



Report Number: PL10258-001A
Model: ZR24RK-40L-30K-10V-FD
Date: 03/02/2017

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

Prepared For:

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Prepared By:

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Approved By:

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Product Information	
Manufacturer	Cree Inc
Model Number (SKU)	ZR24RK-40L-30K-10V-FD
Serial Number	1LL02Q90001
LED Type	Lextar PC56H19

Product Description
 2 x 4 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
4"	48"	23.75"

Sample
 The following sample was submitted for evaluation





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Key Photometric Data	Sphere Output	Goniophotometer	
Luminous Flux	4240.0	4191.7	lm
Efficacy	133.75	132.86	lm/W
Correlated Color Temperature (CCT)	3047	K	
Color Rendering Index (CRI)	83		
R ₉	12		
Duv	0.000140		
S/P Ratio*	1.33		

Electrical Measurements	Sphere		Goniophotometer		
	120V	277V	120V	277V	
Input Wattage	31.70	31.49	31.55	31.31	W
Input Current	0.27	0.12	0.26	0.12	A
Input Voltage	120.02	276.99	120.07	277.08	V
Power Factor	0.996	0.961	0.996	0.959	
Off-State Power	0	0	0	0	W
Total Harmonic Distortion (Voltage)	0.07	0.05	0.08	0.07	%
Total Harmonic Distortion (Amperage)	7.16	10.99	7.20	10.82	%

Note: All photometric measurements taken at 120VAC.

Luminous Intensity Distribution	Goniophotometer	
Maximum Candela	1484.7	Cd
Horizontal Angle of Max Candela	70	°
Vertical Angle of Max Candela	2.5	°
Zonal Lumens (0° – 30°)	1130.5 (27%)	lm (%)
Zonal Lumens (0° – 40°)	1838.2 (43.9%)	lm (%)
Zonal Lumens (0° – 60°)	3210.8 (76.6%)	lm (%)
Zonal Lumens (60° – 90°)	980.9 (23.4%)	lm (%)
Color Angular Uniformity	NA	

Key Test Parameters	Sphere Output	Goniophotometer	
Stabilization Time	45	50	min
Total Operating Time (Stabilization + Test)	45	70	min
Ambient Temperature	24.4	24.6	°C

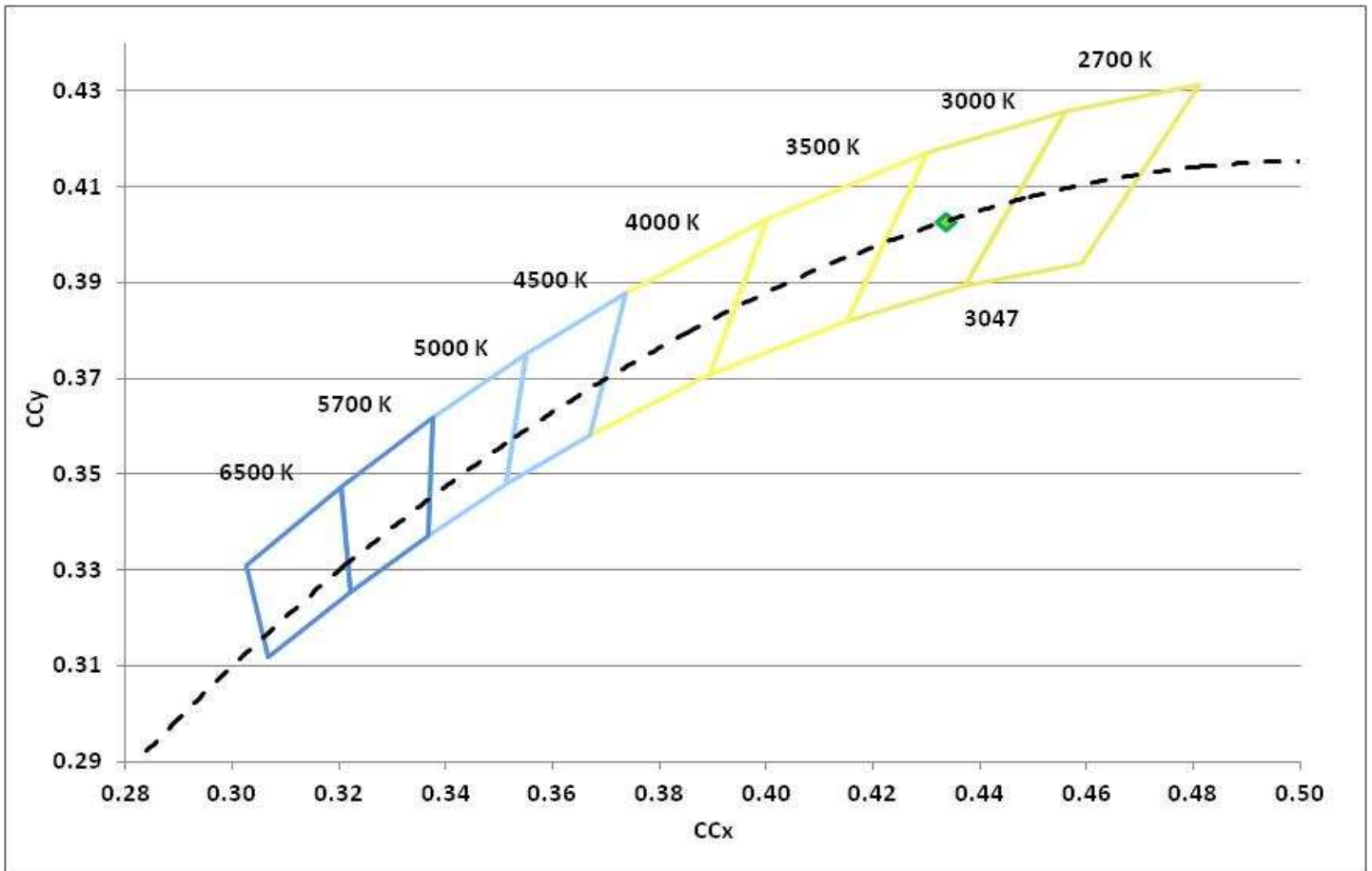
Chromaticity Coordinates

x	y	u	v	u'	v'	Duv
0.4336	0.4029	0.2489	0.3470	0.2489	0.5204	0.000140

Color Rendering Index Details

Ra	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
83	82	89	96	83	81	86	85	63	12	75	83	70	83	97

Chromaticity Diagram



Spectral Distribution

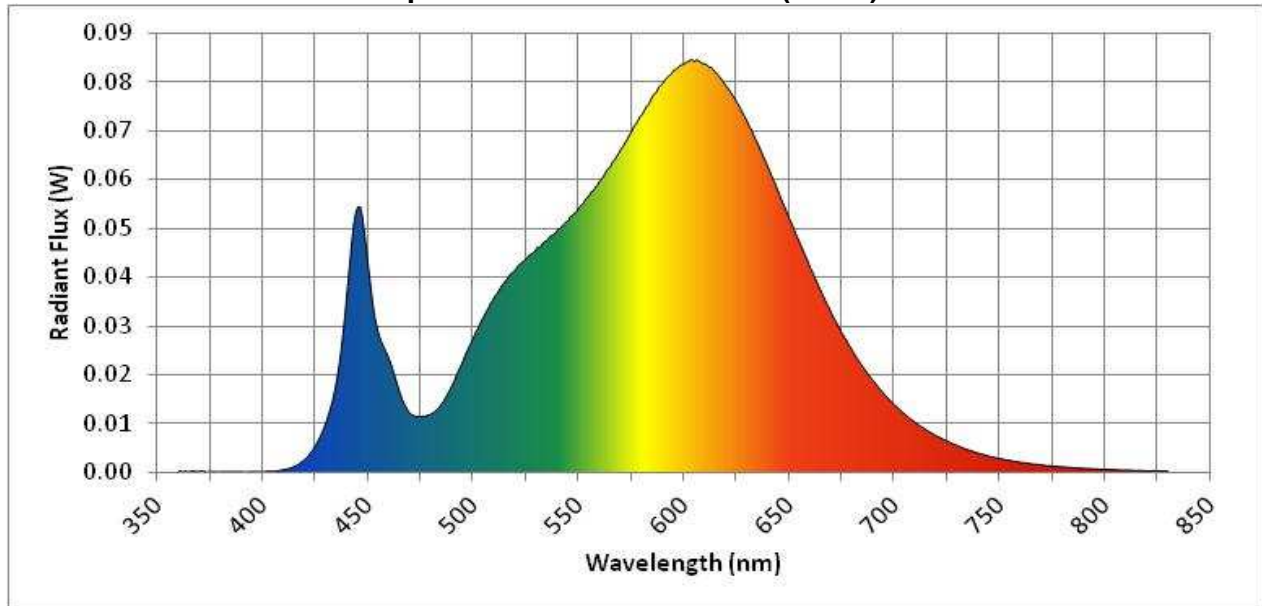
λ (nm)	W/nm
360	0.000353
370	0.000284
380	0.000230
390	0.000177
400	0.000188
410	0.000608
420	0.002857
430	0.010507
440	0.037732
450	0.041724
460	0.023131
470	0.012082
480	0.012124
490	0.018077
500	0.027737
510	0.036154
520	0.041670

λ (nm)	W/nm
530	0.046017
540	0.049883
550	0.054367
560	0.059921
570	0.066336
580	0.073350
590	0.079931
600	0.083812
610	0.083841
620	0.079292
630	0.071996
640	0.062552
650	0.052119
660	0.041996
670	0.032703
680	0.025008
690	0.018778

λ (nm)	W/nm
700	0.013963
710	0.010261
720	0.007506
730	0.005527
740	0.003975
750	0.002886
760	0.002124
770	0.001581
780	0.001182
790	0.000882
800	0.000671
810	0.000530
820	0.000412
830	0.000305

Dominant Wavelength	582	nm
Peak Wavelength:	606	nm

Spectral Power Distribution (W/nm)





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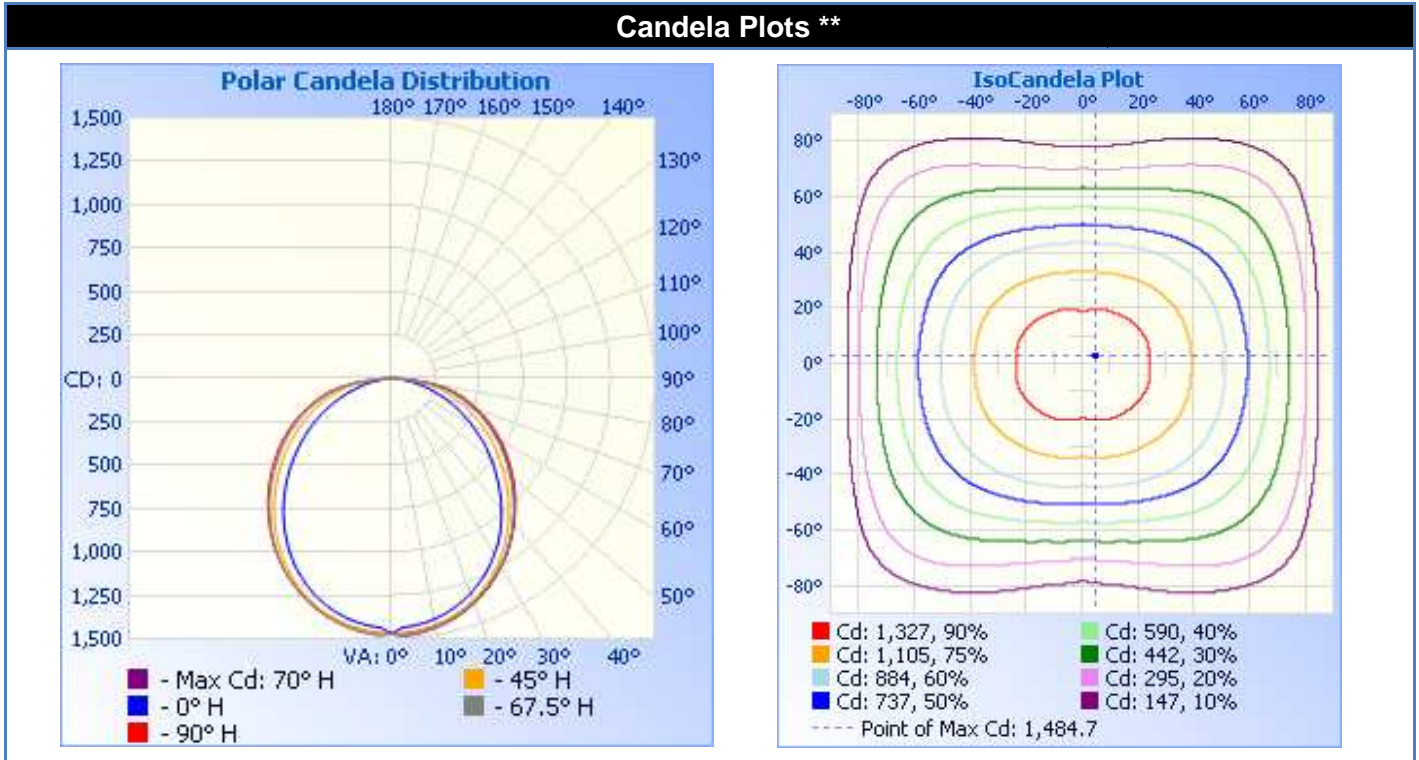
Zonal Lumen Summary **

Zone	Lumens	% of Total	Zone	Lumens	% of Total
0-5	35.1	0.8%	90-95	0	0%
5-10	103.9	2.5%	95-100	0	0%
10-15	168.8	4.0%	100-105	0	0%
15-20	227.4	5.4%	105-110	0	0%
20-25	277.7	6.6%	110-115	0	0%
25-30	317.7	7.6%	115-120	0	0%
30-35	346.0	8.3%	120-125	0	0%
35-40	361.6	8.6%	125-130	0	0%
40-45	364.9	8.7%	130-135	0	0%
45-50	356.9	8.5%	135-140	0	0%
50-55	338.6	8.1%	140-145	0	0%
55-60	312.2	7.4%	145-150	0	0%
60-65	279.0	6.7%	150-155	0	0%
65-70	239.3	5.7%	155-160	0	0%
70-75	195.4	4.7%	160-165	0	0%
75-80	148.9	3.6%	165-170	0	0%
80-85	92.0	2.2%	170-175	0	0%
85-90	26.3	0.6%	175-180	0	0%
Total			4191.7 lm	100%	

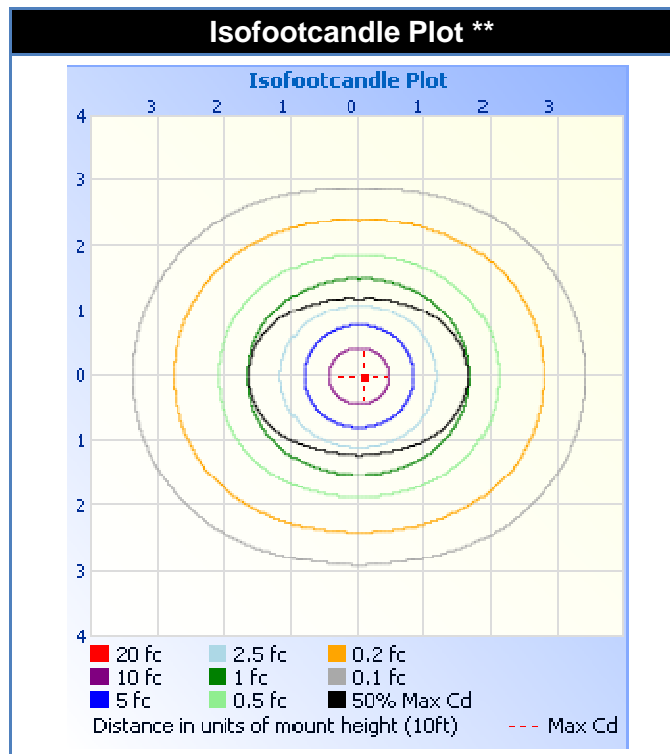
Spacing Criteria **

Spacing Criterion (0 - 180)	1.20
Spacing Criterion (90 - 270)	1.28
Spacing Criterion (Diagonal)	1.36

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	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470
2.5	1436	1443	1456	1466	1469	1474	1477	1479	1481	1483	1484	1485	1484	1484	1481
5	1430	1437	1450	1460	1464	1469	1471	1474	1476	1477	1478	1479	1479	1479	1476
7.5	1421	1427	1440	1450	1454	1460	1462	1464	1466	1467	1468	1469	1469	1468	1466
10	1407	1413	1425	1435	1440	1446	1449	1452	1454	1455	1456	1456	1456	1456	1453
12.5	1390	1395	1407	1417	1422	1429	1434	1437	1439	1440	1441	1442	1442	1441	1439
15	1369	1374	1386	1395	1401	1410	1415	1418	1420	1422	1423	1423	1423	1423	1420
17.5	1345	1349	1360	1371	1377	1387	1393	1396	1398	1400	1401	1402	1402	1401	1399
20	1317	1320	1332	1343	1350	1360	1367	1371	1373	1375	1376	1378	1378	1377	1375
22.5	1286	1287	1299	1311	1319	1330	1339	1343	1345	1347	1348	1350	1349	1349	1347
25	1251	1250	1264	1275	1285	1298	1307	1312	1314	1316	1318	1319	1319	1319	1317
27.5	1213	1210	1224	1237	1248	1262	1273	1279	1281	1283	1285	1286	1286	1286	1285
30	1171	1167	1181	1194	1207	1223	1236	1242	1245	1247	1249	1250	1251	1252	1251
32.5	1128	1121	1135	1149	1164	1181	1196	1203	1205	1208	1210	1212	1213	1213	1213
35	1081	1072	1085	1100	1117	1136	1154	1161	1163	1166	1168	1171	1172	1172	1172
37.5	1030	1020	1033	1049	1068	1089	1109	1117	1120	1122	1125	1128	1128	1129	1129
40	976	966	979	996	1018	1040	1062	1070	1074	1077	1080	1083	1084	1085	1085
42.5	920	912	924	942	966	990	1014	1023	1026	1030	1033	1036	1038	1039	1040
45	864	856	867	887	913	940	965	974	978	982	986	990	991	993	994
47.5	808	799	811	831	860	887	914	925	930	934	938	942	944	945	947
50	751	741	753	774	805	834	863	875	880	884	889	893	895	898	900
52.5	694	684	695	718	750	782	812	825	830	835	840	844	847	849	851
55	638	627	638	663	696	730	762	775	781	786	791	796	799	802	804
57.5	580	571	582	610	644	680	713	727	733	739	744	749	752	755	757
60	524	515	528	556	591	630	664	679	685	691	696	701	705	708	710
62.5	468	460	473	503	539	579	616	630	636	642	648	653	656	660	663
65	414	406	420	451	488	529	566	580	587	593	598	604	607	611	614
67.5	361	353	367	400	438	479	516	530	536	543	548	554	558	561	564
70	311	301	318	351	390	430	467	480	486	492	498	503	507	510	513
72.5	260	252	270	304	342	382	417	430	436	442	448	453	457	460	463
75	213	205	225	258	295	333	367	381	387	393	399	404	408	413	415
77.5	167	162	181	214	249	285	320	334	339	345	350	356	359	363	364
80	126	121	140	171	205	239	269	279	283	287	291	296	298	300	300
82.5	88	84	102	129	159	185	204	209	210	212	214	217	217	218	217
85	55	50	66	88	106	118	126	127	126	125	126	127	127	126	126
87.5	25	21	30	38	43	45	46	46	45	44	44	44	44	44	44
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	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470
2.5	1479	1476	1473	1471	1469	1473	1484	1482	1476	1474	1468	1464	1455	1443	1436
5	1474	1471	1469	1467	1465	1469	1479	1476	1470	1467	1462	1459	1450	1438	1431
7.5	1463	1461	1459	1457	1455	1459	1470	1467	1461	1458	1453	1449	1440	1428	1421
10	1451	1449	1446	1445	1443	1447	1458	1456	1450	1446	1441	1437	1428	1415	1407
12.5	1437	1434	1432	1431	1429	1432	1442	1440	1434	1430	1425	1420	1411	1398	1390
15	1418	1416	1414	1413	1412	1415	1423	1420	1414	1411	1405	1400	1390	1377	1369
17.5	1397	1395	1394	1392	1392	1394	1402	1399	1391	1387	1381	1375	1365	1352	1343
20	1373	1372	1370	1369	1369	1371	1378	1374	1366	1361	1354	1347	1336	1324	1314
22.5	1346	1344	1343	1342	1342	1344	1350	1346	1338	1331	1324	1315	1304	1292	1281
25	1316	1315	1314	1313	1313	1315	1321	1317	1307	1298	1290	1279	1268	1256	1244
27.5	1284	1283	1282	1282	1282	1284	1288	1284	1273	1262	1252	1240	1228	1217	1204
30	1249	1249	1249	1248	1248	1249	1253	1247	1235	1223	1211	1198	1185	1175	1161
32.5	1212	1212	1211	1212	1212	1212	1215	1208	1195	1181	1168	1154	1139	1130	1114
35	1172	1172	1172	1172	1172	1172	1175	1167	1152	1137	1122	1106	1091	1081	1066
37.5	1130	1130	1130	1130	1131	1130	1132	1124	1108	1091	1073	1055	1039	1030	1014
40	1086	1086	1087	1087	1087	1087	1087	1078	1061	1043	1023	1004	986	977	961
42.5	1041	1041	1042	1043	1043	1042	1042	1032	1013	994	971	950	932	923	906
45	995	996	997	998	998	997	996	984	965	943	918	896	876	867	850
47.5	948	950	951	952	952	951	949	936	916	892	864	840	820	810	794
50	901	903	904	905	906	904	902	889	866	841	811	784	763	752	738
52.5	854	855	857	858	859	857	854	840	817	788	756	729	706	695	680
55	806	808	810	811	812	810	805	790	766	736	702	673	649	638	624
57.5	759	762	764	765	766	764	758	742	717	684	649	618	592	581	568
60	713	715	717	718	719	718	711	695	668	634	597	564	537	525	512
62.5	665	667	669	670	671	670	663	646	620	585	545	511	483	470	456
65	616	618	620	621	622	621	614	597	571	535	495	458	430	415	402
67.5	566	568	570	571	572	571	564	547	521	485	445	408	377	361	348
70	515	517	519	520	520	520	513	496	471	436	396	358	327	309	296
72.5	465	467	468	469	470	470	463	446	422	388	349	311	278	260	247
75	417	419	420	421	422	421	415	398	373	340	303	265	232	212	200
77.5	366	368	369	369	370	369	366	350	326	293	257	221	188	169	156
80	302	302	303	303	303	302	304	294	276	247	212	179	147	127	115
82.5	217	217	217	217	217	217	222	219	212	195	168	138	109	90	79
85	125	125	125	125	125	125	131	133	134	129	117	97	72	56	46
87.5	44	44	44	44	45	44	48	49	54	55	53	48	36	26	18
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	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.

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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.

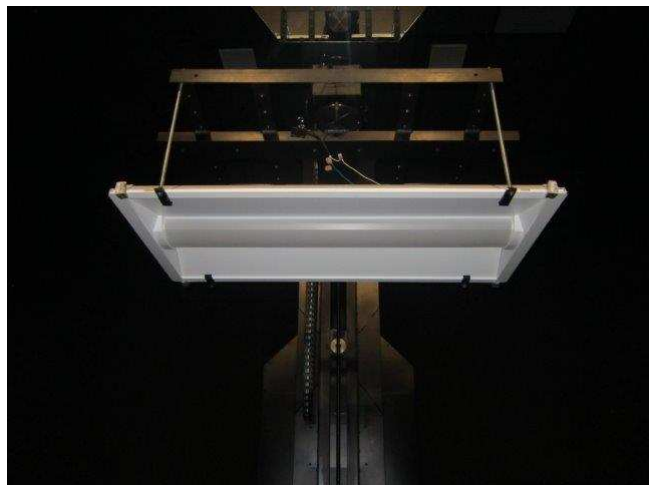
Additional Comments:

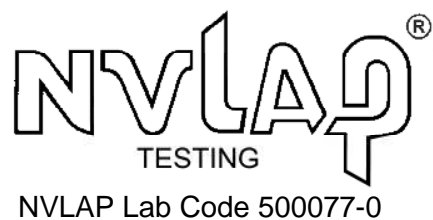
The photos below are intended to show the orientation and fixturing/set-up of the units under test. These are critical to understanding the results of the test given the sensitivity of many products and measurement systems to orientation and set-up considerations, and also for reproducing the conditions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

Sphere Picture



Goniophotometer Picture





Document Revision History:

Each subsequent revision of this report replaces the preceding report.

Date	Rev	DCN #	Change Details	By	Approval
03/02/17	A	DMS	Origination	A. Gressel	C. McLaurin