

# Light Measurement Report

Print date: 5-11-2025

Measurement date and time: 5-11-2025 13:02:43 – Measurement no. VFR-251105-3925-MS

Measurement tracking No. and Link: [n/a](#)

Operator:



## Laboratory and Equipment

Laboratory Owner and Location

Goniospectrometer System and Type

Sensor Name, Calibr. Date and Serial No.

Spectrometer Manufacturer and Model

Viso Systems, Copenhagen V, Denmark

LabSpion – Type C, horizontal

LabSensor Model2 – 11-1-2024 – 3130191315

Ibsen Photonics, Denmark – Freedom VIS (Custom Viso)

## Measurement Conditions

Number of C-planes and Resolution

$\gamma$  (gamma)-Resolution

Test Distance

Input Power, Power and Displ. Factors

Input RMS Voltage and Current

Frequency of Input Power

Warm-up Time and Variation

48 planes – 7,5°

5°

1,99 m

4,0 W – PF 0,79 – DPF 0,84

230 V – 0,022 A

50 Hz

Lamp stabilized in 15 min 1 sec – 2,0%

## Tested Light Source

Product Name

Item No. and Manufacturer

Product Description (line 1)

813512-5700K

813512-5700K – Dutchfulfillment

LED INBOUWSPOT | MIMI | 4W | DIM | ZWART | CCT-SWITCH | IP65

## Main Light Measurement Results

Output – Total Lumen (Up% / Down%)

Efficiency

Peak Intensity and Beam Angle

Correlated Color Temperature, Target/Measured

Color Rendering Index

Color Rendering TM30-18

Color Shift, CIE duv and MacAdam Steps

Flicker

411 lm – 0,24% / 99,76%

102 lm/W

492 cd – 48,7°

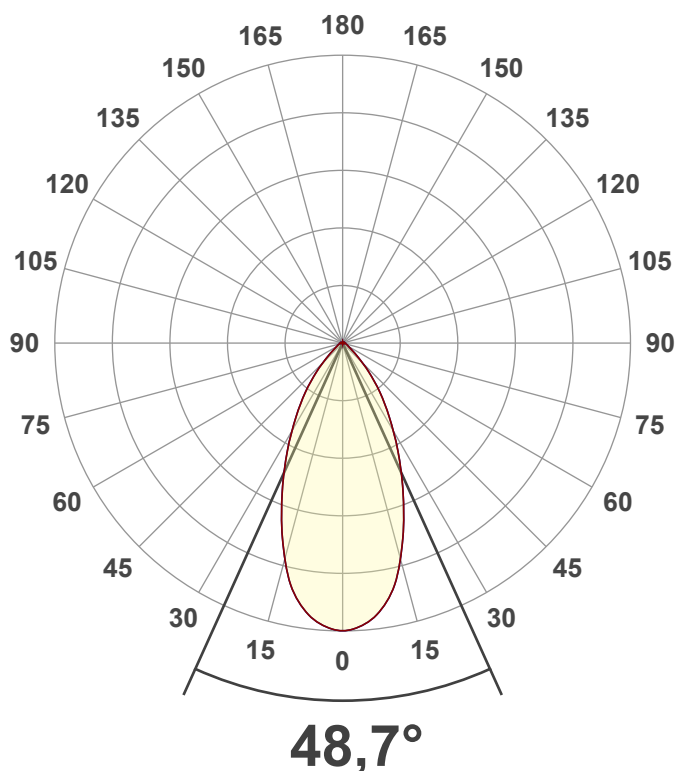
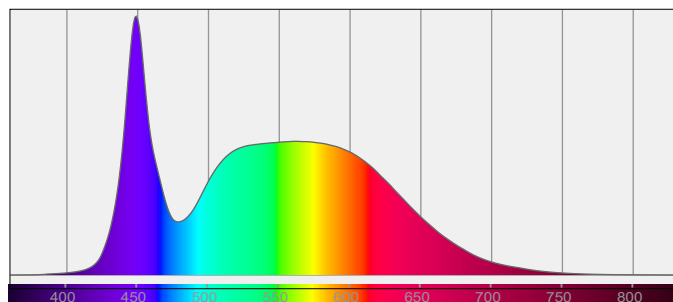
CCT = 5700 K / 5739 K

CRI 82,4

R<sub>f</sub> 83,5 – R<sub>g</sub> 96,6

Duv 0,0049 – SDCM 6,7

SVM 0,01 – PstLM 0,06



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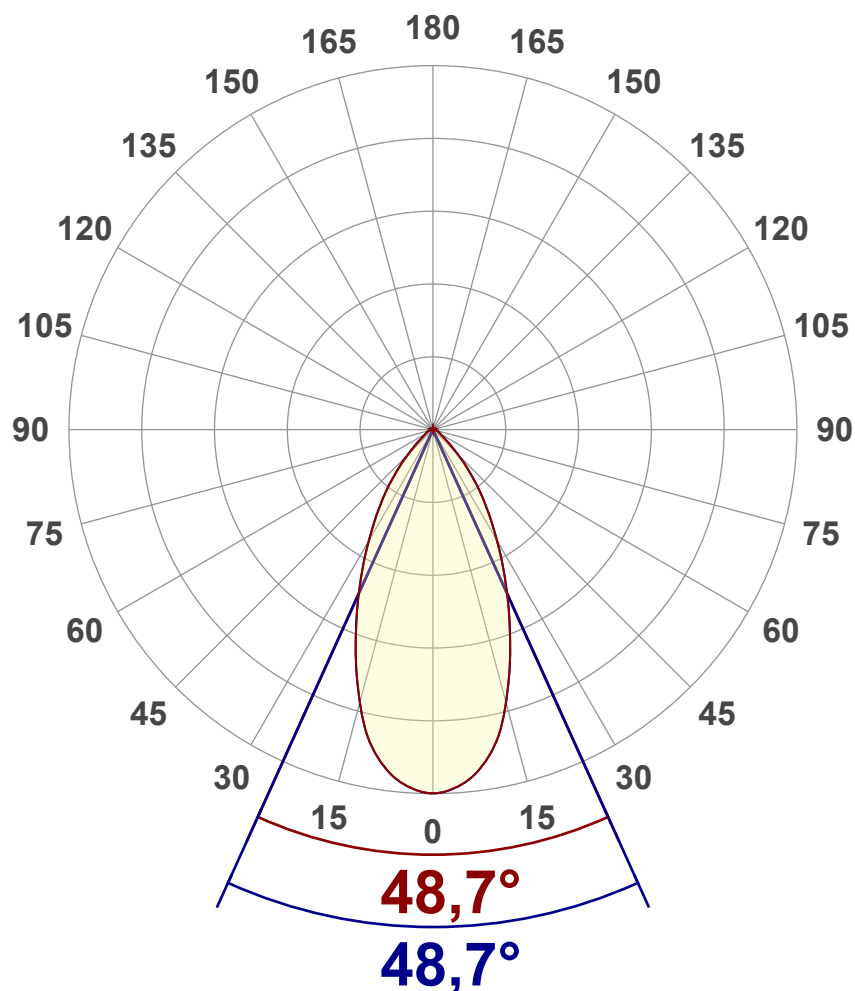
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## Luminous Intensity diagram

Unit: 0-100% of peak intensity



## Main Values

|                      |                |
|----------------------|----------------|
| Output (total Lumen) | 411 lm         |
| Lumen Up% / Down%    | 0,24% / 99,76% |
| Peak Intensity       | 492 cd         |
| Beam Angle (50%)     | 48,7°          |
| Beam Angle (90%)     | 48,7°          |
| Beam Angle (10%)     | 48,7°          |

## Cut-off Angle

|              |      |
|--------------|------|
| Average 2,5% | 119° |
|--------------|------|

## Field Angle

|             |       |
|-------------|-------|
| Average 10% | 90,4° |
|-------------|-------|

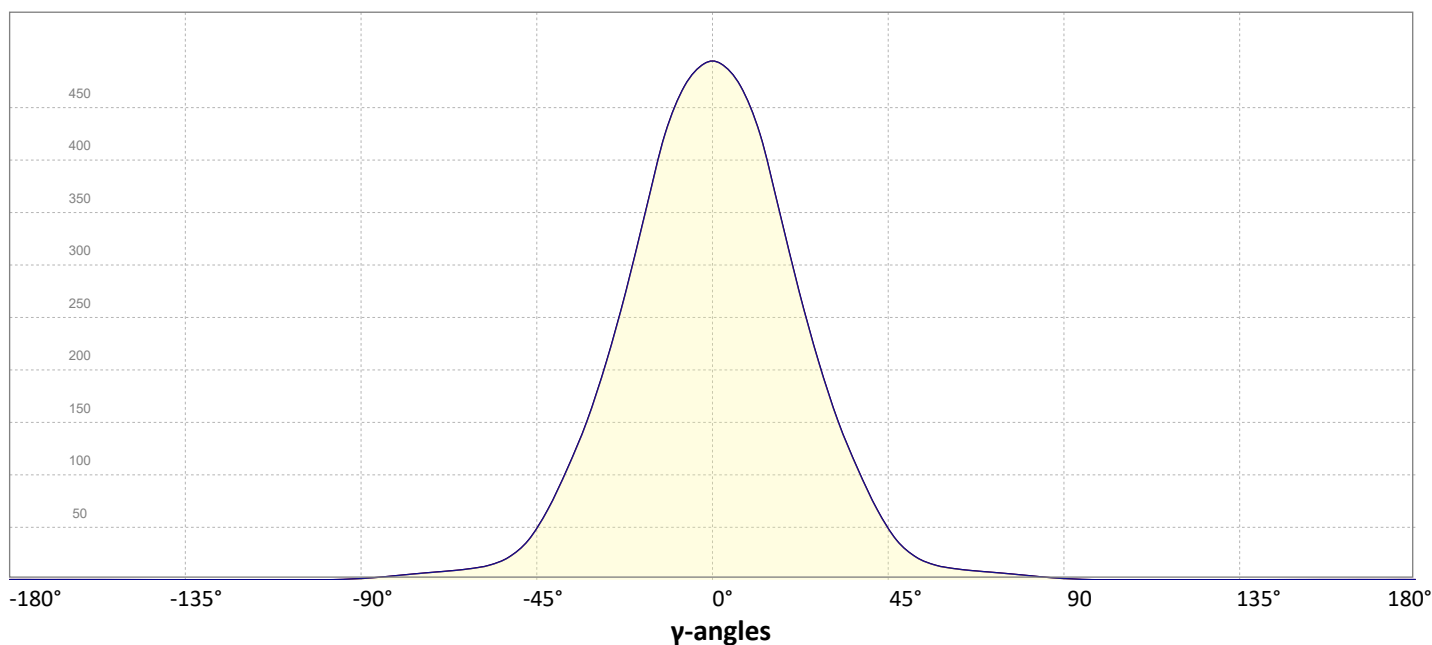
## Intensity Ratio

|              |       |
|--------------|-------|
| In 120° cone | 95,3% |
| In 90° cone  | 87,9% |

C000-C180

C090-C270

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

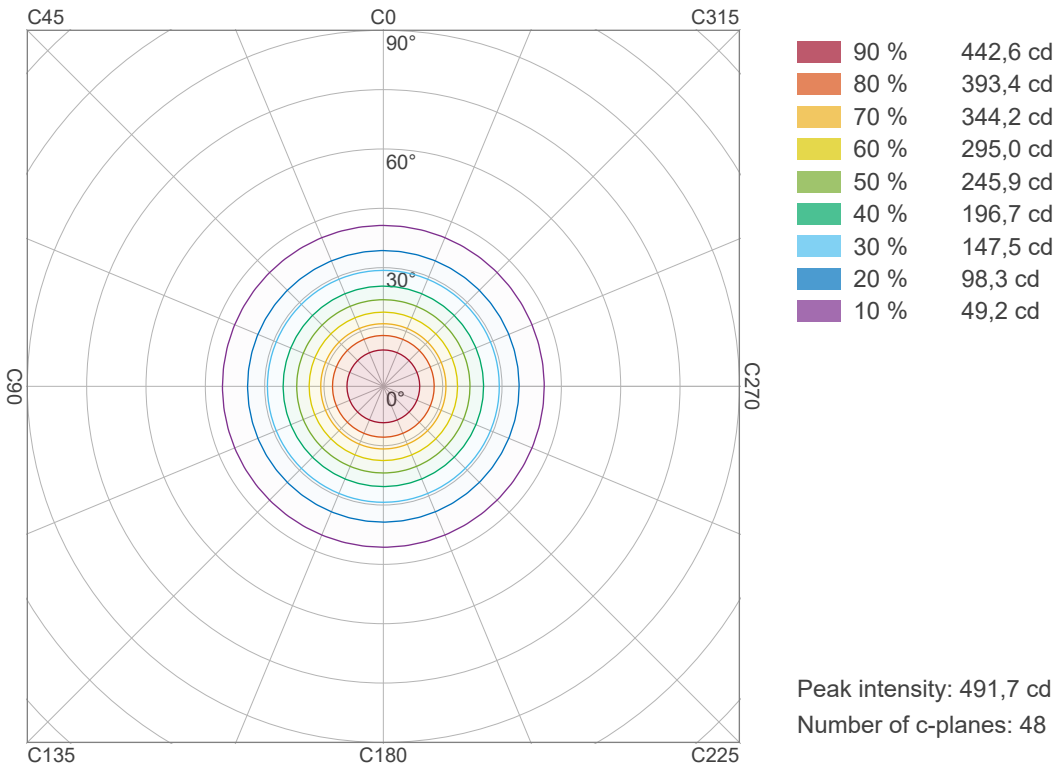


# Light Measurement Report

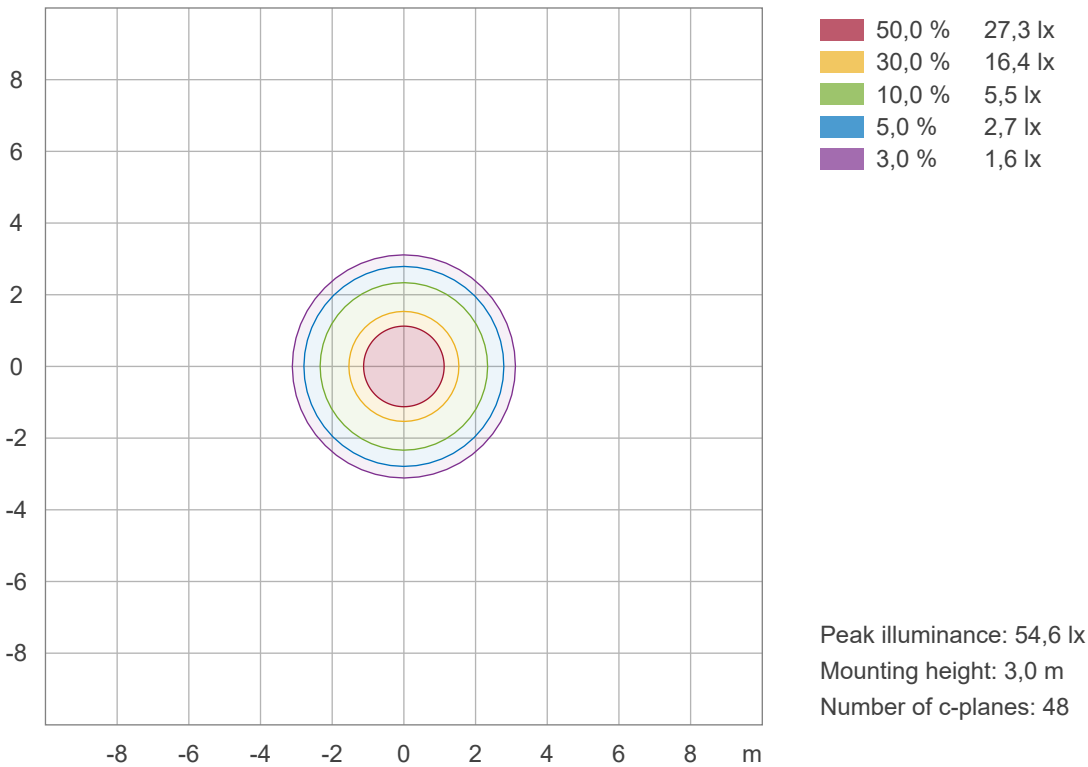
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## Iso-intensity Diagram (Iso-candela)



## Iso-illuminance Diagram (Iso-lux)



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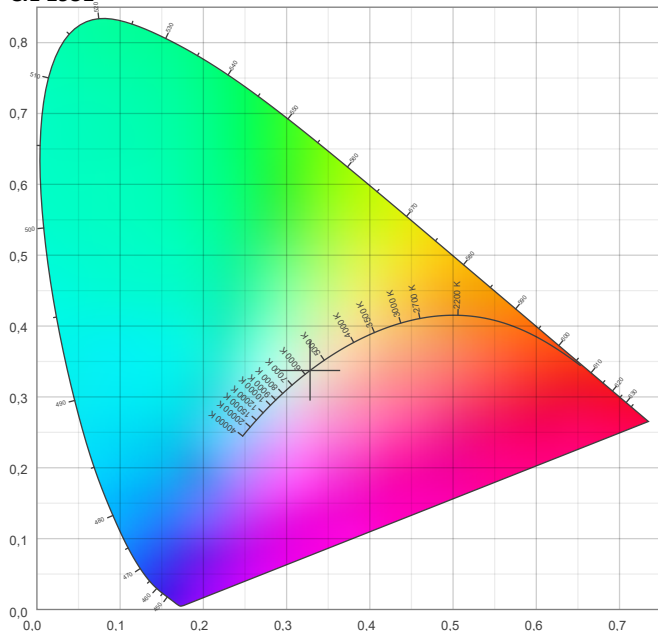


## Color details

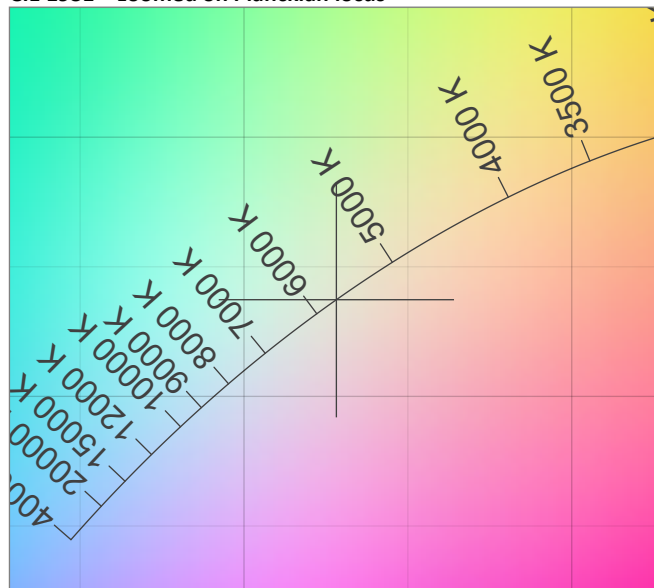
Correlated Color Temperature, Target CCT = 5700 K  
Correlated Color Temperature, Measured CCT = 5739 K  
Color Rendering Index CRI 82,4  
Color Rendering Index, R9 (red component) R9 = 7,2  
Color Rendering TM30-18 R<sub>f</sub> 83,5 – R<sub>g</sub> 96,6  
Color Quality Scale CQS = 81,6

MacAdam Steps  
Color coordinates CIE 1931 (x;y) = (0,328;0,337)  
Color coordinate CIEs 1960 (u;v) = (0,205;0,317)  
Color deviation from BBL Duv = 0,0049  
Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,205;0,475)

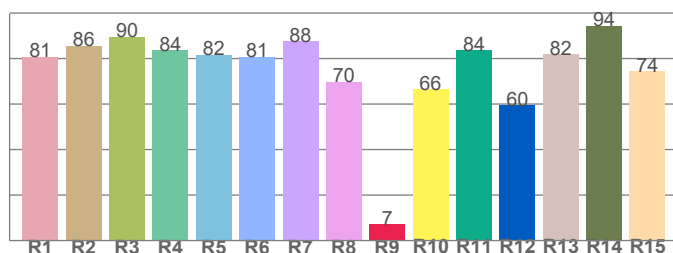
## CIE 1931



## CIE 1931 – zoomed on Planckian locus



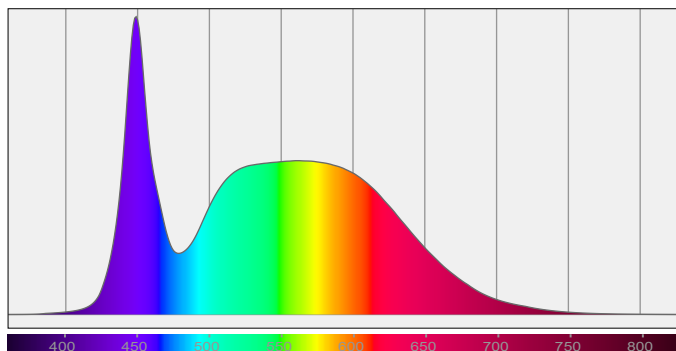
## Color Rendering Index per reference color (CIE 1995)



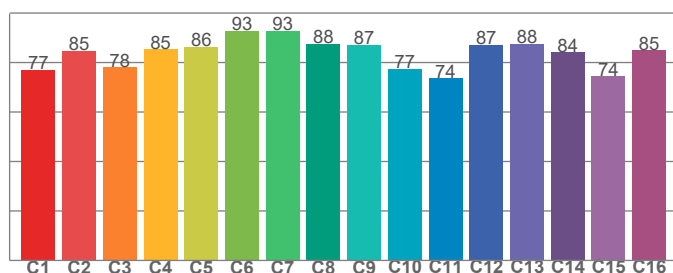
CRI R values, only R1-R8 are used to calculate final CRI value

| R1   | R2   | R3   | R4   | R5   | R6   | R7   | R8   | R9  | R10  | R11  | R12  | R13  | R14  | R15  |
|------|------|------|------|------|------|------|------|-----|------|------|------|------|------|------|
| 80,7 | 85,7 | 89,6 | 83,7 | 81,6 | 80,8 | 87,6 | 69,8 | 7,2 | 66,5 | 83,6 | 59,5 | 81,8 | 94,5 | 74,5 |

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



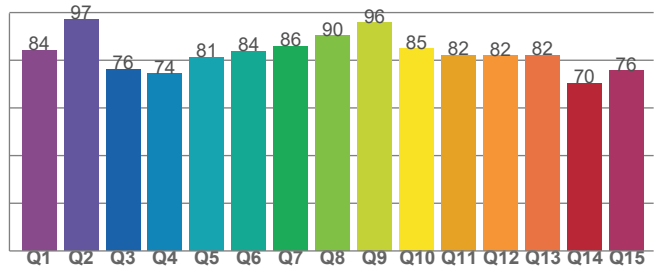
## TM30-18 R<sub>f</sub>-values per hue bin



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  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 77,1 | 84,8 | 78,2 | 85,3 | 86,4 | 92,8 | 92,9 | 87,5 | 87,2 | 77,4 | 73,6 | 87,2 | 87,6 | 84,0 | 74,5 | 84,9 |

## Color Quality Scale by reference color



CQS Q values

| Q1   | Q2   | Q3   | Q4   | Q5   | Q6   | Q7   | Q8   | Q9   | Q10  | Q11  | Q12  | Q13  | Q14  | Q15  |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 84,2 | 97,2 | 76,2 | 74,4 | 81,4 | 83,7 | 85,9 | 90,3 | 95,8 | 84,8 | 82,2 | 81,9 | 82,2 | 70,4 | 75,6 |

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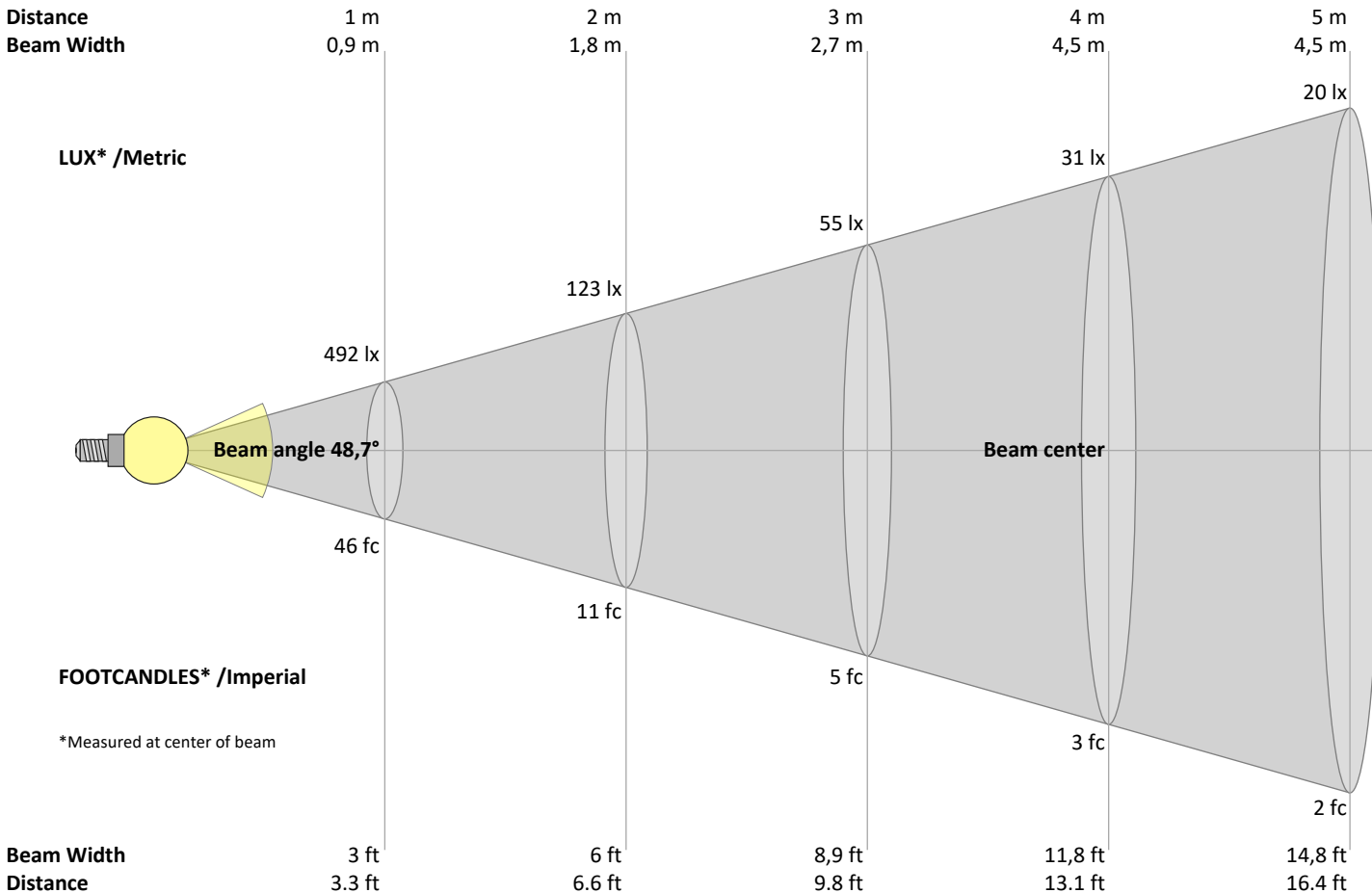
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## Beam Details



### 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  |
| 492  | 123  | 55  | 31   | 20   | 14   | 10  | 8    | 6    | 5    | 4    | 3    | 3    | 3    | 2    | 2    | 2    | 2    | 1    | 1    | lux |
| 45,7 | 11,4 | 5,1 | 2,9  | 1,8  | 1,3  | 0,9 | 0,7  | 0,6  | 0,5  | 0,4  | 0,3  | 0,3  | 0,2  | 0,2  | 0,2  | 0,2  | 0,1  | 0,1  | 0,1  | 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° | $\gamma$ |
|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|
| 492  | 492  | 484 | 475 | 463 | 445 | 426 | 398 | 368 | 338 | 308 | 277 | 250 | 224 | 198 | 176 | 153 | 134 | 116 | 99  | cd       |
| 100% | 100% | 98% | 97% | 94% | 90% | 87% | 81% | 75% | 69% | 63% | 56% | 51% | 45% | 40% | 36% | 31% | 27% | 24% | 20% | 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° | $\gamma$  |
|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------|
| 492  | 492  | 484 | 475 | 463 | 445 | 426 | 398 | 368 | 338 | 308 | 277 | 250 | 224 | 198 | 176 | 153 | 134 | 116 | 99  | cd        |
| 100% | 100% | 98% | 97% | 94% | 90% | 87% | 81% | 75% | 69% | 63% | 56% | 51% | 45% | 40% | 36% | 31% | 27% | 24% | 20% | 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        |
|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|
| 492  | 492  | 484 | 475 | 463 | 445 | 426 | 398 | 368 | 338 | 308 | 277 | 250 | 224 | 198 | 176 | 153 | 134 | 116 | 99  | cd       |
| 100% | 100% | 98% | 97% | 94% | 90% | 87% | 81% | 75% | 69% | 63% | 56% | 51% | 45% | 40% | 36% | 31% | 27% | 24% | 20% | 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        |
|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|
| 492  | 492  | 484 | 475 | 463 | 445 | 426 | 398 | 368 | 338 | 308 | 277 | 250 | 224 | 198 | 176 | 153 | 134 | 116 | 99  | cd       |
| 100% | 100% | 98% | 97% | 94% | 90% | 87% | 81% | 75% | 69% | 63% | 56% | 51% | 45% | 40% | 36% | 31% | 27% | 24% | 20% | 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        | 23,6                                               | 24,3 | 23,7 | 24,6 | 24,8 | 23,6                                             | 24,3 | 23,7 | 24,6 | 24,8 |
|                                                                      | 3H        | 23,7                                               | 24,6 | 24,1 | 24,8 | 25,0 | 23,7                                             | 24,6 | 24,1 | 24,8 | 25,0 |
|                                                                      | 4H        | 23,9                                               | 24,7 | 24,3 | 24,9 | 25,2 | 23,9                                             | 24,7 | 24,3 | 24,9 | 25,2 |
|                                                                      | 6H        | 24,1                                               | 24,8 | 24,4 | 25,1 | 25,4 | 24,1                                             | 24,8 | 24,4 | 25,1 | 25,4 |
|                                                                      | 8H        | 24,1                                               | 24,8 | 24,5 | 25,1 | 25,5 | 24,1                                             | 24,8 | 24,5 | 25,1 | 25,5 |
|                                                                      | 12H       | 24,1                                               | 24,8 | 24,5 | 25,1 | 25,6 | 24,1                                             | 24,8 | 24,5 | 25,1 | 25,6 |
| 4H                                                                   | 2H        | 23,4                                               | 24,3 | 23,8 | 24,5 | 24,8 | 23,4                                             | 24,3 | 23,8 | 24,5 | 24,8 |
|                                                                      | 3H        | 23,9                                               | 24,5 | 24,2 | 24,9 | 25,3 | 23,9                                             | 24,5 | 24,2 | 24,9 | 25,3 |
|                                                                      | 4H        | 24,1                                               | 24,7 | 24,5 | 25,1 | 25,6 | 24,1                                             | 24,7 | 24,5 | 25,1 | 25,6 |
|                                                                      | 6H        | 24,4                                               | 25,0 | 24,9 | 25,3 | 25,7 | 24,4                                             | 25,0 | 24,9 | 25,3 | 25,7 |
|                                                                      | 8H        | 24,4                                               | 25,0 | 25,0 | 25,4 | 25,7 | 24,4                                             | 25,0 | 25,0 | 25,4 | 25,7 |
|                                                                      | 12H       | 24,5                                               | 25,0 | 25,0 | 25,4 | 25,8 | 24,5                                             | 25,0 | 25,0 | 25,4 | 25,8 |
| 8H                                                                   | 4H        | 24,2                                               | 24,7 | 24,7 | 25,1 | 25,4 | 24,2                                             | 24,7 | 24,7 | 25,1 | 25,4 |
|                                                                      | 6H        | 24,5                                               | 24,9 | 25,0 | 25,4 | 25,9 | 24,5                                             | 24,9 | 25,0 | 25,4 | 25,9 |
|                                                                      | 8H        | 24,7                                               | 25,1 | 25,3 | 25,6 | 26,2 | 24,7                                             | 25,1 | 25,3 | 25,6 | 26,2 |
|                                                                      | 12H       | 24,9                                               | 25,1 | 25,5 | 25,6 | 26,3 | 24,9                                             | 25,1 | 25,5 | 25,6 | 26,3 |
| 12H                                                                  | 4H        | 24,1                                               | 24,6 | 24,6 | 25,0 | 25,5 | 24,1                                             | 24,6 | 24,6 | 25,0 | 25,5 |
|                                                                      | 6H        | 24,6                                               | 24,9 | 25,1 | 25,4 | 26,1 | 24,6                                             | 24,9 | 25,1 | 25,4 | 26,1 |
|                                                                      | 8H        | 24,8                                               | 25,0 | 25,4 | 25,6 | 26,2 | 24,8                                             | 25,0 | 25,4 | 25,6 | 26,2 |
| Variations with the observer position for the luminaire spacings, S: |           |                                                    |      |      |      |      |                                                  |      |      |      |      |
| S = 1.0H                                                             |           | 1,6 / -1,5                                         |      |      |      |      | 1,6 / -1,5                                       |      |      |      |      |
| S = 1.5H                                                             |           | 3,4 / -2,0                                         |      |      |      |      | 3,4 / -2,0                                       |      |      |      |      |
| S = 2.0H                                                             |           | 5,0 / -2,4                                         |      |      |      |      | 5,0 / -2,4                                       |      |      |      |      |

## 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                   | 113 | 109                      | 106 | 104 | 110                                                                            | 107 | 105 | 102 | 103 | 101 | 99  | 99  | 98  | 96  | 96  | 94  | 93  | 91  |
| 2                   | 106 | 101                      | 96  | 92  | 104                                                                            | 99  | 95  | 91  | 96  | 92  | 89  | 93  | 90  | 87  | 90  | 87  | 85  | 84  |
| 3                   | 100 | 93                       | 88  | 83  | 98                                                                             | 92  | 87  | 82  | 89  | 85  | 81  | 86  | 83  | 80  | 84  | 81  | 78  | 77  |
| 4                   | 95  | 86                       | 80  | 76  | 93                                                                             | 85  | 80  | 75  | 83  | 78  | 74  | 81  | 77  | 73  | 79  | 75  | 72  | 71  |
| 5                   | 90  | 80                       | 74  | 69  | 88                                                                             | 79  | 74  | 69  | 78  | 72  | 68  | 76  | 71  | 68  | 74  | 70  | 67  | 66  |
| 6                   | 85  | 75                       | 69  | 64  | 83                                                                             | 74  | 68  | 64  | 73  | 67  | 63  | 71  | 67  | 63  | 70  | 66  | 62  | 61  |
| 7                   | 80  | 70                       | 64  | 60  | 79                                                                             | 70  | 64  | 59  | 68  | 63  | 59  | 67  | 62  | 59  | 66  | 62  | 58  | 57  |
| 8                   | 76  | 66                       | 60  | 56  | 75                                                                             | 66  | 60  | 55  | 65  | 59  | 55  | 63  | 58  | 55  | 62  | 58  | 55  | 53  |
| 9                   | 73  | 62                       | 56  | 52  | 71                                                                             | 62  | 56  | 52  | 61  | 56  | 52  | 60  | 55  | 52  | 59  | 55  | 51  | 50  |
| 10                  | 69  | 59                       | 53  | 49  | 68                                                                             | 59  | 53  | 49  | 58  | 52  | 49  | 57  | 52  | 48  | 56  | 52  | 48  | 47  |

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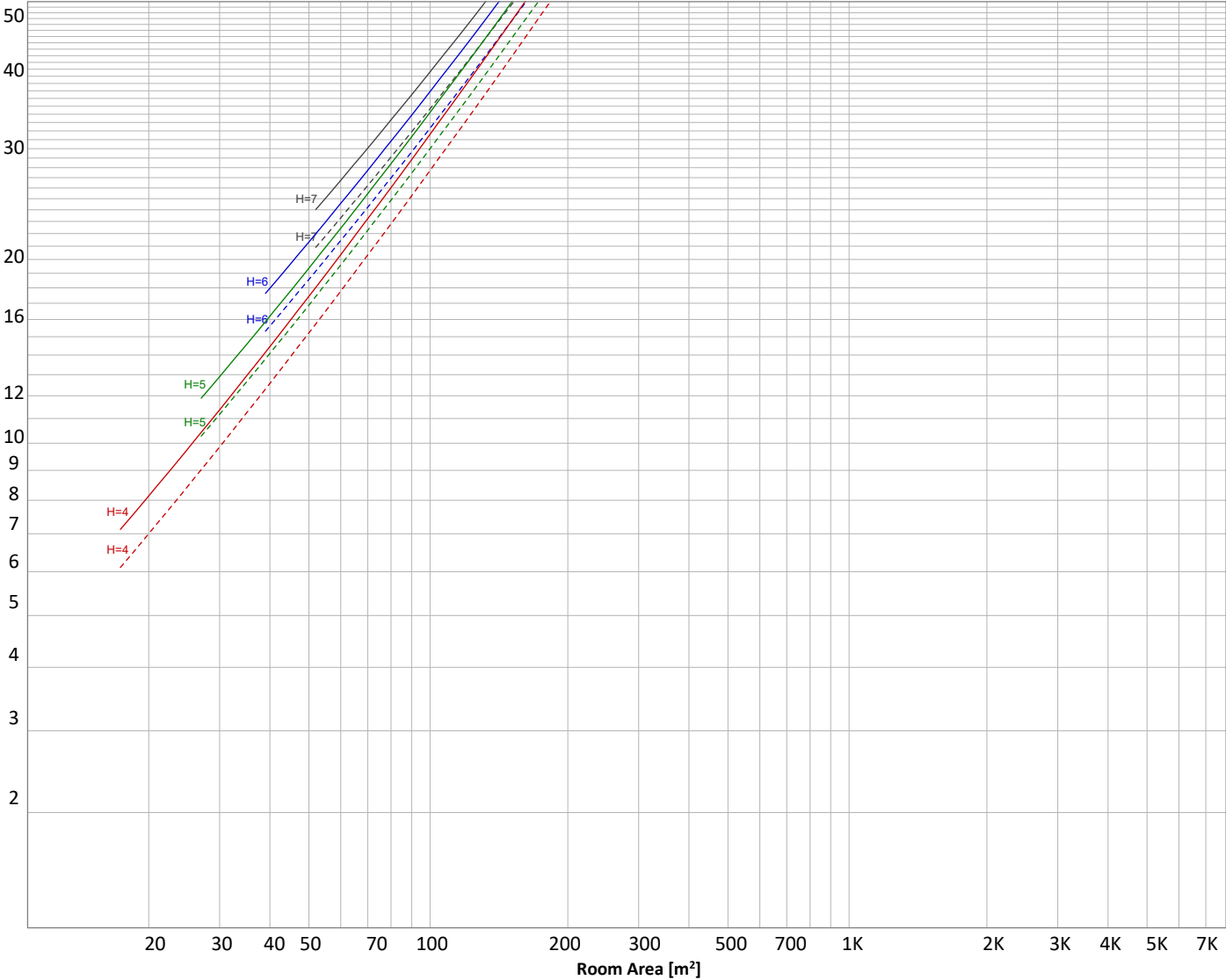
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## Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



### Conditions

|                                                   |               |           |                     |                   |
|---------------------------------------------------|---------------|-----------|---------------------|-------------------|
| H = Room height                                   | Flux = 411 lm | p(%)      |                     |                   |
| H <sub>down</sub> = Lamp distance from ceiling =  | 0.00 m        | Line type | Ceiling reflectance | Wall reflectance  |
| H <sub>work</sub> = Work area height from floor = | 0.00 m        | -----     | 70                  | 50                |
| E <sub>work</sub> = 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°   |
| 45,1 lm  | 107 lm    | 108 lm    | 77,9 lm   | 38,8 lm   | 15,4 lm   | 9,28 lm   | 6,35 lm   | 2,82 lm   |
| 90°-100° | 100°-110° | 110°-120° | 120°-130° | 130°-140° | 140°-150° | 150°-160° | 160°-170° | 170°-180° |
| 0,471 lm | 0,071 lm  | 0,069 lm  | 0,073 lm  | 0,070 lm  | 0,080 lm  | 0,083 lm  | 0,056 lm  | 0,020 lm  |





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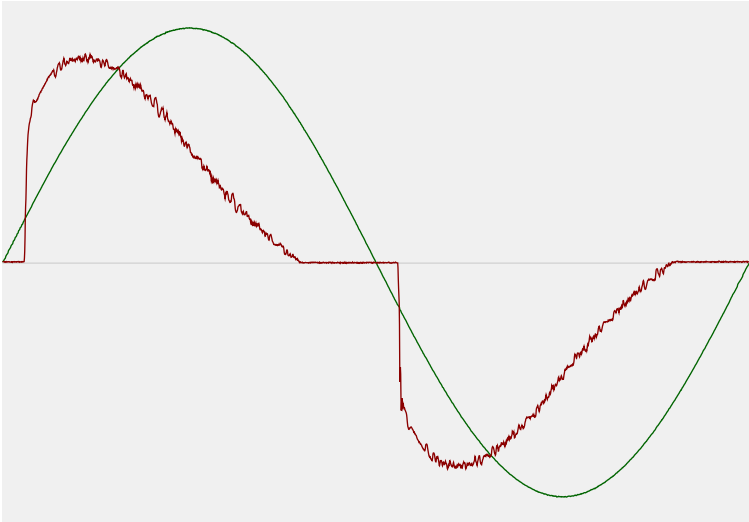


Power Details

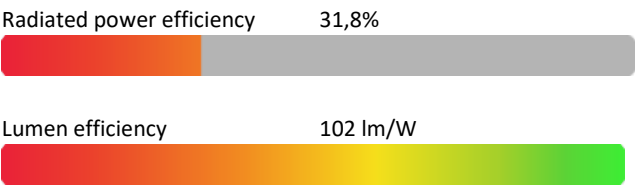
Input Power

|                                                         |         |
|---------------------------------------------------------|---------|
| Power feed to light source                              | 4,0 W   |
| Frequency of input power                                | 50 Hz   |
| RMS Input voltage feed, $V_{RMS}$                       | 230 V   |
| RMS Input current feed, $I_{RMS}$                       | 0,022 A |
| Volt-Ampere or apparent power = $V_{RMS} \cdot I_{RMS}$ | 5,13 VA |
| Displacement factor of AC power feed                    | 0,84    |
| Power factor of AC current feed                         | 0,79    |
| Total harmonic distortion of the current                | 38,07%  |
| Total harmonic distortion of the voltage                | 0,07%   |

Input Power Curve



Efficiency



Stabilization Details

Warmup Conditions

|                   |        |
|-------------------|--------|
| Stable period     | 15 min |
| Stable change max | 2,0%   |
| Minimum time      | 15 min |

Color Temperature Change

|           |        |
|-----------|--------|
| CCT start | 5698 K |
| CCT shift | +2 K   |
| CCT end   | 5700 K |

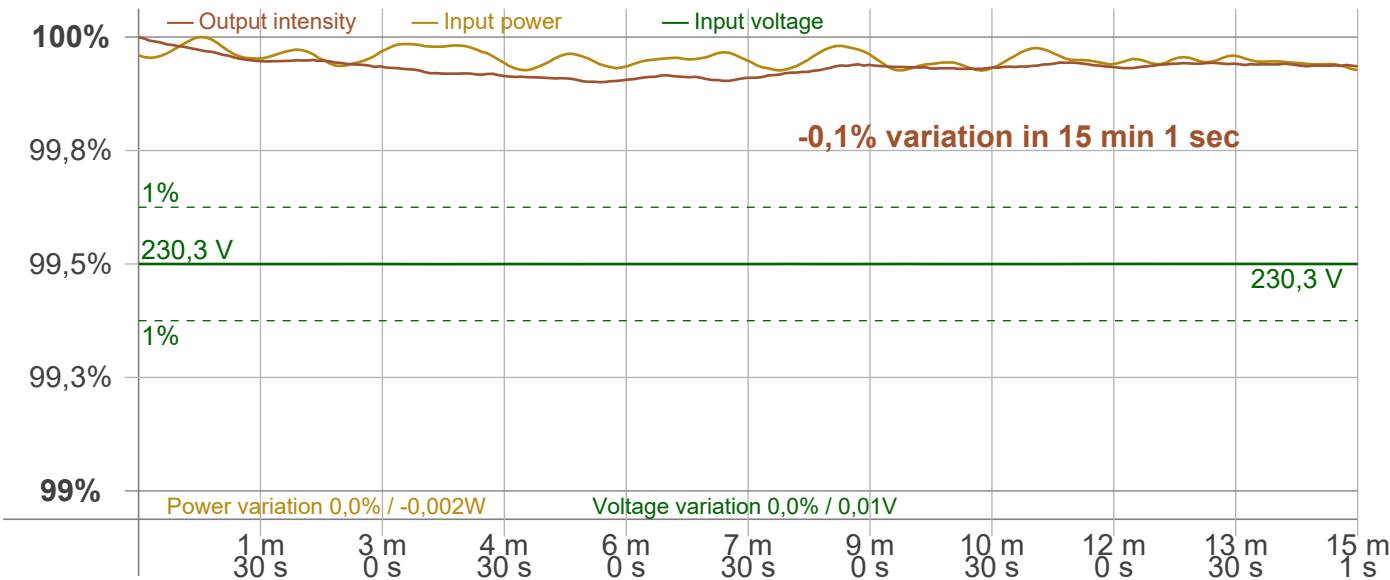
Warmup Result

|                   |                                 |
|-------------------|---------------------------------|
| Total warmup time | Lamp stabilized in 15 min 1 sec |
| Warmup variation  | -0,1%                           |

Output Change

|               |        |
|---------------|--------|
| Output start  | 412 lm |
| Output change | lm     |
| Output end    | 411 lm |

Stabilization Curve



# Light Measurement Report

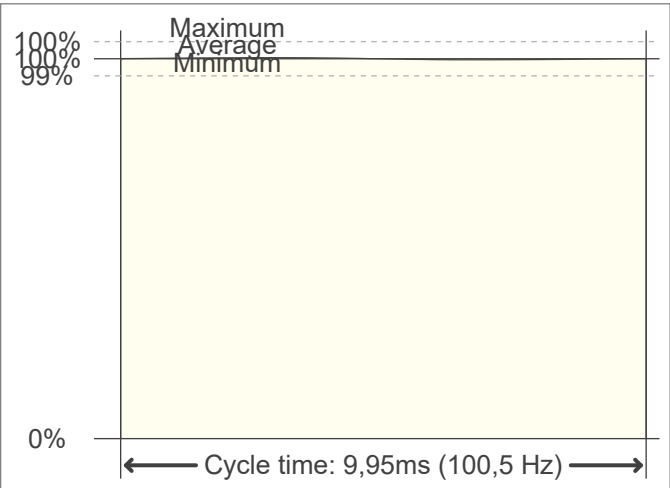
Print date: 5-11-2025  
Measurement date and time: 5-11-2025 13:02:43 – Measurement no. VFR-251105-3925-MS  
Measurement tracking No. and Link: [n/a](#)  
Operator:



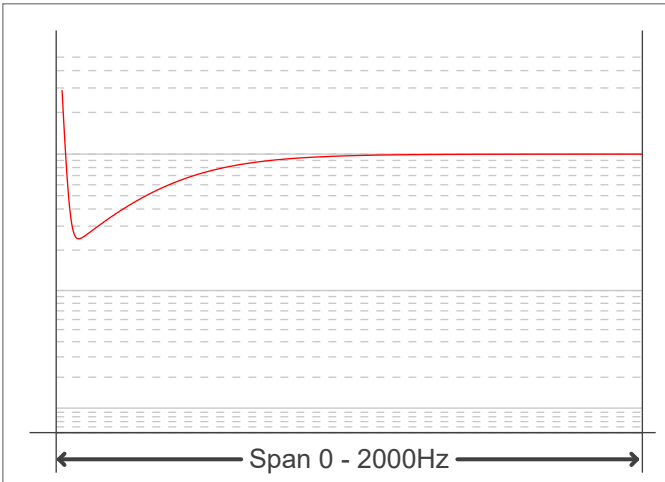
## Flicker /TLA details

|                                                                     |                         |                                                                       |         |
|---------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------|---------|
| Flicker Meter Type                                                  | Viso Systems LabFlicker | Measurement time                                                      |         |
| Frequency of input power                                            | 50 Hz                   | PstLM                                                                 | 180 sec |
| Flicker/TLA sample rate                                             | 20000 samples/s         | All other indices                                                     | 1,2 sec |
| Flicker indices according to Illuminating Engineering Society (IES) |                         | Flicker indices according to California Energy Commission (CEC) 2016b |         |
| Flicker frequency                                                   | 100,5 Hz                | JA8/10 40 Hz                                                          | 0,12 %  |
| Percent Flicker                                                     | 0,41 %                  | JA8/10 90 Hz                                                          | 0,12 %  |
| Flicker index                                                       | 0                       | JA8/10 200 Hz                                                         | 0,4 %   |
|                                                                     |                         | JA8/10 400 Hz                                                         | 0,4 %   |
|                                                                     |                         | JA8/10 1000 Hz                                                        | 0,4 %   |
| TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)   |                         | Flicker indices according to Lighting Research Center (2015)          |         |
| PstLM value (F < 80 Hz)                                             | 0,06                    | Perception metric, Assist Mp                                          | 0,02    |
| SVM value (80 < F < 2000 Hz)                                        | 0,01                    |                                                                       |         |

Flicker frame (frame of one flicker period in time domain)



Flicker FFT (flicker curve in frequency domain)



IEEE 1789 Frequency/modulation plot

