

Technical Requirements Table 1, v1.6

	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	2700K, 3000K, 3500K, 4000K, 4500K, 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	Track or Mono-point Directional Lighting Fixtures	250 lm	≥ 85%: 0-90°	40 lm/W	2700K, 3000K, 3500K, 4000K, 4500K, 5000K	80	50,000 hrs	5 years
9	Vertical Refrigerated Case Lighting	Ctr-Mounted*: ≥100 lm/ft End-Mounted**: ≥50 lm/ft	Vertical Lighting ≥95%: 10-90°	45 lm/W	2700K, 3000K, 3500K, 4000K, 4500K, 5000K	70	50,000 hrs	5 years
10	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	2700K, 3000K, 3500K, 4000K, 4500K, 5000K	Standard: 70 High CRI: 80	50,000 hrs	5 years
11	Display Case Lighting	End-Mounted**: =50 lm/ft	≥95%: 0-80°	35 lm/W	2700K, 3000K, 3500K, 4000K, 4500K, 5000K	75	35,000 hrs	5 years
12	Linear Panels: 2x2 Troffers	3,000 lm	Spacing Criteria: 0-180°: 1.15-1.25 90-270°: 1.2-1.6	60 lm/W	2700K, 3000K, 3500K, 4000K, 4500K, 5000K	80	35,000 hrs	5 years
13	Linear Panels: 1x4 Troffers	2,000 lm	Spacing Criteria: 0-180°: 1.15-1.25 90-270°: 1.25-1.7	≥65 lm/W	2700K, 3000K, 3500K, 4000K, 4500K, 5000K	80	35,000 hrs	5 years

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	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	Linear Panels: 2x4 Troffers	4,000 lm	Spacing Criteria: 0-180°: 1.15-1.25 90-270°: 1.25-1.7	≥65 lm/W	2700K, 3000K, 3500K, 4000K, 4500K, 5000K	80	35,000 hrs	5 years
15	High-bay and Low-bay fixtures for Commercial and Industrial buildings	10,000 lm	≥30% 20-50°	70 lm/W	2700K, 3000K, 3500K, 4000K, 4500K, 5000K, 5700K	70	35,000 hrs	5 years
16	High-bay-Aisle Lighting	10,000 lm	≥50%: 20-50° ≥30%: 0-20°	60 lm/W	2700K, 3000K, 3500K, 4000K, 4500K, 5000K, 5700K, 6500K	70	35,000 hrs	5 years
Retrofit and Replacement Lamps***								
17	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
18	Retrofit Kits For Outdoor Decorative Luminaires	1,000 lm	≥ 65%: 0-90°	40 lm/W	<5700K	50	50,000 hrs	5 years
19	Four-foot Linear Replacement Lamps	2 Lamps, Tested In Fixture: 4033 Bare Lamp: 2400	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	2700K, 3000K, 3500K, 4000K, 4500K, 5000K	80, R ₉ >0	50,000 hrs	5 years

* Bilateral, symmetric light distribution on two hemispheres
 ** One-sided, single hemisphere light distribution
 *** Retrofit Kits and Replacement Lamps must be tested inside fixtures, per the policies for those products. See Outdoor Retrofit Kit Policy and T8 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 1.6.

Lumen Maintenance: Explanation of LM-80 thresholds is below. The 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 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 3: Exponential Decay Function $L=e^{-at}$

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%

NOTE: When TM-21 is published by IES, the DLC will incorporate new lumen maintenance procedures, as appropriate.

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

Table 4: 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-center	10-90°	≥95%	-3%	≥92%
9-end	10-90°	≥95%	-5%	≥90%
10-horizontal	0-90°	≥95%	-3%	≥92%
11	0-80°	≥95%	-5%	≥90%
12	0-180°	1.15-1.25	±0.1	1.05-1.35
	90-270°	1.2-1.6	±0.1	1.1-1.7
13	0-180°	1.15-1.25	±0.1	1.05-1.35
	90-270°	1.25-1.7	±0.1	1.15-1.8
14	0-180°	1.15-1.25	±0.1	1.05-1.35
	90-270°	1.25-1.7	±0.1	1.15-1.8
15	20-50°	≥30%	-10%	≥20%
16	20-50°	≥50%	-10%	≥40%
	0-20°	≥30%	-10%	≥20%
17	0-90°	100%	0%	100%
	80-90°	<10%	3%	<13%
18	0-90°	≥65%	-3%	≥62%
19 (Ref A)	0-180°	1.24	±0.1	1.14-1.34
	90-270°	1.5	±0.1	1.4-1.6
19 (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.

DLC Outdoor Retrofit Kit Policy

DLC will accept QPL applications for SSL Outdoor Retrofit Kits. The testing and reporting requirements described below are intended to subject the retrofit kits to worst-case thermal conditions in order to assure confidence in lumen maintenance.

For testing purposes, DLC specifies typical fixture housings for retrofit products to be tested in. These typical fixture housings are intended to provide testing results of the most common worst case conditions that the retrofit kits would be installed in. In providing this list of typical fixture housings, DLC does not endorse or exclude any particular make or model frame for use in energy efficiency programs. Note that in each recommended variation, it states, "or approved other." In selecting a fixture for testing, the applicant shall consider the purpose of subjecting the tested kit to extreme confinement for thermal endurance.

Applicants shall test and report fixture performance under the following restrictions and conditions:

- **Required Tests and Reports:** All DLC QPL testing and reporting requirements that apply to new fixtures shall also apply to any outdoor retrofit kit application, e.g.: LM79, ISTMT, IES file, product data sheet, etc. (Note: For lumen maintenance testing, the source manufacturer is responsible for light package's LM80 test).

Fixture level tests

LM79, ISTMT and Option 2 of LM80 shall be conducted in a fully functional DLC-approved fixture with the kit properly installed as per manufacturer's instructions.

Only one LM79, ISTMT, IES file is needed for the retrofit kit to be tested on one of the fixtures approved below. The option you choose to use for LM80 will determine how many tests you will need. If you choose Option 1, one LM80 report is needed. If you choose Option 2, you will need two LM79 reports to test the retrofit kit for 0 hrs and then 6,000 hrs on the fixture.

Manufacturer shall select a fixture for these tests among the following:

- Area & Roadway Luminaires
 - Cobrahead Fixture Retrofit Kits:
 - Kits shall be tested in
 - American Electric Roadway Series 115 Fixture
 - GE M250R2 fixture
 - Kim Archetype SAR
 - Cooper OVH Series or
 - Pre-approved equal
 - Kits must replace all reflectors and optical systems of existing fixture
 - Shoebox Fixtures:
 - If the kit may be applied to both cobraheads and shoebox fixtures, choose a fixture from among those listed herein under shoebox and cobrahead
 - If the kit is specific to shoebox fixtures (not applicable to cobraheads) the kit shall be tested in:
 - WideLite XL Excel-Lyte 400
 - Lithonia KAD Contour Series
 - Lumark TR Tribute

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- Kim Archetype SAR or
 - Pre-approved equal
- Kits must replace all reflectors and optical systems of existing fixture.

- Decorative Luminaires
 - Acorn, globe, etc. The kit shall be tested, fully and properly mounted in a glass or polymer globe with optics as similar as possible to the kit's intended use
 - King Luminaire K400 series
 - Lexalite Lindy Model 424
 - GE Patriarch Luminaire
 - Holophane GV Luminaires Washington PostLite or
 - Pre-approved equal
 - Kits must replace all reflectors and optical systems of existing fixture.

Application Review

DLC shall log, analyze, and evaluate outdoor retrofit kit applications in accordance with procedures followed for any individual fixture application: 1) for completeness and accuracy of the filed application data and 2) for qualification according to DLC category specifications.

For outdoor retrofit kit applications, DLC will apply the appropriate category and the specification values which are in effect as of the date of application submission. These categories are the following:

1. Outdoor Pole or Arm-Mounted Area and Roadway Luminaires
2. Outdoor Pole or Arm-Mounted Decorative Luminaires

DLC 4-foot Linear Replacement Lamp Policy

DLC will accept QPL applications for 4' linear T8 replacement lamps. The testing and reporting requirements described below are intended to evaluate the performance both of the lamp itself, **and** its performance in reference 2x4 troffers, their most common application.

For testing purposes, DLC requires testing both of the bare lamp, **and** in two typical fixture housings. These typical fixture housings are intended to provide testing results of the most common applications these products are used in, as well as representative thermal conditions in the fixtures that the lamps would be installed in. In specifying these particular fixture housings, DLC does not endorse or exclude any particular make or model frame for use in energy efficiency programs.

Applicants shall test and report performance under the following restrictions and conditions.

Lamp level tests

All lamps seeking qualification of the DLC must test the bare lamp according to LM-79.

Table 5: Individual T-8 Replacement Lamp Criteria

Individual Lamp Criteria	
System Efficacy	≥ 96 LPW
Initial Light Output	≥ 2400 lumens
Correlated Color Temperature (CCT)	2700K, 3000K, 3500K, 4000K, 4500K or 5000K
Color Rendering Index (CRI)	≥ 80, R ₉ > 0
Output Operating Frequency	≥ 200 Hz
Power Factor	≥ 0.90
Total Harmonic Distortion	≤ 20%
Warranty	≥ 5 Years

Testing notes

For integrating sphere testing, use the manufacturer’s power supply or a standard 0.88 ballast factor Instant Start ballast (if the system uses the existing ballast).

Fixture level tests

All lamps seeking qualification must be tested with two lamps inside two reference troffers.

Reference Troffer #1:

Tested according to LM-79 with 2 lamps installed in Lithonia 2GT8-2-32-A19-277-GEB10IS Prismatic Troffer.

Reference Troffer #2:

Tested according to LM-79 with 2 lamps installed in Lithonia 2PM2 2GT8-2-32-12LD-277-GEB10IS Parabolic Troffer.

Table 6: In-situ T-8 Replacement Testing Requirements

In-situ Lamp Criteria	
Luminaire Efficacy (when two (2) lamps are installed in Reference Troffers #1 and #2)	≥ 75 LPW
Minimum Initial Luminaire Light Output (when two (2) lamps are installed in Reference Troffer #1 and #2)	3750 lumens
Spacing Criteria	<u>Reference Troffer #1:</u> @ 0° ≤ 1.24 ± 0.1 @ 90° ≤ 1.5 ± 0.1 <u>Reference Troffer #2:</u> @ 0° ≤ 1.25 ± 0.1 @ 90° ≤ 1.63 ± 0.1
Lumen Maintenance L ₇₀	50,000 hours

Lumen Maintenance

1. LM-80 for the package/module/ array (6,000 hours minimum)
2. In-situ Temperature Measurement Test (ISTMT) in Reference Luminaire #1 with two identical lamps (only one is required to have thermocouple(s) attached).

Application Review

DLC shall log, analyze and evaluate T8 replacement lamp applications in accordance with procedures followed for any individual fixture application: 1) for completeness and accuracy of the filed application data and 2) for qualification according to DLC category specifications.