



Report Number: PL09234-001A
Model: ZR24M-50L-40K-10V-FD
Date: 9/8/2016

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

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Product Information	
Manufacturer	Cree Inc
Model Number (SKU)	ZR24M-50L-40K-10V-FD
Serial Number	JK301A75792
LED Type	XH-G

Product Description
 2x4 Troffer. Linear light engine with white metal trim plate and frosted plastic lens.

Driver Information (Where Applicable)
 Integral

Length	Width
48"	24"

Sample
 The following sample was submitted for evaluation





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Key Photometric Data	Sphere Output	Goniophotometer	
Luminous Flux	5134.0	5011.3	lm
Efficacy	134.86	131.53	lm/W
Correlated Color Temperature (CCT)	4079	K	
Color Rendering Index (CRI)	84		
R ₉	21		
Duv	0.000322		
S/P Ratio*	1.71		

Electrical Measurements	Sphere		Goniophotometer		
	120V	277V	120V	277V	
Input Wattage	38.07	37.66	38.10	37.66	W
Input Current	0.32	0.14	0.32	0.14	A
Input Voltage	119.98	276.99	120.05	277.05	V
Power Factor	0.995	0.945	0.995	0.944	
Off-State Power	0	0	0	0	W
Total Harmonic Distortion (Voltage)	0.06	0.05	0.07	0.06	%
Total Harmonic Distortion (Amperage)	5.38	13.55	5.99	12.98	%

Note: All photometric measurements taken at 120VAC.

Luminous Intensity Distribution	Goniophotometer	
Maximum Candela	1611.1	Cd
Horizontal Angle of Max Candela	67.5	°
Vertical Angle of Max Candela	2.5	°
Zonal Lumens (0° – 30°)	1239.7 (24.7%)	lm (%)
Zonal Lumens (0° – 40°)	2036.8 (40.6%)	lm (%)
Zonal Lumens (0° – 60°)	3668.0 (73.2%)	lm (%)
Zonal Lumens (60° – 90°)	1343.4 (26.8%)	lm (%)
Color Angular Uniformity	N/A	

Key Test Parameters	Sphere Output	Goniophotometer	
Stabilization Time	65	91	min
Total Operating Time (Stabilization + Test)	65	111	min
Ambient Temperature	25.4	24.8	°C

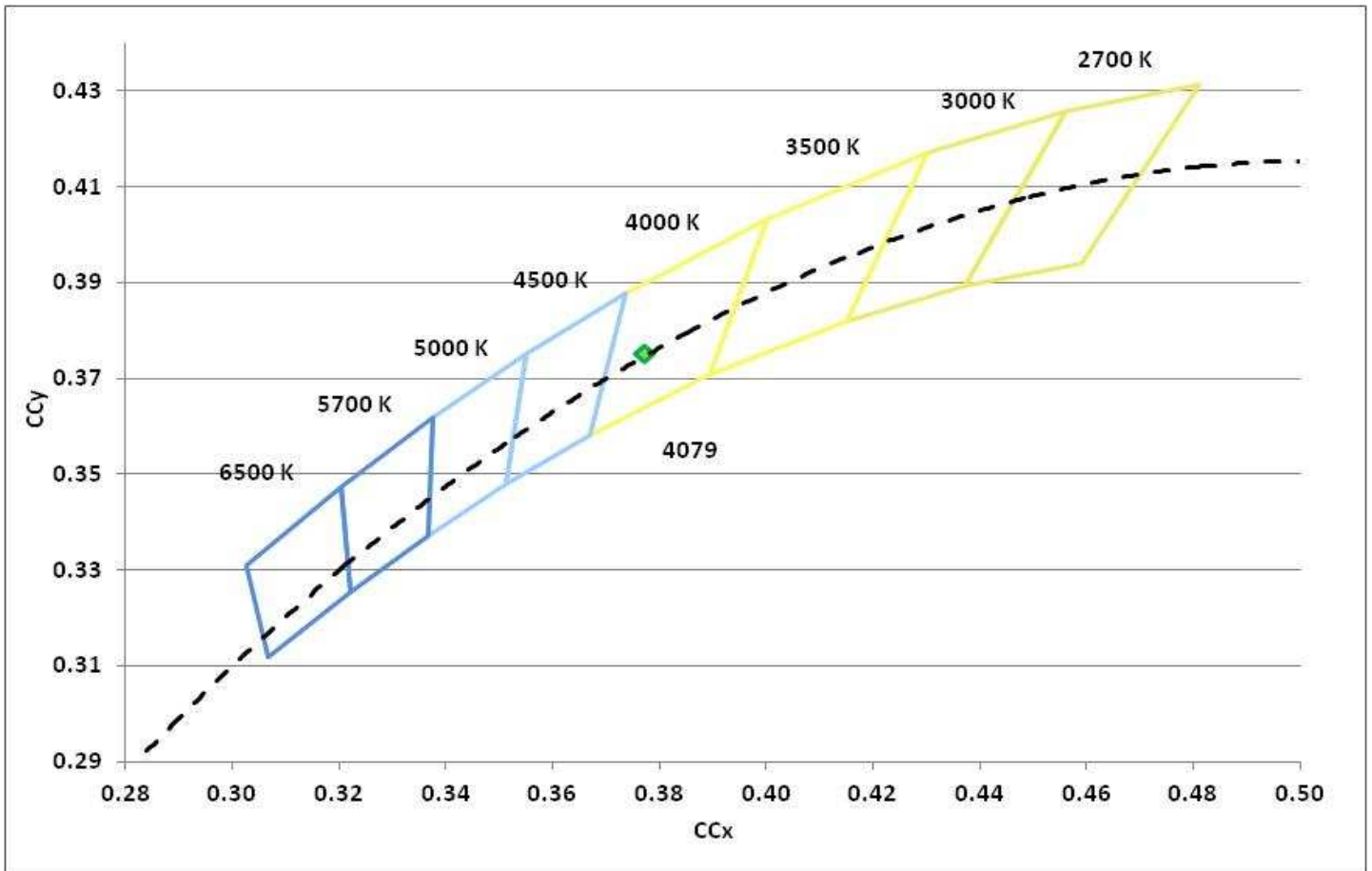
Chromaticity Coordinates

x	y	u	v	u'	v'	Duv
0.3771	0.3753	0.2235	0.3336	0.2235	0.5004	0.000322

Color Rendering Index Details

Ra	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
84	83	89	93	83	82	84	88	70	21	74	81	59	85	96

Chromaticity Diagram



Spectral Distribution

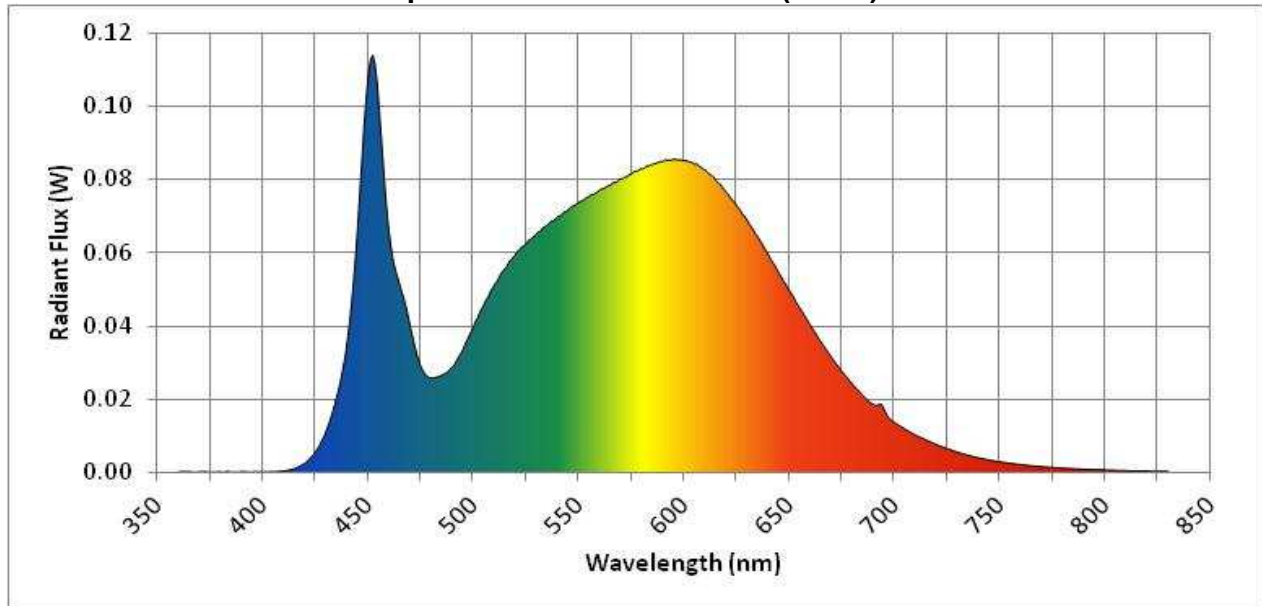
λ (nm)	W/nm
360	0.000284
370	0.000288
380	0.000203
390	0.000242
400	0.000201
410	0.000518
420	0.002693
430	0.011537
440	0.036037
450	0.108971
460	0.064467
470	0.039396
480	0.025852
490	0.028891
500	0.039906
510	0.051329
520	0.059591

λ (nm)	W/nm
530	0.065400
540	0.069966
550	0.073844
560	0.077305
570	0.080211
580	0.082926
590	0.084937
600	0.085102
610	0.082694
620	0.076505
630	0.068863
640	0.059576
650	0.049662
660	0.040236
670	0.031526
680	0.024219
690	0.018616

λ (nm)	W/nm
700	0.013757
710	0.010278
720	0.007670
730	0.005566
740	0.004056
750	0.002980
760	0.002238
770	0.001678
780	0.001245
790	0.000933
800	0.000748
810	0.000559
820	0.000450
830	0.000362

Dominant Wavelength	578	nm
Peak Wavelength:	452	nm

Spectral Power Distribution (W/nm)





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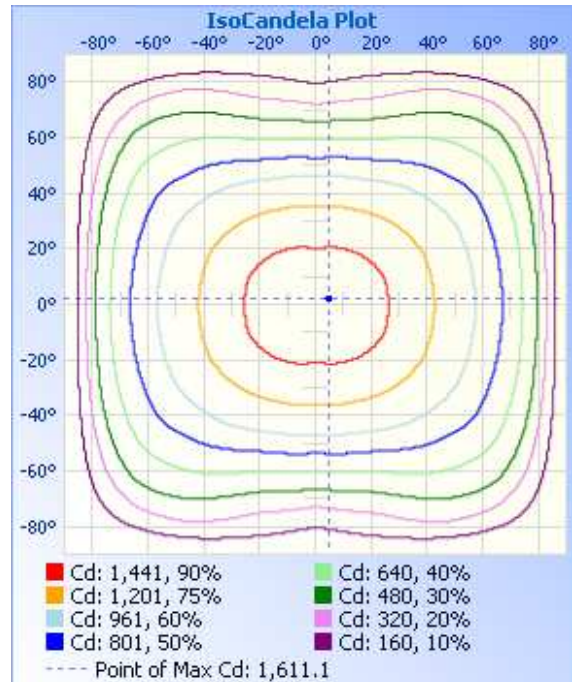
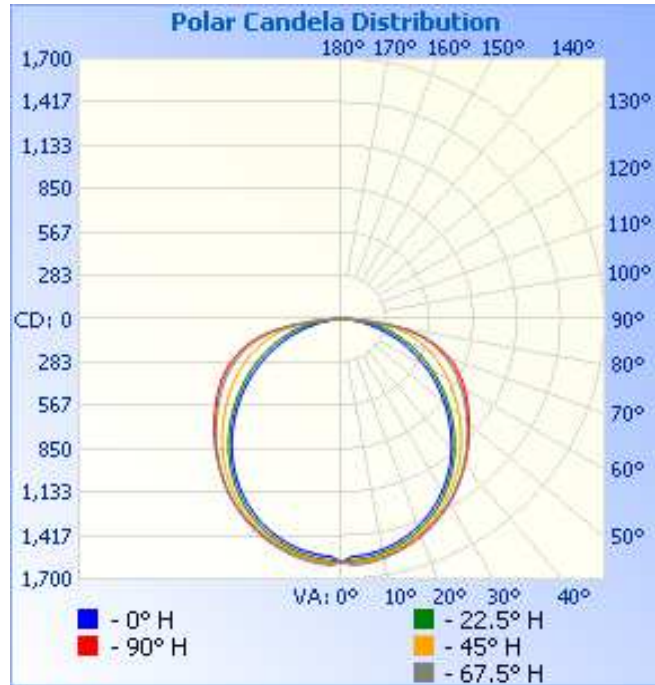
Zonal Lumen Summary **

Zone	Lumens	% of Total	Zone	Lumens	% of Total
0-5	38.0	0.8%	90-95	0	0%
5-10	112.6	2.2%	95-100	0	0%
10-15	183.5	3.7%	100-105	0	0%
15-20	248.4	5.0%	105-110	0	0%
20-25	305.3	6.1%	110-115	0	0%
25-30	352.0	7.0%	115-120	0	0%
30-35	387.2	7.7%	120-125	0	0%
35-40	409.9	8.2%	125-130	0	0%
40-45	420.1	8.4%	130-135	0	0%
45-50	418.4	8.3%	135-140	0	0%
50-55	406.5	8.1%	140-145	0	0%
55-60	386.2	7.7%	145-150	0	0%
60-65	357.7	7.1%	150-155	0	0%
65-70	320.3	6.4%	155-160	0	0%
70-75	273.5	5.5%	160-165	0	0%
75-80	215.5	4.3%	165-170	0	0%
80-85	135.8	2.7%	170-175	0	0%
85-90	40.5	0.8%	175-180	0	0%
Total			5011.3 lm	100%	

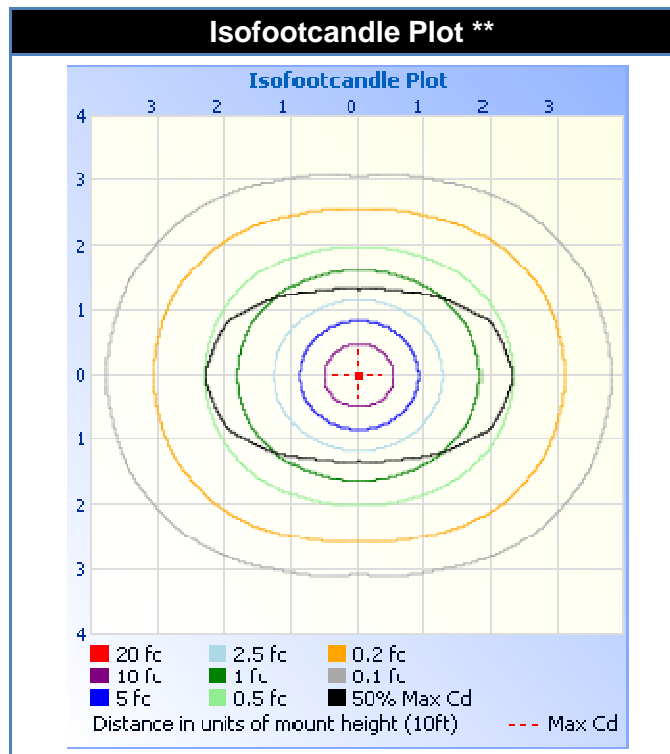
Spacing Criteria **

Spacing Criterion (0 - 180)	1.24
Spacing Criterion (90 - 270)	1.30
Spacing Criterion (Diagonal)	1.40

Candela Plots **



Isofootcandle Plot **





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Candela Tabulations **

	0	22.5	45	67.5	90
0	1589	1589	1589	1589	1589
2.5	1556	1580	1594	1611	1596
5	1551	1575	1588	1606	1591
7.5	1542	1565	1579	1598	1582
10	1530	1552	1567	1586	1571
12.5	1514	1536	1551	1571	1558
15	1494	1516	1533	1553	1541
17.5	1471	1494	1511	1533	1523
20	1444	1468	1487	1512	1501
22.5	1414	1438	1460	1486	1476
25	1380	1405	1430	1457	1449
27.5	1342	1368	1396	1426	1420
30	1302	1327	1359	1392	1388
32.5	1258	1283	1320	1356	1353
35	1211	1237	1279	1317	1317
37.5	1161	1187	1235	1277	1279
40	1108	1136	1190	1235	1239
42.5	1052	1082	1142	1192	1198
45	994	1026	1094	1149	1158
47.5	935	969	1045	1105	1117
50	876	911	994	1061	1077
52.5	815	853	945	1017	1036
55	754	796	895	974	996
57.5	692	738	847	933	957
60	630	680	799	892	919
62.5	566	622	751	850	879
65	504	564	702	806	835
67.5	442	507	652	759	788
70	381	451	600	708	737
72.5	320	396	547	653	681
75	262	341	491	592	618
77.5	207	288	432	522	545
80	155	236	365	443	453
82.5	109	184	287	322	324
85	68	127	182	194	195
87.5	31	58	78	82	85
90	0	0	0	0	0



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Candela Tabulations (Continued) **

	0	22.5	45	67.5	90
92.5	0	0	0	0	0
95	0	0	0	0	0
97.5	0	0	0	0	0
100	0	0	0	0	0
102.5	0	0	0	0	0
105	0	0	0	0	0
107.5	0	0	0	0	0
110	0	0	0	0	0
112.5	0	0	0	0	0
115	0	0	0	0	0
117.5	0	0	0	0	0
120	0	0	0	0	0
122.5	0	0	0	0	0
125	0	0	0	0	0
127.5	0	0	0	0	0
130	0	0	0	0	0
132.5	0	0	0	0	0
135	0	0	0	0	0
137.5	0	0	0	0	0
140	0	0	0	0	0
142.5	0	0	0	0	0
145	0	0	0	0	0
147.5	0	0	0	0	0
150	0	0	0	0	0
152.5	0	0	0	0	0
155	0	0	0	0	0
157.5	0	0	0	0	0
160	0	0	0	0	0
162.5	0	0	0	0	0
165	0	0	0	0	0
167.5	0	0	0	0	0
170	0	0	0	0	0
172.5	0	0	0	0	0
175	0	0	0	0	0
177.5	0	0	0	0	0
180	0	0	0	0	0



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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 G141
Type C Goniophotometer	Tungsten Halogen Omni-Directional 500W Calibration Lamp, Serial Number 97A

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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:



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Each subsequent revision of this report replaces the preceding report.

Date	Rev	DCN #	Change Details	By	Approval
09/8/16	A	DMS	Origination	A. Gressel	C. McLaurin