LCTECH

NVLAP LAB CODE 500080-0

IESNA SUSTAINING MEMBER

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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, IL 60013

For products:
LED Lamp

Models:
LED-8088M40/LED-8088M40C,LED-8088E40/LED-8088E40C,LED-8088M57/LED-8088M57C,LED-8088E57/LED-8088E57C

Test date:	June 26, 2015
Test laboratory:	LCTECH (Zhongshan) Testing Service Co.,Ltd 2/F.,Technology and Enterprise Development Center, Guangyuan Road, Xiaolan, Zhongshan, Guangdong, China
Laboratory note:	LED-8088M40,LED-8088M40C,LED-8088E40,LED-8088E40C and LED-8088M57,LED-8088M57C,LED-8088E57,LED-8088E57C is all the same except from lamp base and CCT, model LED-80888M40,LED-8088M40C was selected as the representative test sample.

Complied by:	**Reviewed by:**
Bowen Pang	**Richard Li**
Test Engineer	**Technical Manager**
July 22, 2015	**July 22, 2015**

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1 General

1.1 Product Information

Brand Name	Light Efficient Design
Trade Mark	-
Lamp Type	LED Lamp
Model Number	LED-8088M40/LED-8088M40C, LED-8088E40/LED-8088E40C, LED-8088M57/LED-8088M57C, LED-8088E57/LED-8088E57C
Rated Inputs	120-347V,50/60Hz
Rated Power	50 W
Rated Initial Lamp Lumens	6000lm,
Declared CCT	LED-8088M40/LED-8088M40C, 4000K; LED-8088E40/LED-8088E40C, 4000K; LED-8088M57/LED-8088M57C, 6500K; LED-8088E57/LED-8088E57C, 6500K
Power Supply	Integral LED driver
LED Package, Array or Module	No Provide
Date of Receipt Samples	June 18, 2015
Quantity of Receipt Samples	1 unit
Photo	

Picture 1

Picture 2

1.2 Reference standards or methods

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

No.	Name
ANSI/UL 1598:2008 (Secs. 19.7, 19.10-16)	Luminaires
IES LM-80-08	Approved Method for Measuring Lumen Maintenance of LED Light Sources
IES TM-21-2011	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	2015-02-09	2016-02-08
Power analyzer	LC-I-954	WT210	2015-03-04	2016-03-03
Multimeter	LC-I-972	Fluke 17B	2014-08-15	2015-08-14
J thermocouple	LC-I-096	TT-J-30-SLE(200m/r)	2015-02-19	2016-02-18
Data acquisition/Switch unit	LC-I-098	34970A	2015-02-12	2016-02-11
T&H recorder	LC-I-903	WS-1	2015-03-01	2016-03-01

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 0.05mm^2.

2.4 Draught-free test enclosure

The luminaire 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 Mounting methods

The luminaire was mounted on a designated bracket for flood luminaires or road luminaires.

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 3.4 for the photo of thermocouple contact.

3 Test Result

3.1 Electrical data

Criteria Item	Result
Input voltage	277.02 V~60Hz
Input current	0.211 A
Total power	52.50 W
Power factor	0.896

3.2 Temperature data

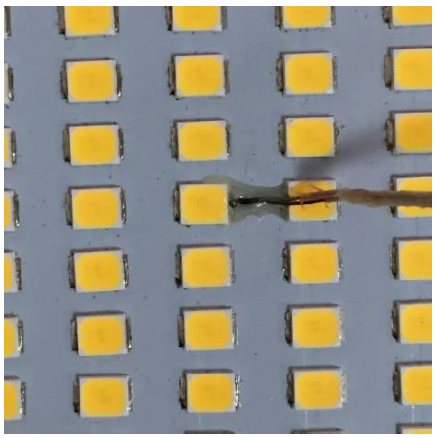
Criteria Item	Result
Total operated period (hours)	4.2 hours
Ambient temperature	25.5°C
Measured maximum Temperature @TMP_{LED}	80.6°C
Maximum Temperature @TMP_{LED}(Normalized to 25°C)	**80.1°C**

3.3 Lumen Maintenance Projection (IESNA TM-21 Method)

Criteria Item	Result
6000 hours lumen maintenance of LED light source	96.23%
Drive current on each LED light source	150 mA
Projected L_{70} lumen maintenance life	44000 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	Guangzhou Hongli Opto-Electronic Co., Ltd..	
Manufactured by	Guangzhou Hongli Opto-Electronic Co., Ltd.	
LM-80 report No.	RSZ120424502-10-M4	
LED Model	HL-A-2835DW-S1-08-HR3	
LED Part Number	HL-A-2835DW-S1-08-HR3	
Number of LED light source tested	25 units	
Drive Current	150 mA	
Case temperature	75°C	85°C
6000 hours lumen maintenance	96.95%	95.19%
6000 hours color maintenance(Δu'v')	0.0009	0.0011

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".

Description of LED Light Source Tested (manufacturer, model, catalog number)
Model: HL-A-2835DW-S1-08-HR3, manufactured by GuangZhou HongLi Opto-Electronic Co.,Ltd,

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):	6000
Tested drive current (mA):	150
Tested case temperature 1 (T_c, °C):	55
Tested case temperature 2 (T_c, °C):	75
Tested case temperature 3 (T_c, °C):	85

LM-80 Test Inputs

Test Data for 55°C Case Temperature		Test Data for 75°C Case Temperature		Test Data for 85°C Case Temperature	
Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)
0	100.00%	0	100.00%	0	100.00%
1000	99.99%	1000	100.05%	1000	99.94%
2000	99.86%	2000	99.69%	2000	99.61%
3000	99.29%	3000	99.18%	3000	98.59%
4000	98.38%	4000	98.32%	4000	97.17%
5000	97.93%	5000	97.70%	5000	96.04%
6000	97.34%	6000	96.96%	6000	95.19%

In-Situ Inputs

Drive current for each LED package/array/module (mA):	150
In-situ case temperature (T_c, °C):	80.1
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) (%):	96.23%
Calculated L70 (hours):	44,000
Reported L70 (hours):	>36000

Appendix 3 TM-21 Results

TM-21 Report

Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)	Model: HL-A-2835DW-S1-08-HR3, manufactured by GuangZhou HongLi Opto-Electr				
Test Condition 1 - 55°C Case Temp		**Test Condition 2 - 75°C Case Temp**		**Test Condition 3 - 85°C Case Temp**	
Sample size	25	Sample size	25	Sample size	25
Number of failures	0	Number of failures	0	Number of failures	0
DUT drive current used in the test (mA)	150	DUT drive current used in the test (mA)	150	DUT drive current used in the test (mA)	150
Test duration (hours)	6,000	Test duration (hours)	6,000	Test duration (hours)	6,000
Test duration used for projection (hour to hour)	1,000 - 6,000	Test duration used for projection (hour to hour)	1,000 - 6,000	Test duration used for projection (hour to hour)	1,000 - 6,000
Tested case temperature (°C)	55	Tested case temperature (°C)	75	Tested case temperature (°C)	85
α	5.773E-06	α	6.459E-06	α	1.050E-05
B	1.008	B	1.009	B	1.014
Calculated L70(6k)	63,000	Calculated L70(6k)	57,000	Calculated L70(6k)	35,000
Reported L70(6k)	>36000	Reported L70(6k)	>36000	Reported L70(6k)	35,000

Table 2: Interpolation Report (projection based on *in-situ* temperature entered)	
$T_{s,1}$ (°C)	75.00
$T_{s,1}$ (K)	348.15
α_1	6.459E-06
B_1	1.009
$T_{s,2}$ (°C)	85.00
$T_{s,2}$ (K)	358.15
α_2	1.050E-05
B_2	1.014
E_a/k_b	6.06E+03
A	2.331E+02
B_0	1.011
$T_{s,j}$ (°C)	80.10
$T_{s,j}$ (K)	353.25
α_j	8.303E-06
Projected L70(6k) at 80.1°C (hours)	44,000
Reported L70(6k) at 80.1°C (hours)	>36000

Report Generated By: Bowen Pang	Notes: N.A
Company: LCTECH (Zhongshan) Testing Service Co.,Ltd.	
Date:July 21, 2015	

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****End of test report****

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