TESTING
NVLAP LAB CODE 600106-0

ENERGY STAR ® Luminaire ISTMT Test Report

ENERGY STAR® Program Requirements Product Specification for Luminaires - Version 2.2

Prepared For

Beyond LED Technology

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Catalog Number
D228-20W-90--****

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N/A

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1.0 Test List

Test Item	Test	Test Date	Test Model	Tests Conducted By
1	Integrating Sphere Test	9/17/2020	D236-90-5000-WH	Ethan Song
2	Goniophotometer Test	9/10/2020	D236-90-5000-WH	Ethan Song
3	Operating Frequency Test	9/19/2020	D236-90-5000-WH	Ethan Song
4	Transient Protection Test	9/19/2020	D236-90-5000-WH	Ethan Song
5	Start Time Test	9/19/2020	D236-90-5000-WH	Ethan Song
6	Standby Power Consumption	N/A	N/A	N/A
7	Flicker Test	9/19/2020	D236-90-5000-WH	Ethan Song
8	In-Situ Temperature Measurement Test	10/16/2020	D236-90-5000-WH	Ethan Song

Remark (if any)

1. UL test equipment information is recorded on Meter Use in UL's Aurora database.

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2.0 Test Summary

ENERGY STAR® Program Requirements Product Specification for Luminaires - Version 2.2

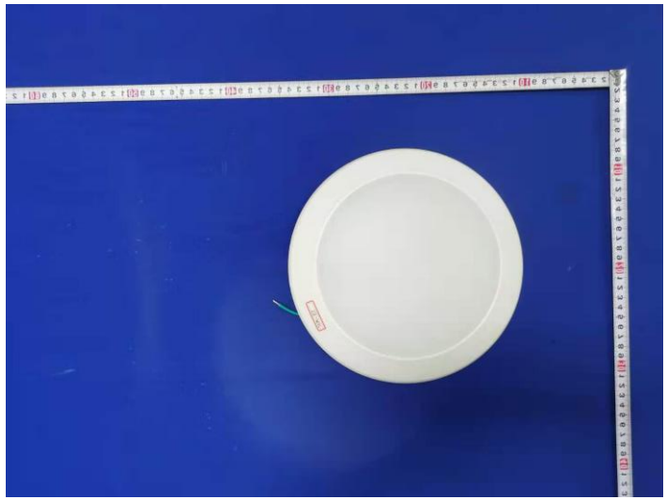
SSL Downlight retrofits			
Requirement Category	**Test Method**	**Requirement**	**Test Value**
Efficacy (lm/W)	IES LM-79-08	Downlights: • Recessed • Surface • Pendant: 55 lm/W	85.25
Light Output (lm)	IES LM-79-08	≤ 4.5" aperture: 345 lumens > 4.5" aperture: 575 lumens	1732.3
Zonal Lumen Density	IES LM-79-08	Luminaire shall deliver a minimum of 75% of total lumens within the 0-60° zone (axially symmetric about the nadir)	75.70%
CCT (K)	ANSI C78.377-2011	The luminaire, retrofit kit, or replaceable LED light engine or module chromaticity shall also fall within the corresponding 7step chromaticity quadrangle as defined in ANSI C78.377-2015 or C78.377-2017.	2836
CRI	IES LM-79-08, CIE 13.3-1995	The luminaire, retrofit kit, or LED light engine shall be capable of meeting or exceeding Ra ≥ 80	95.45
R9	IES LM-79-08, CIE 13.3-1996	The luminaire, retrofit kit, or LED light engine shall be capable of meeting or exceeding R9 > 0.	66.5
Color Angular Uniformity	IES LM-79-08 or ANSI/IES LM-79-19 IES LM-58-13 CIE 15: 2004	Throughout the beam angle, the variation of chromaticity shall be within a total linear distance of 0.006 from the weighted average point on the CIE 1976 (u',v') diagram.	0.001
Lumen Maintenance & Light Source Life (hours)	IES LM-80-08*, IES TM-21-11*	L70(6K) ≥ 25,000 hours for indoor; L70(6K) ≥ 35,000 hours for outdoor; L70 (6K)≥ 50,000 h for inseparable luminaires	>54000
Color Maintenance	IES LM-84-14	≤ 0.007 on the CIE 1976 (u',v') diagram	0.004
Start time(ms)	ENERGY STAR Start Time Test Method	1s for connected luminaires;750 ms for other luminaires.	15.35
Power Factor	C82.77-10:2014	power ≤ 5 watts: PF ≥ 0.5; power > 5 watts: PF ≥ 0.7	0.9964
Transient Protection	IEEE C62.41.2-2002	Survival	Survival
Standby Power Consumption (W)	IEC 62301 ED.2.0 B	Shall not draw power in the off state.	N/A
Operating Frequency (Hz)	N/A	Frequency ≥ 120 Hz	120.3

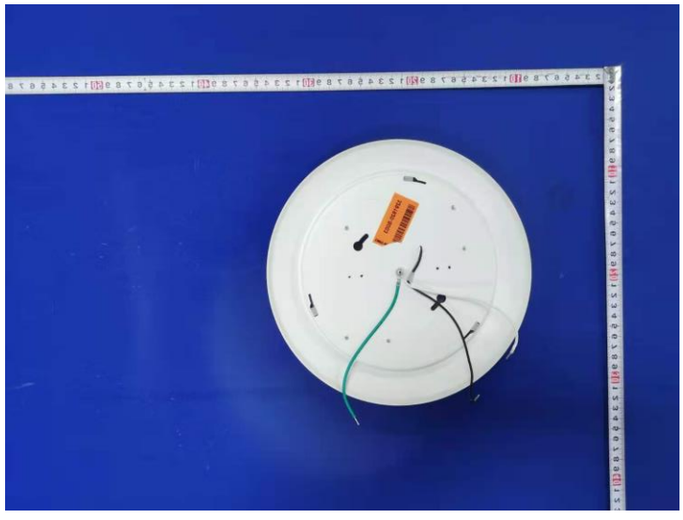
Flicker: Short Term Flicker Indicator (Pst)	NEMA 77-2017	Optional: meet NEMA 77-2017 for temporal light modulation limits.	4.30
Flicker: Stroboscopic Visibility Measure (SVM)	NEMA 77-2017	Optional: meet NEMA 77-2017 for temporal light modulation limits.	3.73
Light Source Replaceability	N/A	Fluorescent & Non-Directional LED luminaire	N/A
LED Tc Temperature (°C)	ANSI/UL 153:2002 ANSI/UL 1598:2008	Within the highest test temperature in LM-80 report	77.3
Driver Case Temperature (°C)	ANSI/UL 153:2002 ANSI/UL 1598:2008	≤ TMPC driver manufacturer's maximum recommended temperature	72.1
Recessed Downlight Thermal Performance	N/A	Insulation contact & Airtight construction	N/A
SAFETY REQUIREMENTS for luminaire and driver	UL Safety standards	Safety documentation	To be determine
Dimming: Noice*	N/A	24dBA at 1 meter	18
Dimming: Range (Minimum)	N/A	≤20%	1.53%
Labeling & Packaging	N/A	Relevant document	N/A
WARRANTY REQUIREMENTS	N/A	no less than 3 years	5
Lighting Toxics Reduction Requirements	N/A	Relevant Documentations	N/A

3.0 Production Description

Luminaire Description: SSL Downlight retrofits
Rated Voltage: 120Vac
Frequency: 50/60Hz
LED Package: XUYU OPTOELECTRONICS（SHENZHEN）CO.,LTD/9.2835W3V32F-S02
Representive Model: D236-90-5000-WH
Family model: D228-20W-90-**-**(First ** means Color temperature (CCT), and it can be 27, 30, 35, 40, 50; Second** means product color, and it can be WH, BR, BL, NI, GR; WH=White, BR=

Photos of Luminaire Characteristics





4.0 Photometric Measurements

4.1 Integrating Sphere Test

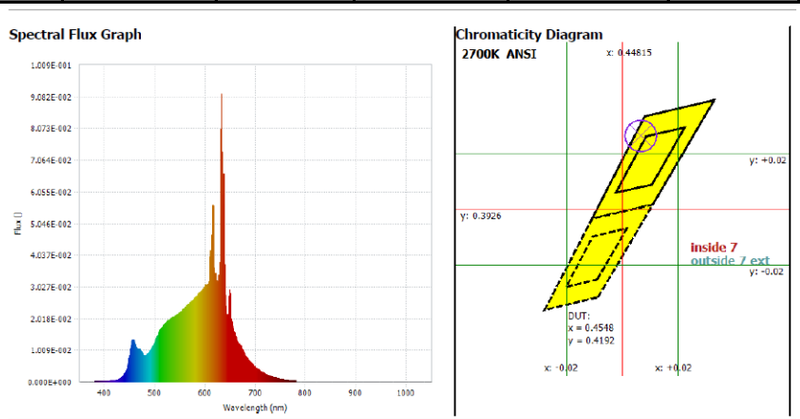
Model No.	D236-90-5000-WH	Sample ID.	3291920-S002	Temperature (°C)	25
Operate time (Min.)	90	Stabilization time (Min.)	45		

Test Method

1. The sample was tested according to the IES LM-79-2008.
2. Photometric paramters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature inside the sphere was maintained at 25°C ± 1°C.
3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. The sample was operated at 120 Volts AC, 60Hz. It was stabilized before measurement was made. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 1 nm intervals over the range of 380 to 780 nm.

Integrating Sphere Conditions and Results

Model Number	Orientation	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	CCT (K)	CRI (Ra)	R9	Luminous Flux (lm)	Luminous Efficacy (lm/W)
D236-90-5000-WH	Horizontal	119.93	60	0.170	20.43	0.9964	2836	95.5	66.5	1764.1	86.35



5.0 Photometric Measurements

5.1 Goniophotometer Test

Model No.	D236-90-5000-WH	Sample ID.	3291920-S002
Opreate time (Min.)	90	Stabilization time (Min.)	45

Test Method

1.The sample was tested according to the IES LM-79-2008, and the product is assume to be brand new without seasoning.
2.Photometric parameters were measured using a type C goniophotometer and software.
3.The ambient temperature shall be maintained at 25° C ± 1° C, measured at a point not more than 1 m from the sample and at the same height as the sample. The reference standard lamp is rated current 3.8601A, 3.8618A, 3.8466A omni-directional Incandescent lamp and was calibrated by National Institute of Metrology P.R.China.
4.The samples were operated at rated voltage and was stabilized before measurement. Luminous flux, luminaire efficacy, zonallumen were calculated from the software taken at 1° vertical intervals and 22.5° horizontal intervals. Photometric distance was more than five times of the largest dimension of the test SSL product.

Goniophotometer Test Conditions

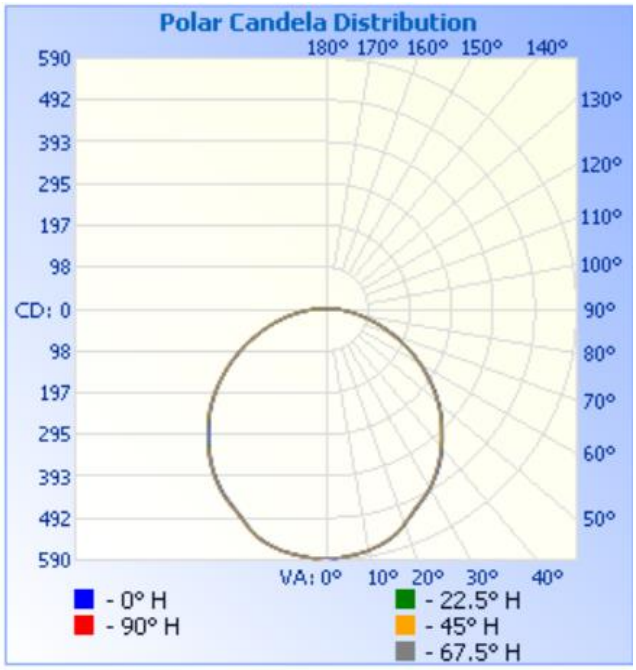
Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Orientation
25.0	119.94	60	0.170	20.32	0.9964	Horizontal

Test Results

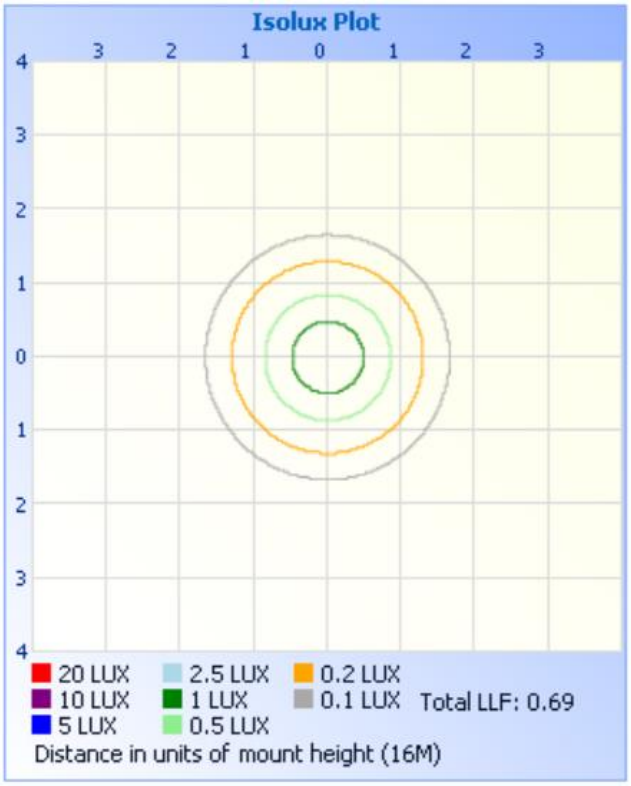
Flux (lm)	Zonal Lumen Requirement (0-60°)	Field Angle (10%)		Beam Angle (50%)		Luminous Efficacy (lm/W)
		Horizontal Spread	Vertical Spread	Horizontal Spread	Vertical Spread	
1732.3	75.7%	167.4	167.8	112.7	112.6	85.25

Goniophotometer Test (Cont'd)

Light Distribution Curve



Isolux Plot



Goniophotometer Test (Cont'd)

Zonal Lumen Summary

Zonal Lumen Summary		
Zone	Lumens	% Luminaire
0-30	451.2	26%
0-40	739.0	42.7%
0-60	1,311.1	75.7%
60-90	398.5	23%
70-100	203.6	11.8%
90-120	17.5	1%
0-90	1,709.6	98.7%
90-180	22.7	1.3%
0-180	1,732.3	100%

Lumens Per Zone

Lumens Per Zone					
Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	14.0	0.8%	90-95	10.7	0.6%
5-10	41.5	2.4%	95-100	4.0	0.2%
10-15	67.7	3.9%	100-105	1.2	0.1%
15-20	91.1	5.3%	105-110	0.6	0%
20-25	110.1	6.4%	110-115	0.5	0%
25-30	126.8	7.3%	115-120	0.5	0%
30-35	139.9	8.1%	120-125	0.5	0%
35-40	147.9	8.5%	125-130	0.5	0%
40-45	150.7	8.7%	130-135	0.5	0%
45-50	149.1	8.6%	135-140	0.5	0%
50-55	142.1	8.2%	140-145	0.5	0%
55-60	130.1	7.5%	145-150	0.5	0%
60-65	114.4	6.6%	150-155	0.5	0%
65-70	95.3	5.5%	155-160	0.5	0%
70-75	75.2	4.3%	160-165	0.4	0%
75-80	55.2	3.2%	165-170	0.3	0%
80-85	36.8	2.1%	170-175	0.2	0%
85-90	21.6	1.2%	175-180	0.1	0%

6.0 Color Angular Uniformity

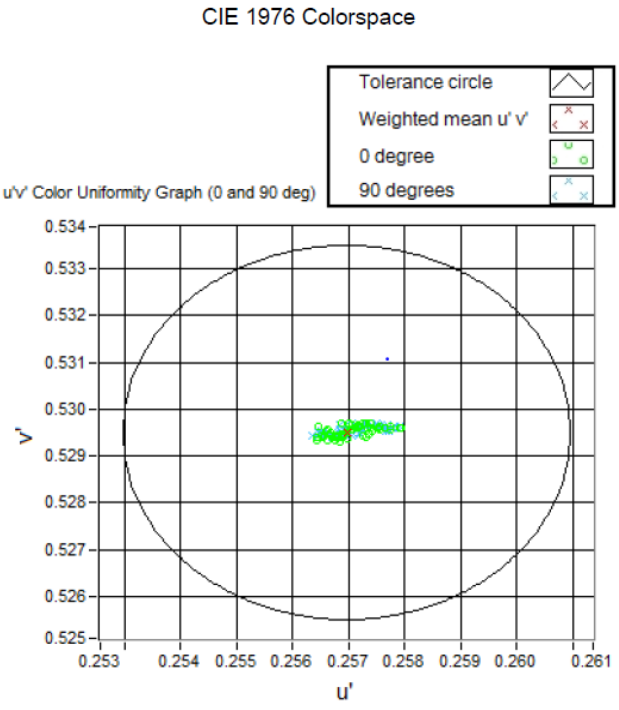
Model No.	D236-90-5000-WH	Sample ID.	3291920-S002

Test Method

1. The sample was tested according to the IES LM-79-2008.
2. Photometric paramters were measured using a type C goniophotometer and software.
3. The ambient temperature shall be maintained at 25° C ± 1° C, measured at a point not more than 1 m from the sample and at the same height as the sample.
4. The sample was operated at 120 Volts AC, 60Hz. It was stabilized before measurement was made.Color spatial uniformity was calculated from the software taken at 1° vertical intervals and 90° horizontal intervals.

Test Results

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Maximum Δu'v'
25.0	119.94	60	0.170	20.32	0.001



7.0 Electrical Test

7.1 Operating Frequency Test

Model No.	D236-90-5000-WH	Sample ID.	3291920-S002

Test Method

1. The sample was tested according to ANSI C82.2-2002 for fluorescent luminaires.
2. Each test sample was operated at rated input voltage. Light output waveform shall be measured with a photodetector, transimpedance amplifier and oscilloscope. The AC ripple on the output DC line was measured and recorded by the oscilloscope according to Energy Star directions.

Test Results

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Operating Frequency (Hz)
25.0	120.00	60	120.3

8.0 Source Start Time & Run-Up time

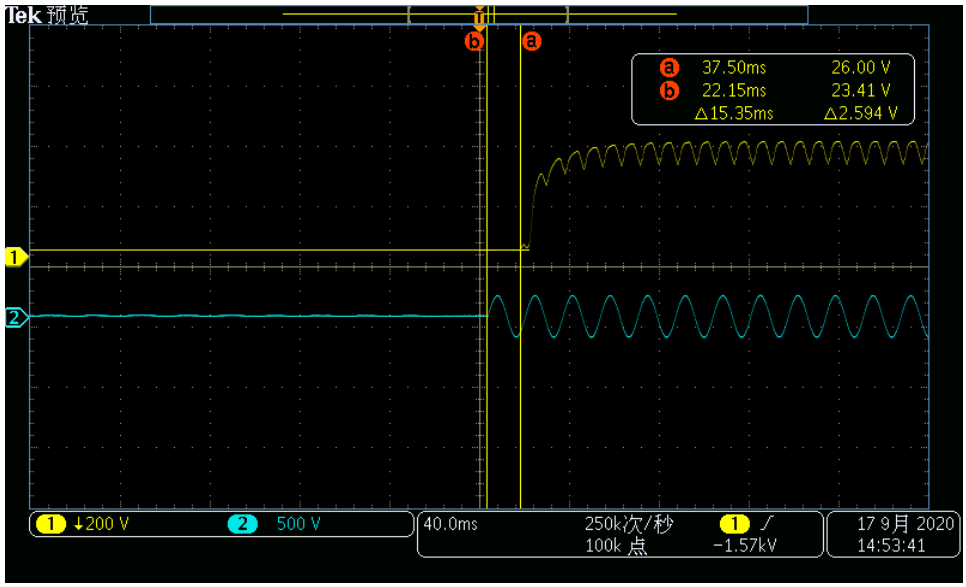
Model No.	D236-90-5000-WH	Sample ID.	3291920-S002

Test Method

1. The sample was tested according to ENERGY STAR Start Time Test and ENERGY STAR Run-Up Time Test for fluorescent luminaires only.
2.Each test sample was operated in its designated orientation at rated input voltage in a 25 ± 5º C ambient . A photodetector is used to monitor the luminaire light output. Time was recorded when the sample was fully illuminated and reached 90% of stabilized lumen output.

Test Results

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Start Time (ms)	Run-Up time (s)
25.0	120.00	60	15.35	N/A



9.0 Electrical Test

9.1 Transient Protection Test

Model No.	D236-90-5000-WH	Sample ID.	3291920-S002

Test Method

The transient protection tests at ambient temperature were performed on one sample. Each sample was operated at rated input voltage in the specific orientation during the tests. A Model PSVAGE8000 test system with an 100kHz Ring Wave Module and a Coupler/Decoupler Module was used to generate the 2500 volt ring wave transient strike across the luminaire contacts. Each wave consisted of a 0.5 microsecond rise time. Seven strikes were performed on each sample in accordance with ANSI/IEEE C62.41 (Category A): Recommended Practice on Surge Voltages in Low – Voltage AC Circuits.

Test Results

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	After Test - Seven Strikes
25	120.00	60	Survival

10.0 Electrical Test

10.1 Standby Power Consumption

Model No.	D236-90-5000-WH	Sample ID.	3291920-S002

Test Method

A sample was tested according to the IEC 62301-2011 Edition 2. The sample was operated at rated voltage and frequency, working in the active and standby mode*. For loads greater than or equal to 10 W, at least three significant figures shall be reported. After stability, the electral parameter would be measured using proper menthod** and the value of Ue*** was calculated according to the Annex D. The test results shall be compliant with the relative requirements#.

Test Results

Temperature (°C)	Mode	Voltage (Vac)	Frequency (Hz)	Current (mA)	Power Factor	Standby Power (W)
N/A	N/A	N/A	N/A	N/A	N/A	N/A

11.0 Flicker Test

Dimmer Information

Dimmable/Non-dimmable	Dimming Type		Prodcut Model No.	Sample ID	Temperature (°C)
Dimmable	**Manufacture**	LUTRON	D236-90-5000-WH	3291920-S002	24.8
	Model Number	ASAP			

Test Method

1. The test was performed using a relative photometry method, according to NEMA 77-2017.
2. The measurement was taken one test sample combined with the dimmers. The sample was tested at the rated electrical parameter, and allowed to stabilize and verify by taking light output measurements every minute with interval 0.00004 seconds and equipment period 2 seconds, until consecutive measurements are no more than 0.5% apart.

Test Results

Test Condition	Input Voltage (V)	Input Current (A)	Power (W)	Power Factor	Light Output	Pst	SVM
Without dimmer	119.94	0.1700	20.32	0.9964	1198.33	3.2657	2.91302
Maximum Level (100%)	120.05	0.1543	18.27	0.9598	1062.59	2.0816	3.21133
Maximum Level (50%)	120.07	0.0924	9.42	0.7497	531.77	2.3928	3.832402
Minimum Level	120.08	0.0169	0.99	0.3235	16.25	3.1992	0.15397

12.0 Dimming Test

Model No.	D236-90-5000-WH	Sample ID.	3291920-S002

Test Method

1. The test was performed using a relative photometry method, according to ENERGY STAR Recommended Practice - Light Output on a Dimmer and ENERGY STAR® Recommended Practice - Noise.
2. The measurement was taken one test sample combined with the dimmers. The sample was tested at the rated electrical parameter, and allowed to stabilize and verify by taking light output measurements every minute, until consecutive measurements are no more than 0.5% apart.
3. The noise test shall be conducted on sample in the sound chamber with one microphone. The microphoe was located in six position to get the peak noise.

Test Results

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Baseline Light Output (lx)		Maximum Light Output (lx)	Minimum Light Output (lx)
24.8	120.01	60	1062.59		1198.33	16.25
Ambient Sound (dBA)	**Peak Noise at BLO (dBA)**	**Peak Noise at MaxLO (dBA)**	**Peak Noise at MinLO (dBA)**	**Position**	**Maximum Light Output Ratio (%)**	**Minimum Light Output Ratio (%)**
18.0	18.0	18.1	18.0	Back for base	112.77%	1.53%

13.0 In-Situ Temperature Measurement Test

Model No.	D236-90-5000-WH	Sample ID.	3291920-S002

Test Method

1. In-Situ Temperature Measurement Test is conducted according to the UL1598-2008, Section 14 or UL 153-2002, Sections 124.
2. The testing was conducted in a room with ambient temperature of 25°C ± 5°C. The apparatus construction followed those described in UL1598-2008 for normal temperature testing. Thermocpuples were placed on the LED package in the locations indicated by LM-80 report. The temperature was recorded after the lamp was operating for a minimum of 7.5 hours.

In-Situ Temperature Measurement Test Conditions

Temperature	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Orientation
25.0	119.94	60	0.170	20.32	0.9964	Horizontal

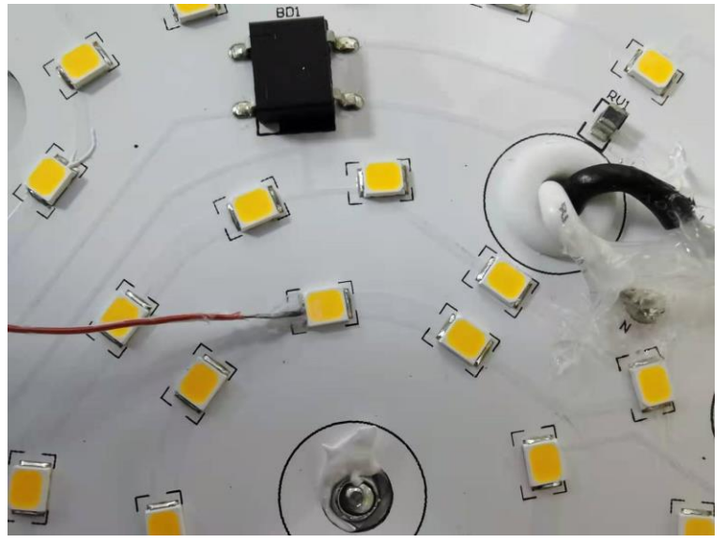
Test Results

Thermocouple Location	Measured Current (mA)	Temperature for Lighting source (°C)		LED Model Number	LM-80 Limit Current (mA)	LM-80 Limit Temp. (°C)
		Test result	Test result (Correct to 25 °C)			
TMP of LEDs	56	77.3	77.3	9.2835W3V32F-S02	150	105
Ambient temperature	N/A	25.0	25.0			

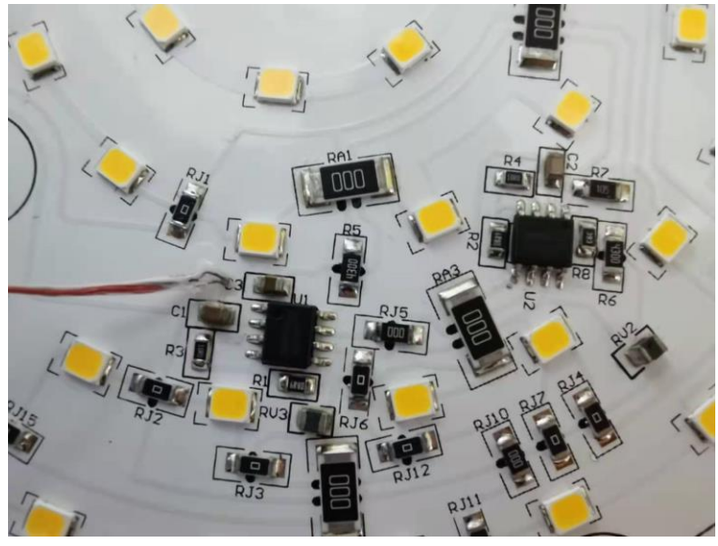
Thermocouple Location	Temperature for LED driver (as indicated by manufacturer		LED driver Model Number	LED Driver Tc Temp. (°C)
	Test result	Test result (Correct to 25 °C)		
TMP of LED drivers	72.1	72.1	Built in luminaire	105
Ambient temperature	25.0	25.0		

13.1 In-Situ Temperature Measurement Test (Cont'd)

Test Photos for LEDs



Test Photos for LED Drivers



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