



## Product Test Report - Goniometer Luminaire Evaluation

Method: LM-79:2019

Evaluation: Horticulture Summary

### Test results reported for:

Atreum Lighting

Product Description: HYDRA-1000 LED

### Issued Report:

ATRG003-012\_HYDRA-1000 LED

Project: 80074933-TPPPT

### Original issue date:

Tuesday, March 23, 2021

### Revision Issue Date:

Friday, April 2, 2021

### Prepared for:

Atreum Lighting

### Testing performed by:

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# Product Test Report - Goniometer Luminaire Evaluation

**Manufacturer:** Atreum Lighting

**Report Number:** ATRG003-012

**Product Description:** HYDRA-1000 LED

**Release Date:** 3/23/2021

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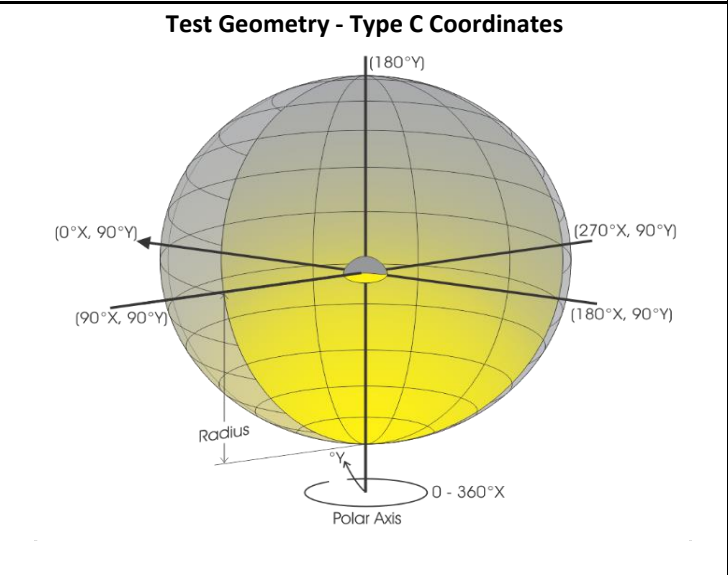
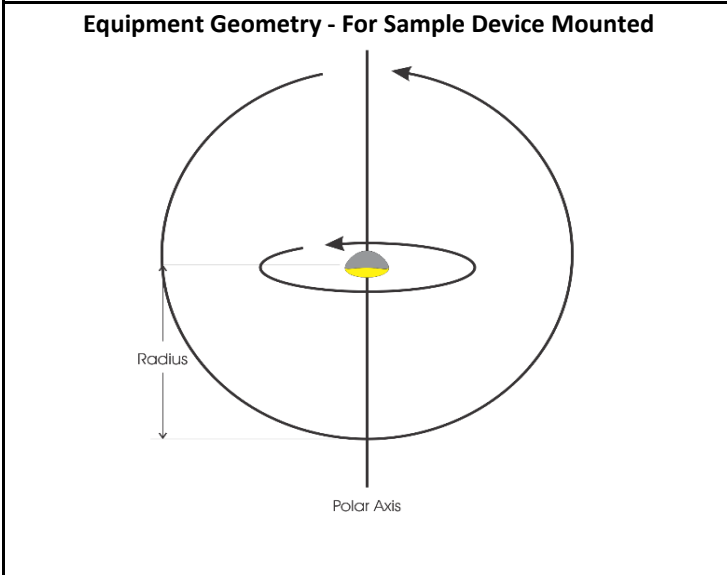
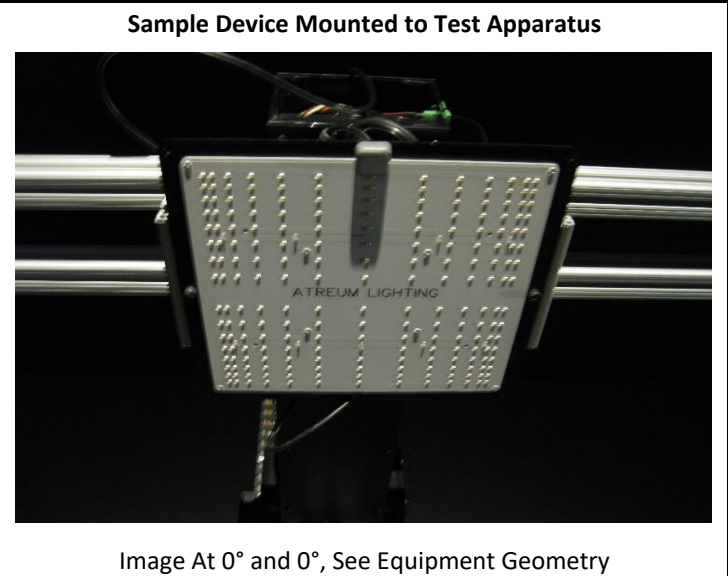
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## SAMPLE DESCRIPTION

Lab sample identification: 1 Customer Identification: NA Manufacturer: Atreum Lighting Part number: NA Model Number: NA Description: NA	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="text-align: center;">Manufacturer's ratings</th> </tr> <tr> <td style="padding: 2px;">Max Current (A):</td> <td style="padding: 2px;">NA</td> </tr> <tr> <td style="padding: 2px;">Operating voltage:</td> <td style="padding: 2px;">120-277 V AC</td> </tr> <tr> <td style="padding: 2px;">CCT:</td> <td style="padding: 2px;">NA</td> </tr> <tr> <td style="padding: 2px;">Frequency (Hz):</td> <td style="padding: 2px;">50-60</td> </tr> <tr> <td style="padding: 2px;">Type:</td> <td style="padding: 2px;">LED (Variable, tested max)</td> </tr> </table>	Manufacturer's ratings		Max Current (A):	NA	Operating voltage:	120-277 V AC	CCT:	NA	Frequency (Hz):	50-60	Type:	LED (Variable, tested max)
Manufacturer's ratings													
Max Current (A):	NA												
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CCT:	NA												
Frequency (Hz):	50-60												
Type:	LED (Variable, tested max)												



**Coordinate System Description**  
**Reference: LM-75-01 Goniophotometer Types and Photometric Coordinates**  
 Type C coordinate system, the polar axis is vertical. The angles measure in the vertical half planes of data are called vertical angles, and the angles to the horizontal half planes are called lateral angles. The vertical V angles range in value from 0° to 180°. The lateral L planes range in value from 0° to 360°.

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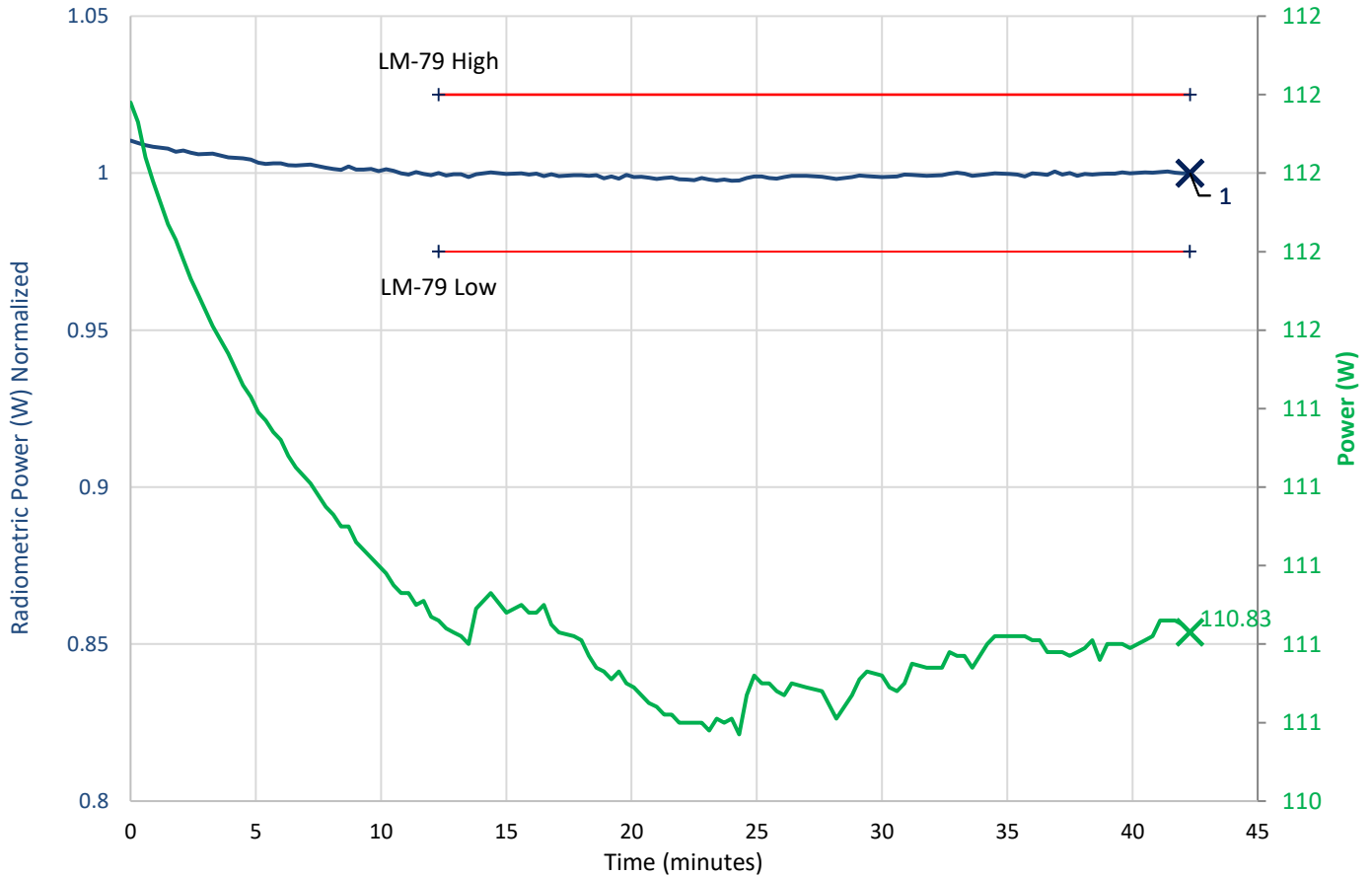
**Release Date:** 3/23/2021

### OPTICAL STABILIZATION

Stabilization Description - A series of 123 measurements are recorded during the stabilization period. The final stabilized measurement of normalized radiant power, as defined by LM-79:2019, is reported after 42 minutes of recorded device runtime. The 'Measurements in Range', provided below, are a histogram of measurements recorded during the 30 minute stabilization window.

% of range	Power (W) Normalized	Measurements in Range
99.758%	1.00	4
99.788%	1.00	5
99.818%	1.00	7
99.848%	1.00	8
99.877%	1.00	10
99.907%	1.00	12
99.937%	1.00	15
99.967%	1.00	19
99.997%	1.00	8
100.027%	1.00	5
100.000%	1.00	Reported

% of range	Power (W)	Measurements in Range
99.765%	110.57	7
99.798%	110.61	6
99.830%	110.64	5
99.863%	110.68	13
99.895%	110.71	10
99.928%	110.75	11
99.960%	110.79	20
99.993%	110.82	6
100.025%	110.86	9
100.058%	110.89	7
100.000%	110.83	Reported



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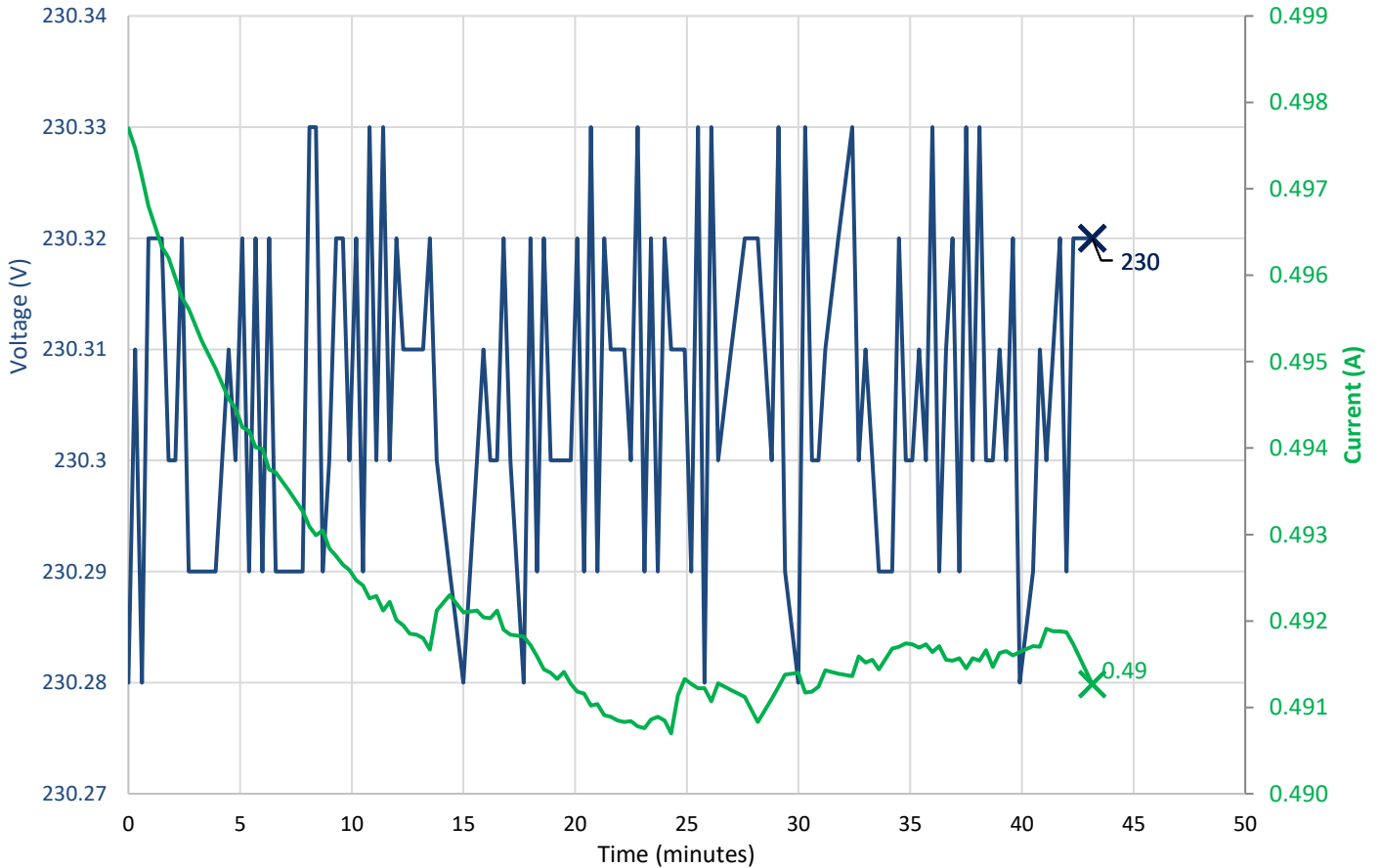
**Release Date:** 3/23/2021

### ELECTRICAL STABILIZATION

Stabilization Description - A series of 124 measurements are recorded during the stabilization period. The final stabilized measurement, as defined by LM-79:2019, is reported after 43 minutes of recorded device runtime. The 'Measurements in Range', provided below, are a histogram of measurements recorded during the 30 minute stabilization window.

% of range	Voltage (V)	Measurements in Range
99.983%	230.28	7
99.985%	230.29	24
99.987%	230.29	24
99.989%	230.30	31
99.991%	230.30	31
99.993%	230.31	21
99.996%	230.31	21
99.998%	230.32	27
100.000%	230.32	27
100.002%	230.33	14
100.000%	230.32	Reported

% of range	Current (A)	Measurements in Range
99.884%	0.491	9
99.917%	0.491	5
99.949%	0.491	10
99.982%	0.491	13
100.014%	0.491	11
100.047%	0.492	15
100.079%	0.492	15
100.112%	0.492	8
100.145%	0.492	6
100.177%	0.492	1
100.000%	0.491	Reported



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### HORTICULTURE SUMMARY

Photon Flux (µmol/s)				
WL (nm)	50 nm BIN	100 nm bin	300 nm bin	Total Bin
350-400	0.12 0.0%	-	-	310.92 100%
400-450	14.01 4.5%	51.77 16.7%	296.55 95.4%	
450-500	37.76 12.1%			
500-550	49.06 16%	124.07		
550-600	75.01 24.1%	39.9%	13.69 4.4%	
600-650	75.42 24.3%	120.72		
650-700	45.29 14.6%	38.8%		
700-750	10.37 3.3%	13.07	0.61 0.2%	
750-800	2.70 0.9%	4.2%		
800-900	-	0.47		
900-1000	-	0.2%		

	<i>Value</i>	<i>units</i>	<i>Description</i>
① <b>Photosynthetic Photon Flux:</b>	297	µmol/s	(400 - 700nm)
<b>PPF Efficacy :</b>	2.678	µmol/joule	(PPF/Active Power)
<b>Photon Flux:</b>	311	µmol/s	(350 - 1000nm)
<b>Photon Efficacy :</b>	2.808	µmol/joule	(Photon Flux/Active Power)
<b>Total Integrated YPF (µmol/s):</b>	264.6	µmol/s	(Yield Photon Flux)
② <b>YPF Efficacy:</b>	2.389	µmol/joule	(Total Integrated YPF/Active Power)
<b>Photosynthetically Active Yield Efficiency :</b>	89.21	%	(YPF/PPF)

NOTE 1: Photosynthetic Photon Flux: weighted equally by wavelength and summed between 400nm and 700nm.

NOTE 2: Yield Photon Flux: PPF weighted by action spectrum (average of 20 plant species as defined by McCree) and summed between 350nm and 750nm. (See Spectrum)

#### Electrical Performance

**Voltage:** 230.3 V  
**Current:** 0.5 A  
**Frequency:** 60.0 Hz  
**Active Power:** 110.7 W  
**Apparent Power:** 113.2 VA  
**Power Factor:** 0.98 W/VA

**THD Voltage:** 0.0 %  
**THD Current:** 5.7 %

#### Thermal Performance

**Ambient Temperature:** 25.0 °C

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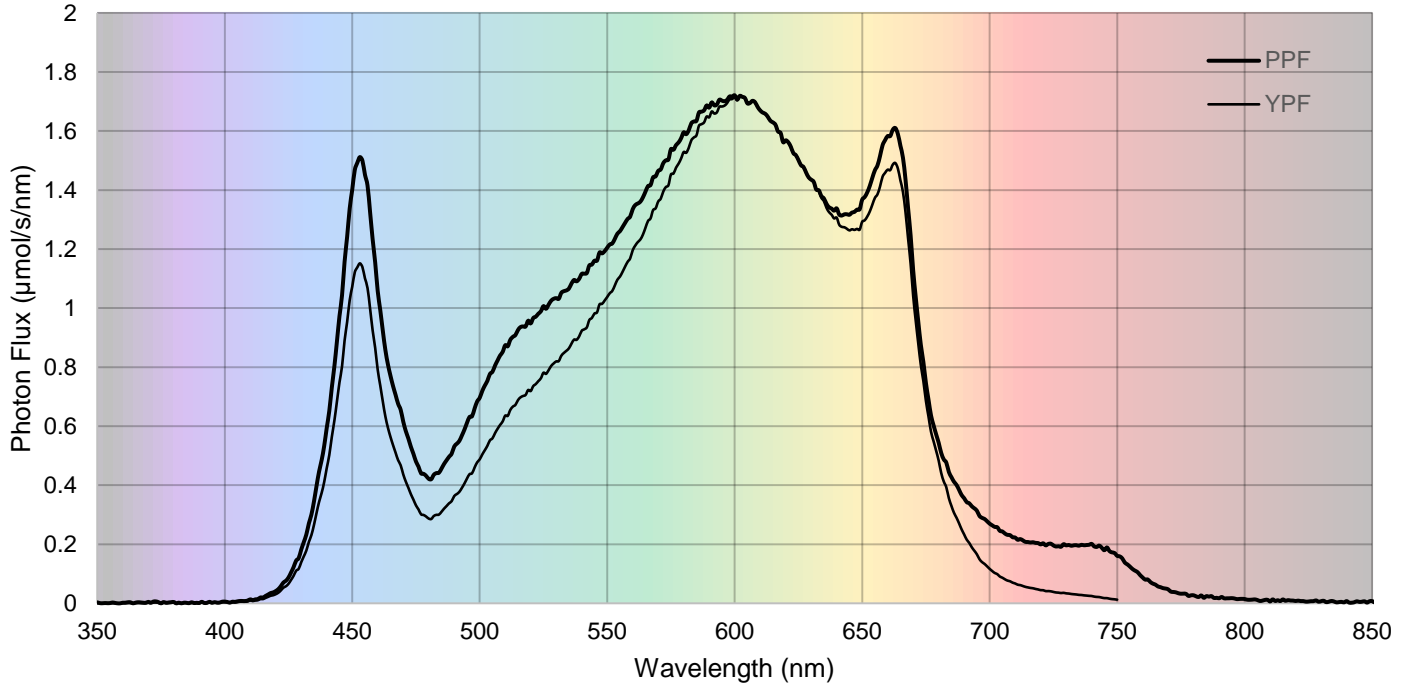
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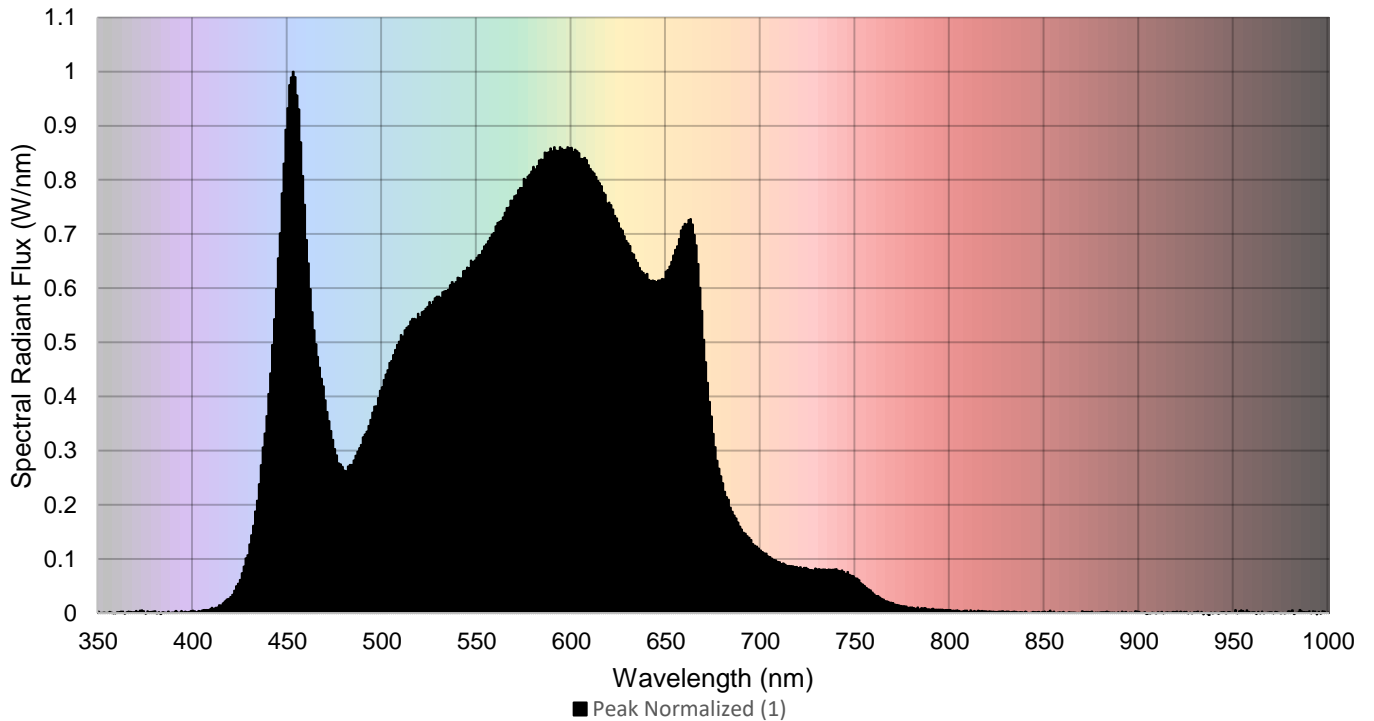
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## SPECTRAL QUANTUM DISTRIBUTION

### Spectral Quantum Distribution



### Spectral Radiant Flux (Normalized)



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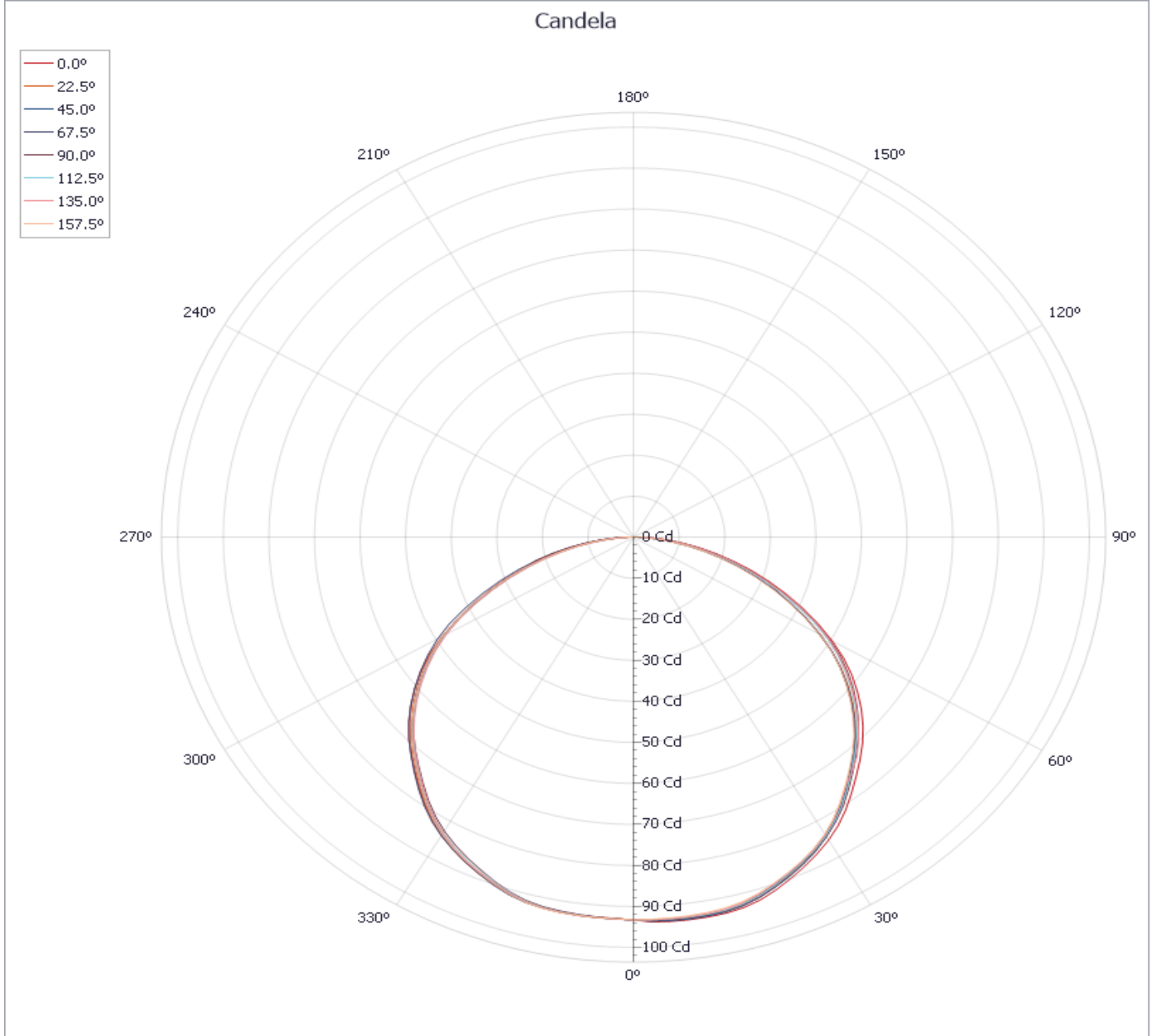
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## PHOTOSYNTHETIC PHOTON INTENSITY

Axis values of Candela (Cd) do not represent units of measurement. Actual value reported are Photosynthetic Photon Intensity Distribution (PPID) in units of ( $\mu\text{mol/s}\cdot\text{sr}$ )





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### PPID TABLE

LOWER HEMISPHERE

	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5	360
South Pole	0	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93
	2.5	94	94	94	93	93	93	93	93	93	93	93	93	93	93	93	93
	5	94	94	94	93	93	93	93	93	93	93	93	93	93	93	93	93
	7.5	94	94	94	93	93	93	93	93	93	93	93	93	93	93	93	93
	10	94	94	94	93	93	93	93	93	93	93	93	93	93	93	93	93
	12.5	94	93	94	93	93	93	93	92	92	92	93	92	92	93	93	93
	15	93	93	93	93	93	92	92	92	92	92	92	92	92	92	92	93
	17.5	93	92	92	92	92	91	91	91	91	91	91	91	91	91	91	92
	20	91	91	91	90	91	90	90	90	90	90	90	89	89	90	90	91
	22.5	90	89	89	89	89	89	89	89	89	89	89	88	88	88	89	89
	25	89	88	88	87	88	88	87	87	87	87	87	86	87	87	87	88
	27.5	87	86	86	86	86	86	86	86	86	86	86	85	85	85	86	86
	30	85	84	84	84	84	84	84	84	84	84	84	83	83	83	84	85
	32.5	83	82	82	82	82	82	82	82	82	82	82	81	81	81	82	83
	35	81	80	80	79	80	80	79	79	80	79	80	78	79	79	79	80
	37.5	79	77	77	77	77	76	76	77	77	77	77	76	76	76	77	78
	40	76	74	74	74	75	74	75	74	74	74	75	73	74	73	74	75
	42.5	74	72	72	71	72	73	71	72	72	71	72	71	71	71	71	73
	45	71	69	69	69	70	69	70	68	70	69	69	68	68	68	69	70
	47.5	68	66	66	66	67	66	67	65	67	66	66	67	66	66	65	68
	50	65	63	62	62	64	63	64	62	64	63	62	64	63	62	62	63
	52.5	62	59	59	59	61	60	60	59	60	59	61	60	59	59	60	61
	55	58	56	55	55	57	57	57	55	57	56	56	57	56	56	55	58
	57.5	55	51	52	52	54	53	53	51	53	53	52	54	52	52	52	54
	60	50	47	47	47	50	49	49	47	48	49	48	50	48	48	48	50
	62.5	46	42	43	43	45	44	45	43	44	44	44	45	43	43	43	45
	65	41	38	38	38	40	40	40	38	39	39	39	41	38	38	38	41
	67.5	36	34	34	34	36	35	36	33	34	34	34	36	34	34	34	36
	70	32	31	29	29	31	30	31	29	30	30	30	31	29	29	29	32
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	75	23	22	20	20	22	21	22	20	21	21	21	22	22	20	21	23
	77.5	19	18	16	16	18	17	18	16	17	17	16	18	18	16	17	19
	80	15	14	12	12	14	13	14	12	13	13	12	14	14	12	13	15
	82.5	11	10	9	9	10	10	10	8	9	9	9	10	10	9	9	11
	85	7	7	5	6	7	6	7	5	6	6	6	7	7	5	6	7
	87.5	4	4	3	3	4	4	4	3	3	3	3	4	4	3	3	4
Equator	90	2	2	1	1	2	2	2	1	1	1	1	2	2	1	1	2



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### EQUIPMENT

Item	Description/use	Manufacturer	Model	Serial #	Calibration Due
Spectrometer	Spectrum	Orb Optronix	SP-75	4013726	7/16/2021
Radiometer	Power Meter	Newport	2936R	18953	3/25/2021
Quantum Sensor	PAR vs Angle	Gigahertz-Optik	PS-3701	44466	3/25/2021
AC Power Supply	DUT AC Voltage	QuadTech	31015	QT3101500128	Not Applicable
Power Analyzer	Electrical	Yokogawa	WT310E	C25K10003V	8/16/2021
Goniometer	Angular & IES data	Orb Optronix	Gono 7_M	GONO007	8/16/2021
Spectral Suite	Software - Spectrum	Orb Optronix	SS V3	3.1.17.901	Not Applicable
Spectral Suite	Software - IES	Orb Optronix	SS V3	3.0.16.951	Not Applicable

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### REVISION HISTORY

REVISION	DATE	APPROVED	DESCRIPTION OF REVISION
010	3/23/2021	ACM	① ORIGINAL
011	4/1/2021	ACM	① Increases settings from as-shipped to MAXIMUM OUTPUT
012	4/2/2021	ACM	① Update the Product Description field to: HYDRA-1000 LED Light

END OF REPORT