

# Light Measurement Report

Print date: 12-8-2025

Measurement date and time: 31-7-2025 16:37:13 – Measurement no. VFR-250731-2288-MS

Measurement tracking No. and Link: [VT250731-008701](#)

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°  
6,22 m  
30,8 W – PF 0,97 – DPF 0,97  
230 V – 0,138 A  
50 Hz  
Lamp stabilized in 15 min 1 sec – 2,0%

## Tested Light Source

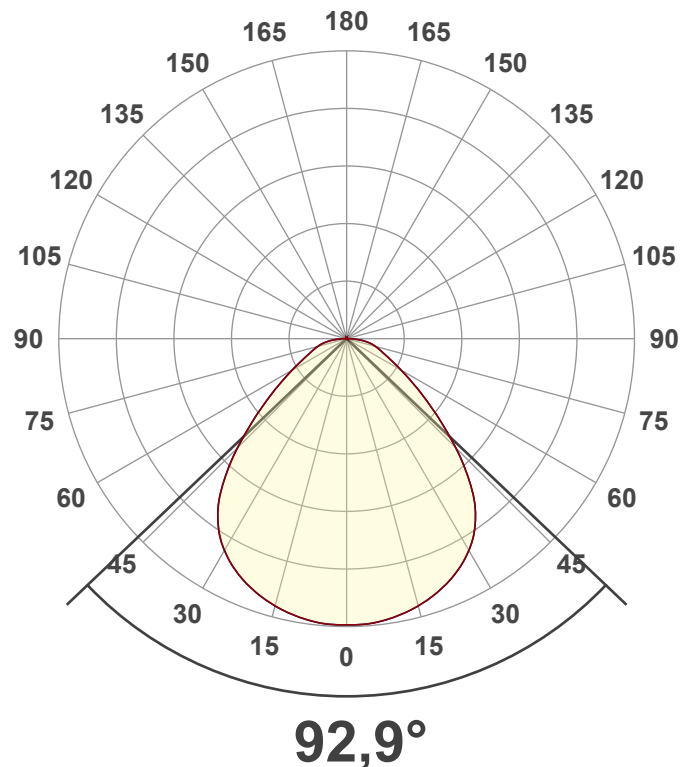
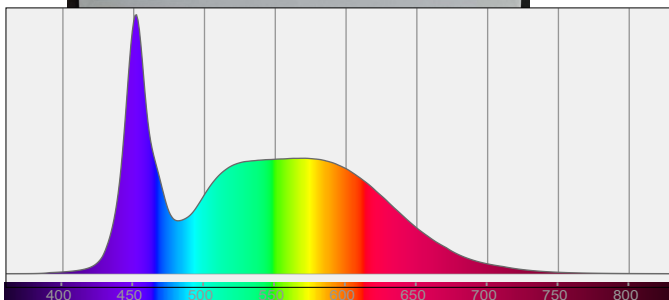
Product Name  
Item No. and Manufacturer  
Product Description (line 1)  
ZONDER DRIVER

812645-28W-6000K  
812645-28W-6000K – Dutchfulfillment  
BACK-LIT LED PANEEL | EUROPA | 60X60CM | 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

3457 lm – 0,48% / 99,52%  
112 lm/W  
1508 cd – 92,9°  
CCT = 6000 K / 6168 K  
CRI 82,8  
 $R_f$  82,8 –  $R_g$  94,7  
Duv 0,0042 – SDCM 6,3  
SVM 0,02 – PstLM 0,01



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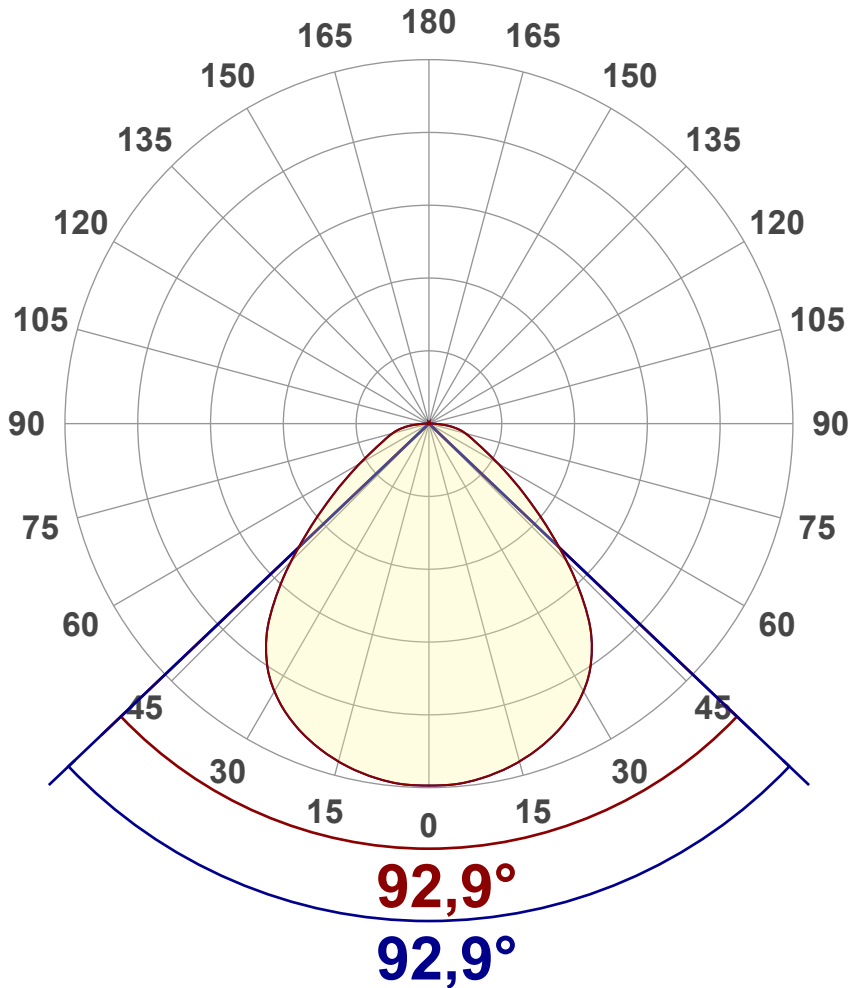
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## Luminous Intensity diagram

Unit: 0-100% of peak intensity



## Main Values

Output (total Lumen)	3457 lm
Lumen Up% / Down%	0,48% / 99,52%
Peak Intensity	1508 cd
Beam Angle (50%)	92,9°
Beam Angle (90%)	92,9°
Beam Angle (10%)	92,9°

## Cut-off Angle

Average 2,5%	175,2°
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## Field Angle

Average 10%	151,8°
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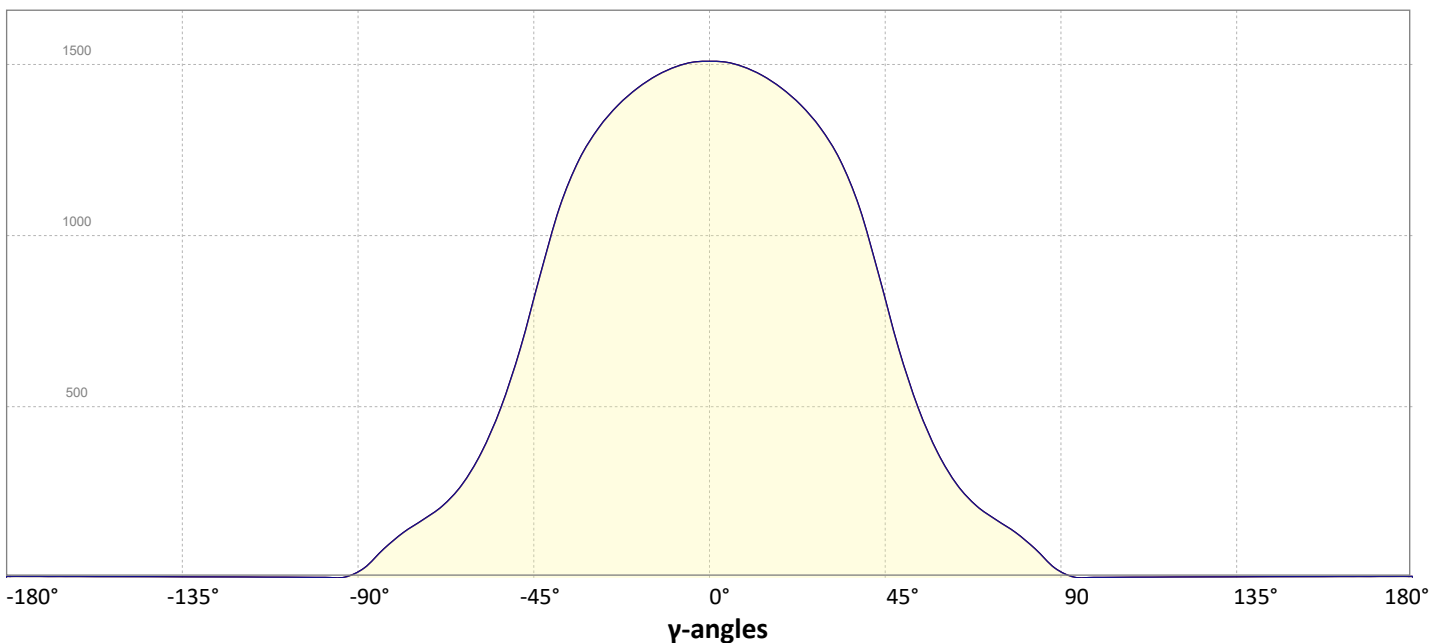
## Intensity Ratio

In 120° cone	85,3%
In 90° cone	65,2%

**C000-C180**

**C090-C270**

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



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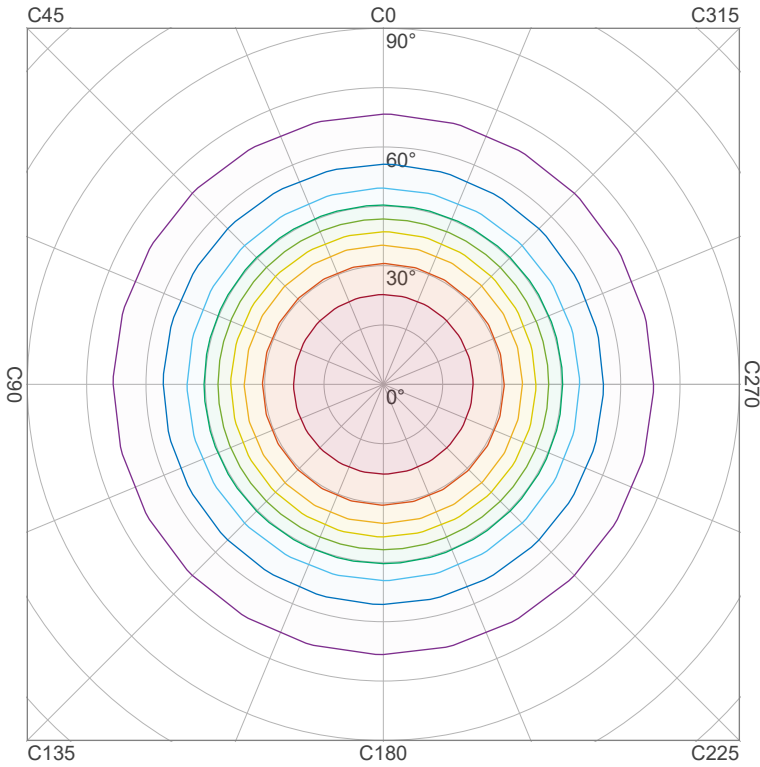
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## Iso-intensity Diagram (Iso-candela)

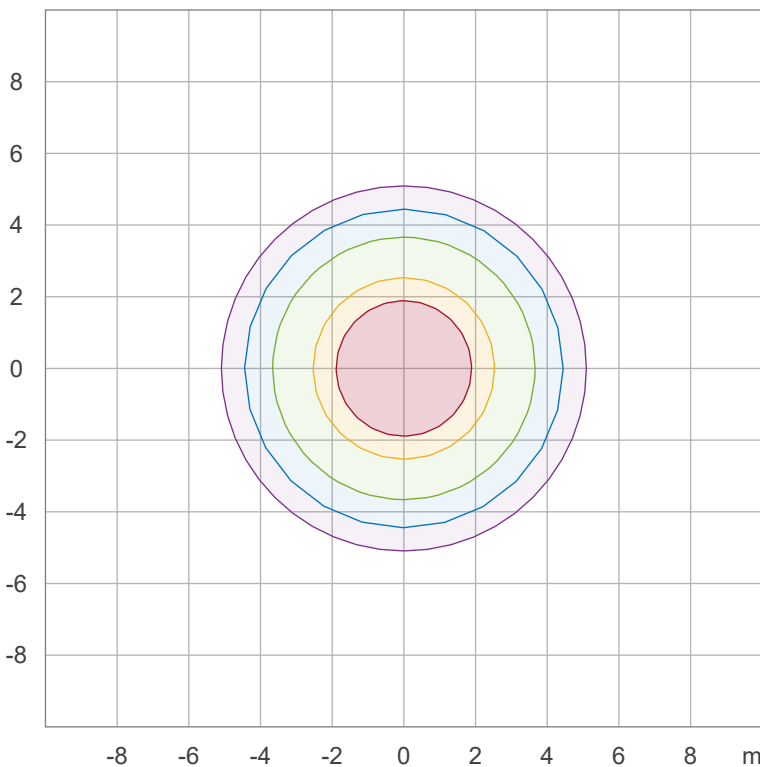


90 %	1357,0 cd
80 %	1206,2 cd
70 %	1055,4 cd
60 %	904,7 cd
50 %	753,9 cd
40 %	603,1 cd
30 %	452,3 cd
20 %	301,6 cd
10 %	150,8 cd

Peak intensity: 1507,8 cd

Number of c-planes: 12

## Iso-illuminance Diagram (Iso-lux)



50,0 %	83,8 lx
30,0 %	50,3 lx
10,0 %	16,8 lx
5,0 %	8,4 lx
3,0 %	5,0 lx

Peak illuminance: 167,5 lx

Mounting height: 3,0 m

Number of c-planes: 12

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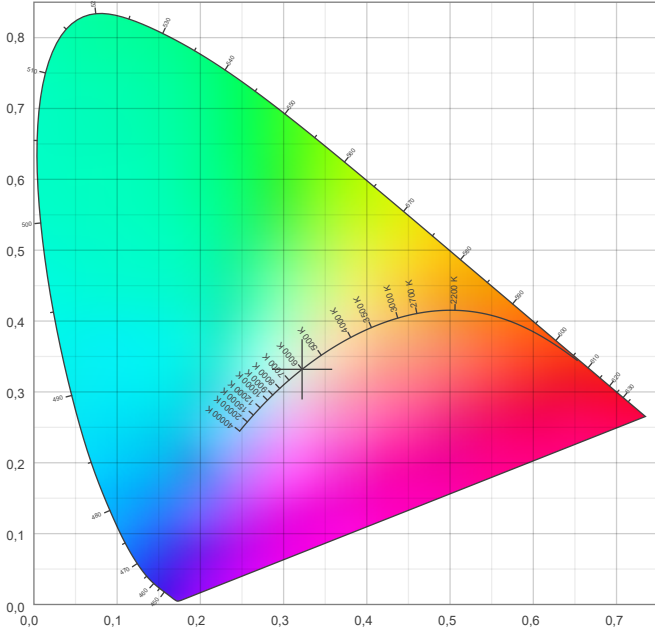


## Color details

Correlated Color Temperature, Target CCT = 6000 K  
 Correlated Color Temperature, Measured CCT = 6168 K  
 Color Rendering Index CRI 82,8  
 Color Rendering Index, R9 (red component) R9 = 5,5  
 Color Rendering TM30-18 R<sub>f</sub> 82,8 – R<sub>g</sub> 94,7  
 Color Quality Scale CQS = 80,6

MacAdam Steps  
 Color coordinates CIE 1931 (x;y) = (0,322;0,332)  
 Color coordinate CIEs 1960 (u;v) = (0,203;0,314)  
 Color deviation from BBL Duv = 0,0042  
 Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,203;0,471)

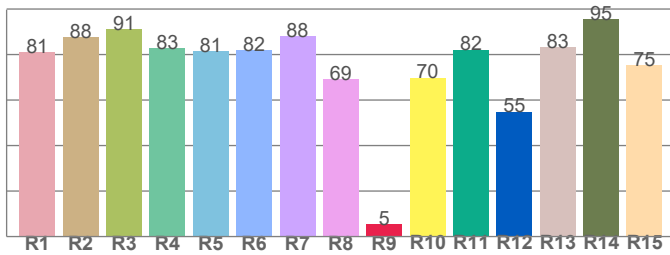
### CIE 1931



### CIE 1931 – zoomed on Planckian locus



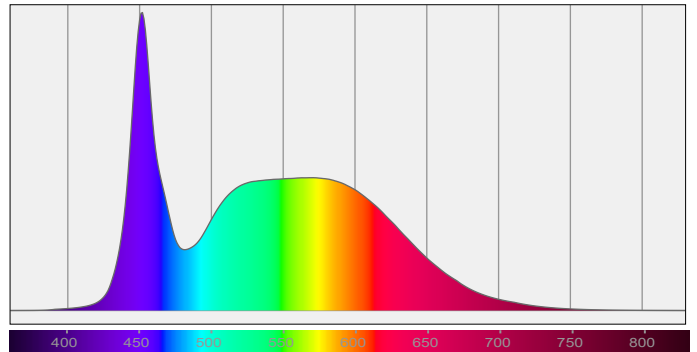
### Color Rendering Index per reference color (CIE 1995)



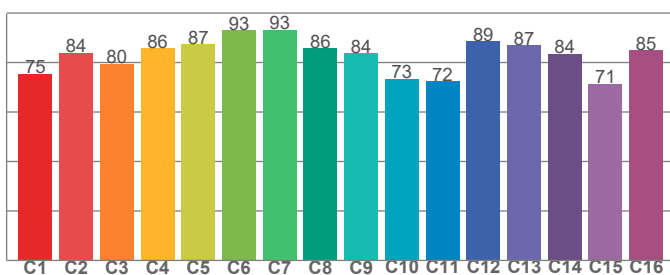
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
81,0	87,5	91,1	82,7	81,3	81,8	88,0	69,1	5,5	69,7	82,1	54,9	83,1	95,4	75,2

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



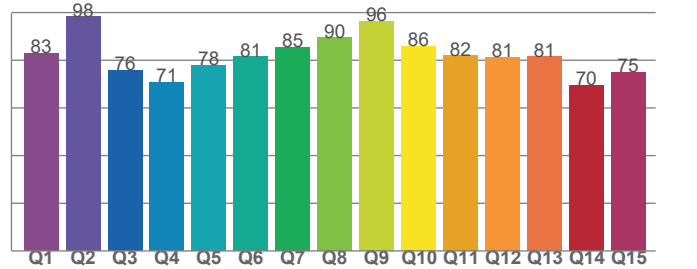
### TM30-18 R<sub>f</sub>-values per hue bin



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
75,4	84,0	79,5	85,7	87,4	93,2	93,3	85,8	83,6	73,5	72,3	88,7	87,0	83,6	71,4	85,0

### Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
82,9	98,3	75,8	70,7	77,9	81,4	85,5	89,5	96,3	85,9	82,0	81,3	81,5	69,6	74,9

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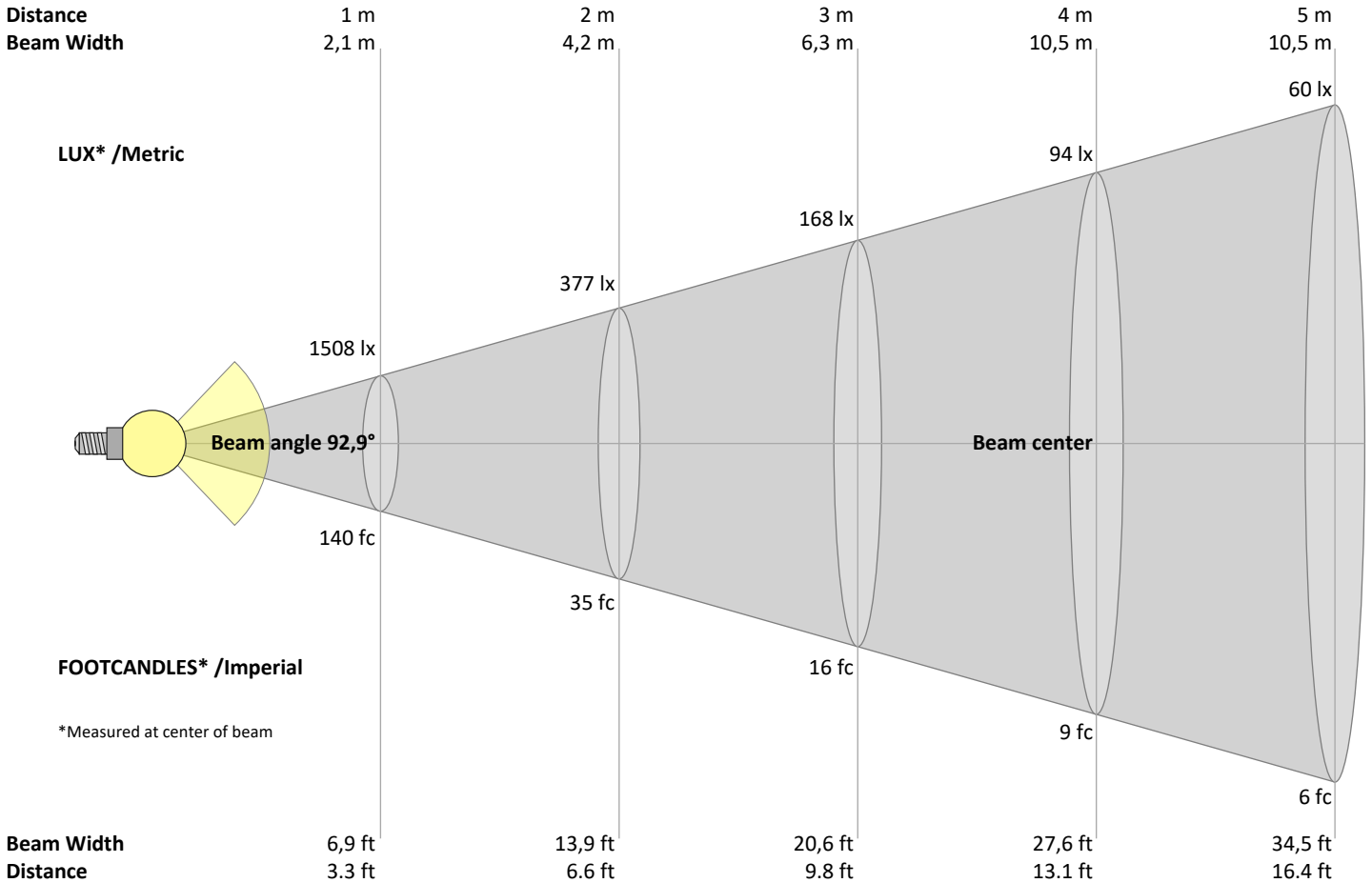
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Operator:



## 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
1508	377	168	94	60	42	31	24	19	15	12	10	9	8	7	6	5	5	4	4	lux
140,1	35	15,6	8,8	5,6	3,9	2,9	2,2	1,7	1,4	1,2	1	0,8	0,7	0,6	0,5	0,5	0,4	0,4	0,4	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
1508	1503	1486	1456	1415	1360	1285	1177	1018	815	616	455	336	252	197	157	117	67	20	2	cd
100%	100%	99%	97%	94%	90%	85%	78%	68%	54%	41%	30%	22%	17%	13%	10%	8%	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
1508	1503	1486	1456	1415	1360	1285	1177	1018	815	616	455	336	252	197	157	117	67	20	2	cd
100%	100%	99%	97%	94%	90%	85%	78%	68%	54%	41%	30%	22%	17%	13%	10%	8%	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
1508	1503	1486	1456	1415	1360	1285	1177	1018	815	616	455	336	252	197	157	117	67	20	2	cd
100%	100%	99%	97%	94%	90%	85%	78%	68%	54%	41%	30%	22%	17%	13%	10%	8%	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
1508	1503	1486	1456	1415	1360	1285	1177	1018	815	616	455	336	252	197	157	117	67	20	2	cd
100%	100%	99%	97%	94%	90%	85%	78%	68%	54%	41%	30%	22%	17%	13%	10%	8%	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	15,4	16,5	15,6	16,8	17,0	15,4	16,5	15,6	16,8	17,0
	3H	16,2	17,4	16,7	17,7	17,9	16,2	17,4	16,7	17,7	17,9
	4H	16,8	17,9	17,2	18,2	18,4	16,8	17,9	17,2	18,2	18,4
	6H	17,4	18,4	17,7	18,7	19,0	17,4	18,4	17,7	18,7	19,0
	8H	17,7	18,6	18,0	18,9	19,3	17,7	18,6	18,0	18,9	19,3
	12H	17,9	18,8	18,3	19,1	19,6	17,9	18,8	18,3	19,1	19,6
4H	2H	15,7	16,8	16,1	17,1	17,3	15,7	16,8	16,1	17,1	17,3
	3H	16,9	17,8	17,3	18,2	18,6	16,9	17,8	17,3	18,2	18,6
	4H	17,6	18,4	18,0	18,8	19,4	17,6	18,4	18,0	18,8	19,4
	6H	18,3	19,1	18,8	19,5	19,9	18,3	19,1	18,8	19,5	19,9
	8H	18,7	19,4	19,2	19,8	20,2	18,7	19,4	19,2	19,8	20,2
	12H	19,0	19,6	19,5	20,0	20,5	19,0	19,6	19,5	20,0	20,5
8H	4H	17,9	18,6	18,4	19,0	19,4	17,9	18,6	18,4	19,0	19,4
	6H	18,8	19,4	19,3	19,9	20,4	18,8	19,4	19,3	19,9	20,4
	8H	19,3	19,8	19,9	20,3	21,0	19,3	19,8	19,9	20,3	21,0
	12H	19,8	20,2	20,4	20,7	21,3	19,8	20,2	20,4	20,7	21,3
12H	4H	17,9	18,5	18,4	18,9	19,4	17,9	18,5	18,4	18,9	19,4
	6H	19,0	19,4	19,5	20,0	20,6	19,0	19,4	19,5	20,0	20,6
	8H	19,5	19,9	20,1	20,4	21,0	19,5	19,9	20,1	20,4	21,0

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

S = 1.0H	0,1 / -0,2	0,1 / -0,2
S = 1.5H	0,4 / -0,4	0,4 / -0,4
S = 2.0H	0,8 / -0,7	0,8 / -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	106	106	106	102	102	102	100	100
1	110	105	101	98	107	103	99	96	99	96	93	95	92	90	91	89	87	85
2	101	93	87	82	98	91	86	81	88	83	79	85	81	77	82	78	75	73
3	93	83	76	70	90	82	75	69	79	73	68	76	71	67	73	69	66	64
4	86	75	67	60	84	73	66	60	71	64	59	69	63	58	66	62	58	56
5	79	67	59	53	77	66	59	53	64	57	52	62	56	52	60	55	51	49
6	74	61	53	47	72	60	52	47	59	52	46	57	51	46	55	50	45	44
7	69	56	48	42	67	55	47	42	54	47	42	52	46	41	51	45	41	39
8	64	51	43	38	63	51	43	38	49	42	37	48	42	37	47	41	37	35
9	60	47	40	34	59	47	39	34	46	39	34	45	38	34	43	38	34	32
10	56	44	36	31	55	43	36	31	42	36	31	41	35	31	40	35	31	29

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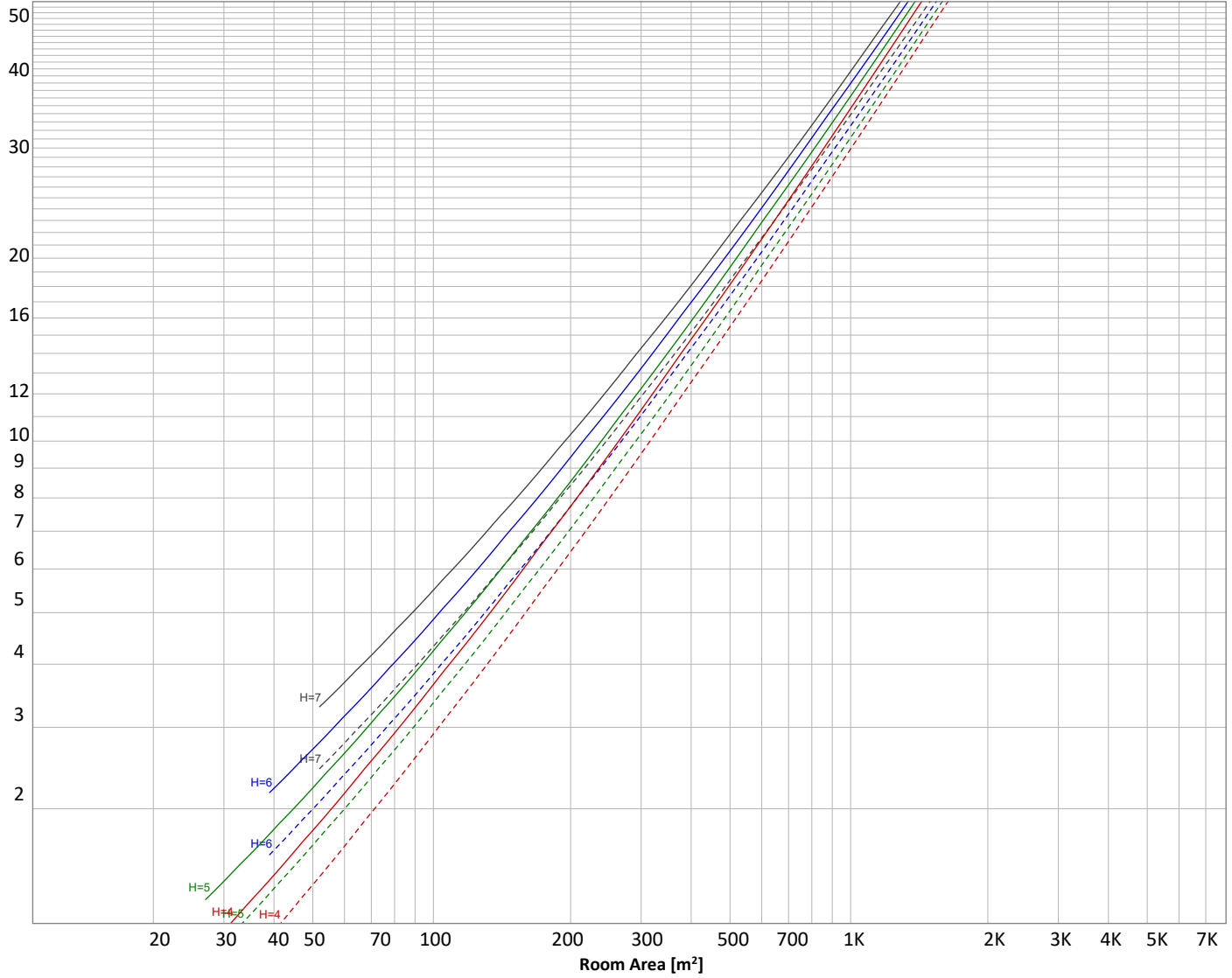
Operator:



## Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



### Conditions

H = Room height	Flux = 3457 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°
143 lm	412 lm	627 lm	733 lm	626 lm	410 lm	252 lm	167 lm	71,7 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
4,27 lm	1,52 lm	1,89 lm	2,07 lm	2,03 lm	1,97 lm	1,54 lm	1,03 lm	0,370 lm

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## Outdoor Light Planning

### Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	143 lm	4,1%
10-20°	412 lm	11,9%
20-30°	627 lm	18,1%
30-40°	733 lm	21,2%
40-50°	626 lm	18,1%
50-60°	410 lm	11,8%
60-70°	252 lm	7,3%
70-80°	167 lm	4,8%
80-90°	72 lm	2,1%
90-100°	4 lm	0,1%
100-110°	2 lm	0,0%
110-120°	2 lm	0,1%
120-130°	2 lm	0,1%
130-140°	2 lm	0,1%
140-150°	2 lm	0,1%
150-160°	2 lm	0,0%
160-170°	1 lm	0,0%
170-180°	0 lm	0,0%
<b>Total</b>	<b>3457 lm</b>	<b>100,0%</b>

### Intensity peaks

Max intensity	1508 cd
Intensity, 90°	20 cd
Intensity, 0°	1508 cd

### Zonal Lumen summary

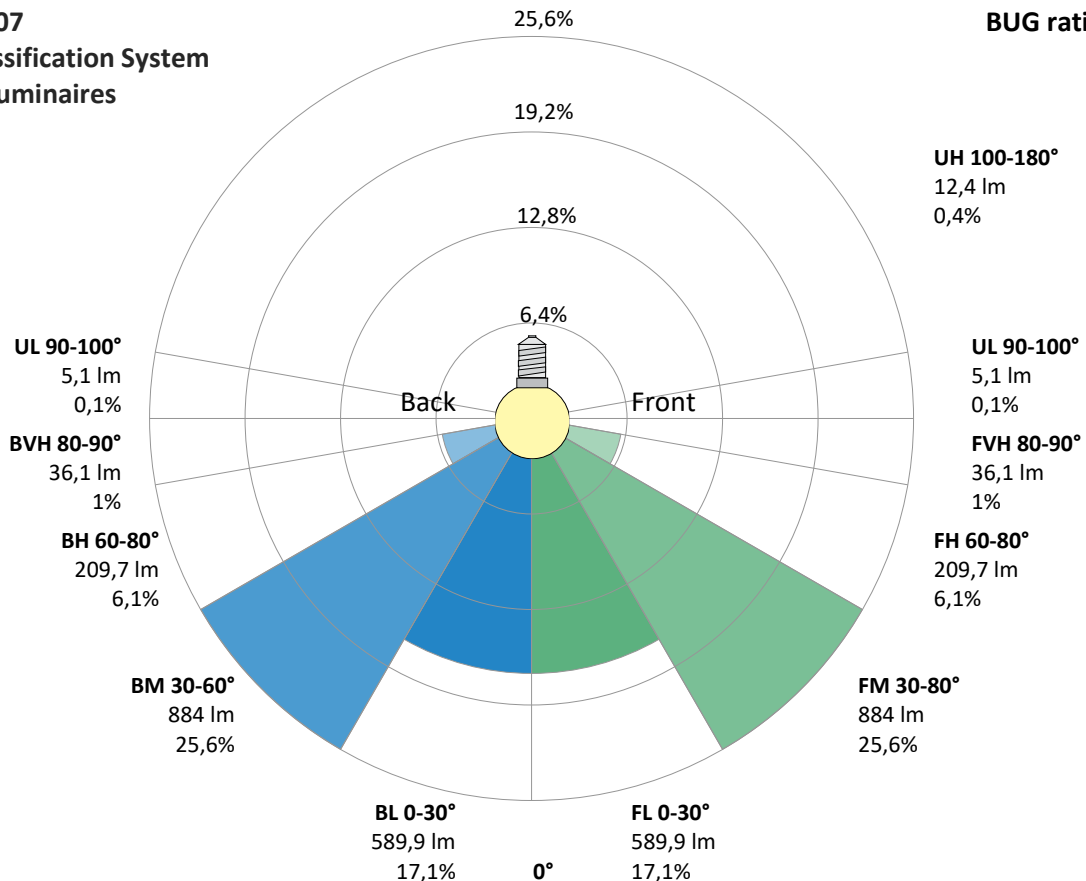
Zone (γ)	Lumen	% Total
0-30°	1181 lm	34,2%
0-40°	1915 lm	55,4%
0-60°	2950 lm	85,3%
60-90°	490 lm	14,2%
70-100°	242 lm	7,0%
90-120°	8 lm	0,2%
0-90°	3440 lm	99,5%
90-180°	17 lm	0,5%
0-180°	3457 lm	100,0%

### BUG rating

	Lumen	% Total
<b>Forward light</b>		
Low(0-30°)	590 lm	17,1%
Medium(30-60°)	884 lm	25,6%
High(60-80°)	210 lm	6,1%
Very high(80-90°)	36 lm	1,0%
<b>Back light</b>		
Low(0-30°)	590 lm	17,1%
Medium(30-60°)	884 lm	25,6%
High(60-80°)	210 lm	6,1%
Very high(80-90°)	36 lm	1,0%
<b>Uplight</b>		
Low(90-100°)	5 lm	0,1%
High(100-180°)	12 lm	0,4%

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

**BUG rating B2 U2 G1**



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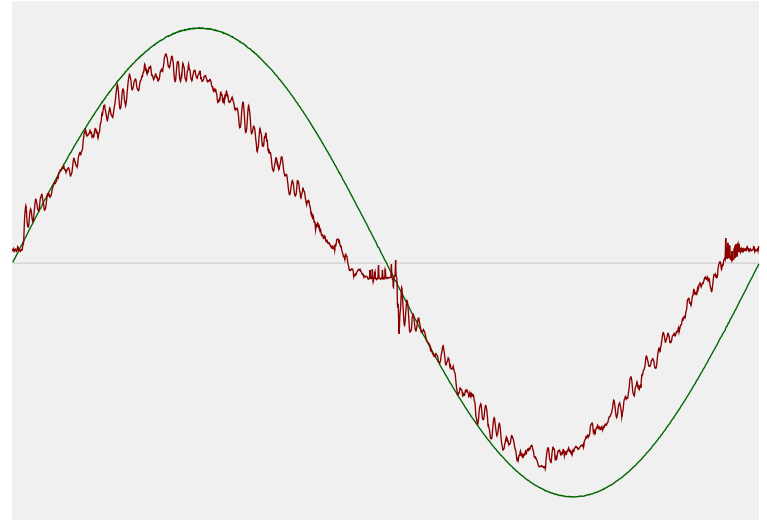


## Power Details

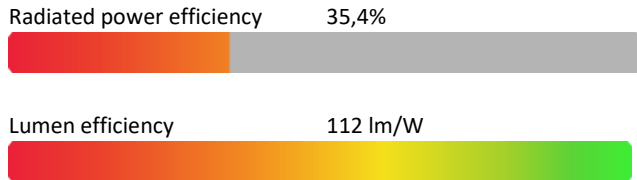
### Input Power

Power feed to light source	30,8 W
Frequency of input power	50 Hz
RMS Input voltage feed, $V_{RMS}$	230 V
RMS Input current feed, $I_{RMS}$	0,138 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	31,86 VA
Displacement factor of AC power feed	0,97
Power factor of AC current feed	0,97
Total harmonic distortion of the current	12,32%
Total harmonic distortion of the voltage	0,14%

### 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	5996 K
CCT shift	+4 K
CCT end	6000 K

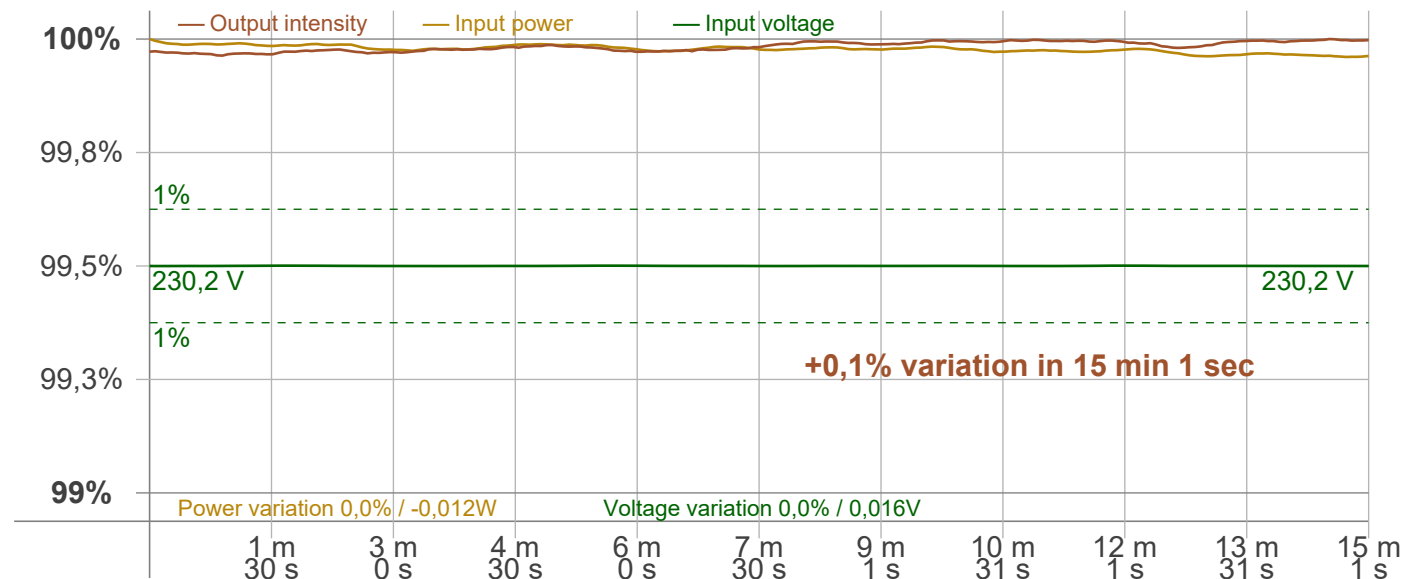
### Warmup Result

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

### Output Change

Output start	3456 lm
Output change	+1 lm
Output end	3457 lm

### Stabilization Curve



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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 188,68 Hz  
 Percent Flicker 1,43 %  
 Flicker index 0

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

JA8/10 40 Hz 0,02 %  
 JA8/10 90 Hz 0,04 %  
 JA8/10 200 Hz 0,75 %  
 JA8/10 400 Hz 1,33 %  
 JA8/10 1000 Hz 1,4 %

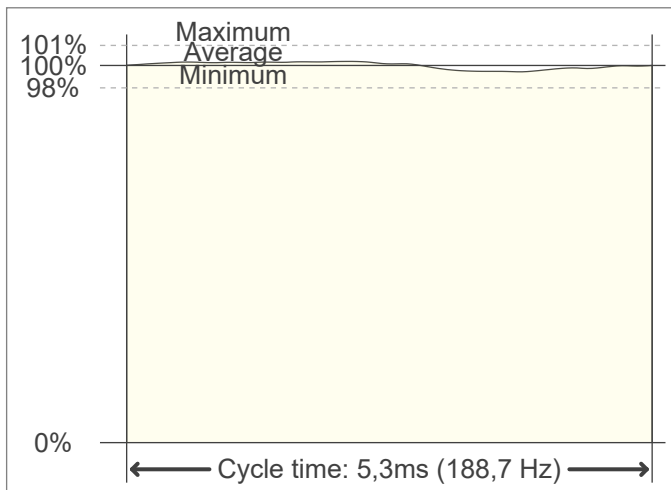
### TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

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

