



# **Solid-State Lighting (SSL) Technical Requirements Version 5.0**

**Final Version**

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# Introduction

Version 5.0 of the Solid-State Lighting (SSL) Technical Requirements is the first of two revisions (V5.0 and V5.1) designed to improve the quality and controllability of high performance, energy efficient commercial lighting products by establishing requirements and reporting standards for DLC listed products. V5.0 lays the groundwork to capture and promote continuing advances in energy-efficient technology so that maximum energy savings and user satisfaction are possible. The requirements in this version are focused on efficacy and dimming, whereas V5.1 includes additional metrics around quality of light and controllability. The phased approach of V5.0 and V5.1 to incorporate quality of light metrics on the QPL will help ensure that high-quality products are listed, superior performing products can be differentiated, and additional energy savings are realized.

V5.0 applications will be accepted beginning on February 18, 2020. More information can be found in the [V5.0 & V5.1 Manufacturer and Industry Guidance](#), published along with the V5.0 and V5.1 Technical Requirements.

## Goals of Version 5.0



The efficacy of listed products increases with the pace of technology, without compromising quality of light.



Virtually all listed indoor luminaires and retrofit kits are dimmable, providing increased energy savings and improved user satisfaction.

## V4.4 Requirements Not Addressed in This Document

This document describes additions to the V4.4 SSL Technical Requirements. Any technical requirements not addressed within this document, including but not limited to warranty, power quality, and safety certification, will not change with V5.0, and V4.4 requirements will apply. Please see [the DLC website](#) for complete requirements within the Technical Requirement Tables (TRT).

## Manufacturer and Industry Guidance

The DLC has released [V5.0 & V5.1 Manufacturer and Industry Guidance](#) along with the policy that provides information on how the V5.0 Technical Requirements will be applied to the SSL QPL. Manufacturers who may wish to update their product listings or others interested in how V5.0 will be implemented should consult this guidance document for information about:

- Submitting applications under V5.0
- Required product testing under the V5.0 Technical Requirements
- Transition timelines, grace periods, and updating instructions for products qualified under previous versions of the Technical Requirements

# V5.0 Technical Requirements: Efficacy Update

V5.0 includes requirements related to minimum light output (measured in lumens) and efficacy (measured in lumens per Watt). **Table 1** shows efficacy requirements for DLC Standard and Premium classified luminaires and retrofit kits. **Table 2** shows V5.0 efficacy requirements for DLC Standard linear replacement lamps and four pin-base replacement lamps for CFLs (in-luminaire and bare-lamp requirements). **Table 3** shows efficacy requirements for DLC Standard mogul screw-base (E39/E40) replacements for HID lamps (in-luminaire). Lamps are not eligible for DLC Premium classification.

**Table 1: Efficacy Requirements for Luminaires and Retrofit Kits [DLC Standard and DLC Premium Classifications]**

Category	General Application	Minimum Light Output (lm) <sup>1</sup>	Minimum Efficacy (lm/W)	
			DLC Standard	DLC Premium
Outdoor Luminaires	Low Output	250-5,000	105	120
	Mid Output	5,000-10,000	105	120
	High Output	10,000-30,000	105	120
	Very High Output	≥30,000	105	120
Indoor Luminaires	Interior Directional	≥250	80	95
	Case Lighting	≥50 lm/ft	95	110
	Troffer	≥1,500	110	125
	Linear Ambient	≥375 lm/ft	115	130
	High-Bay	≥10,000	120	135
	Low-Bay <sup>2</sup>	5,000-10,000	115	130
Outdoor Retrofit Kits	Low Output	250-5,000	105	120
	Mid Output	5,000-10,000	105	120
	High Output	≥10,000	105	120
	Very High Output	≥30,000	105	120
Indoor Retrofit Kits	Troffer	≥1,500	110	125
	Linear Ambient	≥375 lm/ft	115	130
	High-Bay	≥10,000	120	135
	Low-Bay <sup>2</sup>	5,000-10,000	115	130

<sup>1</sup> Specific Primary Use Designations may have higher minimum light output requirements than presented in this table. Please refer to the full Technical Requirements Table for details: <https://www.designlights.org/solid-state-lighting/qualification-requirements/v5-0-technical-requirements-tables/>

<sup>2</sup> Due to IT system constraints, Low-Bay luminaires and retrofit kits will continue appearing under the High-Bay General Application until V5.1 applications open on July 1, 2020. Until that time, the V5.0 efficacy levels will be implemented for the Primary Use Designation of "Low-Bay", within the High-Bay General Application.

**Table 2: Efficacy Requirements for DLC Standard Linear Replacement Lamps and Four Pin-Base Replacement Lamps for CFLs [In-Luminaire and Bare-Lamp]**

Category	General Application	Minimum Light Output (lm)		Minimum Efficacy (lm/W)	
		In-Luminaire	Bare-Lamp	In-Luminaire	Bare-Lamp
Linear Replacement Lamps	2' T8 Lamps	2 lamps: 1,350 3 lamps: 2,000 4 lamps: 2,700	800	110	120
	3' T8 Lamps	2 lamps: 2,200	1,200	110	120
	4' T8 Lamps	2 lamps: 3,000 3 lamps: 4,500 4 lamps: 6,000	1,600	110	120
	4' T5 Lamps	2 lamps: 3,000 3 lamps: 4,500 4 lamps: 6,000	1,600	110	120
	4' T5HO Lamps	3 lamps: 7,500 4 lamps: 10,000 6 lamps: 15,000	3,200	115	120
	8' T8 Lamps	2 lamps: 6,000	3,200	110	120
	U-Bend Lamps	2 lamps: 2,500 3 lamps: 3,750	1,400	110	120
Four Pin-Base Replacement Lamps for CFLs	Vertically-Mounted Lamps	1 lamp: 575	675	75	85
	Horizontally-Mounted Lamps	2 lamps: 800	675	75	85
	2G11 Base Lamps	2 lamps: 1,350 3 lamps: 2,000	1,900	110	120

**Table 3: Efficacy Requirements for DLC Standard Mogul Screw-Base (E39/E40) Replacements for HID Lamps [In-Luminaire]**

Category	General Application	Minimum Light Output (lm)	Minimum Efficacy (lm/W)
		In-Luminaire	In-Luminaire
Mogul Screw-Base (E39/E40) Replacements for HID Lamps	Outdoor: Low Output	250-5,000	105
	Outdoor: Mid Output	5,000-10,000	105
	Outdoor: High Output	10,000-30,000	105
	Outdoor: Very High Output	≥30,000	105
	High-Bay	≥10,000	120
	Low-Bay <sup>2</sup>	5,000-10,000	115

# V5.0 Technical Requirements: Controllability

V5.0 Controllability Testing and Reporting Requirements for all SSL products are as shown in **Table 4**. 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 4: Controllability Testing and Reporting Requirements**

Metric	V5.0 Requirements	QPL Listing	Method of Evaluation <sup>3</sup>
Dimming	<i>Indoor luminaires and retrofit kits (excluding case lighting and Specialty primary uses intended for hazardous locations):</i> <b>Continuous dimming capability required</b>	1. Dimming capability ( <i>continuous, stepped, none</i> ) 2. Range of continuous dimming (if applicable) ( <i>Below 10%, Above 10%</i> )	Product specification sheet shall clearly identify dimming capability
	<i>All other products:</i> <b>Required reporting of dimming capability</b>		
Integral Controls	<b>Optional reporting of integral controls capability</b>	1. Integral control capability ( <i>Yes, No</i> )	Product specification sheet or supplemental controls documentation shall clearly identify the option for integral controls

## Dimming

- All products shall report the dimming capability. Dimming capabilities are defined in the “Definitions: Controllability” section below.
- Indoor luminaires and retrofit kits shall be capable of continuous dimming, with the following exceptions:
  - All Primary Use designations within the Case Lighting General Application
  - Any Specialty Primary Use Designation intended for a hazardous location<sup>4</sup>

<sup>3</sup> Controllability capabilities are based on manufacturer claims; performance is not verified by the DLC.

<sup>4</sup> Dimming requirements on future Specialty designations will be determined at the time the designation is requested and/or granted.

- Dimming capability shall be documented on the manufacturer’s published product specification sheet.
- All products pursuing the DLC Premium classification shall be capable of continuous dimming. Lamps and Specialty PUDs are not eligible for DLC Premium regardless of dimming capability.
- The DLC does *not* issue requirements around utilization of a specific dimming control protocol (0-10V, DALI, etc.) for the dimming capability requirement. *The act of dimming itself is the focus of this requirement.*

## Integral Controls

- Reporting on integral controls availability (“Yes” or “No”) is required for all DLC Premium products and optional for all DLC Standard products.

## Test Report and Implementation Requirements

- Given the rapidly evolving technical capabilities included in the controllability requirements, the DLC review staff will not evaluate any of these 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.

## Definitions: Controllability

- **Dimmable:** a product that (a) includes a dimmable driver and/or is capable of being dimmed by an external control signal, and (b) is identified as dimmable on the product specification sheet.
- **Continuous Dimming:** Per NEMA LSD-64: *a lighting control strategy that varies the light output of a lighting system over a continuous range from full light output to a minimum light output without flickering in imperceptible steps.* Continuous dimming shall be capable of reducing the light output to at least 20% of full light output.
- **Stepped Dimming:** Per NEMA LSD-64: *a lighting control strategy that varies the light output of a lighting system in one or more predetermined steps of greater than one percent of full output. The changes between levels are generally perceptible.* Stepped dimming shall be capable of reducing the light output to at least 70% of full light output.
- **Integral Controls:** The capability to have sensing and/or control of light output directly integrated or embedded into the lamp or luminaire and available as an option within the lamp or luminaire product model number.

# V5.0 Technical Requirements: DLC Premium

DLC Premium is a higher-performance classification for luminaires and retrofit kits. The V5.0 Premium classification is intended to differentiate products that achieve efficacy and controllability performance that exceeds DLC Standard requirements. Products submitted to the DLC Premium classification must meet more stringent efficacy and controllability requirements as outlined in **Table 5**. 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.

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 classification:

- Replacement Lamps
- Linear-Style Retrofit Kits for 2x2, 1x4, and 2x4 Luminaires
- Products with a Primary Use designated as “Specialty”

**Table 5: V5.0 DLC Premium Testing and Reporting Requirements**

Metric	V5.0 Premium Requirements*	QPL Listing	Method of Evaluation
Efficacy	+15 lumens per watt over V5.0 Standard efficacy requirements	Same as V5.0 Standard	Same as V5.0 Standard
Controllability	All products shall be <b>capable of continuous dimming</b>	Same as V5.0 Standard	Same as V5.0 Standard
	All products shall report on the availability of integral controls (Indicate: Yes/No)		
Lumen Maintenance	$L_{90} \geq 36,000$ hours (No additional $L_{70}$ requirement)	Lumen Maintenance values not published on the QPL	TM-21 projections in the same manner as the V5.0 Standard $L_{70}$ requirements
Driver ISTMT	Measured temperature at the $TMP_{ps}$ is less than or equal to the allowable operating temperature specified by the power supply manufacturer when tested in-situ under steady-state operating conditions, with case temperature measured at the designated TMP (No change from V4.4)	Driver ISTMT values not published on the QPL	(1) Laboratory test report indicating the measured temperature from the $TMP_{ps}$ ; (2) A picture of the $TMP_{ps}$ location; (3) Driver manufacturer documentation indicating the maximum case temperature for which the driver is designed to last $\geq 50,000$ hours

\* For any metric not listed in **Table 5**, V5.0 Standard requirements apply.



## **Test Report and Implementation Requirements**

If a manufacturer seeks qualification of its product(s) to the DLC Premium classification, it shall provide all the necessary testing to demonstrate that the product(s) meet the Premium classification's requirements in addition to meeting all base V5.0 Standard requirements.

