



Report of Test LLI-19244-5

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 616S X 5 30 X 3G2S XXXX XXXX
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.
16 LEDs in 4 x 4 array with clear plastic sheet of individual lenses.
One Osram Optotronic LED driver. Model: QT50W/UNV/1250C/2DIMLT2/P6 set to 600ma.
Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	4282 lm	Min Power Factor	0.91 @ 277 V
Luminaire Power	32.6 W	Max THD(i)*	12.0 % @ 277 V
Luminous Efficacy	131.3 lm/W	0-90° Zonal Flux %	100.0 %
CCT	2980 K	80-90° Zonal Flux %	0.6 %
CIE(x,y) 1931	(0.440, 0.406)	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



LightLab
INTERNATIONAL

LightLab International, LLC
Phoenix AZ 85085



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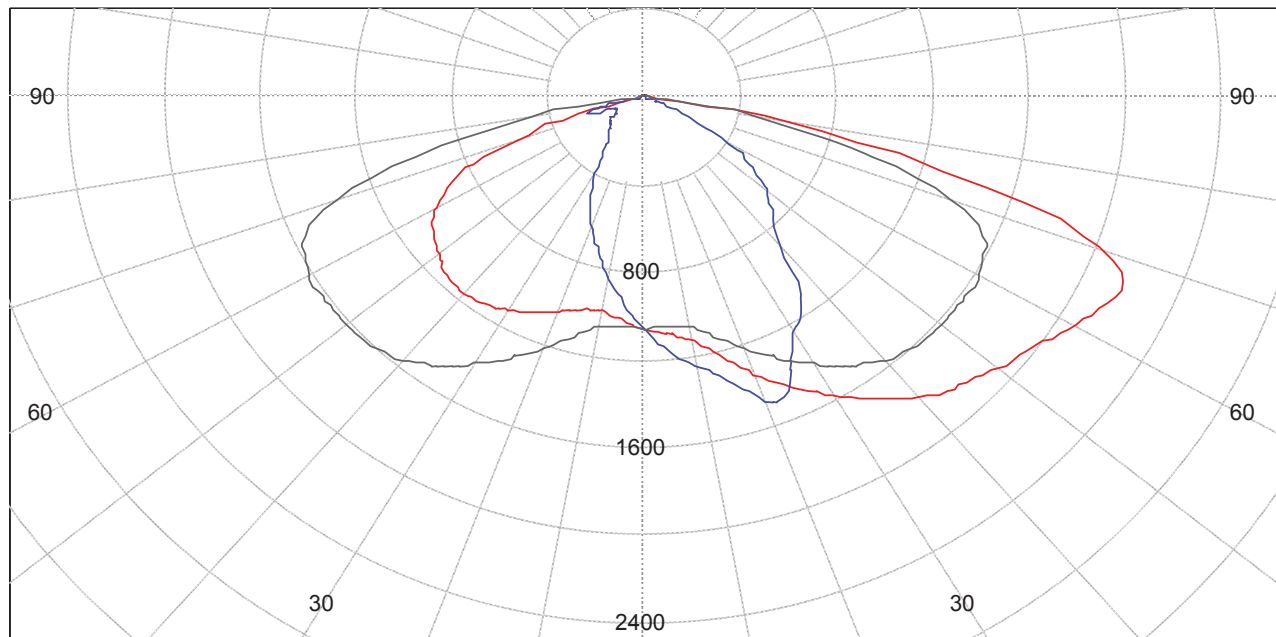




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Polar Light Distribution Curves



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 %	67.9 %	67.9 %
House Side	0.0 %	32.1 %	32.1 %
	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

18-Sep-2019
23-Sep-2019



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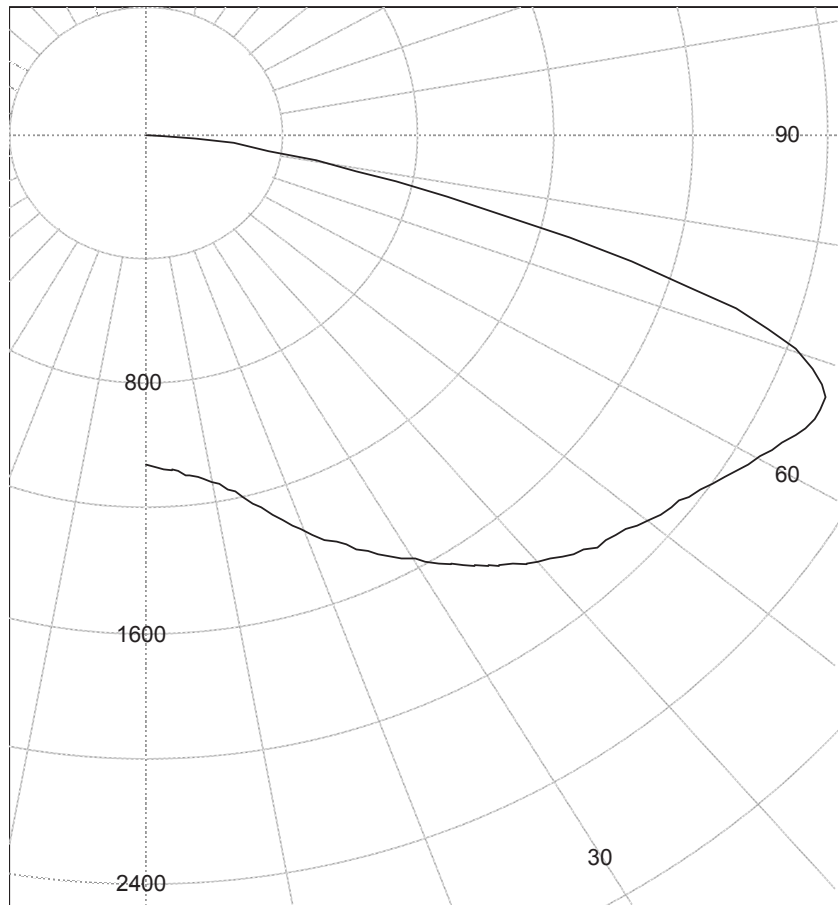
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Operating at 120v AC and 60 Hz.

Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	1059.2
10.0	1128.0
20.0	1347.6
30.0	1574.5
35.0	1686.8
40.0	1788.6
45.0	1864.4
47.5	1891.3
50.0	1922.4
52.5	1954.1
55.0	1982.8
57.5	2030.3
60.0	2076.1
62.5	2122.2
65.0	2163.0
67.5	2153.8
70.0	2022.5
72.5	1747.0
75.0	1288.3
77.5	828.2
80.0	507.5
82.5	202.7
85.0	8.7
87.5	3.6
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
1621.5 cd @ (90.0°, 58.0°)

Street side max intensity
2169.7 cd @ (72.5°, 66.0°)

Coordinates expressed in the C Type coordinate system

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



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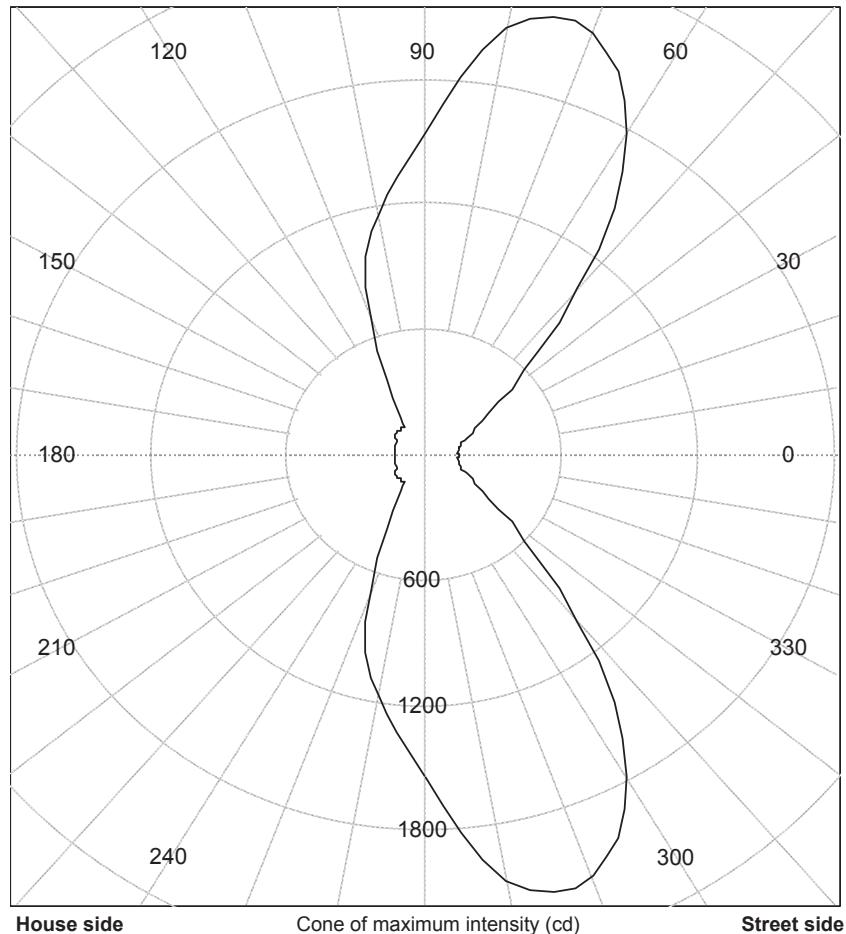
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Operating at 120v AC and 60 Hz.

Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V66.0) (cd)
0	144.8
15	155.2
30	252.9
40	488.6
45	699.9
50	1036.7
55	1448.0
60	1776.0
65	2025.5
70	2142.2
75	2166.4
80	2066.1
85	1817.1
90	1543.0
95	1336.8
100	1176.7
105	978.0
110	691.6
115	392.4
120	207.3
125	154.8
130	159.3
135	166.9
140	161.2
150	141.7
165	133.0
180	127.0

Principal Conical Surface



House side max intensity
1621.5 cd @ (90.0°, 58.0°)

Street side max intensity
2169.7 cd @ (72.5°, 66.0°)

Coordinates expressed in the C Type coordinate system

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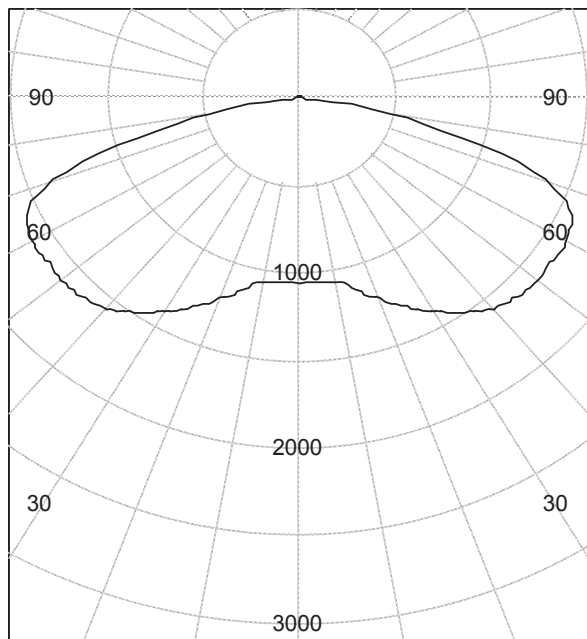
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Operating at 120v AC and 60 Hz.

Polar curve through L90 / L270

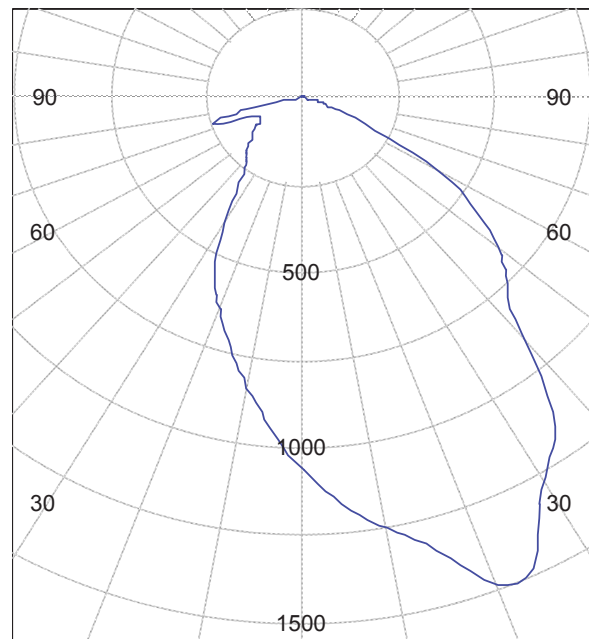


(L90)

(cd)

(L270)

Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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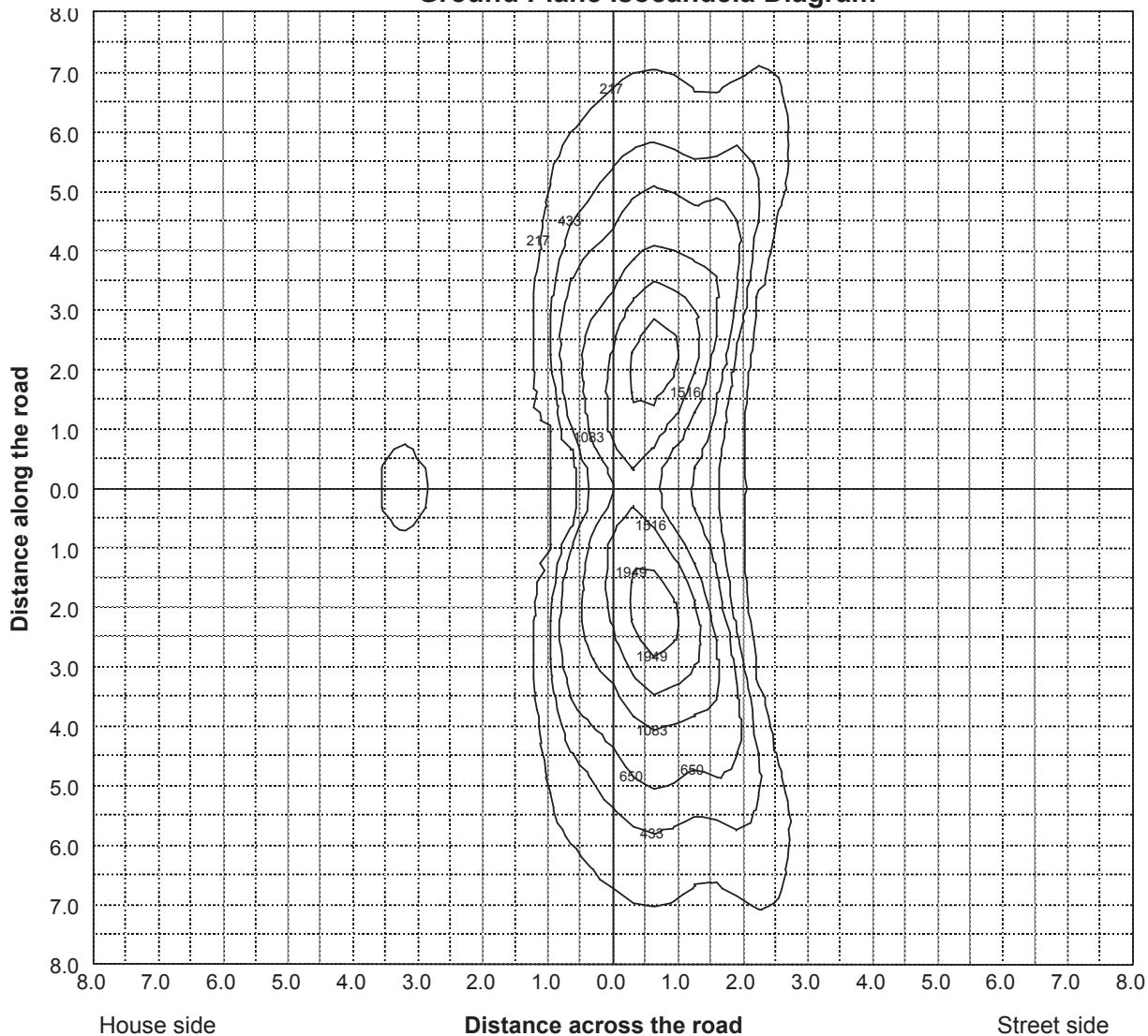
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Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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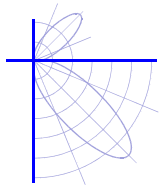
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Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	1059	1059	1059	1059	1059	1059	1059	1059	1059
10.0	1248	1239	1224	1211	1204	1194	1179	1165	1150
20.0	1477	1461	1427	1409	1396	1390	1386	1384	1374
30.0	1251	1287	1449	1605	1645	1652	1631	1613	1596
35.0	1141	1178	1311	1510	1618	1699	1734	1733	1718
40.0	883	988	1199	1401	1525	1658	1767	1823	1825
45.0	750	810	1055	1308	1447	1599	1738	1843	1887
47.5	710	768	989	1258	1413	1573	1717	1834	1901
50.0	663	719	933	1207	1378	1548	1694	1827	1912
52.5	601	652	880	1149	1346	1528	1684	1824	1927
55.0	533	576	805	1079	1309	1507	1674	1826	1938
57.5	472	498	709	996	1247	1483	1682	1848	1968
60.0	370	407	605	893	1148	1441	1684	1869	2000
62.5	269	295	467	761	994	1328	1634	1864	2030
65.0	174	190	310	578	793	1137	1510	1809	2036
67.5	110	120	171	356	551	865	1319	1709	1969
70.0	78	91	104	168	311	556	1017	1507	1813
72.5	58	72	82	87	132	266	625	1169	1516
75.0	47	57	64	63	65	98	249	730	1167
77.5	37	46	44	49	46	49	65	318	733
80.0	30	36	28	32	32	30	33	101	368
82.5	13	18	14	15	16	17	17	26	102
85.0	5	5	6	6	6	7	7	7	10
87.5	2	2	3	3	3	3	3	3	3
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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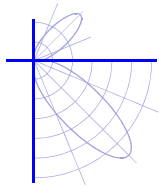
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Vertical	Intensity data (cd)								
	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	1059	1059	1059	1059	1059	1059	1059	1059	1059
10.0	1136	1120	1102	1083	1063	1044	1024	1006	985
20.0	1361	1333	1300	1266	1227	1183	1136	1080	1021
30.0	1585	1563	1524	1467	1407	1341	1260	1175	1088
35.0	1697	1673	1634	1567	1496	1413	1319	1215	1111
40.0	1804	1771	1725	1650	1566	1468	1355	1239	1120
45.0	1879	1842	1785	1701	1604	1487	1357	1229	1105
47.5	1905	1869	1806	1715	1612	1485	1346	1214	1088
50.0	1935	1901	1831	1733	1620	1482	1333	1195	1062
52.5	1963	1934	1858	1744	1615	1468	1314	1178	1037
55.0	1986	1963	1888	1761	1613	1452	1292	1156	1006
57.5	2029	2015	1933	1789	1621	1447	1281	1139	969
60.0	2072	2063	1971	1806	1611	1421	1253	1104	911
62.5	2113	2111	2012	1817	1595	1395	1230	1061	830
65.0	2142	2158	2058	1822	1565	1360	1199	1008	735
67.5	2115	2159	2058	1787	1495	1286	1129	914	614
70.0	1972	2047	1975	1682	1363	1160	1008	766	456
72.5	1696	1774	1752	1467	1145	971	830	563	290
75.0	1267	1326	1377	1159	869	736	603	340	151
77.5	874	811	871	796	608	490	365	162	70
80.0	554	439	459	473	381	289	176	60	35
82.5	196	161	130	160	140	94	43	17	16
85.0	10	8	8	8	8	8	8	7	7
87.5	4	3	3	4	4	4	4	3	3
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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Operating at 120v AC and 60 Hz.

Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	1059	1059	1059	1059	1059	1059	1059	1059	1059
10.0	965	945	924	908	894	879	858	840	838
20.0	961	906	852	803	761	725	683	648	639
30.0	1002	917	830	747	666	597	504	432	405
35.0	1008	906	805	701	596	498	374	299	280
40.0	1006	887	753	618	477	361	263	238	233
45.0	978	835	668	476	319	243	224	210	201
47.5	949	795	600	390	260	221	216	197	186
50.0	915	742	517	315	225	213	205	189	177
52.5	875	667	431	259	212	208	197	183	170
55.0	818	572	341	220	204	203	189	177	155
57.5	741	475	272	198	198	198	180	158	138
60.0	647	385	223	185	192	190	168	146	130
62.5	541	302	187	175	184	179	157	139	124
65.0	435	233	162	164	173	167	145	135	124
67.5	325	173	143	152	155	152	137	135	140
70.0	223	131	125	141	137	137	126	159	197
72.5	138	99	106	120	115	118	107	208	244
75.0	84	76	87	91	92	94	112	178	199
77.5	54	55	62	61	62	68	87	135	160
80.0	32	33	35	34	37	40	46	66	88
82.5	15	14	13	13	14	13	9	17	29
85.0	6	5	4	3	2	2	2	2	1
87.5	2	2	1	1	1	1	0	0	0
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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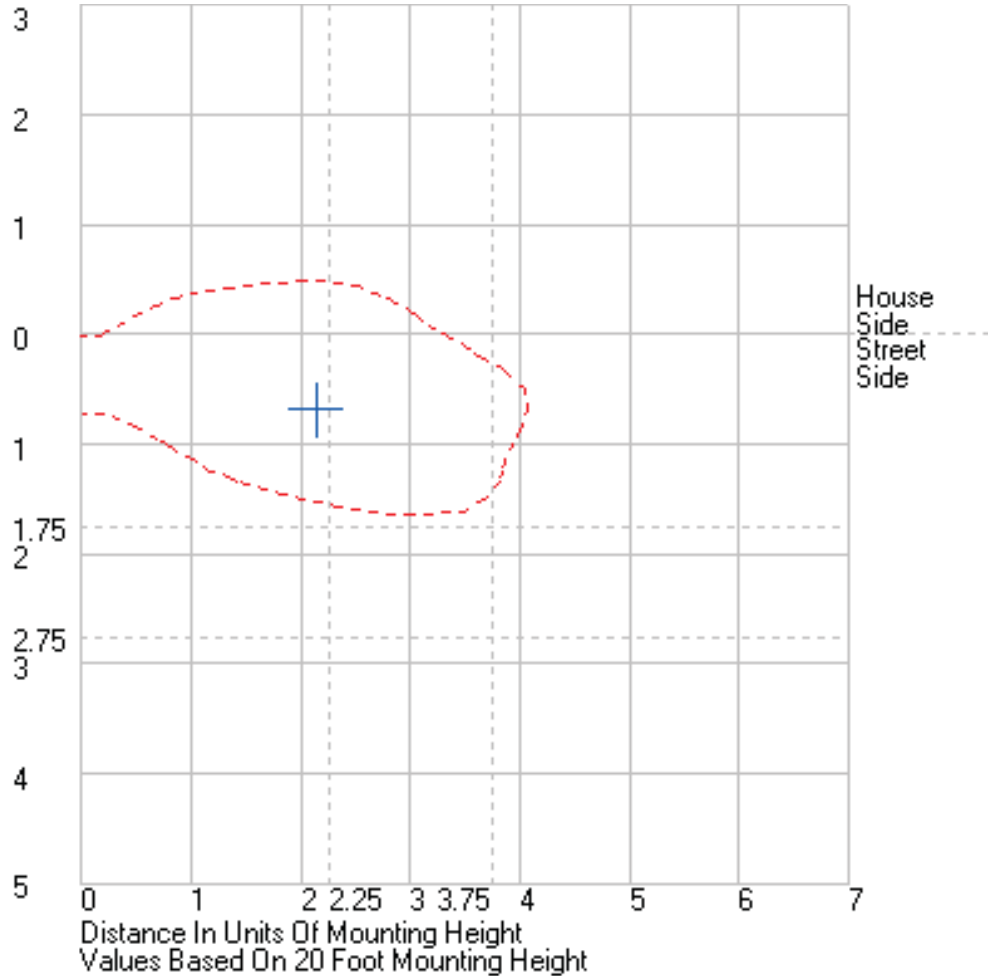
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.440, 0.406)
	CIE 1976 (u', v') ⁽¹⁾	(0.251, 0.523)
	Correlated Color Temperature (CCT) ⁽¹⁾	2980 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	2.76E-03
	Color Rendering Index (Ra) ⁽¹⁾	71.1
	Special CRI 9 (R ₉) ^{(1),(3)}	-41.9
	Distance from Planckian Locus (Duv) ^{(1),(3)}	5.89E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.21

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.275 A	
	Power	32.6 W	
	Power Factor	0.99	
	Current THD	4.6 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.129 A	
	Power	32.5 W	
	Power Factor	0.91	
	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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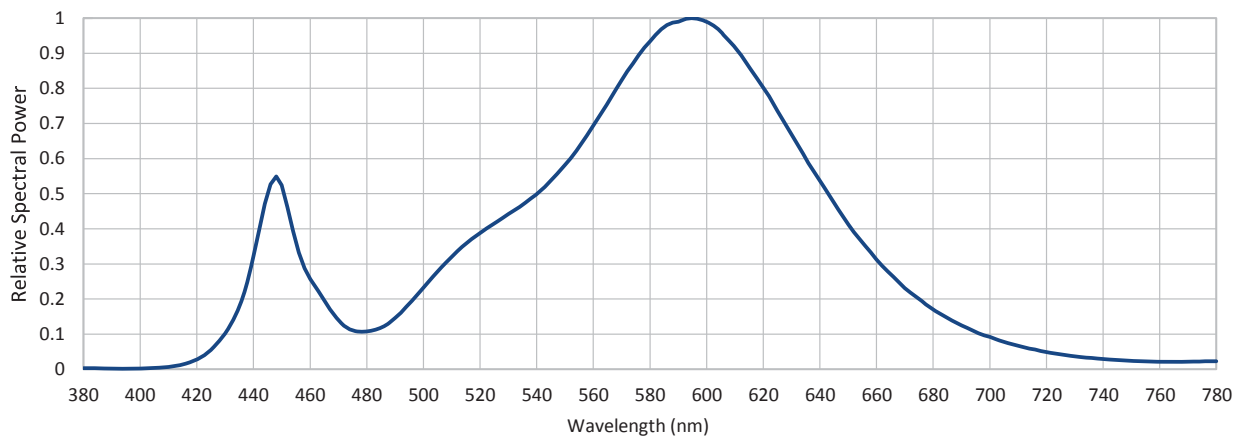
Operating at 120v AC and 60 Hz.

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	0.003	460	0.257	540	0.499	620	0.802	700	0.092
385	0.003	465	0.196	545	0.537	625	0.736	705	0.078
390	0.002	470	0.139	550	0.582	630	0.669	710	0.067
395	0.002	475	0.111	555	0.634	635	0.600	715	0.057
400	0.002	480	0.108	560	0.694	640	0.538	720	0.049
405	0.004	485	0.119	565	0.758	645	0.473	725	0.043
410	0.007	490	0.146	570	0.823	650	0.415	730	0.037
415	0.014	495	0.186	575	0.883	655	0.361	735	0.033
420	0.028	500	0.233	580	0.934	660	0.313	740	0.029
425	0.056	505	0.278	585	0.974	665	0.270	745	0.026
430	0.102	510	0.320	590	0.990	670	0.231	750	0.024
435	0.180	515	0.358	595	1.000	675	0.200	755	0.022
440	0.321	520	0.388	600	0.990	680	0.170	760	0.022
445	0.499	525	0.416	605	0.961	685	0.146	765	0.021
450	0.524	530	0.442	610	0.916	690	0.125	770	0.021
455	0.363	535	0.469	615	0.862	695	0.107	775	0.023
								780	0.023





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Operating at 120v AC and 60 Hz.

LM-79 Performance Data

Spatial measurements

Vert. angle (°)	CIE 1976 (u',v') coordinates	
	Horiz. 0.0° plane	Horiz. ° plane
0.0	(0.249, 0.521)	(0.249, 0.521)
10.0	(0.250, 0.521)	(0.251, 0.522)
20.0	(0.251, 0.522)	(0.250, 0.521)
30.0	(0.251, 0.522)	(0.252, 0.523)
40.0	(0.251, 0.523)	(0.250, 0.522)
50.0	(0.251, 0.522)	(0.250, 0.523)
60.0	(0.252, 0.523)	(0.251, 0.524)
70.0	(0.253, 0.524)	I <= 10% peak
80.0	(0.250, 0.521)	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 0.75 / 3.0 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)

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Test Report No. LLI-19244-5

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 616S X 5 30 X 3G2S XXXX XXXX

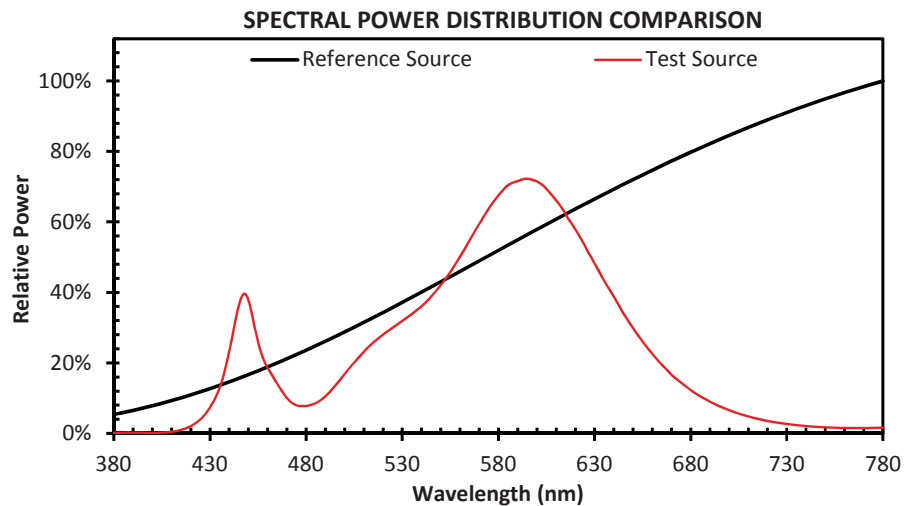
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.

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

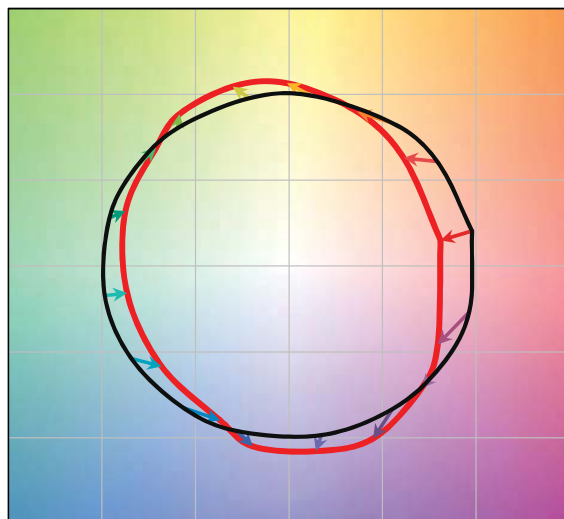
One Osram Optotronic LED driver. Model: QT50W/UNV/1250C/2DIMLT2/P6 set to 600ma.

Operating at 120v AC and 60 Hz.

R_f	72
R_g	93



COLOR VECTOR GRAPHIC



— Test Source

→ Series1

COLOR DISTORTION GRAPHIC





Test Report No. LLI-19244-5

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 616S X 5 30 X 3G2S XXXX XXXX
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.
16 LEDs in 4 x 4 array with clear plastic sheet of individual lenses.
One Osram Optotronic LED driver. Model: QT50W/UNV/1250C/2DIMLT2/P6 set to 600ma.
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.