REPORT

545 E. Algonquin Rd., Arlington Heights, IL 60005

Project No. G101718486 Date: July 10, 2014

REPORT NO. 101718486CHI-001A

TEST OF ONE LED DECORATIVE PENDANT

MODEL NO. SWL-23P-SN
LED MODEL NO. SAMSUNG LM231A
DRIVER MODEL NO. INVENTRONICS, LLC-040S070RSP

RENDERED TO

BLACKJACK LIGHTING
2961 KINGSTON DRIVE
BUFFALO GROVE, IL 60089

TEST: Electrical and Photometric tests as required to the IESNA test standard.

STATEMENT OF LIMITATION: This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

AUTHORIZATION: The testing performed was authorized by signed quote number 500537269.

STANDARDS USED: The following American National Standards or Illuminating Engineering Society of North America Test Guides were used in part or totally to test each specimen:

IESNA LM-79 - 2008: Electrical and Photometric Measurements of Solid State Lighting

ANSI NEMA ANSLG C78.377: 2012: Specifications of the Chromaticity of Solid State Lighting Products

ANSI/UL 1598-2008: Standard for Safety of Luminaires

Energy Star Manufacturer's Guide Version 2.1 (2010): Guide for Qualifying Solid State Lighting Luminaires

DESCRIPTION OF SAMPLE: The client submitted one production sample of model number 2SWL-M9PL-SN. The sample was received by Intertek on June 26, 2014, in undamaged condition and one sample was tested as received. The sample designation was 06262014015554.

DATES OF TESTS: July 7, 2014 through July 10, 2014.

SUMMARY

Model No.:	SWL-23P-SN
Description:	LED decorative pendant

	Result	
Criteria	Sphere	Goniometer
Total Lumen Output (Lumens)	3577	3464
Total Power (W)	41.61	41.74
Luminaire Efficacy (LPW)	85.96	82.99

Criteria	Result
Power Factor	0.974
Current ATHD %	16.02
Correlated Color Temperature (CCT - K)	3102
Color Rendering Index (CRI - Ra)	83.0
Color Rendering Index (CRI - R9)	17.3
DUV	0.002
Chromaticity Coordinate (x)	0.428
Chromaticity Coordinate (y)	0.397
Chromaticity Coordinate (u')	0.248
Chromaticity Coordinate (v')	0.517
In-Situ Source Temperature Point (°C)	35.6
Maximum In-Situ Driver Case Temperature (°C)	85.6
Reported L70(10K) Hours@35.6°C (hrs)	>60000

EQUIPMENT LIST

Equipment Used	Model Number	Control Number	Last Date Calibrated	Calibration Due Date
Labsphere Spectroradiometer	CDS1100	CHI0091	VBU	VBU
3 Meter Sphere	SPR600	CHI0088	VBU	VBU
Elgar AC Power Supply	CW1251M	146112	VBU	VBU
Sorenson DC Power Supply	XFR150-8	146846	VBU	VBU
Newport Humidty Recorder	iTHX-SD	146382	08/26/13	08/26/14
Yokoga Power Meter	WT1600	146768	01/16/14	01/16/15
Omega Temperature Meter	MDSi8	146139	04/02/14	04/02/15
Yokogawa Power Meter	WT210	146919	09/06/13	09/06/14
Omega Newport Thermometer	DPI8-C24	146920	12/04/13	12/04/14
LSI High Speed Mirror Goniometer	6440T	146928	VBU	VBU
Newport Thermohygrometer	iServer	146956	01/02/14	01/02/15
Elgar, AC Power Supply	CW1251P	146918	VBU	VBU
Cole-Parmer Triple Timer	94440-00	CHI0041	04/01/14	04/01/15
Agilent Datalogger	34970A	CHI0124	09/05/13	09/05/14
Ambient Temperature and Humidity Meter	146965	146965	01/21/14	01/21/15
Pacific AC Power Supply	118-ACX	CHI0154	01/24/14	01/21/15
Intertek Test Ceiling	Ceiling 1	146632	VBU	VBU

TEST METHODS

Seasoning in Sample Orientation – LED Products

No seasoning was performed in accordance with IESNA LM-79.

Photometric and Electrical Measurements – Integrating Sphere Method

A Labsphere Model CDS 1100 CCD Array Spectroradiometer and Three Meter Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit.

Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation. Each SSL unit was allowed to stabilize for at least thirty minutes before measurements were made. Electrical measurements including voltage, current, and power were measured using the Xitron or Yokogawa Power Analyzer.

The calibration of the sphere photometer-spectroradiometer system is traceable to the National Institute of Standards and Technology.

Photometric and Electrical Measurements – Distribution Method

A LSI Type C High Speed Model 6440 Mirror Goniometer was used to measure the intensity (candelas) at each angle of distribution for each sample.

Ambient temperature was measured equal to the height of the sample mounted on the Goniometer equipment. Each sample was operated at input rated voltage in its designated orientation. Each sample was allowed to stabilize for at least thirty minutes before measurements were made. Electrical measurements including voltage, current, and power were measured using the Xitron or Yokogawa Power Analyzer.

Some graphics were created with Photometrics Plus software.

In-Situ Maximum Measured Power Supply Case and LED Source Point Temperature

Power supply case and/or LED source operating temperature measurements were taken on one test sample per model with a thermocouple and a temperature meter. The SSL sample was allowed to reach thermal equilibrium for seven and a half hours before measurements were taken. Power supply or source temperature measurements were measured at the TMPPS or TS point as indicated by the included diagram in accordance with manufacturers declared hot spot location, or at a hot spot location found with a thermal camera when no diagram from the manufacturer is given. The maximum temperature was recorded for the sample. A simulated ceiling or other enclosure may be used in accordance to UL 1598 or UL 153 as applicable.

RESULTS OF TEST

Photometric and Electrical Measurements at Ambient Temperature (25℃ +/- 1℃) - Integrating Sphere Met hod

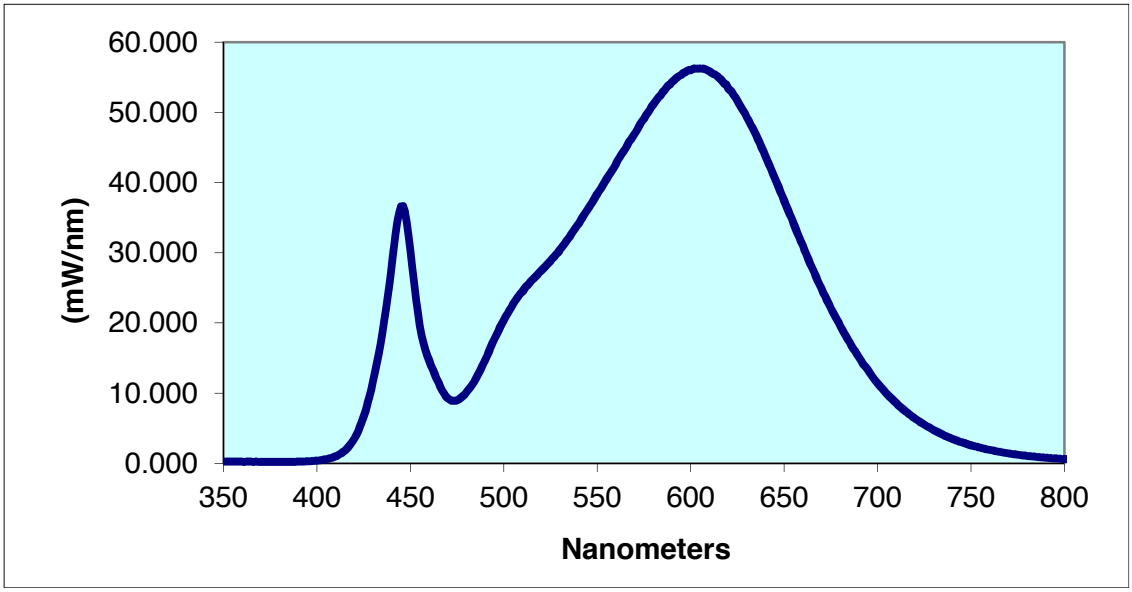
Intertek Sample No.	Base Orientation	Input Voltage {Vac}	Input Current (mA)	Input Power (Watts)	Input Power Factor	Current ATHD (%)	Luminous Flux (Lumens)	Lumen Efficacy (LPW)
06262014015554	HORIZONTAL	120.0	355.9	41.61	0.974	16.02	3577	85.96

Correlated Color Temperature (K)	CRI -Ra	CRI -R9	DUV	CIE 31' Chromaticity Coordinate (x)	CIE 31' Chromaticity Coordinate (y)	CIE 76' Chromaticity Coordinate (u')	CIE 76' Chromaticity Coordinate (v')
3102	83.0	17.3	0.002	0.428	0.397	0.248	0.517

Spectral Distribution over Visible Wavelengths

nm	mW/nm	nm	mW/nm	nm	mW/nm	nm	mW/nm	nm	mW/nm
350	0.243	440	28.25	530	30.43	620	53.45	710	8.563
355	0.202	445	36.62	535	32.21	625	51.68	715	7.382
360	0.214	450	30.39	540	34.1	630	49.34	720	6.379
365	0.209	455	19.67	545	36.24	635	46.75	725	5.522
370	0.178	460	14.65	550	38.42	640	43.8	730	4.73
375	0.172	465	11.51	555	40.51	645	40.67	735	4.051
380	0.174	470	9.251	560	42.68	650	37.43	740	3.475
385	0.173	475	8.986	565	44.84	655	34.23	745	2.98
390	0.205	480	10.11	570	46.98	660	31	750	2.563
395	0.262	485	12.07	575	49.09	665	27.81	755	2.21
400	0.375	490	14.73	580	51.11	670	24.88	760	1.906
405	0.569	495	17.72	585	52.96	675	22.13	765	1.645
410	0.988	500	20.4	590	54.37	680	19.59	770	1.408
415	1.814	505	22.69	595	55.37	685	17.24	775	1.212
420	3.491	510	24.5	600	56.03	690	15.09	780	1.041
425	6.637	515	26.06	605	56.28	695	13.21		
430	11.66	520	27.46	610	55.88	700	11.43		
435	18.67	525	28.84	615	54.98	705	9.907		

Spectral Data Over Visible Wavelengths



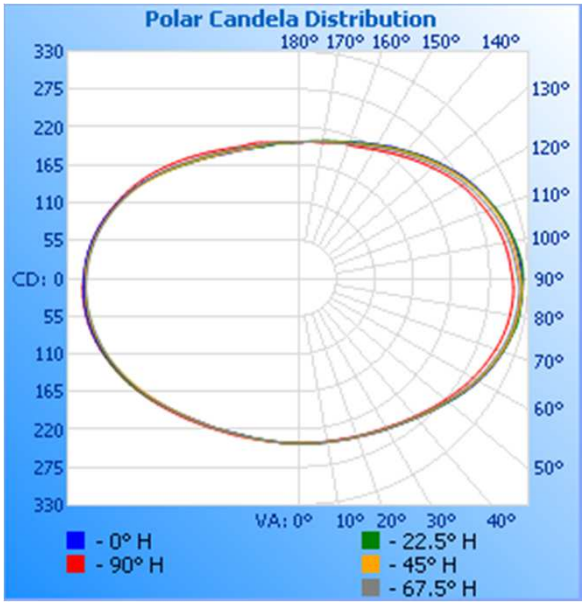
RESULTS OF TEST (cont'd)

Photometric and Electrical Measurements at Ambient Temperature (25℃ +/- 1℃) – Distribution Method

Intertek Sample No.	Base Orientation	Input Voltage {Vac}	Input Current (mA)	Input Power (Watts)	Input Power Factor	Absolute Luminous Flux (Lumens)	Lumen Efficacy (Lumens Per Watt)
06262014015554	HORIZONTAL	120.0	358.0	41.74	0.971	3464	82.99

Intensity (Candlepower) Summary at 25℃ - Candelas

Angle	0	22.5	45	67.5	90
0	240	240	240	240	240
5	241	241	240	240	240
10	242	242	242	242	241
15	244	243	244	243	242
20	246	245	246	245	244
25	249	248	249	248	247
30	254	253	253	252	251
35	258	258	257	257	256
40	265	264	264	263	262
45	272	272	271	270	268
50	280	280	279	278	275
55	290	289	288	286	282
60	299	297	297	295	290
65	306	305	305	302	296
70	313	312	311	308	302
75	317	318	316	313	306
80	320	321	319	317	309
85	322	322	321	318	310
90	322	322	319	315	308
95	318	321	315	311	304
100	314	315	311	307	300
105	308	308	306	301	294
110	300	300	298	294	287
115	292	291	290	285	279
120	283	282	281	276	270
125	273	271	270	266	261
130	262	261	260	256	251
135	252	251	250	246	241
140	242	241	240	237	232
145	234	232	231	228	224
150	225	224	223	220	217
155	218	217	216	214	210
160	211	211	210	209	207
165	206	207	205	204	204
170	202	203	202	201	201
175	200	200	200	200	200
180	198	198	198	198	198



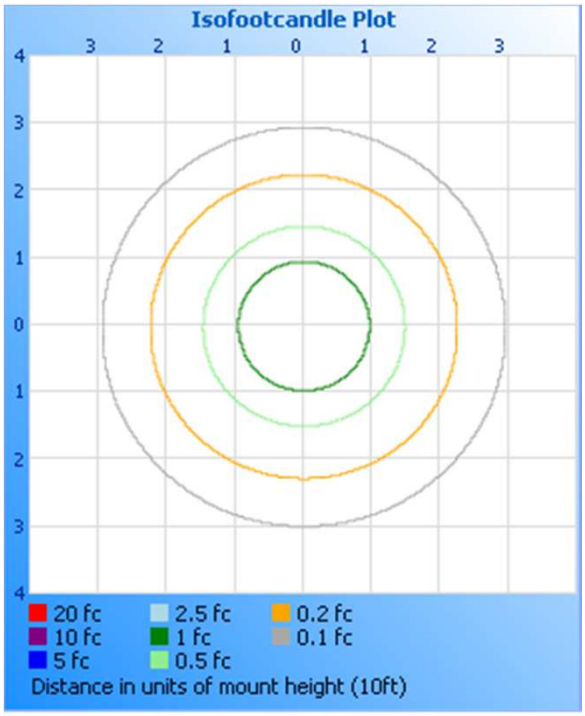
RESULTS OF TEST (cont'd)

Illumination Plots

Mounting Height: 10 ft.

Illuminance - Cone of Light

Isoillumination Plot



Zonal Lumen Summary and Percentages at 25℃

Zone	Lumens	% Luminaire
0-30	206.2	6.0
0-40	367.1	10.6
0-60	830.0	24.0
60-90	963.3	27.8
0-90	1793	51.8
90-180	1670.0	48.2
0-180	3464	100.0

Zonal Lumens and Percentages at 25°C

Zone	Lumens	% Luminaire
0-10	23.0	0.7
10-20	68.7	2.0
20-30	114.5	3.3
30-40	160.9	4.6
40-50	208.0	6.0
50-60	254.9	7.4
60-70	296.2	8.6
70-80	326.5	9.4
80-90	340.6	9.8
90-100	336.5	9.7
100-110	315.2	9.1
110-120	279.9	8.1
120-130	235.5	6.8
130-140	187.5	5.4
140-150	141.1	4.1
150-160	98.0	2.8
160-170	57.6	1.7
170-180	19.1	0.6

RESULTS OF TEST (cont'd)

In-Situ Measured LED Source Temperature

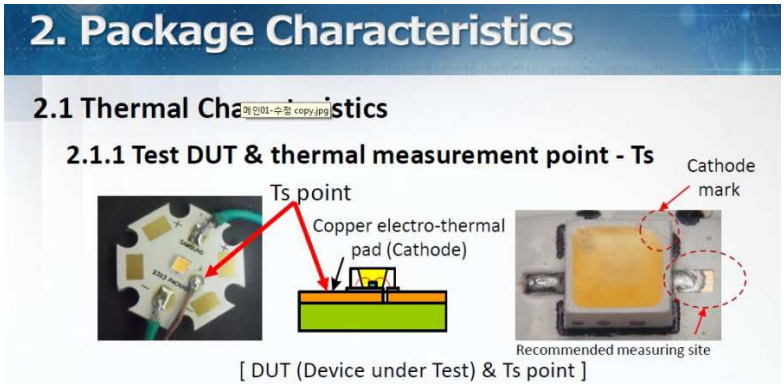
Manufacturer Supplied Documentation:

1) Absolute Maximum Rating

Item	Symbol	Rating	Condition
LED junction temperature	T_J	110℃	-
Thermal resistance	$R_{th,\ j\text{-}s}$	20℃/W	Junction to solder point

2) Electro-optical Characteristics

Item	Unit	Nominal CCT	Product Code	Rank		Min	Typ	Max
Forward Voltage[1] (V_F) (@65 mA, Ts = 25℃)	V	-	-	WA	AZ	2.70	-	2.80
					A1	2.80	-	2.90
					A2	2.90	-	3.00
					A3	3.00	-	3.10
					A4	3.10	-	3.20



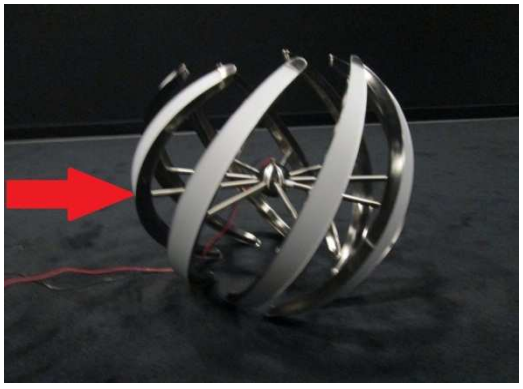
Maximum Junction Temperature from LED specification (Tj) = 110℃
Thermal Resistance Formula from LED specification = 20℃/W
Maximum Forward Voltage (Vf) from LED specification = 3.2V
Measured LED Current = 48mA
Calculated LED Wattage = Vf x Measured LED Current = 0.154W
Maximum Source Temperature (Ts) = Tj – (LED Wattage x Thermal Resistance) = 106.9℃

Measured Manufacturer Designated Source Temperature

Sample No.	Measured Source Temperature (℃)	Location	Maximum Rated Source Temperature (℃)
06262014015554	35.6	Per diagram	106.9

In-Situ Picture – Ts

In-Situ Picture – Ts location



RESULTS OF TEST (cont'd)

Maximum Measured Power Supply Case Temperature

Manufacturer Supplied Documentation

Power Supply Picture – Tc location

Sample No.	Maximum Measured Case Temperature (℃)	Location	Maximum Rated Power Supply Case Temperature (℃)
06262014015554	85.624	Per diagram	90

PICTURE (not to scale)

CONCLUSION

The results tabulated in this report are representative of the actual test samples submitted for this report only. The data is provided to the client for further evaluation. Compliance to the referenced specification requirements was not determined in this report.

In Charge Of Tests:

Kenneth Prettyman
Technician
Lighting Division

Report Reviewed By:

Timothy Quigley
Engineer
Lighting Division

Attachment: None