

Light Measurement Report

Print date: 4-12-2024

Measurement date and time: 4-12-2024 14:44:09 – Measurement no. VFR-241204-2391-MS

Measurement tracking No. and Link: [VT241204-008962](#)

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°
11,90 m
17,8 W – PF 0,55 – DPF 0,84
230 V – 0,141 A
50 Hz
Lamp stabilized in 15 min 2 sec – 2,0%

Tested Light Source

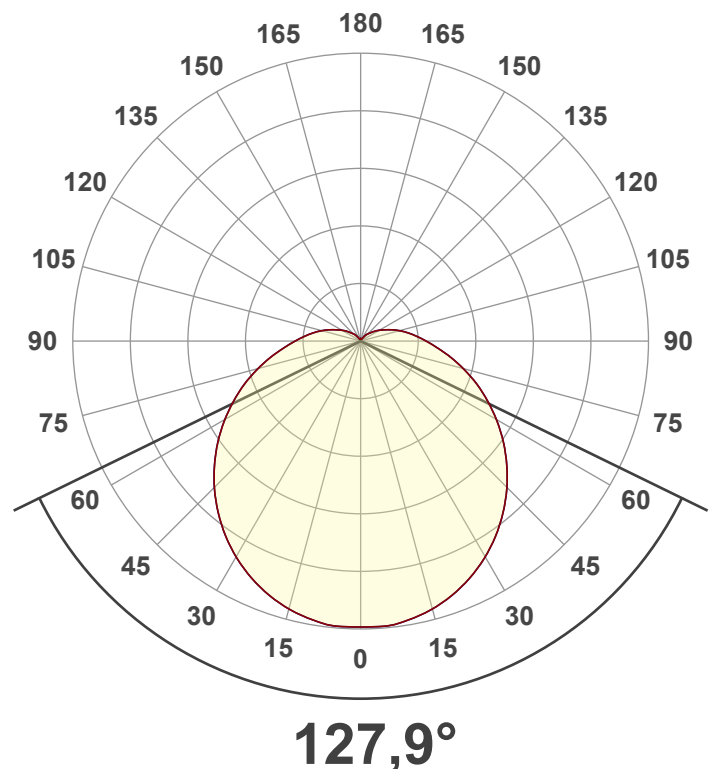
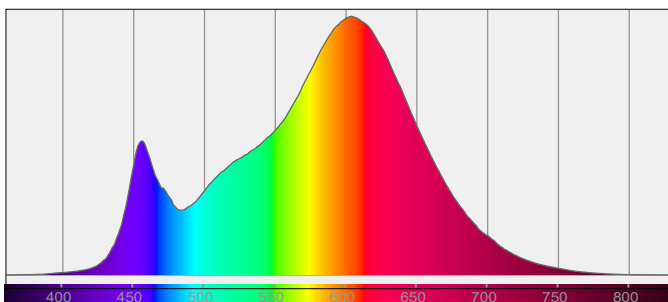
Product Name
Item No. and Manufacturer
Product Description (line 1)

276826-3000K
276826-3000K – Dutchfulfillment
T5 BALK | KOPPELBAAR | 120CM | 18W

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

1707 lm – 13,47% / 86,53%
96 lm/W
413 cd – 127,9°
CCT = 3000 K / 2966 K
CRI 83,7
 R_f 85,4 – R_g 94,8
Duv -0,0031 – SDCM 3,1
SVM 0,01 – PstLM 0,02



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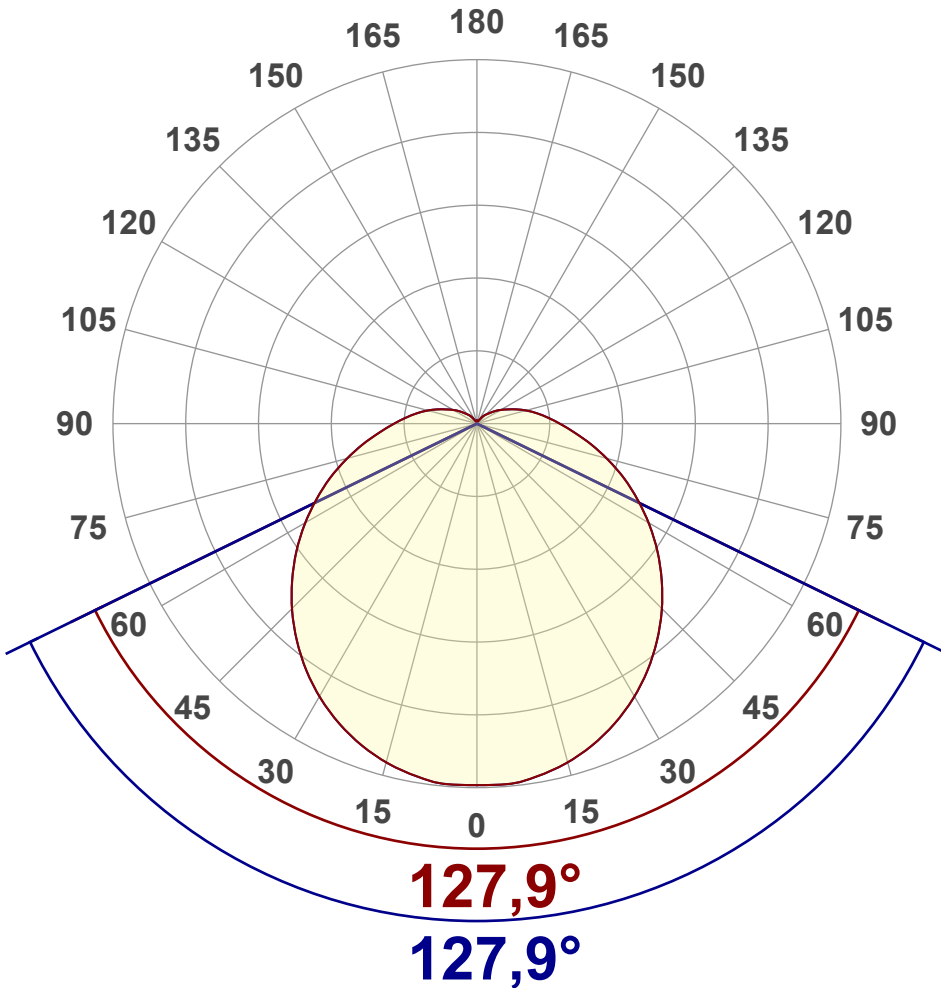
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Operator:



Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

Output (total Lumen)	1707 lm
Lumen Up% / Down%	13,47% / 86,53%
Peak Intensity	413 cd
Beam Angle (50%)	127,9°
Beam Angle (90%)	127,9°
Beam Angle (10%)	127,9°

Cut-off Angle

Average 2,5%	281,8°
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Field Angle

Average 10%	226,7°
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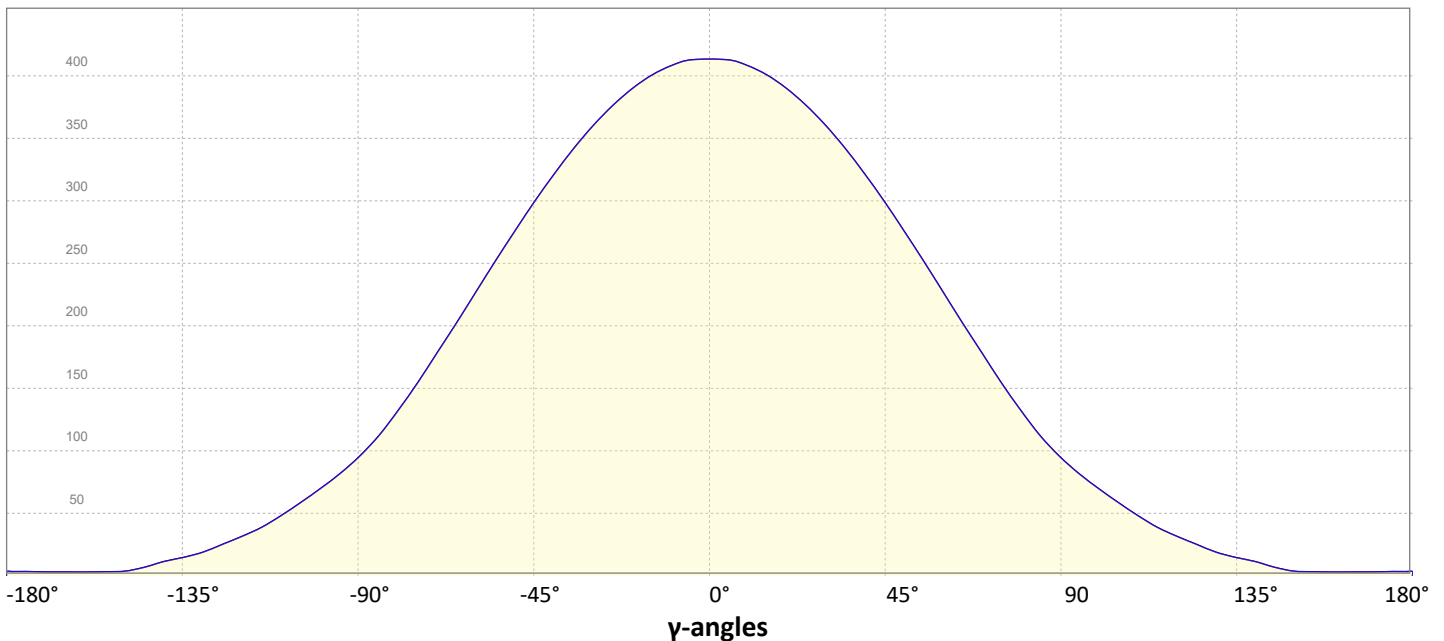
Intensity Ratio

In 120° cone	58,2%
In 90° cone	38,2%

C000-C180

C090-C270

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



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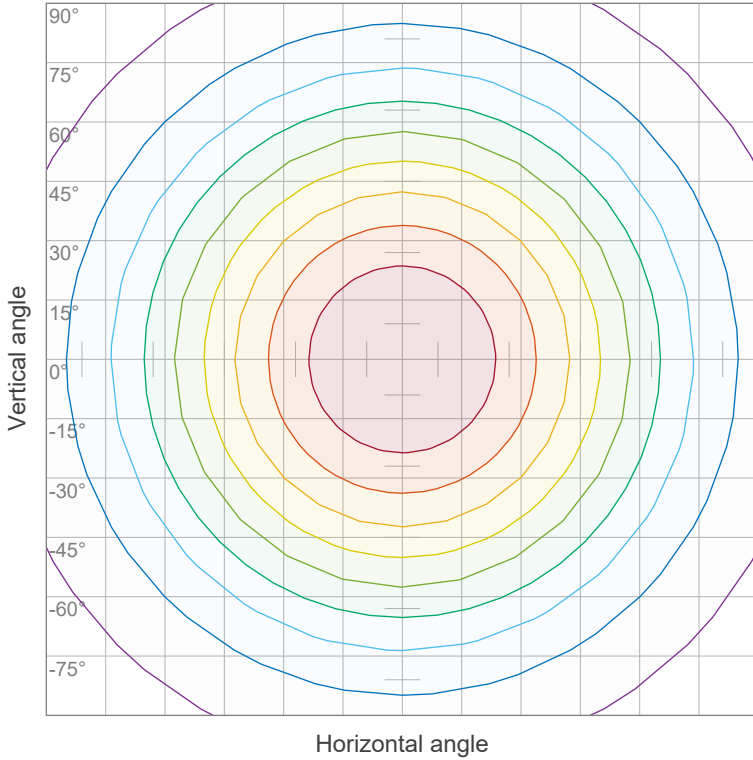
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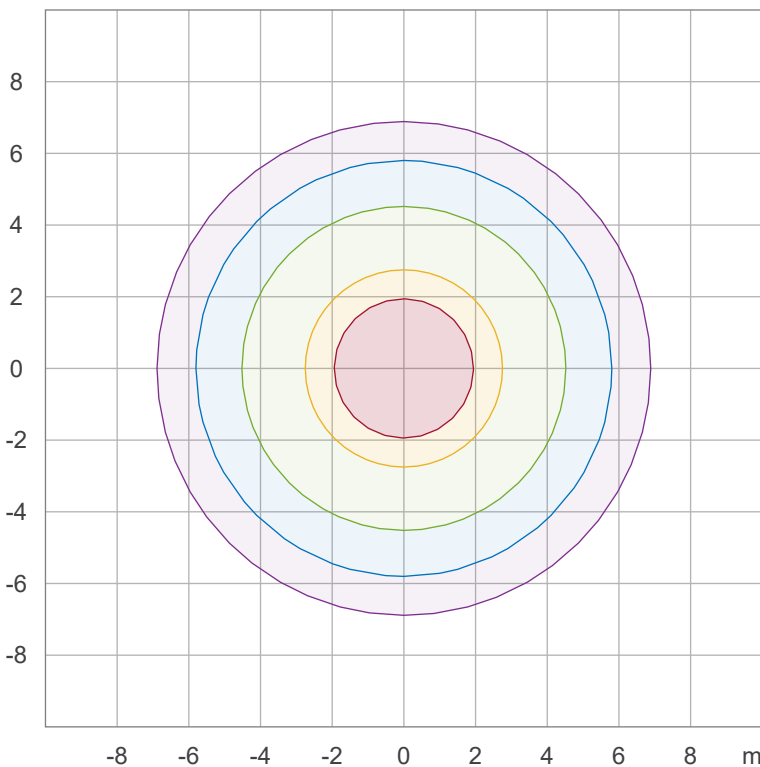
Iso-intensity Diagram (Iso-candela)



90 %	371,5 cd
80 %	330,3 cd
70 %	289,0 cd
60 %	247,7 cd
50 %	206,4 cd
40 %	165,1 cd
30 %	123,8 cd
20 %	82,6 cd
10 %	41,3 cd

Peak intensity: 412,8 cd
Number of c-planes: 12

Iso-illuminance Diagram (Iso-lux)



50,0 %	22,9 lx
30,0 %	13,8 lx
10,0 %	4,6 lx
5,0 %	2,3 lx
3,0 %	1,4 lx

Peak illuminance: 45,9 lx
Mounting height: 3,0 m
Number of c-planes: 12

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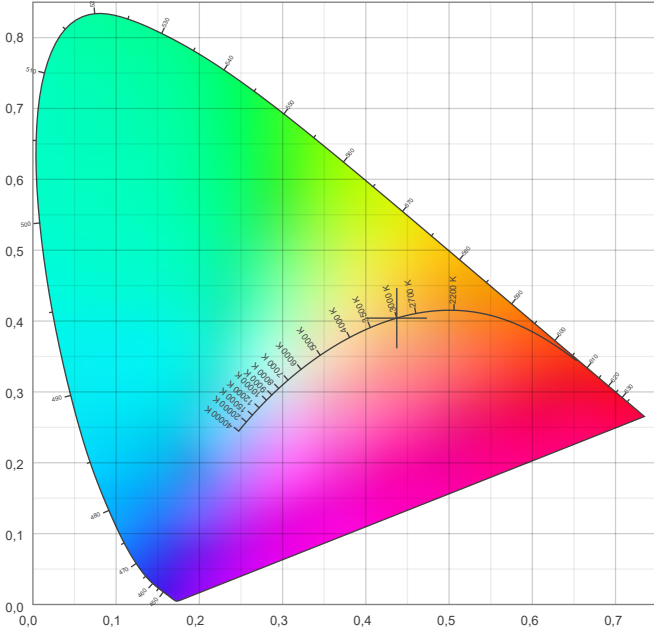


Color details

Correlated Color Temperature, Target CCT = 3000 K
 Correlated Color Temperature, Measured CCT = 2966 K
 Color Rendering Index CRI 83,7
 Color Rendering Index, R9 (red component) R9 = 12,1
 Color Rendering TM30-18 R_f 85,4 – R_g 94,8
 Color Quality Scale CQS = 82,8

MacAdam Steps
 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 = -0,0031
 Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,251;0,521)

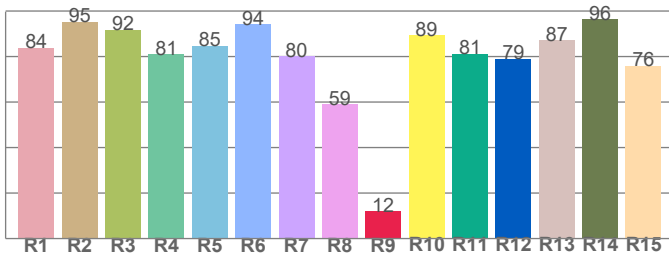
CIE 1931



CIE 1931 – zoomed on Planckian locus



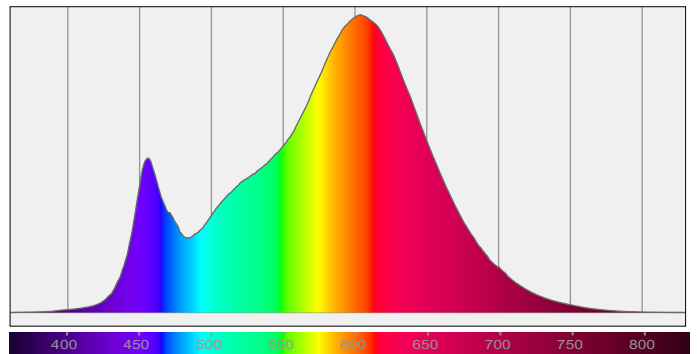
Color Rendering Index per reference color (CIE 1995)



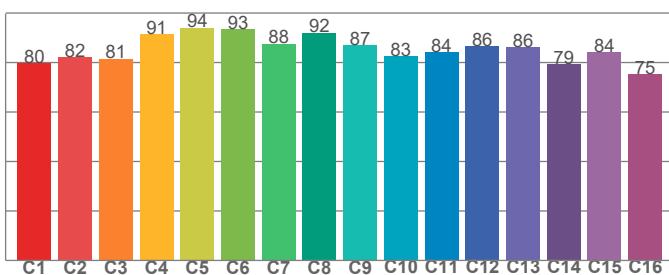
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
83,9	95,3	91,8	81,0	84,7	94,1	80,2	58,9	12,1	89,4	81,2	79,0	87,2	96,3	76,0

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



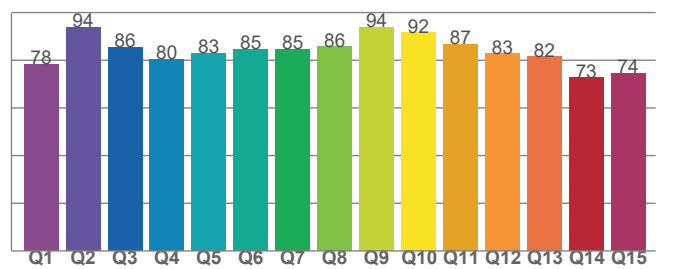
TM30-18 R_f-values per hue bin



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
79,8	82,1	81,5	91,4	94,1	93,4	87,5	92,0	86,9	82,5	84,2	86,5	86,1	79,2	84,2	75,2

Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
78,3	93,7	85,5	80,4	82,9	84,6	84,6	85,7	93,8	91,6	86,8	82,8	81,5	72,7	74,5

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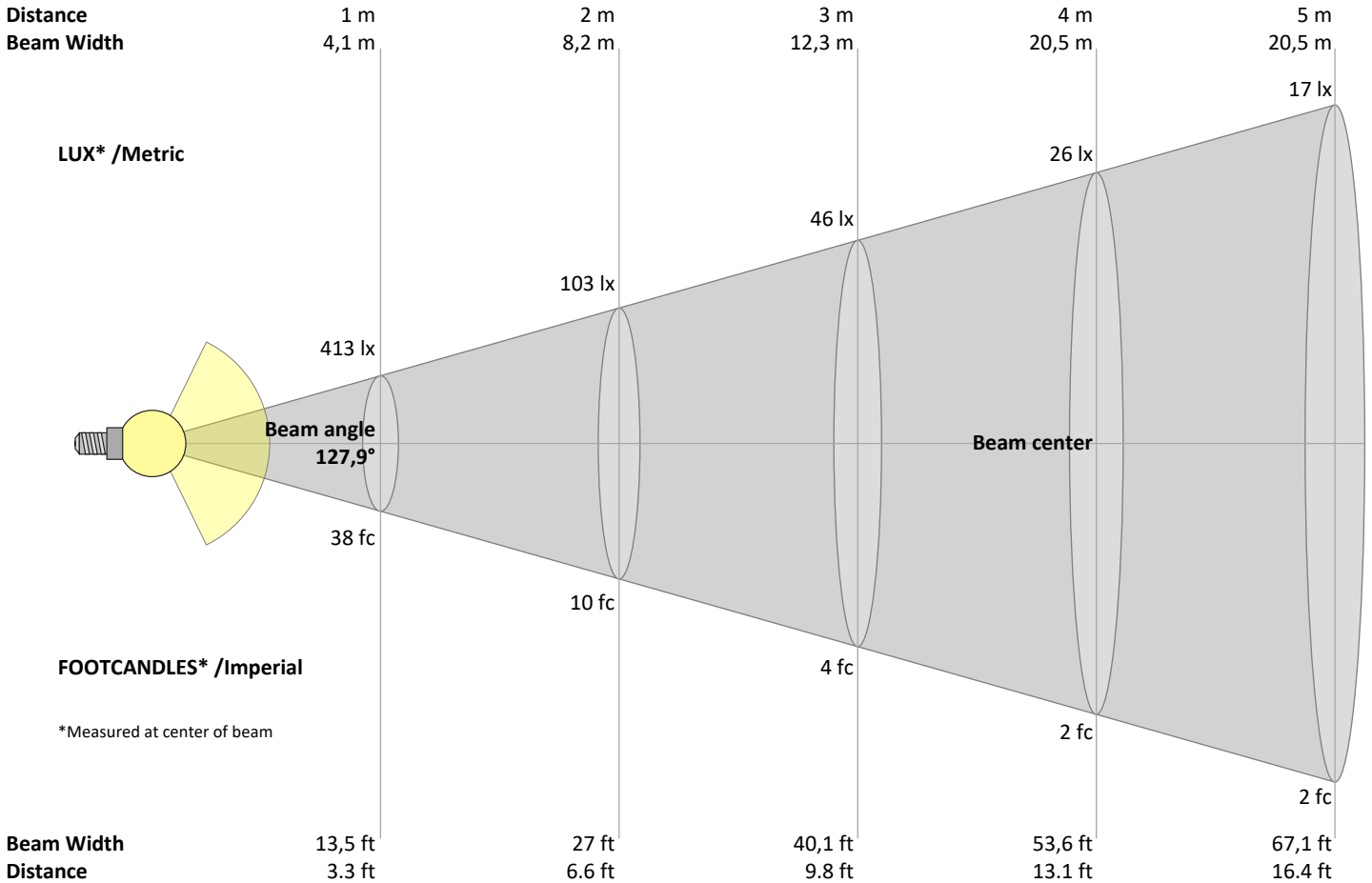
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Beam Details



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
413	103	46	26	17	11	8	6	5	4	3	3	2	2	2	2	1	1	1	1	lux
38,4	9,6	4,3	2,4	1,5	1,1	0,8	0,6	0,5	0,4	0,3	0,3	0,2	0,2	0,2	0,1	0,1	0,1	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
413	409	394	369	337	298	256	211	168	127	95	71	52	35	24	15	7	3	3	3	cd
100%	99%	95%	89%	82%	72%	62%	51%	41%	31%	23%	17%	13%	9%	6%	4%	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
413	409	394	369	337	298	256	211	168	127	95	71	52	35	24	15	7	3	3	3	cd
100%	99%	95%	89%	82%	72%	62%	51%	41%	31%	23%	17%	13%	9%	6%	4%	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
413	409	394	369	337	298	256	211	168	127	95	71	52	35	24	15	7	3	3	3	cd
100%	99%	95%	89%	82%	72%	62%	51%	41%	31%	23%	17%	13%	9%	6%	4%	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
413	409	394	369	337	298	256	211	168	127	95	71	52	35	24	15	7	3	3	3	cd
100%	99%	95%	89%	82%	72%	62%	51%	41%	31%	23%	17%	13%	9%	6%	4%	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	19,9	21,1	20,4	21,6	22,1	19,1	20,3	19,6	20,8	21,3
	3H	22,1	23,3	22,6	23,8	24,3	20,9	22,1	21,5	22,6	23,1
	4H	23,2	24,4	23,8	24,9	25,4	21,8	22,9	22,4	23,5	24,0
	6H	24,5	25,5	25,0	26,0	26,7	22,7	23,7	23,2	24,3	24,9
	8H	25,2	26,2	25,7	26,7	27,3	23,1	24,1	23,7	24,7	25,3
	12H	25,9	26,9	26,5	27,4	28,1	23,5	24,5	24,1	25,0	25,7
4H	2H	20,5	21,6	21,1	22,1	22,7	19,9	21,0	20,4	21,5	22,0
	3H	22,9	23,9	23,5	24,4	25,1	22,0	23,0	22,5	23,5	24,2
	4H	24,1	25,2	24,8	25,7	26,4	22,9	24,0	23,6	24,5	25,2
	6H	25,5	26,4	26,2	26,9	27,6	23,9	24,8	24,6	25,4	26,0
	8H	26,3	27,0	26,9	27,6	28,3	24,4	25,2	25,1	25,8	26,4
	12H	27,1	27,8	27,8	28,4	29,1	24,9	25,6	25,6	26,2	26,9
8H	4H	24,5	25,2	25,1	25,8	26,5	23,4	24,2	24,1	24,8	25,4
	6H	26,1	26,7	26,7	27,3	28,1	24,7	25,3	25,4	26,0	26,7
	8H	27,0	27,5	27,6	28,2	29,0	25,3	25,9	26,0	26,6	27,4
	12H	28,0	28,4	28,7	29,1	29,9	25,9	26,4	26,7	27,1	27,9
12H	4H	24,5	25,2	25,1	25,8	26,5	23,5	24,2	24,2	24,8	25,5
	6H	26,2	26,7	26,9	27,4	28,3	24,9	25,4	25,6	26,1	27,0
	8H	27,1	27,6	27,9	28,3	29,1	25,6	26,1	26,3	26,8	27,6

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	0,1 / -0,1
S = 2.0H	0,2 / -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	116	116	116	116	112	112	112	112	104	104	104	96	96	96	90	90	90	87
1	103	97	92	87	99	93	89	84	86	83	79	80	77	74	74	72	70	66
2	93	83	75	69	88	80	73	67	74	68	63	69	64	60	64	60	56	53
3	84	72	63	56	80	69	61	55	64	58	52	60	54	49	56	51	47	44
4	76	63	54	47	73	61	52	46	57	49	44	53	47	42	49	44	40	37
5	70	56	47	40	67	54	46	39	51	43	37	47	41	36	44	38	34	31
6	64	50	41	34	62	49	40	34	46	38	32	43	36	31	40	34	30	27
7	60	46	37	30	57	44	36	30	41	34	28	39	32	27	36	31	26	24
8	55	41	33	27	53	40	32	26	38	30	25	35	29	24	33	28	23	21
9	52	38	30	24	50	37	29	23	35	28	23	33	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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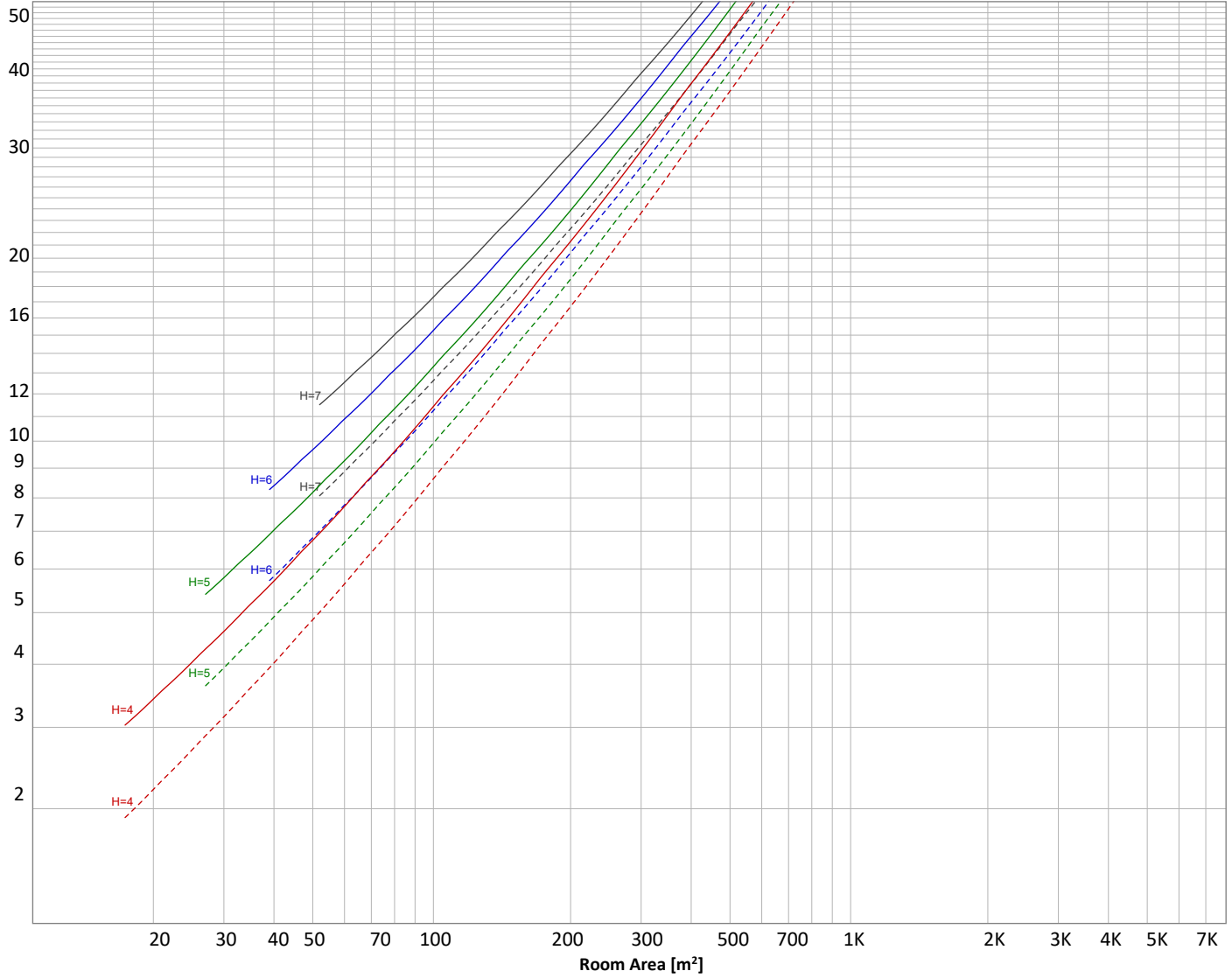
Operator:



Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 1707 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°
39,2 lm	113 lm	173 lm	213 lm	230 lm	224 lm	200 lm	162 lm	122 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
88,7 lm	61,6 lm	38,6 lm	22,4 lm	11,5 lm	4,48 lm	1,53 lm	0,865 lm	0,313 lm

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Outdoor Light Planning

Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	39 lm	2,3%
10-20°	113 lm	6,6%
20-30°	173 lm	10,1%
30-40°	213 lm	12,5%
40-50°	230 lm	13,5%
50-60°	224 lm	13,1%
60-70°	200 lm	11,7%
70-80°	162 lm	9,5%
80-90°	122 lm	7,1%
90-100°	89 lm	5,2%
100-110°	62 lm	3,6%
110-120°	39 lm	2,3%
120-130°	22 lm	1,3%
130-140°	11 lm	0,7%
140-150°	4 lm	0,3%
150-160°	2 lm	0,1%
160-170°	1 lm	0,1%
170-180°	0 lm	0,0%
Total	1707 lm	100,0%

Intensity peaks

Max intensity	413 cd
Intensity, 90°	95 cd
Intensity, 0°	413 cd

Zonal Lumen summary

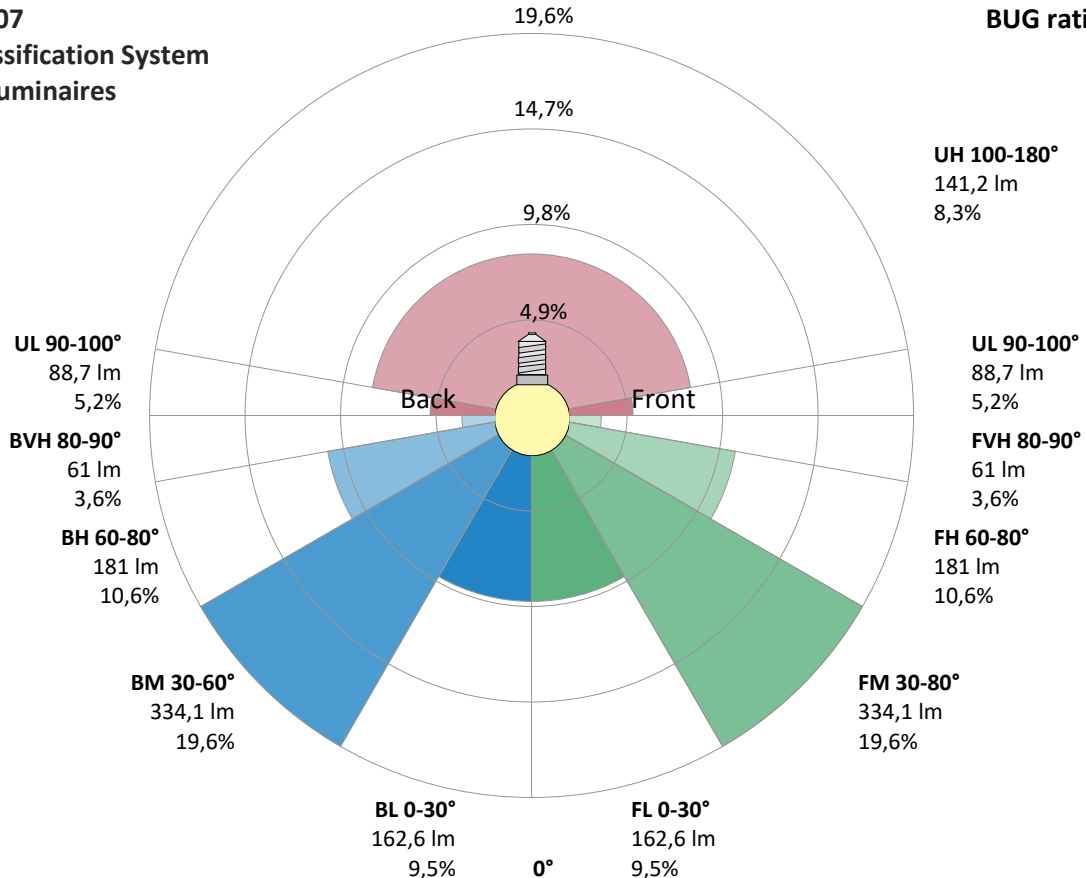
Zone (γ)	Lumen	% Total
0-30°	325 lm	19,0%
0-40°	538 lm	31,5%
0-60°	993 lm	58,2%
60-90°	484 lm	28,3%
70-100°	373 lm	21,9%
90-120°	189 lm	11,1%
0-90°	1477 lm	86,5%
90-180°	230 lm	13,5%
0-180°	1707 lm	100,0%

BUG rating

	Lumen	% Total
Forward light		
Low(0-30°)	163 lm	9,5%
Medium(30-60°)	334 lm	19,6%
High(60-80°)	181 lm	10,6%
Very high(80-90°)	61 lm	3,6%
Back light		
Low(0-30°)	163 lm	9,5%
Medium(30-60°)	334 lm	19,6%
High(60-80°)	181 lm	10,6%
Very high(80-90°)	61 lm	3,6%
Uplight		
Low(90-100°)	89 lm	5,2%
High(100-180°)	141 lm	8,3%

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

BUG rating B1 U3 G1



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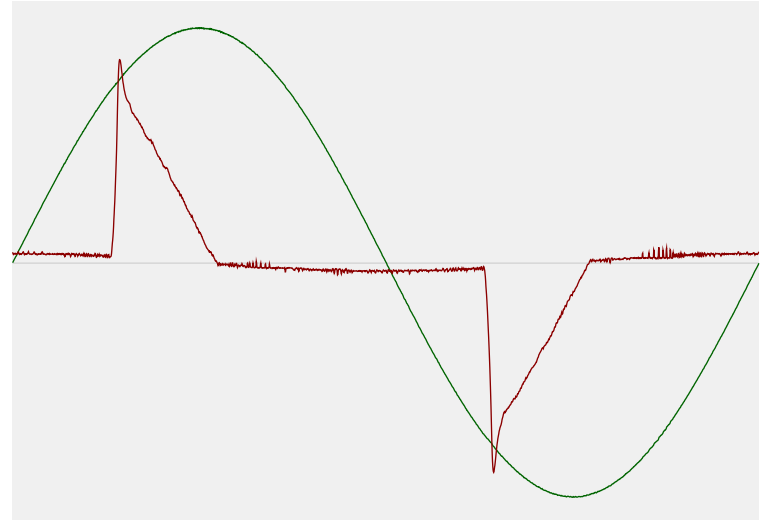


Power Details

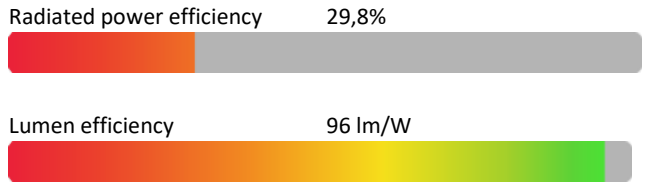
Input Power

Power feed to light source	17,8 W
Frequency of input power	50 Hz
RMS Input voltage feed, V_{RMS}	230 V
RMS Input current feed, I_{RMS}	0,141 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	32,46 VA
Displacement factor of AC power feed	0,84
Power factor of AC current feed	0,55
Total harmonic distortion of the current	111,99%
Total harmonic distortion of the voltage	0,11%

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	2995 K
CCT shift	+5 K
CCT end	3000 K

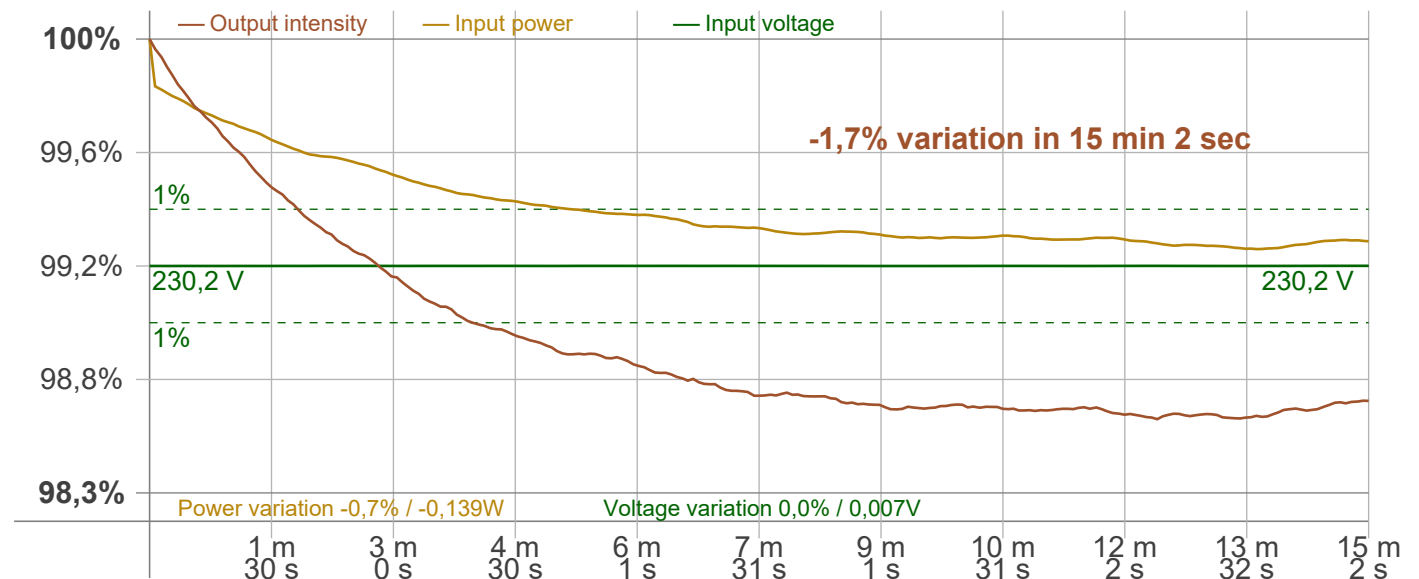
Warmup Result

Total warmup time	Lamp stabilized in 15 min 2 sec
Warmup variation	-1,7%

Output Change

Output start	1733 lm
Output change	-26 lm
Output end	1707 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 101,01 Hz
 Percent Flicker 0,4 %
 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 0,31 %
 JA8/10 400 Hz 0,37 %
 JA8/10 1000 Hz 0,39 %

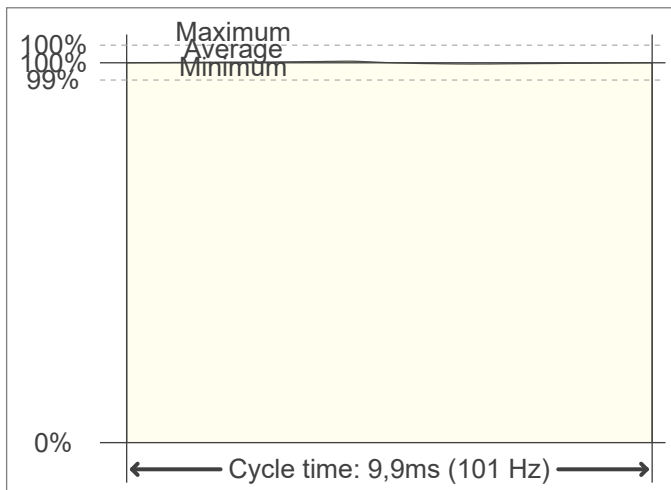
TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

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

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

