

Report Number: PL08620-002C
Model: CR24-40L-ACK-CMA-EB10W_4500K
Date: 11/1/2016

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

Prepared For:

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Product Information

Manufacturer	Cree Inc
Model Number (SKU)	CR24-40L-ACK-CMA-EB10W_4500K
Serial Number	JJ33Q52418
LED Type	XTE AWT

Product Description

2x4 troffer. Linear light engine. Linear finned heat sink below LEDs. Two frosted plastic lenses. White metal trim plate.

Driver Information (Where Applicable)

Integral

Length	Width
48"	24"

Sample

The following sample was submitted for evaluation



Key Photometric Data	Sphere Output	Goniophotometer	
Luminous Flux	3959.0	3881.1	lm
Efficacy	92.22	90.20	lm/W
Correlated Color Temperature (CCT)	4569	K	
Color Rendering Index (CRI)	96		
R ₉	74		
Duv	0.002269		
S/P Ratio*	1.98		

	Sphere		Goniophotometer		
Electrical Measurements	120V	277V	120V	277V	
Input Wattage	42.93	42.66	43.03	42.69	W
Input Current	0.36	0.17	0.36	0.17	A
Input Voltage	119.97	276.99	119.99	277.01	V
Power Factor	0.991	0.887	0.991	0.884	
Off-State Power	0	0	0	0	W
Total Harmonic Distortion (Voltage)	0.05	0.05	0.08	0.06	%
Total Harmonic Distortion (Amperage)	6.91	13.73	6.24	13.20	%

Note: All photometric measurements taken at 120VAC.

Luminous Intensity Distribution	Goniophotometer	
Center Beam Candlepower (Max Candela)	1329.3	Cd
Horizontal Angle	65	°
Vertical Angle	2.5	°
Zonal Lumens (0° – 30°)	1052.5 (27.1)	lm (%)
Zonal Lumens (0° – 40°)	1749.6 (45.1)	lm (%)
Zonal Lumens (0° – 60°)	3146.9 (81.1)	lm (%)
Zonal Lumens (60° – 90°)	734.2 (18.9)	lm (%)
Color Angular Uniformity	0.00054	

Key Test Parameters	Sphere Output	Goniophotometer	
Stabilization Time	87	60	min
Total Operating Time (Stabilization + Test)	87	80	min
Ambient Temperature	25.6	25.8	°C

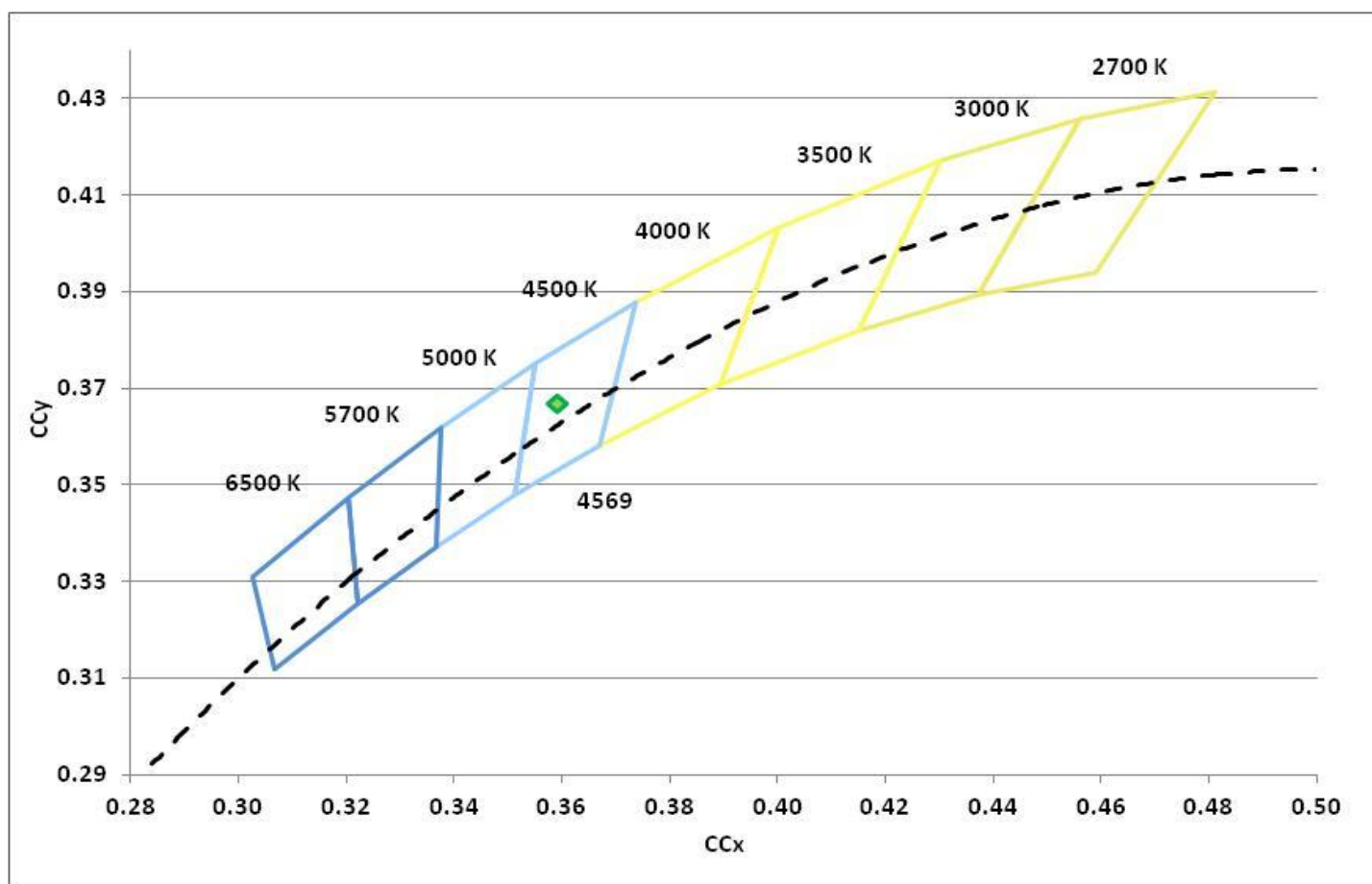
Chromaticity Coordinates

x	y	u	v	u'	v'	Duv
0.3592	0.3670	0.2149	0.3293	0.2149	0.4940	0.002269

Color Rendering Index Details

Ra	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
96	99	98	94	99	97	96	97	92	74	91	96	74	99	95

Chromaticity Diagram



Spectral Distribution

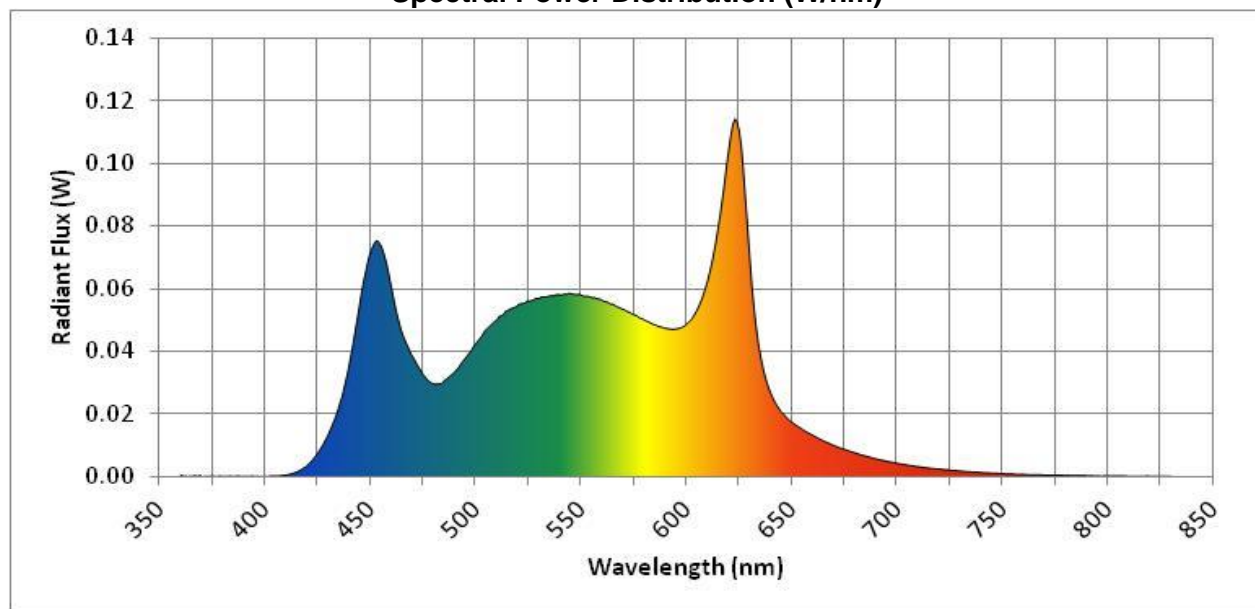
$\lambda(\text{nm})$	W/nm
360	0.000592
370	0.000019
380	0.000275
390	0.000152
400	0.000256
410	0.000597
420	0.003813
430	0.013826
440	0.036658
450	0.072259
460	0.059912
470	0.038404
480	0.029685
490	0.033739
500	0.042748
510	0.050301
520	0.055164

$\lambda(\text{nm})$	W/nm
530	0.057115
540	0.058308
550	0.058149
560	0.056458
570	0.053704
580	0.050145
590	0.047527
600	0.048912
610	0.062845
620	0.104645
630	0.069819
640	0.026680
650	0.017506
660	0.013323
670	0.010104
680	0.007728
690	0.005799

$\lambda(\text{nm})$	W/nm
700	0.004407
710	0.003313
720	0.002529
730	0.001881
740	0.001398
750	0.001056
760	0.000775
770	0.000613
780	0.000480
790	0.000398
800	0.000385
810	0.000242
820	0.000207
830	0.000188

Dominant Wavelength	574	nm
Peak Wavelength:	623	nm

Spectral Power Distribution (W/nm)





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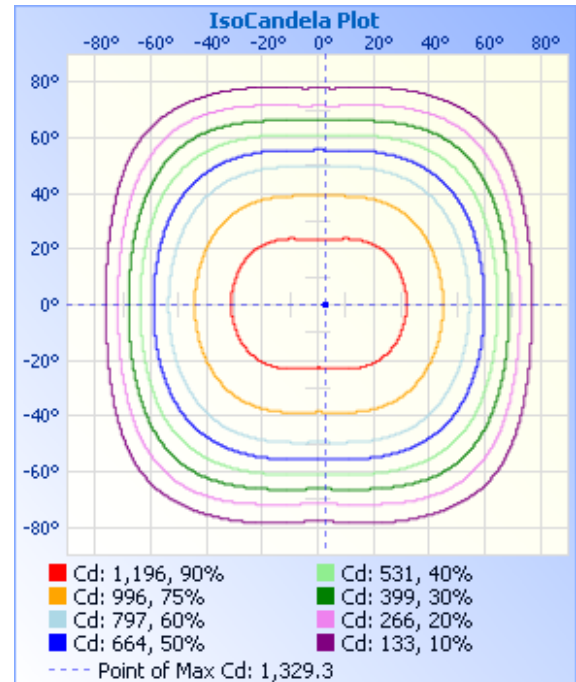
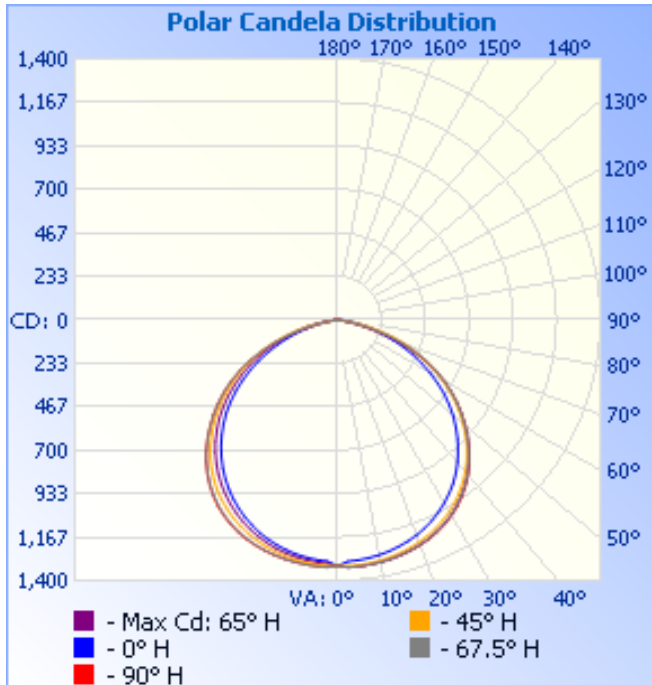
Zonal Lumen Summary **

Zone	Lumens	% of Total	Zone	Lumens	% of Total
0-5	31.5	0.8%	90-95	0	0%
5-10	93.7	2.4%	95-100	0	0%
10-15	153.6	4.0%	100-105	0	0%
15-20	209.7	5.4%	105-110	0	0%
20-25	260.4	6.7%	110-115	0	0%
25-30	303.6	7.8%	115-120	0	0%
30-35	337.4	8.7%	120-125	0	0%
35-40	359.8	9.3%	125-130	0	0%
40-45	369.4	9.5%	130-135	0	0%
45-50	365.2	9.4%	135-140	0	0%
50-55	347.2	8.9%	140-145	0	0%
55-60	315.3	8.1%	145-150	0	0%
60-65	270.4	7.0%	150-155	0	0%
65-70	212.8	5.5%	155-160	0	0%
70-75	145.8	3.8%	160-165	0	0%
75-80	77.7	2.0%	165-170	0	0%
80-85	25.0	0.6%	170-175	0	0%
85-90	2.6	0.1%	175-180	0	0%
Total			3881.1 lm	100%	

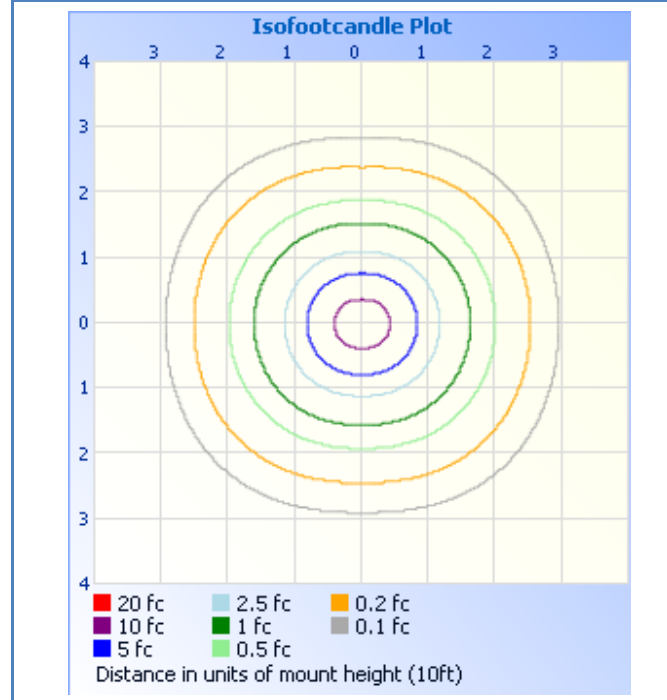
Spacing Criteria **

Spacing Criterion (0 - 180)	1.28
Spacing Criterion (90 - 270)	1.36
Spacing Criterion (Diagonal)	1.44

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	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320
2.5	1297	1297	1303	1312	1318	1323	1327	1329	1329	1329	1329	1329	1329	1328	1328
5	1294	1294	1301	1310	1316	1321	1325	1327	1327	1328	1327	1327	1327	1326	1326
7.5	1289	1288	1296	1305	1312	1317	1322	1324	1324	1324	1324	1324	1324	1323	1323
10	1281	1281	1288	1298	1306	1311	1317	1319	1319	1320	1320	1320	1319	1318	1318
12.5	1272	1271	1278	1288	1297	1303	1310	1312	1313	1313	1313	1314	1313	1313	1313
15	1260	1259	1266	1277	1286	1294	1301	1304	1304	1305	1305	1306	1306	1305	1305
17.5	1246	1244	1252	1264	1274	1282	1290	1293	1294	1296	1296	1296	1296	1296	1296
20	1229	1227	1235	1248	1259	1269	1278	1281	1282	1284	1284	1285	1285	1285	1285
22.5	1210	1207	1216	1230	1242	1253	1263	1267	1268	1269	1270	1270	1271	1271	1271
25	1188	1185	1194	1209	1223	1235	1246	1250	1251	1252	1253	1253	1253	1254	1254
27.5	1163	1159	1170	1186	1201	1213	1225	1229	1230	1232	1233	1233	1234	1234	1235
30	1135	1131	1143	1159	1176	1190	1202	1205	1207	1209	1209	1210	1210	1211	1212
32.5	1105	1100	1112	1130	1148	1162	1175	1179	1180	1181	1182	1183	1183	1184	1184
35	1072	1066	1079	1098	1116	1131	1144	1148	1149	1150	1151	1152	1152	1152	1153
37.5	1035	1029	1043	1063	1082	1097	1109	1113	1114	1115	1116	1116	1117	1118	1118
40	994	990	1004	1025	1044	1059	1072	1074	1076	1077	1077	1077	1078	1079	1079
42.5	949	946	962	984	1004	1019	1030	1033	1034	1034	1035	1035	1035	1036	1036
45	904	900	916	940	960	975	986	988	988	988	988	988	988	989	989
47.5	855	853	868	892	912	927	936	938	938	938	939	939	939	939	939
50	805	802	819	842	861	875	883	885	885	886	886	887	887	887	887
52.5	749	746	764	789	809	822	829	831	832	833	833	833	833	833	833
55	693	688	707	732	752	765	774	776	776	776	776	776	776	776	776
57.5	631	628	647	674	693	708	715	716	717	717	717	717	717	716	716
60	568	567	586	613	632	647	654	655	655	655	655	655	655	654	653
62.5	504	504	523	550	569	583	590	590	590	590	589	589	588	587	586
65	441	439	458	484	504	518	524	523	522	521	520	518	517	515	514
67.5	378	375	393	419	439	451	454	451	449	447	444	441	439	437	435
70	316	312	329	354	373	384	381	376	372	369	366	363	361	358	355
72.5	256	253	268	291	308	313	306	299	294	288	284	280	276	273	268
75	199	197	211	231	244	242	229	217	210	204	199	194	191	188	184
77.5	148	146	158	175	180	169	151	139	134	129	125	121	119	116	113
80	102	100	110	121	118	99	83	75	72	68	66	63	61	59	58
82.5	64	61	67	72	61	45	34	29	27	25	24	22	21	20	19
85	31	29	31	28	18	10	7	6	5	5	5	5	5	4	4
87.5	7	6	7	4	2	2	2	2	2	2	2	2	2	2	2
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



NVLAP Lab Code 500077-0

Candela Tabulations (Continued) **

	80	82.5	85	87.5	90	95	105	115	125	135	145	155	165	175	180
0	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320
2.5	1328	1328	1329	1329	1328	1328	1328	1328	1326	1321	1316	1309	1301	1295	1296
5	1326	1327	1328	1327	1327	1327	1326	1326	1323	1317	1312	1305	1297	1290	1293
7.5	1323	1323	1324	1324	1324	1323	1322	1322	1318	1312	1307	1299	1291	1284	1286
10	1318	1318	1319	1319	1319	1318	1317	1317	1313	1306	1299	1292	1282	1275	1277
12.5	1313	1313	1314	1314	1314	1312	1310	1309	1305	1298	1291	1281	1271	1263	1265
15	1305	1306	1307	1307	1306	1305	1303	1301	1295	1287	1279	1269	1258	1250	1251
17.5	1296	1297	1297	1297	1298	1296	1293	1290	1283	1274	1265	1254	1243	1233	1234
20	1285	1286	1286	1286	1286	1284	1281	1278	1269	1260	1249	1237	1225	1215	1215
22.5	1271	1272	1272	1272	1272	1270	1267	1262	1254	1243	1231	1217	1204	1194	1192
25	1255	1255	1256	1256	1256	1254	1250	1245	1236	1223	1209	1195	1181	1170	1168
27.5	1235	1236	1236	1236	1237	1234	1230	1224	1214	1201	1186	1170	1155	1144	1141
30	1212	1213	1213	1213	1214	1211	1206	1200	1190	1176	1160	1142	1126	1115	1111
32.5	1185	1185	1186	1186	1186	1185	1179	1172	1162	1148	1131	1113	1095	1083	1079
35	1154	1154	1155	1155	1155	1153	1148	1141	1132	1117	1099	1080	1061	1048	1043
37.5	1119	1119	1119	1120	1120	1118	1113	1106	1097	1083	1064	1044	1024	1011	1004
40	1080	1080	1080	1080	1080	1078	1074	1068	1059	1045	1026	1006	985	971	963
42.5	1036	1036	1037	1036	1036	1034	1032	1025	1017	1004	985	965	943	928	920
45	989	990	990	990	990	988	984	979	972	960	941	920	897	882	873
47.5	939	940	941	940	940	938	934	929	923	912	893	872	849	834	826
50	887	888	888	888	888	886	882	877	871	862	844	824	799	782	774
52.5	833	833	833	834	834	832	829	824	818	808	790	769	745	727	719
55	775	776	776	776	776	774	771	766	760	750	733	712	688	669	661
57.5	715	716	716	716	716	714	712	707	701	690	673	652	628	609	600
60	652	652	652	652	652	651	649	646	640	630	612	592	566	547	538
62.5	584	584	584	584	584	582	582	581	577	568	550	529	503	484	474
65	512	510	509	510	510	508	510	513	512	503	486	464	439	420	411
67.5	432	431	429	429	429	429	432	439	443	437	421	400	376	357	348
70	351	350	348	348	348	348	354	362	370	370	357	336	313	296	286
72.5	263	262	260	259	258	258	268	282	297	300	293	275	254	238	228
75	179	178	177	176	175	174	182	198	219	231	230	216	197	183	174
77.5	110	109	108	107	107	106	112	124	141	159	168	162	146	134	126
80	56	55	54	54	53	53	57	64	76	91	107	110	100	90	84
82.5	18	18	18	17	17	17	19	22	29	39	52	64	60	54	48
85	4	4	4	4	4	4	4	4	5	7	13	22	26	24	20
87.5	2	2	2	1	1	1	1	1	2	2	2	2	4	4	2
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	115	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

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-65:2001	Single-Ended Compact Fluorescent Lamps – Life Test Performance
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 K142
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.

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

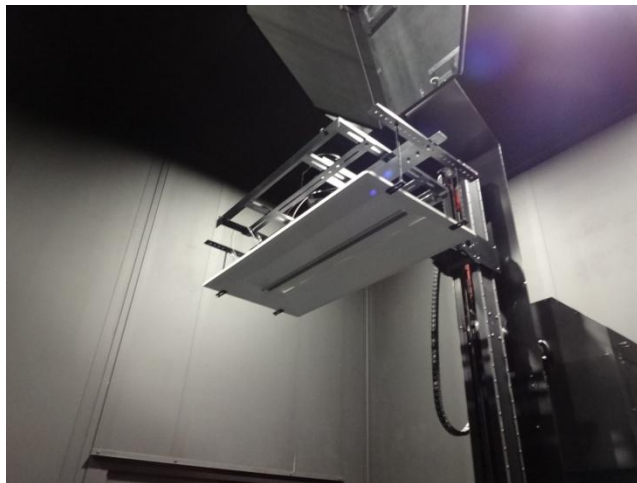
In the event that the recorded temperature is outside of $25 \pm 1^\circ\text{C}$, this is considered a non-standard condition.

** 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 at the time of this test	By	Approval
7/25/16	A	DMS	Origination	A. Gressel	C. McLaurin
10/27/16	B	DMS	Updated Part Number	A. Gressel	C. McLaurin
11/1/16	C	DMS	Updated Lumen Package	A. Gressel	C. McLaurin