



Report of Test LLI-20010-2

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 25 X 3G2S 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 750 ma.
Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	14110 lm	Min Power Factor	0.93 @ 277 V
Luminaire Power	94.4 W	Max THD(i)*	7.3 % @ 277 V
Luminous Efficacy	149.5 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3010 K	80-90° Zonal Flux %	1.1 %
CIE(x,y) 1931	(0.437, 0.405)	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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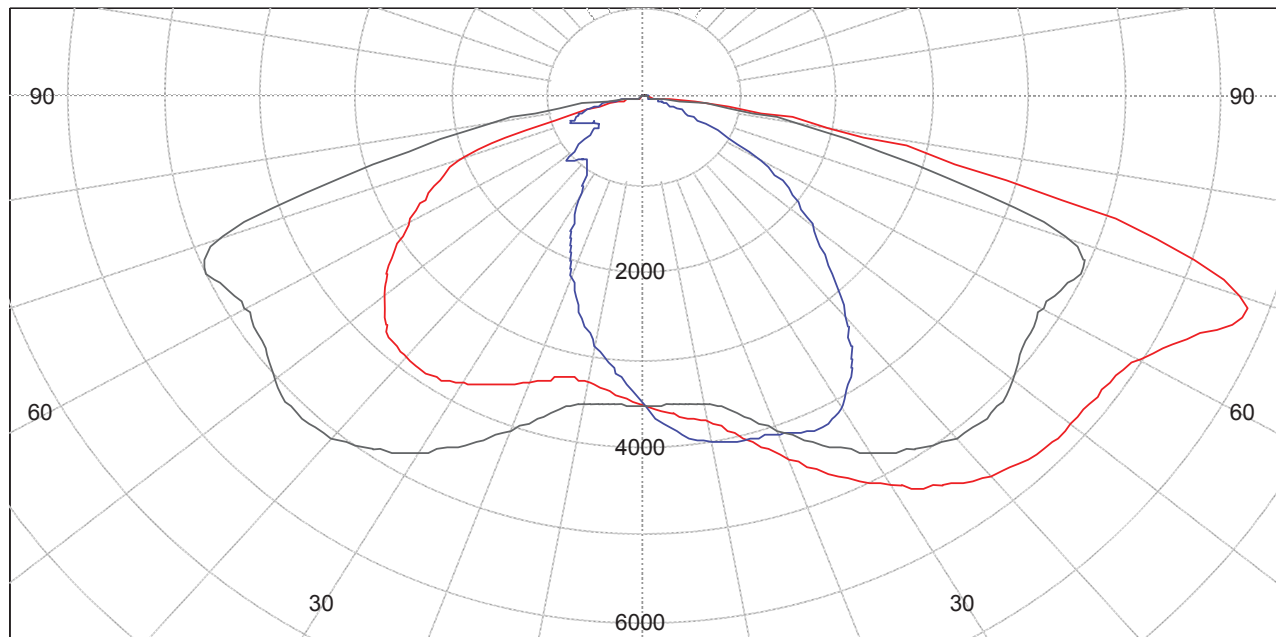




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Polar Light Distribution Curves



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 %	67.0 %	67.0 %
House Side	0.0 %	33.0 %	33.0 %
	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

13-Jan-2020
14-Jan-2020

RT



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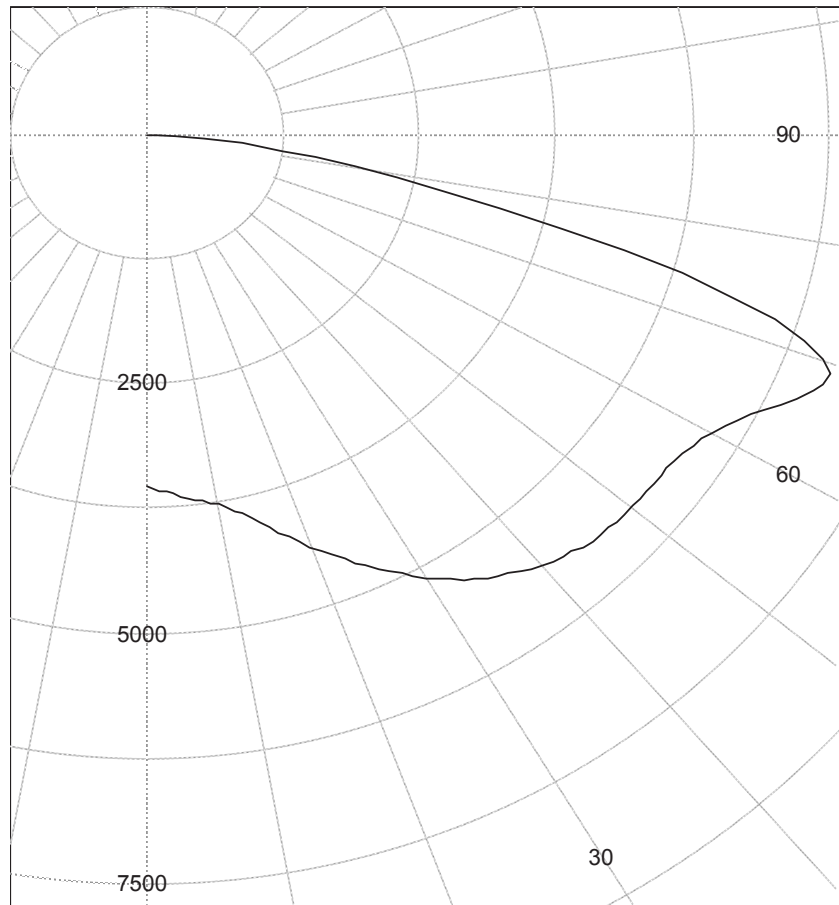
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Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	3524.8
10.0	3765.6
20.0	4393.0
30.0	5123.5
35.0	5420.7
40.0	5635.4
45.0	5761.8
47.5	5797.0
50.0	5800.1
52.5	5801.7
55.0	5823.5
57.5	5867.1
60.0	5976.3
62.5	6155.7
65.0	6394.2
67.5	6674.2
70.0	6602.0
72.5	5832.8
75.0	4516.1
77.5	3038.3
80.0	1940.5
82.5	1061.2
85.0	261.6
87.5	8.4
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



House side max intensity
5112.3 cd @ (90.0°, 43.5°)

Street side max intensity
6723.0 cd @ (72.5°, 68.5°)

Coordinates expressed in the C Type coordinate system

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



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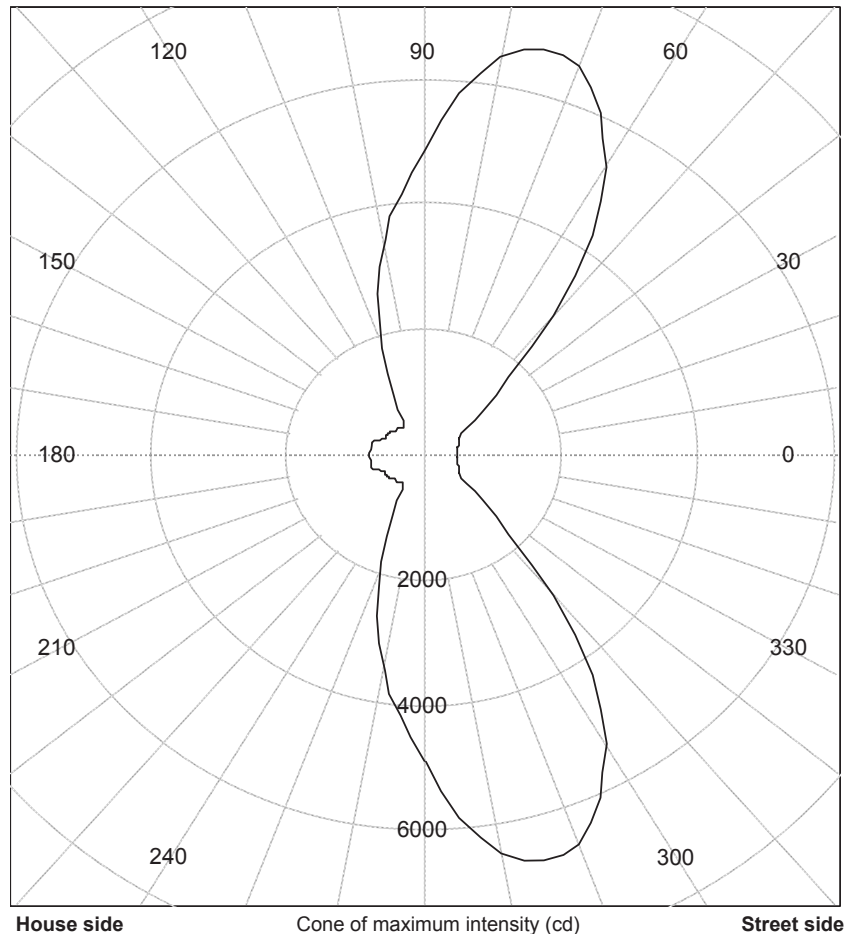
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Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V68.5) (cd)
0	439.3
15	484.4
30	565.3
40	1084.2
45	1743.6
50	2923.1
55	4272.2
60	5305.4
65	6064.9
70	6612.4
75	6714.0
80	6451.9
85	5810.7
90	4895.0
95	4176.7
100	3496.3
105	2658.8
110	1791.0
115	1077.3
120	612.0
125	526.3
130	541.4
135	579.1
140	616.9
150	642.1
165	805.9
180	803.1

Principal Conical Surface



House side max intensity
5112.3 cd @ (90.0°, 43.5°)

Street side max intensity
6723.0 cd @ (72.5°, 68.5°)

Coordinates expressed in the C Type coordinate system

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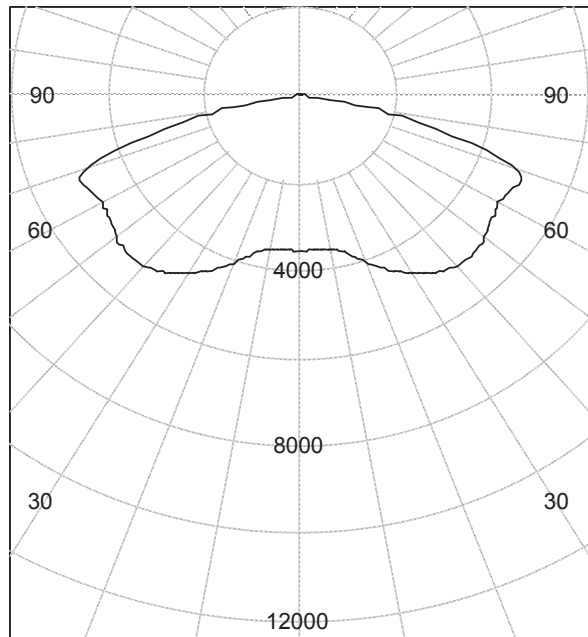
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Polar curve through L90 / L270

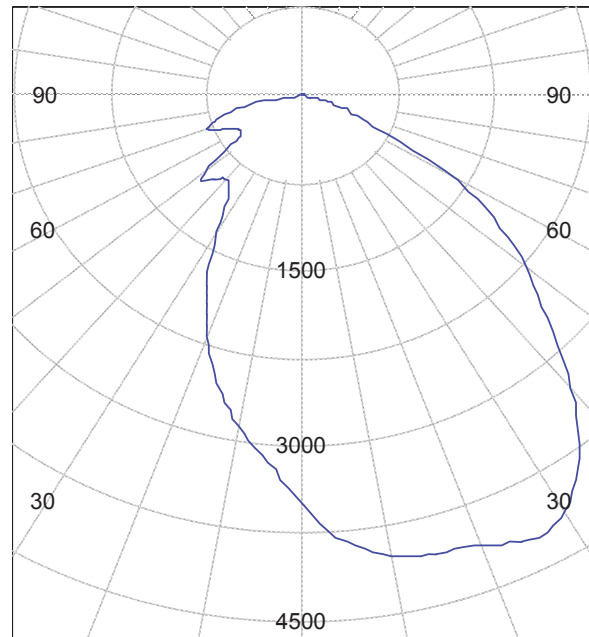


(L90)

(cd)

(L270)

Polar curve through L0 / L180



House side (L180)

(cd)

Street side (L0)



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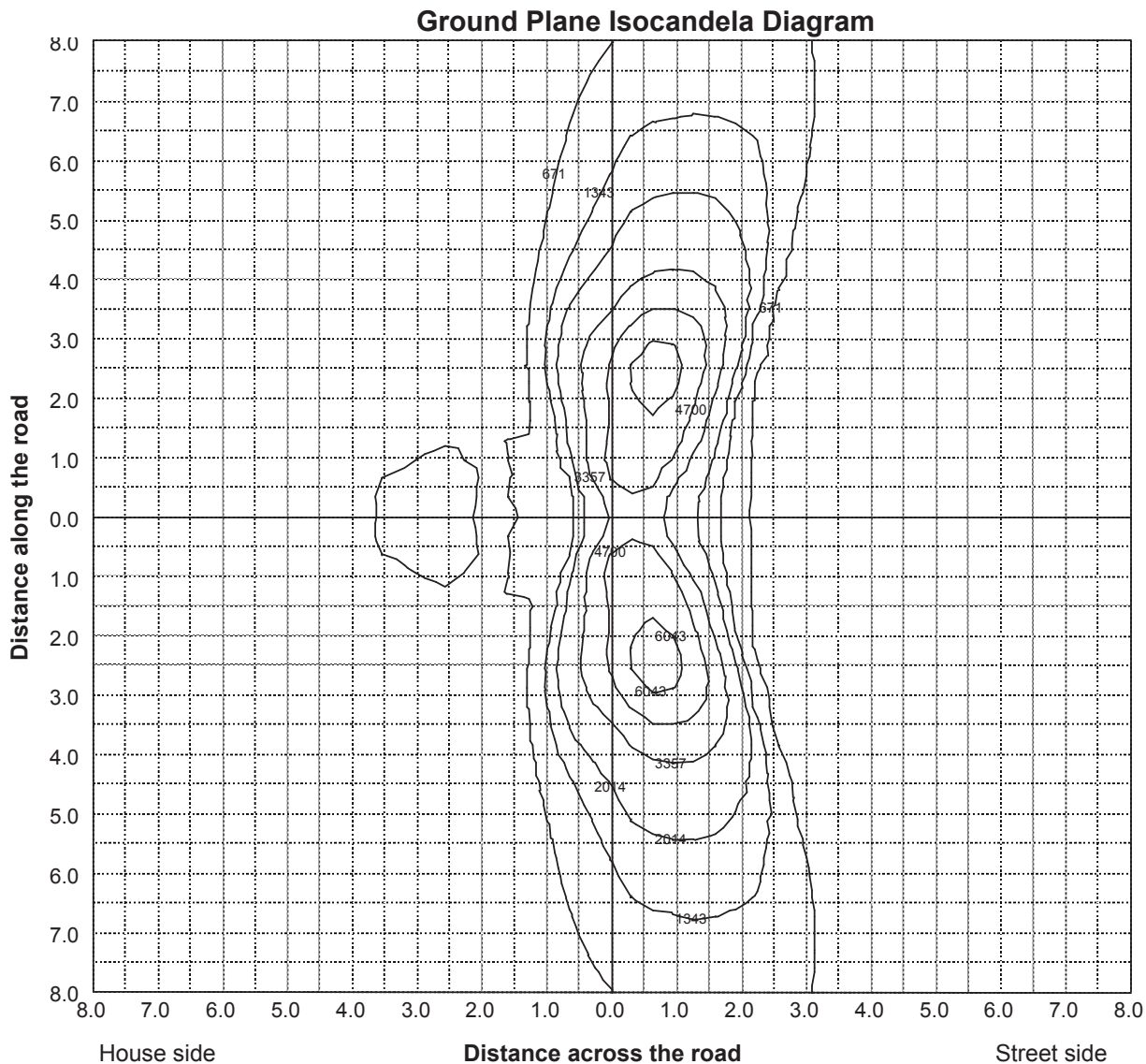
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The isocandela contour units are expressed as cd

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	3525	3525	3525	3525	3525	3525	3525	3525	3525
10.0	4001	4008	3988	3959	3939	3922	3889	3862	3828
20.0	4099	4105	4151	4256	4310	4370	4407	4433	4437
30.0	4096	4195	4452	4678	4769	4853	4942	5037	5103
35.0	3778	3929	4387	4837	5010	5142	5226	5319	5405
40.0	3266	3458	4100	4769	5081	5348	5492	5574	5639
45.0	2703	2934	3695	4565	4999	5363	5630	5725	5777
47.5	2462	2686	3487	4421	4907	5335	5642	5788	5818
50.0	2259	2449	3265	4261	4819	5310	5635	5814	5844
52.5	2045	2207	3040	4086	4718	5251	5603	5806	5868
55.0	1819	1942	2790	3832	4534	5176	5557	5796	5863
57.5	1580	1681	2468	3493	4339	5027	5481	5734	5855
60.0	1269	1400	2084	3117	4042	4801	5364	5684	5905
62.5	902	1058	1625	2666	3561	4468	5167	5637	5997
65.0	613	729	1115	2099	2910	3998	4880	5557	6088
67.5	485	529	676	1375	2095	3285	4477	5410	6118
70.0	367	416	479	706	1219	2281	3858	5071	5888
72.5	267	320	397	405	568	1233	2813	4401	5263
75.0	195	241	293	309	324	518	1429	3179	4105
77.5	151	182	199	235	233	267	451	1713	2672
80.0	111	140	132	158	170	174	199	628	1441
82.5	67	89	79	95	98	108	111	206	616
85.0	30	39	37	41	42	44	45	59	132
87.5	8	10	9	9	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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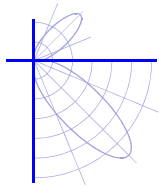
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One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 750 ma.

Operating at 120v AC and 60 Hz.

Intensity data (cd)

Vertical	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	3525	3525	3525	3525	3525	3525	3525	3525	3525
10.0	3790	3743	3686	3620	3552	3479	3409	3342	3282
20.0	4417	4368	4298	4187	4041	3875	3711	3555	3398
30.0	5132	5108	5033	4897	4680	4430	4183	3941	3663
35.0	5435	5401	5313	5152	4914	4635	4355	4070	3737
40.0	5659	5613	5511	5330	5062	4757	4435	4093	3716
45.0	5789	5730	5616	5408	5101	4770	4404	4036	3602
47.5	5828	5755	5616	5398	5075	4724	4336	3922	3472
50.0	5833	5748	5591	5353	5014	4648	4243	3806	3335
52.5	5833	5748	5570	5305	4931	4546	4132	3675	3173
55.0	5843	5768	5568	5272	4862	4447	4009	3522	2979
57.5	5879	5822	5608	5274	4812	4345	3879	3353	2761
60.0	5983	5940	5708	5331	4794	4276	3766	3186	2531
62.5	6151	6136	5900	5465	4842	4250	3678	3027	2303
65.0	6362	6392	6172	5673	4932	4266	3626	2886	2090
67.5	6595	6670	6431	5837	4966	4248	3565	2747	1895
70.0	6464	6614	6319	5602	4651	3955	3302	2448	1580
72.5	5741	5822	5571	4795	3886	3275	2707	1890	1096
75.0	4460	4488	4256	3675	2910	2380	1886	1198	607
77.5	2986	3049	2921	2620	2041	1559	1113	601	314
80.0	1833	1972	1925	1810	1400	982	578	275	198
82.5	1029	1080	1071	985	761	506	248	126	116
85.0	270	263	257	244	197	128	56	48	40
87.5	9	8	8	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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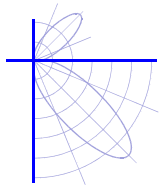
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Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	3525	3525	3525	3525	3525	3525	3525	3525	3525
10.0	3225	3176	3136	3092	3059	3022	2967	2908	2881
20.0	3238	3072	2916	2766	2642	2536	2381	2236	2180
30.0	3371	3073	2771	2464	2181	1947	1662	1436	1357
35.0	3388	3015	2630	2240	1884	1596	1263	1064	1020
40.0	3312	2873	2405	1918	1496	1192	965	927	934
45.0	3119	2602	2027	1468	1068	900	864	944	1018
47.5	2975	2410	1798	1236	919	843	850	1009	1082
50.0	2796	2185	1561	1034	840	822	849	985	959
52.5	2588	1939	1318	877	812	806	843	832	741
55.0	2349	1677	1082	776	769	781	807	718	617
57.5	2089	1413	882	722	732	755	760	659	582
60.0	1827	1173	756	689	706	728	698	624	590
62.5	1585	981	674	654	671	697	650	614	599
65.0	1380	828	612	609	634	662	619	672	682
67.5	1180	676	551	562	593	628	631	791	776
70.0	894	522	487	510	555	599	648	794	799
72.5	568	412	416	450	508	562	609	699	730
75.0	352	323	341	380	435	482	491	582	657
77.5	244	241	260	294	329	350	339	455	553
80.0	179	166	182	205	222	227	200	321	419
82.5	103	99	105	117	130	137	113	166	262
85.0	37	37	41	45	53	58	54	39	73
87.5	6	6	7	7	7	8	9	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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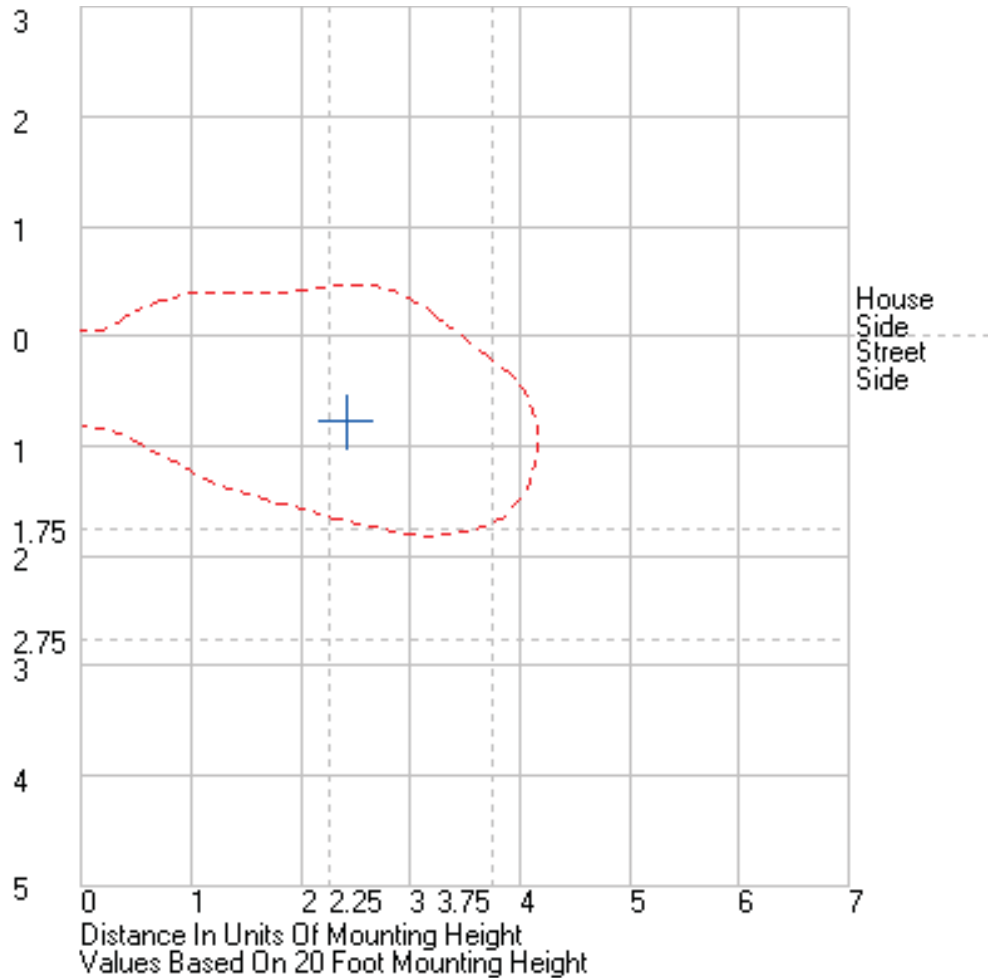
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.437, 0.405)
	CIE 1976 (u', v') ⁽¹⁾	(0.250, 0.522)
	Correlated Color Temperature (CCT) ⁽¹⁾	3010 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	2.24E-03
	Color Rendering Index (Ra) ⁽¹⁾	71.6
	Special CRI 9 (R ₉) ^{(1),(3)}	-40.0
	Distance from Planckian Locus (Duv) ^{(1),(3)}	5.56E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.23

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.790 A	
	Power	94.4 W	
	Power Factor	1.00	
	Current THD	3.5 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.362 A	
	Power	93.2 W	
	Power Factor	0.93	
	Current THD	7.3 %	

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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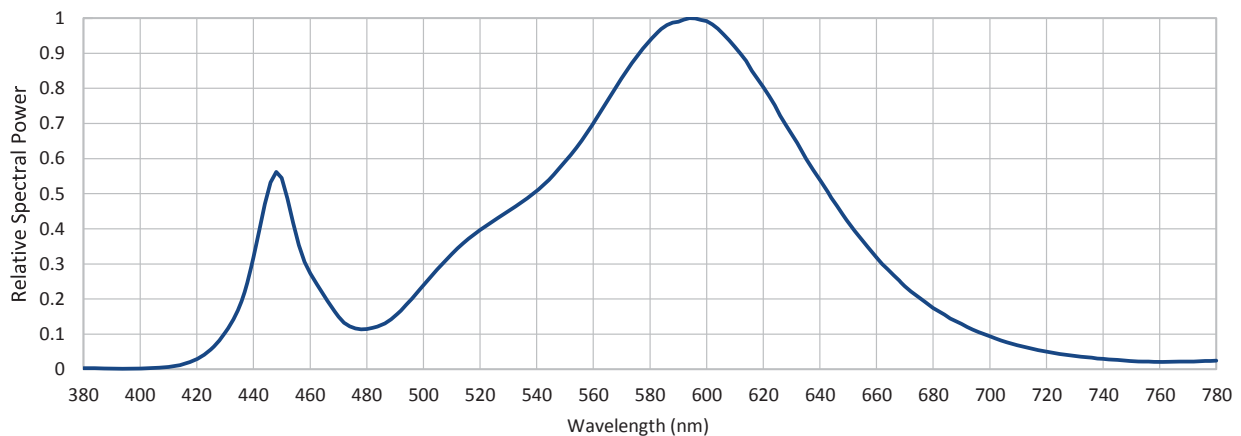
Operating at 120v AC and 60 Hz.

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	0.273	540	0.508	620	0.804	700	0.094
385	0.002	465	0.209	545	0.546	625	0.737	705	0.080
390	0.002	470	0.150	550	0.591	630	0.670	710	0.068
395	0.002	475	0.119	555	0.642	635	0.602	715	0.058
400	0.002	480	0.115	560	0.701	640	0.540	720	0.050
405	0.004	485	0.125	565	0.765	645	0.476	725	0.043
410	0.007	490	0.152	570	0.829	650	0.420	730	0.038
415	0.014	495	0.192	575	0.888	655	0.366	735	0.033
420	0.029	500	0.240	580	0.937	660	0.319	740	0.030
425	0.058	505	0.286	585	0.975	665	0.276	745	0.026
430	0.104	510	0.328	590	0.990	670	0.236	750	0.023
435	0.180	515	0.366	595	1.000	675	0.205	755	0.022
440	0.318	520	0.397	600	0.991	680	0.175	760	0.021
445	0.501	525	0.424	605	0.962	685	0.150	765	0.022
450	0.545	530	0.451	610	0.918	690	0.129	770	0.022
455	0.385	535	0.478	615	0.864	695	0.110	775	0.024
								780	0.025





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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)	(0.250, 0.521)
20.0	(0.251, 0.523)	(0.250, 0.521)
30.0	(0.250, 0.522)	(0.250, 0.522)
40.0	(0.250, 0.522)	(0.250, 0.522)
50.0	(0.250, 0.522)	(0.250, 0.522)
60.0	(0.251, 0.523)	(0.250, 0.523)
70.0	(0.248, 0.521)	I <= 10% peak
80.0	(0.251, 0.522)	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 0.5 / 2.5 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-20010-2

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 25 X 3G2S XXXX

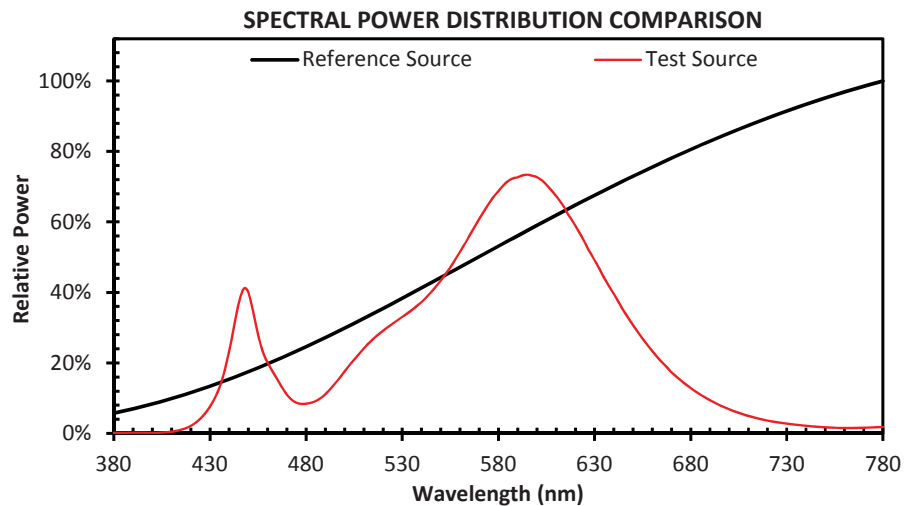
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.

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

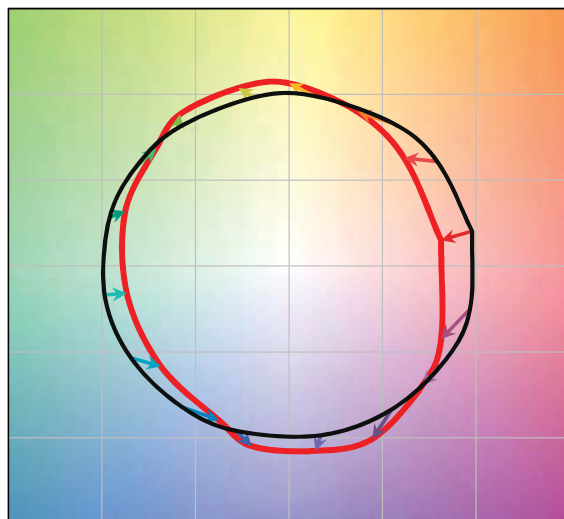
One Osram Optotronic LED driver. Model: QT180W/UNV/1250C/2DIM/P6 set to 750 ma.

Operating at 120v AC and 60 Hz.

R_f	73
R_g	93



COLOR VECTOR GRAPHIC



— Test Source

→ Series1

COLOR DISTORTION GRAPHIC





Test Report No. LLI-20010-2

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 660M X 5 25 X 3G2S 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 750 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.