



Report of Test LLI-19120-5

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES M 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 400ma.

Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	3359 lm	Min Power Factor	0.81 @ 277 V
Luminaire Power	23.2 W	Max THD(i)*	17.0 % @ 277 V
Luminous Efficacy	144.8 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3830 K	80-90° Zonal Flux %	1.1 %
CIE(x,y) 1931	(0.390, 0.387)	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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Phoenix AZ 85085



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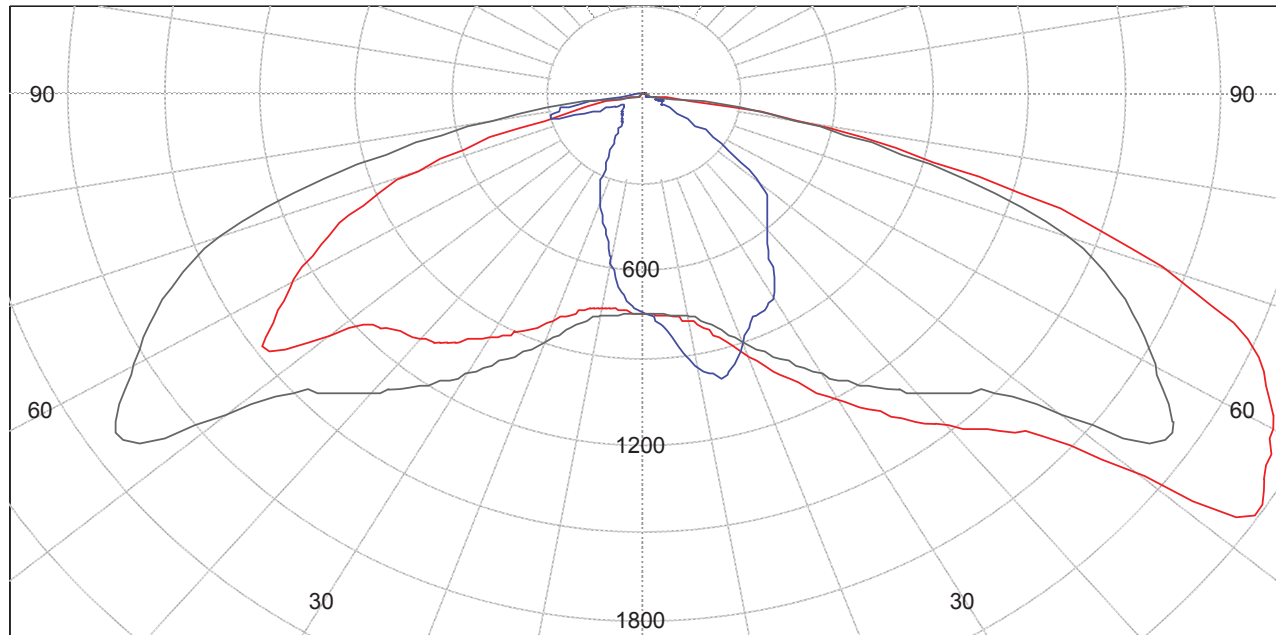
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Polar Light Distribution Curves



House side / L270

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

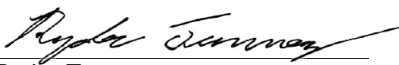
Street side / L90

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

6-May-2019
7-May-2019

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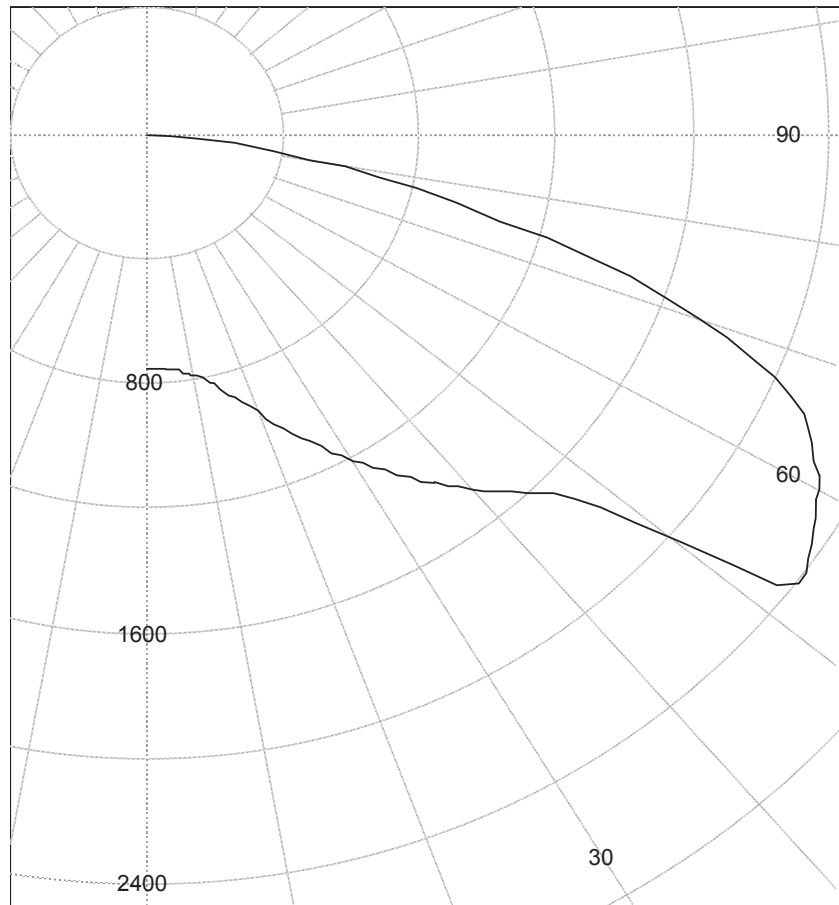
One Osram power supply. Model: OT 50/120-277/800 2DIMLT2 P set to 400ma.

Operating at 120v AC and 60 Hz.

Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	748.5
10.0	783.1
20.0	949.5
30.0	1204.0
35.0	1344.7
40.0	1478.9
45.0	1634.0
47.5	1746.2
50.0	2033.7
52.5	2372.9
55.0	2371.3
57.5	2321.0
60.0	2278.0
62.5	2209.2
65.0	2120.1
67.5	1961.2
70.0	1722.0
72.5	1422.9
75.0	1075.3
77.5	748.8
80.0	486.0
82.5	200.6
85.0	14.7
87.5	1.5
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



House side max intensity
2026.2 cd @ (90.0°, 54.5°)

Street side max intensity
2395.7 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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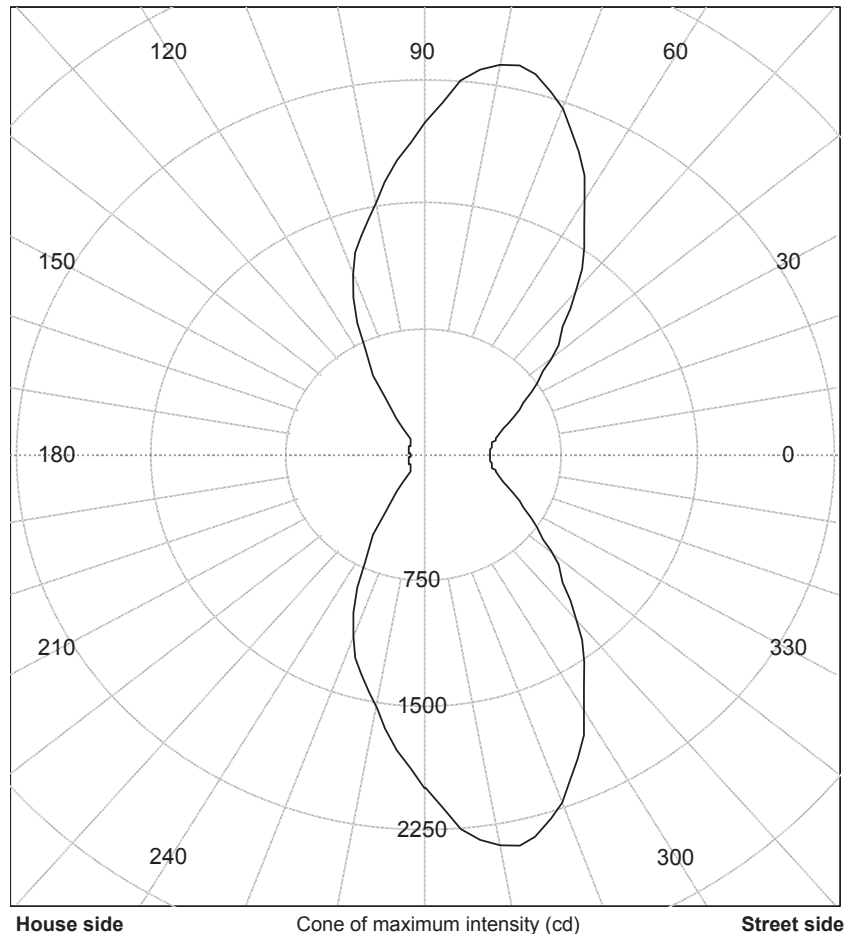
One Osram power supply. Model: OT 50/120-277/800 2DIMLT2 P set to 400ma.

Operating at 120v AC and 60 Hz.

Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V53.5) (cd)
0	355.9
15	406.2
30	631.6
40	894.0
45	1081.9
50	1297.1
55	1521.5
60	1769.7
65	2020.6
70	2221.6
75	2362.5
80	2381.0
85	2246.7
90	1995.1
95	1766.2
100	1543.2
105	1358.9
110	1161.3
115	879.1
120	546.6
125	271.3
130	126.2
135	103.5
140	104.7
150	98.3
165	89.3
180	81.0

Principal Conical Surface



House side max intensity
2026.2 cd @ (90.0°, 54.5°)

Street side max intensity
2395.7 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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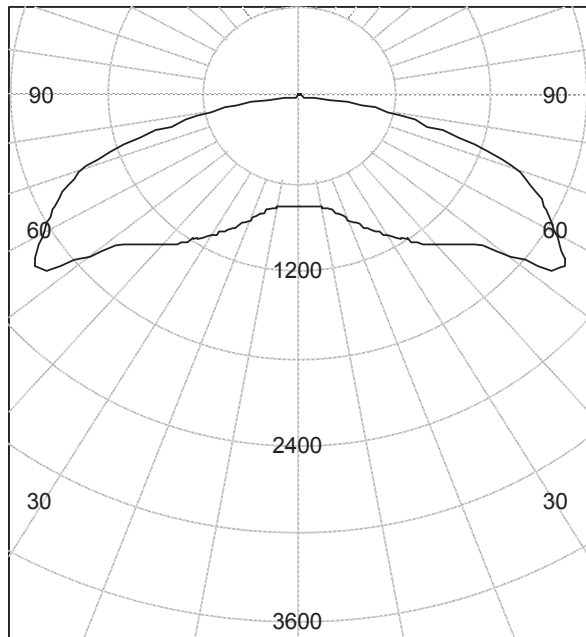
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Operating at 120v AC and 60 Hz.

Polar curve through L90 / L270

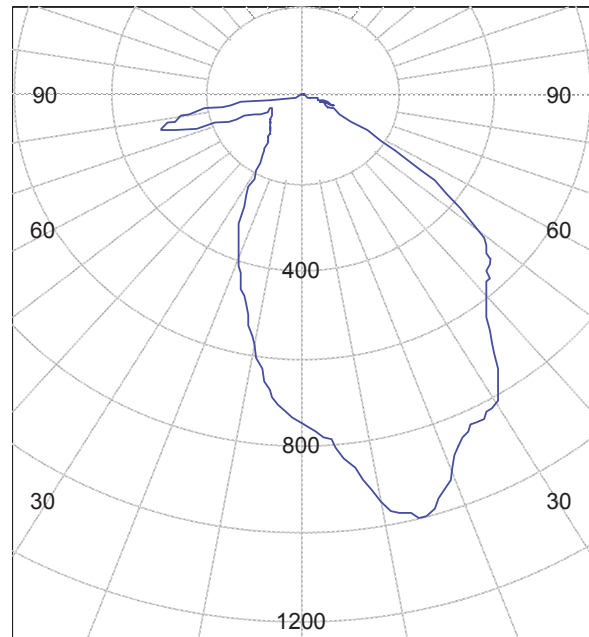


(L90)

(cd)

(L270)

Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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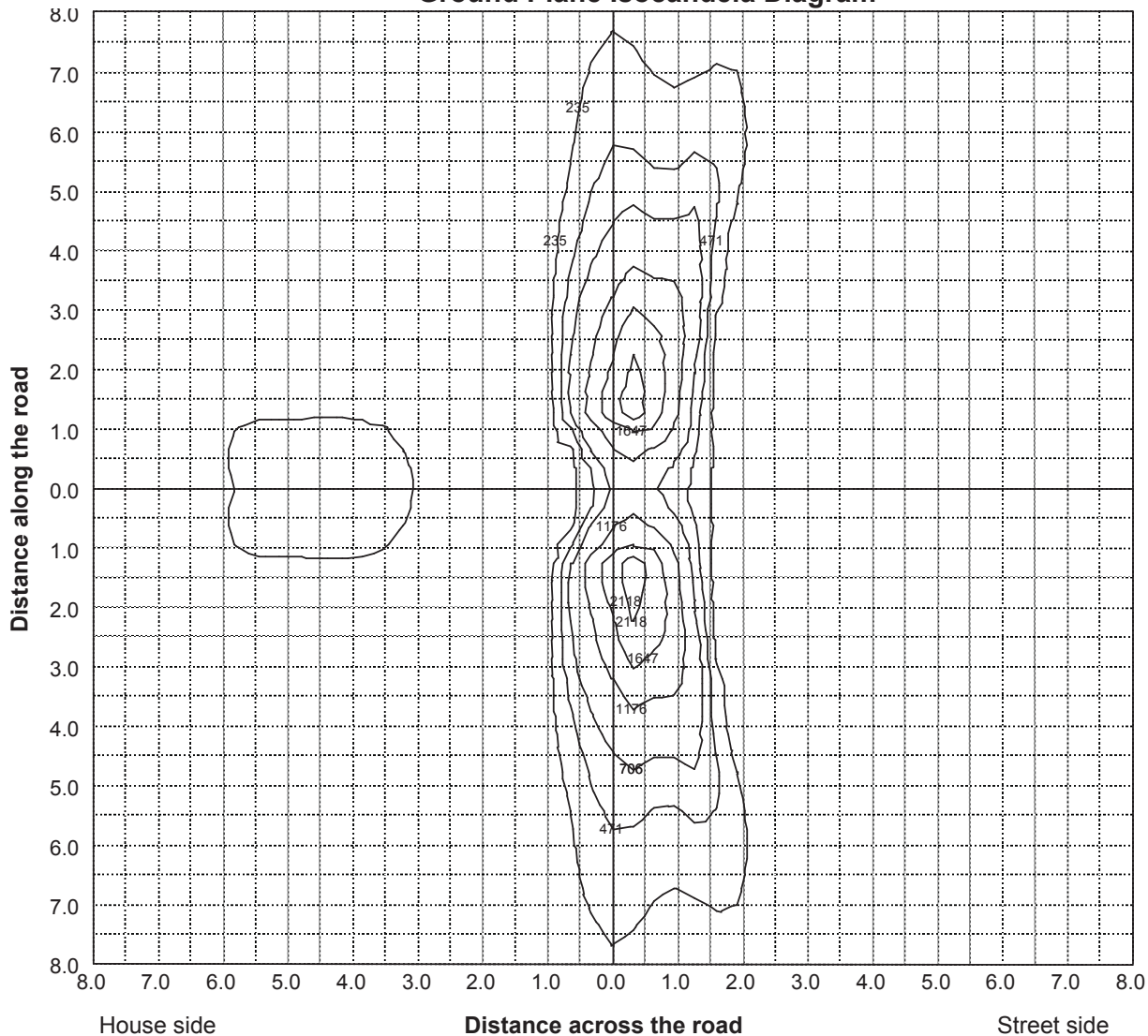
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Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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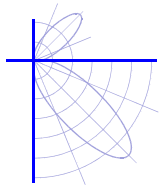
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Operating at 120v AC and 60 Hz.

Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	748	748	748	748	748	748	748	748	748
10.0	939	928	900	875	863	847	833	821	806
20.0	902	922	986	1037	1050	1063	1059	1053	1024
30.0	805	822	898	989	1046	1122	1185	1243	1259
35.0	686	746	881	980	1043	1120	1208	1293	1355
40.0	596	663	841	1000	1076	1155	1242	1338	1428
45.0	544	615	823	1046	1180	1305	1415	1494	1554
47.5	519	578	776	1006	1174	1329	1478	1594	1698
50.0	478	524	717	953	1147	1366	1578	1748	1905
52.5	396	444	663	911	1086	1314	1550	1830	2049
55.0	297	348	569	855	1038	1267	1491	1737	1964
57.5	211	242	402	681	892	1143	1430	1674	1905
60.0	117	141	243	462	654	912	1260	1553	1822
62.5	65	74	128	275	431	664	1016	1392	1695
65.0	57	57	60	133	228	421	731	1197	1545
67.5	47	49	51	67	101	191	423	924	1416
70.0	40	43	46	52	62	76	161	500	1187
72.5	63	48	39	41	46	50	59	156	740
75.0	57	57	32	35	33	37	43	52	360
77.5	34	36	23	30	27	27	32	36	79
80.0	24	27	15	18	22	18	20	23	34
82.5	9	12	8	9	10	11	10	11	16
85.0	2	3	3	3	3	3	3	3	4
87.5	1	1	1	1	1	1	1	1	1
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

RT



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Intensity data (cd)

Vertical	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	748	748	748	748	748	748	748	748	748
10.0	796	784	781	773	767	759	746	737	720
20.0	992	962	938	915	900	874	837	797	748
30.0	1257	1228	1180	1142	1105	1057	993	907	817
35.0	1378	1362	1324	1276	1218	1152	1072	970	861
40.0	1485	1500	1461	1406	1328	1244	1134	1018	905
45.0	1609	1631	1611	1533	1438	1318	1184	1054	926
47.5	1758	1766	1716	1650	1516	1381	1230	1079	948
50.0	2034	2063	1988	1873	1703	1528	1346	1176	1013
52.5	2230	2364	2351	2164	1940	1718	1515	1337	1157
55.0	2176	2327	2384	2262	2020	1748	1520	1321	1086
57.5	2112	2275	2335	2218	1927	1632	1418	1233	991
60.0	2037	2212	2298	2155	1841	1531	1323	1140	863
62.5	1925	2124	2249	2117	1752	1426	1225	1025	712
65.0	1784	2017	2190	2057	1658	1320	1135	888	528
67.5	1651	1817	2059	1952	1538	1194	1028	724	347
70.0	1539	1610	1832	1799	1407	1074	890	520	200
72.5	1306	1397	1507	1546	1192	909	704	321	98
75.0	881	1121	1075	1181	925	708	461	157	53
77.5	495	816	708	800	690	499	240	53	34
80.0	267	520	420	457	480	293	92	21	21
82.5	96	202	164	173	246	116	18	10	10
85.0	11	15	13	13	22	12	4	3	3
87.5	1	2	2	2	2	2	2	2	1
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	748	748	748	748	748	748	748	748	748
10.0	710	696	682	665	655	637	609	587	581
20.0	693	639	586	543	508	478	437	403	393
30.0	728	646	562	487	415	357	274	212	194
35.0	759	658	560	450	349	263	179	141	132
40.0	788	673	538	382	245	167	122	112	110
45.0	803	655	467	270	139	108	104	102	96
47.5	801	623	411	210	108	100	102	99	90
50.0	826	603	354	169	102	99	100	95	88
52.5	920	601	303	135	102	103	98	92	83
55.0	798	474	227	118	106	106	97	86	78
57.5	678	359	164	107	109	110	97	82	74
60.0	528	244	115	105	114	115	95	85	73
62.5	364	152	94	106	118	118	92	81	70
65.0	226	98	88	105	118	115	88	76	85
67.5	126	77	85	107	120	109	85	101	121
70.0	82	66	80	107	116	103	82	140	168
72.5	62	55	73	103	109	100	80	188	257
75.0	45	46	64	93	99	95	87	257	302
77.5	31	32	52	74	86	87	107	240	279
80.0	19	22	34	52	62	68	102	208	242
82.5	9	11	17	26	33	44	56	137	160
85.0	3	4	5	7	6	6	19	46	70
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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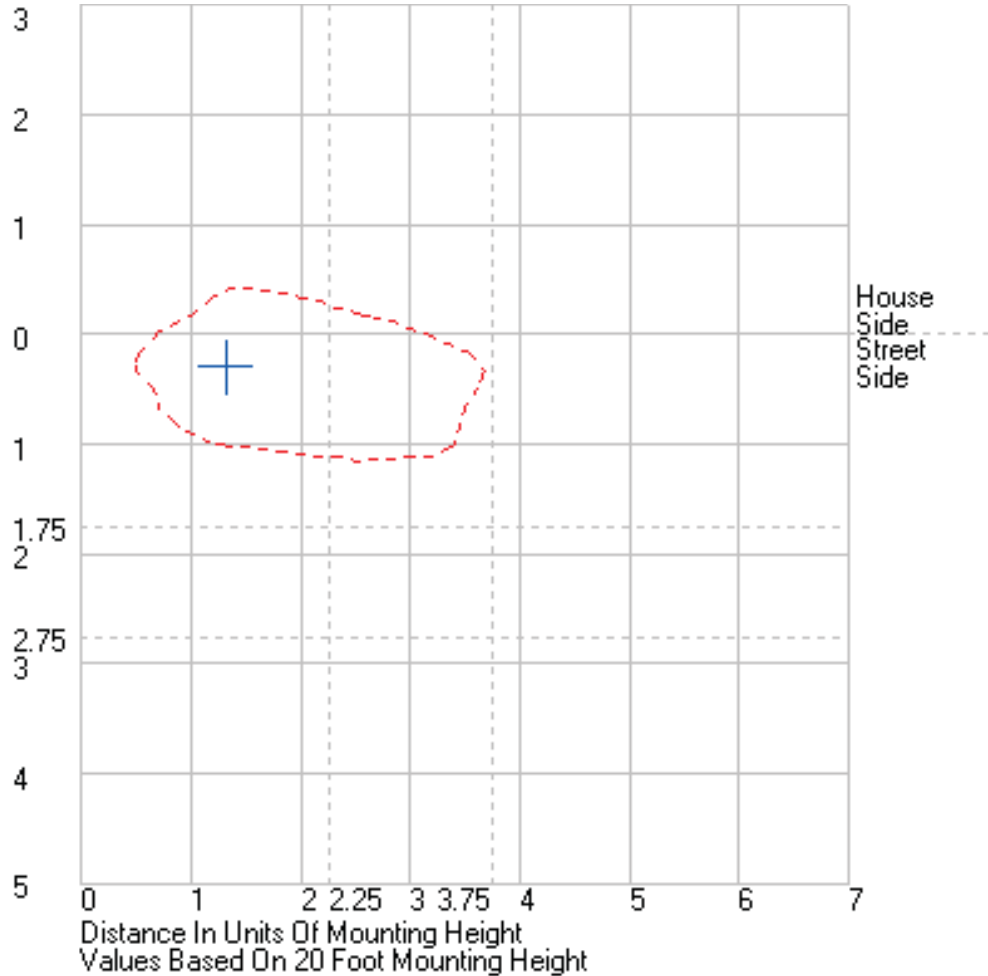
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.390, 0.387)
	CIE 1976 (u', v') ⁽¹⁾	(0.227, 0.507)
	Correlated Color Temperature (CCT) ⁽¹⁾	3830 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	3.39E-03
	Color Rendering Index (Ra) ⁽¹⁾	70.9
	Special CRI 9 (R ₉) ^{(1),(3)}	-38.0
	Distance from Planckian Locus (Duv) ^{(1),(3)}	2.04E-03
	Scotopic/Photopic Ratio ^{(1),(3)}	1.46

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.197 A	
	Power	23.2 W	
	Power Factor	0.98	
	Current THD	9.8 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.103 A	
	Power	23.3 W	
	Power Factor	0.81	
	Current THD	17 %	

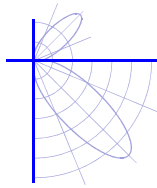
Performance data in accordance with IESNA LM-79-08. Spectral calculations are for a CIE 2° observer

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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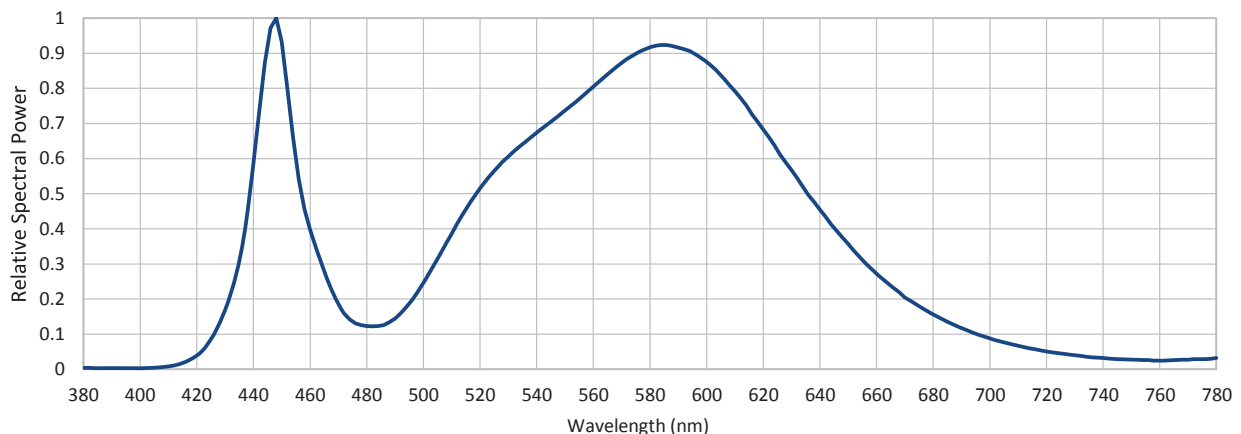
Operating at 120v AC and 60 Hz.

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	0.396	540	0.674	620	0.683	700	0.088
385	0.003	465	0.279	545	0.704	625	0.624	705	0.077
390	0.003	470	0.184	550	0.737	630	0.567	710	0.067
395	0.003	475	0.136	555	0.770	635	0.508	715	0.059
400	0.003	480	0.123	560	0.805	640	0.455	720	0.051
405	0.004	485	0.125	565	0.840	645	0.402	725	0.045
410	0.008	490	0.145	570	0.872	650	0.357	730	0.040
415	0.018	495	0.187	575	0.899	655	0.312	735	0.035
420	0.039	500	0.247	580	0.917	660	0.273	740	0.032
425	0.086	505	0.315	585	0.924	665	0.238	745	0.029
430	0.169	510	0.386	590	0.916	670	0.205	750	0.027
435	0.312	515	0.456	595	0.902	675	0.180	755	0.026
440	0.585	520	0.515	600	0.875	680	0.156	760	0.025
445	0.922	525	0.566	605	0.838	685	0.135	765	0.026
450	0.933	530	0.606	610	0.792	690	0.117	770	0.027
455	0.600	535	0.642	615	0.739	695	0.101	775	0.029
								780	0.032





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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, 0.505)	(0.226, 0.506)
10.0	(0.226, 0.505)	(0.227, 0.506)
20.0	(0.227, 0.507)	(0.227, 0.507)
30.0	(0.227, 0.508)	(0.227, 0.505)
40.0	(0.228, 0.508)	(0.227, 0.507)
50.0	(0.227, 0.507)	(0.226, 0.505)
60.0	(0.228, 0.510)	I <= 10% peak
70.0	(0.228, 0.507)	I <= 10% peak
80.0	(0.225, 0.505)	I <= 10% peak
-	-	-

Spatial measurements

Vert. angle (°)	CIE 1976 (u',v') coordinates	
	Horiz. 0.0° plane	Horiz. ° plane
-	-	-
-	-	-
-	-	-
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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 1.5 / 15.25 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-19120-5

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

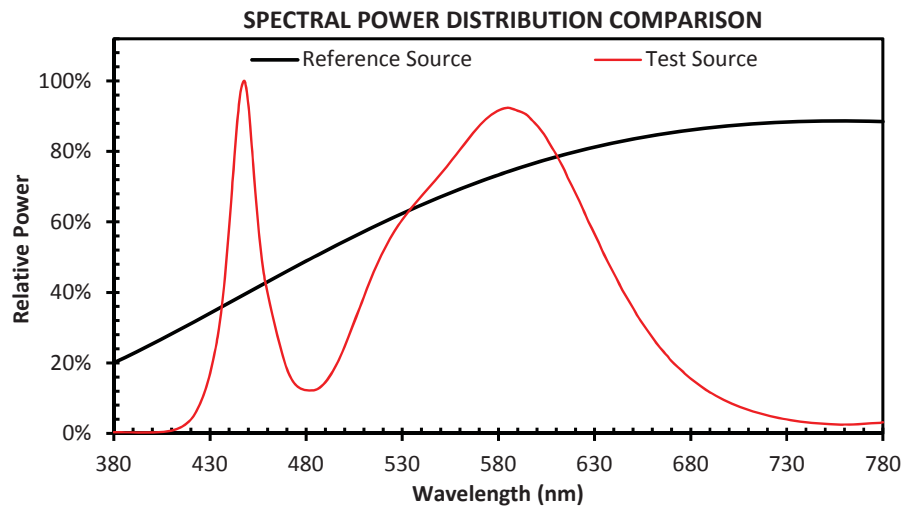
Grey painted cast aluminum housing with no lens.

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

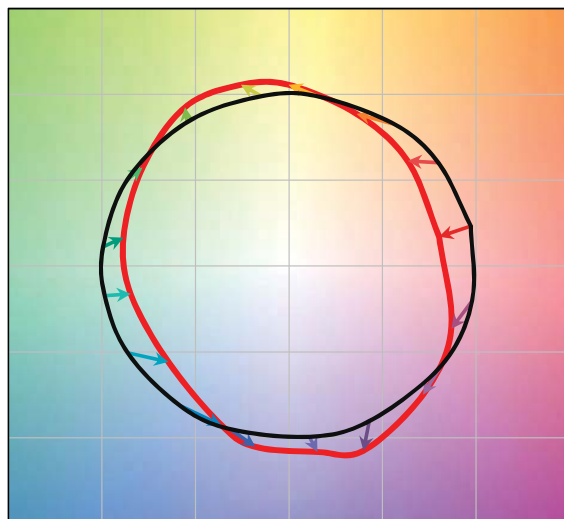
One Osram power supply. Model: OT 50/120-277/800 2DIMLT2 P set to 400ma.

Operating at 120v AC and 60 Hz.

R_f	71
R_g	93



COLOR VECTOR GRAPHIC



— Test Source

→ Series1

COLOR DISTORTION GRAPHIC





Test Report No. LLI-19120-5

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES M 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 400ma.

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.