

# Light Measurement Report

Print date: 15-8-2025

Measurement date and time: 15-8-2025 11:23:33 – Measurement no. VFR-250815-2573-MS

Measurement tracking No. and Link: [VT250815-000981](https://www.viso-systems.com/track/VT250815-000981)

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

32 planes – 11,25°  
5°  
3,99 m  
24,5 W – PF 0,98 – DPF 0,98  
230 V – 0,109 A  
50 Hz  
Lamp stabilized in 15 min 0 sec – 2,0%

## Tested Light Source

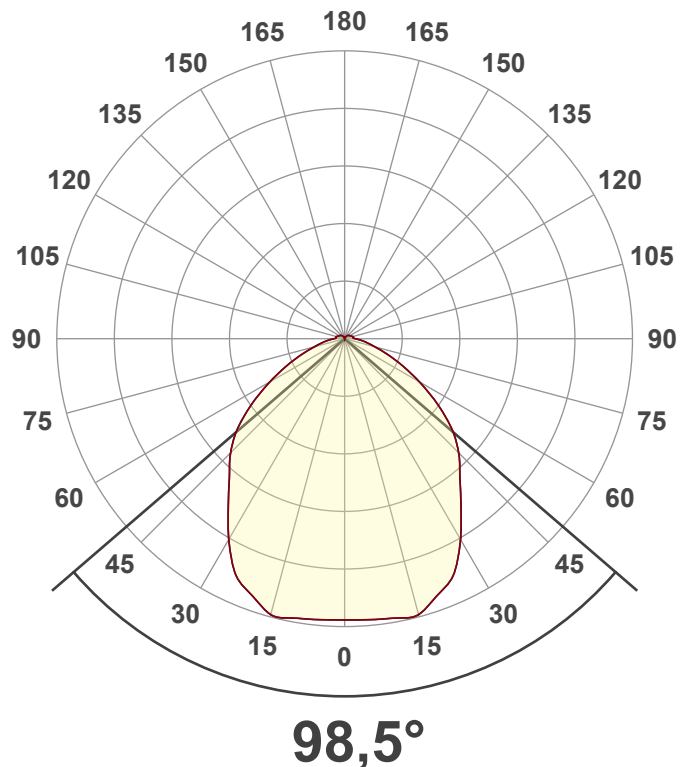
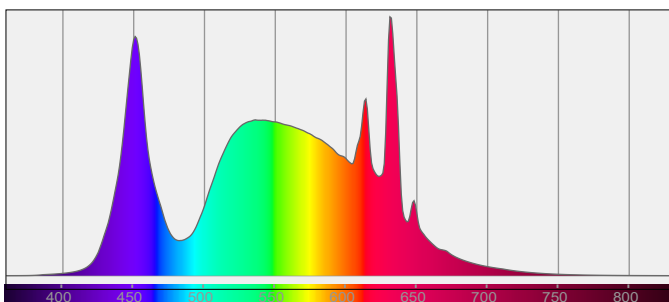
Product Name  
Item No. and Manufacturer  
Product Description (line 1)  
ZWART | CCT SWITCH

812959-5000K-24W  
812959-5000K-24W – Dutchfulfillment  
3-FASE RAILARMATUUR | TARVOS | 60CM | 12W/16W/20W/24W |

## 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

3016 lm – 5,03% / 94,97%  
123 lm/W  
1184 cd – 98,5°  
CCT = 5000 K / 4906 K  
CRI 82,8  
 $R_f$  83,0 –  $R_g$  99,5  
Duv 0,0067 – SDCM 6,7  
SVM 0 – PstLM 0,01



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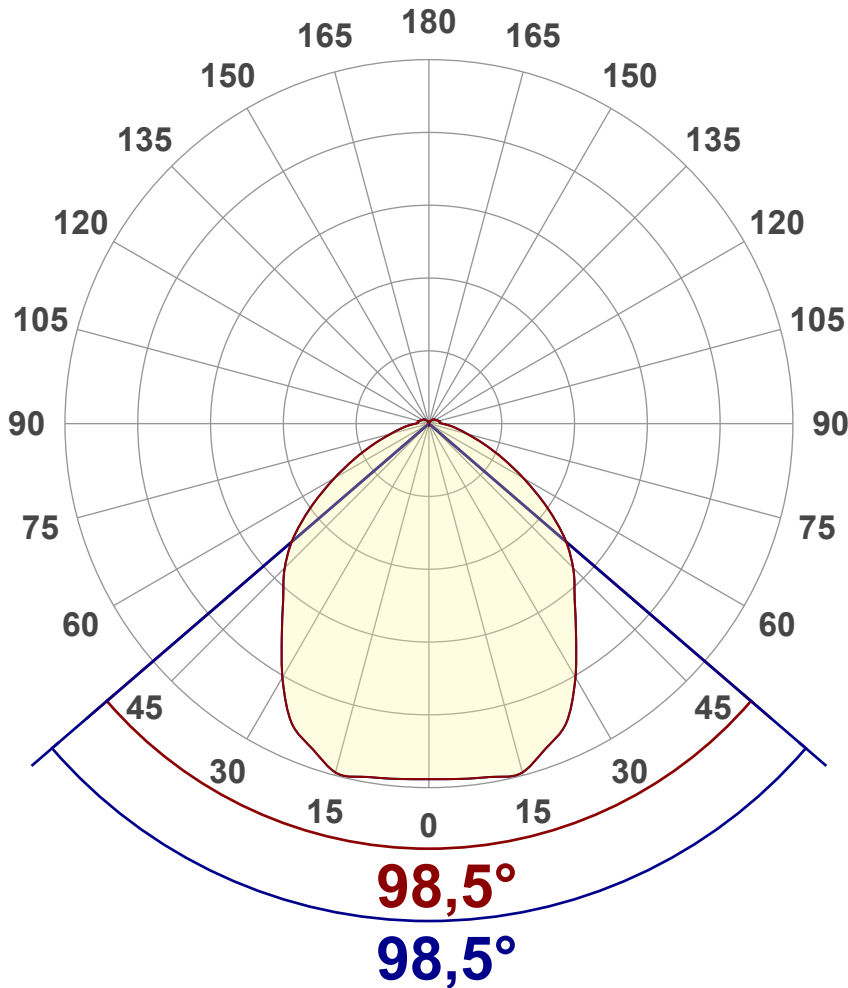
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## Luminous Intensity diagram

Unit: 0-100% of peak intensity



## Main Values

Output (total Lumen)	3016 lm
Lumen Up% / Down%	5,03% / 94,97%
Peak Intensity	1184 cd
Beam Angle (50%)	98,5°
Beam Angle (90%)	98,5°
Beam Angle (10%)	98,5°

## Cut-off Angle

Average 2,5%	221°
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## Field Angle

Average 10%	153,1°
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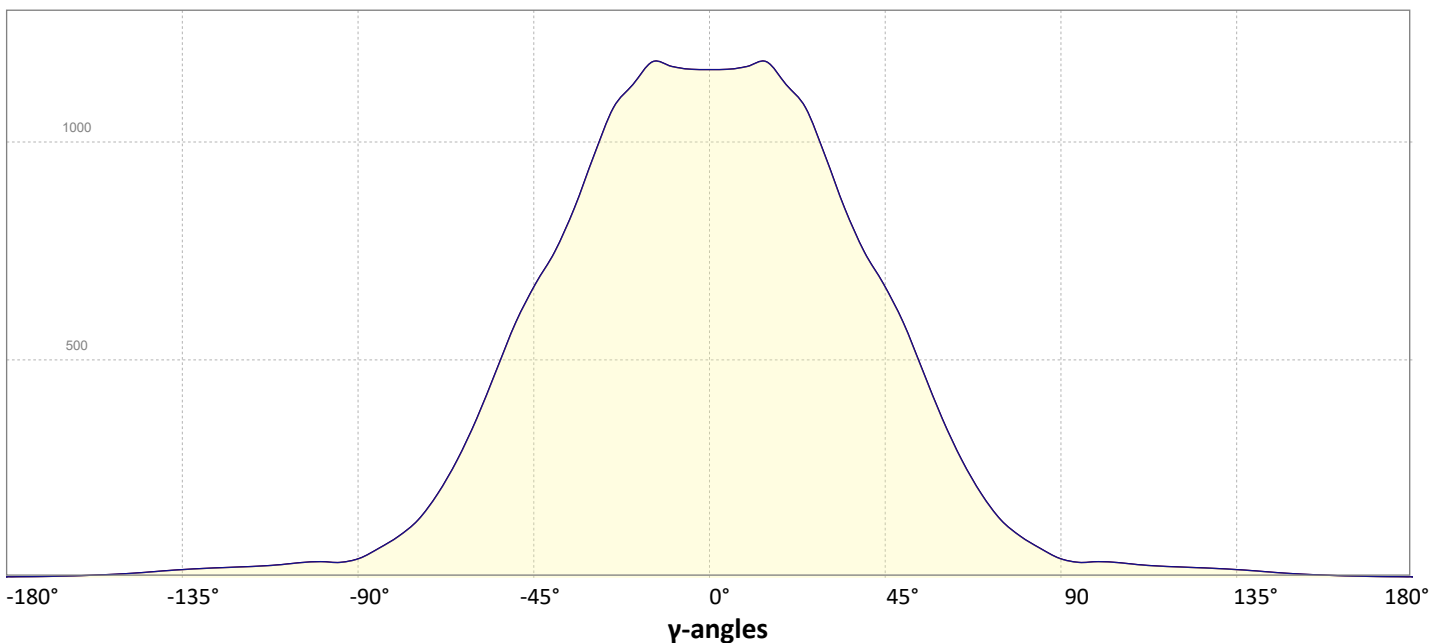
## Intensity Ratio

In 120° cone	79,1%
In 90° cone	56,9%

**C000-C180**

**C090-C270**

## Linear distribution diagram - Intensity (candela) vs $\gamma$ -angle



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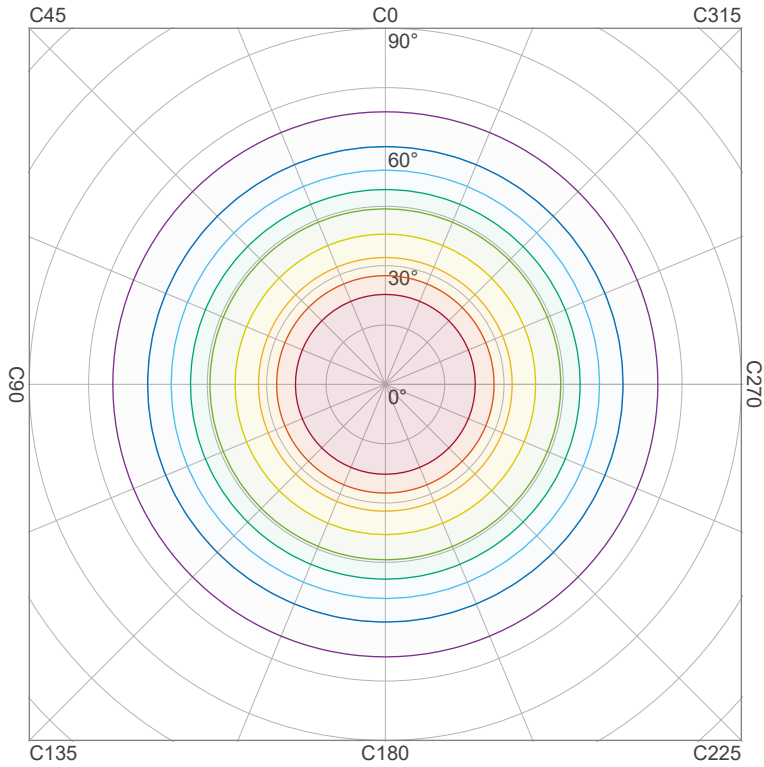
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## Iso-intensity Diagram (Iso-candela)

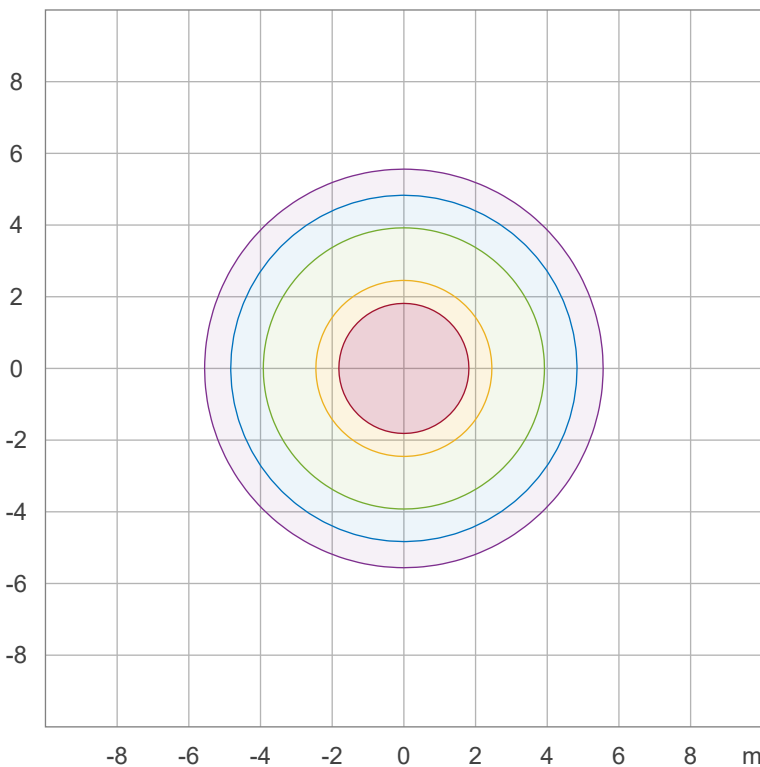


90 %	1064,4 cd
80 %	946,1 cd
70 %	827,9 cd
60 %	709,6 cd
50 %	591,3 cd
40 %	473,1 cd
30 %	354,8 cd
20 %	236,5 cd
10 %	118,3 cd

Peak intensity: 1182,7 cd

Number of c-planes: 32

## Iso-illuminance Diagram (Iso-lux)



50,0 %	64,8 lx
30,0 %	38,9 lx
10,0 %	13,0 lx
5,0 %	6,5 lx
3,0 %	3,9 lx

Peak illuminance: 129,6 lx

Mounting height: 3,0 m

Number of c-planes: 32

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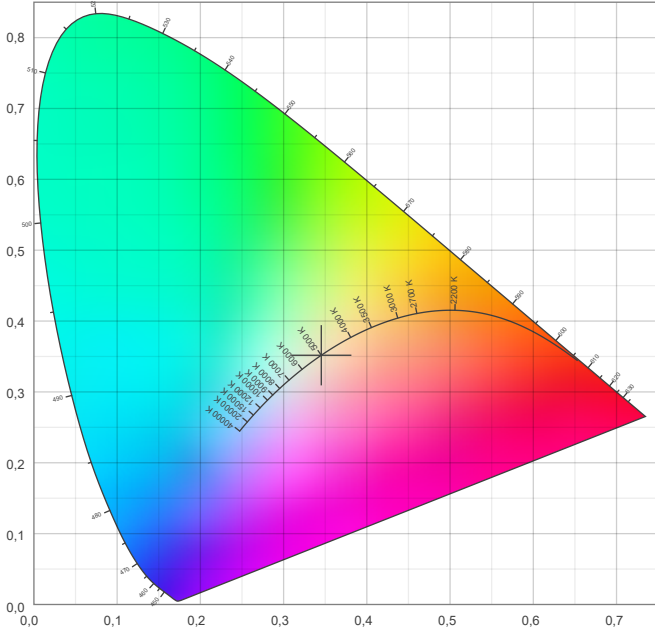


## Color details

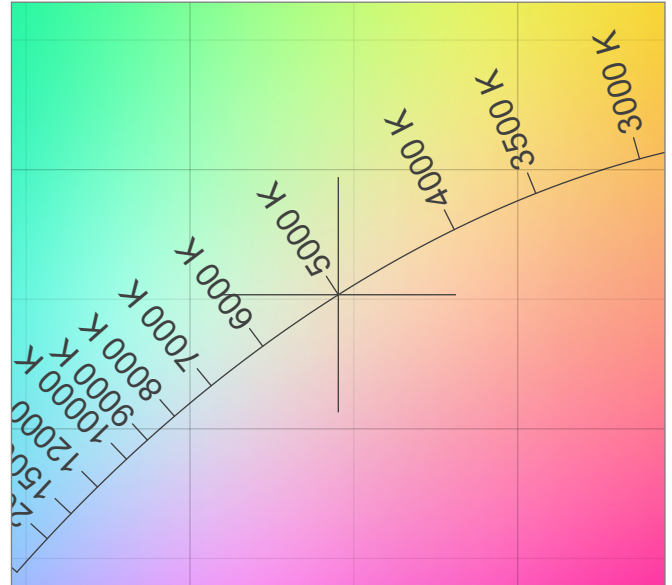
Correlated Color Temperature, Target CCT = 5000 K  
 Correlated Color Temperature, Measured CCT = 4906 K  
 Color Rendering Index CRI 82,8  
 Color Rendering Index, R9 (red component) R9 = 38,5  
 Color Rendering TM30-18 R<sub>f</sub> 83,0 – R<sub>g</sub> 99,5  
 Color Quality Scale CQS = 83,9

MacAdam Steps SDCM = 6,7  
 Color coordinates CIE 1931 (x;y) = (0,345;0,352)  
 Color coordinate CIEs 1960 (u;v) = (0,211;0,323)  
 Color deviation from BBL Duv = 0,0067  
 Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,211;0,485)

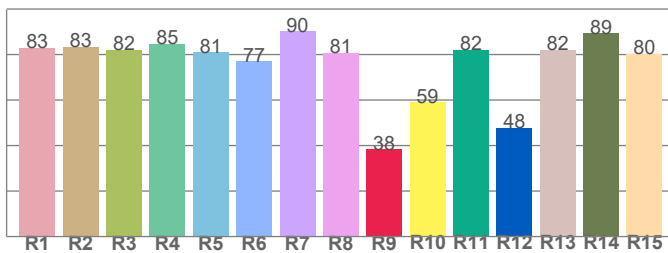
### CIE 1931



### CIE 1931 – zoomed on Planckian locus



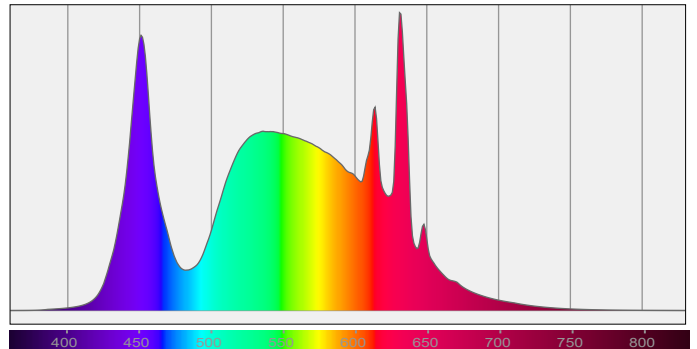
### Color Rendering Index per reference color (CIE 1995)



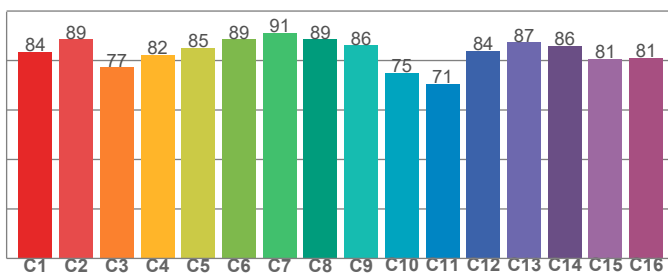
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
83,0	83,5	82,1	84,7	81,1	77,1	90,3	80,7	38,5	59,0	82,1	47,8	82,2	89,5	80,3

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



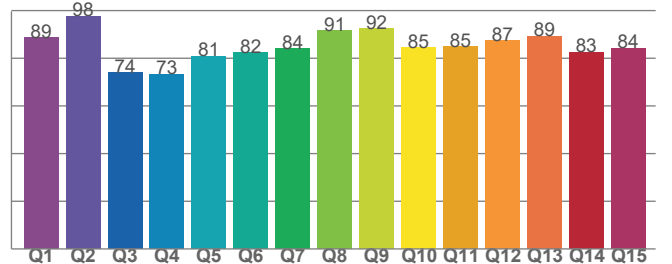
### TM30-18 R<sub>f</sub>-values per hue bin



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
83,6	88,5	77,2	82,3	85,2	88,5	91,2	88,6	86,3	75,1	70,6	84,0	87,3	86,0	80,7	81,1

### Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
88,7	97,6	74,0	73,4	80,9	82,2	84,0	91,5	92,4	84,5	84,8	87,4	89,2	82,6	84,2

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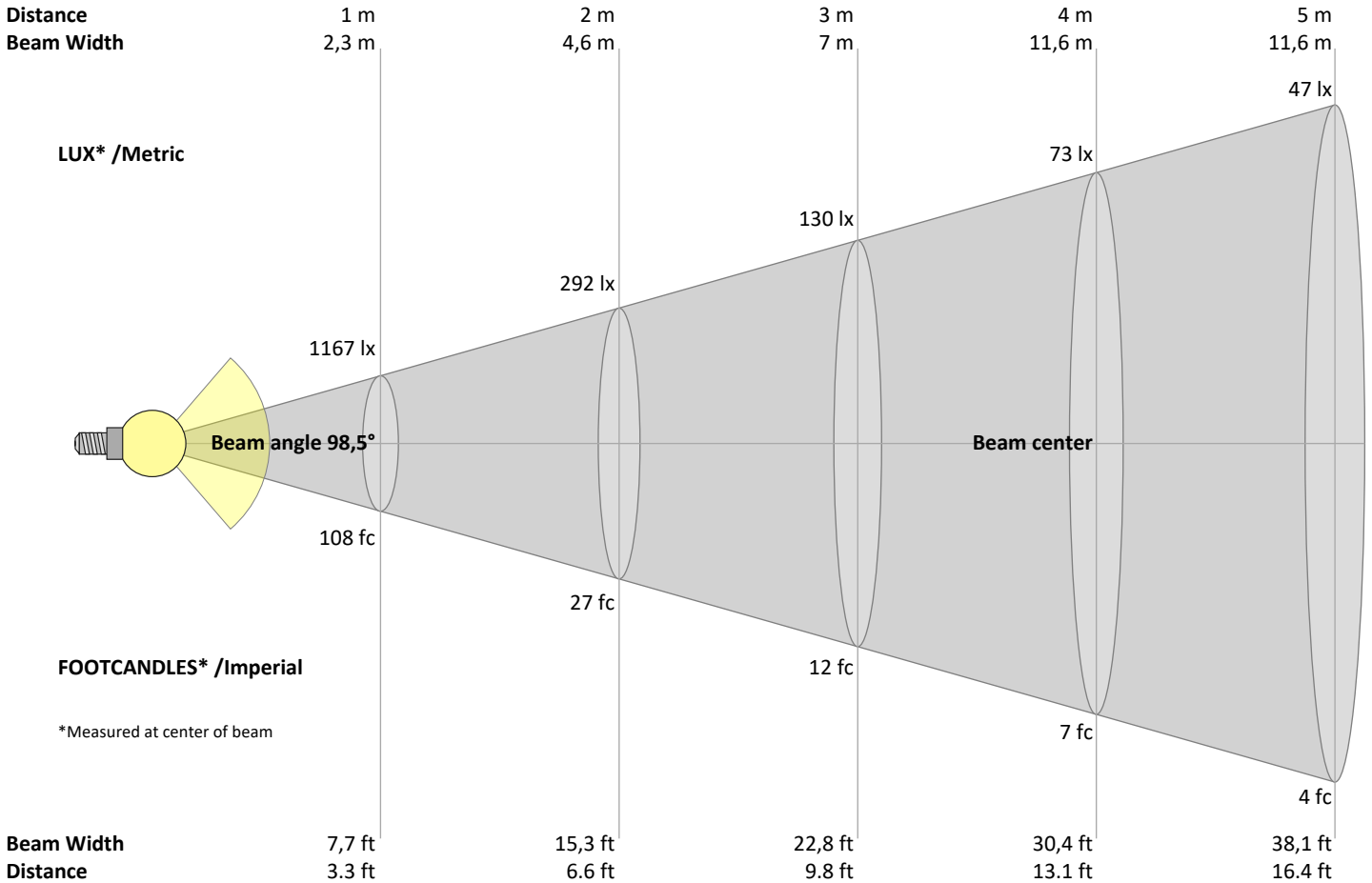
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## Beam Details



### 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
1167	292	130	73	47	32	24	18	14	12	10	8	7	6	5	5	4	4	3	3	lux
108,4	27,1	12	6,8	4,3	3	2,2	1,7	1,3	1,1	0,9	0,8	0,6	0,6	0,5	0,4	0,4	0,3	0,3	0,3	fc

### Intensities in 0° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
1167	1167	1174	1180	1128	1070	959	840	742	667	577	467	358	264	188	130	93	66	44	35	cd
100%	100%	101%	101%	97%	92%	82%	72%	64%	57%	49%	40%	31%	23%	16%	11%	8%	6%	4%	3%	of 0°val

### Intensities in 90° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
1167	1167	1174	1180	1128	1070	959	840	742	667	577	467	358	264	188	130	93	66	44	35	cd
100%	100%	101%	101%	97%	92%	82%	72%	64%	57%	49%	40%	31%	23%	16%	11%	8%	6%	4%	3%	of 0°val

### Intensities in 180° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
1167	1167	1174	1180	1128	1070	959	840	742	667	577	467	358	264	188	130	93	66	44	35	cd
100%	100%	101%	101%	97%	92%	82%	72%	64%	57%	49%	40%	31%	23%	16%	11%	8%	6%	4%	3%	of 0°val

### Intensities in 270° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
1167	1167	1174	1180	1128	1070	959	840	742	667	577	467	358	264	188	130	93	66	44	35	cd
100%	100%	101%	101%	97%	92%	82%	72%	64%	57%	49%	40%	31%	23%	16%	11%	8%	6%	4%	3%	of 0°val

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## Light Planning – UGR table

Uncorrected, comprehensive UGR table according to 117-1995

Reflectances		70	70	50	50	30	70	70	50	50	30
	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	23,8	24,9	24,1	25,2	25,5	24,1	25,2	24,4	25,5	25,9
	3H	24,6	25,7	25,0	26,1	26,4	25,0	26,1	25,5	26,5	26,8
	4H	24,9	26,0	25,4	26,3	26,7	25,4	26,5	25,9	26,8	27,2
	6H	25,3	26,2	25,7	26,6	27,0	25,9	26,8	26,2	27,2	27,6
	8H	25,4	26,3	25,8	26,7	27,2	26,1	27,0	26,5	27,4	27,9
	12H	25,5	26,4	25,9	26,8	27,3	26,3	27,2	26,7	27,6	28,1
4H	2H	24,1	25,2	24,6	25,6	25,9	24,4	25,5	24,9	25,8	26,2
	3H	25,3	26,2	25,7	26,6	27,1	25,6	26,5	26,1	26,9	27,5
	4H	25,6	26,5	26,1	26,9	27,6	26,1	26,9	26,6	27,4	28,0
	6H	26,0	26,8	26,6	27,3	27,7	26,6	27,4	27,2	27,8	28,3
	8H	26,2	26,9	26,8	27,4	27,9	26,9	27,6	27,4	28,0	28,5
	12H	26,4	27,0	27,0	27,5	28,1	27,2	27,7	27,7	28,2	28,8
8H	4H	25,8	26,5	26,4	27,0	27,4	26,2	26,9	26,8	27,4	27,8
	6H	26,4	26,9	27,0	27,5	28,1	26,9	27,4	27,5	28,0	28,6
	8H	26,7	27,1	27,3	27,7	28,5	27,3	27,8	27,9	28,4	29,1
	12H	27,0	27,4	27,6	27,9	28,6	27,7	28,1	28,4	28,7	29,4
12H	4H	25,8	26,4	26,4	26,9	27,5	26,2	26,8	26,8	27,3	27,9
	6H	26,5	26,9	27,0	27,5	28,2	27,0	27,4	27,5	28,0	28,7
	8H	26,8	27,2	27,4	27,8	28,5	27,4	27,8	28,0	28,4	29,0

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

S = 1.0H	0,1 / -0,2	0,1 / -0,1
S = 1.5H	0,3 / -0,5	0,2 / -0,4
S = 2.0H	0,8 / -0,9	0,7 / -0,8

## 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	118	118	118	118	115	115	115	115	108	108	108	103	103	103	97	97	97	95
1	108	104	100	96	105	101	97	94	96	93	90	91	89	86	87	85	83	81
2	99	91	85	79	96	89	83	78	85	80	76	81	77	73	77	74	71	68
3	91	81	73	67	88	79	72	66	75	69	64	72	67	63	69	65	61	59
4	84	72	64	58	81	71	63	57	67	61	56	65	59	54	62	57	53	51
5	77	65	56	50	75	64	56	50	61	54	49	58	52	48	56	51	47	45
6	71	59	50	44	69	58	50	44	55	48	43	53	47	42	51	46	41	39
7	66	53	45	39	64	52	45	39	50	43	38	49	42	38	47	41	37	35
8	62	49	41	35	60	48	40	35	46	39	34	45	38	34	43	38	33	32
9	58	45	37	32	56	44	37	32	43	36	31	41	35	31	40	34	30	29
10	54	42	34	29	53	41	34	29	40	33	28	38	32	28	37	32	28	26

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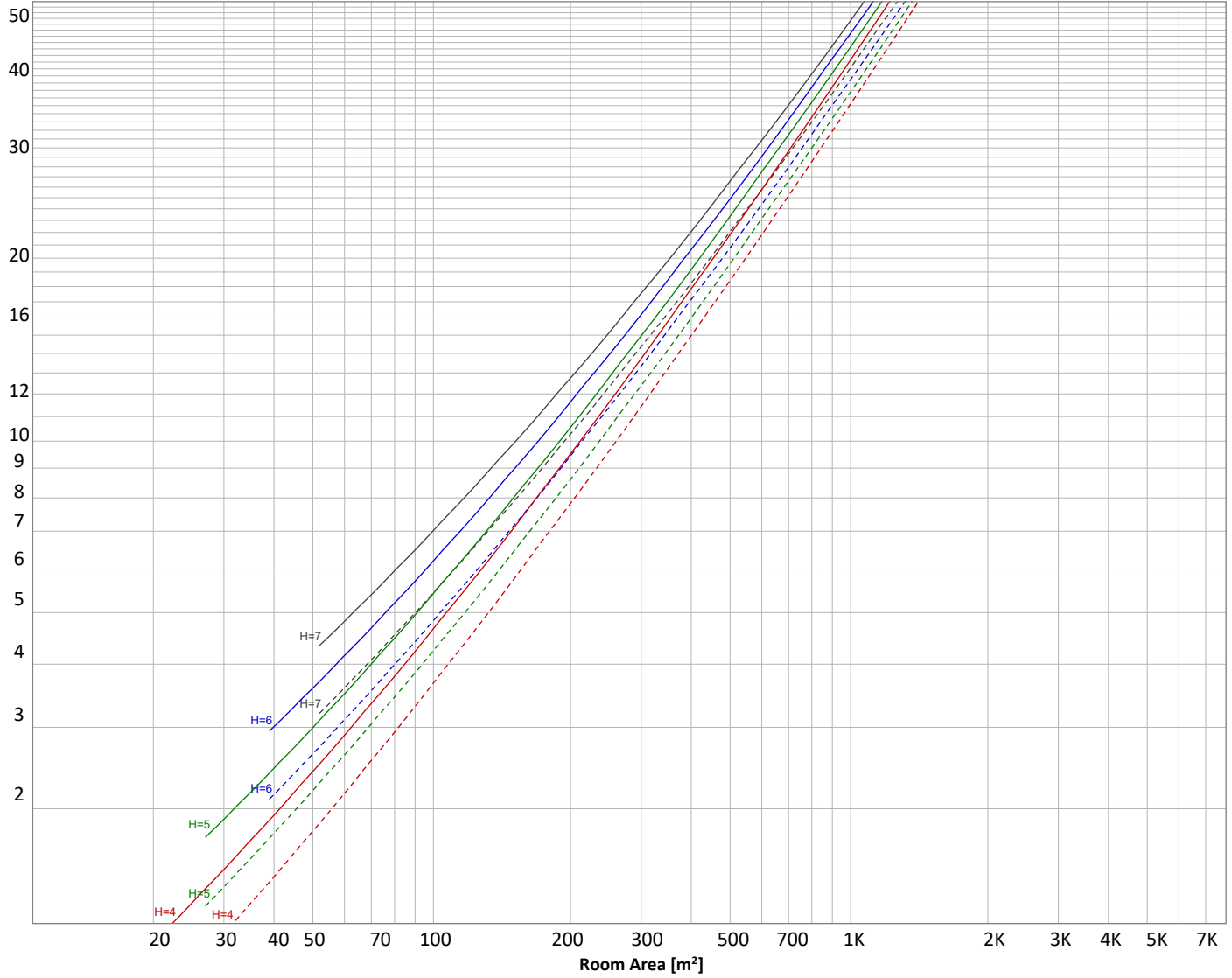
Operator:



## Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



### Conditions

H = Room height	Flux = 3016 lm			
H <sub>down</sub> = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	ρ(%) 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°
112 lm	330 lm	487 lm	527 lm	512 lm	417 lm	264 lm	142 lm	73,0 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
41,2 lm	35,9 lm	26,9 lm	20,7 lm	14,4 lm	7,76 lm	3,34 lm	1,14 lm	0,251 lm

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## Outdoor Light Planning

### Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	112 lm	3,7%
10-20°	330 lm	10,9%
20-30°	487 lm	16,1%
30-40°	527 lm	17,5%
40-50°	512 lm	17,0%
50-60°	417 lm	13,8%
60-70°	264 lm	8,8%
70-80°	142 lm	4,7%
80-90°	73 lm	2,4%
90-100°	41 lm	1,4%
100-110°	36 lm	1,2%
110-120°	27 lm	0,9%
120-130°	21 lm	0,7%
130-140°	14 lm	0,5%
140-150°	8 lm	0,3%
150-160°	3 lm	0,1%
160-170°	1 lm	0,0%
170-180°	0 lm	0,0%
<b>Total</b>	<b>3016 lm</b>	<b>100,0%</b>

### Intensity peaks

Max intensity	1184 cd
Intensity, 90°	44 cd
Intensity, 0°	1167 cd

### Zonal Lumen summary

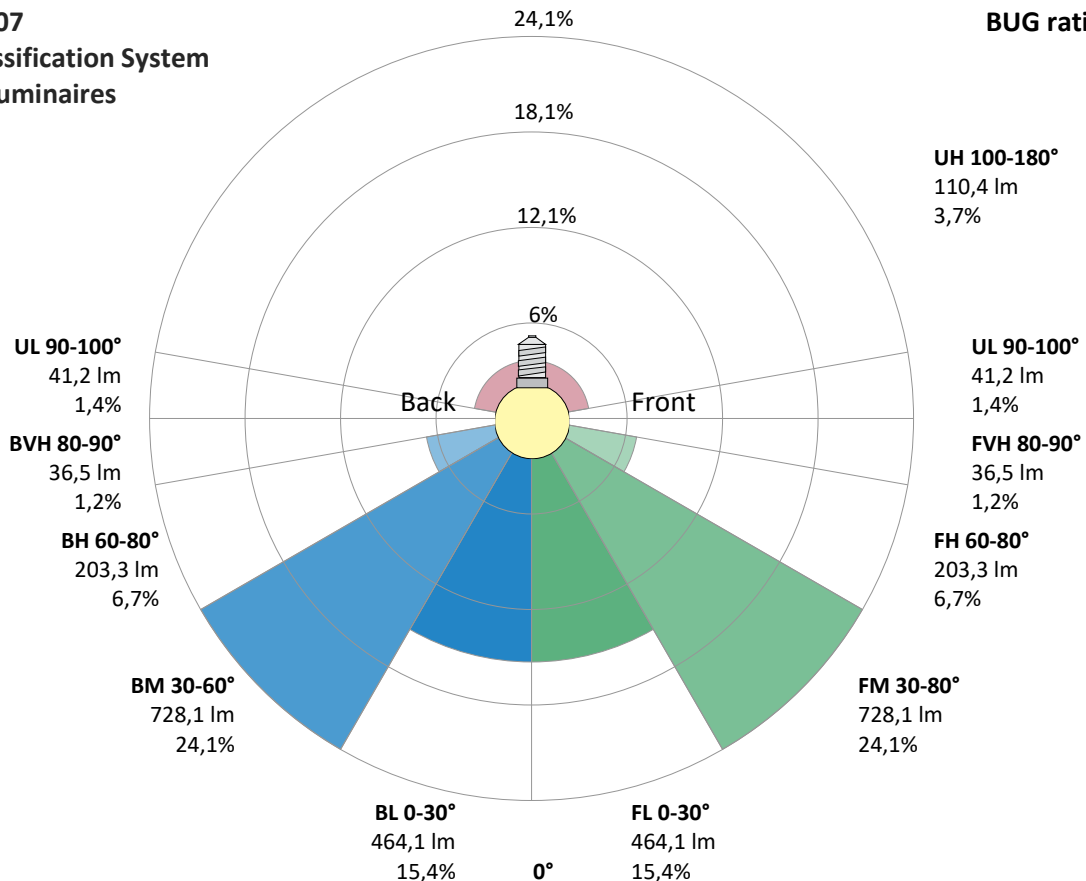
Zone (γ)	Lumen	% Total
0-30°	928 lm	30,8%
0-40°	1456 lm	48,3%
0-60°	2385 lm	79,1%
60-90°	479 lm	15,9%
70-100°	256 lm	8,5%
90-120°	104 lm	3,4%
0-90°	2864 lm	95,0%
90-180°	152 lm	5,0%
0-180°	3016 lm	100,0%

### BUG rating

	Lumen	% Total
<b>Forward light</b>		
Low(0-30°)	464 lm	15,4%
Medium(30-60°)	728 lm	24,1%
High(60-80°)	203 lm	6,7%
Very high(80-90°)	37 lm	1,2%
<b>Back light</b>		
Low(0-30°)	464 lm	15,4%
Medium(30-60°)	728 lm	24,1%
High(60-80°)	203 lm	6,7%
Very high(80-90°)	37 lm	1,2%
<b>Uplight</b>		
Low(90-100°)	41 lm	1,4%
High(100-180°)	110 lm	3,7%

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

BUG rating B1 U3 G1



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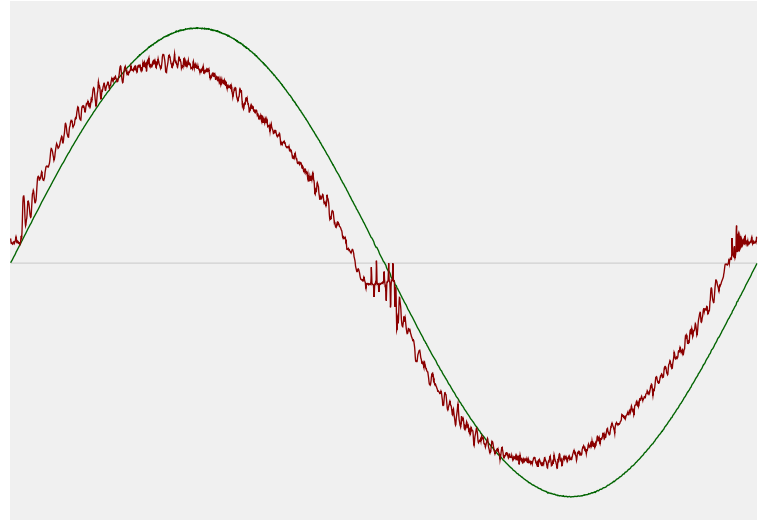


## Power Details

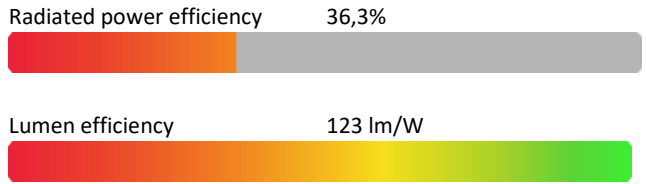
### Input Power

Power feed to light source	24,5 W
Frequency of input power	50 Hz
RMS Input voltage feed, $V_{RMS}$	230 V
RMS Input current feed, $I_{RMS}$	0,109 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	25,01 VA
Displacement factor of AC power feed	0,98
Power factor of AC current feed	0,98
Total harmonic distortion of the current	5,1%
Total harmonic distortion of the voltage	0,06%

### 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	5000 K
CCT shift	+0 K
CCT end	5000 K

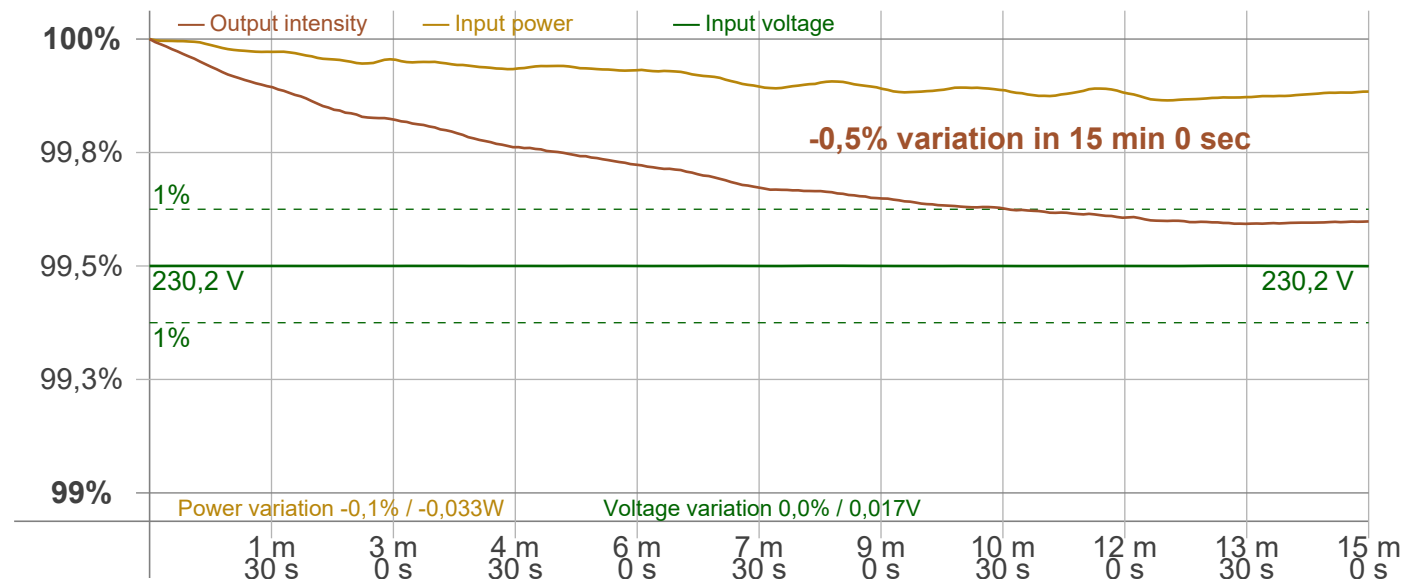
### Warmup Result

Total warmup time	Lamp stabilized in 15 min 0 sec
Warmup variation	-0,5%

### Output Change

Output start	3028 lm
Output change	-13 lm
Output end	3016 lm

### Stabilization Curve



# Light Measurement Report

Print date: 15-8-2025

Measurement date and time: 15-8-2025 11:23:33 – Measurement no. VFR-250815-2573-MS

Measurement tracking No. and Link: [VT250815-000981](https://www.viso-systems.com/VT250815-000981)

Operator:



## Flicker /TLA details

Flicker Meter Type Viso Systems LabFlicker  
 Frequency of input power 50 Hz  
 Flicker/TLA sample rate 20000 samples/s

**Measurement time**  
 PstLM 180 sec  
 All other indices 1,2 sec

### Flicker indices according to Illuminating Engineering Society (IES)

Flicker frequency 100 Hz  
 Percent Flicker 0,11 %  
 Flicker index 0

### Flicker indices according to California Energy Commission (CEC) 2016b

JA8/10 40 Hz 0,02 %  
 JA8/10 90 Hz 0,02 %  
 JA8/10 200 Hz 0,09 %  
 JA8/10 400 Hz 0,1 %  
 JA8/10 1000 Hz 0,1 %

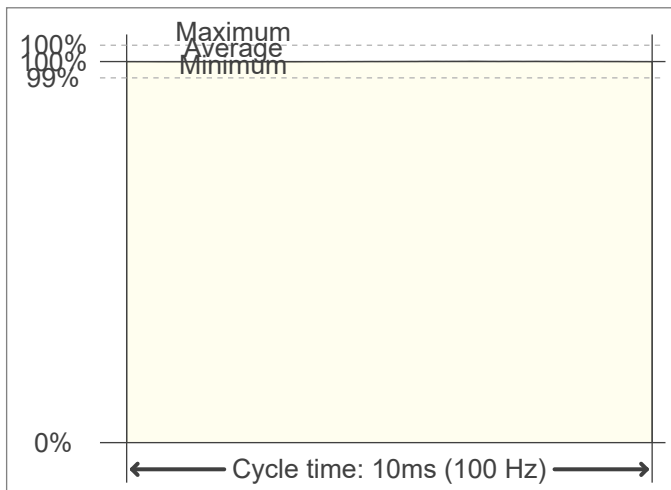
### TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

PstLM value (F < 80 Hz) 0,01  
 SVM value (80 < F < 2000 Hz) 0

### Flicker indices according to Lighting Research Center (2015)

Perception metric, Assist Mp 0,01

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



### Flicker FFT (flicker curve in frequency domain)



### IEEE 1789 Frequency/modulation plot

