UL Verification Services Inc.
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Allentown, PA 18106
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ACCREDITED
Testing Laboratory

NVLAP LAB CODE 201042-0

Photometric Test Report

Relevant Standards
IES LM-79-2008, ANSI C82.77-2002, UL 1598-2008
CIE 13.3-1995, CIE 15-2004, ANSI C78.377-2015
IES TM-30-2015

Prepared For

Renova Lighting Systems Inc

36 Bellair Ave
Warwick, RI 02886
United States

Catalog Number

CRF22-N-L030-UNV-DM-C35-AF-XX-XX

Order Number
12162057
Test Number
12162057.01

Test Date

2018-01-31 - 2018-02-02

Prepared By

Javier Caban

Javier Caban, Technician

Approved By

Justin Benner, Project Handler

Table of Contents

Laboratory results may not be representative of field performance
Ballast factors have not been applied

Testing was performed in a 2-meter integrating sphere using the 4π geometry method.

Absorption correction was employed for Sphere measurement

Luminaire Description: White formed steel housing, frosted plastic linear prismatic lens enclosures
Lamp: 224 white LEDs
Mounting: Recessed
Ballast/Driver: One Osram Oti 20/120-277/700 DIM L driver

Luminaire

Luminaire Characteristics

Luminous Length:	20.50 in.
Luminous Width:	20.50 in.

Summary of Results

Integrating Sphere

Luminous Flux:	2796 Lumens
Efficacy:	137.8 lm/w
CCT:	3452 K
CRI (Ra):	83.5

Distribution

Total Luminaire Output:	2773 Lumens
Luminaire Efficacy:	136.5 lm/w
Maximum Candela:	993 Candela

Electrical Data at 277 VAC

Test Temperature:	25.4 °C
Voltage:	277.1 VAC
Current:	0.07800 A
Power:	21.02 W
Power Factor:	0.971
Frequency:	60 Hz
Current THD:	7.84 %

In-Situ

LED Temperature:	34.3 °C
Driver Temperature:	40.4 °C
Measured LED Current:	0.02775 A

Temperature is offset to an ambient temperature of 25°C as described in UL1598-2008.

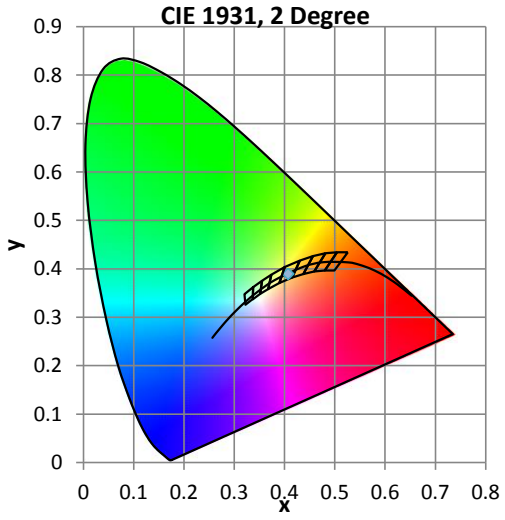
Color Quality - Integrating Sphere

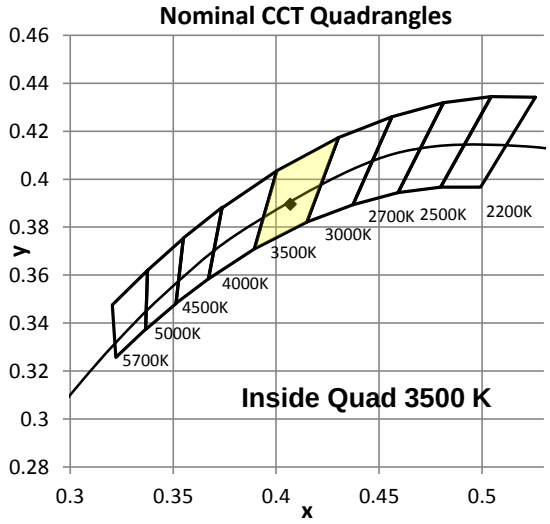
Integrating Sphere Test Conditions

Temperature	Voltage	Current	Power	Power Factor	Frequency	Current THD
25.3 °C	120.1 VAC	0.1693 A	20.29 W	0.998	60 Hz	4.24 %

Summary of Results

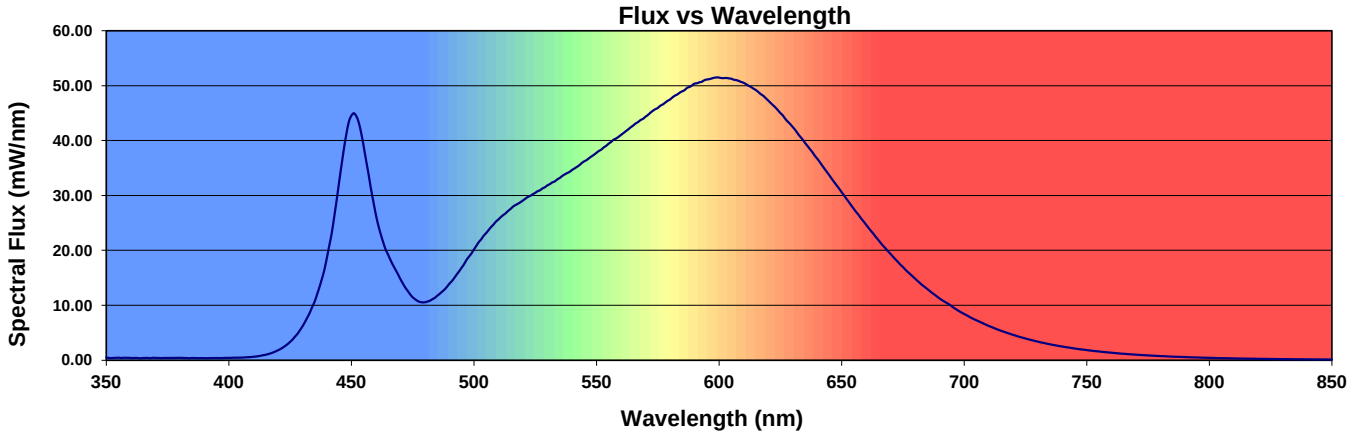
Total Output:	2796	Lumens	**Chromaticity (x):**	0.4070
Efficacy:	137.8	lm/w	**Chromaticity (y):**	0.3896
CCT:	3452	K	**Chromaticity (u'):**	0.2372
CRI (Ra):	83.5		**Chromaticity (v'):**	0.5111
CRI (R9):	15.1		**TM-30 Rf:**	82.5
Peak Wavelength:	599.2	nm	**TM-30 Rg:**	97
Dominant Wavelength:	581.4	nm	**Duv:**	0.0011
S/P Ratio:	1.505			





Color Rendering Index Detail

Ra (CRI)	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
83.5	82.1	89.7	95.2	82.2	81.8	85.8	85.7	65.0	15.1	75.5	81.0	65.0	83.8	97.4	76.5



Distribution - Goniophotometer

Distribution Test Conditions

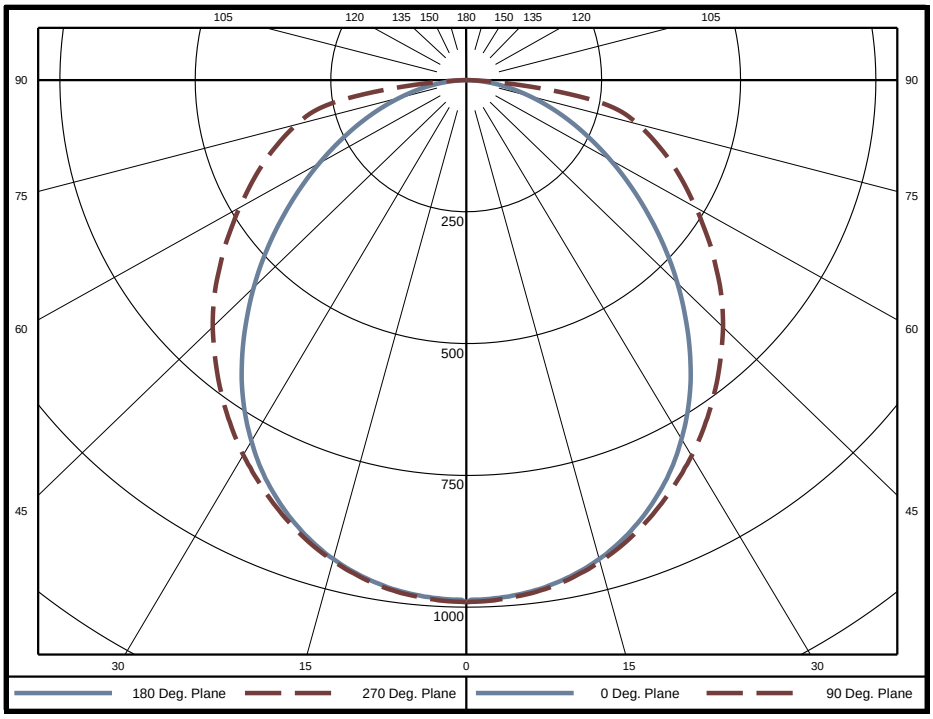
Temperature	Voltage	Current	Power	Power Factor	Frequency	Current THD
24.7 °C	120.1 VAC	0.1695 A	20.32 W	0.998	60 Hz	4.18 %

Summary of Results

Spacing Criteria
0-180: 1.19
90-270: 1.24

Total Lumen Output: 2773 Lumens
Luminaire Efficacy: 136.5 lm/w
Maximum Candela: 993 Candela

Polar Plot



Zonal Lumen Summary

Zone	Lumens	% of Luminaire	Zone	Lumens	% of Luminaire	Zone	Lumens	% of Luminaire
0-5	23.6	0.9%	60-65	181.1	6.5%	120-125	0	0.0%
5-10	70.1	2.5%	65-70	157.1	5.7%	125-130	0	0.0%
10-15	113.8	4.1%	70-75	131.0	4.7%	130-135	0	0.0%
15-20	153.0	5.5%	75-80	102.5	3.7%	135-140	0	0.0%
20-25	186.1	6.7%	80-85	60.9	2.2%	140-145	0	0.0%
25-30	212.0	7.6%	85-90	13.7	0.5%	145-150	0	0.0%
30-35	229.8	8.3%	90-95	0	0.0%	150-155	0	0.0%
35-40	239.1	8.6%	95-100	0	0.0%	155-160	0	0.0%
40-45	240.3	8.7%	100-105	0	0.0%	160-165	0	0.0%
45-50	234.3	8.4%	105-110	0	0.0%	165-170	0	0.0%
50-55	221.5	8.0%	110-115	0	0.0%	170-175	0	0.0%
55-60	203.2	7.3%	115-120	0	0.0%	175-180	0	0.0%

Zone	Lumens	% of Luminaire
0-40	1228	44.3%
0-60	2127	76.7%
0-90	2773	100.0%
90-180	0	0.0%

Candela Tabulation

Horizontal Angle (Degrees)

Vertical Angle (Degrees)	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5
0	990.6	990.6	990.6	990.6	990.6	990.6	990.6	990.6	990.6	990.6	990.6	990.6	990.6	990.6	990.6	990.6
5	981.6	986.8	986.6	987.9	984.2	987.9	986.6	986.8	981.6	986.8	986.6	987.9	984.2	987.9	986.6	986.8
10	967.2	972.0	972.4	973.9	970.5	973.9	972.4	972.0	967.2	972.0	972.4	973.9	970.5	973.9	972.4	972.0
15	940.9	945.8	947.2	948.7	945.8	948.7	947.2	945.8	940.9	945.8	947.2	948.7	945.8	948.7	947.2	945.8
20	902.1	908.2	911.2	913.6	911.4	913.6	911.2	908.2	902.1	908.2	911.2	913.6	911.4	913.6	911.2	908.2
25	852.0	859.3	865.7	871.0	869.6	871.0	865.7	859.3	852.0	859.3	865.7	871.0	869.6	871.0	865.7	859.3
30	789.4	800.4	813.6	823.3	823.4	823.3	813.6	800.4	789.4	800.4	813.6	823.3	823.4	823.3	813.6	800.4
35	717.2	730.9	753.7	770.5	772.5	770.5	753.7	730.9	717.2	730.9	753.7	770.5	772.5	770.5	753.7	730.9
40	634.9	654.9	689.0	714.5	718.5	714.5	689.0	654.9	634.9	654.9	689.0	714.5	718.5	714.5	689.0	654.9
45	550.1	574.6	621.5	656.8	663.7	656.8	621.5	574.6	550.1	574.6	621.5	656.8	663.7	656.8	621.5	574.6
50	465.3	494.7	553.6	597.4	605.0	597.4	553.6	494.7	465.3	494.7	553.6	597.4	605.0	597.4	553.6	494.7
55	383.7	416.3	484.7	533.1	544.3	533.1	484.7	416.3	383.7	416.3	484.7	533.1	544.3	533.1	484.7	416.3
60	308.3	342.2	414.5	469.0	485.0	469.0	414.5	342.2	308.3	342.2	414.5	469.0	485.0	469.0	414.5	342.2
65	240.0	274.1	345.8	408.6	430.6	408.6	345.8	274.1	240.0	274.1	345.8	408.6	430.6	408.6	345.8	274.1
70	179.3	212.1	280.5	349.7	377.9	349.7	280.5	212.1	179.3	212.1	280.5	349.7	377.9	349.7	280.5	212.1
75	124.1	154.2	217.4	290.4	325.7	290.4	217.4	154.2	124.1	154.2	217.4	290.4	325.7	290.4	217.4	154.2
80	75.8	99.2	151.9	218.4	252.8	218.4	151.9	99.2	75.8	99.2	151.9	218.4	252.8	218.4	151.9	99.2
85	31.9	42.2	67.0	82.5	84.8	82.5	67.0	42.2	31.9	42.2	67.0	82.5	84.8	82.5	67.0	42.2
90	0.0	1.5	2.1	2.8	3.2	2.8	2.1	1.5	0.0	1.5	2.1	2.8	3.2	2.8	2.1	1.5
95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
105	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
115	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
130	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
135	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
140	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
165	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
170	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
175	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
180	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Average Luminance (cd/m^2)

Horizontal Angle (Degrees)

Vertical Angle (Degrees)	0	45	90
0	3654	3654	3654
45	2869	3242	3462
55	2467	3117	3500
65	2095	3018	3758
75	1768	3098	4642
85	1348	2837	3588

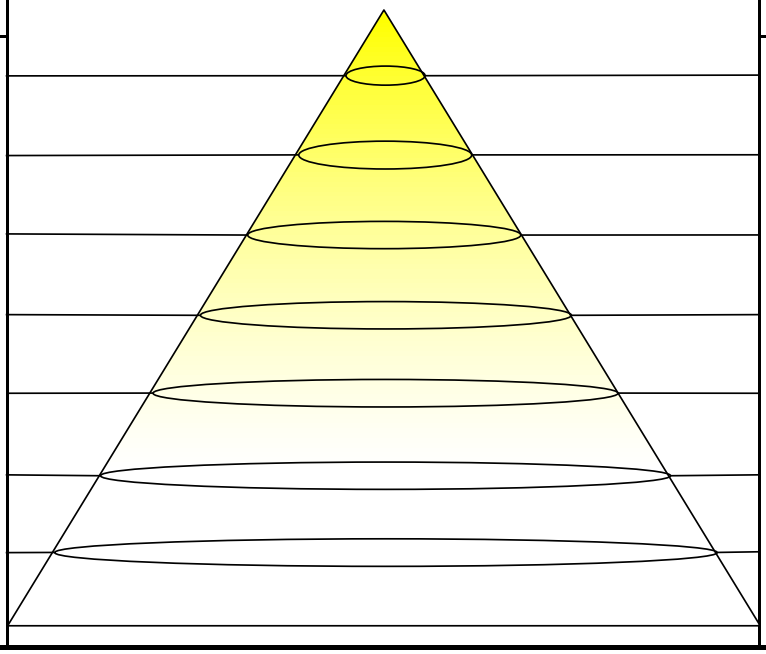
Utilization of Lumens - Zonal Cavity Method

Effective Floor Cavity Reflectance 20%																		
Ceiling Cavity Reflectance	80				70				50			30			10			0
Wall Reflectance	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
Room Cavity Ratio (RCR)	** Values are expressed as Lumens delivered to the task surface **																	
0	3301	3301	3301	3301	3225	3225	3225	3225	3081	3081	3081	2950	2950	2950	2830	2830	2830	2773
1	3000	2861	2736	2623	2924	2797	2684	2580	2679	2585	2498	2569	2493	2421	2469	2407	2349	2290
2	2722	2485	2289	2124	2648	2432	2251	2098	2332	2180	2048	2241	2113	2001	2156	2050	1956	1895
3	2479	2178	1946	1761	2409	2134	1918	1744	2050	1865	1713	1973	1815	1682	1901	1768	1653	1591
4	2269	1929	1680	1490	2204	1892	1659	1480	1821	1619	1459	1756	1581	1438	1695	1544	1419	1357
5	2087	1724	1471	1284	2028	1693	1455	1276	1633	1423	1262	1578	1393	1248	1526	1364	1234	1174
6	1928	1553	1302	1121	1874	1527	1289	1116	1476	1264	1106	1429	1240	1096	1385	1217	1086	1028
7	1788	1409	1164	991	1740	1387	1153	988	1343	1133	980	1303	1114	973	1265	1095	965	910
8	1666	1287	1049	885	1622	1268	1041	883	1231	1024	877	1196	1008	871	1163	993	866	812
9	1557	1182	953	798	1517	1166	946	795	1134	932	791	1103	919	787	1075	906	782	731
10	1461	1092	871	724	1425	1077	865	722	1049	854	719	1023	843	715	998	832	712	663

Beam and Field Information	
CIE Type:	Direct
Center Beam Intenisty:	990.6 Candela
Central Cone Intensity:	989 Candela
Beam Flux:	1893.1 Lumens
Beam Angle (0-180):	96.4 Degrees
Beam Angle (90-270):	118.2 Degrees
Field Angle (0-180):	155.0 Degrees
Field Angle (90-270):	169.1 Degrees

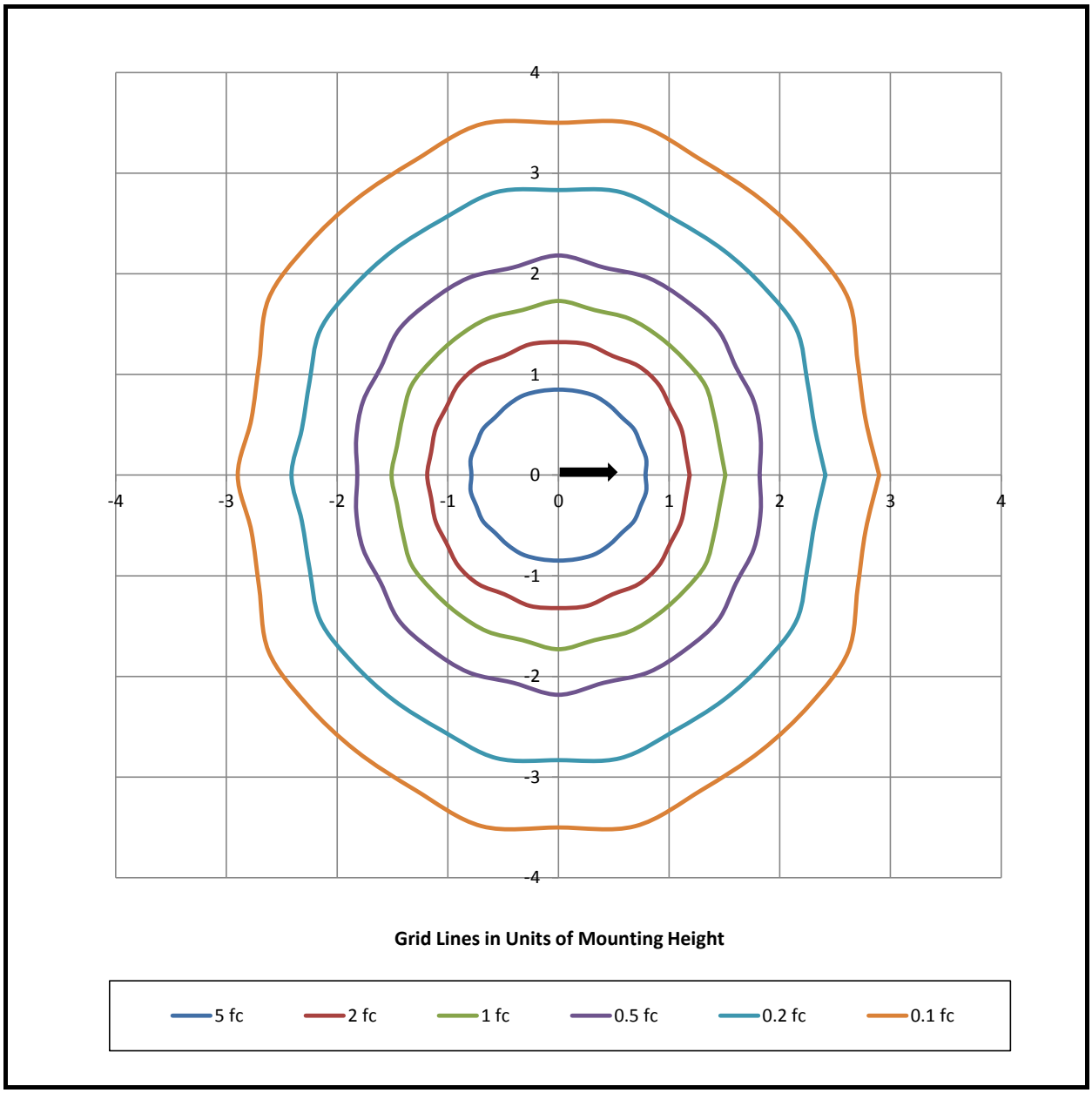
Cone of Light Tabulation

Mounting Height (Feet)	Footcandles at Nadir	Diameter (Feet)
4.00	61.9	4.87
6.00	27.5	7.31
8.00	15.5	9.75
10.0	9.91	12.2
12.0	6.88	14.6
14.0	5.05	17.1
16.0	3.87	19.5



ISOFootcandle Plot

Mounting Height - 8 Feet



In-Situ Test

In-Situ Test Conditions

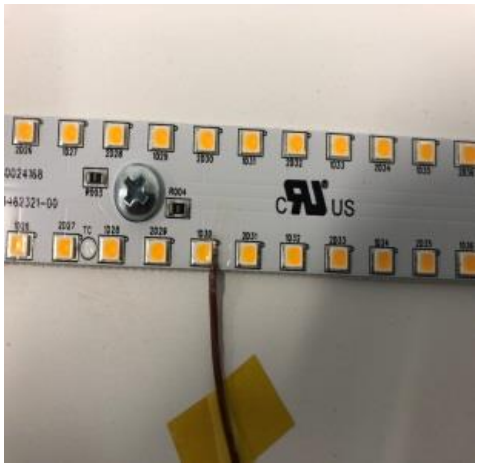
Temperature	Voltage	Current	Power	Power Factor	Frequency	Current THD
25.1 °C	120.2 VAC	N/A	N/A	N/A	60 Hz	N/A

Summary of Results

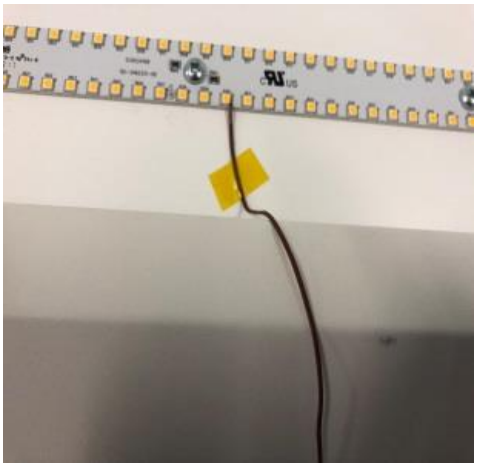
LED Temperature:	34.3	°C
Driver Temperature:	40.4	°C
Measured LED Current:	0.02775	A

Temperatures are offset to an ambient temperature of 25°C as described in UL1598-2008

LED Temperature Location



Thermocouple Reference



Driver Temperature Location