



Report Number: PL08620-005C
Model: CR24-40L-ACK-CMA-EB10W_3000K
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_3000K
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	3942.0	3856.2	lm
Efficacy	93.66	91.99	lm/W
Correlated Color Temperature (CCT)	3046	K	
Color Rendering Index (CRI)	94		
R ₉	73		
Duv	0.000212		
S/P Ratio*	1.45		

	Sphere		Goniophotometer		
Electrical Measurements	120V	277V	120V	277V	
Input Wattage	42.09	41.87	41.92	42.10	W
Input Current	0.35	0.17	0.35	0.17	A
Input Voltage	120.00	276.98	120.02	277.04	V
Power Factor	0.990	0.884	0.990	0.882	
Off-State Power	0	0	0	0	W
Total Harmonic Distortion (Voltage)	0.06	0.06	0.07	0.06	%
Total Harmonic Distortion (Amperage)	7.14	14.18	7.24	13.34	%

Note: All photometric measurements taken at 120VAC.

Luminous Intensity Distribution	Goniophotometer	
Center Beam Candlepower (Max Candela)	1321.7	Cd
Horizontal Angle	65	°
Vertical Angle	2.5	°
Zonal Lumens (0° – 30°)	1046.7 (27.1)	lm (%)
Zonal Lumens (0° – 40°)	1740.3 (45.1)	lm (%)
Zonal Lumens (0° – 60°)	3129.1 (81.1)	lm (%)
Zonal Lumens (60° – 90°)	727.0 (18.9)	lm (%)
Color Angular Uniformity	0.00066	

Key Test Parameters	Sphere Output	Goniophotometer	
Stabilization Time	137	62	min
Total Operating Time (Stabilization + Test)	137	82	min
Ambient Temperature	24.6	24.9	°C

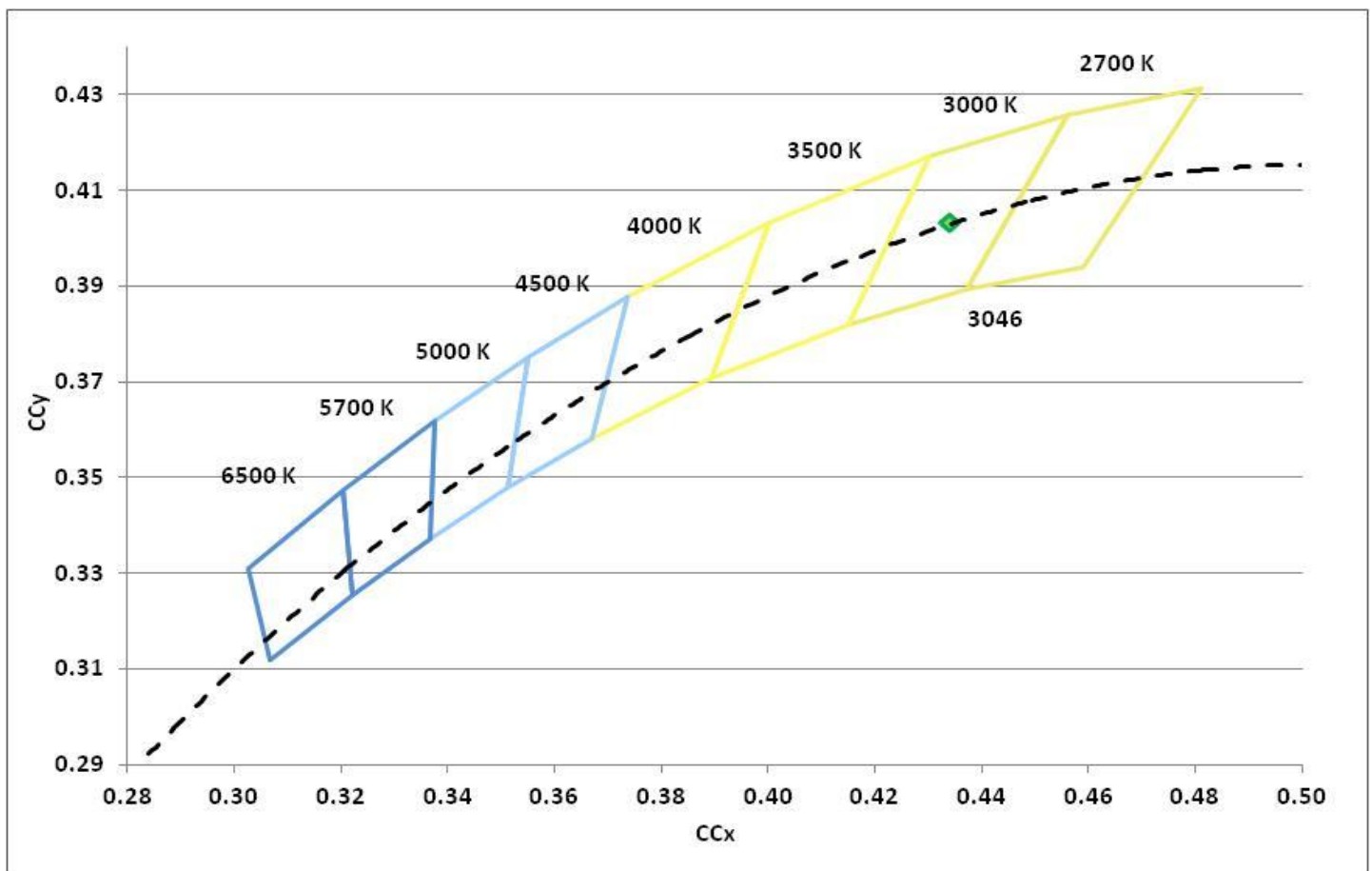
Chromaticity Coordinates

x	y	u	v	u'	v'	Duv
0.4338	0.4034	0.2489	0.3471	0.2489	0.5206	0.000212

Color Rendering Index Details

Ra	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
94	93	99	90	89	96	95	96	92	73	92	85	90	95	91

Chromaticity Diagram



Spectral Distribution

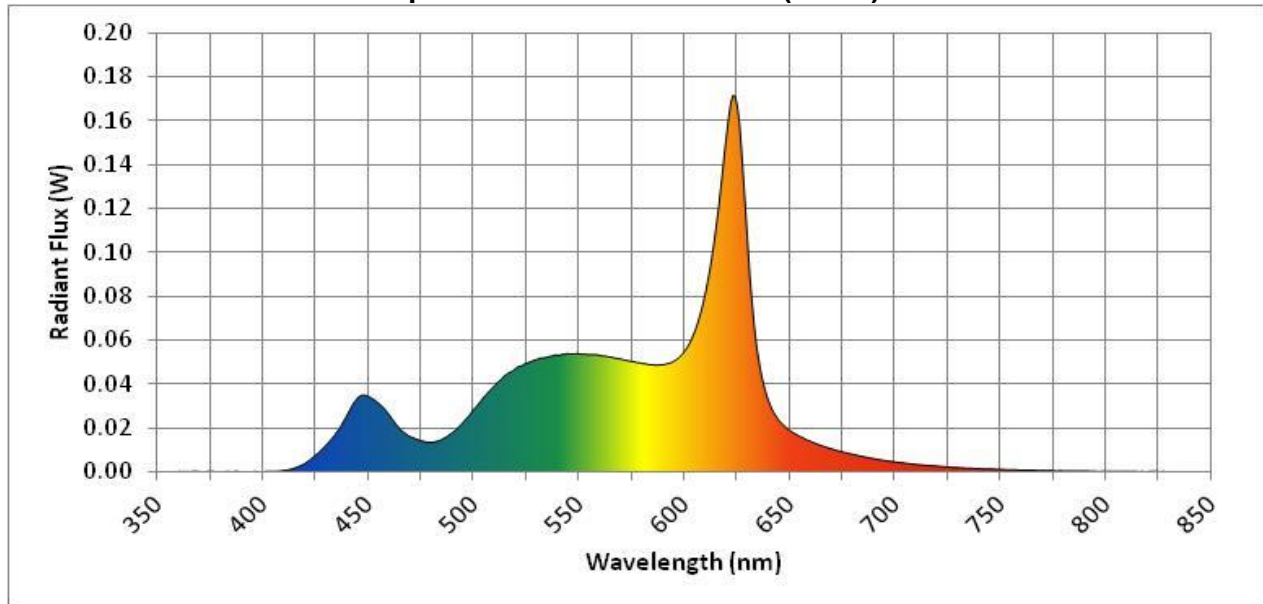
$\lambda(\text{nm})$	W/nm
360	0.000332
370	0.000002
380	0.000120
390	0.000072
400	0.000123
410	0.000624
420	0.004142
430	0.012572
440	0.026565
450	0.034404
460	0.025688
470	0.015997
480	0.013540
490	0.018167
500	0.028691
510	0.039540
520	0.047476

$\lambda(\text{nm})$	W/nm
530	0.051346
540	0.053436
550	0.053903
560	0.053076
570	0.051581
580	0.049388
590	0.048956
600	0.055183
610	0.082266
620	0.154538
630	0.103277
640	0.032108
650	0.018899
660	0.013917
670	0.010519
680	0.007990
690	0.006047

$\lambda(\text{nm})$	W/nm
700	0.004588
710	0.003463
720	0.002679
730	0.001974
740	0.001503
750	0.001095
760	0.000854
770	0.000692
780	0.000503
790	0.000419
800	0.000340
810	0.000277
820	0.000214
830	0.000055

Dominant Wavelength	582	nm
Peak Wavelength:	623	nm

Spectral Power Distribution (W/nm)





NVLAP Lab Code 500077-0

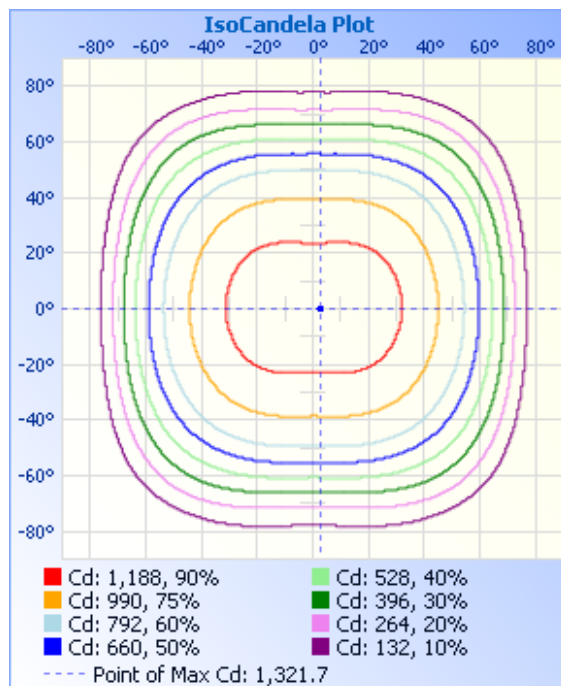
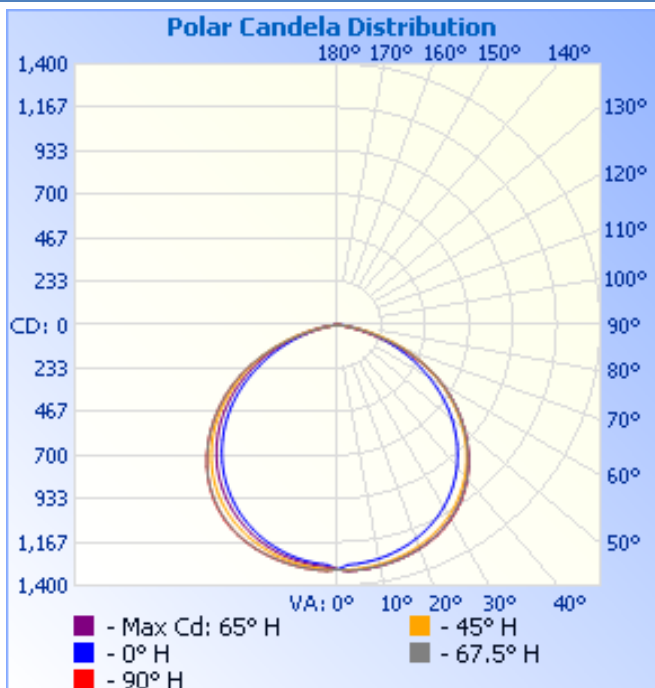
Zonal Lumen Summary **

Zone	Lumens	% of Total	Zone	Lumens	% of Total
0-5	31.3	0.8%	90-95	0	0%
5-10	93.1	2.4%	95-100	0	0%
10-15	152.7	4.0%	100-105	0	0%
15-20	208.6	5.4%	105-110	0	0%
20-25	258.9	6.7%	110-115	0	0%
25-30	302.0	7.8%	115-120	0	0%
30-35	335.6	8.7%	120-125	0	0%
35-40	358.0	9.3%	125-130	0	0%
40-45	367.6	9.5%	130-135	0	0%
45-50	363.3	9.4%	135-140	0	0%
50-55	344.9	8.9%	140-145	0	0%
55-60	313.0	8.1%	145-150	0	0%
60-65	268.2	7.0%	150-155	0	0%
65-70	211.0	5.5%	155-160	0	0%
70-75	144.2	3.7%	160-165	0	0%
75-80	76.6	2.0%	165-170	0	0%
80-85	24.5	0.6%	170-175	0	0%
85-90	2.5	0.1%	175-180	0	0%
Total			3856.2 lm 100%		

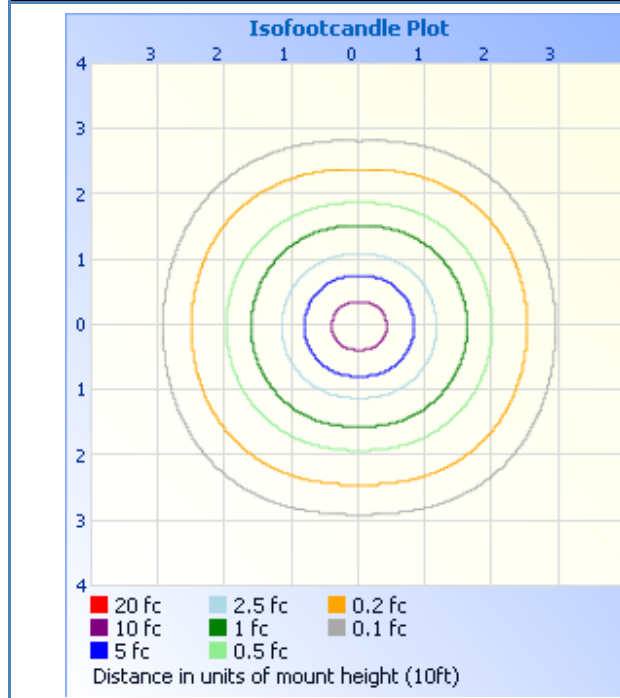
Spacing Criteria **

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

Candela Plots **



Isofootcandle Plot **





NVLAP Lab Code 500077-0

Candela Tabulations **

	0	5	15	25	35	45	55	60	62.5	65	67.5	70	72.5	75	77.5
0	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313
2.5	1289	1289	1296	1305	1311	1315	1320	1321	1321	1322	1321	1321	1321	1320	1320
5	1287	1287	1294	1302	1309	1314	1318	1319	1320	1320	1320	1319	1319	1318	1318
7.5	1281	1282	1288	1298	1305	1310	1315	1316	1316	1317	1316	1316	1316	1315	1315
10	1274	1274	1281	1291	1298	1304	1310	1312	1312	1312	1312	1312	1311	1311	1310
12.5	1264	1264	1272	1281	1290	1297	1303	1305	1306	1306	1306	1306	1306	1305	1305
15	1252	1252	1260	1271	1280	1287	1295	1297	1298	1298	1298	1298	1298	1298	1298
17.5	1238	1238	1246	1258	1268	1276	1284	1287	1288	1288	1289	1289	1289	1288	1288
20	1222	1221	1230	1242	1253	1263	1272	1275	1276	1277	1277	1278	1278	1277	1278
22.5	1203	1202	1211	1224	1237	1247	1257	1261	1262	1263	1263	1264	1264	1264	1264
25	1181	1180	1190	1204	1218	1229	1240	1244	1245	1246	1246	1247	1247	1247	1248
27.5	1157	1155	1166	1181	1196	1208	1220	1224	1225	1226	1227	1227	1228	1228	1228
30	1130	1127	1138	1155	1172	1185	1197	1200	1201	1202	1203	1204	1204	1205	1206
32.5	1100	1096	1108	1126	1143	1158	1170	1174	1175	1176	1177	1178	1178	1178	1178
35	1067	1063	1076	1095	1112	1127	1140	1143	1144	1145	1146	1147	1147	1147	1148
37.5	1030	1026	1040	1060	1079	1093	1106	1109	1110	1110	1111	1112	1112	1113	1113
40	990	987	1001	1022	1042	1057	1068	1071	1072	1072	1073	1073	1074	1074	1075
42.5	945	944	960	982	1001	1016	1027	1029	1030	1031	1031	1030	1031	1032	1032
45	900	899	915	938	958	973	982	984	984	985	985	984	984	984	985
47.5	850	850	867	890	910	925	933	935	935	935	936	936	936	936	935
50	799	799	816	840	859	873	880	882	882	883	883	884	884	884	883
52.5	744	744	762	786	806	819	826	827	828	829	828	828	828	829	828
55	688	686	705	730	750	763	770	772	772	772	772	771	771	771	771
57.5	627	627	646	672	691	704	712	713	713	713	713	713	712	712	711
60	564	565	584	611	630	644	650	652	652	652	651	650	650	650	649
62.5	501	502	521	548	567	581	587	587	587	586	586	585	584	583	582
65	437	438	457	483	503	516	521	520	519	518	516	515	514	512	510
67.5	375	375	392	418	438	450	452	449	447	444	441	438	436	434	432
70	312	312	329	354	372	383	379	374	370	367	364	361	358	356	352
72.5	253	252	268	291	307	312	304	297	292	286	282	277	273	270	265
75	196	196	211	231	243	240	226	215	208	202	197	192	189	185	181
77.5	146	146	158	174	179	168	149	138	132	127	123	120	117	114	111
80	101	100	109	121	118	99	82	74	71	67	65	62	60	58	57
82.5	62	61	67	72	60	44	33	28	26	24	23	21	20	19	18
85	30	29	32	28	18	10	6	5	5	5	5	5	4	4	4
87.5	7	6	7	4	2	2	2	2	2	2	2	2	2	2	1
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



NVLAP Lab Code 500077-0

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	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313	1313
2.5	1320	1320	1321	1321	1320	1320	1319	1320	1318	1313	1308	1302	1294	1287	1289
5	1318	1319	1320	1320	1320	1318	1318	1318	1315	1309	1304	1297	1290	1283	1285
7.5	1315	1315	1316	1316	1316	1315	1314	1314	1311	1304	1299	1291	1283	1276	1278
10	1310	1311	1312	1312	1311	1310	1309	1309	1305	1298	1292	1283	1275	1267	1269
12.5	1305	1305	1306	1306	1306	1304	1302	1301	1297	1290	1282	1274	1263	1256	1257
15	1298	1298	1299	1299	1299	1297	1294	1293	1287	1279	1272	1261	1251	1242	1243
17.5	1289	1289	1290	1290	1290	1288	1285	1282	1276	1266	1257	1246	1235	1226	1226
20	1278	1278	1279	1279	1279	1277	1273	1270	1262	1252	1241	1229	1217	1207	1207
22.5	1264	1265	1266	1265	1265	1263	1259	1255	1246	1235	1223	1209	1196	1186	1185
25	1248	1249	1249	1249	1249	1248	1243	1238	1228	1215	1202	1187	1173	1163	1161
27.5	1229	1229	1230	1230	1230	1228	1223	1217	1208	1193	1178	1162	1147	1136	1134
30	1206	1206	1207	1207	1206	1205	1199	1193	1183	1168	1152	1134	1119	1107	1104
32.5	1179	1179	1179	1179	1179	1178	1172	1165	1155	1140	1123	1104	1088	1076	1071
35	1148	1149	1149	1149	1149	1147	1141	1134	1125	1110	1091	1072	1054	1041	1037
37.5	1114	1114	1114	1114	1114	1112	1107	1100	1091	1075	1057	1036	1017	1004	998
40	1075	1075	1075	1075	1075	1073	1069	1061	1053	1038	1019	998	978	963	957
42.5	1032	1032	1032	1032	1031	1029	1026	1020	1011	997	979	957	935	920	914
45	985	985	986	985	985	983	979	973	966	953	934	912	890	874	868
47.5	935	936	936	936	936	934	929	923	917	906	886	865	841	825	818
50	883	884	884	884	884	882	878	872	865	855	836	815	790	774	766
52.5	828	828	828	828	828	826	823	818	810	800	782	761	736	719	712
55	770	770	770	770	770	769	765	760	752	742	725	704	679	660	655
57.5	711	711	711	710	710	709	706	701	694	683	666	644	620	600	595
60	648	648	648	647	647	646	643	639	633	623	604	584	558	539	532
62.5	580	580	579	580	580	578	576	575	570	560	542	521	496	477	469
65	508	507	505	506	506	504	505	507	505	496	479	458	432	414	406
67.5	429	427	425	426	426	425	428	434	437	431	415	393	370	352	344
70	349	347	345	345	345	345	350	357	365	364	351	330	308	290	283
72.5	261	259	257	256	254	255	264	278	292	296	288	270	249	233	225
75	177	176	174	173	172	171	180	194	214	227	226	212	193	179	172
77.5	109	108	106	106	105	104	110	121	138	155	164	158	143	131	125
80	55	54	53	53	52	52	56	63	74	88	105	107	98	88	83
82.5	18	17	17	17	16	16	18	21	28	37	51	61	58	52	48
85	4	4	4	4	4	4	4	4	5	7	12	21	25	23	20
87.5	1	1	1	1	1	1	1	1	2	2	2	2	4	3	2
90	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
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 Reqt'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.

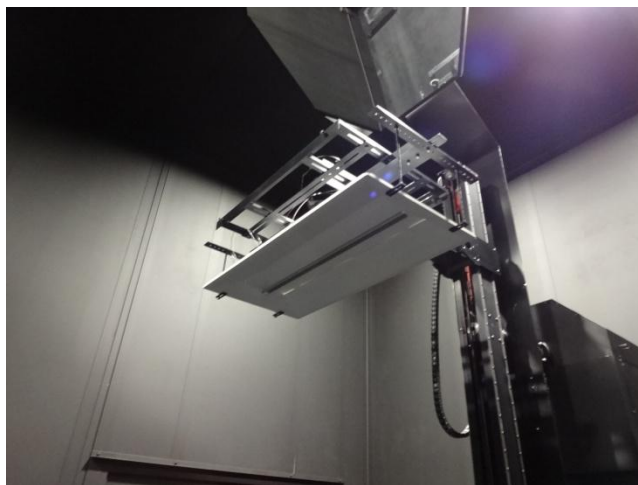
The goniophotometer information in the equipment list, report items marked with **, or results specifically identified as “Goniophotometer”, are the actual equipment used, and test results produced, by the subcontracted laboratory.

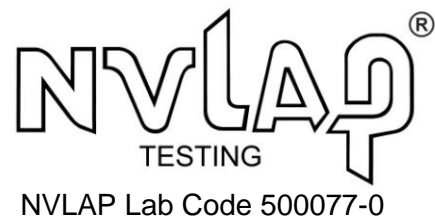
Additional Comments: The photos below are intended to show the orientation and fixturing/set-up of the units under test. These are critical to understanding the results of the test given the sensitivity of many products and measurement systems to orientation and set-up considerations, and also for reproducing 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
7/26/16	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