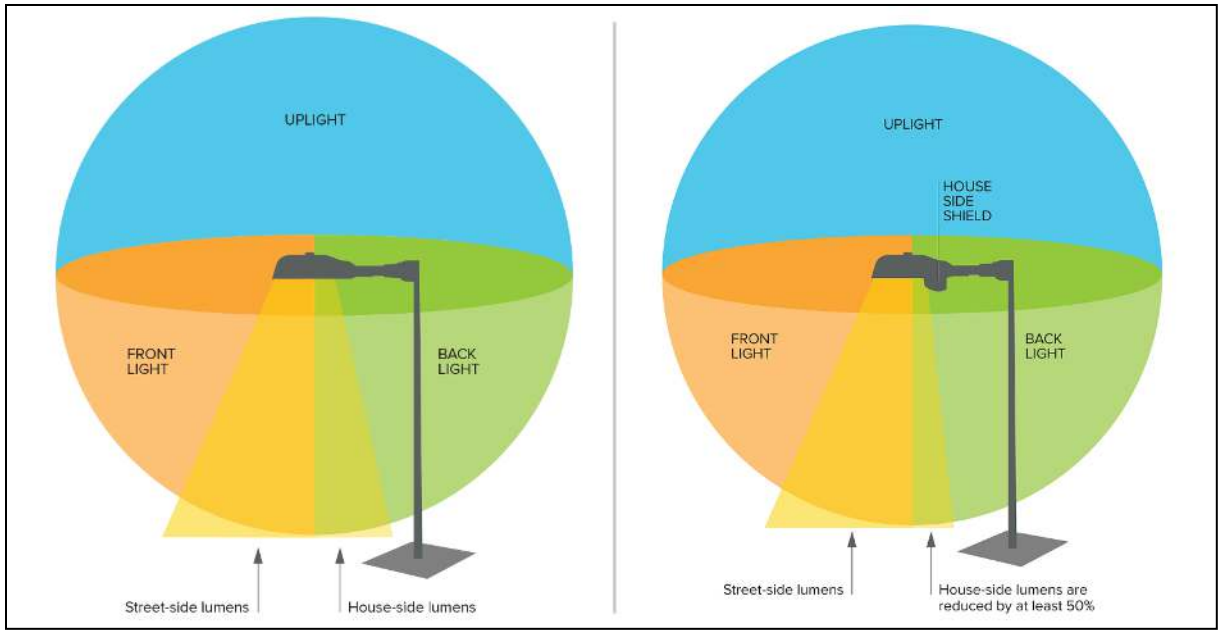

Figure 2: *Example of a hypothetical product with a house-side-shield (HSS) (right image) and without (left image). This hypothetical product with a HSS would be eligible for a shielding efficacy allowance if the house-side lumens are reduced by at least 50% compared to an unshielded equivalent product. Note that other shielding efficacy allowances for other shield types will require different reduction in house-side or street-side lumens, per* ***Table 34****.*

Table 34: Efficacy Allowances Specific to LUNA Products

Feature	Primary Use Designation	Performance Metric	Allowance under V6.0
All Bollards	Bollards	N/A	-25%
Shielding	• Outdoor Pole/Arm-Mounted Area and Roadway Luminaires • Outdoor Pole/Arm-Mounted Decorative Luminaires • Hazardous Environment Area Lighting • Specialty: Hazardous Environment Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	Luminaires with internal or external house-side shields (HSS) that reduce the house-side lumens by at least 50% compared to an equivalent unshielded product.	-20%
		Luminaires with internal or external cul-de-sac shields (CSS) that reduce the house-side lumens by at least 70% compared to an equivalent unshielded product.	-35%
		Luminaires with internal or external front-side shields (FSS) that reduce the street-side lumens by at least 30% compared to an equivalent unshielded product.	-20%

20.4.1 Documentation Requirements for LUNA Efficacy Allowances

For LUNA qualified products seeking an allowance for shielding, the submitted specification sheet or supplemental document should clearly show the relationship between the unshielded product and shielded product. In addition to the .ies file, the LM-79/distribution report for the worst-case distribution parent must be submitted as a PDF file and must include a product image with the shield with sufficient granularity that the shield is clearly visible in the image. For information on minimum required testing, see **Minimum Testing Requirements: LUNA Shielding Efficacy Allowances**.

21 Tolerances

21.1 Changes in SSL V6.0

Tolerance details in this section are unchanged from SSL V5.1.

21.2 Tolerances

The DLC accepts measurement tolerances for most metrics listed in the Technical Requirements as described in **Table 35**. Tolerances are intended to account for all testing variation, rounding, and significant digits.

For nominal value performance metrics, tolerance is a percentage of the required value. For example, for a minimum efficacy requirement of 110 lm/W with a -3% tolerance, the functional requirement is 106.7 lm/W (i.e., 110 x 97% = 106.7). For zonal lumen tolerances specific to each Primary Use Designation, please refer to Distribution Requirements.

Table 35: Tolerances

Performance Metric	Product Type	V6.0 Tolerance
Light Output	All	±10%
Luminaire Efficacy	All	-3%
Color Rendition	All	CIE Ra (CRI): -1 Point CIE R9: -1 Point IES Rf: -1 Point IES Rg: -1 Point IES $R_{cs,h1}$: +/- 1%
Color Maintenance	All	$\Delta u'v'$: + 0.0004 points*
Power Factor	All	-3 percentage points
Total Harmonic Distortion	All	+5 percentage points
Beam Angle	Medium screw-base, Mogul screw-base, Linear replacement lamps, 2G11 lamps	-5°
Dominant wavelength	de-Amber, pc-Amber	+ 10 nm
Full-width half-maximum (FWHM)	de-Amber, pc-Amber	+/- 10 nm

* Data must be consistent with the LM-80 testing and reporting guidelines.

21.2.1 Reporting and Implementation Details

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 the applicant's responsibility to check all data presented in an application before submission to ensure compliance with the DLC requirements.

22 Warranty

22.1 Changes in SSL V6.0

Requirements in this section are unchanged from SSL V5.1.

22.2 Warranty Requirements

The DLC requires a minimum warranty period of 5 years on all products listed on the QPL. The warranty must cover the complete luminaire or retrofit kit/replacement lamp 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 or retrofit kit/replacement lamp 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.

23 Testing Constraints

23.1 Changes in SSL V6.0

Requirements in this section are unchanged from SSL V5.1.

23.2 Alternative Testing Pathway

The DLC understands that in some scenarios, products that are required to be tested may not physically fit within the testing apparatus needed to conduct testing. This is often seen with 8-foot linear-type luminaires that do not fit in standard goniophotometers, though other restrictions may exist. In the event that a product is identified as requiring testing for a DLC application but cannot be tested due to the constraints of the testing equipment, the DLC will need to understand and collect the following information:

1. Specific reasons why the product in question cannot be tested.
2. A proposal from the manufacturer on how to evaluate the performance of the product. Proposals must be technically sound and demonstrate a thorough understanding of the product's construction and performance-affecting variables.
3. Rationale for why the proposal is representative of the product's performance.

Proposals, once complete with the details mentioned above, will be reviewed on a case-by-case basis by DLC program management. Please provide this information ahead of submitting an application as proposals need to be approved prior to allowing the use of alternate data within an application. This will help ensure application reviews are completed as efficiently as possible. The DLC reserves the right to request additional information, and manufacturers should be prepared to provide documentation that addresses concerns that arise.

23.3 Alternative Testing for Linear Style Products

Linear style products with a length greater than or equal to five feet must be submitted as a Level 2 application and may deviate from the requirement that "the multiplier field in the .ies files shall be 1.0 and cannot be scaled" by following the requirements and procedures below:

- Products with a length equal to or greater than five feet must be submitted in a family with equivalent shorter products that can be tested in a goniophotometer.
    - Equivalent shorter products are defined as products whose cross-sectional distribution is equivalent to that of the 5+ foot configuration at issue. The configuration at issue is the configuration that would be tested to demonstrate compliance with the UGR requirement, were there to be no testing constraints.

- A full LM-79/color report must be provided for the 5+ foot configuration at issue and must be conducted strictly according to LM-79, with no scaling. This is anticipated to be an integrating sphere test.
- A full LM-79/color report and a full LM-79/distribution report must be provided for the equivalent shorter product.
- A full LM-79/distribution report must be provided for the 5+ foot configuration at issue, and must contain:
    - Electrical characteristics from the full LM-79/color report of the 5+ foot configuration at issue.
    - Luminous intensity distribution (candela array) derived from the goniophotometer testing of the equivalent shorter product and a multiplier whose value is the lumen output result of the full LM-79/color report of the 5+ foot configuration at issue divided by the lumen output result of the full LM-79/color report of the equivalent shorter product. The luminous surface information in the .ies file must be reflective of the 5+ foot configuration at issue.
- If using this alternative method, data from scaled .ies files will not be shown on the QPL as tested data. The equivalent shorter product will be listed on the QPL as a parent product with tested data from the equivalent shorter product's .ies file shown on the QPL.

23.4 Alternative Testing for Linear Ambient Luminaires with Indirect Components

The DLC understands that for **linear ambient luminaires with indirect components**, complying with the full LM-79/distribution report requirements may not be feasible due to testing burden.

For most products, distribution changes cannot easily be scaled. Developing engineering logic to estimate light distribution can require sophisticated ray-tracing lighting software, which also has some technical limitations. Additionally, small, seemingly insignificant changes to optics can have large impacts on the light distribution. This uncertainty informed the DLC requirement that all unique optical variations are tested and a full LM-79/distribution report is provided during the submission process.

Linear ambient luminaires with indirect components can represent an exception to this rule because simple engineering logic can be used to estimate certain distribution changes. For these products, lumen output can differ for the direct and indirect components individually, which can cause differences in the overall luminaire light distribution. Since lumen output can be easily and accurately scaled, these types of distribution changes can also be scaled accurately.

Due to the testing burden and confidence in the ability to scale certain distribution changes, linear ambient products with direct and indirect lighting components can, but are not required to, deviate from the requirement that "the multiplier field in .ies files shall be 1.0 and cannot be scaled" by following the requirements and procedure below:

- A completed **Linear Ambient with Indirect Component Distribution Performance Summary Excel file** must be provided, containing all models to be qualified.

- Worst-case analysis conducted using the procedure described herein must take into account the effect of color properties.

- A detailed description of the scaling methodology used to generate the estimated zonal lumen density must be included in the distribution performance summary Excel.
  - The recommended method for scaling is as follows:
    - LM-79 sphere tests to be conducted at each lumen output option for downlight and uplight individually at a single optic, CCT, and CRI configuration.
      - Based on this testing, generate a factor to apply to estimate lumen output based on the change of lumen package.
      - This test will also provide the wattages for each lumen package, which, in general, does not change significantly based on color characteristics or optics.
    - LM-79 sphere tests to be conducted with each distribution pattern at a single lumen package, CCT, and CRI combination.
      - Based on this testing, generate a factor to apply to estimate lumen output based on optical changes.
    - LED manufacturers can provide factors to apply to estimate lumen output based on CRI or CCT changes.
    - Goniometer testing must be conducted on each unique direct and each unique indirect distribution pattern. This testing is not only recommended to scale performance data but is also required to submit applications using this method.
    - The lumen output factors for lumen output option, distribution pattern, CRI, and CCT can then be applied to the .ies files to estimate the lumen output, wattage, efficacy, and ZLD for all configurations.
    - For configurations with uplight and downlight, the scaled .ies file for the product with only the downlight energized can be combined with the scaled .ies file for the product with only the uplight energized to output a bi-directional .ies file.
  - The DLC does not require the use of this scaling methodology; however, other scaling methods will undergo increased scrutiny during the review process.

- A full LM-79/distribution report must be provided for each unique direct distribution pattern at any lumen output in isolation (that is, with the indirect component de-energized).

- A full LM-79/distribution report must be provided for all unique indirect distribution patterns at any lumen output in isolation (that is, with the direct component de-energized).

- Full LM-79/distribution reports must be provided for the worst-case configurations (UGR, if applicable, and zonal lumen density) with only the direct component energized.

- Full LM-79/distribution reports must be provided for the worst-case configurations (UGR, if applicable, and zonal lumen density) with only the indirect component energized.

- Full LM-79/color reports must be provided for the worst-case configurations with both direct and indirect components energized.

- Full LM-79/distribution reports must be provided for the worst-case configurations containing:
    - Electrical characteristics from the full LM-79/color reports with both direct and indirect components energized.
    - Luminous intensity distribution (candela array) derived from a combination of the direct and indirect distribution reports.
    - .ies file with distribution information derived from a combination of the goniophotometer testing of the direct and indirect LM-79/distribution reports, a lumen output multiplier whose value is the lumen output result of the full LM-79/color report of the worst-case configuration, and a luminous area reflective of the direct component of the worst-case configuration.

If using this alternative method, data from scaled .ies files will not be shown on the QPL as tested data.

The DLC reserves the right to seek clarification on any aspect of the process described above and manufacturers should be prepared to provide documentation that addresses concerns that arise.

23.5 Alternative Testing for Eight-Foot T8 Replacement Lamps

All eight-foot T8 replacement lamps seeking qualification must be tested using an appropriate integrating sphere. Additionally, using a goniophotometer, a four-foot linear replacement lamp with identical construction as half of the eight-foot linear replacement lamp must be tested. “Identical” linear lamps, while having the base type G13 as outlined in four-foot lamp requirements, are defined as having the same type and quantity of driver(s), driving the LEDs at the same current, and having the same number of LEDs and PCBs as half of the eight-foot lamp. The representative lamp must also be of identical construction, having identical cross-sections, the same tube material and thickness, and the same heatsink material and extrusion. The goniophotometer testing results from the four-foot lamp shall be extrapolated to represent the eight-foot lamp by multiplying the candela of the four-foot goniophotometer output by a scale factor. That factor shall be derived through dividing the tested lumen output of the eight-foot lamp by the tested lumen output of the four-foot lamp, as obtained from the integrating sphere.

The results must meet the beam angle requirements. Applicants must provide results from the eight-foot testing in the integrating sphere, the four-foot testing in the integrating sphere, and the four-foot testing in the goniophotometer, as well as the scaled eight-foot IES file. Applicant must also provide workflow demonstrating the calculation of the scale factor and identifying, within the photometric report, the candela values derived via calculation. In addition, a photo of the eight-foot and four-foot LED layout side-by-side, as well as a cross-section diagram of construction for both products must be submitted.

24 Lamps and Reference Housings

The DLC does not endorse or exclude any particular make or model of reference luminaire. The options listed are intended to illustrate common luminaires of that type. Manufacturers may test in alternative fixtures to those listed, with pre-approval from the DLC.

Requirements for Lamps and General Applications described in this section are unchanged from SSL V5.1.

24.1 Pre-Approved Equivalent Luminaires and Ballasts

Pre-approved luminaires and ballasts must meet the following conditions:

Alternative luminaires and ballasts must be commonly used in the General Application category intended to be applied for. Documentation may be required to demonstrate luminaires appropriate use if questions arise.

Alternative luminaires and ballasts must provide similar thermal and electrical environments to those listed under each category below. Particularly, alternative luminaires may not be significantly different in internal volume or construction materials. Note: pre-approved equivalent requests will only be evaluated against the approved luminaires listed below. Evaluation will not be made against the list of pre-approved equivalents. Alternative ballasts must be commonly used in the intended field use designation. Particularly, alternative ballasts must be consistent in intended wattage, ballast factor, efficiency, and power quality under consistent loading conditions. Documentation may be required to demonstrate ballast intended use.

To request that a luminaire and/or ballast be considered as a pre-approved equal for testing purposes, please send the spec sheet for the luminaire and/or ballast to applications@designlights.org, along with a spec sheet for your replacement lamp. DLC review staff may need additional details, depending on the request and details available on the spec sheet.

24.2 Luminaire Level Tests

Lamps need to be tested in (i.e., supply an LM-79, ISTMT, IES file from testing in) only one of the approved luminaires or a pre-approved equivalent. Please refer to the Reference Housings details below for detailed guidance on luminaire level testing in appropriate reference housings.

All eligible lamp product categories other than Type A and Type B lamps, which are exempt from the driver lifetime requirements, shall conduct in-situ temperature measurement testing (ISTMT) in the most restrictive thermal environment for which the product is rated, per its safety certifications (e.g., UL/CSA 1993) to be evaluated against lifetime requirement thresholds. That is, ISTMTs for DLC submission shall be in the same thermal environment and use the same apparatus as is used by the safety organizations for evaluation thermal performance in safety testing. ISTMTs will be reviewed to

ensure the safety standard is referenced and that the apparatus used is specifically noted/described in the test report. TM-21 projections will use this thermal measurement in conjunction with the provided LM-80 data and driver lifetime per the reported specification sheet to evaluate lumen maintenance and driver lifetime.

24.3 Mogul screw-base (E39/E40) Screw Base Replacement Lamps

The following information describes testing requirements for mogul screw-base HID replacement lamps that meet SSL V6.0 Technical Requirements previously described.

For testing purposes, DLC specifies typical “reference” luminaire housings for mogul screw-base HID replacement lamp products to be tested in. This is done to provide testing results under common conditions in which the mogul screw-base HID replacement lamps would be installed. In providing this list of typical luminaire housings, DLC does not endorse or exclude any particular make or model frame for use in energy efficiency programs. Note that in each recommended variation, an option for testing in a “Pre-approved Equivalent” is available. Some approved housings can come with medium or mogul sockets. For the purpose of DLC testing, the luminaire housing with the mogul socket must be used. All test reports, including LM-79 and ISTMT test reports, must directly state the reference luminaire used for testing. The complete model number of the reference luminaire must be stated directly, including (where necessary), clarity on the specific socket type contained within the fixture.

In selecting a luminaire for testing, the applicant shall consider the purpose of subjecting the tested lamp to extreme confinement for thermal endurance. If a product demonstrates necessary performance in a given luminaire, the product will be considered qualified in that luminaire and in luminaires of similar types and applications, only. The product will not be considered generically qualified, nor qualified in other applications, unless the product is tested, demonstrates necessary performance, and is also listed on the DLC QPL in that application.

In populating the Application Form during submission, reported data must be representative of the same tested configuration (i.e., reported data based on performance in the reference housing).

Applicants should test and report luminaire performance under the following restrictions and conditions:

24.4 Four Pin-Base Replacement Lamps for CFLs

The following information describes testing requirements for four pin-base replacement lamps for CFLs that meet SSL V6.0 Technical Requirements previously described.

The DLC accepts SSL QPL applications for four-pin base replacement lamps to include all base types G24q/GX24q lamps and 2G11 base lamps greater than or equal to twenty inches. At this time, G24q/GX24q and 2G11 UL Type A lamps (designed to operate utilizing the existing CFL ballast), and 2G11 UL Type B (designed to operate utilizing direct line voltage), 2G11 UL Type C (designed to operate

utilizing a non-integral driver), and 2G11 UL dual mode (designed to operate utilizing the existing CFL ballast or direct line voltage) are all eligible.

G24q or GX24q UL Type B lamps and UL Type C lamps, as well as products with other bases (including 2-pin products), remain under consideration for future development. Note that due to testing considerations, at this time, only products that can operate utilizing specific ballast types are eligible. Please see testing requirements below. Replacement lamps designed to operate utilizing magnetic ballasts, or other types of electronic ballasts not specified, are not eligible at this time.

The testing and reporting requirements described below are intended to subject the lamps to conditions found in typical luminaires to assure confidence in performance.

For testing purposes, the DLC specifies typical reference luminaire housings for lamp products to be tested in, as well as reference ballasts to be included in testing. This is so that testing results provided and used in evaluation of the product are similar to common installed conditions. In providing this list of typical luminaire housings and ballasts, the DLC does not endorse any particular make or model for use in energy efficiency programs. Note that in each recommended housing variation, an option for testing in a "Pre-approved Equivalent" is available for applicants to propose an alternative housing.

In selecting a luminaire or ballast for testing, the applicant must consider the purpose of subjecting the tested lamp to extreme confinement for thermal endurance and electrical factors. For the purposes of the Four Pin-Base Replacement Lamps for CFLs category, if a product demonstrates necessary performance in a given pre-approved luminaire and reference ballast, the product will be considered qualified generally.

24.4.1 Compatibility Tests

Due to concerns of compatibility of LED lamps with the existing CFL ballasts, the DLC requires that lamps undergo system-level testing on a variety of ballasts to demonstrate compatibility. *Please note that the DLC may seek to evolve compatibility testing requirements as appropriate, based on experience and demonstrated need to assess products in the market.* The DLC requires all lamps seeking qualification to undergo testing as per the ENERGY STAR® requirements for Frequency. These requirements are found Section 11.3 of the ENERGY STAR Lamps V2.0 Specification, and are reproduced in **Table 36** for reference.

Table 36: Compatibility Testing Requirements: G24q/GX24q Base Type Lamps

Requirement	Methods of Measurement and/or Reference Document	Testing Guidance
Lamp light output shall have a frequency of ≥120 Hz	**Method of Measurement:** None **Reference Document:** IEEE Std 1789™- 2015	Sample Size: One unit per model Light output waveform shall be measured with a photodetector with a rise time of 10 microseconds or less, transimpedance amplifier, and oscilloscope. Employed equipment models and methods of measurement shall be documented. Temporal response, amplification, and filtering characteristics of the system shall be suitably designed to capture the photometric waveform. Digitized photometric waveform data and an image of the relative photometric amplitude waveform shall be recorded. Measured data shall be recorded to a digital file with an interval between each measurement no greater than 0.00005 sec (50 microseconds), corresponding to an equipment measurement rate of no less than 20 kHz and capture at least 1 second of data.

The lamp must be tested and results documented according to **Table 36** above on each of the following ballasts:

- Philips ICF-2S18-HI-LD
- Philips ICF-2S26-HI-LD
- OSRAM/Sylvania QTP1/2x18CF/UNV
- OSRAM/Sylvania QTP2x26CF/UNV
- Triad C218UNVBE or Triad C218UNVME
- Triad C2642UNVBE or Triad C2642UNVME
- Fulham NPY-120-226-CFL
- Robertson RED1L10-120

Pre-approved equivalent requests will *not* be accepted for compatibility testing purposes.

24.5 Linear Replacement Lamps and 2G11-base Replacement Lamps for CFLs

All linear replacement lamps and 2G11-base replacement lamps for CFLs have historically had to provide test information on the lamps themselves and other test information obtained from testing the lamps

installed in a reference luminaire housing. Under the V5.1 Technical Requirements and maintained in the SSL V6.0 Draft proposal, the DLC has removed the reference housing testing requirements for these product types and replaced them with alternative requirements as described below.

24.6 Test Report and Implementation Requirements for Linear Replacement Lamps and 2G11-base Replacement Lamps for CFLs

The testing and reporting requirements for linear replacement lamps and 2G11-base replacement lamps for CFLs under V6.0 are described below. Additional performance requirements for these products are otherwise as described in the applicable Technical Requirements above (for color, controllability, etc.). **Table 37** provides information on the reference ballasts required for LM-79 testing.

In addition to full LM-79/color reports for worst-case light output, worst-case efficacy, and appropriate color properties per rules applicable to all products, submitters shall provide a full LM-79/distribution (goniophotometer) test for each optical variation (including lens variations) of a lamp product without consideration of lumen package and the effect of color properties, tested at the maximum (non-dimmed) light output and the .ies file based on the LM-79 test data, for the purposes of evaluating the beam angle. Full LM-79/color reports and full LM-79/distribution reports must conform to **Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports**.

All linear replacement lamps (including child products) shall report their beam angle in the Reported Performance Table on the application form.

Table 37: Type A and Dual Mode Reference Ballast Criteria

Type A and Dual Mode Reference Ballast Criteria	
General Applications	**Reference Ballast for Type A and Dual Mode Type A/B**
T8 Linear Replacement Lamps	T8 electronic instant-start ballast with 0.88 ballast factor
T5/T5HO Linear Replacement Lamps	T5/T5HO electronic programmed-start ballast with 1.0 ballast factor

For Type-B and Type-C products (i.e., lamp-style retrofit kits, which connect mechanically and/or electrically to the fixture via standard lamp holders, but which require an electrical modification to the existing fixture), “lamp”-level testing is also required.

If the system is designed to operate multiple lamps utilizing an external driver, the driver should be loaded as it would be in the field, with appropriate steps taken to calculate the efficacy of the single lamp. For example, for a two-lamp kit, one lamp should be measured for light output, while the system as intended (with two identical lamps on the driver) should be measured for electrical input. The wattage into the driver can then be divided by two, and that wattage divided into the lamp lumens to determine system efficacy.

Appropriate steps to measure the electrical and photometric properties of the lamp system, under most circumstances, would be to load the driver or ballast appropriately, then isolate a single lamp in the apparatus being used for photometric measurements. In a sphere, for example, this could be accomplished by placing one lamp from the system inside the sphere while the other one is outside the sphere.

24.7 Other Categories (Retrofit Kits, Mogul Screw-Base (E39/E40) Replacements for HID Lamps, and G24q-base Replacement Lamps for CFLs)

For retrofit kits, mogul screw-base (E39/E40) replacements for HID lamps, and G24q-base replacement lamps for CFLs, the DLC will continue using reference housing testing as a necessary evaluation of the performance of these products in a typical end use. To address availability concerns, both the pre-approved equivalent provisions and the “Option B” pathway for luminaire-specific retrofit kits remains in place. Additionally, the DLC periodically reviews public sources to check that the housings listed on the DLC Approved Housing webpage appear to be available on the market. In cases where they do not appear to be available, the DLC will continue to evaluate alternative housings and add them to the acceptable reference housing list. The DLC does not endorse any particular manufacturer associated with particular reference housings listed as part of these policy provisions.

Performance requirements for these products remain otherwise as described in other sections of this Technical Requirements document (for light output, efficacy, color, etc.).

25 Testing Guidance

25.1 Rationale for Update

As many of the Technical Requirements proposed are minimum requirements, by demonstrating that the worst-case models within a family group meet the minimum requirements, it can be assumed that models performing better than the worst-case models will also meet the requirements.

This section is intended to describe the minimum testing required to demonstrate compliance with SSL V6.0 Draft and is unchanged from required testing to demonstrate compliance with SSL V5.1.

25.2 Changes in SSL V6.0

Changes from SSL V5.1

- This is a new section that clarifies testing guidelines and does not introduce new requirements

Changes from Draft 1 to Draft 2

- All minimum testing and reporting requirements previously inside other topic sections were moved here

25.3 Demonstrating Compliance with SSL V6.0 Draft Proposals

Table 38 describes the minimum testing required for all OEM product applications under SSL V6.0. For more information on how to demonstrate compliance to technical requirements and how these apply to families of products please review the Level 2 (formerly family grouping) application requirements.

Table 38: Required Testing to Demonstrate Compliance to SSL V6.0 Draft Proposals

Metric	Tested Models	Required Test
Minimum Light Output	Worst-case light output for each PUD	Full LM-79/color report, including accompanying .SPDX document.
Minimum Efficacy	Worst-case efficacy for each PUD, classification and allowance grouping	Full LM-79/color report, including accompanying .SPDX document.
Maximum CCT	Highest CCT in family at lowest color rendition option	Full LM-79/color report, including accompanying .SPDX document.

Metric	Tested Models	Required Test
Minimum CCT	Lowest CCT in family at lowest color rendition option	LM-79/color report, including accompanying .SPDX document.
Minimum Color Rendering	Lowest color rendition option in family	LM-79/color report, including accompanying .SPDX document.
Chromaticity	Lowest CCT at lowest color rendition option Highest CCT at lowest color rendition option Lowest CCT at highest color rendition option (Premium only)	Full LM-79/color report, including accompanying .SPDX document.
Minimum L70 Lumen Maintenance (L90 for Premium)	ISTMT at worst-case thermal conditions of LED, LM-80 for single LED package/module/array as required for lumen maintenance projection	ISTMT LM-80/LM-84 / TM-21/TM-28
Color Maintenance	LM-80 for single LED package/module/array that is evaluated for color shift	LM-80/LM-84
Driver Lifetime	Worst-case driver temperature for each unique driver	Driver spec & ISTMT
Zonal Lumen Distribution (ZLD) / Spacing Criteria (SC)	Each unique optical and distribution pattern	Tested LM-79/distribution report, including accompanying IES file
BUG Ratings (outdoor only)	Each unique optical and distribution pattern	Tested LM-79/distribution report, including accompanying IES file
UGR (specific indoor PUDs and Premium only)	Each unique optical and distribution pattern at the highest lumen output without consideration of the effect of color properties	Tested LM-79/distribution report, including accompanying IES file
THD/PF	Worst-case performing driver in family	Benchtop Electrical Testing

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25.3.1 Minimum Testing Requirements: DLC Standard Spectral Quality

This section describes the test reports related to spectral quality that are required to qualify products to the DLC SSL QPL under the Standard qualification.

25.3.1.1 Color Rendition and Chromaticity (CCT & D_{uv}): DLC Standard

The DLC has several pathways for demonstrating color rendition and chromaticity compliance, depending on the level of product-variation complexity. In the pathways described below, "option" (color rendition or CCT) is used to describe a specific, nominal performance variation in a given set, for a product or product family.

Additionally, all color rendition options shall meet or exceed either the ANSI/IES TM-30 color rendition requirements (Option 1) or the CIE 13.3.-1995 color rendition requirements (Option 2) and both sets of color rendition measures shall be measured and reported.

- **For product families that offer one color rendition option and one or more CCT options:**
    - A full LM-79/color report, per the **Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports**, shall be provided at the lowest and highest CCT options offered.
- **For product families that offer one or more color rendition option(s) and one CCT option:**
    - A full LM-79/color report, per the **Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports** shall be provided at the minimum color rendition option for the CCT option offered.
- **For product families that offer one or more color rendition option(s) and one or more CCT option(s):**
    - A full LM-79/color report, per the **Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports** , shall be provided for the lowest and highest CCT options offered, at the minimum color rendition option.
- The DLC also requires that testing be conducted on the worst-case efficacy variation, which is likely the combination of lowest CCT and highest color rendition. If the overall minimum color rendition option was not captured in any LM-79/color report above, this configuration must be tested.
- In all cases, testing requirements correspond to Technical Requirements by classification (DLC Standard or Premium), in addition to product options. For example, if a family includes multiple color rendition options, some of which are eligible Efficacy Allowances, and some of which are not, testing would be required at the worst-case (efficacy) color rendition option *that meets the allowance requirement*, for the subgroup of products which want to be granted the allowance, and the minimum color rendition *overall* for the remainder of the group.

25.3.1.2 Color Maintenance: DLC Standard

The DLC has two pathways for demonstrating color maintenance compliance.

- **Color Maintenance Option 1:**
    - An LM-80 report for each LED package/module/array used within the product shall be provided and shall include chromaticity data for at least ≈1000-hour and ≈6000-hour time intervals. If the LM-80 report uses uneven test intervals, the closest measurement points

below the 1000-hour measurement point (<1000 hours) and beyond the 6000-hour measurement point (>6000 hours) will be referenced for evaluation of color maintenance. Additionally, color maintenance will be evaluated against the appropriate LM-80's 55°C data set, or the lowest temperature data set provided that is greater than 55°C, if there isn't a 55°C data set available. An appropriate LM-80 data set will be tested at a drive current at or above the drive current utilized for the TM-21 calculations on submitted product(s).

- **Color Maintenance Option 2:**
    - Luminaire-level performance data that follow LM-84 test procedures for the product shall be provided and shall include chromaticity data for at least ≈1000-hour and ≈6000-hour time intervals.
- Due to the length of this type of testing, it is recommended that the submitter contact the DLC at applications@designlights.org to ensure the testing plan will align with DLC Testing and Reporting Requirements before beginning any testing using the LM-84 method.

In the case that average chromaticity coordinate data at the ≈1000-hour and ≈6000-hour measurement points are not provided and only chromaticity shift (Δu'v') data is available, the DLC will assume the worst-case shift between these two measurement points. To clarify, the DLC will assume the ≈1000-hour and ≈6000-hour measurement points represent color shifts in opposite directions and will add the two reported chromaticity shift values to ensure that the worst-case shift meets the appropriate color maintenance requirement.

Additionally, to move toward color maintenance reporting based on consensus-based industry-developed standards, Draft 2 proposes to allow optional reporting of CS4 and CS7 values (in hours) per ANSI/IES TM-35-19. These values rely on existing LM-80/LM-84 chromaticity data and are proposed to be reported on the QPL with the listed product. While no thresholds are proposed for SSL V6.0, future SSL Technical Requirement revisions intend to introduce thresholds based on analysis of CS4 and CS7 data collected and will remove the existing color maintenance thresholds described in Option 1 and Option 2 above.

25.3.1.3 Interactions with other DLC Requirements: Color-Tunable Products and Field Adjustable Light Output (FALO) Products

For **color-tunable**Color-Tunable ProductsColor-Tunable Products products and/or **dimmable** and Field Adjustable Light Output (FALO)field adjustable light output (FALO) products, additional clarifications on meeting the SSL V6.0 spectral quality requirements are provided below.

- For color-tunable products, testing and reporting requirements for chromaticity (CCT & D_{uv}), color rendition, and color maintenance are applicable, unless specifically excluded.
- For parent products in a Level 2 application, the tested chromaticity (CCT & D_{uv}) and color rendition at the CCT setting required by the Color-Tunable Testing and Reporting Requirements will be listed on the QPL. D_{uv} will not be reported or listed for child products.
    - Color maintenance will be evaluated for each unique LED within a product that uses separate LM-80 data.

- CCT-tunable and Full Color-Tunable products shall test and report at the minimum, maximum, and mid-point eligible CCT settings.
- CCT-tunable and Full Color-Tunable products are not required to meet the chromaticity requirements in V6.0.

- For dimmable and/or FALO products, testing and reporting requirements for chromaticity (CCT & D_{uv}), color rendition, and color maintenance are applicable and are evaluated at the maximum light output setting. For parent products in a Level 2 application, chromaticity (CCT & D_{uv}) and color rendition will be listed on the QPL under the Tested Data section. For child products, reporting of CCT and all color rendition measures is required, and all information will be listed on the QPL as Reported Data.
- Dimmable/FALO products will not be evaluated for chromaticity (CCT & D_{uv}), color rendition, or color maintenance at dimmed output settings.

25.3.2 Minimum Testing Requirements: DLC Premium Spectral Quality

If a manufacturer seeks qualification of its product(s) to the DLC Premium qualification, it shall provide all the necessary testing to demonstrate that the product(s) meet the Premium qualification's requirements in addition to meeting all Draft 2 Standard requirements.

In the pathways described below, "option" (color rendition or CCT) is used to describe a specific, nominal performance variation in a given set for a product or product family.

- In addition to the test report and implementation requirements for DLC Standard qualification, a full LM-79/color report, per the **Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports** for the maximum color rendition option at the lowest CCT option, shall be provided.
- For example, if a product family consists of two color rendition options (e.g., CRI Ra=80, R9=0 and CRI Ra=90, R9=50) and four CCT options (e.g., 2700 K, 3500 K, 4000 K, and 5000 K), and *all* variations are to be qualified to DLC Premium, a minimum of three LM-79 test reports shall be provided. That is, one test for the highest CCT at the minimum color rendition option, one test for the lowest CCT at the minimum color rendition option, and one test at the lowest CCT for the higher color rendition option.
- Consistent with the Standard qualification requirement, tested color rendition options shall meet either (Option 1) the ANSI/IES TM-30 color rendition requirements or (Option 2) the CIE 13.3-1995 color rendition requirements, as described in **Table 10**, and *both* sets of color rendition measures shall be measured and reported.
- The DLC also requires that testing be conducted on the worst-case efficacy variation, which is likely the combination of lowest CCT and highest color rendition.
- In all cases, testing requirements correspond to technical requirements levels, in addition to product options. For example, if a family includes multiple color rendition options, some of which are eligible for an allowance, and some of which are not, testing would be required at the worst-case (efficacy) color rendition option *that meets the allowance requirement*, for the subgroup of products which want to be granted the allowance, and the minimum color rendition *overall* for the remainder of the group.

25.3.3 Minimum Testing Requirements: LUNA Spectral Quality

In addition to the test report and implementation requirements applicable to DLC Standard and Premium qualifications under SSL V6.0, the spectral quality test reports required to list products under the LUNA V2.0 qualification are as follows.

Within a product family, LUNA products are required to test and report the following:

- For product families that offer **one color rendition option and one or more CCT option(s)**:
    - A full LM-79/color report, per the **Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports**, must be provided at the lowest and highest CCT options offered on LUNA qualifying products.

- For product families that offer **one or more color rendition option(s) and one CCT option**:
    - A full LM-79/color report, per the **Additional Reporting Requirements** for LM-79, LM-80, and TM-21 Reports, must be provided at the minimum color rendition option for the CCT option offered on LUNA qualifying products.

- For product families that offer **one or more color rendition option(s) and one or more CCT option(s)**:
    - A full LM-79/color report, per the **Additional Reporting Requirements** for LM-79, LM-80, and TM-21 Reports, must be provided for the lowest and highest CCT options offered, at the minimum color rendition option offered on LUNA qualifying products.

- For product families that offer one or more Amber LED options:
    - A full LM-79/color report, per the **Additional Reporting Requirements** for LM-79, LM-80, and TM-21 Reports, must be provided for one representative pc-Amber, de-Amber, and filtered-Amber LUNA qualifying product(s), as appropriate.

- All LM-79/color tests for LUNA qualification may be conducted at any light output for at least one optical variation within the family when operating at the maximum (non-dimmed) light output, and if providing TM-33 data, the .xml document based on the LM-79 test data must include both spectral and luminous intensity distribution data, per the **Additional Reporting Requirements** for LM-79, LM-80, and TM-21 Reports.
    - For the product with the highest CCT, the TM-33 .xml document must include both the emitter spectral data and the emitter luminous intensity data for a single tested product, if submitted.
    - For the product with the lowest CCT, the TM-33 .xml document may include only the emitter spectral data without the emitter luminous data for a single tested product, if submitted.

25.3.4 Minimum Testing Requirements: Spectral Quality for Efficacy Allowances

To qualify for efficacy allowances, applications shall include the following additional materials:

- A full LM-79/color report, per the **Additional Reporting Requirements** for LM-79, LM-80, and TM-21 Reports, for the worst-case (efficacy) color rendition option and the minimum color rendition overall of the group that intends to qualify for an efficacy allowance.
    - All color rendition options shall meet the color rendition requirements, and *both* sets of color rendition measures (IES TM-30 and CIE 13.3) shall be measured and reported.
    - All variations of CCT offered shall meet DLC Standard or Premium chromaticity requirements.
- The DLC also requires that testing be conducted on the worst-case efficacy variation, which is likely the combination of the lowest CCT and highest color rendition.
- In all cases, testing requirements correspond to Technical Requirements levels, in addition to product options. For example, if a family includes multiple color rendition options, some of which are eligible for an allowance, and some of which are not, testing would be required at the worst-case (efficacy) color rendition option *that meets the allowance requirement*, for the subgroup of products which want to be granted the allowance, and the minimum color rendition *overall* for the remainder of the group.

25.3.5 Minimum Testing Requirements: DLC Standard Light Output and Distribution

The lighting distribution test reports required to qualify products to the DLC SSL QPL under the Standard classification are described as follows.

- A full LM-79/distribution report, and .ies file, per the **Additional Reporting Requirements** for LM-79, LM-80, and TM-21 Reports shall be provided for each unique distribution pattern in the family, without consideration of the lumen package and the effect of color properties[8], tested at the maximum (non-dimmed) light output.
    - For indoor or outdoor Level 2 applications, products chosen for goniophotometric testing may be at any CCT and any light output.
- Zonal lumen distribution (ZLD), spacing criteria (SC), beam angle (linear replacement and 2G11 base lamps only), and BUG ratings (outdoor products only) will be verified using the .ies files associated with the full LM-79/distribution test reports.
- Reported data, including beam angle (linear replacement and 2G11 base lamps only) and BUG ratings (outdoor products only), shall be reported in the Reported Performance Table tab on the application form.

[8] The color properties, such as CCT and color rendition, of the indoor products within the product family used for the LM-79/distribution test may be of the applicant's choice and the tested configuration may be the same configuration used to meet other Technical Requirements if applicable.

- The DLC review process will use Photometric Toolbox (Lighting Analysts, Inc., version 2.07 or newer) to verify ZLD, SC, beam angle, and BUG ratings (outdoor products only) using the submitted tested .ies file.

Products under the Standard classification seeking efficacy allowances based on meeting the maximum UGR thresholds in **Table 33** shall include the following additional materials:

- A full LM-79/distribution report per the Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports for the products that have the highest total lumen output for each optical variation in the family without consideration of the effect of color properties[9], tested at the maximum (non-dimmed) light output and the .ies file based on the LM-79 test data.
- Indication on the application form which UGR bin the product's Corrected UGR value falls in. The options for the UGR bins on the application form are 10.0-12.9, 13.0-15.9, 16.0-18.9, 19.0-21.9, 22.0-24.9, and 25.0-27.9. If the product has a UGR less than 10.0, it will fall in the 10.0-12.9 bin.
- Qualification for UGR efficacy allowances is verified by the application reviewer using the Corrected UGR table in Photometric Toolbox (Lighting Analysts, Inc., version 2.07 or newer) generated from the submitted tested .ies file. If the values in the UGR table for the glare evaluation reference condition (room dimension: X = 4H, Y = 8H; spacing to height ratio: 1; reflectances: 70/50/20%) meet the requirements in Table 33, both viewed endwise and crosswise, the product, or family of products in the case of Level 2 applications, qualifies for the efficacy allowance.

25.3.6 Minimum Testing Requirements: DLC Premium Light Output and Distribution

The lighting distribution and discomfort glare test reports required to qualify products under the Premium qualification are described as follows:

For all eligible products:

- A full LM-79/distribution report per the **Additional Reporting Requirements** for LM-79, LM-80, and TM-21 Reports for each optical variation within the family without consideration of lumen package and the effect of color properties[2], tested at the maximum (non-dimmed) light output and the .ies file based on the LM-79 test data.
- ZLD, SC, UGR, and BUG ratings (outdoor products only) will be verified using the .ies files associated with the full LM-79/distribution test report.
- Reported data, including BUG ratings (outdoor products only), shall be reported on the application form.
- DLC reviewers will use Photometric Toolbox (Lighting Analysts, Inc., version 2.07 or newer) to verify ZLD, SC, UGR (Premium and Efficacy Allowance pursuance), beam angle and BUG ratings (outdoor products only) using the submitted tested .ies file.

[9] The color properties, such as CCT and CRI, of the product within the product family used for the LM-79/distribution test may be of the applicant's choice.

25.3.6.1 Discomfort Glare: DLC Premium

The Premium discomfort glare requirements are only applicable to Troffer products within the eligible luminaire and retrofit General Applications. Submitted applications shall include the following additional materials:

- A full LM-79/distribution report per the **Additional Reporting Requirements** for LM-79, LM-80, and TM-21 Reports for the products that have the highest total lumen output for each optical variation in the family without consideration of the effect of color properties[10], tested at the maximum (non-dimmed) light output and the .ies file based on the LM-79 test data.
- Indication on the application form which UGR bin the product's Corrected UGR value falls in. The options for the UGR bins on the application form are 10.0-12.9, 13.0-15.9, 16.0-18.9, 19.0-21.9, 22.0-24.9, and 25.0-27.9. If the product has a UGR less than 10.0, it will fall in the 10.0-12.9 bin.

  Qualification for Premium is verified by the application reviewer using the Corrected UGR table in Photometric Toolbox (Lighting Analysts, Inc., version 2.07 or newer) generated from the submitted tested .ies file. If the values in the UGR table for the glare evaluation reference condition (room dimension: X = 4H, Y = 8H; spacing to height ratio: 1; reflectances: 70/50/20%) meet the requirements in **Table 26**, both viewed endwise and crosswise, the product, or family of products in the case of Level 2 applications, qualifies for the DLC Premium qualification.

25.3.7 Minimum Testing Requirements: LUNA Light Output and Distribution

The lighting intensity distribution test reports required to list products under the LUNA qualification are as follows:

- A full IES/ANSI LM-79/distribution report in PDF format, per the **Additional Reporting Requirements** for LM-79, LM-80, and TM-21 Reports, for the products that have the highest total lumen output for each optical variation across the LUNA family members with the highest qualifying CCT (e.g., 3000K) tested at the maximum (non-dimmed) light output.
- An .ies file, and optionally, an ANSI/IES TM-33-18 or -23 .xml document, both based on the LM-79 test data, must be submitted along with the PDF distribution report.
- Product image(s) of the tested product showing the optics and shields, if applicable, must be included in the PDF distribution report. Product image(s) may be of the tested product on the bench, not in the measuring equipment. Images will be used by reviewers to understand the product being tested and will not be published on the QPL.
- For tested products, threshold U Ratings from the BUG Ratings will be verified using the .ies files associated with the full LM-79/distribution test report.
- For all products where LM-79/distribution reports are not required, reported data, including BUG ratings, must be reported in the reported values on the application form.

[10] The color properties, such as CCT and CRI, of the product within the product family used for the LM-79/distribution test may be of the applicant's choice.

- The DLC review process will analyze the submitted .ies files using Photometric Toolbox (Lighting Analysts, Inc., version 2.07 or newer) to verify BUG Ratings and house-side or street-side lumens (for products pursuing shielding efficacy allowances) using the submitted tested photometric files.
- The DLC review process will evaluate drawings and text information on the submitted specification sheets and installation instructions to verify that the qualified mounting bracket does not allow a tilt angle greater than 10 degrees. For products with permitted mounting options or accessories, the mounting bracket and related maximum tilt angle must be graphically shown on either the specification sheet or installation instructions (see **Figure 1**).
- To attain LUNA qualification, listed pole/arm-mounted area/roadway/decorative PUD products must offer at least one specifiable shielding option or accessory on the product specification sheet or supplemental documentation. The shields may be external to the luminaire or internal to the glass or optic. DLC reviewers will evaluate submitted documentation to ensure that a shield option or accessory is available.

25.3.8 Minimum Testing Requirements: Discomfort Glare Efficacy Allowances

To qualify for the efficacy allowances, applications shall include the following additional materials:

- A full LM-79/distribution report per the **Additional Reporting Requirements** for LM-79, LM-80, and TM-21 Reports for the products that have the highest total lumen output for each optical variation within the family without consideration of the effect of color properties[11], tested at the maximum (non-dimmed) light output and the .ies file based on the LM-79 test data.
- Indication on the application form which UGR bin the product's Corrected UGR value falls in. The options for UGR bins on the application form are 10.0-12.9, 13.0-15.9, 16.0-18.9, and 19.0-21.9. If the product has a UGR less than 10.0, it will fall in the 10.0-12.9 bin.

The product's qualification for efficacy allowances is verified by the application reviewer using the corrected UGR table generated in Photometric Toolbox (Lighting Analysts, Inc. version 2.07 or newer) from the submitted tested .ies file. If the values in the UGR table for the glare evaluation reference condition (room dimension: X = 4H, Y = 8H; spacing to height ratio: 1; reflectances: 70/50/20%) meet the requirements endwise and crosswise, the product qualifies for the allowances. In the case of a Level 2 application, all products of the same optical variations as the submitted luminaires within the family automatically qualify for the allowances.

25.3.9 Minimum Testing Requirements: LUNA Shielding Efficacy Allowances

Manufacturers that choose to list LUNA qualified products with shields must test their products with shields as described below.

- Shields that are offered as options must have the shield indicated in the luminaire catalog/ordering code number and will be shown on the QPL as such.

[11] The color properties, such as CCT and CRI, of the product within the product family used for the LM-79/distribution test may be of the applicant's choice and the tested configuration may be the same configuration used to meet other Technical Requirements if applicable.

- Shields that are offered as accessories must have the accessory listed in the luminaire catalog/ordering code number and will be displayed on the QPL in parentheses (e.g., "ABC-100W-30K80CRI-HA (with accessory HSS-Black)", where HA is the nomenclature/ordering code for a horizontal arm, and HSS-Black is the nomenclature/ordering code for this shield accessory).
    - QPL performance and testing required on products with accessories included with the model number in the application will be treated as though the accessory is an option within the model number (i.e., performance will reflect product performance with accessory attached, worst-case testing will include products with accessory attached, etc.).

If a manufacturer offers more than one configuration of a specific shield type (HSS, CSS, and FSS), the variety of configurations under each shield type is treated as a shield type subgroup within the product family (e.g., an HSS subgroup could include internal and external HSS, or an HSS subgroup could include a Type II HSS with a 30-degree shielding angle[12] and a Type II HSS shield with a 45-degree shielding angle). Each shielding option configuration will be listed as a separate reported family member, with the effect on the distribution and light output of the luminaire documented. If products are available with multiple shield colors, the shield color and/or finish must be specified in the model number, cannot be listed as a wildcard option in the listing, and cannot be combined, because lighter color shields will potentially reflect more light to the sky dome and not meet the required U Rating threshold for that PUD. An example of a hypothetical shield subgroup is shown in **Table 39**.

In all cases, the testing to achieve an efficacy allowance for shielding is in addition to other testing specified in these technical requirements unless specific provisions are made. Shielded products must meet all other SSL V6.0 and LUNA V2.0 requirements and are offered efficacy allowances as long as zonal lumens are reduced by the amount specified in **Table 34**: Efficacy Allowances Specific to LUNA Products. For example, if a family includes model numbers with house-side shielding accessories or options, of which some meet the efficacy requirement with an allowance and some do not, testing would be required for 1) the worst-case-efficacy house-side shielded product that meets the allowance requirement, and 2) for the product with the lowest house-side lumen reduction as a function of the shield. Shielded products that have efficacies better than the worst-case shielded products, or the lowest house-side lumen reduction, can be child products. Submitters must supply the reported performance for their shielded and unshielded products. The allowance would apply to the specific subgroup of products using the given shield (e.g., HSS or CSS). Shield types may not be combined to create a larger subgroup. In other words, cul-de-sac shields and house-side shields may not be combined to create one subgroup.

Table 39 provides an example of a luminaire family with various HSS and FSS options. The worst-case efficacy parent in each subgroup (HSS or FSS) is the product that results in the lowest efficacy, assuming that all HSS or FSS products in the subgroup meet the specified requirements (i.e., reduce the house-side lumens by at least 50% compared to the unshielded equivalent product, and all FSS products reduce the street-side lumens by at least 30% compared to the unshielded equivalent product). The worst-case

[12] Shielding angle is defined in ANSI/IES LS-1-20 as "the angle between a horizontal line through the light center and the line of sight at which the bare source first becomes visible."

distribution parent in each subgroup is the product that reduces the house-side or street-side lumens the least.

Table 39: Example of hypothetical shielded products and identified worst-case efficacy and distribution Parents for one luminaire family with two shield type subgroups (HSS and FSS)

Family name	Optic	Luminaire efficacy w/o shielding (lm/W)	House-side *(or street-side)* lumens w/o shield	Shield type	Shielding angle	Shield type subgroup	Luminaire efficacy with shield (lm/W)	House-side *(or street-side)* lumens with shield	House-/ Street-side reduction	Test required
AXBXC	Type II	125	3000	HSS	30	A	85	1400	53%	LM-79/ color
AXBXC	Type II	125	3000	HSS	45	A	88	1200	60%	
AXBXC	Type III	125	3500	HSS	30	A	87	1700	51%	LM-79/ distribution
AXBXC	Type III	125	3500	HSS	45	A	89	1500	57%	
AXBXC	Type II	125	10000	FSS	30	B	88	6500	32%	LM-79/ color
AXBXC	Type II	125	10000	FSS	45	B	90	5000	47%	
AXBXC	Type III	125	9500	FSS	30	B	89	7000	30%	LM-79/ distribution
AXBXC	Type III	125	9500	FSS	45	B	91	6000	40%	

Note: Worst-case-efficacy parent for each shield type subgroup is shown in yellow. LM-79 color testing is required for the least efficacious shielded luminaire in shield type subgroup A (HSS), and the least efficacious shielded luminaire in shield type subgroup B (FSS) – rows 1 and 5. Worst-case distribution parent in each shield type subgroup is shown in blue. LM-79 distribution testing is required for luminaires with the lowest reduction in house-side or street-side lumens.

To determine if the shielding efficacy allowance may be granted, applicants must submit an .ies file of the equivalent unshielded product with the same optical distribution and nominal light output as the submitted shielded worst-case efficacy parent. To confirm the shielding allowance, the .ies file associated with the unshielded product does not need to use absolute photometry (scaled photometry is acceptable).

25.3.10 Minimum Testing Requirements: Power Quality

Qualifying products must meet the requirements for power quality 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. 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.

Our 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 277 V, while photometrics (specifically efficacy) are commonly worst case at 120 V. 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 347 V and/or 480 V 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, 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).

25.3.11 Minimum Testing Requirements: CCT-Tunable, Full Color-Tunable, and FACT Products

The testing for CCT-Tunable, Full Color-Tunable, and FACT products must be provided to cover all areas of investigation as with non-color tuning family groups, plus additional testing across the color-tunable range for the least efficacious product.

Based on consideration of the entire color input signal range for all members of the product family, the product family member with the lowest efficacy of any product-and-color-control-setting combination in the group shall provide full LM-79/color reports for all metrics other than distribution at the following test points:

- The **minimum CCT input control** setting
- The **maximum CCT input control** setting
- One **intermediate point**:
    - For products with continuously variable input signals and those with input signals offering an odd number of discrete settings, the mid-point between the minimum and maximum CCT input signals or the middle setting
    - For input signals with an even number of discrete settings, the lower of the two middle CCT input settings
- Where none of the above tests result in the lowest efficacy condition, the **least efficacious** setting shall be LM-79/color tested.

If none of these test points represent the product in the family with the 1) the minimum lumen output product-color-control-setting combination, 2) the minimum nominal CCT output, 3) the maximum nominal CCT output, 4) the minimum CRI, 5) the highest power consumption and 6) the worst power quality, then additional LM-79 testing shall be performed for whichever product-and-color-control setting combination within the group performs at the worst-case family-wide for:

- Full LM-79/distribution report(s) (goniophotometric testing) for a representative product for each optical variation within the group.
- A test of the product at the color control setting that produces the lowest lumen output within the group
- Where the minimum CCT is at least 100 K less than the CCT produced at the minimum CCT input control setting, a test of a product at the **minimum CCT**
- Where the maximum CCT is at least 200 K greater than the CCT produced at the maximum CCT input control setting, a test of a product at the **maximum CCT**
- A test of a product at the **minimum CRI**
- A test of the product at the highest power consumption setting
- Where none of the above tests result in the worst-case Power Quality, applicant shall submit bench data documenting with the worst Power Quality (Power Factor and THDi)

Manufacturers must report the power consumption for each ANSI/NEMA C78.377-2024 CCT quadrangle from the minimum CCT to the maximum CCT, and for one reported CCT that falls between these upper and lower limits. If discrete input control settings do not allow the product to provide light within the CCT range of a particular bin, manufacturers must provide the CCT and power consumption of the closest CCT to that range. If input control settings allow for more than one setting within an ANSI quadrangle, only the data for the setting that produces the actual CCT closest to the nominal CCT center point for the bin per the ANSI standard shall be provided. The data should be provided in the format of

Table 40. The DLC will accept the following sources for self-reported/rated performance data.

- **In-house laboratory test**: In-house test reports from tests conducted in accordance with ANSI/IES LM-79
- **Calculated Scaling:** Provide mathematical characterization of luminaire performance based on manufacturer-developed scaling methodology. The manufacturer must provide a description of the scaling methodology employed and the technical basis for its validity. The DLC reserves the right to accept or reject the methodology for use in qualifying products.

Table 40: Data Reporting Format for FACT, CCT-tunable and Full Color-Tunable Product Submissions

ANSI CCT Quadrangle (omit any outside product range) / Worst-Case Value	Measured CCT (K)	Power Consumption (W)	Lumen Output (lm)	Input Control Signal Applied
1800 K				
2000 K				
2200 K				
2500 K				
2700 K				
3000 K				
3500 K				
4000 K				
4500 K				
5000 K				
5700 K				
6500 K				
Lowest Efficacy				
Maximum Power				

25.3.11.1 Guidance for "Input Control Signal Applied" Field in Table 40

Applicants should use the following guidance when completing the “Input Control Signal Applied” field for Color-Tunable Products. The values shown should be specific to how the luminaire responds to the control signal, not varying for a single luminaire depending on the control hardware or software used.

0 – 10 V control systems should provide an actual DC voltage value, shown to the tenth of a volt.

DALI color control using DALI 209 should provide a value from 0 to 254. Other DALI color control schemes not based around values from 0 to 254 should follow the guidelines for proprietary signals below.

All other control protocols for color tuning, including those that use proprietary control signals, should provide a percentage value from 0% to 100%. The percentage, from 0 to 100, should represent control signal applied from lowest CCT to highest CCT, rounded to the nearest percentage. Please note this percent should not be the % of CCT range from lowest CCT to highest CCT; rather, it should reflect the control signal applied. DLC is not looking for values that simply show that 3500 K is numerically 25% of the way from 3000 K to 5000 K but wants to document how manufacturers have chosen to translate the CCT range.

The values shown should encompass the full CCT range of the product. If the maximum CCT or minimum CCT point varies for a given product depending on the control signal used, values provided in the table

should include the highest maximum CCT and the lowest minimum CCT, even if different control signals are required to achieve the two.

25.3.12 Minimum Testing Requirements: Warm-Dimming Products

Warm-Dimming product submittals must include a single full LM-79/color report performed at the **maximum setting of the dimming input control**.

Other testing reports are required as per existing DLC policies for lumen maintenance and in-situ temperature measurement, etc.

Manufacturers can provide in-house testing on driver characteristics and zonal lumen output or other testing that might be necessary to support the designation of a least-efficacious or highest power-consumption control setting.

The Level 2 Testing Requirements apply to Warm-Dimming products in the same manner as with non-color tuning products.

25.3.13 Minimum Testing Requirements: Modular Products

The DLC requires specific testing and reporting to qualify modular products with external power supplies. The DLC lists modular products with external power supplies by unit, with unit-level performance data for light output characteristics. To obtain data that is accurate to all relevant metrics for an individual module and appropriately-construct the system, the DLC requires testing conducted as follows:

- Each individually unique module should be tested alone using the goniophotometer method according to LM-79 for light output and light distribution measurements. From this testing, the DLC will obtain the light output and light distribution (zonal lumen density) information.
- Additionally, the worst-case system configuration should be tested (using either the integrating sphere-spectroradiometer method or gonio-spectroradiometer method in accordance with LM-79) for the other necessary metrics: efficacy, color, power quality, etc. This may involve multiple photometric measurements to appropriately measure the total light output of the system for efficacy calculations, along with the electrical measurements for the system as a whole. The DLC will use the measurements on this system to evaluate compliance with the DLC requirements and determined listed test performance information for these metrics.
    - The worst-case system will be the configuration in the submitted product line that would result in the lowest efficacy – typically at the worst (smallest) loading conditions for a given power supply/driver – that would meet the DLC requirements.

26 Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports

26.1 Rationale for Update

The DLC introduced the following requirements as part of SSL V5.1 that require complete information to be included in LM-79 test reports (information that may not have been required in the past). SSL V6.0 includes the latest industry standards, such as the ANSI/IES LM-79-24 standard in addition to the requirements introduced as part of V5.1. To move away from deprecated test standards, Draft 2 also proposes to no longer accept test reports tested to IES LM-79-08.

Additionally, to support the adoption of the latest industry reporting standards, SSL V6.0 Draft 2 proposes to include additional reporting pathways for the digital format of LM-80 report results in accordance with ANSI/IES TM-41-24, along with a PDF of the LM-80 report. This includes maintaining the compliance requirements related to TM-21 and its Addendum B to address concerns around projected lumen maintenance claims and current DLC provisions.

This section specifies additional reporting requirements for all submitted LM-79, LM-80, and TM-21 reports for all Categories, General Applications, and Primary Use Designations. Test reports that do not comply will not be accepted.

26.2 Changes in SSL V6.0

Changes from SSL V5.1

- Accept LM-79 reports tested to 2019 and 2024 versions of the standard and no longer accept test reports tested to IES LM-79-08 for newly qualifying V6.0 products
- Require all LM-79 test reports (color and distribution) to be submitted in PDF format
- Require an image of the tested product in submitted LM-79 test reports
- Accept LM-80 report results in accordance with ANSI/IES TM-41-24

Changes from Draft 1 to Draft 2

- “Optics” language updated to “luminous aperture”

26.3 ANSI/IES LM-79 (–19 and -24 versions)

SSL Level 1 products and Level 2 products shall be tested according to the guidelines in specified ANSI/IES Lighting Measurement (LM) documents. Test reports generated by a test lab that complies with the DLC LM-79 Testing Requirements will be accepted only if all optical and electrical performance are tested and documented as described below. ANSI/IES LM-79-19 and -24 versions will be accepted. All tests shall be conducted at the full output or non-dimmed state.

All submitted photometric test reports must comply with the full LM-79/color report or full LM-79/distribution report definitions below. Configurations tested to produce full LM-79/color reports and full LM-79/distribution reports will be listed as parent products on the QPL with the tested performance data based on the QPL listing information in each applicable section. If a full LM-79/color report and full LM-79/distribution report are provided on the same configuration, the tested performance listed on the QPL will be the lowest efficacy data set.

Test reports that require color performance information (generally expected to be from testing in an integrating sphere, though gonio-spectroradiometer testing is also acceptable) do not require distribution performance information. These color-specific test reports are generally referred to within this V6.0 policy as **"full LM-79/color reports"** and shall be in PDF format and include, but are not limited to:

- Image of the tested product including the luminous aperture (benchtop photo is acceptable)
- Electrical characteristics (Wattage, Input Voltage, THD, and PF)
- Total luminous flux
- Efficacy
- Chromaticity ((x,y) and (u',v'))
- CCT and D_{uv}
- ANSI/IES TM-30-18 or ANSI/IES TM-30-24 Full Report (per Annex D, Figure D-3)
- CIE 13.3-1995 complete Color Rendering Index Detail
- Accompanying ANSI/IES TM-27 .spdx files document (IES TM-27-14 or ANSI/IES TM-27-20) with spectral power distribution data from 380-780 nm in ≤5nm increments
    - The product model number shall be present and matched in both the TM-27 and LM-79 documents.
- (Optional for LUNA V2.0) A TM-33 (ANSI/IES TM-33-18 or -23) .xml document meeting the following requirements:
    - Test report number, test lab, report date, manufacturer, luminaire catalog number, description are correctly and pertinently indicated using the header elements <ReportNumber>, <Laboratory>, <ReportDate>, <Manufacturer>, <CatalogNumber> and <Description>, respectively.
    - The Luminaire Dimension Elements (4.3.1) indicate the housing dimensions, and Number of Emitters are required. DLC reviewers will verify the luminaire dimensions in the TM-33 .xml document against the luminaire physical dimensions that are provided either in the specification sheet, LM-79 test report, or as separate application submission materials.
    - Emitter elements (4.5) must include all required elements from Table 10 in ANSI/IES TM-33-18 or -23.
    - o Emitter spectral data with absolute luminaire-level spectral power distribution data from 380-780 nm in ≤5 nm increments.

  - For the spectral subgrouping parent with the highest CCT and highest lumen output, the TM-33 .xml document must either 1) include both the emitter spectral data and the emitter luminous intensity data for a single tested product, or 2) provide emitter spectral and emitter luminous intensity data for a single tested product in separate TM-33 .xml documents.
  - For the products with the lowest CCT and highest lumen output, the TM-33 .xml document may include only the emitter spectral data without the emitter luminous data for a single tested product.
  - The DLC recommends inclusion of additional, optional TM-30 elements that describe color quality attributes, such as Color Correlated Temperature and Color Rendering, but they are not required at this time.
- Required TM-27 files and optional TM-33 documents must report spectral data in wavelength increments of ≤5 nm.
- The product catalog number must be present and matched in all relevant TM-27/TM-33/LM-63 and LM-79 documents.
- All information listed above, except the accompanying .spdx and/or TM-33 .xml document, must be included in a single LM-79/color test report.

All information listed above, except the accompanying ANSI/IES TM-27 .spdx files or ANSI/IES TM-33 .xml documents, shall be included in a single LM-79 test report. Separate ANSI/IES TM-30-18 or -24 reports will not be accepted.

Test reports that require distribution performance information (generally expected to be from testing with a goniophotometer) do not require color performance information. These distribution-specific test reports are generally referred to within this V6.0 policy as **"full LM-79/distribution reports"** and shall be in PDF format and include, but are not limited to:

- Image of the tested product including the luminous aperture (benchtop photo is acceptable)
- Electrical characteristics (Wattage and input voltage)
- Luminous intensity distribution (Candela array)
- Accompanying .ies file (IES LM-63 R2008 or ANSI/IES LM-63-19) meeting the following requirements:
  - Test report number, test lab, issue date, manufacturer, and luminaire catalog number are correctly and pertinently indicated using the keywords [TEST], [TESTLAB], [ISSUEDATE], [MANUFAC], and [LUMCAT], respectively.
  - Scaled .ies files are not allowed. The multiplier field in IES LM-63-02 R2008 files shall only be 1.0, i.e., the candela values shall be from an actual goniophotometer test, and scaled values are not permitted.
  - For manufacturers submitting an ANSI/IES LM-63-19 .ies file, products must be tested and reported using absolute photometry methods per ANSI/IES LM-63-19, not scaled photometry, and must include a [FILEGENINFO] keyword with information about the File Generation Type and the File Generation Type Value 1.10000 or 1.11000, per ANSI/IES LM-63-19 Table 2.

- The luminous intensity data shall be presented using Type C photometry format, except for products in the Primary Use Designations of Flood and Spot Luminaires, which may use the Type B photometry format.
- The luminous dimensions shall appropriately reflect the luminous opening of the luminaire. See next section, “Additional Guidance on Luminous Dimensions,” for additional detailed guidelines. In no circumstances shall the luminous dimensions be zero or exceed the luminaire’s physical dimensions, and DLC reviewers will verify the luminous dimensions in the .ies file against the luminaire physical dimensions that are provided either in the specification sheet, LM-79 test report, or as separate application submission materials.
- The angular resolution for the luminous intensity distribution data shall comply with the scanning resolution specified in LM-79 (Section 7.3.3 in ANSI/IES LM-79-19 and ANSI/IES LM-79-24) and be fine enough to accurately characterize the product’s intensity distribution. For products with a wide-angle, smooth intensity distribution, the luminous intensity distribution data shall be in a resolution of 5 degrees or less in the vertical plane and 22.5 degrees or less in horizontal planes. A smaller vertical angular increment must be used for products whose luminous intensity changes rapidly as a function of angle.

- (Optional for LUNA V2.0) A TM-33 (ANSI/IES TM-33-18) .xml document meeting the following minimum requirements:
  - Alongside other TM-33 required elements, test report number, test lab, report date, manufacturer, luminaire catalog number, and description are correctly and pertinently indicated using the header elements <ReportNumber>, <Laboratory>, <ReportDate>, <Manufacturer>, <CatalogNumber>, and <Description>, respectively.
  - The Luminaire Dimension Elements (4.3.1) indicating the housing dimensions and Number of Emitters are required. DLC reviewers will verify the luminaire dimensions in the TM-33 .xml document against the luminaire physical dimensions that are provided either in the specification sheet, LM-79 test report, or as separate application submission materials.
  - Emitter elements (4.5) must include all required elements from Table 10 in TM-33-18.
  - The Intensity Scaling Element (4.5.13.2.4.1) must be ‘false’, meaning that the reported intensity data has not been scaled uniformly with respect to laboratory measurements.
  - The luminous intensity distribution must be presented as emitter luminous intensity data.
  - If a given parent product or single product with a unique optic and the highest lumen output has been tested to meet both the spectral and distribution requirements, a TM33 .xml document must be submitted with both spectral and luminous intensity data or provide emitter spectral and emitter luminous intensity data for a single tested product in separate TM-33 .xml documents. The emission area elements (4.5.23) must appropriately reflect the luminous opening of the luminaire. In no circumstances should the emission areas be zero or exceed the luminaire’s housing dimensions.
  - The angular resolution for the emitter luminous intensity data in the TM-33 .xml document must comply with the scanning resolution specified in LM-79 (Section 7.3.3 in ANSI/IES LM-79-19 and ANSI/IES LM-79-24) and be fine enough to accurately characterize the product’s intensity distribution. For products with a wide-angle, smooth intensity distribution, the luminous intensity distribution data must be in a resolution of 5 degrees or less in the vertical plane and 22.5 degrees or less in horizontal planes. A smaller vertical angular

increment must be used for products whose luminous intensity changes rapidly as a function of angle.

- The DLC will allow submitters to use the symmetry rules for horizontal angles from ANSI/IES LM-63 to represent their luminous intensity distribution data in the .xml document.

Test reports containing only a partial set of LM-79 metrics (for example, an integrating sphere test report without luminous flux reported), will not be accepted for application review purposes. For clarity, even if a test is needed for purposes of verifying chromaticity, it must be a full LM-79/color report as described herein, with all required metrics reported.

- Indoor luminaires with uplight and downlight distributions may be tested such that the uplight and downlight components are measured separately in the goniophotometer, if the goniophotometer mounting structure occludes the uplight or downlight distribution during testing. In the case of separate measurements:
  - The distributions shall then be combined to produce the full LM-79/distribution report, including the .ies file. The data from this .ies file will not be displayed on the QPL.
    - An [OTHER] keyword shall be added to the .ies file header as follows:
    - [OTHER] This photometric file contains combined distribution data from separate measurements.

The DLC reserves the right to request additional information about the separate measurements, and manufacturers should be prepared to provide documentation to address concerns.

26.3.1 Additional Guidance on Luminous Dimensions for UGR Calculations

Per IES LM-63-02 (R2008), "[The luminous dimensions] refer to the luminous (that is, light emitting) opening of the luminaire, not its physical dimensions. They are meant to approximate the luminous opening (either as a luminous area or luminous volume) for lighting calculations. It is assumed that there is only one luminous opening in each IESNA LM-63-2002 data file. Modern SSL luminaires may have more than one luminous opening, and regardless of the number of luminous openings, the width, length and height fields in the .ies file must use one of the luminous shapes available in IES LM-63 to describe the smallest geometry that completely encompasses all of the light emitting surfaces of the product. For example, for a troffer with a luminous basket, the length, width, and height of the entire luminaire must be represented as a rectangle with luminous sides or a rectangle, per Annex D in IES LM-63-02 (R2008). **Figure 3** and **Figure 4** show examples of luminous shapes for luminaires in each General Application.

Figure 3: *Isometric view of a troffer with luminous basket and non-luminous panels on each side. The luminous shape would have the width, length, and height of the rectangle or rectangle with luminous sides encompassing the entire luminaire.*

Figure 4: *Isometric view of a troffer with a luminous basket and luminous panels on each side. The luminous shape would be represented by a rectangle or rectangle with luminous sides encompassing the entire luminaire.*

26.3.2 Additional Reporting Guidelines: Photometric Software in Application Review

During the application review process, DLC reviewers will use Photometric Toolbox (Lighting Analysts, Inc, version 2.07 or newer) to calculate ZLD, SC, BUG ratings (for Outdoor Luminaires only) beam angle and UGR threshold values (for Premium and Efficacy Allowance pursuance for Troffer PUDs) from the tested .ies files.

26.4 IES TM-21-11 and its Addendum B and the Transition to ANSI/IES TM-21-21 and the ANSI/IES TM-21 Calculator

SSL Level 1 products or Level 2 products shall project long-term lumen maintenance according to the guidelines in specified ANSI/IES TM-21-11 documents and current addenda, ANSI/IES TM-21-21, OR current version of the ANSI/IES TM-21 standard. Long term lumen maintenance projections will be

accepted only if fully compliant with TM-21-11 and its Addendum B, ANSI/IES TM-21-21, OR current version of the ANSI/IES TM-21 standard. This includes, but is not limited to, the following:

- Luminous flux data collection and selection (sections 4.3 and 4.4)
- Data used for the curve-fit (section 5.2.3)
- Temperature data interpolation (section 6.0)
- Limit for Extrapolation (section 6.5) or Limit for Projecting Flex Maintenance (section 5.2.7)

The DLC is making an exception to allow uneven interval reporting for TM-21 projections drawing from an LM-80 report initiated prior to March 31, 2015, one year after the introduction of even intervals in Addendum A to TM-21. Otherwise, TM-21 projections not fully compliant with Addendum B revisions, ANSI/IES TM-21-21, OR current version of the ANSI/IES TM-21 standard will not be accepted. A complete and accurate copy of the December 31, 2023 version of the ENERGY STAR TM-21 calculator OR a complete and accurate copy of the ANSI/IES TM-21 Calculator report in both PDF and JSON format is required for submission, and will suffice in meeting the above requirements, unless uneven interval reporting is used for TM-21 projections. In cases where uneven intervals are used, the February 08, 2016 version of the ENERGY STAR TM-21 calculator shall be used. In no case will the DLC allow uneven intervals of <250 hours.

Additionally, under V6.0, the DLC will require LM-80 sets to be sufficient for projecting to the required lumen-maintenance hours via TM-21 rules alone to demonstrate compliance with the L_{70} lumen maintenance requirement. Products with LM-80 sets insufficient to do so will be ineligible for qualification. To clarify, projections shall not extend beyond 6 times the test duration for 20 or more samples (5.5 times for 10 to 19 samples).

- For example, LM-80 sets used to project 50,000 hours are required to demonstrate a test duration of ≥ 8,333.33 hours for 20 or more samples.

In response to ENERGY STAR retiring its TM-21 calculator, the DLC intends to transition away from all pathways requiring ENERGY STAR TM-21 calculators to requiring use of the ANSI/IES TM-21 calculator. ENERGY STAR pathways are still acceptable under SSL V6.0.

27 Policy Clarifications and Updates

As the DLC processes applications for V6.0, as industry standards and definitions are updated, and interacts with stakeholders, it is expected that opportunities for minor corrections, terminology clarifications, and policy interpretations will be revealed. To be as transparent as possible, the V6.0 Policy documents will be updated as needed, and the changes will be tracked on the table below and on the DLC website once SSL V6.0 is finalized and published. **Table 41** shows the corrections or clarifications and where they can be found in the document.

Table 41: V6.0 Technical Requirement Corrections and Clarifications Published as Needed

Date Updated	Subject	Change Type	Description	Affected Page(s)