



Report of Test LLI-19120-4

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 1 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 350ma.

Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	2976 lm	Min Power Factor	0.78 @ 277 V
Luminaire Power	20.6 W	Max THD(i)*	18.0 % @ 277 V
Luminous Efficacy	144.5 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3820 K	80-90° Zonal Flux %	1.1 %
CIE(x,y) 1931	(0.390, 0.388)	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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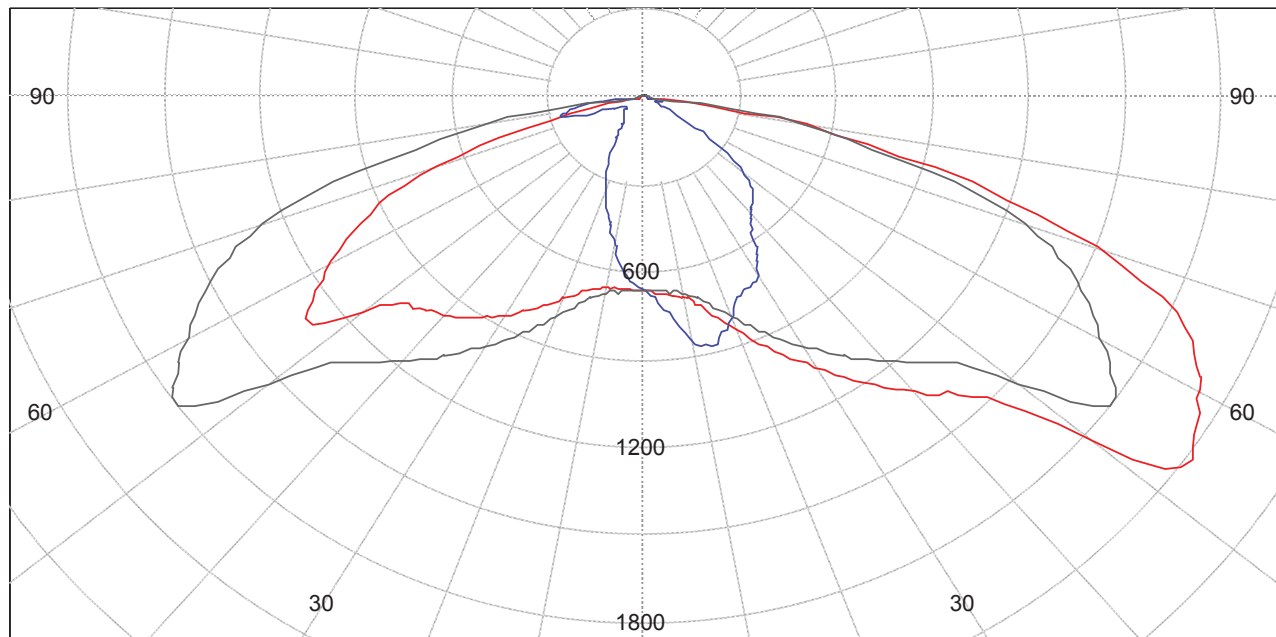
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Polar Light Distribution Curves



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 %	66.7 %	66.7 %
House Side	0.0 %	33.3 %	33.3 %
	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

6-May-2019
7-May-2019



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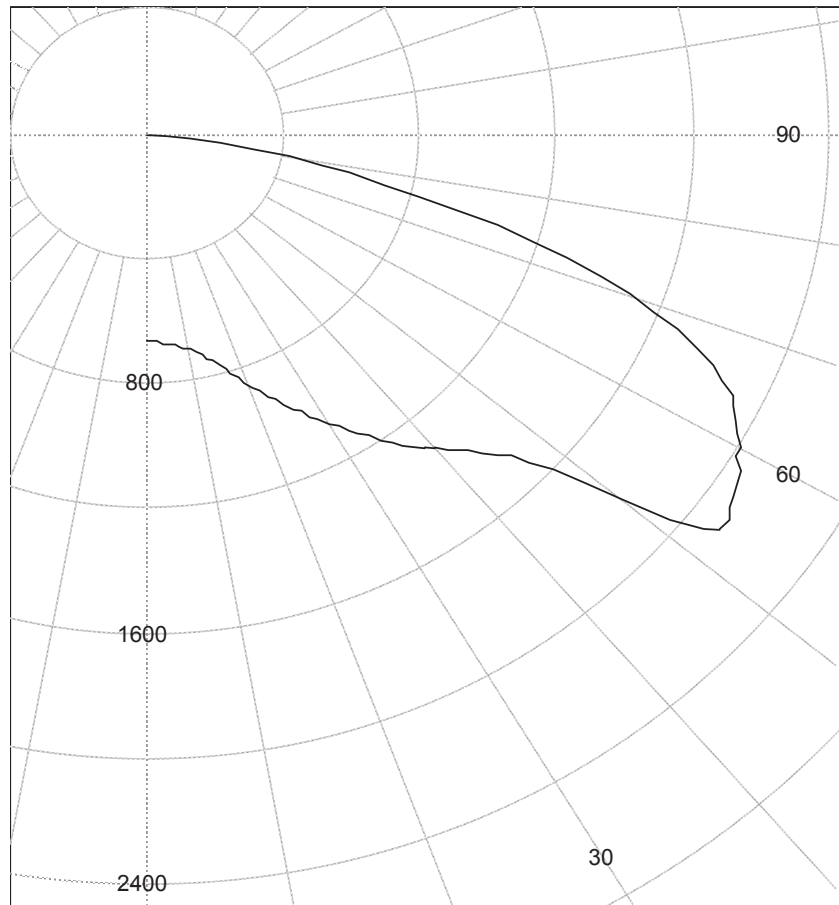
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Operating at 120v AC and 60 Hz.

Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	664.7
10.0	697.1
20.0	847.3
30.0	1069.3
35.0	1196.0
40.0	1314.4
45.0	1449.5
47.5	1570.2
50.0	1825.9
52.5	2099.1
55.0	2085.5
57.5	2052.0
60.0	2005.9
62.5	1940.4
65.0	1859.8
67.5	1723.5
70.0	1505.7
72.5	1242.5
75.0	946.0
77.5	659.7
80.0	423.1
82.5	174.9
85.0	16.5
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



Plane of maximum intensity (cd)

House side max intensity
1799.6 cd @ (90.0°, 54.5°)

Street side max intensity
2111.2 cd @ (77.5°, 54.0°)

Coordinates expressed in the C Type coordinate system

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



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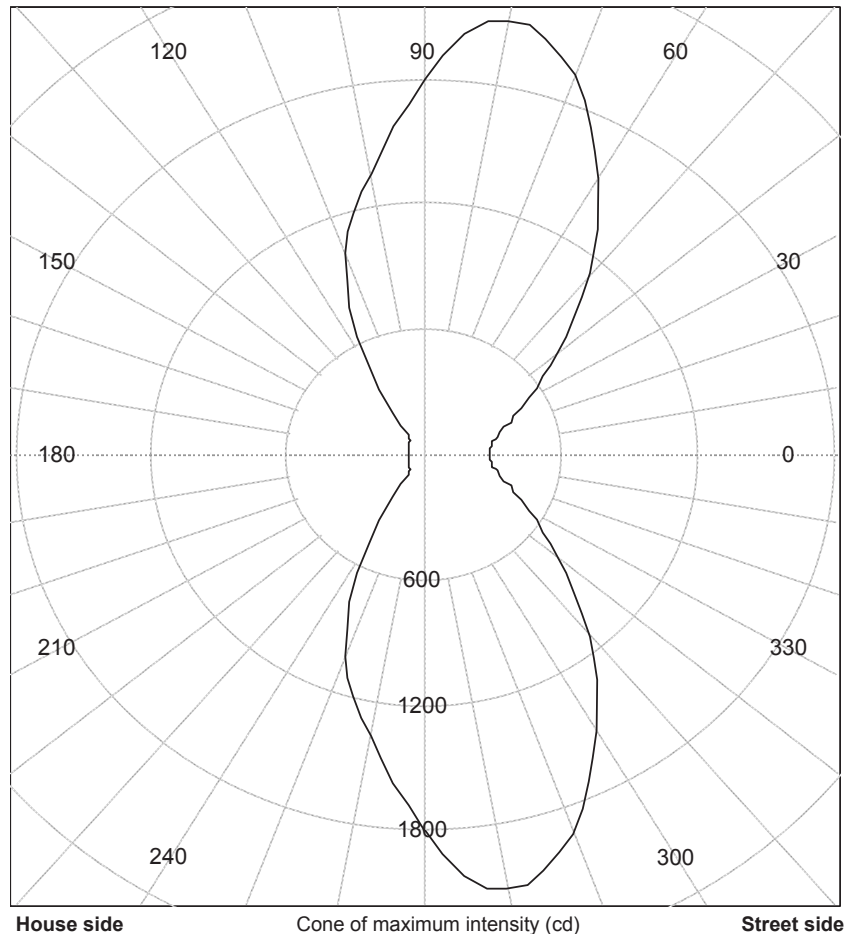
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Operating at 120v AC and 60 Hz.

Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V54.0) (cd)
0	282.4
15	327.1
30	526.3
40	769.2
45	928.1
50	1126.9
55	1321.6
60	1529.8
65	1729.4
70	1929.2
75	2062.4
80	2109.6
85	2022.6
90	1799.1
95	1579.4
100	1367.7
105	1201.4
110	1018.4
115	779.3
120	492.0
125	247.0
130	115.5
135	93.4
140	92.9
150	87.5
165	79.5
180	71.7

Principal Conical Surface



House side max intensity
1799.6 cd @ (90.0°, 54.5°)

Street side max intensity
2111.2 cd @ (77.5°, 54.0°)

Coordinates expressed in the C Type coordinate system

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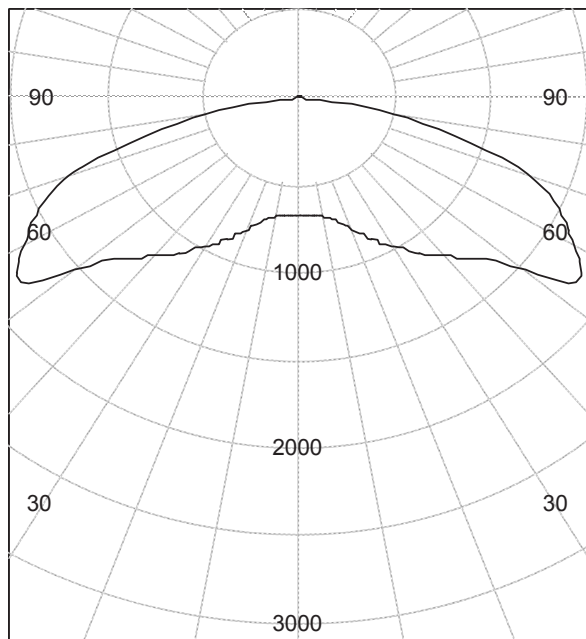
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Polar curve through L90 / L270

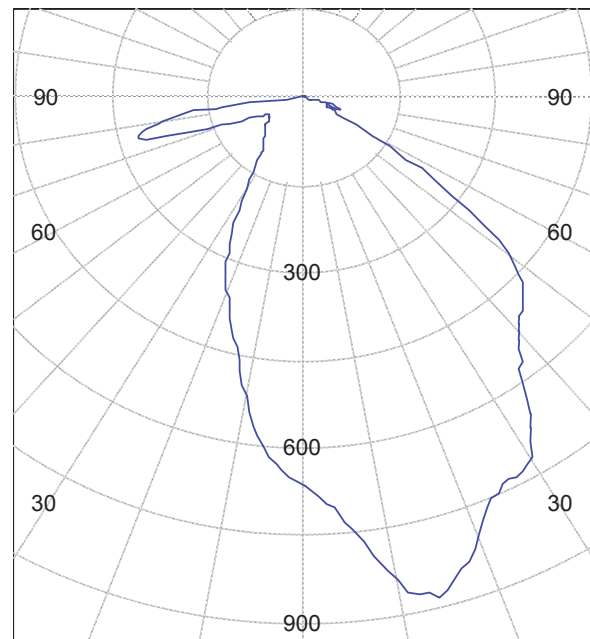


(L90)

(cd)

(L270)

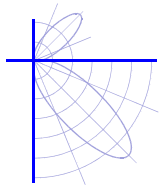
Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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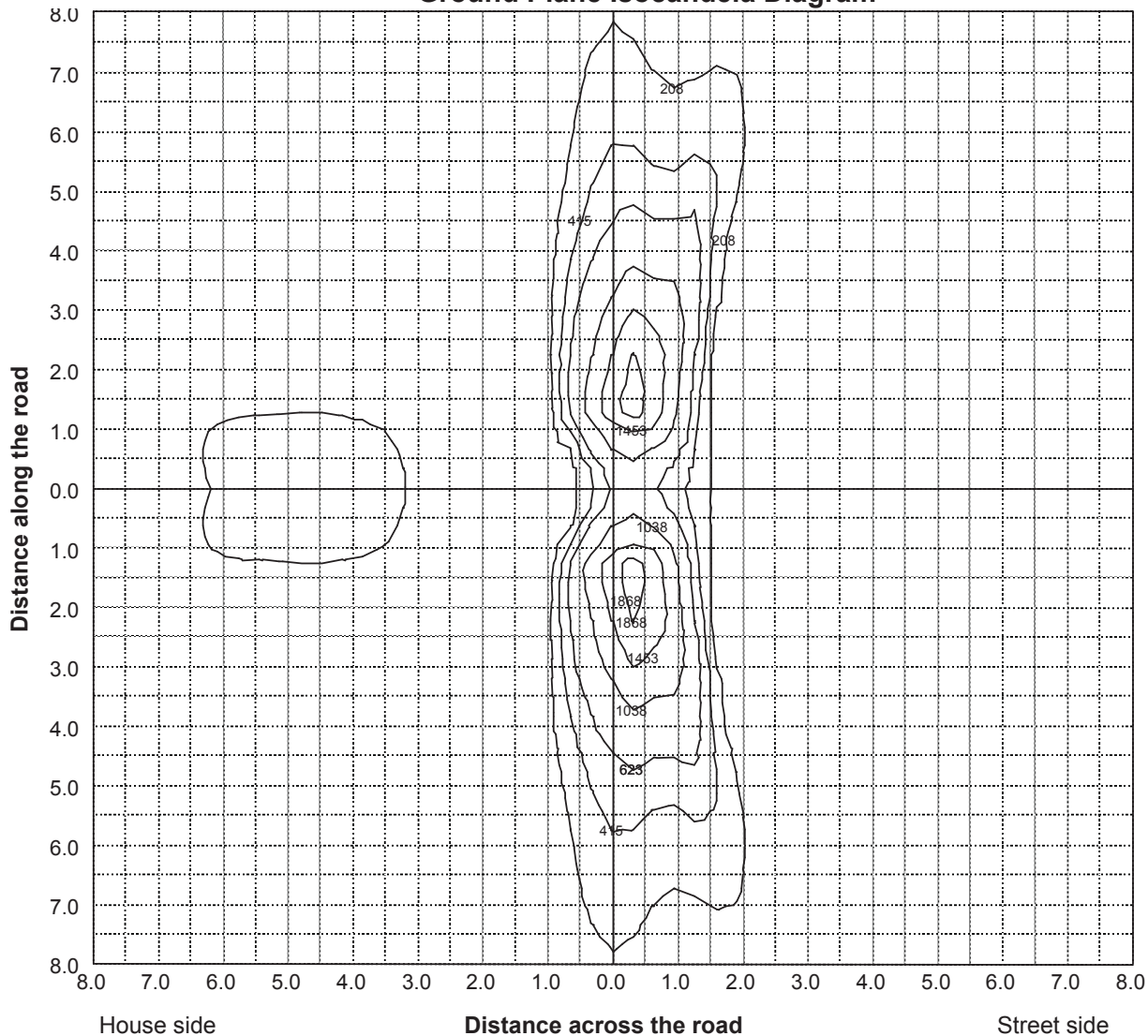
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Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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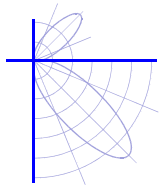
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Operating at 120v AC and 60 Hz.

Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	665	665	665	665	665	665	665	665	665
10.0	837	823	814	784	771	759	745	730	723
20.0	795	806	865	910	930	936	944	933	923
30.0	710	726	792	864	917	982	1044	1091	1122
35.0	596	650	774	870	921	987	1058	1132	1189
40.0	520	579	742	882	949	1019	1092	1178	1260
45.0	480	539	718	914	1034	1153	1252	1322	1380
47.5	455	506	675	876	1027	1168	1304	1417	1503
50.0	415	454	620	829	995	1192	1391	1564	1683
52.5	336	379	572	796	948	1142	1348	1577	1791
55.0	249	291	483	734	903	1095	1312	1511	1724
57.5	175	199	330	571	757	977	1249	1466	1663
60.0	94	112	198	379	541	766	1077	1359	1603
62.5	56	60	99	223	356	559	853	1196	1469
65.0	49	49	50	104	180	341	613	1027	1338
67.5	40	43	45	55	81	147	339	779	1242
70.0	36	37	40	45	52	63	119	395	1016
72.5	58	46	34	36	38	43	49	116	608
75.0	43	48	27	31	29	32	37	44	283
77.5	29	30	19	25	24	23	27	30	61
80.0	20	23	12	15	18	16	17	19	29
82.5	6	9	6	7	7	9	8	9	13
85.0	2	2	2	2	2	3	2	3	3
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	665	665	665	665	665	665	665	665	665
10.0	708	702	694	691	683	678	663	657	645
20.0	889	866	839	816	800	777	751	713	676
30.0	1122	1092	1053	1017	985	938	889	815	739
35.0	1220	1211	1175	1142	1087	1031	956	868	770
40.0	1313	1328	1304	1241	1184	1106	1016	910	807
45.0	1424	1446	1428	1378	1286	1185	1059	942	828
47.5	1561	1579	1542	1471	1359	1242	1101	969	848
50.0	1808	1846	1793	1672	1528	1369	1209	1053	907
52.5	1957	2065	2083	1925	1733	1529	1349	1187	1031
55.0	1899	2049	2099	2004	1797	1560	1347	1183	984
57.5	1839	1996	2059	1968	1724	1467	1262	1105	894
60.0	1787	1940	2029	1918	1643	1372	1183	1019	792
62.5	1709	1866	1988	1891	1579	1272	1099	927	656
65.0	1560	1767	1924	1833	1492	1177	1017	815	495
67.5	1438	1589	1819	1740	1389	1072	916	668	330
70.0	1358	1408	1612	1597	1264	958	800	484	193
72.5	1136	1228	1321	1363	1064	810	640	304	96
75.0	747	983	952	1047	831	635	431	150	49
77.5	416	719	622	708	614	456	233	54	31
80.0	222	451	367	408	428	272	90	19	19
82.5	82	178	145	160	225	112	19	9	10
85.0	8	16	15	17	31	16	4	3	3
87.5	1	1	1	2	2	2	2	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



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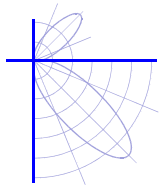
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Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	665	665	665	665	665	665	665	665	665
10.0	636	622	612	598	587	577	550	528	519
20.0	627	576	532	491	458	433	395	363	351
30.0	657	584	512	443	378	327	254	196	180
35.0	683	597	509	414	325	246	167	130	120
40.0	708	606	492	360	233	158	111	101	99
45.0	722	596	434	263	136	98	93	91	86
47.5	721	570	388	203	101	90	91	89	81
50.0	746	555	338	164	93	88	88	86	79
52.5	827	556	289	133	92	90	87	82	74
55.0	734	447	219	109	93	94	87	77	70
57.5	625	342	157	96	97	97	87	73	67
60.0	497	235	108	92	100	101	85	75	66
62.5	348	149	85	93	104	105	82	73	62
65.0	218	91	78	93	104	102	79	67	72
67.5	121	70	75	93	105	98	76	84	99
70.0	75	59	70	93	103	93	74	116	140
72.5	57	49	65	91	97	89	71	156	206
75.0	42	41	57	83	89	85	75	224	265
77.5	29	30	47	68	77	78	91	216	257
80.0	18	20	31	48	58	63	93	189	223
82.5	9	11	17	26	32	43	62	131	153
85.0	3	4	5	7	8	9	21	67	84
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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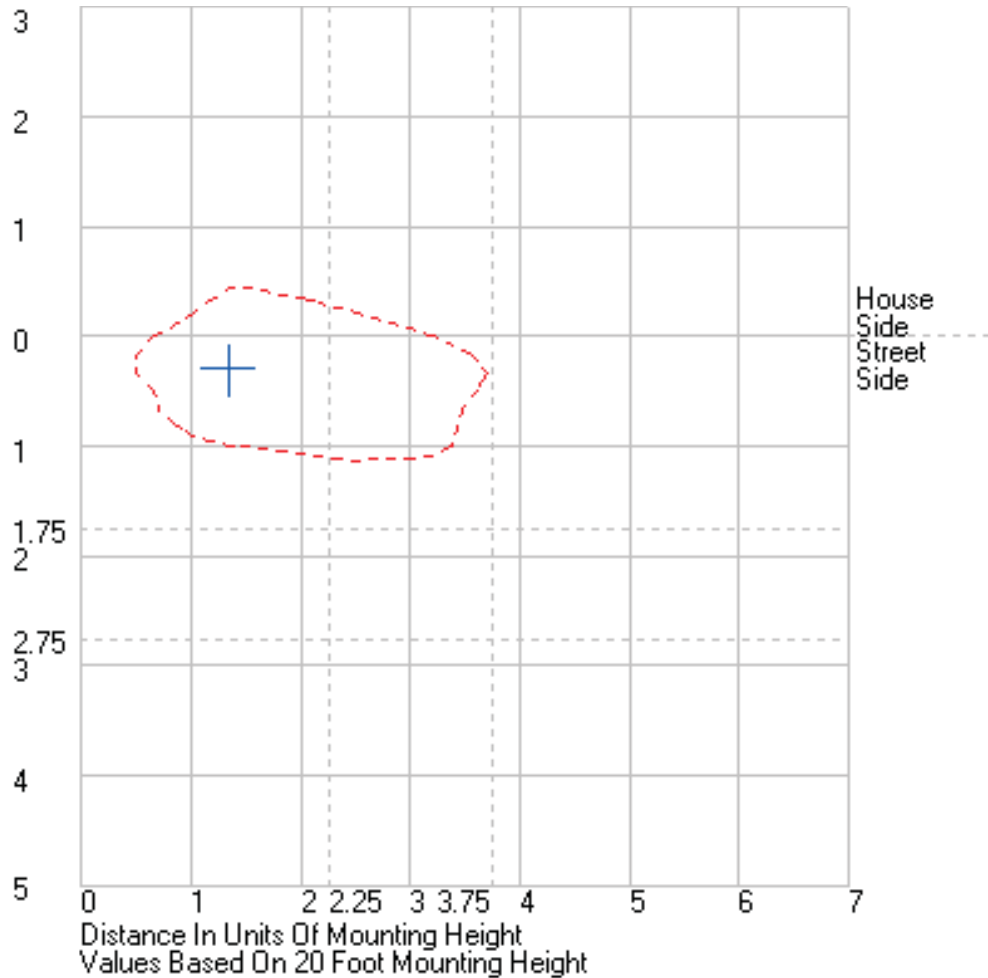
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.390, 0.388)
	CIE 1976 (u', v') ⁽¹⁾	(0.227, 0.508)
	Correlated Color Temperature (CCT) ⁽¹⁾	3820 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	3.43E-03
	Color Rendering Index (Ra) ⁽¹⁾	70.9
	Special CRI 9 (R ₉) ^{(1),(3)}	-38.3
	Distance from Planckian Locus (Duv) ^{(1),(3)}	2.24E-03
	Scotopic/Photopic Ratio ^{(1),(3)}	1.46

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.176 A	
	Power	20.6 W	
	Power Factor	0.98	
	Current THD	10 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.096 A	
	Power	20.8 W	
	Power Factor	0.78	
	Current THD	18 %	

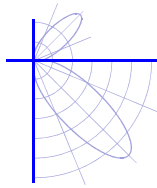
Performance data in accordance with IESNA LM-79-08. Spectral calculations are for a CIE 2° observer

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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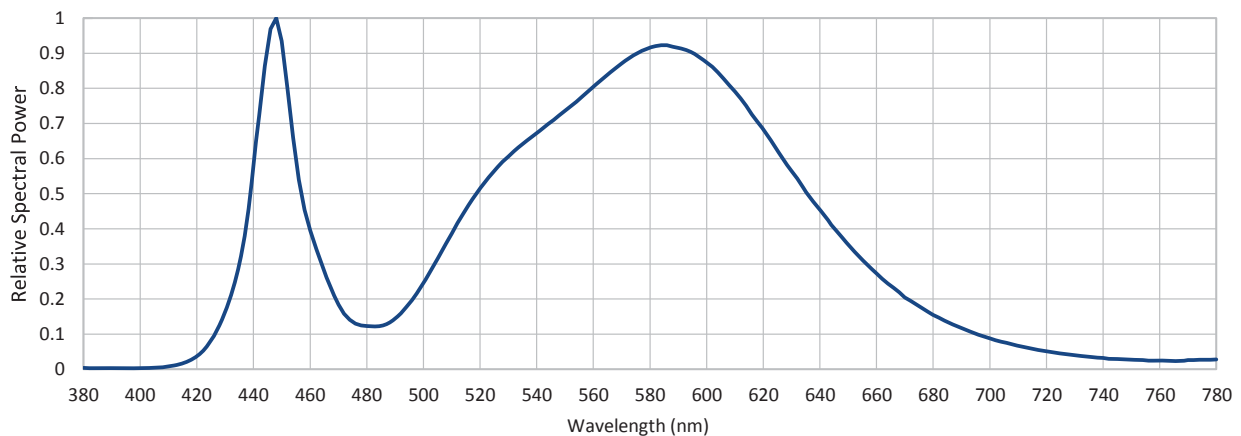
Operating at 120v AC and 60 Hz.

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	0.395	540	0.673	620	0.682	700	0.088
385	0.003	465	0.279	545	0.704	625	0.623	705	0.077
390	0.003	470	0.184	550	0.736	630	0.565	710	0.067
395	0.003	475	0.136	555	0.769	635	0.507	715	0.059
400	0.003	480	0.123	560	0.805	640	0.454	720	0.051
405	0.004	485	0.124	565	0.839	645	0.402	725	0.045
410	0.008	490	0.145	570	0.871	650	0.356	730	0.040
415	0.017	495	0.187	575	0.898	655	0.312	735	0.035
420	0.037	500	0.246	580	0.916	660	0.273	740	0.032
425	0.083	505	0.315	585	0.923	665	0.238	745	0.029
430	0.162	510	0.386	590	0.915	670	0.205	750	0.027
435	0.303	515	0.456	595	0.902	675	0.180	755	0.026
440	0.574	520	0.515	600	0.874	680	0.155	760	0.025
445	0.917	525	0.565	605	0.837	685	0.135	765	0.024
450	0.935	530	0.606	610	0.791	690	0.117	770	0.026
455	0.600	535	0.642	615	0.738	695	0.101	775	0.027
								780	0.028





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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)	(0.227, 0.507)
10.0	(0.226, 0.505)	(0.227, 0.506)
20.0	(0.227, 0.507)	(0.227, 0.508)
30.0	(0.227, 0.508)	(0.227, 0.505)
40.0	(0.228, 0.509)	(0.227, 0.507)
50.0	(0.227, 0.507)	(0.226, 0.506)
60.0	(0.228, 0.510)	I <= 10% peak
70.0	(0.228, 0.508)	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
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

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 3.5 / 5.25 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-19120-4

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 1 X XX 4 XX X X

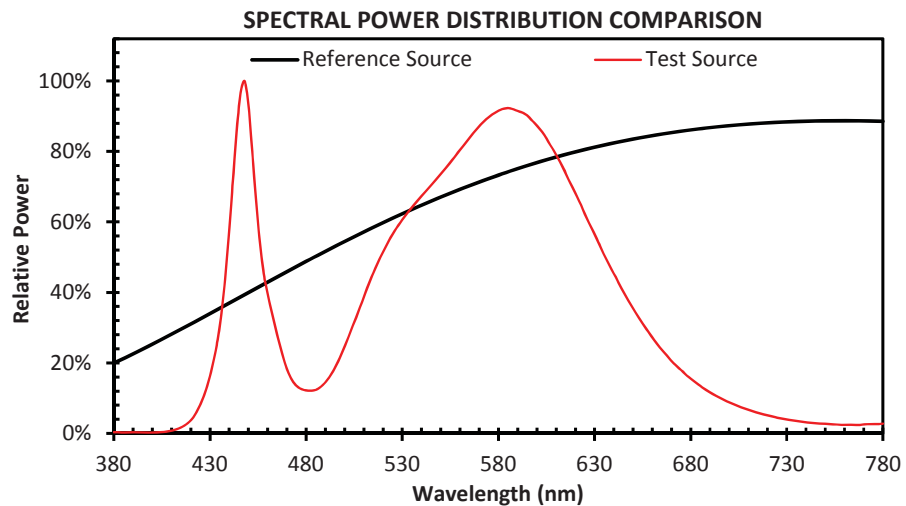
Grey painted cast aluminum housing with no lens.

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

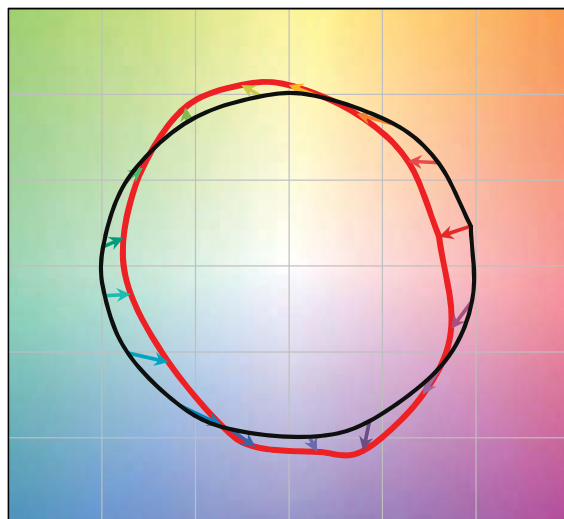
One Osram power supply. Model: OT 50/120-277/800 2DIMLT2 P set to 350ma.

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-19120-4

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 1 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 350ma.

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.