

PRESENTED BY COST-LESS LED LIGHTING, INC.

Understanding IES LM-79 &
IES LM-80

U.S. Department of Energy
Energy Efficiency and Renewable Energy

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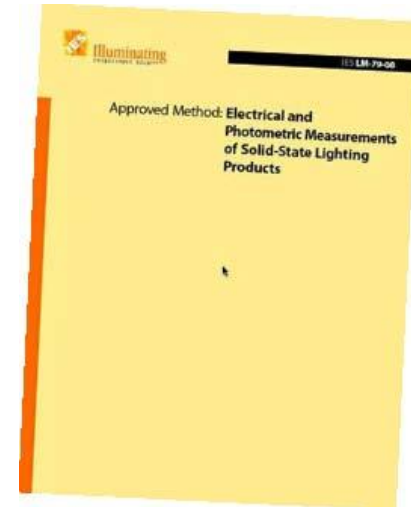
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IES LM-79

“Electrical and Photometric Measurements of Solid-State Lighting Products”

- Approved method describing procedures and precautions in performing reproducible measurements of LEDs:
 - total flux,
 - electrical power,
 - efficacy (lm/watt), and
 - chromaticity



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LM-79 Scope

- **Applies to LED-based products incorporating control electronics and heat sinks:**
 - Products requiring only line voltage or DC power supply
 - Includes complete LED luminaires and
 - Integrated LED sources (LED chips with heat sinks)
- **Does *not* cover**
 - *LED products requiring external operating circuits or heat sinks (bare LED chips, pkgs, and modules)*
 - Fixtures designed for LED products but sold without a light source



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Absolute Photometry Basis

- LM-79 requires Complete luminaire testing
- Traditionally, photometric evaluation of lighting products is based on separate tests for lamps and luminaires (“relative”)
- For SSL products, LED lamps typically *cannot be separated from their luminaires because of heat effects (“absolute”)*



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Relative vs. Absolute Photometry

- **Relative testing**

- Lamps of interest and luminaries (with reference lamp) are measured separately. Then the actual light distribution and intensity of the complete luminaries of interest is derived by normalization of the test data

- **Absolute testing**

- The actual light distribution and intensity of the luminaries of interest is measured directly from the complete luminaries



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Procedures/Conditions

- **Ambient conditions**

- Temperature – maintain at 25C +/-1C (within 1m)
- Mounting – limit thermal transfer
- Air flow - limited

- **Power Supply characteristics**

- AC wave shape limit to harmonic RMS of 3%
- Voltage regulation to +/- 2%

- **Seasoning and stabilization**

- **Testing orientation**

- **Electrical settings**

- **Instrumentation**



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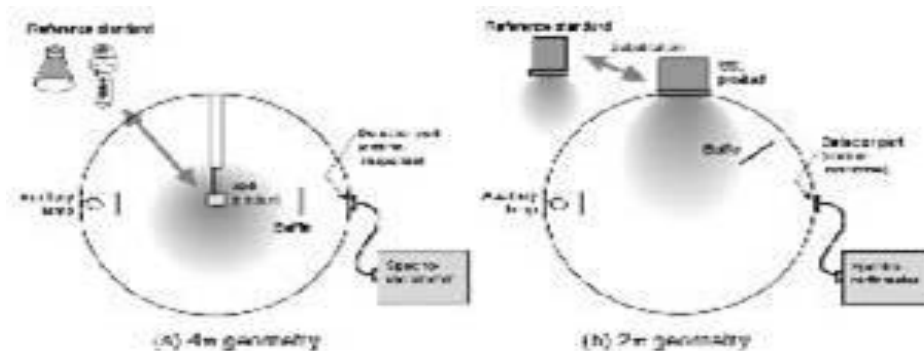
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Test Methods: Integrating Sphere System

For measuring Total luminous flux and color:

- Photometer – Total Luminous Flux
- Spectral Radiometer (preferred) - Spectral Radiant Flux (to derive total luminous flux and color qualities)



(a) Setup for all types of SSL products

(b) Setup for SSL products with only forward emission



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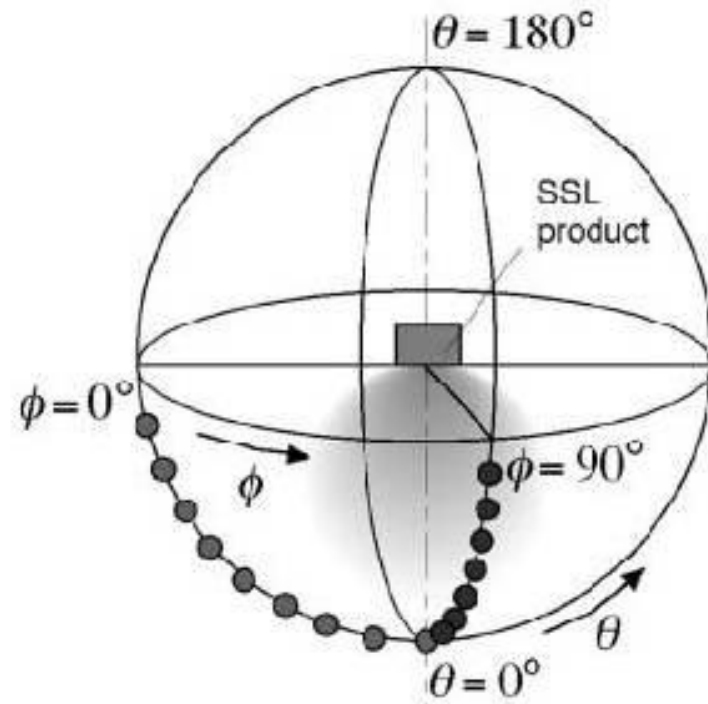
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Test Methods: Goniophotometer System

For measuring luminous
Intensity Distribution

- Total Luminous Flux is derived
- Provides color characteristics with Spectral radiometer including CCT, CRI



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Test Outputs/Calculations

- Total Luminous Flux
- Luminous Intensity Distribution
- Electrical Power
- Luminous Efficacy (calculation)
- Color Characteristics
 - Chromaticity
 - CCT
 - CRI



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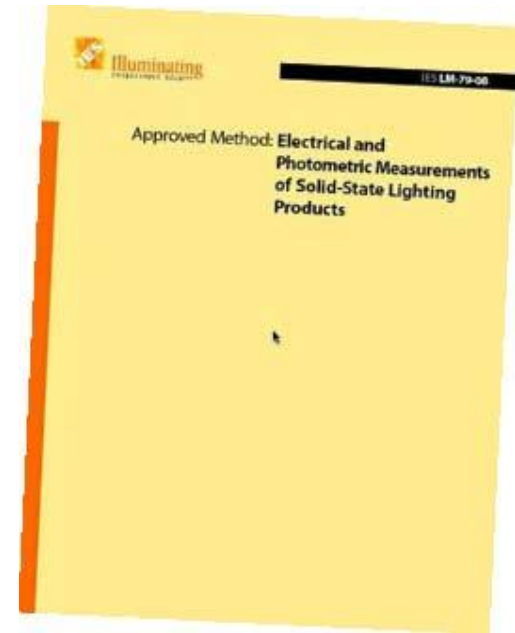
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IES LM-80 “Measuring Lumen Maintenance of LED Light Sources”

Approved method for measuring lumen depreciation of solid-state (LED) light sources, arrays and modules
Does not cover measurement of luminaries.
Does not define or provide methods for estimation of life.



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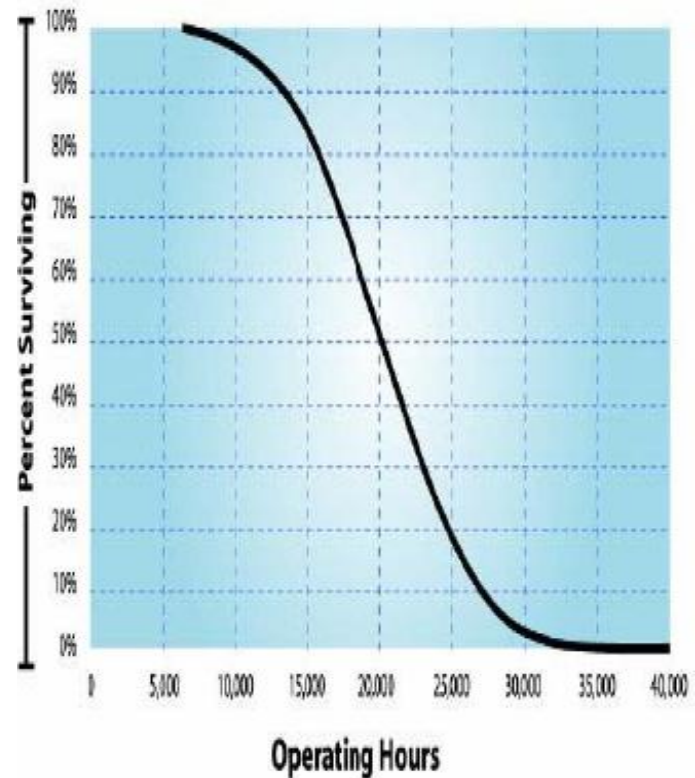
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What is “Life” for Lighting?

“Operational failure”

- Most light sources “burn out” (End of “Life”)
- Lamp life is typically rated at 50% failure rate
- **LEDs typically don’t fail** (no filament to “burn”)



Rated lamp life is point where 50% of lamps have failed, or 20,000 hours on this curve.



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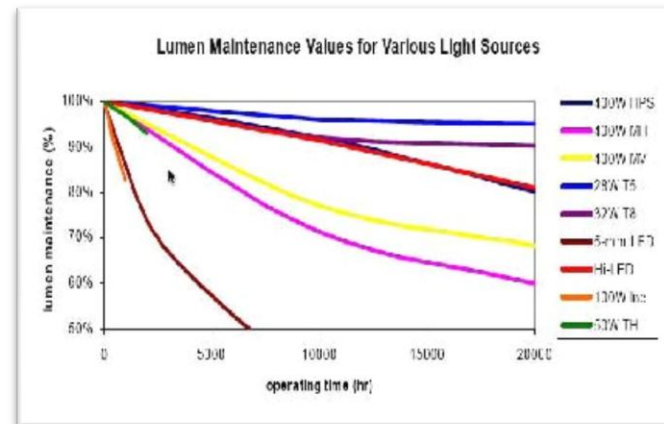
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“Life” for LEDs

- Useful light output (Lumen Maintenance)
 - All light sources degrade but most just “burn out” before serious loss of light output
 - LEDs continue to degrade – eventually beyond useful light output



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Procedures/Conditions

- **Ambient conditions and setup**
 - Case Temperature measured and maintained
 - Case Temperature measurement point
 - Airflow minimized
 - Operating orientation & spacing per manufacturer
- **Electrical**
 - Voltage and Current (AC or DC levels)
 - Voltage waveshape (harmonic distortion <3%)
 - Current Regulation
- **Instrumentation**



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Measurement Methods

- **Case Temperatures**

- Measurement performed at multiple temperatures to address in-situ conditions
- 55C, 85C and 3rd manufacturer selected temperature

- **Photometry**

- Spectral radiometer preferred method
- Temperature: 25C ambient
- Drive current per manufacturer

- **Testing Intervals**

- 6000 hours min testing period. 10K preferred.
- Minimum at least every 1000 hours



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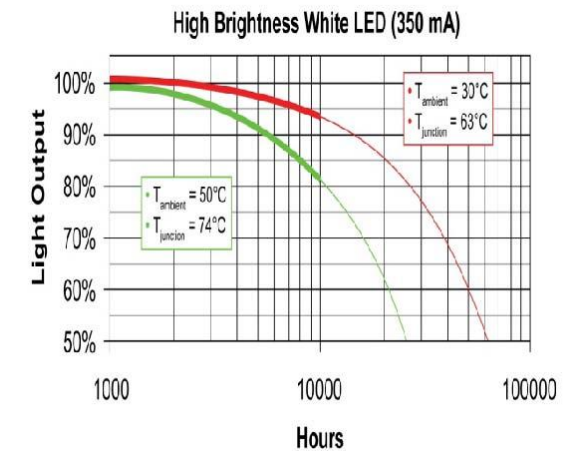
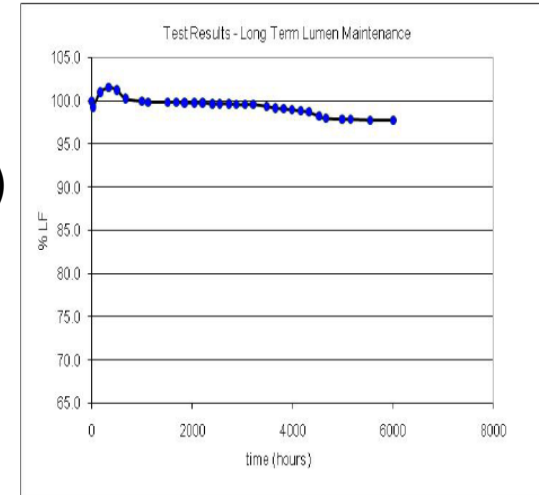


Testing Output and Use

- **Test report basics**

- Description of Sources tested
- Ambient conditions (Air flow, temperature, RH etc.)
- Case Test point temperature
- Electrical conditions
- Lumen maintenance data
- Observation of failures
- LED monitoring interval
- Chromaticity shift over time

LM-80 provides no determination or estimation of expected life or lumen output beyond test data.
Separate estimation method (TM-21) is in development



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