

# Light Measurement Report

Print date: 23-9-2025

Measurement date and time: 23-9-2025 14:39:09 – Measurement no. VFR-250923-3311-MS

Measurement tracking No. and Link: [VT250923-004312](#)

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°  
11,89 m  
20,9 W – PF 0,56 – DPF 0,86  
230 V – 0,163 A  
50 Hz  
Lamp stabilized in 15 min 1 sec – 2,0%

## Tested Light Source

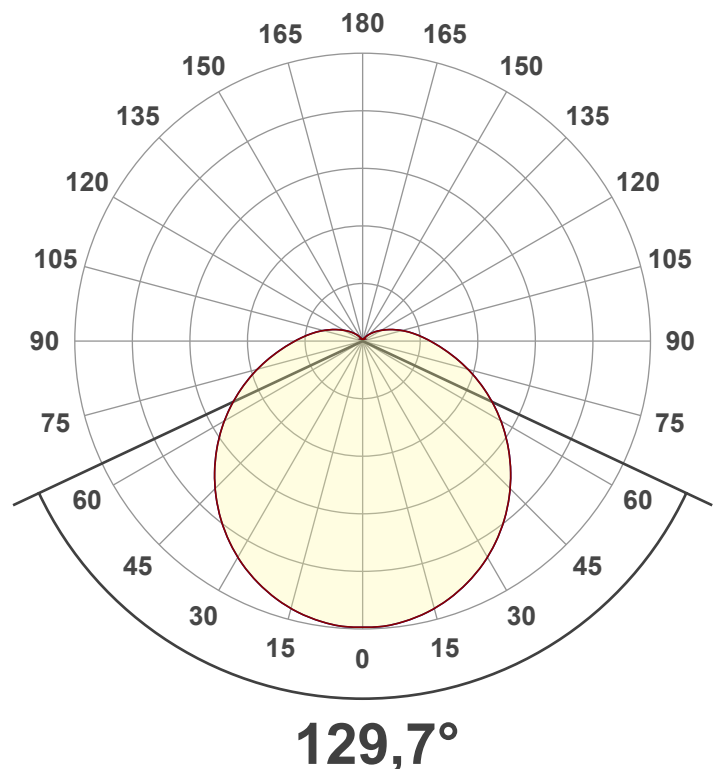
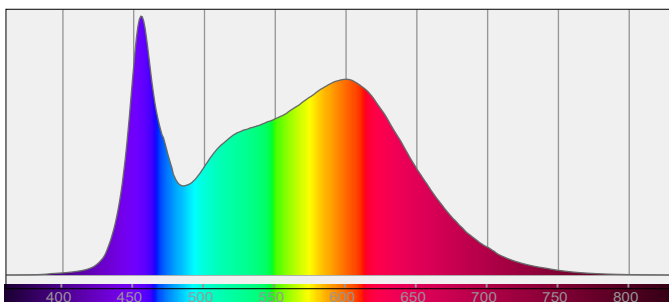
Product Name  
Item No. and Manufacturer  
Product Description (line 1)

812539-4000K  
812539-4000K – Dutchfulfillment  
T5 BALK | KOPPELBAAR | 150CM | 22W | 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

2419 lm – 13,5% / 86,5%  
116 lm/W  
577 cd – 129,7°  
CCT = 4000 K / 4378 K  
CRI 88,5  
 $R_f$  86,1 –  $R_g$  95,3  
Duv -0,0025 – SDCM 8,1  
SVM 0,02 – PstLM 0,02



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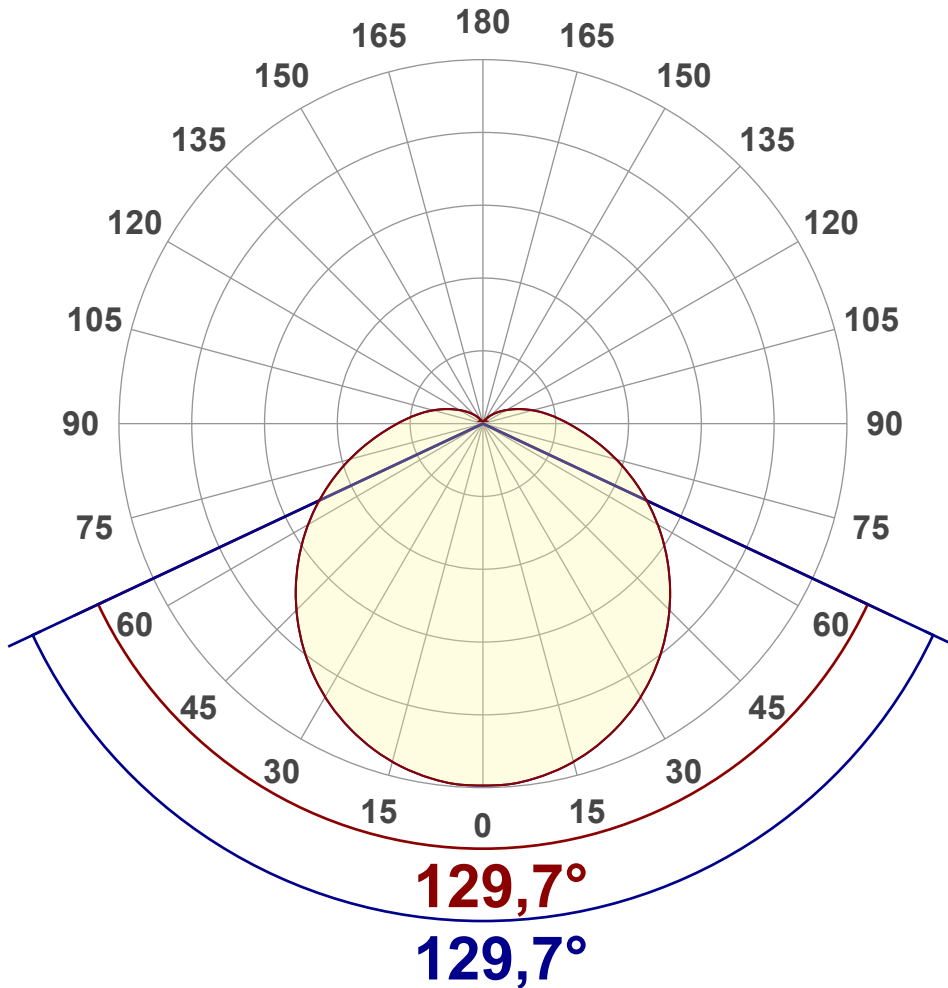
Measurement tracking No. and Link: [VT250923-004312](#)

Operator:



## Luminous Intensity diagram

Unit: 0-100% of peak intensity



## Main Values

Output (total Lumen)	2419 lm
Lumen Up% / Down%	13,5% / 86,5%
Peak Intensity	577 cd
Beam Angle (50%)	129,7°
Beam Angle (90%)	129,7°
Beam Angle (10%)	129,7°

## Cut-off Angle

Average 2,5%	280,3°
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## Field Angle

Average 10%	227,4°
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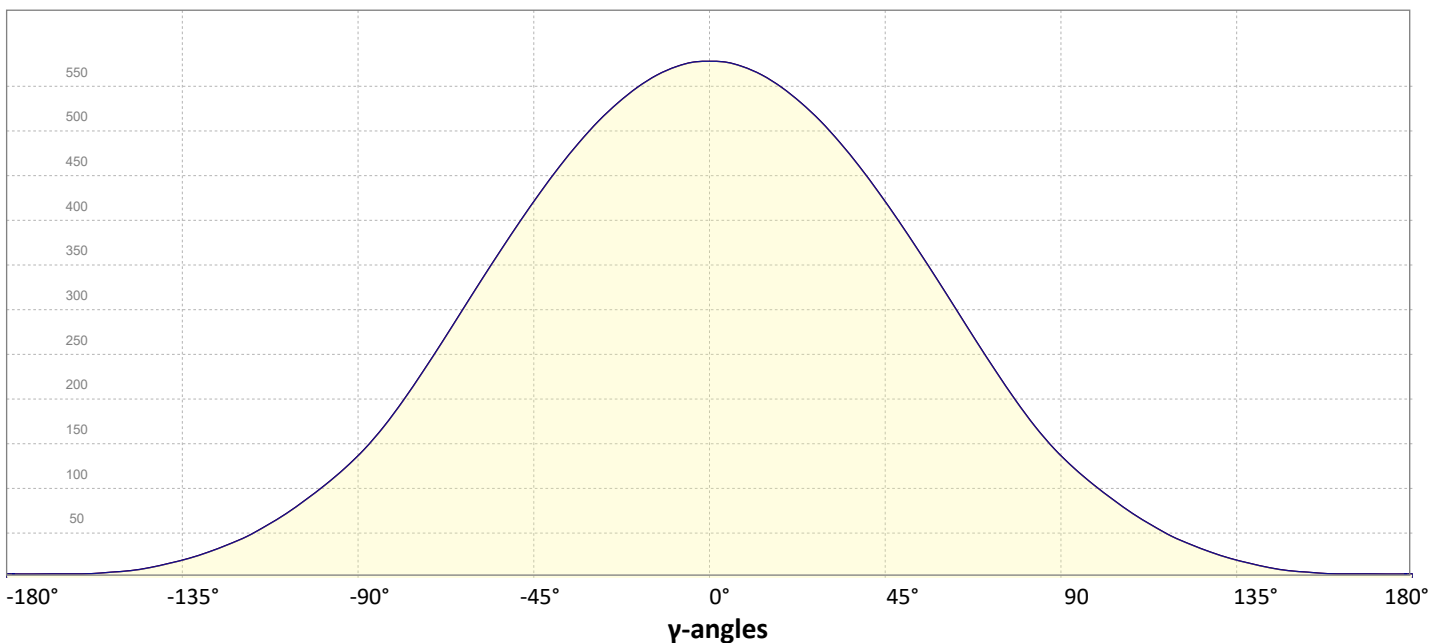
## Intensity Ratio

In 120° cone	57,8%
In 90° cone	37,9%

**C000-C180**

**C090-C270**

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



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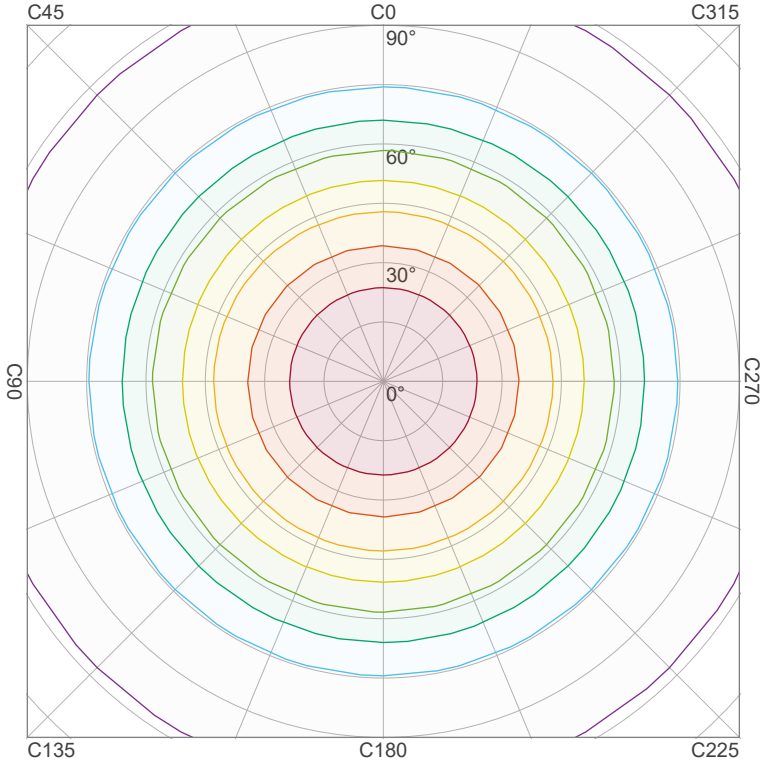
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Operator:



## Iso-intensity Diagram (Iso-candela)

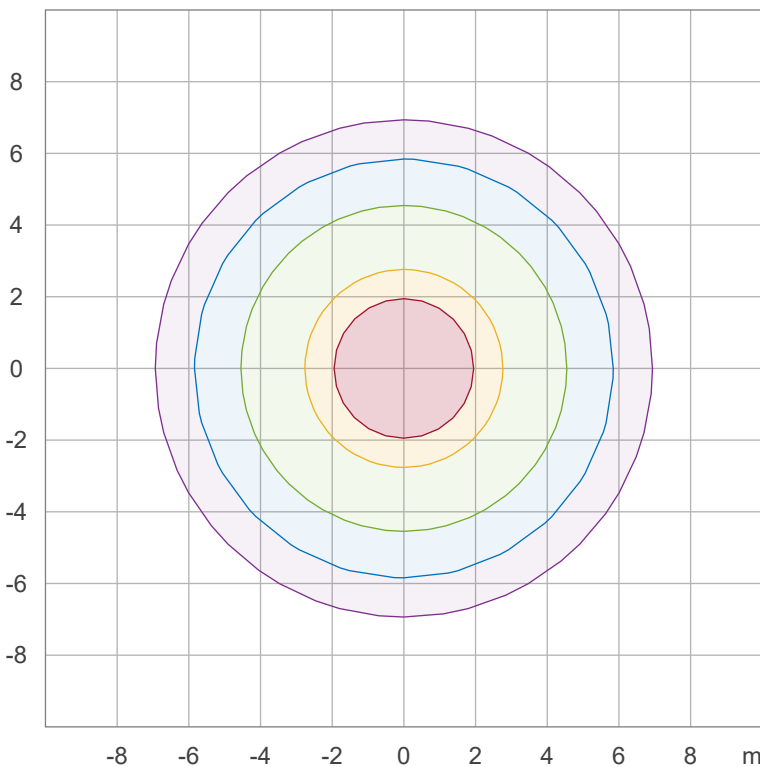


90 %	519,6 cd
80 %	461,9 cd
70 %	404,2 cd
60 %	346,4 cd
50 %	288,7 cd
40 %	230,9 cd
30 %	173,2 cd
20 %	115,5 cd
10 %	57,7 cd

Peak intensity: 577,4 cd

Number of c-planes: 12

## Iso-illuminance Diagram (Iso-lux)



50,0 %	32,1 lx
30,0 %	19,2 lx
10,0 %	6,4 lx
5,0 %	3,2 lx
3,0 %	1,9 lx

Peak illuminance: 64,2 lx

Mounting height: 3,0 m

Number of c-planes: 12

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## Color details

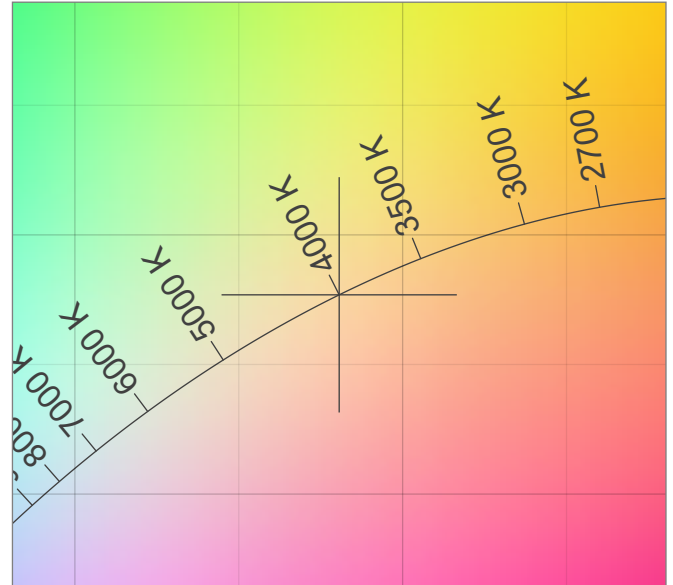
Correlated Color Temperature, Target CCT = 4000 K  
 Correlated Color Temperature, Measured CCT = 4378 K  
 Color Rendering Index CRI 88,5  
 Color Rendering Index, R9 (red component) R9 = 34,5  
 Color Rendering TM30-18 R<sub>f</sub> 86,1 – R<sub>g</sub> 95,3  
 Color Quality Scale CQS = 86,0

MacAdam Steps SDCM = 8,1  
 Color coordinates CIE 1931 (x;y) = (0,381;0,377)  
 Color coordinate CIEs 1960 (u;v) = (0,225;0,334)  
 Color deviation from BBL Duv = -0,0025  
 Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,225;0,502)

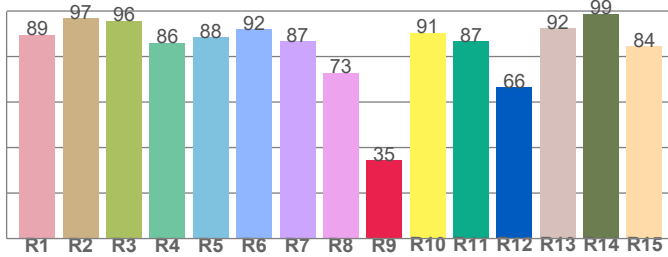
CIE 1931



CIE 1931 – zoomed on Planckian locus



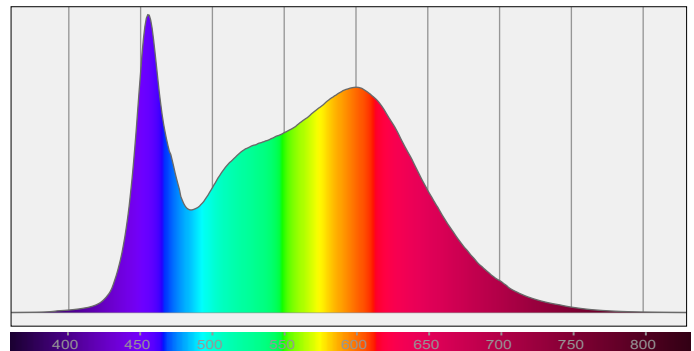
Color Rendering Index per reference color (CIE 1995)



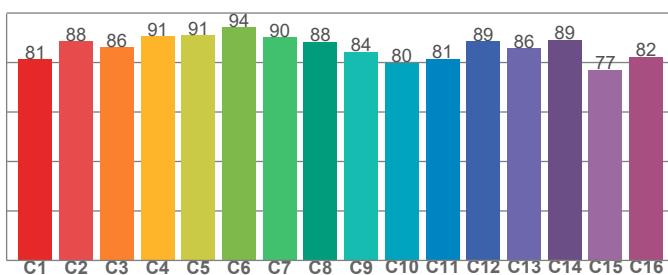
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
89,5	96,7	95,8	86,0	88,4	92,0	86,7	72,9	34,5	90,5	86,7	66,4	92,5	98,8	84,4

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



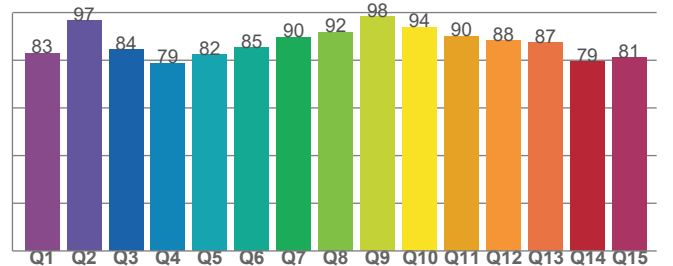
TM30-18 R<sub>f</sub>-values per hue bin



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
81,4	88,5	86,1	90,5	91,0	94,4	90,1	88,5	84,4	80,0	81,5	88,7	85,8	89,2	77,0	82,4

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	96,7	84,4	78,7	82,4	85,2	89,7	91,6	98,3	93,9	90,0	88,1	87,4	79,4	81,1

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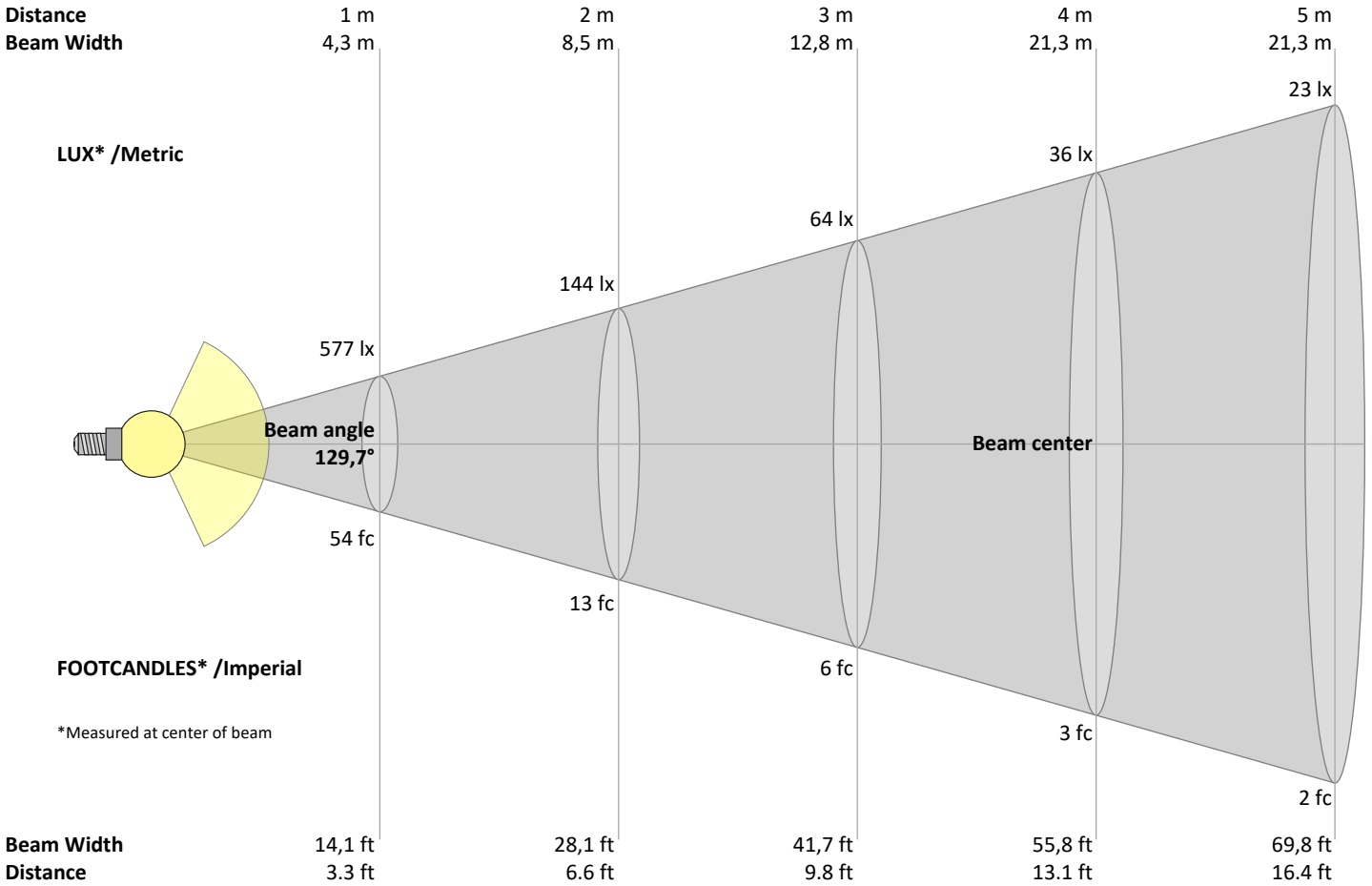
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Operator:



## 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
577	144	64	36	23	16	12	9	7	6	5	4	3	3	3	2	2	2	2	1	lux
53,6	13,4	6	3,4	2,1	1,5	1,1	0,8	0,7	0,5	0,4	0,4	0,3	0,3	0,2	0,2	0,2	0,2	0,1	0,1	fc

### Intensities in 0° c-plane

0°	9°	18°	27°	36°	45°	54°	63°	72°	81°	90°	99°	108°	117°	126°	135°	144°	153°	162°	171°	γ
577	571	550	517	473	421	363	301	240	183	137	102	73	50	33	20	11	6	4	4	cd
100%	99%	95%	90%	82%	73%	63%	52%	42%	32%	24%	18%	13%	9%	6%	3%	2%	1%	1%	1%	of 0°val

### Intensities in 90° c-plane

0°	9°	18°	27°	36°	45°	54°	63°	72°	81°	90°	99°	108°	117°	126°	135°	144°	153°	162°	171°	γ
577	571	550	517	473	421	363	301	240	183	137	102	73	50	33	20	11	6	4	4	cd
100%	99%	95%	90%	82%	73%	63%	52%	42%	32%	24%	18%	13%	9%	6%	3%	2%	1%	1%	1%	of 0°val

### Intensities in 180° c-plane

0°	9°	18°	27°	36°	45°	54°	63°	72°	81°	90°	99°	108°	117°	126°	135°	144°	153°	162°	171°	γ
577	571	550	517	473	421	363	301	240	183	137	102	73	50	33	20	11	6	4	4	cd
100%	99%	95%	90%	82%	73%	63%	52%	42%	32%	24%	18%	13%	9%	6%	3%	2%	1%	1%	1%	of 0°val

### Intensities in 270° c-plane

0°	9°	18°	27°	36°	45°	54°	63°	72°	81°	90°	99°	108°	117°	126°	135°	144°	153°	162°	171°	γ
577	571	550	517	473	421	363	301	240	183	137	102	73	50	33	20	11	6	4	4	cd
100%	99%	95%	90%	82%	73%	63%	52%	42%	32%	24%	18%	13%	9%	6%	3%	2%	1%	1%	1%	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	20,0	21,2	20,5	21,7	22,2	21,2	22,4	21,7	22,9	23,4
	3H	21,7	22,9	22,3	23,4	23,9	23,3	24,6	23,9	25,1	25,6
	4H	22,6	23,7	23,1	24,2	24,7	24,5	25,7	25,1	26,2	26,7
	6H	23,4	24,4	23,9	24,9	25,6	25,8	26,8	26,3	27,4	28,0
	8H	23,8	24,8	24,3	25,3	26,0	26,5	27,5	27,0	28,0	28,7
	12H	24,1	25,1	24,7	25,6	26,3	27,3	28,3	27,8	28,8	29,5
4H	2H	20,8	21,9	21,4	22,4	23,0	21,7	22,8	22,3	23,3	23,9
	3H	22,8	23,8	23,3	24,3	25,0	24,1	25,1	24,7	25,6	26,3
	4H	23,7	24,8	24,3	25,2	26,0	25,3	26,4	26,0	26,9	27,6
	6H	24,6	25,5	25,3	26,1	26,7	26,7	27,6	27,4	28,2	28,8
	8H	25,1	25,8	25,7	26,4	27,1	27,5	28,3	28,2	28,9	29,5
	12H	25,5	26,2	26,1	26,8	27,5	28,3	29,0	29,0	29,6	30,3
8H	4H	24,2	25,0	24,8	25,6	26,2	25,6	26,4	26,3	27,0	27,6
	6H	25,3	26,0	26,0	26,6	27,4	27,2	27,8	27,9	28,5	29,2
	8H	25,9	26,5	26,6	27,2	28,0	28,1	28,6	28,8	29,3	30,2
	12H	26,5	27,0	27,2	27,7	28,5	29,1	29,5	29,8	30,2	31,0
12H	4H	24,3	24,9	24,9	25,6	26,3	25,6	26,3	26,3	26,9	27,6
	6H	25,5	26,1	26,2	26,8	27,6	27,3	27,8	28,0	28,5	29,4
	8H	26,2	26,7	26,9	27,4	28,2	28,2	28,7	28,9	29,4	30,2

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

S = 1.0H	0,1 / -0,1	0,1 / -0,1
S = 1.5H	0,1 / -0,1	0,2 / -0,2
S = 2.0H	0,2 / -0,3	0,3 / -0,3

## 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	0			
Floor reflectance	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	116	116	116	116	112	112	112	112	104	104	104	96	96	96	90	90	90	86
1	103	97	91	87	99	93	88	84	86	82	79	80	77	74	74	72	69	66
2	92	83	75	68	88	80	73	67	74	68	63	69	64	59	64	60	56	53
3	84	72	63	56	80	69	61	54	64	57	52	60	54	49	55	51	46	44
4	76	63	54	46	73	61	52	45	57	49	43	53	46	41	49	44	39	37
5	70	56	47	40	67	54	45	39	50	43	37	47	41	35	44	38	34	31
6	64	50	41	34	61	49	40	33	45	38	32	42	36	31	40	34	29	27
7	59	45	36	30	57	44	35	29	41	34	28	39	32	27	36	30	26	24
8	55	41	33	26	53	40	32	26	38	30	25	35	29	24	33	27	23	21
9	52	38	29	24	49	37	29	23	34	27	22	32	26	22	31	25	21	19
10	48	35	27	21	46	34	26	21	32	25	20	30	24	20	28	23	19	17

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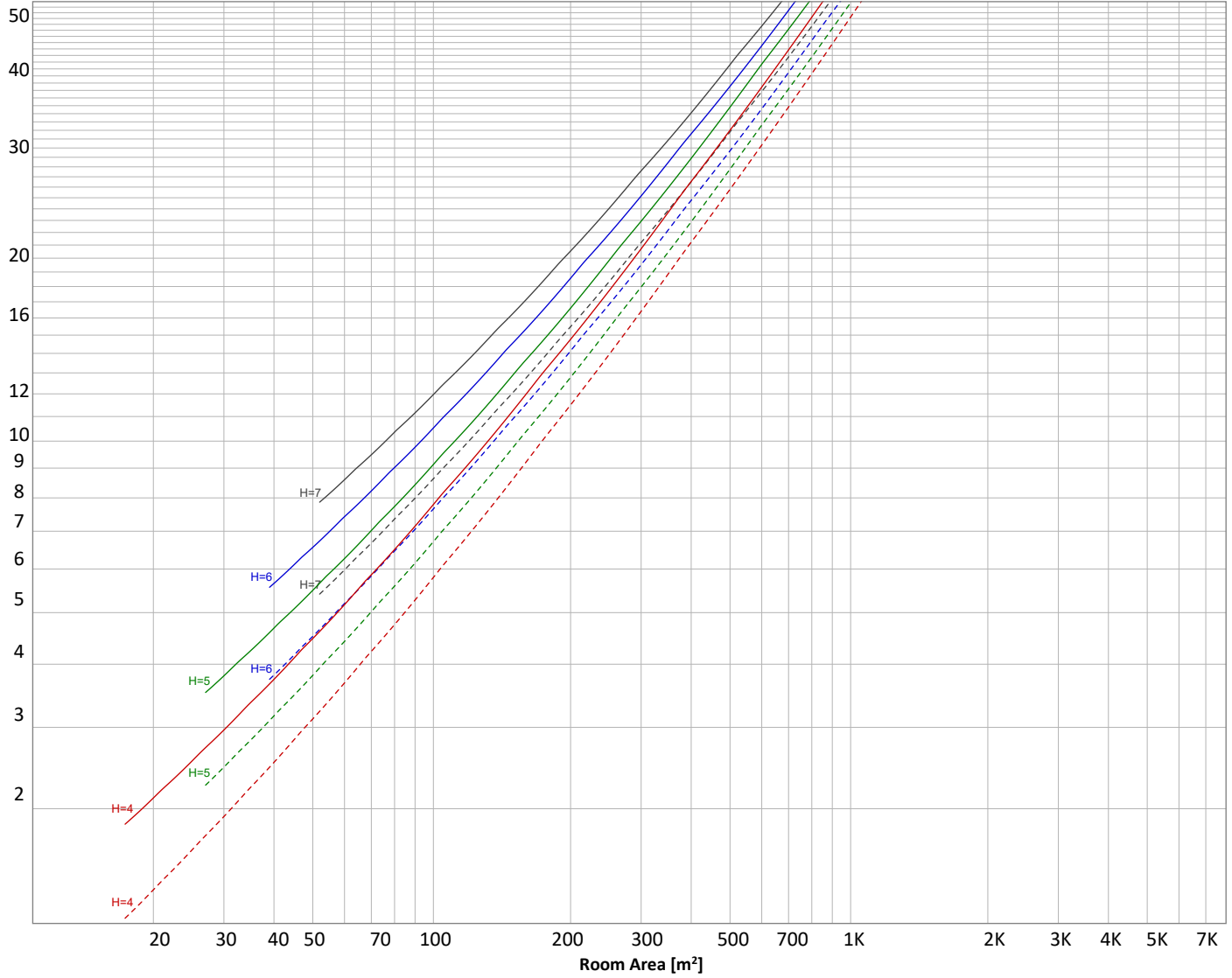
Operator:



## Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



### Conditions

H = Room height	Flux = 2419 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°
54,8 lm	158 lm	242 lm	300 lm	325 lm	319 lm	285 lm	233 lm	176 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
127 lm	87,3 lm	54,4 lm	31,0 lm	15,6 lm	6,57 lm	2,67 lm	1,23 lm	0,401 lm

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## Outdoor Light Planning

### Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	55 lm	2,3%
10-20°	158 lm	6,5%
20-30°	242 lm	10,0%
30-40°	300 lm	12,4%
40-50°	325 lm	13,4%
50-60°	319 lm	13,2%
60-70°	285 lm	11,8%
70-80°	233 lm	9,6%
80-90°	176 lm	7,3%
90-100°	127 lm	5,3%
100-110°	87 lm	3,6%
110-120°	54 lm	2,3%
120-130°	31 lm	1,3%
130-140°	16 lm	0,6%
140-150°	7 lm	0,3%
150-160°	3 lm	0,1%
160-170°	1 lm	0,1%
170-180°	0 lm	0,0%
<b>Total</b>	<b>2419 lm</b>	<b>100,0%</b>

### Intensity peaks

Max intensity	577 cd
Intensity, 90°	137 cd
Intensity, 0°	577 cd

### Zonal Lumen summary

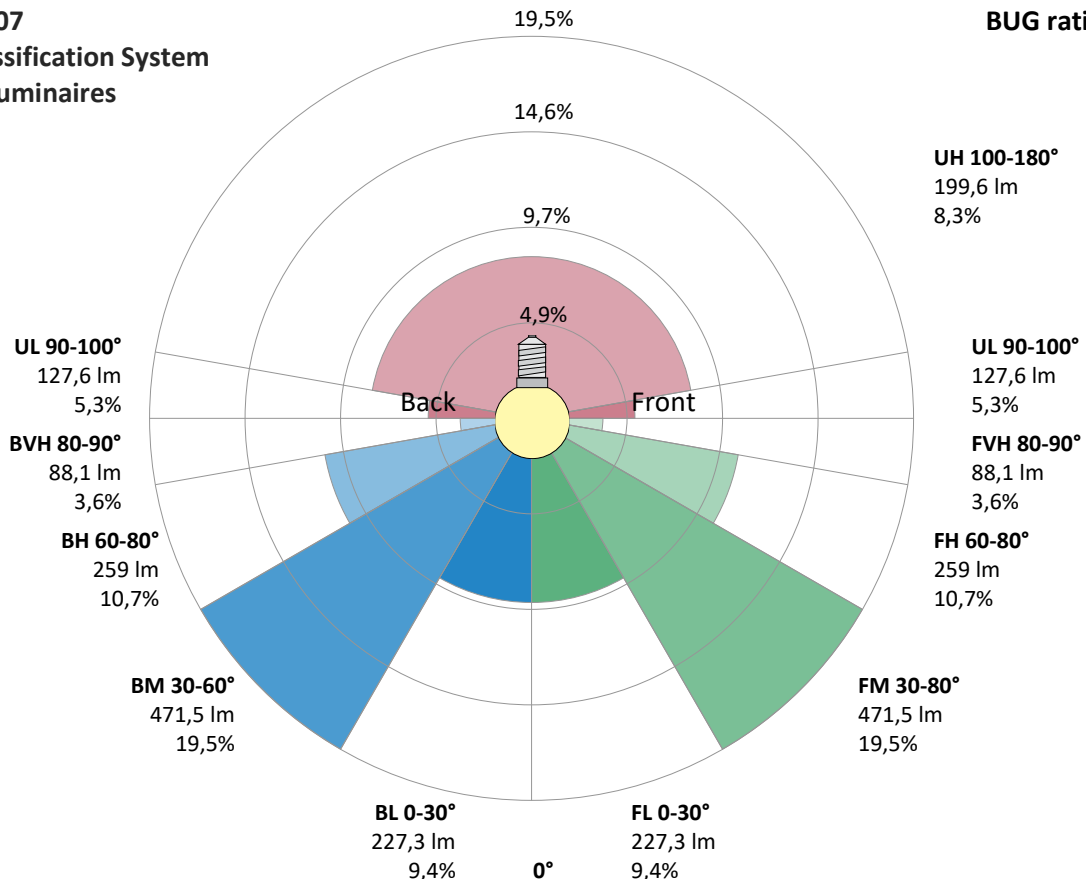
Zone (γ)	Lumen	% Total
0-30°	455 lm	18,8%
0-40°	755 lm	31,2%
0-60°	1398 lm	57,8%
60-90°	694 lm	28,7%
70-100°	536 lm	22,2%
90-120°	269 lm	11,1%
0-90°	2092 lm	86,5%
90-180°	327 lm	13,5%
0-180°	2419 lm	100,0%

### BUG rating

	Lumen	% Total
<b>Forward light</b>		
Low(0-30°)	227 lm	9,4%
Medium(30-60°)	472 lm	19,5%
High(60-80°)	259 lm	10,7%
Very high(80-90°)	88 lm	3,6%
<b>Back light</b>		
Low(0-30°)	227 lm	9,4%
Medium(30-60°)	472 lm	19,5%
High(60-80°)	259 lm	10,7%
Very high(80-90°)	88 lm	3,6%
<b>Uplight</b>		
Low(90-100°)	128 lm	5,3%
High(100-180°)	200 lm	8,3%

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

**BUG rating B1 U3 G1**



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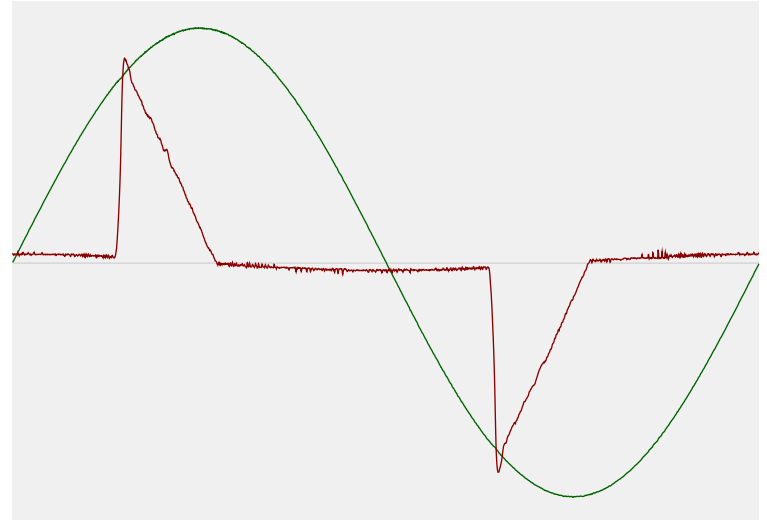


## Power Details

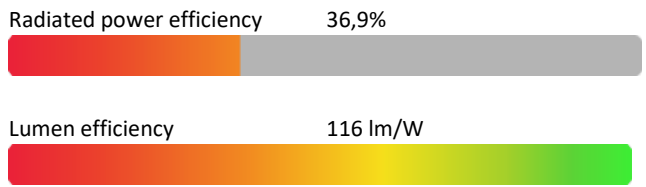
### Input Power

Power feed to light source	20,9 W
Frequency of input power	50 Hz
RMS Input voltage feed, $V_{RMS}$	230 V
RMS Input current feed, $I_{RMS}$	0,163 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	37,58 VA
Displacement factor of AC power feed	0,86
Power factor of AC current feed	0,56
Total harmonic distortion of the current	117,02%
Total harmonic distortion of the voltage	0,18%

### 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	3998 K
CCT shift	+2 K
CCT end	4000 K

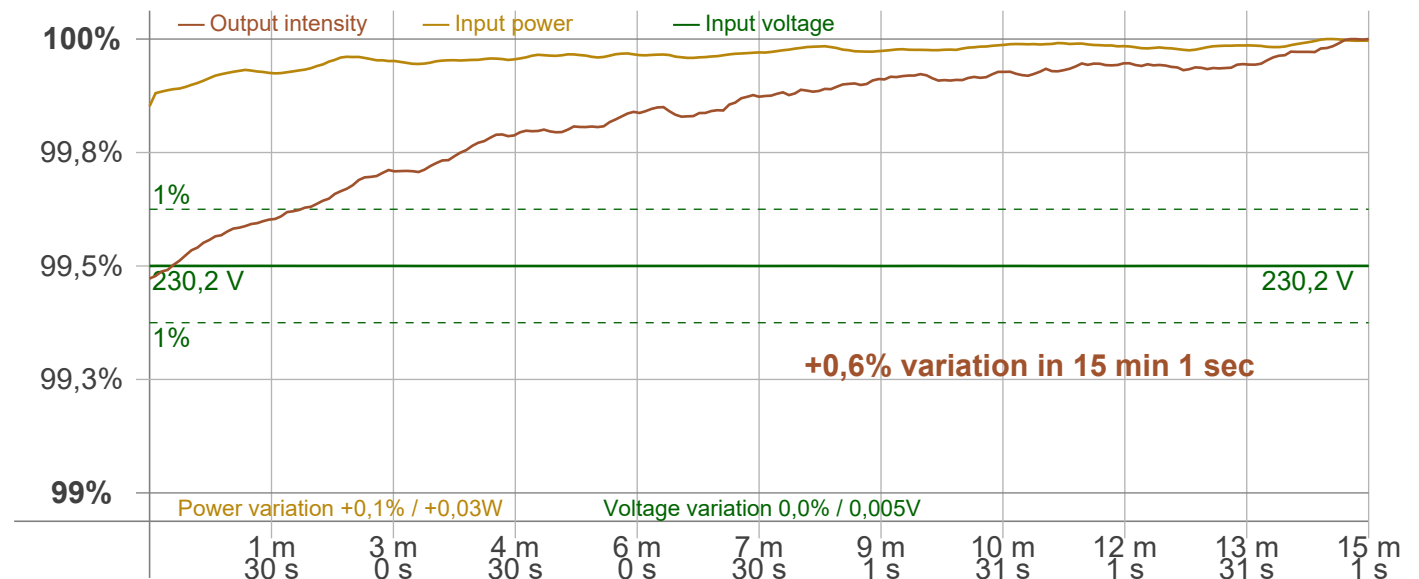
### Warmup Result

Total warmup time	Lamp stabilized in 15 min 1 sec
Warmup variation	+0,6%

### Output Change

Output start	2407 lm
Output change	+12 lm
Output end	2419 lm

### Stabilization Curve



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## 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: 0,8 %  
 Flicker index: 0

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

JA8/10 40 Hz: 0,03 %  
 JA8/10 90 Hz: 0,03 %  
 JA8/10 200 Hz: 0,62 %  
 JA8/10 400 Hz: 0,79 %  
 JA8/10 1000 Hz: 0,8 %

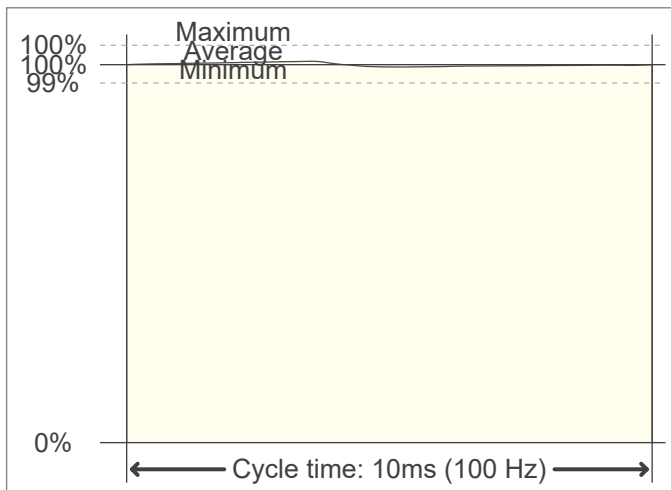
### TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

PstLM value (F < 80 Hz): 0,02  
 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

