



Report Number: PL08620-004C
Model: CR24-40L-ACK-CMA-EB10W_3500K
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_3500K
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	3985.0	3890.2	lm
Efficacy	95.38	93.36	lm/W
Correlated Color Temperature (CCT)	3469	K	
Color Rendering Index (CRI)	95		
R ₉	77		
Duv	-0.000493		
S/P Ratio*	1.63		

	Sphere		Goniophotometer		
Electrical Measurements	120V	277V	120V	277V	
Input Wattage	41.78	41.55	41.67	41.45	W
Input Current	0.35	0.17	0.35	0.17	A
Input Voltage	120.01	276.99	120.05	276.99	V
Power Factor	0.990	0.884	0.989	0.879	
Off-State Power	0	0	0	0	W
Total Harmonic Distortion (Voltage)	0.05	0.05	0.07	0.07	%
Total Harmonic Distortion (Amperage)	7.58	14.38	7.67	13.94	%

Note: All photometric measurements taken at 120VAC.

Luminous Intensity Distribution	Goniophotometer	
Center Beam Candlepower (Max Candela)	1332.6	Cd
Horizontal Angle	65	°
Vertical Angle	2.5	°
Zonal Lumens (0° – 30°)	1055.0 (27.1)	lm (%)
Zonal Lumens (0° – 40°)	1754.0 (45.1)	lm (%)
Zonal Lumens (0° – 60°)	3154.9 (81.1)	lm (%)
Zonal Lumens (60° – 90°)	735.2 (18.9)	lm (%)
Color Angular Uniformity	0.00067	

Key Test Parameters	Sphere Output	Goniophotometer	
Stabilization Time	117	61	min
Total Operating Time (Stabilization + Test)	117	81	min
Ambient Temperature	24.4	25.3	°C

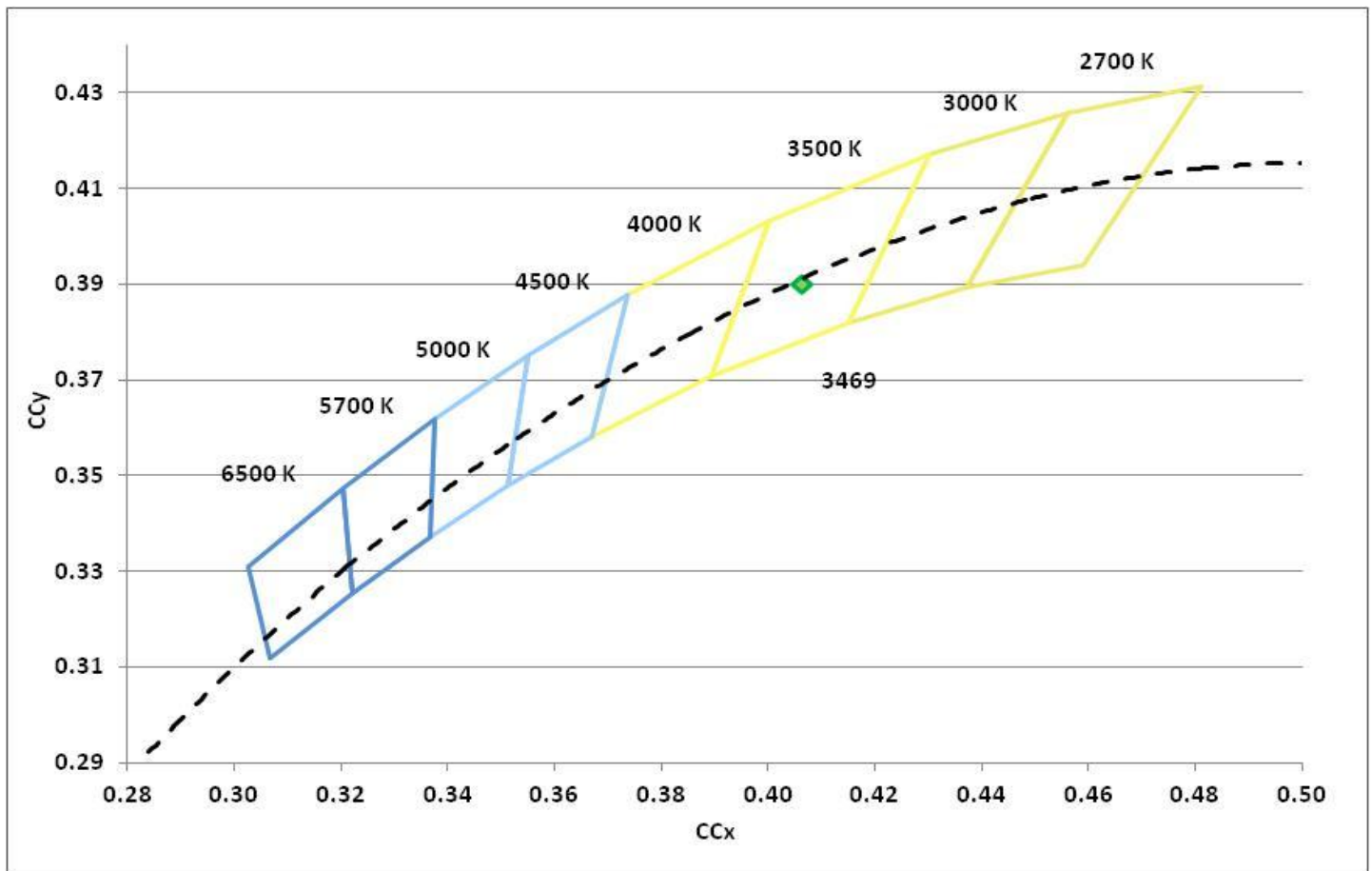
Chromaticity Coordinates

x	y	u	v	u'	v'	Duv
0.4064	0.3902	0.2367	0.3408	0.2367	0.5112	-0.000493

Color Rendering Index Details

Ra	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
95	94	99	91	92	97	96	97	94	77	93	89	86	96	93

Chromaticity Diagram



Spectral Distribution

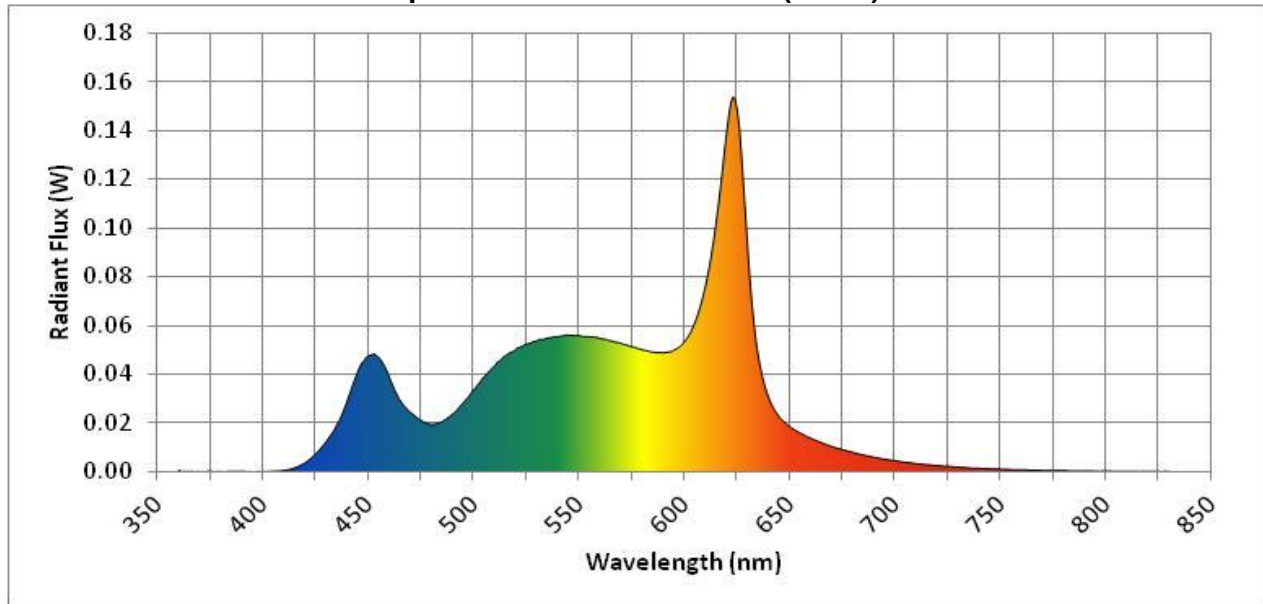
$\lambda(\text{nm})$	W/nm
360	0.000790
370	0.000068
380	0.000226
390	0.000177
400	0.000245
410	0.000565
420	0.003948
430	0.012671
440	0.029743
450	0.047730
460	0.038344
470	0.024309
480	0.019411
490	0.023844
500	0.033905
510	0.043698
520	0.050516

$\lambda(\text{nm})$	W/nm
530	0.053843
540	0.055575
550	0.055865
560	0.054670
570	0.052794
580	0.050101
590	0.048920
600	0.053555
610	0.076583
620	0.139579
630	0.091100
640	0.030248
650	0.018555
660	0.013821
670	0.010493
680	0.007999
690	0.006007

$\lambda(\text{nm})$	W/nm
700	0.004646
710	0.003436
720	0.002735
730	0.001949
740	0.001458
750	0.001124
760	0.000893
770	0.000623
780	0.000483
790	0.000395
800	0.000499
810	0.000293
820	0.000193
830	0.000221

Dominant Wavelength	581	nm
Peak Wavelength:	623	nm

Spectral Power Distribution (W/nm)





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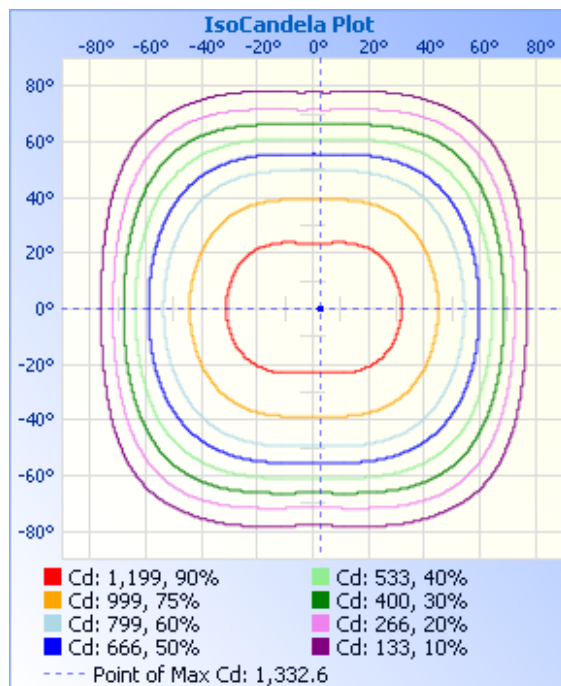
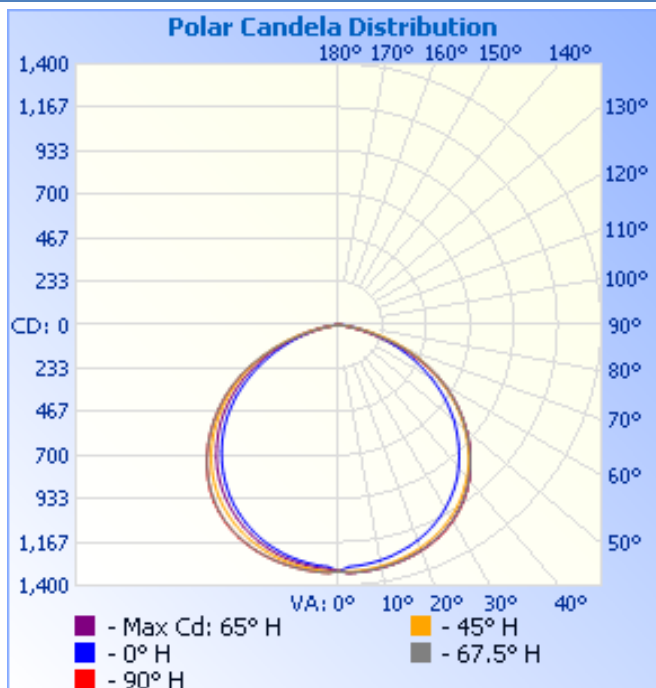
Zonal Lumen Summary **

Zone	Lumens	% of Total	Zone	Lumens	% of Total
0-5	31.6	0.8%	90-95	0	0%
5-10	93.9	2.4%	95-100	0	0%
10-15	154.0	4.0%	100-105	0	0%
15-20	210.2	5.4%	105-110	0	0%
20-25	261.0	6.7%	110-115	0	0%
25-30	304.4	7.8%	115-120	0	0%
30-35	338.2	8.7%	120-125	0	0%
35-40	360.8	9.3%	125-130	0	0%
40-45	370.4	9.5%	130-135	0	0%
45-50	366.1	9.4%	135-140	0	0%
50-55	348.2	8.9%	140-145	0	0%
55-60	316.2	8.1%	145-150	0	0%
60-65	271.0	7.0%	150-155	0	0%
65-70	213.3	5.5%	155-160	0	0%
70-75	145.9	3.8%	160-165	0	0%
75-80	77.6	2.0%	165-170	0	0%
80-85	24.8	0.6%	170-175	0	0%
85-90	2.5	0.1%	175-180	0	0%
Total			3890.2 lm 100%		

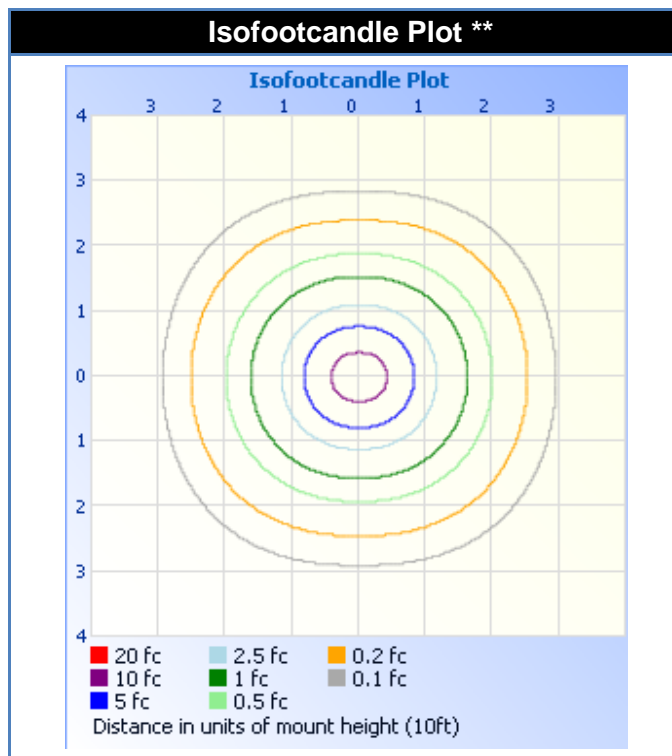
Spacing Criteria **

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

Candela Plots **



Isofootcandle Plot **





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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	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323
2.5	1300	1300	1307	1315	1322	1325	1330	1332	1332	1333	1332	1332	1331	1331	1331
5	1296	1297	1304	1313	1320	1324	1329	1330	1331	1331	1331	1330	1330	1329	1330
7.5	1291	1292	1299	1308	1315	1320	1325	1327	1327	1328	1327	1327	1327	1326	1326
10	1283	1284	1291	1301	1308	1315	1320	1322	1322	1323	1323	1322	1322	1322	1321
12.5	1273	1274	1281	1292	1300	1307	1313	1316	1316	1317	1317	1316	1316	1316	1316
15	1260	1262	1269	1280	1290	1298	1305	1307	1308	1309	1309	1309	1309	1308	1309
17.5	1247	1248	1255	1267	1277	1286	1294	1297	1298	1299	1299	1299	1299	1299	1299
20	1230	1230	1239	1252	1263	1273	1282	1285	1286	1287	1288	1288	1288	1288	1288
22.5	1212	1210	1220	1234	1246	1257	1267	1270	1272	1273	1273	1273	1274	1274	1274
25	1191	1188	1198	1213	1227	1239	1249	1253	1255	1256	1256	1257	1257	1258	1258
27.5	1165	1163	1174	1189	1205	1218	1229	1233	1234	1236	1236	1236	1237	1238	1239
30	1137	1135	1147	1163	1180	1194	1206	1210	1211	1213	1213	1213	1214	1214	1215
32.5	1106	1104	1116	1134	1152	1167	1178	1182	1184	1185	1186	1186	1186	1187	1188
35	1073	1070	1083	1102	1121	1136	1148	1152	1153	1154	1155	1155	1155	1156	1157
37.5	1037	1033	1047	1066	1086	1102	1113	1117	1118	1119	1120	1120	1121	1122	1122
40	996	993	1009	1028	1049	1065	1076	1079	1080	1081	1081	1080	1082	1083	1083
42.5	950	950	966	987	1008	1024	1034	1037	1038	1039	1038	1037	1038	1039	1040
45	903	904	922	943	964	980	989	991	992	992	992	991	991	992	992
47.5	854	855	873	894	916	932	939	940	942	943	942	942	942	942	943
50	804	805	824	845	864	880	886	887	888	890	890	889	889	890	890
52.5	749	750	769	792	813	827	832	834	835	837	836	835	836	836	836
55	692	692	712	735	756	771	777	778	779	780	779	778	778	778	779
57.5	631	632	652	676	697	712	718	719	720	721	720	719	719	719	719
60	568	570	590	615	635	651	656	657	658	658	658	657	656	656	656
62.5	504	506	527	551	572	587	592	592	592	593	592	590	590	589	588
65	440	442	462	486	508	522	526	524	524	524	522	520	518	517	516
67.5	378	378	397	420	442	455	456	453	451	450	446	443	441	438	437
70	316	314	333	355	376	388	382	376	374	371	368	365	362	358	356
72.5	255	254	272	292	310	316	307	299	294	290	285	280	276	272	269
75	198	198	214	232	246	244	229	215	210	204	199	194	190	187	184
77.5	147	146	160	175	181	170	150	138	134	129	125	120	118	115	113
80	102	101	111	121	119	101	83	74	71	69	66	62	60	58	57
82.5	63	62	69	72	61	45	33	28	26	24	23	21	20	19	18
85	31	30	32	28	18	10	6	5	5	5	5	4	4	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



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Candela Tabulations (Continued) **

	80	82.5	85	87.5	90	95	105	115	125	135	145	155	165	175	180
0	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323	1323
2.5	1331	1331	1332	1332	1332	1331	1330	1331	1328	1323	1319	1312	1304	1298	1299
5	1330	1330	1330	1331	1330	1330	1329	1329	1325	1320	1315	1308	1300	1293	1295
7.5	1326	1326	1327	1327	1327	1326	1325	1325	1321	1315	1309	1302	1293	1286	1288
10	1321	1322	1322	1322	1322	1321	1320	1320	1316	1309	1303	1294	1284	1278	1279
12.5	1316	1316	1317	1317	1317	1315	1313	1312	1307	1300	1293	1284	1274	1266	1268
15	1309	1309	1310	1310	1310	1308	1305	1303	1297	1289	1282	1272	1260	1252	1254
17.5	1300	1300	1301	1301	1301	1299	1296	1293	1286	1276	1268	1257	1245	1236	1238
20	1289	1289	1290	1289	1289	1288	1284	1280	1273	1262	1252	1239	1226	1217	1218
22.5	1275	1275	1276	1276	1276	1274	1269	1265	1257	1245	1233	1219	1206	1196	1196
25	1258	1259	1259	1259	1260	1258	1253	1248	1239	1226	1212	1197	1183	1172	1171
27.5	1239	1239	1240	1240	1240	1238	1233	1227	1217	1203	1188	1171	1157	1146	1145
30	1216	1216	1216	1216	1216	1215	1209	1203	1192	1178	1162	1144	1128	1117	1115
32.5	1189	1189	1189	1189	1189	1188	1182	1175	1165	1149	1133	1114	1097	1084	1082
35	1158	1158	1158	1158	1158	1157	1150	1143	1134	1118	1101	1081	1062	1050	1046
37.5	1123	1123	1123	1123	1123	1121	1115	1109	1099	1084	1066	1045	1025	1012	1009
40	1084	1084	1084	1083	1083	1081	1076	1070	1061	1046	1028	1006	986	972	968
42.5	1040	1040	1040	1040	1039	1038	1033	1028	1019	1005	988	965	943	928	924
45	993	993	993	993	992	991	986	981	974	960	943	920	897	881	878
47.5	943	943	944	943	943	941	936	931	925	913	895	872	849	834	830
50	891	891	891	890	890	889	884	879	872	862	845	823	799	783	778
52.5	837	836	836	836	835	835	830	826	818	808	792	769	744	727	723
55	779	779	778	778	777	777	772	768	761	750	735	711	687	669	665
57.5	719	719	718	717	717	717	712	708	702	690	674	651	627	608	604
60	656	655	654	654	653	653	649	647	641	630	613	590	565	546	542
62.5	588	587	586	585	584	584	582	582	577	566	550	528	502	483	478
65	515	513	511	510	510	510	509	514	511	502	487	463	438	419	414
67.5	436	433	430	430	429	430	430	440	442	436	422	398	375	356	351
70	355	352	349	348	347	349	352	362	370	369	357	335	312	294	289
72.5	265	262	260	258	256	258	265	282	296	300	293	273	252	236	231
75	181	178	176	175	173	174	180	198	217	230	230	215	196	182	177
77.5	111	110	108	107	105	106	111	124	140	157	168	160	146	133	129
80	56	55	54	53	52	53	56	64	75	90	107	109	99	89	86
82.5	18	18	17	16	16	16	17	21	28	38	52	62	59	53	50
85	4	4	4	4	4	4	4	4	5	7	13	21	26	23	22
87.5	2	1	1	1	1	1	1	2	2	2	2	2	4	3	3
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.

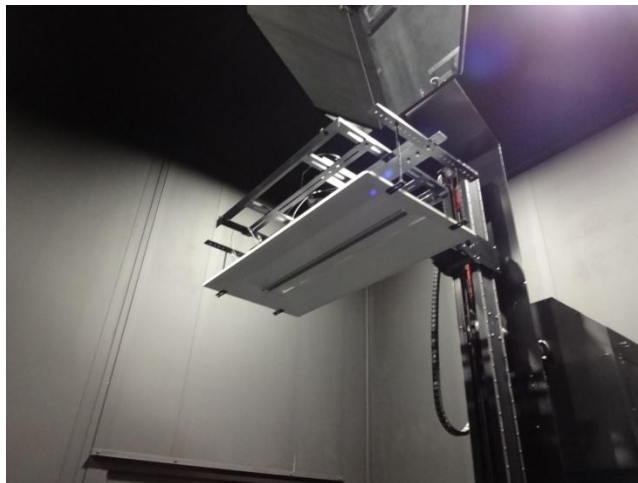
In the event that the recorded temperature is outside of $25 \pm 1^\circ\text{C}$, this is considered a non-standard condition.

** 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
7/26/16	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