



Report of Test LLI-20010-8

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 40 X 4G2S XXXX

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

60 LEDs in three 4 x 5 arrays with clear plastic sheets of individual lenses.

One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 1200 ma.

Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	22412 lm	Min Power Factor	0.97 @ 277 V
Luminaire Power	155.3 W	Max THD(i)*	6.2 % @ 277 V
Luminous Efficacy	144.3 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3990 K	80-90° Zonal Flux %	1.1 %
CIE(x,y) 1931	(0.381, 0.377)	BUG Rating*	B3-U0-G3
CRI	72	Street Classification*	Type III Medium

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



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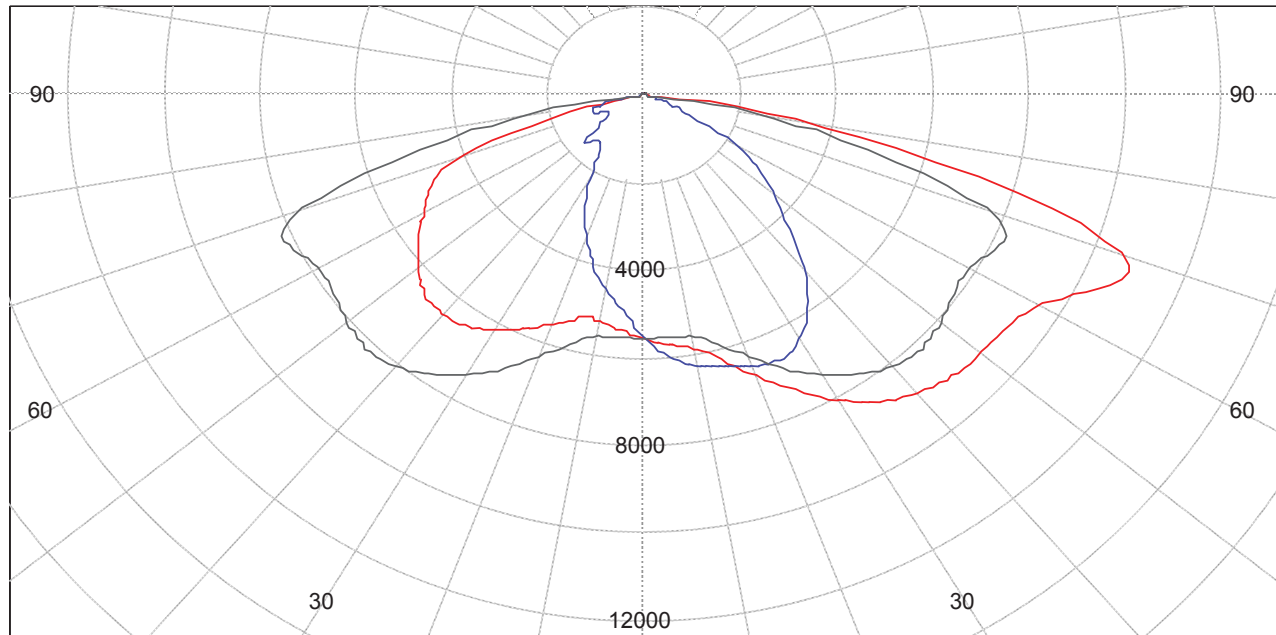




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Polar Light Distribution Curves



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 %	66.8 %	66.8 %
House Side	0.0 %	33.2 %	33.2 %
	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

14-Jan-2020
14-Jan-2020



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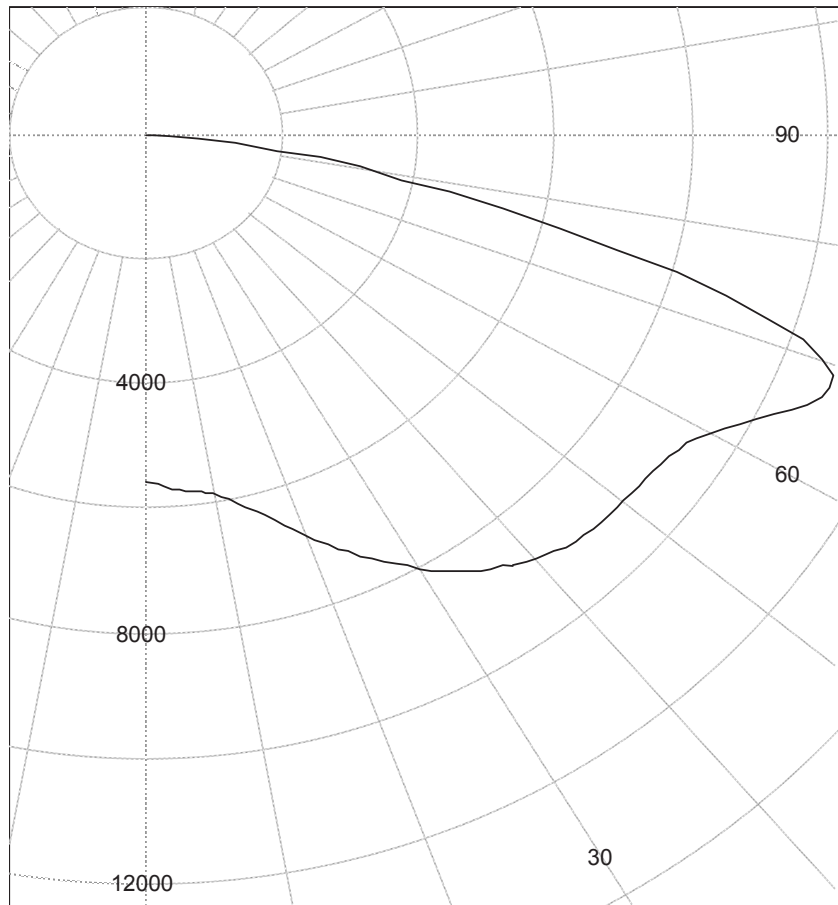
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Operating at 120v AC and 60 Hz.

Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (L75.0) (cd)
0.0	5555.2
10.0	5866.2
20.0	6842.2
30.0	8038.9
35.0	8532.0
40.0	8883.5
45.0	9090.2
47.5	9140.3
50.0	9143.6
52.5	9156.0
55.0	9210.7
57.5	9327.3
60.0	9557.0
62.5	9934.8
65.0	10429.5
67.5	10827.1
70.0	10557.9
72.5	9249.5
75.0	7167.8
77.5	4963.7
80.0	3184.3
82.5	1647.1
85.0	370.5
87.5	11.5
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
8230.1 cd @ (90.0°, 66.5°)

Street side max intensity
10845.7 cd @ (75.0°, 68.0°)

Coordinates expressed in the C Type coordinate system

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



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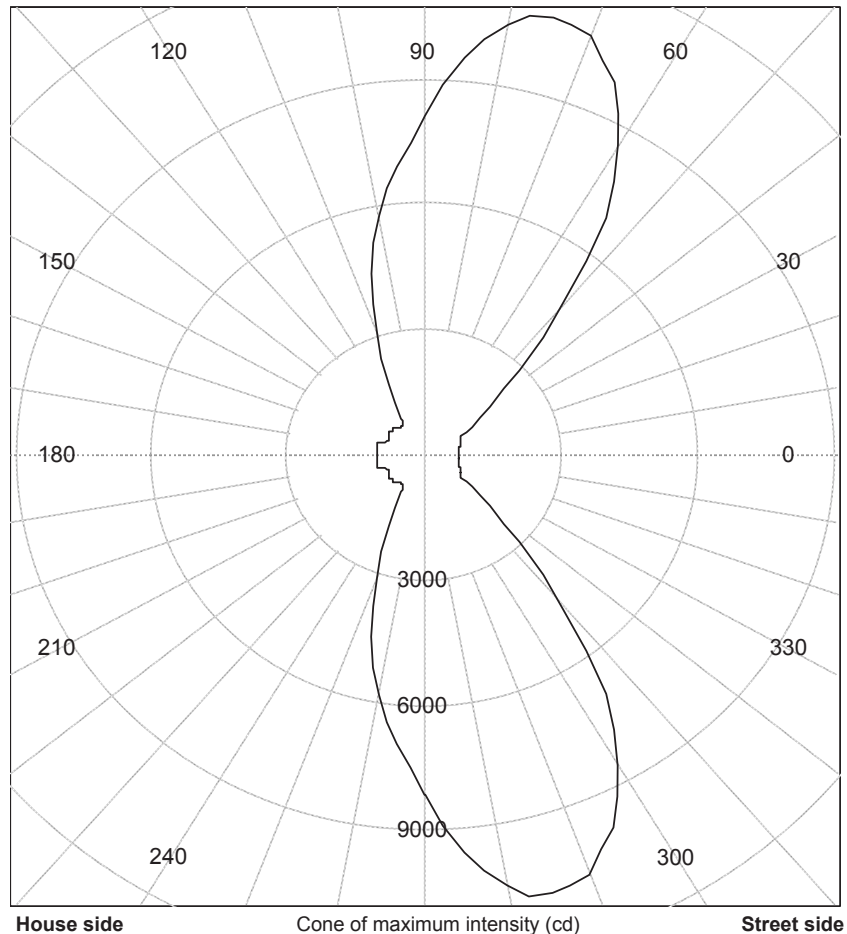
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Operating at 120v AC and 60 Hz.

Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V68.0) (cd)
0	722.1
15	791.1
30	927.3
40	1842.7
45	2905.8
50	4776.1
55	6927.9
60	8587.1
65	9816.2
70	10640.0
75	10845.7
80	10485.5
85	9512.2
90	8112.9
95	6940.7
100	5847.2
105	4512.7
110	3096.5
115	1858.9
120	1035.8
125	844.0
130	867.5
135	910.4
140	944.9
150	877.0
165	1066.4
180	1055.9

Principal Conical Surface



House side max intensity
8230.1 cd @ (90.0°, 66.5°)

Street side max intensity
10845.7 cd @ (75.0°, 68.0°)

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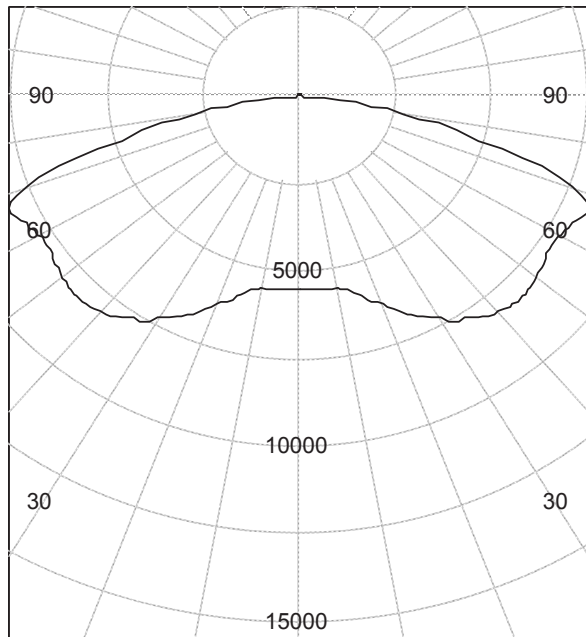
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Polar curve through L90 / L270

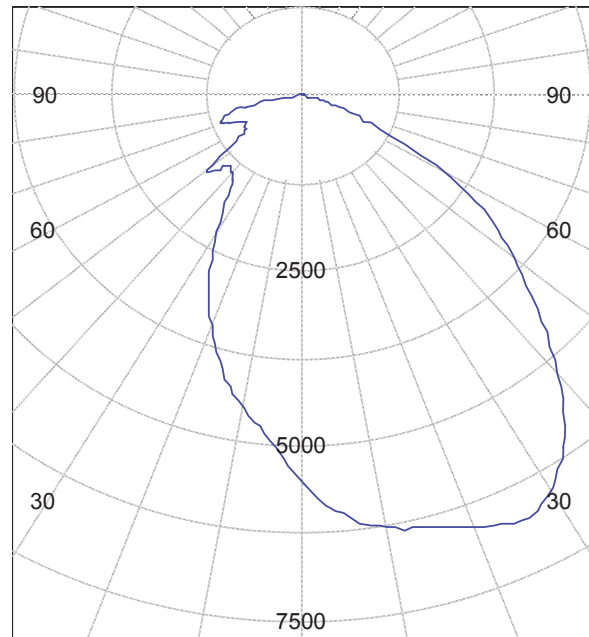


(L90)

(cd)

(L270)

Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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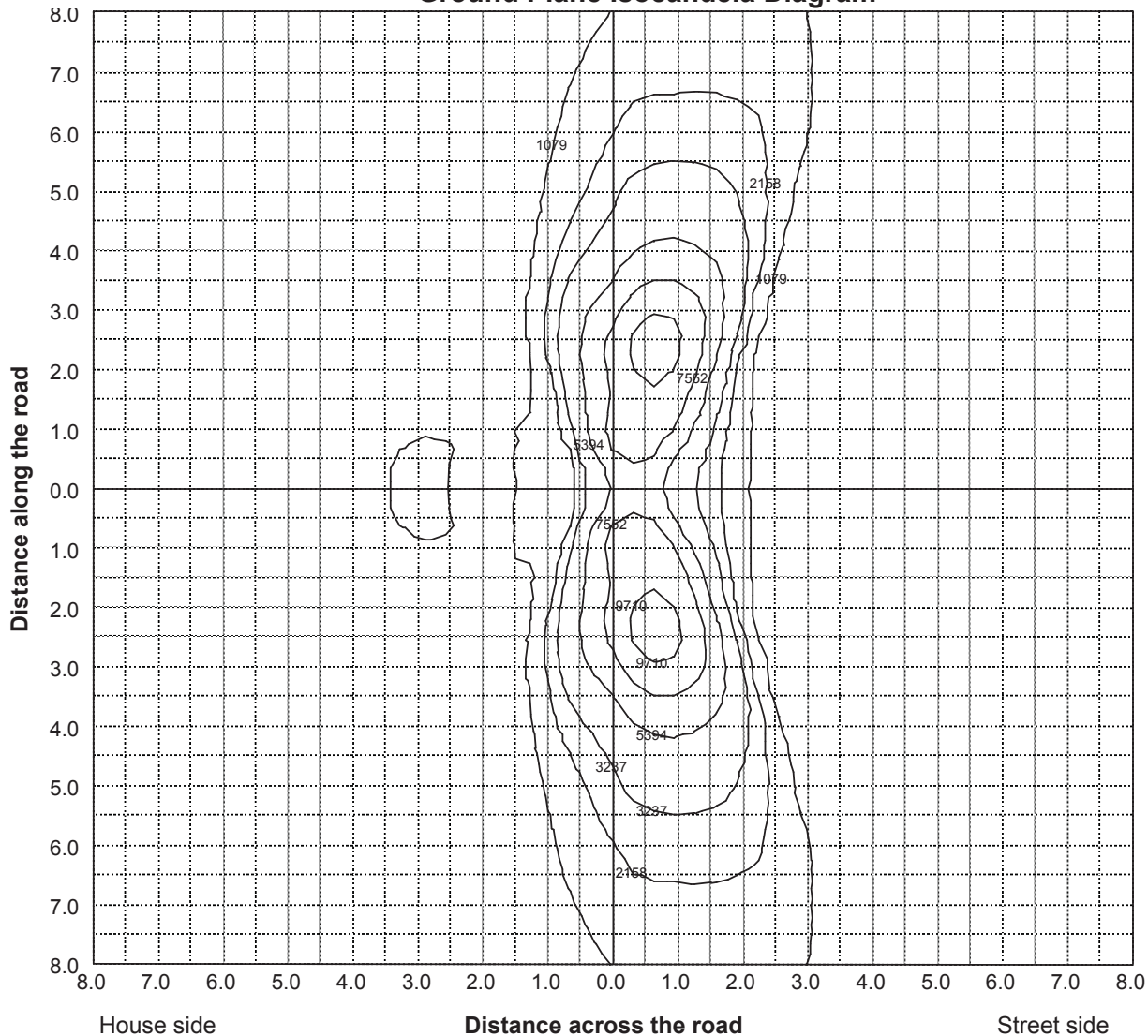
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Ground Plane Isocandela Diagram



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	5555	5555	5555	5555	5555	5555	5555	5555	5555
10.0	6256	6269	6232	6187	6164	6135	6092	6034	5984
20.0	6576	6568	6586	6674	6757	6836	6895	6931	6948
30.0	6466	6638	7084	7421	7596	7706	7801	7906	8007
35.0	5938	6168	6909	7637	7940	8139	8290	8401	8515
40.0	5167	5464	6445	7488	8007	8461	8690	8830	8915
45.0	4284	4669	5856	7172	7875	8457	8898	9061	9155
47.5	3889	4277	5532	6962	7739	8418	8901	9155	9233
50.0	3570	3889	5200	6746	7595	8370	8895	9203	9268
52.5	3229	3500	4859	6474	7444	8302	8844	9176	9301
55.0	2875	3081	4463	6079	7198	8172	8777	9176	9316
57.5	2495	2657	3947	5556	6878	7972	8713	9123	9306
60.0	1984	2182	3303	4955	6378	7628	8577	9106	9438
62.5	1401	1633	2533	4211	5614	7138	8266	9056	9661
65.0	954	1120	1712	3231	4546	6302	7787	8933	9820
67.5	757	827	1019	2060	3189	5061	7106	8682	9858
70.0	566	645	721	1056	1811	3421	5948	8005	9388
72.5	407	493	597	602	839	1829	4174	6739	8199
75.0	296	370	444	455	467	745	2014	4746	6295
77.5	233	286	303	347	336	373	666	2511	4122
80.0	170	221	199	231	248	243	280	896	2229
82.5	99	134	118	137	139	152	150	285	924
85.0	41	56	52	56	56	58	58	73	175
87.5	10	11	11	12	12	12	12	11	11
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	5555	5555	5555	5555	5555	5555	5555	5555	5555
10.0	5930	5866	5789	5697	5584	5473	5358	5246	5136
20.0	6923	6842	6736	6586	6357	6090	5814	5565	5313
30.0	8057	8039	7918	7719	7381	6974	6583	6194	5756
35.0	8567	8532	8394	8155	7783	7333	6888	6434	5912
40.0	8948	8884	8731	8473	8060	7566	7053	6517	5924
45.0	9175	9090	8911	8622	8168	7626	7038	6458	5795
47.5	9237	9140	8923	8615	8136	7570	6947	6305	5613
50.0	9265	9144	8904	8567	8056	7467	6817	6136	5408
52.5	9274	9156	8894	8518	7948	7336	6663	5953	5176
55.0	9313	9211	8918	8495	7875	7209	6497	5741	4886
57.5	9390	9327	9026	8535	7833	7084	6325	5504	4562
60.0	9590	9557	9237	8673	7852	7011	6193	5281	4228
62.5	9929	9935	9601	8951	7975	7023	6107	5070	3893
65.0	10340	10429	10108	9340	8181	7094	6070	4883	3573
67.5	10636	10827	10480	9546	8170	7006	5914	4598	3193
70.0	10316	10558	10168	9052	7566	6424	5388	4021	2605
72.5	9028	9249	8927	7788	6338	5291	4384	3101	1808
75.0	6956	7168	6907	6087	4812	3895	3121	2008	1026
77.5	4754	4964	4830	4394	3447	2606	1906	1036	516
80.0	2974	3184	3147	2992	2369	1663	1020	459	309
82.5	1587	1647	1607	1521	1259	847	429	197	175
85.0	361	370	365	333	305	202	93	70	59
87.5	11	11	11	11	10	10	10	9	9
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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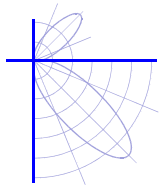
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Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	5555	5555	5555	5555	5555	5555	5555	5555	5555
10.0	5042	4967	4897	4836	4775	4734	4643	4552	4515
20.0	5066	4816	4572	4345	4148	4001	3772	3567	3491
30.0	5311	4862	4392	3922	3480	3128	2701	2364	2246
35.0	5370	4800	4199	3598	3041	2596	2071	1720	1633
40.0	5299	4620	3879	3117	2443	1944	1532	1442	1435
45.0	5039	4229	3317	2411	1733	1416	1339	1378	1458
47.5	4828	3940	2954	2030	1463	1310	1293	1467	1593
50.0	4566	3592	2580	1687	1316	1278	1275	1569	1633
52.5	4249	3211	2183	1407	1265	1252	1292	1431	1303
55.0	3884	2794	1791	1224	1202	1215	1296	1164	1011
57.5	3491	2373	1440	1120	1140	1170	1188	1020	896
60.0	3086	1974	1209	1067	1093	1124	1081	954	875
62.5	2698	1639	1063	1013	1048	1076	994	896	836
65.0	2351	1355	960	948	998	1022	927	883	864
67.5	1951	1087	863	882	925	956	882	1026	1021
70.0	1448	834	764	800	852	882	876	1161	1137
72.5	936	650	653	699	758	799	890	1096	1117
75.0	570	508	537	579	650	715	768	904	1016
77.5	385	385	409	454	506	553	548	718	853
80.0	281	266	286	322	353	366	332	514	660
82.5	160	156	168	191	212	220	185	272	439
85.0	56	59	65	75	87	94	89	72	139
87.5	9	9	10	11	12	12	15	3	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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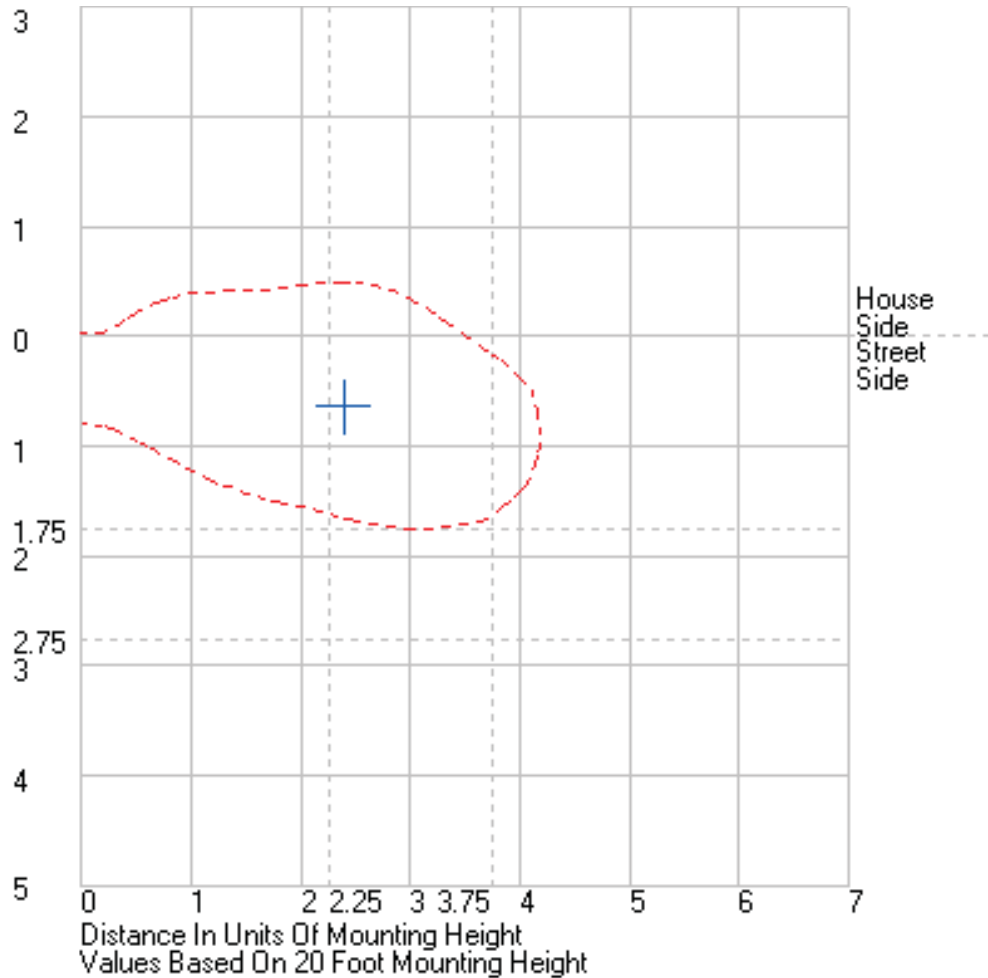
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.381, 0.377)
	CIE 1976 (u', v') ⁽¹⁾	(0.225, 0.502)
	Correlated Color Temperature (CCT) ⁽¹⁾	3990 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	2.19E-03
	Color Rendering Index (Ra) ⁽¹⁾	71.5
	Special CRI 9 (R ₉) ^{(1),(3)}	-38.0
	Distance from Planckian Locus (Duv) ^{(1),(3)}	8.45E-05
	Scotopic/Photopic Ratio ^{(1),(3)}	1.52

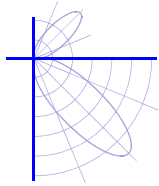
Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	1.301 A	
	Power	155 W	
	Power Factor	0.99	
	Current THD	3.3 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.566 A	
	Power	152 W	
	Power Factor	0.97	
	Current THD	6.2 %	

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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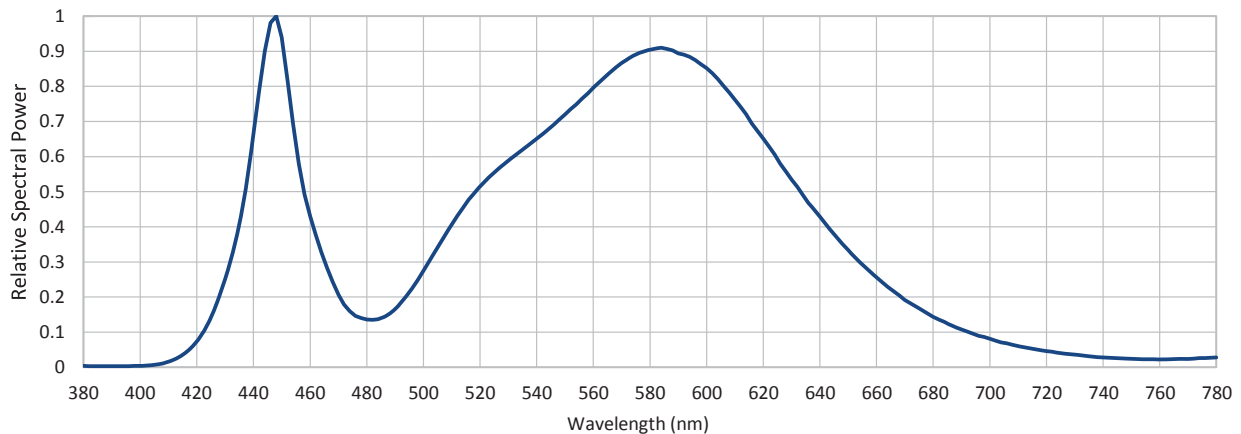
Operating at 120v AC and 60 Hz.

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	0.429	540	0.650	620	0.651	700	0.081
385	0.003	465	0.305	545	0.684	625	0.593	705	0.069
390	0.003	470	0.206	550	0.720	630	0.535	710	0.061
395	0.003	475	0.153	555	0.757	635	0.479	715	0.053
400	0.004	480	0.136	560	0.796	640	0.429	720	0.046
405	0.007	485	0.140	565	0.833	645	0.378	725	0.040
410	0.016	490	0.166	570	0.866	650	0.334	730	0.036
415	0.036	495	0.213	575	0.891	655	0.293	735	0.031
420	0.073	500	0.275	580	0.904	660	0.256	740	0.028
425	0.145	505	0.342	585	0.909	665	0.223	745	0.026
430	0.251	510	0.406	590	0.894	670	0.192	750	0.024
435	0.410	515	0.466	595	0.879	675	0.168	755	0.023
440	0.663	520	0.515	600	0.852	680	0.144	760	0.022
445	0.941	525	0.555	605	0.811	685	0.125	765	0.023
450	0.940	530	0.589	610	0.762	690	0.108	770	0.024
455	0.635	535	0.620	615	0.707	695	0.093	775	0.026
								780	0.028





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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	(0.225, 0.501)	(0.225, 0.501)
10.0	(0.225, 0.501)	(0.225, 0.501)
20.0	(0.226, 0.504)	(0.225, 0.502)
30.0	(0.225, 0.502)	(0.225, 0.501)
40.0	(0.225, 0.502)	(0.225, 0.501)
50.0	(0.226, 0.503)	(0.225, 0.500)
60.0	(0.226, 0.503)	(0.225, 0.501)
70.0	(0.224, 0.500)	I <= 10% peak
-	-	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 / 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-20010-8

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 40 X 4G2S XXXX

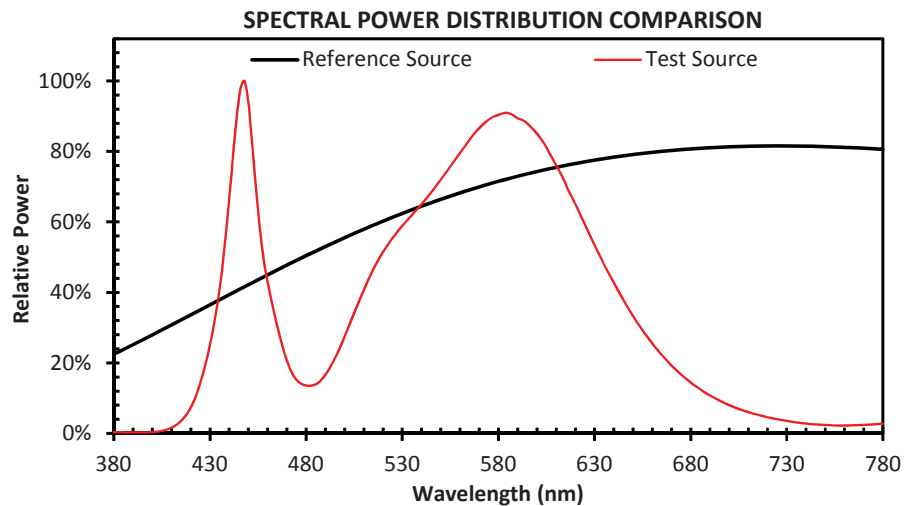
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.

60 LEDs in three 4 x 5 arrays with clear plastic sheets of individual lenses.

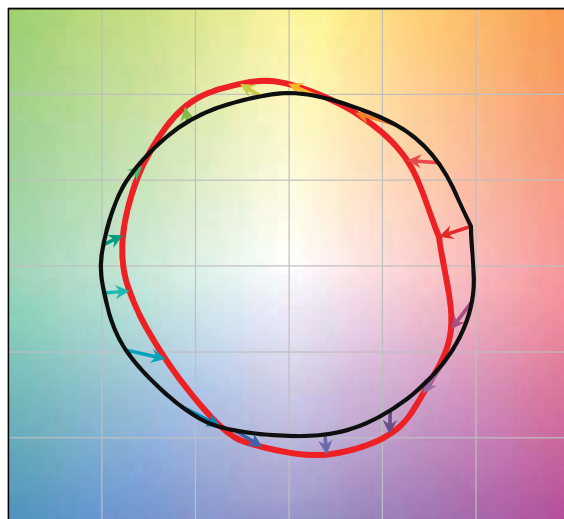
One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 1200 ma.

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-20010-8

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 40 X 4G2S XXXX
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.
60 LEDs in three 4 x 5 arrays with clear plastic sheets of individual lenses.
One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 1200 ma.
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.