

Goniophotometry Report

1_PHOT_REFLEKTER-XL-4300lmChip-3000K-38Deg-ConcentricLouvre_2303
www.factorylux.com



Tested Light Source - 1_PHOT_REFLEKTER-XL-4300lmChip-3000K-38Deg-ConcentricLouvre_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

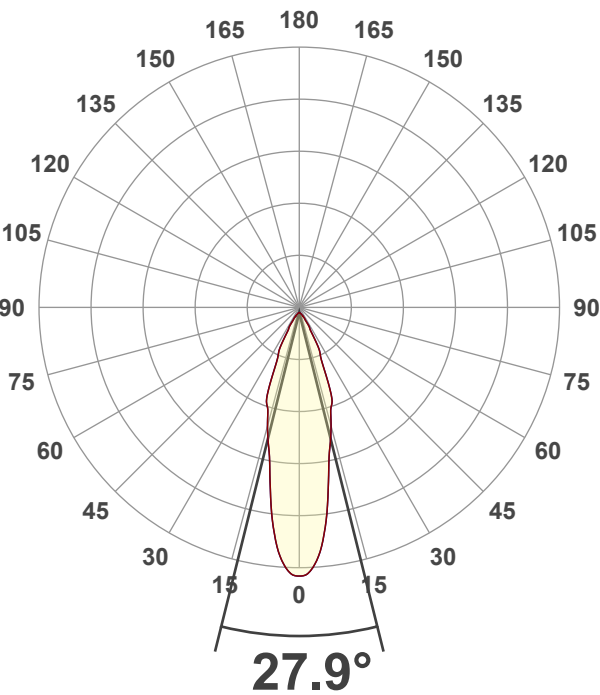
32 planes – 11.25°
1°
4.50 m
41.4 W – PF 0.97 – DPF 0.97
241 V – 0.178 A
50 Hz

Main Light Measurement Results

Output
Efficiency
Peak Intensity and Beam Angle
Color Rendering Index

2641 lm
64 lm/W
6629 cd – 27.9°
CRI 92.8

Light Intensity Distribution



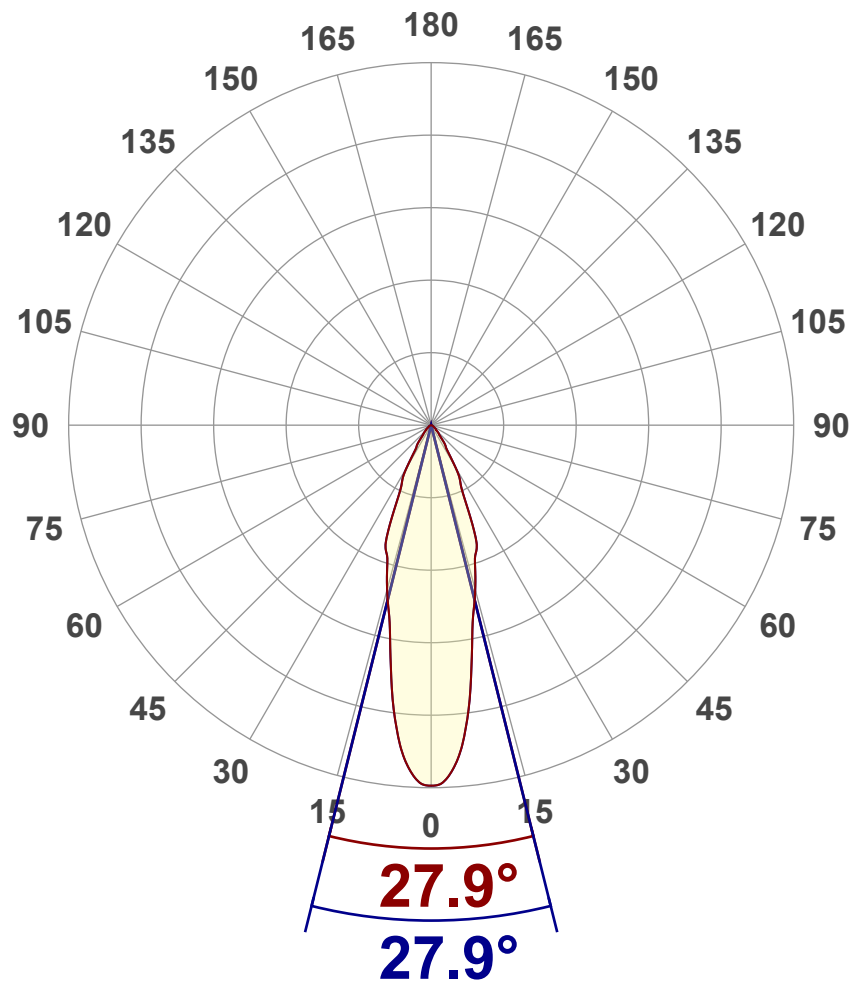
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Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

| | |
|----------------------|---------|
| Output (total Lumen) | 2641 lm |
| Peak Intensity | 6629 cd |
| Beam Angle (50%) | 27.9° |
| Beam Angle (90%) | 27.9° |
| Beam Angle (10%) | 27.9° |

Cut-off Angle

| | |
|--------------|-------|
| Average 2,5% | 88.6° |
|--------------|-------|

Field Angle

| | |
|-------------|-------|
| Average 10% | 63.1° |
|-------------|-------|

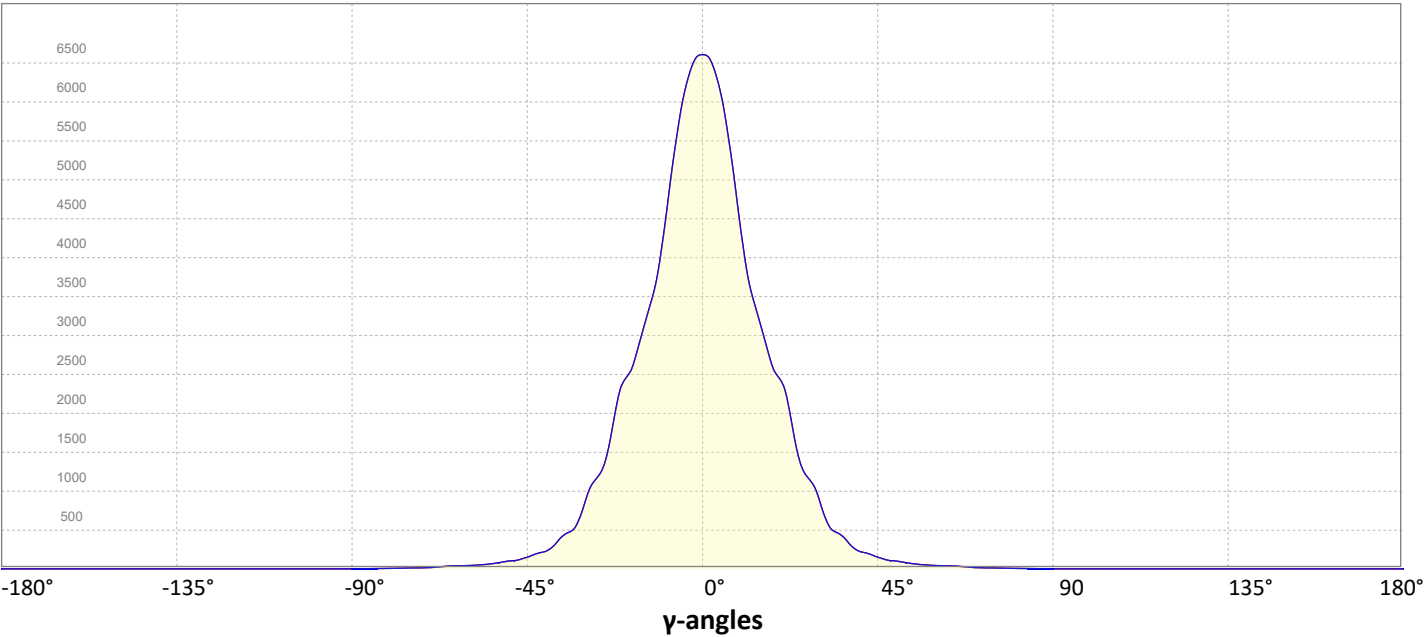
Intensity Ratio

| | |
|--------------|-------|
| In 120° cone | 97.0% |
| In 90° cone | 92.8% |

C000-C180

C090-C270

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

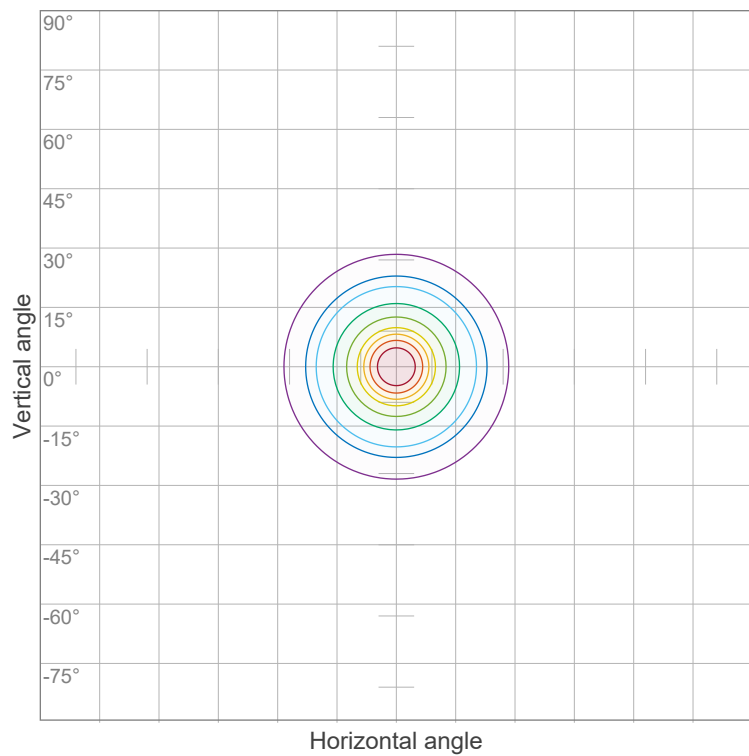


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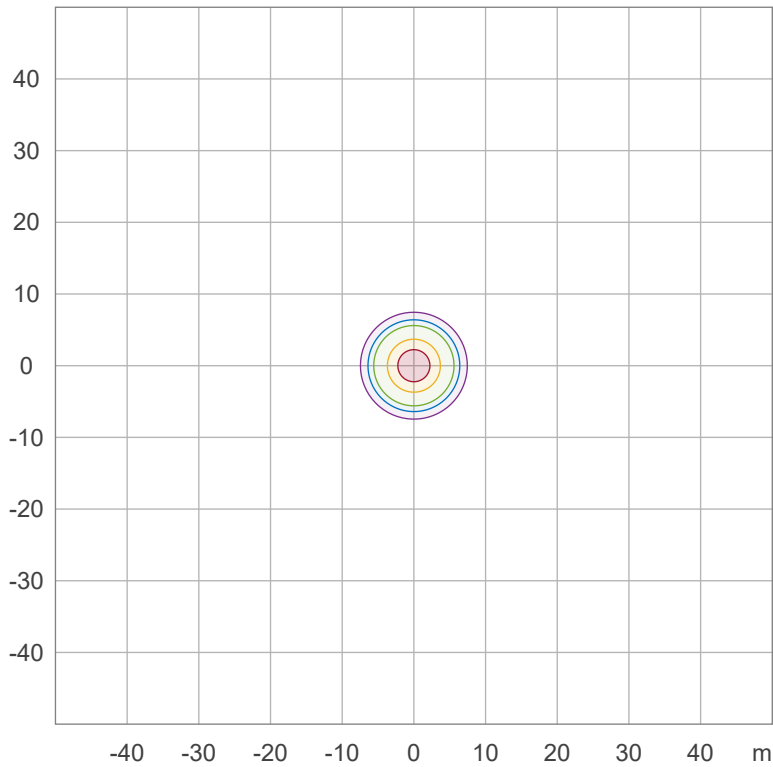
Iso-intensity Diagram (Iso-candela)



| | |
|------|-----------|
| 90 % | 5966.4 cd |
| 80 % | 5303.5 cd |
| 70 % | 4640.5 cd |
| 60 % | 3977.6 cd |
| 50 % | 3314.7 cd |
| 40 % | 2651.7 cd |
| 30 % | 1988.8 cd |
| 20 % | 1325.9 cd |
| 10 % | 662.9 cd |

Peak intensity: 6629.3 cd
Number of c-planes: 32

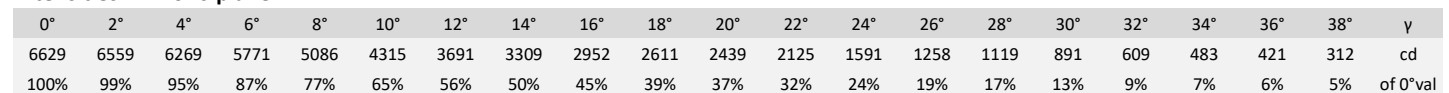
Iso-illuminance Diagram (Iso-lux)



| | |
|--------|---------|
| 50.0 % | 33.1 lx |
| 30.0 % | 19.9 lx |
| 10.0 % | 6.6 lx |
| 5.0 % | 3.3 lx |
| 3.0 % | 2.0 lx |

Peak illuminance: 66.3 lx
Mounting height: 10.0 m
Number of c-planes: 32

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Light Planning – UGR table

Uncorrected, comprehensive UGR table according to 117-1995

| Reflectances | | | | | | | | | | | |
|--|-----|--|------|------|------|------|--|------|------|------|------|
| p Ceiling | | 70 | 70 | 50 | 50 | 30 | 70 | 70 | 50 | 50 | 30 |
| p Walls | | 50 | 30 | 50 | 30 | 30 | 50 | 30 | 50 | 30 | 30 |
| p 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 | 20.0 | 20.6 | 20.1 | 20.8 | 21.0 | 20.0 | 20.6 | 20.1 | 20.8 | 21.0 |
| | 3H | 20.1 | 20.8 | 20.5 | 21.0 | 21.2 | 20.1 | 20.8 | 20.5 | 21.0 | 21.2 |
| | 4H | 20.1 | 20.8 | 20.5 | 21.1 | 21.3 | 20.1 | 20.8 | 20.5 | 21.1 | 21.3 |
| | 6H | 20.3 | 20.8 | 20.6 | 21.1 | 21.5 | 20.3 | 20.8 | 20.6 | 21.1 | 21.5 |
| | 8H | 20.3 | 20.8 | 20.6 | 21.1 | 21.5 | 20.3 | 20.8 | 20.6 | 21.1 | 21.5 |
| | 12H | 20.3 | 20.8 | 20.6 | 21.2 | 21.6 | 20.3 | 20.8 | 20.6 | 21.2 | 21.6 |
| 4H | 2H | 19.9 | 20.6 | 20.3 | 20.9 | 21.1 | 19.9 | 20.6 | 20.3 | 20.9 | 21.1 |
| | 3H | 20.3 | 20.8 | 20.6 | 21.2 | 21.6 | 20.3 | 20.8 | 20.6 | 21.2 | 21.6 |
| | 4H | 20.3 | 20.8 | 20.7 | 21.2 | 21.8 | 20.3 | 20.8 | 20.7 | 21.2 | 21.8 |
| | 6H | 20.4 | 21.0 | 20.9 | 21.3 | 21.6 | 20.4 | 21.0 | 20.9 | 21.3 | 21.6 |
| | 8H | 20.5 | 20.9 | 21.0 | 21.3 | 21.7 | 20.5 | 20.9 | 21.0 | 21.3 | 21.7 |
| | 12H | 20.5 | 20.9 | 21.0 | 21.3 | 21.7 | 20.5 | 20.9 | 21.0 | 21.3 | 21.7 |
| 8H | 4H | 20.3 | 20.8 | 20.8 | 21.1 | 21.5 | 20.3 | 20.8 | 20.8 | 21.1 | 21.5 |
| | 6H | 20.5 | 20.8 | 21.0 | 21.3 | 21.8 | 20.5 | 20.8 | 21.0 | 21.3 | 21.8 |
| | 8H | 20.6 | 20.9 | 21.1 | 21.4 | 22.0 | 20.6 | 20.9 | 21.1 | 21.4 | 22.0 |
| | 12H | 20.7 | 20.9 | 21.3 | 21.4 | 22.0 | 20.7 | 20.9 | 21.3 | 21.4 | 22.0 |
| 12H | 4H | 20.2 | 20.6 | 20.7 | 21.0 | 21.5 | 20.2 | 20.6 | 20.7 | 21.0 | 21.5 |
| | 6H | 20.5 | 20.8 | 21.0 | 21.3 | 21.9 | 20.5 | 20.8 | 21.0 | 21.3 | 21.9 |
| | 8H | 20.6 | 20.8 | 21.2 | 21.3 | 21.9 | 20.6 | 20.8 | 21.2 | 21.3 | 21.9 |
| Variations with the observer position for the luminaire spacings, S: | | | | | | | | | | | |
| S = 1.0H | | 2.3 / -1.8 | | | | | 2.3 / -1.8 | | | | |
| S = 1.5H | | 4.4 / -2.4 | | | | | 4.4 / -2.4 | | | | |
| S = 2.0H | | 6.0 / -3.3 | | | | | 6.0 / -3.3 | | | | |

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 | 101 | 101 | 101 | 99 |
| 1 | 114 | 111 | 108 | 106 | 111 | 109 | 106 | 104 | 104 | 103 | 101 | 101 | 99 | 98 | 97 | 96 | 95 | 93 |
| 2 | 108 | 104 | 100 | 97 | 106 | 102 | 98 | 95 | 99 | 96 | 93 | 95 | 93 | 91 | 93 | 91 | 89 | 87 |
| 3 | 103 | 97 | 93 | 89 | 101 | 96 | 92 | 88 | 93 | 90 | 87 | 91 | 88 | 85 | 88 | 86 | 84 | 82 |
| 4 | 99 | 92 | 87 | 83 | 97 | 91 | 86 | 82 | 88 | 84 | 81 | 86 | 83 | 80 | 84 | 81 | 79 | 78 |
| 5 | 94 | 87 | 81 | 77 | 93 | 86 | 81 | 77 | 84 | 80 | 76 | 82 | 78 | 76 | 81 | 77 | 75 | 73 |
| 6 | 90 | 82 | 77 | 73 | 89 | 81 | 76 | 73 | 80 | 75 | 72 | 79 | 75 | 72 | 77 | 74 | 71 | 70 |
| 7 | 87 | 78 | 73 | 69 | 85 | 78 | 72 | 69 | 76 | 72 | 68 | 75 | 71 | 68 | 74 | 70 | 68 | 66 |
| 8 | 83 | 75 | 69 | 65 | 82 | 74 | 69 | 65 | 73 | 68 | 65 | 72 | 68 | 65 | 71 | 67 | 64 | 63 |
| 9 | 80 | 71 | 66 | 62 | 79 | 71 | 66 | 62 | 70 | 65 | 62 | 69 | 65 | 62 | 68 | 64 | 62 | 60 |
| 10 | 77 | 68 | 63 | 60 | 76 | 68 | 63 | 59 | 67 | 62 | 59 | 66 | 62 | 59 | 65 | 62 | 59 | 58 |

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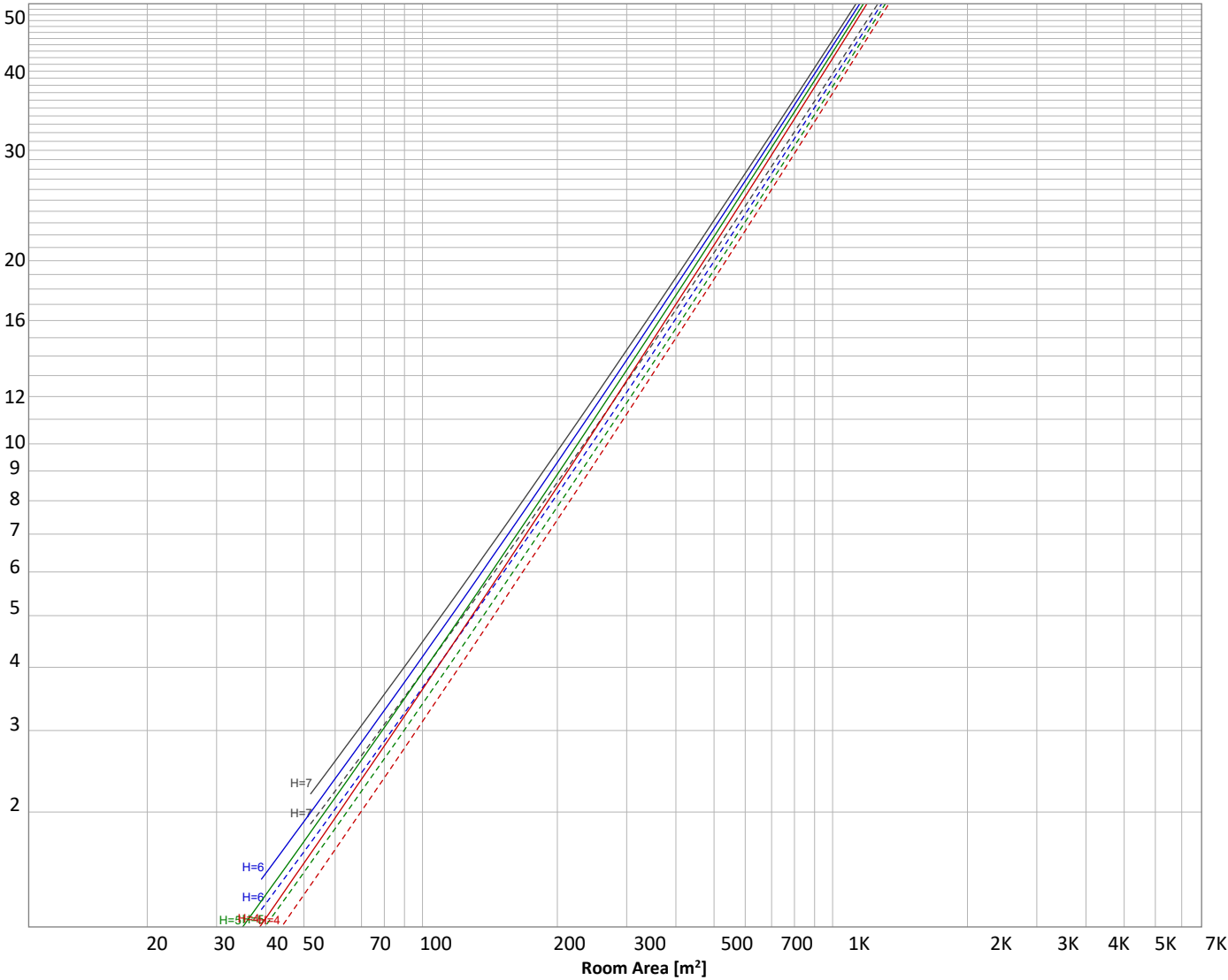
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Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

| | | | | |
|---|----------------|-----------|---------------------|-------------------|
| H = Room height | Flux = 2641 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 |
| | | | | 30 |
| | | | | 20 |

Zonal Lumen Summary

| | | | | | | | | |
|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 0°-10° | 10°-20° | 20°-30° | 30°-40° | 40°-50° | 50°-60° | 60°-70° | 70°-80° | 80°-90° |
| 520 lm | 872 lm | 697 lm | 290 lm | 122 lm | 61.0 lm | 35.9 lm | 15.2 lm | 7.50 lm |
| 90°-100° | 100°-110° | 110°-120° | 120°-130° | 130°-140° | 140°-150° | 150°-160° | 160°-170° | 170°-180° |
| 3.62 lm | 3.51 lm | 3.29 lm | 2.98 lm | 2.57 lm | 2.09 lm | 1.54 lm | 0.941 lm | 0.317 lm |

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Outdoor Light Planning

Lumen per Zone

| Zone (γ) | Lumen | % Total |
|----------|---------|---------|
| 0-10° | 520 lm | 19.7% |
| 10-20° | 872 lm | 33.0% |
| 20-30° | 697 lm | 26.4% |
| 30-40° | 290 lm | 11.0% |
| 40-50° | 122 lm | 4.6% |
| 50-60° | 61 lm | 2.3% |
| 60-70° | 36 lm | 1.4% |
| 70-80° | 15 lm | 0.6% |
| 80-90° | 7 lm | 0.3% |
| 90-100° | 4 lm | 0.1% |
| 100-110° | 4 lm | 0.1% |
| 110-120° | 3 lm | 0.1% |
| 120-130° | 3 lm | 0.1% |
| 130-140° | 3 lm | 0.1% |
| 140-150° | 2 lm | 0.1% |
| 150-160° | 2 lm | 0.1% |
| 160-170° | 1 lm | 0.0% |
| 170-180° | 0 lm | 0.0% |
| Total | 2641 lm | 100.0% |

Intensity peaks

| | |
|----------------|---------|
| Max intensity | 6629 cd |
| Intensity, 90° | 3 cd |
| Intensity, 0° | 6629 cd |

Zonal Lumen summary

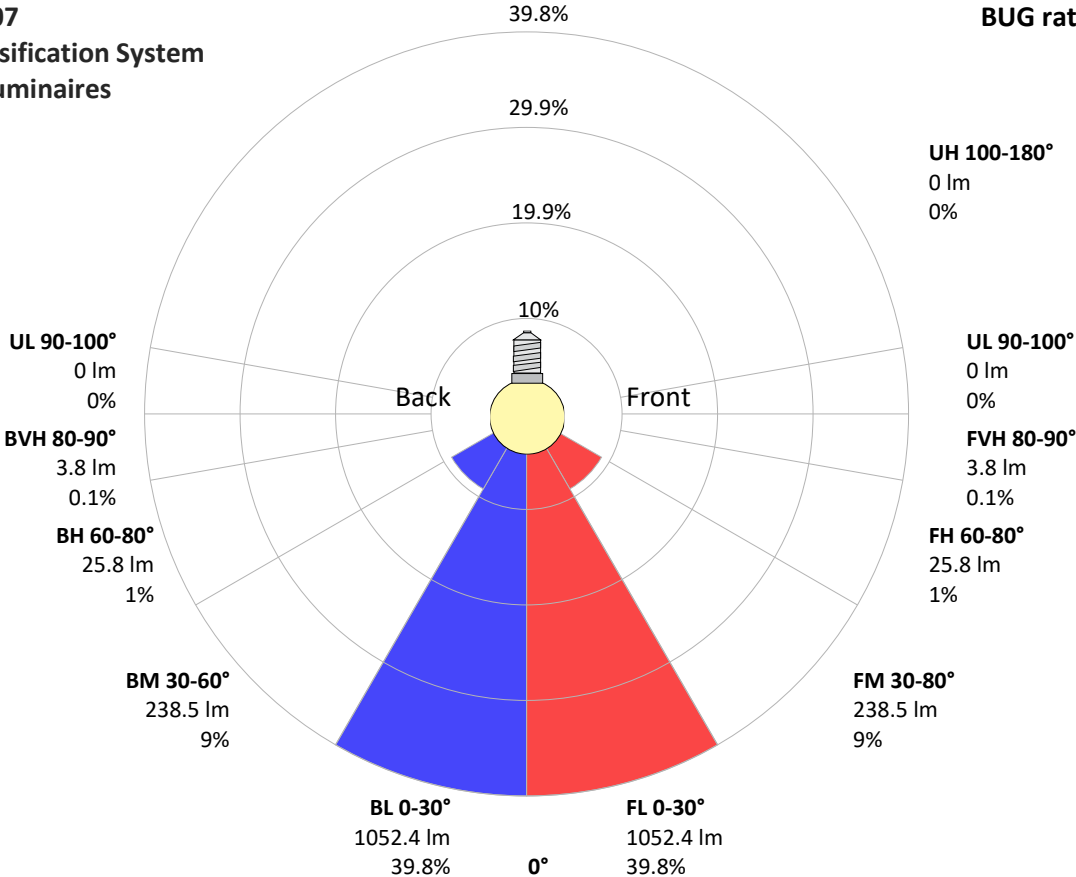
| Zone (γ) | Lumen | % Total |
|----------|---------|---------|
| 0-30° | 2089 lm | 79.1% |
| 0-40° | 2379 lm | 90.1% |
| 0-60° | 2562 lm | 97.0% |
| 60-90° | 59 lm | 2.2% |
| 70-100° | 26 lm | 1.0% |
| 90-120° | 10 lm | 0.4% |
| 0-90° | 2620 lm | 99.2% |
| 90-180° | 21 lm | 0.8% |
| 0-180° | 2641 lm | 100.0% |

BUG rating

| | Lumen | % Total |
|----------------------|---------|---------|
| Forward light | | |
| Low(0-30°) | 1052 lm | 39.8% |
| Medium(30-60°) | 239 lm | 9.0% |
| High(60-80°) | 26 lm | 1.0% |
| Very high(80-90°) | 4 lm | 0.1% |
| Back light | | |
| Low(0-30°) | 1052 lm | 39.8% |
| Medium(30-60°) | 239 lm | 9.0% |
| High(60-80°) | 26 lm | 1.0% |
| Very high(80-90°) | 4 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

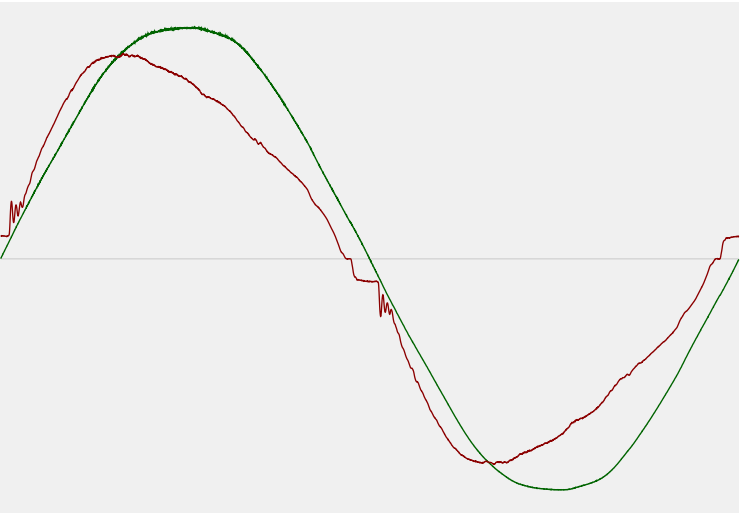
Input Power

| | |
|---|----------|
| Power feed to light source | 41.4 W |
| Frequency of input power | 50 Hz |
| RMS Input voltage feed, V_{RMS} | 241 V |
| RMS Input current feed, I_{RMS} | 0.178 A |
| Volt-Ampere or apparent power = $V_{RMS} \cdot I_{RMS}$ | 42.77 VA |
| Displacement factor of AC power feed | 0.97 |
| Power factor of AC current feed | 0.97 |
| Total harmonic distortion of the current | 11.01% |
| Total harmonic distortion of the voltage | 1.46% |

Efficiency

| | |
|---------------------------|---------|
| Radiated power efficiency | 23.2% |
| <div><div></div></div> | |
| Lumen efficiency | 64 lm/W |
| <div><div></div></div> | |

Input Power Curve



Goniophotometry Report

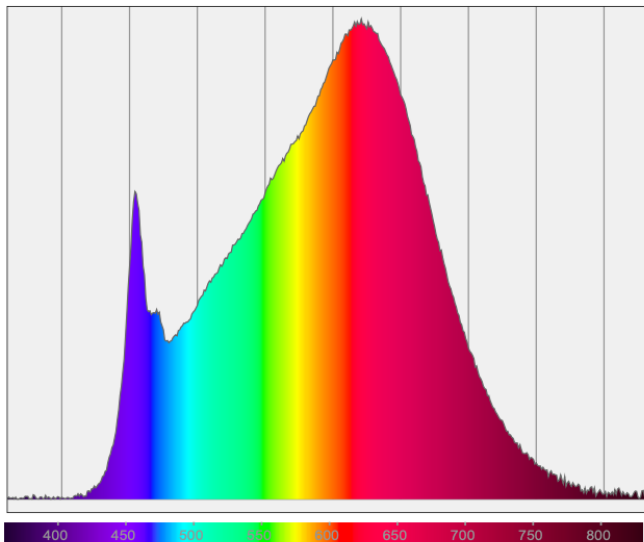
1_PHOT_REFLEKTER-XL-4300lmChip-3000K-38Deg-ConcentricLouvre_2303
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Color Measurements

| | |
|------------------------------|---|
| 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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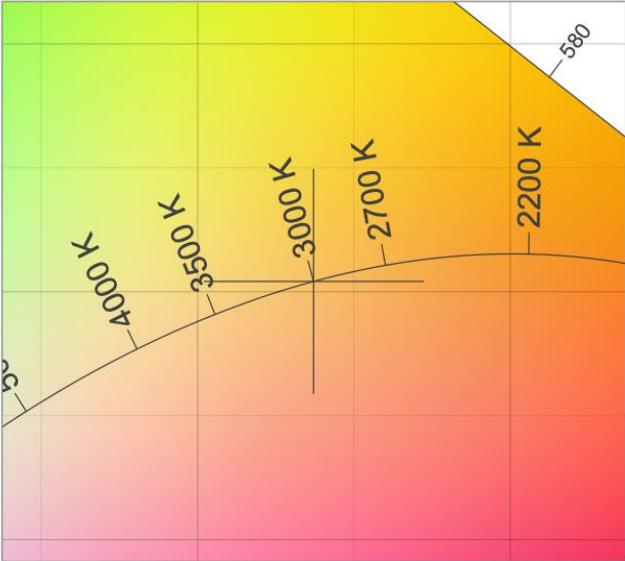
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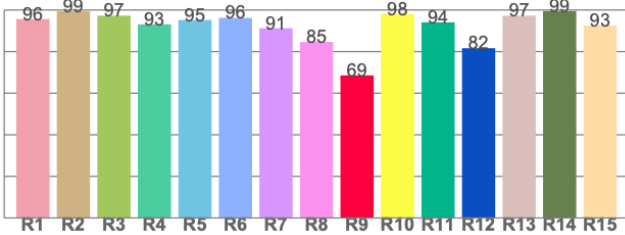
CIE 1931



CIE 1931 – zoomed on Planckian locus



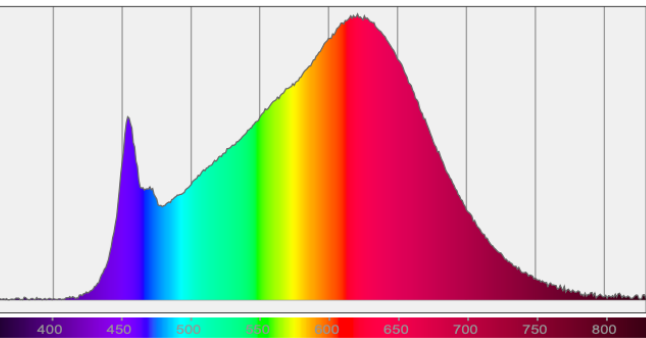
Color Rendering Index per reference color (CIE 1995)



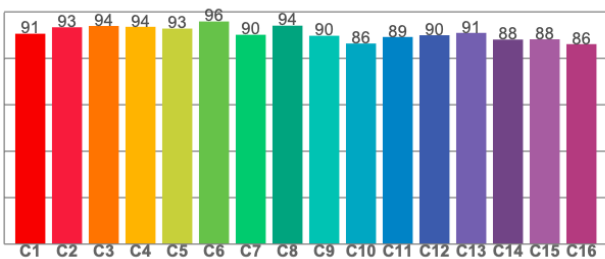
CRI R values, only R1-R8 are used to calculate final CRI value

| 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%



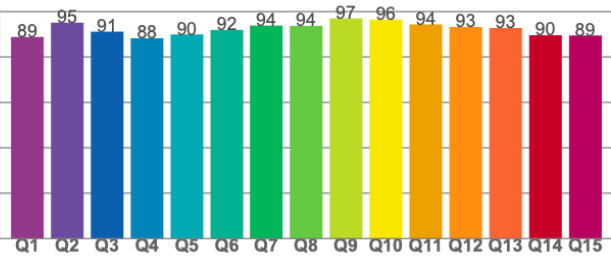
TM30-18 Rf-values per hue bin



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 |