



Report of Test LLI-20010-7

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 35 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 1050 ma.
Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	20016 lm	Min Power Factor	0.96 @ 277 V
Luminaire Power	134.7 W	Max THD(i)*	6.5 % @ 277 V
Luminous Efficacy	148.6 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3970 K	80-90° Zonal Flux %	1.1 %
CIE(x,y) 1931	(0.382, 0.378)	BUG Rating*	B3-U0-G3
CRI	71	Street Classification*	Type III Medium

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



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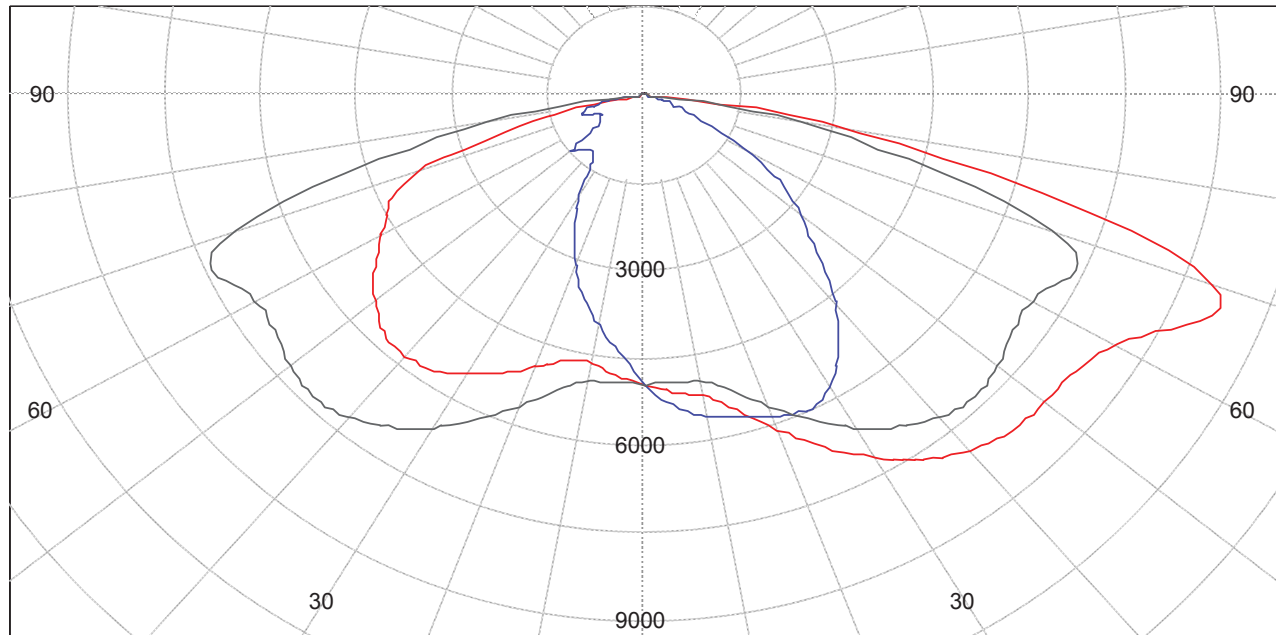




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Polar Light Distribution Curves



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 %	66.9 %	66.9 %
House Side	0.0 %	33.1 %	33.1 %
	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

RT



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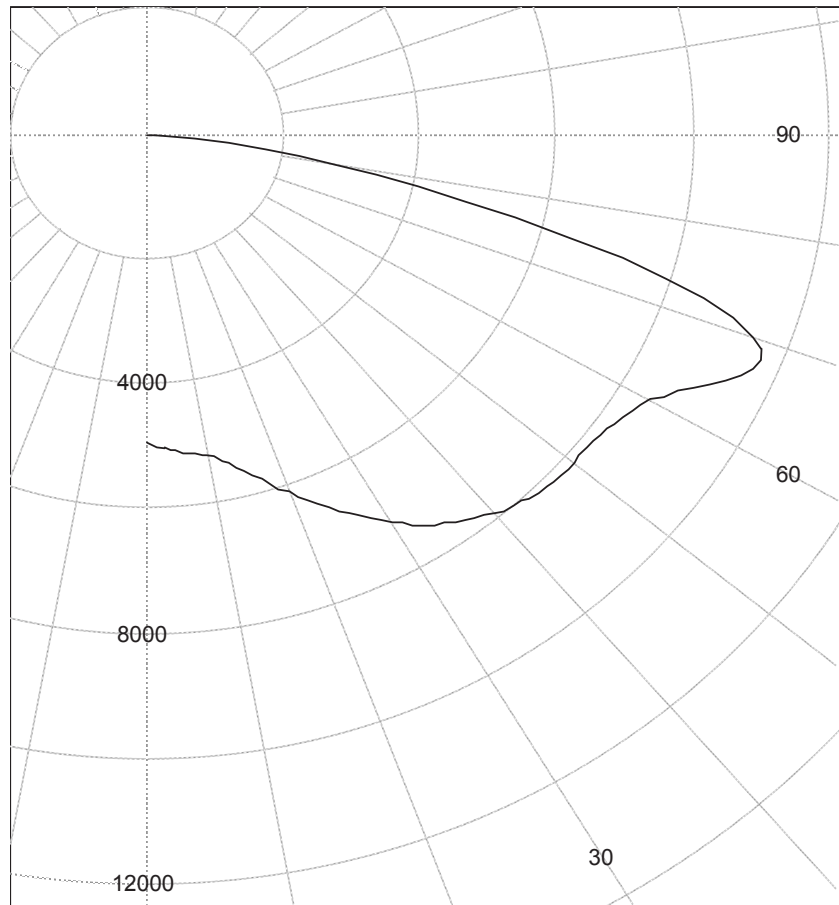
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Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	4950.7
10.0	5233.8
20.0	6103.1
30.0	7172.3
35.0	7613.7
40.0	7936.4
45.0	8120.5
47.5	8163.8
50.0	8169.7
52.5	8179.7
55.0	8231.4
57.5	8342.8
60.0	8545.6
62.5	8885.8
65.0	9327.4
67.5	9690.1
70.0	9453.9
72.5	8281.7
75.0	6412.6
77.5	4437.4
80.0	2833.1
82.5	1473.8
85.0	332.5
87.5	10.4
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
7370.9 cd @ (90.0°, 66.5°)

Street side max intensity
9706.7 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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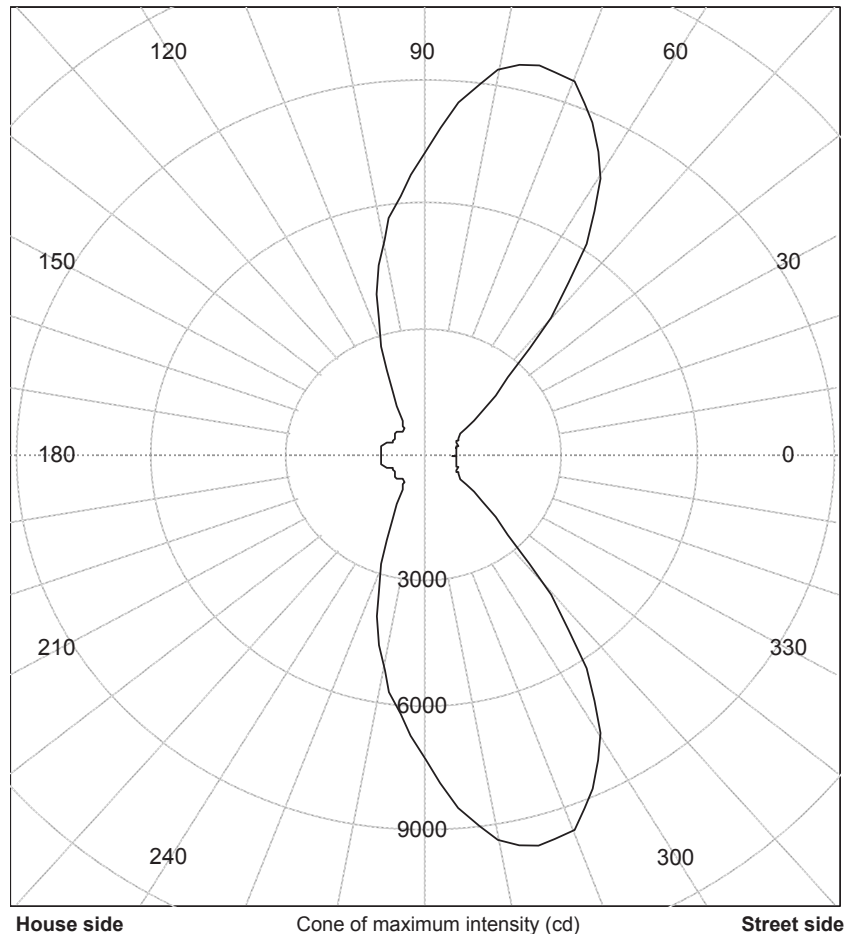
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Operating at 120v AC and 60 Hz.

Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V68.0) (cd)
0	648.8
15	709.8
30	833.3
40	1659.2
45	2598.9
50	4285.1
55	6212.0
60	7688.7
65	8799.1
70	9530.3
75	9706.7
80	9384.4
85	8512.2
90	7264.8
95	6220.5
100	5240.6
105	4042.4
110	2775.5
115	1664.0
120	921.8
125	751.2
130	771.5
135	809.4
140	840.8
150	781.1
165	952.1
180	941.6

Principal Conical Surface



House side

Cone of maximum intensity (cd)

Street side

House side max intensity
7370.9 cd @ (90.0°, 66.5°)

Street side max intensity
9706.7 cd @ (75.0°, 68.0°)

Coordinates expressed in the C Type coordinate system

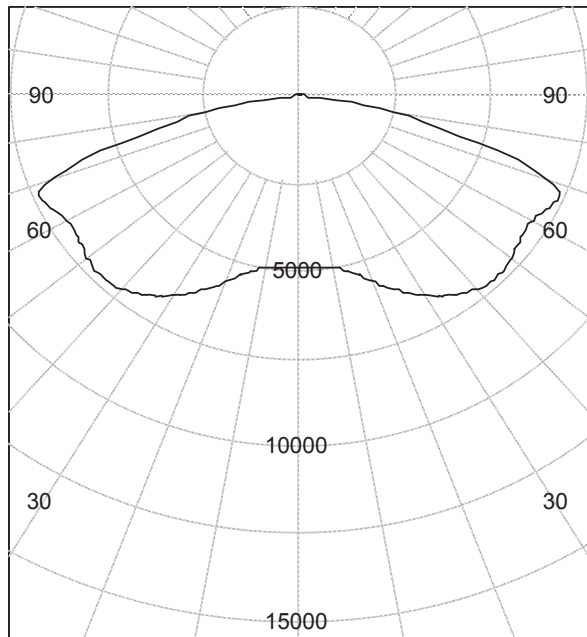
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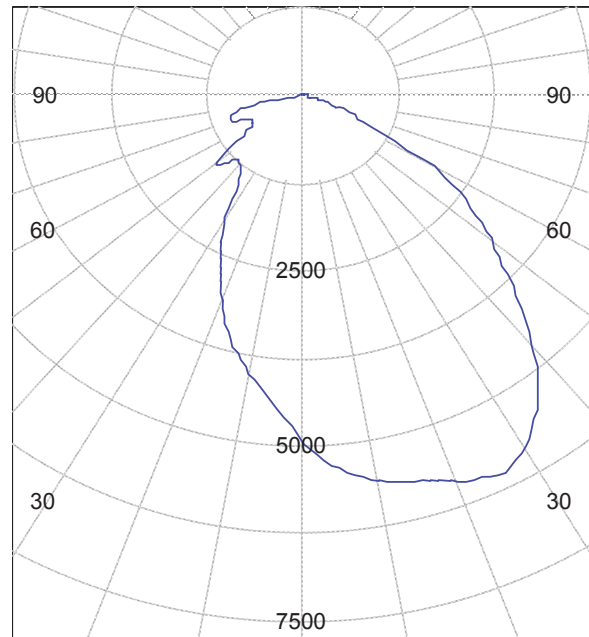
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Polar curve through L90 / L270



(L90) (cd) (L270)

Polar curve through L0 / L180



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



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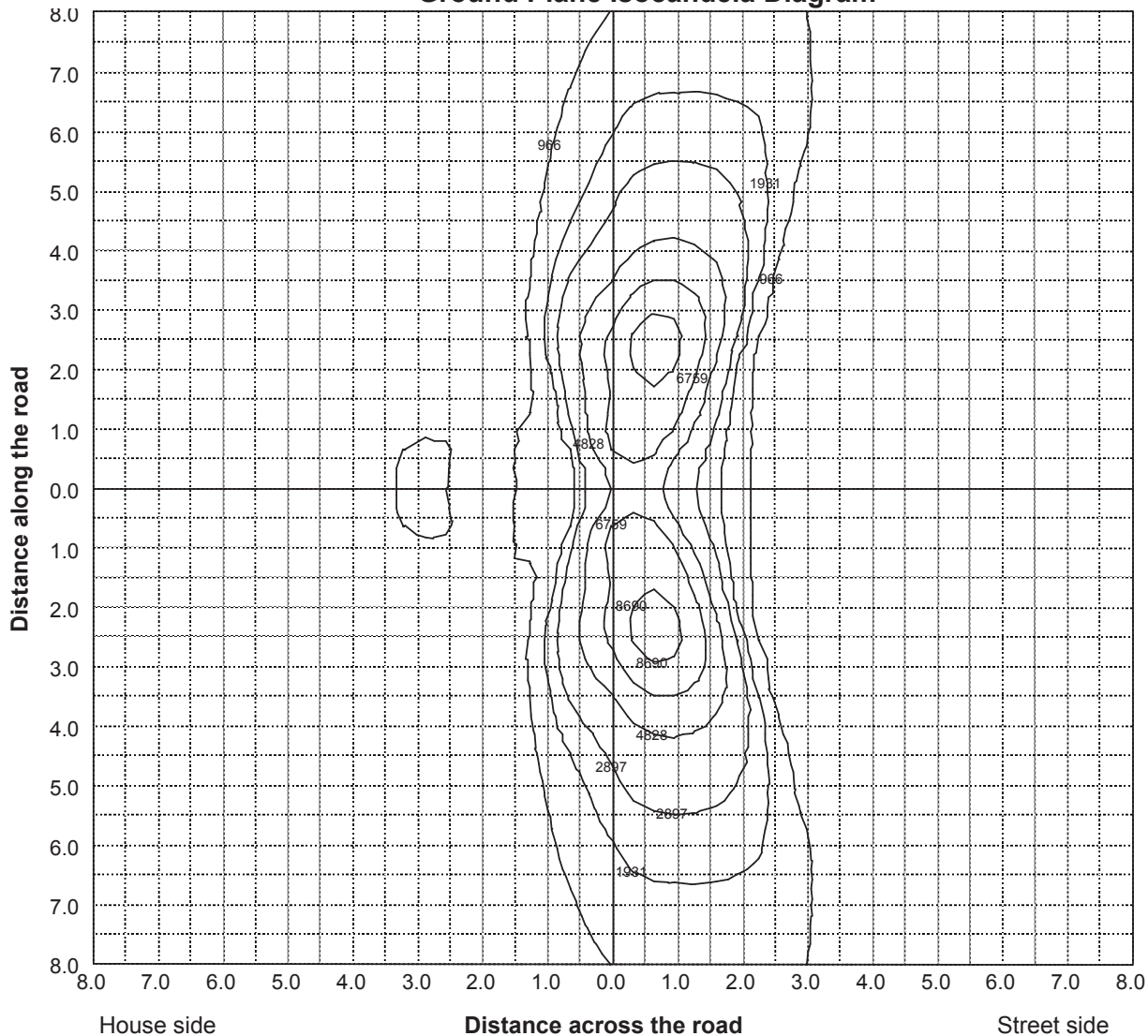
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Ground Plane Isocandela Diagram



The isocandela contour units are expressed as cd

Upstream and downstream sides have been averaged.



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Intensity data (cd)

Vertical	L-Plane								
	L0	L15	L30	L40	L45	L50	L55	L60	L65
0.0	4951	4951	4951	4951	4951	4951	4951	4951	4951
10.0	5580	5591	5561	5518	5497	5470	5427	5377	5333
20.0	5863	5862	5876	5956	6026	6098	6150	6181	6195
30.0	5775	5930	6329	6627	6777	6875	6960	7055	7143
35.0	5304	5511	6173	6823	7087	7268	7398	7503	7603
40.0	4622	4886	5761	6689	7152	7562	7762	7887	7961
45.0	3837	4173	5235	6409	7034	7556	7951	8096	8180
47.5	3483	3826	4945	6221	6914	7517	7960	8186	8251
50.0	3198	3478	4649	6030	6787	7486	7948	8228	8280
52.5	2891	3129	4347	5793	6656	7413	7909	8202	8310
55.0	2576	2754	3997	5447	6437	7305	7848	8203	8331
57.5	2236	2377	3538	4975	6154	7136	7789	8157	8321
60.0	1784	1954	2964	4441	5714	6832	7675	8144	8435
62.5	1260	1463	2275	3777	5028	6391	7401	8108	8637
65.0	858	1005	1540	2906	4068	5652	6978	7993	8788
67.5	679	741	916	1855	2856	4543	6369	7783	8831
70.0	509	579	647	950	1621	3061	5349	7173	8415
72.5	366	442	535	540	751	1632	3762	6055	7368
75.0	266	333	400	409	418	664	1816	4278	5657
77.5	210	257	273	312	302	334	586	2272	3706
80.0	153	198	180	209	224	218	249	809	1999
82.5	89	121	107	124	125	137	135	254	823
85.0	38	51	48	52	51	53	53	66	158
87.5	9	11	11	11	11	11	11	11	10
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	4951	4951	4951	4951	4951	4951	4951	4951	4951
10.0	5292	5234	5163	5078	4975	4873	4775	4672	4578
20.0	6174	6103	6009	5870	5664	5424	5181	4959	4737
30.0	7192	7172	7067	6884	6584	6217	5872	5524	5130
35.0	7649	7614	7495	7280	6945	6541	6146	5740	5272
40.0	7990	7936	7796	7562	7197	6752	6298	5817	5285
45.0	8198	8120	7964	7700	7291	6811	6285	5763	5170
47.5	8258	8164	7970	7695	7265	6761	6204	5625	5009
50.0	8281	8170	7954	7648	7192	6670	6090	5479	4827
52.5	8294	8180	7947	7606	7101	6554	5953	5316	4622
55.0	8323	8231	7970	7592	7038	6441	5807	5125	4364
57.5	8397	8343	8065	7621	6999	6332	5655	4915	4078
60.0	8578	8546	8260	7752	7021	6270	5538	4719	3781
62.5	8877	8886	8584	7997	7136	6284	5464	4533	3483
65.0	9256	9327	9040	8349	7326	6353	5437	4372	3202
67.5	9518	9690	9372	8535	7322	6277	5300	4119	2861
70.0	9243	9454	9103	8094	6781	5759	4831	3601	2335
72.5	8092	8282	7995	6967	5670	4742	3934	2775	1618
75.0	6243	6413	6187	5441	4299	3483	2798	1792	915
77.5	4269	4437	4329	3927	3086	2328	1709	922	459
80.0	2661	2833	2817	2669	2119	1481	919	407	274
82.5	1416	1474	1444	1370	1126	751	390	172	156
85.0	324	332	326	307	273	184	83	62	52
87.5	10	10	10	10	9	9	8	8	8
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	4951	4951	4951	4951	4951	4951	4951	4951	4951
10.0	4490	4425	4363	4309	4253	4216	4134	4057	4020
20.0	4515	4290	4072	3869	3693	3562	3357	3174	3104
30.0	4733	4332	3913	3489	3095	2782	2400	2097	1992
35.0	4789	4278	3739	3202	2702	2307	1837	1525	1450
40.0	4729	4120	3455	2771	2167	1725	1361	1284	1278
45.0	4501	3768	2953	2140	1536	1259	1192	1227	1299
47.5	4313	3512	2633	1800	1297	1167	1151	1307	1421
50.0	4076	3204	2297	1496	1170	1140	1135	1395	1448
52.5	3797	2866	1944	1248	1127	1115	1150	1263	1148
55.0	3470	2493	1593	1087	1070	1082	1152	1031	895
57.5	3119	2118	1280	997	1015	1042	1056	905	796
60.0	2760	1762	1077	950	973	1000	961	847	779
62.5	2413	1464	947	901	933	958	884	797	744
65.0	2106	1211	855	844	888	910	825	787	770
67.5	1747	969	768	785	823	851	785	917	911
70.0	1295	741	680	711	757	784	780	1033	1011
72.5	832	578	580	620	673	711	792	972	989
75.0	507	451	477	513	576	634	681	798	897
77.5	343	342	362	402	448	490	484	632	753
80.0	248	235	254	285	312	324	292	449	581
82.5	142	139	148	166	184	193	163	224	378
85.0	50	51	56	64	74	81	78	55	104
87.5	8	8	9	9	10	10	12	2	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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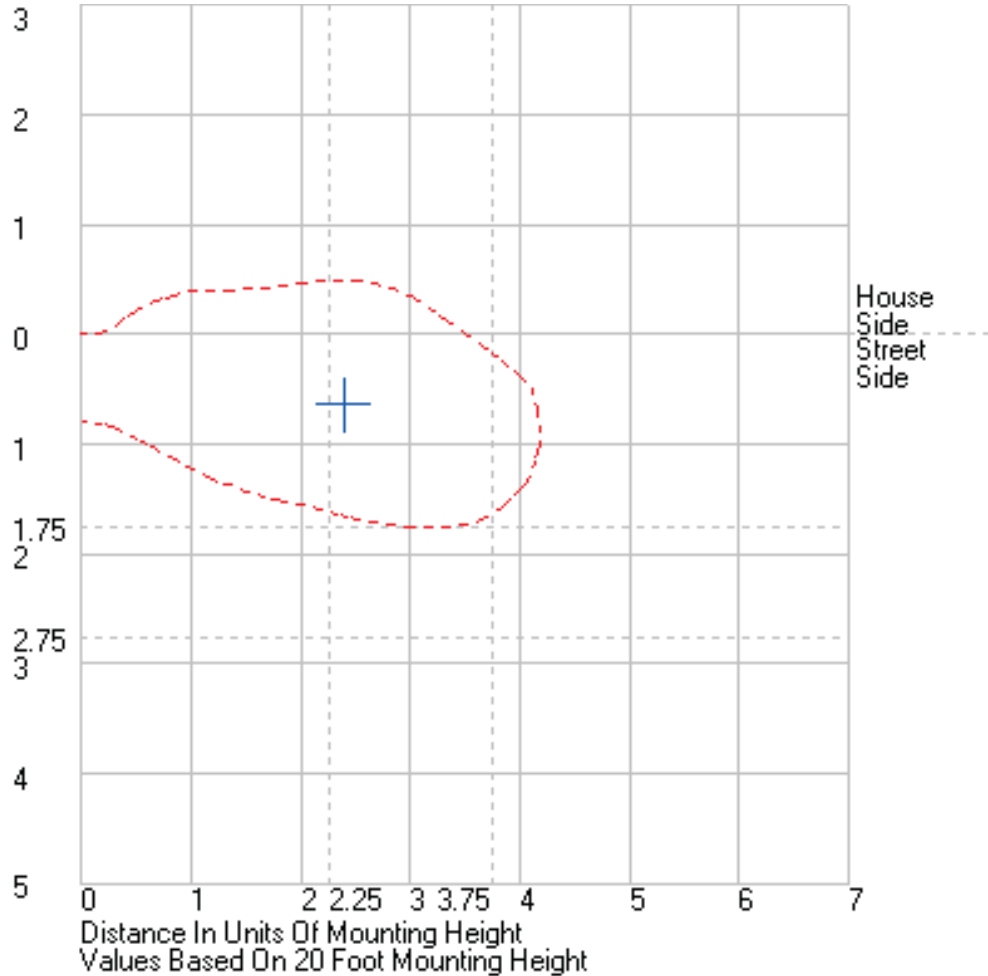
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.382, 0.378)
	CIE 1976 (u', v') ⁽¹⁾	(0.225, 0.502)
	Correlated Color Temperature (CCT) ⁽¹⁾	3970 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	2.26E-03
	Color Rendering Index (Ra) ⁽¹⁾	71.4
	Special CRI 9 (R ₉) ^{(1),(3)}	-38.3
	Distance from Planckian Locus (Duv) ^{(1),(3)}	2.17E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.52

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	1.128 A	
	Power	135 W	
	Power Factor	1.00	
	Current THD	3.7 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.496 A	
	Power	132 W	
	Power Factor	0.96	
	Current THD	6.5 %	

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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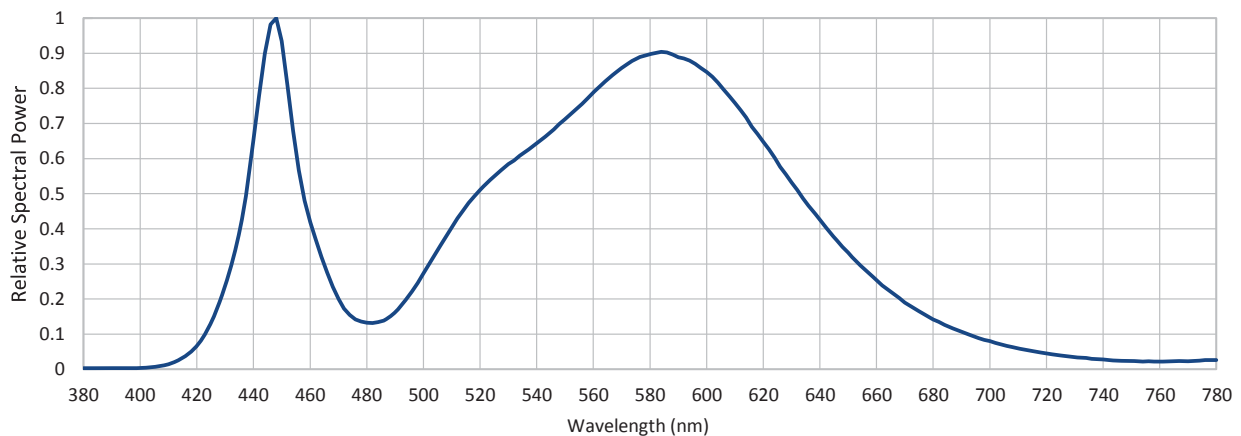
Operating at 120v AC and 60 Hz.

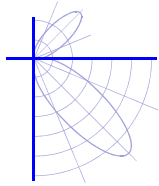
LM-79 Performance Data

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	0.419	540	0.643	620	0.648	700	0.080
385	0.003	465	0.298	545	0.676	625	0.590	705	0.069
390	0.003	470	0.200	550	0.712	630	0.532	710	0.060
395	0.003	475	0.149	555	0.749	635	0.477	715	0.052
400	0.004	480	0.133	560	0.788	640	0.426	720	0.045
405	0.007	485	0.137	565	0.825	645	0.376	725	0.040
410	0.014	490	0.163	570	0.858	650	0.332	730	0.035
415	0.033	495	0.211	575	0.884	655	0.290	735	0.031
420	0.067	500	0.273	580	0.897	660	0.254	740	0.028
425	0.134	505	0.339	585	0.903	665	0.221	745	0.025
430	0.237	510	0.404	590	0.889	670	0.190	750	0.024
435	0.394	515	0.463	595	0.875	675	0.166	755	0.022
440	0.652	520	0.511	600	0.847	680	0.142	760	0.022
445	0.941	525	0.550	605	0.807	685	0.124	765	0.023
450	0.935	530	0.584	610	0.758	690	0.107	770	0.023
455	0.622	535	0.614	615	0.704	695	0.092	775	0.026
								780	0.026





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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, 0.502)	(0.225, 0.502)
20.0	(0.226, 0.504)	(0.225, 0.502)
30.0	(0.225, 0.503)	(0.225, 0.501)
40.0	(0.225, 0.503)	(0.225, 0.501)
50.0	(0.226, 0.503)	(0.225, 0.501)
60.0	(0.226, 0.504)	(0.225, 0.502)
70.0	(0.225, 0.500)	I <= 10% peak
80.0	(0.226, 0.502)	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 %
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-20010-7

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 35 X 4G2S XXXX

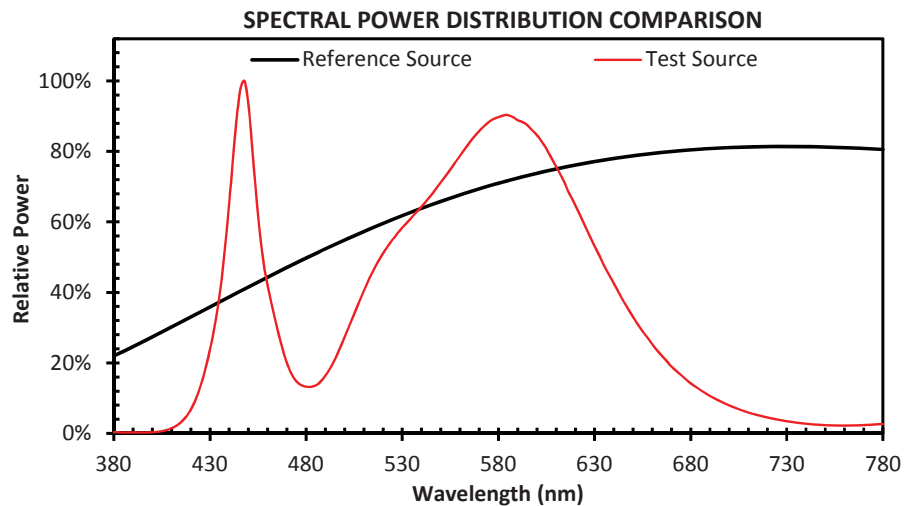
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.

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

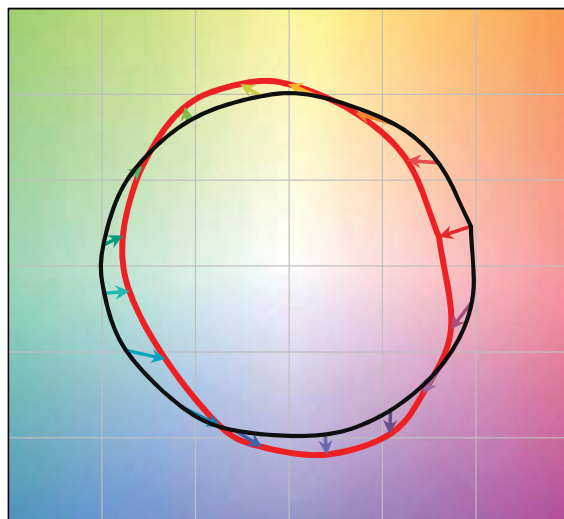
One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 1050 ma.

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-20010-7

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 35 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 1050 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.