IESNA LM79-2008 Test Report

TÜV SÜD America

Photometric Testing and Evaluation in Accordance with LM79-2008

Report Prepared for:

Ivars Lauzums
Certification Manager

Lighting Science Group Corporation
1227 South Patrick Drive, Bldg. 2A
Satellite Beach, FL 32937
USA

Telephone: (321) 779-5528

Sample Tested:	**LS 38 90WE NW NFL G1 BX**
Manufacturer:	**Lighting Science Group Corporation**
Technical Report Number:	**JI1400199-14-LM79**
Report Issue Date:	**January 23rd, 2014**
Total Number of Pages:	**10** (including this page)

Report Prepared by:
Byrd Evans
TÜV SÜD Project Handler

Report Reviewed by:
Bryan Cubitt
TÜV SÜD Program Manager

IESNA LM79-2008
TEST REPORT

January 23, 2014

Summary of Key Test Results

Model#	**LS 38 90WE NW NFL G1 BX**
Manufacturer	LSGC
TÜV Sample#	1183-14
Date of Test	January 14th 2014

Notes:

Tested in LBU orientation (Lamp-Base-Up)

Parameter	Measured Result
Luminous Flux	**1220.0 Lumens**
Input Power	**17.57 Watts**
Efficacy	**69.44 Lumens/Watt**
C.C.T.	**4084 K**
C.R.I. (R_a)	**83.8**
Stabilization Time	**60 minutes**

The above results are recorded / derived from measurements in accordance with LM79-08

IESNA LM79-2008
TEST REPORT

January 23, 2014

TABLE OF CONTENTS

IESNA LM79-2008
TEST REPORT

January 23, 2014

Test Results –

The following results were obtained after stabilization of the sample in accordance with the requirements set forth in section 5.0 of IES LM79-2008. Stability is achieved when the variation of 3 readings of light output and electrical power over a period of 30 minutes, taken 15 minutes apart, is less than 0.5%.

Photometric Results	LS 38 90WE NW NFL G1 BX	
	Integrating Sphere	Goniophotometer
Total Luminous Flux (Lumens)	1220.0	1225.6
Luminous Efficacy (Lumens/Watt)	69.44	69.68
Total Radiant Flux (Watts)	3.9	-
Correlated Color Temperature (CCT)	4084	-
Color Rendering Index (CRI – R_a)	83.8	-
R_9 Value	19.8	-
Chromaticity (Chroma x / Chroma y)	0.3766 / 0.3741	-
Chromaticity (Chroma u / Chroma v)	0.2236 / 0.3332	-
Chromaticity (Chroma u' / Chroma v')	0.2236 / 0.4998	-
D_{uv} Value	-0.00011	-

Electrical Results	LS 38 90WE NW NFL G1 BX	
	Integrating Sphere	Goniophotometer
Input Power (Watts)	17.57	17.59
Input Voltage (Volts AC)	119.98	120.00
Input Current (Amps)	0.156	0.160
Power Factor	0.939	0.940
Input Frequency (Hertz)	60.0	60.0
A-THD (Current %)	34.31 %	34.09 %

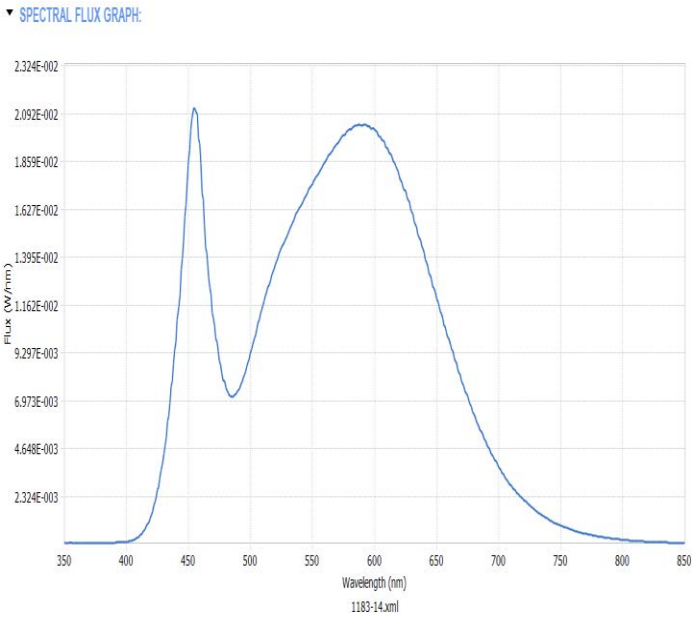
Additional Parameters	LS 38 90WE NW NFL G1 BX	
	Integrating Sphere	Goniophotometer
Stabilization Time (Light and Power)	60 minutes	60 minutes
Test Geometry Configuration	4π	Type C
Spectroradiometer	Labsphere CDS1100	Gigahertz Optik P9801
Ambient Temperature	24.7 °C	24.5 °C
ISTMT (In-Situ Temperature Measurement)	Not tested	
Spacing Criteria	N/A	

IESNA LM79-2008
TEST REPORT

January 23, 2014

Spectral Flux and Chromaticity Diagram

Spectral Flux

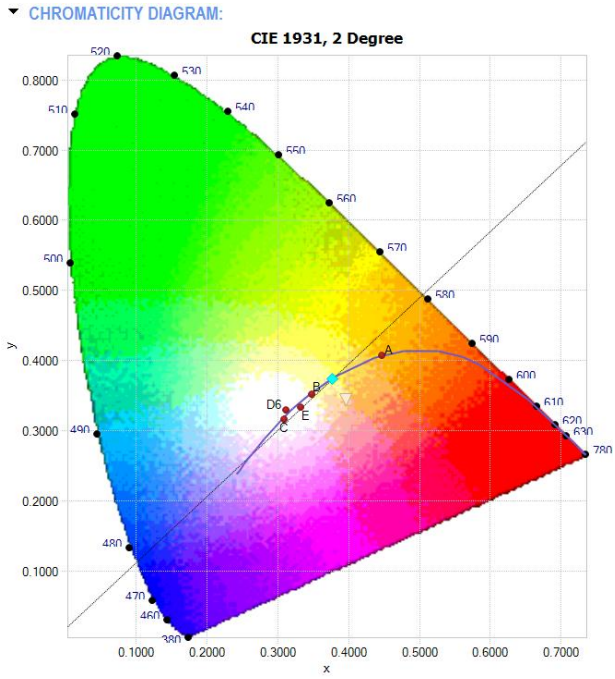


Spectral response of the Radiant Flux

(350nm to 850nm)

Parameter	Stable Data
Peak Wavelength (nm)	454.8
Dominant Wavelength (nm)	578.8

Chromaticity Diagram



Tristimulus values (from page 5):

x / y = 0.3766 / 0.3741

The locations on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Zonal Lumen Summary

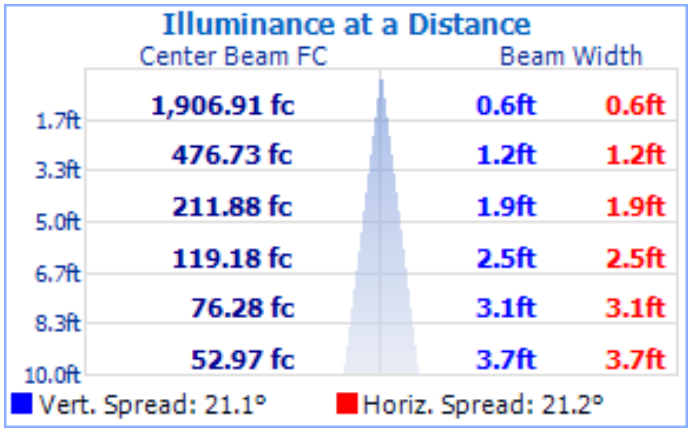
Zone	Lumens	% Lamp / Luminaire
0 - 60	1164.6	95.0 %
60 - 90	61.0	5.0 %
0 - 90	1225.6	100 %
90 - 180	0.0	0.0 %
0 - 180	1225.6	100 %

IESNA LM79-2008
TEST REPORT

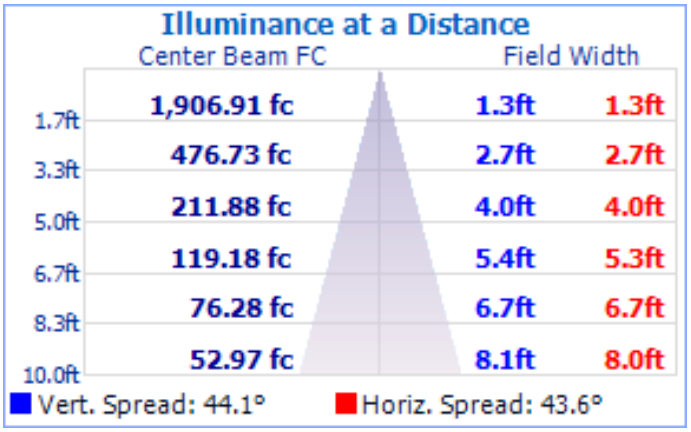
January 23, 2014

Test Results – Illuminance Plots

The following images depict the illuminance characteristics of the luminaire.



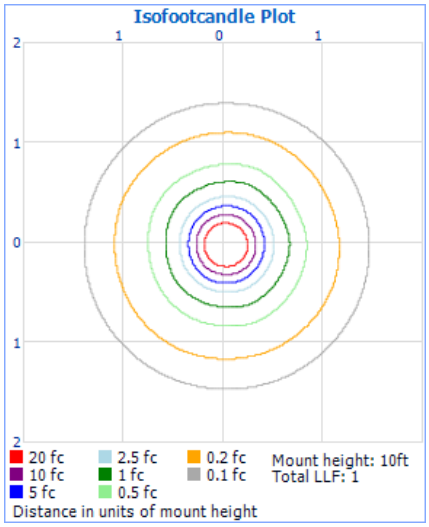
Beam Angle = 21.1°



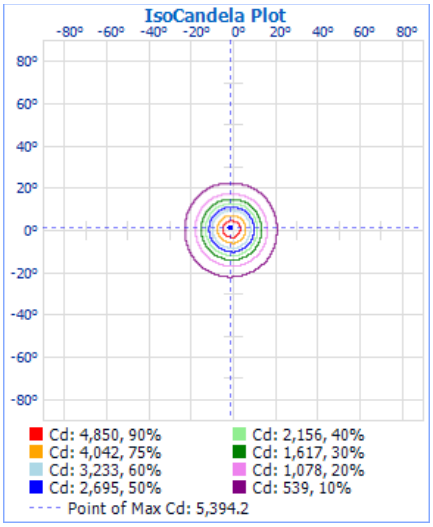
Field Angle = 44.1°

Test Results – Candela Plots

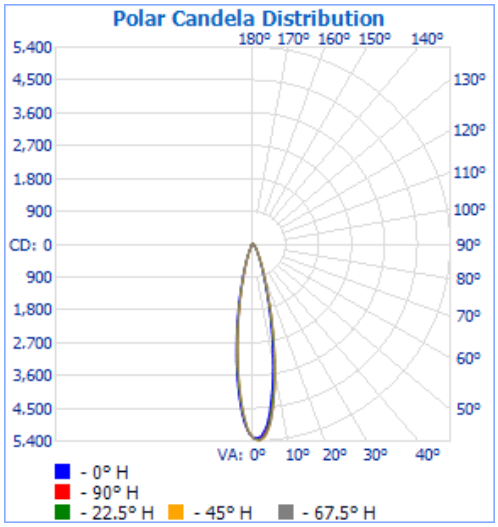
The following images depict the luminous intensity distribution characteristics of the luminaire:



Isofootcandle Plot



Isocandela Plot



Polar Candela

IESNA LM79-2008
TEST REPORT

January 23, 2014

Test Results – Candela Tabulation

The table below displays the tabulated Candela measurements from the IES file:
Horizontal (lateral) angles are shown in **red** across the top of the table, in increments of 22.5°.
Vertical (longitudinal) angles are shown in **blue** down the side of the table, in increments of 0.5 and 2.5°.

	0.0	22.5	45.0	67.5	90.0	112.5	135.0	157.5	180.0	202.5	225.0	247.5	270.0	292.5	315.0	337.5	360.0
0.0	5297	5297	5297	5297	5297	5297	5297	5297	5297	5297	5297	5297	5297	5297	5297	5297	5297
0.5	5290	5343	5336	5350	5337	5322	5280	5243	5245	5234	5253	5241	5251	5265	5283	5303	5290
1.0	5327	5345	5365	5354	5330	5305	5240	5214	5210	5183	5155	5179	5196	5244	5260	5307	5327
1.5	5298	5343	**5394**	5373	5337	5270	5217	5136	5131	5108	5071	5102	5131	5186	5245	5278	5298
2.0	5290	5364	5381	5383	5331	5258	5176	5048	5035	4989	4977	4981	5025	5091	5191	5261	5290
2.5	5258	5339	5350	5350	5287	5213	5086	4973	4952	4872	4842	4846	4902	5005	5104	5235	5258
3.0	5186	5288	5344	5307	5235	5133	5001	4870	4839	4758	4694	4716	4789	4909	5028	5168	5186
3.5	5117	5246	5303	5275	5197	5055	4919	4724	4684	4607	4558	4568	4658	4768	4935	5067	5117
4.0	5037	5187	5222	5212	5122	4978	4789	4593	4553	4437	4402	4389	4485	4621	4800	4986	5037
4.5	4943	5080	5141	5116	5013	4865	4655	4456	4411	4291	4220	4236	4323	4487	4658	4880	4943
5.0	4804	4964	5062	5030	4914	4723	4509	4296	4253	4136	4052	4084	4171	4331	4527	4730	4804
5.5	4683	4856	4941	4941	4807	4615	4388	4124	4074	3950	3896	3905	3993	4145	4368	4582	4683
6.0	4516	4713	4788	4801	4654	4467	4212	3965	3918	3775	3725	3726	3806	3984	4187	4448	4516
6.5	4342	4545	4655	4647	4493	4301	4040	3811	3761	3620	3540	3565	3639	3826	4028	4278	4342
7.0	4177	4390	4514	4510	4350	4131	3892	3637	3571	3448	3380	3396	3475	3645	3867	4100	4177
7.5	4021	4239	4338	4351	4183	3972	3731	3467	3408	3264	3217	3210	3291	3457	3683	3942	4021
8.0	3852	4059	4163	4161	3999	3792	3548	3318	3251	3103	3036	3040	3112	3291	3500	3777	3852
8.5	3648	3876	4011	3982	3829	3612	3379	3144	3083	2940	2868	2880	2948	3116	3333	3593	3648
9.0	3497	3712	3833	3821	3673	3441	3218	2983	2905	2763	2710	2710	2781	2924	3159	3405	3497
9.5	3313	3541	3642	3631	3487	3274	3037	2815	2751	2598	2549	2539	2600	2760	2972	3247	3313
10.0	3135	3358	3464	3442	3302	3092	2869	2668	2598	2449	2382	2386	2442	2596	2798	3066	3135
10.5	2972	3179	3297	3280	3138	2922	2713	2502	2432	2298	2233	2232	2289	2427	2633	2878	2972
11.0	2802	3021	3111	3104	2966	2764	2567	2340	2275	2140	2097	2078	2130	2259	2460	2719	2802
11.5	2616	2838	2920	2916	2783	2588	2397	2197	2138	2000	1955	1941	1981	2112	2293	2559	2616
12.0	2459	2661	2761	2743	2618	2420	2254	2062	2004	1869	1817	1818	1849	1969	2147	2389	2459
12.5	2312	2506	2598	2589	2466	2272	2119	1923	1861	1736	1697	1692	1724	1819	2001	2224	2312
13.0	2153	2344	2425	2427	2305	2127	1975	1794	1744	1616	1582	1563	1595	1691	1857	2082	2153
13.5	2001	2183	2268	2259	2142	1986	1837	1679	1622	1509	1469	1454	1480	1573	1723	1939	2001
14.0	1867	2031	2128	2117	2004	1846	1719	1560	1509	1404	1363	1351	1377	1455	1604	1796	1867
14.5	1747	1898	1983	1979	1873	1735	1606	1455	1400	1300	1270	1248	1271	1344	1486	1673	1747
15.0	1612	1766	1839	1836	1737	1611	1491	1357	1306	1208	1167	1157	1171	1248	1375	1562	1612
17.5	1095	1219	1286	1269	1204	1109	1016	958	910	836	807	793	798	847	942	1017	1095
20.0	770	854	893	883	846	798	749	688	641	586	568	553	549	586	653	734	770
22.5	540	597	624	622	600	565	538	495	462	420	407	393	385	413	461	509	540
25.0	384	429	442	443	435	406	386	368	336	304	299	285	273	296	329	361	384
27.5	282	318	322	323	322	295	283	273	247	224	226	212	200	218	246	262	282
30.0	213	241	238	238	242	217	208	211	187	171	175	165	153	167	187	199	213
32.5	168	190	183	182	189	166	161	167	148	138	141	134	125	133	149	158	168
35.0	139	156	148	146	151	132	131	138	124	118	119	116	109	114	125	133	139
37.5	120	133	127	125	126	113	112	118	107	103	104	102	97	100	109	116	120
40.0	107	116	112	110	109	99	99	102	95	91	92	91	87	90	97	104	107
42.5	95	102	100	99	97	88	88	90	84	82	81	82	79	81	87	94	95

TÜV SÜD America, Inc.
5945 Cabot Parkway, Suite 100,
Alpharetta GA 30005
Telephone: 678-341-5900 www.tuvamerica.com

IESNA LM79-2008
TEST REPORT

January 23, 2014

Test Results – Candela Tabulation cont'd

	0.0	22.5	45.0	67.5	90.0	112.5	135.0	157.5	180.0	202.5	225.0	247.5	270.0	292.5	315.0	337.5	360.0
45.0	85	90	90	90	86	80	79	80	75	73	72	74	72	74	79	84	85
47.5	77	80	81	81	77	72	71	71	68	66	65	67	65	67	72	76	77
50.0	69	71	72	72	69	65	64	64	61	60	59	60	60	62	65	68	69
52.5	62	64	65	65	63	60	58	57	55	54	53	54	55	56	59	62	62
55.0	57	58	59	59	57	55	53	51	50	49	48	49	50	52	54	56	57
57.5	51	53	53	53	51	50	48	46	45	45	44	44	45	47	49	50	51
60.0	46	48	48	47	46	45	43	41	41	40	39	40	41	43	44	45	46
62.5	42	44	43	42	41	41	38	37	36	36	35	35	36	38	39	41	42
65.0	37	39	39	38	37	36	34	32	32	32	31	31	32	34	35	36	37
67.5	33	35	34	33	33	32	30	28	28	28	27	27	29	30	31	32	33
70.0	29	31	30	29	28	28	26	24	24	24	23	24	25	26	27	28	29
72.5	25	27	26	25	24	24	22	21	21	21	20	20	21	22	23	24	25
75.0	21	23	22	21	21	20	19	17	17	17	16	17	17	19	20	21	21
77.5	18	19	18	18	17	17	15	14	14	14	13	13	14	15	16	17	18
80.0	14	15	15	14	13	13	11	10	10	10	10	10	10	11	12	13	14
82.5	10	11	11	10	10	9	8	7	7	7	6	7	7	8	9	10	10
85.0	7	7	7	7	7	6	5	4	4	4	3	3	4	5	6	7	7
87.5	4	4	4	4	3	3	2	1	1	1	1	1	1	2	3	3	4
90.0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1

Maximum Candela = **5394.2** at Horizontal 45.0°, Vertical: 1.5°

IESNA LM79-2008
TEST REPORT

January 23, 2014

TÜV SÜD Photometric Testing Information

Testing is performed in accordance with the procedures outlined in IESNA LM79-2008. The sample is evaluated for photometric and electrical characteristics using an integrating sphere and a goniophotometer, located in an accredited, temperature and humidity-controlled, draft free photometric laboratory.

Sphere Geometry

The integrating spheres used for measurement utilize a "4π geometry" configuration in accordance with section 9 of IES LM-79-2008 and is applicable for all types of SSL products (directional and non-directional light projections). The spectroradiometer is an array-type detector manufactured and calibrated by Labsphere (Model# CDS1100).

Self-Absorption Correction

The integrating sphere uses self-absorption correction to eliminate errors due to mismatches between the standard reference lamp and the test samples being measured. This auxiliary correction lamp is a halogen type lamp powered by a calibrated Lamp Power Supply manufactured and calibrated by Labsphere (model LPS150). Ambient temperature is measured using a thermocouple located inside the integrating sphere at the same height as the sample under test (UUT) and not more than 1 meter in horizontal distance away from the sample (section 2.2 of LM79-2008). The thermocouple is located behind a baffle in order to eliminate any direct optical radiation from the sample under test.

Sample Stabilization

The sample (UUT) is placed inside the integrating sphere and powered by a regulated and conditioned alternating or direct current supply. The stabilization times shown on the results pages of this report denote the time of the 3rd measurement (of the 3 consecutive readings) since this is the minimum time that the sample is assumed to have taken to reach stabilization in accordance with section 5.0 of LM79-2008.

Sphere Calibration

The integrating sphere is calibrated using a quartzline halogen lamp with the following specifications:

Manufacturer: EYE Lighting International
Model# J94/JD28V75W
Voltage = 28.0 Volts DC
Wattage = 75.0 Watts
Calibration Current = 2.679 Amperes
Luminous Flux = 1685 Lumens
Calibration Date = 2-17-2011 (calibrated by Labsphere – NIST traceable).

Continued…..

IESNA LM79-2008
TEST REPORT

January 23, 2014

TÜV SÜD Photometric Testing Information (continued)

Goniophotometer

The Goniophotometer is a Type C optical measurement system in accordance with section 9.3.1 of IESNA LM79-2008.

Goniophotometer Calibration

The Goniophotometer is calibrated using a frosted tungsten filament FDS/DZE lamp with the following specifications:

Manufacturer: General Electric
Part Number: CSB-110
Lamp Number: 105-A
Voltage: 16.71 Volts DC
Wattage: 150.0 Watts
Calibration Current: 4.847 Amperes
Luminous Intensity: 166.3 Candelas
Calibration Date: 11-07-2011 (NIST traceable)

TÜV SÜD Test Equipment List:

TÜV SÜD Sphere System – contains the following:			
Description	**Manufacturer / Model#**	**TÜV SÜD Ref#**	**Calibration Due Date**
Integrating Sphere	Labsphere LM760	SPH003	weekly
Spectroradiometer	Labsphere CDS1100	ATLE0048	9/7/2016
Power Analyzer	Yokogawa WT210	ATLE0058	3/7/2014
Power Source	Chroma 61602	AC003	N/A
Thermometer	Fluke 52-II	ATLE0008	11/17/2014
TÜV SÜD Goniophotometer System – contains the following:			
Goniophotometer	M.E. GONC01	GON001	weekly
Spectroradiometer	Gigahertz Optik P9801	GIG001	weekly
Power Analyzer	Yokogawa WT210	ATLE0031	11/16/2014
Power Source	Chroma 61602	AC006	N/A