



**Report Number:** PL10256-001A  
**Model:** ZR22RK-32L-30K-10V-FD  
**Date:** 02/28/2017

## Cree Engineering Services Testing Laboratory (CESTL) Photometric Testing and Evaluation Report

**Prepared For:**

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**Prepared By:**

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Product Information	
Manufacturer	Cree Inc
Model Number (SKU)	ZR22RK-32L-30K-10V-FD
Serial Number	1LL02Q90019
LED Type	Lextar PC56H19

**Product Description**  
 2 x 2 Retro-fit troffer with a white painted aluminum reflector, white plastic end caps, and curved diffuse lens, attached to a white painted metal pan.

**Driver Information (Where Applicable)**  
 Philips XI040C110V054BST1

Height	Length	Width
3"	24"	24"

**Sample**  
 The following sample was submitted for evaluation





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Key Photometric Data	Sphere Output	Goniophotometer	
Luminous Flux	3473.0	3446.3	lm
Efficacy	130.76	129.71	lm/W
Correlated Color Temperature (CCT)	3049	K	
Color Rendering Index (CRI)	83		
R <sub>9</sub>	12		
Duv	0.000368		
S/P Ratio*	1.34		

Electrical Measurements	Sphere		Goniophotometer		
	120V	277V	120V	277V	
Input Wattage	26.56	26.56	26.57	26.56	W
Input Current	0.22	0.10	0.22	0.10	A
Input Voltage	120.00	276.98	120.08	277.07	V
Power Factor	0.995	0.956	0.995	0.954	
Off-State Power	0	0	0	0	W
Total Harmonic Distortion (Voltage)	0.07	0.05	0.08	0.07	%
Total Harmonic Distortion (Amperage)	8.72	12.25	8.69	11.72	%

**Note:** All photometric measurements taken at 120VAC.

Luminous Intensity Distribution	Goniophotometer	
Maximum Candela	1244.2	Cd
Horizontal Angle of Max Candela	0	°
Vertical Angle of Max Candela	2.5	°
Zonal Lumens (0° – 30°)	941.8 (27.3%)	lm (%)
Zonal Lumens (0° – 40°)	1527.6 (44.3%)	lm (%)
Zonal Lumens (0° – 60°)	2656.1 (77.1%)	lm (%)
Zonal Lumens (60° – 90°)	790.1 (22.9%)	lm (%)
Color Angular Uniformity	NA	

Key Test Parameters	Sphere Output	Goniophotometer	
Stabilization Time	53	46	min
Total Operating Time (Stabilization + Test)	53	66	min
Ambient Temperature	24.3	24.1	°C

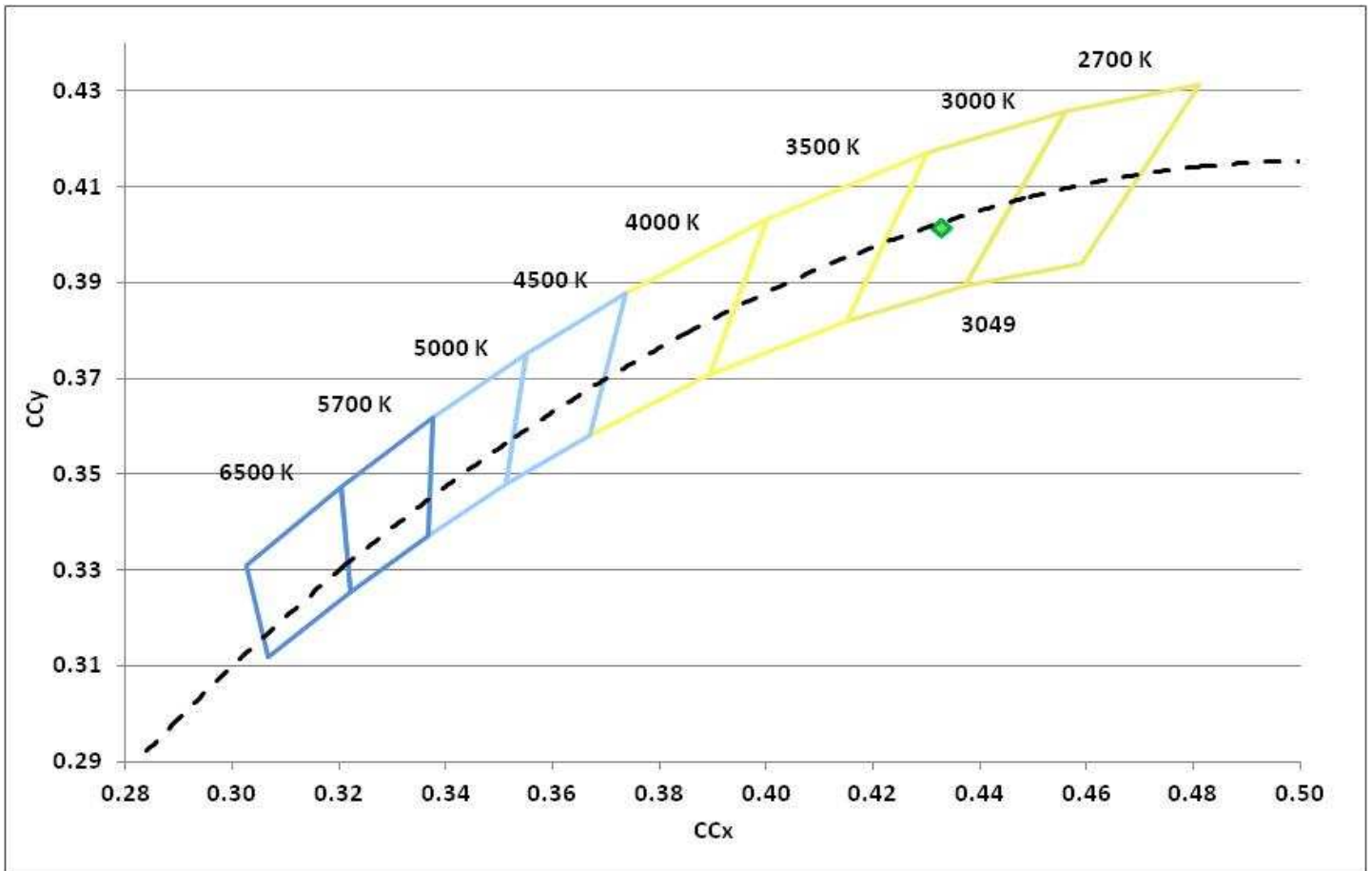
**Chromaticity Coordinates**

x	y	u	v	u'	v'	Duv
0.4327	0.4018	0.2489	0.3466	0.2489	0.5199	0.000368

**Color Rendering Index Details**

Ra	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
83	81	89	96	83	81	86	85	62	12	75	82	70	83	98

**Chromaticity Diagram**



**Spectral Distribution**

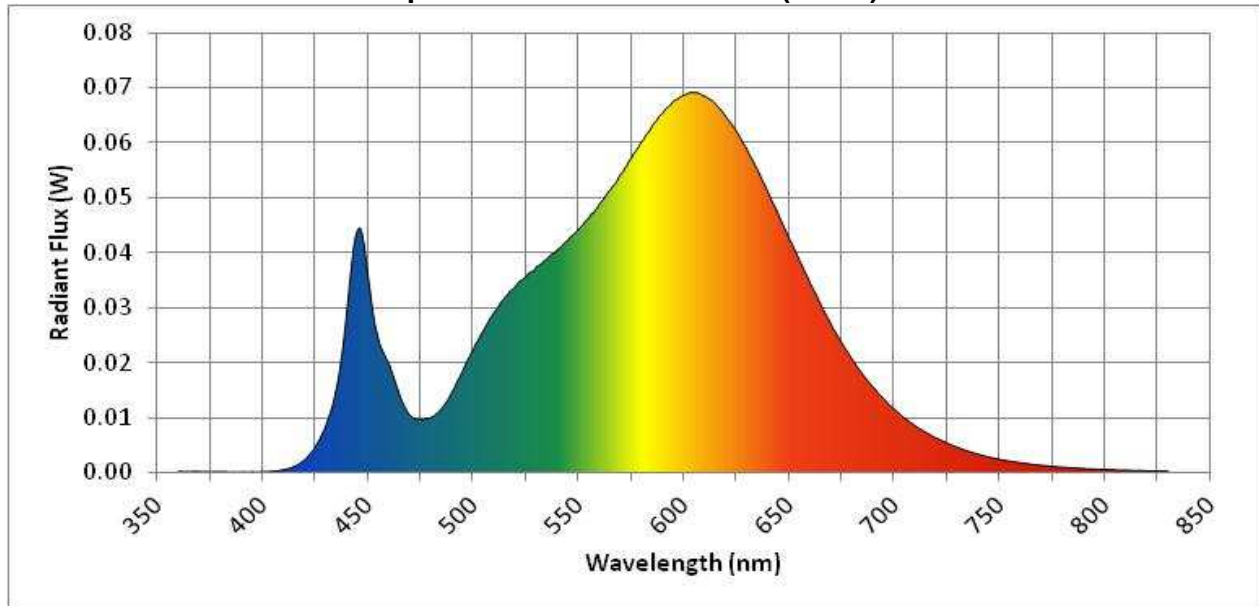
$\lambda$ (nm)	W/nm
360	0.000247
370	0.000151
380	0.000153
390	0.000142
400	0.000186
410	0.000539
420	0.002508
430	0.008886
440	0.030356
450	0.035087
460	0.019591
470	0.010348
480	0.010143
490	0.014877
500	0.022604
510	0.029372
520	0.034041

$\lambda$ (nm)	W/nm
530	0.037581
540	0.040781
550	0.044448
560	0.049098
570	0.054473
580	0.060325
590	0.065562
600	0.068798
610	0.068647
620	0.064766
630	0.058790
640	0.051055
650	0.042632
660	0.034477
670	0.026908
680	0.020565
690	0.015516

$\lambda$ (nm)	W/nm
700	0.011552
710	0.008500
720	0.006278
730	0.004604
740	0.003355
750	0.002433
760	0.001809
770	0.001313
780	0.000985
790	0.000751
800	0.000573
810	0.000436
820	0.000352
830	0.000271

<b>Dominant Wavelength</b>	582	nm
<b>Peak Wavelength:</b>	606	nm

**Spectral Power Distribution (W/nm)**





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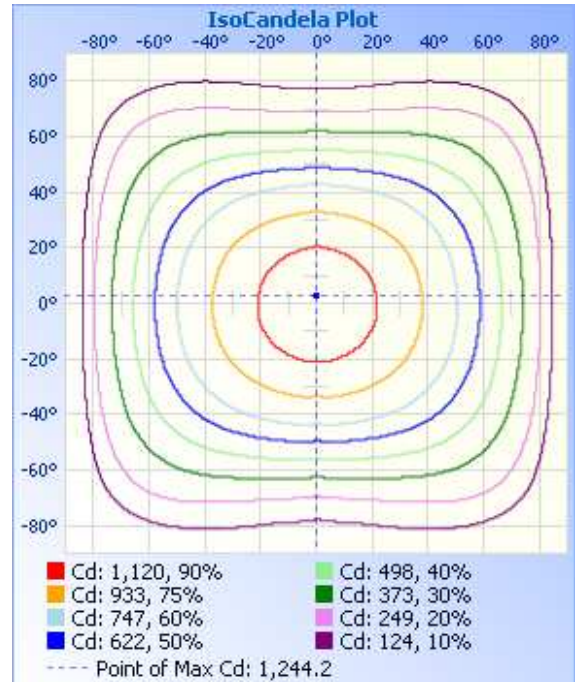
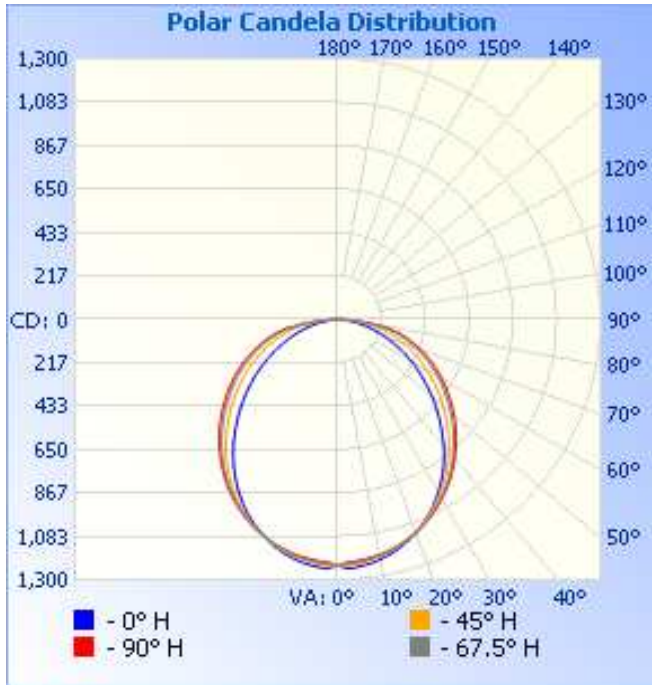
### Zonal Lumen Summary \*\*

Zone	Lumens	% of Total	Zone	Lumens	% of Total
0-5	29.3	0.9%	90-95	0	0%
5-10	86.8	2.5%	95-100	0	0%
10-15	140.9	4.1%	100-105	0	0%
15-20	189.6	5.5%	105-110	0	0%
20-25	231.2	6.7%	110-115	0	0%
25-30	264.0	7.7%	115-120	0	0%
30-35	286.8	8.3%	120-125	0	0%
35-40	299.0	8.7%	125-130	0	0%
40-45	301.1	8.7%	130-135	0	0%
45-50	293.8	8.5%	135-140	0	0%
50-55	278.0	8.1%	140-145	0	0%
55-60	255.7	7.4%	145-150	0	0%
60-65	228.0	6.6%	150-155	0	0%
65-70	195.0	5.7%	155-160	0	0%
70-75	158.6	4.6%	160-165	0	0%
75-80	119.6	3.5%	165-170	0	0%
80-85	70.8	2.1%	170-175	0	0%
85-90	18.0	0.5%	175-180	0	0%
<b>Total</b>			<b>3446.3 lm</b>	<b>100%</b>	

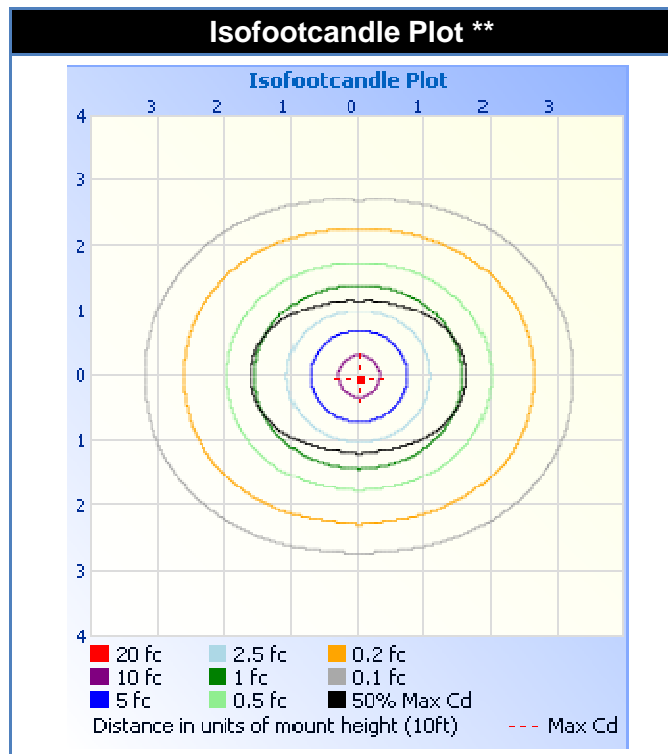
### Spacing Criteria \*\*

<b>Spacing Criterion (0 - 180)</b>	1.22
<b>Spacing Criterion (90 - 270)</b>	1.26
<b>Spacing Criterion (Diagonal)</b>	1.34

**Candela Plots \*\***



**Isofootcandle Plot \*\***







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**Candela Tabulations \*\***

	0	5	15	25	35	45	55	60	62.5	65	67.5	70	72.5	75	77.5
0	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230
2.5	1244	1243	1239	1234	1231	1227	1224	1222	1221	1220	1219	1219	1218	1217	1216
5	1239	1237	1233	1229	1226	1223	1220	1218	1217	1216	1216	1215	1214	1213	1212
7.5	1229	1228	1224	1220	1216	1214	1212	1210	1209	1208	1207	1206	1206	1205	1204
10	1216	1214	1211	1207	1204	1202	1201	1199	1198	1197	1197	1196	1196	1195	1194
12.5	1200	1198	1194	1191	1189	1188	1187	1186	1186	1186	1185	1185	1184	1183	1182
15	1181	1178	1174	1172	1170	1171	1171	1170	1170	1170	1169	1169	1168	1168	1167
17.5	1158	1155	1151	1150	1149	1150	1152	1152	1152	1152	1152	1152	1151	1151	1150
20	1133	1128	1125	1125	1125	1128	1131	1131	1131	1132	1132	1132	1132	1131	1131
22.5	1104	1098	1096	1096	1098	1102	1107	1107	1108	1108	1109	1109	1109	1109	1109
25	1072	1064	1063	1065	1068	1074	1080	1081	1082	1083	1084	1084	1084	1084	1084
27.5	1036	1028	1027	1031	1036	1044	1051	1053	1055	1056	1057	1057	1058	1058	1058
30	996	988	988	993	1000	1010	1020	1023	1024	1025	1027	1028	1028	1029	1030
32.5	955	946	947	953	963	974	986	989	991	992	994	996	997	998	998
35	913	901	903	911	923	936	950	955	957	959	961	963	964	964	966
37.5	865	854	858	867	881	896	912	918	920	923	925	927	928	930	931
40	817	806	811	822	837	856	873	880	883	885	888	891	892	894	896
42.5	765	757	762	776	793	814	833	841	844	847	850	853	855	857	859
45	716	707	714	729	749	771	793	801	805	809	812	815	818	820	822
47.5	666	657	665	682	704	728	752	761	765	769	773	776	779	781	784
50	617	607	616	634	658	685	710	720	724	729	733	737	740	742	745
52.5	566	557	567	586	612	641	667	678	683	688	692	696	700	702	705
55	518	508	518	540	566	597	626	638	642	647	652	657	660	663	665
57.5	471	461	472	494	523	555	585	598	603	608	613	618	621	625	627
60	425	414	426	450	480	513	545	558	564	569	574	579	583	586	589
62.5	379	369	381	406	437	471	504	517	523	529	534	539	543	547	549
65	332	324	336	363	394	430	463	477	483	489	494	499	503	507	509
67.5	289	281	294	321	352	388	422	436	442	448	453	458	462	465	468
70	246	239	253	280	312	346	380	394	400	406	411	416	420	424	426
72.5	207	199	214	240	272	306	339	353	359	365	370	376	379	383	385
75	169	162	176	202	233	266	298	312	318	324	330	335	339	343	345
77.5	134	127	140	165	194	226	257	271	276	282	287	292	296	300	302
80	100	94	106	129	156	185	212	222	226	231	235	239	242	244	246
82.5	68	64	74	93	115	137	155	161	163	165	168	171	172	174	174
85	41	36	43	57	70	81	90	92	92	93	94	96	96	97	98
87.5	17	13	15	20	23	26	30	30	30	30	31	32	32	33	33
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0





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**Candela Tabulations (Continued) \*\***

	80	82.5	85	87.5	90	95	105	112	125	135	145	155	165	175	180
0	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230
2.5	1216	1215	1214	1213	1213	1214	1217	1220	1224	1227	1231	1234	1239	1244	1244
5	1212	1211	1210	1209	1209	1210	1213	1215	1219	1222	1225	1228	1234	1238	1238
7.5	1204	1203	1202	1202	1201	1203	1206	1208	1211	1214	1217	1220	1225	1229	1229
10	1194	1193	1193	1193	1193	1194	1197	1199	1202	1204	1206	1209	1213	1217	1216
12.5	1182	1182	1181	1181	1181	1183	1185	1186	1188	1191	1192	1193	1197	1200	1199
15	1167	1166	1166	1166	1166	1168	1170	1171	1172	1174	1174	1175	1177	1180	1179
17.5	1150	1150	1149	1150	1151	1152	1153	1153	1153	1154	1153	1152	1154	1157	1154
20	1131	1131	1131	1132	1132	1133	1134	1132	1131	1131	1129	1127	1128	1131	1127
22.5	1108	1109	1109	1110	1110	1111	1112	1109	1107	1105	1102	1099	1100	1101	1096
25	1084	1085	1085	1086	1086	1087	1088	1084	1081	1077	1072	1069	1067	1068	1062
27.5	1059	1059	1060	1060	1061	1062	1061	1056	1052	1046	1040	1034	1032	1032	1024
30	1030	1031	1031	1032	1033	1033	1032	1026	1020	1014	1005	998	994	993	984
32.5	999	1000	1001	1002	1003	1002	1001	994	987	978	967	959	953	951	941
35	967	968	969	970	970	970	968	960	951	940	928	917	910	907	896
37.5	933	934	935	936	937	936	934	925	914	901	886	874	865	862	850
40	897	898	900	900	901	900	898	887	875	860	843	829	818	814	801
42.5	860	862	863	864	865	864	860	849	836	818	799	783	770	765	751
45	823	825	827	828	829	827	823	811	795	777	754	737	722	716	701
47.5	786	788	789	790	791	790	785	772	754	734	709	690	673	666	650
50	747	749	751	752	753	751	746	732	713	690	664	642	624	616	601
52.5	707	709	711	712	714	712	706	692	671	647	619	595	576	566	553
55	668	670	672	673	674	672	666	651	629	603	573	548	527	517	504
57.5	630	632	634	635	636	635	628	612	588	560	529	502	480	469	456
60	592	594	596	596	598	596	589	573	548	519	486	457	434	422	408
62.5	552	554	556	557	558	557	550	533	508	477	443	413	389	376	362
65	512	514	515	516	518	516	510	492	468	435	401	370	345	331	318
67.5	470	472	474	475	476	475	468	451	426	394	359	327	302	287	274
70	428	430	432	432	434	433	426	410	385	353	318	286	260	246	232
72.5	387	389	390	391	392	391	385	369	344	313	278	247	220	206	193
75	347	348	350	351	352	351	346	328	303	272	240	208	182	168	156
77.5	303	305	306	307	309	308	303	286	263	232	201	171	147	133	122
80	247	248	249	251	253	251	249	236	218	192	163	136	113	100	90
82.5	176	176	178	179	180	179	179	172	162	146	124	101	80	69	60
85	98	100	101	102	103	102	103	100	98	90	78	64	49	41	34
87.5	33	34	34	35	36	35	36	35	36	33	28	26	20	17	11
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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Candela Tabulations (Continued) \*\*

	0	5	15	25	35	45	55	60	62.5	65	67.5	70	72.5	75	77.5
92.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97.5	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
102.5	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
107.5	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
112.5	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
117.5	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
122.5	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
127.5	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
132.5	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
137.5	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
142.5	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
147.5	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
152.5	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
157.5	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
162.5	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
167.5	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
172.5	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
177.5	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



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Candela Tabulations (Continued) \*\*

	80	82.5	85	87.5	90	95	105	112	125	135	145	155	165	175	180
92.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97.5	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
102.5	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
107.5	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
112.5	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
117.5	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
122.5	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
127.5	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
132.5	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
137.5	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
142.5	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
147.5	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
152.5	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
157.5	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
162.5	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
167.5	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
172.5	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
177.5	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



NVLAP Lab Code 500077-0

### Integrating Sphere Equipment List

Description	Manufacturer	Model	Serial Number
3M Sphere	Labsphere	CSTM-CSLMS-3M98-HDS	82456
CCD Array Spectrometer	Otsuka	MC-9801	98010165
Programmable AC Source	Chroma	61603	616030000761
Single Channel Power Analyzer	Xitron	2801	28011110008
Aux Lamp Power Supply	Labsphere	LPS-100-0833	1002104538

### Goniophotometer Equipment List

Description	Manufacturer	Model	Serial Number
AC Power Source	Adaptive	FC210	2300229
AC Power Source	Elgar	CW1251	1126A06399
Type C Goniophotometer	LSI / UL	6440T	6440TE0192T
Spectroradiometer	Gooch & Housego	770VIS/NIR	11414155
Power Meter	Yokogawa	WT210	91L220953

### Test Methods Used:

Title	Description
ANSI C82.77:2002	Harmonic Emission Limits- Related Power Quality Req't's for Lighting Equipment
CIE Pub. 13.3:1995	Method of Measuring and Specifying Color Rendering of Light Sources
CIE Pub. 15:2004	Colorimetry
IES LM-58:1994	Spectroradiometric Measurements
IES LM-79:2008	Electrical and Photometric Measurements of Solid-State Lighting Products

### Reference Standard Used:

Equipment	Description
3m Sphere	Tungsten Halogen Omni-Directional 75W Calibration Lamp, Serial Number G141
Type C Goniophotometer	Tungsten Halogen Omni-Directional 500W Calibration Lamp, Serial Number 97A

**Disclaimers:**

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

The results contained in this report pertain only to the tested sample.

This report shall not be reproduced, except in full, without written approval of the CESTL.

\* Items marked with a single asterisk are not covered by the NVLAP accreditation.

In the event that the recorded temperature is outside of  $25 \pm 1^\circ\text{C}$ , this is considered a non-standard condition.

\*\* In the event that testing is subcontracted, test results in this report marked with the symbol \*\*, or noted as “Goniophotometer”, were performed by the subcontracted laboratory identified in the footer on the first page of this report. Subcontracted testing is strictly goniophotometer based. All other tests are performed using an integrating sphere.

The goniophotometer information in the equipment list, report items marked with \*\*, or results specifically identified as “Goniophotometer”, are the actual equipment used, and test results produced, by the subcontracted laboratory.

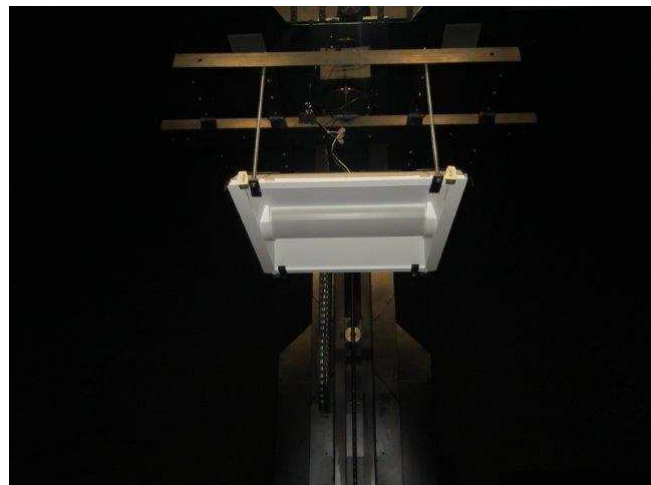
**Additional Comments:**

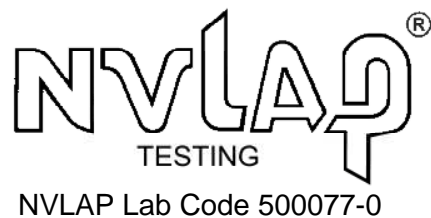
The photos below are intended to show the orientation and fixturing/set-up of the units under test. These are critical to understanding the results of the test given the sensitivity of many products and measurement systems to orientation and set-up considerations, and also for reproducing the conditions of the test.

**Sphere Picture**



**Goniophotometer Picture**





**Document Revision History:**

Each subsequent revision of this report replaces the preceding report.

Date	Rev	DCN #	Change Details	By	Approval
02/28/17	A	DMS	Origination	A. Gressel	C. McLaurin