



Report of Test LLI-19214-18

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 H16S X 5 40 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: QT 100/120-277/800 2DIMLT2 P set to 800ma.
Operating at 120v AC and 60 Hz.



Performance Summary

Total Light Output	8933 lm	Min Power Factor	0.92 @ 277 V
Luminaire Power	81.0 W	Max THD(i)*	14.0 % @ 277 V
Luminous Efficacy	110.3 lm/W	0-90° Zonal Flux %	100.0 %
CCT	3070 K	80-90° Zonal Flux %	0.9 %
CIE(x,y) 1931	(0.430, 0.397)	BUG Rating*	B2-U0-G2
CRI	72	Street Classification*	Type III Medium

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



Test Report No. LLI-19214-18

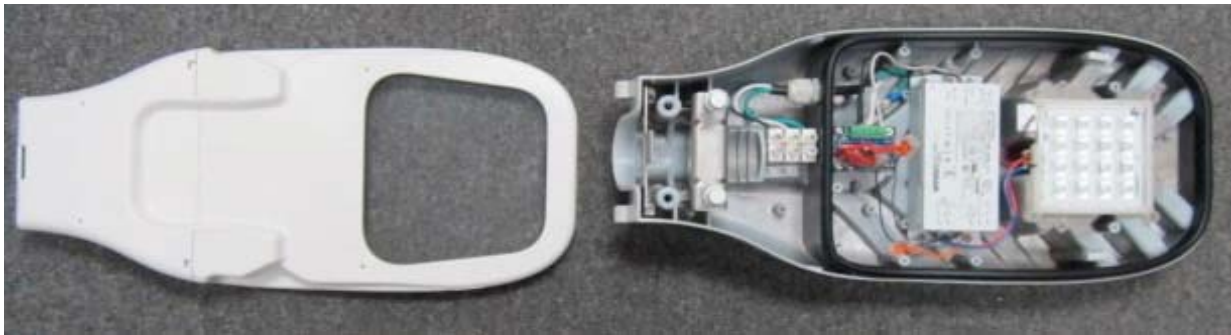
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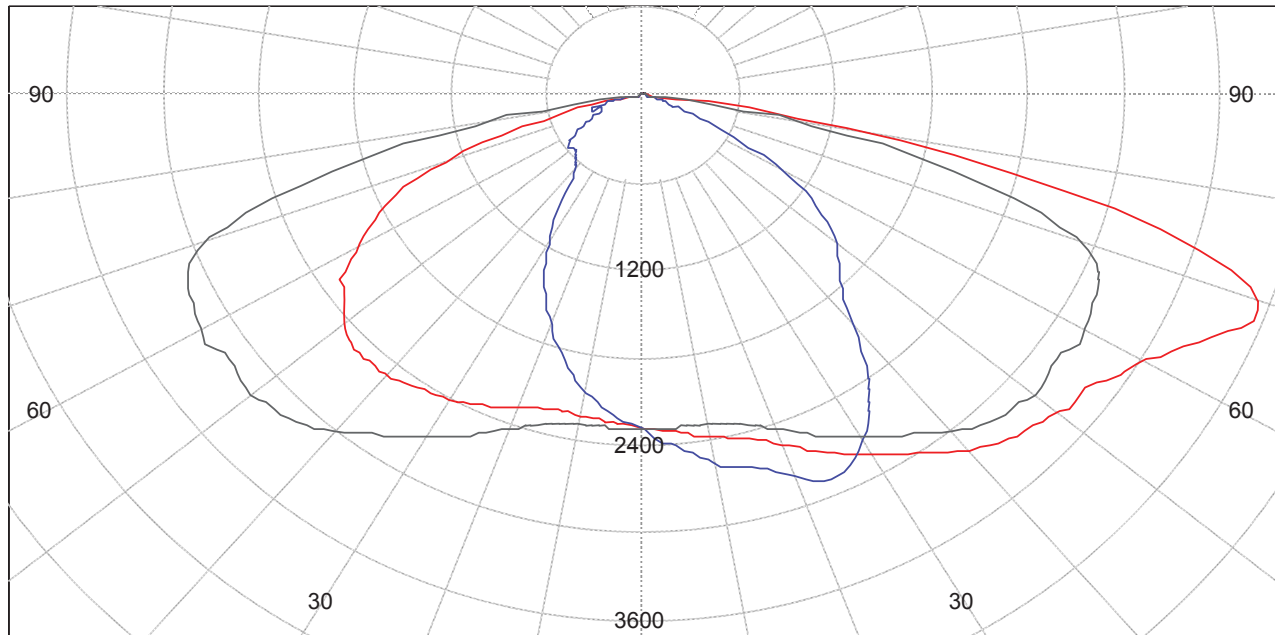




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Polar Light Distribution Curves



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 %	64.3 %	64.3 %
House Side	0.0 %	35.7 %	35.7 %
	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

28-Aug-2019
29-Aug-2019



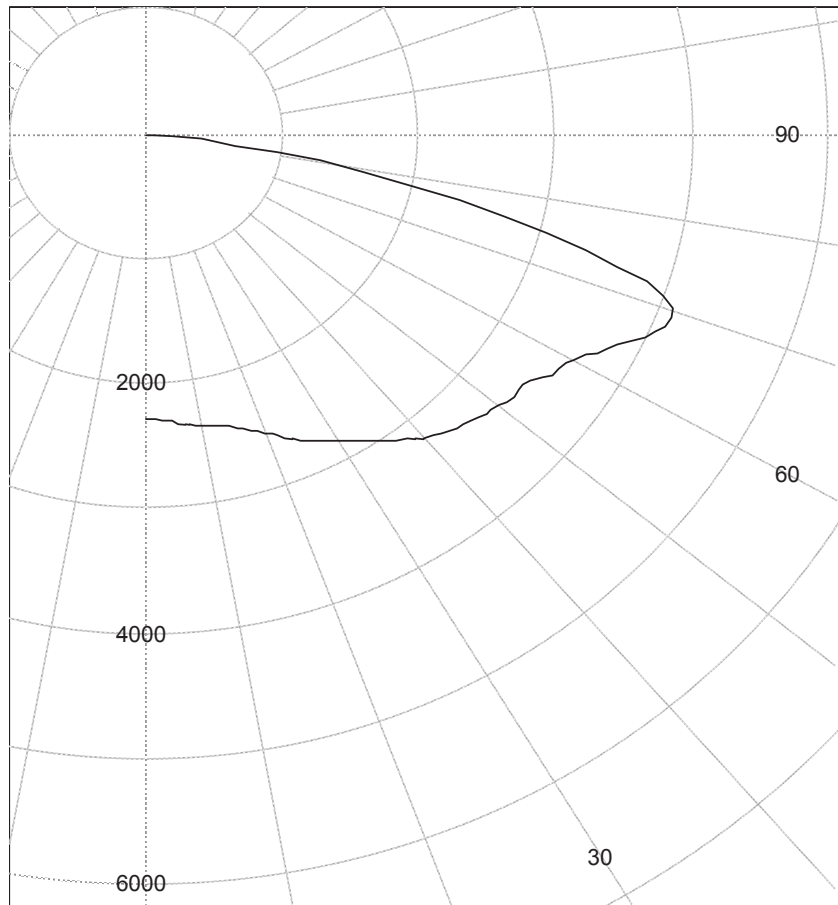
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Intensity in principal plane
(based on overall max intensity)

Vertical Angle (°)	Intensity (cd)
0.0	2283.0
10.0	2371.8
20.0	2546.1
30.0	2841.9
35.0	2999.7
40.0	3169.5
45.0	3289.9
47.5	3336.1
50.0	3380.1
52.5	3416.3
55.0	3444.0
57.5	3548.1
60.0	3620.4
62.5	3765.6
65.0	3919.3
67.5	4086.7
70.0	4102.7
72.5	3753.7
75.0	3041.7
77.5	2174.7
80.0	1292.7
82.5	533.8
85.0	54.7
87.5	6.8
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
3218.6 cd @ (90.0°, 58.5°)

Street side max intensity
4120.9 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.



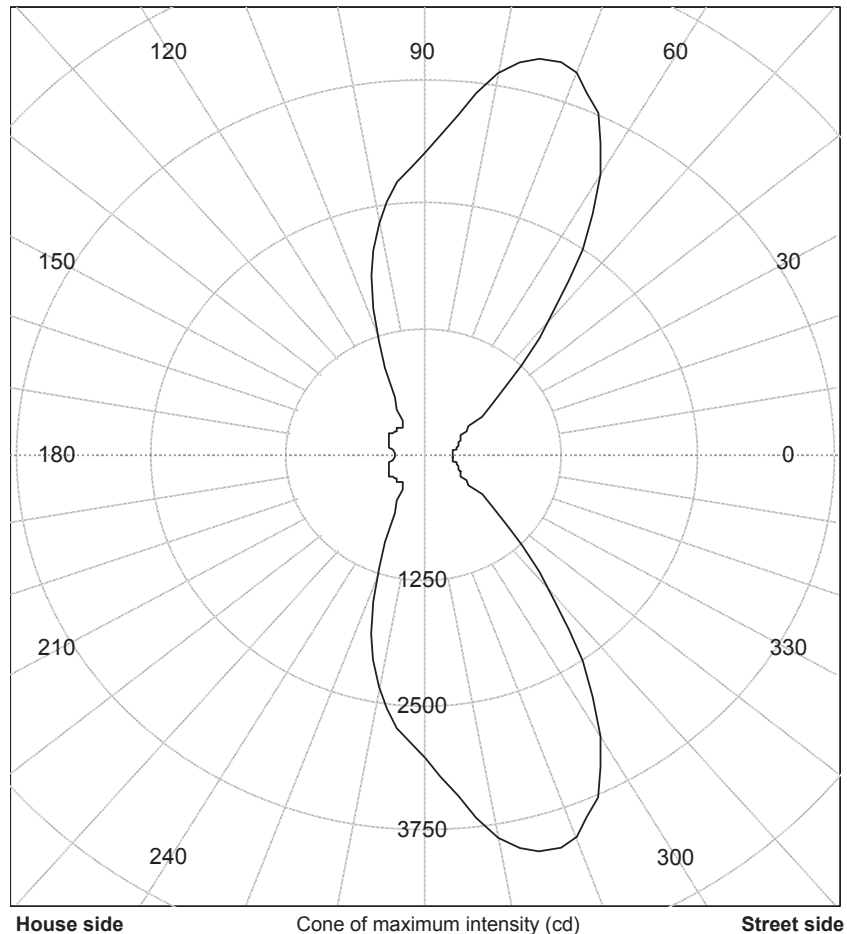
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Intensity in principal cone
(based on overall max intensity)

Lateral Plane (°)	(V68.5) (cd)
0	251.4
15	289.9
30	387.1
40	798.9
45	1270.6
50	1848.3
55	2513.9
60	3230.5
65	3768.4
70	4068.2
75	4103.9
80	3862.8
85	3424.2
90	3015.4
95	2733.6
100	2344.9
105	1842.9
110	1219.6
115	643.4
120	385.3
125	339.1
130	342.6
135	357.8
140	368.2
150	363.5
165	341.4
180	266.4

Principal Conical Surface



House side max intensity
3218.6 cd @ (90.0°, 58.5°)

Street side max intensity
4120.9 cd @ (72.5°, 68.5°)

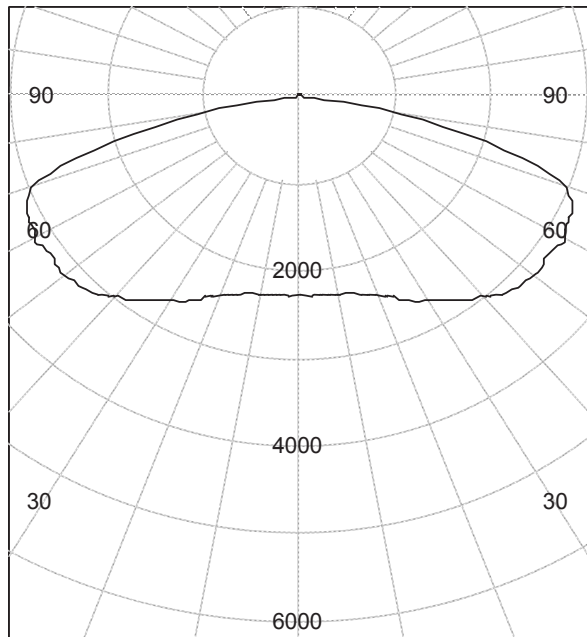
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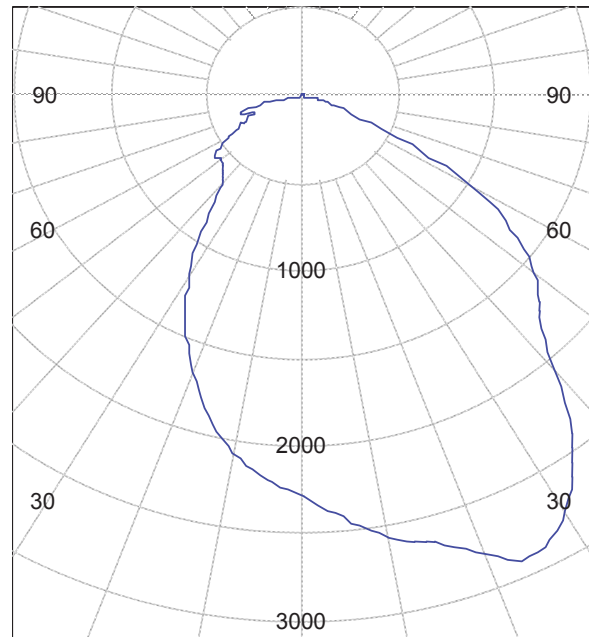
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Polar curve through L90 / L270



(L90) (cd) (L270)

Polar curve through L0 / L180



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



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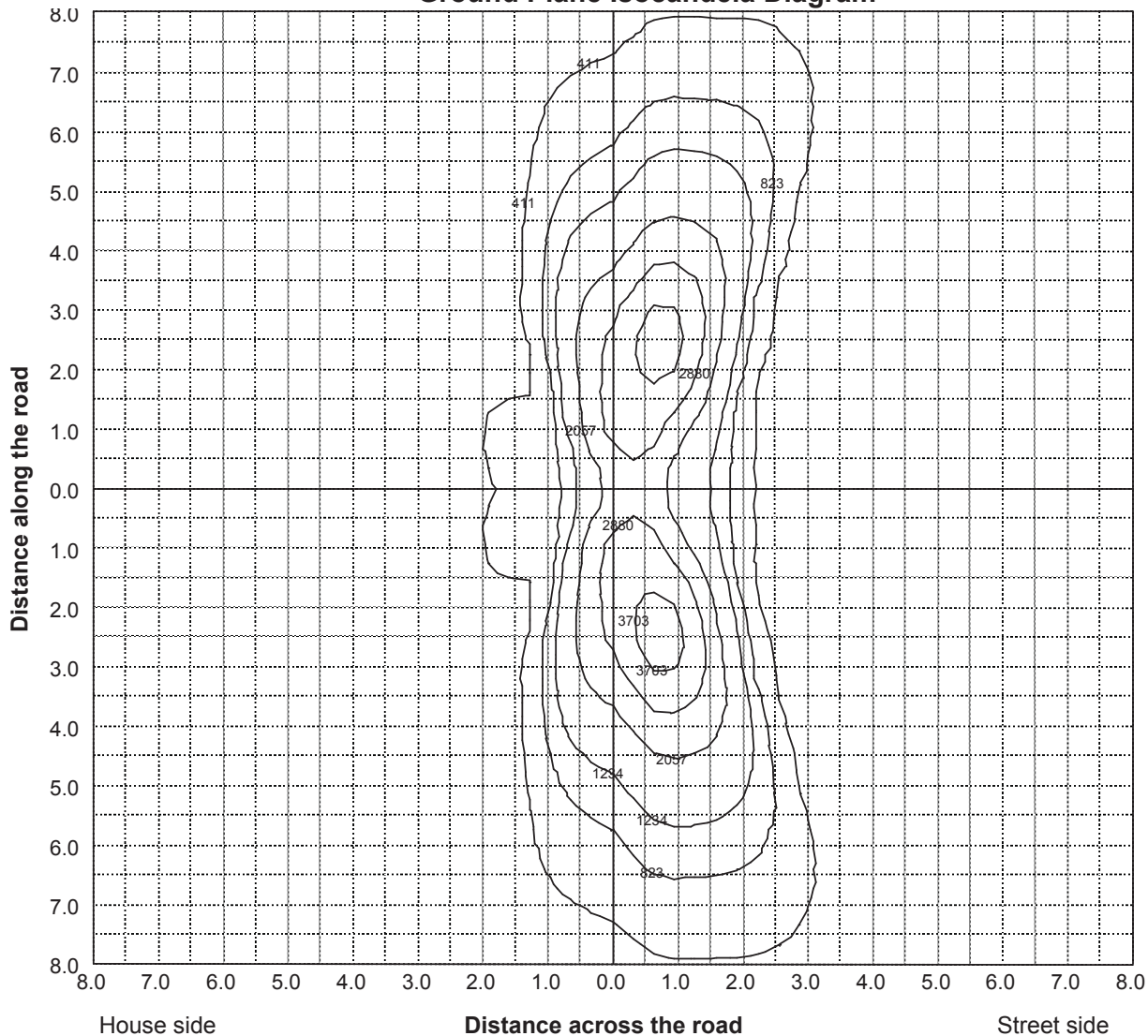
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Ground Plane Isocandela Diagram



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	2283	2283	2283	2283	2283	2283	2283	2283	2283
10.0	2555	2538	2512	2487	2468	2453	2436	2407	2390
20.0	2780	2756	2689	2661	2650	2646	2647	2626	2595
30.0	2737	2764	2872	2930	2918	2890	2869	2856	2855
35.0	2459	2527	2725	2909	2986	3041	3027	3001	2994
40.0	2026	2176	2466	2755	2901	3034	3135	3165	3164
45.0	1734	1806	2227	2551	2727	2923	3115	3258	3291
47.5	1656	1707	2111	2454	2654	2891	3102	3275	3333
50.0	1577	1615	1974	2353	2549	2813	3071	3284	3395
52.5	1467	1500	1843	2245	2466	2762	3058	3286	3408
55.0	1321	1357	1719	2141	2401	2721	3039	3305	3439
57.5	1176	1206	1578	2048	2350	2691	3026	3291	3470
60.0	956	1022	1419	1937	2280	2665	3057	3355	3529
62.5	690	768	1162	1754	2157	2602	3076	3433	3674
65.0	451	500	811	1426	1904	2409	2968	3454	3779
67.5	299	326	477	984	1473	2038	2681	3338	3807
70.0	199	245	309	546	948	1524	2208	3007	3646
72.5	145	185	229	307	494	920	1576	2441	3180
75.0	109	145	162	219	289	435	873	1715	2506
77.5	83	111	109	138	190	232	373	983	1720
80.0	61	78	65	78	99	117	163	411	953
82.5	27	37	31	37	41	46	63	136	366
85.0	9	9	11	13	14	16	17	22	44
87.5	3	3	4	5	5	5	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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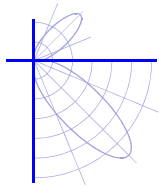
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One Osram Optotronic LED driver. Model: QT 100/120-277/800 2DIMLT2 P set to 800ma.

Operating at 120v AC and 60 Hz.

Intensity data (cd)

Vertical	L-Plane								
	L70	L75	L80	L85	L90	L95	L100	L105	L110
0.0	2283	2283	2283	2283	2283	2283	2283	2283	2283
10.0	2380	2363	2338	2316	2293	2275	2254	2238	2222
20.0	2568	2526	2507	2468	2431	2393	2352	2303	2246
30.0	2848	2827	2793	2751	2696	2642	2575	2481	2357
35.0	3008	2990	2951	2901	2840	2764	2673	2545	2387
40.0	3170	3161	3128	3072	3006	2914	2784	2614	2413
45.0	3294	3287	3255	3203	3130	3022	2857	2652	2402
47.5	3344	3331	3295	3249	3154	3034	2847	2621	2380
50.0	3396	3367	3342	3297	3193	3072	2857	2604	2315
52.5	3429	3391	3351	3293	3177	3042	2818	2542	2224
55.0	3457	3419	3371	3287	3154	3001	2762	2477	2135
57.5	3545	3539	3480	3358	3201	3044	2776	2424	2005
60.0	3616	3609	3532	3397	3185	2966	2660	2302	1859
62.5	3763	3745	3615	3414	3160	2919	2596	2201	1711
65.0	3910	3900	3735	3452	3135	2866	2514	2076	1543
67.5	4047	4070	3843	3452	3070	2790	2407	1921	1325
70.0	4023	4099	3833	3319	2880	2600	2221	1696	1042
72.5	3615	3789	3554	2987	2519	2261	1906	1375	741
75.0	2917	3103	2990	2447	2006	1800	1498	989	473
77.5	2094	2221	2164	1800	1420	1265	1023	594	279
80.0	1235	1316	1304	1139	856	751	559	284	155
82.5	512	537	509	471	351	301	217	102	64
85.0	56	52	51	50	44	41	33	24	21
87.5	6	7	7	7	7	7	7	7	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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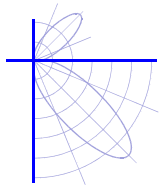
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Operating at 120v AC and 60 Hz.

Intensity data (cd)

Vertical	L-Plane								
	L115	L120	L125	L130	L135	L140	L150	L165	L180
0.0	2283	2283	2283	2283	2283	2283	2283	2283	2283
10.0	2206	2191	2174	2158	2139	2128	2105	2076	2071
20.0	2182	2115	2045	1978	1915	1867	1785	1704	1679
30.0	2220	2077	1924	1778	1644	1534	1376	1241	1186
35.0	2213	2037	1852	1663	1483	1337	1133	950	881
40.0	2191	1965	1729	1493	1272	1089	848	693	659
45.0	2118	1822	1524	1234	983	792	652	609	587
47.5	2051	1718	1390	1085	832	678	617	592	573
50.0	1969	1597	1238	922	699	606	590	585	563
52.5	1848	1443	1072	767	609	565	568	592	573
55.0	1705	1255	870	637	553	541	556	608	547
57.5	1524	1046	688	539	514	524	553	567	481
60.0	1342	847	550	471	480	500	527	491	427
62.5	1148	664	459	421	446	471	478	434	375
65.0	943	519	398	385	412	427	427	392	329
67.5	724	417	356	355	373	384	382	352	275
70.0	534	342	314	321	333	344	336	336	283
72.5	386	276	267	277	278	299	277	373	345
75.0	271	216	214	219	220	239	261	326	291
77.5	182	157	152	151	157	176	202	217	213
80.0	115	97	91	88	97	107	108	123	142
82.5	54	45	42	40	41	41	30	36	66
85.0	18	15	13	10	9	9	7	6	6
87.5	5	4	4	3	3	2	1	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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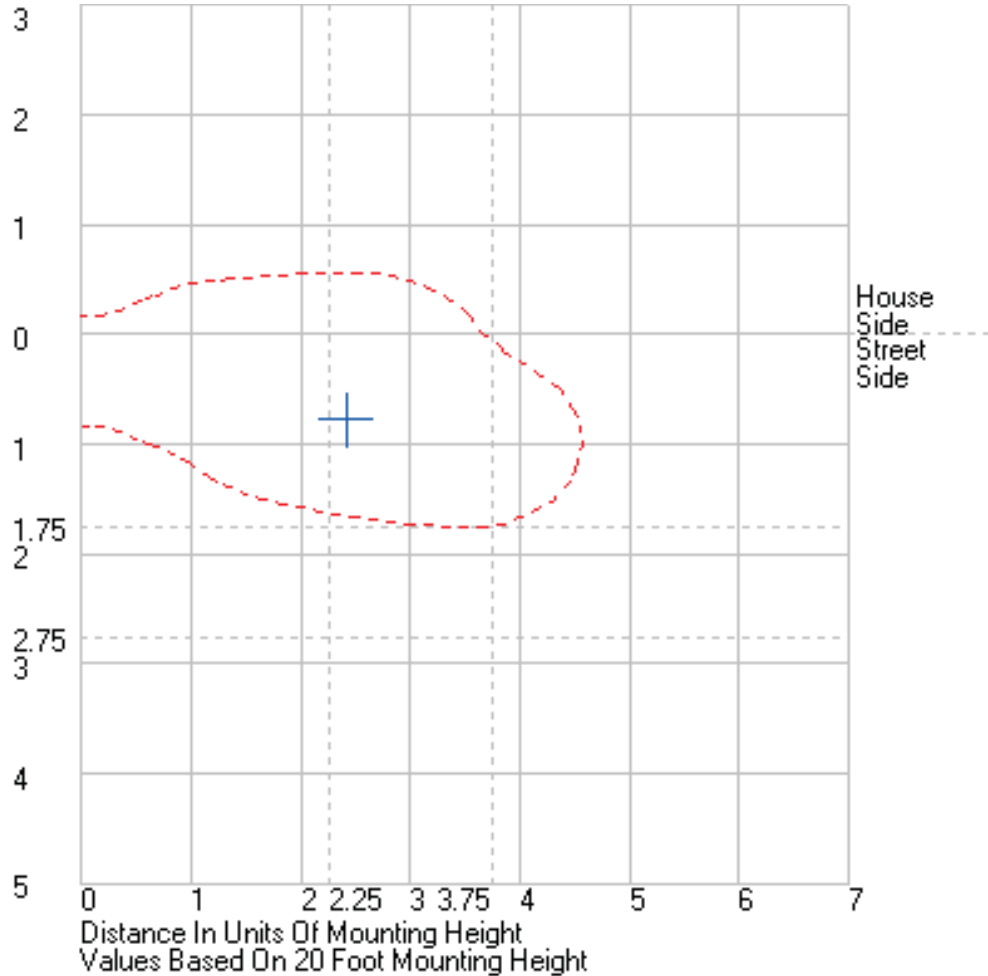
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.430, 0.397)
	CIE 1976 (u', v') ⁽¹⁾	(0.249, 0.518)
	Correlated Color Temperature (CCT) ⁽¹⁾	3070 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	0.0144
	Color Rendering Index (Ra) ⁽¹⁾	71.9
	Special CRI 9 (R ₉) ^{(1),(3)}	-26.5
	Distance from Planckian Locus (Duv) ^{(1),(3)}	-1.71E-03
	Scotopic/Photopic Ratio ^{(1),(3)}	1.22

Electrical	Voltage	120.0 V	(Setpoint 1)
	Frequency	60.0 Hz	
	Current	0.680 A	
	Power	81.0 W	
	Power Factor	0.99	
	Current THD	6.7 %	
	Voltage	277.0 V	(Setpoint 2)
	Frequency	60.0 Hz	
	Current	0.311 A	
	Power	79.6 W	
	Power Factor	0.92	
	Current THD	14 %	

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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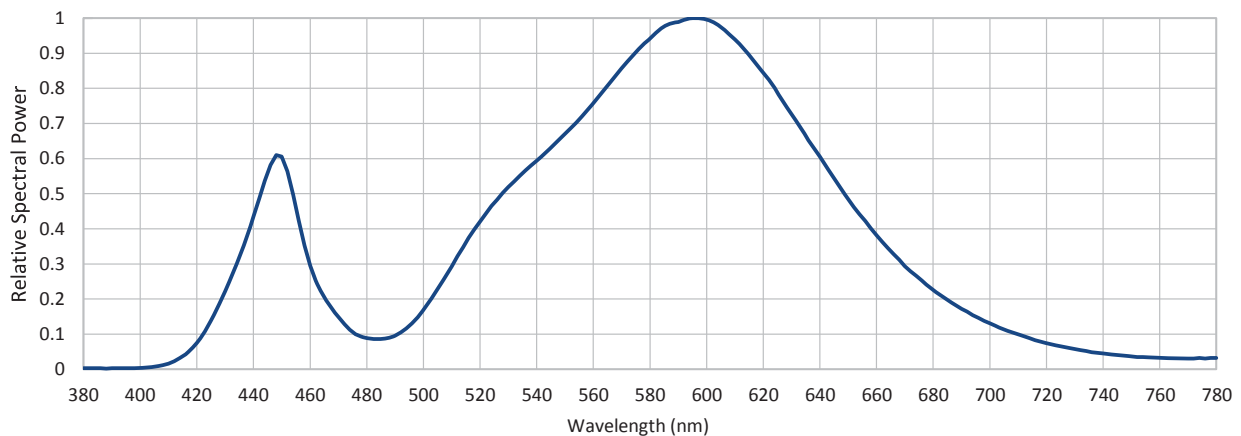
Operating at 120v AC and 60 Hz.

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	0.295	540	0.594	620	0.845	700	0.131
385	0.003	465	0.206	545	0.631	625	0.788	705	0.113
390	0.003	470	0.148	550	0.670	630	0.727	710	0.099
395	0.003	475	0.107	555	0.712	635	0.665	715	0.086
400	0.004	480	0.089	560	0.758	640	0.606	720	0.074
405	0.007	485	0.086	565	0.807	645	0.543	725	0.065
410	0.016	490	0.096	570	0.857	650	0.485	730	0.058
415	0.037	495	0.124	575	0.903	655	0.431	735	0.051
420	0.075	500	0.170	580	0.942	660	0.382	740	0.045
425	0.140	505	0.228	585	0.975	665	0.337	745	0.041
430	0.222	510	0.293	590	0.989	670	0.294	750	0.037
435	0.320	515	0.361	595	1.000	675	0.259	755	0.034
440	0.434	520	0.421	600	0.996	680	0.226	760	0.032
445	0.560	525	0.474	605	0.974	685	0.198	765	0.031
450	0.606	530	0.519	610	0.939	690	0.172	770	0.031
455	0.460	535	0.558	615	0.895	695	0.150	775	0.031
								780	0.032





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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	(0.247, 0.512)	(0.247, 0.512)
10.0	(0.247, 0.512)	(0.248, 0.513)
20.0	(0.247, 0.513)	(0.249, 0.514)
30.0	(0.248, 0.513)	(0.249, 0.518)
40.0	(0.248, 0.514)	(0.248, 0.519)
50.0	(0.248, 0.516)	(0.250, 0.524)
60.0	(0.249, 0.517)	(0.253, 0.531)
70.0	(0.249, 0.517)	I <= 10% peak
80.0	(0.250, 0.527)	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 7.25 / 19.5 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-19214-18

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 H16S X 5 40 3G2S XXXX XXXX

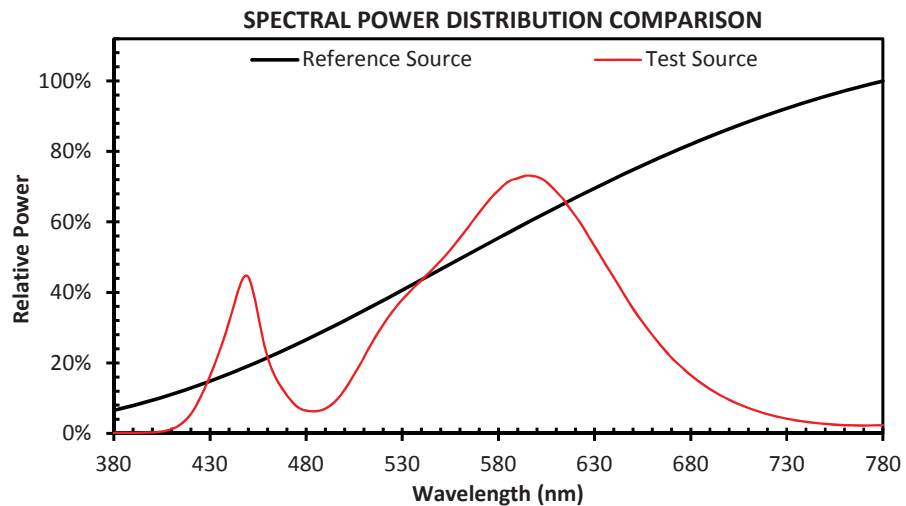
Grey cast aluminum top housing and white plastic bottom housing with clear flat glass lens.

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

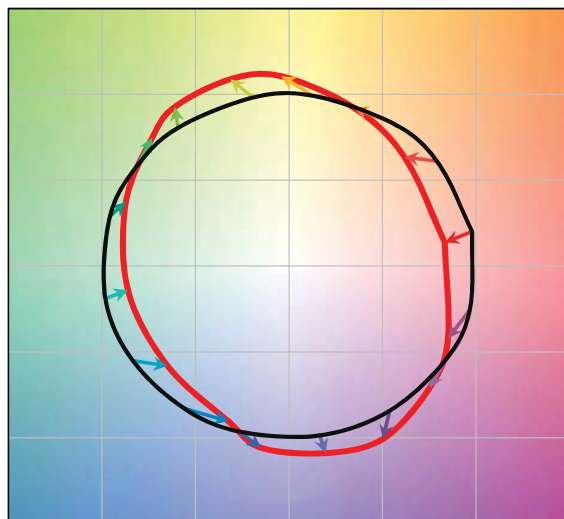
One Osram Optotronic LED driver. Model: QT 100/120-277/800 2DIMLT2 P set to 800ma.

Operating at 120v AC and 60 Hz.

R_f	70
R_g	96



COLOR VECTOR GRAPHIC



— Test Source

→ Series1

COLOR DISTORTION GRAPHIC





Test Report No. LLI-19214-18

LED Roadway Lighting - Roadway luminaire. Product ID: QB 00 H16S X 5 40 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: QT 100/120-277/800 2DIMLT2 P set to 800ma.
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.