ENERGY STAR® Criteria for Reflector CFLs

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ENERGY STAR® Criteria Meeting
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Today’s Topics

• The market for R-CFLs
• The need for in-situ testing
• Key changes specific to R-CFLs in version 4.0
• Description of elevated temperature test apparatuses and procedures
Residential Lighting Market

2000 Residential Lighting Fixtures Sold (% of market)

- Incandescent Ceiling or Pendant: 21%
- Incandescent Wall or Bracket: 5%
- Incandescent Recessed: 27%
- Incandescent Outdoor Attached: 5%
- Incandescent Outdoor - Not Attached: 19%
- Fluorescent Wraparounds: 5%
- Fluorescent Ceiling Decorative: 7%
- Fluorescent Ceiling General Purpose: 9%
- Fluorescent Pendant: 1%
- Fluorescent Recessed: <1%
- Fluorescent Wall or Bracket: 1%
Results of 10 R-CFLs tested by PNNL in a simulated ICAT environment showed that most operated at above manufacturer maximum operating temperature guidelines (typically 50°C).
Key Changes in Version 4.0

• All R-CFLs tested base-up
• 50°C “Maximum Ambient Temperature Rating”
• Requirement for “Elevated Temperature” Testing
  – Initial Light Output
  – 1000-hour Lumen Maintenance
  – Lumen Maintenance at 40% of Rated Life
  – Rated Life Testing
• May use non-NVLAP facility if testing begins prior to Oct. 1, 2006
Initial Elevated Temperature Light Output

- Lamps must maintain 90% of their $25^\circ \pm 5^\circ$C rated light output in the ICAT environment
- Determines a “Thermal Factor” for the lamp
- Uses a relative approach
Effect of Amalgam

![Graph showing the effect of amalgam on relative luminous flux in relation to ambient temperature.](image-url)
Amalgam Lamp Ramp-up

![Run-up curve after ignition](image-url)

**Run-up curve after ignition**

- **X-axis:** Time (minutes)
- **Y-axis:** Relative luminous output %

Courtesy of GE Lighting
The “Ambient” Luminaire Apparatus

UL 1598 Thermal Test Apparatus (no cellulose insulation)

Ambient Luminaire

Reflector CFL

36"

Photodetector
The “IC-rated” Luminaire Apparatus

- UL 1598 Thermal Test Apparatus
- Nominal 6" aperture, 8" deep ICAT Downlight
- Reflector CFL
- Cellulose Insulation
- Photodetector

Dimensions:
- 36"
UL 1598 Standard for IC Rated Recessed Luminaires

Photo 1. During UL 1598 luminary tests, temperatures are measured by means of thermocouples and suitable indicating devices.

Photo 2. UL 1598 requires recessed luminaire to be tested in wood boxes having dimensions based on installation clearances allowed by National Electrical Code.

Photo 3. Temperatures of combustible building materials may not exceed 90°C.
UL 1598 Test Apparatus Clearances

- D = height of housing
- Filled with cellulose insulation
Initial Elevated Temperature Light Output Apparatus
Initial Elevated Temperature Light Output Procedure

1. Install the lamp in the "ambient luminaire within the UL 1598 apparatus.
2. Apply the lamp’s nominal rated voltage to the system.
3. Allow the system to reach stabilization (60 minute period with less than 0.5 percent fluctuation.)
4. Record the photometric measurement at nadir.
5. Remove power from the system.
6. Install the IC Rated Luminaire and fill the apparatus with loose fill cellulose insulation to the levels specified in UL 1598.
7. Apply the lamp’s nominal rated voltage to the system.
8. After six hours, record the photometric measurement at nadir.
9. Record the operating temperature within the luminaire.
10. Remove power from the system
Sample Test Report

TEMPERATURE MEASUREMENTS OVER TIME
IC CAN WITH INSULATION AND LID ON

Legend:
A - Ambient Lamp #1
B - Ambient Lamp #2
C - Ambient Lamp #3
D - Ambient Lamp #4
E - Capacitor
F - Ambient Ceiling

Temperature (Degrees Celsius)

Time (hh:mm:ss)
Elevated Temperature Testing

- Testing conducted at 55°± 5°C
- Standard test cycle 3 hrs. ON/20 min. OFF
- Uses a “relative” approach, i.e. a point illuminance
Elevated Temperature Test Apparatus

- Ceramic lampholders
- Thermostatically controlled exhaust
- Temperature sensor(s)
- Insulation
- Perforated substrate
- 25°C ± 5°C Intake
- 55°C ± 5°C Radiant baffles
- 25°C ± 5°C Intake
Elevated Temperature Test Apparatus
Elevated Temperature Test Apparatus
Elevated Temperature Test Procedure

1. Season ten (10) lamps
   • Internal 100 hrs.
   • External (79 hrs. external/21 hrs. internal)
2. At the 100-hour point, record the photometric measurement for each lamp. Establishes baseline illuminance.
3. Initiate 3 hours ON/20 minutes OFF cycle
4. At the 1000-hour point, record the photometric measurement for each lamp
5. At 40% of the lamps’ rated life, record the photometric measurement for each lamp
6. Continue to monitor the lamps until rated life is achieved (the point of failure for 6 lamps)
Lumen Depreciation

- 1000 hr
- 40% of Rated Life

Lumen Maintenance
Contact Information

• Emerging Technologies Website: http://www.pnl.gov/r-lamps/

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Questions?