

# Light Measurement Report

Print date: 20-2-2025

Measurement date and time: 20-2-2025 11:27:34 – Measurement no. VFR-250220-0078-MS

Measurement tracking No. and Link: [VT250220-004890](https://www.viso-systems.com/track/VT250220-004890)

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°  
12,10 m  
18,1 W – PF 0,93 – DPF 0,94  
230 V – 0,085 A  
50 Hz  
Lamp stabilized in 15 min 0 sec – 2,0%

## Tested Light Source

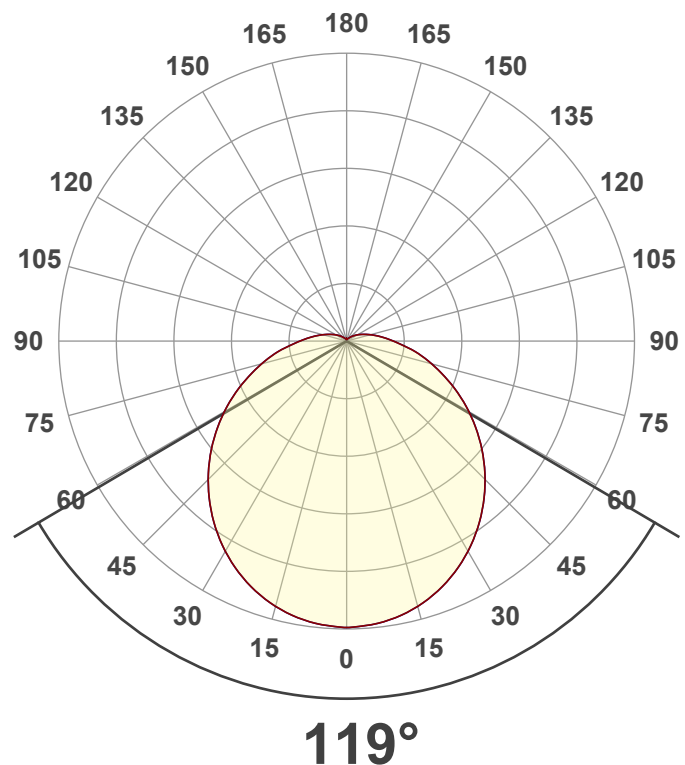
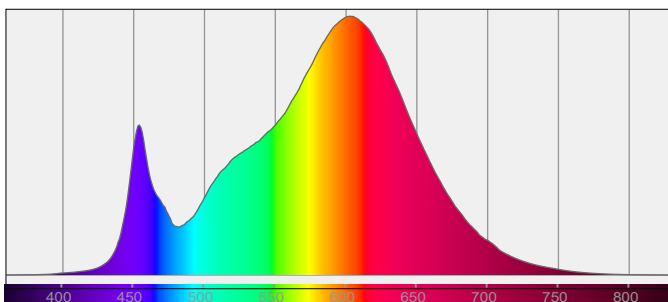
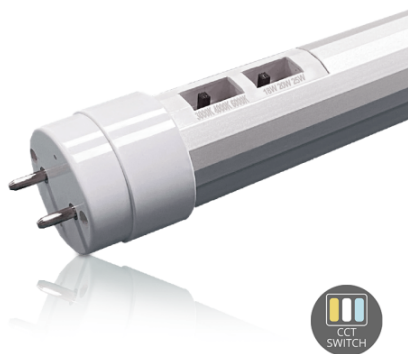
Product Name  
Item No. and Manufacturer  
Product Description (line 1)

802301-3000K-18W  
802301-3000K-18W – Dutchfulfillment  
LED TL-BUIS | T8 | 150CM | 18W-20W-25W | 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

2460 lm – 9,75% / 90,25%  
136 lm/W  
677 cd – 119°  
CCT = 3000 K / 2976 K  
CRI 81,7  
 $R_f$  83,8 –  $R_g$  94,3  
Duv -0,0004 – SDCM 0,9  
SVM 2,48 – PstLM 0,13



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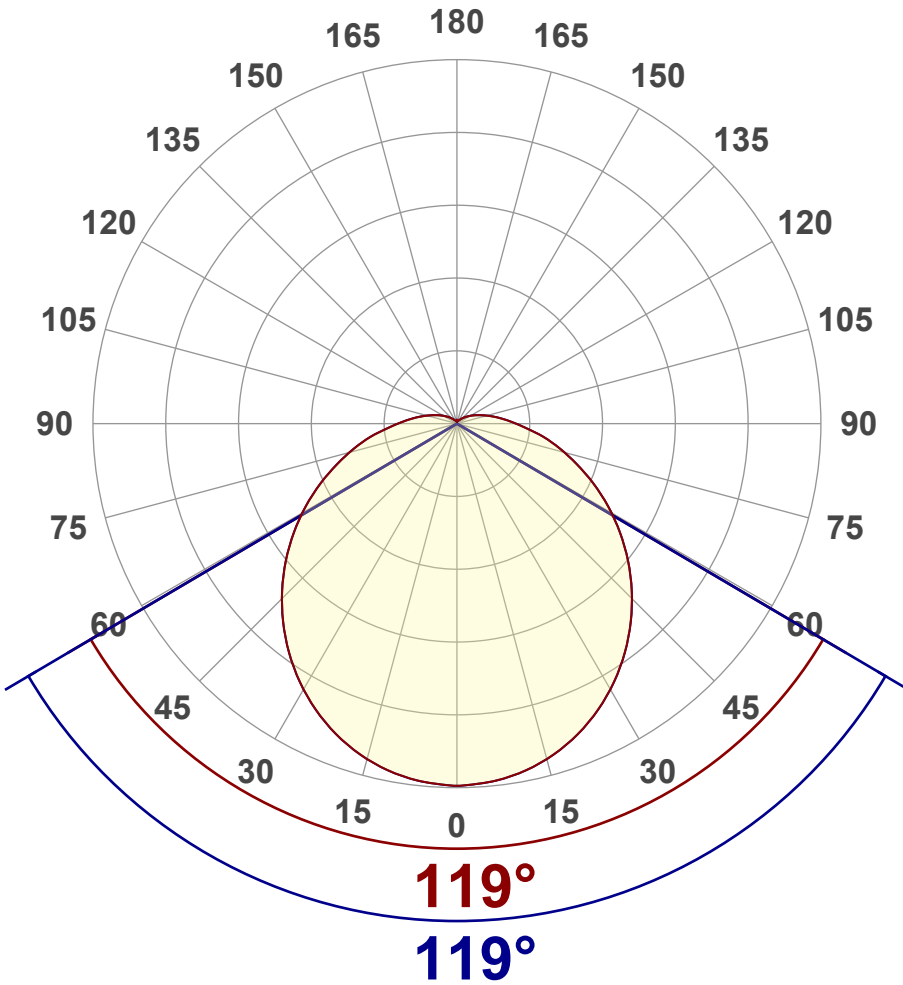
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Operator:



## Luminous Intensity diagram

Unit: 0-100% of peak intensity



## Main Values

Output (total Lumen)	2460 lm
Lumen Up% / Down%	9,75% / 90,25%
Peak Intensity	677 cd
Beam Angle (50%)	119°
Beam Angle (90%)	119°
Beam Angle (10%)	119°

## Cut-off Angle

Average 2,5%	262,6°
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## Field Angle

Average 10%	203,1°
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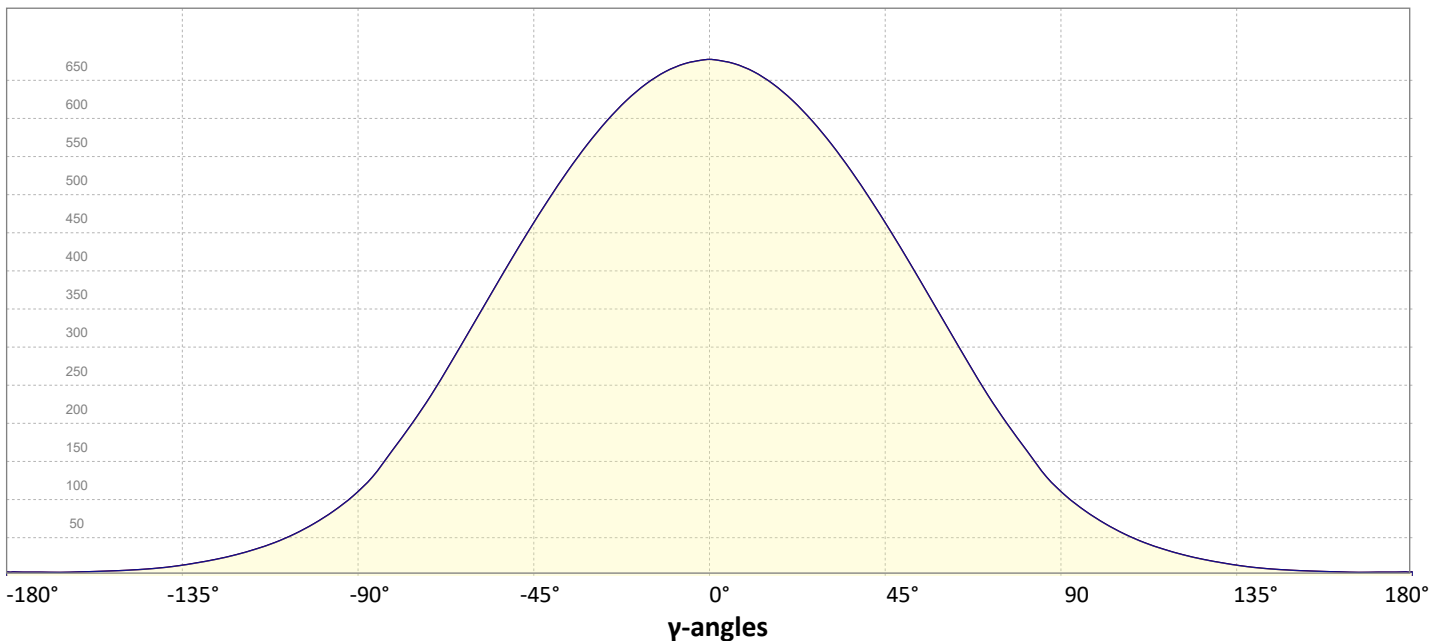
## Intensity Ratio

In 120° cone	63,4%
In 90° cone	42,4%

**C000-C180**

**C090-C270**

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



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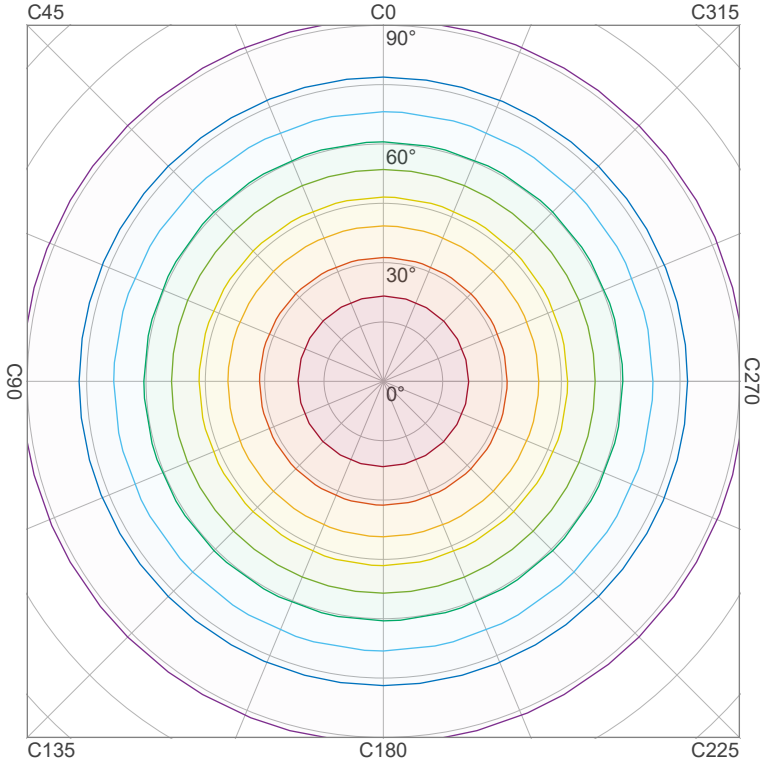
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## Iso-intensity Diagram (Iso-candela)

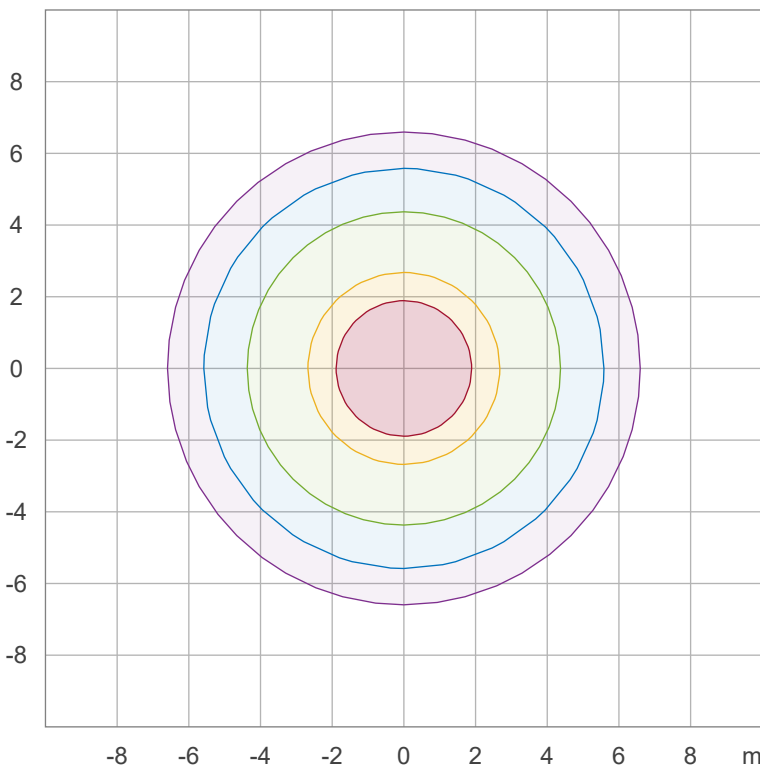


90 %	609,2 cd
80 %	541,5 cd
70 %	473,8 cd
60 %	406,1 cd
50 %	338,5 cd
40 %	270,8 cd
30 %	203,1 cd
20 %	135,4 cd
10 %	67,7 cd

Peak intensity: 676,9 cd

Number of c-planes: 12

## Iso-illuminance Diagram (Iso-lux)



50,0 %	37,6 lx
30,0 %	22,6 lx
10,0 %	7,5 lx
5,0 %	3,8 lx
3,0 %	2,3 lx

Peak illuminance: 75,2 lx

Mounting height: 3,0 m

Number of c-planes: 12

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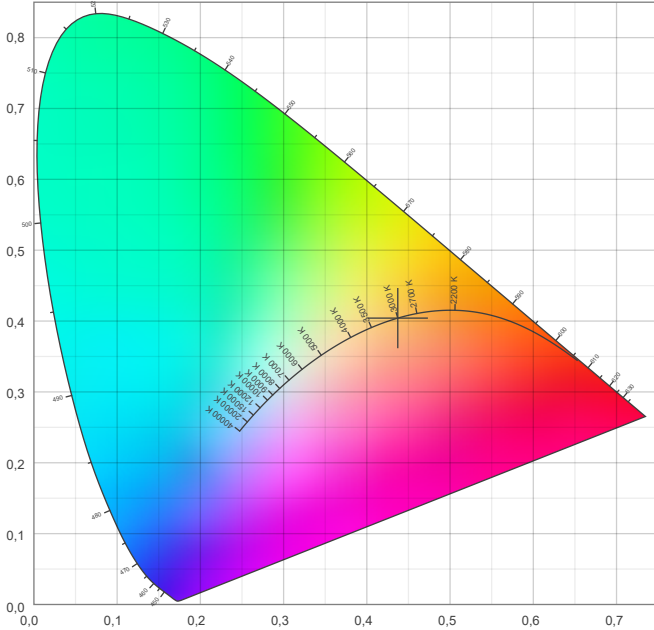


## Color details

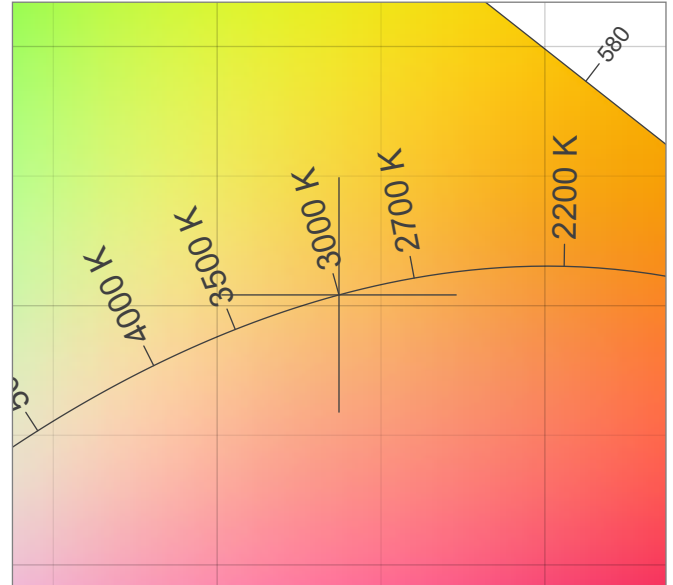
Correlated Color Temperature, Target CCT = 3000 K  
 Correlated Color Temperature, Measured CCT = 2976 K  
 Color Rendering Index CRI 81,7  
 Color Rendering Index, R9 (red component) R9 = 1,7  
 Color Rendering TM30-18 R<sub>f</sub> 83,8 – R<sub>g</sub> 94,3  
 Color Quality Scale CQS = 81,1

MacAdam Steps SDCM = 0,9  
 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 = -0,0004  
 Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,251;0,521)

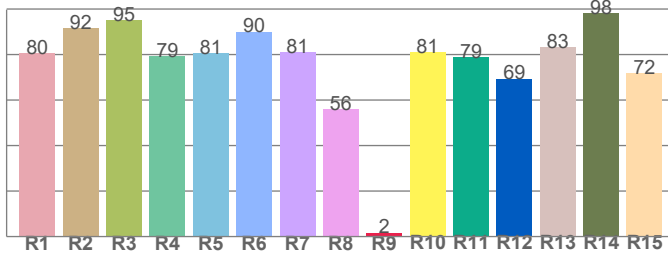
### CIE 1931



### CIE 1931 – zoomed on Planckian locus



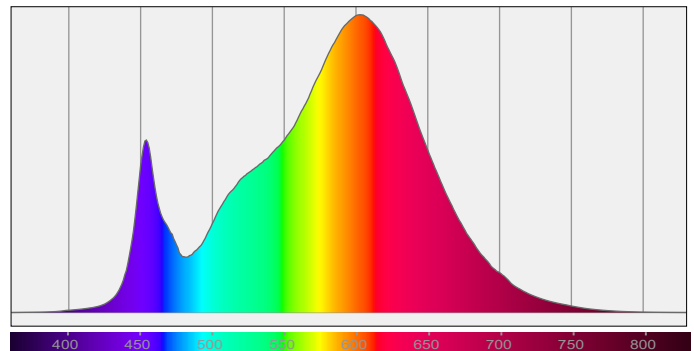
### Color Rendering Index per reference color (CIE 1995)



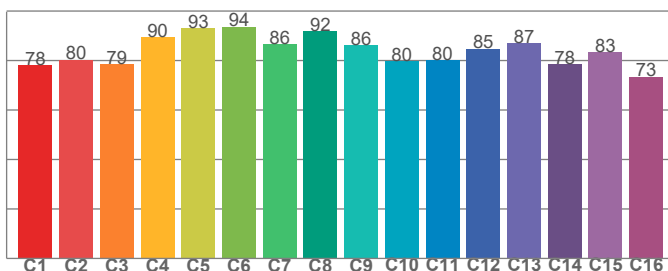
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
80,4	91,6	95,0	79,2	80,5	90,0	80,9	56,0	1,7	80,9	78,7	69,3	83,3	98,1	71,7

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



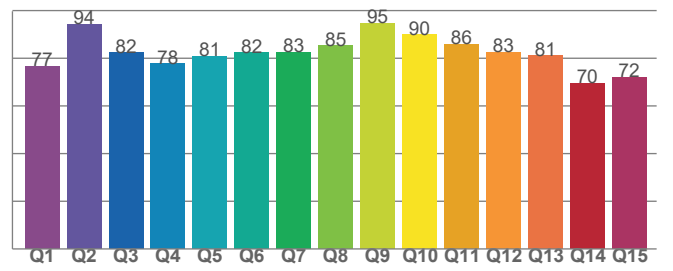
### TM30-18 R<sub>f</sub>-values per hue bin



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
78,0	80,3	78,5	89,5	92,9	93,7	86,5	91,8	86,1	79,8	80,2	84,8	86,9	78,5	83,4	73,5

### Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
76,7	94,2	82,3	77,8	80,9	82,3	82,6	85,2	94,8	89,9	85,9	82,6	81,1	69,6	72,0

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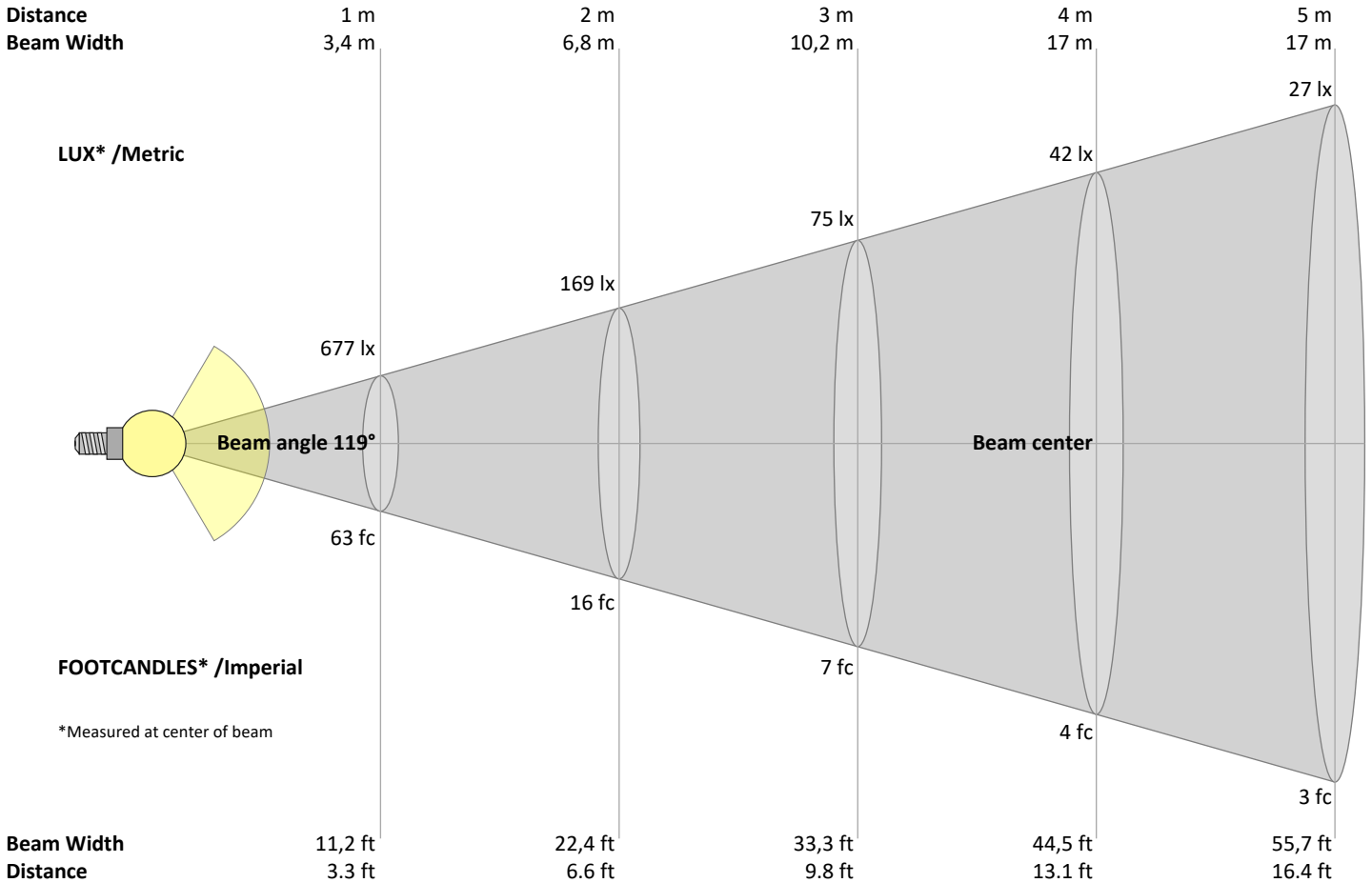
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## Beam Details



### 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
677	169	75	42	27	19	14	11	8	7	6	5	4	3	3	3	2	2	2	2	lux
62,9	15,7	7	3,9	2,5	1,7	1,3	1	0,8	0,6	0,5	0,4	0,4	0,3	0,3	0,2	0,2	0,2	0,2	0,2	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
677	666	638	592	533	463	387	308	231	166	111	76	51	34	22	14	9	6	5	5	cd
100%	98%	94%	88%	79%	68%	57%	45%	34%	25%	16%	11%	8%	5%	3%	2%	1%	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
677	666	638	592	533	463	387	308	231	166	111	76	51	34	22	14	9	6	5	5	cd
100%	98%	94%	88%	79%	68%	57%	45%	34%	25%	16%	11%	8%	5%	3%	2%	1%	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
677	666	638	592	533	463	387	308	231	166	111	76	51	34	22	14	9	6	5	5	cd
100%	98%	94%	88%	79%	68%	57%	45%	34%	25%	16%	11%	8%	5%	3%	2%	1%	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
677	666	638	592	533	463	387	308	231	166	111	76	51	34	22	14	9	6	5	5	cd
100%	98%	94%	88%	79%	68%	57%	45%	34%	25%	16%	11%	8%	5%	3%	2%	1%	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	21,3	22,5	21,7	22,9	23,4	20,4	21,6	20,8	22,0	22,5
	3H	23,2	24,4	23,8	24,9	25,3	22,0	23,2	22,5	23,6	24,0
	4H	24,3	25,4	24,8	25,9	26,3	22,7	23,9	23,3	24,4	24,8
	6H	25,4	26,4	25,9	26,9	27,5	23,5	24,5	24,0	25,0	25,6
	8H	26,0	27,0	26,5	27,5	28,0	23,8	24,9	24,3	25,3	25,9
	12H	26,6	27,6	27,1	28,1	28,7	24,1	25,2	24,6	25,6	26,2
4H	2H	21,8	22,9	22,3	23,4	23,8	21,1	22,2	21,6	22,7	23,1
	3H	24,0	25,0	24,5	25,5	26,1	23,0	24,0	23,5	24,5	25,1
	4H	25,1	26,1	25,7	26,6	27,3	23,8	24,9	24,4	25,3	26,0
	6H	26,4	27,2	27,0	27,7	28,3	24,7	25,6	25,3	26,1	26,6
	8H	27,0	27,8	27,6	28,3	28,9	25,1	25,9	25,7	26,4	27,0
	12H	27,7	28,4	28,4	29,0	29,6	25,5	26,1	26,1	26,7	27,4
8H	4H	25,4	26,2	26,0	26,7	27,3	24,3	25,1	24,9	25,6	26,2
	6H	26,8	27,4	27,5	28,1	28,8	25,4	26,0	26,0	26,6	27,3
	8H	27,6	28,2	28,3	28,8	29,6	25,9	26,4	26,5	27,1	27,9
	12H	28,5	29,0	29,2	29,6	30,4	26,4	26,9	27,1	27,5	28,3
12H	4H	25,4	26,1	26,0	26,7	27,3	24,4	25,0	25,0	25,6	26,2
	6H	26,9	27,5	27,6	28,1	28,9	25,5	26,1	26,2	26,8	27,5
	8H	27,8	28,2	28,5	28,9	29,6	26,1	26,6	26,8	27,3	28,0

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

S = 1.0H	0,1 / 0,0	0,1 / -0,1
S = 1.5H	0,1 / -0,1	0,1 / -0,1
S = 2.0H	0,3 / -0,3	0,2 / -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	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	117	117	117	117	113	113	113	113	106	106	106	99	99	99	93	93	93	90	
1	104	99	93	89	100	95	91	87	89	85	82	84	81	78	78	76	74	71	
2	94	85	77	71	90	82	75	69	77	71	66	72	67	63	68	64	60	57	
3	85	74	65	58	82	72	63	57	67	60	55	63	57	52	59	54	50	48	
4	78	65	56	49	75	63	55	48	59	52	46	56	50	44	53	47	43	40	
5	71	58	49	42	69	56	47	41	53	45	40	50	43	38	47	41	37	34	
6	66	52	43	36	63	51	42	36	48	40	34	45	38	33	43	37	32	30	
7	61	47	38	32	59	46	37	31	43	36	30	41	34	29	39	33	29	26	
8	57	43	34	28	55	42	34	28	40	32	27	38	31	26	36	30	26	23	
9	53	39	31	25	51	38	30	25	36	29	24	35	28	24	33	27	23	21	
10	50	36	28	23	48	35	28	23	34	27	22	32	26	21	31	25	21	19	

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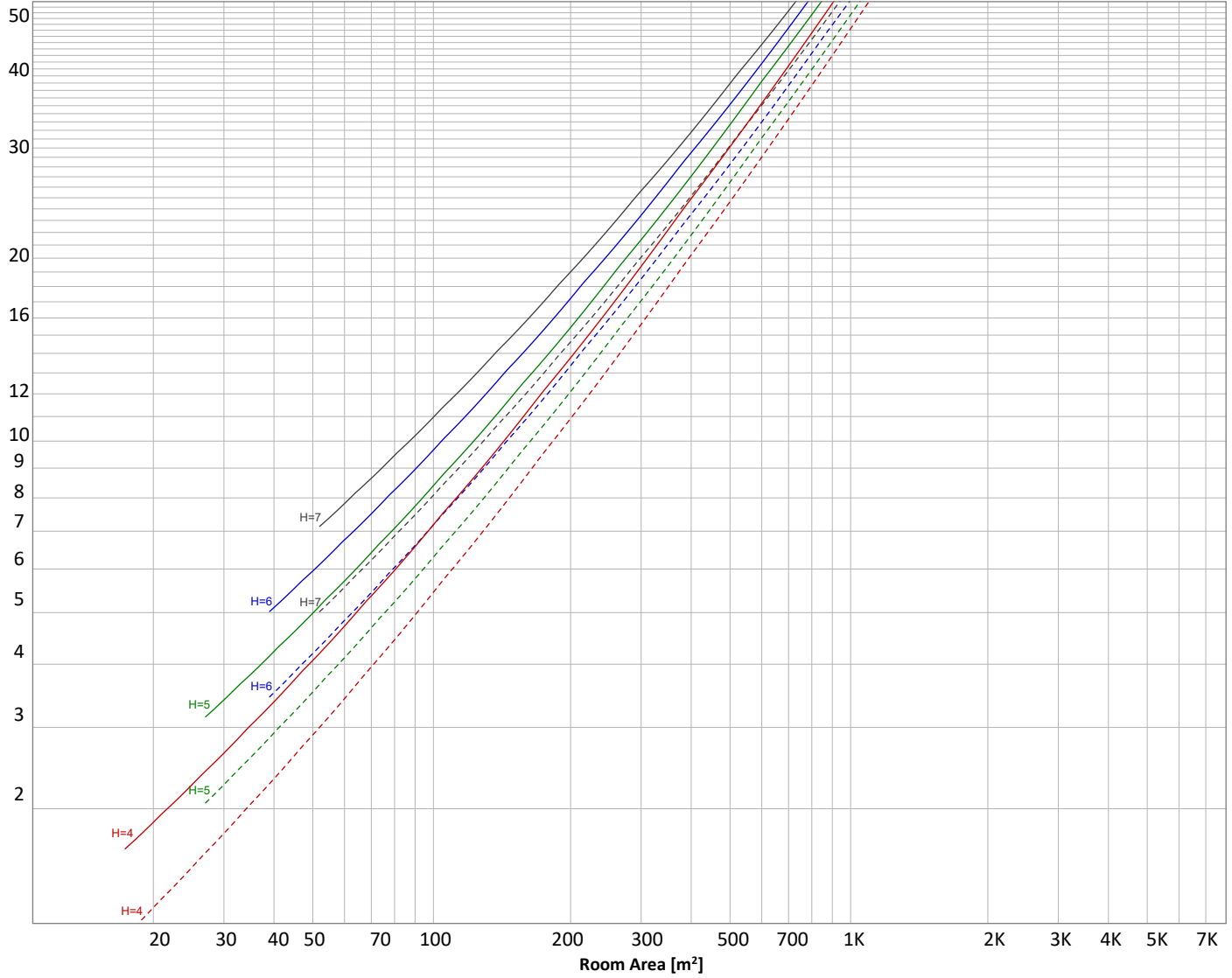
Operator:



## Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



### Conditions

H = Room height	Flux = 2460 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°
64,0 lm	183 lm	278 lm	338 lm	357 lm	338 lm	288 lm	221 lm	152 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
98,6 lm	62,1 lm	37,1 lm	21,0 lm	11,0 lm	5,46 lm	2,82 lm	1,35 lm	0,455 lm

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## Outdoor Light Planning

### Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	64 lm	2,6%
10-20°	183 lm	7,5%
20-30°	278 lm	11,3%
30-40°	338 lm	13,7%
40-50°	357 lm	14,5%
50-60°	338 lm	13,7%
60-70°	288 lm	11,7%
70-80°	221 lm	9,0%
80-90°	152 lm	6,2%
90-100°	99 lm	4,0%
100-110°	62 lm	2,5%
110-120°	37 lm	1,5%
120-130°	21 lm	0,9%
130-140°	11 lm	0,4%
140-150°	5 lm	0,2%
150-160°	3 lm	0,1%
160-170°	1 lm	0,1%
170-180°	0 lm	0,0%
<b>Total</b>	<b>2460 lm</b>	<b>100,0%</b>

### Intensity peaks

Max intensity	677 cd
Intensity, 90°	111 cd
Intensity, 0°	677 cd

### Zonal Lumen summary

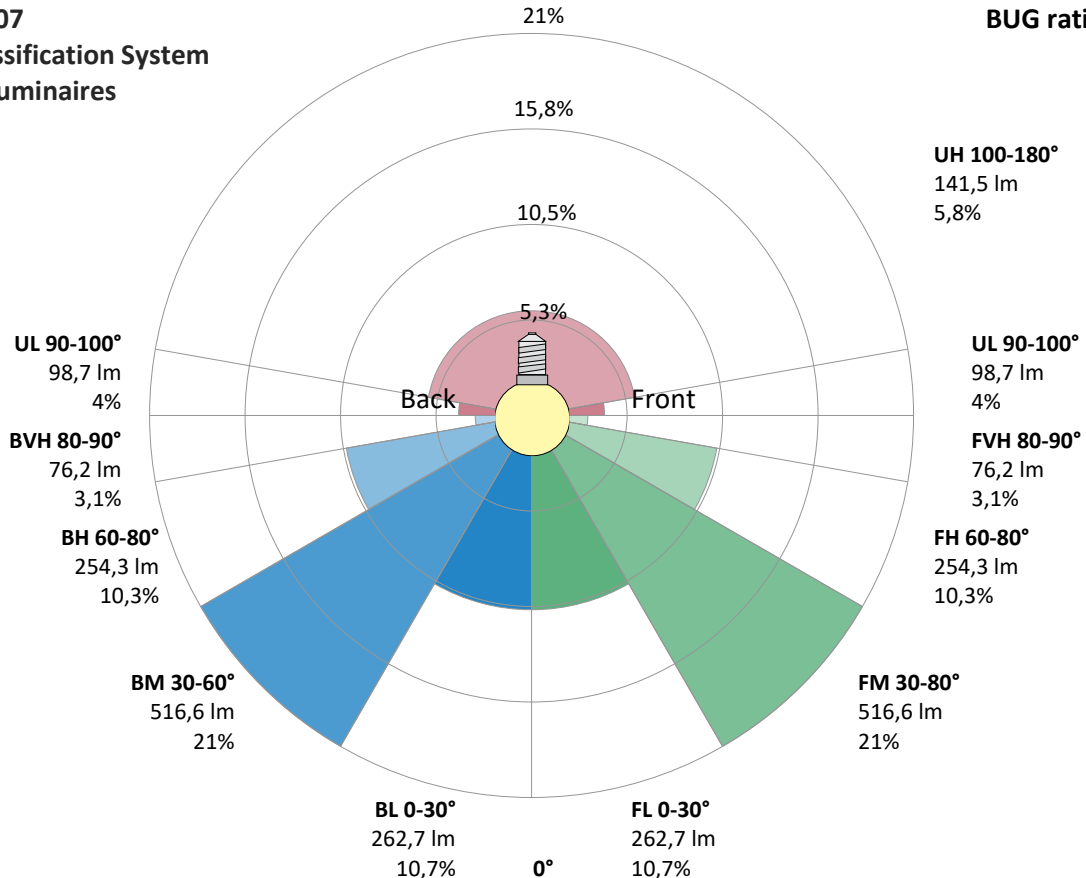
Zone (γ)	Lumen	% Total
0-30°	526 lm	21,4%
0-40°	864 lm	35,1%
0-60°	1559 lm	63,4%
60-90°	661 lm	26,9%
70-100°	472 lm	19,2%
90-120°	198 lm	8,0%
0-90°	2220 lm	90,2%
90-180°	240 lm	9,8%
0-180°	2460 lm	100,0%

### BUG rating

	Lumen	% Total
<b>Forward light</b>		
Low(0-30°)	263 lm	10,7%
Medium(30-60°)	517 lm	21,0%
High(60-80°)	254 lm	10,3%
Very high(80-90°)	76 lm	3,1%
<b>Back light</b>		
Low(0-30°)	263 lm	10,7%
Medium(30-60°)	517 lm	21,0%
High(60-80°)	254 lm	10,3%
Very high(80-90°)	76 lm	3,1%
<b>Uplight</b>		
Low(90-100°)	99 lm	4,0%
High(100-180°)	142 lm	5,8%

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

**BUG rating B1 U3 G1**



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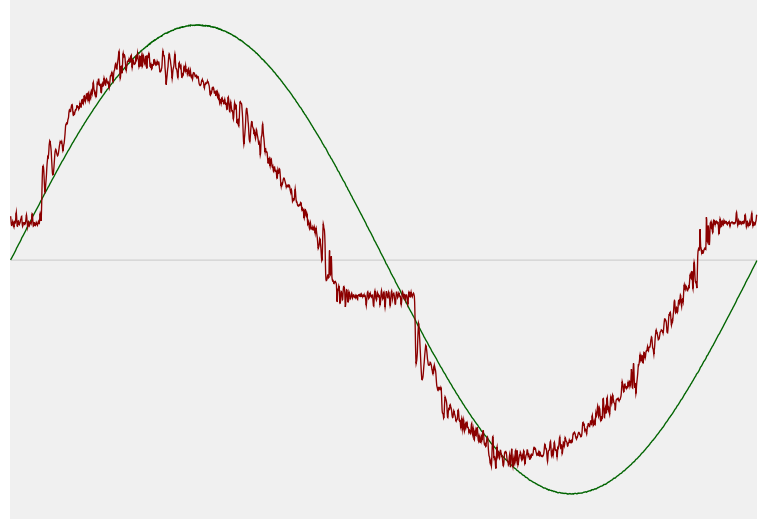


## Power Details

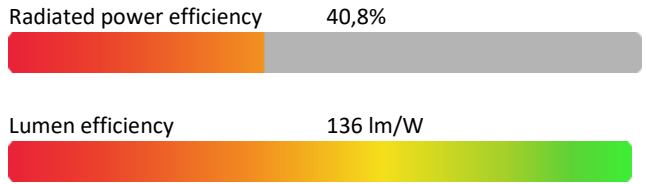
### Input Power

Power feed to light source	18,1 W
Frequency of input power	50 Hz
RMS Input voltage feed, $V_{RMS}$	230 V
RMS Input current feed, $I_{RMS}$	0,085 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	19,49 VA
Displacement factor of AC power feed	0,94
Power factor of AC current feed	0,93
Total harmonic distortion of the current	14,88%
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	2998 K
CCT shift	+2 K
CCT end	3000 K

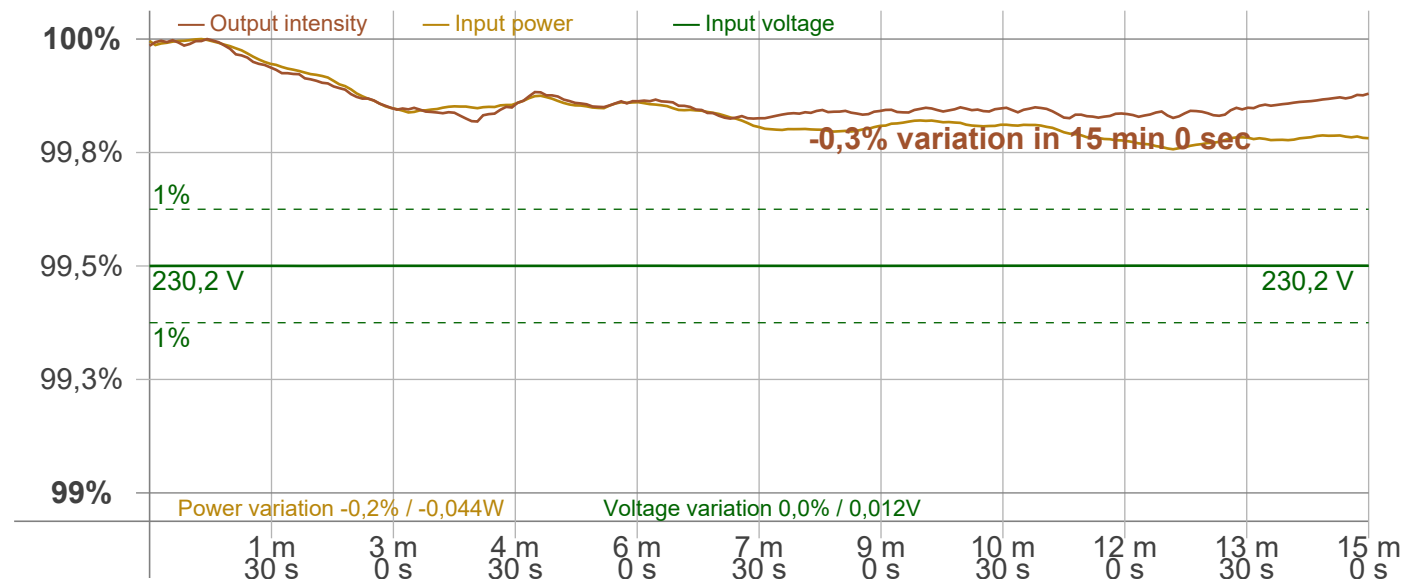
### Warmup Result

Total warmup time	Lamp stabilized in 15 min 0 sec
Warmup variation	-0,3%

### Output Change

Output start	2463 lm
Output change	-3 lm
Output end	2460 lm

### Stabilization Curve



# Light Measurement Report

Print date: 20-2-2025

Measurement date and time: 20-2-2025 11:27:34 – Measurement no. VFR-250220-0078-MS

Measurement tracking No. and Link: [VT250220-004890](https://www.viso-systems.com/VT250220-004890)

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: 63,44 %  
 Flicker index: 0,2

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

JA8/10 40 Hz: 0,14 %  
 JA8/10 90 Hz: 0,49 %  
 JA8/10 200 Hz: 63,56 %  
 JA8/10 400 Hz: 63,02 %  
 JA8/10 1000 Hz: 63,37 %

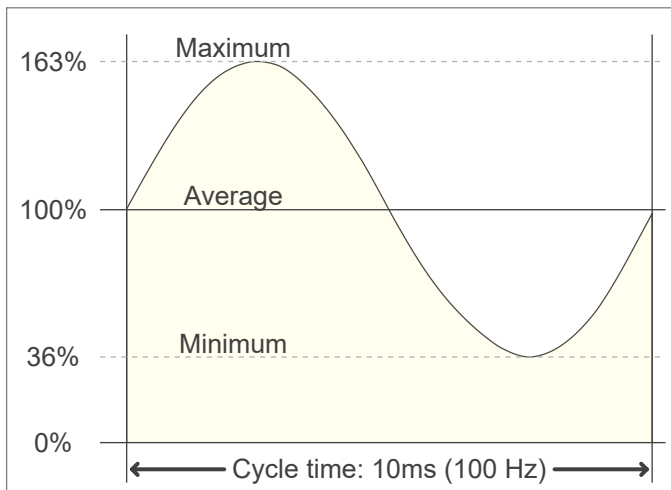
### TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

PstLM value (F < 80 Hz): 0,13  
 SVM value (80 < F < 2000 Hz): 2,48

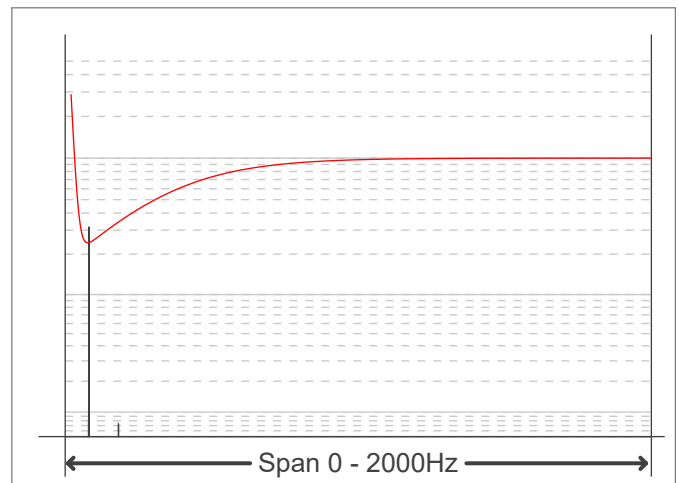
### Flicker indices according to Lighting Research Center (2015)

Perception metric, Assist Mp: 0,08

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



Flicker FFT (flicker curve in frequency domain)



IEEE 1789 Frequency/modulation plot

