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Test report of In Situ Temperature Measurement And Lumen Maintenance Projection

Rendered to:

LIGHT EFFICIENT DESIGN, DIV OF TADD LLC
188 S. Northwest Highway Cary, IL60013

For products:

LED Lamp

Models:

LED-8089M40, LED-8089M40C; LED-8089M50, LED-8089M50C;

Test date: May 29, 2015

Test laboratory: LCTECH (Zhongshan) Testing Service Co.,Ltd
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Xiaolan, Zhongshan, Guangdong, China

Laboratory note: *Models LED-8089M40, LED-8089M40C and LED-8089M50, LED-8089M50C are same (LED model, LED align, LED number, size, LED driver) except the LED source color temperature. Model LED-8089M40, LED-8089M40C was selected as the representative test sample.*

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June 1, 2015

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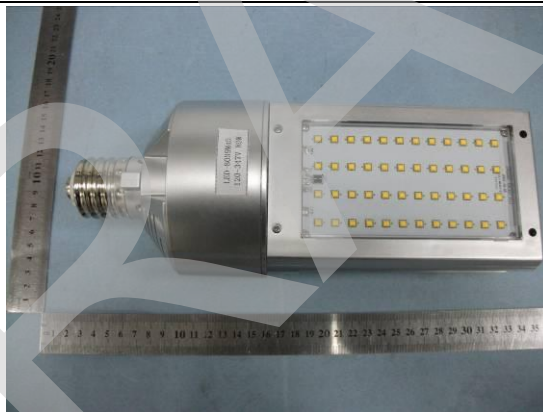
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1 General

1.1 Product Information

Brand Name	Light Efficient Design
Trade Mark	-
LampType	LED Lamp
Model Number	LED-8089M40, LED-8089M40C; LED-8089M50, LED-8089M50C
Rated Inputs	120-347VAC,50/60Hz
Rated Power	80 W
Rated Initial Lamp Lumens	7000 lm
Declared CCT	LED-8089M40, LED-8089M40C: 4000 K; LED-8089M50, LED-8089M50C: 5000 K;
Power Supply	Integral LED driver
Date of Receipt Samples	Dec 8, 2014
Quantity of Receipt Samples	1 unit

Photo



Picture 1



Picture 2



1.2 Standards or methods

The following standards are partly or totally used or referenced for test:

No.	Name
IEC 62560-2011 Cl.10	Self-ballasted LED-lamps for general lighting services by voltage>50V- Safety specifications
IES LM-80-08	Approved Method for Measuring Lumen Maintenance of LED Light Sources
IES TM-21-11	Projecting Long Term Lumen Maintenance of LED Sources

1.3 Equipment list

ID	Instrument	Model name	Cal. date	Next cal. Date
AC Power supply	LC-I-923	CHP-500	2015-02-05	2016-02-04
AC Power supply	LC-I-987	APW-110N	2015-02-05	2016-02-04
Power analyzer	LC-I-928	WT210	2015-02-08	2016-02-08
Power analyzer	LC-I-954	WT210	2015-03-04	2016-03-04
Multimeter	LC-I-972	Fluke 17B	2014-08-15	2015-08-14
J thermocouple	LC-I-096	TT-J-30-SLE(200m/r)	2015-03-02	2016-03-01
Data acquisition/Switch unit	LC-I-098	34970A	2015-03-02	2016-03-01
T&H recorder	LC-I-958	DWRP-B(0)	2014-08-19	2015-08-18

2 Test conducted and method

2.1 Ambient Condition

Test was conducted in an ambient temperature of 25 ± 5 °C. Ambient temperature variations above or below 25 °C was subtracted from or added to temperatures recorded at points on the luminaire.

The ambient temperature was measured by a thermocouple which was immersed in 15 ml of mineral oil in a glass container.

2.2 Temperature Stabilization

Temperatures were measured after they have stabilized when the temperature were changing at a rate less than 1°C per hour and would not rise.

2.3 Thermocouples

Type J thermocouple was used for temperature measurement. The diameter of thermocouple conductor was 0.05mm².

2.4 Draught-free test enclosure

The lamp was positioned in a rectangular draught-proof enclosure with a double skin on the top and on at least three sides, and with a solid base. The double skins were of perforated metal, spaced apart approximately 150mm, with regular perforations of 1 mm to 2 mm diameter, occupying about 40% of the whole area of each skin. The internal surfaces of enclosure are painted with a matt paint.

2.5 Suspension methods

The lamp assembling in the test lampholder was suspended from the top of the enclosure directly by the supply leads in base-up position

2.6 Thermocouples contact

Thermocouples were in contact with the TMP_{LED} location described in LM-80 test report. In order to gain the maximum temperature, if appropriate, more than one thermocouple was contact in these locations. For details information, please refer to clause 3.3 for the photo of thermocouple contact.

3 Test Result

3.1 Electrical data

Criteria Item	Result
Input voltage	277.03 V~60Hz
Input current	0.342 A
Total power	80.86 W
Power factor	0.854

3.2 Temperature data

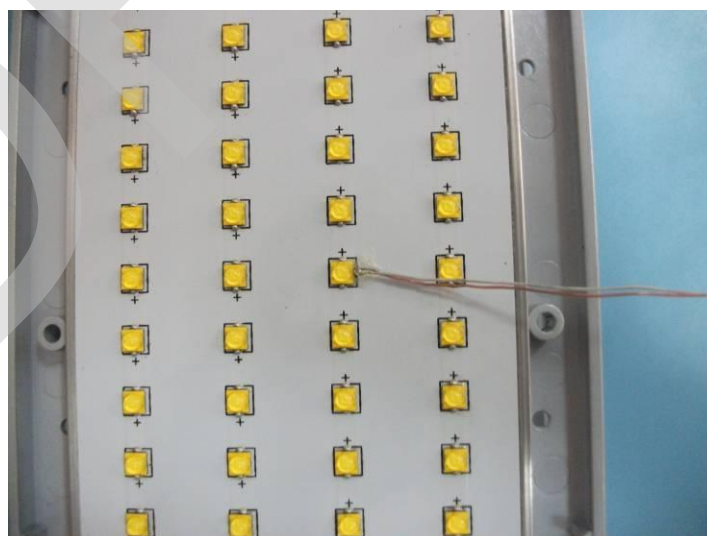
Criteria Item	Result
Total operated period	4.5 hours
Ambient temperature	24.3 °C
Measured maximum Temperature @TMP _{LED}	63.3 °C
Maximum Temperature @TMP _{LED} (Normalized to 25°C)	64.0 °C

3.3 Lumen Maintenance Projection (IESNA TM-21 Method)

Criteria Item	Result
6000 hours lumen maintenance of LED light source	97.01 %
Drive current on each LED light source	530 mA
Projected L ₇₀ lumen maintenance life	202,000 hours
Reported L ₇₀ lumen maintenance life	>36000 hours

Note: Please refer to appendix 2 and 3 for details of TM-21 inputs and results.

3.4 Thermocouple contact photo



**Appendix 1 LM-80 report summary**

Report originated by	Cree, Inc.		
Manufactured by	Cree, Inc.		
LM-80 report No.	CLD-AP73 REV 2		
LED Part Number	XLamp XT-E White LEDs (Series: XTEAWT)		
Number of LED light source tested	25 units		
Drive Current	1250 mA		
Case temperature	55°C	85°C	-
6048 hours lumen maintenance	96.3%	95.6%	-
6048 hours color maintenance($\Delta u'v'$)	0.0008	0.0012	-

Appendix 2 TM-21 inputs

TM-21 Inputs

Instructions

Yellow fields are completed by the user. Fields not used should be left blank. Cyan fields are calculated based on user entries.

First, enter a description of the LED light source tested. Then complete the fields labeled "LM-80 Testing Details". Test duration must be at least 6,000 hours. If only one case temperature data set is to be used (no interpolation), complete only "Tested case temperature 1". For only two case temperature data sets, complete 1 and 2.

Next, further to the right, in the corresponding box(es) for each tested case temperature, enter the test data along with the time (in hours) at which each measurement was taken. Data entered must be normalized then averaged measured data (per TM-21 sections 5.2.1 and 5.2.2).

Enter drive current, *in-situ* temperature data and the percentage of initial lumens to project to in the fields labeled "In-Situ Inputs".

Results can be tailored to estimate lumen maintenance at a specific time by entering a value (t) in the yellow field.

A complete TM-21 report will appear on the next tab labeled "Report".

LM-80 Test Inputs

Description of LED Light Source Tested (manufacturer, model, catalog number)	Test Data for 55°C Case Temperature		Test Data for 85°C Case Temperature		Tested Case Temperature 3	
	Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)
Manufacturer:Cree, Inc. Model:XLamp XT-E White LEDs (Series: XTEAWT)	0	100.00%	0	100.00%		
	168	97.83%	168	98.72%		
	1008	97.42%	1008	98.89%		
	1512	97.28%	1512	97.57%		
	2016	96.97%	2016	97.58%		
	2520	97.01%	2520	97.80%		
	3024	96.60%	3024	97.12%		
	3528	97.23%	3528	97.77%		
	4032	97.57%	4032	97.62%		
	4536	97.25%	4536	97.52%		
	5040	96.83%	5040	96.95%		
	5544	96.76%	5544	96.22%		
	6048	96.33%	6048	95.56%		

LM-80 Testing Details

Total number of units tested per case temperature:	25
Number of failures:	0
Number of units measured:	25
Test duration (hours):	6048
Tested drive current (mA):	1250
Tested case temperature 1 (T _c , °C):	55
Tested case temperature 2 (T _c , °C):	85
Tested case temperature 3 (T _c , °C):	

In-Situ Inputs

Drive current for each LED package/array/module (mA):	530
In-situ case temperature (T _c , °C):	64.8
Percentage of initial lumens to project to (e.g. for L ₇₀ , enter 70):	70

Results

Time (t) at which to estimate lumen maintenance (hours):	6,000
Lumen maintenance at time (t) (%):	97.01%
Calculated L70 (hours):	202,000
Reported L70 (hours):	>36000

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Appendix 3 TM-21 Results

Table 1: Report at each LM-80 Test Condition						Table 2: Interpolation Report (projection based on <i>in-situ</i> temperature entered)	
Description of LED Light Source Tested (manufacturer, model, catalog number)		Manufacturer:Cree, Inc. Model:XLamp XT-E White LEDs (Series: XTEAWT)				$T_{s,1}$ (°C)	55.00
		Test Condition 1 - 55°C Case Temp		Test Condition 2 - 85°C Case Temp		$T_{s,1}$ (K)	328.15
Sample size	25	Sample size	25	Sample size	-	α_1	1.072E-06
Number of failures	0	Number of failures	0	Number of failures	-	B_1	0.974
DUT drive current used in the test (mA)	1250	DUT drive current used in the test (mA)	1250	DUT drive current used in the test (mA)	-	$T_{s,2}$ (°C)	85.00
Test duration (hours)	6,048	Test duration (hours)	6,048	Test duration (hours)	-	$T_{s,2}$ (K)	358.15
Test duration used for projection (hour to hour)	1,512 - 6,048	Test duration used for projection (hour to hour)	1,512 - 6,048	Test duration used for projection (hour to hour)	-	α_2	3.834E-06
Tested case temperature (°C)	55	Tested case temperature (°C)	85	Tested case temperature (°C)	-	B_2	0.986
α	1.072E-06	α	3.834E-06	α	-	E_a/k_b	4.99E+03
B	0.974	B	0.986	B	-	A	4.326E+00
Calculated L70(6k)	308,000	Calculated L70(6k)	89,000	Calculated L70(6k)	-	B_0	0.980
Reported L70(6k)	>36000	Reported L70(6k)	>36000	Reported L70(6k)	-	$T_{s,1}$ (°C)	64.80
						$T_{s,1}$ (K)	337.95
						α	1.667E-06
						Projected L70(6k) at 64.8°C (hours)	202,000
						Reported L70(6k) at 64.8°C (hours)	>36000

Report Generated By: Lin Qiu	Notes: N.A
Company: LCTECH (Zhongshan) Testing Service Co.,Ltd.	
Date: June 1, 2015	

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End of test report