DesignLights Consortium Product Qualification Criteria, *(Last Updated 11/13/12)*

Technical Requirements Table, v1.7

	Application	Minimum Light Output	Zonal Lumen Requirements	Minimum Luminaire Efficacy	Allowable CCTs (ANSI C78.377-2008)	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°	60 lm/W	≤5700K	50	50,000 hrs	5 years
2	Outdoor Pole/Arm-Mounted Decorative Luminaires	1,000 lm	≥ 65%: 0-90°	40 lm/W	≤5700K	50	50,000 hrs	5 years
3	Outdoor Wall-Mounted Area Luminaires	300 lm	=100%: 0-90° <10%: 80-90°	60 lm/W	≤5700K	50	50,000 hrs	5 years
4	Bollards	500 lm	<15%: 90-110° 0%: >110°	35 lm/W	≤6500K	50	50,000 hrs	5 years
5	Wall-wash Luminaires	575 lm	≥ 50%: 20-40°	40 lm/W	≤5000K	50	50,000 hrs	5 years
6	Parking Garage Luminaires	2,000 lm	≥30%: 60-80° <25%: 70-80°	60 lm/W	≤5700K	50	50,000 hrs	5 years
7	Fuel Pump Canopy	2,000 lm	≥40%: 0-40° ≥40%: 40-70°	70 lm/W	≤5700K	50	50,000 hrs	5 years
8	**Landscape/Accent Flood and Spot Lighting**	**250 lm (<1000 lm)**	**≥85% 0-90°**	**60 lm/W**	**≤5700K**	**65**	**50,000 hrs**	**5 years**
9	**Architectural Flood and Spot Lighting**	**1000 lm**	**≥85% 0-90°**	**60 lm/W**	**≤5700K**	**65**	**50,000 hrs**	**5 years**
10	**Stairwell and Passageway Lighting**	**750 lm**	**≥85% 0-90°*****	**70 lm/W**	**≤5700K**	**65**	**50,000 hrs**	**5 years**
11	Track or Mono-point Directional Lighting Fixtures	250 lm	≥ 85%: 0-90°	40 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°	45 lm/W	≤5000K	70	50,000 hrs	5 years
13	Horizontal Refrigerated Case Lighting	Standard: ≥125 lm/ft High CRI: ≥100 lm/ft	Horizontal Lighting ≥95%: 0-90°	Standard: 45 lm/W High CRI: 35 lm/W	≤5000K	Standard: 70 High CRI: 80	50,000 hrs	5 years

	Application	Minimum Light Output	Zonal Lumen Requirements	Minimum Luminaire Efficacy	Allowable CCTs (ANSI C78.377-2008)	Minimum CRI	L_{70} Lumen Maintenance	Minimum Luminaire Warranty
14	Display Case Lighting	End-Mounted**: =50 lm/ft	≥95%: 0-80°	35 lm/W	≤5000K	75	35,000 hrs	5 years
15	Linear Panels: 2x2 Troffers	3,000 lm	Spacing Criteria: 0-180°: 1.15-1.30 90-270°: 1.2-1.6	60 lm/W	≤5000K	80	35,000 hrs	5 years
16	Linear Panels: 1x4 Troffers	2,000 lm	Spacing Criteria: 0-180°: 1.15-1.25 90-270°: 1.25-1.7	≥65 lm/W	≤5000K	80	35,000 hrs	5 years
17	Linear Panels: 2x4 Troffers	4,000 lm	Spacing Criteria: 0-180°: 1.15-1.25 90-270°: 1.25-1.7	≥65 lm/W	≤5000K	80	35,000 hrs	5 years
18	High-bay and Low-bay fixtures for Commercial and Industrial buildings	10,000 lm	≥30% 20-50°	70 lm/W	≤5700K	70	35,000 hrs	5 years
19	High-bay-Aisle Lighting	10,000 lm	≥50%: 20-50° ≥30%: 0-20°	60 lm/W	≤6500K	70	35,000 hrs	5 years
	Retrofit and Replacement Lamps**							
20	Retrofit Kits For Outdoor Area and Roadway Luminaires	1,000 lm	=100%: 0-90° <10%: 80-90°	60 lm/W	≤5700K	50	50,000 hrs	5 years
21	Retrofit Kits For Outdoor Decorative Luminaires	1,000 lm	≥ 65%: 0-90°	40 lm/W	≤5700K	50	50,000 hrs	5 years
22	**Retrofit Kits For Large Outdoor Area and Roadway Luminaires**	**1,000 lm**	**=100%: 0-90° <10%: 80-90°**	**60 lm/W**	**≤5700K**	**50**	**50,000 hrs**	**5 years**
23	**Retrofit Kits For Outdoor Wall-Mounted Area Luminaires**	**300 lm**	**=100%: 0-90° <10%: 80-90°**	**60 lm/W**	**≤5700K**	**50**	**50,000 hrs**	**5 years**

	Application	Minimum Light Output	Zonal Lumen Requirements	Minimum Luminaire Efficacy	Allowable CCTs (ANSI C78.377-2008)	Minimum CRI	L_{70} Lumen Maintenance	Minimum Luminaire Warranty
24	**Retrofit Kits For Parking Garage Luminares**	**2,000 lm**	**≥30%: 60-80° <25%: 70-80°**	**60 lm/W**	**≤5700K**	**50**	**50,000 hrs**	**5 years**
25	**Retrofit Kits For Fuel Pump Canopy Luminares**	**2,000 lm**	**≥40%: 0-40° ≥40%: 40-70°**	**70 lm/W**	**≤5700K**	**50**	**50,000 hrs**	**5 years**
26	**Retrofit Kits For Linear Panels, 2x2 Troffers†**	**3,000 lm**	**Spacing Criteria: 0-180°: 1.15-1.30 90-270°: 1.2-1.6**	**60 lm/W**	**≤5000K**	**80**	**35,000 hrs**	**5 years**
27	**Retrofit Kits For Linear Panels, 1x4 Troffers†**	**2,000 lm**	**Spacing Criteria: 0-180°: 1.15-1.25 90-270°: 1.25-1.7**	**≥65 lm/W**	**≤5000K**	**80**	**35,000 hrs**	**5 years**
28	**Retrofit Kits For Linear Panels, 2x4 Troffers†**	**4,000 lm**	**Spacing Criteria: 0-180°: 1.15-1.25 90-270°: 1.25-1.7**	**≥65 lm/W**	**≤5000K**	**80**	**35,000 hrs**	**5 years**
29	**Retrofit Kits for High- and Low-Bay Fixtures for Commercial and Industrial Buildings**	**10,000 lm**	**≥30% 20-50°**	**70 lm/W**	**≤5700K**	**70**	**35,000 hrs**	**5 years**
30	Four-foot Linear Replacement Lamps	2 Lamps, Tested In Fixture: 3750 lm Bare Lamp: 2200 lm	Spacing Criteria: Reference Troffer #1: 0°: 1.24 90°: 1.5 Reference Troffer #2: 0°: 1.25 90°: 1.63	In Fixture: ≥75 lm/W Bare Lamp: ≥96 lm/W	<5000K	80, R9>0	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 Outdoor Retrofit Kit Policy and Four-foot Linear Replacement Lamp Policy for details.

† Retrofit Kits for Linear Panels will be classified on the DLC QPL as either 'Lamp-style' or 'Integrated-style'. Please refer to the Retrofit Kit Policy for more information.

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 current THD of ≤20%. This applies to every category listed in Table 1.7. Qualified products must meet the requirements in their worst case loading conditions.

Tolerances: Below are tolerances that are applicable to all categories listed above in Table v1.7. 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 1.7a: 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 35,000 hour products	Required lumen maintenance for 50,000 hour products
33,000 hours	≥71.44%	≥79.03%
36,000 hours	$L_{70} \geq 35{,}000$	≥77.35%
38,500 hours	$L_{70} \geq 35{,}000$	≥75.98%
42,000 hours	$L_{70} \geq 35{,}000$	≥74.11%
44,000 hours	$L_{70} \geq 35{,}000$	≥73.06%
48,000 hours	$L_{70} \geq 35{,}000$	≥71.01%
49,500 hours	$L_{70} \geq 35{,}000$	≥70.25%
50,000 hours	$L_{70} \geq 35{,}000$	≥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%

These 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	Actual Requirement
1	0-90°	100%	0%	100%

	80-90°	<10%	3%	<13%
2	0-90°	≥65%	-3%	≥62%
3	0-90°	100%	0%	100%
	80-90°	<10%	3%	<13%
4	90-110°	<15%	3%	<18%
	>110°	0%	0%	0%
5	20-40°	≥50%	-3%	≥47%
6	60-80°	≥30%	-3%	≥27%
	70-80°	<25%	+3%	<28%
7	0-40°	≥40%	-3%	≥37%
	40-70°	≥40%	-3%	≥37%
8	**0-90°**	**≥85%**	**-3%**	**≥82%**
9	**0-90°**	**≥85%**	**-3%**	**≥82%**
10	**0-90°**	**≥85%**	**-3%**	**≥82%**
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	0-180°	1.15-1.30	±0.1	1.05-1.40
	90-270°	1.2-1.6	±0.1	1.1-1.7
16	0-180°	1.15-1.25	±0.1	1.05-1.35
	90-270°	1.25-1.7	±0.1	1.15-1.8
17	0-180°	1.15-1.25	±0.1	1.05-1.35
	90-270°	1.25-1.7	±0.1	1.15-1.8
18	20-50°	≥30%	-10%	≥20%
19	20-50°	≥50%	-10%	≥40%
	0-20°	≥30%	-10%	≥20%
20	0-90°	100%	0%	100%
	80-90°	<10%	3%	<13%
21	0-90°	≥65%	-3%	≥62%
22	**0-90°**	**100%**	**0%**	**100%**
	80-90°	**<10%**	**3%**	**<13%**
23	**0-90°**	**100%**	**0%**	**100%**
	80-90°	**<10%**	**3%**	**<13%**
24	**60-80°**	**≥30%**	**-3%**	**≥27%**
	70-80°	**<25%**	**+3%**	**<28%**
25	**0-40°**	**≥40%**	**-3%**	**≥37%**
	40-70°	**≥40%**	**-3%**	**≥37%**
26	**0-180°**	**1.15-1.30**	**±0.1**	**1.05-1.40**
	90-270°	**1.2-1.6**	**±0.1**	**1.1-1.7**
27	**0-180°**	**1.15-1.25**	**±0.1**	**1.05-1.35**

	90-270°	**1.25-1.7**	**±0.1**	**1.15-1.8**
28	**0-180°**	**1.15-1.25**	**±0.1**	**1.05-1.35**
	90-270°	**1.25-1.7**	**±0.1**	**1.15-1.8**
29	**20-50°**	**≥30%**	**-10%**	**≥20%**
30 (Ref A)	0-180°	1.24	±0.1	1.14-1.34
	90-270°	1.5	±0.1	1.4-1.6
30 (Ref B)	0-180°	1.25	±0.1	1.15-1.35
	90-270°	1.63	±0.1	1.53-1.73

Horizontal Refrigerator Case Lighting:

It is recognized that refrigerator case lighting may have different needs, depending on the merchandise it is highlighting. To accommodate this, high-CRI products (above 80 CRI) are given an allowance on the efficacy criteria. Products with a CRI higher than 80 must have an efficacy of at least 35 lm/W. Products with a CRI between 70 and 80 must have an efficacy of at least 45 lm/W.

Flood and Spot Lighting Categories:

For both architectural and landscape/accent flood and spot lighting categories, manufacturers must declare the NEMA Beam Classification (see chart below) of their luminaire in the 0-180 degree and 90-270 degree planes. DLC will verify these claims against the IES files provided.

Table 6: NEMA Beam Classification

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

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 v1.7 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 4-foot Linear Replacement Lamp Policy

DLC will accept QPL applications for 4' linear T8 replacement lamps. 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.