



Solid-State Lighting (SSL) Technical Requirements Version 5.0

Draft 2

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Introduction

This Version 5.0 revision to the SSL Technical Requirements is the first of a series of specifications designed to improve the quality of light produced by high performing, energy efficient commercial lighting by establishing requirements and reporting standards for quality of light and connectivity capabilities of listed products. This draft of Technical Requirements V5.0 lays the groundwork to capture and promote continuing advances and innovation in human-centric lighting characteristics such as color performance, flicker, glare, and light distribution, as well as increase the controls functionality of installed energy efficient technology so that maximum energy savings and user benefits are realized.

Quality of light encompasses the characteristics of lighting that impact productivity, performance, comfort, mood, safety, health, and wellbeing. The DLC's proposed lighting controllability requirements support additional energy savings while promoting better quality of light for people living and working in the built environment. V5's phased approach to incorporating quality of light metrics on the QPL will help ensure only high-quality products are listed, superior performing products can be differentiated, and additional energy savings are realized.

Goals of this Version



The efficacy of listed products increases by an average of 10.8%, and up to 23% for some categories of lighting.



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



V5.0 color quality requirements help provide people the lighting they want with more color consistency over time.



Lighting decision makers can use DLC Premium classification to have better confidence in the glare performance of listed products.

Draft 2 Revision Summary

To develop the V5.0 second draft, the DLC received and considered over 1,000 comments from 46 organizations made up of manufacturers, utilities, testing labs, lighting designers, nonprofit organizations, and interested individuals. Additionally, each DLC topic team considered feedback gathered from in-depth discussion sessions with stakeholders during the annual DLC Stakeholder Meeting, held in St. Louis, Missouri on April 1-3, 2019.

While Draft 1 laid out the DLC's broad vision for improving the quality of light and controllability of products on the SSL QPL, Draft 2 focuses on implementing these requirements on a timeline that aligns with industry development cycles and current research. Metrics and capabilities that do not appear in Draft 2 may still appear in future DLC specifications as deemed appropriate.

V4.4 Requirements Not Addressed in Draft 2

This document describes additions to the current SSL Technical Requirements. Any technical requirements not addressed explicitly within the document will not change with V5.0, and V4.4 requirements will apply. Please see [the DLC website](#) for the V4.4 Technical Requirements.

Manufacturer and Industry Implementation Guidance

The Manufacturer and Industry Guidance section of this draft provides information on how the V5.0 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 section for information about:

- Submitting product and private label applications under V5.0
- Required product testing under the V5.0 requirements
- Transition timelines and grace periods for V4.4 products
- Updating V4.4 products to qualify under V5.0
- Updating family groupings to meet V5.0

Testing and Reporting Guidance for Manufacturers

V5.0 adds additional testing requirements for qualifying products. An example of what the typical required testing and reporting for a family of products will look like under V5.0 is provided in the Manufacturer and Industry Implementation Guidance section. Specific testing and reporting requirements for each of the Technical Requirements can be found in the corresponding sections of the draft.

Energy Efficiency Administrators' Program Guidance

With the final release of the V5.0 Technical Requirements, program guidance materials will be made available to energy efficiency programs to provide explanations of new metrics, benefits to customers and trade allies, and timelines for transitioning to the new requirements.

Draft Technical Requirements: Efficacy

SSL V5.0 Efficacy Update

Feedback Received and Key Changes from Draft 1

The DLC received 94 comments on Draft 1 Efficacy Testing and Reporting Requirements during the first comment period. After careful consideration of the both stakeholder feedback and implementation considerations, modifications were made within Draft 2 as described in this section. The bullets below describe general themes of the feedback received and sub-bullets describe how the DLC incorporated those changes into Draft 2:

- **Quality of light considerations**
 - Comments reiterated the need for efficacy increases that consider the accompanying quality of light requirements, such as spectral quality and glare. A main objective of the V5.0 efficacy increase is a balance of energy savings and the ability of DLC listed products to provide high spectral quality and proper glare control and the DLC believes the proposed efficacy levels support this objective.
- **Include allowances to efficacy to account for tradeoffs with quality of light**
 - With Draft 2, the DLC is proposing allowances for improved spectral quality and glare control. Please see the Draft Technical Requirements: Allowances for more detailed information.

Draft Testing and Reporting Requirements

This draft of the SSL V5.0 proposal includes efficacy changes for Standard and Premium products as shown in **Table 1**. These requirements represent a DLC Standard classified product-weighted average¹ increase to efficacy of 10.8%, and up to 23%² over Version 4.4.

In addition to updated minimum efficacy requirements, Table 1 includes a new General Application for Low-Bay luminaires. This change is made to better align low-bay luminaire requirements with linear ambient products, which are similar in terms of form, function, and application. This change to separate low-bay from high-bay allows for a slight (5 lm/W) decrease in efficacy for low-bay products and a separate glare threshold to be established (falling between high-bay and linear ambient) for the related allowance and Premium requirements. More information on DLC Premium and Allowances is included later in the document.

¹ The product-weighted average is calculated by weighting the efficacy increase by the number of products in each General Application, i.e. General Applications with higher numbers of products will have more of an impact on the efficacy increase, QPL wide.

² Interior Directional luminaires propose to be increased from 65 lumens per Watt to 80 lumens per Watt; a 23.1% increase.

Table 1: Draft Efficacy Requirements for DLC Standard and DLC Premium Designations

Category	General Application	Minimum Light Output (lm)		Minimum Efficacy (lm/W)					
				DLC Standard		DLC Premium			
				V4.4	V5.0	V4.4	V5.0		
Outdoor Luminaires	Low Output	250-5,000		90	105	110	120		
	Mid Output	5,000-10,000		95	105	115	120		
	High Output	10,000-30,000		100	105	120	120		
	Very High Output	≥30,000		100	105	120	120		
Indoor Luminaires	Interior Directional	≥250		65	80	90	95		
	Case Lighting	≥50 lm/ft		80	95	125	110		
	Troffer	≥1,500		100	110	125	125		
	Linear Ambient	≥375 lm/ft		105	115	130	130		
	High-Bay	≥10,000		105	120	130	135		
	Low-Bay	5,000 (<10,000)		n/a	115	n/a	130		
Outdoor Retrofit Kit	Low Output	250-5,000		90	105	110	120		
	Mid Output	5,000-10,000		95	105	115	120		
	High Output	≥10,000		100	105	120	120		
	Very High Output	≥30,000		100	105	120	120		
Indoor Retrofit Kit	Troffer	≥1,500		100	110	125	125		
	Linear Ambient	≥375 lm/ft		105	115	130	130		
	High-Bay	≥10,000		105	120	130	135		
	Low-Bay	5,000 (<10,000)		n/a	115	n/a	130		
Linear Replacement Lamps	2' T8 Lamps	Bare lamp: 800		Bare lamp: 110	Bare lamp: 120	n/a	n/a		
	3' T8 Lamps	Bare lamp: 1,200		Bare lamp: 110	Bare lamp: 120				
	4' T8 Lamps	Bare lamp: 1,600		Bare lamp: 110	Bare lamp: 120				
	4' T5 Lamps	Bare lamp: 1,600		Bare lamp: 110	Bare lamp: 120				
	4' T5HO Lamps	Bare lamp: 3,200		Bare lamp: 110	Bare lamp: 120				
	8' T8 Lamps	Bare lamp: 3,200		Bare lamp: 110	Bare lamp: 120				
	U-Bend Lamps	Bare lamp: 1,400		Bare lamp: 110	Bare lamp: 120				
Mogul Screw-Base (E39) Replacements for HID Lamps	Outdoor: Low Output	In luminaire: 250-5,000		In luminaire: 90	In luminaire: 105	n/a	n/a		
	Outdoor: Mid Output	In luminaire: 5,000-10,000		In luminaire: 90	In luminaire: 105				
	Outdoor: High Output	In luminaire: 10,000-30,000		In luminaire: 95	In luminaire: 105				
	Outdoor: V. High Output	In luminaire: ≥30,000		In luminaire: 95	In luminaire: 105				
	High-Bay	In luminaire: ≥5,000		In luminaire: 100	In luminaire: 120				
Four Pin-Base Replacement Lamps for CFLs	Vertically-Mounted Lamps	In luminaire: 575 (1-lamp)	Bare lamp: 675	In luminaire: 65	Bare lamp: 75	In luminaire: 75	Bare lamp: 85	n/a	n/a
	Horizontally-Mounted Lamps	In luminaire: 800 (2-lamp)	Bare lamp: 675	In luminaire: 65	Bare lamp: 75	In luminaire: 75	Bare lamp: 85		
	2G11 Base Lamps	Bare lamp: 1,900		Bare lamp: 110		Bare lamp: 120			

Draft Technical Requirements: Quality of Light

In Draft 2 of SSL V5.0, a product's quality of light is evaluated in the aspects of spectral quality, light distribution and glare, and flicker.

Spectral Quality

Feedback Received and Key Changes from Draft 1

The DLC received 262 comments on the Draft 1 Spectral Quality Testing and Reporting Requirements during the first comment period. After careful consideration of both stakeholder feedback and implementation considerations, modifications were made within Draft 2 as described in this section. The bullets below describe general themes of the feedback received and sub-bullets describe how the DLC incorporated those changes into Draft 2.

- **Testing burden associated with reporting of additional metrics**
 - Optional reporting and testing for [Angular Color Uniformity](#) has been removed
 - Required reporting and testing for [Consistency \(of Chromaticity\)](#) has been removed
- **Application specific requirements for outdoor**
 - Draft 2 proposes specific requirements for outdoor and high-bay lighting
- **Confusion associated with proposed tiers and their relationship to allowances and Premium**
 - Proposed tiers have been eliminated from Standard qualification to eliminate complexity
 - Draft 2 proposes efficacy allowances for products that demonstrate greater color quality to accommodate the tradeoff between efficacy and color rendition
 - Draft 2 proposes stricter color maintenance and chromaticity binning requirements for Premium qualification
- **Uncertainty and lack of consensus around circadian metrics**
 - Draft 2 removes any considerations not specifically related to color quality, e.g. circadian considerations

Draft Testing and Reporting Requirements

The Draft 2 Spectral Quality Testing and Reporting Requirements for all SSL products are as shown in Table 2 for DLC Standard classification and Table 3 for DLC Premium Classification.

Table 2: Draft Testing and Reporting Requirements for Spectral Quality (DLC Standard)

Metric and/or Application	Current V4.4 Requirements	V5.0 Draft Requirements	QPL Listing	Method of Measurement/Evaluation
Chromaticity (CCT & D_{uv})	Products shall exhibit chromaticity consistent with at least one of the basic, nominal, 7-step quadrangle CCTs ≤ 5000 K (indoor) and CCT ≤ 5700 K (outdoor & high bay)	Products shall exhibit chromaticity consistent with at least one of the basic or extended nominal, 7-step quadrangle CCTs from 2200K – 6500K	CCT and D _{uv} for parent products that are from LM-79 test reports will be listed as Tested Data. Nominal CCT for child products will be listed as Reported Data.	ANSI/IES LM-79 ANSI C78.377-2017 (See Draft Additional Reporting Guidelines for required information)
Color Rendition	CRI (CIE 13.3-1995): R _a ≥ 80 (indoor)	<i>Indoor, except high-bay:</i> Option 1 - ANSI/IES TM-30-18: <ul style="list-style-type: none"> IES R_f ≥ 70 IES R_g ≥ 89 -12% ≤ IES R_{cs,h1} ≤ +23% Option 2 - CIE 13.3-1995: <ul style="list-style-type: none"> R_a ≥ 80 R₉ ≥ 0 	All color rendition metrics for parent products that are from LM-79 test reports will be listed as Tested Data. All color rendition metrics for child products will be listed as Reported Data.	ANSI/IES LM-79 ANSI/IES TM-30-18 CIE 13.3-1995 (See Draft Additional Reporting Guidelines for required information)
	CRI (CIE 13.3-1995): R _a ≥ 65 (outdoor) R _a ≥ 70 (high bay)	<i>Outdoor and high-bay:</i> Option 1 - ANSI/IES TM-30-18: <ul style="list-style-type: none"> IES R_f ≥ 70 IES R_g ≥ 89 -18% ≤ IES R_{cs,h1} ≤ +23% Option 2 - CIE 13.3-1995: <ul style="list-style-type: none"> R_a ≥ 70 R₉ ≥ -40 		
Color Maintenance	None	<i>Indoor, except high-bay:</i> 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 (<i>u'</i> , <i>v'</i>) chromaticity diagram. <i>Outdoor and high-bay:</i> Chromaticity shift from 1,000-hour measurement to 6,000 hours shall be within a linear distance of 0.007 ($\Delta u'v' \leq 0.007$) on the CIE 1976 (<i>u'</i> , <i>v'</i>) chromaticity diagram.	Color maintenance information will not be listed on the QPL at this time.	ANSI/IES LM-80, and/or IES LM-84-14

Table 3: Additional Draft Testing and Reporting Requirements for Spectral Quality (DLC Premium)

Metric and/or Application	Current V4.4 Premium Requirements	V5.0 Draft Premium Requirements	QPL Listing	Method of Measurement/Evaluation
Chromaticity (CCT & D_{uv})	Products shall exhibit chromaticity consistent with at least one of the basic, nominal, 7-step quadrangle CCTs ≤ 5000 K (indoor) and CCT ≤ 5700 K (outdoor & high bay)	<i>Indoor, except high-bay:</i> Products shall exhibit chromaticity consistent with at least one of the basic or extended nominal, 4-step quadrangle CCTs from 2200 K – 6500 K. <i>All other products:</i> Same as V5.0 Standard	CCT and D _{uv} for parent products will be listed as Tested Data. Nominal CCT for child products will be listed as Reported Data.	ANSI/IES LM-79 ANSI C78.377-2017 (See Draft Additional Reporting Guidelines for required information)
Color Maintenance	None	<i>Indoor, except high-bay:</i> Chromaticity shift from 1,000-hour measurement to 6,000-hour measurement shall be within a linear distance of 0.002 ($\Delta u'v' \leq 0.002$) on the CIE 1976 (u', v') chromaticity diagram. <i>Outdoor and high-bay:</i> Chromaticity shift from 1,000-hour measurement to 6,000 hours shall be within a linear distance of 0.004 ($\Delta u'v' \leq 0.004$) on the CIE 1976 (u', v') chromaticity diagram.	Color maintenance information will not be listed on the QPL at this time.	ANSI/IES LM-80, and/or IES LM-84-14

65

66 Test Report and Implementation Requirements: DLC Standard

67 This section describes the test reports that will be required to qualify families of products to the DLC SSL
68 QPL under the Standard classification.

69 Color Rendition and Chromaticity (CCT & D_{uv})

70 The DLC has several pathways for demonstrating color rendition and chromaticity compliance,
71 depending on the level of product-variation complexity.

72 • For product families that offer one or more CCT option(s) and one color rendition option:

73 ○ A full LM-79/color report must be provided at the lowest and highest CCT options
74 offered and shall conform to the [Draft Additional Reporting Guidelines](#).

75 ■ The color rendition option must meet or exceed either the IES TM-30-18 color
76 rendition requirements or the CIE 13.3.-1995 color rendition requirements for
77 both the highest and lowest CCTs, however *both* must be reported.

- 78 ▪ The chromaticity coordinates must fall within at least one of the basic or
79 extended nominal, 7-step quadrangle CCTs from 2200 K – 6500 K as defined by
80 ANSI C78.377-2017.
- 81 • **For product families that offer one or more color rendition option(s) and one CCT option:**
- 82 ○ A full LM-79/color report must be provided at the minimum color rendition option for
83 the CCT option offered and shall conform to the Draft Additional Reporting Guidelines.
- 84 ▪ The minimum color rendition option must meet or exceed either the IES TM-30-
85 18 color rendition requirements or the CIE 13.3-1995 color rendition
86 requirements, however *both* must be reported.
- 87 ▪ The chromaticity coordinates must fall within at least one of the basic or
88 extended nominal, 7-step quadrangle CCTs from 2200 K – 6500 K as defined by
89 ANSI C78.377-2017.
- 90 • **For product families that offer one or more color rendition option(s) and more than one CCT
91 option:**
- 92 ○ A full LM-79/color report must be provided for the lowest and highest CCT options
93 offered, at the minimum color rendition option and shall conform to the *Draft*
94 *Additional Reporting Guidelines*.
- 95 ▪ The minimum color rendition option must meet either the IES TM-30-18 color
96 rendition requirements or the CIE 13.3-1995 color rendition requirements for
97 both the highest and lowest CCTs.
- 98 ▪ The chromaticity coordinates must fall within at least one of the basic or
99 extended nominal, 7-step quadrangle CCTs from 2200 K – 6500 K as defined by
100 ANSI C78.377-2017.
- 101 ○ Please note that the DLC also requires that testing be conducted on the worst-case
102 efficacy variation, which is likely the combination of lowest CCT and highest color
103 rendition.

104 **Color Maintenance**

105 The DLC has two pathways for demonstrating DLC Standard color maintenance compliance.

- 106 • **Color Maintenance Option 1:**
- 107 ○ An LM-80 report for the LED package/module/array used within the product must be
108 provided and must include chromaticity data for at least 1000-hour and 6000-hour time
109 intervals.
- 110 • **Color Maintenance Option 2:**
- 111 ○ Luminaire-level performance data that follow LM-84 test procedures for the product
112 must be provided and must include chromaticity data for at least 1000-hour and 6000-
113 hour time intervals.

114

115 **Test Report and Implementation Requirements: DLC Premium**

116 This section describes the test reports required to qualify families of products to the DLC SSL QPL under
117 the Premium classification.

118 **Color Rendition and Chromaticity (CCT & D_{uv})**

- 119 • A full LM-79/color report for each CCT at the minimum color rendition option, with full LM-
120 79/color reports for each additional color rendition option at the lowest CCT, shall be provided
121 and conform to the [Draft Additional Reporting Guidelines](#).
- 122 • All color rendition options must meet either the IES TM-30-18 color rendition requirements or
123 the CIE 13.3-1995 color rendition requirements described in Table 2.
- 124 • All variations of CCT offered must fall within at least one of the basic, flexible, or extended
125 nominal, 4-step (indoor products only, except high-bay) quadrangles, or 7-step (outdoor and
126 high-bay products only) quadrangles from 2200 K to 6500 K as defined by ANSI C78.377-2017.
- 127 • For example, if a product family consists of two color rendition options (e.g. CRI Ra=80, R9=0
128 and CRI Ra=90, R9=50) and four CCT options (e.g. 2700K, 3500K, 4000K, and 5000K), and *all*
129 variations are to be qualified to DLC Premium, a minimum of five LM-79 test reports must be
130 provided. That is, one test for each CCT at the minimum color rendition option, and one test at
131 the lowest CCT for the higher color rendition option.
- 132 • Please note that the DLC also requires that testing be conducted on the worst-case efficacy
133 variation (likely the combination of lowest CCT and highest color rendition) which is likely
134 covered by a test required to meet spectral quality requirements.

135 **Color Maintenance**

136 The DLC has two pathways for demonstrating DLC Premium color maintenance compliance, both of
137 which are identical to the [Standard color maintenance compliance](#) pathways.

138 **Interactions with other DLC Policies**

139 For [Color-Tunable](#) (white-tunable and warm-dimming) products and/or [Dimmable and Field Adjustable](#)
140 [Light Output](#) (FALO) products, additional clarifications on meeting the Spectral Quality requirements are
141 provided below.

- 142 • Testing and reporting requirements for chromaticity (CCT & D_{uv}), color rendition, and color
143 maintenance are applicable to color-tunable products, unless specifically excluded per the
144 Color-Tunable policy. For parent products in a family grouping application, the chromaticity (CCT
145 & D_{uv}) and color rendition at the CCT setting required by the Color-Tunable policy will be listed
146 on the QPL under the Tested Data section. For child products, reporting of CCT and color
147 rendition is required at the worst-case efficacy setting, and all information will be listed as
148 Reported Data. D_{uv} will not be listed for child products.
 - 149 ○ Color maintenance will be evaluated for each LED within a product that uses separate
150 LM-80 data.

- 151 ○ Color-Tunable products that intend to qualify as DLC Premium shall be required to test
152 and report at the CCT settings designated per the Color-Tunable policy, i.e. at the
153 highest, lowest, and mid-point CCT settings.
- 154 ○ White-Tunable products are not required to meet the chromaticity requirements as
155 described in V5.0.
- 156 • Testing and reporting requirements for chromaticity (CCT & D_{uv}), color rendition, and color
157 maintenance are applicable to Dimmable/FALO products, and are evaluated at the highest light
158 output setting. For parent products in a family grouping application, chromaticity (CCT & D_{uv}) and
159 color rendition will be listed on the QPL under the Tested Data section. For child products,
160 reporting of CCT and color rendition is required, and all information will be listed as Reported
161 Data.
- 162 ○ Dimmable/FALO products will not be evaluated for chromaticity (CCT & D_{uv}), color
163 rendition, or color maintenance at dimmed output settings.

164 **Key Questions: Spectral Quality**

- 165 1. What additional information, education, or other considerations should the DLC prepare or
166 address to support the V5.0 spectral quality requirements?

167 Please provide your responses to these key questions in the Excel-based SSL V5.0 Comment Form, under
168 the Spectral Quality tab.

169 Light Distribution and Glare

170 Feedback Received and Key Changes from Draft 1

171 The DLC received 233 comments on Draft 1 Light Distribution and Glare Testing and Reporting
172 Requirements during the first comment period. After careful assessment of stakeholder feedback and
173 implementation considerations, modifications were made within Draft 2 as described in this section. The
174 bullets below describe general themes of the feedback received and sub-bullets describe how the DLC
175 incorporated those changes into Draft 2:

176 • Testing burden associated with reporting of performance metrics

- 177 ○ Light distribution and glare requirements are simplified and combined into one section.
- 178 ○ Testing requirements are reduced to allow some reporting of rated and scaled data in
179 place of tested data.
- 180 ○ .ies files must be submitted only for the product with the highest nominal output of
181 each optical variation in a product family, not for every product.
- 182 ○ No additional reporting of distribution plots, beam angles or field angles is required.
- 183 ○ Zonal lumen distribution (ZLD) and spacing criteria (SC) for child products in a family
184 grouping application are required to be reported but may be based on the applicant's
185 calculations instead of test reports.
- 186 ○ BUG ratings for outdoor products are required to be reported on the application form
187 by the applicants. BUG ratings of a single product application and the parent products in
188 a family grouping application will be verified using the submitted .ies files and listed as
189 Tested Data; BUG ratings of child products will be listed as Reported Data on the QPL.

190 • Application-specific requirements, Allowances, and Premium

- 191 ○ To address concerns about misuse and misinterpretation of glare metrics, no glare
192 information will be listed on the QPL for either Standard or Premium products.
- 193 ○ Standard products are not required to meet any glare control requirements (Unified
194 Glare Rating or UGR).
- 195 ○ Premium products for certain indoor General Applications must meet a UGR threshold
196 to demonstrate acceptable glare control performance. (However, the UGR values will
197 not be listed on the QPL.)
- 198 ○ Optional reporting of a low glare rating can unlock efficacy allowances for indoor
199 products under certain General Applications when meeting a UGR threshold to
200 demonstrate superior glare control.

201 Draft Testing and Reporting Requirements

202 The Draft 2 Light Distribution and Glare Testing and Reporting Requirements for all SSL products are
203 shown in **Table 4** for DLC Standard classification. The DLC has proposed use of the UGR metric for DLC
204 Premium products, but not for Standard products. The Unified Glare Rating (UGR) is defined in [CIE 117-](#)
205 [1995](#) as a metric for evaluating glare performance of certain products in the indoor category. It can be
206 determined for luminaires using the procedure described in [CIE 190-2010](#). The UGR metric has been



207 widely used in Europe and other regions and has been updated recently in [CIE 232-2019](#) for luminaires
 208 with non-uniform source luminance, such as LEDs. The DLC has proposed a measured approach in
 209 introducing this metric with V5.0 to apply only to products seeking DLC Premium classification and for
 210 providing efficacy allowances for products designed specifically for applications demanding low glare.
 211 Table 5 is an excerpt of the Premium requirements that are related to glare (see the DLC Premium
 212 section and Table 11 for the complete requirements).

213 **Table 4: Draft Testing and Reporting Requirements for Distribution (DLC Standard)**

Metric and/or Data Set	Current V4.4 Requirements	V5.0 Draft Requirements			Method of Evaluation
		Threshold	Reported	QPL Listing	
Zonal Lumen Distributions (ZLD) & Spacing Criteria (SC)	Specific Requirements for each PUD	Identical to V4.4	ZLD & SC for each product	ZLD and SC for parent products that are from LM-79 test reports will be listed under the Tested Data section. ZLD & SC for child products will be listed under the Reported Data section.	ANSI/IES LM-79 per the Draft Additional Reporting Guidelines , and values produced by photometric analysis from tested .ies files.
Backlight, Uplight, and Glare (BUG) <i>Outdoor luminaires and outdoor retrofit kits only</i>	n/a	None	BUG ratings for each product	BUG ratings for parent products that are generated by the DLC using tested photometric data will be listed under the Tested Data section. BUG ratings for child products are reported by the applicants and will be listed under the Reported Data section.	BUG rating generated per IES TM-15-11 and Addendum A for IES TM-15-11 using luminaire photometric data

214 **Zonal Lumen Distribution and Spacing Criteria**

215 SSL products whose PUD falls under the general category of indoor luminaires, indoor retrofit kits,
 216 outdoor luminaires and outdoor retrofit kits must meet the zonal lumen distribution (ZLD) and spacing
 217 criteria (SC) requirements, as currently required in V4.4. For a single product application and the parent
 218 products in a family grouping application, ZLD and SC shall be reported in accordance with the ZLD and
 219 SC data documented in the submitted LM-79 test report. For child products in a family grouping
 220 application, ZLD and SC shall be reported on the application form and may be calculated from the parent
 221 product’s photometric data based on the manufacturer’s own calculation method.

222 **BUG (Backlight, Uplight, and Glare) Rating**

223 SSL products in the Outdoor and Outdoor Retrofit Kit categories must report the 6-character BUG
 224 values. Applicability to future Specialty PUDs will be determined on a case-by-case basis. The following
 225 PUDs are exempt from BUG reporting requirements:

- 226 • Landscape/Accent Flood and Spot Luminaires
- 227 • Architectural Flood and Spot Luminaires
- 228 • Specialty: Wall Grazing/Slicing
- 229 • Specialty: Hazardous Flood and Spot Luminaires
- 230 • Specialty: Soffit Lighting
- 231 • Specialty: Sports Flood
- 232 • Specialty: Natatorium Lighting
- 233 • Specialty: Tunnel Lighting

234 The representation of a BUG Rating is similar to the example: **B2 U0 G2**. BUG rating is determined based
235 on the method described in [IES TM-15-11 Luminaire Classification System for Outdoor Luminaires](#) and
236 the [Addendum A for IES TM-15-11: Backlight, Uplight, and Glare \(BUG\) Ratings](#). For a single product
237 application and the parent products in a family grouping application, BUG rating will be generated by
238 the DLC reviewer using the photometric data from the submitted LM-79 test report. For child products
239 in a family grouping application, BUG rating shall be reported on the application form and may be
240 calculated from the parent product's photometric data based on the manufacturer's own calculation
241 method as long as the procedures in [IES TM-15-11](#) and the [Addendum A for IES TM-15-11](#) are followed.

242 **Glare Performance Metric for Indoor Products**

243 Glare performance requirements are not specified in SSL V5.0 for Standard classification products due to
244 the lack of a familiar and well-understood metric in the U.S. market. The Unified Glare Rating (UGR)
245 defined in CIE [117-1995](#)¹⁷ is a metric for evaluating glare performance of certain products in the indoor
246 category. It has been widely used in Europe and other regions and has been updated recently in [CIE 232-](#)
247 [2019](#)³ for luminaires with non-uniform source luminance, such as LEDs. In V5.0, UGR requirements are
248 only specified for products seeking [DLC Premium](#) classification and for providing [efficacy allowances](#) for
249 Premium or Standard classification products designed specifically for applications demanding low glare.
250 Table 5 is an excerpt of the Premium requirements that are related to glare (see the [DLC Premium](#)
251 section and Table 11 for the complete requirements). The DLC may consider adopting a reporting
252 approach similar to BUG ratings for outdoor products and requiring Standard classification products to
253 report their UGR values, without imposing thresholds, in later versions of the SSL Technical
254 Requirements.

³ [CIE 232-2019 Discomfort Caused by Glare from Luminaires with a Non-Uniform Source Luminance](#)

Table 5: Additional Draft Testing and Reporting Requirements for Glare (DLC Premium)

Metric	V4.4 Premium Requirements	Draft V5.0 Premium Requirements	QPL Listing	Method of Evaluation
Glare	None	<p><i>Troffer and Linear Ambient: UGR < 19</i> <i>Low-Bay: UGR < 22</i> <i>High-Bay: UGR < 25</i> <i>All other products: n/a</i></p> <p>(Note: Linear-Style Retrofit Kits for 2x2, 1x4, and 2x4 Luminaires and Retrofit Kits for Direct Linear Ambient Luminaires are not eligible for Premium qualification at this time.)</p>	UGR values will not be published on the QPL	Room dimension: X = 4H, Y = 8H Spacing to height ratio (S/H): 1 Reflectances: 70/50/20%

256 Test Report and Implementation Requirements: DLC Standard

257 This section describes the test reports that will be required to qualify products to the DLC SSL QPL under
 258 the Standard classification.

- 259 • A full LM-79/distribution report shall be provided for each unique optical and distribution
 260 pattern at the highest light output and shall conform to the [Draft Additional Reporting](#)
 261 [Guidelines](#).
- 262 • Zonal lumen distribution (ZLD), spacing criteria (SC) and BUG ratings (outdoor products only) of
 263 a single product application or parent products in a family grouping application will be verified
 264 using the .ies files associated with the LM-79 test reports.
- 265 • For all child products in a family grouping application where LM-79 test reports are not required,
 266 rated data, including ZLD, SC and BUG rating (outdoor products only), shall be reported on the
 267 application form.

268 Test Report and Implementation Requirements: DLC Premium

269 This section describes the test reports that will be required to qualify products to the DLC SSL QPL under
 270 the Premium classification.

- 271 • For a single product application,
 272 1) a full LM-79/distribution report per the [Draft Additional Reporting Guidelines](#) for the
 273 product tested at the maximum light output and the .ies file based on the LM-79 test
 274 data,
 275 2) indicate on the application form which UGR bin⁴ that the product's Corrected UGR value
 276 falls in.
- 277 • For a family grouping application,
 278 1) a full LM-79/distribution report per the [Draft Additional Reporting Guidelines](#) for the
 279 products that have the highest total lumen output for each optical variation within the

⁴ The UGR bins on the application form are 10-13, 13-16, 16-19, 19-22, 22-25, where the lower bound of the bins are inclusive and the upper bound of the bins are exclusive.

280 family, regardless of color properties, for which the applicant is seeking the Premium
281 classification designation tested at the maximum light output and the .ies file based on
282 the LM-79 test data,
283 2) indicate on the application form which UGR bin that the product's Corrected UGR value
284 falls in.

285 **Interactions with other DLC Policies**

286 For [Field Adjustable Light Distribution \(FALD\)](#) products, additional clarifications on meeting the Light
287 Distribution and Glare requirements are provided below.

- 288 • Testing and reporting requirements for zonal lumen distributions (ZLD) and spacing criteria (SC)
289 are applicable to FALD products. For parent products in a family grouping application, ZLD and
290 SC at the light distribution setting designated, per the FALD policy, for meeting the ZLD
291 requirements will be listed on the QPL under the Tested Data section. For child products,
292 reporting of ZLD and SC is exempted, and no ZLD and SC information will be listed as Reported
293 Data on the QPL.
- 294 • Testing and reporting requirements for BUG ratings are applicable to FALD products in the
295 Outdoor and Outdoor Retrofit Kit Categories, except for the exempted PUDs. For parent
296 products in a family grouping application, BUG ratings at the light distribution setting
297 designated, per the FALD policy, for meeting the ZLD requirements will be listed on the QPL
298 under the Tested Data section. For child products, reporting of BUG rating is exempted, and no
299 BUG rating will be listed as Reported Data on the QPL.
- 300 • Testing and reporting requirements for UGR are applicable to FALD products seeking Premium
301 classification. The UGR values shall meet the threshold at the light distribution setting
302 designated, per the FALD policy, for meeting the ZLD requirements of the PUD, for which the
303 product is seeking qualification.
- 304 • Testing and reporting requirements for UGR are not applicable to FALD products seeking
305 efficacy allowances. FALD products are currently not eligible for efficacy allowances.

306 **Key Questions: Light Distribution and Glare**

- 307 1. What are the potential issues and challenges to require reporting and listing of ZLD, SC and BUG
308 ratings (outdoor products only) for all products that the DLC should consider?
- 309 2. What additional information, education or other considerations should the DLC incorporate into
310 V5.0 to prepare for broadening the glare metric reporting requirement (without specific
311 thresholds) in V5.1 to include Standard products?

312 Please provide your responses to these key questions in the Excel-based SSL V5.0 Comment Form, under
313 the Light Distribution and Glare tab.

314 **Flicker**

315 **Feedback Received and Key Changes from Draft 1**

316 The DLC received 112 comments on Draft 1 Flicker Testing and Reporting Requirements during the first
317 comment period. After careful consideration of both stakeholder feedback and implementation
318 considerations, modifications were made within Draft 2 as described in this section. The bullets below
319 cover general themes of the feedback received and sub-bullets describe how the DLC incorporated
320 those changes into Draft 2:

321 • **Testing burden associated with luminaire-level testing**

- 322 ○ Draft 2 proposes to limit flicker testing to a single member of a product family.
- 323 ○ Draft 2 proposes testing for flicker at full light output and 20% of full light output and
324 eliminates the requirement of testing at minimum light output, as proposed in Draft 1.
- 325 ○ The DLC understands that a single member of a product family may not be
326 representative of that family, so flicker information (test data or dimmers used) will not
327 be published on the QPL at this time.

328 • **Uncertainty and lack of consensus around flicker metrics and thresholds**

- 329 ○ The DLC heard from many stakeholders that advocated for the various flicker metrics
330 and thresholds. The intent of testing for four metrics is to address flicker without bias
331 toward one set of metrics over another, and the metrics required have not changed
332 from Draft 1. However, the DLC has determined that there is not enough data to
333 support setting a threshold at this time and has decided to collect data on the various
334 flicker metrics and contribute to research on appropriate flicker thresholds.

335 • **Interactions between dimmers and drivers need to be carefully considered**

- 336 ○ Due to the large number of variations and wide array of controls and light source
337 combinations, Draft 2 proposes that the DLC require listing of the dimmer used during
338 flicker testing, with no requirements pertaining to the dimmer.

339 • **Application specific requirements**

- 340 ○ Some commenters noted that flicker requirements vary by application type. Because
341 the DLC is not proposing required thresholds in Draft 2, there are no application specific
342 requirements.

343 **Draft Testing and Reporting Requirements**

344 The draft Flicker Testing and Reporting Requirements for all SSL products are as shown in **Table 6**.
 345 Sample reporting tables are shown in **Table 7** and **Table 8**.

346 *Table 6: Draft Testing and Reporting Requirements for Flicker*

Metric	V4.4 Requirements	Draft V5.0 Requirements	QPL Listing	Method of Evaluation
Short Term Flicker (P _{st})	n/a	Report values at 100% and for dimmable products, also test at 20% of light output	Flicker information will not be listed on the QPL at this time.	ANSI/IES LM-xx-19 Approved Method: Measuring Optical Waveforms for use in Temporal Light Artifact (TLA) Calculations ⁵
Stroboscopic Visibility Measure (SVM)				
Percent Flicker				
Flicker Index				

347 **Test Report and Implementation Requirements**

348 For the member of a product family with the lowest nominal light output (likely the combination of
 349 lowest CCT and highest color rendition) the flicker metrics shall be reported using the format displayed
 350 in Table 7 (this table will be included in the updated Application Form.) The reported values of all
 351 metrics shall be the highest value measured during testing. Waveform data shall be submitted in CSV
 352 format to support the reported values. The type of dimming and dimmer used in testing shall be
 353 reported.

354 *Table 7: Sample Reporting Table for Flicker Testing and QPL Listing*

Metric	Value at 100% Light Output	Value at 20% Light Output
Fundamental Frequency		
Short Term Flicker (P _{st})		
Stroboscopic Visibility Measure (SVM)		
Percent flicker; unfiltered		
Percent flicker; 1,000 Hz cut-off		
Percent flicker; 400 Hz cut-off		
Percent flicker; 200 Hz cut-off		
Percent flicker; 90 Hz cut-off		
Percent flicker; 40 Hz cut-off		
Flicker Index		

⁵ ANSI/IES LM-xx-19 Approved Method: Measuring Optical Waveforms for use in Temporal Light Artifact (TLA) Calculations has yet to be published but is expected in late 2019.

355

Table 8: Dimmer Reporting Template for Flicker Testing

Dimmer Used in Testing	[Manufacturer, make, and model number]
Dimmer Type	Options include: 0-10V, DALI, DMX, Zigbee, Bluetooth, Wi-Fi, Phase-cut, Proprietary, Other

356 **Interactions with other DLC Policies**

357 For [Field Adjustable Light Output \(FALO\)](#), [Color Tunable](#), and [DC/PoE products](#), additional clarifications
358 on meeting the Flicker requirements are provided below.

- 359 • A FALO product might be installed at lower light output than its highest capable output from the
360 factory, so 20% of highest light output would not represent the flicker performance at 20%
361 when installed. The DLC understands this and maintains the requirement to test flicker at 20% of
362 maximum full light output.
- 363 • In Color Tunable products, individual primaries could range from 0 - 100% output when color
364 tuning and impacts to flicker may result. Both the flicker policy proposal and bullet #6 in the
365 Color Tuning policy require testing of the product in the family with the lowest light output. This
366 common testing point should standardize testing across products.
- 367 • Flicker performance may vary based on whether a product is used as a direct PoE powered
368 device (PD) or an indirect satellite of a PD. DC/PoE products should test for flicker as they are
369 tested for LM-79 (whether direct or indirect; either is fine).

370 **Key Questions: Flicker**

- 371 1. Should the DLC specify that flicker testing at dimmed states be done at 20% of maximum light
372 output or 20% of dimming signal? If the former, will manufacturers and testing laboratories be
373 able to clearly define the testing point that delivers 20% light output?

374 Please provide your responses to these key questions in the Excel-based SSL V5.0 Comment Form, under
375 the Flicker tab.

376

Draft Technical Requirements: Controllability

377

378 Controllability

379 Feedback Received and Key Changes from Draft 1

380 The DLC received 95 comments on the Draft 1 Controllability Testing and Reporting Requirements
381 during the first comment period. After careful consideration of both stakeholder feedback and
382 implementation considerations, modifications were made within Draft 2 as described in this section. The
383 bullets below describe general themes of the feedback received and sub-bullets describe how the DLC
384 incorporated those changes into Draft 2:

- 385 • **A dimming requirement for outdoor and lamp General Applications would add cost and**
386 **complexity to products for a capability that is unlikely to be used**
 - 387 ○ The DLC heard from many stakeholders that outdoor and lamp products are rarely
388 dimmed in the field. A clear majority of the products listed on the QPL within these
389 General Applications are not dimmable. Upgrading all products to become dimmable
390 would increase cost and complexity without delivering value to all customers. To
391 address this concern, the DLC has removed outdoor and lamp General Applications from
392 the dimming capability requirement. Indoor luminaires and retrofit kits must be
393 continuously dimmable. Any product pursuing DLC Premium designation must also be
394 continuously dimmable.
- 395 • **Integral controls reporting needs more clarity**
 - 396 ○ Stakeholders were generally supportive of the additional reporting requirements for
397 integral controls but expressed concern about the specific options that will be available
398 and the manner in which these options will be reported on the QPL. To address these
399 concerns, the DLC has defined the list of integral control options that will be available to
400 manufacturers during product application process.

401

402 **Draft Testing and Reporting Requirements**

403 The draft Controllability Testing and Reporting Requirements for all SSL products are as shown in **Table**
 404 **9**.

405 *Table 9: Controllability Testing and Reporting Requirements*

Metric	V4.4 Requirements	Draft V5.0 Requirements	QPL Listing	Method of Evaluation ⁶
Dimming	Required reporting of dimming capability for all products	<p><i>Indoor luminaires and retrofit kits, excluding case lighting and specialty hazardous:</i> Continuous dimming capability required.</p> <p><i>All other products:</i> Required reporting of dimming capability.</p>	<ol style="list-style-type: none"> 1. Dimming capability: continuous, step, none 2. Range of continuous dimming (if applicable): Below 10%, Above 10%. 	Product specification sheet must clearly identify dimming capability and range of continuous dimming (if applicable)
Integral Controls	Optional reporting of integral controls capability (Yes/No); Reporting required for Premium.	<p>All products are required to report integral control capability. Products with integral controls must provide additional detail regarding the type of controls.</p> <p>* Options include: Occupancy/Vacancy Sensing, Daylight Sensing, Multifunction Sensing (Occupancy + Daylight), High-end Trim, LLLC, Energy Monitoring, Traffic Sensing, Exterior Photocell, Networked Replacement Lamp <i>Multiple selections are permitted</i></p>	<ol style="list-style-type: none"> 1. Integral control capability: yes, no 2. Type of integral controls * (if applicable) 	Product specification sheet must clearly identify the types of integral controls available.
Controls Compatibility	None	<p>All products listed as dimmable are required to report the control signal communication type and dimming protocol.</p> <p>** Wired options include: 0-10V, DALI, DMX, Power Signal / Phase-cut, Proprietary, Other Wired ** Wireless options include: Zigbee, Bluetooth, Wi-Fi, Proprietary, Other Wireless <i>Multiple selections are permitted</i></p>	<ol style="list-style-type: none"> 1. Communication type: wired, wireless, none 2. Dimming protocol ** (for continuously dimmable products) 	Product specification sheet must clearly identify the communication type and dimming protocol (if applicable)

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

406 Dimming

- 407 • All products must report the dimming capability. Dimming capabilities are defined in the section
408 *Definitions: Controllability*.
- 409 • Indoor products must be capable of continuous dimming, excluding case lighting and any
410 “specialty” primary use designation intended for a hazardous location.
- 411 • Dimming capability must be demonstrated via the product specification sheet that the product
412 can dim according to an external communications signal, internal control sensing signal, or
413 modulation of the power signal (i.e. phase-cut dimming).
- 414 • All products pursuing the DLC Premium designation must be capable of continuous dimming.
- 415 • The DLC does *not* issue requirements around dimming control protocol (0-10V, DALI, etc.) for
416 the dimming capability requirement. The act of dimming itself is the focus of this requirement.

417 Integral Controls

- 418 • Reporting of “Yes/No” about integral controls availability is required for all products.
- 419 • If “Yes”, products must provide more detail on a set of integral control types as defined in Table
420 10. These integral control types will not be evaluated against any standards and will be treated
421 as manufacturer-reported assertions of capability validated with references on the product
422 specification sheet.
- 423 • Multiple selections of integral control types will be permitted. Integral control types will be
424 displayed within a single searchable field on the QPL. Product model number wild carding and
425 bracketing of products will be allowed as is currently permissible under SSL V4.4.

426 Controls Compatibility

- 427 • Reporting of the control communication type (wired, wireless, none) and the dimming protocol
428 (if applicable) for all products is required.
- 429 • The QPL may include free-form fields for manufacturers to note SKU variants or other useful
430 information to readers interested in a specific capability.
- 431 • Multiple selections of dimming protocol will be permitted. Dimming protocols will be displayed
432 within a single searchable field on the QPL. Wild carding within product model numbers will be
433 allowed.

434 Test Report and Implementation Requirements

- 435 • Given the rapidly-evolving technical capabilities represented by the proposed controllability
436 requirements, the DLC review staff will not evaluate any of these claims against test standards.
437 Reviewers will rely on manufacturer claims represented directly on the product specification
438 sheet. Specification sheets will need to have explicit declaration of a capability, along with any
439 ordering information (i.e. SKU variants) that are associated to the specific capability or attribute.
440 Terminology that will be acceptable for indicating specific product capabilities on the product
441 specification sheet is shown below in Table 10.

- 442 • The DLC will closely monitor its member programs' experience with using QPL controllability
 443 details for products and will use Surveillance Testing procedures to address any concerns about
 444 Controllability performance claims not matching QPL or market available data.

445 *Table 10: Integral Control Type Descriptions*

Integral Control Types	Definition	Acceptable Terms on the Product Spec Sheet
Occupancy/Vacancy Sensing	The capability to affect the operation of lighting equipment based upon detecting the presence or absence of people in a space or exterior environment.	Occupancy Sensor, Vacancy Sensor, Motion Sensor, Exterior Motion Sensor
Daylight Sensing	The capability to automatically affect the operation of lighting or other equipment based on the amount of daylight and/or ambient light that is present in a space, area.	Daylight Sensor, Daylight Harvesting, Daylight Dimming, Daylight Response
Multifunction Sensing (Occupancy + Daylight)	A combination sensor that provides both occupancy sensing and daylight sensing.	Multifunction Sensor, Dual/Combination Sensor, Occupancy/Vacancy/Motion Sensor + Daylight Sensor
High-End Trim	The capability to set the maximum light output to a less-than-maximum state of an individual luminaire/lamp at the time of installation or commissioning. High-end trim must be field reconfigurable.	High-end trim, task tuning, tuning
LLLC	The capability to have a networked occupancy sensor, ambient light sensor, and high-end trim installed for each luminaire/kit/lamp, and directly integrated or embedded into the form factor during the manufacturing process.	Integrated/embedded networked lighting control, luminaire-level lighting control, LLLC. The LLLC must be a DLC qualified system and the system name must be shown on the product specification sheet.
Energy Monitoring	The capability of a system to report the energy consumption of a luminaire/lamp	Power/Energy Monitoring, Power/Energy Metering, Power/Energy Measurement.
Traffic Sensing	The capability to affect the operation of lighting or other equipment based upon detecting the presence or absence of moving vehicles in an area.	Traffic Sensor, Adaptive Traffic Sensor
Exterior Photocell	The capability to 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, Daylight Sensor, Dusk-to-Dawn
Networked Replacement Lamp	A linear, mogul screw-base, or four pin-base replacement lamp that includes <u>all</u> the following controllability features built into the lamp: continuous dimming; wireless communication; high-end trim; and individual addressability. Some networked replacement lamps may also incorporate integrated sensors such as occupancy/vacancy sensing.	Networked, Smart, Intelligent, Connected, Advanced, NLC

446 **Key Questions: Controllability**

- 447 1. The DLC intends to list and display products with integral controls in the same manner as SSL
448 V4.4, where product model number wild carding and product bracketing is permissible.
449 Information about integral control types may be searchable and filterable on the QPL. Is there a
450 need to identify product model numbers that represent specific integral control capabilities?
451 2. If a manufacturer indicates that a product has integral LLLC, should manufacturers report (and
452 the SSL QPL display) the model name of the associated LLLC product(s)?
453 3. Are there any other commonly used dimming protocols that should be listed?
454

455 Please provide your responses to these key questions in the Excel-based SSL V5.0 Comment Form, under
456 the Controllability tab.

457

Draft Technical Requirements: DLC Premium

458

459 **Feedback Received and Key Changes from Draft 1**

460 DLC Premium requirements were not defined in Draft 1. Stakeholders were asked to comment on the
 461 DLC Premium concept as part of the section titled “Other Topics Under Consideration”. The DLC
 462 received comments on DLC Premium directly from 12 different organizations, and many other
 463 commenters referenced DLC Premium within their feedback on other topic areas. Following the
 464 Stakeholder Meeting, the DLC engaged in research and outreach to utilities and manufacturers about
 465 their perceptions and desires for DLC Premium. After careful consideration of both stakeholder feedback
 466 and implementation considerations, DLC Premium has been proposed within Draft 2 as described in this
 467 section.

468 **Draft Testing and Reporting Requirements**

469 DLC Premium under V5.0 is a higher-performance classification for luminaires and retrofit kits. The
 470 Premium classification is intended to promote products that can achieve higher energy savings *while*
 471 delivering quality of light and controllability performance that exceeds DLC Standard requirements.
 472 Products submitted to the DLC Premium classification must meet more stringent efficacy, quality of
 473 light, and controllability requirements as outlined in **Table 11**. Only luminaires and retrofit kits are
 474 eligible for qualification under DLC Premium.

475 The following PUDs are not eligible to qualify for the DLC Premium classification at this time:
 476 Replacement lamps, Linear-Style Retrofit Kits for 2x2, 1x4, and 2x4 Luminaires, Retrofit Kits for Direct
 477 Linear Ambient Luminaires and luminaire products with a Primary Use designated as “Specialty”.

478 *Table 11: DLC Premium Testing and Reporting Requirements*

Metric	V4.4 Premium Requirements	Draft V5.0 Premium Requirements*	QPL Listing	Method of Evaluation
Efficacy	Premium efficacy requirements vary by General Application. The product-weighted average is +22 lumens per watt over V4.4 Standard efficacy.	+15 lumens per watt over V5.0 Standard efficacy requirements	Same as V5.0 Standard	Same as V5.0 Standard

Metric	V4.4 Premium Requirements	Draft V5.0 Premium Requirements*	QPL Listing	Method of Evaluation
Chromaticity (CCT & D_{uv})	None	<i>Indoor, except High-Bay:</i> Products shall exhibit chromaticity consistent with at least one of the basic or extended nominal, 4-step quadrangle CCTs from 2200K – 6500K <i>All other products:</i> Same as V5.0 Standard	Same as V5.0 Standard	Same as V5.0 Standard
Color Maintenance	None	<i>Indoor, except high-bay:</i> Chromaticity shift from 1000-hour measurement to 6,000 hours shall be within a linear distance of 0.002 ($\Delta u'v' \leq 0.002$) on the CIE 1976 (u', v') chromaticity diagram. <i>Outdoor and high-bay:</i> Chromaticity shift from 1000-hour measurement to 6,000 hours shall be within a linear distance of 0.004 ($\Delta u'v' \leq 0.004$) on the CIE 1976 (u', v') chromaticity diagram.	Same as V5.0 Standard	Same as V5.0 Standard
Glare	None	<i>Troffer and Linear Ambient:</i> UGR < 19 <i>Low-Bay: UGR < 22</i> <i>High-Bay: UGR < 25</i> <i>All other products: n/a</i> (Note: Linear-Style Retrofit Kits for 2x2, 1x4, and 2x4 Luminaires, and Retrofit Kits for Direct Linear Ambient Luminaires are not eligible for Premium qualification)	UGR values will not be published on the QPL	Room dimension: X = 4H, Y = 8H Spacing to height ratio (S/H): 1 Reflectances: 70/50/20%
Controllability	Products are required to report integral controls capability.	All products must be capable of continuous dimming. (note: integral control reporting is no longer a Premium requirement since it is required of all products)	Same as V5.0 Standard	Same as V5.0 Standard
Lumen Maintenance	Products are required to pass L ₉₀ > 36,000 hours. This requirement is in addition to the L ₇₀ > 50,000 hours requirement of the DLC Standard classification.	No change. (Note new LM-80 / TM-21 guidance. See Additional Reporting Guidelines: IES TM-21-11 and its Addendum B)	Same as V4.4/V5.0 Standard	Same as V4.4/V5.0 Standard

Metric	V4.4 Premium Requirements	Draft V5.0 Premium Requirements*	QPL Listing	Method of Evaluation
Driver ISTMT	$TMP_{ps} \leq$ driver operating temp specification	No change.	Driver ISTMT values will not be 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.

479 * For any metric not listed in **Table 11**, V5.0 Standard requirements apply.

480 Test Report and Implementation Requirements

481 If a manufacturer seeks qualification of its products to the DLC Premium classification, it must provide all
 482 the necessary testing to demonstrate that the product(s) meet the higher classification's additional
 483 requirements in addition to meeting all base V5.0 Standard requirements. Topic-specific details are
 484 described below.

485 Color Rendition and Chromaticity (CCT & D_{uv})

- 486 • A full LM-79/color report for each CCT at the minimum color rendition option, with full LM-
 487 79/color reports for each additional color rendition option at the lowest CCT, shall be provided
 488 and conform to the [Draft Additional Reporting Guidelines](#).
- 489 • All color rendition options must meet either the IES TM-30-18 color rendition requirements or
 490 the CIE 13.3-1995 color rendition requirements described in Table 2.
- 491 • All variations of CCT offered must fall within at least one of the basic, flexible, or extended
 492 nominal, 4-step (indoor products only, except high-bay) quadrangles, or 7-step (outdoor and
 493 high-bay products only) quadrangles from 2200 K to 6500 K as defined by ANSI C78.377-2017.
- 494 • For example, if a product family consists of two color rendition options (e.g. CRI Ra=80, R9=0
 495 and CRI Ra=90, R9=50) and four CCT options (e.g. 2700K, 3500K, 4000K, and 5000K), and *all*
 496 variations are to be qualified to DLC Premium, a minimum of five LM-79 test reports must be
 497 provided. That is, one test for each CCT at the minimum color rendition option, and one test at
 498 the lowest CCT for the higher color rendition option.
- 499 • Please note that the DLC also requires that testing be conducted on the worst-case efficacy
 500 variation (likely the combination of lowest CCT and highest color rendition) which is likely
 501 covered by a test required to meet spectral quality requirements.

502

503 **Color Maintenance**

504 The DLC has two pathways for demonstrating DLC Premium color maintenance compliance, both of
505 which are identical to the [Standard color maintenance compliance](#) pathways.

506 **Glare**

507 The Premium glare requirements are only applicable to luminaires and integrated retrofit kits within the
508 eligible General Applications, namely, Troffers, Linear Ambient, Low-Bay and High-Bay with luminous
509 distribution that is either laterally symmetric in all planes⁷ or quadrantally symmetric⁸. (Note: Linear-
510 Style Retrofit Kits for 2x2, 1x4, and 2x4 Luminaires and Retrofit Kits for Direct Linear Ambient Luminaires
511 are not eligible for Premium qualification at this time.) Applications must include the following
512 additional materials:

- 513 • For a single product application:
 - 514 1) A full LM-79/distribution report per [Draft Additional Reporting Guidelines](#) for the
 - 515 product tested at the maximum light output and the .ies file based on the LM-79 test
 - 516 data
 - 517 2) Indicate on the application form which UGR bin⁹ that the product's Corrected UGR value
 - 518 falls in
- 519 • For a family grouping application:
 - 520 1) A full LM-79/distribution report per [Draft Additional Reporting Guidelines](#) for the
 - 521 products that have the highest total lumen output for each optical variation within the
 - 522 family, regardless of color properties, for which the applicant is seeking the Premium
 - 523 classification designation tested at the maximum light output and the .ies file based on
 - 524 the LM-79 test data
 - 525 2) Indicate on the application form which UGR bin that the product's Corrected UGR value
 - 526 falls in

527 Qualification for Premium is verified by the application reviewer using the Corrected UGR table
528 generated from the submitted .ies file. If the values in the UGR table for the glare evaluation reference
529 condition (room dimension: X = 4H, Y = 8H; spacing to height ratio: 1; reflectances: 70/50/20%) meet the
530 requirements in Table 11, both viewed lengthwise and crosswise, the product, or family of products in
531 the case of family grouping applications, qualifies for the DLC Premium classification. In the case of a
532 family grouping application, all products of the same optical variations as the submitted luminaires
533 within the family automatically qualify for the Premium designation.

⁷ A luminaire or integrated retrofit kit has the same candela value across all horizontal angles at a given vertical angle. In this case, only the luminous intensity value at 0° horizontal angle is listed for each vertical angle in the .ies file.

⁸ A luminaire or integrated retrofit kit has a luminous distribution that is symmetric in each quadrant. In this case, only the luminous intensity values between 0° and 90° horizontal angle are listed for each vertical angle in the .ies file.

⁹ The UGR bins on the application form are 10-13, 13-16, 16-19, 19-22, 22-25, where the lower bound of the bins are inclusive and the upper bound of the bins are exclusive.

534 **Interactions with other DLC Policies**

535 For [Field Adjustable Light Distribution \(FALD\)](#) products seeking Premium classification, the UGR value
536 shall meet the threshold at the light distribution setting designated, per the FALD policy, for meeting the
537 ZLD requirements of the PUD, for which the product is seeking qualification.

538 **Key Questions: DLC Premium**

- 539 1. Do the proposed requirements for V5.0 DLC Premium strike the right balance between efficacy,
540 quality, and controllability?
- 541 2. Some retrofit kit PUDs are not eligible for Premium, since their glare performance is dependent
542 on the optics of the housing and cannot be fairly evaluated using the proposed metric. Should
543 this restriction apply to all retrofit kits?
- 544

545 Please provide your responses to these key questions in the Excel-based SSL V5.0 Comment Form, under
546 the DLC Premium tab.

547

Draft Technical Requirements: Allowances

548

549 As with previous versions of the DLC Technical Requirements, the V5.0 revision includes increases in
550 minimum efficacy thresholds. Additionally, V5.0 more intentionally considers the trade-offs between
551 efficacy and quality of light. The DLC recognizes that quality must go hand-in-hand with efficacy if long-
552 term energy savings are to be realized. The DLC also recognizes the risk of products that achieve higher
553 efficacy at the expense of quality factors that can leave customers unsatisfied and/or negatively impact
554 human health or wellbeing. The DLC is incorporating quality requirements to ensure that the QPL
555 includes a balance of products that provide good quality of light, while at the same time saving energy
556 through high efficacy and controllability.

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

561 A summary of allowances included in Version 5.0 can be seen in **Table 12**. Allowances are cumulative up
562 to a maximum allowance of 15%. For example, a 2700K product that exhibits superior Color Rendition
563 may utilize a maximum allowance of 10%, whereas a 2700K, Low Glare product that exhibits superior
564 color rendition may utilize a maximum allowance of 15%, to be applied to the efficacy requirement for
565 the Category and General Application to which the product is applying. Additionally, a product may take
566 advantage of an efficacy allowance in conjunction with the luminaire efficacy tolerance, as stated in
567 **Table 13**. In this situation, the allowance would be applied first, and then the tolerance.

Table 12: Allowances to Efficacy under Version 5.0

Feature	General Application	Performance Metric	Allowance under V4.4	Allowance under V5.0
CCT	All	$\leq 3000\text{K}$	-3%	None
	All	$\leq 2700\text{K}$	-5%	-5%
Color Rendition	Indoor, excluding high-bay	Option 1 - ANSI/IES TM-30-18: <ul style="list-style-type: none"> IES $R_f \geq 75$ IES $R_g \geq 92$ $-7\% \leq \text{IES } R_{cs,h1} \leq +19\%$ Option 2 - CIE 13.3-1995: <ul style="list-style-type: none"> $R_a \geq 90$ and $R_9 \geq 50$ 	-5%	-5%
		ANSI/IES TM-30-18: <ul style="list-style-type: none"> IES $R_f \geq 78$ IES $R_g \geq 95$ $-1\% \leq \text{IES } R_{cs,h1} \leq +15\%$ 	n/a	-10%
	Outdoor and high-bay	Option 1 - ANSI/IES TM-30-18: <ul style="list-style-type: none"> IES $R_f \geq 70$ IES $R_g \geq 89$ $-12\% \leq \text{IES } R_{cs,h1} \leq +23\%$ Option 2 - CIE 13.3-1995: <ul style="list-style-type: none"> $R_a \geq 80$ and $R_9 \geq 0$ 	n/a	-5%
Glare	Troffer and Linear Ambient (Luminaires and Integrated Retrofit Kits only)	$\text{UGR} < 16$ at the glare evaluation reference condition of <ul style="list-style-type: none"> 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 and Retrofit Kits for Direct Linear Ambient Luminaires are not eligible for efficacy allowances at this time.)	n/a	-10%
	Low-Bay (Luminaires only)	$\text{UGR} < 19$ at the glare evaluation reference condition of <ul style="list-style-type: none"> Room dimension: $X = 4H$, $Y = 8H$ Spacing to height ratio (S/H): 1 Reflectances: 70/50/20% 	n/a	-10%
	High-Bay (Luminaires only)	$\text{UGR} < 22$ at the glare evaluation reference condition of <ul style="list-style-type: none"> Room dimension: $X = 4H$, $Y = 8H$ Spacing to height ratio (S/H): 1 Reflectances: 70/50/20% 	n/a	-10%

570 Efficacy Allowances: Spectral Quality

571 To enable a qualification pathway for luminaires designed for applications that demand higher level
572 color rendition and to recognize the tradeoff between efficacy and color rendition, efficacy allowances
573 are provided for products with improved color rendition that meet all other QPL criteria. Recognizing
574 the tradeoff between CCT and efficacy, efficacy allowances are also provided for products with CCT
575 ≤ 2700 K.

576 To qualify for efficacy allowances, the applications must include the following additional materials.

- 577 • A full LM-79/color report for the worst-case efficacy variation must be provided for each color
578 rendition option and shall conform to the Draft Additional Reporting Guidelines. Typically, this
579 could be the lowest CCT option.
 - 580 ○ All color rendition options must meet either the IES TM-30-18 color rendition threshold
581 or the CIE 13.3-1995 color rendition threshold detailed in the adopted allowances table.
- 582 • All variations of CCT offered must fall within at least one of the basic or extended nominal, 4-
583 step (indoor products only, except high-bay) quadrangles, or 7-step (outdoor products only, and
584 high-bay) quadrangles from 2200 K – 6500 K as defined by ANSI C78.377-2017.

585 Efficacy Allowances: Glare

586 Recognizing that luminaires and retrofit kits for applications demanding low glare are often designed at
587 the expense of efficacy, allowances are provided for products with low glare design that meet all other
588 QPL criteria. The allowances are currently only provided for luminaires and integrated retrofit kits within
589 the General Applications of Troffers, Linear Ambient, Low-Bay and High-Bay with luminous distribution
590 that is either laterally symmetric in all planes¹⁰ or quadrantally symmetric¹¹.

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

- 592 • For a single product application:
 - 593 1) A full LM-79/distribution report per the [Draft Additional Reporting Guidelines](#) for the
594 product tested at the maximum light output and the .ies file based on the LM-79 test
595 data
 - 596 2) Indicate on the application form which UGR bin¹² that the product's Corrected UGR
597 value falls in
- 598 • For a family grouping application:
 - 599 1) A full LM-79/distribution report per the [Draft Additional Reporting Guidelines](#) for the
600 product that has the highest total lumen output for each optical variation within the

¹⁰ A luminaire or integrated retrofit kit has the same candela value across all horizontal angles at a given vertical angle. In this case, only the luminous intensity value at 0° horizontal angle is listed for each vertical angle in the .ies file.

¹¹ A luminaire or integrated retrofit kit has a luminous distribution that is symmetric in each quadrant. In this case, only the luminous intensity values between 0° and 90° horizontal angles are listed for each vertical angle in the .ies file.

¹² The UGR bins on the application form are 10-13, 13-16, 16-19, 19-22, where the lower bound of the bins are inclusive and the upper bound of the bins are exclusive.

601 family, regardless of color properties, for which the applicant is seeking allowances
602 tested at the maximum light output and the .ies file based on the LM-79 test data
603 2) Indicate on the application form which UGR bin that the product's Corrected UGR value
604 falls in

605 The product's qualification for efficacy allowances is verified by the application reviewer using the
606 Corrected UGR table generated from the submitted .ies file. If the values in the UGR table for the glare
607 evaluation reference condition (room dimension: X = 4H, Y = 8H; spacing to height ratio: 1; reflectances:
608 70/50/20%) meet the requirements in **Table 12**, both viewed lengthwise and crosswise, the product
609 qualifies for the allowances. In the case of a family grouping application, all products of the same optical
610 variations as the submitted luminaires within the family automatically qualify for the allowances.

611 **Interactions with other DLC Policies**

612 [Field Adjustable Light Distribution \(FALD\)](#) products are not eligible for efficacy allowances, and therefore
613 the testing and reporting requirements for UGR are not applicable to FALD products.



Draft Technical Requirements: Tolerances

The DLC accepts measurement tolerances to all metrics listed in the Technical Requirements. For zonal lumen tolerances specific to each Primary Use designation, please refer to the [DLC website](#).

Table 13: Tolerances under Version 5.0

Performance Metric	V4.4 Tolerance	V5.0 Tolerance
Light Output	±10%	±10%
Luminaire Efficacy	-3%	-3%
Allowable CCT	Defined by ANSI C78.377-2015†	Defined by ANSI C78.377-2017†
Minimum Color Rendering	-2 points Ra	All reported color rendition metrics, except IES $R_{cs,h1}$: -1 point IES $R_{cs,h1}$: -1%
Color Maintenance	n/a	$\Delta u'v'$: + 0.0004 points Data must be collected within a ±48-hour window of both the “1000 hour measurement point” and the “6000 hour measurement point”, with a $\Delta t \geq 5000$ hours.
UGR	n/a	+1.0
Power Factor	-3%	n/a
Total Harmonic Distortion	+5%	n/a
Beam Angle (TLEDs only)	n/a	-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. $110 \times 97\% = 106.7$).

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

631

Draft Technical Requirements:

632

Total Harmonic Distortion & Power Factor

633 In order to balance the new requirements with the DLC's effort to minimize testing burden, this draft
634 proposes to remove the total harmonic distortion (THD) and power factor (PF) requirements for listing
635 on the QPL.

636 From the data collected for qualification since first collecting these metrics in 2012, the power quality of
637 SSL products has been fairly consistent and reliable. As such, the DLC believes that removing these
638 requirements is an appropriate tradeoff in asking for more testing around the quality of light.

639

Table 14: Proposed Removal of Power Quality Requirements

Metric	Current V4.4 Requirements	Draft V5.0 Requirement	Method of Evaluation
THD	≤20%	none	n/a
PF	≥0.9	none	n/a

640

Draft Technical Requirements: Reference Housings

641 The DLC offered a number of “Other Topics Under Consideration” for comment in Draft 1. One of the
642 topics that received substantial comment and priority was the DLC’s use of testing in reference housings
643 for various types of eligible lamps and retrofit kits.
644
645

646 **Feedback Received and Key Changes from Draft 1**

647 The DLC received comments from 13 organizations regarding the lamp and retrofit kit policy. Combined
648 with previous commentary gathered on this topic and outreach conducted while investigating
649 alternative approaches for assessing performance, several key themes emerged from the feedback:

- 650 • Many stakeholders view the requirement to test in reference housings as adding burden to the
651 application process. This is due to the fact that the testing is generally DLC-specific, and not
652 already being conducted for other purposes, or that can be repurposed for additional value
653 elsewhere.
- 654 • Linear replacement lamps (TLEDs) performance is well established.
 - 655 ○ In general, there was less concern expressed about additional burden from use of
656 reference housing testing for retrofit kits or other lamp categories (Screw-base
657 Replacements for HID Lamps, and Four Pin-Base Replacement Lamps for CFLs) and
658 there are legitimate concerns about how the performance of lamps and retrofit kits will
659 be affected by the luminaires they are eventually installed within.
- 660 • Several of the approved reference housings are no longer in production or are not readily
661 commercially available, creating a logistical barrier to conducting the necessary testing.
- 662 • There is variability among the existing list of reference housings, resulting in the potential for
663 significantly different performance assessments between products, and the possibility of gaming
664 the requirements.

665 Additionally, the DLC notes that the current reference housing policy creates complications in the
666 surveillance testing program, particularly when the housing originally used in the application process
667 is discontinued or otherwise unavailable to the surveillance testing laboratory.

668 Consideration of the feedback received led to proposal of the following policy revisions to the
669 reference-housing testing policy:

670 **Linear Replacement Lamps (TLEDs and 2G11-base CFLEDs)**

671 Linear Replacement Lamps (TLEDs) are the dominant product categories discussed in the feedback DLC
672 received on the reference housing policies. TLED products and market acceptance has evolved
673 significantly since DLC first introduced this category. While there are still concerns about performance,

674 the most common feedback has been that TLEDs are an increasingly mature technology, with more
 675 standardization of design and less variability in performance than when the category was established.
 676 With this in mind, the DLC proposes to eliminate the requirements for testing TLEDs and 2G11-base
 677 replacement lamps for CFLs in reference housings as part of V5.0. These requirements will be replaced
 678 with specific distribution requirements, and in place of reference housing testing, optical performance
 679 will be assessed through a goniophotometer testing evaluation of the lamps directly, as well as ensuring
 680 that ISTMTs have been conducted in an appropriate thermal environment.

681 Test Report and Implementation Requirements

682 The proposed requirements for linear replacement lamps under V5.0 will be as follows:

683 *Table 15: Linear Replacement Lamp Technical Requirements*

TLED General Application	Initial Light Output	Bare-lamp Efficacy	Bare-lamp Beam Angle*
Two-foot Lamps, T8 Replacements	≥ 800 lm	≥ 120 lm/W	≥ 160°
Three-foot Lamps, T8 Replacements	≥ 1,200 lm	≥ 120 lm/W	≥ 160°
Four-Foot Lamps, T8 Replacements	≥ 1,600 lm	≥ 120 lm/W	≥ 160°
Four-Foot Lamps, T5 Replacements	≥ 1,600 lm	≥ 120 lm/W	≥ 160°
Four-Foot Lamps, T5HO Replacements	≥ 3,200 lm	≥ 120 lm/W	≥ 160°
Eight-Foot Lamps, T8 Replacements	≥ 3,200 lm	≥ 120 lm/W	≥ 160°
U-bend Lamps, T8 Replacements	≥ 1,400 lm	≥ 120 lm/W	≥ 160°
2G11 Replacement Lamps	≥ 1,900 lm	≥ 120 lm/W	≥ 160°

684
 685 Performance requirements for these products are otherwise as described in sections above (for color,
 686 etc.).
 687 Submitters will be required to provide a full LM-79/distribution (goniophotometer) test for each optical
 688 variation (including lens variations) of a lamp product and shall conform to *Draft Additional Reporting*
 689 *Guidelines*, at the highest nominal light output, and associated IES file, for purposes of evaluating the
 690 beam angle. For the DLC’s purposes, the definition of beam angle for linear replacement lamps will be as
 691 follows:

- 692 • ***Beam Angle** – the angle between the two opposite directions in which the average intensity is
 693 50% of the center beam intensity as measured in the azimuthal plane perpendicular to and at
 694 the center of the TLED lamp axis.

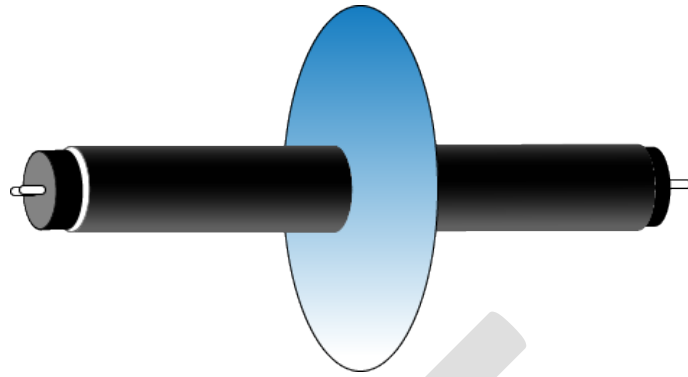


Figure 1: TLED Beam Angle Definition

695

696

697 Additionally, all TLED products (including child products) will be required to report their beam angle in
 698 the scaled/reported values on the application form, in the same manner that is required for the Zonal
 699 Lumen Distribution fields in other luminaire and retrofit kit categories.

700 All categories above will be required to conduct *in-situ temperature measurement testing* (ISTMT) in the
 701 most restrictive thermal environment the product is rated for, per its safety certifications (e.g. UL/CSA
 702 1993). ISTMTs will be reviewed to ensure the safety standard is referenced, and the apparatus used is
 703 specifically noted/described in the test report. TM-21 projections will use this thermal measurement in
 704 conjunction with the provided LM-80 data to evaluate lumen maintenance and compliance with L70
 705 requirements.

706 **Other Categories (Retrofit Kits, MogLEDs, and Four Pin-Base**
 707 **Replacement Lamps for CFLs)**

708 For non-TLED and 2G11 categories, the DLC proposes to continue using reference housing testing as a
 709 necessary evaluation of the performance of these products in a typical end use. However, to address the
 710 issues of availability of reference housings and inconsistency in performance between housings (and
 711 therefore between products applying for qualification), the DLC proposes restricting the allowable
 712 housings used for testing to a single reference housing. The policy revision and list of housings indicated
 713 below is intended to create a simpler policy and a more level playing field, while specifying commonly-
 714 used and readily-available housings wherever possible. The DLC does not endorse any particular
 715 manufacturer associated with this housing selection. These models were selected based on research on
 716 availability and analytics on common housings used during DLC qualification.

Category/Primary Use	Reference Housing
Retrofit Kits for Pole/Arm-Mounted Area and Roadway Luminaires; Mogul-screw base (E39) Replacement Lamps for Pole/Arm-Mounted Area and Roadway Luminaires	GE M250R2
Retrofit Kits for Large Pole/Arm-Mounted Area and Roadway Luminaires	GE M400R2

Retrofit Kits for Decorative Area Luminaires; Mogul-screw base (E39) Replacement Lamps for Decorative Area Luminaires	King Luminaire K400 Series
Retrofit Kits for Full-Cutoff Wall-Mounted Area Luminaires	Lithonia TWF1 100S
Mogul Screw-base (E39) Replacement Lamps for Full-Cutoff Wall-Mounted Area Luminaires	Lithonia TWF2
Retrofit Kits for Parking Garage Luminaires; Mogul-screw base (E39) Replacement Lamps for Parking Garage Luminaires	Lithonia KACM Series Fixture
Retrofit Kits for Fuel Pump Canopy Luminaires; Mogul-screw base (E39) Replacement Lamps for Fuel Pump Canopy Luminaires	LSI Scottsdale Series Fixture
Retrofit Kits for 2x2 Luminaires; 2G11-base CFLs	Lithonia 2GT8 lensed 2X2
Retrofit Kits for 1x4 Luminaires	Lithonia GT8 lensed 1X4
Retrofit Kits for 2x4 Luminaires	Lithonia 2GT8 lensed 2X4
Retrofit Kits for Direct Linear Ambient Luminaires	Lithonia C2 32 MVOLT GEB10IS
Retrofit Kits for High-bay Luminaires; Mogul-screw base (E39) Replacement Lamps for High-Bay Luminaires	Lithonia THD 400S A15 TB (HID-style) Lithonia MS5HB (Fluorescent-style)
Retrofit Kits for Low-bay Luminaires; Mogul-screw base (E39) Replacement Lamps for Low-Bay Luminaires	Lithonia TGR 175MP A125 TB SCWA (HID-style) Lithonia L Series (Fluorescent-style)
G24q/GX24q CFL Replacement Lamps	Prescolite LF6CFH 218 EB LCFH WT (horizontally-mounted) Prescolite LF6CFV 32 EB LCFHV WT (vertically-mounted)

717 Performance requirements for these products remain otherwise as described in sections above (for light
718 output, efficacy, color, etc.).

719 **Key Questions: Reference Housings**

- 720 1. For the TLED categories, does the proposed performance requirement for beam angle
721 sufficiently address optical performance concerns? If not, what additional parameters and
722 thresholds would you propose?
723 a. Is -5% an appropriate testing tolerance for this threshold value?
- 724 2. For the non-TLED categories, does the selected reference housing represent a typical housing
725 for that application? If not, please describe why that housing is problematic, and what other
726 luminaire housing you would propose in place?

727 Please provide your responses to these key questions in the Excel-based SSL V5.0 Comment Form, under
728 the Reference Housings tab.



Draft Additional Reporting Guidelines Required for Submitted LM-79, LM-80, and TM-21 Reports

The DLC has proposed new requirements as part of V5.0 that will require complete information be included in LM-79 test reports that may not have been required in the past. Additionally, the DLC is proposing new 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 guidelines required for all submitted LM-79, LM-80, and TM-21 reports. Testing reports that do not include this information will not be accepted.

Additional Reporting Guidelines: IES LM-79 (-08 and -19 versions)

SSL products or family groupings shall be tested according to the guidelines in specified ANSI/IES Lighting Measurement (LM) documents. Test reports generated by a test lab with NVLAP accreditation will be accepted only if all optical and electrical performance are tested and documented as described below.

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 V5.0 policy as **“full LM-79/color reports”** and shall include the following at minimum:

- Electrical characteristics (Wattage, input voltage)
- Total luminous flux
- Efficacy
- Chromaticity ((x,y), (u,v) and (u',v'))
- CCT and Duv
- ANSI/IES TM-30-18 Full Report and CIE 13.3-1995 complete Color Rendering Index Detail
- Accompanying .SPDX document (IES TM-27) with spectral power distribution data from 380-780 nm in 1nm increments

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 V5.0 policy as **“full LM-79/distribution reports”** and shall include the following at minimum:

- Electrical characteristics (Wattage, input voltage)
- Luminous intensity distribution (Candela array)
- .ies file ([ANSI/IES LM-63-02\(R2008\)](#)) using Type C photometry with luminous intensity distribution data in a resolution of 5 degree or less vertical and 15 degree or less for horizontal

763 planes. The width, length and height fields in the .ies file must pertinently reflect the luminous
764 dimensions of the product's luminous opening.

765 Please note that test reports containing only a partial set of LM-79 metrics, for example, an integrating
766 sphere test report without luminous flux reported, will not be accepted.

767 **Additional Reporting Guidelines: IES TM-21-11 and its Addendum B**

768 SSL products or family groupings shall project long term lumen maintenance according to the guidelines
769 in specified ANSI/IES TM documents and current addenda. Long term lumen maintenance projections
770 will be accepted only if fully compliant with TM-21-11 and its Addendum B. This shall include, but is not
771 limited to, the following:

- 772 • Luminous flux data collection and selection (section 4.3)
- 773 • Data used for the curve-fit (section 5.2.3)
- 774 • Temperature data interpolation (section 6.0)
- 775 • Limit for Extrapolation (section 6.5)

776 Please note that TM-21 projections not fully compliant with Addendum B revisions, for example, one
777 drawing from an LM-80 report not adhering to the even interval provisions, will not be accepted. Also
778 note that a complete and accurate copy of [the June 18, 2018 version of the ENERGY STAR TM-21](#)
779 [calculator](#) will be required for submission, and will suffice in meeting the above requirements.
780 Additionally, and consistent with the above, under V5.0, the DLC will eliminate the provisions for
781 complying with lumen maintenance requirements for projection end points $\leq 50,000$ hours, as is listed in
782 the current "Table 7", per V4.0. Therefore, LM-80 sets will need to be sufficient for projecting to 50,000
783 hours via TM-21 rules alone in order to demonstrate compliance with the L70 lumen maintenance
784 requirement, and products with LM-80 sets insufficient to do so will be ineligible for qualification. To
785 clarify, projections shall not extend beyond 6 times the test duration for 20 or more samples (5.5 times
786 for 10 to 19 samples). For example, LM-80 sets used to project to 50,000 hours will be required to
787 demonstrate a test duration of $\geq 8,333.33$ hours for 20 or more samples. 6,000 hours of test data will no
788 longer be accepted.

789 **Key Questions: Additional Reporting Guidelines**

- 790 1. What are the potential issues and challenges you see in requiring test report alignment with
791 current versions of IES LM-79 and LM-80? (For example, requiring all submitted LM-79 test
792 reports be LM-79-19 test reports and no longer accepting, for example, LM-79-08 test reports).
793 Are there specific concerns with this proposal? What current versions of IES Standards are there
794 specific concerns and challenges for?
- 795 2. What are the potential issues and challenges you see in requiring alignment with Addendum B
796 for TM-21-11 and the specific TM-21 calculator version?

797 Please provide your responses to these key questions in the Excel-based SSL V5.0 Comment Form, under
798 the Additional Reporting Guidelines tab.



799

Manufacturer and Industry Implementation Guidance

800

801 This guidance section is provided for stakeholders to understand how the V5.0 requirements will take
802 effect and to offer information for manufacturers who may wish to update their product listings during
803 the upcoming grace period.

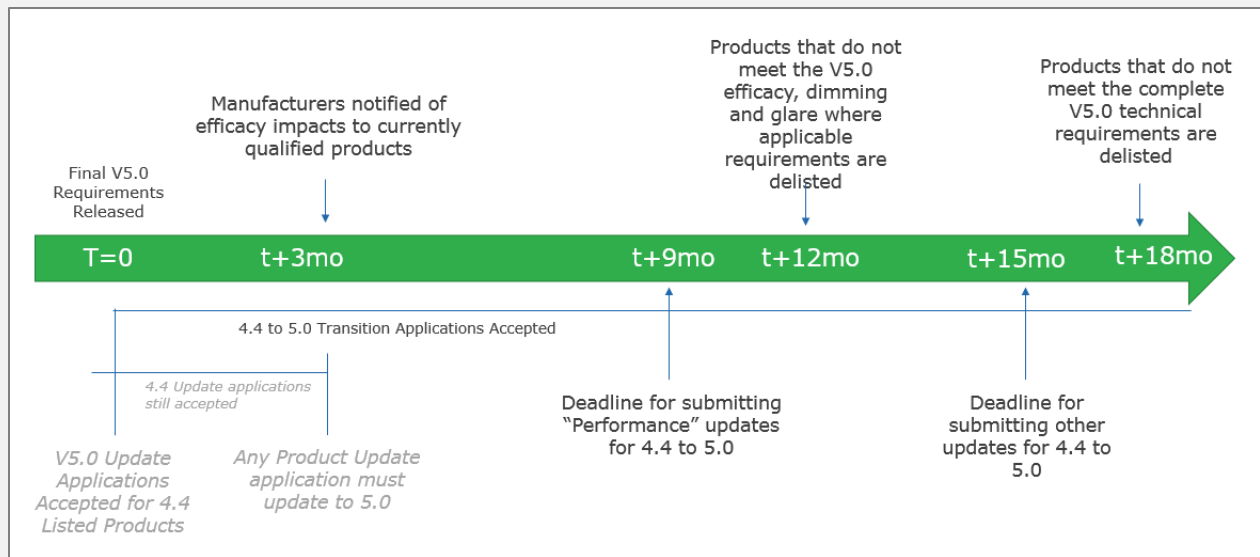
804 In this guidance section, all of the dates which correspond to grace periods, deadlines, and milestones
805 are represented as a variable where “T” is the date on which the final Technical Requirements are
806 released and “T+x” represents a date that is ‘x’ months after the release date. For example, if the final
807 Technical Requirements are released on January 1, 2020, then “T” can be interpreted as January and
808 “T+3” can be interpreted as April 1, 2020. Actual dates will be published with the final V5.0 Technical
809 Requirements.

810 Implementation Timeline and Grace Periods

811 The DLC recognizes that the V5.0 Technical Requirements may result in a need to perform new testing
812 and/or product design changes. A reasonable grace period has been planned to allow manufacturers
813 time to comply with the new requirements. **Products qualified under V4.4 will remain active on the**
814 **QPL for a period of 12 months from the release of the final V5.0 Technical Requirements.**

815 In an effort to provide a reasonable and manageable transition process for manufacturers, the DLC has
816 established multiple update/transition paths that manufacturers may choose to follow. There will be
817 two grace periods established to allow time for transition.

- 818 • First, there will be a 12-month grace period to allow manufacturers to take the necessary action
819 to meet the new V5.0 Efficacy and Dimming and Glare (where applicable) requirements and
820 submit any update materials required.
- 821 • Second, there will be an additional 6-month grace period (a total of 18 months from the release
822 of the V5.0 Technical Requirements) to submit any additional required testing or reporting
823 information required for the V5.0 Technical Requirements.



824

825 Each of the grace periods will have a submission deadline as noted. The DLC will ensure that submissions
 826 received before those dates are processed prior to the ends of each grace period. At the end of each
 827 grace period, the DLC will remove any product that does not yet comply with the criteria required at
 828 each milestone.

829 At T+12mo, products that do not meet the V5.0 Efficacy, Dimming, and Glare requirements will be
 830 removed from the QPL and will no longer be considered qualified.

831 At T+18mo, products that do not meet the complete set of V5.0 testing and reporting requirements will
 832 be removed from the QPL and no longer be considered qualified.

833 Manufacturers will have the option to either complete a full update within the first 12-month grace
 834 period or process any required updates as separate steps within the two applicable grace periods, e.g.
 835 efficacy, dimming and glare (if applicable) update first, followed by a separate submission of additional
 836 data.

837 As with previous de-listings, products not meeting the new V5.0 requirements will still be searchable
 838 using the “Include De-Listed Products” feature of the DLC search page.

839 Analysis and individual outreach to manufacturers regarding which of their products may not meet V5.0
 840 efficacy levels will take place in the first 3 months after release of the final Technical Requirements.

841 Though the DLC will strive to notify manufacturers as part of this effort, manufacturers are expected to
 842 understand their product listings and submit updates as needed (see below for additional guidance on
 843 updates).

844 A summary of this implementation timeline is provided below.

845

Table 16: Summary of V5.0 Implementation Timeline

Milestone	Date(s)
Final V5.0 Technical Requirements Announced	T
Last date to submit products for qualification under V4.4 Technical Requirements	T+3 months
Analysis of listings, individual outreach to manufacturers	T → T+3 months
Products not meeting V5.0 Efficacy and Dimming requirements removed from QPL	T+12 months
Products not meeting complete V5.0 requirements removed from QPL	T+18 months

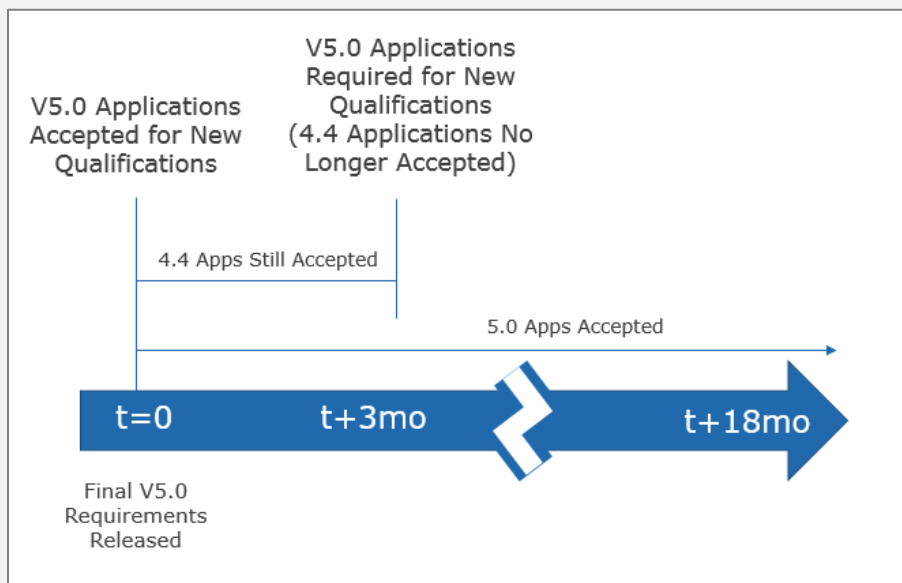
846

847 OEM Products

848 New Product Qualification Applications Submitted After Release of V5.0

849 Manufacturers may choose to submit products for qualification and listing under the new V5.0
850 requirements immediately upon release of the final V5.0 Technical Requirements.

851 The DLC recognizes that products may be under development or testing with the intent to qualify under
852 V4.4 at the time of this announcement. To accommodate these products, **manufacturers may continue**
853 **to submit products for qualification and listing on the QPL under the V4.4 Technical Requirements for**
854 **T+3mo.**



855

856

857 All submissions received on and after T+3mo will be evaluated against the V5.0 requirements. Any
858 products submitted under V4.4 between T and T+3mo must be updated to meet the V5.0 requirements
859 by the end of the transition periods outlined in the transition timeline below.

860 An example of the typical required testing and reporting for a family of products is provided below
 861 based on the latest draft Technical Requirements. Specific testing and reporting requirements for each
 862 of the Technical Requirements can be found in the corresponding sections of this V5.0 draft.

863 **Table 17: Example of typical required testing and reporting for a family of products**

Criterion	Which Model(s)	Test Required
Minimum Light Output	Worst Case Light Output	LM-79 (complete test report which includes color and spectral data), Accompanying .SPDX document
Minimum Efficacy	Worst Case Efficacy	
Max CCT	Highest CCT in Family	
Min CCT	Lowest CCT in Family	
Minimum Color Rendering	Lowest CRI in Family	
Chromaticity	Lowest CCT at Lowest CRI, Highest CCT at Lowest CRI	
Minimum L70 Lumen Maintenance	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
Flicker Data (Pst, SVM, Flicker Index, Percent Flicker)	Lowest Nominal Light Output	LM-xx-19s at 100% light output LM-xx-19s at 20% light output
Driver ISTMT (Premium)	Worst cast Driver Temperature for each unique driver	ISTMT
Zonal Lumen Distribution	Each unique optical and distribution pattern at the highest output.	Tested IES file
BUG rating (outdoor only)	Each unique optical and distribution pattern at the highest output.	Tested IES file

864

865 **Impacts to Currently Qualified Products**

866 As noted above, products that do not meet the complete set of V5.0 requirements will be de-listed from
 867 the active QPL on T+12mo or T+18mo as appropriate. The DLC recognizes that products often undergo
 868 revisions to improve performance. The DLC also understands that for large family groups, parts of the
 869 group may meet the new requirements, while other parts may not. De-listing of products will be based
 870 on the tested performance information DLC has on file regarding any given product or product family,
 871 including test data in the original application and any additional test data provided to update the listing
 872 since its original qualification.

873 As in previous revisions of the Technical Requirements, the DLC will perform analysis and individual
 874 outreach to manufacturers regarding which of their products may not meet V5.0 efficacy levels.

875 **Manufacturers will be notified of the qualification impacts of each of their currently qualified**
 876 **products based on the new V5.0 efficacy requirements only.** This analysis will not include a review of



877 any other V5.0 Technical Requirements criteria, impact of any new Allowances, or any previously
878 submitted test reports or information that were not reviewed as part of the original application review
879 process.

880 If the data provided in the application of a product or product family and represented on the QPL does
881 not demonstrate that a product meets the new V5.0 efficacy and dimming requirements, manufacturers
882 will need to update their products during the first 12-month grace period to avoid de-listing. Update
883 applications will be processed under normal review timelines and should be submitted by T+9mo to
884 ensure processing prior to the T+12mo transition date.

885 Manufacturers may choose to update only efficacy, dimming and glare if applicable during the first 12-
886 month period or provide all of the required testing and reporting to meet the complete set of V5.0
887 Technical Requirements. Guidance on updating products submitted through specific application types is
888 provided below.

889 If the data provided in the original application of a product or product family and represented on the
890 QPL demonstrate that a product already meets the new V5.0 efficacy and dimming requirements, the
891 product must still be updated to meet glare requirements if they are applicable. All products must still
892 be updated to meet the rest of the new V5.0 Technical Requirements within the 18-month grace period
893 to avoid de-listing.

894 **Transition Process: Update Application Guidance and Expectations**

895 **Updating Products Originally Submitted Through Standard or Family Grouping** 896 **Applications**

897
898 In order to transition products from their current listing status to V5.0, manufacturers will need to
899 submit a V5.0 Transition Application through the DLC Application Portal. This will be a different form
900 than used for a new or update application. The information manufacturers must provide with the
901 application will vary depending on the pathway they are taking to update their listings.

902 All previously qualified products are subject to the V5.0 Testing and Reporting Requirements as
903 described above. Consistent with previous revisions to the Technical Requirements, changes in design
904 that result in changes in product performance must be described and substantiated with appropriate
905 testing based on the change(s). A transition example appears below to help manufacturers understand
906 and prepare for the transition.

907 A manufacturer may wish to “re-bracket” a currently qualified product family because – although the
908 performance has not changed – **some members of the original family group meet the V5.0 Technical**
909 **Requirements**. In this case, the new worst-case members of the group must be identified, and
910 appropriate testing will be necessary.

911 In preparation for the release of the final V5.0 Technical Requirements, more detailed documentation
 912 will be provided to help manufacturers understand the specific steps involved in transitioning their
 913 products based on several common scenarios. As with any update, new test reports that are reviewed
 914 during the transition will be subject to application review fees.

915 **Transition Example:**

916 Consider a small family of outdoor area lighting products (product line “ABC”) that are currently
 917 qualified as Standard classification and will not meet the V5.0 Efficacy Requirements. The family
 918 consists of two light outputs/wattages (“P1” and “P2”), two optical distributions (“T3” and “T4”),
 919 and two CCTs (4000K and 5000K). The product comes only in one CRI (Ra of 70 nominal) and is
 920 dimmable. A summary of the performance information for this product family, at the time it
 921 was originally qualified, is:

922 **Table 1:** Original Performance of Example Group

Model	Light Output	Wattage	Efficacy
ABC-P1-T3-4000K	10,500	105	100.00
ABC-P1-T3-5000K	10,600	105	100.95
ABC-P1-T4-4000K	10,700	105	101.90
ABC-P1-T4-5000K	10,802	105	102.88
ABC-P2-T3-4000K	15,500	160	96.88
ABC-P2-T3-5000K	15,650	160	97.81
ABC-P2-T4-4000K	15,800	160	98.75
ABC-P2-T4-5000K	15,953	160	99.71

923 *(Worst-case efficacy product highlighted for clarity.)*

924 This family of products is currently listed on the DLC QPL and is qualified to the V4.4 Technical
 925 Requirements.

926 This family of products, as originally tested and submitted, and currently listed on the DLC QPL,
 927 does not meet the V5.0 requirements. Foremost, this group does not meet the V5.0 efficacy
 928 requirements, as the tested (parent) products in the original submission do not meet the new
 929 5.0 efficacy levels. Therefore, in order for any of the products in this group to remain on the DLC
 930 QPL once the transition periods are complete, the manufacturer would be required to take
 931 action with a transition application to the DLC. The manufacturer may choose to do this in one
 932 of two ways:

933 **Option 1: Update Only Necessary Information in Phase 1**

934 To remain qualified, at a minimum a manufacturer would be required to provide new
 935 information regarding worst-case efficacy performance.

936 Most commonly, a product will have improved performance since the time of original
 937 qualification. In the case at hand, if the product group now performs 10% better than it
 938 originally did, a new LM-79 test on ABC-P2-T3-4000K demonstrating, along with new scaled

939 performance values for the remainder of the products in the group, would be sufficient for the
 940 products to remain qualified at the end of the 12-month transition.

941 **Table 2:** Updated Performance of Example Group; Worst-case Efficacy Product Highlighted

Model	Light Output	Wattage	Efficacy
ABC-P1-T3-4000K	10,500	94.5	111.11
ABC-P1-T3-5000K	10,600	94.5	112.17
ABC-P1-T4-4000K	10,700	94.5	113.23
ABC-P1-T4-5000K	10,802	94.5	114.31
ABC-P2-T3-4000K	15,500	144	107.64
ABC-P2-T3-5000K	15,650	144	108.68
ABC-P2-T4-4000K	15,800	144	109.72
ABC-P2-T4-5000K	15,953	144	110.78

942 Alternatively, if a product has *not* improved in efficacy performance, any products within the
 943 group that happen to meet the new requirements could maintain qualification by having the
 944 new worst-case-product that meets the requirements tested, to provide a new bracketing
 945 parent:

946 **Table 3:** Original Performance of Example Group; New Worst-case-that-meets highlighted; note
 947 only passing due to tolerances

Model	Light Output	Wattage	Efficacy
ABC-P1-T3-4000K	10,500	105	100.00
ABC-P1-T3-5000K	10,600	105	100.95
ABC-P1-T4-4000K	10,700	105	101.90
ABC-P1-T4-5000K	10,802	105	102.88
ABC-P2-T3-4000K	15,500	160	96.88
ABC-P2-T3-5000K	15,650	160	97.81
ABC-P2-T4-4000K	15,800	160	98.75
ABC-P2-T4-5000K	15,953	160	99.71

948
 949 In this example, both ABCP1-T4-4000K (new tested product), and ABC-123-T4-5000K (which is
 950 bracketed by the 4000K product), would remain qualified.

951 Note that the LM-79 test provided in either situation above will be required to be a “full LM-
 952 79/color report”, including light output, wattage, efficacy, and a complete set of color metrics,
 953 and will be required to have the associated .SPDX document provided. The provided LM-79 will
 954 need to show performance in other metrics sufficient to meet V5.0 requirements across all
 955 metrics, not just efficacy.

956 If a manufacturer chose this option, they would be allowed to submit *only* the required LM-79
957 test on worst-case efficacy in Phase 1 of the transition. This submission must be received by DLC
958 no later than T+9 months to ensure products do not fall off the QPL at T+12 months.

959 In this pathway, a second transition application would be required for this group prior to the
960 T+15 month mark. This second transition application would be required to have all necessary
961 additional testing and reporting information, including light output, controllability, flicker,
962 distribution (goniophotometer testing), and color performance on other products (high CCT, for
963 example). In the event that the products chosen to demonstrate efficacy compliance in phase 1
964 did not meet a requirement in phase 2 (for example, R9), efficacy rebracketing would also need
965 to be addressed in this phase.

966 **Option 2: Update All Necessary Metrics in One Step**

967 At the manufacturer's discretion during the first 12 month transition period, they may provide
968 the all of the additional necessary testing and reporting information to the DLC. In this case, the
969 transition update application would include:

- 970 • A new worst-case efficacy product LM-79 ("full LM-79/color", including light output,
971 wattage, efficacy, all relevant color metrics, and the associated .SPDX Document)
- 972 • A new LM-79 on the worst-case light output product ("full LM-79/color", including light
973 output, wattage, efficacy, all relevant color metrics, and the associated .SPDX
974 Document)
- 975 • A new LM-79 on a representative 5000K member of the group ("full LM-79/color",
976 including light output, wattage, efficacy, all relevant color metrics, and the associated
977 .SPDX Document)
- 978 • A new LM-79 on a representative 4000K member of the group ("full LM-79/color",
979 including light output, wattage, efficacy, all relevant color metrics, and the associated
980 .SPDX Document)
 - 981 ▪ This would likely be covered by the worst-case light output or efficacy test.
982 Redundant testing is not required so long as each metric is addressed. In this
983 example, this is covered by other testing and would not need an independent
984 test.
- 985 • A new LM-79 on a representative 70 CRI (Ra) member of the group ("full LM-79/color",
986 including light output, wattage, efficacy, all relevant color metrics, and the associated
987 .SPDX Document)
 - 988 ▪ This would likely be covered by another test. Redundant testing is not required
989 so long as each metric is addressed. In this example, this is covered by other
990 testing, as there is only one nominal CRI.
- 991 • A new LM-80 for checking color maintenance
- 992 • A new ISTMT and TM-21, if any changes in design affect lumen maintenance (new LED;
993 new, optics, heat sink, or electrical design)
- 994 • Two flicker tests at 100% and 20% light output for the model with lowest nominal light
995 output in the group

- 996 • New goniophotometer testing, including associated IES files, for the maximum light
- 997 output product in each optical distribution
- 998 • New ZLD and BUG ratings for each product
- 999 • New information provided regarding controllability and dimming.

1000 **Allowances Considerations**

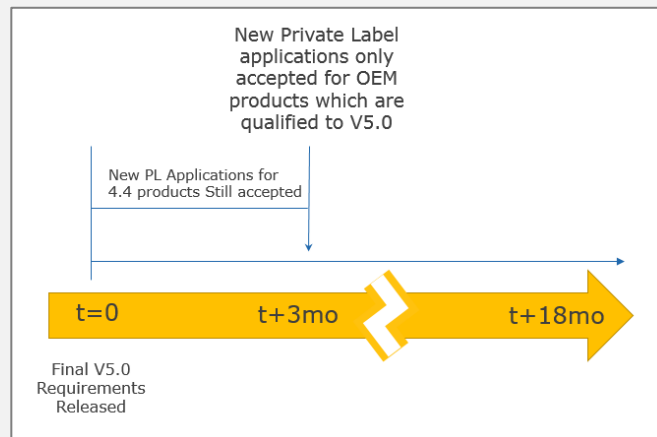
1001 During phase 1, if a product would like to remain qualified due to being able to claim a given
 1002 allowance (for example, for glare or high color rendering), in addition to worst-case efficacy
 1003 testing (LM-79), sufficient information must be provided to demonstrate that products are
 1004 eligible for the allowance(s) claimed. For example, if a product would like to claim the allowance
 1005 for UGR (glare), goniometer testing on the highest light-output version of each optical
 1006 distribution, including associated IES files, needs to be provided. This principle applies to all
 1007 allowances, including color rendering, and CCT (full LM-79/color test(s) and .SPDX document(s)
 1008 required).

1009 **Private Label Products**

1010 **New Private Label Applications Submitted After Release of V5.0**

1011 Private Labelers may choose to submit applications to private label OEM products which are qualified to
 1012 the V5.0 requirements effective immediately upon release of the final V5.0 Technical Requirements. The
 1013 OEM product must be actively qualified to the complete set of V5.0 requirements before the private
 1014 label application will be processed.

1015 The DLC recognizes that products and private label relationships may be under development or testing
 1016 intending to qualify under V4.4 at the time of this announcement. To accommodate these products,
 1017 private labelers may continue to submit for qualification and listing on the QPL for OEM products that
 1018 are currently qualified under the V4.4 Technical Requirements through T+3mo. After this date, private
 1019 label applications will only be accepted and processed for OEM products which meet the V5.0 Technical
 1020 Requirements.



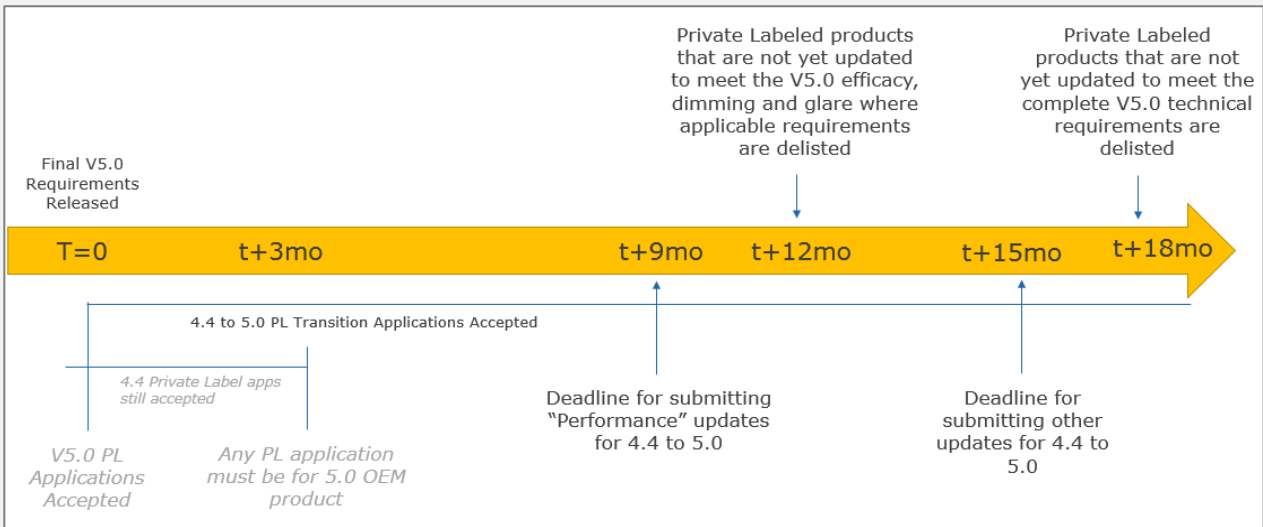
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1022 **Updating Products Originally Submitted Through Private Labeling Applications:**

1023
1024 All previously-listed private labeled products must be updated to meet the V5.0 Technical Requirements
1025 within the same published transition deadlines. Transitions of private labeled products are not
1026 automatic. Private Labeled products that have not been updated in the manner described above to
1027 comply with the series of V5.0 Technical Requirements will be subject to the same grace periods and de-
1028 listed if they are not updated.

1029 Before private labeled products can be updated, the original manufacturer’s (OEM) product must be
1030 updated in the manner listed above to comply with the new requirements. Manufacturers with private
1031 labeled products should work with their OEM to determine when updates to the OEM’s products have
1032 been completed. Once the original product has been updated, either the original manufacturer or the
1033 private labeler must submit a new application through the DLC Application Portal.

1034 A summary of the private label grace periods is provided below:



1035

1036 **Impacts to Application Fees and Processing Timelines**

1037 The DLC remains considerate of the impact of the general costs associated with program participation
1038 and is working to limit additional fee impacts that may arise as a result of the V5.0 Testing and Reporting
1039 Requirements. The current fee model is under review and any change to application fees will be
1040 communicated with the final V5.0 Technical Requirements.

1041 Applications for transitions from V4.4 to V5.0 are expected to be performed within the same processing
1042 timelines. Manufacturers will be urged to comply with the published submission deadlines and timeline
1043 considerations in order to ensure their currently-qualified products remain active on the QPL
1044 throughout the transition phase.

Definitions

Unless otherwise noted, the terms in this policy directly reference the definitions from the Illuminating Engineering Society (IES) [ANSI/IES RP-16-17: Nomenclature and Definitions for Illuminating Engineering](#)¹³, and, where applicable, the International Commission on Illumination (CIE) *CIE S 017/E:2011 ILV: International Lighting Vocabulary*¹⁴, with key deviations noted below.

Definitions: Spectral Quality

Explanations below reference the DLC's understanding of definitions as used by the industry. In some instances, the term "color" is used to describe chromaticity of the light emitted by the product.

- **Spectral Power Distribution (SPD):** Describes the power emanating from a light source as a function of wavelength. The information can be presented graphically or as a numerical table.
- **Color Rendition (of Objects):** Effect of an illuminant on the [color](#) appearance of objects by conscious or subconscious comparison with their color appearance under a reference illuminant.
- **Color of Light**
 - **Chromaticity:** The aspects specified by the chromaticity coordinates of the color. It describes the color of the emitted light, independent of its intensity.
 - **D_{uv} :** A signed measure of the distance from the blackbody locus in the CIE 1960 (u, v) color space. A positive D_{uv} indicates that the chromaticity of the light is above the blackbody locus (on the green side). A negative D_{uv} means the chromaticity is below the blackbody the blackbody locus (on the blue/pink/purple side).
 - **Correlated Color Temperature (CCT):** The thermodynamic temperature of a [blackbody](#) whose chromaticity most nearly resembles that of the [light](#) source. Expressed in kelvin (K).
 - **Color Consistency:** The initial product-to-product variation in chromaticity.
 - **Color Maintenance:** A product's ability to maintain a specific chromaticity over time. This is the spectral corollary to luminous flux maintenance, which describes depreciation in luminous flux over time.
 - **Angular Color Uniformity:** The variance in chromaticity throughout the intended light distribution, such as the [beam angle](#), the angle where light intensity is 50% of the maximum intensity.

¹³ [ANSI/IES RP-16-17 Nomenclature and Definitions for Illuminating Engineering](#)

¹⁴ [CIE S 017/E:2011 ILV International Lighting Vocabulary](#)

1075 **Definitions: Light Distribution and Glare**

1076 • **Discomfort glare**¹⁵ is glare that produces discomfort. It does not necessarily interfere with visual
1077 performance or visibility.

1078 Other definitions of discomfort glare include:

1079 • Discomfort glare is a sensation of annoyance or pain caused by high luminance in the field of
1080 view. Four factors are known to participate in the perception of discomfort glare: Luminance
1081 of the glare source, Size of the glare source, Position of the source in the field of view,
1082 Luminance of the background ([10th edition of the IES Handbook](#), Chapter 4.10.1.)
1083

1084 • **Unified Glare Rating (UGR)** is a measure of the discomfort produced by a lighting system along a
1085 psychometric scale of discomfort.¹⁶

1086 ○ The Unified Glare Rating formula is a discomfort glare likelihood assessment method
1087 developed, published, and recommended by the CIE in 1995. The UGR formula produces a
1088 glare rating which is a psychophysical parameter estimating the discomfort in response to
1089 glare in a visual environment containing light sources. The practical UGR range is from 10 to
1090 30 with most lighting systems producing values in that range. A high value indicates
1091 [likelihood of] significant discomfort glare, while a low value indicates little likelihood of
1092 discomfort glare.¹⁷

1093 ○ The development of UGR predated the application of LEDs in general lighting, and studies
1094 have reported that the original UGR formula tends to underestimate the discomfort
1095 sensation provoked by the highly non-uniform source luminance from some LED luminaires.
1096 A correction term to the original UGR formula was consequently formalized by the CIE in
1097 2019 taking into consideration the effects of non-uniform glare sources¹⁸. Due to the
1098 recency of this new development, UGR in the remainder of this policy refers to the 1995
1099 UGR formula, and the DLC will adopt UGR with the correction term in future updates when
1100 the industry gains familiarity with it.

1101 • **Uncorrected UGR table**¹⁹ refers to a set of UGR values of the luminaire tested based on pre-set
1102 room definitions and a luminous flux of 1000 lumens, as defined in CIE 190-2010. The data are
1103 provided for 19 standard room shapes with 5 different combinations of room surface reflectance.
1104 For application of the uncorrected UGR table, the values must be corrected to the actual luminous
1105 flux in the luminaire.

1106 • **Corrected UGR table** refers to a set of UGR values presented in the same format as the uncorrected
1107 UGR table with the same pre-set room definitions but corrected using the actual luminous flux of
1108 the luminaire.

¹⁵ [ANSI/IES RP-16-17 5.9.11.5.](#)

¹⁶ [ANSI/IES RP-16-17 Definitions and Nomenclature 5.9.11.5.8](#)

¹⁷ [CIE 117-1995 Discomfort Glare in Interior Lighting](#)

¹⁸ [CIE 232-2019 Discomfort Caused by Glare from Luminaires with a Non-Uniform Source Luminance](#)

¹⁹ [CIE 190-2010 Calculation and Presentation of Unified Glare Rating Tables for Indoor Lighting Luminaires](#)

- 1109 • **BUG Rating**²⁰ is the IES Luminaire Classification System (LCS) that defines the distribution of light
1110 from a luminaire within three primary solid angles: forward light, backlight and uplight. These are
1111 further divided into ten secondary solid angles as described in IES TM-15-11. The BUG rating is then
1112 determined using Addendum A for IES TM-15-11 according to a luminaire’s lumen output within the
1113 secondary solid angle zones as defined in the document.

1114 **Definitions: Flicker**

1115 The DLC uses “flicker” as a general term to describe three categories of Temporal Light Artifacts (TLA)
1116 that all result from the variation in light output from a light source over time. TLA is an undesired change
1117 in visual perception induced by a light stimulus (Temporal Light Modulation, TLM) whose luminance or
1118 spectral distribution fluctuates with time. TLA includes the following categories:

- 1119 • **Visible Flicker (< 80Hz):** Perception of visual unsteadiness for a static observer in a static
1120 environment.
- 1121 • **Stroboscopic Effect (80Hz – 2,000Hz):** Change of motion perception for a static observer in a
1122 non-static environment
- 1123 • **Phantom Array Effect (also known as the Ghost effect) (80Hz – 4,000Hz):** Change in perceived
1124 shape or spatial layout of objects for a non-static observer in an otherwise static environment

1125 **Definitions: Controllability**

1126 This policy references three areas of controllability: dimming (stepped and continuous), integral
1127 controls, and controls compatibility.

- 1128 • **Continuous Dimming:** Per NEMA LSD-64, a lighting control strategy that varies the light output
1129 of a lighting system over a continuous range from full light output to a minimum light output
1130 without flickering in imperceptible steps.
- 1131 • **Stepped Dimming:** A lighting control strategy that varies the light output of a lighting system in
1132 one or more predetermined steps of greater than one percent of full output. The changes
1133 between levels are generally perceptible.
- 1134 • **Integral Controls:** The capability to have sensing and/or control of light output based on this
1135 sensing, installed for each lamp or luminaire and directly integrated or embedded into the lamp
1136 or luminaire during the manufacturing process.
- 1137 • **Controls Compatibility:** The method and capability of a lighting system to receive and
1138 implement commanded changes to the operation, dimmed state, color setting, timing, etc.

²⁰ [IES TM-15-11 Luminaire Classification System for Outdoor Luminaires and Addendum A for IES TM-15-11: Backlight, Uplight, and Glare \(BUG\) Ratings](#)