

Tested Light Source - 1_PHOT_NINETY-NINE-1650lmChip-2700K-58Deg-HoneycombLouvre_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°

2°

1.50 m

14.6 W – PF 0.47 – DPF 0.78

244 V – 0.128 A

50 Hz

Main Light Measurement Results

Output

Efficiency

Peak Intensity and Beam Angle

Color Rendering Index

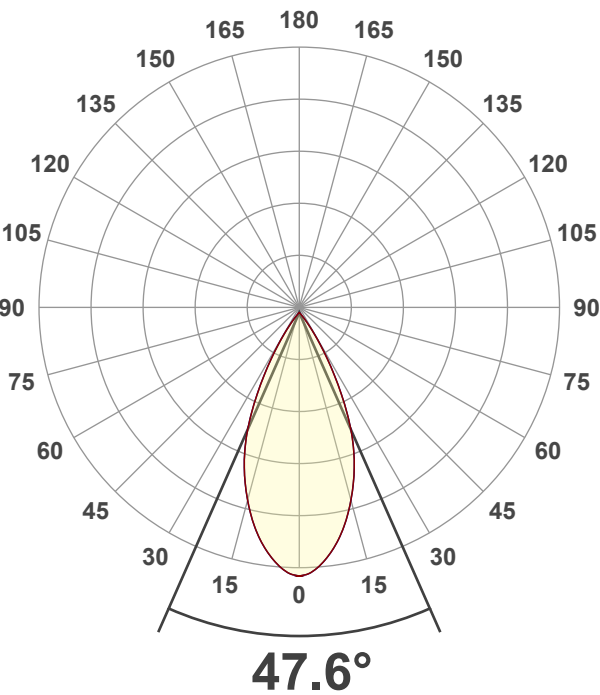
781 lm

54 lm/W

1319 cd – 47.6°

CRI 93.0

Light Intensity Distribution



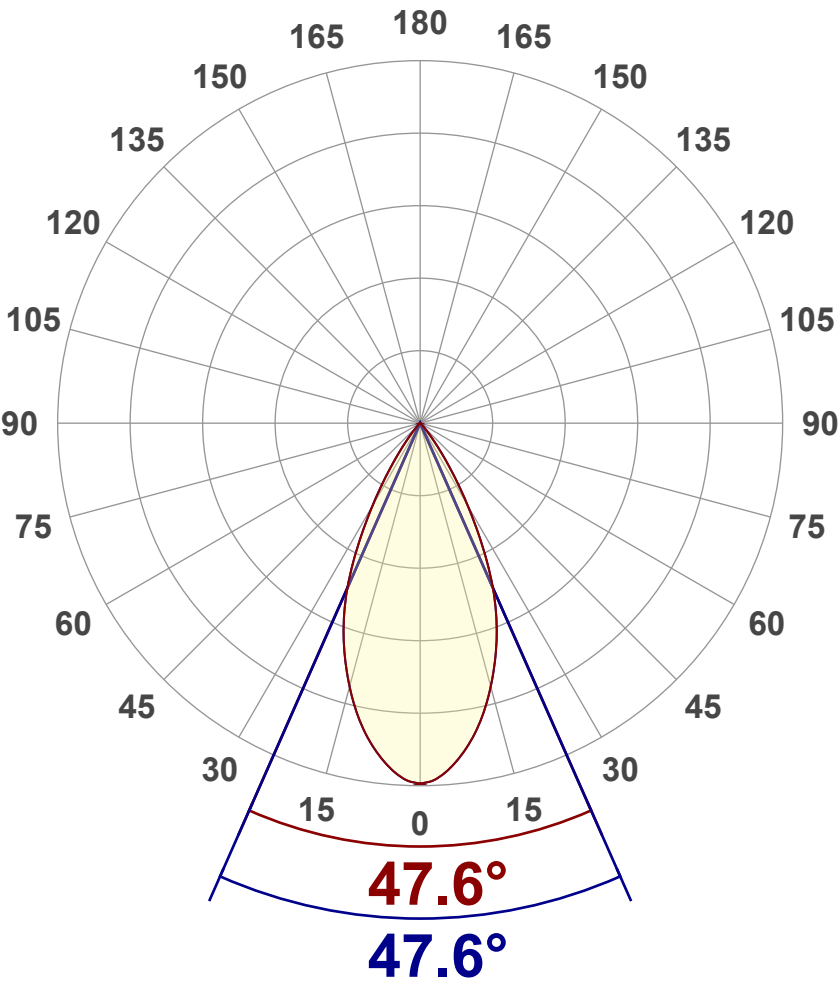
Goniophotometry Report

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Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

| | |
|----------------------|---------|
| Output (total Lumen) | 781 lm |
| Peak Intensity | 1319 cd |
| Beam Angle (50%) | 47.6° |
| Beam Angle (90%) | 47.6° |
| Beam Angle (10%) | 47.6° |

Cut-off Angle

| | |
|--------------|-------|
| Average 2,5% | 82.3° |
|--------------|-------|

Field Angle

| | |
|-------------|-------|
| Average 10% | 71.3° |
|-------------|-------|

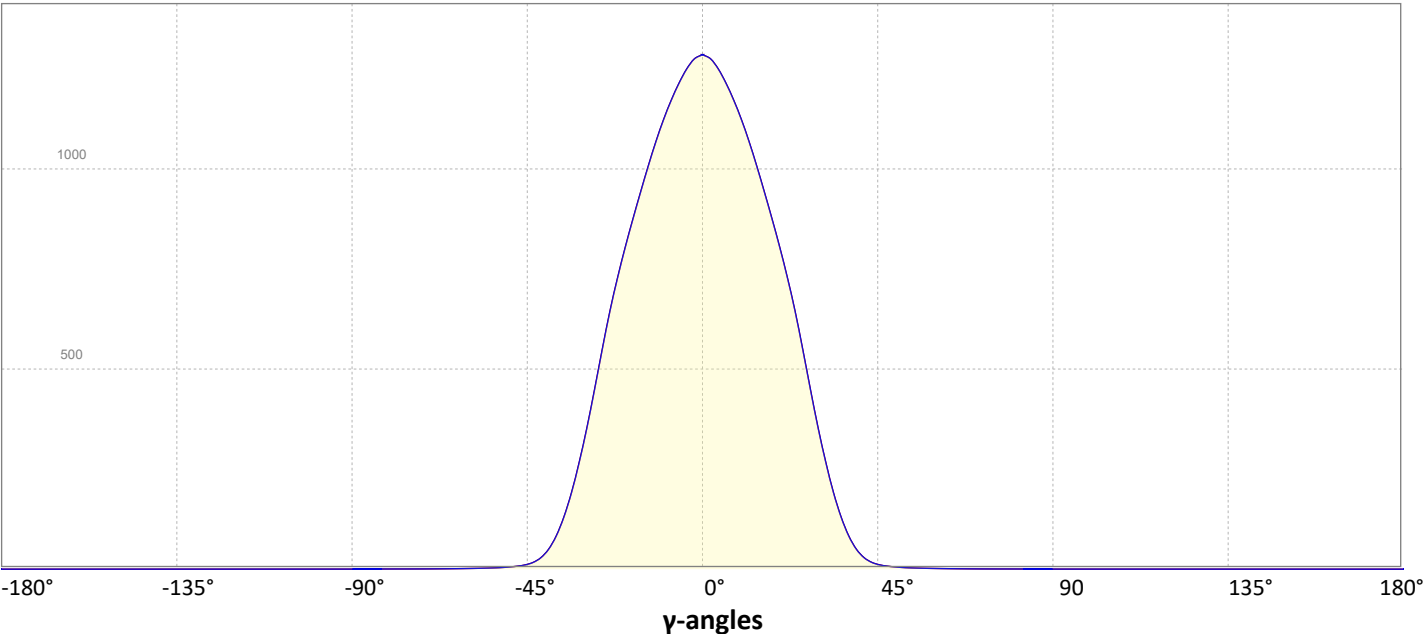
Intensity Ratio

| | |
|--------------|-------|
| In 120° cone | 99.6% |
| In 90° cone | 98.9% |

C000-C180

C090-C270

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

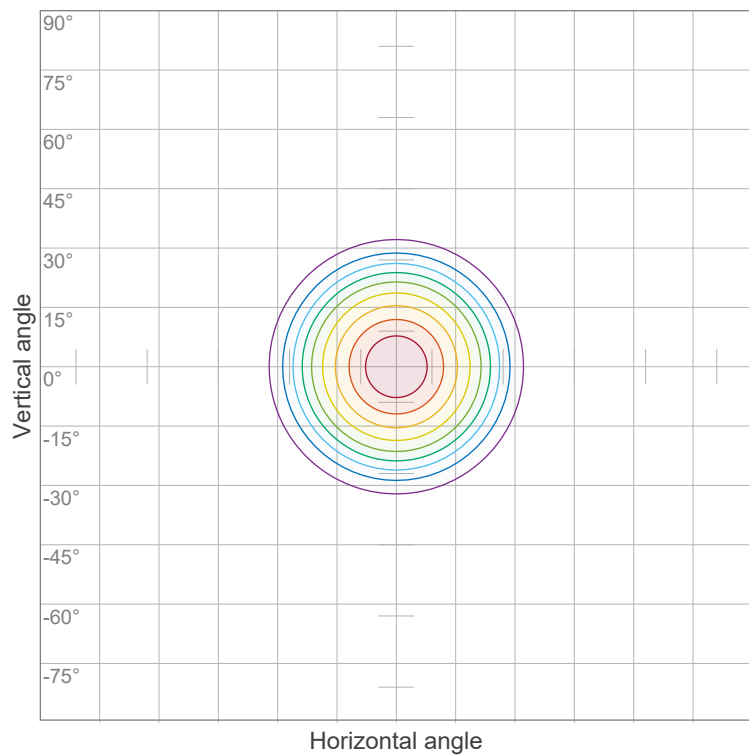


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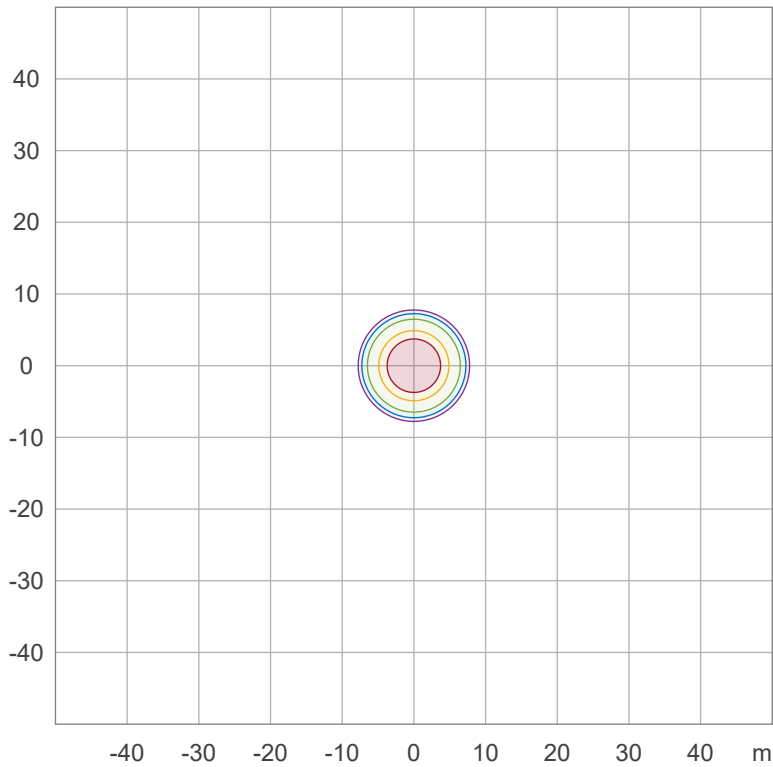
Iso-intensity Diagram (Iso-candela)



| | |
|------|-----------|
| 90 % | 1187.5 cd |
| 80 % | 1055.5 cd |
| 70 % | 923.6 cd |
| 60 % | 791.7 cd |
| 50 % | 659.7 cd |
| 40 % | 527.8 cd |
| 30 % | 395.8 cd |
| 20 % | 263.9 cd |
| 10 % | 131.9 cd |

Peak intensity: 1319.4 cd
Number of c-planes: 32

Iso-illuminance Diagram (Iso-lux)



| | |
|--------|--------|
| 50.0 % | 6.6 lx |
| 30.0 % | 4.0 lx |
| 10.0 % | 1.3 lx |
| 5.0 % | 0.7 lx |
| 3.0 % | 0.4 lx |

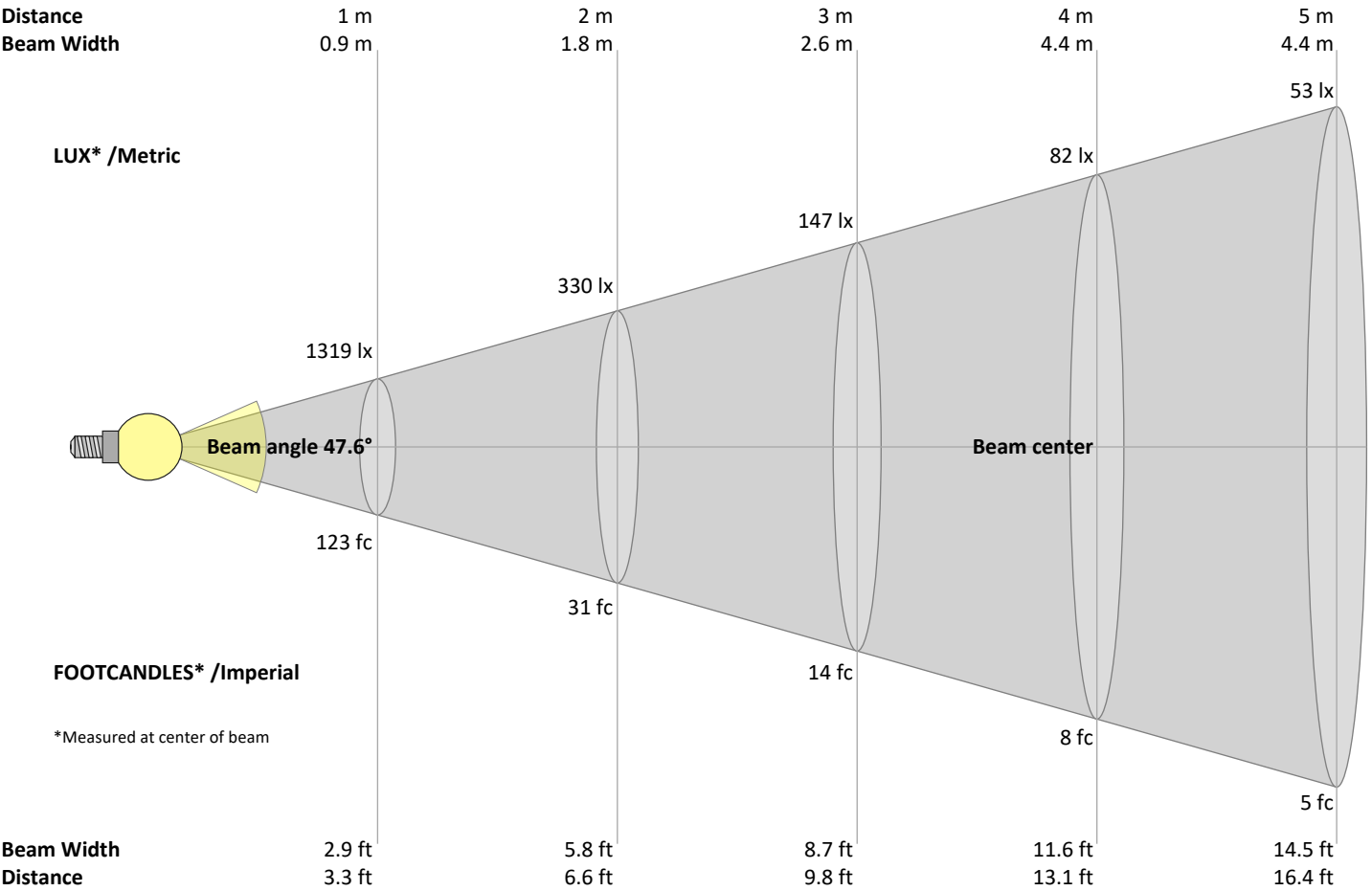
Peak illuminance: 13.2 lx
Mounting height: 10.0 m
Number of c-planes: 32

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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 |
| 1319 | 330 | 147 | 82 | 53 | 37 | 27 | 21 | 16 | 13 | 11 | 9 | 8 | 7 | 6 | 5 | 5 | 4 | 4 | 3 | lux |
| 122.6 | 30.6 | 13.6 | 7.7 | 4.9 | 3.4 | 2.5 | 1.9 | 1.5 | 1.2 | 1 | 0.9 | 0.7 | 0.6 | 0.5 | 0.5 | 0.4 | 0.4 | 0.3 | 0.3 | 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 |
|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|
| 1319 | 1310 | 1284 | 1248 | 1204 | 1154 | 1096 | 1032 | 964 | 894 | 820 | 739 | 651 | 551 | 447 | 349 | 261 | 185 | 124 | 78 | cd |
| 100% | 99% | 97% | 95% | 91% | 87% | 83% | 78% | 73% | 68% | 62% | 56% | 49% | 42% | 34% | 26% | 20% | 14% | 9% | 6% | 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 |
|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|
| 1319 | 1310 | 1284 | 1248 | 1204 | 1154 | 1096 | 1032 | 964 | 894 | 820 | 739 | 651 | 551 | 447 | 349 | 261 | 185 | 124 | 78 | cd |
| 100% | 99% | 97% | 95% | 91% | 87% | 83% | 78% | 73% | 68% | 62% | 56% | 49% | 42% | 34% | 26% | 20% | 14% | 9% | 6% | 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 |
|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|
| 1319 | 1310 | 1284 | 1248 | 1204 | 1154 | 1096 | 1032 | 964 | 894 | 820 | 739 | 651 | 551 | 447 | 349 | 261 | 185 | 124 | 78 | cd |
| 100% | 99% | 97% | 95% | 91% | 87% | 83% | 78% | 73% | 68% | 62% | 56% | 49% | 42% | 34% | 26% | 20% | 14% | 9% | 6% | 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 |
|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|
| 1319 | 1310 | 1284 | 1248 | 1204 | 1154 | 1096 | 1032 | 964 | 894 | 820 | 739 | 651 | 551 | 447 | 349 | 261 | 185 | 124 | 78 | cd |
| 100% | 99% | 97% | 95% | 91% | 87% | 83% | 78% | 73% | 68% | 62% | 56% | 49% | 42% | 34% | 26% | 20% | 14% | 9% | 6% | of 0°val |

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 | | | | | | | | | | | |
| H = mounting height above eye level | | Viewed Crosswise | | | | | Viewed Endwise | | | | |
| X | Y | (Viewing direction orthogonal to lamp length axis) | | | | | (Viewing direction parallel to lamp length axis) | | | | |
| 2H | 2H | 15.2 | 15.7 | 15.3 | 16.0 | 16.1 | 15.2 | 15.7 | 15.3 | 16.0 | 16.1 |
| | 3H | 14.9 | 15.6 | 15.3 | 15.8 | 16.0 | 14.9 | 15.6 | 15.3 | 15.8 | 16.0 |
| | 4H | 14.8 | 15.5 | 15.2 | 15.7 | 15.9 | 14.8 | 15.5 | 15.2 | 15.7 | 15.9 |
| | 6H | 14.8 | 15.4 | 15.1 | 15.7 | 16.0 | 14.8 | 15.4 | 15.1 | 15.7 | 16.0 |
| | 8H | 14.8 | 15.3 | 15.1 | 15.6 | 16.0 | 14.8 | 15.3 | 15.1 | 15.6 | 16.0 |
| | 12H | 14.7 | 15.2 | 15.1 | 15.6 | 16.0 | 14.7 | 15.2 | 15.1 | 15.6 | 16.0 |
| 4H | 2H | 14.8 | 15.5 | 15.2 | 15.7 | 15.9 | 14.8 | 15.5 | 15.2 | 15.7 | 15.9 |
| | 3H | 14.7 | 15.2 | 15.1 | 15.6 | 16.0 | 14.7 | 15.2 | 15.1 | 15.6 | 16.0 |
| | 4H | 14.6 | 15.1 | 15.0 | 15.5 | 16.0 | 14.6 | 15.1 | 15.0 | 15.5 | 16.0 |
| | 6H | 14.5 | 15.0 | 15.0 | 15.3 | 15.7 | 14.5 | 15.0 | 15.0 | 15.3 | 15.7 |
| | 8H | 14.5 | 14.9 | 15.0 | 15.3 | 15.6 | 14.5 | 14.9 | 15.0 | 15.3 | 15.6 |
| | 12H | 14.4 | 14.8 | 14.9 | 15.2 | 15.6 | 14.4 | 14.8 | 14.9 | 15.2 | 15.6 |
| 8H | 4H | 14.4 | 14.9 | 15.0 | 15.3 | 15.6 | 14.4 | 14.9 | 15.0 | 15.3 | 15.6 |
| | 6H | 14.4 | 14.7 | 14.9 | 15.2 | 15.7 | 14.4 | 14.7 | 14.9 | 15.2 | 15.7 |
| | 8H | 14.4 | 14.6 | 14.9 | 15.2 | 15.8 | 14.4 | 14.6 | 14.9 | 15.2 | 15.8 |
| | 12H | 14.3 | 14.5 | 14.9 | 15.1 | 15.7 | 14.3 | 14.5 | 14.9 | 15.1 | 15.7 |
| 12H | 4H | 14.4 | 14.7 | 14.9 | 15.1 | 15.6 | 14.4 | 14.7 | 14.9 | 15.1 | 15.6 |
| | 6H | 14.4 | 14.6 | 14.9 | 15.1 | 15.8 | 14.4 | 14.6 | 14.9 | 15.1 | 15.8 |
| | 8H | 14.3 | 14.5 | 14.9 | 15.0 | 15.6 | 14.3 | 14.5 | 14.9 | 15.0 | 15.6 |
| Variations with the observer position for the luminaire spacings, S: | | | | | | | | | | | |
| S = 1.0H | | 6.1 / -11.7 | | | | | 6.1 / -11.7 | | | | |
| S = 1.5H | | 8.8 / -12.2 | | | | | 8.8 / -12.2 | | | | |
| S = 2.0H | | 10.8 / -12.7 | | | | | 10.8 / -12.7 | | | | |

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 | 109 | 107 | 112 | 109 | 107 | 105 | 105 | 104 | 102 | 102 | 100 | 99 | 98 | 97 | 96 | 95 |
| 2 | 109 | 105 | 101 | 98 | 107 | 103 | 100 | 97 | 100 | 97 | 95 | 97 | 95 | 93 | 94 | 92 | 91 | 89 |
| 3 | 104 | 99 | 94 | 91 | 102 | 97 | 93 | 90 | 95 | 91 | 88 | 92 | 89 | 87 | 90 | 88 | 86 | 84 |
| 4 | 100 | 93 | 88 | 84 | 98 | 92 | 87 | 84 | 90 | 86 | 83 | 88 | 85 | 82 | 86 | 83 | 81 | 80 |
| 5 | 96 | 88 | 83 | 79 | 94 | 87 | 82 | 79 | 85 | 81 | 78 | 84 | 80 | 77 | 82 | 79 | 77 | 75 |
| 6 | 91 | 84 | 78 | 74 | 90 | 83 | 78 | 74 | 81 | 77 | 74 | 80 | 76 | 73 | 79 | 75 | 73 | 71 |
| 7 | 88 | 79 | 74 | 70 | 86 | 79 | 74 | 70 | 78 | 73 | 70 | 76 | 72 | 69 | 75 | 72 | 69 | 68 |
| 8 | 84 | 76 | 70 | 67 | 83 | 75 | 70 | 66 | 74 | 69 | 66 | 73 | 69 | 66 | 72 | 68 | 66 | 64 |
| 9 | 81 | 72 | 67 | 63 | 80 | 71 | 66 | 63 | 71 | 66 | 63 | 70 | 66 | 63 | 69 | 65 | 62 | 61 |
| 10 | 77 | 69 | 63 | 60 | 76 | 68 | 63 | 60 | 67 | 63 | 60 | 67 | 63 | 60 | 66 | 62 | 59 | 58 |

Goniophotometry Report

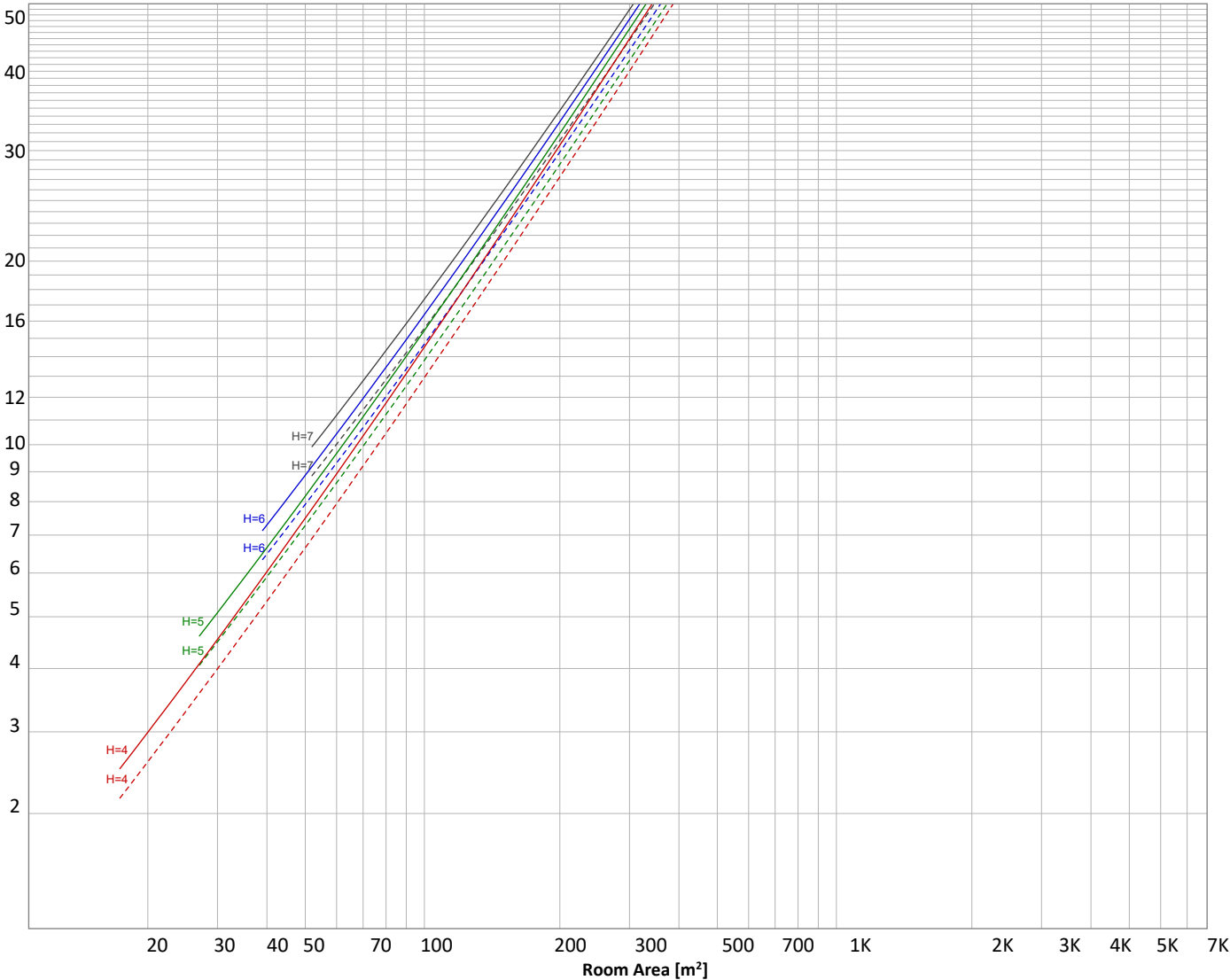
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Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

| | | | | |
|---|---------------|-----------|---------------------|-------------------|
| H = Room height | Flux = 781 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° |
| 117 lm | 277 lm | 268 lm | 101 lm | 12.4 lm | 2.60 lm | 1.10 lm | 0.527 lm | 0.380 lm |
| 90°-100° | 100°-110° | 110°-120° | 120°-130° | 130°-140° | 140°-150° | 150°-160° | 160°-170° | 170°-180° |
| 0.183 lm | 0.178 lm | 0.167 lm | 0.151 lm | 0.063 lm | 0.000 lm | 0.000 lm | 0.000 lm | 0.000 lm |

Outdoor Light Planning

Lumen per Zone

| Zone (γ) | Lumen | % Total |
|----------|--------|---------|
| 0-10° | 117 lm | 15.0% |
| 10-20° | 277 lm | 35.4% |
| 20-30° | 268 lm | 34.3% |
| 30-40° | 101 lm | 13.0% |
| 40-50° | 12 lm | 1.6% |
| 50-60° | 3 lm | 0.3% |
| 60-70° | 1 lm | 0.1% |
| 70-80° | 1 lm | 0.1% |
| 80-90° | 0 lm | 0.0% |
| 90-100° | 0 lm | 0.0% |
| 100-110° | 0 lm | 0.0% |
| 110-120° | 0 lm | 0.0% |
| 120-130° | 0 lm | 0.0% |
| 130-140° | 0 lm | 0.0% |
| 140-150° | 0 lm | 0.0% |
| 150-160° | 0 lm | 0.0% |
| 160-170° | 0 lm | 0.0% |
| 170-180° | 0 lm | 0.0% |
| Total | 781 lm | 100.0% |

Intensity peaks

| | |
|----------------|---------|
| Max intensity | 1319 cd |
| Intensity, 90° | 0 cd |
| Intensity, 0° | 1319 cd |

Zonal Lumen summary

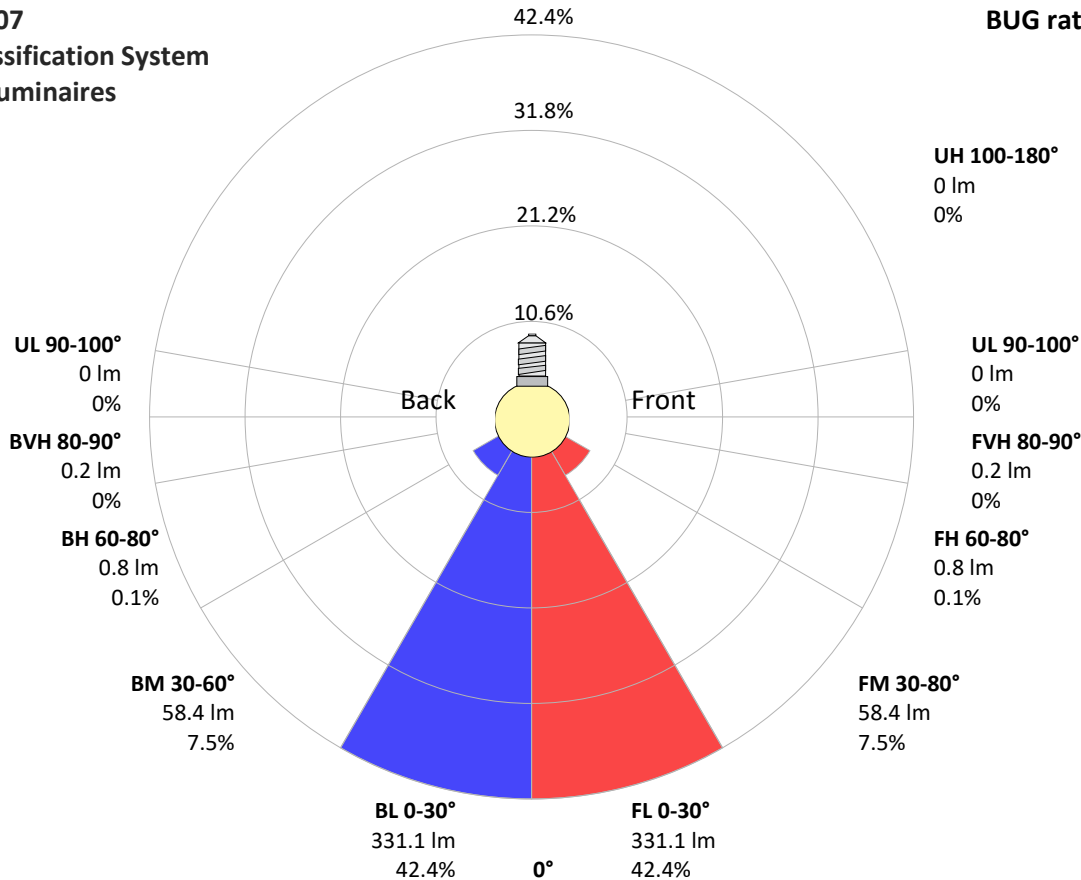
| Zone (γ) | Lumen | % Total |
|----------|--------|---------|
| 0-30° | 662 lm | 84.8% |
| 0-40° | 763 lm | 97.7% |
| 0-60° | 778 lm | 99.6% |
| 60-90° | 2 lm | 0.3% |
| 70-100° | 1 lm | 0.1% |
| 90-120° | 1 lm | 0.1% |
| 0-90° | 780 lm | 99.9% |
| 90-180° | 1 lm | 0.1% |
| 0-180° | 781 lm | 100.0% |

BUG rating

| | Lumen | % Total |
|----------------------|--------|---------|
| Forward light | | |
| Low(0-30°) | 331 lm | 42.4% |
| Medium(30-60°) | 58 lm | 7.5% |
| High(60-80°) | 1 lm | 0.1% |
| Very high(80-90°) | 0 lm | 0.0% |
| Back light | | |
| Low(0-30°) | 331 lm | 42.4% |
| Medium(30-60°) | 58 lm | 7.5% |
| High(60-80°) | 1 lm | 0.1% |
| Very high(80-90°) | 0 lm | 0.0% |
| 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 B1 U1 G0



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Power Details

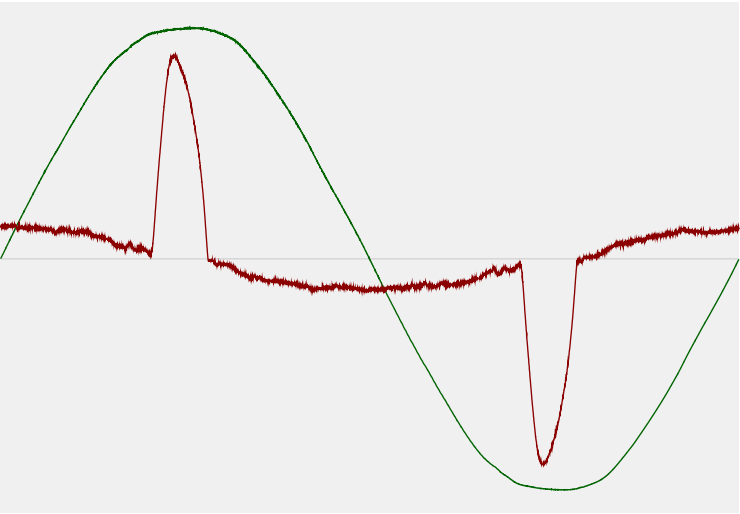
Input Power

| | |
|---|----------|
| Power feed to light source | 14.6 W |
| Frequency of input power | 50 Hz |
| RMS Input voltage feed, V_{RMS} | 244 V |
| RMS Input current feed, I_{RMS} | 0.128 A |
| Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$ | 31.17 VA |
| Displacement factor of AC power feed | 0.78 |
| Power factor of AC current feed | 0.47 |
| Total harmonic distortion of the current | 132.16% |
| Total harmonic distortion of the voltage | 1.39% |

Efficiency

| | |
|---------------------------|---------|
| Radiated power efficiency | 19.6% |
| <div><div></div></div> | |
| Lumen efficiency | 54 lm/W |
| <div><div></div></div> | |

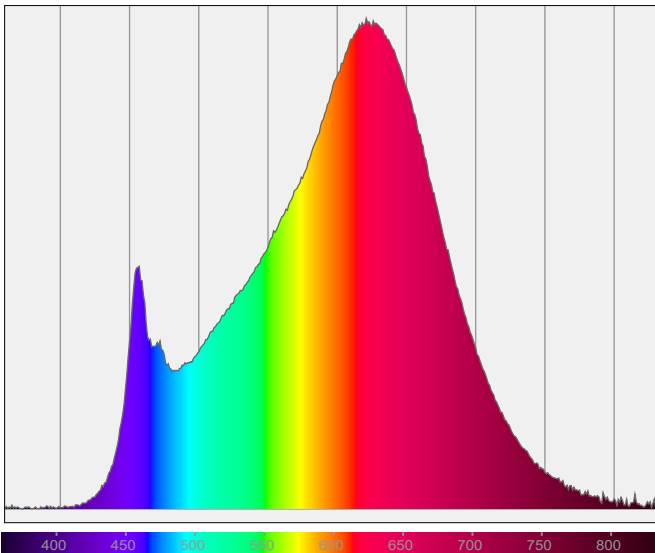
Input Power Curve



Color Measurements

| | |
|------------------------------|---|
| Correlated Color Temperature | CCT = 2700 K |
| Color Rendering TM30-18 | R _f 91.4 — R _g 98.9 |
| Color Shift, CIE duv | Duv ±0.0003 |

Spectral distribution



Color details

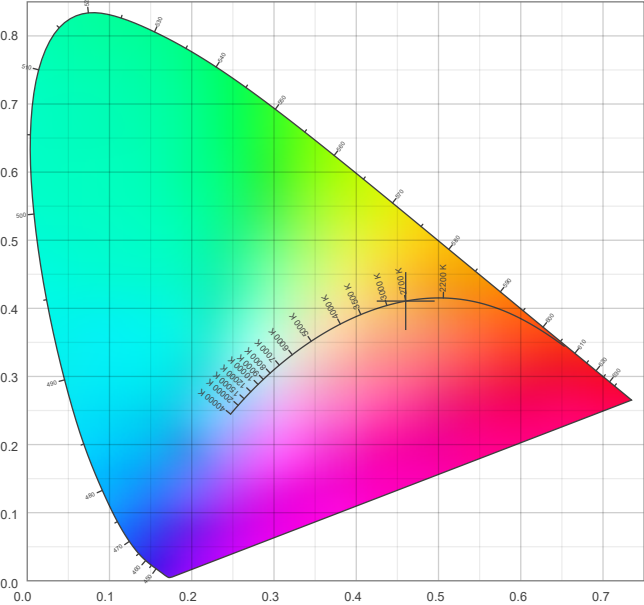
| | | | |
|---|---|-------------------------------------|-------------------------|
| Correlated Color Temperature | CCT = 2700 K | Color coordinates CIE 1931 | (x;y) = (0.460;0.411) |
| Color Rendering Index | CRI 93.0 | Color coordinate CIEs 1960 | (u;v) = (0.263;0.352) |
| Color Rendering Index, R9 (red component) | R9 = 68.6 | Color deviation from BBL | Duv = ±0.0003 |
| Color Rendering TM30-18 | R _f 91.4 — R _g 98.9 | Color coordinate CIEs 1976 (CIELUV) | (u';v') = (0.263;0.263) |
| Color Quality Scale | CQS = 90.9 | | |

Goniophotometry Report

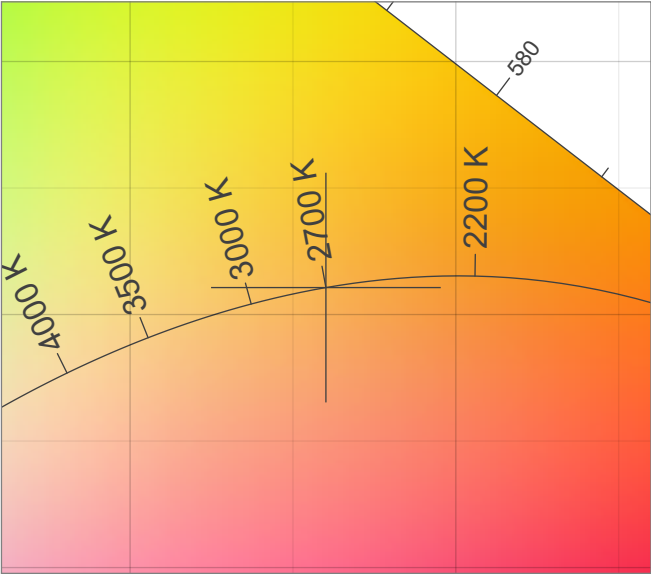
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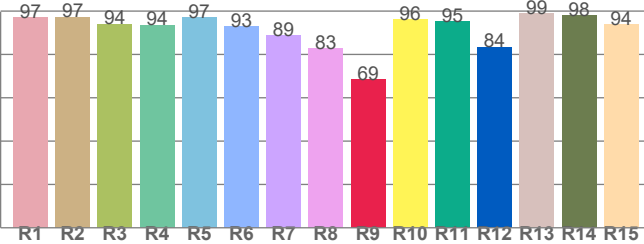
CIE 1931



CIE 1931 – zoomed on Planckian locus



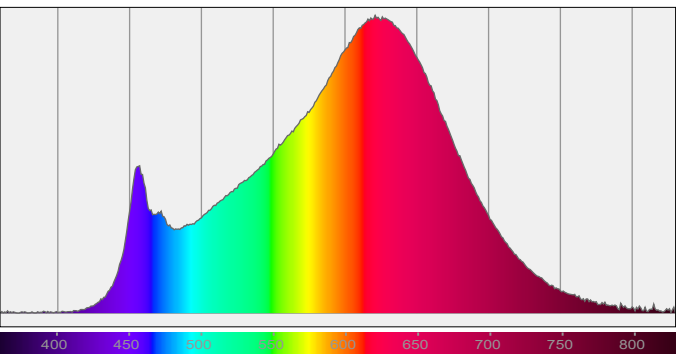
Color Rendering Index per reference color (CIE 1995)



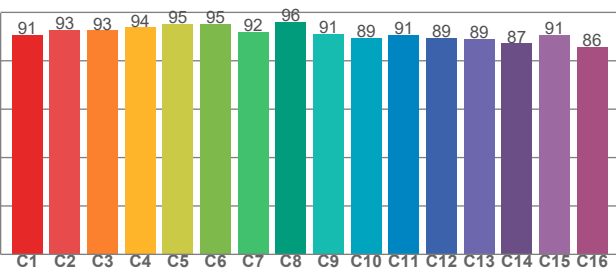
CRI R values, only R1-R8 are used to calculate final CRI value

| R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 | R13 | R14 | R15 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 96.9 | 97.4 | 94.1 | 93.7 | 97.3 | 92.9 | 88.7 | 83.0 | 68.6 | 96.0 | 95.1 | 83.5 | 98.8 | 97.9 | 93.7 |

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



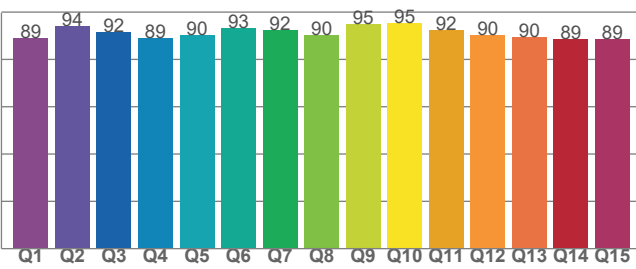
TM30-18 Rf-values per hue bin



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 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 90.7 | 92.7 | 92.5 | 93.7 | 95.1 | 95.2 | 91.9 | 95.9 | 91.1 | 89.5 | 90.6 | 89.5 | 88.9 | 87.1 | 90.8 | 85.6 |

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 | 94.0 | 91.5 | 88.8 | 90.4 | 93.4 | 92.3 | 90.4 | 94.9 | 95.3 | 92.4 | 90.3 | 89.5 | 88.6 | 88.7 |