



Report of Test LLI-19120-2

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 3 X XX 4 XX X X

Grey painted cast aluminum housing with no lens.

16 LEDs in one 4 x 4 array with clear plastic sheet of individual lenses.

One Osram power supply. Model: OT 50/120-277/1A2 2DIMLT2 P set to 700ma.

Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	5262 lm	Min Power Factor	0.91 @ 277 V
Luminaire Power	38.7 W	Max THD(i)*	14.0 % @ 277 V
Luminous Efficacy	136.0 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3960 K	80-90° Zonal Flux %	1.7 %
CIE(x,y) 1931	(0.382, 0.378)	BUG Rating*	B1-U0-G1
CRI	72	Street Classification*	Type II Short

PREPARED FOR : LED Roadway Lighting Ltd, 115 Chain Lake Drive, Halifax. NS Canada



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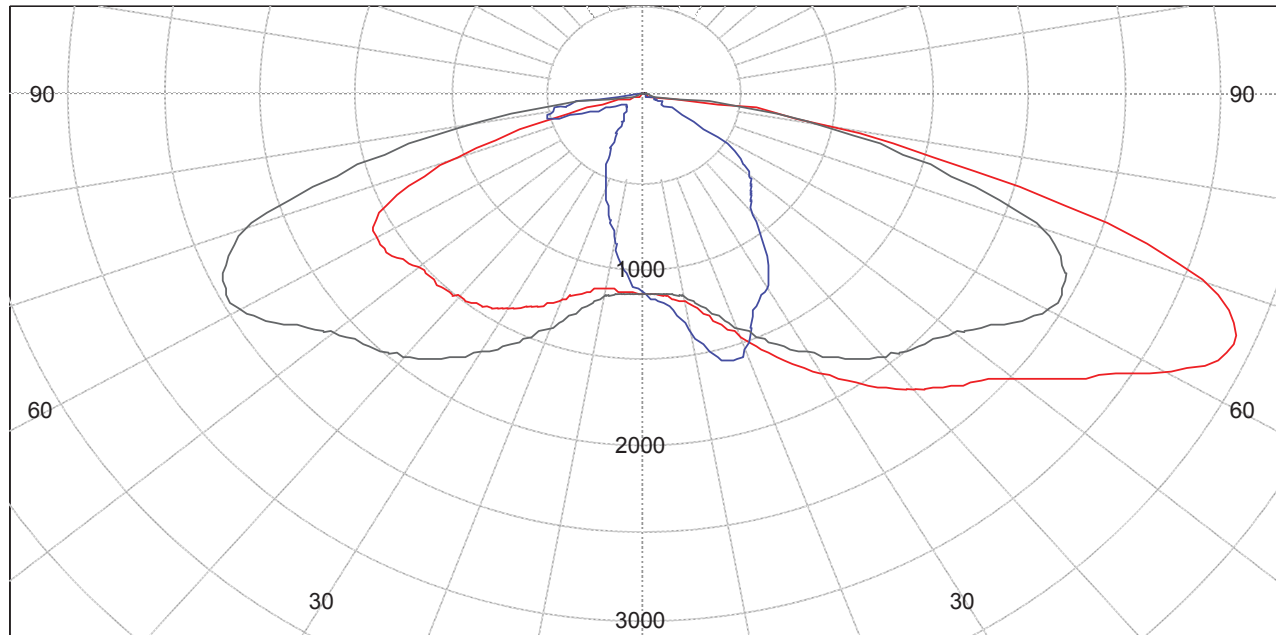
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Polar Light Distribution Curves



House side / L270

L90 / 270 - Black, Plane of maximum - Red, L0 / 180 - Blue (cd)

Street side / L90

Percentage Outputs

	Upward	Downward	Total
Street Side	0.0 %	68.3 %	68.3 %
House Side	0.0 %	31.7 %	31.7 %
	0.0 %	100.0 %	100.0 %

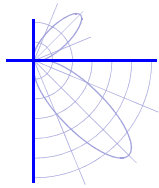
Report data based on absolute values as measured.

Signed:

Ryder Tunney
Ryder Tunney
Authorized Signatory

Date of test
Date of report

2-May-2019
2-May-2019



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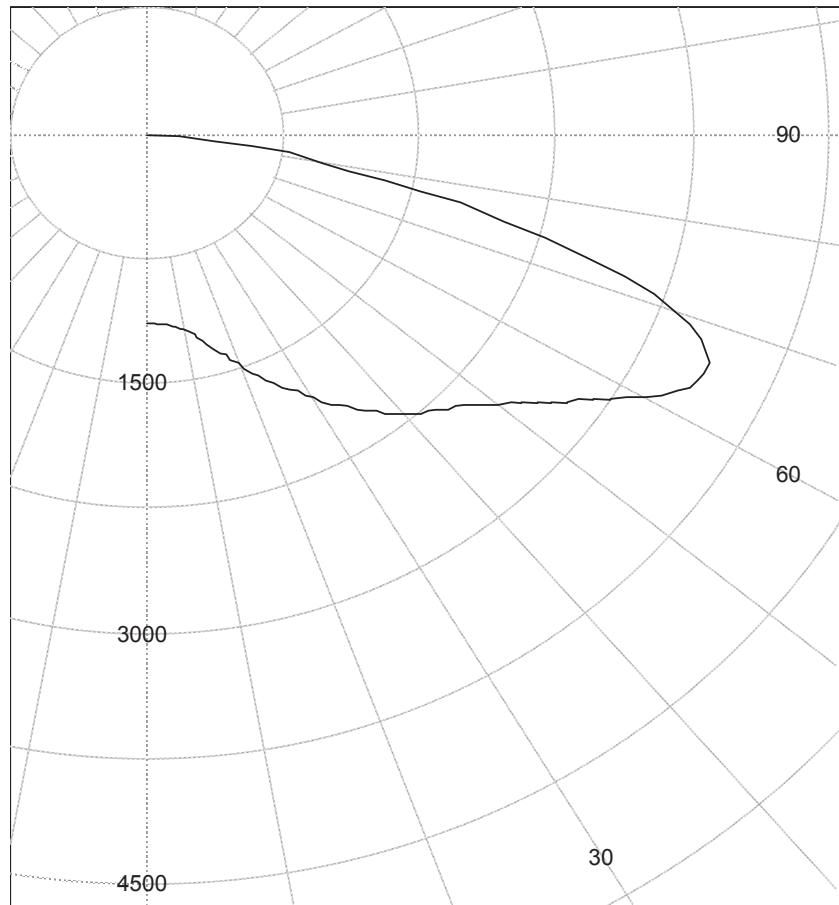
One Osram power supply. Model: OT 50/120-277/1A2 2DIMLT2 P set to 700ma.

Operating at 120v AC and 60 Hz.

Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	1132.6
10.0	1198.1
20.0	1472.8
30.0	1833.8
35.0	2020.8
40.0	2194.1
45.0	2334.4
47.5	2400.1
50.0	2518.1
52.5	2645.5
55.0	2807.8
57.5	2967.3
60.0	3159.8
62.5	3330.8
65.0	3381.5
67.5	3312.6
70.0	3090.6
72.5	2646.5
75.0	2029.0
77.5	1434.0
80.0	979.0
82.5	474.4
85.0	19.2
87.5	3.9
90.0	0.0
92.5	0.0
95.0	0.0
97.5	0.0
100.0	0.0
102.5	0.0
105.0	0.0
120.0	0.0
135.0	0.0
150.0	0.0
165.0	0.0
180.0	0.0

Principal Vertical Plane



Plane of maximum intensity (cd)

House side max intensity
2459.5 cd @ (90.0°, 62.0°)

Street side max intensity
3388.8 cd @ (75.0°, 64.5°)

Coordinates expressed in the C Type coordinate system

Data for the two symmetric halves of the luminaire has been averaged.



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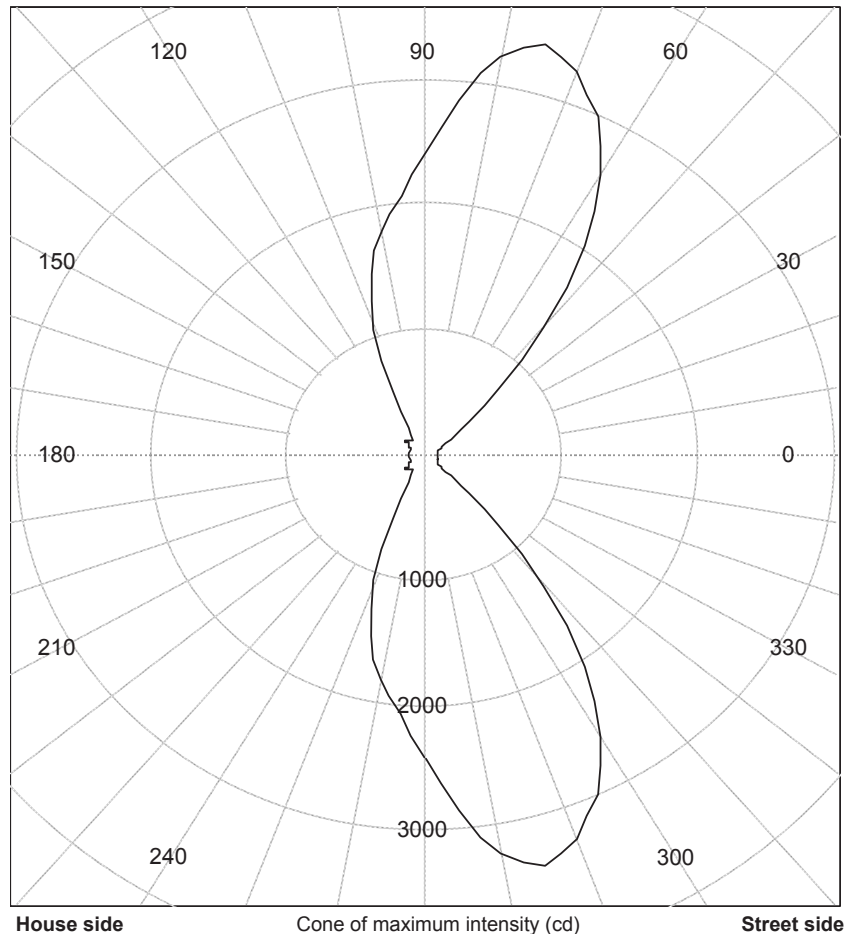
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Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V64.5) (cd)
0	90.0
15	93.0
30	136.2
40	432.9
45	754.4
50	1333.1
55	2055.3
60	2581.5
65	2984.5
70	3259.9
75	3388.8
80	3239.9
85	2854.9
90	2421.3
95	2075.2
100	1818.7
105	1507.5
110	1060.6
115	557.9
120	237.8
125	142.5
130	160.7
135	176.8
140	176.9
150	132.7
165	113.1
180	111.9

Principal Conical Surface



House side

Cone of maximum intensity (cd)

Street side

House side max intensity
2459.5 cd @ (90.0°, 62.0°)

Street side max intensity
3388.8 cd @ (75.0°, 64.5°)

Coordinates expressed in the C Type coordinate system

Data for the two symmetric halves of the luminaire has been averaged.



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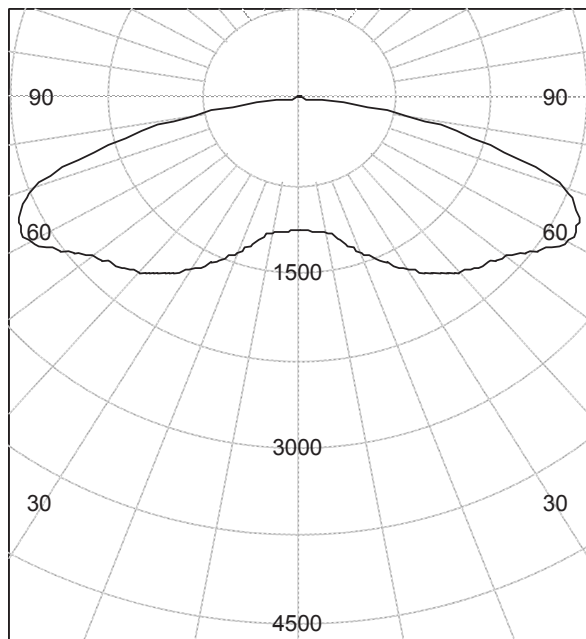
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Polar curve through L90 / L270

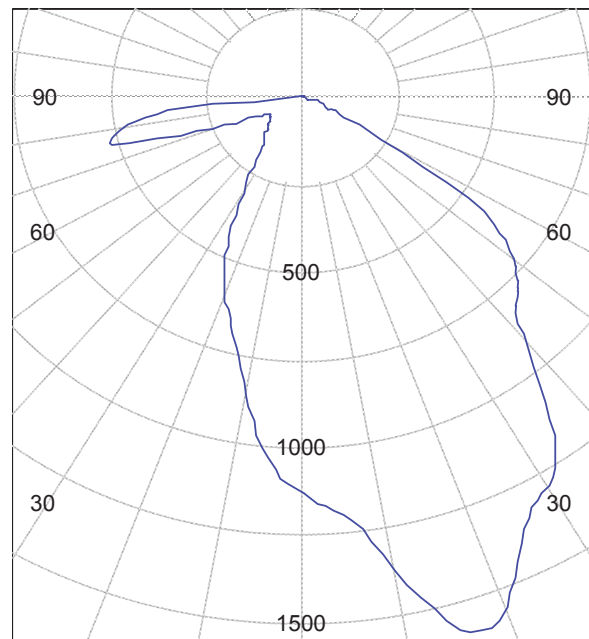


(L90)

(cd)

(L270)

Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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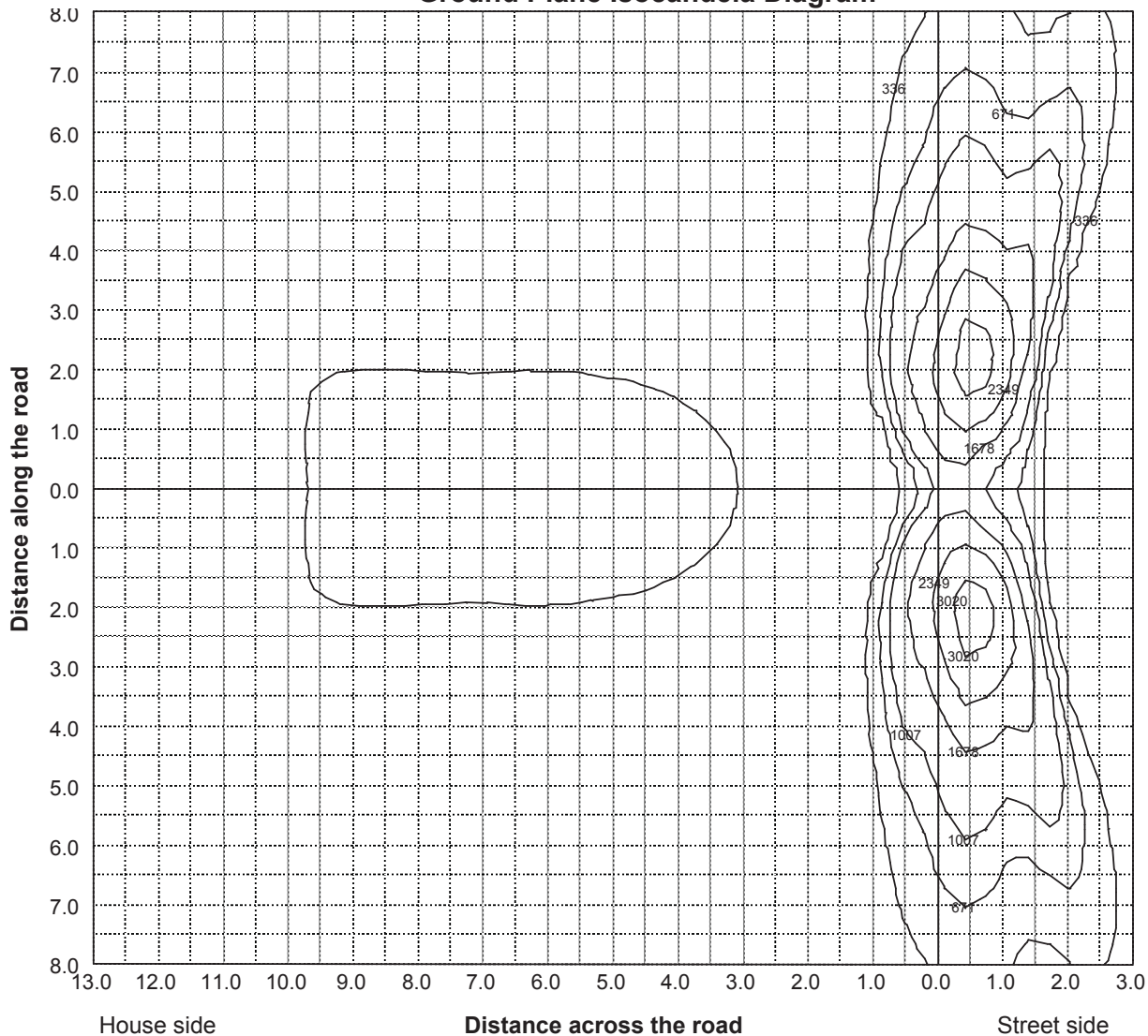
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Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	1133	1133	1133	1133	1133	1133	1133	1133	1133
10.0	1368	1343	1306	1274	1257	1243	1231	1220	1214
20.0	1548	1569	1631	1665	1663	1647	1621	1576	1534
30.0	1278	1307	1450	1651	1766	1872	1944	1975	1959
35.0	1122	1201	1391	1584	1713	1854	1988	2082	2126
40.0	888	1004	1297	1557	1693	1845	2005	2147	2234
45.0	787	884	1187	1545	1738	1907	2057	2201	2318
47.5	754	846	1145	1526	1758	1955	2107	2249	2376
50.0	711	794	1104	1506	1784	2018	2190	2332	2466
52.5	657	718	1033	1457	1782	2062	2275	2440	2587
55.0	572	630	924	1365	1726	2060	2334	2538	2704
57.5	407	476	790	1236	1604	2000	2339	2616	2824
60.0	237	287	558	1030	1411	1885	2296	2648	2941
62.5	108	131	298	701	1083	1660	2215	2643	3016
65.0	86	89	112	370	677	1234	1995	2558	2967
67.5	69	74	77	128	306	704	1519	2320	2801
70.0	56	62	68	75	102	266	867	1874	2523
72.5	52	52	60	62	66	86	253	1199	2129
75.0	49	51	47	53	48	58	72	554	1543
77.5	46	54	34	46	40	40	51	107	887
80.0	25	40	23	27	30	25	29	43	445
82.5	9	10	10	12	12	11	13	18	134
85.0	2	2	2	3	3	3	4	5	10
87.5	1	1	1	1	1	1	2	2	2
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0



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Intensity data (cd)

Vertical	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	1133	1133	1133	1133	1133	1133	1133	1133	1133
10.0	1206	1198	1189	1182	1173	1158	1143	1126	1103
20.0	1500	1473	1453	1431	1406	1367	1310	1242	1160
30.0	1902	1834	1789	1747	1698	1626	1526	1405	1261
35.0	2095	2021	1956	1899	1832	1741	1617	1469	1313
40.0	2248	2194	2115	2040	1948	1829	1679	1507	1346
45.0	2370	2334	2247	2148	2030	1880	1702	1524	1356
47.5	2433	2400	2312	2199	2060	1896	1705	1523	1349
50.0	2538	2518	2415	2280	2118	1930	1721	1530	1347
52.5	2667	2646	2538	2376	2184	1968	1750	1559	1361
55.0	2806	2808	2703	2519	2282	2029	1801	1600	1367
57.5	2950	2967	2860	2653	2367	2085	1841	1615	1327
60.0	3125	3160	3035	2774	2439	2129	1869	1609	1264
62.5	3259	3331	3175	2843	2454	2125	1867	1580	1174
65.0	3250	3381	3243	2857	2411	2058	1797	1478	1023
67.5	3099	3313	3252	2845	2333	1949	1665	1283	780
70.0	2841	3091	3162	2764	2170	1799	1509	1037	513
72.5	2443	2647	2874	2551	1874	1555	1277	751	300
75.0	2046	2029	2347	2181	1537	1244	937	408	136
77.5	1588	1434	1578	1624	1187	891	553	174	66
80.0	1038	979	901	1111	855	570	216	48	36
82.5	403	474	355	533	419	252	52	19	22
85.0	13	19	18	33	44	23	9	9	11
87.5	3	4	4	4	4	4	4	4	4
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0



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Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	1133	1133	1133	1133	1133	1133	1133	1133	1133
10.0	1079	1051	1026	1002	977	952	912	871	861
20.0	1069	979	894	827	770	722	661	606	589
30.0	1126	1001	881	768	659	565	436	343	315
35.0	1164	1019	875	724	573	441	292	213	193
40.0	1187	1028	839	634	434	290	181	158	156
45.0	1186	985	747	478	254	164	150	143	134
47.5	1166	942	668	373	183	148	147	137	123
50.0	1135	880	563	281	151	144	149	136	117
52.5	1112	797	450	212	147	150	151	134	112
55.0	1058	683	350	173	154	160	150	129	106
57.5	957	556	266	157	160	166	146	115	101
60.0	832	430	200	153	167	172	140	112	100
62.5	693	320	158	156	175	177	136	112	101
65.0	520	218	140	160	177	176	132	114	116
67.5	335	142	134	160	180	168	130	139	171
70.0	191	114	125	158	173	159	128	198	253
72.5	121	95	118	154	163	149	126	278	368
75.0	86	79	107	142	149	143	135	402	513
77.5	56	60	92	122	131	134	174	432	509
80.0	36	44	68	88	99	113	208	395	466
82.5	23	28	44	56	77	85	176	332	397
85.0	12	14	19	22	29	50	82	203	238
87.5	4	4	4	4	5	6	6	5	5
90.0	0	0	0	0	0	0	0	0	0
92.5	0	0	0	0	0	0	0	0	0
95.0	0	0	0	0	0	0	0	0	0
97.5	0	0	0	0	0	0	0	0	0
100.0	0	0	0	0	0	0	0	0	0
102.5	0	0	0	0	0	0	0	0	0
105.0	0	0	0	0	0	0	0	0	0
120.0	0	0	0	0	0	0	0	0	0
135.0	0	0	0	0	0	0	0	0	0
150.0	0	0	0	0	0	0	0	0	0
165.0	0	0	0	0	0	0	0	0	0
180.0	0	0	0	0	0	0	0	0	0



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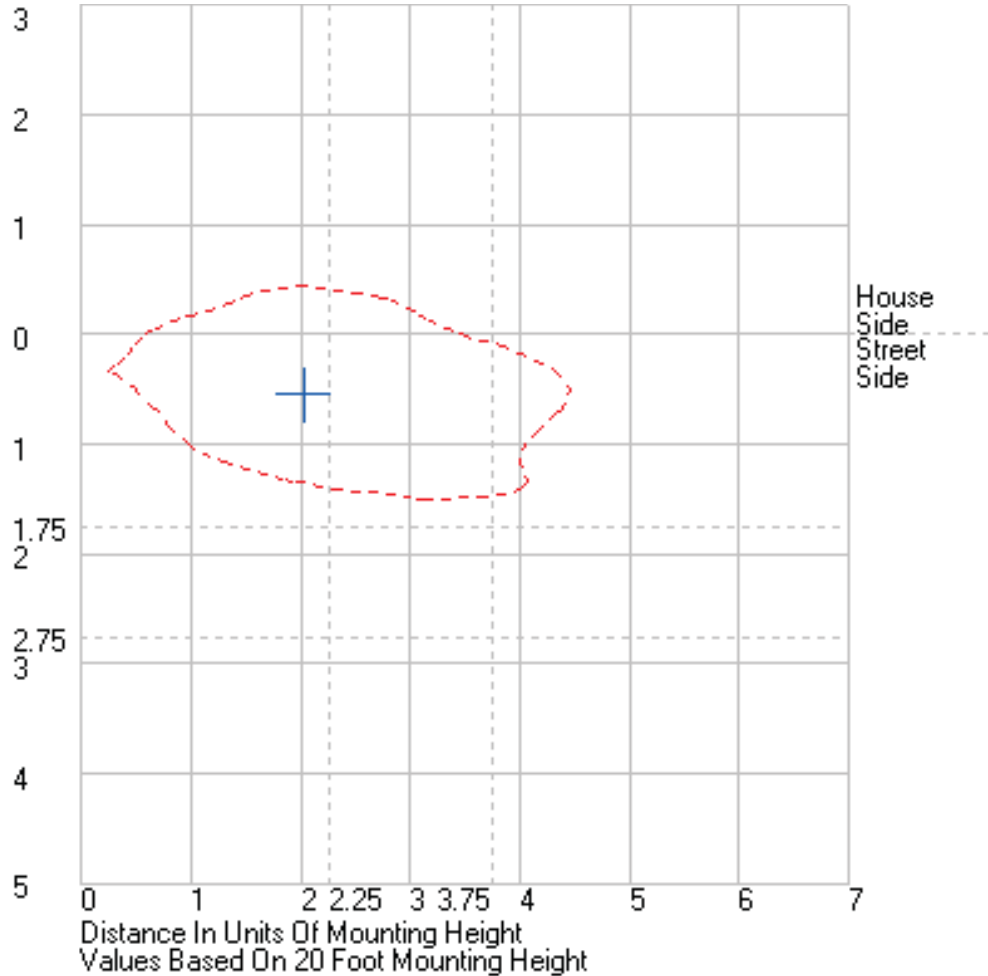
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.382, 0.378)
	CIE 1976 (u', v') ⁽¹⁾	(0.226, 0.502)
	Correlated Color Temperature (CCT) ⁽¹⁾	3960 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	3.91E-03
	Color Rendering Index (Ra) ⁽¹⁾	72.0
	Special CRI 9 (R ₉) ^{(1),(3)}	-32.9
	Distance from Planckian Locus (Duv) ^{(1),(3)}	-1.13E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.52

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.325 A	
	Power	38.7 W	
	Power Factor	0.99	
	Current THD	6.7 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.151 A	
	Power	38.0 W	
	Power Factor	0.91	
	Current THD	14 %	

Performance data in accordance with IESNA LM-79-08. Spectral calculations are for a CIE 2° observer

Photometric and spectral values were measured at Setpoint 1

(1) Value is computed from the weighted average of the spatial measurements

(2) Value is the maximum deviation of the spatial u' and v' measurements from the weighted average

(3) Quantity is in addition to the scope of IESNA LM-79-08



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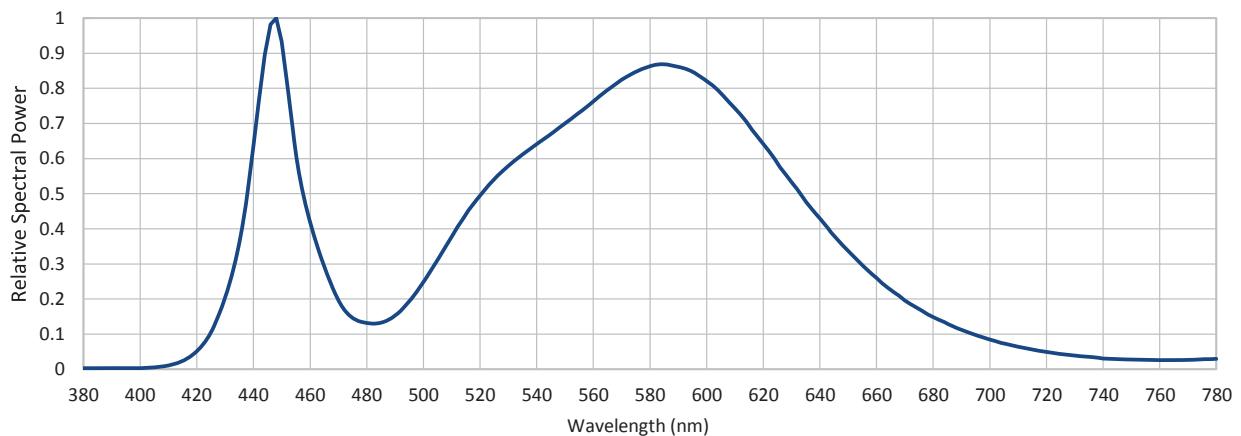
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LM-79 Performance Data

Relative spectral power distribution

(Relative to peak = 1, weighted average of spatial measurements)

λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power
380	0.003	460	0.417	540	0.641	620	0.642	700	0.085
385	0.003	465	0.293	545	0.670	625	0.587	705	0.073
390	0.003	470	0.196	550	0.700	630	0.533	710	0.064
395	0.003	475	0.147	555	0.731	635	0.478	715	0.056
400	0.003	480	0.132	560	0.763	640	0.429	720	0.049
405	0.005	485	0.133	565	0.795	645	0.380	725	0.044
410	0.011	490	0.153	570	0.824	650	0.338	730	0.039
415	0.024	495	0.193	575	0.847	655	0.296	735	0.035
420	0.051	500	0.249	580	0.863	660	0.260	740	0.031
425	0.107	505	0.312	585	0.869	665	0.226	745	0.029
430	0.203	510	0.378	590	0.861	670	0.196	750	0.028
435	0.364	515	0.441	595	0.848	675	0.172	755	0.026
440	0.635	520	0.495	600	0.821	680	0.149	760	0.026
445	0.939	525	0.542	605	0.787	685	0.130	765	0.026
450	0.933	530	0.579	610	0.743	690	0.112	770	0.027
455	0.621	535	0.612	615	0.694	695	0.098	775	0.028
								780	0.030





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LM-79 Performance Data

Spatial measurements

Vert. angle (°)	CIE 1976 (u',v') coordinates	
	Horiz. 0.0° plane	Horiz. ° plane
0.0	(0.224, 0.499)	(0.224, 0.500)
10.0	(0.224, 0.500)	(0.225, 0.502)
20.0	(0.225, 0.502)	(0.224, 0.500)
30.0	(0.226, 0.503)	(0.226, 0.502)
40.0	(0.226, 0.503)	(0.225, 0.501)
50.0	(0.226, 0.502)	(0.225, 0.501)
60.0	(0.227, 0.503)	I <= 10% peak
70.0	(0.226, 0.503)	I <= 10% peak
80.0	(0.225, 0.498)	I <= 10% peak
-	-	-

Spatial measurements

Vert. angle (°)	CIE 1976 (u',v') coordinates	
	Horiz. 0.0° plane	Horiz. ° plane
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

Test procedure

All measurements were performed in an environmentally controlled laboratory employing suitable baffling to minimize stray light. The sample was mounted in its normal operating orientation on a rotating mirror goniophotometer and operated from a stabilized supply. The photometric output was monitored and measurements were performed once stability was achieved.

The goniophotometer was used to measure the spatial distribution of both luminous intensity and, in conjunction with a spectroradiometer, spectral irradiance. The distribution locus comprises points in two or more planes (as indicated in the table above) at no more than 10° vertical intervals. The CIE (x,y) coordinates and other derived metrics (CIE (u', v'), CCT and CRI) are calculated from the weighted sum (weighted for intensity and represented solid angle) of the measured spectral irradiances.

Sample Orientation

Horizontal

Stabilization & total operation time 0.5 / 2.75 hours

Equipment and uncertainties

LightLab International R80A C-gamma rotating mirror goniophotometer with a test distance of 8 m.

Luminous Intensity ± 4 %
Luminous Flux ± 4 %
Horiz., Vert. Angles ± 0.25°

Temperature ± 1 °C
Luminous Efficacy ± 4.5 %

PhotoResearch PR-670 spectroradiometer (grating with 380 - 780 nm range, 2 nm / pixel, 5 nm bandwidth, incandescent/halogen calibration source). Measured at a distance from the sample deemed >5 times the maximum observed luminous opening dimension.

CIE (x, y) coordinates ± 0.003 CCT ± 100 K
CIE (u', v') coordinates ± 0.002 CRI (Ra) ± 2
Spatial Δ (u', v') uniformity ± 0.001 Scotopic / Photopic Ratio * ± 0.02
Rel. Spectral Irradiance * ± 2 % R9 * ± 2
Duv * ± 5E-04

Yokogawa WT210 power meter connected in circuit to the sample electrical supply

Voltage ± 0.5 % Frequency * ± 0.1 Hz
Current ± 0.5 % Power ± 0.5 %
Current THD * ± 3 % Power Factor ± 0.02

This report contains data that are not covered by the NVLAP accreditation. Quantities marked with * are not covered.

Calculator / report version 1.0.10 / 5.9 (14th Dec 2017)

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Test Report No. LLI-19120-2

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 3 X XX 4 XX X X

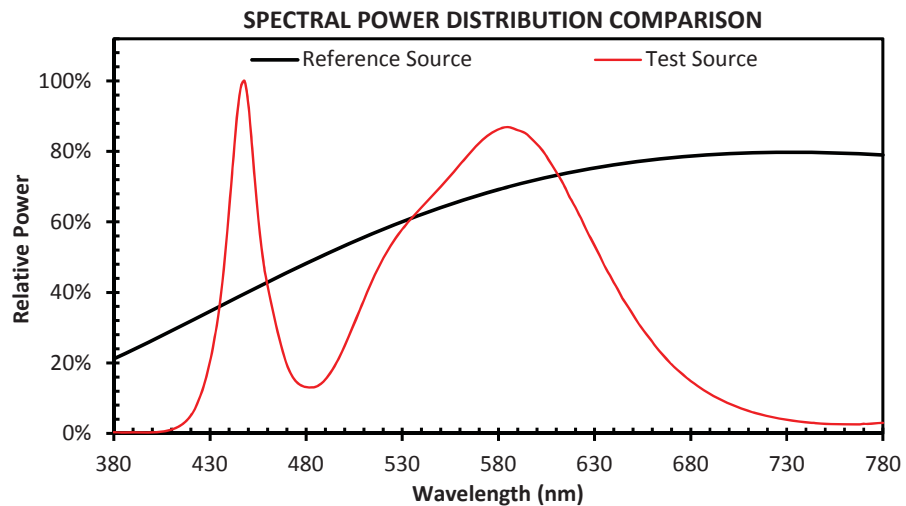
Grey painted cast aluminum housing with no lens.

16 LEDs in one 4 x 4 array with clear plastic sheet of individual lenses.

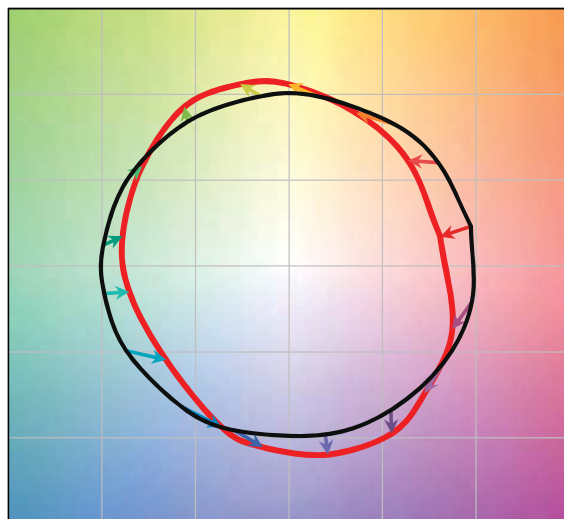
One Osram power supply. Model: OT 50/120-277/1A2 2DIMLT2 P set to 700ma.

Operating at 120v AC and 60 Hz.

R_f	71
R_g	94



COLOR VECTOR GRAPHIC



— Test Source

→ Series1

COLOR DISTORTION GRAPHIC





Test Report No. LLI-19120-2

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 3 X XX 4 XX X X

Grey painted cast aluminum housing with no lens.

16 LEDs in one 4 x 4 array with clear plastic sheet of individual lenses.

One Osram power supply. Model: OT 50/120-277/1A2 2DIMLT2 P set to 700ma.

Operating at 120v AC and 60 Hz.

Test Distance 8.0 m
Test Temperature 25.3 °C

Notes The laboratory has not participated in the selection of samples to be tested. All testing is performed on the understanding that the significance of the report is limited to the extent that the test sample is representative of production units.

Tested in accordance with the applicable sections of publications: IES LM-79-08 (Sec. 12), IES LM-16-93, IES LM-58-13, CIE 13.3:1995, CIE 15:2004, ANSI C78.377:2015, ANSI C82.77-10:2014.

The luminous intensity values, and other derived quantities, contained in this report are based on the absolute data, as measured.

Prorating the performance of the sample for the use of other component combinations (such as lamp / LED / Ballast / driver), or for use in different environmental conditions than that tested, may produce erroneous results.

This report is free of erasures and corrections.

Photometric intensity values are reported using the IESNA Type C coordinate system (L, V) as defined in IESNA publication LM-75.

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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.