

Light Measurement Report

Print date: 26-11-2024

Measurement date and time: 26-11-2024 12:21:27 – Measurement no. VFR-241126-2169-MS

Measurement tracking No. and Link: [VT241126-000162](https://www.viso-systems.com/VT241126-000162)

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
 γ (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°
2,00 m
20,5 W – PF 0,79 – DPF 0,99
230 V – 0,113 A
50 Hz
Lamp stabilized in 15 min 2 sec – 2,0%

Tested Light Source

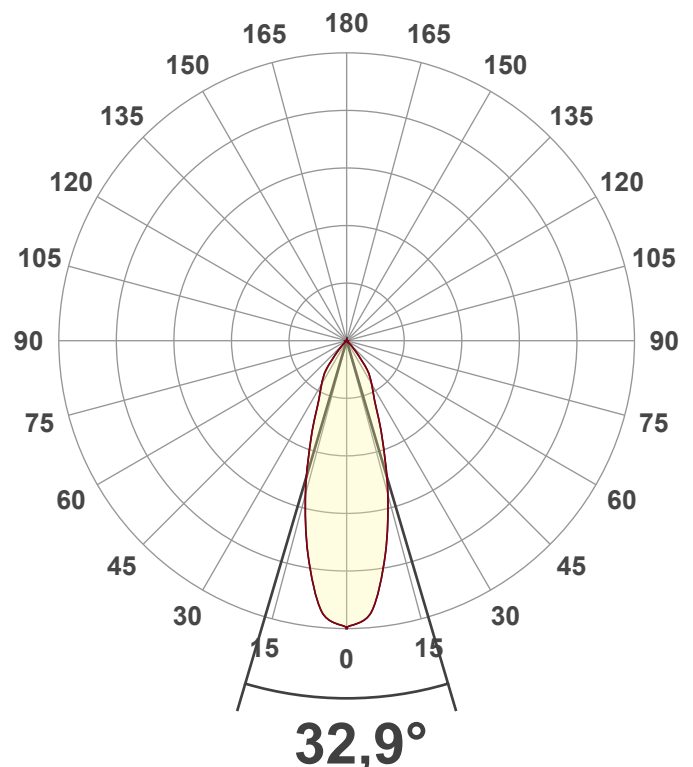
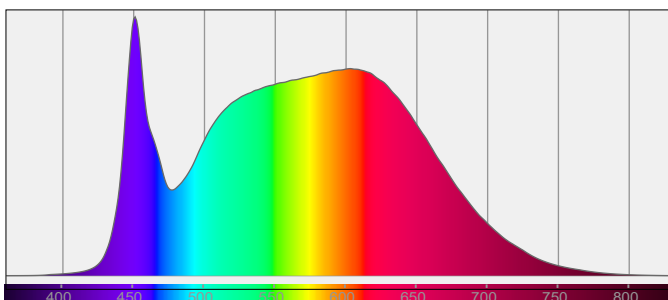
Product Name
Item No. and Manufacturer
Product Description (line 1)
SWITCH

807887-4000K-20W
807887-4000K-20W – Dutchfulfillment
3-FASE RAILSPOT | ROSALIN | 10W-20W-30W | WIT | DIMBAAR | CCT-

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

1705 lm – 0,07% / 99,93%
83 lm/W
3842 cd – 32,9°
CCT = 4000 K / 4252 K
CRI 89,8
R_f 89,2 – R_g 96,5
Duv 0,0052 – SDCM 6,4
SVM 0,04 – PstLM 0,06



Light Measurement Report

Print date: 26-11-2024

Measurement date and time: 26-11-2024 12:21:27 – Measurement no. VFR-241126-2169-MS

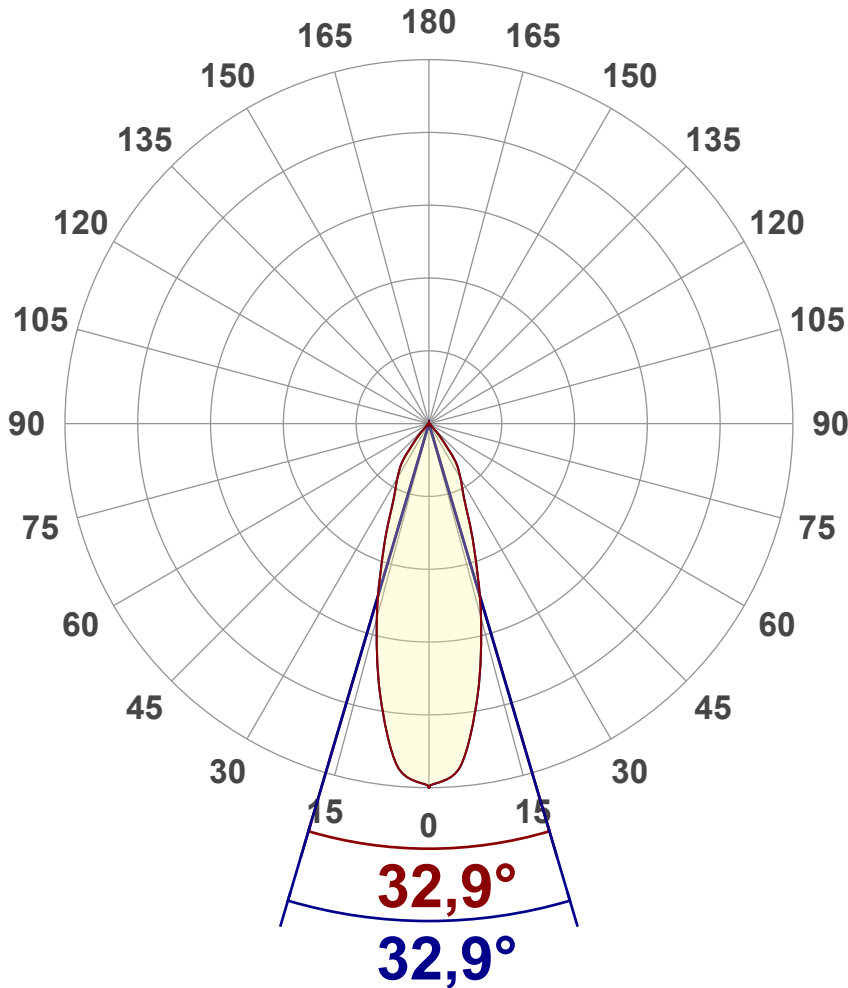
Measurement tracking No. and Link: [VT241126-000162](https://www.viso-systems.com/VT241126-000162)

Operator:



Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

Output (total Lumen)	1705 lm
Lumen Up% / Down%	0,07% / 99,93%
Peak Intensity	3842 cd
Beam Angle (50%)	32,9°
Beam Angle (90%)	32,9°
Beam Angle (10%)	32,9°

Cut-off Angle

Average 2,5%	86,7°
--------------	-------

Field Angle

Average 10%	73,7°
-------------	-------

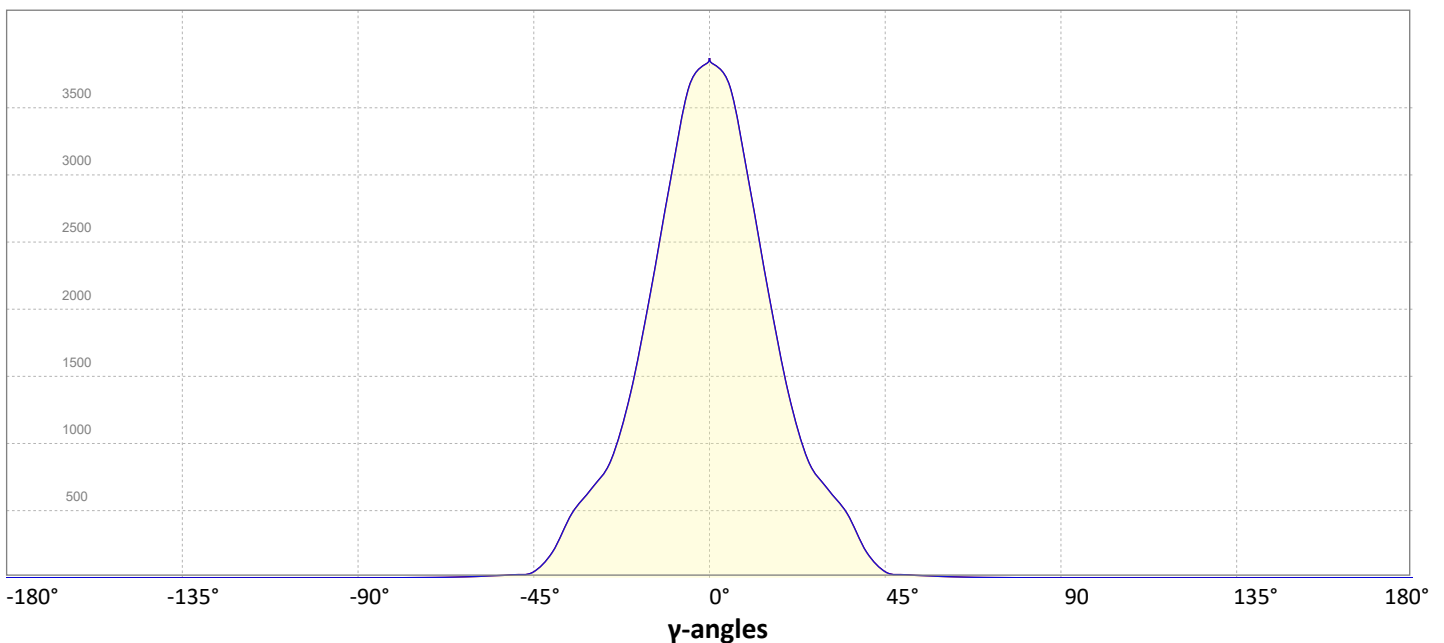
Intensity Ratio

In 120° cone	99,5%
In 90° cone	97,9%

C000-C180

C090-C270

Linear distribution diagram - Intensity (candela) vs γ -angle



Light Measurement Report

Print date: 26-11-2024

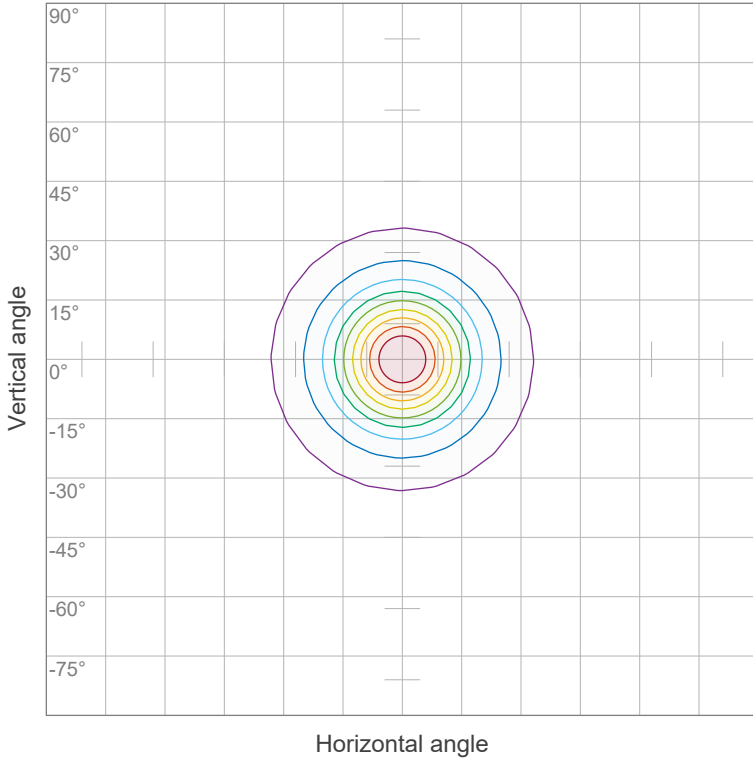
Measurement date and time: 26-11-2024 12:21:27 – Measurement no. VFR-241126-2169-MS

Measurement tracking No. and Link: [VT241126-000162](https://www.viso-systems.com/VT241126-000162)

Operator:



Iso-intensity Diagram (Iso-candela)

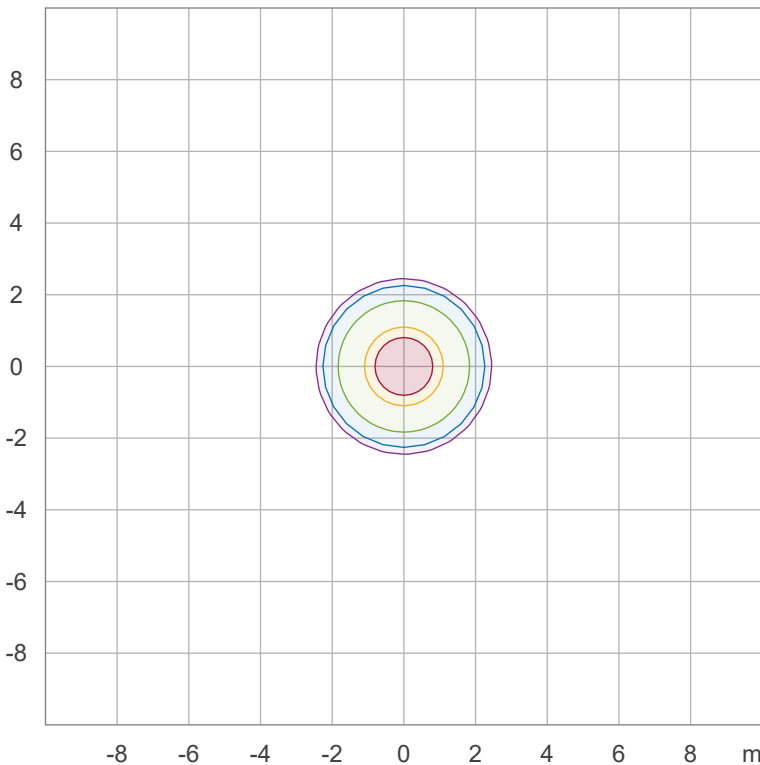


90 %	3458,0 cd
80 %	3073,8 cd
70 %	2689,6 cd
60 %	2305,4 cd
50 %	1921,1 cd
40 %	1536,9 cd
30 %	1152,7 cd
20 %	768,5 cd
10 %	384,2 cd

Peak intensity: 3842,3 cd

Number of c-planes: 12

Iso-illuminance Diagram (Iso-lux)



50,0 %	213,5 lx
30,0 %	128,1 lx
10,0 %	42,7 lx
5,0 %	21,3 lx
3,0 %	12,8 lx

Peak illuminance: 426,9 lx

Mounting height: 3,0 m

Number of c-planes: 12

Light Measurement Report

Print date: 26-11-2024

Measurement date and time: 26-11-2024 12:21:27 – Measurement no. VFR-241126-2169-MS

Measurement tracking No. and Link: [VT241126-000162](#)

Operator:

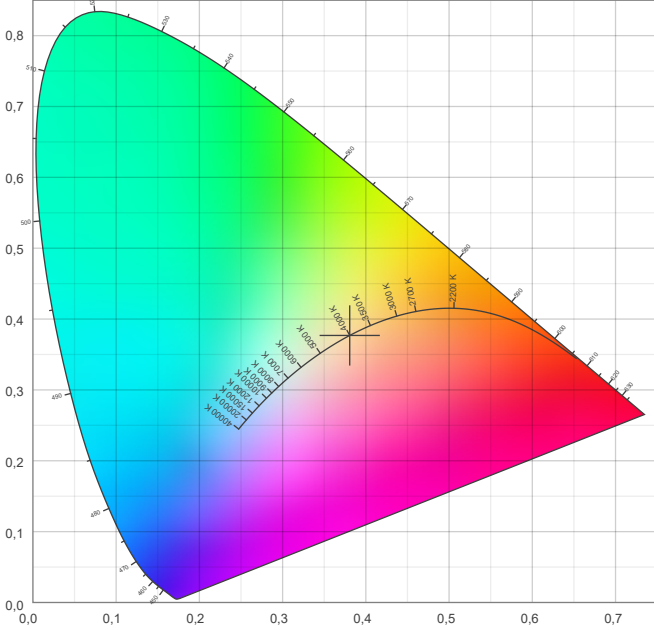


Color details

Correlated Color Temperature, Target CCT = 4000 K
 Correlated Color Temperature, Measured CCT = 4252 K
 Color Rendering Index CRI 89,8
 Color Rendering Index, R9 (red component) R9 = 47,9
 Color Rendering TM30-18 R_f 89,2 – R_g 96,5
 Color Quality Scale CQS = 90,1

MacAdam Steps SDCM = 6,4
 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 = 0,0052
 Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,225;0,502)

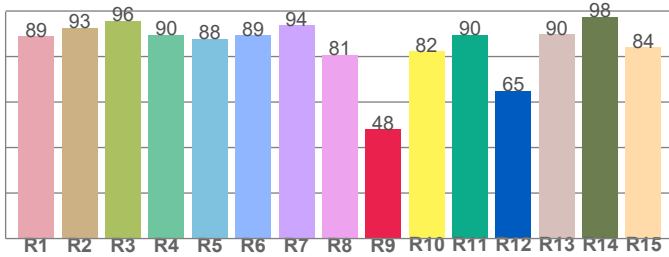
CIE 1931



CIE 1931 – zoomed on Planckian locus



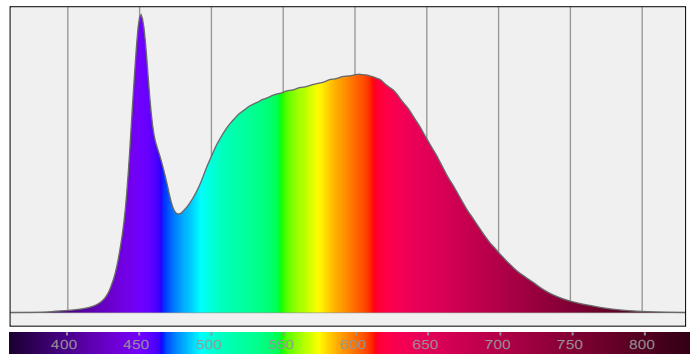
Color Rendering Index per reference color (CIE 1995)



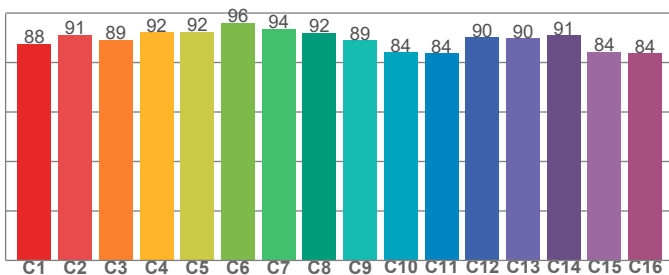
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
88,8	92,6	95,8	89,7	87,8	89,5	93,6	80,7	47,9	82,2	89,5	65,0	89,7	97,6	84,0

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



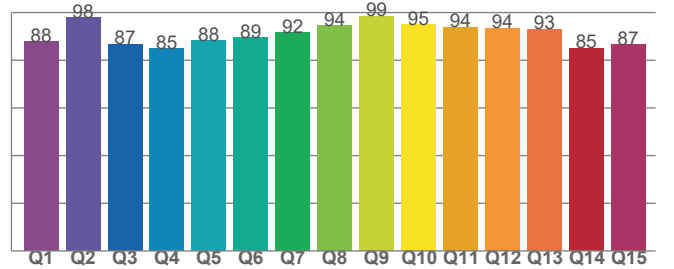
TM30-18 R_f-values per hue bin



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
87,6	91,2	89,2	92,3	92,4	96,1	93,6	92,0	89,0	84,2	83,7	90,2	89,8	91,1	84,3	83,9

Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
87,8	97,8	86,8	84,8	88,3	89,4	91,5	94,5	98,6	95,0	93,9	93,6	93,0	85,0	86,6

Light Measurement Report

Print date: 26-11-2024

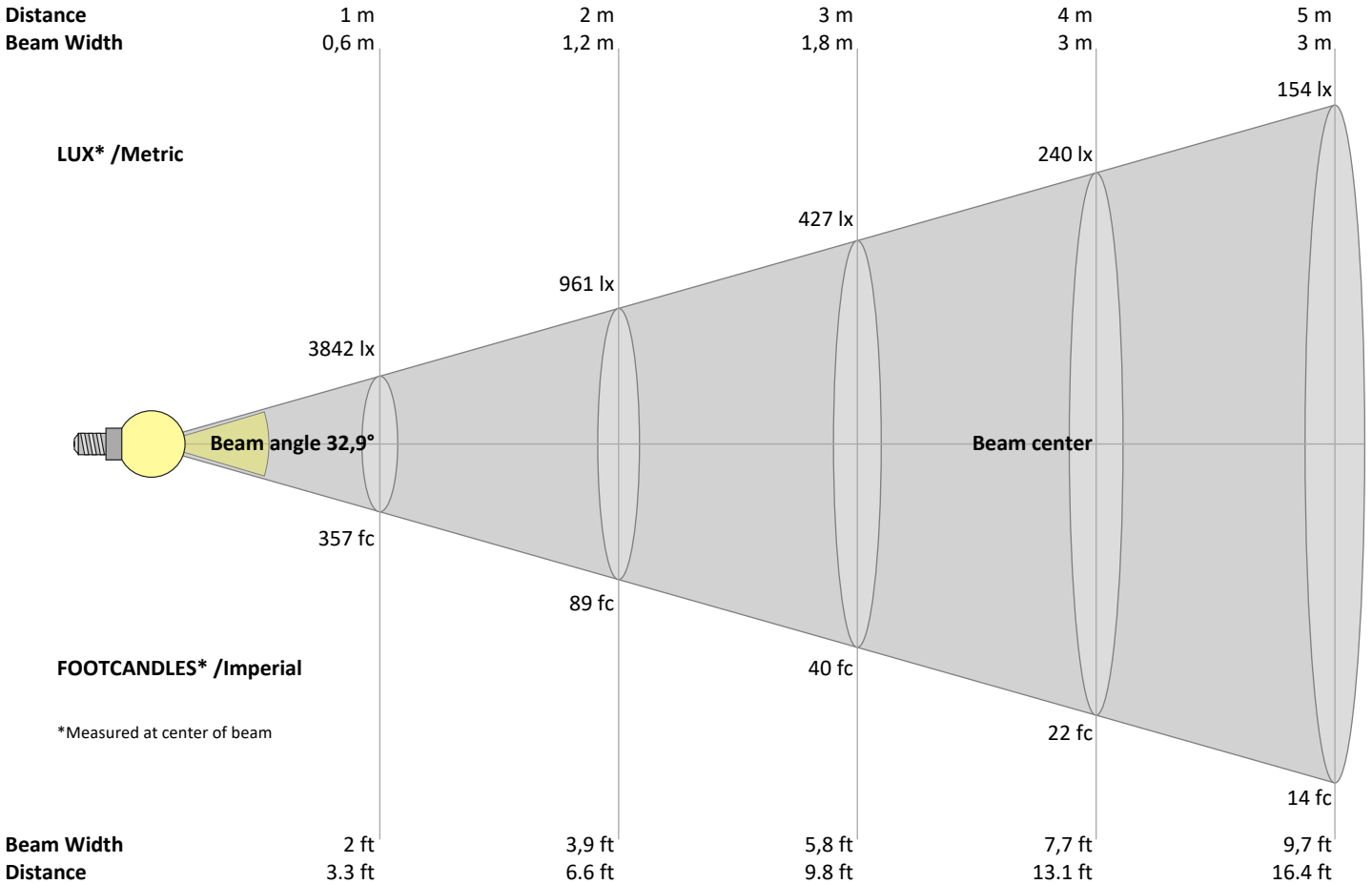
Measurement date and time: 26-11-2024 12:21:27 – Measurement no. VFR-241126-2169-MS

Measurement tracking No. and Link: [VT241126-000162](https://www.viso-systems.com/VT241126-000162)

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
3842	961	427	240	154	107	78	60	47	38	32	27	23	20	17	15	13	12	11	10	lux
357	89,2	39,7	22,3	14,3	9,9	7,3	5,6	4,4	3,6	3	2,5	2,1	1,8	1,6	1,4	1,2	1,1	1	0,9	fc

Intensities in 0° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
3842	3777	3703	3544	3249	2955	2631	2303	1990	1697	1405	1195	996	842	757	672	598	524	434	319	cd
100%	98%	96%	92%	85%	77%	68%	60%	52%	44%	37%	31%	26%	22%	20%	17%	16%	14%	11%	8%	of 0°val

Intensities in 90° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
3842	3777	3703	3544	3249	2955	2631	2303	1990	1697	1405	1195	996	842	757	672	598	524	434	319	cd
100%	98%	96%	92%	85%	77%	68%	60%	52%	44%	37%	31%	26%	22%	20%	17%	16%	14%	11%	8%	of 0°val

Intensities in 180° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
3842	3777	3703	3544	3249	2955	2631	2303	1990	1697	1405	1195	996	842	757	672	598	524	434	319	cd
100%	98%	96%	92%	85%	77%	68%	60%	52%	44%	37%	31%	26%	22%	20%	17%	16%	14%	11%	8%	of 0°val

Intensities in 270° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
3842	3777	3703	3544	3249	2955	2631	2303	1990	1697	1405	1195	996	842	757	672	598	524	434	319	cd
100%	98%	96%	92%	85%	77%	68%	60%	52%	44%	37%	31%	26%	22%	20%	17%	16%	14%	11%	8%	of 0°val

Light Measurement Report

Print date: 26-11-2024

Measurement date and time: 26-11-2024 12:21:27 – Measurement no. VFR-241126-2169-MS

Measurement tracking No. and Link: [VT241126-000162](#)

Operator:



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	18,6	19,2	18,7	19,4	19,6	18,6	19,2	18,7	19,4	19,6
	3H	18,3	19,0	18,7	19,2	19,4	18,3	19,0	18,7	19,2	19,4
	4H	18,2	18,9	18,6	19,1	19,4	18,2	18,9	18,6	19,1	19,4
	6H	18,2	18,8	18,5	19,1	19,4	18,2	18,8	18,5	19,1	19,4
	8H	18,2	18,7	18,5	19,0	19,4	18,2	18,7	18,5	19,0	19,4
	12H	18,1	18,6	18,5	19,0	19,4	18,1	18,6	18,5	19,0	19,4
4H	2H	18,2	18,9	18,6	19,1	19,4	18,2	18,9	18,6	19,1	19,4
	3H	18,1	18,7	18,5	19,0	19,4	18,1	18,7	18,5	19,0	19,4
	4H	18,0	18,5	18,4	18,9	19,4	18,0	18,5	18,4	18,9	19,4
	6H	17,9	18,4	18,4	18,8	19,1	17,9	18,4	18,4	18,8	19,1
	8H	17,9	18,3	18,4	18,7	19,0	17,9	18,3	18,4	18,7	19,0
	12H	17,8	18,2	18,3	18,6	19,0	17,8	18,2	18,3	18,6	19,0
8H	4H	17,9	18,3	18,4	18,7	19,0	17,9	18,3	18,4	18,7	19,0
	6H	17,8	18,1	18,3	18,6	19,1	17,8	18,1	18,3	18,6	19,1
	8H	17,8	18,0	18,3	18,6	19,2	17,8	18,0	18,3	18,6	19,2
	12H	17,7	17,9	18,3	18,4	19,0	17,7	17,9	18,3	18,4	19,0
12H	4H	17,8	18,2	18,3	18,6	19,0	17,8	18,2	18,3	18,6	19,0
	6H	17,8	18,0	18,3	18,6	19,2	17,8	18,0	18,3	18,6	19,2
	8H	17,7	17,9	18,3	18,4	19,0	17,7	17,9	18,3	18,4	19,0

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

S = 1.0H	5,1 / -12,3	5,1 / -12,3
S = 1.5H	7,8 / -15,3	7,8 / -15,3
S = 2.0H	9,7 / -17,9	9,7 / -17,9

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	102	102	102	100
1	114	111	109	107	112	109	107	105	105	104	102	102	100	99	98	97	96	95
2	109	105	101	98	107	103	100	97	100	97	95	97	95	93	94	92	91	89
3	104	98	94	90	102	97	93	90	95	91	88	92	89	87	90	88	86	84
4	100	93	88	84	98	92	87	84	90	86	83	88	84	82	86	83	81	79
5	95	88	83	79	94	87	82	79	85	81	78	84	80	77	82	79	77	75
6	91	83	78	74	90	83	78	74	81	77	74	80	76	73	79	75	73	71
7	88	79	74	70	86	79	74	70	77	73	70	76	72	69	75	72	69	68
8	84	76	70	67	83	75	70	66	74	69	66	73	69	66	72	68	66	64
9	81	72	67	63	80	72	67	63	71	66	63	70	66	63	69	65	63	61
10	78	69	64	60	77	69	64	60	68	63	60	67	63	60	66	63	60	59

Light Measurement Report

Print date: 26-11-2024

Measurement date and time: 26-11-2024 12:21:27 – Measurement no. VFR-241126-2169-MS

Measurement tracking No. and Link: [VT241126-000162](https://www.viso-systems.com/VT241126-000162)

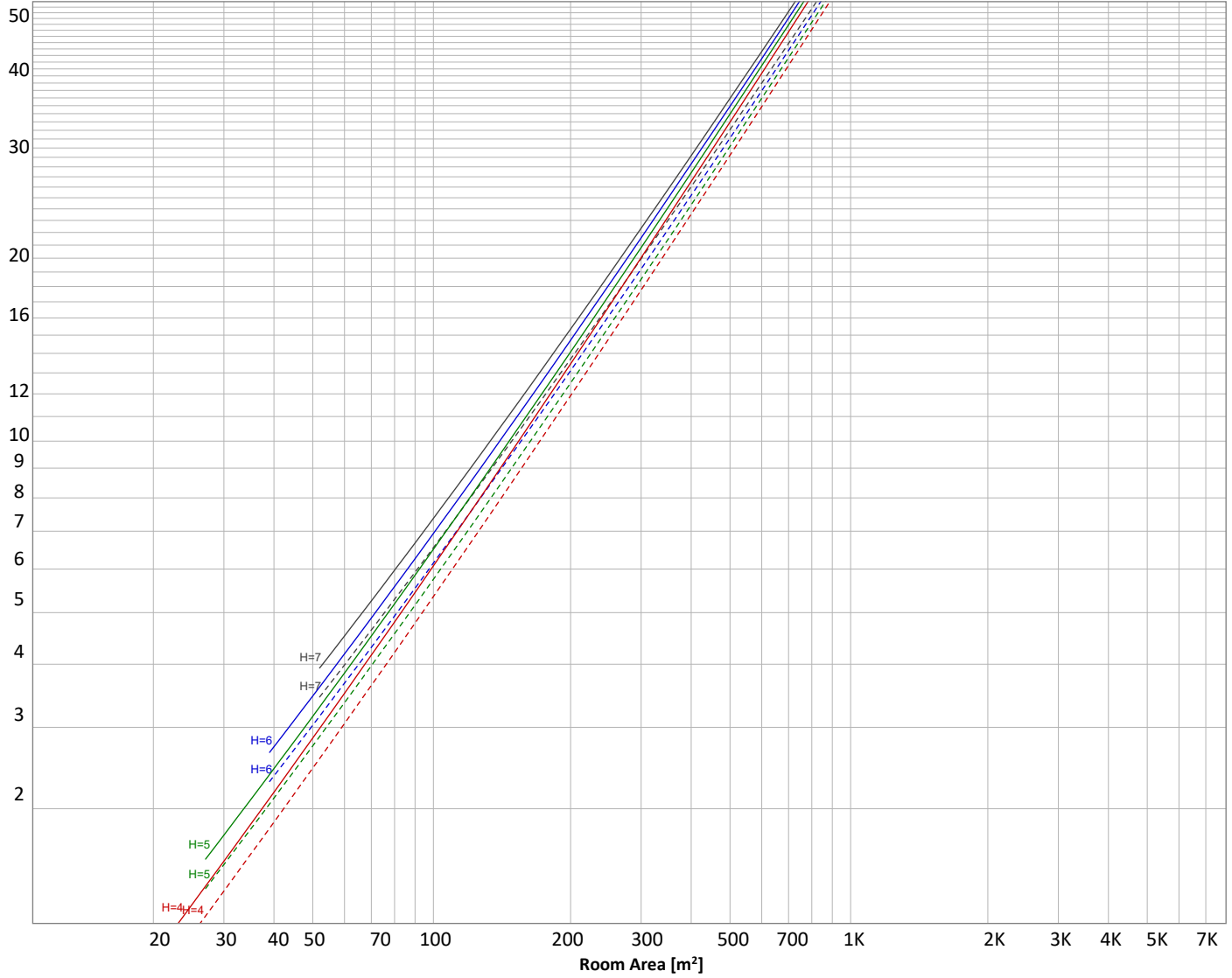
Operator:



Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 1705 lm				
H _{down} = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	ρ(%) Wall reflectance	Floor reflectance
H _{work} = Work area height from floor =	0.00 m	-----	70	50	30
E _{work} = 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°
322 lm	585 lm	433 lm	284 lm	57,8 lm	14,0 lm	5,24 lm	1,60 lm	0,283 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
0,123 lm	0,095 lm	0,087 lm	0,105 lm	0,131 lm	0,181 lm	0,227 lm	0,207 lm	0,066 lm

Light Measurement Report

Print date: 26-11-2024

Measurement date and time: 26-11-2024 12:21:27 – Measurement no. VFR-241126-2169-MS

Measurement tracking No. and Link: [VT241126-000162](https://www.viso-systems.com/VT241126-000162)

Operator:



Outdoor Light Planning

Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	322 lm	18,9%
10-20°	585 lm	34,3%
20-30°	433 lm	25,4%
30-40°	284 lm	16,7%
40-50°	58 lm	3,4%
50-60°	14 lm	0,8%
60-70°	5 lm	0,3%
70-80°	2 lm	0,1%
80-90°	0 lm	0,0%
90-100°	0 lm	0,0%
100-110°	0 lm	0,0%
110-120°	0 lm	0,0%
120-130°	0 lm	0,0%
130-140°	0 lm	0,0%
140-150°	0 lm	0,0%
150-160°	0 lm	0,0%
160-170°	0 lm	0,0%
170-180°	0 lm	0,0%
Total	1705 lm	100,0%

Intensity peaks

Max intensity	3842 cd
Intensity, 90°	0 cd
Intensity, 0°	3842 cd

Zonal Lumen summary

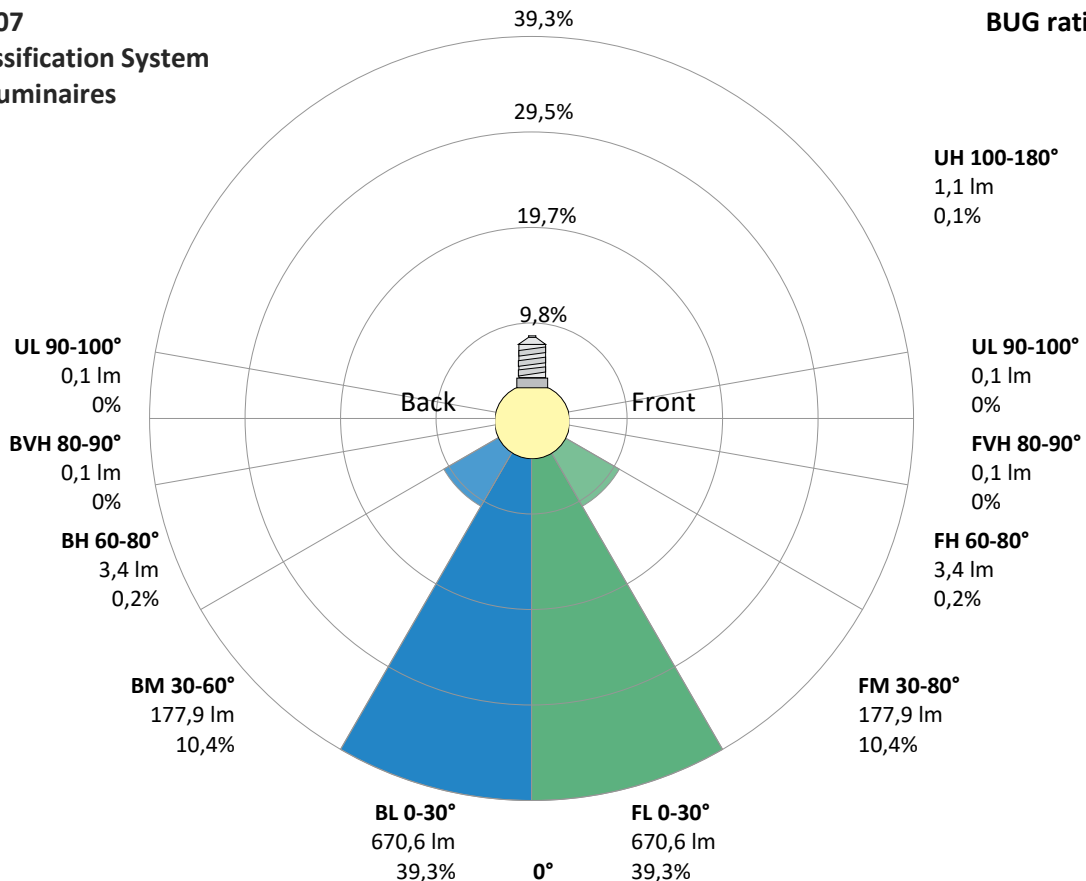
Zone (γ)	Lumen	% Total
0-30°	1341 lm	78,6%
0-40°	1625 lm	95,3%
0-60°	1697 lm	99,5%
60-90°	7 lm	0,4%
70-100°	2 lm	0,1%
90-120°	0 lm	0,0%
0-90°	1704 lm	99,9%
90-180°	1 lm	0,1%
0-180°	1705 lm	100,0%

BUG rating

	Lumen	% Total
Forward light		
Low(0-30°)	671 lm	39,3%
Medium(30-60°)	178 lm	10,4%
High(60-80°)	3 lm	0,2%
Very high(80-90°)	0 lm	0,0%
Back light		
Low(0-30°)	671 lm	39,3%
Medium(30-60°)	178 lm	10,4%
High(60-80°)	3 lm	0,2%
Very high(80-90°)	0 lm	0,0%
Uplight		
Low(90-100°)	0 lm	0,0%
High(100-180°)	1 lm	0,1%

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

BUG rating B2 U1 G0



Light Measurement Report

Print date: 26-11-2024

Measurement date and time: 26-11-2024 12:21:27 – Measurement no. VFR-241126-2169-MS

Measurement tracking No. and Link: [VT241126-000162](#)

Operator:

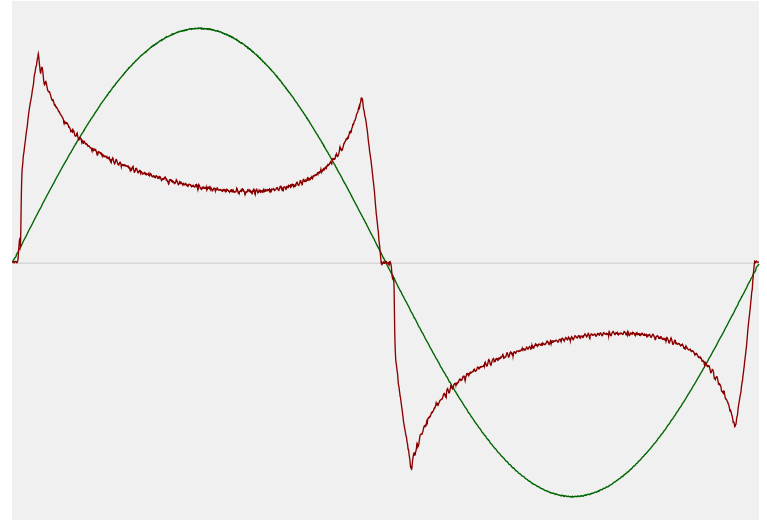


Power Details

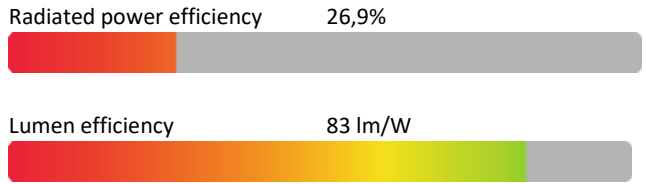
Input Power

Power feed to light source	20,5 W
Frequency of input power	50 Hz
RMS Input voltage feed, V_{RMS}	230 V
RMS Input current feed, I_{RMS}	0,113 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	26,1 VA
Displacement factor of AC power feed	0,99
Power factor of AC current feed	0,79
Total harmonic distortion of the current	75,98%
Total harmonic distortion of the voltage	0,12%

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

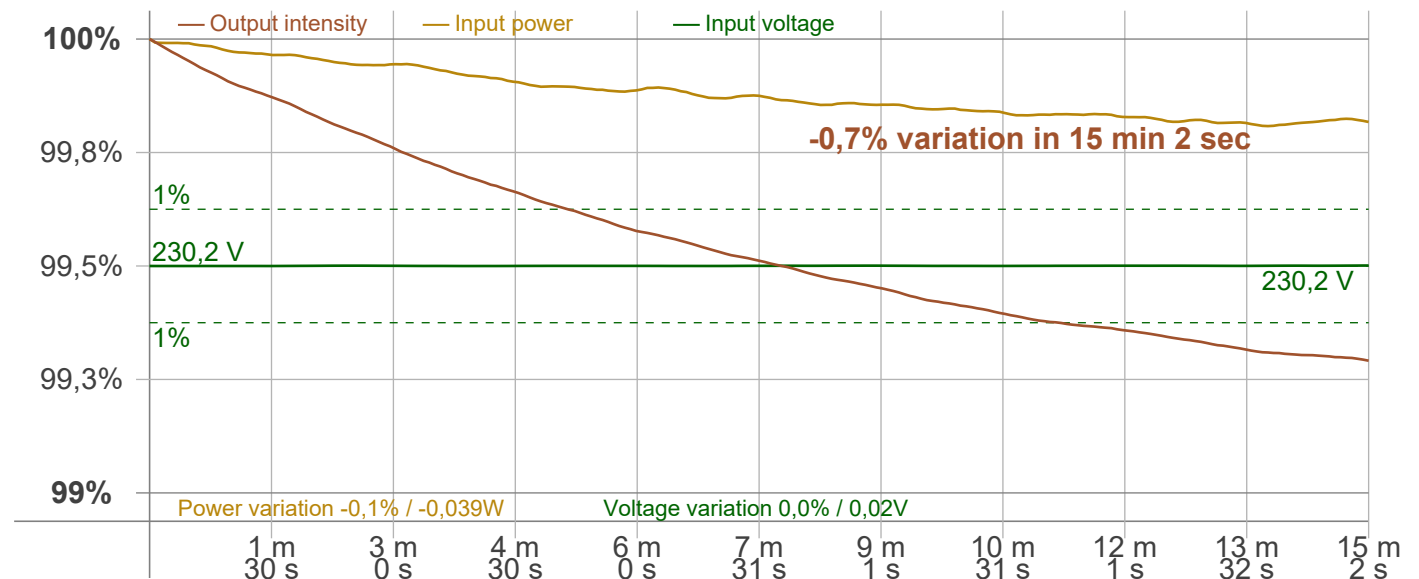
Warmup Result

Total warmup time	Lamp stabilized in 15 min 2 sec
Warmup variation	-0,7%

Output Change

Output start	1718 lm
Output change	-12 lm
Output end	1705 lm

Stabilization Curve



Light Measurement Report

Print date: 26-11-2024

Measurement date and time: 26-11-2024 12:21:27 – Measurement no. VFR-241126-2169-MS

Measurement tracking No. and Link: [VT241126-000162](https://www.viso-systems.com/VT241126-000162)

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: 99,5 Hz
 Percent Flicker: 1,38 %
 Flicker index: 0

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

JA8/10 40 Hz: 0,05 %
 JA8/10 90 Hz: 0,05 %
 JA8/10 200 Hz: 1,19 %
 JA8/10 400 Hz: 1,3 %
 JA8/10 1000 Hz: 1,37 %

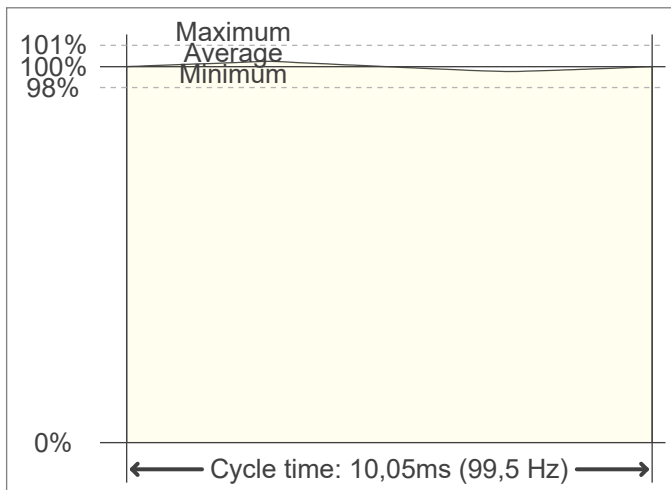
TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

PstLM value (F < 80 Hz): 0,06
 SVM value (80 < F < 2000 Hz): 0,04

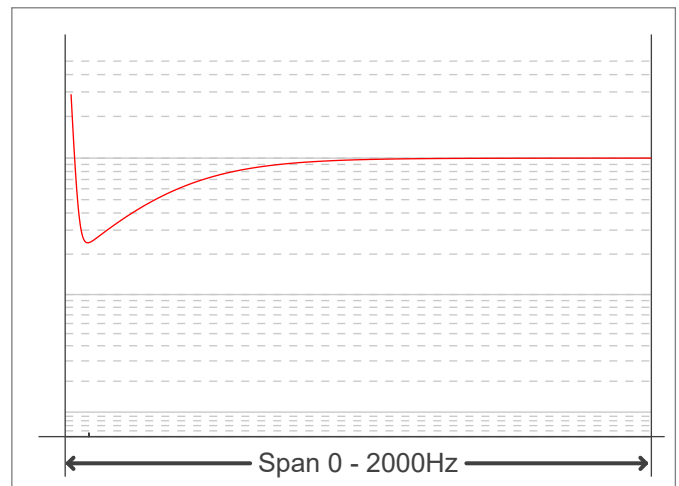
Flicker indices according to Lighting Research Center (2015)

Perception metric, Assist Mp: 0,03

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



Flicker FFT (flicker curve in frequency domain)



IEEE 1789 Frequency/modulation plot

