LCTECH

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, IL60013

For products:
LED Lamp

Models:
LED-8032M42, LED-8032M42C;
LED-8032M57, LED-8032M57C

Test date:	Oct 24, 2014
Test laboratory:	LCTECH (Zhongshan) Testing Service Co.,Ltd 2/F.,Technology and Enterprise Development Center, Guangyuan Road, Xiaolan, Zhongshan, Guangdong, China
Laboratory note:	*Models LED-8032M42, LED-8032M42C and LED-8032M57, LED-8032M57C are same (LED model, LED align, LED number, size, LED driver) except the LED source color temperature. Model LED-8032M42, LED-8032M42C was selected as the representative test sample..*

Complied by:	**Reviewed by:**
Lin Qiu	**Henry Li**
Test Engineer	**Technical Manager**
Nov 4, 2014	**Nov 6, 2014**

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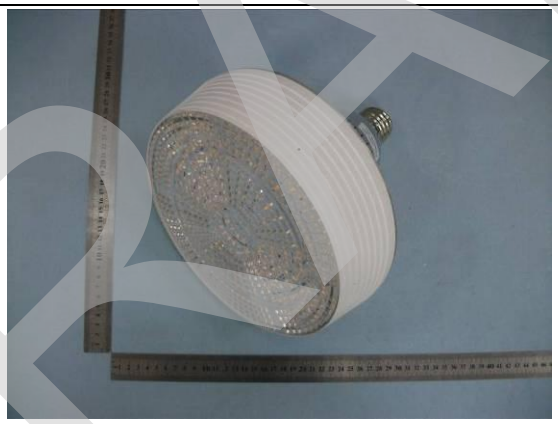
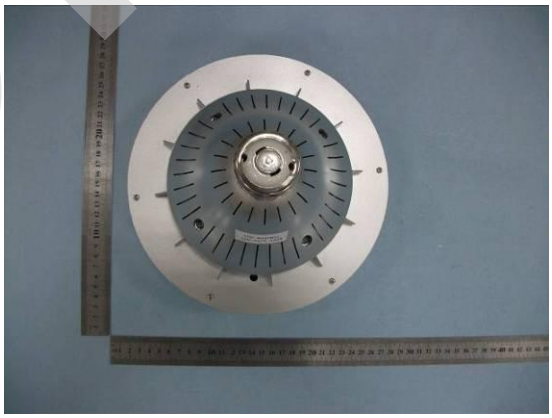
1 General

1.1 Product Information

Brand Name	Light Efficient Design
Trade Mark	-
LampType	LED Lamp
Model Number	LED-8032M42, LED-8032M42C; LED-8032M57, LED-8032M57C
Rated Inputs	120-347VAC,50/60Hz
Rated Power	150 W
Rated Initial Lamp Lumens	15000 lm
Declared CCT	LED-8032M42, LED-8032M42C: 4000 K; LED-8032M57, LED-8032M57C: 5700 K
Power Supply	Integral LED driver
Date of Receipt Samples	Oct 7, 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	2014-03-04	2015-03-03
AC Power supply	LC-I-953	APW-110N	2014-03-04	2015-03-03
Power analyzer	LC-I-928	WT210	2014-03-21	2015-03-20
Power analyzer	LC-I-954	WT210	2014-03-04	2015-03-03
J thermocouple	LC-I-096	TT-J-30-SLE(200m/r)	2014-02-20	2015-02-19
Data acquisition/Switch unit	LC-I-098	34970A	2014-03-04	2015-03-03
T&H recorder	LC-I-903	WS-1	2014-03-04	2015-03-03

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 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	277.01 V~60Hz
Input current	0.557 A
Total power	148.26 W
Power factor	0.961

3.2 Temperature data

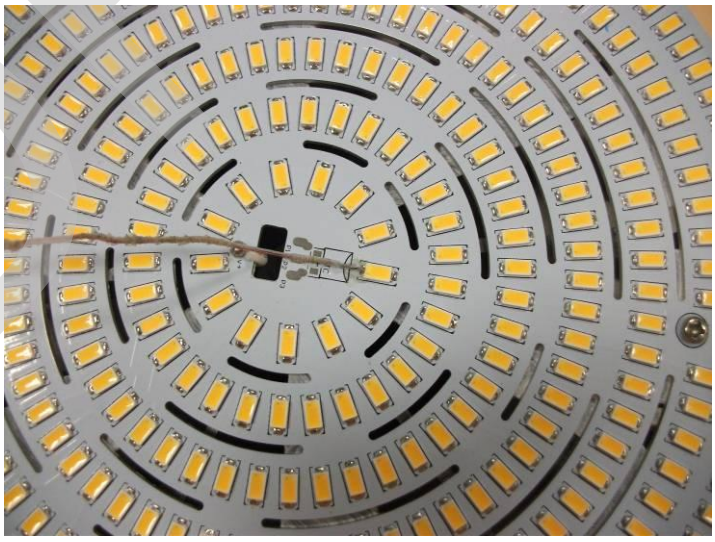
Criteria Item	Result
Total operated period	3.5 hours
Ambient temperature	25.6 °C
Measured maximum Temperature @TMP_{LED}	56.1 °C
Maximum Temperature @TMP_{LED}(Normalized to 25°C)	**55.5 °C**

3.3 Lumen Maintenance Projection (IESNA TM-21 Method)

Criteria Item	Result
6000 hours lumen maintenance of LED light source	97.83 %
Drive current on each LED light source	100 mA
Projected L_{70} lumen maintenance life	**146,000 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	SAMSUNG		
Manufactured by	SAMSUNG		
LM-80 report No.	SLED-13-007		
LED Part Number	SPMWHT541MXXXXXXXX		
Number of LED light source tested	30 units		
Drive Current	150 mA		
Case temperature	55°C	55°C	55°C
6000 hours lumen maintenance	98.10%	98.10%	98.10%
6000 hours color maintenance(Δu'v')	0.0005	0.0005	0.0005

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)
Manufacturer:SAMSUNG Model:SPMWHT541MXXXXXXXX

LM-80 Testing Details	
Total number of units tested per case temperature:	30
Number of failures:	0
Number of units measured:	30
Test duration (hours):	6000
Tested drive current (mA):	150
Tested case temperature 1 (T_c, C):	55
Tested case temperature 2 (T_c, C):	85
Tested case temperature 3 (T_c, C):	105

LM-80 Test Inputs

Test Data for 55 C Case Temperature		Test Data for 85 C Case Temperature		Test Data for 105 C Case Temperature	
Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)
0	100.00%	0	100.00%	0	100.00%
500	99.40%	500	99.30%	500	99.60%
1000	99.40%	1000	99.00%	1000	99.90%
2000	98.90%	2000	98.20%	2000	99.70%
3000	98.80%	3000	97.70%	3000	98.90%
4000	98.60%	4000	97.60%	4000	97.70%
5000	98.40%	5000	97.40%	5000	96.20%
6000	98.10%	6000	97.30%	6000	95.00%

In-Situ Inputs

Drive current for each LED package/array/module (mA):	100
In-situ case temperature (T_c, C):	55.5
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) (%):	97.83%
Calculated L70 (hours):	146,000
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)		Manufacturer:SAMSUNG Model:SPMWHT541MXXXXXXXX						
Test Condition 1 - 55 C Case Temp		Test Condition 2 - 85 C Case Temp		Test Condition 3 - 105 C Case Temp	
Sample size	30	Sample size	30	Sample size	30
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)	85	Tested case temperature (C)	105
α	2.373E-06	α	3.205E-06	α	1.060E-05
B	0.995	B	0.990	B	1.016
Calculated L70(6k)	148,000	Calculated L70(6k)	108,000	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)	55.00
$T_{s,1}$ (K)	328.15
α_1	2.373E-06
B_1	0.995
$T_{s,2}$ (C)	85.00
$T_{s,2}$ (K)	358.15
α_2	3.205E-06
B_2	0.990
E_a/k_b	1.18E+03
A	8.576E-05
B_0	0.992
$T_{s,i}$ (C)	55.50
$T_{s,i}$ (K)	328.65
α_i	2.386E-06
Projected L70(6k) at 55.5 C (hours)	146,000
Reported L70(6k) at 55.5 C (hours)	>36000

Report Generated By: Lin Qiu	Notes: N.A
Company: LCTECH (Zhongshan) Testing Service Co.,Ltd.	
Date:Nov 4,2014	

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