

Goniophotometry Report

1_PHOT_REFLEKTER-XL-4300lmChip-3000K-21Deg_2303
www.factorylux.com



Tested Light Source - 1_PHOT_REFLEKTER-XL-4300lmChip-3000K-21Deg_2303

Laboratory and Equipment

Laboratory Owner and Location
Goniospectrometer System and Type
Spectrometer Manufacturer and Model

Factorylux, Greenhill Mills, Hebden Bridge, HX7 5QF, UK
BaseSpion – Type C, horizontal
Ibsen Photonics, Denmark – Freedom VIS (Custom Viso)

Measurement Conditions

Number of C-planes and Resolution
 γ (gamma)-Resolution
Test Distance
Input Power, Power and Displ. Factors
Input RMS Voltage and Current
Frequency of Input Power

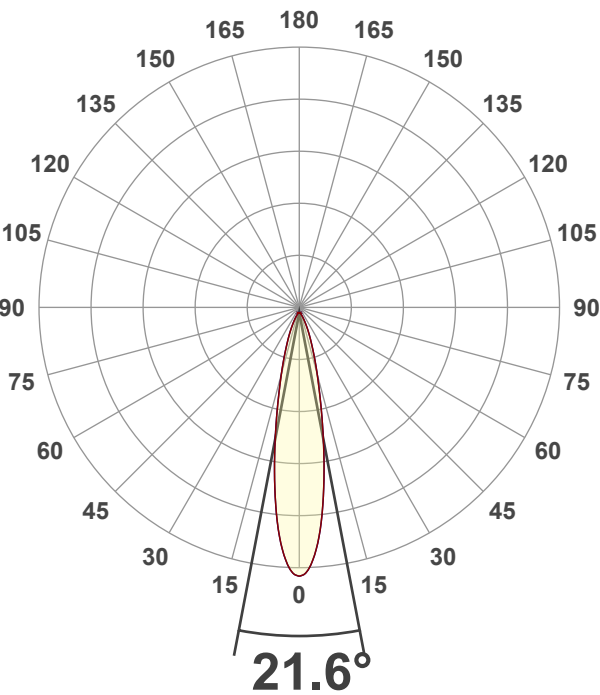
32 planes – 11.25°
1°
4.50 m
41.5 W – PF 0.97 – DPF 0.97
239 V – 0.180 A
50 Hz

Main Light Measurement Results

Output
Efficiency
Peak Intensity and Beam Angle
Color Rendering Index

3621 lm
87 lm/W
15315 cd – 21.6°
CRI 92.7

Light Intensity Distribution



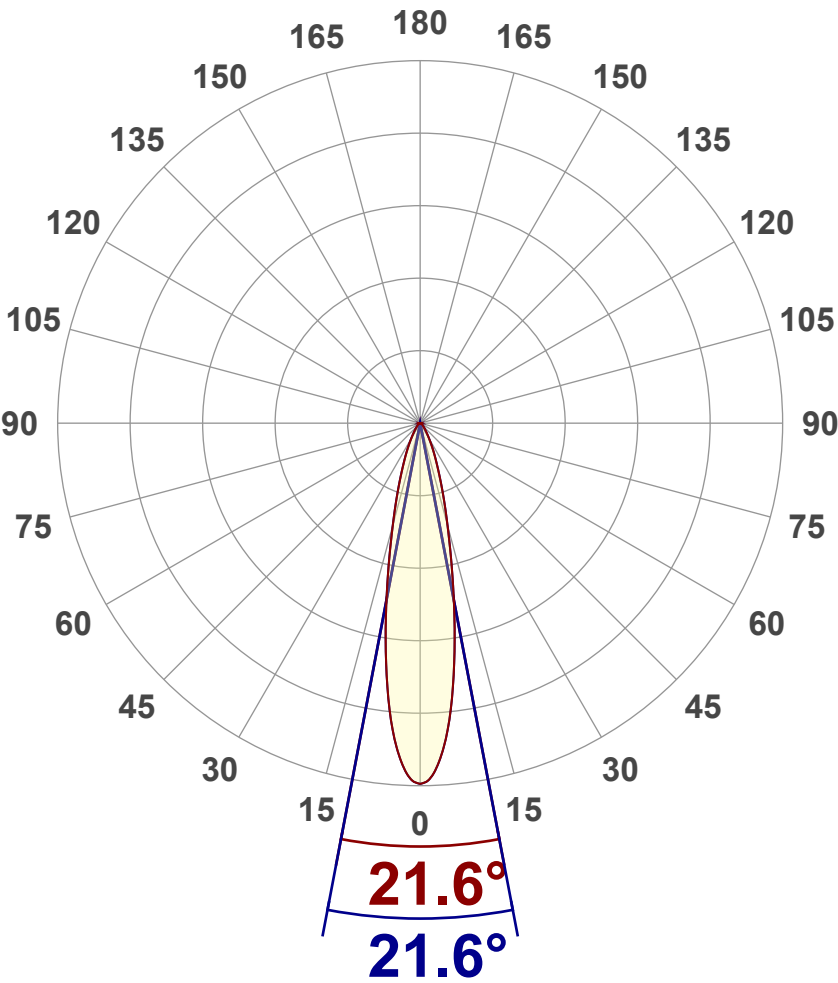
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Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

Output (total Lumen)	3621 lm
Peak Intensity	15315 cd
Beam Angle (50%)	21.6°
Beam Angle (90%)	21.6°
Beam Angle (10%)	21.6°

Cut-off Angle

Average 2,5%	73.2°
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Field Angle

Average 10%	48.1°
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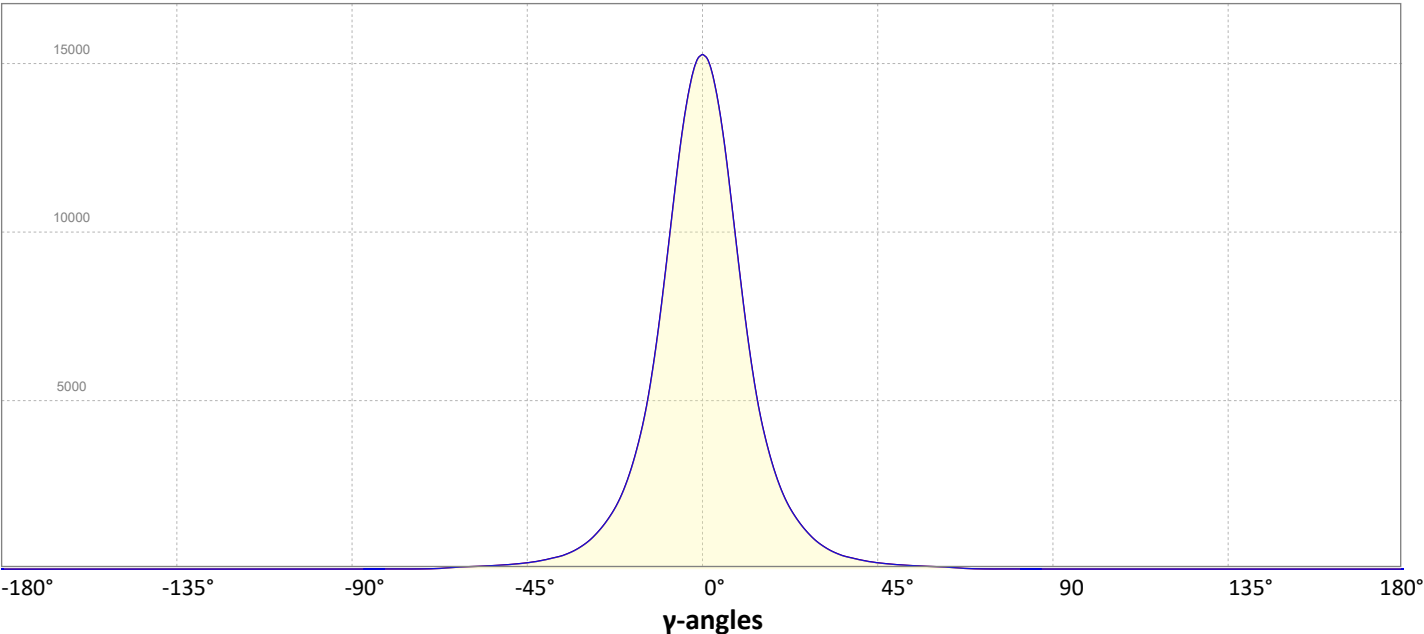
Intensity Ratio

In 120° cone	98.1%
In 90° cone	93.9%

C000-C180

C090-C270

Linear distribution diagram - Intensity (candela) vs γ-angle

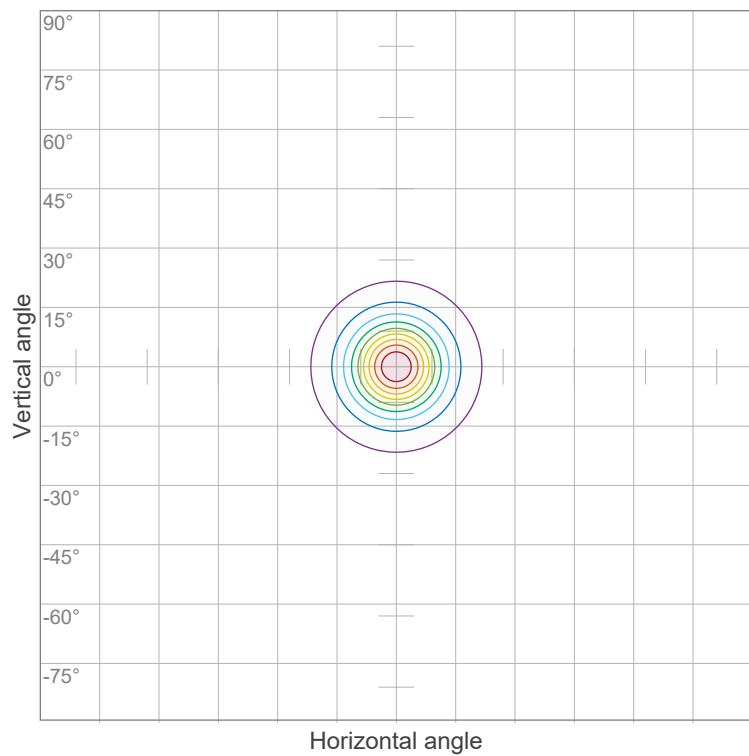


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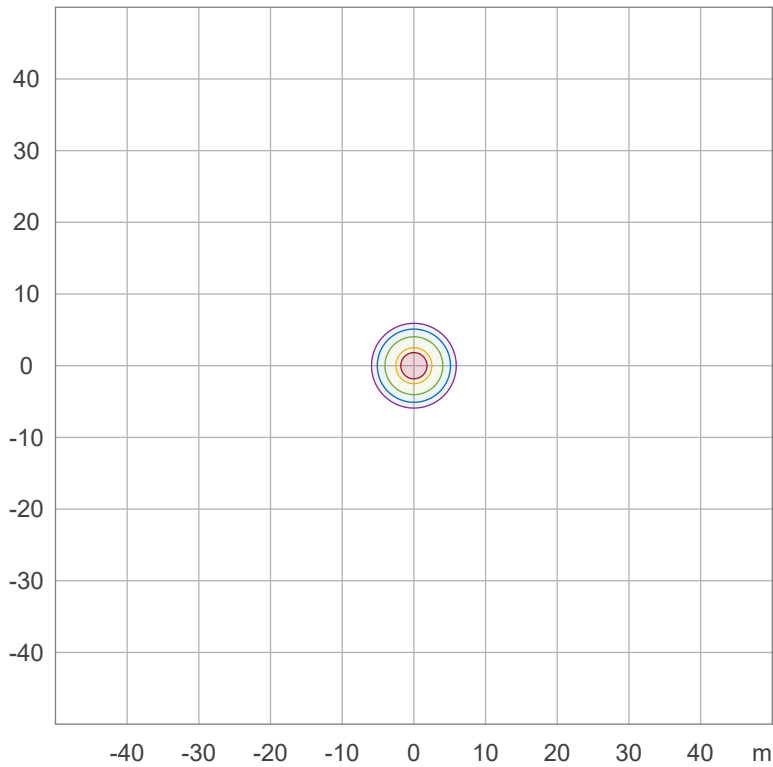
Iso-intensity Diagram (Iso-candela)



90 %	13783.2 cd
80 %	12251.7 cd
70 %	10720.3 cd
60 %	9188.8 cd
50 %	7657.3 cd
40 %	6125.9 cd
30 %	4594.4 cd
20 %	3062.9 cd
10 %	1531.5 cd

Peak intensity: 15314.7 cd
Number of c-planes: 32

Iso-illuminance Diagram (Iso-lux)



50.0 %	76.6 lx
30.0 %	45.9 lx
10.0 %	15.3 lx
5.0 %	7.7 lx
3.0 %	4.6 lx

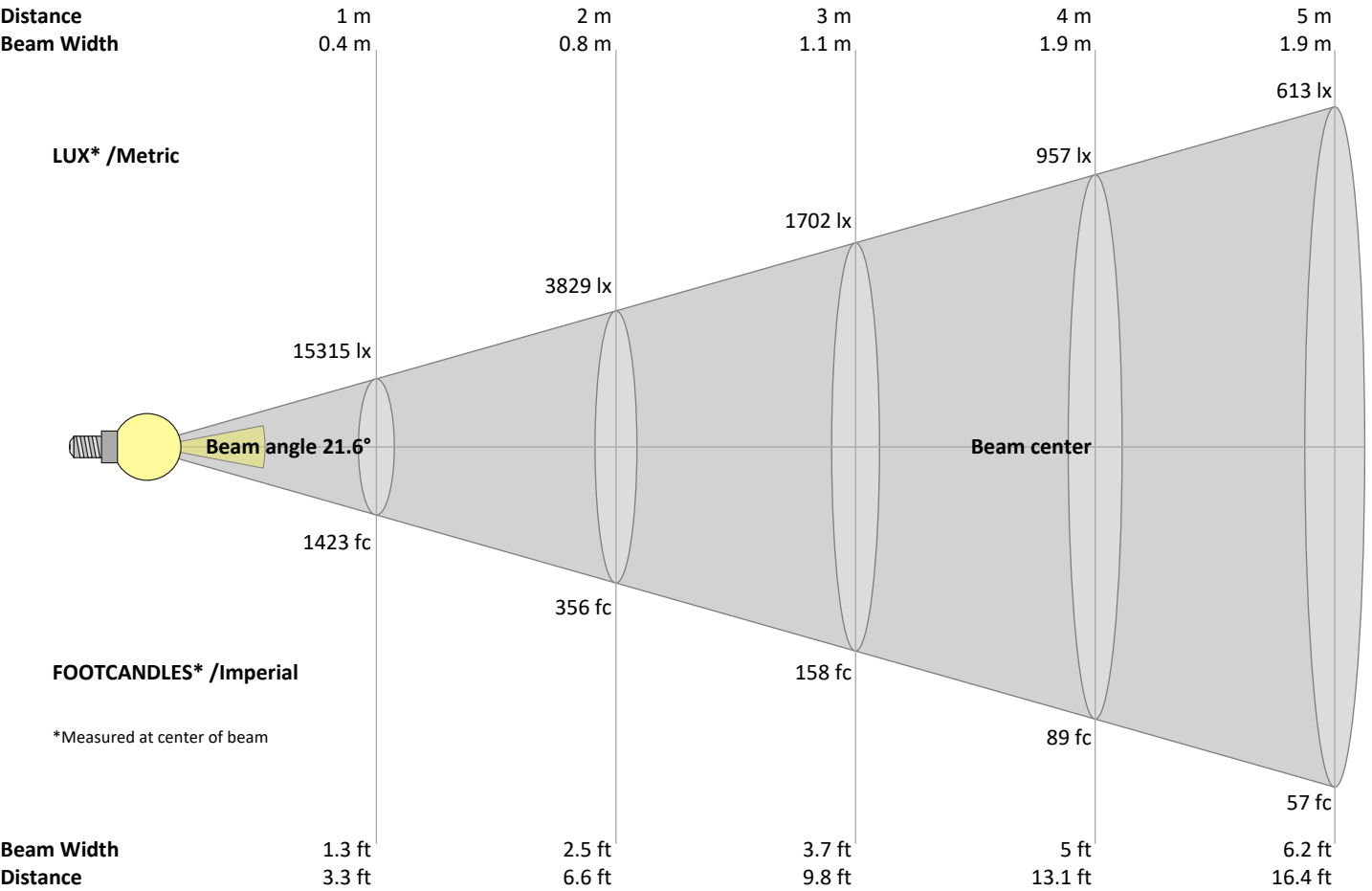
Peak illuminance: 153.1 lx
Mounting height: 10.0 m
Number of c-planes: 32

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Beam Details



Beam intensities from 1 – 20 m

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	m
3.3	6.6	9.8	13.1	16.4	19.7	23	26.2	29.5	32.8	36.1	39.4	42.7	45.9	49.2	52.5	55.8	59.1	62.3	65.6	ft
15315	3829	1702	957	613	425	313	239	189	153	127	106	91	78	68	60	53	47	42	38	lux
1422.8	355.7	158.1	88.9	56.9	39.5	29	22.2	17.6	14.2	11.8	9.9	8.4	7.3	6.3	5.6	4.9	4.4	3.9	3.6	fc

Intensities in 0° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
15.3K	15.0K	13.9K	12.3K	10.4K	8.4K	6.6K	5.1K	4.0K	3.1K	2.4K	1.9K	1.5K	1.2K	1.0K	0.8K	0.6K	0.5K	0.4K	0.3K	cd
100%	98%	91%	80%	68%	55%	43%	33%	26%	20%	16%	13%	10%	8%	6%	5%	4%	3%	3%	2%	of 0°val

Intensities in 90° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
15.3K	15.0K	13.9K	12.3K	10.4K	8.4K	6.6K	5.1K	4.0K	3.1K	2.4K	1.9K	1.5K	1.2K	1.0K	0.8K	0.6K	0.5K	0.4K	0.3K	cd
100%	98%	91%	80%	68%	55%	43%	33%	26%	20%	16%	13%	10%	8%	6%	5%	4%	3%	3%	2%	of 0°val

Intensities in 180° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
15.3K	15.0K	13.9K	12.3K	10.4K	8.4K	6.6K	5.1K	4.0K	3.1K	2.4K	1.9K	1.5K	1.2K	1.0K	0.8K	0.6K	0.5K	0.4K	0.3K	cd
100%	98%	91%	80%	68%	55%	43%	33%	26%	20%	16%	13%	10%	8%	6%	5%	4%	3%	3%	2%	of 0°val

Intensities in 270° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
15.3K	15.0K	13.9K	12.3K	10.4K	8.4K	6.6K	5.1K	4.0K	3.1K	2.4K	1.9K	1.5K	1.2K	1.0K	0.8K	0.6K	0.5K	0.4K	0.3K	cd
100%	98%	91%	80%	68%	55%	43%	33%	26%	20%	16%	13%	10%	8%	6%	5%	4%	3%	3%	2%	of 0°val

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Light Planning – UGR table

Uncorrected, comprehensive UGR table according to 117-1995

Reflectances											
	ρ Ceiling	70	70	50	50	30	70	70	50	50	30
	ρ Walls	50	30	50	30	30	50	30	50	30	30
	ρ Floor	20	20	20	20	20	20	20	20	20	20
Room size		Viewed Crosswise					Viewed Endwise				
H = mounting height above eye level		(Viewing direction orthogonal to lamp length axis)					(Viewing direction parallel to lamp length axis)				
X	Y										
2H	2H	20.4	20.9	20.4	21.1	21.3	20.4	20.9	20.4	21.1	21.3
	3H	20.2	20.9	20.6	21.1	21.3	20.2	20.9	20.6	21.1	21.3
	4H	20.2	20.8	20.6	21.0	21.3	20.2	20.8	20.6	21.0	21.3
	6H	20.2	20.7	20.5	21.0	21.4	20.2	20.7	20.5	21.0	21.4
	8H	20.2	20.7	20.5	21.0	21.4	20.2	20.7	20.5	21.0	21.4
	12H	20.1	20.6	20.5	21.0	21.4	20.1	20.6	20.5	21.0	21.4
4H	2H	20.3	20.9	20.7	21.1	21.4	20.3	20.9	20.7	21.1	21.4
	3H	20.4	20.9	20.7	21.2	21.6	20.4	20.9	20.7	21.2	21.6
	4H	20.3	20.7	20.7	21.1	21.7	20.3	20.7	20.7	21.1	21.7
	6H	20.2	20.7	20.7	21.0	21.4	20.2	20.7	20.7	21.0	21.4
	8H	20.2	20.7	20.7	21.0	21.4	20.2	20.7	20.7	21.0	21.4
	12H	20.2	20.5	20.7	20.9	21.4	20.2	20.5	20.7	20.9	21.4
8H	4H	20.1	20.6	20.7	20.9	21.3	20.1	20.6	20.7	20.9	21.3
	6H	20.1	20.4	20.6	20.9	21.4	20.1	20.4	20.6	20.9	21.4
	8H	20.2	20.4	20.7	20.9	21.5	20.2	20.4	20.7	20.9	21.5
	12H	20.2	20.4	20.8	20.9	21.5	20.2	20.4	20.8	20.9	21.5
12H	4H	20.1	20.4	20.6	20.8	21.3	20.1	20.4	20.6	20.8	21.3
	6H	20.1	20.4	20.6	20.9	21.5	20.1	20.4	20.6	20.9	21.5
	8H	20.1	20.3	20.7	20.8	21.4	20.1	20.3	20.7	20.8	21.4

Variations with the observer position for the luminaire spacings, S:

S = 1.0H	2.2 / -1.8	2.2 / -1.8
S = 1.5H	4.0 / -2.7	4.0 / -2.7
S = 2.0H	5.6 / -6.4	5.6 / -6.4

Coefficients of Utilization

Ceiling 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
Floor reflectance	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0
RCR		(RCR: Room Cavity Ratio) Room Values are expressed as percentage of Lumen 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	114	112	110	108	112	110	108	106	105	104	102	102	100	99	98	97	96	95
2	110	105	102	99	107	104	100	98	100	98	96	97	95	93	95	93	92	90
3	105	100	95	92	103	98	94	91	96	93	90	93	91	88	91	89	87	86
4	101	95	90	87	99	94	89	86	92	88	85	90	87	84	88	85	83	82
5	97	90	86	82	96	90	85	82	88	84	81	86	83	80	85	82	79	78
6	94	87	82	78	93	86	81	78	84	80	77	83	79	77	82	79	76	75
7	91	83	78	75	89	82	78	75	81	77	74	80	76	74	79	76	73	72
8	88	80	75	72	87	79	75	72	78	74	71	77	74	71	76	73	71	70
9	85	77	72	69	84	77	72	69	76	72	69	75	71	69	74	71	68	67
10	82	74	70	67	81	74	70	67	73	69	66	73	69	66	72	69	66	65

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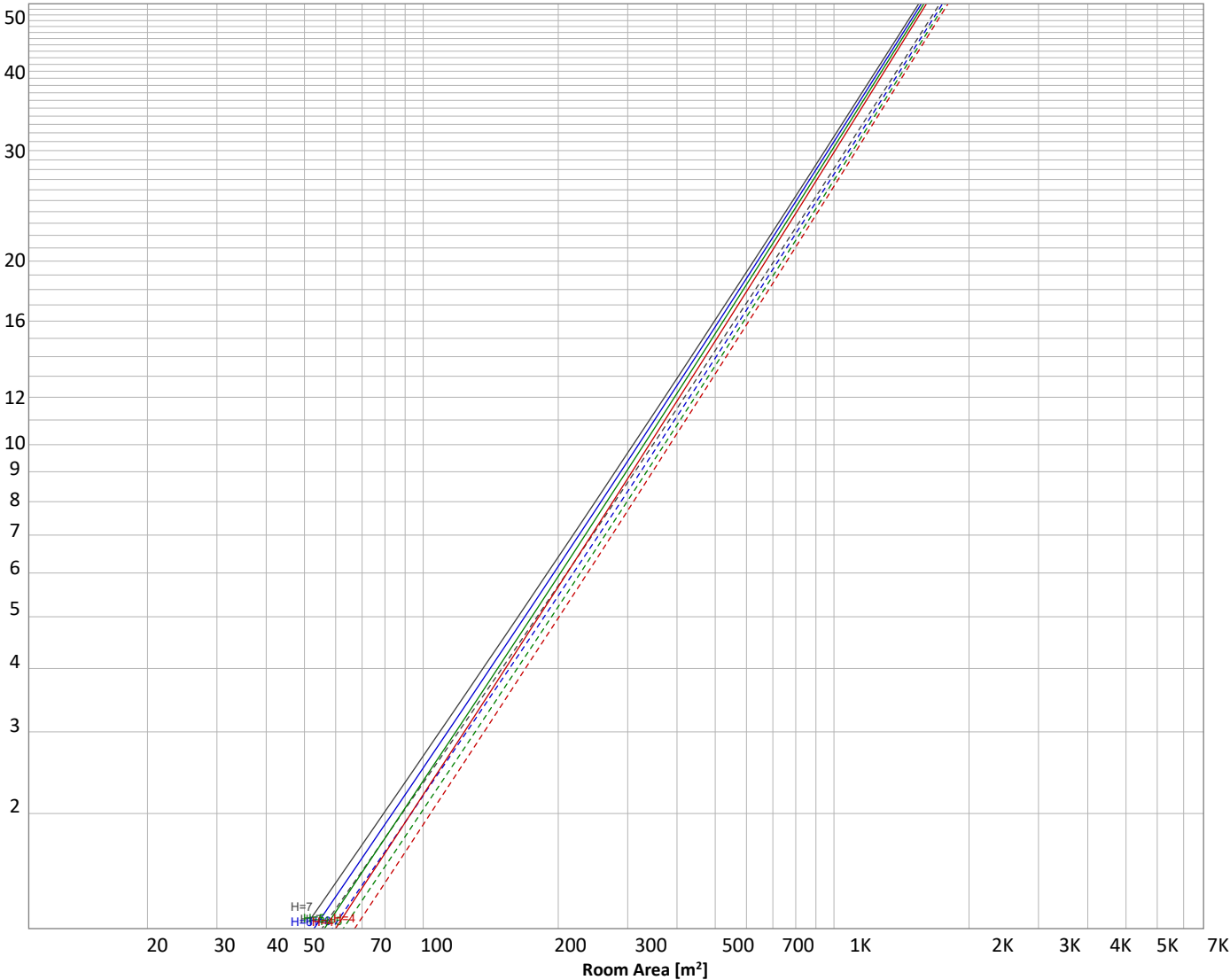
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Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 3621 lm	p(%)		
H _{down} = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	Wall reflectance
H _{work} = Work area height from floor =	0.00 m	-----	70	50
E _{work} = Average lux on work area =	100 lx	-----	50	30
				Floor reflectance
				20

Zonal Lumen Summary

0°-10°	10°-20°	20°-30°	30°-40°	40°-50°	50°-60°	60°-70°	70°-80°	80°-90°
1096 lm	1275 lm	645 lm	294 lm	153 lm	88.8 lm	41.1 lm	6.79 lm	5.76 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
3.47 lm	3.36 lm	3.15 lm	2.85 lm	1.59 lm	0.679 lm	0.501 lm	0.307 lm	0.103 lm

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Outdoor Light Planning

Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	1096 lm	30.3%
10-20°	1275 lm	35.2%
20-30°	645 lm	17.8%
30-40°	294 lm	8.1%
40-50°	153 lm	4.2%
50-60°	89 lm	2.5%
60-70°	41 lm	1.1%
70-80°	7 lm	0.2%
80-90°	6 lm	0.2%
90-100°	3 lm	0.1%
100-110°	3 lm	0.1%
110-120°	3 lm	0.1%
120-130°	3 lm	0.1%
130-140°	2 lm	0.0%
140-150°	1 lm	0.0%
150-160°	1 lm	0.0%
160-170°	0 lm	0.0%
170-180°	0 lm	0.0%
Total	3621 lm	100.0%

Intensity peaks

Max intensity	15315 cd
Intensity, 90°	3 cd
Intensity, 0°	15315 cd

Zonal Lumen summary

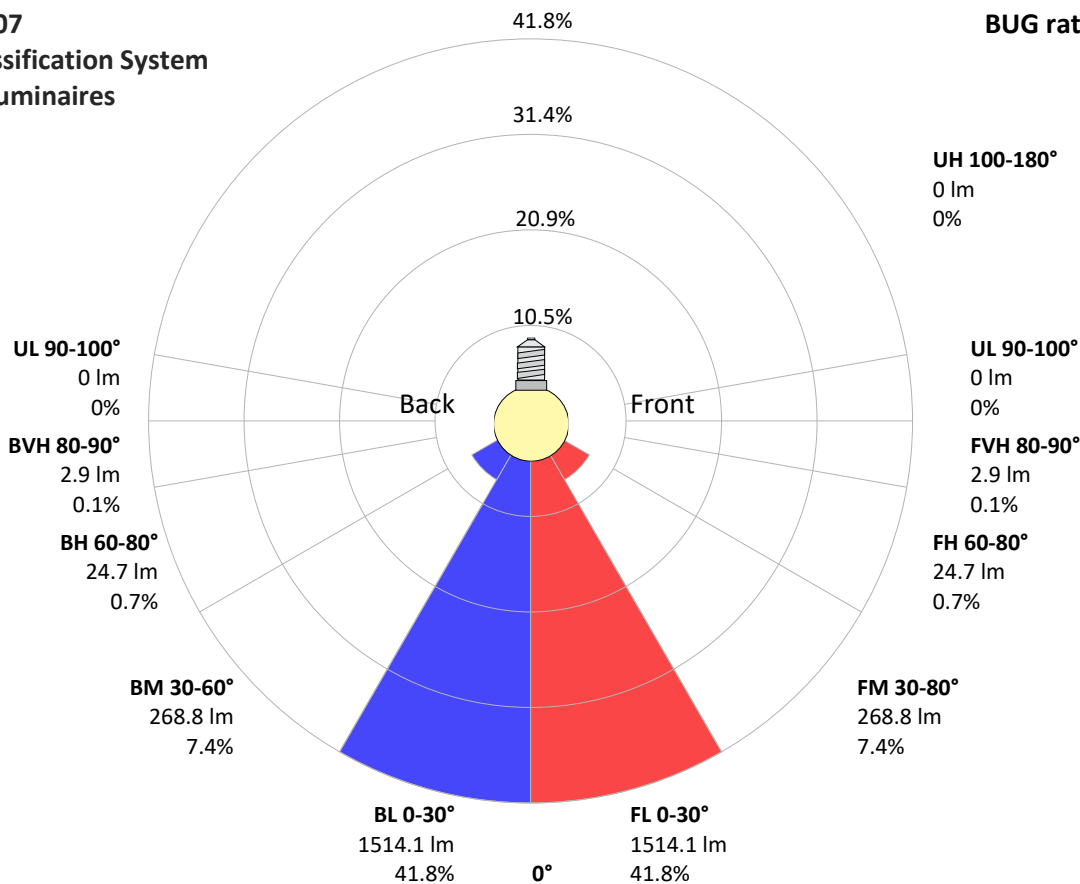
Zone (γ)	Lumen	% Total
0-30°	3016 lm	83.3%
0-40°	3310 lm	91.4%
0-60°	3551 lm	98.1%
60-90°	54 lm	1.5%
70-100°	16 lm	0.4%
90-120°	10 lm	0.3%
0-90°	3605 lm	99.6%
90-180°	16 lm	0.4%
0-180°	3621 lm	100.0%

BUG rating

	Lumen	% Total
Forward light		
Low(0-30°)	1514 lm	41.8%
Medium(30-60°)	269 lm	7.4%
High(60-80°)	25 lm	0.7%
Very high(80-90°)	3 lm	0.1%
Back light		
Low(0-30°)	1514 lm	41.8%
Medium(30-60°)	269 lm	7.4%
High(60-80°)	25 lm	0.7%
Very high(80-90°)	3 lm	0.1%
Uplight		
Low(90-100°)	0 lm	0.0%
High(100-180°)	0 lm	0.0%

IESNA TM-15-07 Luminaire Classification System For Outdoor Luminaires

BUG rating B3 U1 G0



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Power Details

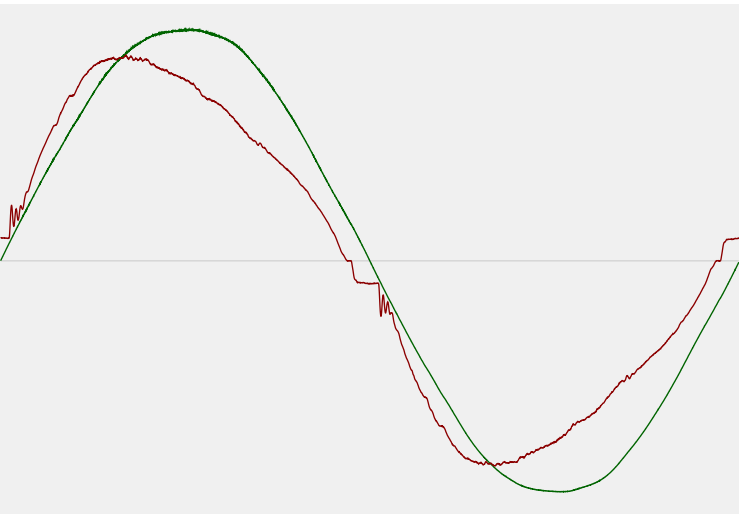
Input Power

Power feed to light source	41.5 W
Frequency of input power	50 Hz
RMS Input voltage feed, V_{RMS}	239 V
RMS Input current feed, I_{RMS}	0.180 A
Volt-Ampere or apparent power = $V_{RMS} \cdot I_{RMS}$	42.84 VA
Displacement factor of AC power feed	0.97
Power factor of AC current feed	0.97
Total harmonic distortion of the current	10.69%
Total harmonic distortion of the voltage	1.14%

Efficiency

Radiated power efficiency	31.7%
<div><div></div></div>	
Lumen efficiency	87 lm/W
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Input Power Curve



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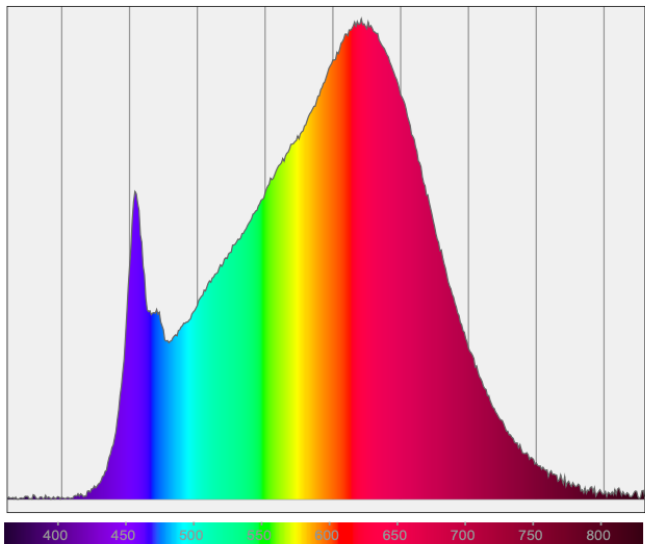
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Color Measurements

Correlated Color Temperature	CCT = 3000 K
Color Rendering TM30-18	R _f 91.0 — R _g 97.7
Color Shift, CIE duv	Duv ±0.0003

Spectral distribution



Color details

Correlated Color Temperature	CCT = 3000 K	Color coordinates CIE 1931	(x;y) = (0.437;0.404)
Color Rendering Index	CRI 94.1	Color coordinate CIEs 1960	(u;v) = (0.251;0.348)
Color Rendering Index, R9 (red component)	R9 = 68.6	Color deviation from BBL	Duv = ±0.0003
Color Rendering TM30-18	R _f 91.0 — R _g 97.7	Color coordinate CIEs 1976 (CIELUV)	(u';v') = (0.251;0.251)
Color Quality Scale	CQS = 91.8		

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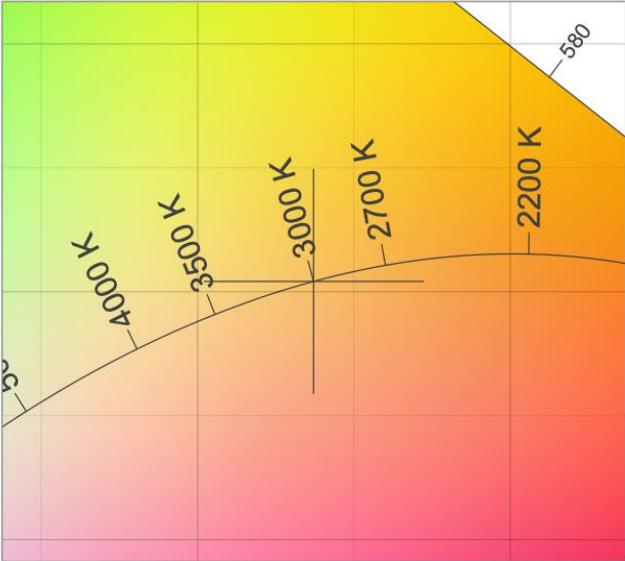
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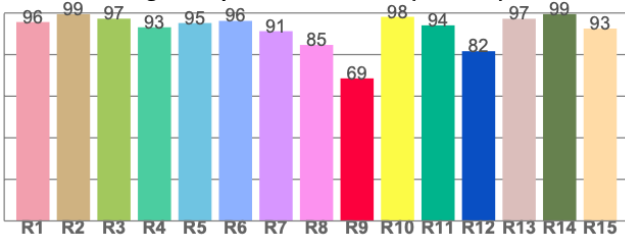
CIE 1931



CIE 1931 – zoomed on Planckian locus



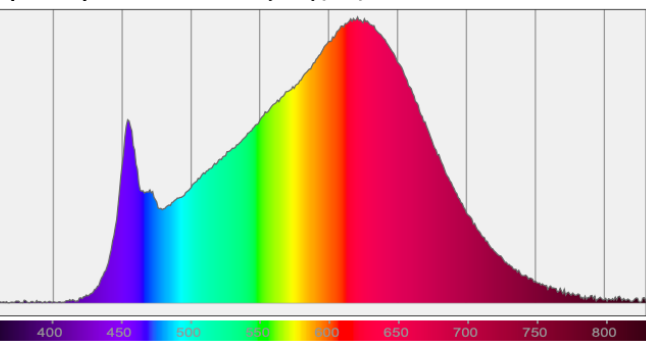
Color Rendering Index per reference color (CIE 1995)



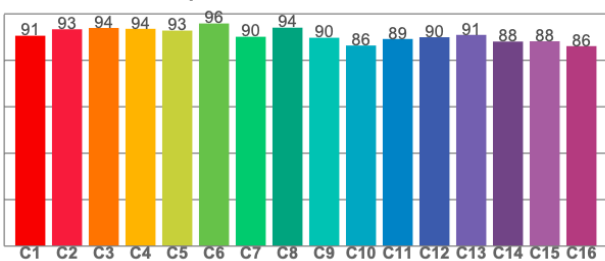
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
95.7	99.5	97.3	93.1	95.2	96.2	91.3	84.6	68.6	98.2	94.1	81.6	97.2	99.5	92.5

Spectral power distribution (SPD) / W/nm – 0-100%



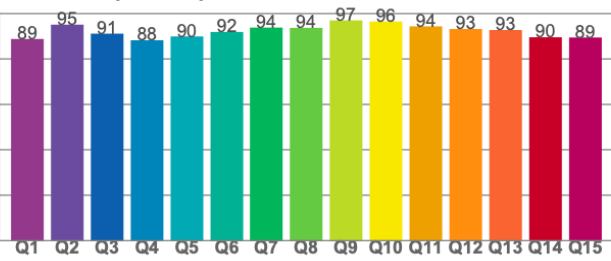
TM30-18 Rf-values per hue bin



TM30 C values, 16 binned values out of total of 99 C values

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
90.6	93.4	93.9	93.6	92.8	95.9	90.1	94.0	89.7	86.4	89.2	89.9	90.9	88.1	88.2	86.1

Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
88.8	95.1	91.2	88.2	89.9	91.9	93.8	93.7	97.0	96.5	94.4	93.2	92.8	89.6	89.5