



Report of Test LLI-19120-6

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 2 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 50/120-277/800 2DIMLT2 P set to 500ma.
Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	4115 lm	Min Power Factor	0.86 @ 277 V
Luminaire Power	28.5 W	Max THD(i)*	16.0 % @ 277 V
Luminous Efficacy	144.4 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3860 K	80-90° Zonal Flux %	1.1 %
CIE(x,y) 1931	(0.388, 0.386)	BUG Rating*	B1-U0-G1
CRI	71	Street Classification*	Type II Short

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

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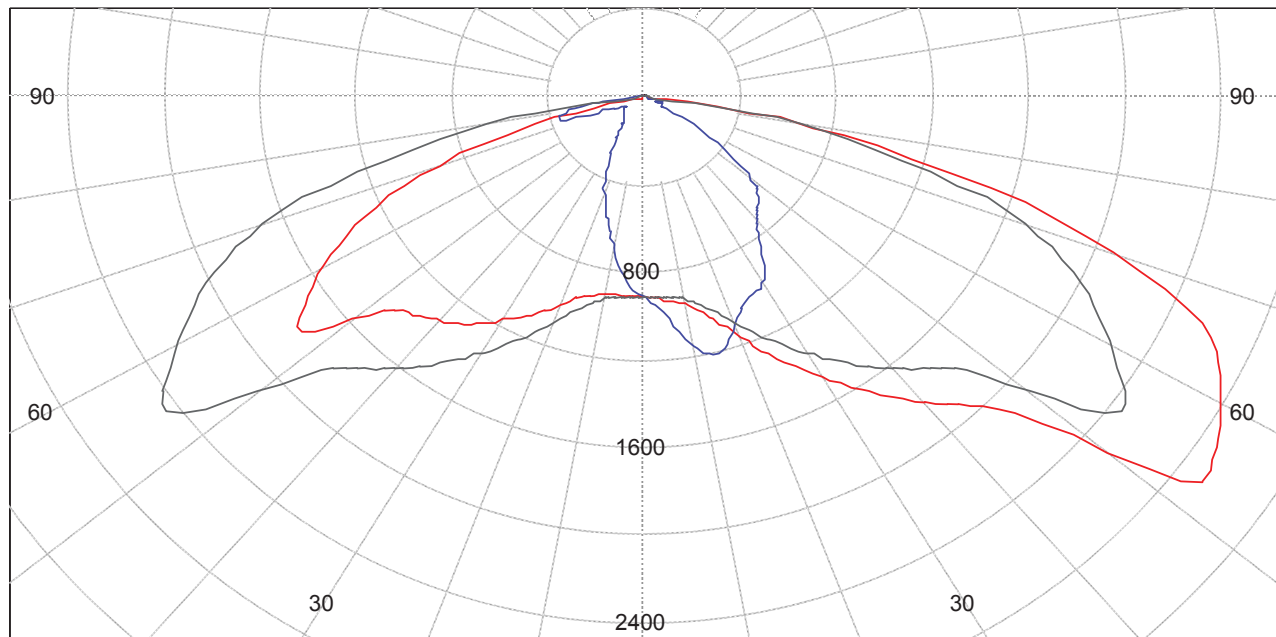
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Polar Light Distribution Curves



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 %	67.3 %	67.3 %
House Side	0.0 %	32.7 %	32.7 %
	0.0 %	100.0 %	100.0 %

Report data based on absolute values as measured.

Signed:


Ryder Tunney
Authorized Signatory

Date of test
Date of report

7-May-2019
8-May-2019



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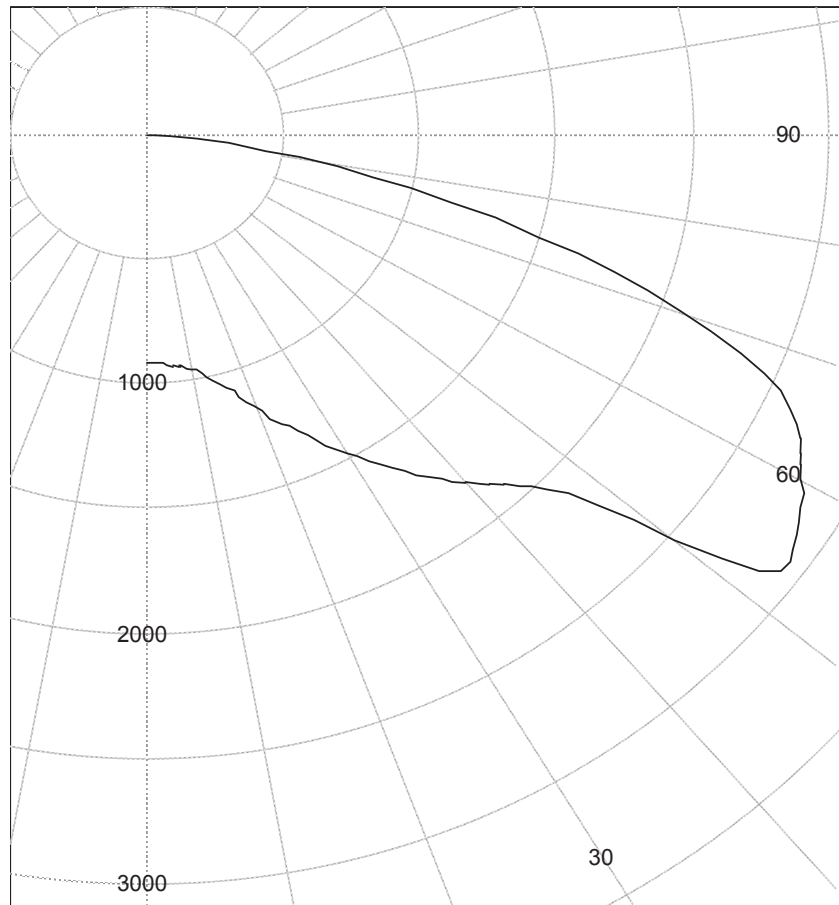
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Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	916.4
10.0	958.9
20.0	1166.0
30.0	1473.9
35.0	1647.3
40.0	1818.4
45.0	2001.1
47.5	2164.0
50.0	2523.1
52.5	2887.2
55.0	2894.2
57.5	2840.3
60.0	2770.0
62.5	2697.6
65.0	2599.4
67.5	2405.9
70.0	2079.8
72.5	1728.3
75.0	1323.6
77.5	919.5
80.0	575.3
82.5	242.3
85.0	30.0
87.5	2.4
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
2458.1 cd @ (90.0°, 54.5°)

Street side max intensity
2914.6 cd @ (77.5°, 53.5°)

Coordinates expressed in the C Type coordinate system

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



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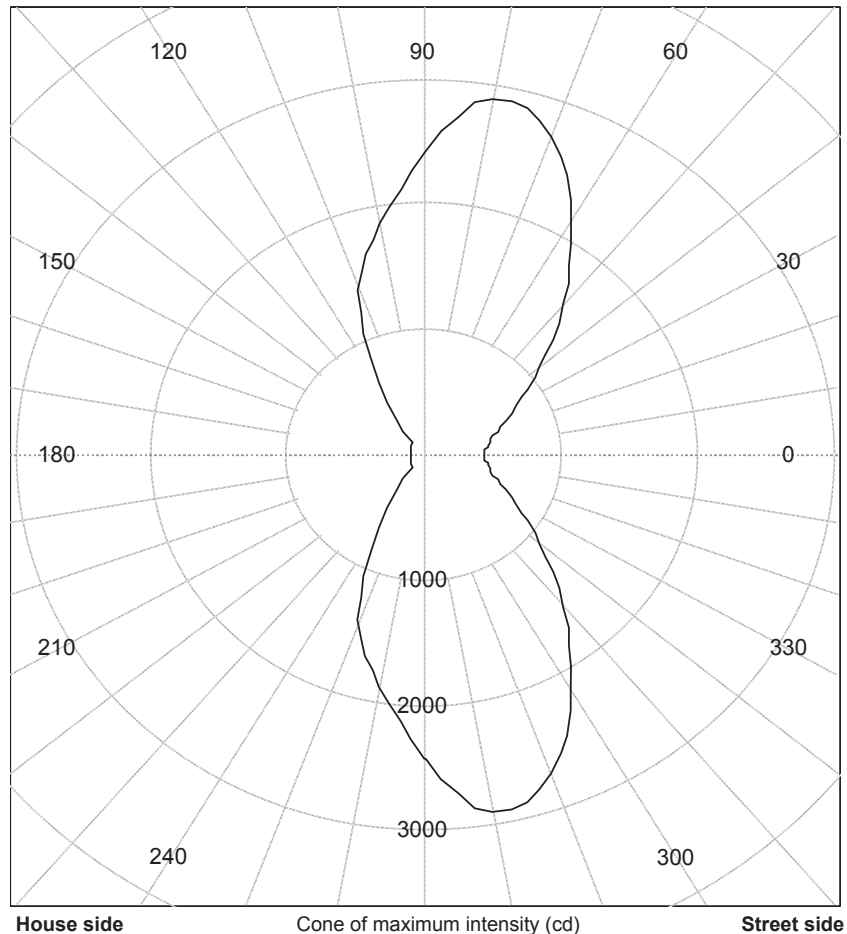
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Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V53.5) (cd)
0	437.0
15	498.8
30	778.1
40	1102.5
45	1318.7
50	1582.9
55	1858.6
60	2160.9
65	2468.3
70	2720.2
75	2878.7
80	2906.1
85	2717.7
90	2425.5
95	2140.1
100	1873.9
105	1653.2
110	1402.6
115	1066.2
120	664.4
125	334.5
130	163.5
135	129.0
140	127.7
150	120.6
165	109.8
180	99.8

Principal Conical Surface



House side

Cone of maximum intensity (cd)

Street side

House side max intensity
2458.1 cd @ (90.0°, 54.5°)

Street side max intensity
2914.6 cd @ (77.5°, 53.5°)

Coordinates expressed in the C Type coordinate system

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



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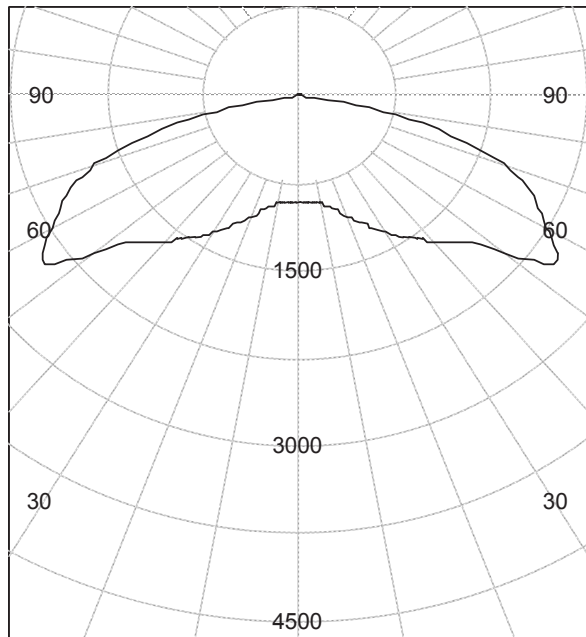
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Polar curve through L90 / L270

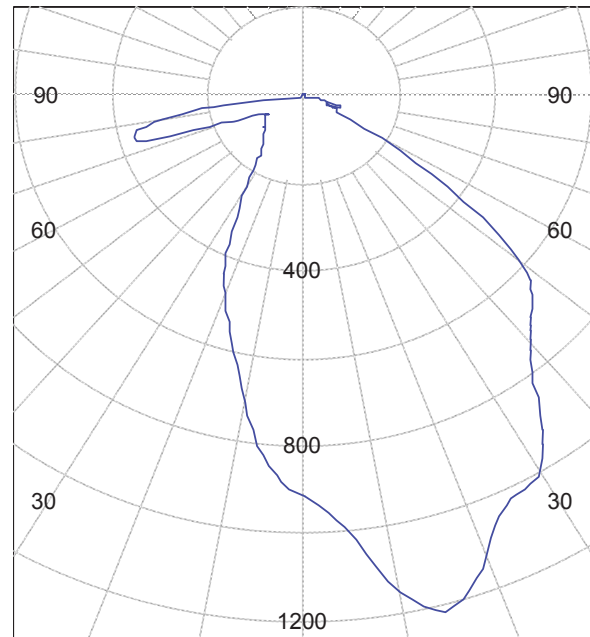


(L90)

(cd)

(L270)

Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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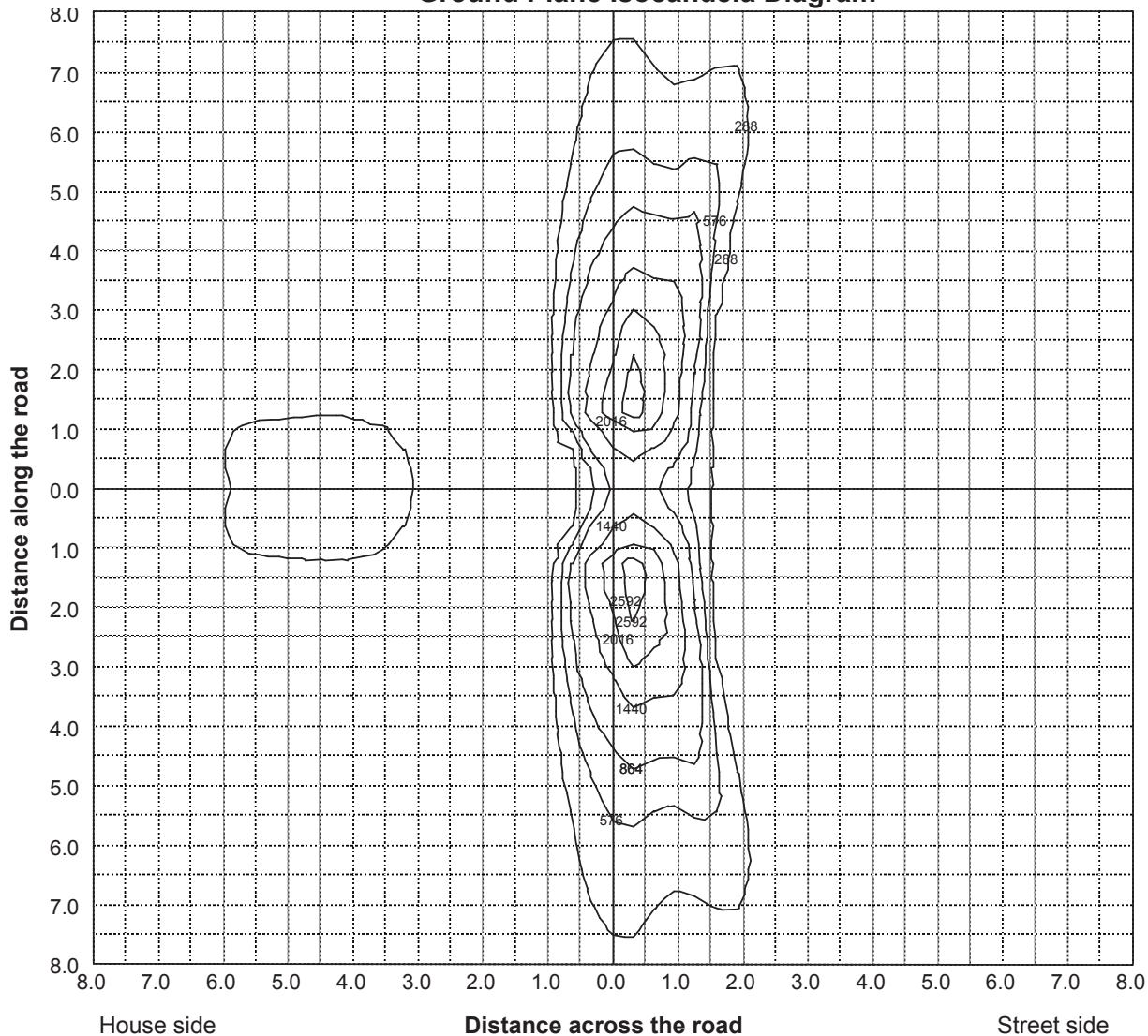
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Ground Plane Isocandela Diagram



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	916	916	916	916	916	916	916	916	916
10.0	1154	1136	1107	1073	1058	1040	1021	1004	987
20.0	1111	1134	1209	1269	1293	1302	1304	1285	1257
30.0	985	1014	1100	1209	1286	1372	1456	1516	1550
35.0	843	915	1084	1209	1283	1375	1477	1583	1659
40.0	728	813	1033	1228	1324	1416	1521	1639	1753
45.0	669	757	1009	1279	1449	1603	1736	1838	1917
47.5	640	708	954	1233	1433	1633	1805	1959	2099
50.0	588	643	881	1171	1395	1664	1925	2146	2349
52.5	487	547	813	1120	1335	1605	1894	2217	2506
55.0	365	427	698	1047	1277	1548	1825	2115	2394
57.5	260	296	493	836	1090	1400	1747	2054	2327
60.0	145	175	298	569	796	1109	1531	1906	2250
62.5	79	90	157	344	536	820	1227	1683	2068
65.0	70	70	74	164	281	522	911	1452	1867
67.5	58	61	63	82	126	236	519	1140	1731
70.0	50	52	56	64	76	97	202	620	1460
72.5	78	58	48	51	56	62	73	209	900
75.0	70	70	40	43	41	46	53	64	412
77.5	42	44	28	36	34	33	40	44	144
80.0	30	34	18	23	26	23	25	28	50
82.5	12	15	9	11	12	13	13	14	22
85.0	3	3	3	4	4	4	4	4	5
87.5	1	1	1	1	1	1	1	1	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	916	916	916	916	916	916	916	916	916
10.0	976	965	952	946	936	927	917	904	887
20.0	1222	1183	1150	1125	1099	1069	1031	982	924
30.0	1546	1501	1447	1396	1348	1289	1218	1120	1011
35.0	1694	1677	1616	1552	1484	1407	1310	1188	1062
40.0	1830	1841	1787	1710	1619	1516	1390	1251	1108
45.0	1985	2012	1969	1883	1754	1616	1453	1296	1141
47.5	2179	2189	2132	2023	1874	1702	1517	1337	1170
50.0	2507	2552	2474	2299	2095	1882	1668	1462	1262
52.5	2727	2863	2850	2634	2358	2094	1856	1637	1410
55.0	2668	2852	2893	2763	2452	2120	1845	1611	1323
57.5	2582	2785	2843	2694	2345	1990	1728	1499	1197
60.0	2506	2699	2799	2627	2235	1866	1621	1389	1048
62.5	2391	2617	2735	2573	2124	1731	1500	1257	855
65.0	2189	2476	2674	2501	2009	1599	1384	1082	637
67.5	2011	2227	2525	2380	1867	1458	1244	868	418
70.0	1899	1960	2233	2190	1691	1300	1072	622	240
72.5	1611	1722	1822	1873	1427	1103	837	382	121
75.0	1081	1373	1323	1438	1114	862	551	180	65
77.5	621	993	872	976	820	605	289	62	42
80.0	332	627	511	568	563	342	102	26	26
82.5	135	261	203	231	280	131	18	12	13
85.0	16	31	26	30	42	17	4	4	4
87.5	2	2	2	2	2	2	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								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	916	916	916	916	916	916	916	916	916
10.0	869	850	835	817	800	781	748	718	711
20.0	852	784	721	668	625	589	536	492	479
30.0	898	793	693	601	515	441	336	258	236
35.0	934	812	686	556	430	325	219	172	162
40.0	968	823	662	476	306	206	149	138	134
45.0	982	799	573	341	176	133	128	125	118
47.5	986	765	504	265	138	124	125	122	111
50.0	1030	752	449	221	130	121	122	118	108
52.5	1107	725	374	177	128	126	121	113	102
55.0	963	578	282	150	131	130	121	105	96
57.5	816	437	201	133	134	135	120	102	93
60.0	641	298	142	128	139	141	117	104	91
62.5	444	188	117	130	144	144	113	99	86
65.0	276	121	108	128	144	141	109	94	105
67.5	153	95	103	130	146	135	105	124	151
70.0	99	80	97	129	141	128	102	174	208
72.5	75	68	90	124	133	124	99	234	318
75.0	55	56	79	111	121	118	109	314	369
77.5	37	41	64	89	103	107	134	296	348
80.0	23	27	41	63	77	84	127	256	300
82.5	11	14	21	31	40	52	74	172	201
85.0	4	5	6	9	8	8	22	59	87
87.5	1	1	1	1	1	2	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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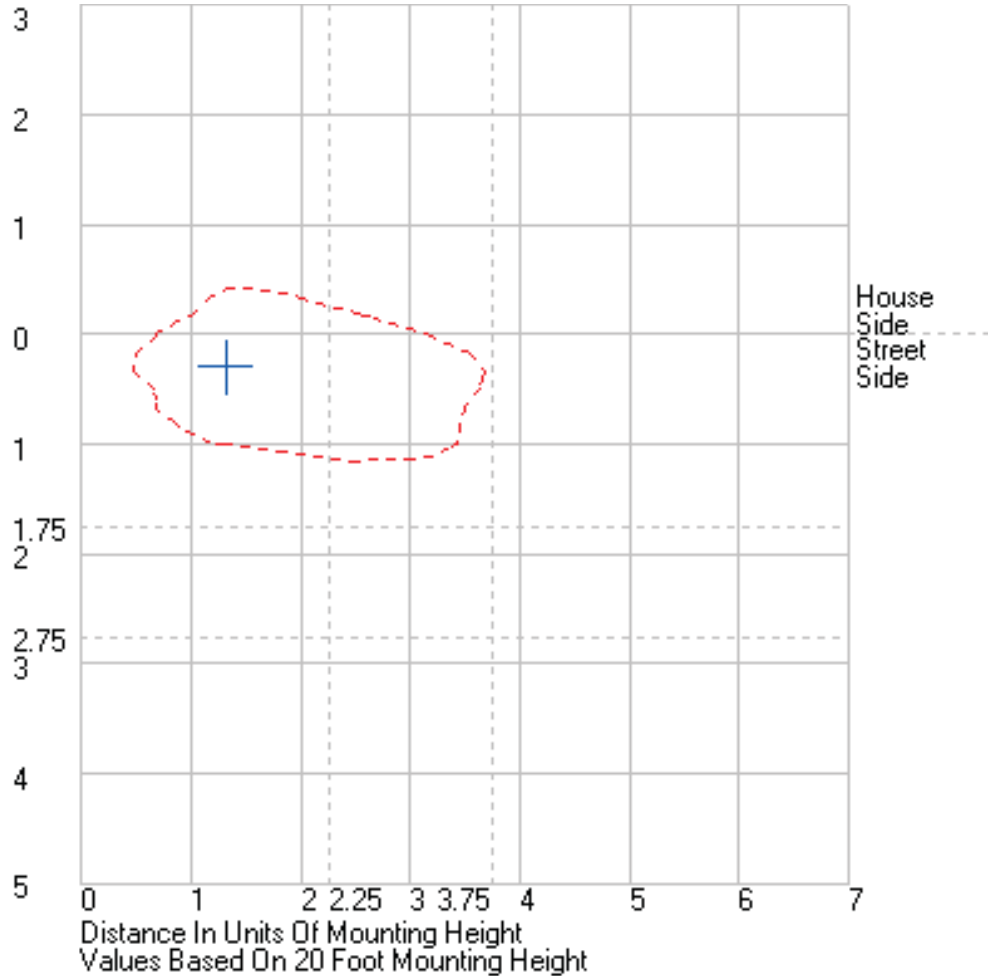
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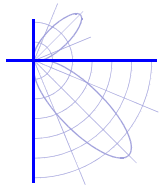
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.388, 0.386)
	CIE 1976 (u', v') ⁽¹⁾	(0.227, 0.507)
	Correlated Color Temperature (CCT) ⁽¹⁾	3860 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	5.08E-03
	Color Rendering Index (Ra) ⁽¹⁾	70.9
	Special CRI 9 (R ₉) ^{(1),(3)}	-38.1
	Distance from Planckian Locus (Duv) ^{(1),(3)}	2.02E-03
	Scotopic/Photopic Ratio ^{(1),(3)}	1.47

Electrical	Voltage	120.1 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.240 A	
	Power	28.5 W	
	Power Factor	0.99	
	Current THD	8.3 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.120 A	
	Power	28.4 W	
	Power Factor	0.86	
	Current THD	16 %	

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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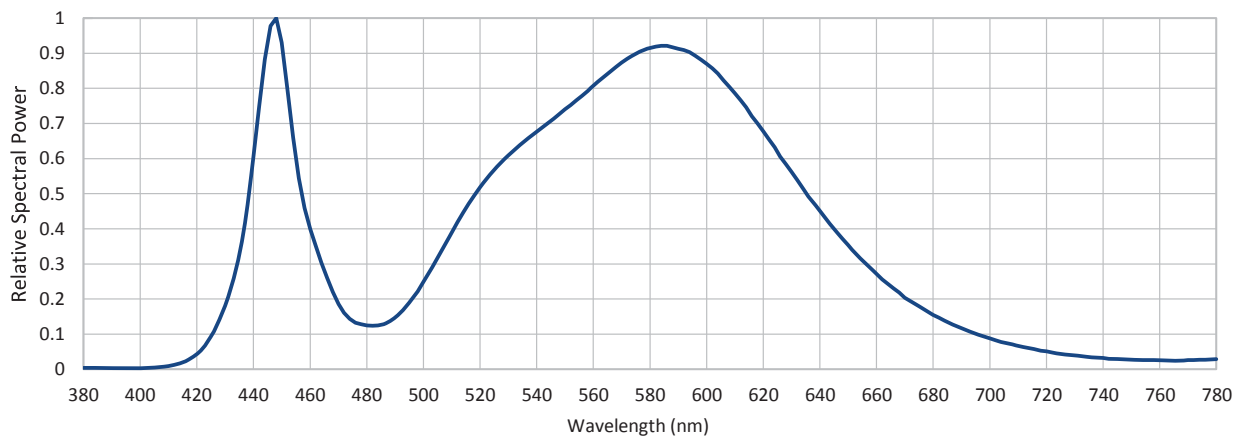
Operating at 120v AC and 60 Hz.

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	0.004	460	0.399	540	0.677	620	0.678	700	0.088
385	0.003	465	0.281	545	0.707	625	0.619	705	0.076
390	0.003	470	0.186	550	0.740	630	0.562	710	0.067
395	0.003	475	0.139	555	0.773	635	0.503	715	0.058
400	0.003	480	0.125	560	0.808	640	0.451	720	0.051
405	0.005	485	0.127	565	0.842	645	0.399	725	0.044
410	0.009	490	0.148	570	0.873	650	0.354	730	0.039
415	0.020	495	0.190	575	0.898	655	0.310	735	0.035
420	0.043	500	0.249	580	0.915	660	0.272	740	0.032
425	0.094	505	0.317	585	0.921	665	0.236	745	0.029
430	0.181	510	0.389	590	0.913	670	0.204	750	0.027
435	0.330	515	0.459	595	0.898	675	0.179	755	0.026
440	0.604	520	0.518	600	0.870	680	0.155	760	0.026
445	0.930	525	0.568	605	0.833	685	0.135	765	0.025
450	0.931	530	0.609	610	0.786	690	0.117	770	0.026
455	0.602	535	0.645	615	0.734	695	0.101	775	0.027
								780	0.029





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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	(0.226, 0.504)	(0.226, 0.505)
10.0	(0.226, 0.504)	(0.226, 0.505)
20.0	(0.226, 0.506)	(0.226, 0.507)
30.0	(0.227, 0.507)	(0.226, 0.505)
40.0	(0.227, 0.508)	(0.226, 0.506)
50.0	(0.227, 0.506)	(0.226, 0.505)
60.0	(0.227, 0.509)	I <= 10% peak
70.0	(0.227, 0.506)	I <= 10% peak
80.0	(0.223, 0.503)	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 4.0 / 23.25 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-19120-6

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

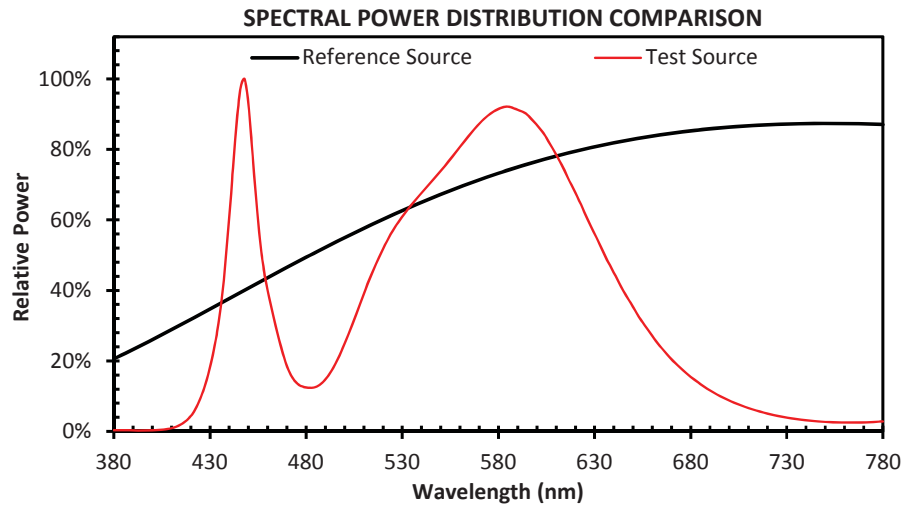
Grey painted cast aluminum housing with no lens.

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

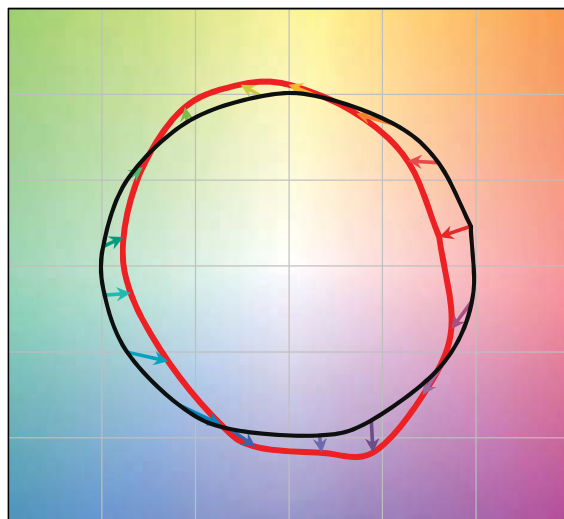
One Osram power supply. Model: OT 50/120-277/800 2DIMLT2 P set to 500ma.

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-19120-6

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 2 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 50/120-277/800 2DIMLT2 P set to 500ma.

Operating at 120v AC and 60 Hz.

Test Distance 8.0 m
Test Temperature 25.2 °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.