



UL LLC
1075 W Lambert Rd Suite B
Brea, CA 92821

Horticultural Lighting Test Report

Relevant Standards
IES LM-79-2008, ANSI C82.77-10-2014, CIE 13.3-1995
CIE 15-2004, ANSI C78.377-2017, IES TM-30-2018
IES LM-58-2013

Prepared For
FOHSE, Inc
Alex Gerard
3720 West Oquendo Road
Las Vegas, NV 89118
United States

Catalog Number
F1V600
Order Number
13413831
Test Number
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2020-08-05 - 2020-08-06

Prepared By

A handwritten signature in black ink, appearing to read 'William Escobar'.

William Escobar, Technician

Approved By

A handwritten signature in black ink, appearing to read 'Eric M. Gaudreau'.

Eric Gaudreau, Engineering Leader

The results contained in this report pertain only to the tested sample.
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Laboratory results may not be representative of field performance
Ballast factors have not been applied

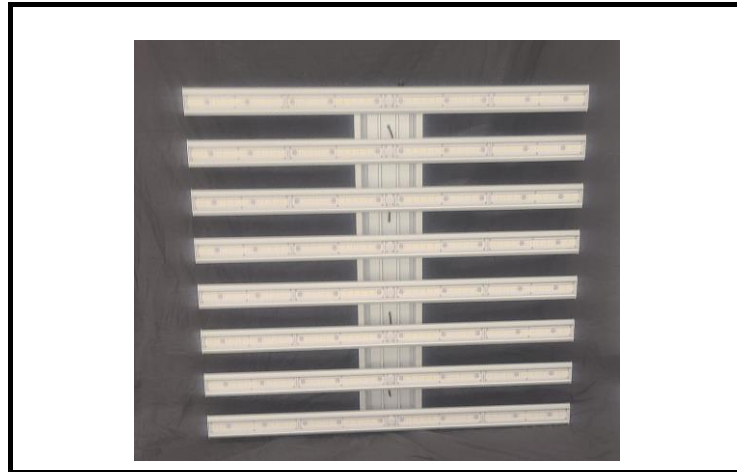
Testing was performed in a 3-meter integrating sphere using the 4π geometry method.

Absorption correction was employed for Sphere measurement



Luminaire Description: White square metal housing with clear lens
Lamp: LED array
Mounting: Pendant
Ballast/Driver: Two (2) INVENTRONICS EUD-320S670DT

Luminaire



Luminaire Characteristics

Luminous Length: 45.50 in.
Luminous Width: 40.50 in.

Summary of Results

Integrating Sphere

PPF (400-700nm): 1845.99 $\mu\text{mol}/\text{sec}$
PPF Efficacy: 2.9948 $\mu\text{mol}/\text{J}$

Distribution

Total Luminaire Output: 74180 Lumens
Luminaire Efficacy: 120.1 lm/w
Maximum Candela: 26923 Candela

Electrical Data at 277 VAC

Test Temperature: 25.0 $^{\circ}\text{C}$
Voltage: 277.1 VAC
Current: 2.243 A
Power: 594.7 W
Power Factor: 0.957
Frequency: 60 Hz
Current THD: 8.72 %



Horticultural Lighting - Integrating Sphere

Integrating Sphere Test Conditions

Temperature	Voltage	Current	Power	Power Factor	Frequency	Current THD
24.2 °C	120.0 VAC	5.148 A	616.4 W	0.998	60 Hz	6.48 %

Summary of Results

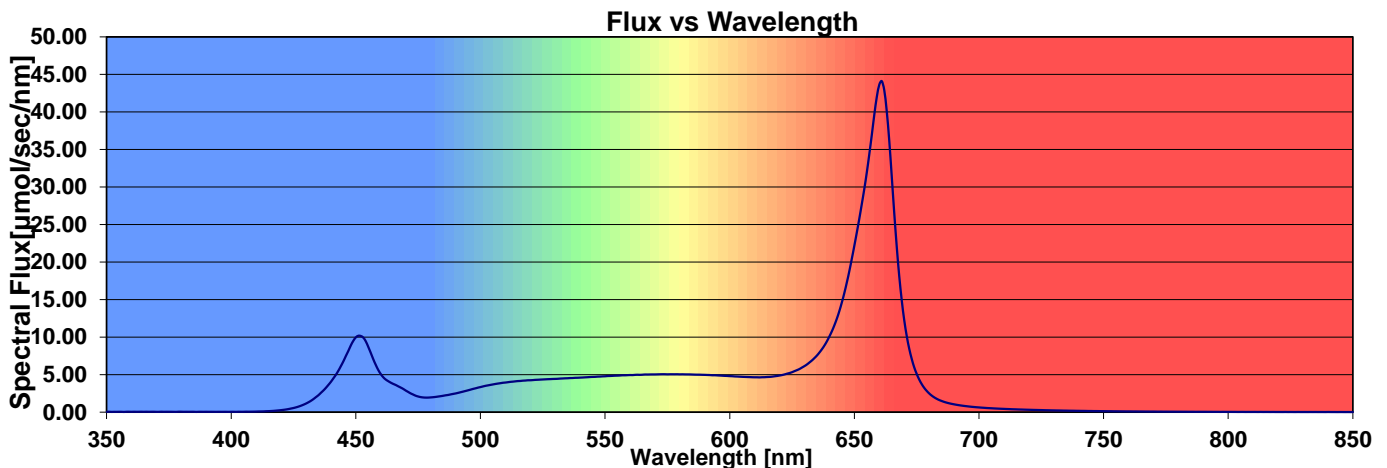
Radiant Flux	381.50 Watts	Radiant Efficiency:	61.9 %
Luminous Flux:	78730 Lumens	Luminous Efficacy:	127.73 lm/W
PPF (400-700nm):	1845.99 $\mu\text{mol}/\text{sec}$	PPF Efficacy:	2.9948 $\mu\text{mol}/\text{J}$
R/FR:	82.64	PSS:	0.88

Lumens to $\mu\text{mol}/\text{sec}$ conversion factor: 0.023447 $\mu\text{mol}/\text{sec}/\text{lm}$

Photon Flux Summary versus Wavelength Bands

	Wavelength Range [nm]	Photon Flux [$\mu\text{mol}/\text{sec}$]	Total Photon Flux/ % of Total
UV	350 - 359	0.462724	2.3961 $\mu\text{mol}/\text{sec}$ 0.13%
	360 - 369	0.515500	
	370 - 379	0.480633	
	380 - 389	0.485713	
	390 - 399	0.451542	
Blue	400 - 409	0.557281	293.4785 $\mu\text{mol}/\text{sec}$ 15.71%
	410 - 419	1.387243	
	420 - 429	5.623582	
	430 - 439	22.323222	
	440 - 449	65.961013	
	450 - 459	85.249159	
	460 - 469	39.385779	
	470 - 479	22.571076	
	480 - 489	21.705976	
	490 - 499	28.714175	
Green	500 - 509	36.513577	461.1749 $\mu\text{mol}/\text{sec}$ 24.68%
	510 - 519	41.102766	
	520 - 529	43.433260	
	530 - 539	45.143482	
	540 - 549	46.860959	
	550 - 559	48.630315	
	560 - 569	49.888746	
	570 - 579	50.442847	
	580 - 589	50.147568	
	590 - 599	49.011430	

	Wavelength Range [nm]	Photon Flux [$\mu\text{mol}/\text{sec}$]	Total Photon Flux/ % of Total
Red	600 - 609	47.249908	1091.0419 $\mu\text{mol}/\text{sec}$ 58.39%
	610 - 619	46.967311	
	620 - 629	53.286485	
	630 - 639	75.438066	
	640 - 649	145.499185	
	650 - 659	320.145413	
	660 - 669	63.419984	
	670 - 679	16.551794	
	680 - 689	8.278762	
	690 - 699	8.278762	
Far Red	700 - 709	5.331918	19.221 $\mu\text{mol}/\text{sec}$ 1.03%
	710 - 719	3.792285	
	720 - 729	2.795316	
	730 - 739	2.069634	
	740 - 749	1.546541	
	750 - 759	1.163940	
	760 - 769	0.892184	
	770 - 779	0.680767	
	780 - 789	0.528121	
	790 - 799	0.420247	
IR	800 - 809	0.332116	1.2497 $\mu\text{mol}/\text{sec}$ 0.07%
	810 - 819	0.284295	
	820 - 829	0.227032	
	830 - 839	0.205160	
	840 - 850	0.201140	





Horticultural Lighting - Definition of Terms

Radiant Flux: The measured radiant power of the test item in units of watts from 350nm to 850 nm.

Luminous Flux: The measured radiant power of the test item in units of lumens from 380nm to 780 nm.

PPF (400-700nm): Photosynthetic Photon Flux - Flux from 400 to 700 nm expressed in units of $\mu\text{mol}/\text{sec}$
This wavelength range has been identified as important to photosynthetic processes.

R/FR: Ratio of Red to Far Red light - The ratio of R to FR light (R:FR) influences growth attributes of floriculture crops including branching and elongation of stems and leaves. It also controls flowering in plants that are sensitive to day length.

Radiant Efficiency: The ratio of light flux in watts to electrical input power in watts expressed in percent.

Luminous Efficacy: The ratio of light flux in lumens to electrical input power in watts expressed in lm/W .

PPF Efficacy: The ratio of photosynthetic photon flux to electrical input power in watts expressed in $\mu\text{mol}/\text{J}$.

PSS: Phytochrome photostationary state - The ratio of the concentration of the phytochrome P_R isoform of phytochrome to the total concentration of both the P_R and P_{FR} isoforms. Related to the R/FR metric.

PPFD: Photosynthetic Photon Flux Density - Flux per unit area expressed in $\mu\text{mol}/\text{sec}/\text{m}^2$.

Lumens to $\mu\text{mol}/\text{sec}$ conversion factor: Multiply flux in lumens by this factor to convert to PPF in units of $\mu\text{mol}/\text{sec}$. This conversion factor can also be used to convert illuminance in lux to photosynthetic photon flux density (PPFD).

To convert from footcandles to PPFD first convert the illuminance in fc to lux by multiplying by 10.7639 lux/fc and then use the lumens to $\mu\text{mol}/\text{sec}$ conversion factor.

Note: This factor applies to the measured spectral distribution only and cannot be applied to other light sources.



Distribution - Goniophotometer

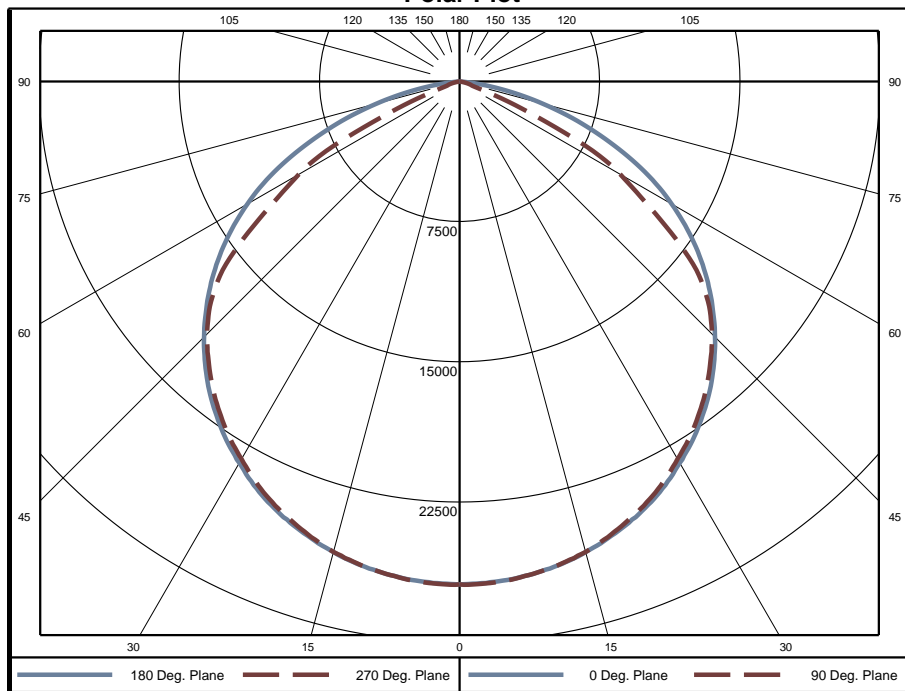
Distribution Test Conditions

Temperature	Voltage	Current	Power	Power Factor	Frequency	Current THD
24.5 °C	120.1 VAC	5.155 A	617.7 W	0.998	60 Hz	6.47 %

Summary of Results

Spacing Criteria	Total Lumen Output:	74180 Lumens
0-180: 1.30	Luminaire Efficacy:	120.1 lm/w
90-270: 1.29	Maximum Candela:	26923 Candela
Corrected UGR (Room Dimension: X=4H, Y=8H, Reflectances: 70/50/20%, S/H: 1)		
Crosswise: 26.7	Endwise: 26.7	

Polar Plot



Zonal Lumen Summary

Zone	Lumens	% of Luminaire	Zone	Lumens	% of Luminaire	Zone	Lumens	% of Luminaire
0-5	642	0.9%	60-65	5025	6.8%	120-125	0	0.0%
5-10	1908	2.6%	65-70	3337	4.5%	125-130	0	0.0%
10-15	3118	4.2%	70-75	1765	2.4%	130-135	0	0.0%
15-20	4239	5.7%	75-80	763	1.0%	135-140	0	0.0%
20-25	5236	7.1%	80-85	186	0.3%	140-145	0	0.0%
25-30	6074	8.2%	85-90	22	0.0%	145-150	0	0.0%
30-35	6727	9.1%	90-95	0	0.0%	150-155	0	0.0%
35-40	7175	9.7%	95-100	0	0.0%	155-160	0	0.0%
40-45	7397	10.0%	100-105	0	0.0%	160-165	0	0.0%
45-50	7370	9.9%	105-110	0	0.0%	165-170	0	0.0%
50-55	7009	9.4%	110-115	0	0.0%	170-175	0	0.0%
55-60	6184	8.3%	115-120	0	0.0%	175-180	0	0.0%

Zone	Lumens	% of Luminaire
0-40	35119	47.3%
0-60	63079	85.0%
0-90	74177	100.0%
90-180	0	0.0%



Candela Tabulation
Horizontal Angle (Degrees)

	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5
0	26900	26900	26900	26900	26900	26900	26900	26900	26900	26900	26900	26900	26900	26900	26900	26900
5	26800	26810	26800	26780	26810	26780	26800	26810	26800	26810	26800	26780	26810	26780	26800	26810
10	26520	26520	26530	26500	26520	26500	26530	26520	26520	26520	26530	26500	26520	26500	26530	26520
15	26060	26070	26060	26010	26060	26010	26060	26070	26060	26070	26060	26010	26060	26010	26060	26070
20	25420	25420	25400	25350	25320	25350	25400	25420	25420	25420	25400	25350	25320	25350	25400	25420
25	24620	24580	24550	24460	24450	24460	24550	24580	24620	24580	24550	24460	24450	24460	24550	24580
30	23560	23540	23460	23390	23330	23390	23460	23540	23560	23540	23460	23390	23330	23390	23460	23540
35	22370	22310	22190	22120	22130	22120	22190	22310	22370	22310	22190	22120	22130	22120	22190	22310
40	20970	20870	20730	20700	20700	20700	20730	20870	20970	20870	20730	20700	20700	20700	20730	20870
45	19320	19230	19080	19100	19110	19100	19080	19230	19320	19230	19080	19100	19110	19100	19080	19230
50	17480	17380	17280	17200	17020	17200	17280	17380	17480	17380	17280	17200	17020	17200	17280	17380
55	15430	15290	15260	14380	13440	14380	15260	15290	15430	15290	15260	14380	13440	14380	15260	15290
60	13090	12960	12780	10500	9932	10500	12780	12960	13090	12960	12780	10500	9932	10500	12780	12960
65	10450	10480	9055	6740	5072	6740	9055	10480	10450	10480	9055	6740	5072	6740	9055	10480
70	7491	7749	5317	1906	1089	1906	5317	7749	7491	7749	5317	1906	1089	1906	5317	7749
75	4629	4553	1163	567	530	567	1163	4553	4629	4553	1163	567	530	567	1163	4553
80	2075	1368	344	207	153	207	344	1368	2075	1368	344	207	153	207	344	1368
85	326	155	51	33	27	33	51	155	326	155	51	33	27	33	51	155
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Average Luminance (cd/m²)
Horizontal Angle (Degrees)

	0	45	90
0	22630	22630	22630
45	22980	22690	22730
55	22630	22380	19710
65	20790	18020	10090
75	15040	3778	1721
85	3146	494	264



Coefficients of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance 20%

Ceiling Cavity Reflectance	80				70				50			30			10			0
Wall Reflectance	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
Room Cavity Ratio (RCR)	** Values are expressed as percent of total lumen output delivered to the task surface **																	
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102	100
1	110	106	102	98	107	103	100	97	99	96	94	95	93	91	92	90	88	86
2	101	93	87	81	98	91	85	80	88	83	78	84	80	77	81	78	75	73
3	92	82	74	68	89	80	73	67	77	71	66	75	70	65	72	68	64	62
4	84	73	64	58	82	71	64	57	69	62	57	67	61	56	64	59	55	53
5	77	65	56	50	75	64	56	50	62	55	49	60	53	48	58	52	48	46
6	71	58	50	43	70	57	49	43	56	48	43	54	47	42	52	47	42	40
7	66	53	44	38	64	52	44	38	51	43	38	49	43	38	48	42	37	35
8	62	48	40	34	60	48	40	34	46	39	34	45	38	34	44	38	33	31
9	57	44	36	31	56	44	36	31	42	35	30	41	35	30	40	34	30	28
10	54	41	33	28	53	40	33	28	39	32	28	38	32	27	37	32	27	26

Beam and Field Information	
CIE Type:	Direct
Center Beam Intensity:	26900 Candela
Central Cone Intensity:	26863 Candela
Beam Flux:	60531.3 Lumens
Beam Angle (0-180):	118.5 Degrees
Beam Angle (90-270):	110.0 Degrees
Field Angle (0-180):	157.4 Degrees
Field Angle (90-270):	135.3 Degrees

