

Technical Requirements Table, v2.1

	Application Category	Minimum Light Output	Zonal Lumen Requirements	Minimum Luminaire Efficacy	Allowable CCTs (ANSI C78.377-2011)	Minimum CRI	L <sub>70</sub> Lumen Maintenance	Minimum Luminaire Warranty
<b>Outdoor Applications—New, Fully Integrated Luminaires</b>								
1	Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1,000 lm	=100%: 0-90° ≤10%: 80-90°	70 lm/W	≤5700K	65	50,000 hrs	5 years
2	Outdoor Pole/Arm-Mounted Decorative Luminaires	1,000 lm	≥65%: 0-90°	60 lm/W	≤5700K	65	50,000 hrs	5 years
3	Outdoor Wall-Mounted Area Luminaires	300 lm	=100%: 0-90° ≤10%: 80-90°	70 lm/W	≤5700K	65	50,000 hrs	5 years
4	Bollards	500 lm	≤15%: 90-110° 0%: >110°	50 lm/W	≤5700K	65	50,000 hrs	5 years
5	Parking Garage Luminaires	2,000 lm	≥30%: 60-80° ≤25%: 70-80°	75 lm/W	≤5700K	65	50,000 hrs	5 years
6	Fuel Pump Canopy Luminaires	2,000 lm	≥40%: 0-40° ≥40%: 40-70°	80 lm/W	≤5700K	65	50,000 hrs	5 years
7	Landscape/Accent Flood and Spot Luminaires	250 lm (<1000 lm)	≥85% 0-90°	65 lm/W	≤5700K	65	50,000 hrs	5 years
8	Architectural Flood and Spot Luminaires	1000 lm	≥85% 0-90°	75 lm/W	≤5700K	65	50,000 hrs	5 years
9	Stairwell and Passageway Luminaires	750 lm	≥85% 0-90°***	75 lm/W	≤5700K	65	50,000 hrs	5 years
<b>Indoor Applications—New, Fully Integrated Luminaires</b>								
10	Wall-Wash Luminaires	575 lm	≥60%: 0-90°**	45 lm/W	≤5000K	80	50,000 hrs	5 years
11	Track or Mono-Point Directional Luminaires	250 lm	≥85%: 0-90°	45 lm/W	≤5000K	80	50,000 hrs	5 years
12	Vertical Refrigerated Case Luminaires	Ctr-mounted*: 100 lm/ft End-mounted**: 50 lm/ft	Vertical Lighting ≥95%: 10-90°	50 lm/W	≤5000K	80	50,000 hrs	5 years

	Application	Minimum Light Output	Zonal Lumen Requirements	Minimum Luminaire Efficacy	Allowable CCTs (ANSI C78.377-2011)	Minimum CRI	L <sub>70</sub> Lumen Maintenance	Minimum Luminaire Warranty
13	Horizontal Refrigerated Case Luminaires	100 lm/ft	Horizontal Lighting ≥95%: 0-90°	50 lm/W	≤5000K	80	50,000 hrs	5 years
14	Display Case Luminaires	End-mounted**: 50 lm/ft	≥95%: 0-80°	50 lm/W	≤5000K	80	35,000 hrs	5 years
15	2x2 Luminaires for Ambient Lighting of Interior Commercial Spaces	2,000 lm	Spacing Criteria: 0-180°: 1.0-2.0 90-270°: 1.0-2.0; ≥75%: 0-60°	85 lm/W	≤5000K	80	50,000 hrs	5 years
16	1x4 Luminaires for Ambient Lighting of Interior Commercial Spaces	1,500 lm	Spacing Criteria: 0-180°: 1.0-2.0 90-270°: 1.0-2.0; ≥75%: 0-60°	85 lm/W	≤5000K	80	50,000 hrs	5 years
17	2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces	3,000 lm	Spacing Criteria: 0-180°: 1.0-2.0 90-270°: 1.0-2.0; ≥75%: 0-60°	85 lm/W	≤5000K	80	50,000 hrs	5 years
18	Linear Ambient Luminaires: Indirect	500 lm/ft	≥50%: 90-150°	85 lm/W	≤5000K	80	50,000 hrs	5 years
19	Linear Ambient Luminaires: Indirect/Direct	500 lm/ft	≥50%: 90-150° ≥25%: 0-60°	85 lm/W	≤5000K	80	50,000 hrs	5 years
20	Linear Ambient Luminaires: Direct/Indirect	500 lm/ft	≥40%: 0-60° ≥35%: 90-150°	85 lm/W	≤5000K	80	50,000 hrs	5 years
21	Linear Ambient Luminaires: Direct	375 lm/ft	≥40%: 0-60°	85 lm/W	≤5000K	80	50,000 hrs	5 years
22	High-Bay Luminaires for Commercial and Industrial buildings	10,000 lm	≥30% 20-50°	80 lm/W	≤5700K	70	35,000 hrs	5 years
23	Low-Bay Luminaires for Commercial and Industrial buildings	5,000 lm	≥30% 20-50°	80 lm/W	≤5700K	70	35,000 hrs	5 years

	Application	Minimum Light Output	Zonal Lumen Requirements	Minimum Luminaire Efficacy	Allowable CCTs (ANSI C78.377-2011)	Minimum CRI	L <sub>70</sub> Lumen Maintenance	Minimum Luminaire Warranty
24	High-Bay Aisle Luminaires	10,000 lm	≥50%: 20-50° ≥30%: 0-20°	80 lm/W	≤5700K	70	35,000 hrs	5 years
<b>Retrofit Kits and Replacement Lamps****</b>								
25	Retrofit Kits for Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1,000 lm	=100%: 0-90° ≤10%: 80-90°	70 lm/W	≤5700K	65	50,000 hrs	5 years
26	Retrofit Kits for Outdoor Pole/Arm-Mounted Decorative Luminaires	1,000 lm	≥65%: 0-90°	60 lm/W	≤5700K	65	50,000 hrs	5 years
27	Retrofit Kits for Large Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	1,000 lm	=100%: 0-90° ≤10%: 80-90°	70 lm/W	≤5700K	65	50,000 hrs	5 years
28	Retrofit Kits for Outdoor Wall-Mounted Area Luminaires	300 lm	=100%: 0-90° ≤10%: 80-90°	70 lm/W	≤5700K	65	50,000 hrs	5 years
29	Retrofit Kits for Parking Garage Luminaires	2,000 lm	≥30%: 60-80° ≥25%: 70-80°	75 lm/W	≤5700K	65	50,000 hrs	5 years
30	Retrofit Kits for Fuel Pump Canopy Luminaires	2,000 lm	≥40%: 0-40° ≥40%: 40-70°	80 lm/W	≤5700K	65	50,000 hrs	5 years
31	Retrofit Kits for 2x2 Luminaires for Ambient Lighting of Interior Commercial Spaces	2,000 lm	Spacing Criteria: 0-180°: 1.0-2.0 90-270°: 1.0-2.0; ≥75%: 0-60°	85 lm/W	≤5000K	80	50,000 hrs	5 years
32	Retrofit Kits for 1x4 Luminaires for Ambient Lighting of Interior Commercial Spaces	1,500 lm	Spacing Criteria: 0-180°: 1.0-2.0 90-270°: 1.0-2.0; ≥75%: 0-60°	85 lm/W	≤5000K	80	50,000 hrs	5 years
33	Retrofit Kits for 2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces	3,000 lm	Spacing Criteria: 0-180°: 1.0-2.0 90-270°: 1.0-2.0; ≥75%: 0-60°	85 lm/W	≤5000K	80	50,000 hrs	5 years

	Application	Minimum Light Output	Zonal Lumen Requirements	Minimum Luminaire Efficacy	Allowable CCTs (ANSI C78.377-2011)	Minimum CRI	L <sub>70</sub> Lumen Maintenance	Minimum Luminaire Warranty
34	Retrofit Kits for High-Bay Luminaires for Commercial and Industrial Buildings	10,000 lm	≥30% 20-50°	80 lm/W	≤5700K	70	35,000 hrs	5 years
35	Retrofit Kits for Low-Bay Luminaires for Commercial and Industrial Buildings	5,000 lm	≥30% 20-50°	80 lm/W	≤5700K	70	35,000 hrs	5 years
36	Four-Foot Linear Replacement Lamps	2 Lamps, Tested In Fixture: 3,000 lm  Bare Lamp: 1,600 lm	Spacing Criteria: 0-180°: 1.0-2.0 90-270°: 1.0-2.0; ≥75%: 0-60°	In Fixture: 85 lm/W  Bare Lamp: 100 lm/W	≤5000K	80	50,000 hrs	5 years
37	Two-Foot Linear Replacement Lamps	3 Lamps, Tested In Fixture: 2,000 lm  Bare Lamp: 800 lm	Spacing Criteria: 0-180°: 1.0-2.0 90-270°: 1.0-2.0; ≥75%: 0-60°	In Fixture: 85 lm/W  Bare Lamp: 100 lm/W	≤5000K	80	50,000 hrs	5 years

\* Bilateral, symmetric light distribution on two hemispheres

\*\* One-sided, single hemisphere light distribution

\*\*\* Bilateral for surface-mounted units, single hemisphere for corner-mounted units

\*\*\*\* Retrofit Kits and Replacement Lamps must be tested inside fixtures, per the policies for those products. See Retrofit Kit Policy and Linear Replacement Lamp Policy for details.

**Power Factor and Total Harmonic Distortion:** In addition to the specific requirements above, all DLC-qualified luminaires must have a power factor of  $\geq 0.9$ , and a THDi of  $\leq 20\%$ . This applies to every category listed in Table 2.1.

**Tolerances:** Below are tolerances that are applicable to all categories listed above in Table v2.1. These tolerances are referenced in the ENERGY STAR Manufacturer’s Guide. For zonal lumen tolerances specific to each category, please refer to Table 5.

**Table 2.1a: Tolerances**

Performance Metric	Tolerance
Light Output	-10%
Luminaire Efficacy	-3%
Allowable CCT	Defined by ANSI C78.377-2011†
CRI	-2 points
Power Factor	-3%
Total Harmonic Distortion	+5%

†ANSI C78.377-2011 also referred to for Duv and (x,y) chromaticity coordinates tolerances for indoor categories.

**Lumen Maintenance:** DLC has two options for demonstrating lumen maintenance compliance. Option 1 is using component-level performance through the TM-21 protocols, which leverage the LM-80 performance and In-Situ Temperature of the LED device. More information is available in the application instructions at <http://www.designlights.org/content/QPL/ProductSubmit/ApplicationInstructions>. For products where the required lifetime is longer than the projection method allows, the necessary lumen maintenance minimums at the end of the allowable projection period are as follows. These percentages result from solving an exponential decay function for 35,000 and 50,000 hours.

**Table 2: TM-21 Projected Lumen Maintenance Requirements**

Projection End Point	Required lumen maintenance for 35,000 hour products	Required lumen maintenance for 50,000 hour products
33,000 hours	$\geq 71.44\%$	$\geq 79.03\%$
36,000 hours	$L_{70} \geq 35,000$	$\geq 77.35\%$
38,500 hours	$L_{70} \geq 35,000$	$\geq 75.98\%$
42,000 hours	$L_{70} \geq 35,000$	$\geq 74.11\%$
44,000 hours	$L_{70} \geq 35,000$	$\geq 73.06\%$
48,000 hours	$L_{70} \geq 35,000$	$\geq 71.01\%$
49,500 hours	$L_{70} \geq 35,000$	$\geq 70.25\%$
50,000 hours	$L_{70} \geq 35,000$	$\geq 70.00\%$

Option 2 is to conduct 6000-hours of luminaire-level testing. For Option 2, DLC uses a pass/fail threshold for lumen maintenance compliance as established in the Energy Star Manufacturer’s Guide v2, pg. 7 ([http://www.energystar.gov/ia/partners/manuf\\_res/downloads/ENERGYSTAR\\_Manufacturers\\_Guide\\_v2.pdf](http://www.energystar.gov/ia/partners/manuf_res/downloads/ENERGYSTAR_Manufacturers_Guide_v2.pdf)). The requirements differ for applications requiring 35,000 hours of useful life and those requiring 50,000 hours, as follows:

**Table 3: Option 2 Lumen Maintenance Requirements**

Lumen Maintenance to L <sub>70</sub>	Required lumen maintenance at 6,000 hours
35,000 hours	94.1%
50,000 hours	95.8%

Table 3 percentages result from solving an exponential decay function for 35,000 and 50,000 hours, respectively, to determine the minimum lumen maintenance necessary to achieve those thresholds. Products can demonstrate compliance with testing longer than 6,000 hours, according to the table below:

**Table 4: Exponential Decay Function  $L=e^{-at}$**

Hours of Testing	LM L <sub>70</sub> =35,000 hr	LM L <sub>70</sub> =50,000 hr
6,000	94.1%	95.8%
7,000	93.1%	95.1%
8,000	92.2%	94.5%
9,000	91.2%	93.8%
10,000	90.3%	93.1%
11,000	89.4%	92.5%
12,000	88.5%	91.8%
13,000	87.6%	91.1%
14,000	86.7%	90.5%
15,000	85.8%	89.9%

When applying the lumen maintenance in accordance with these protocols, DLC applies a tolerance of 5% to drive currents tested under LM-80.

Zonal Lumen Distribution: The following tolerances apply to the zonal lumen distribution requirements:

**Table 5: Zonal Lumen Tolerances**

Category	Zone/Spacing Criteria	Nominal Requirement	Tolerance	Requirement with Tolerance
1	0-90°	100%	-1%	≥99%
	80-90°	≤10%	+3%	≤13%
2	0-90°	≥65%	-3%	≥62%
3	0-90°	100%	-3%	≥97%
	80-90°	≤10%	+3%	≤13%
4	90-110°	≤15%	+3%	≤18%
	>110°	0%	+3%	≤3%

Category	Zone/Spacing Criteria	Nominal Requirement	Tolerance	Requirement with Tolerance
5	60-80°	≥30%	-3%	≥27%
	70-80°	≤25%	+3%	≤28%
6	0-40°	≥40%	-3%	≥37%
	40-70°	≥40%	-3%	≥37%
7	0-90°	≥85%	-3%	≥82%
8	0-90°	≥85%	-3%	≥82%
9	0-90°	≥85%***	-3%	≥82%
10	0-90°	≥60%**	-3%	≥57%
11	0-90°	≥85%	-3%	≥82%
12-center	10-90°	≥95%	-3%	≥92%
12-end	10-90°	≥95%	-5%	≥90%
13	0-90°	≥95%	-3%	≥92%
14	0-80°	≥95%	-5%	≥90%
15	SC:0-180°	1.0-2.0	±0.1	0.9-2.1
	SC:90-270°	1.0-2.0	±0.1	0.9-2.1
	ZL:0-60°	≥75%	-3%	≥72%
16	SC:0-180°	1.0-2.0	±0.1	0.9-2.1
	SC:90-270°	1.0-2.0	±0.1	0.9-2.1
	ZL:0-60°	≥75%	-3%	≥72%
17	SC:0-180°	1.0-2.0	±0.1	0.9-2.1
	SC:90-270°	1.0-2.0	±0.1	0.9-2.1
	ZL:0-60°	≥75%	-3%	≥72%
18	90-150°	≥50%	-3%	≥47%
19	90-150°	≥50%	-3%	≥47%
	0-60°	≥25%	-3%	≥22%
20	0-60°	≥40%	-3%	≥37%
	90-150°	≥35%	-3%	≥32%
21	0-60°	≥40%	-3%	≥37%
22	20-50°	≥30%	-10%	≥20%
23	20-50°	≥30%	-10%	≥20%
24	20-50°	≥50%	-10%	≥40%
	0-20°	≥30%	-10%	≥20%

Category	Zone/Spacing Criteria	Nominal Requirement	Tolerance	Requirement with Tolerance
25	0-90°	100%	-1%	≥99%
	80-90°	≤10%	3%	≤13%
26	0-90°	≥65%	-3%	≥62%
27	0-90°	100%	-1%	≥99%
	80-90°	≤10%	3%	≤13%
28	0-90°	100%	-3%	≥97%
	80-90°	≤10%	3%	≤13%
29	60-80°	≥30%	-3%	≥27%
	70-80°	≤25%	+3%	≤28%
30	0-40°	≥40%	-3%	≥37%
	40-70°	≥40%	-3%	≥37%
31	SC:0-180°	1.0-2.0	±0.1	0.9-2.1
	SC:90-270°	1.0-2.0	±0.1	0.9-2.1
	ZL:0-60°	≥75%	-3%	≥72%
32	SC:0-180°	1.0-2.0	±0.1	0.9-2.1
	SC:90-270°	1.0-2.0	±0.1	0.9-2.1
	ZL:0-60°	≥75%	-3%	≥72%
33	SC:0-180°	1.0-2.0	±0.1	0.9-2.1
	SC:90-270°	1.0-2.0	±0.1	0.9-2.1
	ZL:0-60°	≥75%	-3%	≥72%
34	20-50°	≥30%	-10%	≥20%
35	20-50°	≥30%	-10%	≥20%
36	SC:0-180°	1.0-2.0	±0.1	0.9-2.1
	SC:90-270°	1.0-2.0	±0.1	0.9-2.1
	ZL:0-60°	≥75%	-3%	≥72%
37	SC:0-180°	1.0-2.0	±0.1	0.9-2.1
	SC:90-270°	1.0-2.0	±0.1	0.9-2.1
	ZL:0-60°	≥75%	-3%	≥72%

**Flood and Spot Lighting Categories:**

For both Architectural and Landscape/Accent Flood and Spot Lighting categories, manufacturers must declare the NEMA Beam Classification of their luminaire in the 0-180 degree and 90-270 degree planes. DLC will verify these claims against the IES files provided.



Wall-Wash Luminaires:

For clarity, the zonal lumen criteria for this category is that  $\geq 60\%$  of the lumens must be produced in the “forward” hemisphere, towards the wall.

Stairwell and Passageway Lighting:

DLC requires that products in the Stairwell and Passageway Lighting category to meet once of the following conditions:

- 1) Luminaires may include integral controls for occupancy sensing and bi-level dimming to assure luminaire reverts to lower-power, lower-light output state when there are no occupants in the vicinity.
- 2) Luminaires operating off remote occupancy sensors, including wireless options, are eligible. Remote sensors may be sold as a package together with the luminaire under a single model number or ordering code. Should multiple luminaires be able to operate on a single occupancy sensor, a distinct model number for each multi-luminaire and sensor system must be submitted.
- 3) Luminaires designed to operate off remote occupancy sensors, including wireless options, where the luminaire and sensors are sold separately, but the luminaire has features enabling communication with a remote sensor.

Documentation must be provided to demonstrate compliance with one of the options above, including clear documentation of at least bi-level dimming functionality and communications ability. Features must be designated clearly in the model number. Manufacturers must also declare whether the unit is intended to be surface-mounted or corner-mounted. All performance requirements in Technical Requirements Table v2.1 refer to the full power operating mode.

DLC Retrofit Kit Policy

DLC will accept QPL applications for SSL Retrofit Kits for certain available categories. The testing and reporting requirements described in the link below are intended to subject the retrofit kits to real-world thermal conditions in order to assure confidence in lumen maintenance. For more information, please refer to <http://www.designlights.org/content/QPL/ProductSubmit/RetrofitKits>.

DLC Linear Replacement Lamp Policy

DLC will accept QPL applications for linear tube-style products intended to replace fluorescent lamps in this category. The testing and reporting requirements described in the link below are intended to evaluate the performance both of the lamp itself, and its performance in reference troffers, their most common application. For more information, please refer to <http://www.designlights.org/content/QPL/ProductSubmit/LinearReplacementLamps>. Note that this category covers all LED tubes, including those that are direct, simple replacements for fluorescent tubes and those that require modifications to the existing fixture (such as bypassing the existing ballast).