



Report of Test LLI-19100-2

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 4 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 900ma.

Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	6527 lm	Min Power Factor	0.94 @ 277 V
Luminaire Power	49.6 W	Max THD(i)*	12.0 % @ 277 V
Luminous Efficacy	131.6 lm/W	0-90° Zonal Flux %	100.0 %
CCT	4000 K	80-90° Zonal Flux %	1.7 %
CIE(x,y) 1931	(0.380, 0.376)	BUG Rating*	B2-U0-G2
CRI	72	Street Classification*	Type II Short

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

RT



LightLab
INTERNATIONAL

LightLab International, LLC
Phoenix AZ 85085



This document is issued in accordance with the accreditation requirements of NVLAP. The laboratory is accredited for compliance with ISO/IEC 17025. The results of the tests, calibrations and/or measurements included in this document are traceable to the SI system of units.

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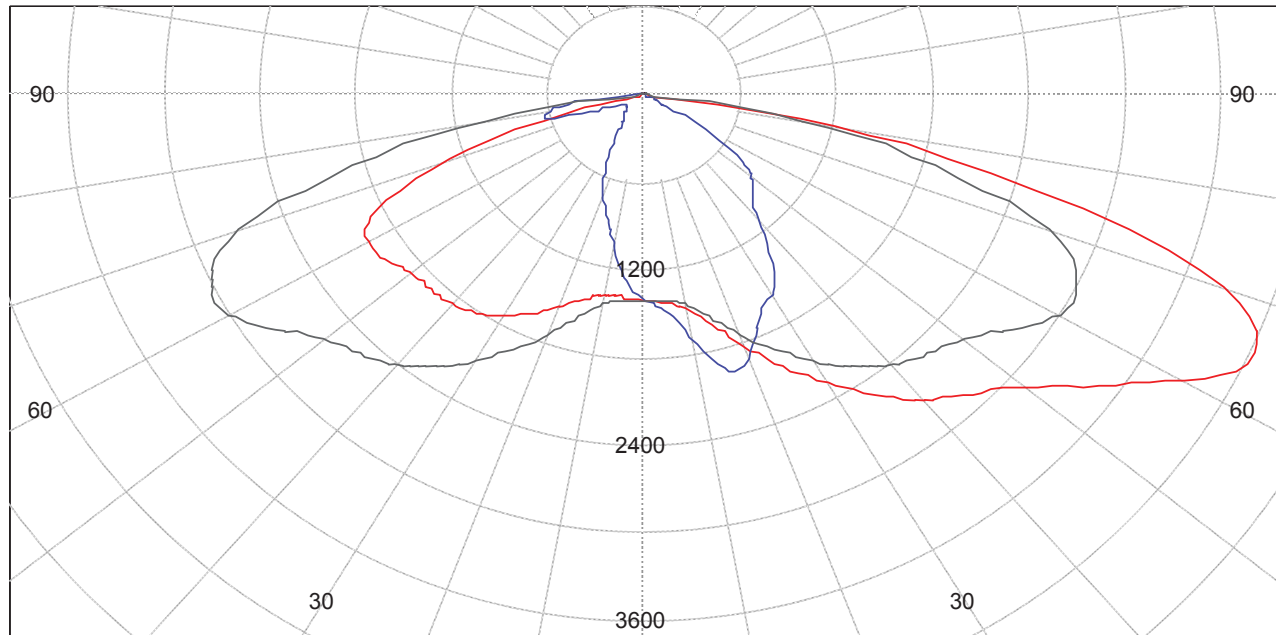
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Polar Light Distribution Curves



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
Authorized Signatory

Date of test
Date of report

15-Apr-2019
16-Apr-2019



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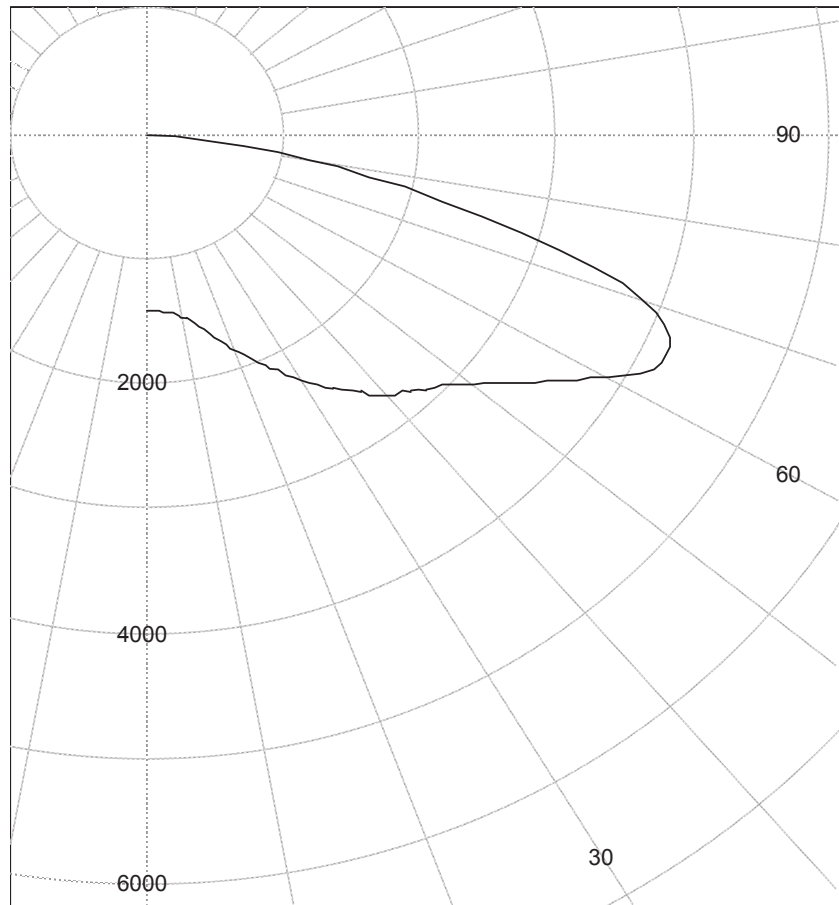
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Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	1404.9
10.0	1486.4
20.0	1831.2
30.0	2275.4
35.0	2507.5
40.0	2720.5
45.0	2893.1
47.5	2980.5
50.0	3119.8
52.5	3274.9
55.0	3473.9
57.5	3667.4
60.0	3899.1
62.5	4126.5
65.0	4209.0
67.5	4122.2
70.0	3853.1
72.5	3307.3
75.0	2542.3
77.5	1801.1
80.0	1221.2
82.5	587.5
85.0	34.6
87.5	5.9
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
3032.0 cd @ (90.0°, 62.0°)

Street side max intensity
4209.0 cd @ (75.0°, 65.0°)

Coordinates expressed in the C Type coordinate system

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



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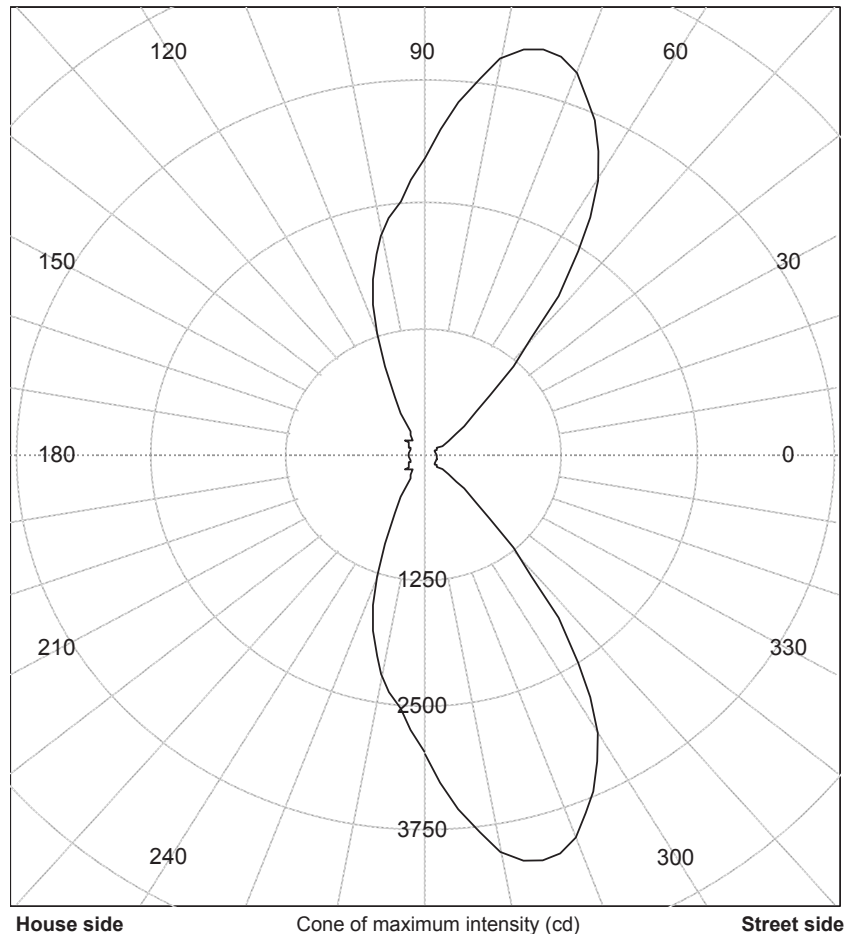
One Osram power supply. Model: OT 50/120-277/1A2 2DIMLT2 P set to 900ma.

Operating at 120v AC and 60 Hz.

Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V65.0) (cd)
0	107.9
15	110.2
30	140.5
40	468.9
45	849.4
50	1546.2
55	2490.8
60	3181.9
65	3694.5
70	4047.2
75	4209.0
80	4023.5
85	3539.0
90	2978.5
95	2550.1
100	2233.5
105	1834.6
110	1274.4
115	649.0
120	273.6
125	173.5
130	197.8
135	219.5
140	217.9
150	163.3
165	140.6
180	141.3

Principal Conical Surface



House side

Cone of maximum intensity (cd)

Street side

House side max intensity
3032.0 cd @ (90.0°, 62.0°)

Street side max intensity
4209.0 cd @ (75.0°, 65.0°)

Coordinates expressed in the C Type coordinate system

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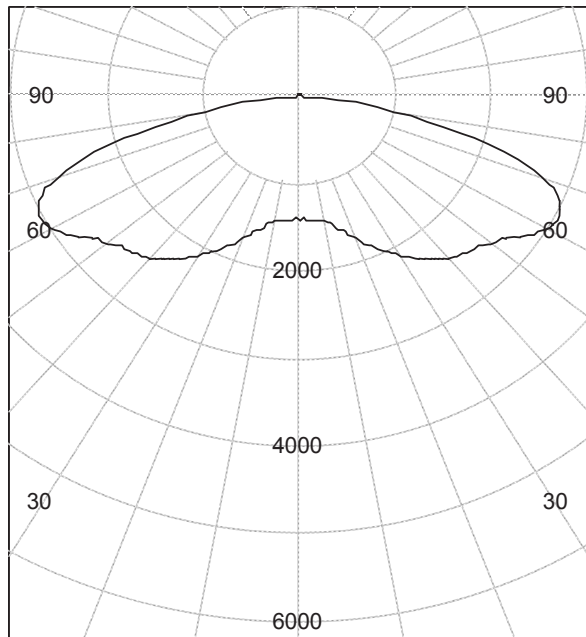
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Polar curve through L90 / L270

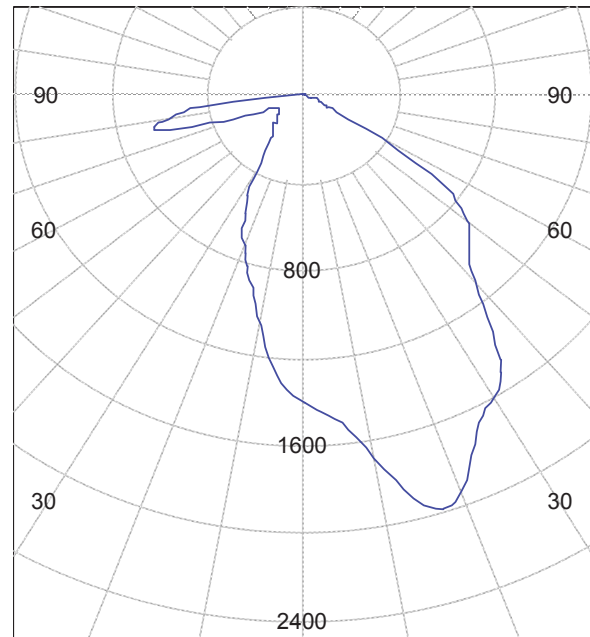


(L90)

(cd)

(L270)

Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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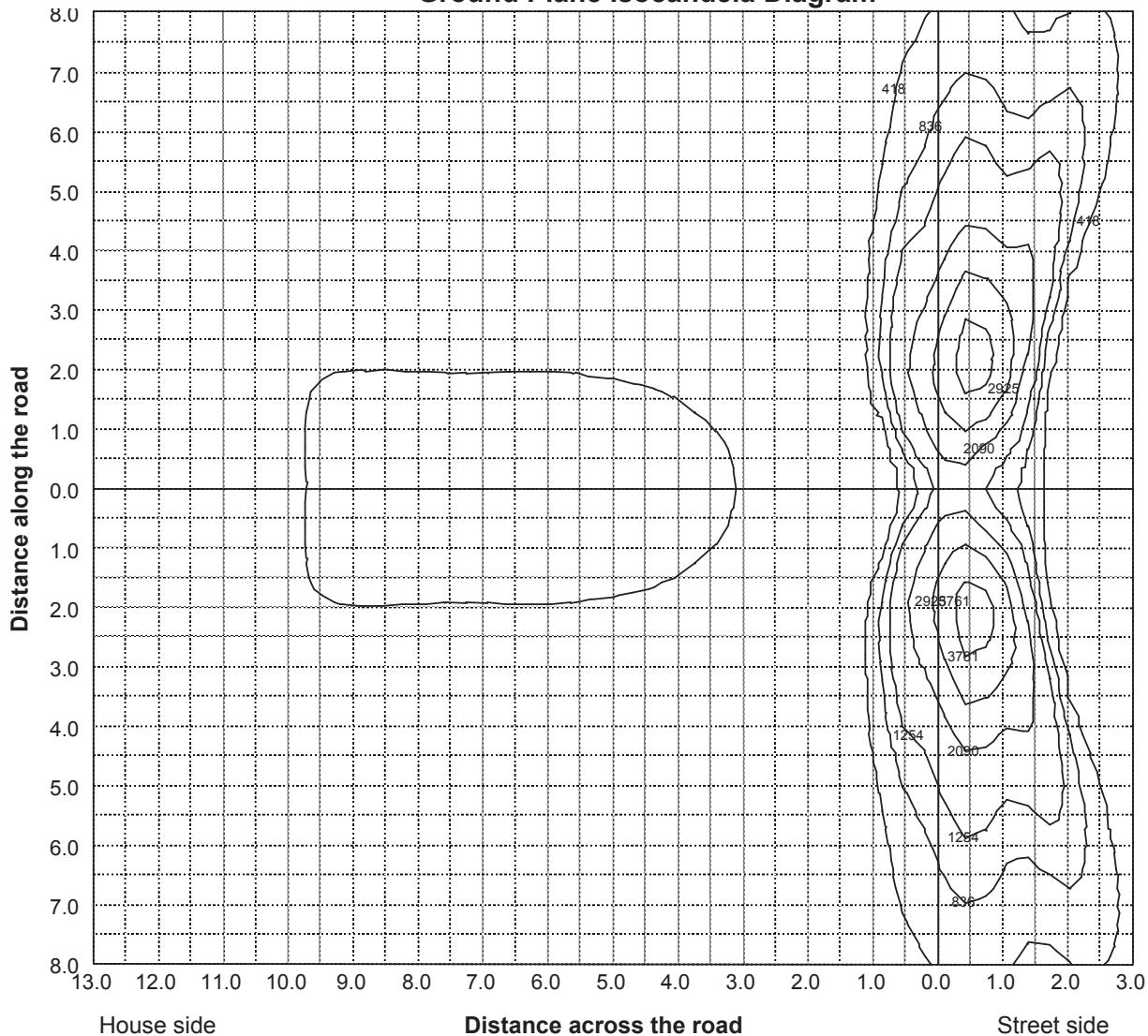
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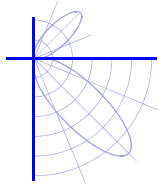
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Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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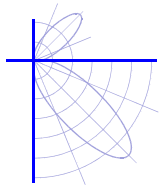
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Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	1405	1405	1405	1405	1405	1405	1405	1405	1405
10.0	1683	1657	1610	1573	1555	1540	1524	1513	1505
20.0	1926	1949	2025	2062	2055	2036	2001	1948	1898
30.0	1583	1621	1801	2057	2201	2326	2414	2451	2427
35.0	1396	1492	1727	1967	2130	2307	2471	2587	2634
40.0	1104	1246	1612	1932	2106	2294	2491	2667	2775
45.0	976	1094	1474	1916	2153	2362	2545	2730	2876
47.5	934	1048	1421	1890	2179	2419	2607	2789	2945
50.0	881	982	1369	1866	2208	2496	2706	2888	3053
52.5	815	891	1279	1808	2209	2554	2809	3014	3196
55.0	712	781	1148	1698	2140	2550	2884	3135	3343
57.5	508	593	983	1534	1990	2479	2901	3235	3489
60.0	296	357	697	1284	1756	2343	2849	3282	3645
62.5	136	162	373	881	1354	2069	2749	3282	3743
65.0	108	110	140	469	849	1546	2491	3182	3695
67.5	86	92	96	160	387	890	1909	2898	3490
70.0	69	76	85	92	127	338	1106	2345	3142
72.5	64	65	74	76	80	106	330	1510	2663
75.0	60	63	59	65	59	71	89	703	1949
77.5	57	65	42	57	49	49	63	145	1134
80.0	31	49	29	34	38	32	37	56	572
82.5	11	12	13	15	16	17	18	24	173
85.0	3	3	3	4	5	5	6	6	13
87.5	1	1	1	1	2	2	2	3	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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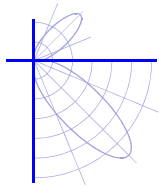
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Intensity data (cd)

Vertical	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	1405	1405	1405	1405	1405	1405	1405	1405	1405
10.0	1497	1486	1473	1465	1452	1436	1419	1397	1369
20.0	1861	1831	1803	1776	1743	1696	1628	1543	1440
30.0	2359	2275	2217	2164	2102	2013	1893	1743	1566
35.0	2596	2508	2422	2353	2269	2155	2004	1818	1629
40.0	2791	2721	2622	2528	2411	2262	2080	1869	1671
45.0	2940	2893	2782	2660	2510	2326	2109	1888	1684
47.5	3020	2981	2862	2720	2549	2345	2111	1885	1672
50.0	3147	3120	2989	2818	2617	2381	2129	1897	1670
52.5	3303	3275	3134	2930	2689	2427	2161	1928	1682
55.0	3474	3474	3343	3106	2807	2502	2222	1975	1689
57.5	3650	3667	3528	3269	2913	2568	2272	1992	1640
60.0	3867	3899	3743	3424	3004	2623	2306	1986	1563
62.5	4044	4126	3926	3516	3031	2624	2308	1953	1453
65.0	4047	4209	4024	3539	2979	2550	2234	1835	1274
67.5	3869	4122	4034	3529	2883	2417	2068	1594	978
70.0	3538	3853	3939	3434	2686	2233	1871	1293	642
72.5	3038	3307	3586	3149	2308	1928	1584	934	376
75.0	2539	2542	2930	2681	1893	1542	1151	511	174
77.5	1978	1801	1983	2000	1438	1109	656	227	82
80.0	1294	1221	1134	1382	1004	716	268	61	45
82.5	526	588	449	667	494	286	71	23	28
85.0	23	35	30	46	55	28	12	11	14
87.5	5	6	5	5	5	5	5	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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Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	1405	1405	1405	1405	1405	1405	1405	1405	1405
10.0	1338	1302	1270	1241	1213	1181	1131	1081	1069
20.0	1326	1213	1109	1026	956	897	821	753	734
30.0	1398	1241	1094	955	820	703	544	429	395
35.0	1444	1265	1087	900	713	551	365	266	241
40.0	1472	1272	1041	790	543	363	226	196	194
45.0	1468	1221	927	596	317	204	186	177	166
47.5	1444	1167	831	466	229	183	183	170	153
50.0	1407	1090	700	351	188	178	185	169	146
52.5	1371	984	559	266	182	185	187	166	139
55.0	1306	845	434	215	190	198	186	160	131
57.5	1183	688	330	195	198	205	181	142	124
60.0	1029	533	249	189	207	213	174	138	123
62.5	858	400	197	193	217	219	168	139	124
65.0	649	274	173	198	219	218	163	141	141
67.5	420	178	166	197	223	209	161	171	206
70.0	241	141	155	196	215	197	158	241	307
72.5	151	118	146	190	202	185	156	340	452
75.0	105	97	133	176	185	178	166	496	632
77.5	69	74	115	151	162	166	215	535	629
80.0	44	54	85	108	123	141	257	489	578
82.5	28	37	55	70	95	106	219	412	493
85.0	15	18	24	28	37	60	105	253	296
87.5	5	5	6	6	6	7	8	7	6
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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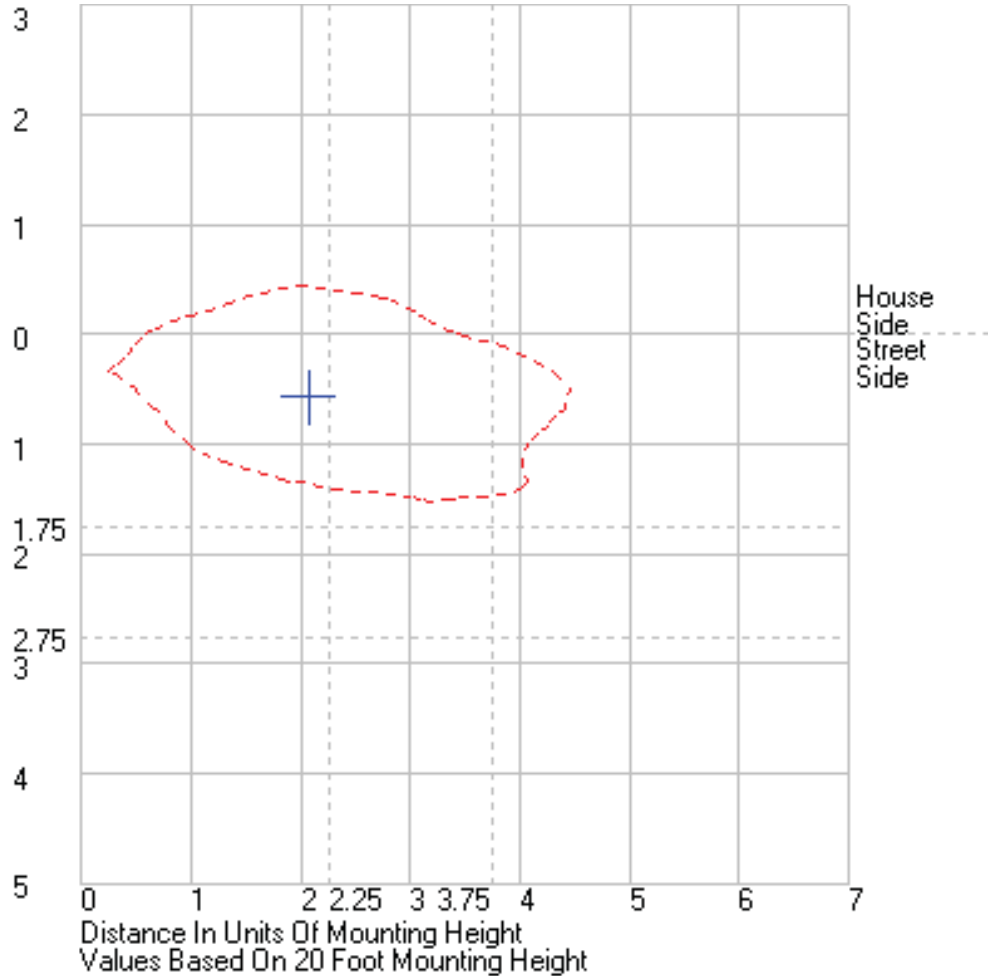
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.380, 0.376)
	CIE 1976 (u', v') ⁽¹⁾	(0.225, 0.501)
	Correlated Color Temperature (CCT) ⁽¹⁾	4000 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	3.48E-03
	Color Rendering Index (Ra) ⁽¹⁾	72.0
	Special CRI 9 (R ₉) ^{(1),(3)}	-32.6
	Distance from Planckian Locus (Duv) ^{(1),(3)}	-3.68E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.53

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.416 A	
	Power	49.6 W	
	Power Factor	0.99	
	Current THD	5.7 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.186 A	
	Power	48.2 W	
	Power Factor	0.94	
	Current THD	12 %	

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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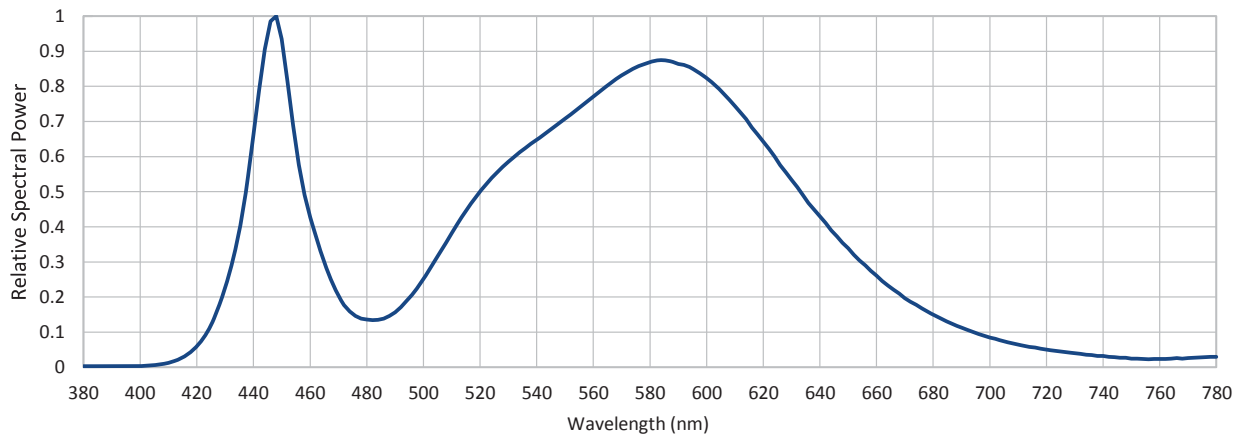
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LM-79 Performance Data

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	0.427	540	0.648	620	0.643	700	0.085
385	0.003	465	0.300	545	0.678	625	0.588	705	0.074
390	0.003	470	0.203	550	0.708	630	0.534	710	0.065
395	0.003	475	0.152	555	0.739	635	0.479	715	0.057
400	0.004	480	0.136	560	0.771	640	0.430	720	0.050
405	0.006	485	0.137	565	0.802	645	0.381	725	0.045
410	0.013	490	0.157	570	0.831	650	0.339	730	0.040
415	0.029	495	0.197	575	0.854	655	0.297	735	0.036
420	0.060	500	0.252	580	0.869	660	0.261	740	0.032
425	0.123	505	0.316	585	0.874	665	0.227	745	0.028
430	0.226	510	0.382	590	0.864	670	0.197	750	0.025
435	0.393	515	0.445	595	0.851	675	0.173	755	0.024
440	0.661	520	0.500	600	0.823	680	0.150	760	0.024
445	0.945	525	0.547	605	0.788	685	0.130	765	0.025
450	0.935	530	0.585	610	0.744	690	0.113	770	0.026
455	0.633	535	0.619	615	0.695	695	0.098	775	0.029
								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, 0.498)	(0.224, 0.499)
10.0	(0.224, 0.499)	(0.225, 0.501)
20.0	(0.225, 0.501)	(0.224, 0.499)
30.0	(0.225, 0.502)	(0.226, 0.502)
40.0	(0.225, 0.502)	(0.224, 0.500)
50.0	(0.226, 0.501)	(0.225, 0.500)
60.0	(0.226, 0.502)	I <= 10% peak
70.0	(0.226, 0.502)	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-19100-2

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

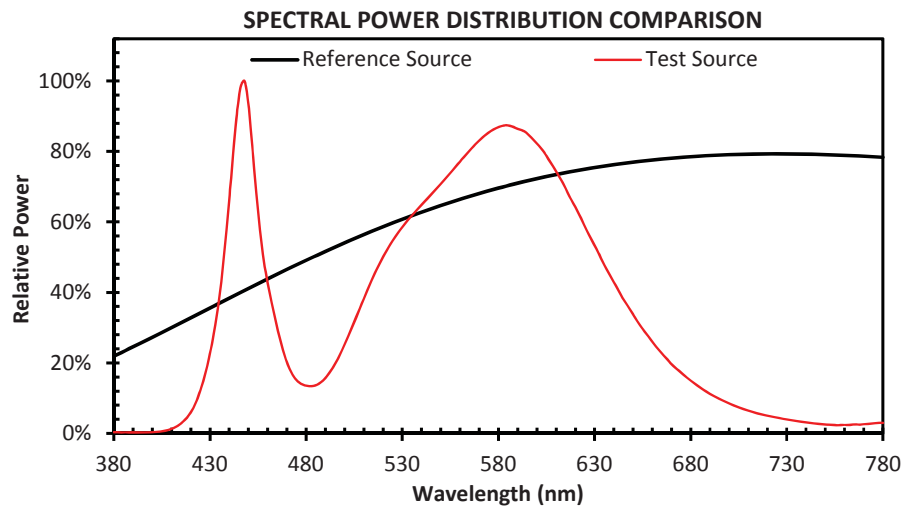
Grey painted cast aluminum housing with no lens.

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

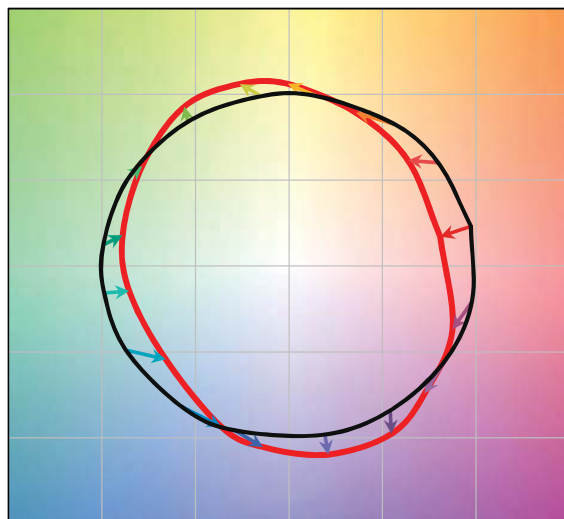
One Osram power supply. Model: OT 50/120-277/1A2 2DIMLT2 P set to 900ma.

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-19100-2

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 4 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 900ma.

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.