

LED Luminaire Lumen Maintenance – LM-80 Data

APPLICABLE MODEL: MILLENIUM SEMI-RECESSED EDGE™ MR13FFR SERIES WITH 20 WATT 4000K LED (20L40K)

The purpose of this document is to demonstrate that Kenall's Millennium Edge MR13FFR follows current industry standard procedures in reporting the expected lumen maintenance of the LEDs within the product under normal operating conditions.

Lumen maintenance of the Philips-Lumileds LEDs used within this product is estimated by the following sets of data:

In-Situ Product Testing of a representative product's temperature characteristics (specifically the measurement related to LED junction temperature). For this product series, this product was evaluated by a UL Accredited DAP laboratory to comply with UL8750 and UL1598 standards under an ambient temperature of 25°C (77°F). The critical measurement concerning lifetime is the LED temperature measurement point ($T_{MP,LED}$), which has been measured per *Lumileds Application Brief AB33*.

LM-80 Test Results for the LED Package: Lumen maintenance evaluation of the LED source by its manufacturer under compliance with IES LM-80-08 guidelines. The purpose of LM-80-08 is to determine the lumen maintenance of an LED package, array or module after 6,000 hours of operation under specific ambient temperature and electrical operating conditions.

The LEDs used within the luminaire are expected to maintain the lumen maintenance shown in the LM-80 testing if the LED temperature measurement point ($T_{MP,LED}$) is less than or equal to the temperature(s) specified in the LM-80 test report for the corresponding drive current and the drive current in the luminaire is less than or equal to the drive current specified in the LM-80 test report at the corresponding temperature or higher.

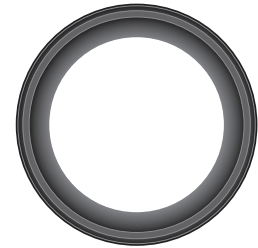
A summary of the lumen maintenance information is shown below:

LED Drive Current	700mA
In-Situ LED Temperature Measurement Point ($T_{MP,LED}$) ¹	84.1°C
<i>Lumileds</i> LM-80 Test Temperature ²	85.0°C
Lumen Maintenance @ 6,000 hours/10,000 hours ²	94.9% / 93.7%
Luminaire L_{70} Design Lifetime	50,000 hours

¹UL DAP Accredited laboratory test results of temperature corrected to 25°C ambient

²Test result values from *Lumileds* LM-80 test results (Design Resource DR03 – 05/28/2010)

Please refer to attached excerpts from Design Resource DR03: LM-80 Test Report



Excerpt from Design Resource DR03: LM-80 Test Report

4. Operating cycle

LUXEON Rebel LEDs are driven with a constant direct current (DC).

5. Ambient conditions including airflow, temperature, and relative humidity

The thermal chamber has minimal airflow. The case temperature within the thermal chamber was characterized by mounting several thermocouples on a sample reliability stress board at the designated thermal measurement point, as shown in Application Brief, LUXEON Rebel Thermal Measurement Guidelines (AB33). In addition, several thermocouples were mounted in the air at a distance of 1.5 mm above the reliability stress board. Then the reliability stress board was mounted in the thermal chamber and driven at the specified stress condition. The thermocouple readings were monitored. After the thermocouples reached thermal equilibrium, the thermocouple readings were data-logged and averaged together. The relative humidity within the oven was also characterized.

6. Case and ambient temperatures (ambient temperature measured 1.5mm above reliability stress board)

The thermal characterization results are summarized in the table below. In all cases, both T_s and T_A meet or exceed the IES LM-80-08 limits (i.e. $T_s \geq 55^\circ\text{C}$ or 85°C , and that $T_A \geq T_s - 5^\circ\text{C}$).

LM-80 Tests							
Required LM-80 Test Temperature	I_f	Actual T_s	Actual T_A	Actual $\Delta[T_A - T_s]$	Actual Relative Humidity	Average lumen output at 6,000 hours	Average lumen output at 10,000 hours
55°C	350 mA	60°C	64°C	+4°C	18%	0.992	0.983
85°C	350 mA	85°C	84°C	-1°C	7%	0.962	0.955
108°C *	350 mA	128°C	103°C	-25°C	TBD	0.979	0.956

* Third temperature chosen by the manufacturer, and adjusted to meet $-5^\circ\text{C } T_A - T_s$ requirement.



Additional Tests Provided

Additional Test Temperature	I_F	Actual T_S	Actual T_A	Actual $\Delta[T_A - T_S]$	Actual Relative Humidity	Average lumen output at 6,000 hours	Average lumen output at 10,000 hours
55°C	700 mA	69°C	73°C	+4°C	18%	0.978	0.967
85°C	700 mA	92°C	87°C	-5°C	7%	0.949	0.937
55°C	1000 mA	71°C	80°C	+9°C	18%	0.955	0.945

7. Drive current of the LED light source during lifetime test

Specified in the tables.

8. Initial Luminous flux and forward voltage at photometric measurement current

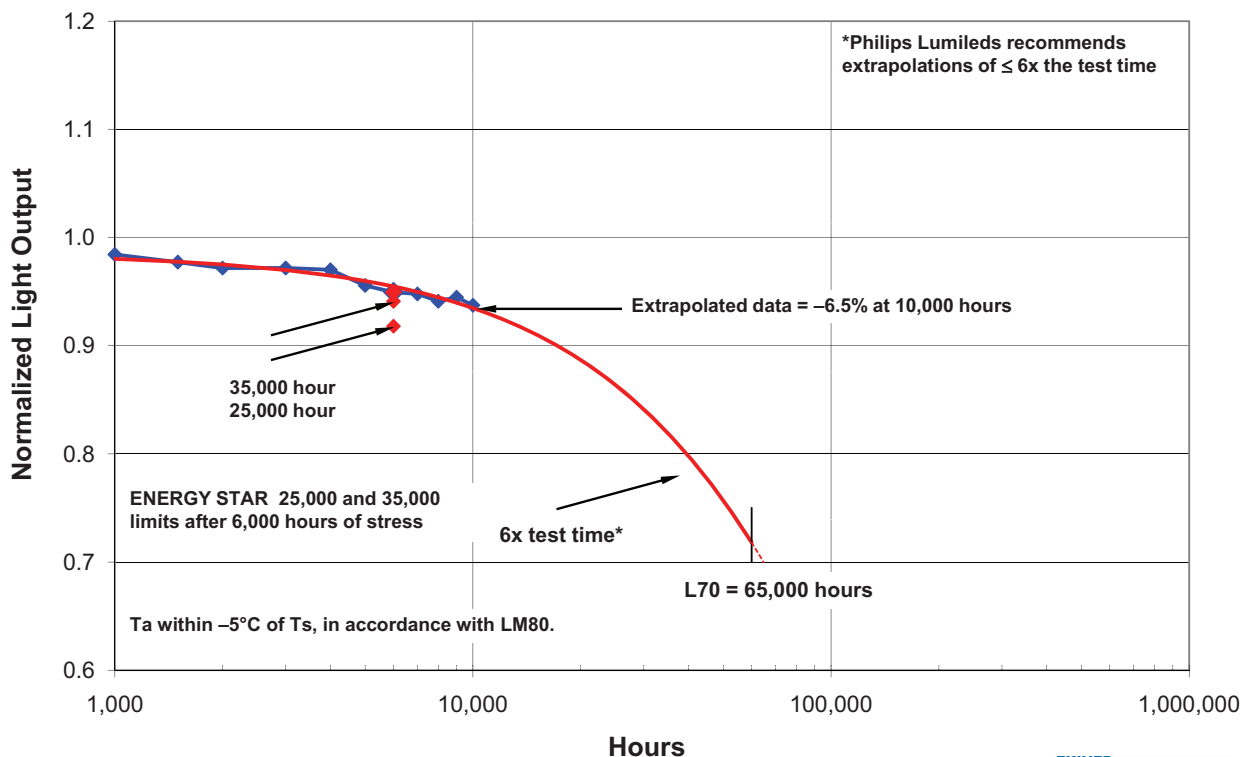
See tables.

9. Lumen maintenance for data for each individual light source along with median value, standard deviation, minimum and maximum lumen maintenance value for all of the light sources

See tables.

PHILIPS

Lumen Maintenance Projection for White LXM3-PWx1 LUXEON Rebel under these conditions 85°C, 0.7A ($T_{\text{junction}} \cong 112^\circ\text{C}$) Normalized to 1 at 24 hours



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www.kenall.com P: 800-4-Kenall F: 847-360-1781 1020 Lakeside Drive Gurnee, Illinois 60031