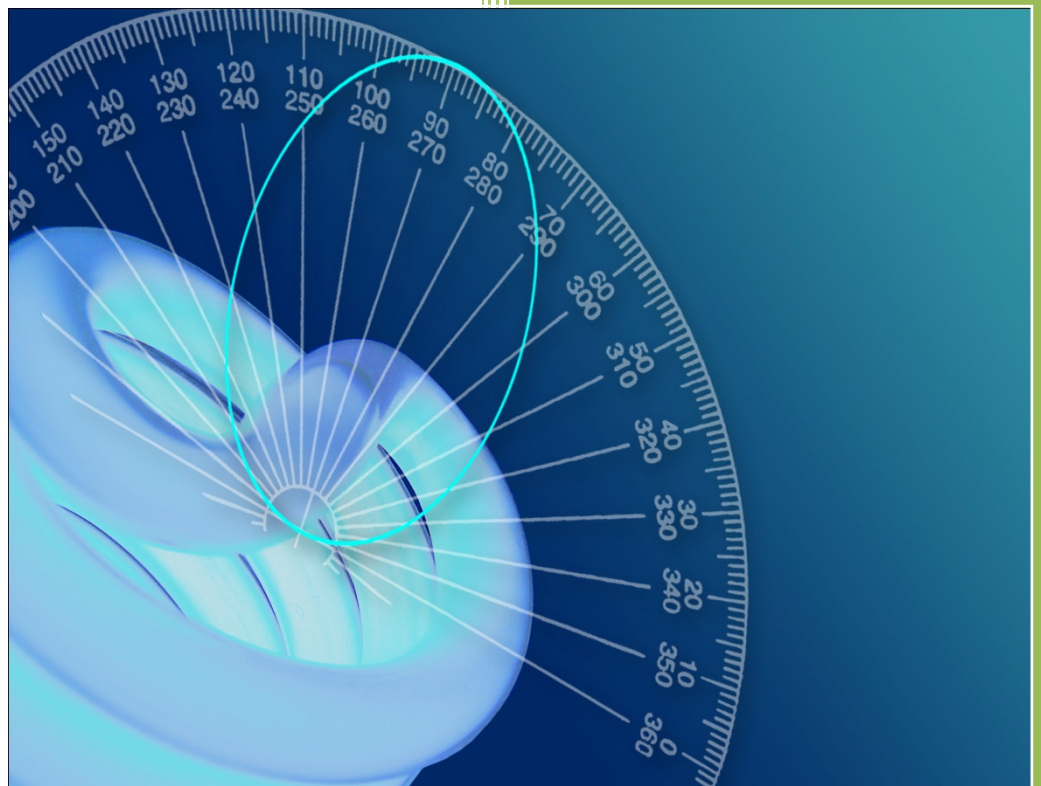


Photometric Test Report



Photometric and Optical Testing
Services
Cheltenham Film and Photographic
Studios
Hatherley Lane
Cheltenham
Gloucestershire
GL51 6PN
UK
Tel: 01242 701300

Photometric Test Report

Report Number: POTS/DC15205	Report Date: 06/11/2015	Prepared By: D CHAMBERS
Test Laboratory: Photometric and Optical Testing Services, Cheltenham Film and Photographic Studios, Hatherley Lane, Cheltenham, Gloucestershire, GL51 6PN		
Company Registration Number: Registered in England & Wales No. OC352911		
Registered Address: Thistle Down Barn, Holcot Lane, Sywell, Northampton, NN6 0BG		

Client Details

Company: Lumena Lights Ltd	Email: sales@lumenalights.com
Address: Centre 33, Long March, Daventry, Northamptonshire, United Kingdom, NN11 4NR	

Test Method(s) Used

POTS Standard Operating Procedure:	INTEGRATING SPHERE PROCEDURE POTS016
POTS Standard Operating Procedure:	NFMS OPERATION GUIDE
Standard:	LM79 08

Details of Product Tested

Manufacturer: LUMENA	Source Type: LED
Model: Lumena Lighthouse 1M (11w Kosnic).	Luminaire Type: BOLLARD
Power Supply Used: Kikusui PCR1000M Voltage Stabiliser S/N SM01191	
Voltage(AC V) = 230.0	Current (mA)= 73
Power (Watts)= 9.47	Power factor= 0.564

Integrating Sphere Test

Date of Test: 20/10/2015	Ambient Temperature:25°C
Measurement Filename: Lumena Lighthouse 1M (11w Kosnic).	
Instrument Used: Labsphere model 2m integrating sphere spectroradiometer AS-02949-012	
Integrating Sphere Size: 2m	Measurement Geometry ($2\pi / 4\pi$): 4π
Sample Orientation: Horizontal	Auxiliary Correction Applied: YES
Comments:	
Date of Last Calibration (Operating Hours): 12-10-2015 (0:57)	Spectral Flux Standard Lamp Used: SCL-600
Standard Lamp Serial Number: L123	Traceable: to NIST standards
Calibration Certificate Number: SCL-600-L123	Calibration Certificate Date: 29/01/2014
Calibration Lamp Uncertainty: $\pm 0.67\%$ ($k=2$)	
Results	
Flux (lumens): 465.4	
CIE 1931 Chromaticity Cx: 0.3135	CIE 1931 Chromaticity Cy: 0.3270
CRI (%):86.95	CCT (K): 6470

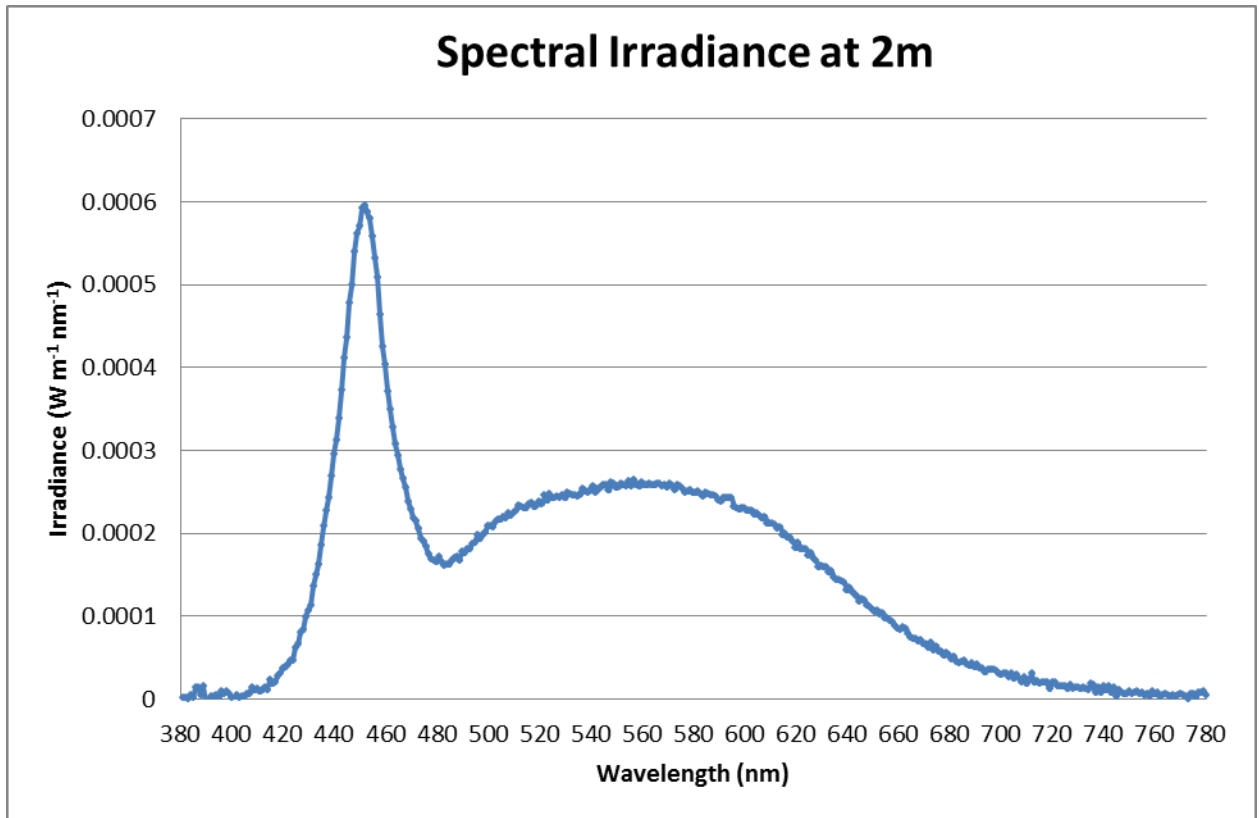


Figure 1: Spectral Irradiance



Figure 2: CIE 1931 diagram.

Goniophotometer Test		
Date of Test: 22/10/2015	Ambient Temperature: 25°C	
Measurement Filename: Lumena Lighthouse 1M (11w Kosnic).		
Instrument Used: Radiant Imaging NFMS0800 Goniometer with ProMetric PM-1200N-1 Imaging Photometer		
Photometer Working Distance: 2m	Measurement Geometry: Near-Field	
Comments:		
Reference Photometer Used: Specbos1211	Reference Photometer Serial Number: 2014754	
Traceable: to NIST standards		
Calibration Certificate Date: 18 June 2015	Sample Stabilisation Time (minutes): 90	
Reference Photometer Calibration Uncertainty: $\pm 2.4\%$ ($k=2$, 20-200 lux, CIE illuminant A source)		
Scan Set Up		
Direction	Range	Increment
Inclination Zone 1	0-180°	3°
Azimuth	0-360°	10°
Results		
Integrated Luminous Flux (lumens):465.4	Peak Intensity (3° Spot, candelas): 63.2	Efficacy (lumens/Watt): 49.1
Photometric Filename (IES LM-63-2002): Lumena Lighthouse 1M (11w Kosnic).		
IES File – Absolute or Relative Format? ABSOLUTE		
Photometric Filename (EULUMDAT): Lumena Lighthouse 1M (11w Kosnic).		
EULUMDAT File – Absolute or Relative Format? ABSOLUTE		

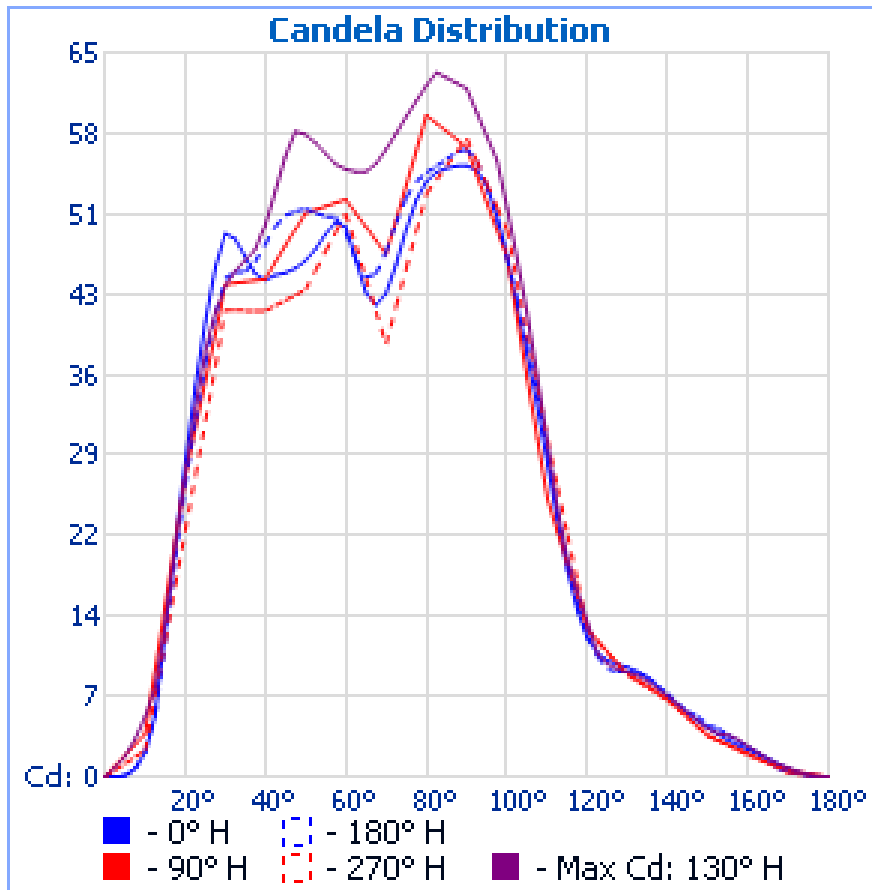


Figure 3: Far-Field Luminous Intensity (C0-180, Cartesian Coordinates)

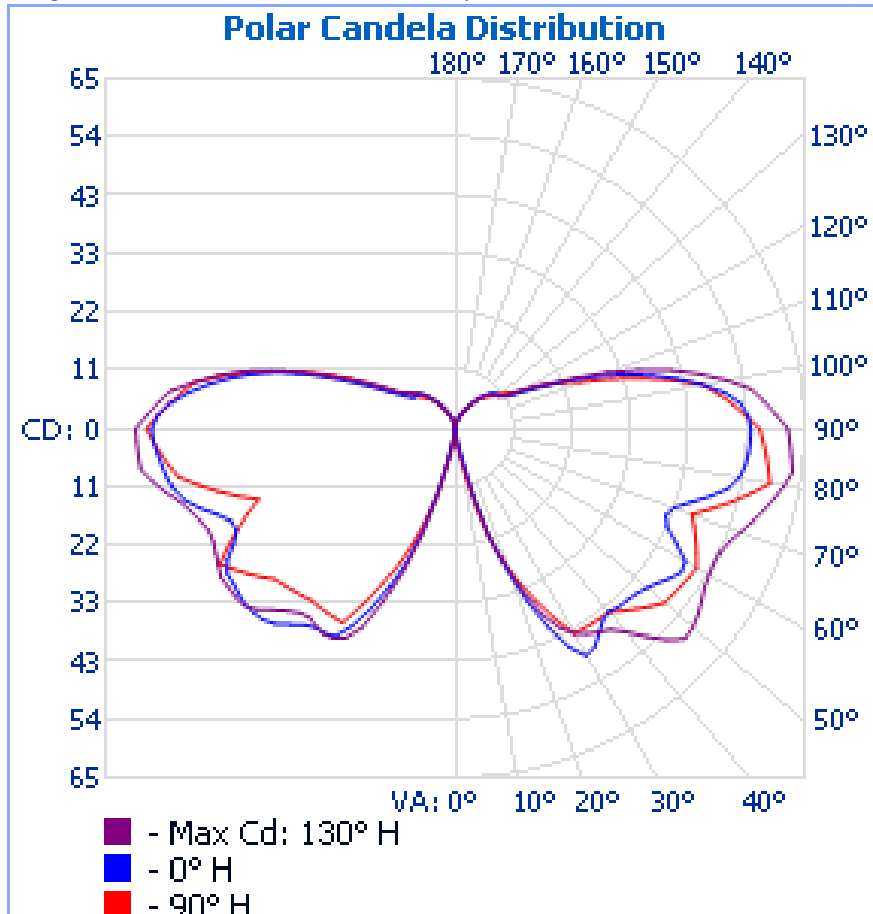


Figure 4: Far-Field Luminous Intensity (C0-180, C90-270, Polar Coordinates)

Room dimension		View endwise (C0)					View crosswise (C90)				
x	y										
Reflectance of											
Ceiling		0.7	0.7	0.5	0.5	0.3	0.7	0.7	0.5	0.5	0.3
Wall		0.5	0.3	0.5	0.3	0.3	0.5	0.3	0.5	0.3	0.3
Floor Cavity		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2H	2H	11.0	12.0	12.0	13.0	14.2	10.4	11.3	11.3	12.3	13.6
	3H	12.8	13.7	13.7	14.7	15.9	12.9	13.8	13.9	14.8	16.0
	4H	13.2	14.0	14.1	15.0	16.3	14.4	15.2	15.3	16.2	17.5
	6H	13.2	14.0	14.2	15.0	16.3	15.9	16.6	16.8	17.6	18.9
	8H	13.2	13.9	14.1	14.9	16.2	16.5	17.3	17.5	18.3	19.6
	12H	13.1	13.8	14.1	14.8	16.1	17.2	17.9	18.2	18.9	20.2
4H	2H	12.0	12.8	12.9	13.8	15.1	10.9	11.7	11.9	12.7	14.0
	3H	14.0	14.8	15.0	15.8	17.1	13.5	14.2	14.4	15.2	16.5
	4H	14.8	15.5	15.8	16.5	17.8	15.0	15.7	16.0	16.7	18.0
	6H	15.2	15.8	16.2	16.8	18.1	16.7	17.3	17.6	18.3	19.6
	8H	15.2	15.8	16.2	16.8	18.1	17.5	18.1	18.5	19.1	20.4
	12H	15.2	15.7	16.2	16.7	18.1	18.4	18.9	19.4	19.9	21.3
8H	4H	15.5	16.1	16.5	17.1	18.4	15.3	15.9	16.3	16.9	18.2
	6H	16.4	16.9	17.4	17.9	19.3	17.0	17.5	18.1	18.6	19.9
	8H	16.8	17.3	17.9	18.3	19.7	18.0	18.5	19.1	19.5	20.9
	12H	17.0	17.4	18.0	18.4	19.8	19.1	19.4	20.1	20.5	21.8
12H	4H	15.7	16.2	16.7	17.2	18.6	15.4	15.9	16.4	16.9	18.3
	6H	16.8	17.2	17.8	18.3	19.6	17.2	17.6	18.2	18.7	20.0
	8H	17.3	17.7	18.3	18.7	20.1	18.2	18.6	19.2	19.6	21.0

Distance between luminaires: 0.25

Due to missing symmetry characteristics the values apply only to the indicated line of sight.

Table 1. UGR values

	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
5	0	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1	1	0
7.5	1	1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	1
10	2	3	4	5	5	5	4	4	4	4	4	5	5	5	5	5	4	4	2
12.5	5	7	8	8	8	7	8	9	9	10	10	10	9	8	8	9	8	7	6
15	13	15	15	14	13	13	14	15	15	15	16	16	15	14	13	14	15	14	12
17.5	21	22	22	20	20	20	21	21	21	21	22	23	22	21	20	21	21	21	20
20	28	30	29	28	27	26	27	28	27	27	28	29	28	27	27	27	28	28	26
22.5	35	36	35	34	34	33	33	33	32	31	33	34	34	33	33	33	34	33	32
25	41	41	41	40	39	39	37	38	36	36	38	38	38	38	38	38	38	38	37
27.5	46	46	44	44	44	43	41	42	41	40	42	42	41	42	42	41	42	42	42
30	49	48	47	46	46	45	44	45	46	44	46	46	44	44	44	44	44	45	45
32.5	48	48	47	47	47	46	47	48	46	44	47	48	46	45	45	46	46	45	45
35	47	47	47	47	47	46	48	48	46	44	46	48	48	46	47	47	47	46	45
37.5	45	46	47	47	47	46	48	48	46	45	46	48	49	47	48	48	48	47	46
40	45	46	47	48	48	47	48	48	46	45	46	49	50	50	50	50	50	49	48
42.5	45	46	48	49	50	49	49	48	47	46	47	50	51	53	52	52	52	50	49
45	45	46	48	50	51	51	49	49	48	48	49	50	52	56	55	54	53	51	50
47.5	46	46	48	50	52	54	51	49	49	49	50	51	54	58	56	55	53	51	51
50	46	47	49	51	53	54	52	49	50	51	51	51	55	58	56	56	53	52	51
52.5	47	48	50	52	55	54	53	49	50	51	51	51	57	57	58	56	53	52	51
55	49	49	51	53	55	53	54	50	51	51	51	51	57	56	57	54	52	52	50
57.5	50	50	51	53	54	53	52	50	51	52	51	50	54	55	56	53	51	51	50
60	49	49	50	52	54	52	50	49	52	52	51	50	52	55	55	52	49	49	49
62.5	46	47	47	50	53	52	48	49	51	51	51	49	50	54	54	50	47	47	46
65	43	44	45	48	52	51	48	48	50	49	51	49	51	54	53	49	47	45	45
67.5	42	43	45	47	51	52	50	48	49	48	51	49	53	55	54	49	47	46	45
70	43	45	47	50	51	53	51	48	47	47	50	50	55	56	55	52	50	48	47
72.5	46	47	49	52	53	54	53	49	50	50	52	51	57	58	57	54	52	51	50
75	49	50	52	55	56	55	54	51	52	53	54	53	59	59	58	57	54	53	52
77.5	52	52	54	57	58	57	55	53	55	56	57	55	60	61	60	58	55	54	53

80	53	54	55	58	60	59	57	55	58	59	59	56	61	62	61	60	56	55	54
82.5	54	55	55	59	61	60	57	55	58	59	59	57	61	63	62	60	56	56	55
85	55	55	56	59	61	60	58	55	58	58	59	56	61	63	62	60	57	56	55
87.5	55	55	56	59	61	60	58	55	58	57	59	56	61	62	62	60	57	56	56
90	55	55	56	59	61	60	59	55	57	57	58	55	60	62	62	60	57	55	56
92.5	54	54	56	57	59	58	56	53	55	54	56	53	58	60	60	57	56	54	55
95	53	53	54	55	56	55	53	51	52	52	53	51	55	58	57	54	54	53	53
97.5	50	50	51	52	53	53	50	49	50	49	50	49	52	55	53	52	51	51	50
100	47	47	47	49	49	49	47	47	47	47	47	47	48	51	50	50	48	47	47
102.5	42	42	43	44	46	45	42	43	43	41	42	42	43	46	46	46	44	43	43
105	38	38	39	39	41	41	38	39	38	36	37	38	38	42	42	41	40	39	39
107.5	33	34	34	34	36	36	34	35	34	30	32	34	33	36	36	36	35	35	34
110	28	29	29	29	31	31	29	30	29	25	27	29	29	30	30	31	30	30	29
112.5	23	23	24	24	26	26	25	26	25	22	23	25	24	24	25	26	25	24	24
115	19	18	19	20	22	21	20	21	21	19	19	20	20	20	20	21	20	19	19
117.5	15	15	16	17	17	18	17	17	17	16	16	15	16	17	16	17	16	16	15
120	12	13	13	14	15	15	15	14	13	13	12	13	14	14	13	14	13	13	13
122.5	11	11	11	12	13	12	13	13	12	12	12	12	12	11	12	12	11	11	11
125	11	10	11	11	11	11	12	12	12	11	11	11	11	10	11	10	10	10	10
127.5	10	10	10	10	10	11	11	11	11	10	10	10	10	10	10	10	10	9	9
130	10	10	10	10	10	10	10	10	10	9	9	10	9	9	9	9	9	9	9
132.5	9	9	10	9	9	10	10	9	9	9	9	9	9	9	9	9	9	10	9
135	9	9	9	9	9	9	9	9	8	8	8	8	8	9	8	9	8	9	9
137.5	8	8	8	8	8	8	8	8	8	8	7	7	8	8	8	8	8	8	8
140	7	7	8	8	8	7	7	7	7	7	6	7	7	7	7	7	7	8	7
142.5	6	7	7	7	7	7	7	6	6	6	6	6	6	7	7	6	7	7	7
145	6	6	6	6	6	6	6	6	6	5	5	5	5	6	6	6	6	6	6
147.5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	6	6	5
150	4	5	5	5	5	5	5	5	4	4	4	4	4	4	5	5	5	5	5
152.5	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4
155	3	3	3	3	3	3	3	4	3	3	3	3	4	4	3	3	3	4	4
157.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

160	2	2	2	2	3	3	3	3	2	2	2	2	2	3	3	3	3	3	3
162.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
165	2	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	1
167.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
170	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1
172.5	0	0	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	0	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	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	0	0	0

Table 2a. Luminous intensity values, azimuth 0-180°

	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0
5	0	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1
7.5	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	2	2
10	3	4	4	4	4	3	2	2	2	3	4	5	5	5	5	4	3
12.5	7	7	7	6	6	6	7	8	7	9	9	8	7	8	8	8	7
15	13	13	12	10	11	13	13	13	12	16	16	15	14	13	14	15	15
17.5	21	20	18	18	18	19	20	19	17	22	22	22	21	20	21	23	23
20	27	27	25	25	24	25	26	25	22	29	29	29	28	28	29	30	30
22.5	33	33	32	32	31	31	31	30	27	33	35	35	35	35	35	36	36
25	38	38	37	37	37	35	36	35	32	38	39	39	41	41	41	41	42
27.5	42	41	41	41	41	40	40	40	37	42	43	42	44	44	44	45	46
30	45	44	44	44	43	43	44	45	42	47	46	45	45	46	46	47	48
32.5	46	46	46	46	45	46	46	45	42	47	48	47	45	46	46	47	48
35	46	46	46	47	46	47	46	45	42	46	47	47	45	45	45	46	47
37.5	47	47	47	48	47	47	47	45	42	45	46	46	44	45	45	46	46
40	48	48	48	49	48	48	47	44	42	44	46	46	45	46	46	46	45
42.5	49	49	50	50	51	49	47	45	42	44	45	46	46	47	47	46	45
45	50	50	50	52	53	50	48	45	43	45	45	46	48	48	47	46	45
47.5	51	50	51	53	55	52	48	46	43	45	46	48	50	49	48	45	45
50	51	51	51	53	56	54	49	46	44	46	46	49	51	51	49	46	46
52.5	52	51	52	54	55	56	49	47	45	47	46	51	52	52	50	48	47

55	52	50	52	54	55	57	49	48	47	48	47	52	52	53	52	50	49
57.5	50	50	51	54	54	54	49	49	49	49	47	50	52	53	52	50	50
60	48	49	50	53	53	53	48	50	51	50	47	48	51	53	51	49	49
62.5	46	47	48	52	52	51	48	49	48	49	47	46	50	52	49	46	46
65	44	45	47	51	52	51	47	47	45	48	46	46	50	50	46	44	44
67.5	45	45	47	50	51	51	46	45	42	46	45	47	50	49	45	43	43
70	47	47	49	51	52	52	46	44	39	45	45	49	50	49	47	45	44
72.5	49	49	51	53	52	53	47	46	42	47	46	50	52	51	49	47	47
75	51	52	53	55	53	54	49	48	46	49	48	51	53	54	52	50	49
77.5	53	53	54	57	56	55	51	51	49	52	50	53	55	56	54	52	51
80	54	54	56	58	58	56	53	53	52	55	52	54	57	58	56	53	53
82.5	54	54	56	59	60	57	53	54	54	55	53	55	59	59	57	54	54
85	55	55	57	59	60	58	54	54	55	56	53	56	59	60	58	55	55
87.5	55	55	57	59	60	60	54	55	56	56	53	57	59	60	58	55	55
90	55	55	57	59	60	61	55	55	57	57	54	59	59	61	58	56	54
92.5	54	55	56	58	59	58	53	54	55	55	52	56	57	58	57	55	54
95	53	54	55	56	58	55	52	52	53	52	51	53	55	56	55	54	53
97.5	50	51	52	53	56	53	51	51	51	50	49	50	53	53	53	51	51
100	47	47	49	50	52	49	50	49	49	47	47	46	49	49	49	47	47
102.5	43	43	44	46	48	45	45	45	44	43	43	42	45	45	45	43	43
105	39	39	40	42	44	41	41	40	40	38	39	38	41	41	40	39	38
107.5	35	35	35	37	39	36	37	36	35	33	35	33	36	36	35	35	34
110	30	30	31	32	33	31	32	31	30	28	30	29	30	30	30	30	29
112.5	25	25	26	27	28	27	27	27	26	24	26	25	25	25	25	24	23
115	20	20	22	23	23	22	23	23	22	20	21	20	21	21	21	20	19
117.5	16	16	18	18	19	18	18	18	17	17	17	17	18	17	17	16	15
120	13	13	14	15	16	16	15	15	13	13	14	15	15	14	14	14	13
122.5	11	11	12	13	12	13	14	13	12	13	13	13	12	13	12	12	11
125	10	10	11	12	11	11	13	12	11	12	12	12	11	12	11	11	11
127.5	10	10	10	10	10	10	11	11	10	11	11	11	11	11	10	10	10
130	9	10	10	10	9	10	10	10	9	10	10	10	10	10	10	10	10
132.5	9	10	9	9	9	9	9	9	9	9	9	10	10	9	9	9	9
135	9	9	9	9	9	9	9	9	8	8	9	9	9	9	9	9	9
137.5	9	9	8	9	8	8	8	8	7	7	8	8	8	8	8	8	8
140	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7
142.5	7	7	7	7	7	7	7	7	6	6	6	6	6	6	6	6	6
145	6	6	6	6	6	6	6	6	5	5	6	6	5	6	5	6	6

147.5	6	6	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5
150	5	5	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4
152.5	5	4	5	5	4	4	4	4	3	4	4	4	4	4	4	4	4
155	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3
157.5	3	4	4	3	3	3	3	3	2	3	3	3	3	3	3	3	3
160	3	3	3	3	3	2	3	3	2	2	2	2	2	2	2	2	2
162.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
165	1	1	1	1	1	2	2	2	1	1	1	1	1	2	2	2	2
167.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
170	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
172.5	0	1	1	1	1	1	1	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	0
177.5	0	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	0

Table 2b. Luminous intensity values, azimuth 190-350°

Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	0	0.00%	90-95	30.5	6.90%
05-10	0.2	0.00%	95-100	27.8	6.30%
10-15	1	0.20%	100-105	23.5	5.30%
15-20	3.5	0.80%	105-110	18.2	4.10%
20-25	7	1.60%	110-115	12.7	2.90%
25-30	10.6	2.40%	115-120	8.3	1.90%
30-35	13.5	3.00%	120-125	5.7	1.30%
35-40	15.5	3.50%	125-130	4.5	1%
40-45	17.8	4.00%	130-135	3.7	0.80%
45-50	20.2	4.50%	135-140	3	0.70%
50-55	22.3	5.00%	140-145	2.2	0.50%
55-60	23.7	5.30%	145-150	1.5	0.30%
60-65	23.9	5.40%	150-155	1	0.20%
65-70	24.3	5.40%	155-160	0.6	0.10%
70-75	26.4	5.90%	160-165	0.3	0.10%
75-80	29.1	6.50%	165-170	0.1	0%
80-85	30.9	6.90%	170-175	0	0%
85-90	31.5	7.10%	175-180	0	0%

Table 3. Zonal Flux Table

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	0
RCR: 0	1.11	1.11	1.11	1.11	1.05	1.05	1.05	0.68	0.93	0.93	0.93	0.82	0.82	0.82	0.72	0.72	0.72	0.68
1	0.95	0.87	0.81	0.75	0.88	0.82	0.76	0.44	0.71	0.67	0.62	0.62	0.58	0.55	0.53	0.5	0.47	0.43
2	0.84	0.73	0.64	0.56	0.78	0.68	0.6	0.32	0.59	0.52	0.47	0.51	0.45	0.41	0.43	0.39	0.35	0.31
3	0.75	0.62	0.52	0.44	0.69	0.58	0.49	0.25	0.5	0.42	0.36	0.43	0.37	0.32	0.36	0.31	0.27	0.23
4	0.68	0.53	0.43	0.35	0.63	0.5	0.4	0.2	0.43	0.35	0.29	0.37	0.3	0.25	0.31	0.26	0.21	0.18
5	0.61	0.47	0.36	0.29	0.57	0.44	0.34	0.16	0.38	0.3	0.24	0.32	0.26	0.21	0.27	0.22	0.18	0.14
6	0.56	0.41	0.31	0.24	0.52	0.39	0.29	0.13	0.33	0.26	0.2	0.29	0.22	0.17	0.24	0.19	0.15	0.12
7	0.52	0.37	0.27	0.2	0.48	0.34	0.26	0.11	0.3	0.22	0.17	0.26	0.19	0.15	0.22	0.16	0.12	0.1
8	0.48	0.33	0.24	0.18	0.44	0.31	0.22	0.1	0.27	0.2	0.15	0.23	0.17	0.13	0.2	0.14	0.11	0.08
9	0.44	0.3	0.21	0.15	0.41	0.28	0.2	0.08	0.24	0.17	0.13	0.21	0.15	0.11	0.18	0.13	0.09	0.07
10	0.41	0.27	0.19	0.13	0.38	0.26	0.18	0.07	0.22	0.16	0.11	0.19	0.14	0.09	0.16	0.11	0.08	0.06

Table 4. Utilisation Factor Table

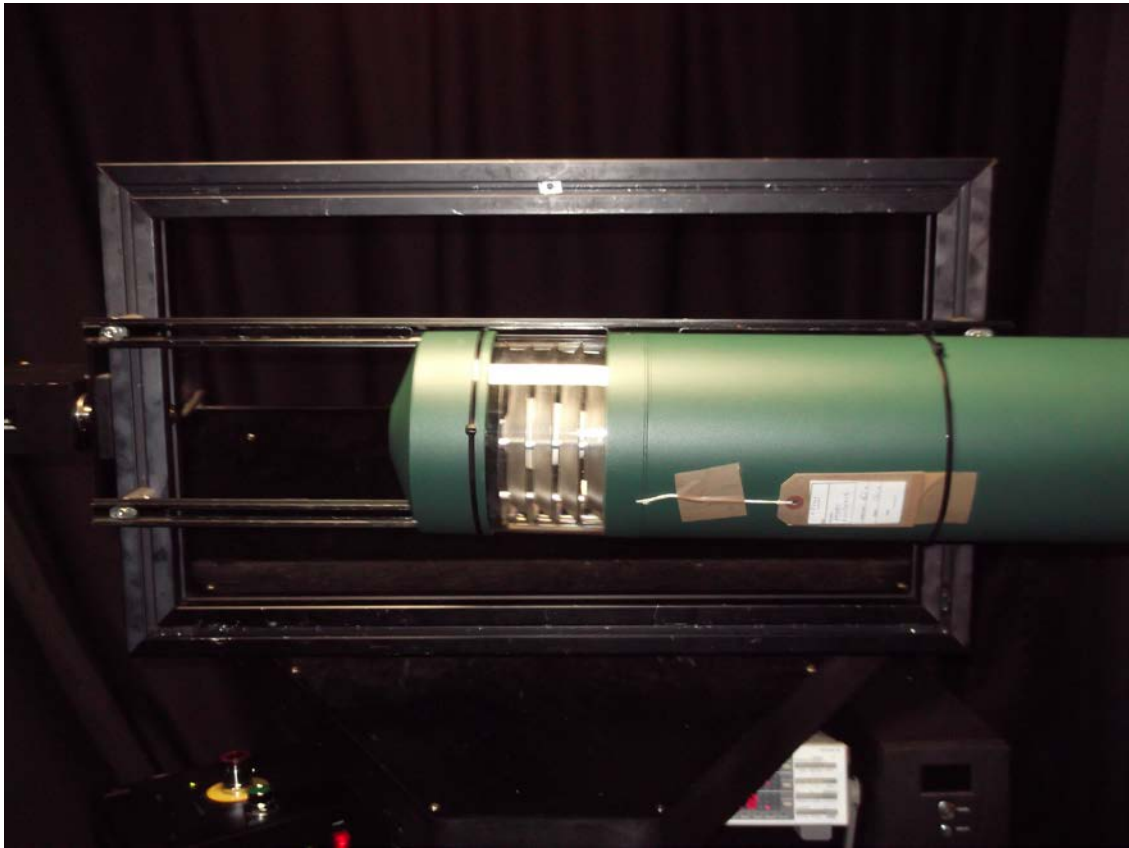


Photo 1: Luminaire on goniometer mount

Signature:

Print Name:

D CHAMBERS

Date:

06/11/2015

Test Engineer

Duly authorised to sign on behalf of:

Photometric and Optical Testing Services LLP

Checked by:

Signature:



Print Name:

G John

Date: 6-11-2015

Technical Director

Duly authorised to sign on behalf of:

Photometric and Optical Testing Services LLP