



Report of Test LLI-19100-1

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES T 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 800ma.

Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	5914 lm	Min Power Factor	0.93 @ 277 V
Luminaire Power	44.1 W	Max THD(i)*	13.0 % @ 277 V
Luminous Efficacy	134.1 lm/W	0-90° Zonal Flux %	100.0 %
CCT	4010 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



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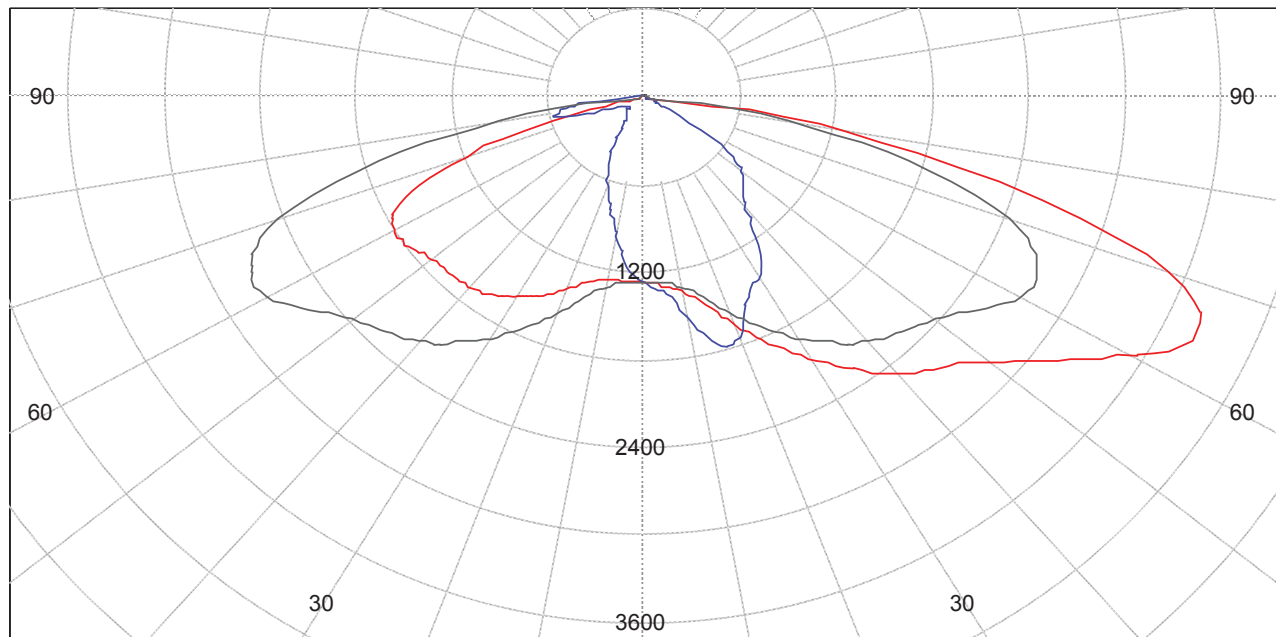
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Polar Light Distribution Curves



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

15-Apr-2019
15-Apr-2019

RT



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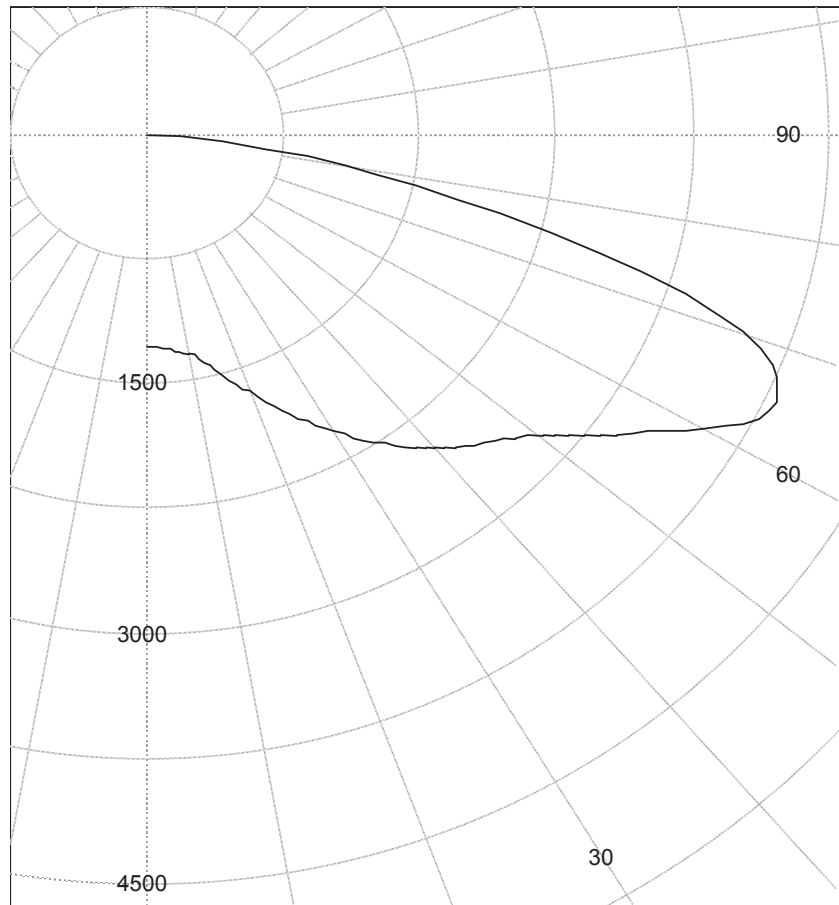
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Operating at 120v AC and 60 Hz.

Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	1272.9
10.0	1347.3
20.0	1657.8
30.0	2063.5
35.0	2272.7
40.0	2468.0
45.0	2624.0
47.5	2701.8
50.0	2831.2
52.5	2973.0
55.0	3152.7
57.5	3328.8
60.0	3540.7
62.5	3746.6
65.0	3817.4
67.5	3737.9
70.0	3490.2
72.5	2988.2
75.0	2290.3
77.5	1625.6
80.0	1104.8
82.5	533.2
85.0	31.8
87.5	5.3
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
2749.1 cd @ (90.0°, 62.0°)

Street side max intensity
3817.4 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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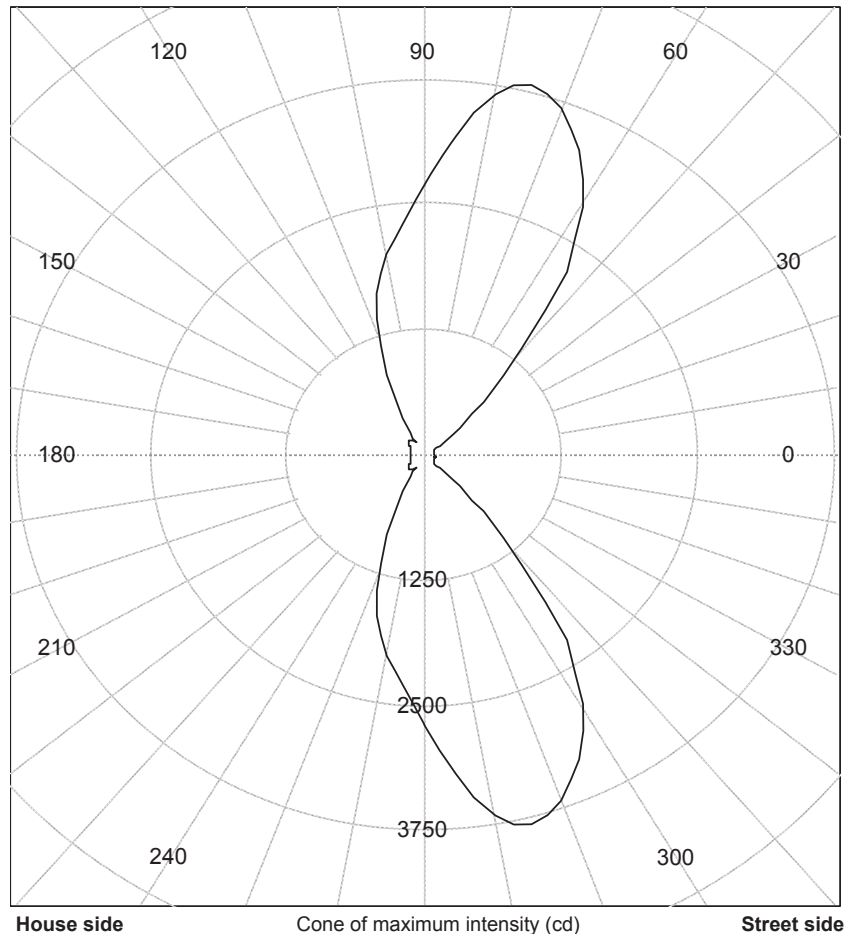
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Operating at 120v AC and 60 Hz.

Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V65.0) (cd)
0	96.6
15	99.4
30	125.6
40	419.3
45	763.0
50	1391.5
55	2246.8
60	2881.0
65	3343.7
70	3663.4
75	3817.4
80	3649.6
85	3207.1
90	2698.0
95	2308.2
100	2023.5
105	1664.3
110	1154.7
115	589.2
120	247.8
125	157.5
130	179.1
135	198.9
140	197.8
150	148.2
165	127.5
180	128.4

Principal Conical Surface



House side

Cone of maximum intensity (cd)

Street side

House side max intensity
2749.1 cd @ (90.0°, 62.0°)

Street side max intensity
3817.4 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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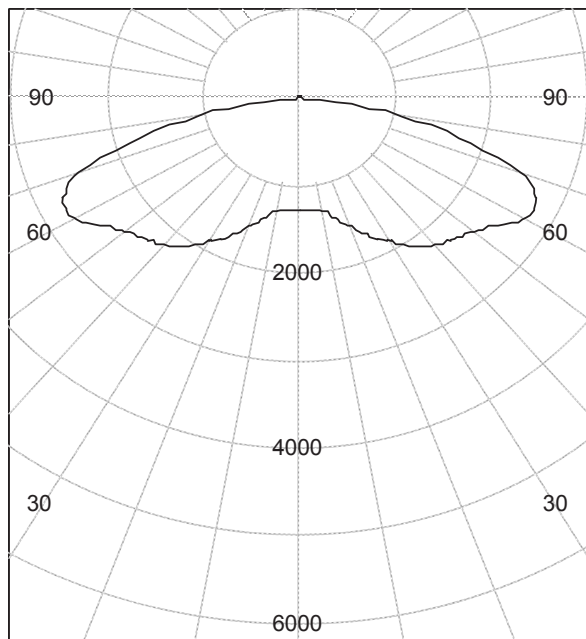
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Polar curve through L90 / L270

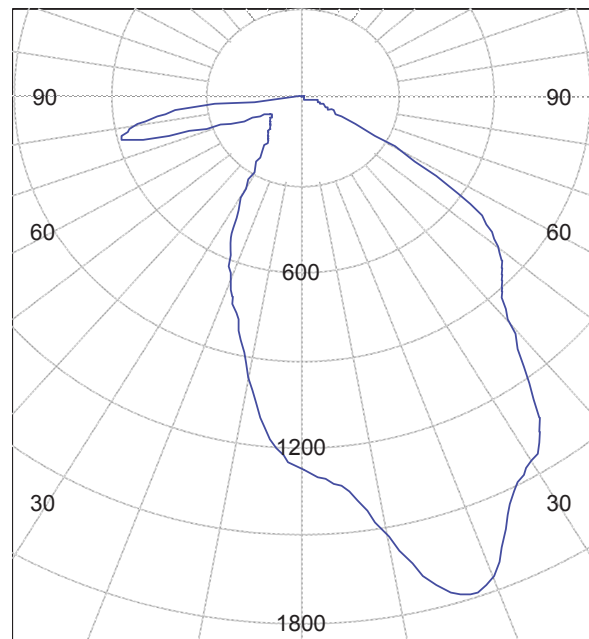


(L90)

(cd)

(L270)

Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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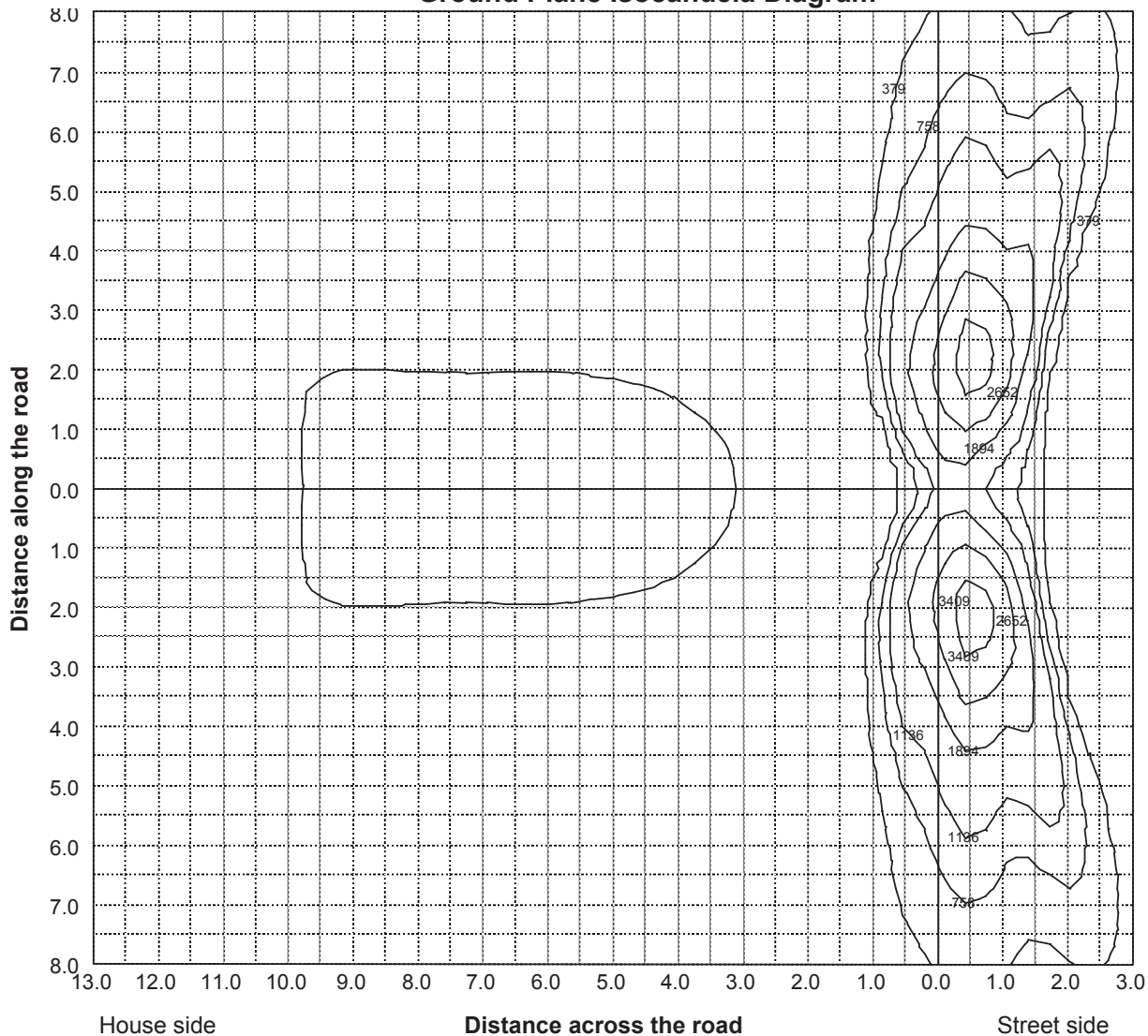
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Ground Plane Isocandela Diagram



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	1273	1273	1273	1273	1273	1273	1273	1273	1273
10.0	1525	1504	1462	1428	1410	1397	1382	1372	1364
20.0	1742	1764	1835	1872	1865	1849	1816	1768	1722
30.0	1433	1465	1631	1862	1992	2109	2187	2223	2200
35.0	1262	1350	1564	1782	1930	2092	2240	2345	2389
40.0	996	1126	1458	1752	1909	2077	2256	2415	2516
45.0	883	991	1335	1735	1954	2143	2310	2476	2607
47.5	842	947	1286	1716	1975	2195	2365	2529	2671
50.0	795	888	1239	1692	2003	2264	2454	2620	2769
52.5	735	805	1159	1639	2003	2317	2544	2734	2899
55.0	640	705	1038	1536	1938	2316	2614	2843	3029
57.5	455	533	888	1388	1802	2250	2629	2935	3161
60.0	264	320	626	1160	1588	2121	2582	2972	3307
62.5	121	146	333	791	1220	1872	2490	2972	3391
65.0	97	99	126	419	763	1392	2247	2881	3344
67.5	78	83	87	142	345	799	1719	2619	3160
70.0	62	69	77	83	113	301	990	2119	2839
72.5	58	58	67	69	73	95	290	1363	2405
75.0	54	57	53	59	54	64	80	633	1756
77.5	51	59	38	51	45	44	57	120	1008
80.0	27	42	26	30	34	29	33	48	512
82.5	10	11	12	14	14	15	16	21	154
85.0	3	2	3	4	4	4	5	5	12
87.5	1	1	1	1	1	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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Intensity data (cd)

Vertical	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	1273	1273	1273	1273	1273	1273	1273	1273	1273
10.0	1357	1347	1336	1327	1315	1301	1284	1264	1241
20.0	1687	1658	1634	1610	1579	1534	1475	1398	1307
30.0	2140	2064	2010	1962	1906	1825	1716	1581	1422
35.0	2357	2273	2197	2134	2054	1954	1818	1651	1479
40.0	2530	2468	2376	2291	2184	2051	1886	1698	1516
45.0	2666	2624	2524	2409	2274	2110	1913	1714	1527
47.5	2742	2702	2597	2466	2312	2125	1914	1711	1519
50.0	2854	2831	2713	2555	2373	2159	1931	1722	1516
52.5	2995	2973	2843	2657	2440	2198	1960	1749	1529
55.0	3150	3153	3032	2815	2547	2269	2016	1792	1531
57.5	3308	3329	3201	2964	2641	2329	2061	1808	1489
60.0	3509	3541	3396	3106	2724	2378	2093	1803	1418
62.5	3665	3747	3560	3187	2746	2377	2095	1774	1317
65.0	3663	3817	3650	3207	2698	2308	2023	1664	1155
67.5	3505	3738	3656	3196	2610	2189	1876	1446	886
70.0	3201	3490	3564	3113	2431	2020	1697	1170	584
72.5	2751	2988	3245	2860	2090	1740	1431	848	340
75.0	2308	2290	2647	2436	1714	1400	1044	461	156
77.5	1805	1626	1793	1815	1306	1007	594	200	75
80.0	1178	1105	1020	1252	915	651	239	53	40
82.5	475	533	401	603	449	265	62	21	25
85.0	21	32	27	42	49	25	10	10	12
87.5	4	5	5	5	5	5	5	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

RT



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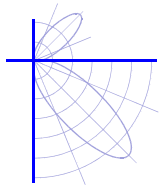
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Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	1273	1273	1273	1273	1273	1273	1273	1273	1273
10.0	1214	1182	1153	1126	1100	1071	1025	982	972
20.0	1203	1100	1006	931	868	814	743	684	667
30.0	1268	1125	991	866	744	638	494	390	360
35.0	1310	1147	985	816	647	500	332	242	219
40.0	1336	1155	945	717	493	330	205	178	176
45.0	1334	1109	842	542	288	185	169	160	151
47.5	1311	1058	754	424	208	166	166	154	139
50.0	1278	989	636	319	170	162	168	153	132
52.5	1246	895	508	241	165	168	169	150	126
55.0	1185	770	395	195	172	179	168	145	119
57.5	1074	626	300	176	179	185	164	129	113
60.0	935	484	225	171	188	193	158	125	112
62.5	781	362	177	175	196	199	152	126	113
65.0	589	248	158	179	199	198	148	128	128
67.5	382	161	151	179	202	189	146	154	186
70.0	218	128	141	178	195	179	143	218	277
72.5	136	107	132	173	183	168	141	307	407
75.0	95	88	121	159	168	161	151	448	572
77.5	62	67	104	137	147	150	193	485	572
80.0	40	49	77	98	111	127	233	443	526
82.5	25	33	50	63	86	96	200	374	450
85.0	14	17	22	26	34	54	99	229	273
87.5	5	5	5	5	6	6	7	6	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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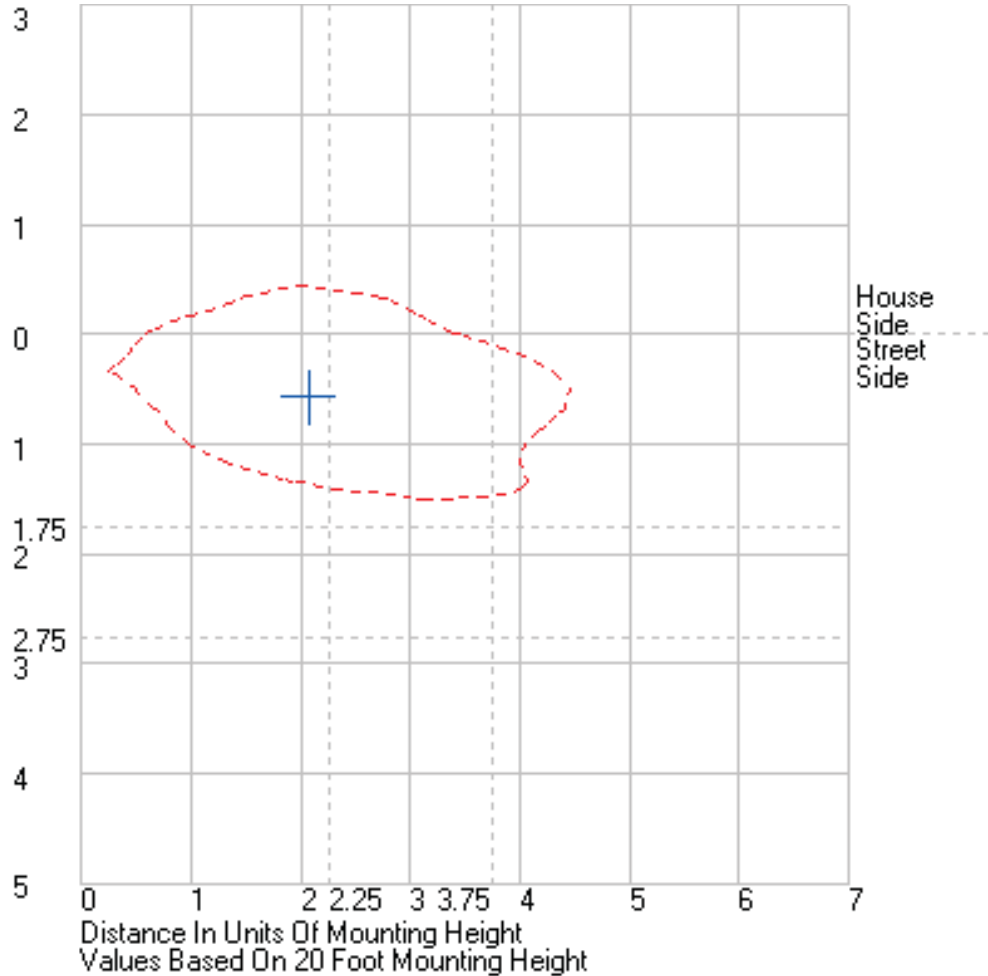
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.380, 0.376)
	CIE 1976 (u', v') ⁽¹⁾	(0.225, 0.501)
	Correlated Color Temperature (CCT) ⁽¹⁾	4010 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	3.39E-03
	Color Rendering Index (Ra) ⁽¹⁾	72.1
	Special CRI 9 (R ₉) ^{(1),(3)}	-32.6
	Distance from Planckian Locus (Duv) ^{(1),(3)}	-2.58E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.53

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.370 A	
	Power	44.1 W	
	Power Factor	0.99	
	Current THD	6.1 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.168 A	
	Power	43.1 W	
	Power Factor	0.93	
	Current THD	13 %	

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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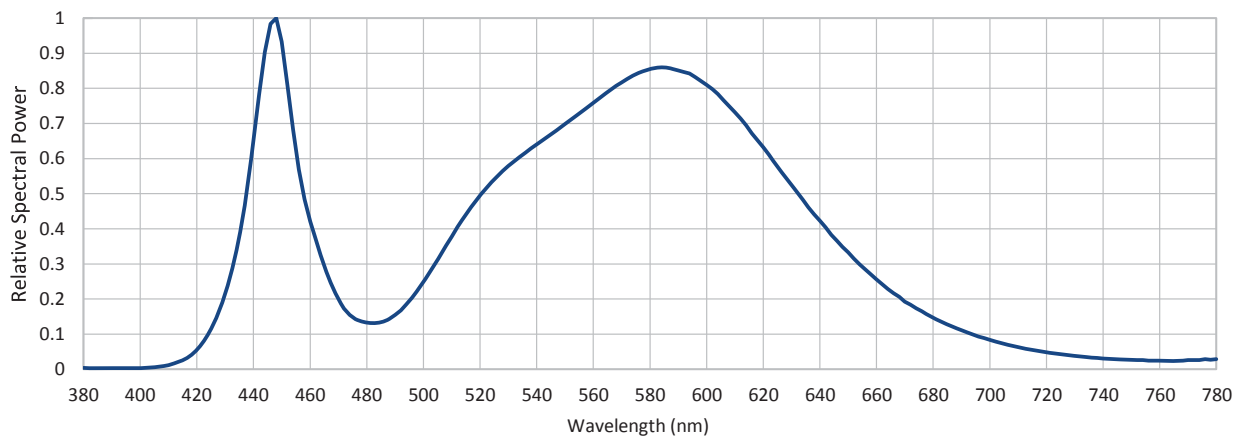
Operating at 120v AC and 60 Hz.

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	0.421	540	0.640	620	0.632	700	0.084
385	0.003	465	0.296	545	0.668	625	0.578	705	0.073
390	0.003	470	0.198	550	0.698	630	0.525	710	0.063
395	0.003	475	0.149	555	0.728	635	0.471	715	0.055
400	0.003	480	0.133	560	0.759	640	0.423	720	0.048
405	0.006	485	0.134	565	0.789	645	0.375	725	0.043
410	0.012	490	0.155	570	0.817	650	0.333	730	0.038
415	0.027	495	0.194	575	0.840	655	0.292	735	0.034
420	0.055	500	0.249	580	0.855	660	0.256	740	0.031
425	0.116	505	0.312	585	0.859	665	0.223	745	0.028
430	0.216	510	0.378	590	0.851	670	0.193	750	0.026
435	0.380	515	0.441	595	0.837	675	0.170	755	0.025
440	0.650	520	0.495	600	0.810	680	0.147	760	0.025
445	0.944	525	0.541	605	0.775	685	0.128	765	0.024
450	0.933	530	0.579	610	0.732	690	0.111	770	0.026
455	0.625	535	0.611	615	0.684	695	0.096	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	(0.224, 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)	(0.225, 0.502)
40.0	(0.225, 0.502)	(0.224, 0.500)
50.0	(0.225, 0.501)	(0.225, 0.500)
60.0	(0.226, 0.502)	I <= 10% peak
70.0	(0.225, 0.502)	I <= 10% peak
80.0	(0.224, 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 / 4.0 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-19100-1

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

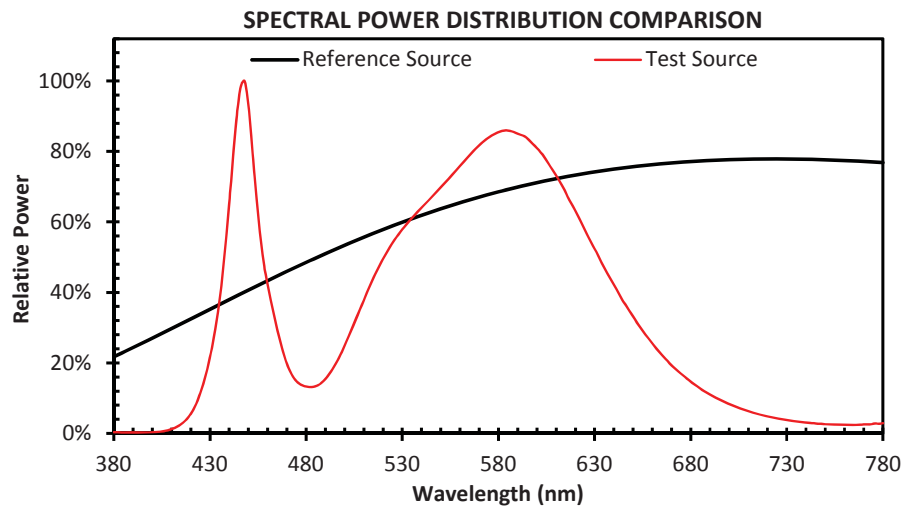
Grey painted cast aluminum housing with no lens.

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

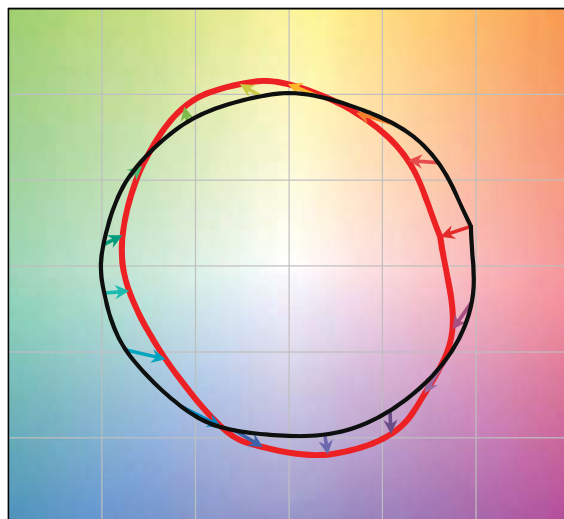
One Osram power supply. Model: OT 50/120-277/1A2 2DIMLT2 P set to 800ma.

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-19100-1

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES T 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 800ma.

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.