

Appendix G

Table of Approved LED Lighting and Utility Approval Process

Appendix G: Table of Approved LED Lighting (effective June 1, 2009)

The *2009 Table of Approved LED Lighting* was generated under the following guidelines:

1. All fixtures must be ENERGY STAR®-qualified or Utility approved.
2. If a fixture is not ENERGY STAR®-qualified, it must be vetted through the Utility for approval. See Section G2 of this appendix for approval process instructions and required manufacturer-provided supporting documentation.

Please note, Utility approval for fixture must be completed prior to application submittal. Replacement lamps are not eligible.

Submittals and/or questions can be sent to: LED@pge.com

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G1: APPROVED LED LIGHTING TABLE

MANUFACTURER	BRAND	MODEL	TYPE	LUMINAIRE EFFICACY (lumens/Watt)	DATE QUALIFIED	ENERGY STAR QUALIFIED	UTILITY APPROVED	REVIEWED BY (IOU/Agency)
Cree LED Lighting Solutions	Cree LED Lighting Solutions	LR4E-15	Recessed downlights	46.4	3/25/2009	Y	Y	ENERGY STAR
Cree LED Lighting Solutions	Cree LED Lighting Solutions	LR4E-15C	Recessed downlights	46.4	3/25/2009	Y	Y	ENERGY STAR
Cree LED Lighting Solutions	Cree LED Lighting Solutions	LR4E-30	Recessed downlights	46.4	3/25/2009	Y	Y	ENERGY STAR
Cree LED Lighting Solutions	Cree LED Lighting Solutions	LR4E-30C	Recessed downlights	46.4	3/25/2009	Y	Y	ENERGY STAR
Cree LED Lighting Solutions	Cree LED Lighting Solutions	LR5E	Recessed downlights	46.4	3/25/2009	Y	Y	ENERGY STAR
Cree LED Lighting Solutions	Cree LED Lighting Solutions	LR5E-15C	Recessed downlights	46.4	3/25/2009	Y	Y	ENERGY STAR
Cree LED Lighting Solutions	Cree LED Lighting Solutions	LR6	Recessed downlights	58.8	2/9/2009	Y	Y	ENERGY STAR
Cree LED Lighting Solutions	Cree LED Lighting Solutions	LR6-GU24	Recessed downlights	58.8	2/9/2009	Y	Y	ENERGY STAR
Cree LED Lighting Solutions	Cree LED Lighting Solutions	LR6C	Recessed downlights	61.3	3/16/2009	Y	Y	ENERGY STAR
Cree LED Lighting Solutions	Cree LED Lighting Solutions	LR6C-GU24	Recessed downlights	61.3	3/16/2009	Y	Y	ENERGY STAR
Cooper Lighting	HALO	ML706830-15W	Recessed downlights	45.8	2/25/2009	Y	Y	ENERGY STAR
Cooper Lighting	HALO	ML706830-15W-493	Recessed downlights	43.3	2/25/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC20LED-35K	Recessed downlights	38.4	3/16/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC20LED-3K	Recessed downlights	35.6	3/16/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC20LED-41K	Recessed downlights	41.6	3/16/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC20RLED-35K	Recessed downlights	38.4	3/16/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC20RLED-3K	Recessed downlights	35.6	3/16/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC20RLED-41K	Recessed downlights	41.6	3/16/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC22LED-35K	Recessed downlights	41	3/16/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC22LED-3K	Recessed downlights	38.5	3/16/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC22LED-41K	Recessed downlights	44.8	3/16/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC22RLED-35K	Recessed downlights	41	3/16/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC22RLED-3K	Recessed downlights	38.5	3/16/2009	Y	Y	ENERGY STAR
Juno Lighting, Inc.	Juno	IC22RLED-41K	Recessed downlights	44.8	3/16/2009	Y	Y	ENERGY STAR
Cree LED Lighting Solutions	Cree LED Lighting Solutions	LR4E-15	Recessed downlights	46.4	3/25/2009	Y	Y	ENERGY STAR

G2: UTILITY APPROVAL PROCESS

Please note, Utility approval for fixture must be completed prior to application submittal. Replacement lamps are not eligible.

Submittals and/or questions can be sent to: LED@pge.com

For Fixture/Luminaires not currently covered by an ENERGY STAR label, submit the following from the **Fixture Manufacturer**:

1. **LM-79 Test:** Provide Independent Testing according to IES LM-79 that provides efficacy, output, color, and photometric distribution of your product. An Integrating Sphere Test will be required to provide color information. A Goniophotometer test by itself is not adequate. A sample test report is included with this document. At a minimum, the LM-79 testing report(s) should include:
 - a. Electrical Data;
 - i. Input voltage,
 - ii. Current in (A)mperes,
 - iii. Power in (W)atts
 - iv. Power Factor & THD
 - b. Total Light Output;
 - i. Luminous Flux in Lumens
 - ii. Luminous efficacy (Lm/W),
 - iii. Zonal Lumen Summary
 - c. Luminous Intensity Distribution;
 - i. Candela Distribution
 - ii. Polar Graph
 - iii. Suggested additional data,
 1. Spacing Criteria,
 2. Coefficient of Utilization (CU) and
 3. isoilluminance plot
 - d. Color characteristics;
 - i. Color Temperature (CCT),
 - ii. Color Rendering Index (CRI),
 - iii. Chromaticity Coordinates
 - iv. Spectral power distribution (SPD)
2. **IES File:** Provide absolute photometric testing data in IES LM-63 electronic file format.
3. **Lifetime:** Provide written explanation of how L70 Lifetime of Product is determined using the LM-80 and In-situ temperature tests referenced below.
 - a. **LM-80 Test:** Provide LED Package Manufacturer IES LM-80 Test Report with results showing relative (%) light output over time at 55°C, 85°C and X°C (a third temperature at the manufacturer's choice).
 - b. **In-Situ Temperature Test:** Provide test report indicating the Temperature of the hottest LED In-Situ in ANSI/UL 1598-04 (hardwired) or ANSI/UL 153-05 (corded) environments. This temperature measurement will be used with LM-80 data to validate lumen maintenance and useful life of product. Note that this temperature measurement should be specially requested by the manufacturer as they are getting their UL testing.

G3: SUBMISSION SUMMARY AND CHECKLIST

MANUFACTURER CONTACT INFORMATION	
Company	
Name	
Address	
Phone	
Fax	
Email	
Web Site	

ATTACHMENTS	
Item	Included Check <input checked="" type="checkbox"/>
1. LM 79 Test Report	<input type="checkbox"/>
2. IES File	<input type="checkbox"/>
3. Lifetime Determination Statement	<input type="checkbox"/>
4. LM 80 Test Report	<input type="checkbox"/>
5. In-situ Temperature Test Report	<input type="checkbox"/>

LUMINAIRE INFORMATION FOR NON-ENERGY STAR QUALIFIED LUMINARIES/FIXTURES			
Required Information & Test Results	Fill In	Verified Table 1 Check <input checked="" type="checkbox"/>	Reviewer Notes For Office use Only
<input type="checkbox"/> Manufacturer Name			
<input type="checkbox"/> Manufacturer Part or Catalog#			
<input type="checkbox"/> Intended application(s)		<input type="checkbox"/>	
<input type="checkbox"/> Wattage as tested		<input type="checkbox"/>	
<input type="checkbox"/> Operating voltage		<input type="checkbox"/>	
<input type="checkbox"/> Operating current		<input type="checkbox"/>	
<input type="checkbox"/> Total Luminous Flux (Lumens)		<input type="checkbox"/>	
<input type="checkbox"/> Luminous Efficacy (Lm/W)		<input type="checkbox"/>	
<input type="checkbox"/> Color temperature (CCT) NTE 6500k		<input type="checkbox"/>	
<input type="checkbox"/> Color Rendering Index (CRI) >75 for Interior		<input type="checkbox"/>	

/ ≥ 70 for Exterior			
<input type="checkbox"/> Manufacturer Warranty (5 yr min)		<input type="checkbox"/>	
<input type="checkbox"/> Off-State Power (Must be zero)		<input type="checkbox"/>	
<input type="checkbox"/> Power Factor (>0.9)		<input type="checkbox"/>	
<input type="checkbox"/> THD (<20%)		<input type="checkbox"/>	
<input type="checkbox"/> UL File #		<input type="checkbox"/>	

Submission:

This information should be submitted in electronic format to LED@pge.com.

G4: APPENDIX OF RESOURCES

Suggested Testing Services

(From CALiPER and [DOE Manufacturer's Guide](#)

http://www.energystar.gov/ia/partners/manuf_res/downloads/ENERGYSTAR_Manufacturers_Guide_30Sept08.pdf)

LM-79 and LM-80 Testing Laboratories

Integrating Sphere (LM-79 Section 9.1 and 9.2)

- Independent Testing Laboratories, Inc. – Boulder, CO <http://www.itlboulder.com/>
- Lighting Sciences, Inc. – Scottsdale, AZ <http://www.lightingsciences.com/home/>
- Lighting Research Center; Rensselaer Polytechnic Institute – Troy, NY <http://www.lrc.rpi.edu/>
- Luminaire Testing Laboratory, Inc. – Allentown, PA <http://www.luminairetesting.com/>

Goniophotometry (LM-79 Section 9.3)

- Independent Testing Laboratories, Inc. – Boulder, CO <http://www.itlboulder.com/>
- Luminaire Testing Laboratory, Inc. – Allentown, PA <http://www.luminairetesting.com/>
- Lighting Sciences, Inc. – Scottsdale, AZ <http://www.lightingsciences.com/home/>

UL 1598 or UL 153 testing Nationally Recognized Testing Laboratories (NRTLs)

- Canadian Standards Association (CSA);
- Intertek Testing Services NA, Inc. (ITSNA);
- MET Laboratories, Inc. (MET);
- NSF International (NSF);
- SGS U.S. Testing Company, Inc. (SGSUS);
- TUV America, Inc. (TUVAM);
- TUV Product Services GmbH (TUVPSG);
- TUV Rheinland of North America, Inc. (TUV);
- Underwriters Laboratories Inc.(UL); and
- Wyle Laboratories, Inc. (WL).
- A complete and current listing of NRTLs: <http://www.osha.gov/dts/otpc/nrtl/>

G5: SUMMARY OF NONRESIDENTIAL TECHNICAL REQUIREMENTS

Application	Min Light Output	Zonal Lumen Density	Minimum Luminaire Efficacy	Allowable CCTs	Minimum CRI	Minimum L70 Lifetime
1. Recessed, surface and pendant-mounted downlights	<4.5" 345 L, >4.5" 575 L	75% 0°-60°	35 L/w	2700 K, 3000 K, 3500 K, 4000K, 5000K	75	35,000 hrs
2. Under cabinet shelf-mounted task Lighting	125 L/ft	60% 0°-60°, 25% 60°-90°	29 L/w	2700K, 3000K, 3500K, 4000K, 5000K	75	35,000 hrs
3. Portable desk task lights	200 L	85% 0°-60°	29 L/w	2700K, 3000K, 3500K, 4000K, 4500K and 5000K	75	35,000 hrs
4. Wall wash luminaires	575 L	50% 20°-40°	40 L/w	2700K, 3000K, 3500K, 4000K, 4500K and 5000K	75	35,000 hrs
5. Bollards	N/A	<15% 90°-110°, 0% >110°	40 L/w	2700K, 3000K, 3500K, 4000K, 4500K and 5000K	75	35,000 hrs
6. Outdoor Pole/Arm-Mounted Area and Roadway Luminaires	2,300 L	100% 0-90°, <10 % 80-90° plus meet IES Type I, II, III, IV, or V	50 L/w	< 6500K	70	50,000 hrs
7. Outdoor Pole/Arm-Mounted Decorative Luminaires	2,300 L	95% 0-90°	50 L/w	< 6500K	70	50,000 hrs
8. Outdoor Wall-Mounted Area Luminaires	1,300 L	100% 0-90°, <10 % 80-90°	50 L/w	< 6500K	70	50,000 hrs
9. Parking Garage Luminaires	4,000 L	>20% 60-70°, >15% 70-80°	50 L/w	< 6500K	70	50,000 hrs
10. Track or Mono-point Directional Lighting Fixtures	250 L	>85% 0-90°	30 L/w	2700K, 3000K, 3500K, 4000K, 5000K	75	35,000 hrs

* **DOE ENERGY STAR V1.1 Non-Residential Applications – Products must be ENERGY STAR qualified:** DOE ENERGY STAR® Eligibility Criteria – Version 1.1 December 19, 2008 http://www.drintl.com/temp/ENERGYSTAR_SSLCriteria_V1.1.pdf

** **Non-Energy Star Applications – Submit Product Information and Testing Results to Utility for qualification**

G6: SAMPLE REPORT IESNA LM-79



LUMINAIRE TESTING LABORATORY, INC.

SUSTAINING
MEMBER
IESNA

905 Harrison Street · Allentown, PA 18103 · 610-770-1044 · Fax 610-770-8912 · www.LuminaireTesting.com
 LTL Number: 13592 Date: 07-16-2008

Prepared For: Cooper Lighting

Catalog Number: ML706830/H750ICAT/494WB06

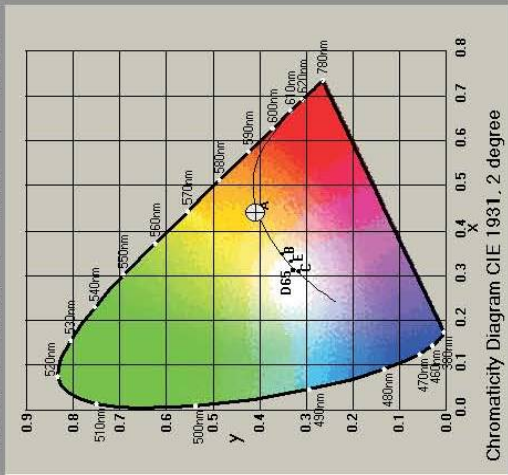
Luminaire: Formed steel housing, formed brushed aluminum upper reflector, spun matte white stepped aluminum lower reflector with white enamel aluminum trim ring.

Lamp: One white LED

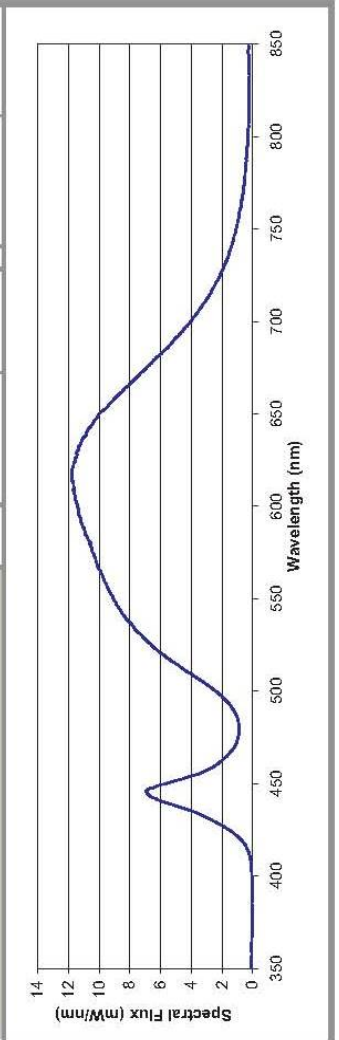
LED Power Supply: One unmarked LED power supply

Luminaire Efficacy: 45.8 Lumens/Watt

Lamp Arc Voltage	Lamp Current	Lamp Watts	Frequency
120.0VAC	0.1177A	13.816W	60.0 Hz
Radiant Flux mW	Luminous Flux lumen	Corr.Color Temperature K	Color Rend. Index Ra
2122.226	632.893	2970	80.2
Chroma x	Chroma y	Chroma u	Chroma v
0.4414	0.4097	0.251	0.3495



Wavelength in nm	Spectral Flux in mW/nm	Wavelength in nm	Spectral Flux in mW/nm
350	0.0778	610	11.6310
360	0.0595	620	11.7420
370	0.0571	630	11.4020
380	0.0494	640	10.8030
390	0.0398	650	9.9865
400	0.0581	660	8.7959
410	0.1748	670	7.5149
420	0.8048	680	6.3227
430	2.6120	690	5.1171
440	5.7686	700	4.0495
450	5.6687	710	3.1690
460	2.4041	720	2.4481
470	1.1795	730	1.8758
480	0.9032	740	1.4115
490	1.2715	750	1.1003
500	2.4128	760	0.8379
510	4.1652	770	0.6452
520	5.8796	780	0.5103
530	7.2159	790	0.4220
540	8.3087	800	0.3364
550	9.0951	810	0.2547
560	9.6703	820	0.2649
570	10.1880	830	0.2331
580	10.5980	840	0.2605
590	11.0900	850	0.2752
600	11.4000		



TESTING WAS PERFORMED IN ACCORDANCE WITH IES LM-79-08. Approved By: 16