DESIGNLIGHTS CONSORTIUM®

Technical Requirements Table, v2.0

	Application Category	Minimum Light Output	Zonal Lumen Requirements	Minimum Luminaire Efficacy	Allowable CCTs (ANSI C78.377)	Minimum CRI	L_{70} Lumen Maintenance	Minimum Luminaire Warranty
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	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 Lighting	250 lm (<1,000 lm)	≥85% 0-90°	65 lm/W	≤5700K	65	50,000 hrs	5 years
8	Architectural Flood and Spot Lighting	1,000 lm	≥85% 0-90°	75 lm/W	≤5700K	65	50,000 hrs	5 years
9	Stairwell and Passageway Lighting	750 lm	≥85% 0-90°***	75 lm/W	≤5700K	65	50,000 hrs	5 years
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 Lighting Fixtures	250 lm	≥85%: 0-90°	45 lm/W	≤5000K	80	50,000 hrs	5 years
12	Vertical Refrigerated Case Lighting	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
13	Horizontal Refrigerated Case Lighting	100 lm/ft	Horizontal Lighting ≥95%: 0-90°	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)	Minimum CRI	L_{70} Lumen Maintenance	Minimum Luminaire Warranty
14	Display Case Lighting	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	High-bay Fixtures for Commercial and Industrial buildings	10,000 lm	≥30% 20-50°	80 lm/W	≤5700K	70	35,000 hrs	5 years
19	Low-bay Fixtures for Commercial and Industrial buildings	5,000 lm	≥30% 20-50°	80 lm/W	≤5700K	70	35,000 hrs	5 years
20	High-bay Aisle Lighting	10,000 lm	≥50%: 20-50° ≥30%: 0-20°	80 lm/W	≤5700K	70	35,000 hrs	5 years
*Retrofit and Replacement Lamps****								
21	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
22	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
23	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

	Application	Minimum Light Output	Zonal Lumen Requirements	Minimum Luminaire Efficacy	Allowable CCTs (ANSI C78.377)	Minimum CRI	L_{70} Lumen Maintenance	Minimum Luminaire Warranty
24	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
25	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
26	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
27	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
28	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
29	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
30	Retrofit Kits for High-bay Fixtures for Commercial and Industrial Buildings	10,000 lm	≥30% 20-50°	80 lm/W	≤5700K	70	35,000 hrs	5 years
31	Retrofit Kits for Low-bay Fixtures for Commercial and Industrial Buildings	5,000 lm	≥30% 20-50°	80 lm/W	≤5700K	70	35,000 hrs	5 years
32	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

* 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 Four-foot 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 ≥0.9, and a THD of ≤20%. This applies to every category listed in Table 2.0.

Tolerances: Below are tolerances that are applicable to all categories listed above in Table v2.0. 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 2.0a: Tolerances

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

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/solidstate.manufacturer.instructions.php. 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 categories requiring ≥35,000 hour L_{70}	Required lumen maintenance for categories requiring ≥50,000 hour L_{70}
33,000 hours	≥71.44%	≥79.03%
36,000 hours	L_{70} ≥35,000	≥77.35%
38,500 hours	L_{70} ≥35,000	≥75.98%
42,000 hours	L_{70} ≥35,000	≥74.11%

44,000 hours	L_{70} ≥35,000	≥73.06%
48,000 hours	L_{70} ≥35,000	≥71.01%
49,500 hours	L_{70} ≥35,000	≥70.25%
50,000 hours	L_{70} ≥35,000	≥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). 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_{70}	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 $L=e^{-\alpha t}$

Hours of Testing	LM L_{70}=35,000 hr	LM L_{70}=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%
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	20-50°	≥30%	-10%	≥20%

19	20-50°	≥30%	-10%	≥20%
20	20-50°	≥50%	-10%	≥40%
	0-20°	≥30%	-10%	≥20%
21	0-90°	100%	-1%	≥99%
	80-90°	≤10%	3%	≤13%
22	0-90°	≥65%	-3%	≥62%
23	0-90°	100%	-3%	≥97%
	80-90°	≤10%	3%	≤13%
24	0-90°	100%	-3%	≥97%
	80-90°	≤10%	3%	<13%
25	60-80°	≥30%	-3%	≥27%
	70-80°	≤25%	+3%	≤28%
26	0-40°	≥40%	-3%	≥37%
	40-70°	≥40%	-3%	≥37%
27	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%
28	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%
29	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%
30	20-50°	≥30%	-10%	≥20%
31	20-50°	≥30%	-10%	≥20%
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%

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 ≥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 include integral controls for occupancy sensing and bi-level dimming. Documentation must be provided to demonstrate bi-level dimming capabilities, and occupancy sensing options 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 v2.0 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/solidstate.manufacturer.instructions.outdoorretrofit.php.

DLC Four-foot Linear Replacement Lamp Policy

DLC will accept QPL applications for 4' 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 2x4 troffers, their most common application. For more information, please refer to http://www.designlights.org/solidstate.manufacturer.instructions.linearreplacementlamps.php. Note that this category covers all four-foot 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).