

PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested
LVLB-VI-1-24-P23F-NW-23

Prepared for:

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Technical Report Number
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This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Program Description

Photometric and electrical testing of a “LVLB-VI-1-24-P23F-NW-23” replacement luminaire to IES LM-79-08.

Executive Summary

Sample Tested = LVLB-VI-1-24-P23F-NW-23

Sample #1

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
77.00	2200	28.57	0.9925

CCT (K)*	CRI*	Stabilization Time (Light & Power)
3975	84.19	60 minutes

* The above results are recorded / derived from measurements made using an Integrating Sphere

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Sample

The following sample was submitted for evaluation:

Bluegate Inc.: LVLB-VI-1-24-P23F-NW-23



LVLB-VI-1-24-P23F-NW-23

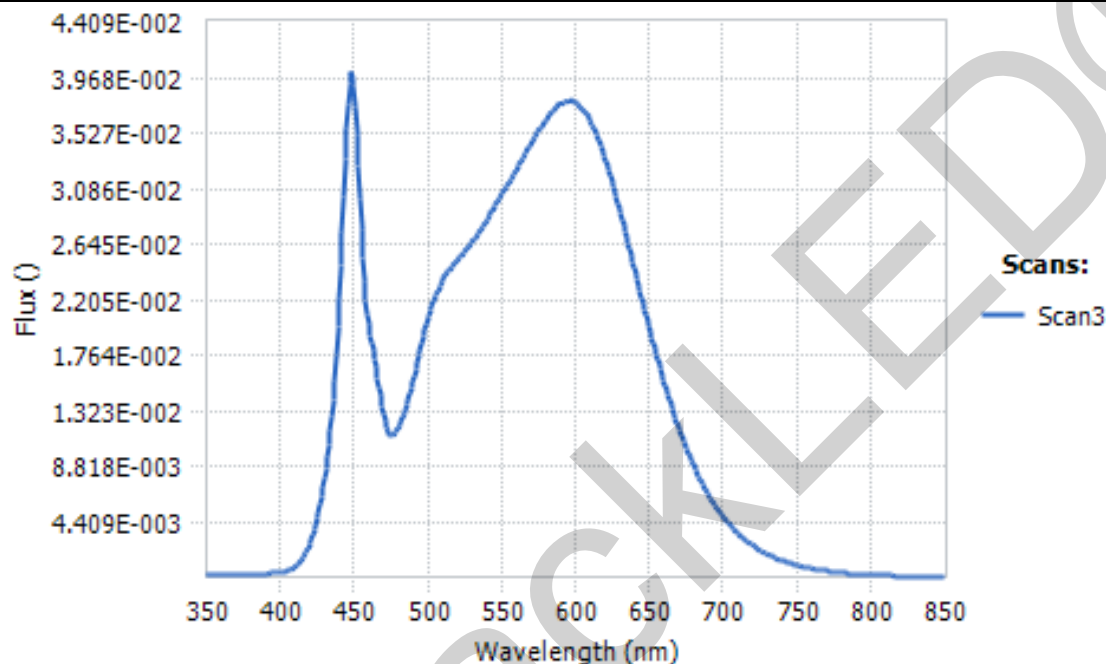
Test Results –

The following results were measured after stabilization of the sample in the **Integrating Sphere** (unless otherwise stated). Stability is reached when the variation of 3 readings of light output and electrical power, taken 15 minutes apart, is less than 0.50% (in accordance with IES LM-79-08).

Key Photometric Results	Sample Reference	
	LVLB-VI-1-24-P23F-NW-23	
	Integrating Sphere	Goniophotometer
Luminous Efficacy (Lumens/Watt)	77.00	76.46
Total Luminous Flux (Lumens)	2200	2184.66
Total Radiant Flux (Watts)	6.73	
Correlated Color Temperature (CCT)	3975	
Color Rendering Index (CRI) (Ra)	84.19	
R9 Value	12	
Chromaticity (Chroma x / Chroma y)	0.3823 / 0.3804	
Chromaticity (Chroma u / Chroma v)	0.2249 / 0.5034	
Chromaticity (Chroma u' / Chroma v')	0.2249 / 0.5034	
D _{uv} Value	0.0011	
Stabilization Time (Light and Power)	Approx. 60 minutes	
Total Run Time – Integrating Sphere	64 minutes	
Total Run Time – Goniophotometer	95 minutes	
Scotopic/Photopic ratio $\Phi(v')/\Phi(v)$	1.69	
Electrical Input Results:	Sample Reference	
	LVLB-VI-1-24-P23F-NW-23	
Input Power (Watts)	28.57	
Input Voltage (Volts AC)	120.06	
Input Current (Amps)	0.23983	
Input Frequency (Hertz)	60.0	
Power Factor	0.9925	
Total Harmonic Distortion (%THD V/A)	0.09 / 9.08	
Additional Information	Sample Reference	
	LVLB-VI-1-24-P23F-NW-23	
Ambient Temperature	25.3 C	
Integrating Sphere Detector	CDS 1100 Spectroradiometer	
Absorption Correction used?	Yes	

Spectral Flux

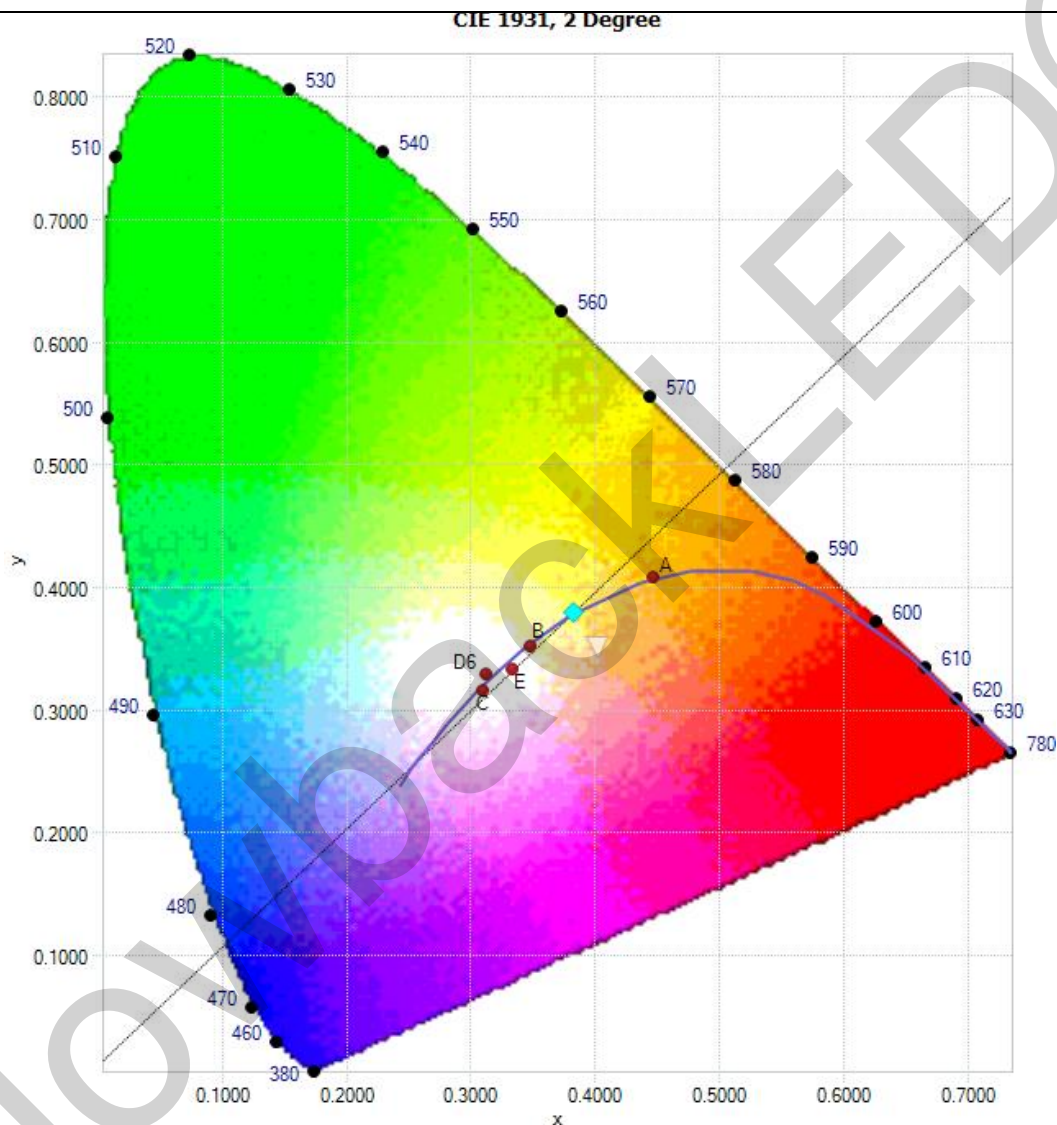
The following graph shows the spectral response curve of the radiant flux for the sample:



Spectral response of the Radiant Flux
(350nm to 850nm – calibrated range of the Spectroradiometer).

Chromaticity Diagram

The following image shows the chromaticity diagram for the sample:



Tristimulus values (from page 6):
x / y = 0.3823 / 0.3804

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

Test Results – Flux Distribution – Zonal Lumen Summary

The following table depicts the zonal lumen distribution for the sample:

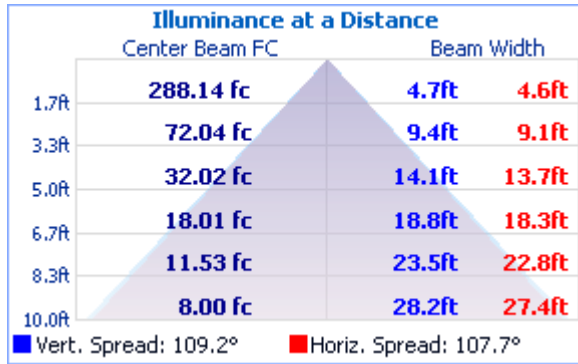
Zone	Lumens	% Total
0-10	75.8	3.5%
10-20	215.3	9.9%
20-30	322.6	14.8%
30-40	384.3	17.6%
40-50	393.3	18.0%
50-60	351.0	16.1%
60-70	264.1	12.1%
70-80	145.4	6.7%
80-90	32.9	1.5%
Total	2184.7 Lumens	100%

Zonal Lumen Summary

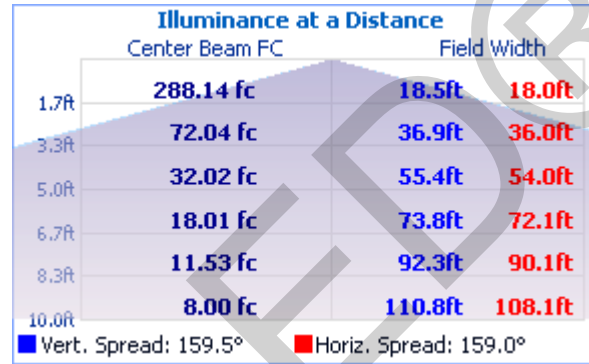
Zone	Lumens	% Total
0-30	613.7	28.1%
0-40	998.0	45.7%
0-60	1,742.3	79.7%
60-90	442.4	20.3%
0-90	2,184.7	100%

Test Results – Illuminance Plots

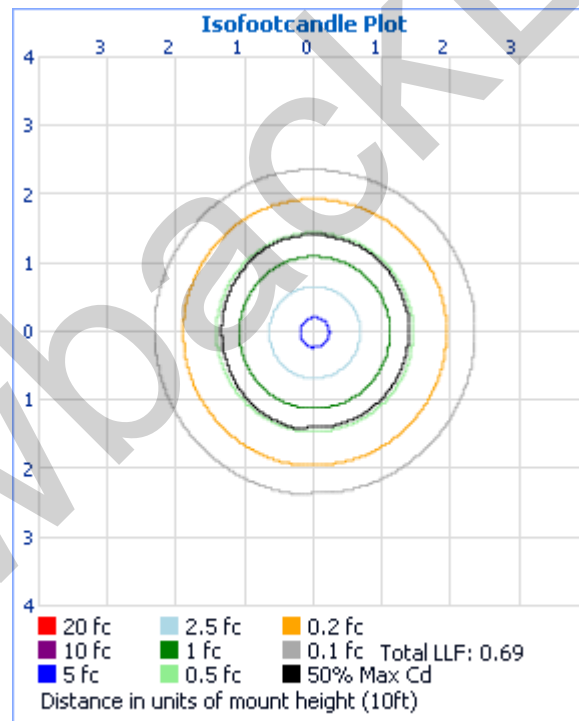
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



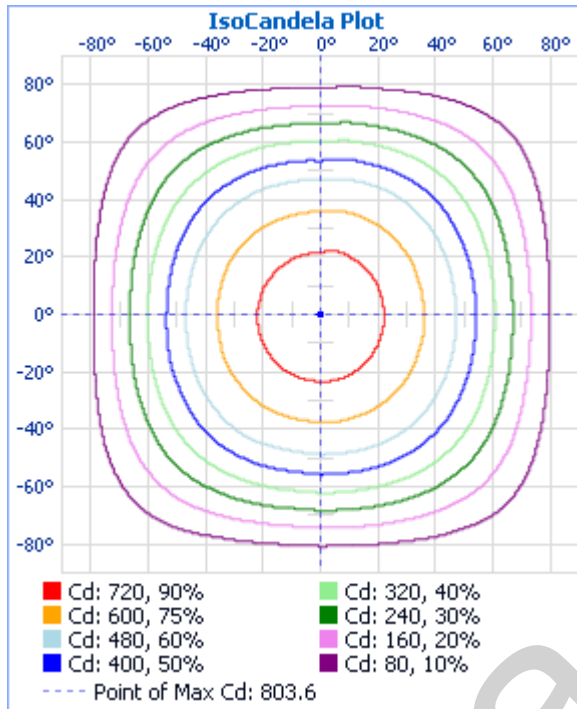
Field Angle



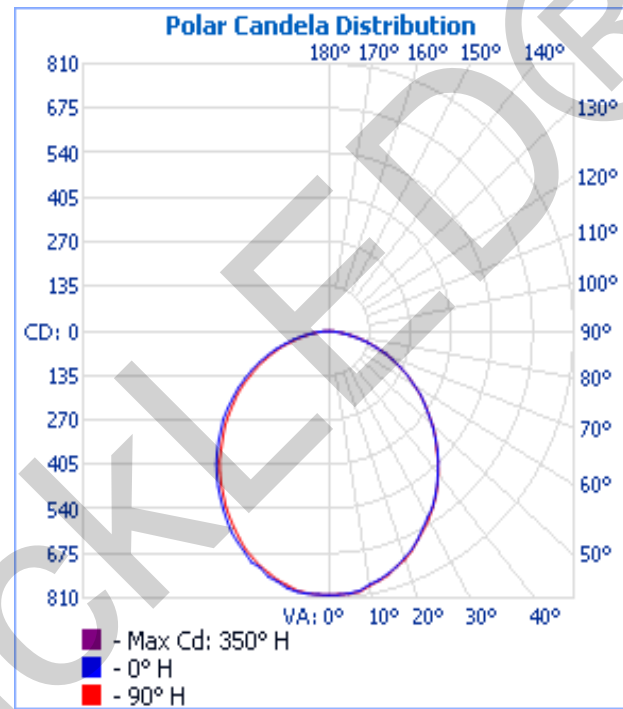
Illuminance Plot (Footcandles)

Test Results – Candela Plots

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



Isocandela Plot



Polar Candela Distribution

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50				30				10				0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00			
1	1.09	1.04	1.00	.96	1.06	1.02	.98	.85	.98	.95	.92	.94	.91	.89	.90	.88	.86	.84			
2	.99	.91	.84	.78	.96	.89	.83	.72	.86	.80	.76	.82	.78	.74	.79	.76	.72	.70			
3	.90	.80	.72	.65	.88	.78	.71	.61	.75	.69	.64	.73	.67	.62	.70	.65	.61	.59			
4	.83	.71	.62	.55	.80	.70	.61	.52	.67	.60	.54	.65	.58	.53	.62	.57	.53	.51			
5	.76	.63	.54	.48	.74	.62	.54	.46	.60	.53	.47	.58	.52	.46	.56	.51	.46	.44			
6	.70	.57	.48	.42	.68	.56	.48	.40	.54	.47	.41	.53	.46	.41	.51	.45	.40	.38			
7	.65	.52	.43	.37	.63	.51	.43	.36	.49	.42	.36	.48	.41	.36	.47	.41	.36	.34			
8	.61	.47	.39	.33	.59	.47	.38	.32	.45	.38	.33	.44	.37	.32	.43	.37	.32	.30			
9	.57	.43	.35	.30	.55	.43	.35	.29	.42	.34	.29	.41	.34	.29	.40	.33	.29	.27			
10	.53	.40	.32	.27	.52	.39	.32	.26	.39	.32	.27	.38	.31	.27	.37	.31	.26	.25			

Test Results – Candela Tabulation

The following table provides the tabulated Candela measurements:

Candela Table - Type C			0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360		
0	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	
2.5	800	800	800	800	799	799	799	800	800	799	800	800	799	800	800	801	801	800	801	803	800	800	800	799	799	799	799	799	799	800	800	800	800	799	801	800	800	801	804	800	800
5	799	798	798	798	798	798	798	798	798	798	798	798	799	799	799	800	799	799	800	800	799	798	798	798	798	798	798	798	798	798	798	798	798	799	799	799	799	800	801	799	800
7.5	794	794	795	794	793	795	794	794	796	797	796	795	797	798	798	799	799	799	799	799	798	797	797	796	794	795	794	794	793	794	795	795	796	797	797	797	798	799	798	794	
10	781	780	781	778	779	780	780	780	783	784	787	785	785	787	789	789	790	792	791	789	788	784	780	782	781	781	781	783	781	779	783	785	787	785	787	785	789	792	781	781	
12.5	773	774	773	773	773	773	773	774	774	774	775	775	776	776	775	778	777	778	776	774	773	774	774	773	774	773	774	773	774	773	773	774	774	774	774	776	778	773	773		
15	761	762	760	762	760	762	762	761	764	766	766	766	766	768	770	769	769	770	772	771	770	769	767	766	764	763	760	762	760	761	762	763	766	767	767	770	772	761	761		
17.5	748	748	748	748	747	748	748	748	749	748	749	749	749	751	750	750	751	754	752	752	750	748	748	748	748	748	748	748	748	748	748	748	748	749	750	750	754	748	748		
20	732	732	731	730	732	735	733	734	736	738	736	737	737	741	742	742	744	744	746	745	741	738	737	736	733	733	731	731	730	732	735	737	737	739	742	744	732	732			
22.5	717	718	719	718	719	718	719	720	718	720	720	721	720	722	724	723	723	725	724	722	720	719	719	718	716	717	716	718	716	718	716	718	720	720	723	723	717	717			
25	697	698	697	696	697	697	697	698	697	699	698	700	698	701	703	703	702	704	708	706	704	700	698	698	696	696	695	695	695	696	695	697	697	698	700	702	707	697	697		
27.5	675	674	677	677	676	678	677	678	677	679	678	681	681	682	686	686	687	688	691	689	688	684	681	679	676	673	676	674	674	673	676	678	681	683	686	690	675	675			
30	653	657	656	656	656	657	657	657	657	660	658	661	662	663	665	665	667	667	668	668	666	660	660	656	654	654	653	653	651	655	657	662	664	665	668	653	653				
32.5	637	635	638	637	636	638	636	635	636	638	639	640	640	642	642	642	644	644	645	644	645	643	639	639	636	632	634	631	634	631	634	636	639	642	643	644	637	637			
35	613	613	614	613	614	614	615	615	614	616	614	617	616	617	619	619	619	618	621	621	620	618	616	615	611	608	612	606	607	606	611	611	616	617	619	619	613	613			
37.5	589	587	588	588	590	589	591	589	588	591	588	593	590	592	594	595	594	594	598	598	596	593	590	591	585	584	583	583	582	583	588	586	590	591	593	595	589	589			
40	562	560	560	562	562	560	562	561	566	564	561	566	565	566	569	569	570	568	574	573	568	566	565	566	561	559	557	558	555	559	560	561	563	564	567	568	562	562			
42.5	536	535	534	535	535	535	533	533	538	535	537	538	541	541	542	543	543	549	547	542	540	540	538	535	535	530	533	531	533	532	537	538	539	541	544	536	536				
45	508	510	508	508	507	508	505	505	508	505	512	507	513	516	514	514	515	517	521	519	516	515	514	509	509	506	504	501	501	501	503	509	512	514	513	518	508	508			
47.5	478	482	483	482	480	481	479	479	476	479	478	482	483	484	488	487	486	486	492	490	490	488	485	482	478	475	476	472	474	472	477	477	483	487	487	489	478	478			
50	449	449	449	452	450	449	449	449	449	450	448	453	452	455	462	462	460	457	463	464	462	459	454	455	449	446	442	446	441	445	446	448	451	454	460	458	449	449			
52.5	417	421	418	419	419	417	415	417	419	418	422	419	427	427	431	435	434	431	438	436	433	428	427	423	422	419	416	415	414	416	414	421	424	425	428	430	417	417			
55	388	393	392	393	390	391	389	390	386	389	393	391	391	397	397	400	399	400	405	402	404	401	398	391	390	386	388	384	385	383	386	388	393	396	397	401	388	388			
57.5	361	358	359	360	362	358	358	359	360	359	357	363	361	362	368	370	368	365	373	374	370	370	363	364	358	357	355	356	357	356	359	357	358	362	368	366	361	361			
60	325	331	330	328	327	326	325	325	328	326	331	329	333	336	334	338	339	338	344	343	337	335	335	332	332	330	325	326	326	325	323	331	332	333	335	338	325	325			
62.5	296	300	301	300	298	297	297	296	295	297	296	299	297	301	303	304	305	305	309	309	309	308	305	299	296	292	296	289	291	291	294	294	298	303	305	306	296	296			
65	263	263	263	262	263	261	262	262	265	262	263	265	268	269	273	276	276	272	279	281	274	272	269	268	265	264	259	262	257	263	262	263	264	267	273	272	263	263			
67.5	229	234	234	234	231	233	231	230	229	230	235	231	235	238	235	238	240	240	248	244	245	240	239	233	233	232	232	228	227	229	229	233	234	238	236	242	229	229			
70	202	198	201	201	203	201	199	202	201	202	198	204	203	202	208	209	208	205	212	212	209	209	204	205	200	198	198	196	198	197	201	197	199	202	207	206	202	202			
72.5	163	168	166	167	165	164	163	164	166	166	171	170	172	175	172	174	176	177	183	180	179	174	174	170	171	170	165	165	164	165	163	168	170	171	171	177	163	163			
75	133	132	135	131	135	135	136	133	136	134	135	136	142	140	139	139	146	146	145	145	142	137	135	133	136	130	131	130	133	133	134	138	141	139	133	133	133				
77.5	101	101	101	102	104	102	102	103	105	105	104	103	108	107	108	110	112	110	118	118	112	108	107	109	105	104	103	104	103	102	103	103	103	104	106	109	101	101			
80	70	76	74	75	72	74	72	73	74	74	78	76	79	79	76	77	78	80	84	81	83	81	81	77	78	76	74	75	73	74	73	75	77	77	75	81	70				
82.5	45	47	48	48	47	49	48	48	48	51	50	49	50	51	50	49	50	53	55	53	53	51	49	49	49	49	48	46	47	47	47	49	51	50	45	45					
85	23	23	25	24	25	25	25	25	24	25	25	25	25	26	26	25	25	29	30	28	28	28	25	25	25	25	24	24	24	24	24	24	25	26	25	23	23				
87.5	4	5	6	4	5	5	5	6	7	6	9	6	8	9	8	9	9	8	14	13	13	13	12	10	11	10	9	10	8	10	9	8	8	7	9	8	4				
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				

Photometric Testing Information

The sample was evaluated for photometric and electrical characteristics using an integrating sphere and a goniophotometer, each located in purpose-built, temperature and humidity-controlled, draft free environments.

The integrating sphere is by Labsphere which exhibits a “ 4π geometry” configuration according to IES LM-79-08 and is applicable for all types of LED products (directional and non-directional light projections). Its spectroradiometer is an array-type detector manufactured and calibrated by Labsphere.

The integrating sphere uses self-absorption correction to eliminate errors due to mismatches between the standard reference lamp and the test samples being measured. The auxiliary lamp used to perform this task is a halogen type lamp powered by a calibrated *Lamp Power Supply* manufactured and calibrated by Labsphere. Ambient temperature (for photometric analysis) is measured using a “J-Type” thermocouple located inside the integrating sphere at the same height as the sample under test and not more than 1 meter in horizontal distance away from the sample. The thermocouple is located behind the baffle of the photo detector in order to eliminate any direct optical radiation from the sample under test.

Luminaire Stabilization.

The sample was placed inside the integrating sphere and powered by a regulated and conditioned Voltage alternating current supply. The correlated color temperature, color rendering index, chromaticity coordinates and electrical power measurements contained in this report are the numeric **averages** of the three readings upon which stabilization is verified. The stabilization times shown on the results pages of this report denote the time of the 1st measurement (of the 3 consecutive readings) since this is the minimum time that the sample is assumed to have taken to reach stabilization.

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

Sphere D	Sphere B & C
Manufacturer: Sylvania	Sylvania
Model# 75Q/CL-28V	796
Voltage = 28.0 Volt	12.0 Volt
Wattage = 75.0 Watts	32.0 Watts
Calibration Current = 2.679 Amperes	2.600 Amperes
Luminous Flux = 1538.8 Lumens	554.0 Lumens
Calibration Date = 8-18-2005	11-13-2013
(calibrated by Labsphere – NIST traceable).	

Continued.....

Photometric Testing Information (continued)

The goniophotometer Mayer Engineering Type C is calibrated using a frosted tungsten filament FDS/DZE lamp with the following specifications:

Manufacturer: GE
Part Number: DZE 88
Bulb Number: 114-A
Voltage: 16.59 Volts DC reference
Calibration Current: 4.810 Amperes
Luminous Intensity: 154.7 Candelas
Calibration Date: 7/12/12 (NIST traceable)

Manufacturer: GE
Part Number: DZE 88
Bulb Number: 114-B
Voltage: 16.61 Volts DC reference
Calibration Current: 4.819 Amperes
Luminous Intensity: 150.6 Candelas
Calibration Date: 7/12/12 (NIST traceable)

Manufacturer: GE
Part Number: DZE 88
Bulb Number: 114-C
Voltage: 16.66 Volts DC reference
Calibration Current: 4.815 Amperes
Luminous Intensity: 155.4 Candelas
Calibration Date: 7/12/12 (NIST traceable)

A Yokogawa WT210 Power Analyzer was used to measure all electrical characteristics of the sample.

CSA is an accredited Test Laboratory
National Voluntary Laboratory Accreditation Program
(NVLAP)200732-0

Equipment List: Goniophotometer Type C (Mirror 1)			
Description	Manufacturer and Model Number	CSA Instrument Reference Number	Calibration Due Date
Optometer	Gigahertz Optik P9801	N/A	N/A
Regulated Power Supply	Chroma Instruments 61602P-80-60	DCP401	N/A
Regulated Power Supply	Chroma Instruments 61602	DCP301	N/A
Power Analyzer	Yokogawa WT210	POA400	11/2018
Equipment List: Sphere B Equipment			
Description	Manufacturer and Model Number	CSA Instrument Reference Number	Calibration Due Date
Integrating Sphere 76"	Labsphere LMS760	SPH200	N/A
Spectroradiometer	Labsphere CDS1100	N/A	N/A
Auxiliary Lamp PSU	Labsphere LPS100	LPS100	N/A
Power Analyzer	Yokogawa WT210	PA111	12/2018
Regulated Power Supply	Chroma Instruments 61603	N/A	N/A

All equipment is calibrated to ISO / IEC 17025-2005 guidelines.