



Report Number: PL08620-001C
Model: CR24-40L-ACK-CMA-EB10W_5000K
Date: 11/1/2016

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

Prepared For:

Tammy Lehrmann

Cree, Inc

9201 Washington Avenue

Racine, WI 53406

Prepared By:

April Gressel, Photometric Technician

Approved By:

Christopher McLaurin, Photometric Specialist

Product Information

Manufacturer	Cree Inc
Model Number (SKU)	CR24-40L-ACK-CMA-EB10W_5000K
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	3989.0	3904.5	lm
Efficacy	88.39	86.54	lm/W
Correlated Color Temperature (CCT)	5106	K	
Color Rendering Index (CRI)	96		
R ₉	72		
Duv	0.003066		
S/P Ratio*	2.12		

	Sphere		Goniophotometer		
Electrical Measurements	120V	277V	120V	277V	
Input Wattage	45.13	44.79	45.12	44.78	W
Input Current	0.38	0.18	0.38	.18	A
Input Voltage	120.07	276.96	120.07	277.03	V
Power Factor	0.992	0.897	0.992	0.895	
Off-State Power	0	0	0	0	W
Total Harmonic Distortion (Voltage)	0.05	0.05	0.08	0.06	%
Total Harmonic Distortion (Amperage)	6.56	12.48	6.27	11.77	%

Note: All photometric measurements taken at 120VAC.

Luminous Intensity Distribution	Goniophotometer	
Center Beam Candlepower (Max Candela)	1336.4	Cd
Horizontal Angle	65	°
Vertical Angle	2.5	°
Zonal Lumens (0° – 30°)	1057.9 (27.1)	lm (%)
Zonal Lumens (0° – 40°)	1758.9 (45)	lm (%)
Zonal Lumens (0° – 60°)	3164.6 (81)	lm (%)
Zonal Lumens (60° – 90°)	740.0 (19)	lm (%)
Color Angular Uniformity	0.00055	

Key Test Parameters	Sphere Output	Goniophotometer	
Stabilization Time	57	61	min
Total Operating Time (Stabilization + Test)	57	81	min
Ambient Temperature	25.5	26.0	°C

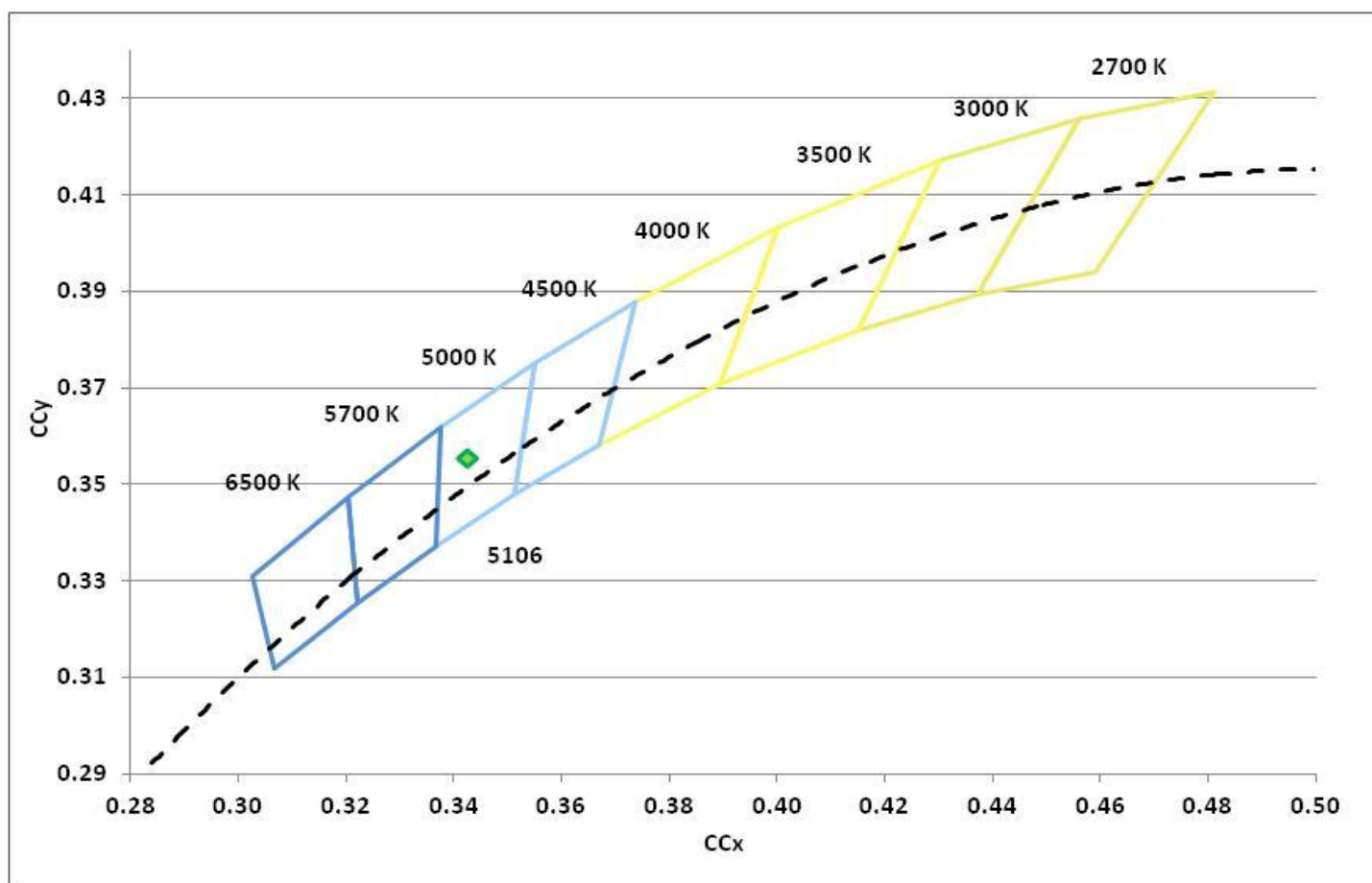
Chromaticity Coordinates

x	y	u	v	u'	v'	Duv
0.3426	0.3557	0.2082	0.3242	0.2082	0.4863	0.003066

Color Rendering Index Details

Ra	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
96	99	98	94	98	97	95	97	91	72	91	96	77	99	96

Chromaticity Diagram



Spectral Distribution

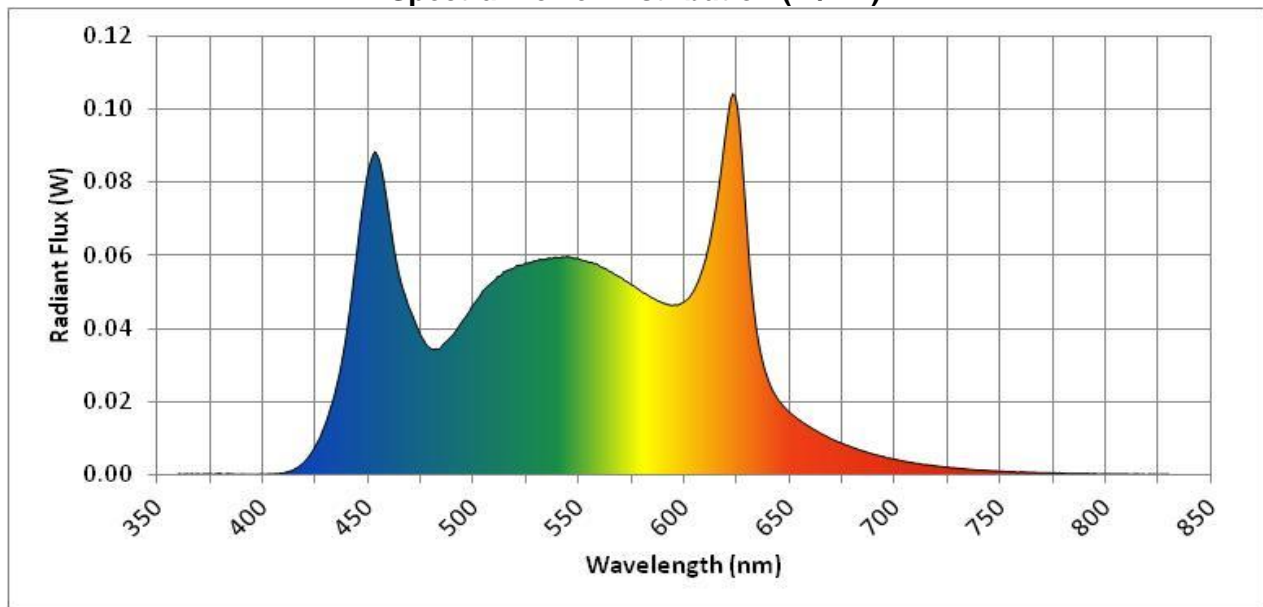
$\lambda(\text{nm})$	W/nm
360	0.000386
370	0.000138
380	0.000238
390	0.000283
400	0.000235
410	0.000601
420	0.004010
430	0.014956
440	0.041065
450	0.084037
460	0.069658
470	0.044755
480	0.034478
490	0.038430
500	0.047001
510	0.053483
520	0.057366

$\lambda(\text{nm})$	W/nm
530	0.058725
540	0.059539
550	0.059221
560	0.057119
570	0.054142
580	0.050059
590	0.047055
600	0.047562
610	0.059286
620	0.095959
630	0.064458
640	0.025602
650	0.017081
660	0.012996
670	0.009868
680	0.007491
690	0.005638

$\lambda(\text{nm})$	W/nm
700	0.004294
710	0.003167
720	0.002442
730	0.001821
740	0.001341
750	0.001023
760	0.000768
770	0.000630
780	0.000465
790	0.000393
800	0.000321
810	0.000330
820	0.000196
830	0.000148

Dominant Wavelength	568	nm
Peak Wavelength:	623	nm

Spectral Power Distribution (W/nm)





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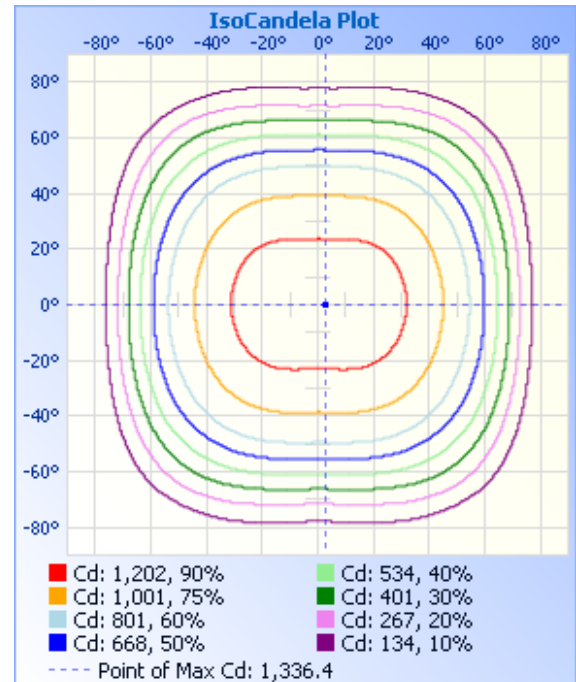
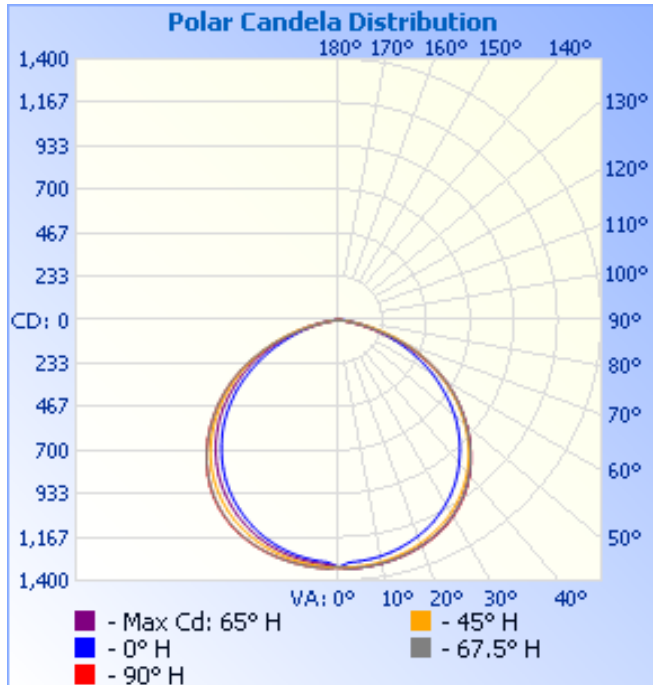
Zonal Lumen Summary **

Zone	Lumens	% of Total	Zone	Lumens	% of Total
0-5	31.6	0.8%	90-95	0	0%
5-10	94.2	2.4%	95-100	0	0%
10-15	154.4	4.0%	100-105	0	0%
15-20	210.8	5.4%	105-110	0	0%
20-25	261.7	6.7%	110-115	0	0%
25-30	305.2	7.8%	115-120	0	0%
30-35	339.2	8.7%	120-125	0	0%
35-40	361.8	9.3%	125-130	0	0%
40-45	371.5	9.5%	130-135	0	0%
45-50	367.4	9.4%	135-140	0	0%
50-55	349.4	8.9%	140-145	0	0%
55-60	317.4	8.1%	145-150	0	0%
60-65	272.3	7.0%	150-155	0	0%
65-70	214.4	5.5%	155-160	0	0%
70-75	146.9	3.8%	160-165	0	0%
75-80	78.4	2.0%	165-170	0	0%
80-85	25.3	0.6%	170-175	0	0%
85-90	2.7	0.1%	175-180	0	0%
Total			3904.5 lm		100%

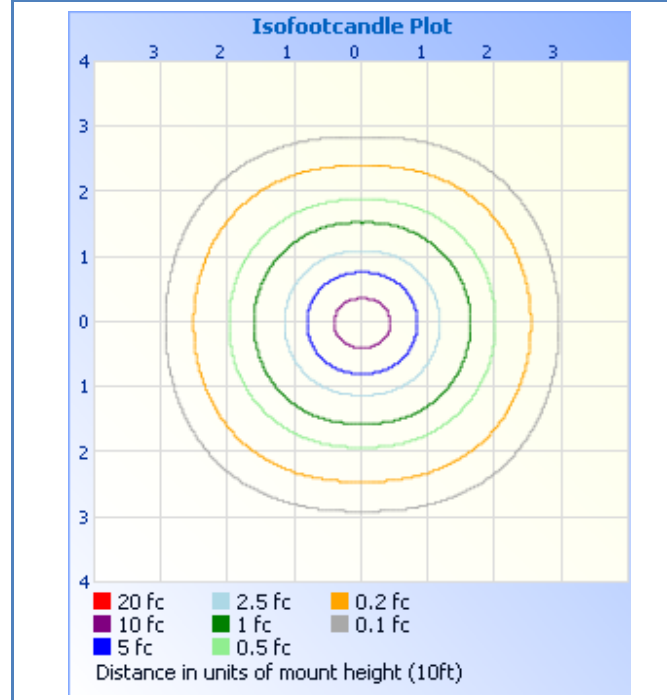
Spacing Criteria **

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	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327
2.5	1303	1303	1310	1318	1325	1329	1334	1335	1336	1336	1336	1336	1335	1335	1335
5	1300	1300	1307	1316	1323	1328	1332	1334	1334	1335	1335	1334	1334	1333	1333
7.5	1295	1295	1302	1311	1319	1324	1329	1330	1331	1331	1331	1331	1330	1330	1330
10	1288	1287	1294	1304	1312	1318	1324	1325	1326	1327	1327	1326	1326	1325	1325
12.5	1278	1277	1284	1294	1303	1310	1317	1319	1320	1320	1320	1320	1320	1320	1320
15	1266	1264	1272	1283	1292	1301	1308	1311	1311	1312	1312	1312	1312	1312	1312
17.5	1252	1250	1258	1269	1280	1289	1297	1300	1301	1302	1302	1303	1303	1303	1303
20	1235	1232	1241	1254	1265	1276	1285	1288	1289	1291	1291	1291	1291	1291	1292
22.5	1218	1212	1222	1236	1248	1260	1270	1274	1275	1276	1276	1277	1277	1277	1278
25	1195	1190	1200	1215	1229	1241	1252	1256	1257	1259	1259	1259	1260	1260	1261
27.5	1170	1165	1176	1191	1206	1220	1231	1235	1237	1238	1239	1239	1240	1241	1241
30	1142	1136	1148	1164	1181	1196	1208	1212	1214	1215	1216	1216	1217	1218	1218
32.5	1112	1104	1118	1135	1153	1169	1180	1185	1186	1188	1188	1188	1189	1190	1191
35	1078	1070	1084	1103	1122	1138	1149	1154	1155	1156	1157	1157	1158	1159	1160
37.5	1041	1034	1048	1067	1087	1104	1115	1119	1120	1122	1122	1122	1123	1124	1125
40	1000	994	1009	1029	1049	1066	1077	1081	1082	1083	1083	1083	1084	1085	1086
42.5	956	950	966	988	1008	1026	1036	1038	1040	1041	1040	1040	1041	1041	1042
45	912	904	922	943	964	981	991	992	993	994	994	993	994	994	995
47.5	863	855	873	895	916	933	941	942	943	944	944	944	944	944	945
50	813	805	823	845	865	881	887	888	890	891	891	891	891	892	893
52.5	755	750	768	791	812	827	834	835	836	838	837	836	837	837	838
55	696	691	711	735	756	771	778	779	780	781	781	780	780	780	781
57.5	635	631	651	676	696	712	719	720	721	722	721	721	720	720	721
60	575	569	589	614	635	651	657	658	659	660	659	658	658	658	657
62.5	512	506	526	551	572	588	593	593	593	594	593	592	592	591	590
65	447	441	461	485	507	522	526	525	525	525	523	522	520	519	518
67.5	382	377	396	419	441	455	457	453	452	450	447	444	442	440	438
70	319	314	332	355	375	387	383	377	375	372	369	365	362	360	358
72.5	260	254	271	292	310	316	308	299	295	291	286	281	278	274	270
75	204	198	213	231	245	244	230	217	212	206	201	196	192	189	186
77.5	152	146	159	174	181	171	151	139	135	131	126	122	119	116	115
80	105	100	111	120	119	101	84	75	73	70	67	64	62	60	59
82.5	65	61	68	71	62	46	34	29	27	26	24	23	22	20	20
85	33	29	32	28	18	11	7	6	6	5	5	5	5	5	5
87.5	8	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	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327
2.5	1335	1335	1336	1336	1335	1336	1334	1335	1333	1327	1323	1316	1308	1301	1303
5	1333	1334	1334	1334	1334	1334	1333	1333	1330	1324	1319	1312	1303	1297	1299
7.5	1330	1330	1331	1331	1331	1330	1329	1329	1325	1319	1313	1306	1297	1290	1292
10	1325	1325	1326	1326	1326	1326	1324	1324	1320	1313	1306	1298	1288	1281	1283
12.5	1319	1320	1321	1321	1321	1319	1317	1316	1312	1304	1297	1288	1278	1270	1271
15	1312	1313	1314	1313	1313	1312	1309	1307	1302	1294	1286	1276	1265	1256	1257
17.5	1303	1304	1304	1304	1304	1303	1299	1297	1290	1281	1272	1261	1249	1240	1240
20	1292	1292	1293	1293	1293	1291	1288	1284	1277	1266	1256	1244	1231	1222	1221
22.5	1278	1279	1279	1279	1279	1277	1273	1269	1261	1249	1238	1224	1210	1200	1199
25	1262	1262	1262	1263	1263	1261	1256	1252	1243	1230	1217	1201	1187	1177	1174
27.5	1242	1242	1243	1243	1243	1241	1236	1231	1221	1208	1193	1176	1162	1151	1147
30	1219	1219	1219	1219	1219	1218	1212	1207	1197	1182	1167	1149	1133	1122	1117
32.5	1192	1192	1192	1192	1192	1191	1185	1179	1169	1154	1138	1119	1102	1090	1084
35	1161	1161	1161	1161	1161	1160	1154	1148	1139	1123	1107	1086	1068	1056	1049
37.5	1125	1126	1126	1126	1125	1124	1119	1112	1104	1089	1072	1050	1031	1018	1010
40	1086	1086	1086	1086	1085	1085	1080	1074	1066	1051	1034	1012	992	978	969
42.5	1042	1043	1043	1042	1042	1041	1036	1032	1024	1010	993	970	949	935	926
45	996	996	996	996	995	994	989	985	978	965	949	926	903	888	879
47.5	946	946	946	946	945	944	939	935	929	918	901	878	855	840	831
50	893	893	893	893	893	892	887	883	877	867	851	829	806	789	778
52.5	838	838	838	838	838	838	833	830	823	813	798	775	751	733	723
55	781	781	780	780	780	780	775	772	765	755	740	717	694	675	665
57.5	721	720	720	720	719	719	715	712	706	695	680	657	633	614	604
60	657	657	657	656	656	655	652	651	645	635	618	596	571	552	541
62.5	589	588	588	587	587	587	585	586	581	572	556	533	508	488	477
65	516	515	513	513	512	513	513	518	515	506	492	468	444	424	413
67.5	437	435	432	432	432	433	435	443	446	440	427	402	379	361	350
70	355	353	350	349	348	351	355	366	373	373	362	339	316	299	288
72.5	267	265	262	260	259	261	268	285	299	303	297	277	256	240	229
75	183	180	178	177	176	176	183	201	221	233	233	218	199	185	175
77.5	113	111	110	108	107	108	113	126	143	160	171	163	148	136	127
80	58	56	55	54	54	54	57	66	77	92	110	111	101	91	84
82.5	20	19	18	18	18	18	19	23	29	39	54	64	61	54	48
85	5	4	4	4	4	4	4	5	5	8	14	22	26	24	20
87.5	2	2	2	2	1	1	1	2	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.

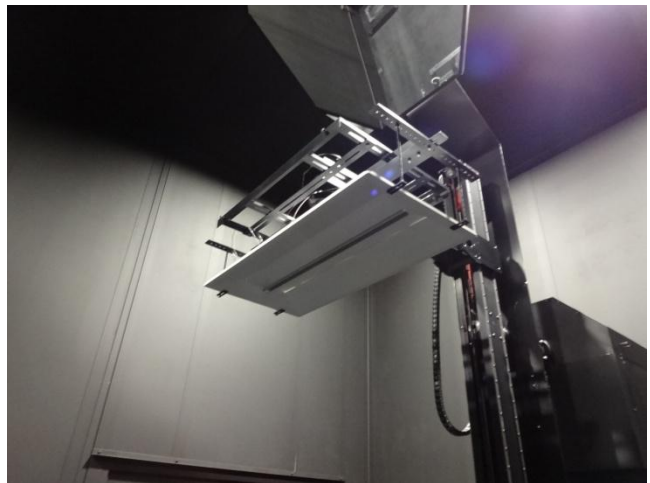
Additional Comments:

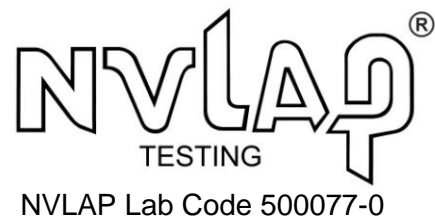
The photos below are intended to show the orientation and fixturing/set-up of the units under test. These are critical to understanding the results of the test given the sensitivity of many products and measurement systems to orientation and set-up considerations, and also for reproducing the conditions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