Solid-State Lighting (SSL) Version 6.0 and LUNA Version 2.0 Technical Requirements

Draft 1

Released for comment April 7, 2025

This draft version of the SSL V6.0 and LUNA V2.0 Technical Requirements document 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. We encourage you to read this draft in its entirety and welcome all feedback.

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Introduction

Solid-State Lighting (SSL) Technical Requirements Version 6.0 (V6.0) is designed to improve the efficacy, quality, and controllability of DesignLights Consortium (DLC) listed high-performance commercial LED lighting products by establishing new and updated performance requirements and reporting criteria for commercial and industrial lighting. The DLC is combining SSL V6.0 and LUNA V2.0 Technical Requirements into one publication with matching timelines. The LUNA V2.0 Technical Requirements are now more closely connected with SSL V6.0 to better support manufacturers seeking to list outdoor products to LUNA.

Minimum efficacy increases are proposed for all DLC qualified product types, resulting in an expected average increase in threshold efficacy of 17%. This increase is representative of both improved product performance across commercial and industrial products and an indication of increasing efficacy trends since the DLC's last efficacy increase in 2020 with SSL V5.0.

Quality of light encompasses the characteristics of lighting that include spectrum, distribution, lumen maintenance, and color maintenance, as well as application considerations like uniformity, controllability, discomfort from glare, light trespass, and light pollution. SSL V6.0 includes new listing pathways for non-white light (NWL) LED products, such as 1800K, 2000K, and amber LED products, to be listed in V6.0 with technology-specific requirements and reporting. Finally, standardized color maintenance reporting per ANSI/IES TM-35-19 is also being proposed as a step toward transitioning away from the custom color maintenance requirements introduced in V5.1

Controllability improvements include expanded lighting controllability requirements and reporting in SSL V6.0 that support additional energy savings while promoting better lighting control for people living and working in the built environment.

LUNA technical requirements promote rigorous performance criteria for specific categories of outdoor lighting so that lighting decision makers can be confident that their selections save energy AND follow best practices for nighttime lighting. LUNA V2.0 proposes to simplify controls reporting by aligning with SSL V6.0 controllability requirements and requiring that LUNA products must meet controls requirements of both SSL V6.0 and LUNA V2.0 to be listed. This includes three new Turtle Lighting PUDs.

To better support test planning and a clearer understanding of the DLC's policy requirements, this publication also includes SSL-specific auxiliary technical requirements policies that were previously standalone documents on the DLC website.

Goals of SSL V6.0 and LUNA V2.0

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.

The following information in **Table 1** is intended to provide readers with a sense of the proposed changes in this draft. Topic sections that have changed will include a rationale explaining the high-level changes. Key questions are added at the end of these sections to obtain feedback from readers. Topic sections that have not changed will indicate that they have not changed. For detailed information, please read the draft in its entirety.

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

Topic Area	Summary of proposed change(s)
Efficacy	• Increase efficacy thresholds for Standard, Premium, and introduce outdoor efficacy thresholds by Primary Use Designation (PUD) rather than using one General Application efficacy threshold for all outdoor products. • Update efficacy allowances against proposed V6 efficacy thresholds to continue to support higher quality performance.
Controllability	• Categorize all SSL QPL listed products by their level of controllability to 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 for field adjustable and controlled products. • Support increased energy savings and installation flexibility by expanding options for field adjustable products. • Enhance baseline controllability requirements by proposing minimum dim percentages and removing stepped dim eligibility for outdoor products.

Topic Area	Summary of proposed change(s)
Quality	• Support responsible outdoor lighting that mitigates light pollution by proposing maximum CCT limits and introducing low CCT and amber product eligibility. • Introduce required reporting of CS4 and CS7 color maintenance values per ANSI/IES TM-35-19 are proposed. • Maximum UGR thresholds are no longer proposed for linear ambient, high-bay and low-bay luminaires and integrated retrofit kits.
New Product Eligibility	New product eligibility has been proposed including: • Solar • Amber LED products that support appropriate illumination in outdoor environments and indoor healthcare, industrial and cleanroom environments. • Low CCTs (1800K, 2000K) • Turtle Lighting products • Segmentation within Linear Ambient • Full Color-Tunable products.
Premium	Premium requirements changes are focused on: • increasing the efficacy levels over Standard listings, • limiting eligibility to specific controls categories, • and requiring digital drivers.
Lumen Maintenance & Driver Lifetime	• Driver lifetime is proposed to become a requirement for all listings (Standard and Premium), rather than just Premium, to ensure lifetime of listed products provides persistent energy savings. • Amber LED product requirements have also been proposed.
Sustainability	• Sustainability certifications are proposed as an option to support the use of sustainable lifecycle practices.
LUNA V2.0	The LUNA V2.0 Technical Requirements include proposals to: • Minimize testing burden • Remove LUNA specific controls requirements and align with V6.0 controls requirements • Allow more product types to qualify 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.

Topic Area	Summary of proposed change(s)

General Improvements for QPL Users and Qualifying Manufacturers	• SSL V6.0, LUNA V2.0, and all SSL-specific standalone policies are being combined to create a single, comprehensive Technical Requirements policy.
	• Required reporting of product features and information useful for identifying the intended end-use of the product is proposed including:
	  ○ Form factor
	  ○ Mounting options
	  ○ Environmental protection
	  ○ Product images
	  ○ Specification sheets
	• A pathway for reporting equivalently performing alternate LEDs and drivers is proposed to better support and address manufacturers' and QPL users' concerns regarding variations of listed products.

Manufacturer and Industry Guidance

The DLC will release Manufacturer and Industry Guidance document(s) with the final SSL V6.0 and LUNA V2.0 policy. This guidance document will provide information on how the Technical Requirements are applied to the application process for qualifying LED lighting products to the SSL QPL. Once available, manufacturers who wish to update their product listings from V5.1 to V6.0 or others interested in how V6.0 Technical Requirements will be implemented should consult this guidance document for information about:

- Submitting applications to be listed under SSL V6.0 and LUNA V2.0
- Required product testing under the SSL V6.0 and LUNA V2.0 Technical Requirements
- An example of typical required testing and reporting for listing a family of products will be provided in the guidance.
- Transition timelines, grace periods, and updating instructions for products qualified under previous versions of the Technical Requirements
- Application fee changes effective with SSL V6.0 and LUNA V2.0 Technical Requirements
- Impacts to application processing timeframes.

Guidance for Energy Efficiency Program Administrators

With the final release of the V6.0 Technical Requirements, program guidance and other resource materials will be made available to energy efficiency programs to provide explanations of new metrics, impacts and benefits to customers and trade allies, and timelines for transitioning to the new requirements.

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 better understanding of terms and nomenclature used throughout the SSL Technical Requirements, the DLC has developed a standalone 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.

Eligibility

Eligible Categories, General Applications, and Primary Use Designations for SSL V6.0 and LUNA V2.0

New or modified Primary Use Designations (PUDs) are shown in bold text in **Table 2**.

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 Floods** • 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 • **Direct Linear 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
12		Mid Output	
13		High Output	
14		Very High Output	• Retrofit Kits for Outdoor Zero-Uplight Wall-Mounted Area Luminaires • Retrofit Kits for Parking Garage Luminaires • Retrofit Kits for Fuel Pump Canopy Luminaires
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	**Outdoor Solar 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)
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)

#	Category	General Application	Primary Use Designation (PUD)
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	Four Pin-Base Replacement Lamps for CFLs	Vertically Mounted Lamps	• Replacement Lamps ("Plug and Play") (UL Type A)
33		Horizontally Mounted Lamps	
34		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. Luminaires using “Specialty: _____” as the Primary Use Designation are not eligible for DLC Premium qualification.
2. Retrofit Kits, 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 section for more detailed information.
3. Turtle Lighting PUDs must meet both SSL V6.0 and LUNA V2.0 requirements and are only listed when qualified with both sets of requirements.
4. For further guidance on qualifying products in the Outdoor Solar Luminaire category, please refer to the Outdoor Solar Luminaire Section.

Additional Guidance for the "Specialty" Primary Use Designation

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

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

The DLC will utilize a number of principles in evaluating products submitted with this designation, including the following:

1. Products with a Specialty designation 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 with a Specialty designation must meet the minimum performance requirements of the broader category under which they are designated.
3. Products with a Specialty designation must report distribution data but are not required to meet specific distribution criteria.
4. Products with a Specialty designation must specify the end-use for which they are intended. For example, products that are intended to be used for canopy lighting that seek qualification under the Specialty designation must indicate on the application form that their intended use is "Specialty: Canopy Lighting". DLC staff will monitor terminology and may make minor modifications to descriptor terms to ensure consistency (for example, "Specialty: Canopy Lighting vs. "Specialty: Canopy Luminaire"). Changes to descriptor terms will be made in consultation with the applicant.
5. As part of the evaluation for any new Specialty designation, the DLC will make a determination on what dimming requirements will apply to that designation. Additional detail on the application and market for the end-use may be requested of the applicant to assist in making this determination.
6. The DLC retains the right to deny access to 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.
7. Products seeking qualification on the QPL and identifying as suitable for Hazardous Locations using the Specialty designations must provide documentation to demonstrate the appropriateness of their products for Hazardous Locations. The documentation must explicitly state that the model numbers in question are certified to the UL844 standard and include the Class and Division to which the products are certified. In situations where questions arise, the DLC will require that the documentation from the applicable safety organization clearly indicate both the model numbers in question, and the certification to the UL 844 standard.

Proposed Updates and Additions to PUDs and Rationale

Converted Specialty PUDs

The “Specialty” designation was created to allow uncommon product types to obtain DLC qualification. Specialty products must meet the same performance requirements as their corresponding regular PUD (with the exclusion of light distribution thresholds), but DLC Member programs have expressed confusion around incentive eligibility for Specialty products. This draft proposes that select Specialty PUDs be converted to regular PUDs in cases where the DLC has recorded a significant and sustained volume of applications with the intent of providing sufficiently common products with clear incentive pathways. SSL V6.0 proposes the conversion of five specialty PUDs to regular PUDs. Distribution thresholds for converted specialty PUDs will be proposed in Draft 2.

- **Sports Floods:** 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 for indoor high ceiling spaces (intended for ceilings ≥25') subject to harsh conditions (e.g., extreme temperatures, vibrations, volatile substances, etc.).
- **Hazardous Environment Area Luminaires:** Luminaires intended for non-directional outdoor illumination of general spaces subject to harsh conditions (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') subject to harsh conditions (e.g., extreme temperatures, vibrations, volatile substances, etc.).

Delineated Linear Ambient PUDs

SSL V6.0 differentiates strip lighting from other linear ambient products and adds a new eligibility pathway for cove lighting products. Distribution types are based on the CIE Luminaire Classification System.

- **(New PUD) Direct Linear Strip 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, direct-indirect or general diffuse, depending on intended lighting distribution. Utilitarian "strip" style fixtures are eligible under this category. Products listed in the Direct Linear Ambient Luminaire PUD or intended for cove lighting 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 listed in the Direct Linear Strip Luminaire PUD are not eligible under this category. Products intended for cove lighting 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 listed in the Direct Linear Strip Luminaire PUD are not eligible under this category. Products intended for cove lighting are eligible under this category.

Other proposed product types

The DLC is seeking feedback on several proposals as we consider including additional lamp types and downlights in V6.0, to support energy efficiency programs. Incentives are being provided by energy efficiency programs and are likely to continue to be provided for LED replacement lamps, including omnidirectional and directional lamps previously covered by ENERGY STAR®. Energy efficiency programs are also offering incentives for medium screw-base replacement lamps for HID, which causes some confusion that the DLC already has PUDs for these product types, which is not accurate.

Finally, the DLC is considering creating PUDs for downlights and integral downlight retrofit kits. While these products are currently covered by ENERGY STAR, the DLC is considering a plan to maintain technical requirements and product lists as a contingency for changes in agency focus.

Multiple DLC members support the DLC creating PUDs for these product types.

Products currently or previously covered by ENERGY STAR®

The DLC is considering creating PUDs for medium screw-base lamps formerly covered by ENERGY STAR and downlights and downlight retrofit kits currently covered by ENERGY STAR. For SSL V6.0 Draft 1, the DLC is querying interest from stakeholders in creating PUDs for these products. We propose that:

- The DLC would adopt all product-specific ENERGY STAR metrics and test methods
- The DLC would adopt ENERGY STAR thresholds for metrics that exceed, or are not addressed by DLC thresholds
- The DLC would update ENERGY STAR thresholds as needed (e.g., efficacy, etc.)
- The relevant DLC metrics and thresholds that did not apply under ENERGY STAR would apply to the PUDs (e.g., warranty and lumen maintenance, etc.)

The DLC is considering creating PUDs for commercial integral downlight products currently covered by ENERGY STAR's Downlights Specification Version 1.0, which covers downlights and downlight retrofit kits. Commercial integral LED downlights and direct-wired- or quick-connect- integral retrofit kits would be included. Downlights with screw-base sockets and screw-base retrofit kits would not be eligible in DLC's specification.

The DLC is considering creating PUDs for medium screw-base (E26) omnidirectional and directional lamps formerly covered by ENERGY STAR.

The following lamp shapes and sizes are being considered for coverage by DLC:

- A19, A21
- G25
- BR30, BR40
- PAR16, PAR20, PAR30, PAR30L, PAR30S, PAR38
- R20

Medium Screw-Base LED Replacements for HID Lamps

The DLC is considering creating a PUD for dimmable medium screw-base LED replacements for HID lamps (Type B) with light outputs ranging from 250 – 10,000 lumens (in luminaire) and proposes that these lamps would be tested in a similar manner to mogul screw-base LED replacements for HID lamps.

Proposed Required Non-Performance Reporting for all Products and Rationale

To help streamline incentive application reviews, SSL V6.0 and LUNA V2.0 Draft 1 proposes required reporting of product features and information useful for identifying the intended end-use of the product. DLC Member programs may have end-use requirements that rely on more specific information than DLC PUDs provide, and additional reported information will increase the ability to quickly verify that the product selected meets requirements for the program.

Form Factor

Form factor descriptors are proposed in **Table 3** and are intended to support common understanding of product types and are not technical descriptor(s). SSL V6.0 draft 1 proposes that submitters are required to report form factor information. Submitters must select one or more form factor descriptors and are free to do so according to how their products are marketed in supplemental documentation.

Table 3: Form Factor Descriptors

Form Factor	Description
Rectangular	When viewing the installed product, it has four sides with corners near 90º which may in some cases be rounded. Square products fall under the rectangular form factor.
Linear	Products with a long and thin form factor are considered linear, but DLC does not specify a ratio of length to width.
Round	When viewing the installed product, it has no distinct corners or edges. Oval, circular, and cylindrical products fall under the round form factor.
Non-Conforming	Non-conforming products are integrated LED fixtures that may combine elements of rectangular or round but may also have an entirely unique form factor as is the case with many decorative products. Submitters will be required to supply a secondary descriptive word for a non-conforming form factor which will not be filterable on the QPL (e.g., “star” or “crescent”).
Non-Integrated	The non-integrated form factor applies to screw-base or retrofit kits that are intended for operation within another housing.

Mounting Options

Submitters are required to report at least one mounting option as described in **Table 4**, but may also select all available mounting options with the exceptions of screw-base, pin-base, and retrofit which will be automatically assigned by DLC application reviewers who will verify that the selected mounting options are present on the specification sheet.

Table 4: Mounting Option Descriptors

Mounting Option	Description
Screw-Base	Products with any type of screw-base must select this mounting option and may not select additional mounting options as mounting options are specific to product housings.
Pin-Base	Products with any type of pin-base must select this mounting option and may not select additional mounting options as mounting options are specific to product housings.
Retrofit	Retrofit products must select this mounting option and may not select additional mounting options as mounting options are specific to product housings.
Recessed	The product can be mounted in a dropped ceiling or otherwise enclosed space such that primarily the luminous surface of the fixture is visible.
Suspended	The product can be suspended by wire, chain, or pendant which are mounted to the ceiling or other structure.
Surface	The product can be mounted directly to any flat surface (ceiling, wall, floor/ground).
Pole-Arm	The product has a receptacle for an arm mounted horizontally to a pole or building.
Slip-Fit	The product has a fitting that encompasses the intended mounting surface, usually a pole. May be square or round.
Yoke	The product has a bracketed mounting mechanism that connects to the fixture at two points and is attached directly to a surface, which may be a square pole or building surface. The mechanism may have a joint and may alternately be called a trunnion mount.
Knuckle	A joint that allows for articulating the product along one axis. May often be combined with other mounting types.

Physical Dimensions

Submitters must report one set of physical dimensions that does not include additional mounting hardware options beyond the standard housing. Physical dimensions must be reported in terms of length, width, and height in both standard or metric units and must match the information provided on the specification sheet. In cases of round or cylindrical products, the diameter and height must be reported.

Environmental Protection

Submitters must report on the availability of environmental protection options specific to each product. The DLC will verify that the submitted information is present on the specification sheet, but submitters are not required to submit testing information. These ratings are proposed to be displayed on the SSL and LUNA QPLs.

Ingress Protection (IP) Rating

One or more IP rating(s) must be selected to reflect all available options specific to each wildcarded listing. 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. However, a product with no IP rating must report "N/A".

UL Environmental Rating

One or more UL environmental ratings must be selected to reflect all available options specific to each wildcarded listing. The Dry, Damp, or Wet Location rating system will be observed as defined in UL 1598. Where a product has no UL environmental rating, the listing must report "N/A".

Product Images and Rationale

To better support energy efficiency incentive programs and assist in verifying rebate eligibility through the SSL QPL, SSL V6.0 and LUNA V2.0 proposes to change from optionally reported images under V5.1 to requiring that all DLC listed products are qualified with a product image. These images will allow efficiency programs to cross-reference their incentive application information with QPL listings and provide increased confidence that the incented products are what is listed on the QPL. For Level 1 and Level 2 applications, 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.

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.

Image Style Guidelines

- The image must be a photograph; drawings or illustrations of products are not allowed.
- The product image should be the product's professional photo or photo commonly used for marketing purposes, if available.

- The product image must have realistic color; digitally altered or greyscale images are not allowed. Minimal photo editing necessary to produce a clean, professional image is not considered digital alteration.
- The background of the photo 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. The DLC will place a disclaimer below these products indicating that the image does not represent all capabilities or aesthetic options.

Product Specification Sheets

To enhance clarity around QPL listings and better support energy efficiency incentive programs in verifying rebate eligibility through the SSL QPL, SSL V6.0 proposes to require a specification sheet that will be linked on the QPL for each product listing. This should initially be the same document submitted to the DLC for qualification review but can be updated in the future to reflect product changes. The DLC reserves the right to periodically review updated specification sheets to ensure product integrity. There are two proposed submission pathways for providing specification sheets.

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.

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 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 for specification sheets listed elsewhere in this document

Key Questions Regarding Proposed Eligibility Changes and Non-Performance Required Reporting

1. What feedback, if any, do you have regarding the proposed requirement that all SSL V6.0 and LUNA V2.0 qualified products (Standard, Premium, and LUNA) be qualified with a product image and a public-facing specification sheet? Are there any changes needed to better support industry standard file types or style guidelines?
2. What feedback do you have on the DLC's proposal to cover LED commercial integral downlights and downlight retrofit kits in SSL Version 6.0?
    a. What considerations should DLC take into account?
    b. Should the DLC use ENERGY STAR®'s test methods and metrics?
3. What feedback do you have on the DLC's proposal to cover medium screw-base omnidirectional and directions general service lamps (GSLs) previously covered by ENERGY STAR?
    a. What considerations should the DLC take into account?
    b. Are there any lamp shapes/sizes that are missing that should be covered?
    c. Should the DLC use ENERGY STAR's test methods and metrics?
4. What feedback do you have on the DLC's proposal to create a PUD for medium screw-base LED replacement lamp for HID?
    a. What considerations should the DLC take into account?
    b. Can the DLC use the mogul screw-base test methods currently in place in V5.1?
    c. What reference luminaire types are available, and that can be used to support standardized in-luminaire (non-bare lamp) performance testing, to support in-luminaire metrics.
    d. Is there a need to include higher lumen outputs bins than 10,000 lumens for in-luminaire testing and what are the ramifications of increasing or not increasing this threshold?
    e. Is allowing only Type B (not Type A or Type C) medium screw-base replacement lamps for HID a concern?

5. What feedback do you have on the DLC's proposal to delineate strip luminaires from other linear ambient products?
6. Do the descriptors for form factor and mounting options accurately describe the range of options available in the market? How could they be improved?
7. Which of the converted specialty PUDs would require corresponding retrofit kits?
8. Is there a need for the DLC to add a retrofit PUD that would correspond with the Direct Linear Strip Luminaire PUD?
9. Due to low product volume, draft 1 proposes to absorb the Landscape/Accent Flood and Spot PUD for outdoor products into the Architectural Flood and Spot PUD. Previously, these were differentiated by output. What is your feedback on this change?
10. Beyond IP and UL, are there any additional environmental protection ratings that the DLC should consider adding?

Efficacy & Minimum Light Output

Rationale

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 1 are determined based on efficacy trends among DLC-listed product types, DOE market projections, and other sources. In draft 1, the DLC proposes adjustments to allowances and separate thresholds for Amber LED products to continue supporting dark sky-friendly and high-quality lighting. To further drive energy savings, higher Premium thresholds are also proposed, ensuring that Premium represents top-tier efficacy, as approximately 75 percent of V5.1-listed products meet the Premium threshold.

Non-white light (NWL) LED luminaires, including low CCT and Amber LED (including phosphor-converted (pc-), direct emission (de-) Amber LEDs, and filtered-Amber LEDs) provide potential benefits in terms of reduced sky glow and wildlife impact for certain outdoor installations, and for indoor installations. 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 percent 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.

Proposed Efficacy Requirements

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

- Increased standard efficacy thresholds for individual product categories or PUDs as appropriate.
- Increased premium efficacy thresholds in relation to standard efficacy thresholds
- Higher allowances for 2700 K or lower CCTs (described in **Table 37**)
- New luminaire efficacy thresholds for Amber LED luminaires

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 (in-luminaire and bare-lamp, as applicable) for standardized CCT quadrangles (1800 K-6500 K CCT as applicable) linear replacement lamps, four pin-base replacement lamps for CFLs, and mogul screw-base (E39/E40) replacements for HID lamps. Products within the Turtle Lighting PUDs are excluded from **Table 5** and **Table 6** as they are required to use de-Amber LEDs. See **Table 7** for efficacy thresholds that apply to Amber LED products. Lamps and NWL (Amber, 1800 K, 2000 K) luminaires are not eligible for DLC Premium. For more information on which products are eligible for DLC qualification with NWL, see **Table 11** and **Table 12.**

583 ***Table 5: SSL V6.0 Proposed Efficacy Requirements for Luminaires and Retrofit Kits Within***
584 ***Standardized CCT Quadrangles (1800 K – 6500 K as applicable) [DLC Standard and DLC***
585 ***Premium Qualifications]***

Category	General Application	Primary Use Designation	DLC Standard Minimum Efficacy (lm/W) [1]	DLC Premium Minimum Efficacy (lm/W)
Outdoor Luminaires and Outdoor Solar Powered Luminaires	Low Output Mid Output High Output Very High Output	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	130	150
		Outdoor Pole/Arm-Mounted Decorative Luminaires	115	135
		Outdoor Zero-Uplight Wall-Mounted Area Luminaires	125	145
		Outdoor Uplight-Emitting Wall-Mounted Area Luminaires	130	150
		Bollards	120	140
		Parking Garage Luminaires	120	140
		Fuel Pump Canopy Luminaires	135	155
		Architectural Flood and Spot Luminaires	130	150
		Stairwell and Passageway	130	150
		Sports Flood	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		140	160
	Low-Bay		130	150

[1] For applicable CCT ranges, please refer to the Spectral Quality requirements subsections (Standard, Premium, and LUNA) of SSL V6.0 draft 1. For applicable efficacy allowances, please refer to the Allowances section of SSL V6.0 draft 1.

Category	General Application	Primary Use Designation	DLC Standard Minimum Efficacy (lm/W) [1]	DLC Premium Minimum Efficacy (lm/W)
Outdoor Retrofit Kits	Low Output Mid Output High Output Very High Output	Retrofit Kits for Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	130	150
	Mid Output	Retrofit Kits for Outdoor Pole/Arm-Mounted Decorative Luminaires	115	135
	High Output	Retrofit Kits for Large Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	130	150
	Very High Output	Retrofit Kits for Outdoor Wall-Mounted Area Luminaires	125	145
		Retrofit Kits for Parking Garage Luminaires	120	140
		Retrofit Kits for Fuel Pump Canopy Luminaires	135	155
Indoor Retrofit Kits	Troffer	All	120	140
	Linear Ambient		125	145
	High-Bay		140	160
	Low-Bay		130	150

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

Category	General Application	DLC Standard Minimum Efficacy (lm/W)[2]	
		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	130	n/a
	Outdoor: Mid Output	130	
	Outdoor: High Output	130	
	Outdoor: Very High Output	130	
	High-Bay	140	
	Low-Bay	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.

Efficacy thresholds for Amber LED products are set based on specific Amber LED technology and apply to any product category eligible for qualification with the associated Amber technology (see **Table 7**).

- de-Amber: Chromaticity outside of C78.377-2024 quadrangles and narrowband SPD with a dominant wavelength between 590 – 610 nm and a FWHM (full width at half maximum) of 20 nm or less. Zero radiation below 560 nm.
- pc-Amber: Chromaticity outside of C78.377-2024 chromaticity quadrangles and broadband SPD with a dominant wavelength between 590 – 600 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.

[2] For applicable CCT ranges, please refer to the Spectral Quality requirements subsections (Standard and LUNA) of SSL V6.0 draft 1. For applicable efficacy allowances, please refer to the Allowances section of SSL V6.0 draft 1.

- Filtered Amber: white LED (2200 K– 5000 K) with amber filtered lens or optic that reduces the short wavelength radiation to meet Hawaii and Maui County Code criteria (<=2% blue and "traffic color compliant").
    - Percent (%) blue is defined as the sum of the optical radiation between 400-500 nm divided by the sum of the optic radiation between 400 – 700 nm.
    - Traffic color compliant is defined as chromaticity outside of ITE Yellow (Amber) (per SAE J578 APR2020).

Table 7: Proposed Efficacy Requirements for all Amber LED Products

Amber LED Technology	DLC Standard Minimum Efficacy (lm/W)
de-Amber	30
pc-Amber	70
Filtered Amber	95

Proposed Minimum Light Output Requirements

Table 8 and **Table 9** describe the light output ranges that qualify for each General Application**. Table 13** provides more detail on minimum and maximum light outputs and distributions for each PUD.

Table 8: Minimum Light Output Requirements

Category	General Application	Minimum and Maximum Light Output (lm)
Outdoor Luminaires and Outdoor Solar Powered Luminaires	Low Output	250-5,000
	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	250-5,000
	Mid Output	5,000-10,000
	High Output	≥10,000
	Very High Output	≥30,000
Indoor Retrofit Kits	Troffer	≥1,500

Category	General Application	Minimum and Maximum Light Output (lm)
	Linear Ambient	≥375 lm/ft
	High-Bay	≥10,000
	Low-Bay	5,000-10,000

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616 ***Table 9: Lamps Minimum Light Output Requirements***

Category	General Application	Minimum and Maximum Light Output (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	
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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Key Questions Regarding Efficacy and Minimum Light Output Proposals

1. What feedback do you have on the efficacy thresholds proposed in tables 5, 6 and 7? Will achieving these thresholds require tradeoffs in other areas? If so, what tradeoffs?
2. What feedback do you have on the DLC's proposal to split out outdoor thresholds by PUD rather than setting one for the whole category?
3. Should in-luminaire thresholds for Mogul screw-base LED replacement for HID lamps match the thresholds for their luminaire counterparts? Is high efficacy harder to achieve in Mogul screw-base LED replacement for HID lamps than luminaires?
4. What feedback do you have on the DLC's proposal to allow lamps and retrofit kits to be listed with 1800 K/2000 K or Amber LEDs? (These Amber and lower CCT outdoor lamps and retrofit kits must meet applicable SSL V6.0 and LUNA V2.0 requirements to be listed.)
5. What feedback do you have on the DLC's chromatic definitions of de-Amber and pc-Amber?
6. As defined, filtered-Amber LED luminaires are intended specifically for Hawaii installations. Is there another use case for indoor or outdoor filtered-Amber LED luminaires that isn't considered, and if so, what is missing?
7. To encourage the use of lower-wattage products for additional energy savings and prevent over lighting, the DLC is considering maximum light output requirements for all PUDs and/or General Application categories without a current light output maximum (e.g., high-bays or troffers). What feedback do you have on this proposal?

Quality of Light

Under SSL V6.0 and LUNA V2.0 Draft 1, a product's quality of light is evaluated by its spectral quality, light distribution, and discomfort from glare.

Rationale

To limit light pollution, the DLC is proposing to limit outdoor luminaires, lamps and retrofit kits to a maximum CCT of 5000 K, because all else being equal in application (same light output, same distribution, etc.), products with higher CCTs (e.g., more blue-violet light) will increase sky glow (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.

To reduce light pollution, the DLC also proposes allowing products with lower CCTs (1800 K and 2000 K) and Amber LEDs to be qualified. These products reduce sky glow compared to whiter LED luminaires and are often recommended or required in sensitive environments. For these products only, draft 1 proposes to require color rendition and color maintenance reporting without any threshold criteria.

To address market changes in the use of the Unified Glare Rating (UGR) metric, the DLC is proposing to no longer require maximum UGR thresholds for Linear Ambient, Low-Bay, and High-Bay) seeking Premium qualification in SSL V6.0 Draft 1. Only Troffer PUDs seeking Premium qualification will continue to have maximum UGR thresholds.

To update the DLC PUD nomenclature from using deprecated terminology and to mitigate light pollution, draft 1 proposes some changes to the nomenclature and requirements for some PUDs shown in **Table 13.** Instead of using the terminology "cutoff" which has been deprecated by the IES since 2011, the DLC is using the terminology "Zero-Uplight" to replace "Full Cutoff" and "Uplight-Emitting" to replace "non-Cutoff and semi-Cutoff". Zero-Uplight products do not emit any uplight, and the tolerance for zonal lumens above 90 degrees vertical is changing to zero. The proposed zonal lumen requirements for PUD D ("Outdoor Uplight-Emitting Wall-Mounted Area Luminaires") have changed for easier evaluation in photometric software and to limit uplight to a maximum of 20 percent of total light output.

Lastly, to support a transition away from custom color maintenance processes specific to the DLC, draft 1 proposes to require standardized color maintenance reporting values in addition to the color maintenance requirements introduced in SSL V5.1.

Spectral Quality Requirements

The Spectral Quality Testing and Reporting Requirements for all SSL products (Standard) are as shown in **Table 10**. DLC Premium spectral quality requirements are described in the Premium requirement section of the Technical Requirements. The "QPL Listing" column describes the information that appears as publicly available on the Qualified Products List, if applicable. The "Method of Evaluation" column

674 describes how the products will be evaluated for qualification, whether by compliance with industry
675 standards, manufacturer claims, or other DLC verification methodology.

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

Metric and/or Application	SSL V6.0 & LUNA V2.0 Draft 1 Standard Requirements	QPL Listing	Method of Measurement/ Evaluation
Chromaticity (CCT & D_{uv})	All indoor products shall exhibit chromaticity consistent with at least one of the basic, flexible, or extended, nominal 7-step quadrangle CCTs from 1800 K – 6500 K	1800 K – 6500 K: CCT and D_{uv} for parent[3] products from LM-79 test reports listed as Tested Data Nominal CCT for child products listed as Reported Data	1800 K – 6500 K: ANSI/IES LM-79 *ANSI C78.377-2024*
	All outdoor products shall exhibit chromaticity consistent with at least one of the basic, flexible, or extended, nominal 7-step quadrangle CCTs from 2200 K – 5000 K) LUNA -eligible outdoor products with the following LED-based options: • chromaticity consistent with at least one of the basic, flexible, or extended, nominal 7-step quadrangle CCTs of 1800 K – 2100 K	1800 K – 5000 K: 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 For LUNA listed outdoor parent products: % blue, traffic color compliance, and Hawaii code will be listed using the LUNA pre-submission tool.	1800 K – 5000 K: ANSI/IES LM-79 *ANSI C78.377-2024*
	All Amber LED indoor products and LUNA-eligible Amber LED outdoor products may also include the following LED-based options: • Direct emission (de-) Amber • Phosphor converted (pc-) Amber • Filtered Amber (outdoor LUNA-eligible products only)	Amber LED products: Nomenclature (de-Amber, pc-Amber, filtered-Amber) Dominant wavelength, Chromaticity coordinates from LM-79 report listed as Test Data Nomenclature listed for child products For LUNA listed outdoor parent products, % blue, traffic color	ANSI/IES LM-79

[3] Please see the definition of a parent product in the Definitions section of this document.

Metric and/or Application	SSL V6.0 & LUNA V2.0 Draft 1 Standard Requirements	QPL Listing	Method of Measurement/ Evaluation
		compliance, and Hawaii code compliance will be listed using the LUNA pre-submission tool.	
Color Rendition	All Indoor products, except high-bay and Amber LED: **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 • $R_9 \geq 0$	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 Products are required to report data in terms of Option 1 and Option 2; both are shown on the QPL. Products only need to meet either Option 1 or Option 2 thresholds. .	ANSI/IES LM-79 *ANSI/IES TM-30* *CIE 13.3-1995*
	All Outdoor and high-bay products, except NWL: **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		
	All NWL products: • *1800 K – 2100 K* • *de-Amber* • *pc-Amber* • *filtered Amber*	NWL products have to report color rendition metrics but there are no minimum color rendition thresholds	
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 Additionally, V6.0 Draft 1 proposes to require reporting of CS4 and CS7	V6.0 Draft 1 proposes to display CS4 and CS7 values on the DLC SSL QPL for all products. NWL products have to report color maintenance values but no thresholds are stipulated.	ANSI/IES LM-80, and/or IES LM-84-14 and ANSI/IES TM-35-19 (for CS4 and CS7 values)

Metric and/or Application	SSL V6.0 & LUNA V2.0 Draft 1 Standard Requirements	QPL Listing	Method of Measurement/ Evaluation
	values per ANSI/IES TM-35-19. No thresholds are proposed.		
	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 Additionally, V6.0 Draft 1 proposes to require reporting of CS4 and CS7 values per ANSI/IES TM-35-19. No thresholds are proposed.		
	All NWL products: • *1800 K – 2100 K* • *de-Amber* • *pc-Amber* • *filtered Amber*	NWL products have to report color maintenance metrics but there are no minimum color maintenance thresholds	

Table 11 and **Table 12** detail the CCT range and Amber LED technologies each PUD may qualify with under SSL V6 and LUNA V2.0 Draft 1. Most outdoor products (exceptions listed in **Table 11**) have a maximum allowed CCT of 5000 K, and CCTs greater than this are not eligible for SSL V6 qualification for the indicated PUDs. Outdoor NWL (Amber, 1800 K, and 2000 K) products must meet both SSL V6.0 and LUNA V2.0 requirements to be listed. Only products emitting white light (2200 K – 6500 K) are eligible for Premium qualification under SSL V6.0.

685 ***Table 11: Eligibility by CCT Range and Amber LED Technology for Luminaires and Retrofit Kits***

Category	General Application	Primary Use Designation (PUD)	Eligible CCT Range and Amber LED Technologies for DLC Standard Qualification*
Indoor Luminaires	All	All	1800 K – 6500 K de-Amber pc-Amber
Outdoor Luminaires and Outdoor Solar Powered Luminaires	Low Output Mid Output High Output Very High Output	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1800 K – 5000 K de-Amber pc-Amber filtered-Amber
		Outdoor Pole/Arm-Mounted Decorative Luminaires	1800 K – 5000 K de-Amber pc-Amber filtered-Amber
		Outdoor Zero-Uplight Wall-Mounted Area Luminaires	1800 K – 5000 K de-Amber pc-Amber filtered-Amber
		Outdoor Uplight-Emitting Wall-Mounted Area Luminaires	2200 K – 5000 K
		Bollards	1800 K – 5000 K de-Amber pc-Amber filtered-Amber
		Parking Garage Luminaires	2200 K – 5000 K
		Fuel Pump Canopy Luminaires	1800 K – 5700 K de-Amber pc-Amber filtered-Amber
		Architectural Flood and Spot Luminaires	2200 K – 5000 K
		Stairwell and Passageway	2200 K – 5000 K
		Sports Flood	2200 K – 5700 K
		Hazardous Environment Area and Roadway Luminaires	1800 K – 5000 K de-Amber pc-Amber filtered-Amber
		Turtle Lighting Zero-Uplight Pole/Arm-Mounted Area and Roadway Luminaires	de-Amber
		Turtle Lighting Zero-Uplight Wall-Mounted Area Luminaires	de-Amber
		Turtle Lighting Zero-Uplight Bollards	de-Amber

Category	General Application	Primary Use Designation (PUD)	Eligible CCT Range and Amber LED Technologies for DLC Standard Qualification*
Outdoor Retrofit Kits	Low Output Mid Output High Output Very High Output	Retrofit Kits for Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1800 K – 5000 K de-Amber pc-Amber filtered-Amber
	Mid Output	Retrofit Kits for Outdoor Pole/Arm-Mounted Decorative Luminaires	1800 K – 5000 K de-Amber pc-Amber filtered-Amber
	High Output	Retrofit Kits for Large Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1800 K – 5000 K de-Amber pc-Amber filtered-Amber
	Very High Output	Retrofit Kits for Outdoor Wall-Mounted Area Luminaires	1800 K – 5000 K de-Amber pc-Amber filtered-Amber
		Retrofit Kits for Parking Garage Luminaires	2200 K – 5000 K
		Retrofit Kits for Fuel Pump Canopy Luminaires	1800 K – 5700 K de-Amber pc-Amber filtered-Amber
Indoor Retrofit Kits	All	All	1800 K – 6500 K de-Amber pc-Amber

*Outdoor NWL (Amber, 1800 K, and 2000 K) products must meet both SSL V6.0 and LUNA V2.0 requirements to be listed.

Table 12: Eligibility by CCT Range and Amber LED Technology for Lamps

Category	General Application	Eligible CCT Range and Amber LED Technologies for DLC Standard Qualification*
Linear Replacement Lamps	All	1800 K – 6500 K de-Amber pc-Amber
Mogul Screw-Base (E39/E40) Replacements for HID Lamps	Outdoor: Low Output	1800 K – 5000 K de-Amber pc-Amber
	Outdoor: Mid Output	1800 K – 5000 K de-Amber pc-Amber
	Outdoor: High Output	1800 K – 5000 K de-Amber pc-Amber
	Outdoor: Very High Output	1800 K – 5000 K de-Amber pc-Amber
	High-Bay	1800 K – 6500 K de-Amber pc-Amber
	Low-Bay	1800 K – 6500 K de-Amber pc-Amber
Four Pin-Base Replacement Lamps for CFLs	All	1800 K – 6500 K

* Outdoor NWL (pc-Amber, de-Amber and filtered-Amber, 1800 K, and 2000 K) products must meet both SSL V6.0 and LUNA V2.0 requirements to be listed.

Test Report and Implementation Requirements: DLC Standard

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.

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. Regardless of which pathway is used to demonstrate color rendition and chromaticity compliance, all chromaticity coordinates shall fall within at least one of the basic, flexible, or extended nominal 7-step quadrangle CCTs from 2200 K – 6500 K as defined by ANSI C78.377-2024.

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, 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, 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, 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 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.

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 1 proposes to require 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 Draft 1, 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.

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

For color-tunable products and/or dimmable and 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.

Light Output and Distribution Requirements by Primary Use Designation

The light output, distribution and testing and reporting requirements for all SSL products are described as follows.

Table 13: Primary Use Designation Technical Requirements: Light Output and Distribution

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)	Zone/Spacing Criteria/Beam Angle	ZLD/SC/BA Nominal Requirement	ZLD/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
A	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1,000	0-90°	100%	-1%	≥99%
			80-90°	≤10%	+3%	≤13%
B	Outdoor Pole/Arm-Mounted Decorative Luminaires	1,000	0-90°	≥65%	-3%	≥62%
C	Outdoor Zero-Uplight Wall-Mounted Area Luminaires	300	0-90°	100%	0%	100%
			80-90°	≤5%	+3%	≤8%
D	Outdoor Uplight Emitting Wall-Mounted Area Luminaires	300	0-90°	≤80%	+3%	≤83%
			>90°	20%	-3%	≤17%
E	Bollards	500	90-110°	≤15%	+3%	≤18%
			>110°	0%	+3%	≤3%
F	Parking Garage Luminaires	2,000	60-80°	≥30%	-3%	≥27%
			70-80°	≤25%	+3%	≤28%
G	Fuel Pump Canopy Luminaires	2,000	0-40°	≥40%	-3%	≥37%
			40-70°	≥40%	-3%	≥37%
I	Architectural Flood and Spot Luminaires	250	0-90°	≥85%	-3%	≥82%
J	Stairwell and Passageway Luminaires	750	0-90°	≥85%‡	-3%	≥82%
BA	Hazardous Environment Area Luminaires	1,000	TBD	TBD	TBD	TBD
BB	Sports Floods	1,000	TBD	TBD	TBD	TBD
K	Wall-wash Luminaires	575	0-90°	≥60%‡‡	-3%	≥57%
L	Track or Mono-Point Directional Luminaires	250	0-90°	≥85%	-3%	≥82%
M	Vertical Refrigerated Case Luminaires-center	100 lm/ft	10-90°†	≥95%†	-3%	≥92%

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)	Zone/Spacing Criteria/Beam Angle	ZLD/SC/BA Nominal Requirement	ZLD/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
N	Vertical Refrigerated Case Luminaires-end	50 lm/ft	10-90°‡‡	≥95%‡‡	-5%	≥90%
O	Horizontal Refrigerated Case Luminaires	100 lm/ft	0-90°	≥95%	-3%	≥92%
P	Display Case Luminaires	50 lm/ft	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	0.9-2.1
			SC: 90-270°	1.0-2.0	±0.1	0.9-2.1
			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	90-150°	≥35%	-3%	≥32%
U	Direct Linear Ambient Luminaires	375 lm/ft	0-60°	≥40%	-3%	≥37%
BC	Direct Linear Strip Luminaires	375 lm/ft	0-60º	≥40%	-3%	≥37%
V	High-Bay Luminaires	10,000	20-50°	≥30%	-10%	≥20%
W	High-Bay Aisle Luminaires	10,000	20-50°	≥50%	-10%	≥40%
			0-20°	≥30%	-10%	≥20%
BD	Hazardous Environment High-Bay Luminaires	10,000	TBD	TBD	TBD	TBD
BE	Indirect High-Bay Luminaires	10,000	TBD	TBD	TBD	TBD
X	Low-Bay Luminaires	5,000 - 10,000	20-50°	≥30%	-10%	≥20%
BF	Hazardous Environment Low-Bay Luminaires	5,000 – 10,000	TBD	TBD	TBD	TBD
Y	Retrofit Kits for Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1,000	0-90°	100%	0%	100%
			80-90°	≤10%	3%	≤13%
Z	Retrofit Kits for Outdoor Pole/Arm-Mounted Decorative Luminaires	1,000	0-90°	≥65%	-3%	≥62%

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)	Zone/Spacing Criteria/Beam Angle	ZLD/SC/BA Nominal Requirement	ZLD/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
AA	Retrofit Kits for Large Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1,000	0-90°	100%	0%	100%
			80-90°	≤10%	3%	≤13%
AB	Retrofit Kits for Zero-Uplight Outdoor Wall-Mounted Area Luminaires	300	0-90°	100%	-3%	≥97%
			80-90°	≤10%	3%	≤13%
AC	Retrofit Kits for Parking Garage Luminaires	2,000	60-80°	≥30%	-3%	≥27%
			70-80°	≤25%	+3%	≤28%
AD	Retrofit Kits for Fuel Pump Canopy Luminaires	2,000	0-40°	≥40%	-3%	≥37%
			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	0.9-2.1
			SC:90-270°	1.0-2.0	±0.1	0.9-2.1
			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	0.9-2.1
			SC:90-270°	1.0-2.0	±0.1	0.9-2.1
			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	0.9-2.1
			SC:90-270°	1.0-2.0	±0.1	0.9-2.1
			ZL:0-60°	≥75%	-3%	≥72%
AH	Retrofit Kits for Direct Linear Ambient Luminaires	375 lm/ft	0-60°	≥40%	-3%	≥37%
AI	Retrofit Kits for High-Bay Luminaires	10,000	20-50°	≥30%	-10%	≥20%
AJ	Retrofit Kits for Low-Bay Luminaires	5,000 (<10,000)	20-50°	≥30%	-10%	≥20%
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	800	Beam Angle:	140°	-5°	135°

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)	Zone/Spacing Criteria/Beam Angle	ZLD/SC/BA Nominal Requirement	ZLD/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
	(all Primary Use Designations)					
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	0-90°	100%	-1%	≥99%
			80-90°	≤10%	3%	≤13%
AR	Mogul Screw-Base Replacements for HID Lamps in Outdoor Pole/Arm-mounted Decorative Luminaires	In luminaire: 1,000	0-90°	≥65%	-3%	≥62%
AS	Mogul Screw-Base Replacements for HID Lamps in Outdoor Zero-Uplight Wall-mounted Area Luminaires	In luminaire: 300	0-90°	100%	0%	100%
			80-90°	≤10%	3%	≤13%
AT	Mogul Screw-Base Replacements for HID Lamps in Parking Garage Luminaires	In luminaire: 2,000	60-80°	≥30%	-3%	≥27%
			70-80°	≤25%	+3%	≤28%
AU	Mogul Screw-Base Replacements for HID Lamps in Fuel Pump Canopy Luminaires	In luminaire: 2,000	0-40°	≥40%	-3%	≥37%
			40-70°	≥40%	-3%	≥37%
AV	Mogul Screw-Base Replacements for HID Lamps in High-Bay Luminaires (Commercial and Industrial)	In luminaire: 10,000	20-50°	≥30%	-10%	≥20%
AW	Mogul Screw-Base Replacements for HID Lamps in Low-	In luminaire: 5,000 - 10,000	20-50°	≥30%	-10%	≥20%

Primary Use Letter	Primary Use Designation	Minimum Light Output (lm)		Zone/Spacing Criteria/Beam Angle	ZLD/SC/BA Nominal Requirement	ZLD/SC/BA Tolerance	ZLD/SC/BA Requirement with Tolerance
	Bay Luminaires (Commercial and Industrial)						
AX	Vertically Mounted Four Pin-Base Replacement Lamps for CFLs	In luminaire: 575 (1-lamp configuration)	Bare lamp: 675	ZL:0-60°	≥75%	-3%	≥72%
AY	Horizontally Mounted Four Pin-Base Replacement Lamps for CFLs	In luminaire: 800 (2-lamp configuration)	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	1000		0-90°	100%	0%	100%
BH	Turtle Lighting Zero-Uplight Wall-mounted Area Luminaires	250		0-90°	100%	0%	100%
BI	Turtle Lighting Zero-Uplight Bollards	250		0-90°	100%	0%	100%

† Bilateral, symmetric light distribution on two hemispheres

‡‡ One-sided, single hemisphere light distribution

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

Beam Angle

SSL products in the linear replacement lamps and 2G11 base replacement lamps categories shall report their beam angle in the reported values on the application form and demonstrate a beam angle of 140˚ or greater. In SSL V6.0 draft 1, the DLC will use the IES definition of beam angle: “The angle between the two directions for which the intensity is 50 percent of the maximum intensity as measured in a plane through the nominal beam centerline.” The beam angle for linear replacement lamps is measured in the azimuthal plane perpendicular to, and at the center of, the linear replacement lamp axis as illustrated in **Figure 1**.

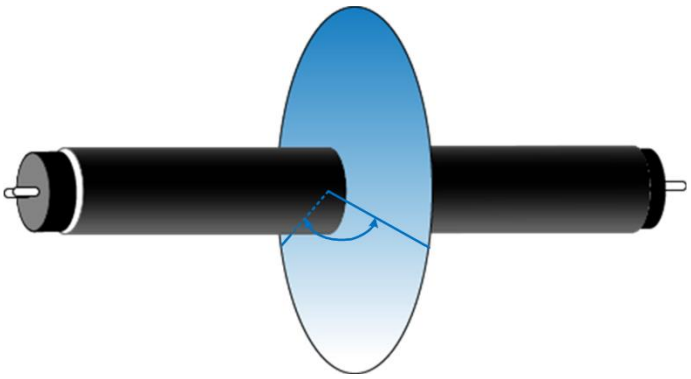

Figure 1: *Linear Replacement Lamp Beam Angle Definition*

BUG (Backlight, Uplight, and Glare) Ratings

SSL products in the Outdoor Luminaire 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 continue to be 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: Sports Flood
- Specialty: Natatorium Lighting
- Specialty: Tunnel Lighting

The nomenclature of BUG Ratings is similar to the example: **B2 U0 G2**. BUG ratings are determined based on the method described in ANSI/IES TM-15-20 Luminaire Classification System for Outdoor Luminaires and the included Annex A. The BUG ratings may be generated either from the photometric data in the LM-79 test report or by the manufacturer's own calculation method based on the tested data as long as the procedures in ANSI/IES TM-15-20 and Annex A are followed. In addition, for products tested for distribution[4] in a Level 2 application, 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.

BUG ratings have been adopted and are referenced by many national, state, and/or local ordinances, regulations, standards, and policies. Listing of BUG ratings on the QPL is intended to provide information that can be used to determine compliance with these regulations. The DLC may update the technical requirements if any changes are made to BUG Ratings or ANSI/IES TM-15-20.

Testing and Reporting Requirements: DLC Standard

The light distribution testing and reporting requirements for all SSL products are shown in **Table 14** 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.

Table 14: V6.0 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 13**	No separate ZLD and SC reporting required	ZLD and SC information will not be published on the QPL	ANSI/IES LM-79 per the Additional Reporting Guidelines, and 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 per the Additional Reporting Guidelines
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[4] 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

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 Guidelines shall be provided for each unique distribution pattern in the family without consideration of lumen package and the effect of color properties[5], tested at the maximum (non-dimmed) light output .
    - For indoor Level 2 applications, products chosen for goniophotometric testing may be at any CCT and any light output.

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

[5] 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.

- For outdoor Level 2 applications that include products with a CCT of 3000 K or lower, goniophotometric tests should be conducted on products with CCT of 3000 K (or at the highest CCT if lower than 3000 K) and at the highest light output within the Level 2 family.
    - This requirement will help manufacturers who want to apply for LUNA V2.0 qualification to minimize additional testing.

- 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.
- 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.

Flood and Spot Luminaires

For Architectural Flood and Spot Luminaires, manufacturers must declare the NEMA Beam Classification of their luminaire in the 0-180° and 90-270° planes as described in **Table 15**. The DLC will verify this information against the IES files provided.

Table 15: NEMA Beam Classification

NEMA Beam Classification	Beam Spread Range
1	10-18°
2	18-29°
3	29-46°
4	46-70°
5	70-100°
6	100-130°
7	≥130°

Wall Wash Luminaires

The zonal lumen criteria for Wall Wash Luminaires Primary Use is that ≥60% of the lumens must be produced in the “forward” hemisphere, toward the wall (i.e., a one-sided, single hemisphere light distribution).

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 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 exempted PUDs (see the BUG Ratings section).
    - 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 not applicable to FALD products seeking efficacy allowances. FALD products are not eligible for efficacy allowances related to discomfort glare control under V6.0.

Key Questions Regarding Quality of Light Proposals

1. The DLC is proposing to specify which outdoor products are required to be tested for Distribution Reports (i.e., products with CCTs at 3000 K and with the highest light output within a family). What feedback, if any, do you have about this proposal?
2. The DLC is proposing to deprecate the use of the term “cutoff” in its PUD nomenclature (PUD letters C & D) and use Zero-Uplight and Uplight-Emitting terms instead. What feedback, if any, do you have about this proposal?
3. The DLC is also proposing changing the zonal lumen requirements for PUD letters C & D to more effectively limit uplight and reduce wasted light and wasted energy. What feedback, if any, do you have about this proposal?
4. The DLC is proposing minimum light output requirements for three new Turtle Lighting PUDs. Are there any concerns with the proposed thresholds?
5. The DLC is proposing to no longer require UGR (tabular) thresholds for Linear Ambient, High-Bay and Low-Bay PUDs qualified to Premium. What, if any, concerns do you have about this proposal?
6. The DLC is proposing to require reporting of CS4 and CS7 color maintenance values per ANSI/IES TM-35-19 as a way to transition away from a custom color maintenance evaluation process previously developed by the DLC. What feedback, if any, do you have about this proposal?

7. Some product categories/types do not allow Amber or 1800 K/2000 K options. What is your feedback on this limitation?

Controllability

Rationale

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 1 proposes to enhance its controllability reporting requirements by adding Controls Categories and other necessary information within the following Controllability section. Draft 1 proposes required reporting of specific information on product variations within individual Product IDs to associate specific orderable control options with a discrete controls category. The addition of controls categories to the SSL QPL will simplify incentive program application and review processes and lower barriers to the adoption of advanced lighting control capabilities. The proposed controls categories for Indoor and Outdoor luminaires are designed to align with differing levels of energy savings claims from control strategies allowed by the various Technical Resource Manuals (TRMs) that govern energy efficiency programs. In turn, efficiency programs that adopt controls categories will be able to align incentive levels with controls categories to streamline their program offers.

Controls Categories

SSL V6.0 Draft 1 proposes the following means for organizing listed products by their controllability. **Table 16** details the controls categories for **Indoor** products. **Table 17** details the controls categories for **Outdoor** products.

Table 16: Indoor Controls Categories

INDOOR		
Category	Name	Description
1	Luminaire Only	A luminaire with no integral control capabilities.
2	Controls Ready Luminaire Only	A luminaire with controls ready capabilities as defined in Controllability Requirements: Controls Ready
3	Luminaire with Occupancy Sensor	A non-networked luminaire, or a networked luminaire without an NLC QPL listing, with an integral occupancy sensor installed at the factory.

INDOOR		
Category	Name	Description
4	Luminaire with Occupancy Sensor + Daylight Sensor	A non-networked luminaire, or a networked luminaire without an NLC QPL listing, with an integral occupancy and daylight sensor capable of dimming installed at the factory. The sensor function may be accomplished with a single device or multiple devices.
5	Luminaire with Networked Controller	A luminaire with an integral networked controller installed at the factory. The networked controller must operate as part of an NLC QPL listed control system.
6	Luminaire Level Lighting Control (LLLC)	A luminaire with an integral networked controller and occupancy sensor and daylight sensor installed at the factory. The sensor function may be accomplished with a single device or multiple devices. The networked controller must operate as part of an NLC QPL listed control system.

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921 ***Table 17: Outdoor Controls Categories***

OUTDOOR		
Category	Name	Description
1	Luminaire Only	A luminaire with no integral control capabilities.
1A	Luminaire with Photocell Only	A luminaire with an integral photocell capable of on/off control corresponding to sunset and sunrise installed at the factory.
1B	Luminaire with Photocell and Part Night Dim	A luminaire with an integral photocell capable of on/off control corresponding to sunset and sunrise and time-based dimming installed at the factory.
2	Controls Ready Luminaire Only	A luminaire with controls ready capabilities as defined in Controllability Requirements: Controls Ready

OUTDOOR		
Category	Name	Description
3	Luminaire with Occupancy Sensor	A luminaire with a non-networked integral occupancy sensor installed at the factory.
4	Luminaire with Occupancy Sensor + Daylight Sensor	A luminaire with a non-networked integral occupancy and daylight sensor capable of dimming installed at the factory. The sensor function may be accomplished with a single device or multiple devices.
4A	Luminaire with Occupancy Sensor + Photocell	A luminaire with a non-networked integral occupancy and photocell capable of on/off control corresponding to sunset and sunrise installed at the factory. The sensor function may be accomplished with a single device or multiple devices.
5	Luminaire with Networked Controller	A luminaire with an integral networked controller installed at the factory. The networked controller must operate as part of an NLC QPL listed control system.
6	Luminaire Level Lighting Control (LLLC)	A luminaire with an integral networked controller and occupancy sensor and daylight sensor/photocell installed at the factory. The sensor function may be accomplished with a single device or multiple devices. The networked controller must operate as part of an NLC QPL listed control system.

Driver and Controller Types

Draft 1 introduces two new reported fields, collected in the application process as noted in the Product and Controls Options tables below that describe the relevant methods of communication with listed products.

Driver Type

The Driver Type establishes the method by which a driver communicates with a lighting controller, whether remote mounted or integral to the luminaire. 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, (expected to be released in 2025).

Integral Controller Type

The Integral Controller Type establishes the method by which the integral controller 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.

Required Data to Support Controls Categories

To facilitate the assignment of controls categories, draft 1 proposes to collect detailed controls information about each product in a Controls Options table.

Controls Ready (Controls Category 2)

SSL V6.0 Draft 1 proposes to define Controls Ready (CR) luminaires as those on which controls can be installed in the field without modifying the luminaire or using additional materials and are capable of supporting the functionality of the control. The following are some examples of luminaires 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 18.** 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.

Draft 1 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 Twistlock receptacle type is included in **Table 18** for completeness and to positively show on the QPL that an otherwise listed luminaire with a 3-pin Twistlock Controls Option Code is *not* qualified.

965 ***Table 18: 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 draft 1 proposes 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
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
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 the 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

Controls Options Tables

Controls Options Tables are tables that contain information on each available controls option listed on a specification sheet for a luminaire. Controls Options Tables are collected during application submittal where one table may apply to multiple Product IDs within the same family. Not every controls option needs to apply to every Product ID in a family.

Table 19 shows the details of the controls information draft 1 proposes to collect in the Controls Options Tables for **Indoor** products. **Table 20** Shows the details of what controls information SSL V6.0 Draft 1 proposes to collect in the Controls Options Tables for **Outdoor** products.

Table 19: Indoor Controls Option Table Details

INDOOR			
Controls Information	**Description**	**Accepted Terms**	**Method of Evaluation[6]**
Model Number	Model number for the associated row on the application spreadsheet, as specified above. This is the same model number used elsewhere in the application.	N/A	N/A
Controls Option Code	The text string that represents the controls options available for each variation. Each Controls Options Code must be orderable and shown on the spec sheet.	As displayed on Specification sheet.	Review of specification sheet.

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

INDOOR			
Controls Information	**Description**	**Accepted Terms**	**Method of Evaluation[6]**
Driver Type	The type of driver that is installed in the luminaire.	• Wired - 0-10 V IEC 60929 Annex E • Wired – BACnet • Wired - D4i Certified • Wired - DALI version-1 • Wired - DALI-2 Certified • 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)	Review of specification sheet.

INDOOR			
Controls Information	**Description**	**Accepted Terms**	**Method of Evaluation[6]**
Integral Controller Type	The type of integral controller that is installed in the luminaire.	• None • Wired – BACnet • Wired - D4i Certified • Wired - DALI version-1 • Wired - DALI-2 Certified • Wired – DMX512 • Wired – Modbus • Wired - KNX • Wired - Other Digital • Wired - Other Digital (Proprietary) • Wired - Other Analog • Wired - Other Analog (Proprietary) • Wired - Phase Cut • Wired - PoE • Wired - RJ45 (Proprietary) • 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)	Review of specification sheet.
Controls Ready Receptacle Type	The type of controls ready receptacle, installed at the factory, that is present on the luminaire.	• None • Zhaga Book 20 • USB C • 3.5mm Phono Jack • Other:___	Review of specification sheet.
Integral Sensor Function	The lighting control strategy function of the integral sensor installed at the factory.	• None • Occupancy Only • Daylight Only	Review of specification sheet.

INDOOR			
Controls Information	**Description**	**Accepted Terms**	**Method of Evaluation[6]**
		• Occupancy + Daylight	
Integral Sensor Technology	The type of sensing technology that the integral sensor installed at the factory uses.	• None • Passive Infrared (PIR) • Ultrasonic • Dual-Tech • Microphonic • Microwave • Millimeter Wave • Camera • Other: ___	Review of specification sheet.
Sensor Maximum Mounting Height	The manufacturer provided maximum mounting height for effective operation of the sensor.	One- or two-digit integer in feet or meters.	Review of specification sheet.
NLC QPL Product ID	The NLC QPL Product ID of the networked lighting control system that the integral control product communications with.	N/A	Review of specification sheet.
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	Review of specification sheet.

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977 ***Table 20: Outdoor Controls Options Table Details***

OUTDOOR			
Controls Information	**Description**	**Accepted Terms**	**Method of Evaluation[7]**
Model Number	Model number for the associated row on the application spreadsheet.	N/A	N/A
Controls Option Code (Controls Option Table Only)	The text string that represents the controls options available for each variation. Each Controls Option Code must be orderable and shown on the spec sheet.	As displayed on specification sheet.	Review of specification sheet.
Driver Type	The type of driver that is installed in the luminaire.	• Wired - 0-10 V IEC 60929 Annex E • Wired – BACnet • Wired - D4i Certified • Wired - DALI version-1 • Wired - DALI-2 Certified • 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)	Review of specification sheet.

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

OUTDOOR			
Controls Information	**Description**	**Accepted Terms**	**Method of Evaluation[7]**
Integral Controller Type	The type of integral controller that is installed in the luminaire	• None • Wired – BACnet • Wired - D4i Certified • Wired - DALI version-1 • Wired - DALI-2 Certified • Wired – DMX512 • Wired – Modbus • Wired - Other Digital • Wired - Other Digital (Proprietary) • Wired - Other Analog • Wired - Other Analog (Proprietary) • Wired - Phase Cut • 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)	Review of specification sheet.

OUTDOOR			
Controls Information	**Description**	**Accepted Terms**	**Method of Evaluation[7]**
Controls Ready Top Receptacle Type	The type of controls ready receptacle, installed at the factory, that is present on the top of the luminaire when mounted in operating orientation.	• 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 • Zhaga Book 18 • Other	Review of specification sheet.
Controls Ready Bottom Receptacle Type	The type of controls ready receptacle, installed at the factory, that is present on the bottom of the luminaire when mounted in operating orientation.	• 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 • Zhaga Book 18 • Other	Review of specification sheet.
Integral Sensor Function	The lighting control strategy function of the integral sensor installed at the factory.	• None • Occupancy Only • Daylight Only • Photocell Only • Occupancy + Daylight • Occupancy + Photocell • Traffic	Review of specification sheet.
Integral Sensor Technology	The type of sensing technology that the integral sensor installed at the factory uses.	• None • Passive Infrared (PIR) • Ultrasonic • Dual-Tech • Microphonic • Microwave • Millimeter Wave • Other	Review of specification sheet.

OUTDOOR			
Controls Information	**Description**	**Accepted Terms**	**Method of Evaluation[7]**
Sensor Maximum Mounting Height	The manufacturer provided maximum mounting height for effective operation of the sensor.	One- or two-digit integer. (in feet or meters)	Review of specification sheet.
NLC QPL Product ID	The NLC QPL Product ID of the networked lighting control system that the integral control product communicates with.	N/A	Review of specification sheet.
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	Review of specification sheet.

Controllability Requirements

Draft 1 proposed controllability testing and reporting requirements for all SSL products are as shown in **Table 21**. Please see **Table 22** for integral control function and technology descriptions, **Table 18** for Controls Ready Receptacle Types, and **Table 23** for Control Communication Method Descriptions.

Table 21: Standard Controllability Testing and Reporting Requirements

Metric	Standard Controllability Requirements	QPL Listing	Method of Evaluation[8]
Dimming	*All products:* **Continuous dimming capability to 20% or less required**	Minimum Dimming Level (e.g., 10%)	Product specification sheet shall clearly identify dimming capability[9]

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

[9] Use of an acceptable term referring to the control communication type noted is an acceptable method to identify dimming capability. Specification sheets do not explicitly need to state "dim", "dimmable", or "dimming".

Dimming

The proposed dimming requirements in draft 1 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.

- All products shall report their minimum dimming level.
- Indoor luminaires and retrofit kits shall be capable of continuous dimming to ≤20% of max output power.
- Outdoor luminaires, solar powered luminaires, and retrofit kits shall be capable of continuous dimming to ≤20% of max output power.
- Lamps shall be capable of continuous dimming to ≤20% of max output power.
- Dimming capability shall be documented on the manufacturer's published product specification sheet.

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.*

Special Considerations for Dimmable Linear Lamps

As stated in **Table 21**, all qualified lamps must be continuously dimmable. Because lamps are most often used in retrofit installations, there are special considerations needed to ensure end users are able to dim lamps as desired. The following considerations apply to each UL Type of linear replacement lamps, mogul-screw base lamps, and pin-based replacement lamps, as appropriate:

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.

Integral Controls

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

Integral control capabilities and technologies are defined in **Table 22**. These integral control 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.

1060 ***Table 22: V6.0 Integral Control Definitions***

Integral Sensor Functions and Technologies		Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
FUNCTION	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.	Occupancy, Vacancy, Motion, Exterior Motion, 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.	Occupancy, Vacancy, Motion, Exterior Motion, 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

Integral Sensor Functions and Technologies		Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
SENSOR TECHNOLOGY	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 monitors 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

Integral Sensor Functions and Technologies		Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
	Other	Presence sensors that utilize another technology not listed above.	N/A

Control Communication

Reporting of the Driver Type and Integral Controller Type for all products is required. Luminaires without integral controls would have "None" in the Integral Controller Type.

Driver Type and Integral Controller Type are defined in **Table 23**. These types 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.

Table 23: 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 Certified	An extension of the DALI-2 standard intended for use within luminaires. and that is eligible to carry the D4i trademark as determined by the Dali Alliance.	D4i Certified
	DALI version-1	A standard lighting control protocol where each luminaire is assigned a unique address and responds to data signals distributed through a common communication line. Developed and maintained by the Dali Alliance.	DALI, DALI version-1, Digital Addressable Lighting Interface
	DALI-2	An updated version of the DALI version-1 standard lighting control protocol where each luminaire is assigned a unique address and responds to data signals distributed through a common communication line. Developed and maintained by the Dali Alliance	DALI-2

Driver and Integral Controller Types		Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
	DALI-2 Certified	An updated version of the DALI version-1 standard lighting control protocol where each luminaire is assigned a unique address and responds to data signals distributed through a common communication line. DALI-2 products are approved by the DALI-2 Certification Program and listed in the Dali Alliance Products Database.	DALI-2 Certified
	DMX512	Lighting control protocol initially created for use in theatrical installations but is in common use in architectural lighting installations where color changing or tuning effects are desired. It describes a 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, Digital Multiplex
	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

Driver and Integral Controller Types		Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
	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
	4G Cellular	Fourth Generation cellular network designed to support all-IP communications and broadband services. Developed by the International Telecommunication Union.	4G, 4G LTE
WIRELESS	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+	A standard that allows DALI signals to be sent over wireless and IP-based networks.	DALI+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	EnOcean, Enocean

Driver and Integral Controller Types		Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
		wireless sensor networks with ultra-low power consumption that utilize energy harvesting technology.	
	Infrared Remote	Usually limited to one-way communication	
	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

Test Report and Implementation 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.

Key Questions Regarding Controls Categories and Other Controllability Proposals

1. The DLC is requiring all qualified products listed to be continuously dimmable down to at least 20%. What feedback, if any, do you have about this proposal?
2. Are there any Driver Types missing in **Table 19** or **Table 20**?
3. Are there any Integral Sensor Types missing in **Table 19** or **Table 20**?
4. Are there any Driver and Integral Controller Types missing in **Table 22**?
5. Are there any Integral Sensor Functions and Technologies missing in **Table 22**?
6. Are there any Controls Ready receptacle types missing in **Table 18**?
7. Draft 1 proposes that luminaires with only 3-pin Twistlock receptacles as an option are not eligible for V6.0 listing because they do not support dimming through the receptacle. What feedback, if any, do you have about this proposal?

Field Adjustable Products

Rationale

To better align with industry practice and discern between field adjustable and controllable products, SSL V6.0 draft 1 proposes to adjust the definition of “field adjustable” and reorganize how information about field adjustable product attributes is collected and displayed on the QPL.

To save energy in all installations, and to encourage the use of lower light output and lower color temperature products in outdoor installations, the DLC is proposing to require that qualified field adjustable light output (FALO) and /or field adjustable color temperature (FACT) products with selectable wattage and/or CCT switches, are shipped from the factory with the switch set to the lowest wattage and CCT, as applicable. For consistency across all qualified products, the DLC is proposing to require this switch setting for all products with selectable wattage and/or CCT switches.

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, only while the user is physically located at the luminaire. Field adjustable parameters are not intended to be changed in the normal course of luminaire operation.

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. Dimming adjustments 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.

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.

For FALD and/or FACT products with selectable wattage and/or CCT switches, the DLC is proposing to require that qualified products are shipped from the factory with the switch set to the lowest wattage and CCT, as applicable.

Field Adjustable Color Temperature (FACT)

Products that are capable of Field Adjustable Color Temperature (FACT) enable the user to make adjustments to the CCT, through either physical or electronic means, only while the user is physically

located at the luminaire. Field adjustable parameters are not intended to be changed in the normal course of luminaire operation. Draft 1 proposes that the default FACT setting shall be the lowest CCT setting. **Table 24** details the reported data requirements for FACT products.

Draft 1 proposes to require that the default CCT setting at which the product is shipped shall match CCT Setting 1, or the lowest CCT setting available.

Table 24: 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 lumen output. SSL V6.0 draft 1 proposes that the Default CCT Setting shall match CCT Setting 1.	xxxxK xxxx K x K x.x K
CCT Setting 1	The correlated color temperature (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

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, only 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 via a proprietary process or separate control (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 1 proposes to require that the default lumen output setting at which the product is shipped shall match Lumen Output Setting 1, or the lowest lumen output setting available.

Draft 1 proposes that all FALO products shall also be dimmable through some other means. **Table 25** details the reported data requirements for FALO products.

Table 25: 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 emerges from production and is shipped with no adjustments to lumen output. SSL V6.0 draft 1 proposes that the Default Lumen Output shall match Lumen Output Setting 1.	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

Field	Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
Default Wattage	The setting at which the product emerges from production and is shipped with no adjustments to lumen output. SSL V6.0 draft 1 proposes that the Default Wattage shall match Wattage Setting 1.	xxxx w xxxx watts
Wattage Setting 1 (Lowest)	The wattage draw of the luminaire at the lowest setting.	xxxx w xxxx watts
Wattage Setting 2	The wattage draw of the luminaire at the second lowest setting.	xxxx w xxxx watts
Wattage Setting 3	The wattage draw of the luminaire at the third lowest setting.	xxxx w xxxx watts
Wattage Setting 4	The wattage draw of the luminaire at the fourth lowest setting, if necessary.	xxxx w xxxx watts
Wattage Setting 5 (Highest)	The wattage draw of the luminaire at the fifth lowest setting, if necessary.	xxxx w xxxx watts

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 26** 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.

Table 26: 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 lumen output.	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

Field	Definition	Acceptable Terms on the Product Spec Sheet or Supplemental Literature
		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

Key Questions regarding field adjustability proposals

1. One implication of the proposed requirements for Field Adjustable Light Output products is that products seeking a FALO listing will need to be dimmable (changes made remote from the luminaire during normal operation) as well as field adjustable (changes made while physically located at the individual luminaire, typically during installation). Does this change have any implications for your current product line?
2. Do you have any feedback about the changes proposed for reported data about field adjustable luminaires?

Testing and Reporting Requirements for FACT and Color-Tunable Products

Rationale

To support increasingly popular products with broader color tuning capabilities, SSL V6.0 draft 1 proposes that Color-Tunable products may be White-Tunable (CCT-tunable, Warm-dimming) or Full Color-Tunable.

Additionally, SSL V6.0 draft 1 proposes changes to clarify that Field Adjustable Color Temperature (FACT) products are eligible for listing as described in the Field Adjustable Color Temperature subsection while relying on testing and reporting requirements that align with CCT-Tunable products as described below.

Other than including language to support Full color-tunable and FACT products, the following testing and reporting requirements for color-tunable products are largely unchanged from SSL V5.1.

Type Definitions of Color-Tunable Products

White-Tunable products are defined as products whose output spectra can be adjusted via an input control of any type and whose chromaticity approximately follows the blackbody locus, providing white light at all input configurations. For this purpose, white light is defined as chromaticity coordinates within the twenty-two, 7-step quadrangles of ANSI C78.377-2024 Basic and Extended Specifications. Products supplying colored light (i.e., those capable of generating color points with D_{uv} magnitudes beyond the limits of the ANSI Extended 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 as characterized above in response to their control signal.

NOTE: 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 and color points with D_{uv} magnitudes beyond the limits of the ANSI Extended specification as characterized above in response to their control signal.

CCT-Tunable and Full Color-Tunable Eligibility

In addition to meeting all applicable SSL Technical Requirement thresholds for Standard, Premium, and LUNA as previously described, the following are eligibility rules for CCT-Tunable and Full Color-Tunable products:

CCT-tunable and Full Color-Tunable products are not eligible to be submitted as Level 1 applications. Both single products and product families must submit a Level 2 Application. For the purposes of color tuning eligibility, the DLC's existing requirements that a family must contain a "standardized set of LED packages/modules/arrays" and must demonstrate scalability or modularity using "any other applicable features" apply also to White-Tunable families, in that they must have identical chipsets and modular groupings of chipsets, resulting in an identical technological approach to color output.

White-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. This includes minimum light output, efficacy, CRI, lumen maintenance, THD, Power Factor, and zonal distribution/spacing criteria requirements.

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 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 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. Standard DLC metric allowances 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.

CCT-Tunable, Full Color-Tunable, and FACT Proposed Testing

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.

All Tunable and FACT product family submittals must include all testing reports required in this section. For products that also have an independent dimming control, testing must be conducted at the highest lumen output setting available for that CCT. For products with multiple control protocol options, testing must be conducted based on the most consumptive driver. For cases where theprovided test results do not appear to reflect the worst-case or setting required by this document, the DLC will require manufacturers to submit additional information and provide technical rationale to the DLC reviewer to support their case.

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 be LM-79 tested for all metrics other than distribution (IES files) 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:

- Photometric distribution testing (goniophotometric testing) for a representative product for each optical variation within the group. This data must be submitted in IES file format and may be represented additionally in a PDF test report.
- A test of the product at the color control setting that produces the lowest lumen output within the group
- For clarity, dimmable products shall NOT be tested in dimmed states. This is a required test of the product that produces the lowest lumen output of any product at any color control setting, at the maximum output dimming control setting
- 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)

In-Situ Temperature Measurement Tests (ISTMTs) must be provided on the following:

- Each LED package/module/array (i.e., each component for which LM-80 testing must be provided) at the worst-case thermal condition (worst-case product-setting combination) for that LED
- It is expected that the worst-case condition for each LED type within a Color-Tunable product will necessarily be under different conditions. If LEDs are employed that have different LM-80s, multiple LED ISTMTs will be required.
- Each driver present in the product, at the worst-case thermal condition for that driver.
- Again, if multiple drivers are used, this may result in the need for multiple driver ISTMTs, under different conditions.

LM-80 testing must be provided for each LED type present in the product. TM-21 projections must be provided for all LEDs at their measured ISTMTs.

As part of the application submittal, manufacturers must report the power consumption for each ANSI C78.377-2024 CCT quadrangle from the minimum CCT to the maximum CCT, and for one reported CCT that falls between the quadrangle 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 27. 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 27: Data Reporting Format for FACT, CCT-tunable and Full Color-Tunable Product Submissions

ANSI CCT Quadrangle (omit any outside product range) / Worst-Case Value	Actual 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				

Manufacturers may 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. In-house testing informs the selection of worst-case. Actual worst-case testing must be conducted per the appropriate test standard at an accredited lab.

Guidance for "Input Control Signal Applied" Field in Table 27

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.

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 metric allowances apply as outlined in **Table 37** 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.

Warm-Dimming Testing

Warm-Dimming product submittals must include a single LM-79 report performed at the **maximum setting of the dimming input control**. If the LM-79 results fail to meet the Technical Requirements, the product will not qualify.

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

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 (formerly Family Grouping) Testing Requirements apply to Warm-Dimming products in the same manner as with non-color tuning products.

Supporting Documentation

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.

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.

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.

Key Questions Regarding Proposals for FACT and Color-tunable Products

1. SSL V6.0 draft 1 proposes eligibility for full color-tunable products (i.e., those that can tune beyond standardized CCT quadrangles defined in C78.377. What feedback, if any, do you have about this proposal?
2. As described in the Field adjustability section of Draft 1, DLC proposes that field adjustable color temperature (FACT) product types are not considered color tunable. What feedback, if any, do you have about this proposal?

Lumen Maintenance and Driver Lifetime

Rationale

Maintaining the expected performance over a product's lifetime is a critical aspect for confidence across all energy-efficiency incentive opportunities. To ensure SSL QPL listed products meet industry standards for maintained performance over the products' lifetime, SSL V6.0 and LUNA V2.0 Draft 1 proposes that all DLC Standard and Premium listings meet the following lumen maintenance and driver lifetime requirements. Requiring driver lifetime for all listings is a key proposed change from V5.1 to ensure minimum driver lifetime, one of the leading failure points for LED luminaires, for all SSL QPL listings, whereas only Premium listings were required to meet a driver lifetime requirement under V5.1.

Additionally, based on evaluated product performance data, the DLC is proposing a lower L_{70} criterion for de-Amber, pc-Amber, and 1800 K – 2000 K LEDs, compared with white light luminaires. Draft 1 also proposes that these product types are not eligible for Premium in SSL V6.0 and LUNA V2.0.

The DLC encourages the use of the latest industry standards while understanding the lab lead time to obtain accreditation or update processes to new standards. As such, SSL V6.0 and LUNA V2.0 Draft 1 proposes an optional pathway for the reporting of In-Situ Temperature Measurement Testing (ISTMT) in accordance with ANSI/IES LM-98-24.

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 28**.

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.

Driver Lifetime

The Driver Lifetime requirements for DLC Standard and DLC Premium are shown in **Table 28**.

To demonstrate compliance with the driver lifetime requirement of ≥50,000 hours 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 standard and allows reporting of ISTMT reports in accordance with LM-98-24.
    a. 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.
2. A picture of the TMP_{ps} location with an arrow indicating the thermocouple attachment point.
3. Documentation from the driver manufacturer that indicates the maximum case temperature for which the driver is designed to last ≥50,000 hours, as well as the TMP location it designates for thermal testing.
    a. Custom and integrated drivers must provide documentation equivalent to that required for drivers from third-party vendors. Manufacturers must supply documentation indicating the maximum acceptable temperature for the driver for 50,000-hour life, as well as the TMP to be used during thermal testing and evaluation.

The luminaire passes the driver 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 ≥50,000 hours specified by the power supply manufacturer. Drivers shall be tested in-situ under steady-state operating conditions, with case temperature measured at the designated TMP.

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

The thermocouple tolerance shall conform to ASTM E230 Table 1 "Special Limits" (≤1.1^{o}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 ≥50,000 hours, and the specific driver model number. Reviewers may ask for additional driver information.

Table 28: Proposed Lumen Maintenance and Driver Lifetime Requirements for DLC Standard and DLC Premium

Metric	DLC Standard	DLC Premium
Lumen Maintenance	2200 K – 6500 K: L70 ≥ 50,000 hours De-Amber, pc-Amber, 1800 K-2000 K: L70 ≥ 36,000 hours	(In addition to L70 thresholds) 2200 K – 6500 K: L90 ≥ 36,000 hours de-Amber, pc-Amber, 1800 K-2000 K: not eligible for Premium
Driver Lifetime	≥ 50,000 hours	

Key Questions Regarding Lifetime Requirement Proposals

1. What feedback, if any, do you have regarding the proposed requirement that all DLC Standard and DLC Premium listed products meet or exceed a 50,000 hour driver lifetime?
2. Draft 1 proposes a driver lifetime exemption for Type A and Type B lamps. What feedback, if any, do you have with this exemption proposal? Are there other product types you believe should be exempt from the driver lifetime requirement proposed?
3. Draft 1 proposes an LED L70 lumen maintenance requirement of 36,000 hours or longer for Amber LEDs and 1800 K-2000 K LEDs. Is there a concern regarding this lumen maintenance requirement for this product type?
4. Solar powered luminaire drivers are understood to operate in variable load conditions which is different than most outdoor luminaires. What feedback, if any, do you have regarding the proposed driver lifetime requirements for solar powered outdoor luminaires?
5. Draft 1 proposes optional reporting for ISTMT reports in accordance with ANSI/IES LM-98-24. What feedback, if any, do you have regarding this proposal?

Sustainability

Rationale

Environmental considerations, such as carbon reduction, which is a key component of the DLC's mission, and material health extends beyond just energy efficiency. Currently, the metrics and QPL data in V5.1 focus solely on a product's use phase, assessing impacts such as energy consumption, light pollution, and other environmental factors from installation to removal. To support market demand for more sustainable lifecycle practices in the lighting industry, SSL V6.0 and LUNA V2.0 Draft 1 proposes to incorporate optionally reported data informing the impact from additional lifecycle stages, providing a more comprehensive view of a product's total environmental impact. By encouraging manufacturers to integrate lifecycle data gathering into their processes, the DLC hopes to drive broader sustainability efforts in lighting and highlight opportunities and successes beyond energy efficiency alone.

Proposed Reporting Options

SSL V6 and LUNA V2.0 Draft 1 uses the term Sustainability to refer to anything encompassed in a lifecycle assessment (LCA) that doesn't solely focus on the use phase. To support sustainable products, e.g., those with low embodied carbon, non-toxic materials, and more, Draft 1 proposes to add optional reported fields for third-party green labels, certifications, and environmental product declarations (EPDs). This information will be available on the QPL. Sustainable certifications, documents, and claims available for reporting to the QPL are listed in **Table 29**, along with any required materials or special considerations for specific claims. The DLC reserves the right to request additional documentation for verification as needed.

Table 29: Optionally Reported Sustainability Fields

Certification Body or Organization	Certification Level	Verification Materials
Environmental Product Declaration (EPD)	ISO 14025 compliant	EPD Document (Must be registered with an EPD program operator)
	ISO 14025 and Product Category Rule Compliant	
Health Product Declaration (HPD)	HPD v2.3 (Full Disclosure of Ingredients to 100 ppm)	HPD Document
	HPD v2.3 (Threshold Disclosure)	
	HPD Pre-verified	
DECLARE	Declared	DECLARE Label
	Red List Approved	
	Red List Free	
Living Product Challenge	Imperative Certification	Product documentation with LPC logo or

Certification Body or Organization	Certification Level	Verification Materials
		certification report from ILFI
Living Product Challenge	Petal Certified Product	Product documentation with LPC logo Or certification report from ILFI
	Full Living Product Certification	
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	
Certified Wood	FSC 100%	Product Documentation with FSC Label or FSC chain of custody Certification Document
	FSC Mix	
	FSC Recycled	
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	
SCS Global Services	Indoor Advantage	Product Documentation with Label or SCS Global certification document
	Indoor Advantage Gold	
	Recycled Content Certification	
Electronic Product Environmental Assessment Tool (EPEAT)	Bronze	Product Documentation with EPEAT label or EPEAT registry listing
	Silver	
	Gold	

Certification Body or Organization	Certification Level	Verification Materials
Climate Neutral	Climate Neutral Certified	Product Documentation with Climate Neutral logo or Climate Neutral certification report

For all products that allow product documentation with a label as a verification method, the provided specification sheet or supporting documentation must include the label or logo that confirms compliance with the associated certification.

Key Questions Regarding Proposed Sustainability Reporting

1. Are there any certifications not included in **Table 29** that should be?
2. Are there any concerns with providing the verification materials listed here as proof of compliance?
3. Are there concerns with including labels that may expire if not renewed?

Safety

Unchanged from SSL V5.1 Technical Requirements, SSL V6.0 includes the following testing and reporting requirements for safety certification.

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.

Power Quality

Unchanged from SSL V5.1 Technical Requirements, SSL V6.0 and LUNA V2.0 Draft 1 includes the following testing and reporting requirements for power quality.

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.

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).

DLC Premium

Rationale

The Premium classification is intended to differentiate products that achieve higher energy savings, improved light quality, and advanced controllability performance *above* DLC Standard requirements. To better support expansion of energy efficiency incentive programs for controlled LED solutions and overall higher energy saving products, DLC Premium under V6.0 and LUNA V2.0 proposes to set a higher-performance qualification for luminaires and retrofit kits with an enhanced focus on efficacy and controllability while maintaining many Premium thresholds established under V5.1.

Additionally, due to feedback on the use of "application UGR" methods with many product types, SSL V6.0 Draft 1 proposes to maintain tabular maximum UGR requirements for Troffer PUDs. Troffers are understood to be modeled representatively with the tabular method. The DLC proposes to remove maximum UGR requirements for Linear Ambient, High-bay, and Low-bay PUDs in SSL V6.0 Draft 1.

Premium Requirements

Products submitted for DLC Premium qualification must meet more stringent efficacy, quality of light, and controllability requirements as outlined in **Table 30**. The DLC is seeking feedback on all of the proposed Premium requirements.

Only luminaires and retrofit kits are eligible for qualification under DLC Premium. 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 DLC Standard section for testing and reporting recommendations for qualifying products to the LUNA V2.0 Technical Requirements.

UGR Requirements for Indoor Products

Discomfort from glare performance requirements in SSL V6.0 are calculated with the Unified Glare Rating (UGR) metric and only apply to products seeking DLC Premium qualification and/or to products seeking efficacy allowances for Premium qualification that meet the given UGR thresholds in **Table 30**. 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.

1656 ***Table 30: Proposed DLC Premium Testing and Reporting Requirements***

Metric	SSL V6.0 & LUNA V2.0 Draft 1 Premium Requirements*	QPL Listing	Method of Evaluation
Efficacy	**+20 lumens per watt** over V6.0 Standard efficacy requirements	Same as V6.0 Standard	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 *All other products*: Same as V6.0 Standard	Same as V6.0 Standard	Same as V6.0 Standard
Discomfort Glare	*Troffer (Luminaire and Integrated Retrofit Kits only):* **Corrected UGR < 22.0** (Note: Linear-Style Retrofit Kits for 2x2, 1x4, and 2x4 Luminaires are not eligible for Premium qualification under V6.0.)	UGR values not published on the QPL	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%
	All other products: **n/a**		

Metric	SSL V6.0 & LUNA V2.0 Draft 1 Premium Requirements*	QPL Listing	Method of Evaluation
Controllability	All products shall: 1. Be capable of continuous dimming down to at least 10%. 2. Utilize one or more of the following Driver Types: a. Wired – BACnet b. Wired – D4i c. Wired - D4i Certified d. Wired - DALI version-1 e. Wired - DALI-2 f. Wired - DALI-2 Certified g. Wired – DMX512 h. Wired – Modbus i. Wired - Other Digital j. Wired - Other Digital (Proprietary) k. Wired - Integrated Driver + Controller 3. Utilize one or more of the following luminaire communication methods: a. Wired – BACnet b. Wired – D4i c. Wired - D4i Certified d. Wired - DALI version-1 e. Wired - DALI-2 f. Wired - DALI-2 Certified g. Wired – DMX512 h. Wired – Modbus i. Wired - Other Digital j. Wired - Other Digital (Proprietary) k. Wireless – 4G l. Wireless - 5G m. Wireless - Bluetooth NLC n. Wireless - Bluetooth (Proprietary) o. Wireless - DALI+ p. Wireless – EnOcean q. Wireless - Infrared Remote r. Wireless – Other s. Wireless - Other (Proprietary) t. Wireless - Wi-Fi u. Wireless – Zigbee v. Wireless - Zigbee (Proprietary) 4. 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	Same as V6.0 Standard

Metric	SSL V6.0 & LUNA V2.0 Draft 1 Premium Requirements*	QPL Listing	Method of Evaluation
Lumen Maintenance	$L_{90} \geq$ 36,000 hours (Note new LM-80 / TM-21 guidance. See Additional Reporting Guidelines: IES TM-21-11 and its Addendum B)	Lumen Maintenance values not published on the QPL	ANSI/IES TM-21 projections in the same manner as the V6.0 Standard L_{70} requirements

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

Spectral Quality Test Report and Implementation Requirements: DLC Premium

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 1 Standard requirements. Topic-specific details are described below.

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

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 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.
- All variations of CCT offered shall fall within at least one of the basic, flexible, or extended nominal, 4-step quadrangles (for all indoor products, except high-bay), or 7-step quadrangles (for all outdoor and high-bay products) from 2200 K to 6500 K as defined by ANSI C78.377-2024.
- 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.

Distribution Test Report and Implementation Requirements: DLC Premium

For SSL products seeking Premium qualification, the testing and reporting requirements related to light distribution and discomfort glare are listed in **Table 30.**

In SSL V6.0 draft 1, 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.

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 Guidelines 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.

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 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

[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.

requirements in **Table 30**, both viewed endwise and crosswise, the product, or family of products in the case of Level 2 applications, qualifies for the DLC Premium qualification.

Interactions with other DLC Requirements

For FALD products seeking Premium qualification, the UGR value shall meet the threshold at the light distribution setting designated, per the FALD requirements, for meeting the ZLD requirements of the PUD, for which the product is seeking qualification.

Key Questions Regarding Premium Requirement Proposals

1. Draft 1 proposes that all Premium listings be required to be eligible for controls categories 2, 5, or 6 as described in **Table 16**. What feedback, if any, do you have regarding this proposal?
2. Draft 1 proposes that all Premium listings are driven by a digital driver to better support higher controls capabilities as described in Controllability requirements 2 and 3 in **Table 30**. What feedback, if any, do you have regarding this proposal? Are there any missing communication methods that should be considered? Are there any methods included that should not be eligible?
3. Are there any luminaires on the market with 5-pin Twistlock receptacles that utilize digital drivers? If so, are there performance limitations when compared to luminaires with 7-pin Twistlock receptacles?
4. What feedback do you have regarding the DLC eliminating its UGR requirements for linear ambient, high-bay, and low-bay PUDs seeking Premium qualification?

Outdoor Solar Powered Luminaires

Rationale

Outdoor solar powered luminaires offer significant potential for decarbonization and resilience, as they rely primarily—or entirely—on solar energy. Fully off-grid systems eliminate the need for grid connections, reducing transmission infrastructure costs while supporting energy independence. These products integrate a solar panel for energy generation, a battery for storage, and a luminaire that draws power from the battery (or the grid in hybrid models). 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 intended to support greater standardization in how manufacturers present performance data on their spec sheets.

Special Considerations for Outdoor Solar Powered 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 that might be incorporated into 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. Luminaires where solar panels fully provide input power (off grid) will be treated as a DC product and should be tested accordance to the DC/POE requirements. Luminaires where solar panels supplement the input power (hybrid) will be reviewed to determine if the luminaire is less efficient when powered by the solar panels (DC) vs. power grid (AC). If the luminaire is less efficient when powered by DC it must be tested and listed per 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 per the V6.0 Technical Requirements with no DC input into the luminaire during any testing or rating performance.

Outdoor solar powered 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 or 3 in **Table 17**. To convey information about the product functionality and components, additional reported information is required for products qualified under this category as described in **Table 31**.

1775 ***Table 31: Additional Reported Fields Required for Outdoor Solar Powered Luminaires***

Reported Field	Options	Description
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.
	Separate Components	The solar panel and battery are mounted separately from the luminaire, but all components are marketed as one product
	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
Grid Connection	Off Grid	The luminaire receives 100% of its energy from a solar panel
	Hybrid	The luminaire is designed to receive energy from both a solar panel and the electric grid
PV Wattage	Enter Value in Watts	Only applicable for products with "Integrated" or "Separate Components" indicated in the Configuration field
Recommended Install Height	Enter Range in Feet	Only applicable for products with "Integrated" or "Separate Components" indicated in the Configuration field
Battery Type	Lithium Iron Phosphate ($LiFePO_4$)	Only applicable for products with "Integrated" or "Separate Components" indicated in the Configuration field
	Lead Acid	
	Nickel-Metal Hydride (NiMH)	
	Lithium Nickel Manganese Cobalt Oxide (NMC)	
	Lead Crystal®	
Battery Capacity	Enter Value in Amp-Hours	Only applicable for products with "Integrated" or "Separate Components" indicated in the Configuration field

Reported Field	Options	Description
Battery Lifetime	Enter Value in Years	Time until battery degenerates to 80% capacity Only applicable for products with “Integrated” or “Separate Components” indicated in the Configuration field
Solar Panel Lifetime	Enter Value in Years	Time until panel generates 80% of initial capacity Only applicable for products with “Integrated” or “Separate Components” indicated in the Configuration field

Key Questions: Outdoor Solar Powered Luminaires

1. Are there any requirements for outdoor lighting in this document that would hinder qualification for solar powered luminaires, specifically, due to technological and application-related differences?
2. Is there any additional information about solar powered luminaire systems not listed above that should be included on the QPL?

LUNA V2.0 Technical Requirements

Rationale

Version 2.0 of the LUNA Technical Requirements establishes additional pathways for DLC LUNA qualification for non-white light (NWL) luminaires, lamps, and retrofit kits that may be suitable for sensitive environments. In general, Amber LED and low CCT (i.e., 1800 K – 2000 K) LED products further reduce sky glow and minimize impacts to wildlife compared to white LED luminaires, as long as uplight and over-lighting are minimized.

New Turtle Lighting PUDs are being introduced in SSL V6.0/LUNA V2.0. These PUDs must meet specific LUNA criteria and thresholds and must be qualified to LUNA to be listed on the SSL/LUNA QPL.

LUNA V2.0 continues to include metrics for light distribution, spectral quality, and controllability – all of which are intended to mitigate light trespass and sky glow.

In V2.0, the DLC is proposing to allow field adjustable color temperature (FACT) luminaires with CCTs above 3000 K to qualify to LUNA, as long as the luminaire is shipped with a CCT of 3000 K or below, and the CCT is not intended to be changed in the course of normal operation.

In V2.0, the DLC is also proposing to allow lamps and outdoor retrofit kits to qualify to LUNA as long as additional LUNA requirements are met.

LUNA Light Distribution Requirements

Rationale

The DLC is continuing to use Uplight (U) Ratings (as defined by Annex A in the ANSI/IES TM-15-20 Luminaire Classification System for Outdoor Luminaires) 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.

BUG ratings 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 to support compliance with these regulations.

LUNA Requirements for Light Distribution

The following section outlines the LUNA 2.0 requirements for light distribution. **Table 32** includes columns for the metric or application and its associated requirements. The “QPL Listing” column describes the information that will appear as publicly available on the QPL, if applicable. 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.

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 to encourage well-shielded products to be listed on the QPL.

Table 33 lists the Primary Use Designations (PUDs) that are eligible for LUNA V2.0 and their respective maximum U-Rating thresholds and light output.

Table 32: LUNA Distribution Requirements

Metric / Application	LUNA V2.0 Requirements	QPL Listing	Method of Measurement/ 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 33**. 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. The submitter will create a .png image for the tested product to be shown on the QPL, based on the submitted .ies file‡.	ANSI/IES LM-79 per the *Additional Reporting Guidelines.* BUG ratings generated per ANSI/IES TM-15-20 Annex A using luminaire photometric data. Note: for LUNA qualification, LM-79/distribution testing must be provided on a LUNA-qualifying product (highest light output at highest LUNA-eligible CCT).
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 2**).	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.

Metric / Application	LUNA V2.0 Requirements	QPL Listing	Method of Measurement/ Evaluation
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 section for more information.

Table 33: Proposed PUDs eligible for LUNA 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
AQ	Screw-Base Replacements for HID Lamps in Outdoor Pole/Arm-mounted Area and Roadway Luminaires	1 (in-luminaire)	10,000 (in luminaire)
AR	Screw-Base Replacements for HID Lamps in Outdoor Zero-Uplight Wall-mounted Area Luminaires	1 (in luminaire)	10,000 (in luminaire)
AU	Screw-Base Replacements for HID Lamps in Fuel Pump Canopy Luminaires	2 (in luminaire)	10,000 (in luminaire)
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
	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

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 Guidelines, 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.
- 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 2**).

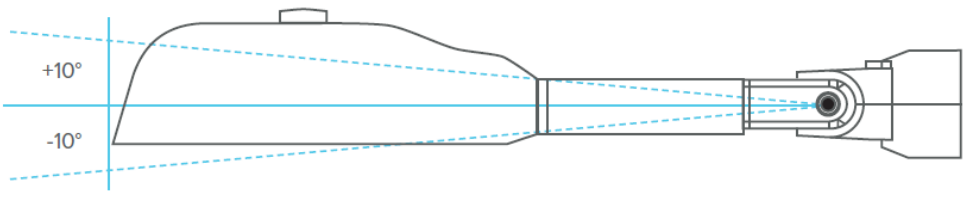

Figure 2: *Acceptable maximum mounting bracket tilt angle for LUNA qualification.*

- 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.

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.

LUNA Spectral Quality Requirements

Rationale

LUNA V2.0 is proposing expanding eligibility to Non-White Light (NWL) outdoor luminaires, lamps, and retrofit kits with low CCTs or Amber LEDs. The DLC is proposing a maximum CCT of 2700 K for lamps and retrofit kits on the advice of members of our LUNA Advisory Group (AG).

Filtered-Amber LED products (e.g., white LEDs with an amber filter or lens) are eligible for LUNA as long as products meet the 2% blue requirement and are "traffic color compliant" per ordinance language in Hawaii County and Maui County codes. See **Table 10** for NWL definitions and metrics.

LUNA Requirements for Spectral Quality

The spectral quality requirements for LUNA products that extend beyond SSL V6.0 requirements are outlined in **Table 34**. 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.

Table 34: LUNA V2.0 Spectral Quality Requirements

Metric and/or Application	LUNA V2.0 Requirements	QPL Listing	Method of Measurement/ Evaluation
Chromaticity (CCT & D_{uv})	All luminaires must exhibit chromaticity consistent with at least one of the basic, flexible, or extended, nominal 7-step quadrangle CCTs from 1800 K - 3000 K. All LED replacement lamps and outdoor retrofit kits must exhibit chromaticity consistent with at least one of the basic, flexible, or extended, nominal 7-step quadrangle CCTs from 1800 K - 2700 K. NWL requirements: see **Table 10**. LUNA qualifying products tested to meet LUNA spectral quality requirements must submit an ANSI/IES TM-27-20 .spdx file 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.[+]	SPD data and image[‡], 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 Guidelines*) ANSI/IES TM-27-20 or IES TM-27-14 Optionally: ANSI/IES TM-33-18 Note: For LUNA qualification, LM-79/color testing must be provided on a LUNA-qualifying product. See **Table 10** for NWL requirements.

‡ The DLC will create a .png image for parent products to be shown on the QPL based on the submitted ANSI/IES TM-27-20 (or IES TM-27-14) .spdx file. 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.

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, 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, 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, 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, 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 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.

Spectral quality interactions with other DLC policies: Color-Tunable

For color-tunable (CCT-tunable, and warm-dimming) and field adjustable CCT products, an additional clarification to meet the LUNA spectral quality requirements is provided below.

CCT-tunable and warm-dimming products are eligible for LUNA V2.0 if the maximum LUNA CCT threshold (3000 K for luminaires and 2700 K for lamps and retrofit kits) is within the minimum and maximum CCT of the product's CCT adjustable range. Per the proposed FACT policy, products with adjustable CCTs must be shipped at the lowest CCT (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.

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

Key Questions on LUNA V2.0 Spectral Quality Requirements

1. Draft 1 proposes to limit the maximum CCT for outdoor lamps and retrofit kits to 2700 K (instead of 3000 K) for these products to qualify to LUNA. Is there any concern with this proposed requirement?

2. Is there a concern with allowing products with field adjustable CCTs above 3000 K (2700 K for lamps and retrofit kits) to be LUNA listed, as long as the product is shipped with the CCT set at a LUNA qualifying CCT level?

3. Recent research has demonstrated that S/P ratio is a better predictor of Sky Glow than CCT. Is there a benefit to the DLC showing product S/P ratios on the LUNA QPL? What feedback, if any, do you have regarding displaying S/P ratios on the LUNA QPL?

LUNA Controllability Requirements

Rationale

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.

LUNA Requirements for Controllability

Sky glow and light trespass can 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 as appropriate, 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 that is needed, only when 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.

Proposed LUNA Turtle Lighting PUDs

Rationale

Turtle Lighting luminaires are required in coastal installations where sea turtle hatchlings are known to nest. While de-Amber lighting is still disorientating to sea turtles, it is considered to be the least disorientating option as long as spectrum, distribution, light output and mounting height are controlled.

In draft 1, de-Amber LEDs will be allowed for turtle lighting products. No additional direct emission long-wavelength LED types (e.g., de-Orange or de-Red) are proposed.

Three new turtle lighting PUDs are proposed in LUNA V2.0. These products must use de-Amber LEDs, and have a proposed maximum lumen output, zero uplight, and minimal high angle light per **Table 35**, below.

Specifications

Requirements for de-Amber thresholds for luminaire efficacy and lumen maintenance are provided in **Table 7**.

Table 35: Proposed Turtle Lighting PUD Technical 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	5000	de-Amber	U0	G1
BH	Turtle Lighting Zero-Uplight Wall-mounted Area Luminaires	1500	de-Amber	U0	G0
BI	Turtle Lighting Zero-Uplight Bollards	1000	de-Amber	U0	G0

Key Questions for Proposed LUNA Turtle Lighting PUDs

1. What is your feedback on the proposed maximum light output requirements?
2. What is your feedback on the proposed use of G-Rating thresholds? Should the DLC specify a limit on high angle light instead (for example, by specifying % lumens in the FVH and BVH zones)?
3. Are there any missing Turtle Lighting PUDs that the DLC should consider adding?
4. What is your feedback on the DLC's proposal to disallow other direct emission long-wavelength LEDs (such as red-orange LEDs) to be included in Turtle Lighting products in LUNA V2.0?
5. Solar powered Turtle Lighting PUDs will be allowed in this proposal. What is your feedback on allowing solar powered Turtle Lighting PUDs?

LUNA Testing and Reporting Requirements

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

LM-79 testing

See the Additional Reporting Guidelines section for more details on V6.0 requirements.

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.

Retrofit Kits

Unchanged from policy, draft 1 includes the following testing and reporting requirements for retrofit kits.

Testing & 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

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 housings 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.

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

- **Notation in the Application Questionnaire**
  Manufacturers must select “No” to the question asking if they are submitting a Retrofit application for qualification within a single specific reference housing (Option B).
- **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. 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 your retrofit kit. DLC review staff may need additional details, depending on the request and details available in the spec sheet.

Option B: Testing in a 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:

- **Notation in the Application Questionnaire**
  Manufacturers must select “Yes” to the question asking if they are submitting a Retrofit application for qualification within a single specific reference housing (Option B) as well as type in the specific reference housing required for use with this retrofit kit
- **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.

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.

Modular Products with External Power Supplies

Unchanged from the previous policy, draft 1 includes the following testing and reporting requirements for modular products with external power supplies.

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.

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 your 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.

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

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

Unchanged from the previous policy, draft 1 include the following testing and reporting requirements for Direct-Current (DC) and Power over Ethernet (POE) products.

Rationale

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 a 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.

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).

    a. 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.

8. 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 **Table 36** 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 **Table 36**, 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 36: 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.

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.

Alternately Sourced Equivalent Components

Rationale

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. 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 1 proposes a pathway for manufacturers to report equivalent, alternately sourced components that are being used as described below.

Testing and Reporting Requirements

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 40**. 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 meet subcomponent-level lumen maintenance and driver lifetime requirements 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.

Key Questions Regarding Alternately Sourced Equivalent Components Proposals:

1. Draft 1 proposes additional reporting for alternately sourced equivalent LEDs and Drivers without requiring LM-79 testing on variations comprised of alternate sources (i.e., only worst-case variations are required to be tested). Should the DLC require an additional LM-79 test on worst-case conditions for multiple variations comprised of alternately sourced equivalent LEDs and drivers to ensure performance between these variations is truly equivalent considering all technical requirement thresholds to be evaluated against SSL V6.0?

2. Draft 1 proposes additional reporting for alternately sourced equivalent LEDs and Drivers. Should this be expanded to include reporting pathways for other alternate components? E.g., Optical components, heat sinks, etc. If so, which other components should be considered in draft 2?
3. What feedback, if any, do you have regarding the reporting of alternate components?

Efficacy Allowances

Rationale

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.

Summary of Proposed SSL V6.0 Efficacy Allowances

A summary of efficacy allowances included in draft 1 can be seen in **Table 37**. Efficacy allowances are cumulative up to a maximum allowance of 15%, except NWL products, which may have a cumulative allowance up to 25%. For example, a 2700 K product that exhibits superior color rendition may utilize a maximum allowance of 10%, whereas a 2700 K, low UGR product that exhibits superior color rendition may utilize a maximum allowance of 15%, to be applied to the efficacy requirement for the Category and General Application under which the product is qualified. Additionally, a product may take advantage of an efficacy allowance in conjunction with the luminaire efficacy tolerance, as stated in **Table 40**.

Table 37: Allowances to Efficacy

Feature	General Application	Performance Metric	Allowance under V6.0
Low CCT	All	≤ 2700 K	-8%
		≤ 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%
		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** at the glare evaluation reference condition of • Room dimension: X = 4H, Y = 8H • Spacing to height ratio (S/H): 1 • Reflectances: 70/50/20% (Note: Linear-Style Retrofit Kits for 2x2, 1x4, and 2x4 Luminaires are not eligible for efficacy allowances under V5.1.)	-10%

Efficacy Allowances: Spectral Quality

To enable a qualification pathway for luminaires designed for installations that demand higher level color rendition and to recognize the tradeoff between efficacy and color rendition, efficacy allowances are provided for products with improved color rendition that meet all other QPL criteria. Recognizing the tradeoff between CCT and efficacy, efficacy allowances are also provided for products with CCT ≤2700 K.

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

- A full LM-79/color report, per the Additional Reporting Requirements, 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.

Efficacy Allowances: Enhanced Discomfort from Glare Control

Recognizing that luminaires and retrofit kits for applications demanding low discomfort from glare are often designed at the expense of efficacy, allowances are provided for Premium products with low UGR values that meet all other QPL criteria. The allowances are currently only provided for the following products:

- Troffer luminaires and integrated retrofit kits

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 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

[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.

application, all products of the same optical variations as the submitted luminaires within the family automatically qualify for the allowances.

Interactions with other DLC Policies: Field Adjustable Light Distribution

Field adjustable light distribution (FALD) products are not eligible for efficacy allowances related to discomfort glare, and testing and reporting requirements for UGR are applicable to FALD products.

LUNA Allowances

Efficacy allowance for bollard PUDs

Bollards that meet all LUNA requirements for distribution, spectrum, and controllability are provided with a 25% efficacy allowance. This allowance may be added to other spectral quality allowances provided under SSL V5.1.

Efficacy allowance for shielded luminaires

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 efficacies, 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. 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. 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.
- 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 38**.

In all cases, the testing to achieve the specified shielding efficacy allowance is in addition to other testing specified in these technical requirements and all other V5.1 testing requirements, unless specific provisions are made for an exception to the approach in this policy. Shielded products must meet all other SSL V5.1 and LUNA requirements and are offered efficacy allowances as long as specific reductions in relevant zonal lumens are achieved. 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, as specified in **Table 39**. 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 38 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 requirements in **Table 39** (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 distribution parent in each subgroup is the product that reduces the house-side or street-side lumens the least.

[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.”

Table 38: 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)

Row #	Family name	Optic	Luminaire efficacy w/o shielding (LPW)	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
1	AXBXC	Type II	125	3000	HSS	30	A	85	1400	53%	LM-79/ color
2	AXBXC	Type II	125	3000	HSS	45	A	88	1200	60%	
3	AXBXC	Type III	125	3500	HSS	30	A	87	1700	51%	LM-79/ distribution
4	AXBXC	Type III	125	3500	HSS	45	A	89	1500	57%	
5	AXBXC	Type II	125	10000	FSS	30	B	88	6500	32%	LM-79/ color
6	AXBXC	Type II	125	10000	FSS	45	B	90	5000	47%	
7	AXBXC	Type III	125	9500	FSS	30	B	89	7000	30%	LM-79/ distribution
8	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 the luminaires with the lowest reduction in house or street side lumens.

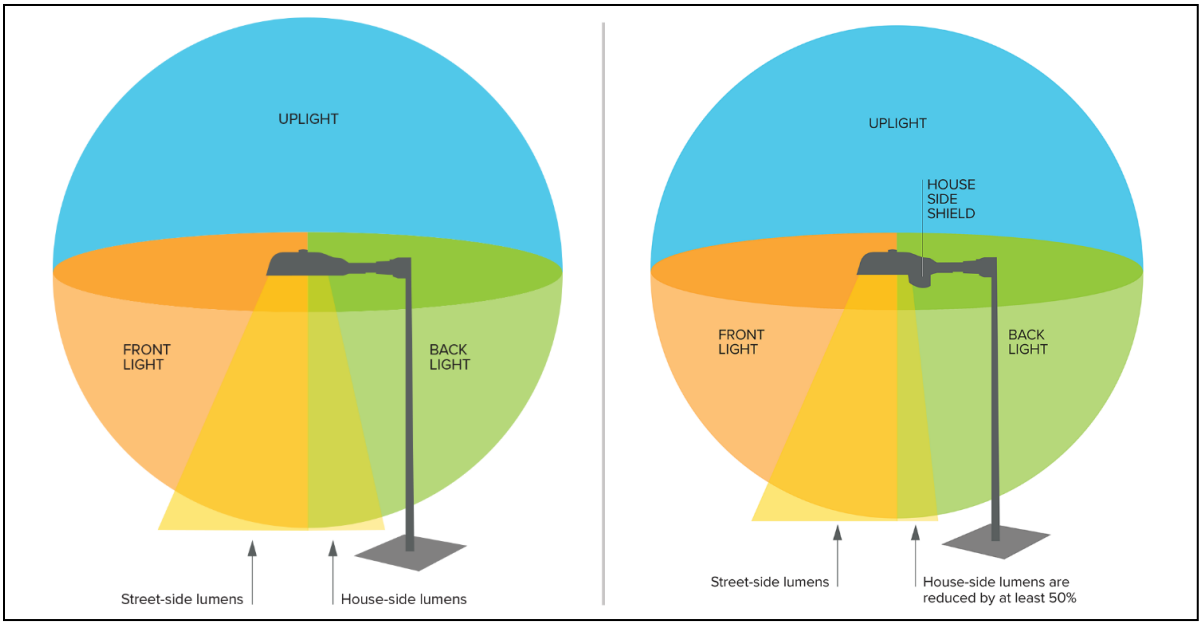

Figure 3: *Example of a hypothetical product with a house-side-shield (HSS) (right image) and without (left image). This hypothetical product with a HSS would be eligible for a shielding efficacy allowance if the house-side lumens are reduced by at least 50% compared to an unshielded equivalent product. Note that other shielding efficacy allowances for other shield types will require different reduction in house-side or street-side lumens, per* ***Table 39****.*

To encourage the listing of shielded products, the DLC is providing efficacy allowances for shielded area lighting, roadway lighting, and pole- or arm-mounted decorative lighting with house-side shields or cul-de-sac shields if the related house-side lumens are reduced by the specified percentage compared to an unshielded product. A similar efficacy allowance is also provided for shielded area lighting, roadway lighting, and pole- or arm-mounted decorative lighting with front-side shields if the related street-side lumens are reduced by the specified percentage compared to an unshielded product.

Table 39 shows the efficacy allowances for LUNA products with shielding. These allowances may be added to other spectral quality allowances provided under SSL V6.0. The maximum allowance for a shielded LUNA product is not limited by the maximum allowance of 10% as stated in the SSL V6.0 requirements. Instead, for LUNA, it may be up to 45%, depending on the shield type.

Table 39: Efficacy Allowances Specific to LUNA Products with Shielding

Feature	Primary Use Designations	Performance Metric	Shielding Efficacy Allowance
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) are offered an efficacy allowance of 20% if they 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) are offered an efficacy allowance of 35% if they 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) are offered an efficacy allowance of 20% if they reduce the street-side lumens by at least 30% compared to an equivalent unshielded product.	-20%

Testing Notes

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). The submitted specification sheet or supplemental document should clearly show the relationship between the unshielded product and shielded product for the reviewer's analysis.

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.

Tolerances

Unchanged from SSL V5.1 Technical Requirements, SSL V6.0 includes the following tolerances described below.

The DLC accepts measurement tolerances to most metrics listed in the Technical Requirements as described in **Table 40**. For zonal lumen tolerances specific to each Primary Use Designation, please refer to the Distribution requirements section of SSL V6.0 draft 1.

Table 40: Proposed Tolerances under Version 6.0

Performance Metric	V6.0 Tolerance
Light Output	±10%
Luminaire Efficacy	-3%
Allowable CCT	Defined by ANSI C78.377-2017†
Color Rendition	CIE Ra (CRI): -1 Point CIE R9: -1 Point IES Rf: -1 Point IES Rg: -1 Point IES $R_{cs,h1}$: +/- 1%
Color Maintenance	$\Delta u'v'$: + 0.0004 points Data must be consistent with the LM-80 testing and reporting guidelines.
UGR	None[13]
Power Factor	-3 percentage points
Total Harmonic Distortion	+5 percentage points
Beam Angle (linear replacement lamps and 2G11 lamps only)	-5°

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

For performance metrics that are a nominal value, a 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).

Tolerances are intended to account for all testing variation, rounding, and significant digits. The requirement values and tolerances will be interpreted by DLC review staff as exact requirements. While test labs will be expected to follow the requirements of their accreditation and relevant test standards, DLC staff will not employ additional rounding to interpret values below the absolute thresholds as passing. For example, if a luminaire is required to have an efficacy of 110 lm/W, then with the efficacy

[13] There is no additional tolerance for UGR threshold values.

tolerance of -3%, any value for efficacy less than 106.70000 will be interpreted as a failing value. It is an applicant's responsibility to check all data presented in an application before submission to ensure compliance with the DLC requirements.

Testing Constraints

Unchanged from SSL V5.1 Technical Requirements, SSL V6.0 includes the following testing and reporting requirements for products that have physical limitations that impact testing the actual product.

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 require additional information, and manufacturers should be prepared to provide documentation that addresses concerns that arise.

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.

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 to 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 testing 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.

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.

Lamps & Reference Housings

Under the V6.0 Technical Requirements, DLC requirements for Lamps and General Applications that previously required testing in reference housings have not changed from previous policy and are described below.

The DLC does not endorse or exclude any particular make or model of reference fixture. 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.

Pre-Approved Equivalent Fixtures and Ballasts

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

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

Alternative fixtures and ballasts must provide similar thermal and electrical 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 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 fixture and/or ballast be considered as a pre-approved equal for testing purposes, please send the spec sheet for the fixture 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 in the spec sheet.

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.

Screw Base Replacement Lamps

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

For testing purposes, DLC specifies typical “reference” luminaire housings for lamp products to be tested in. This is done to provide testing results under common conditions that the lamps would be installed in. 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 housing with the mogul socket must be used. All test reports, including LM-79 and ISTMT test reports, must directly state the reference fixture used for testing. The complete model number of the reference fixture 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:

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 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.

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 41** for reference.

Table 41: 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 41** 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.

Linear Replacement Lamps & 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 1 proposal, the DLC has removed the reference housing testing requirements for these product types and replaced them with alternative requirements as described below.

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 42** 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 Guidelines.

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

Table 42: 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.

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 or Pre-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.).

Testing Guidance

Rationale

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 1 and is unchanged from required testing to demonstrate compliance with SSL V5.1.

Demonstrating Compliance with SSL V6.0 Draft 1 Proposals

Table 43 describes the minimum testing required for all OEM products application under SSL V6.0 Draft 1.

Table 43: Required Testing to Demonstrate Compliance to SSL V6.0 Draft 1 Proposals

Criterion	Which Models	Test Required
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 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.
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.

Criterion	Which Models	Test Required
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	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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Additional Reporting Requirements for LM-79, LM-80, and TM-21 Reports

Rationale

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 1 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 1 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 across all qualification types (DLC Standard, Premium, and LUNA). Test reports that do not comply will not be accepted.

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 optics (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 match 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) 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 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 match 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 optics (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.

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 4** and **Figure 5** show examples of luminous shapes for luminaires in each General Application.

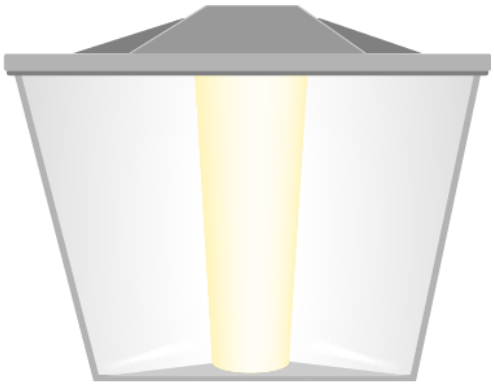

Figure 4: *Isometric view of a troffer with luminous basket and non-luminous panels on each side. The luminous shape would have the width, length, and height of the rectangle or rectangle with luminous sides encompassing the entire luminaire.*

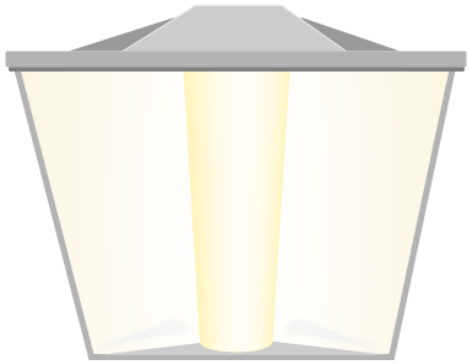

Figure 5: *Isometric view of a troffer with a luminous basket and luminous panels on each side. The luminous shape would be represented by a rectangle or rectangle with luminous sides encompassing the entire luminaire.*

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.

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 OR ANSI/IES TM-21-21. Long term lumen maintenance projections will be accepted only if fully compliant with TM-21-11 and its Addendum B OR ANSI/IES TM-21-21. 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 or ANSI/IES TM-21-21 will not be accepted. A complete and accurate copy of the June 18, 2018 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 to 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.

Key Questions Regarding Additional Reporting Requirement Proposals

1. SSL V6.0 draft 1 proposes a few changes to the format and information included in LM-79/color and LM-79/distribution test reports, including no longer accepting LM-79-08 and requiring test reports be in PDF format with an accompanying image of the tested product. What feedback, if any, do you have on the proposed changes?

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 we will encounter opportunities for minor corrections, terminology clarifications, and policy interpretations. To be as transparent as possible, the V6.0 Policy documents will be updated as needed, and the changes will be tracked in the table below and on the DLC website once SSL V6.0 is finalized and published. **Table 44** shows the corrections or clarifications and where they can be found in the document.

Table 44: V6.0 Technical Requirement Corrections and Clarifications Published as Needed

Date updated	Subject	Change Type	Description	Affected Page(s)