



Report of Test LLI-19150-9

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 6 X XX 4 X X 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 110/120-277/1A2 2DIMLT2 P set to 1200ma.
Operating at 120v AC and 60 Hz. LED current set to 600ma.



Performance Summary

Total Light Output	8170 lm	Min Power Factor	0.89 @ 277 V
Luminaire Power	64.8 W	Max THD(i)*	18.0 % @ 277 V
Luminous Efficacy	126.1 lm/W	0-90° Zonal Flux %	100.0 %
CCT	4020 K	80-90° Zonal Flux %	1.7 %
CIE(x,y) 1931	(0.379, 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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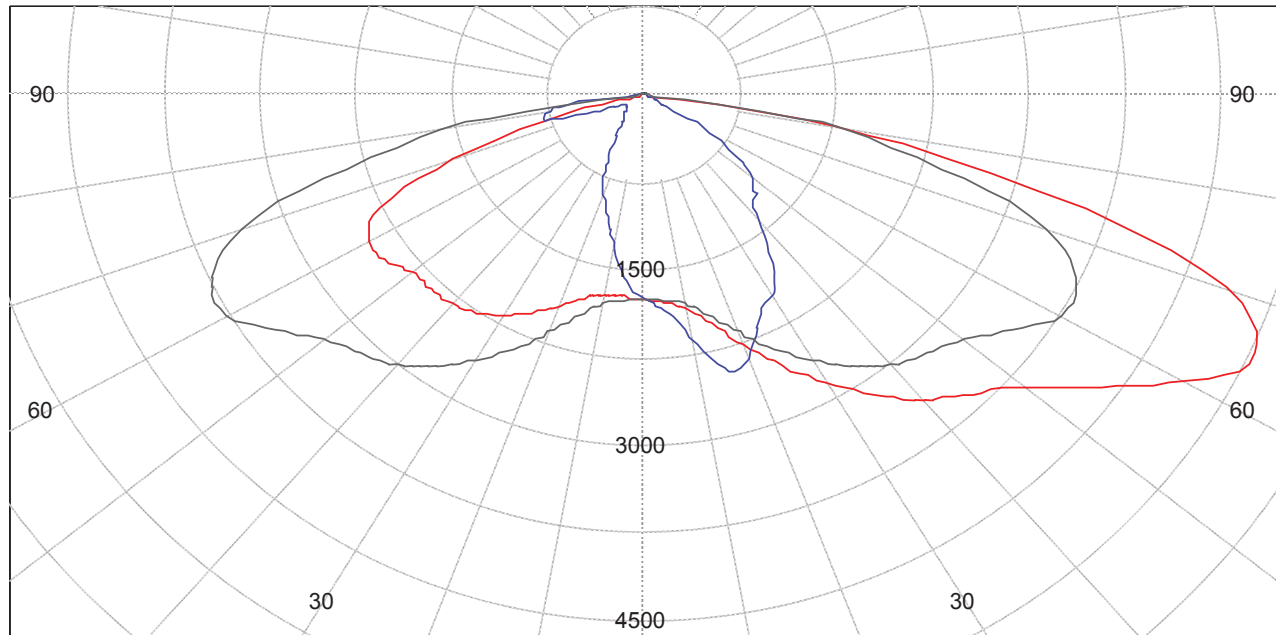
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Polar Light Distribution Curves



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 %	68.5 %	68.5 %
House Side	0.0 %	31.5 %	31.5 %
	0.0 %	100.0 %	100.0 %

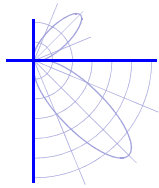
Report data based on absolute values as measured.

Signed:

Ryder Tunney
Ryder Tunney
Authorized Signatory

Date of test
Date of report

18-Jun-2019
19-Jun-2019



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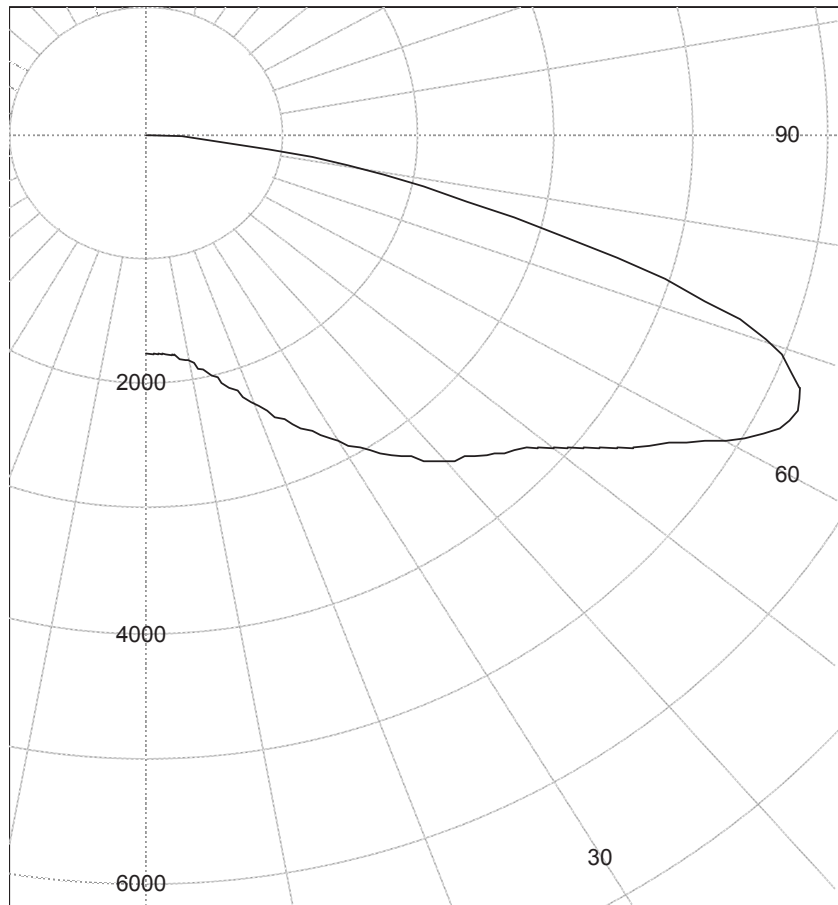
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Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	1753.1
10.0	1854.5
20.0	2281.5
30.0	2841.2
35.0	3133.9
40.0	3402.1
45.0	3618.1
47.5	3727.0
50.0	3902.7
52.5	4118.5
55.0	4366.7
57.5	4612.3
60.0	4904.3
62.5	5172.7
65.0	5264.6
67.5	5156.1
70.0	4824.3
72.5	4155.6
75.0	3191.1
77.5	2235.8
80.0	1518.4
82.5	734.7
85.0	37.7
87.5	7.8
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
3783.1 cd @ (90.0°, 62.0°)

Street side max intensity
5264.6 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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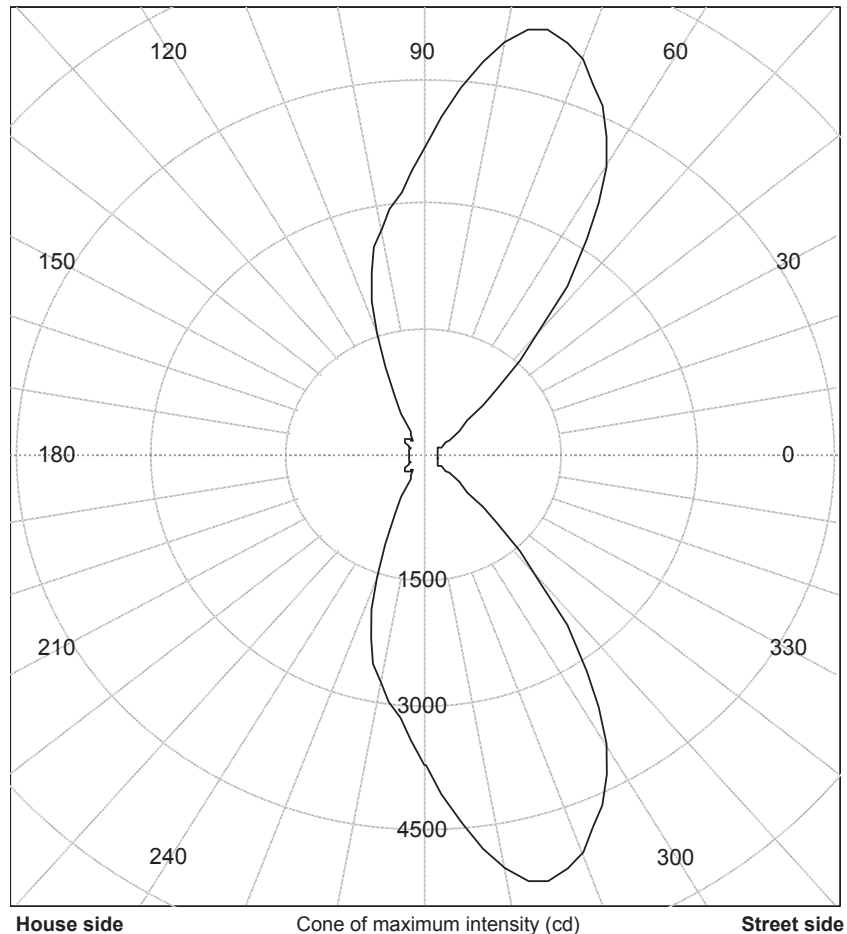
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Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V65.0) (cd)
0	136.3
15	139.4
30	184.4
40	608.6
45	1093.9
50	1968.3
55	3131.1
60	3977.8
65	4619.6
70	5060.2
75	5264.6
80	5029.9
85	4417.0
90	3709.7
95	3170.0
100	2771.1
105	2270.1
110	1555.7
115	775.3
120	323.9
125	217.3
130	248.9
135	276.6
140	272.5
150	204.8
165	179.3
180	188.5

Principal Conical Surface



House side max intensity
3783.1 cd @ (90.0°, 62.0°)

Street side max intensity
5264.6 cd @ (75.0°, 65.0°)

Coordinates expressed in the C Type coordinate system
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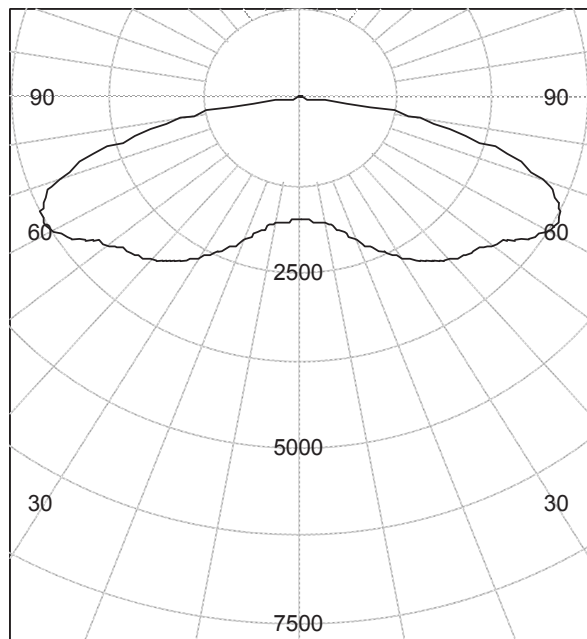
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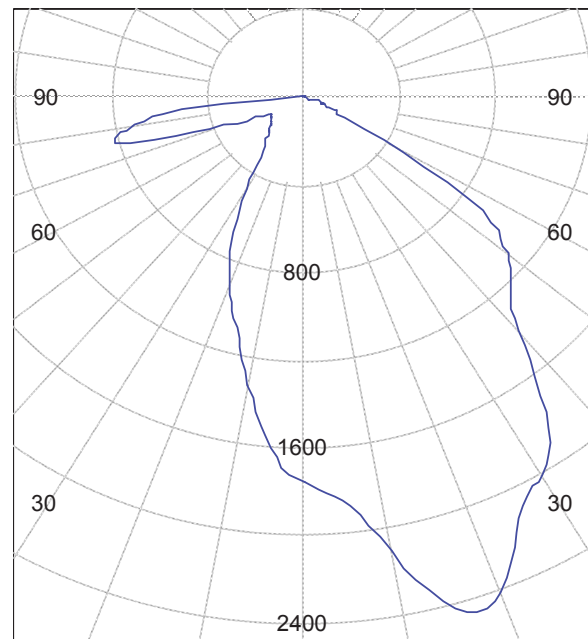
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Polar curve through L90 / L270



(L90) (cd) (L270)

Polar curve through L0 / L180



House side (L180) (cd) Street side (L0)



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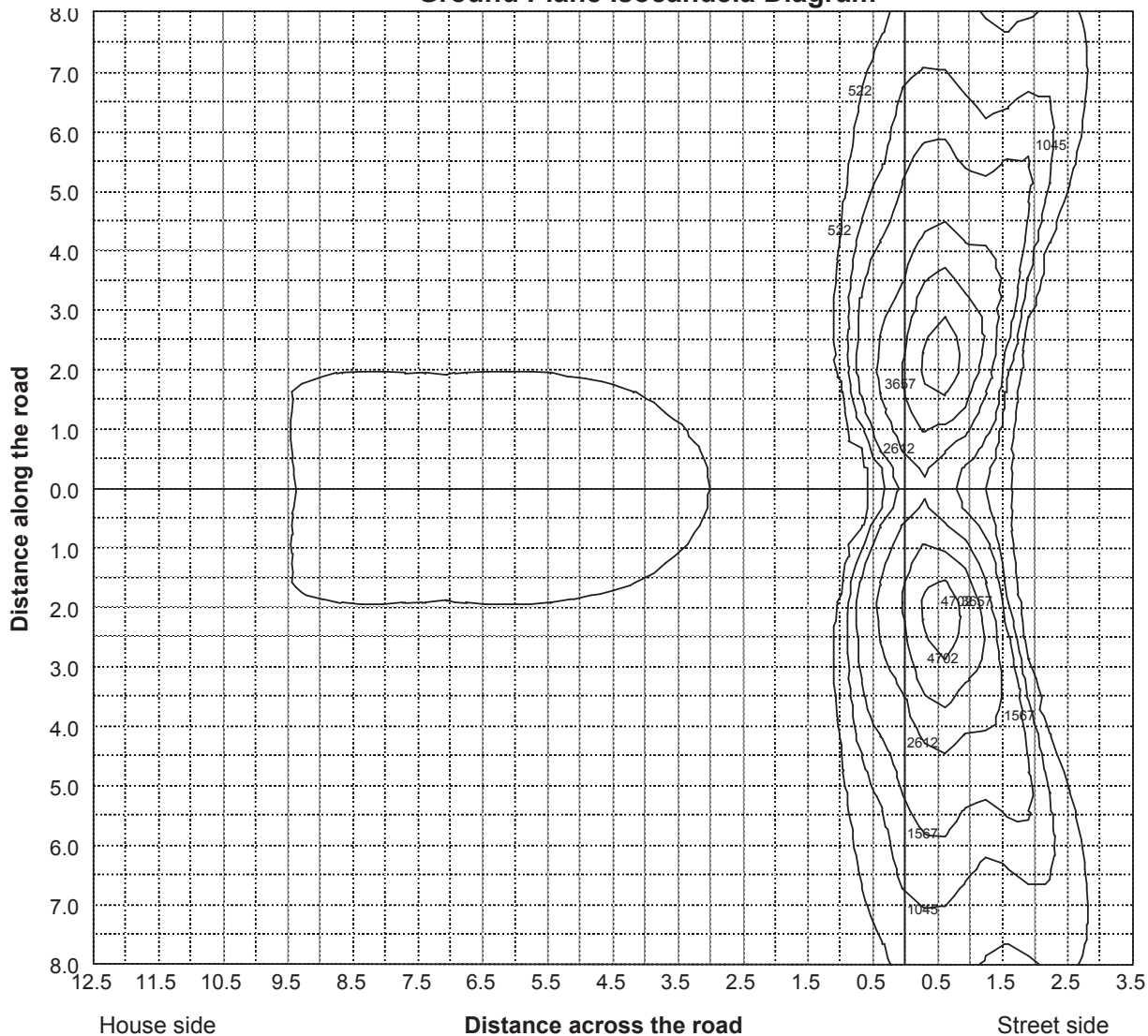
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Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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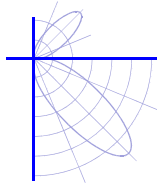
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Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	1753	1753	1753	1753	1753	1753	1753	1753	1753
10.0	2105	2073	2017	1968	1945	1923	1904	1890	1879
20.0	2407	2437	2531	2579	2570	2547	2500	2435	2372
30.0	1982	2029	2257	2574	2754	2911	3017	3065	3033
35.0	1749	1871	2165	2468	2668	2889	3092	3233	3296
40.0	1388	1565	2022	2424	2641	2872	3116	3335	3471
45.0	1224	1375	1853	2408	2705	2963	3189	3416	3599
47.5	1172	1318	1789	2381	2735	3035	3268	3491	3689
50.0	1106	1238	1725	2353	2779	3136	3393	3615	3827
52.5	1025	1124	1617	2281	2780	3209	3528	3790	4016
55.0	902	989	1454	2144	2698	3211	3621	3939	4204
57.5	653	759	1250	1944	2514	3127	3650	4069	4385
60.0	386	465	895	1630	2220	2952	3585	4125	4579
62.5	174	212	489	1130	1724	2610	3448	4114	4694
65.0	136	139	184	609	1094	1968	3131	3978	4620
67.5	109	116	121	213	508	1137	2412	3644	4366
70.0	88	97	107	118	167	447	1402	2951	3952
72.5	81	81	93	97	104	138	432	1902	3337
75.0	76	81	74	82	76	91	114	881	2424
77.5	73	83	53	72	62	63	81	192	1416
80.0	44	69	37	44	50	41	47	72	719
82.5	15	21	17	20	21	23	23	31	230
85.0	4	4	4	6	7	7	7	9	21
87.5	2	1	2	2	2	3	3	4	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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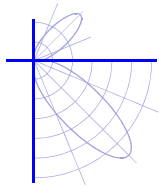
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Intensity data (cd)

Vertical	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	1753	1753	1753	1753	1753	1753	1753	1753	1753
10.0	1869	1854	1839	1827	1810	1790	1768	1741	1708
20.0	2320	2281	2246	2214	2171	2111	2029	1920	1795
30.0	2945	2841	2765	2703	2622	2511	2362	2174	1953
35.0	3247	3134	3025	2937	2829	2686	2500	2268	2032
40.0	3489	3402	3276	3156	3006	2822	2593	2331	2081
45.0	3679	3618	3480	3319	3130	2899	2629	2353	2097
47.5	3779	3727	3581	3397	3180	2922	2633	2350	2086
50.0	3942	3903	3741	3522	3265	2970	2655	2363	2080
52.5	4148	4119	3938	3677	3367	3035	2702	2411	2102
55.0	4368	4367	4198	3898	3518	3135	2786	2476	2111
57.5	4589	4612	4443	4102	3651	3218	2851	2500	2052
60.0	4854	4904	4706	4296	3760	3279	2888	2488	1948
62.5	5058	5173	4921	4398	3780	3267	2876	2431	1796
65.0	5060	5265	5030	4417	3710	3170	2771	2270	1556
67.5	4832	5156	5037	4396	3587	3005	2564	1964	1178
70.0	4435	4824	4907	4265	3338	2776	2319	1581	769
72.5	3823	4156	4471	3952	2910	2411	1964	1139	448
75.0	3176	3191	3673	3398	2405	1908	1447	629	199
77.5	2459	2236	2469	2531	1882	1366	872	259	100
80.0	1624	1518	1420	1719	1423	831	337	70	55
82.5	680	735	566	823	741	378	71	28	34
85.0	34	38	36	63	82	41	13	13	17
87.5	6	8	7	7	7	6	6	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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Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	1753	1753	1753	1753	1753	1753	1753	1753	1753
10.0	1670	1626	1585	1549	1513	1472	1408	1347	1334
20.0	1652	1512	1381	1278	1191	1116	1020	936	911
30.0	1743	1545	1359	1185	1015	868	667	524	482
35.0	1800	1575	1350	1113	878	673	446	325	295
40.0	1834	1583	1290	971	661	440	277	244	241
45.0	1828	1513	1140	723	382	250	232	221	207
47.5	1797	1442	1014	562	278	228	229	213	191
50.0	1748	1341	849	423	233	224	233	212	182
52.5	1706	1208	676	322	228	234	234	208	173
55.0	1620	1032	524	265	239	249	233	199	164
57.5	1462	838	400	243	249	258	226	178	156
60.0	1267	648	304	238	261	268	217	174	155
62.5	1045	478	241	244	273	275	210	175	157
65.0	775	324	217	249	277	272	205	179	189
67.5	497	216	209	249	280	260	201	225	282
70.0	285	176	196	247	269	246	198	323	412
72.5	184	147	184	239	252	232	197	449	599
75.0	130	122	167	221	231	223	213	646	810
77.5	85	93	140	188	202	208	283	675	792
80.0	54	67	102	138	150	175	329	612	722
82.5	35	43	65	85	112	132	273	514	614
85.0	17	21	27	32	40	68	117	295	334
87.5	6	6	6	6	7	8	9	8	7
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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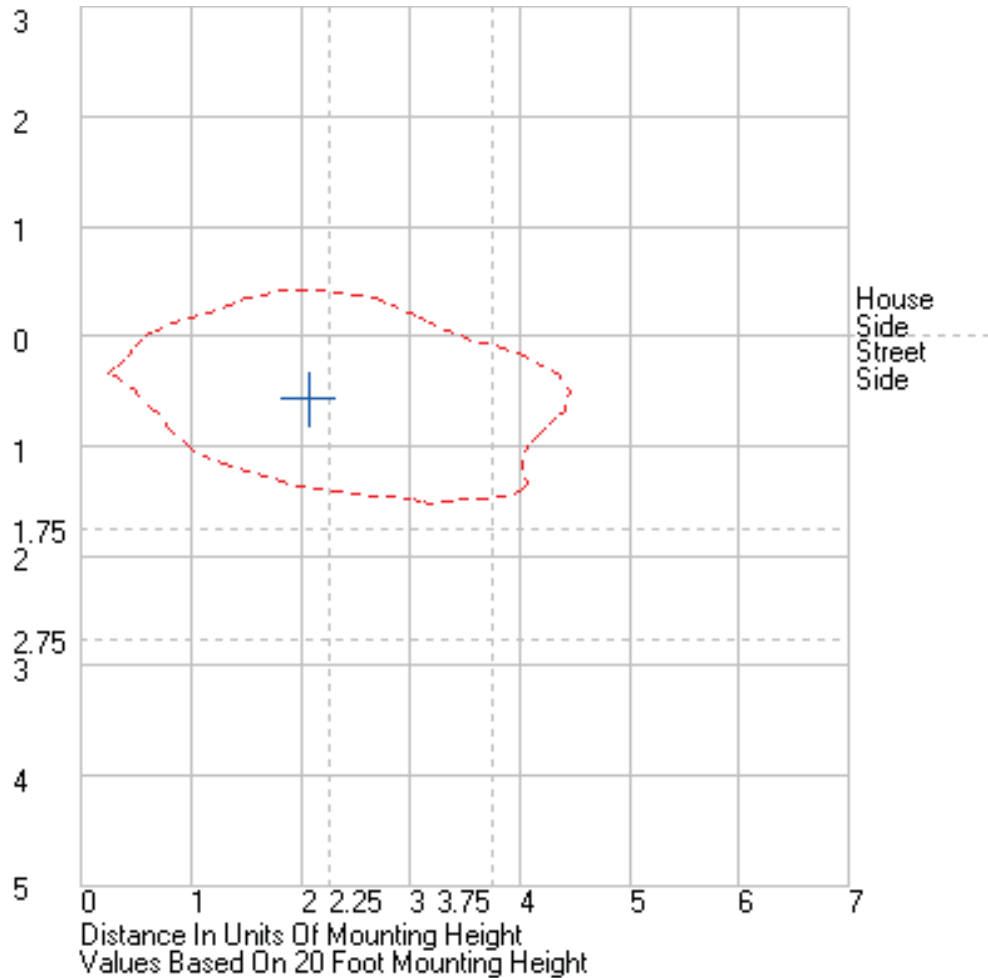
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.379, 0.376)
	CIE 1976 (u', v') ⁽¹⁾	(0.225, 0.501)
	Correlated Color Temperature (CCT) ⁽¹⁾	4020 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	4.02E-03
	Color Rendering Index (Ra) ⁽¹⁾	71.9
	Special CRI 9 (R ₉) ^{(1),(3)}	-33.4
	Distance from Planckian Locus (Duv) ^{(1),(3)}	-1.89E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.53

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.546 A	
	Power	64.8 W	
	Power Factor	0.99	
	Current THD	8.3 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.261 A	
	Power	64.6 W	
	Power Factor	0.89	
	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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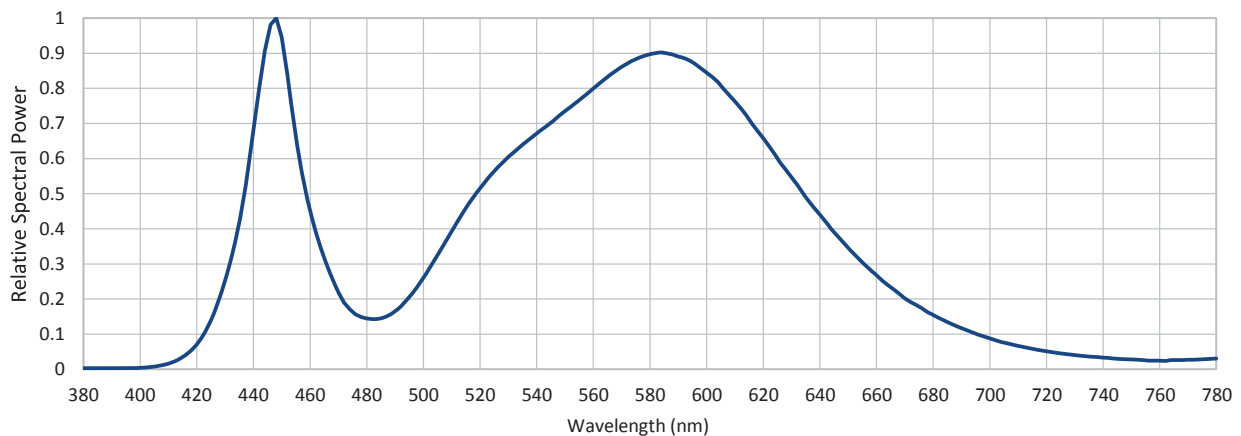
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LM-79 Performance Data

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	0.450	540	0.672	620	0.658	700	0.088
385	0.003	465	0.317	545	0.703	625	0.601	705	0.076
390	0.003	470	0.218	550	0.735	630	0.547	710	0.067
395	0.003	475	0.164	555	0.767	635	0.491	715	0.058
400	0.004	480	0.145	560	0.800	640	0.440	720	0.051
405	0.008	485	0.146	565	0.832	645	0.390	725	0.045
410	0.016	490	0.165	570	0.861	650	0.347	730	0.041
415	0.035	495	0.205	575	0.883	655	0.304	735	0.036
420	0.071	500	0.261	580	0.898	660	0.268	740	0.033
425	0.142	505	0.325	585	0.901	665	0.234	745	0.030
430	0.252	510	0.393	590	0.890	670	0.202	750	0.028
435	0.422	515	0.459	595	0.874	675	0.178	755	0.026
440	0.680	520	0.515	600	0.845	680	0.155	760	0.025
445	0.944	525	0.564	605	0.809	685	0.135	765	0.026
450	0.946	530	0.605	610	0.763	690	0.117	770	0.027
455	0.664	535	0.640	615	0.712	695	0.101	775	0.029
								780	0.031





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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	(0.223, 0.498)	(0.223, 0.498)
10.0	(0.223, 0.498)	(0.224, 0.501)
20.0	(0.224, 0.501)	(0.223, 0.499)
30.0	(0.225, 0.502)	(0.225, 0.501)
40.0	(0.225, 0.501)	(0.224, 0.499)
50.0	(0.225, 0.501)	(0.224, 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 3.0 / 5.25 hours

Equipment and uncertainties

LightLab International R80A C-gamma rotating mirror goniophotometer with a test distance of 8 m.

Luminous Intensity	± 4 %	Temperature	± 1 °C
Luminous Flux	± 4 %	Luminous Efficacy	± 4.5 %
Horiz., Vert. Angles	± 0.25°		

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)

Page 14 of 16
RT



Test Report No. LLI-19150-9

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 6 X XX 4 X X X X

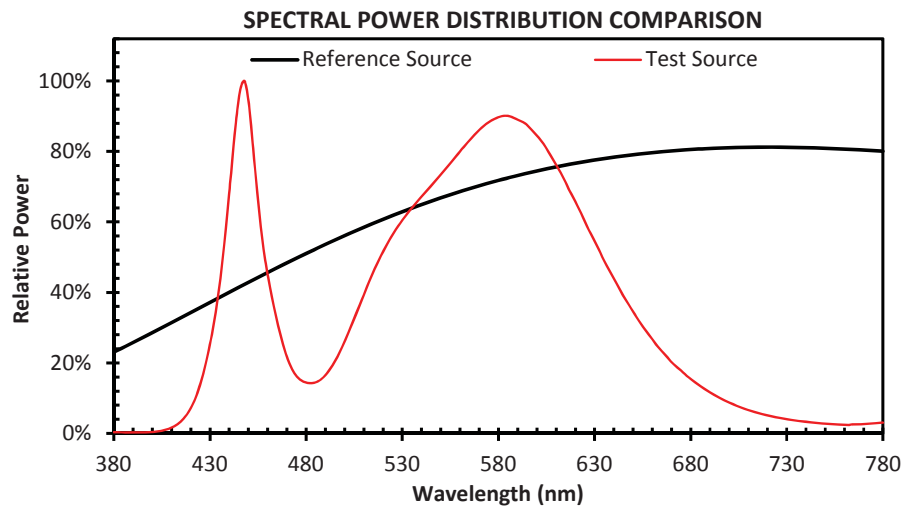
Grey painted cast aluminum housing with no lens.

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

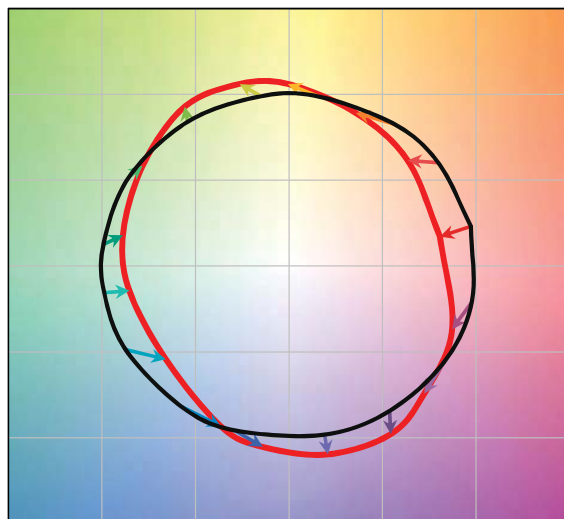
One Osram power supply. Model: OT 110/120-277/1A2 2DIMLT2 P set to 1200ma.

Operating at 120v AC and 60 Hz. LED current set to 600ma.

R_f	71
R_g	94



COLOR VECTOR GRAPHIC



— Test Source

→ Series1

COLOR DISTORTION GRAPHIC





Test Report No. LLI-19150-9

LED Roadway Lighting - Roadway luminaire. Product ID: L6 16S 5 X 2ES 6 X XX 4 X X 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 110/120-277/1A2 2DIMLT2 P set to 1200ma.

Operating at 120v AC and 60 Hz. LED current set to 600ma.

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.