IESNA LM79-2008 Test Report

TÜV SÜD America

Photometric Testing and Evaluation in Accordance with LM79-2008

Report Prepared for:

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Sample Tested:	**LS 38 120WE W27 NFL G1 BX**
Manufacturer:	**Lighting Science Group Corporation**
Technical Report Number:	**JI1400199-18-LM79**
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Summary of Key Test Results

Model#	**LS 38 120WE W27 NFL G1 BX**
Manufacturer	LSGC
TÜV Sample#	1183-18
Date of Test	January 14th 2014

Notes:

Tested in LBU orientation (Lamp-Base-Up)

Parameter	Measured Result
Luminous Flux	**1222.0 Lumens**
Input Power	**20.16 Watts**
Efficacy	**60.62 Lumens/Watt**
C.C.T.	**2599 K**
C.R.I. (R_a)	**82.6**
Stabilization Time	**60 minutes**

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

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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 120WE W27 NFL G1 BX	
	Integrating Sphere	Goniophotometer
Total Luminous Flux (Lumens)	1222.0	1228.1
Luminous Efficacy (Lumens/Watt)	60.62	60.98
Total Radiant Flux (Watts)	3.8	-
Correlated Color Temperature (CCT)	2599	-
Color Rendering Index (CRI – R_a)	82.6	-
R_9 Value	3.7	-
Chromaticity (Chroma x / Chroma y)	0.4690 / 0.4137	-
Chromaticity (Chroma u / Chroma v)	0.2670 / 0.3533	-
Chromaticity (Chroma u' / Chroma v')	0.2670 / 0.5299	-
D_{uv} Value	0.00045	-

Electrical Results	LS 38 120WE W27 NFL G1 BX	
	Integrating Sphere	Goniophotometer
Input Power (Watts)	20.16	20.14
Input Voltage (Volts AC)	120.04	119.98
Input Current (Amps)	0.175	0.180
Power Factor	0.958	0.959
Input Frequency (Hertz)	60.0	60.0
A-THD (Current %)	28.71 %	28.51 %

Additional Parameters	LS 38 120WE W27 NFL G1 BX	
	Integrating Sphere	Goniophotometer
Stabilization Time (Light and Power)	60 minutes	59 minutes
Test Geometry Configuration	4π	Type C
Spectroradiometer	Labsphere CDS1100	Gigahertz Optik P9801
Ambient Temperature	24.7 °C	2 °C
ISTMT (In-Situ Temperature Measurement)	Not tested	
Spacing Criteria	N/A	

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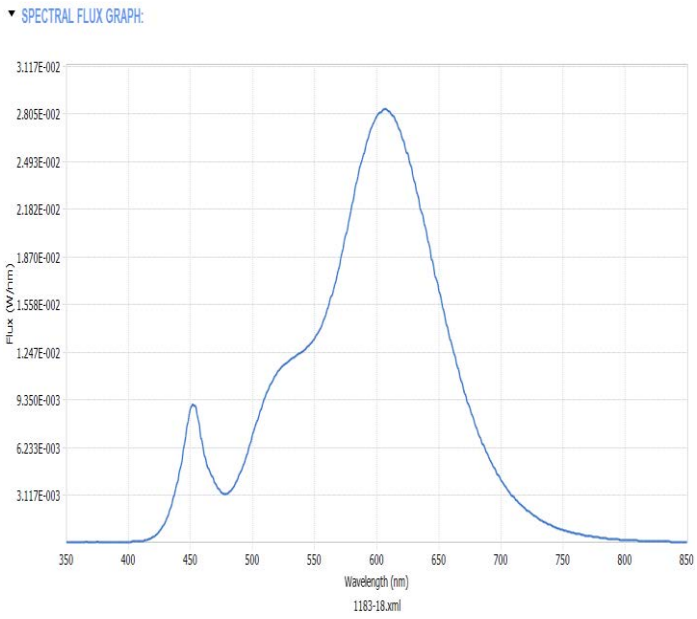
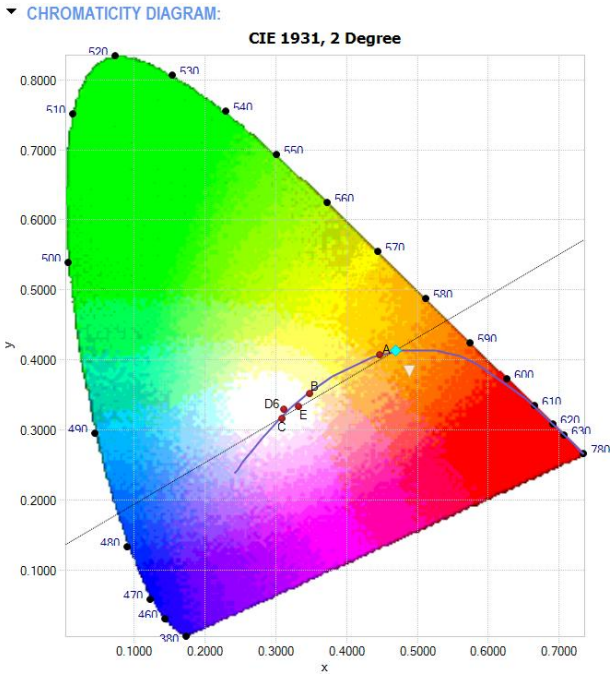
Spectral Flux and Chromaticity Diagram

Spectral Flux



Chromaticity Diagram



Spectral response of the Radiant Flux

(350nm to 850nm)

Parameter	Stable Data
Peak Wavelength (nm)	606.7
Dominant Wavelength (nm)	584.6

Tristimulus values (from page 5):

x / y = 0.4690 / 0.4137

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

Zonal Lumen Summary

Zone	Lumens	% Lamp / Luminaire
0 - 60	1167.4	95.1 %
60 - 90	60.7	4.9 %
0 - 90	1228.1	100 %
90 - 180	0.0	0.0 %
0 - 180	1228.1	100 %

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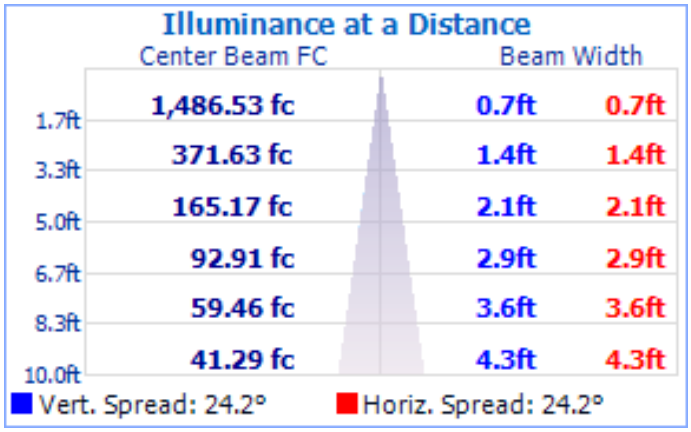
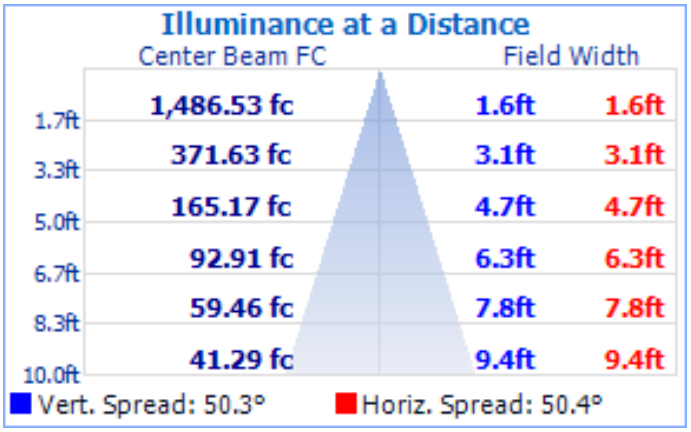
Test Results – Illuminance Plots

The following images depict the illuminance characteristics of the luminaire.



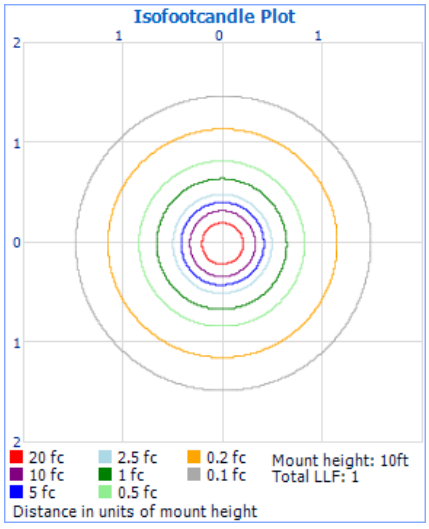


Beam Angle = 24.2°

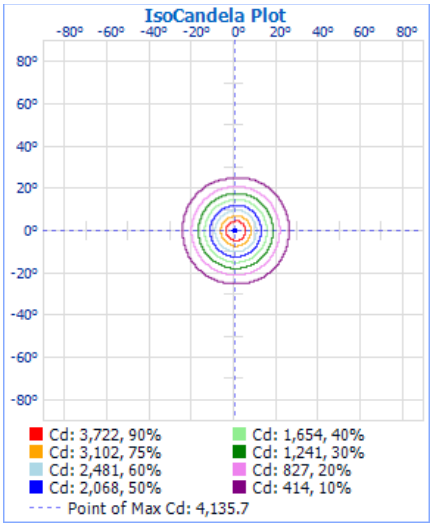
Field Angle = 50.3°

Test Results – Candela Plots

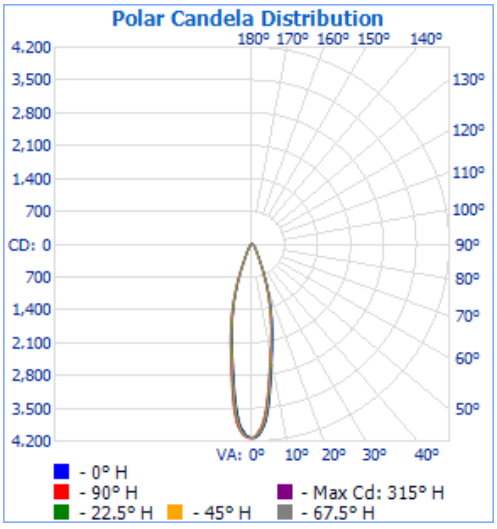
The following images depict the luminous intensity distribution characteristics of the luminaire:



Isofootcandle Plot



Isocandela Plot



Polar Candela

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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	4129	4129	4129	4129	4129	4129	4129	4129	4129	4129	4129	4129	4129	4129	4129	4129	4129
0.5	4127	4129	4125	4116	4107	4112	4110	4105	4117	4121	4122	4127	4133	4126	4127	4126	4127
1.0	4132	4108	4096	4080	4089	4074	4084	4072	4102	4116	4123	4126	4135	4132	**4136**	4127	4132
1.5	4103	4084	4065	4048	4044	4036	4034	4038	4085	4106	4118	4123	4117	4132	4124	4126	4103
2.0	4077	4062	4033	4011	3990	3993	3986	3998	4049	4075	4089	4099	4104	4116	4104	4106	4077
2.5	4033	4012	3980	3955	3942	3929	3933	3936	3994	4033	4054	4062	4086	4083	4087	4066	4033
3.0	3982	3948	3914	3892	3877	3860	3863	3870	3951	3980	4019	4033	4045	4054	4053	4032	3982
3.5	3922	3892	3855	3831	3793	3785	3779	3805	3894	3929	3962	3992	3996	4012	3997	3987	3922
4.0	3854	3822	3778	3739	3699	3686	3689	3703	3815	3862	3886	3927	3948	3955	3944	3926	3854
4.5	3771	3726	3670	3623	3593	3560	3566	3578	3715	3763	3814	3853	3886	3892	3892	3864	3771
5.0	3665	3611	3552	3505	3471	3440	3440	3459	3608	3659	3727	3772	3800	3814	3811	3796	3665
5.5	3560	3493	3436	3383	3345	3321	3315	3343	3489	3544	3608	3666	3703	3716	3706	3687	3560
6.0	3428	3359	3302	3245	3202	3188	3187	3205	3352	3416	3479	3540	3594	3605	3601	3565	3428
6.5	3296	3224	3161	3104	3070	3040	3047	3065	3225	3282	3352	3417	3467	3485	3484	3444	3296
7.0	3161	3088	3028	2973	2942	2916	2910	2939	3095	3151	3219	3287	3326	3345	3345	3320	3161
7.5	3021	2959	2895	2842	2809	2793	2797	2824	2960	3029	3080	3144	3194	3211	3218	3189	3021
8.0	2884	2814	2758	2710	2683	2673	2681	2701	2830	2892	2950	3006	3057	3084	3089	3046	2884
8.5	2756	2691	2640	2595	2578	2565	2571	2593	2717	2767	2829	2876	2914	2952	2956	2923	2756
9.0	2649	2585	2543	2500	2477	2475	2474	2505	2606	2655	2706	2754	2785	2817	2824	2791	2649
9.5	2538	2480	2442	2397	2377	2375	2381	2401	2503	2547	2591	2634	2676	2703	2706	2668	2538
10.0	2438	2379	2344	2305	2293	2280	2287	2308	2407	2440	2493	2533	2570	2593	2596	2557	2438
10.5	2338	2292	2260	2224	2215	2196	2198	2226	2321	2347	2398	2441	2466	2483	2481	2459	2338
11.0	2252	2209	2179	2142	2128	2115	2117	2143	2234	2261	2303	2347	2376	2385	2383	2366	2252
11.5	2169	2120	2092	2054	2042	2028	2039	2058	2143	2172	2215	2255	2290	2298	2297	2271	2169
12.0	2086	2035	2007	1972	1964	1946	1958	1976	2065	2089	2135	2172	2196	2213	2210	2191	2086
12.5	2006	1961	1931	1897	1889	1876	1883	1908	1986	2013	2053	2091	2113	2122	2122	2110	2006
13.0	1927	1882	1850	1816	1808	1799	1807	1830	1906	1936	1971	2005	2037	2043	2045	2027	1927
13.5	1845	1800	1769	1736	1732	1721	1730	1751	1829	1853	1894	1924	1958	1966	1971	1949	1845
14.0	1768	1731	1696	1666	1665	1649	1650	1675	1753	1777	1821	1847	1875	1884	1890	1877	1768
14.5	1704	1663	1627	1601	1594	1580	1579	1603	1678	1704	1745	1770	1799	1807	1813	1799	1704
15.0	1631	1590	1555	1529	1522	1504	1506	1520	1597	1628	1672	1693	1728	1734	1739	1721	1631
17.5	1275	1240	1201	1182	1173	1149	1152	1170	1244	1264	1317	1339	1366	1370	1373	1371	1275
20.0	955	921	879	856	849	832	830	845	906	929	964	985	1014	1026	1021	1018	955
22.5	650	623	597	574	565	547	548	563	608	627	664	683	711	714	724	712	650
25.0	431	411	391	378	370	361	363	373	404	418	440	451	470	474	474	471	431
27.5	300	289	278	268	261	255	256	265	285	293	308	317	326	326	327	324	300
30.0	229	220	212	205	199	195	196	203	216	222	234	239	246	246	245	242	229
32.5	184	178	172	167	162	159	160	165	174	178	186	190	194	194	194	192	184
35.0	152	148	143	138	135	133	135	138	145	149	155	159	162	162	162	160	152
37.5	127	124	120	117	116	114	116	118	123	125	131	134	136	136	135	133	127
40.0	107	105	102	101	100	99	100	102	106	107	111	114	116	116	114	112	107
42.5	92	90	88	87	87	88	88	89	92	92	96	98	99	99	97	96	92

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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	82	80	79	79	79	79	79	80	82	82	84	86	86	86	85	84	82
47.5	73	73	72	72	72	73	72	73	74	73	75	77	77	77	76	75	73
50.0	67	67	66	66	67	67	67	67	67	67	69	70	70	70	69	69	67
52.5	63	62	62	62	62	62	62	62	62	62	63	64	64	64	63	63	63
55.0	58	58	58	58	58	58	58	58	58	58	58	59	59	59	59	59	58
57.5	54	54	54	54	54	54	54	54	54	54	54	54	55	55	54	54	54
60.0	50	50	50	50	50	50	50	49	49	49	50	50	50	50	50	50	50
62.5	45	44	44	44	43	44	43	43	44	44	44	45	45	46	46	45	45
65.0	38	37	37	36	36	36	36	36	36	37	37	38	39	39	39	39	38
67.5	32	31	31	30	30	30	30	30	31	31	32	32	33	33	33	33	32
70.0	26	26	26	26	25	25	25	25	26	26	26	27	27	27	27	27	26
72.5	22	21	21	21	21	21	20	20	21	21	22	22	23	23	23	23	22
75.0	18	17	17	17	16	16	16	16	17	17	18	18	18	18	19	19	18
77.5	14	13	13	13	13	13	13	13	13	14	14	14	15	15	15	15	14
80.0	10	10	9	9	9	9	9	9	10	10	10	11	11	11	11	11	10
82.5	7	7	6	6	6	6	6	6	7	7	7	7	8	8	8	8	7
85.0	4	4	3	3	3	3	3	3	4	4	4	4	5	5	5	5	4
87.5	2	1	1	1	1	1	1	1	2	2	2	2	2	2	3	2	2
90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Maximum Candela = **4135.7** at Horizontal 315.0°, Vertical: 1.0°

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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…..

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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

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