

# Light Measurement Report

Print date: 12-8-2025

Measurement date and time: 31-7-2025 10:20:03 – Measurement no. VFR-250731-2271-MS

Measurement tracking No. and Link: [VT250731-000790](#)

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

12 planes – 30°  
5°  
9,42 m  
31,2 W – PF 0,97 – DPF 0,98  
230 V – 0,140 A  
50 Hz  
Lamp stabilized in 15 min 1 sec – 2,0%

## Tested Light Source

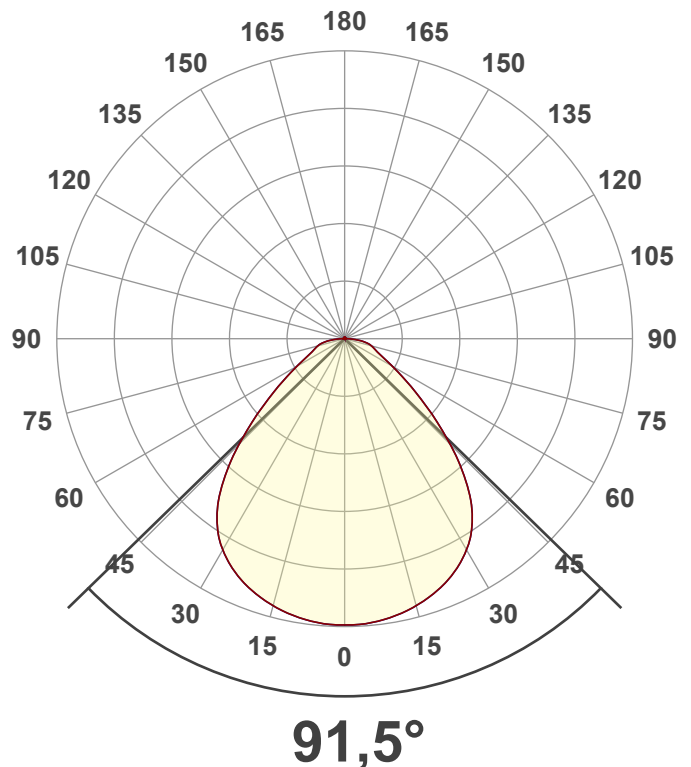
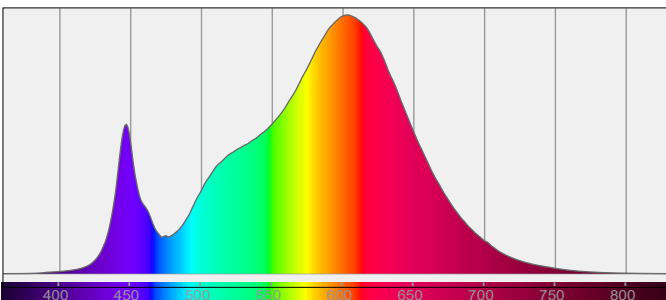
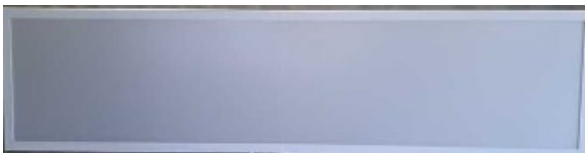
Product Name  
Item No. and Manufacturer  
Product Description (line 1)  
ZONDER DRIVER

812652-28W-3000K  
812652 – Dutchfulfillment  
BACK-LIT LED PANEEL | EUROPA | 120X30CM | 28W | CCT-SWITCH |

## 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

3298 lm – 0,76% / 99,24%  
106 lm/W  
1485 cd – 91,5°  
CCT = 3000 K / 2970 K  
CRI 82,3  
 $R_f$  84,0 –  $R_g$  97,6  
Duv -0,0007 – SDCM 1,1  
SVM 0,02 – PstLM 0,01



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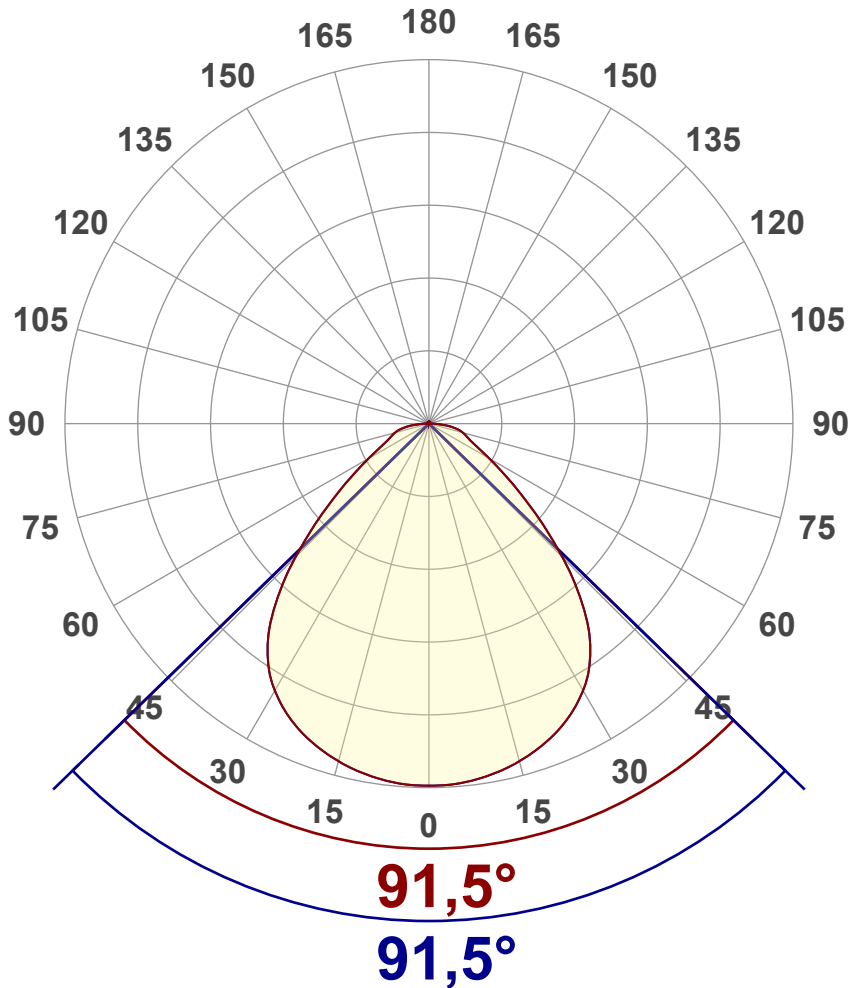
Measurement tracking No. and Link: [VT250731-000790](#)

Operator:



## Luminous Intensity diagram

Unit: 0-100% of peak intensity



## Main Values

Output (total Lumen)	3298 lm
Lumen Up% / Down%	0,76% / 99,24%
Peak Intensity	1485 cd
Beam Angle (50%)	91,5°
Beam Angle (90%)	91,5°
Beam Angle (10%)	91,5°

## Cut-off Angle

Average 2,5%	174,4°
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## Field Angle

Average 10%	148,2°
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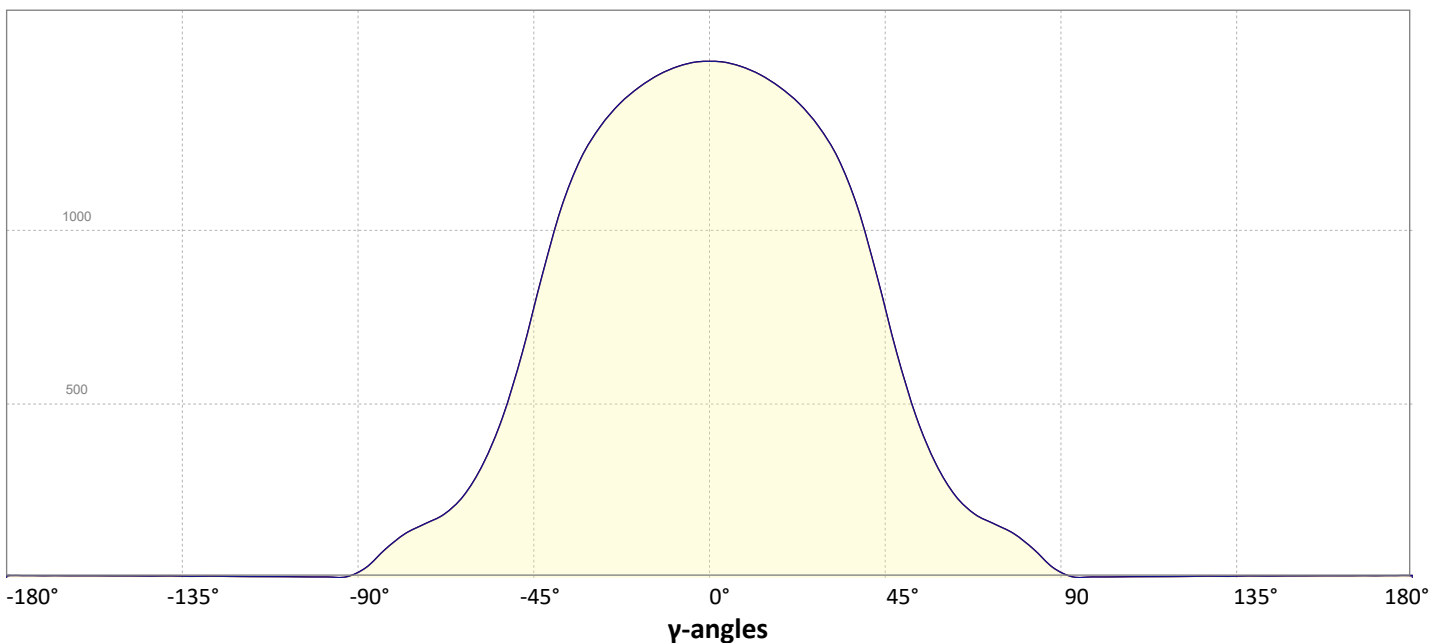
## Intensity Ratio

In 120° cone	86,2%
In 90° cone	66,9%

**C000-C180**

**C090-C270**

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



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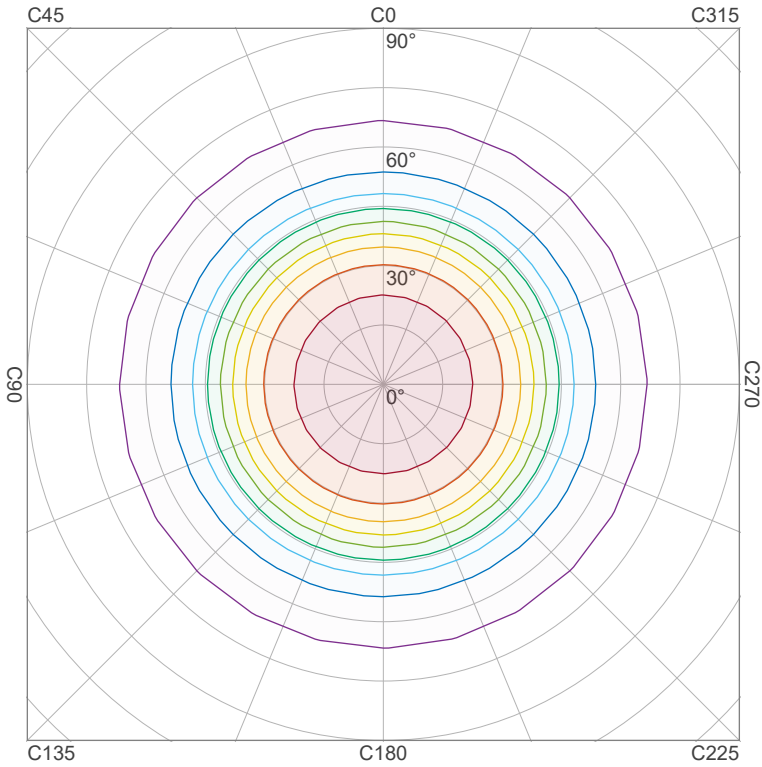
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Operator:



## Iso-intensity Diagram (Iso-candela)

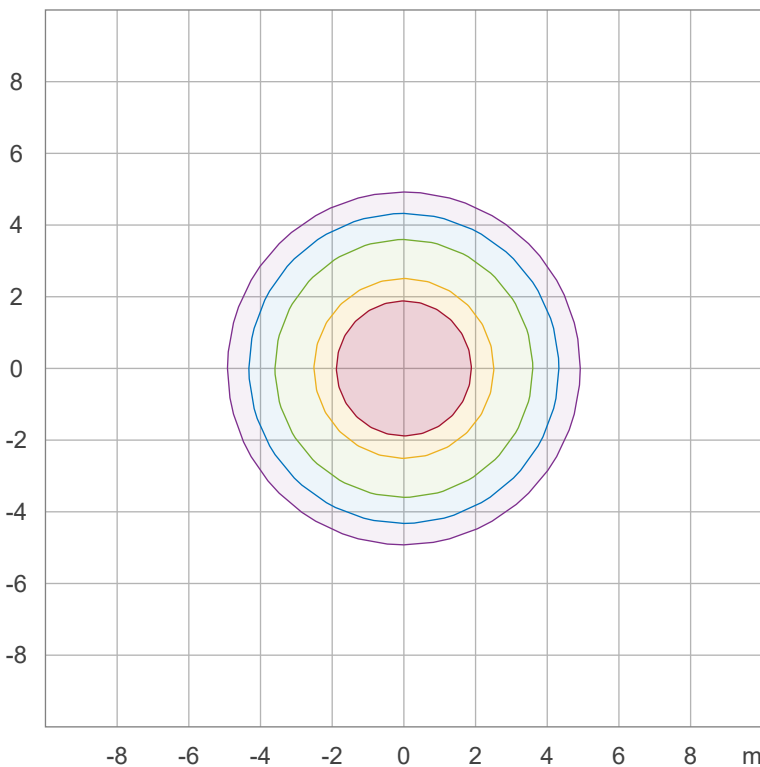


90 %	1336,6 cd
80 %	1188,1 cd
70 %	1039,6 cd
60 %	891,1 cd
50 %	742,6 cd
40 %	594,1 cd
30 %	445,5 cd
20 %	297,0 cd
10 %	148,5 cd

Peak intensity: 1485,2 cd

Number of c-planes: 12

## Iso-illuminance Diagram (Iso-lux)



50,0 %	82,5 lx
30,0 %	49,5 lx
10,0 %	16,5 lx
5,0 %	8,3 lx
3,0 %	5,0 lx

Peak illuminance: 165,0 lx

Mounting height: 3,0 m

Number of c-planes: 12

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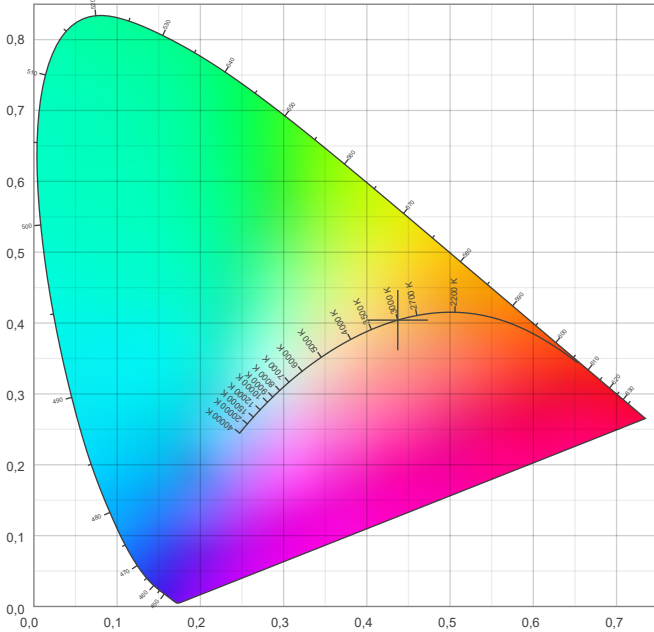


## Color details

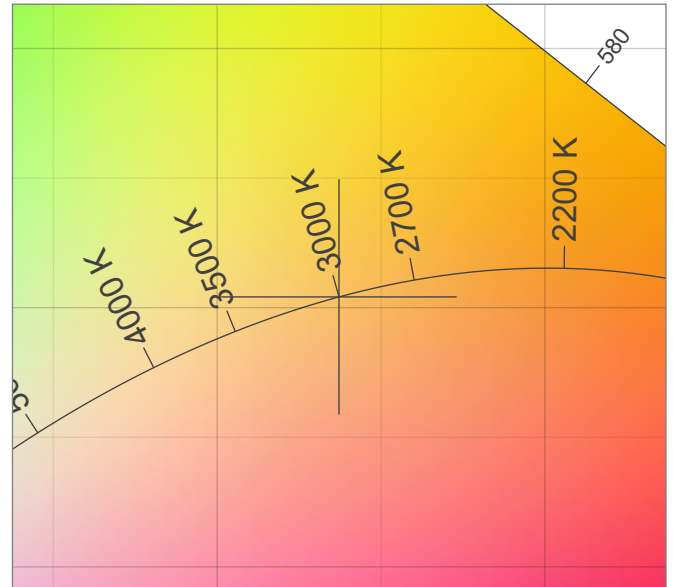
Correlated Color Temperature, Target CCT = 3000 K  
 Correlated Color Temperature, Measured CCT = 2970 K  
 Color Rendering Index CRI 82,3  
 Color Rendering Index, R9 (red component) R9 = 2,4  
 Color Rendering TM30-18 R<sub>f</sub> 84,0 – R<sub>g</sub> 97,6  
 Color Quality Scale CQS = 81,3

MacAdam Steps SDCM = 1,1  
 Color coordinates CIE 1931 (x;y) = (0,437;0,404)  
 Color coordinate CIEs 1960 (u;v) = (0,251;0,348)  
 Color deviation from BBL Duv = -0,0007  
 Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,251;0,521)

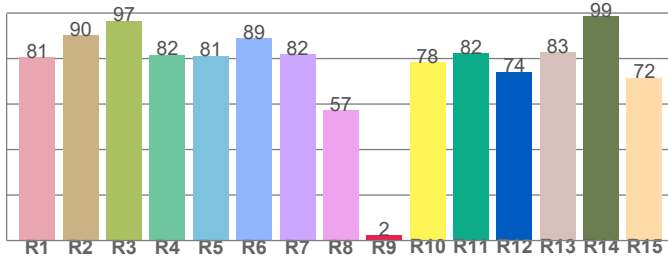
### CIE 1931



### CIE 1931 – zoomed on Planckian locus



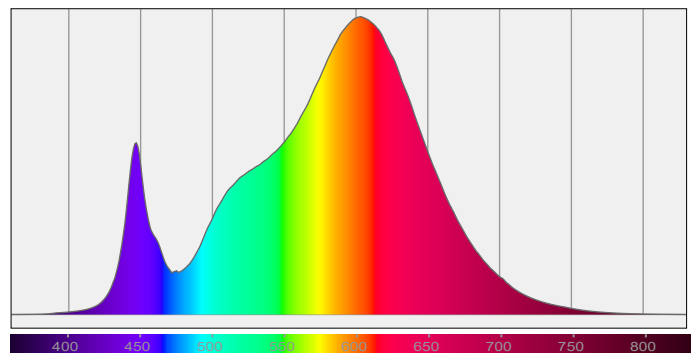
### Color Rendering Index per reference color (CIE 1995)



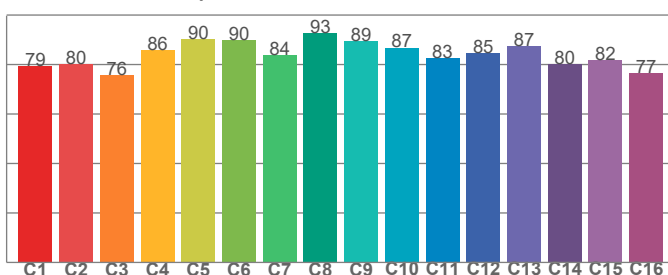
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
80,6	90,2	96,6	81,7	81,2	88,9	82,0	57,2	2,4	78,5	82,5	74,1	82,9	98,7	71,6

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



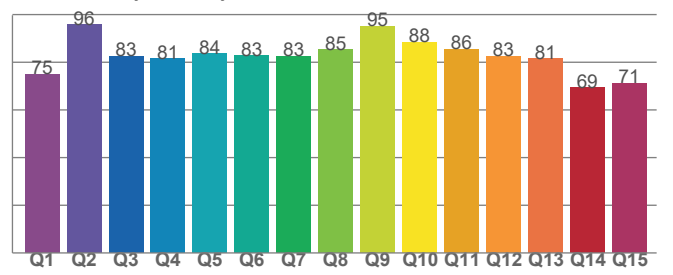
### TM30-18 R<sub>f</sub>-values per hue bin



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
79,4	80,1	75,6	85,7	90,3	89,9	83,7	92,6	89,4	86,7	82,5	84,6	87,4	80,2	81,8	76,5

### Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
75,1	95,7	82,6	81,4	83,6	82,7	82,6	85,2	95,2	88,5	85,6	82,6	81,5	69,3	71,1

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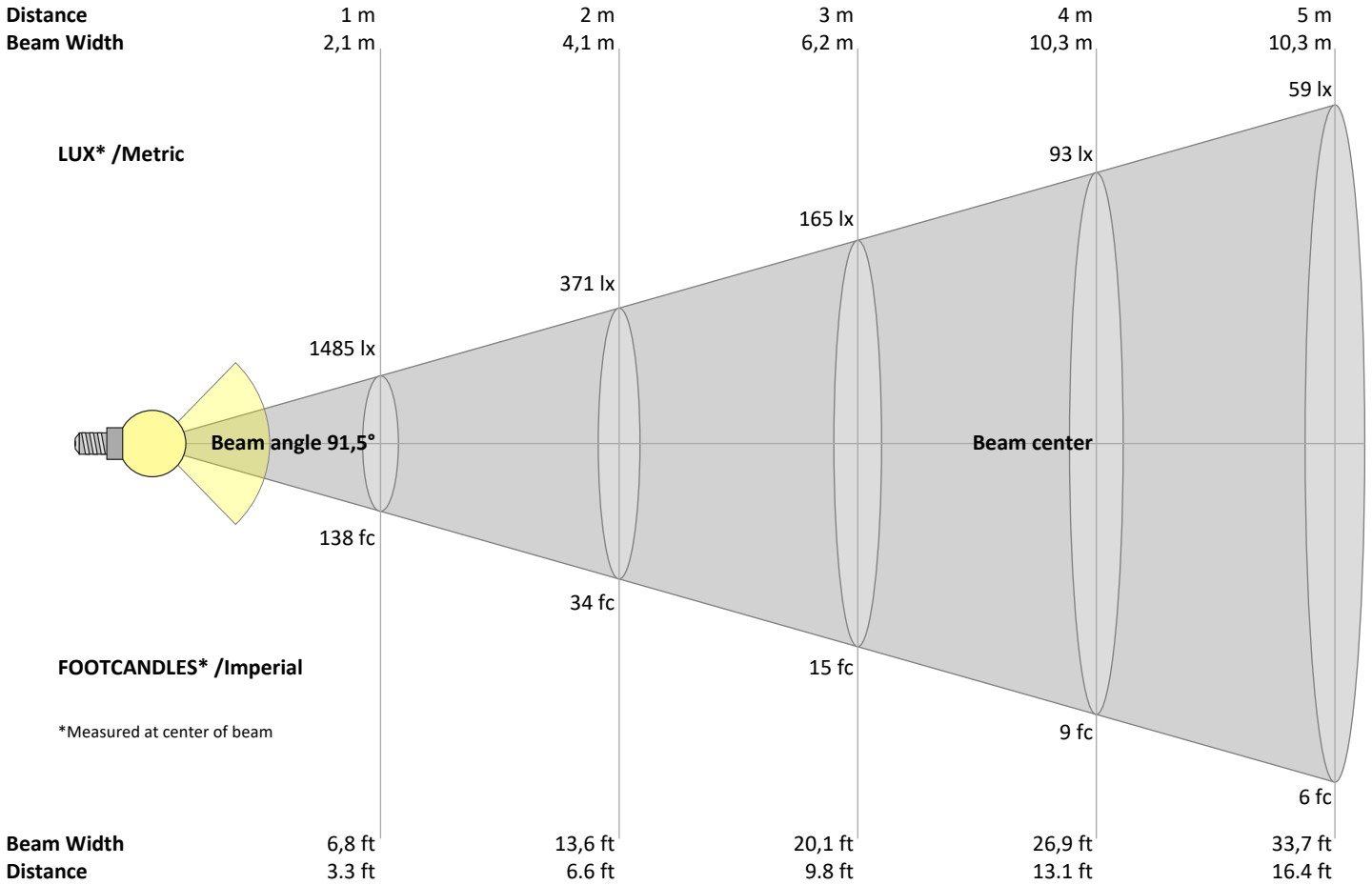
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## Beam Details



### 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
1485	371	165	93	59	41	30	23	18	15	12	10	9	8	7	6	5	5	4	4	lux
138	34,5	15,3	8,6	5,5	3,8	2,8	2,2	1,7	1,4	1,1	1	0,8	0,7	0,6	0,5	0,5	0,4	0,4	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
1485	1480	1462	1434	1393	1338	1261	1149	983	776	572	408	291	214	171	143	109	61	18	2	cd
100%	100%	98%	97%	94%	90%	85%	77%	66%	52%	38%	27%	20%	14%	12%	10%	7%	4%	1%	0%	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
1485	1480	1462	1434	1393	1338	1261	1149	983	776	572	408	291	214	171	143	109	61	18	2	cd
100%	100%	98%	97%	94%	90%	85%	77%	66%	52%	38%	27%	20%	14%	12%	10%	7%	4%	1%	0%	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
1485	1480	1462	1434	1393	1338	1261	1149	983	776	572	408	291	214	171	143	109	61	18	2	cd
100%	100%	98%	97%	94%	90%	85%	77%	66%	52%	38%	27%	20%	14%	12%	10%	7%	4%	1%	0%	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
1485	1480	1462	1434	1393	1338	1261	1149	983	776	572	408	291	214	171	143	109	61	18	2	cd
100%	100%	98%	97%	94%	90%	85%	77%	66%	52%	38%	27%	20%	14%	12%	10%	7%	4%	1%	0%	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	15,0	16,1	15,2	16,4	16,6	15,0	16,1	15,2	16,4	16,6
	3H	15,7	16,9	16,2	17,1	17,3	15,7	16,9	16,2	17,1	17,3
	4H	16,3	17,3	16,7	17,6	17,9	16,3	17,3	16,7	17,6	17,9
	6H	16,9	17,9	17,3	18,2	18,5	16,9	17,9	17,3	18,2	18,5
	8H	17,2	18,1	17,5	18,4	18,8	17,2	18,1	17,5	18,4	18,8
	12H	17,4	18,3	17,8	18,6	19,1	17,4	18,3	17,8	18,6	19,1
4H	2H	15,2	16,3	15,6	16,6	16,8	15,2	16,3	15,6	16,6	16,8
	3H	16,4	17,2	16,7	17,6	18,0	16,4	17,2	16,7	17,6	18,0
	4H	17,0	17,8	17,5	18,2	18,8	17,0	17,8	17,5	18,2	18,8
	6H	17,8	18,6	18,3	19,0	19,3	17,8	18,6	18,3	19,0	19,3
	8H	18,2	18,9	18,7	19,3	19,7	18,2	18,9	18,7	19,3	19,7
	12H	18,5	19,1	19,0	19,5	20,0	18,5	19,1	19,0	19,5	20,0
8H	4H	17,3	18,0	17,8	18,4	18,8	17,3	18,0	17,8	18,4	18,8
	6H	18,3	18,9	18,9	19,4	19,9	18,3	18,9	18,9	19,4	19,9
	8H	18,9	19,3	19,4	19,9	20,5	18,9	19,3	19,4	19,9	20,5
	12H	19,3	19,7	19,9	20,2	20,8	19,3	19,7	19,9	20,2	20,8
12H	4H	17,4	17,9	17,9	18,4	18,9	17,4	17,9	17,9	18,4	18,9
	6H	18,5	18,9	19,0	19,5	20,1	18,5	18,9	19,0	19,5	20,1
	8H	19,0	19,4	19,6	19,9	20,6	19,0	19,4	19,6	19,9	20,6

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

S = 1.0H	0,2 / -0,2	0,2 / -0,2
S = 1.5H	0,4 / -0,4	0,4 / -0,4
S = 2.0H	0,9 / -0,7	0,9 / -0,7

## 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	101	101	101	99
1	110	105	102	98	107	103	100	97	99	96	93	95	93	90	91	89	88	86
2	101	94	88	83	99	92	86	82	88	84	80	85	81	78	82	79	76	74
3	93	84	77	71	91	82	75	70	79	73	69	76	72	67	74	70	66	64
4	86	75	67	61	84	74	67	61	72	65	60	69	64	59	67	62	58	56
5	80	68	60	54	78	67	59	54	65	58	53	63	57	52	61	56	52	50
6	74	62	54	48	72	61	53	48	59	52	47	58	51	47	56	51	46	44
7	69	57	49	43	68	56	48	43	54	47	42	53	47	42	52	46	42	40
8	65	52	44	39	63	51	44	39	50	43	38	49	43	38	48	42	38	36
9	61	48	40	35	59	47	40	35	46	40	35	45	39	35	44	39	34	33
10	57	45	37	32	56	44	37	32	43	36	32	42	36	32	41	36	32	30

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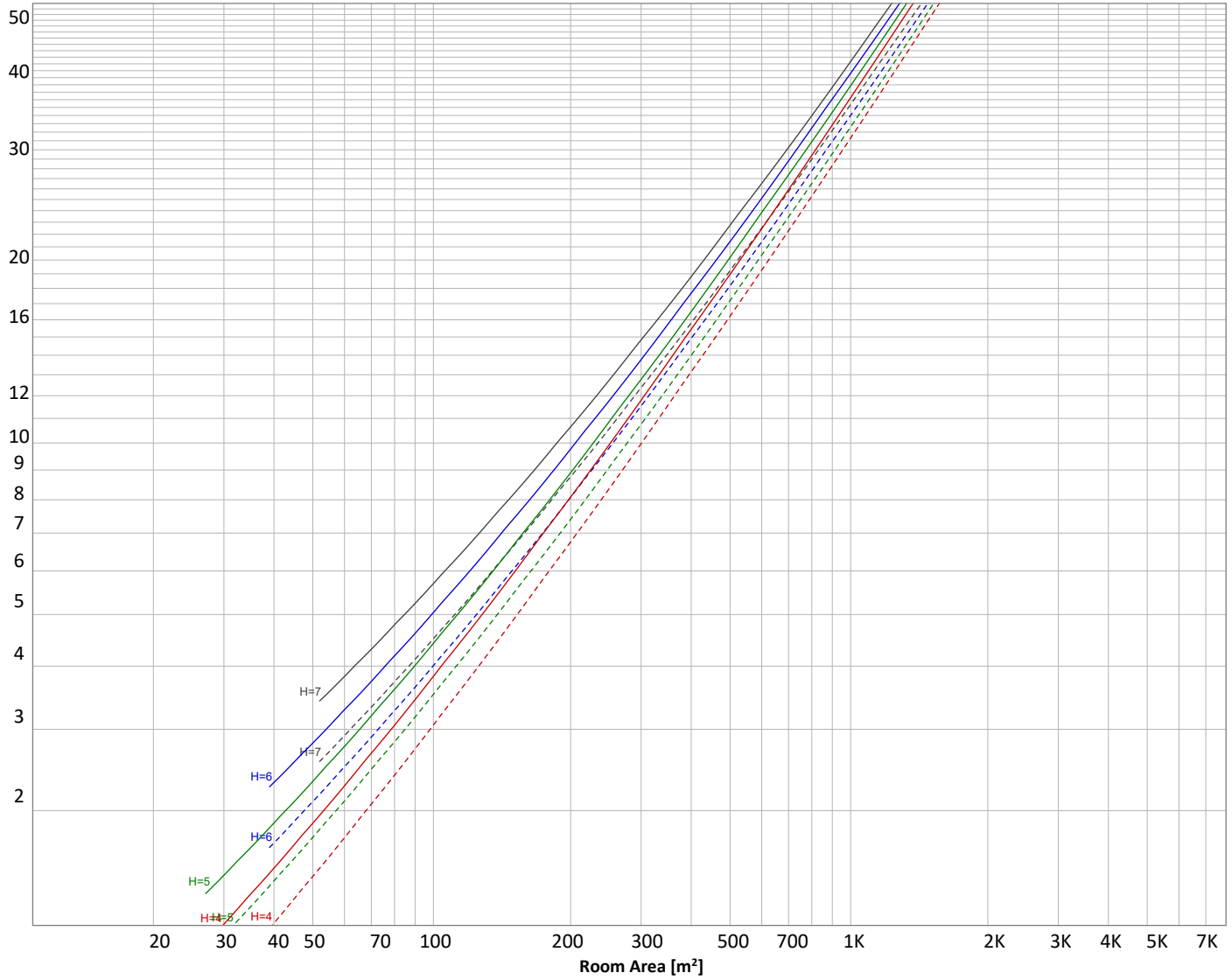
Operator:



## Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



### Conditions

H = Room height	Flux = 3298 lm				
H <sub>down</sub> = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	ρ(%) Wall reflectance	Floor reflectance
H <sub>work</sub> = Work area height from floor =	0.00 m	-----	70	50	30
E <sub>work</sub> = Average lux on work area =	100 lx	—————	50	30	20

### Zonal Lumen Summary

0°-10°	10°-20°	20°-30°	30°-40°	40°-50°	50°-60°	60°-70°	70°-80°	80°-90°
141 lm	405 lm	617 lm	717 lm	596 lm	365 lm	214 lm	151 lm	65,8 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
3,99 lm	2,70 lm	3,25 lm	3,75 lm	3,53 lm	3,11 lm	2,52 lm	1,62 lm	0,571 lm

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## Outdoor Light Planning

### Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	141 lm	4,3%
10-20°	405 lm	12,3%
20-30°	617 lm	18,7%
30-40°	717 lm	21,7%
40-50°	596 lm	18,1%
50-60°	365 lm	11,1%
60-70°	214 lm	6,5%
70-80°	151 lm	4,6%
80-90°	66 lm	2,0%
90-100°	4 lm	0,1%
100-110°	3 lm	0,1%
110-120°	3 lm	0,1%
120-130°	4 lm	0,1%
130-140°	4 lm	0,1%
140-150°	3 lm	0,1%
150-160°	3 lm	0,1%
160-170°	2 lm	0,0%
170-180°	1 lm	0,0%
<b>Total</b>	<b>3298 lm</b>	<b>100,0%</b>

### Intensity peaks

Max intensity	1485 cd
Intensity, 90°	18 cd
Intensity, 0°	1485 cd

### Zonal Lumen summary

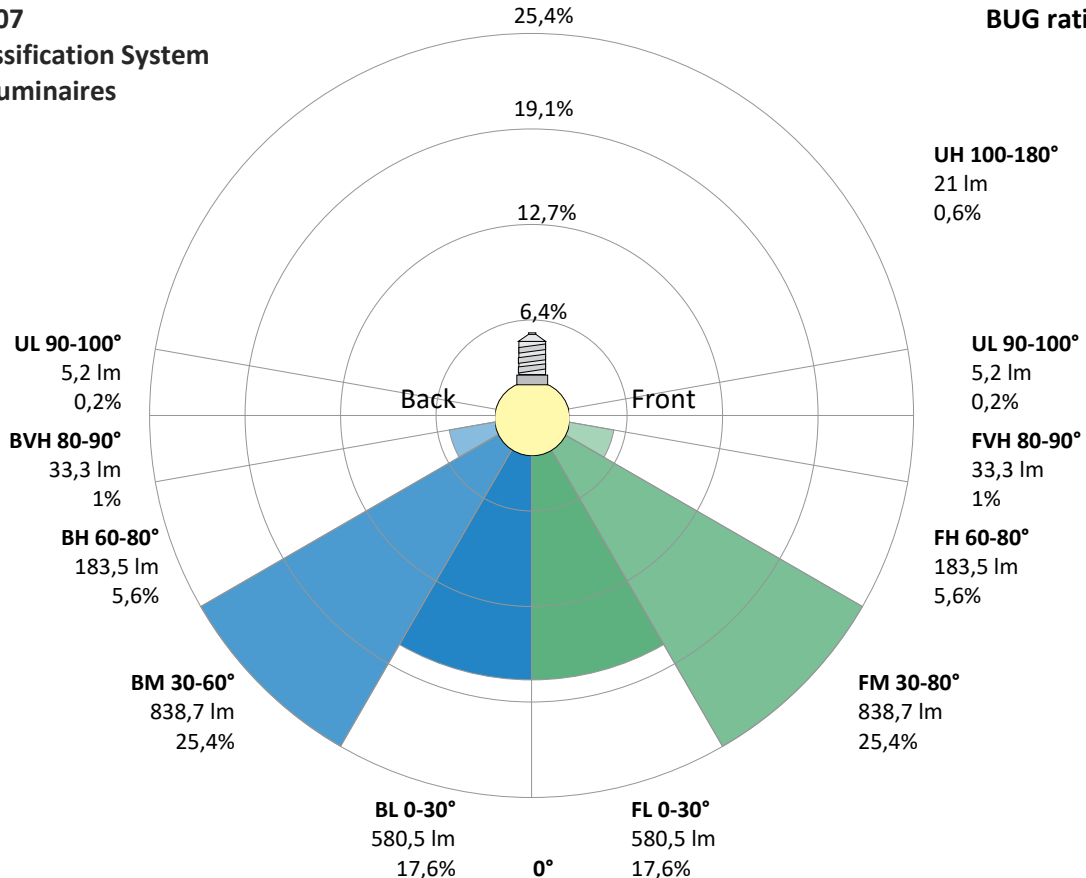
Zone (γ)	Lumen	% Total
0-30°	1163 lm	35,3%
0-40°	1880 lm	57,0%
0-60°	2842 lm	86,2%
60-90°	431 lm	13,1%
70-100°	221 lm	6,7%
90-120°	10 lm	0,3%
0-90°	3273 lm	99,2%
90-180°	25 lm	0,8%
0-180°	3298 lm	100,0%

### BUG rating

	Lumen	% Total
<b>Forward light</b>		
Low(0-30°)	581 lm	17,6%
Medium(30-60°)	839 lm	25,4%
High(60-80°)	183 lm	5,6%
Very high(80-90°)	33 lm	1,0%
<b>Back light</b>		
Low(0-30°)	581 lm	17,6%
Medium(30-60°)	839 lm	25,4%
High(60-80°)	183 lm	5,6%
Very high(80-90°)	33 lm	1,0%
<b>Uplight</b>		
Low(90-100°)	5 lm	0,2%
High(100-180°)	21 lm	0,6%

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

**BUG rating B2 U2 G1**



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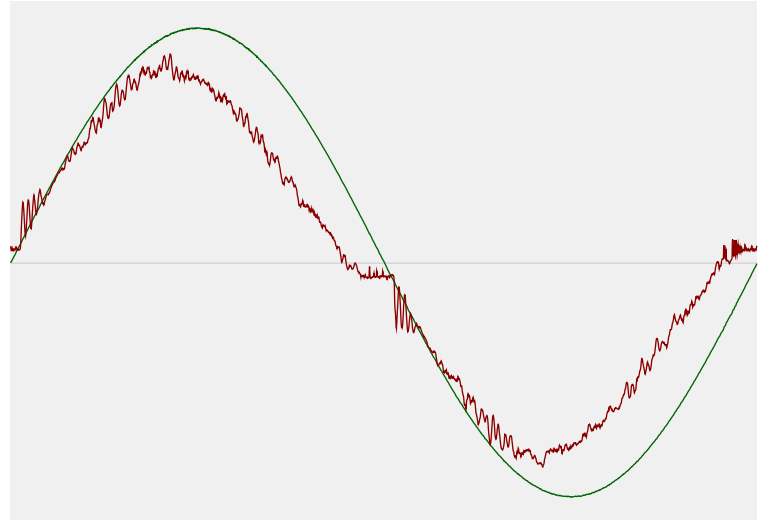


## Power Details

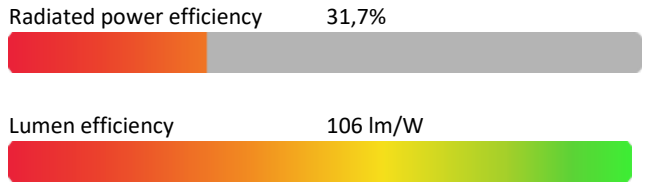
### Input Power

Power feed to light source	31,2 W
Frequency of input power	50 Hz
RMS Input voltage feed, $V_{RMS}$	230 V
RMS Input current feed, $I_{RMS}$	0,140 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	32,23 VA
Displacement factor of AC power feed	0,98
Power factor of AC current feed	0,97
Total harmonic distortion of the current	11,02%
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	2999 K
CCT shift	+1 K
CCT end	3000 K

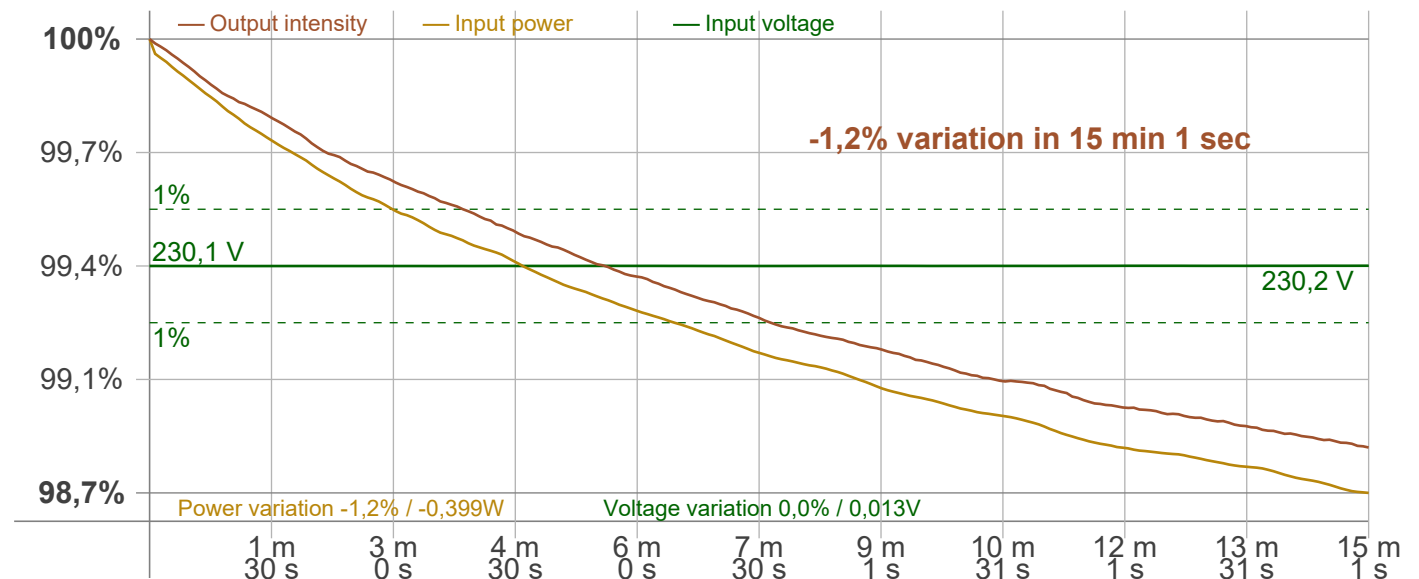
### Warmup Result

Total warmup time	Lamp stabilized in 15 min 1 sec
Warmup variation	-1,2%

### Output Change

Output start	3336 lm
Output change	-38 lm
Output end	3298 lm

### Stabilization Curve



# Light Measurement Report

Print date: 12-8-2025

Measurement date and time: 31-7-2025 10:20:03 – Measurement no. VFR-250731-2271-MS

Measurement tracking No. and Link: [VT250731-000790](https://www.viso-systems.com/VT250731-000790)

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 200 Hz  
 Percent Flicker 1,39 %  
 Flicker index 0

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

JA8/10 40 Hz 0,02 %  
 JA8/10 90 Hz 0,03 %  
 JA8/10 200 Hz 0,77 %  
 JA8/10 400 Hz 1,34 %  
 JA8/10 1000 Hz 1,46 %

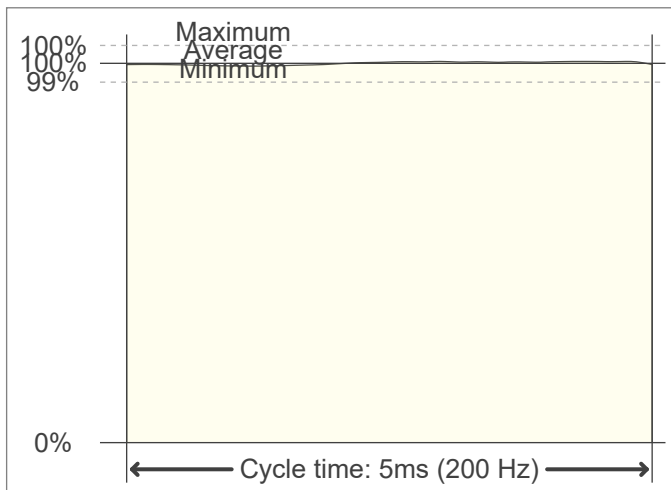
### TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

PstLM value (F < 80 Hz) 0,01  
 SVM value (80 < F < 2000 Hz) 0,02

### 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

