

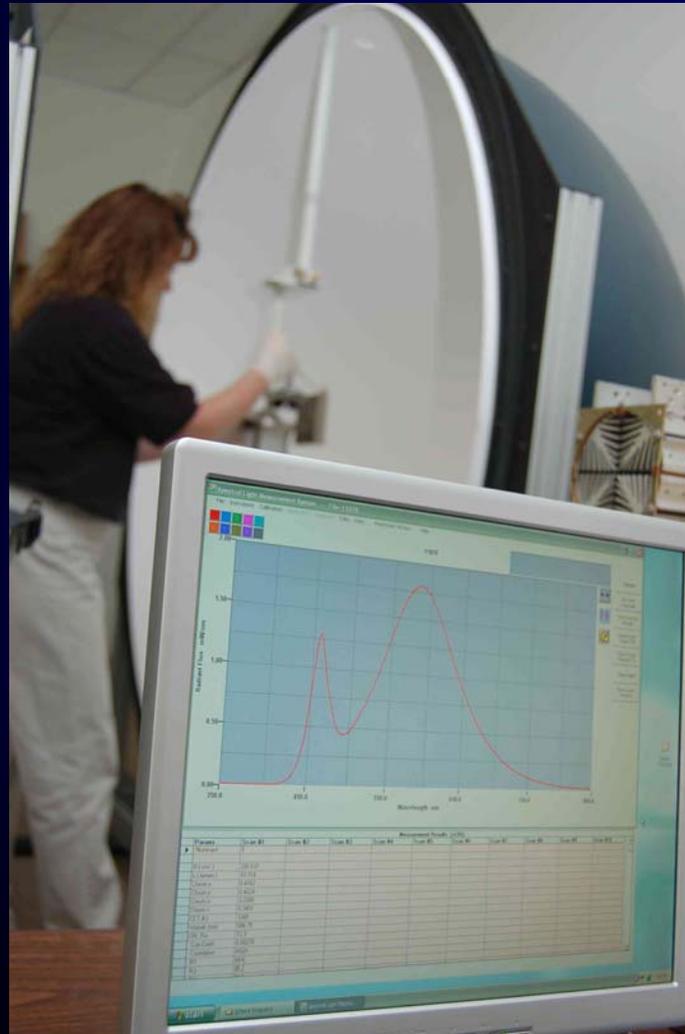
Testing Procedures for Solid State Lighting Products

ENERGY STAR Solid State Lighting Workshop
May 15, 2008

Status of Remaining Procedures

- ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products Published February 2008
- IES LM-79-08 - Electrical and Photometric Measurements of Solid-State Lighting Products Published May 2008
- IES LM-80 - Method for Measuring Lumen Depreciation for SSL Light Sources Expected Summer 2008

How Will the Procedures Be Applied?



Goniophotometry - LM-79-08



- Absolute Photometry
- Type C Goniophotometer
- Total Luminous Flux
- Zonal Lumen Sums
- IES format file
- Spatial Uniformity of Color

Relative vs. Absolute Photometry

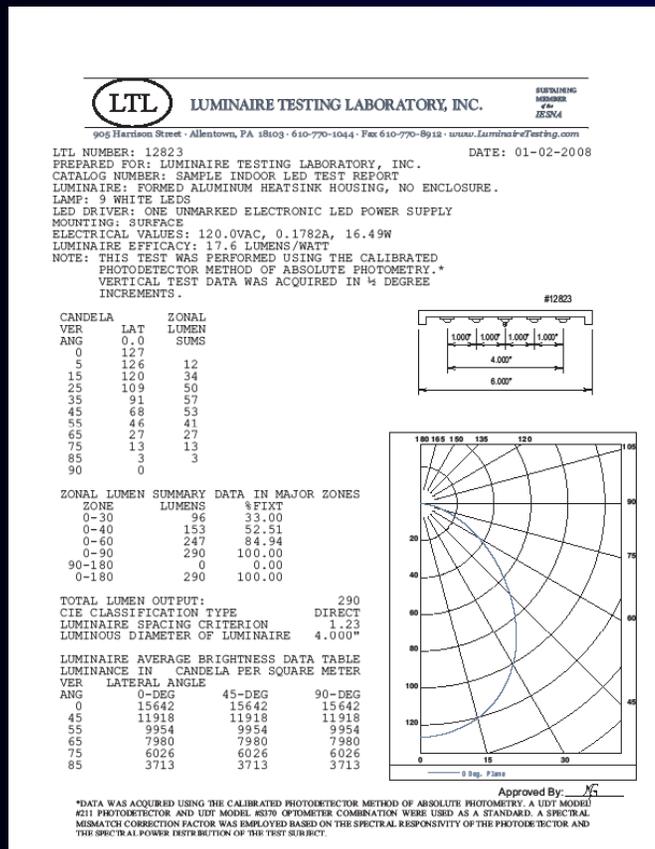
Relative

- Typically performed for luminaires using conventional sources
- Luminaire test is referenced to the luminous flux measured from the “bare” lamp(s)
- cd per rated lumens
- Normalizes ballast factor, lamp age
- Includes luminaire efficiency

Absolute

- Luminaire test is referenced to a calibrated standard lamp
- Absolute luminous intensity (cd)
- No luminaire efficiency
- Total luminous flux (lumens)
- Used to calculate absolute luminaire efficacy (lumens per watt)

Goniophotometry LM-79-08



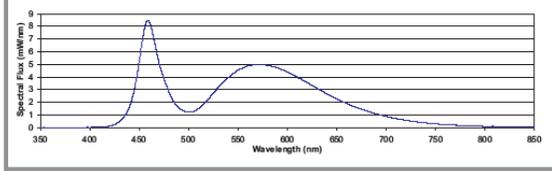
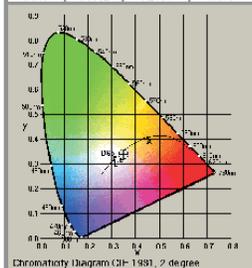
- Total Luminous Flux
- Zonal Lumen Sums
- IES Format File
- Spatial Uniformity of Color

Integrating Sphere LM-79-08



905 Harrison Street · Allentown, PA 18103 · 610-770-1044 · Fax 610-770-8912 · www.LuminaireTesting.com
 LTL Number: 12824
 Prepared For: Luminaire Testing Laboratory, Inc.
 Luminaire: Formed steel housing with aluminum heatsink, clear plastic enclosure.
 Lamp: Nine white LEDs
 Power Supply: One unmarked electronic LED power supply.
 Luminaire Efficacy: 24.7 Lumens/Watt

Lamp Arc Voltage	Lamp Current	Lamp Watts	Frequency	Wavelength in nm	Spectral Flux in mW/nm	Wavelength in nm	Spectral Flux in mW/nm
120.0VAC	0.0974A	11.34W	60.0 Hz	350	0.0210	610	3.9867
				360	0.0172	620	3.5689
				370	0.0192	630	3.1105
				380	0.0182	640	2.6659
				390	0.0208	650	2.2698
				400	0.0228	660	1.9139
				410	0.0405	670	1.5867
				420	0.1244	680	1.3158
				430	0.4777	690	1.0815
				440	1.6595	700	0.8836
				450	5.2515	710	0.7100
				460	8.4329	720	0.5770
				470	5.1190	730	0.4632
				480	2.8241	740	0.3696
				490	1.5782	750	0.3006
				500	1.2124	760	0.2423
				510	1.5096	770	0.1907
				520	2.2697	780	0.1534
				530	3.1762	790	0.1297
				540	3.9583	800	0.1053
				550	4.5473	810	0.1012
				560	4.8861	820	0.0730
				570	4.3985	830	0.0517
				580	4.9083	840	0.0632
				590	4.7133	850	0.0710
				600	4.4045		



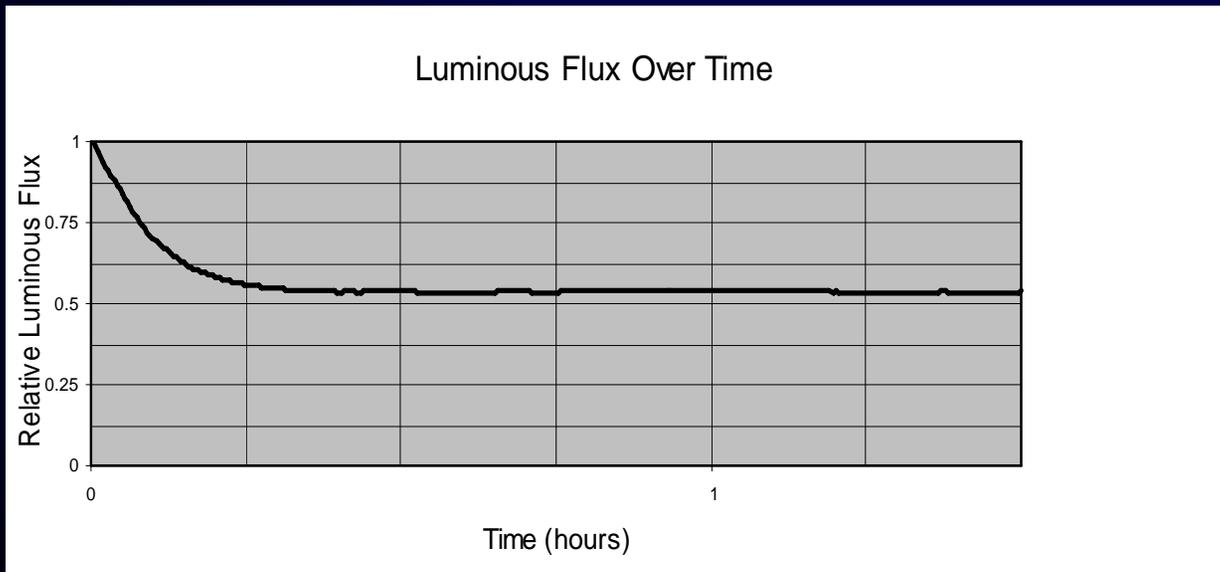
- Total Luminous Flux
- Spectral Power Distribution
- Chromaticity Coordinates
- CRI
- CCT

Lumen Depreciation LM-80

- Lumen Depreciation of Devices (not Luminaires)
- Based on L_{70} and L_{50} at specific drive currents and case temperatures
- Case temperature is related to junction temperature

How Long Does a Test Take?

- Goniophotometry
- Integrating Sphere
- Stabilization Time is the bottleneck.
Preburning can help if done properly.



What aspects of SSL performance will these test procedures measure?

- Total Luminous Flux
- Luminaire Input Electrical Power
- Total Luminaire Efficacy (lumens per watt)
- Spectral Power Distribution
- Chromaticity Coordinates (x, y and u', v')
- CRI (Color Rendering Index)
- CCT (Correlated Color Temperature)
- Spatial Uniformity of Color ($\Delta u'v'$)
- Luminous Intensity Distribution
- Zonal Lumen Sums
- Lumen Maintenance (L_{50} and L_{70})