

Light Measurement Report

Print date: 17-10-2024

Measurement date and time: 17-10-2024 09:26:49 – Measurement no. VFR-241017-1342-MS

Measurement tracking No. and Link: [VT241017-007449](#)

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

9,8 W – PF 0,92 – DPF 0,93

230 V – 0,047 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)

DRT090-4000K

DRT090-4000K – Dutchfulfillment

LED DOWNLIGHT | SIA | CCT-SWITCH | Ø90 | 10W

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

1065 lm – 0,09% / 99,91%

108 lm/W

1223 cd – 57°

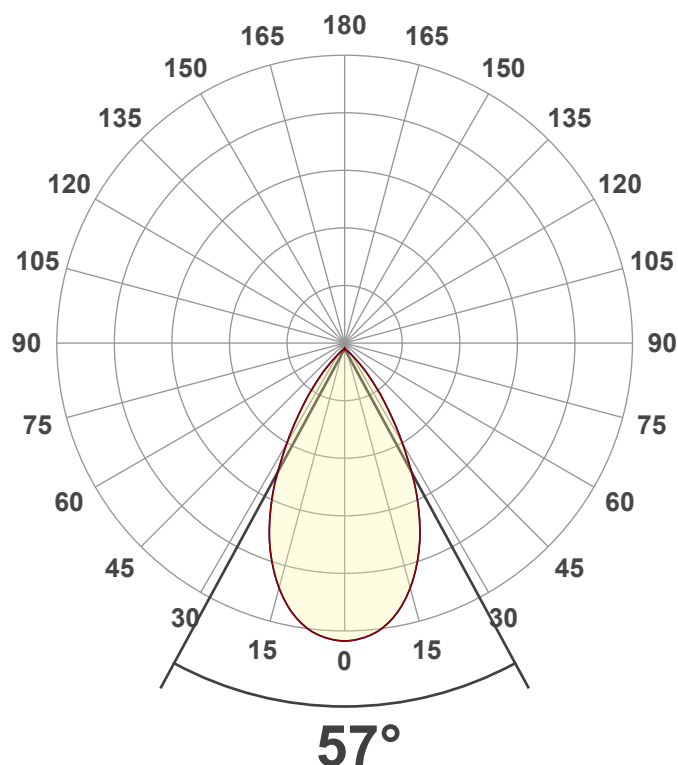
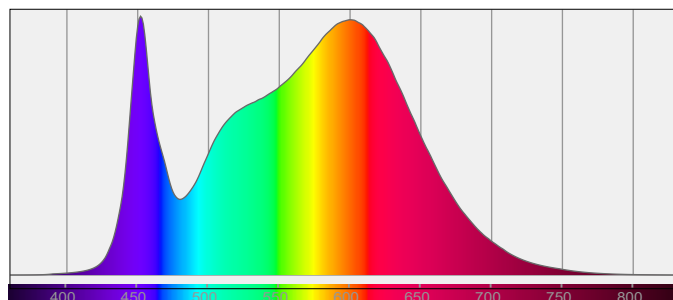
CCT = 4000 K / 3790 K

CRI 86,2

R_f 86,2 – R_g 96,0

Duv -0,0007 – SDCM 4,8

SVM 2,02 – PstLM 0,04



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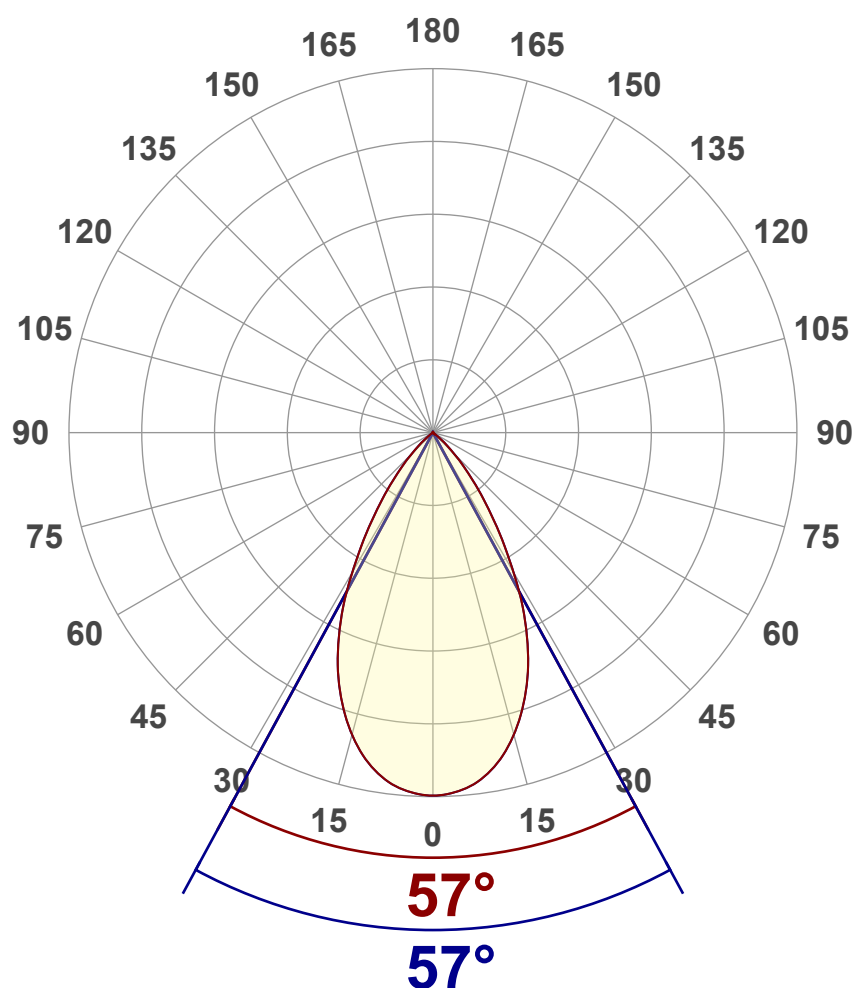
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Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

Output (total Lumen)	1065 lm
Lumen Up% / Down%	0,09% / 99,91%
Peak Intensity	1223 cd
Beam Angle (50%)	57°
Beam Angle (90%)	57°
Beam Angle (10%)	57°

Cut-off Angle

Average 2,5%	101,8°
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Field Angle

Average 10%	88,2°
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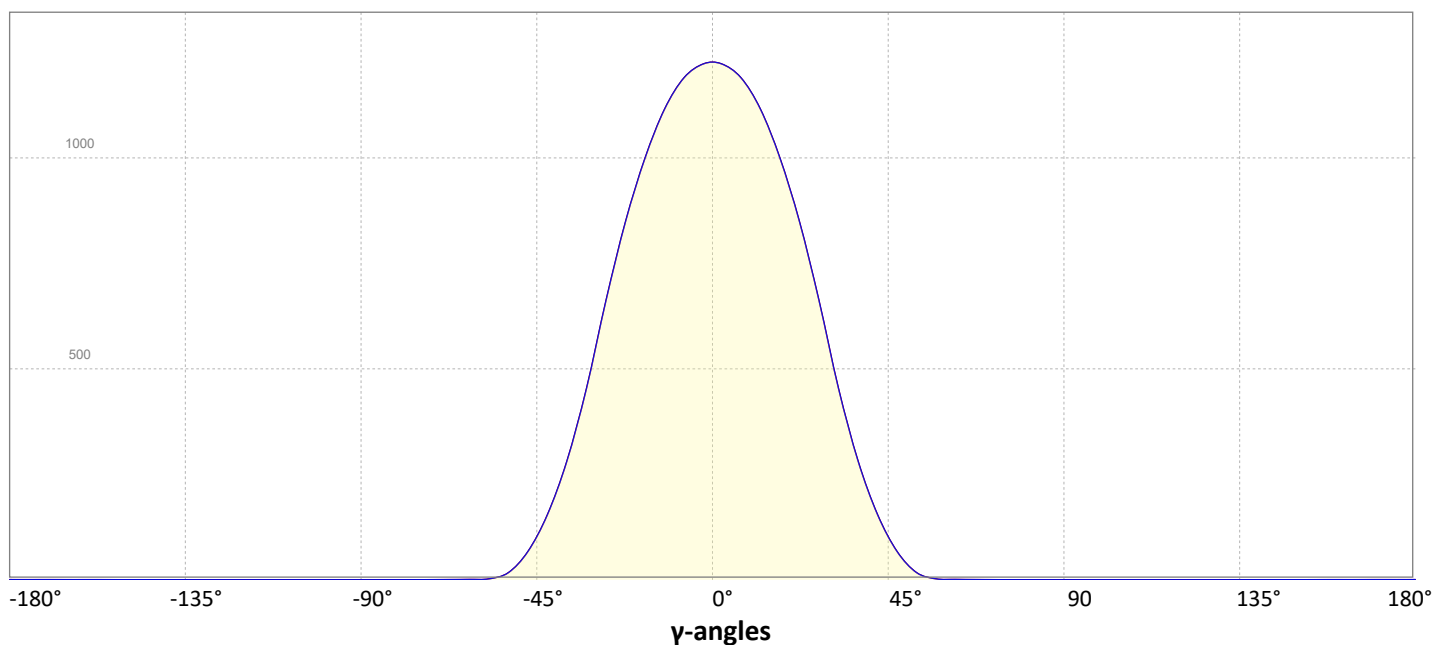
Intensity Ratio

In 120° cone	99,8%
In 90° cone	96,6%

C000-C180

C090-C270

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

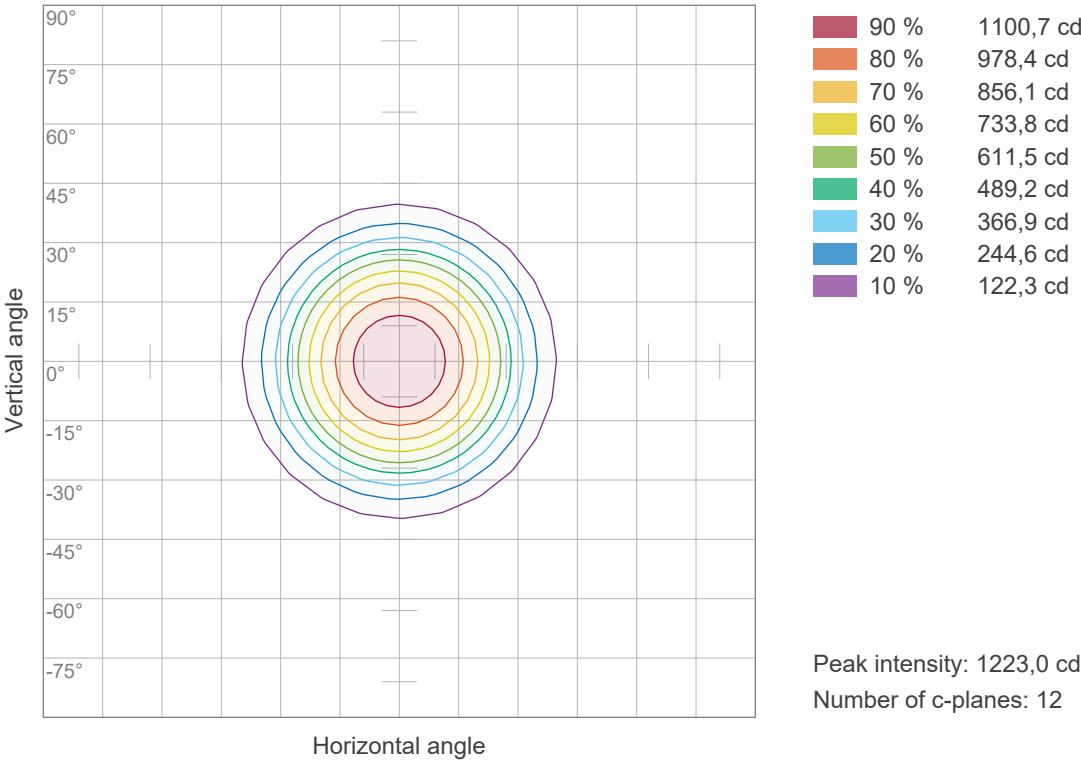


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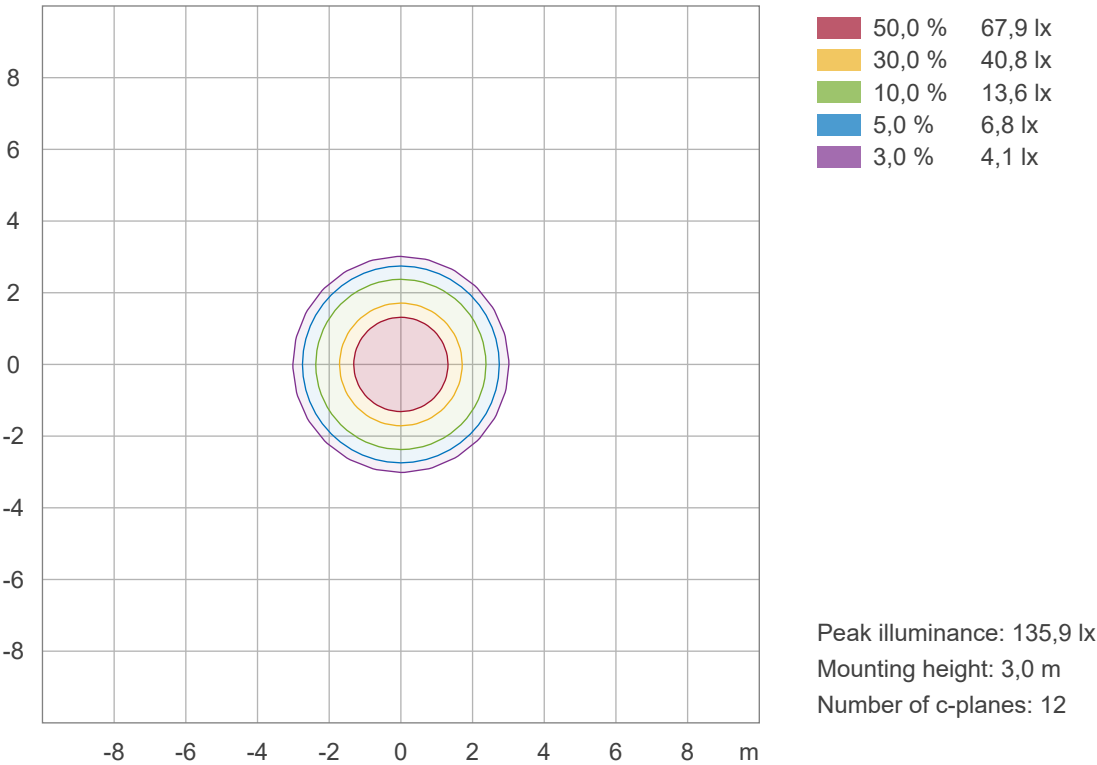
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Iso-intensity Diagram (Iso-candela)



Iso-illuminance Diagram (Iso-lux)



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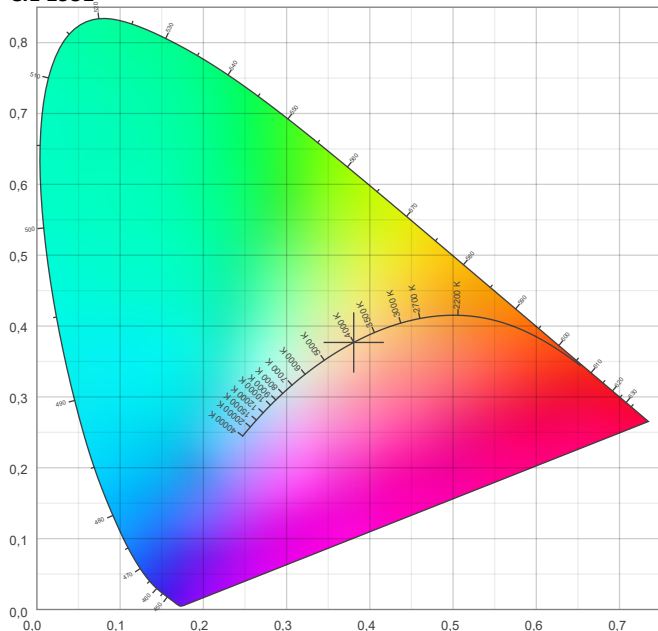


Color details

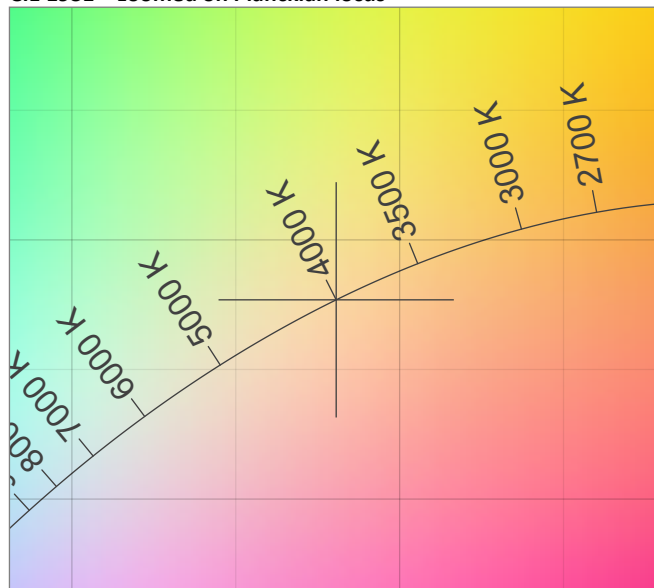
Correlated Color Temperature, Target CCT = 4000 K
Correlated Color Temperature, Measured CCT = 3790 K
Color Rendering Index CRI 86,2
Color Rendering Index, R9 (red component) R9 = 19,8
Color Rendering TM30-18 R_f 86,2 – R_g 96,0
Color Quality Scale CQS = 85,1

MacAdam Steps
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 = -0,0007
Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,225;0,502)

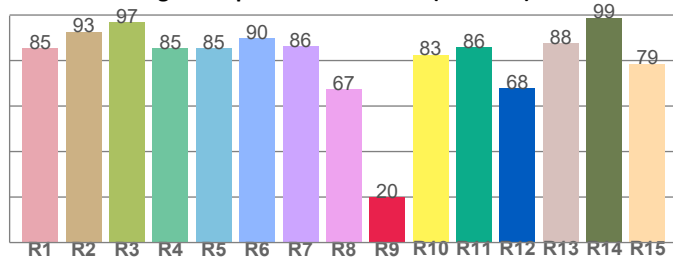
CIE 1931



CIE 1931 – zoomed on Planckian locus



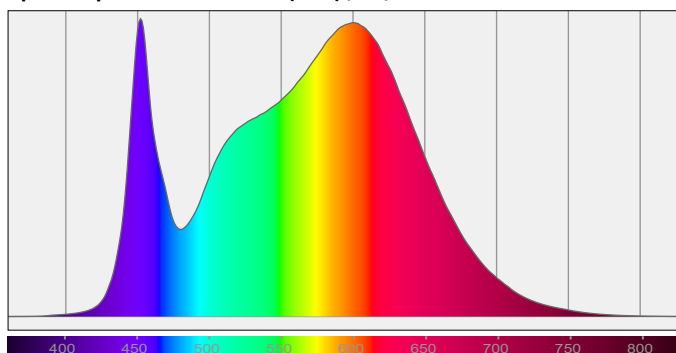
Color Rendering Index per reference color (CIE 1995)



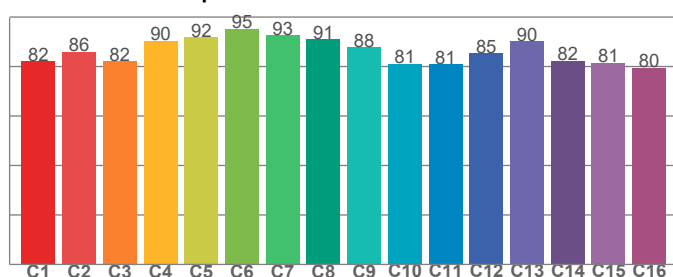
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
85,4	92,7	96,7	85,3	85,4	89,8	86,4	67,5	19,8	82,6	85,7	67,7	87,6	98,8	78,5

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



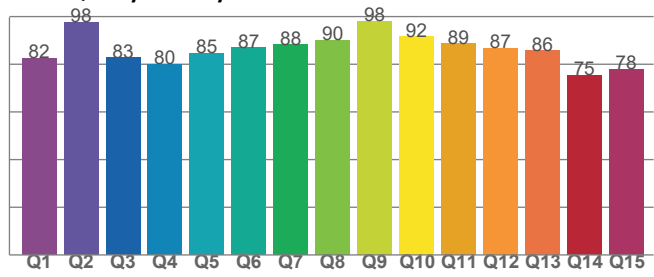
TM30-18 R_f-values per hue bin



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
82,2	85,9	82,2	90,4	91,8	95,3	92,8	91,1	87,8	81,2	80,8	85,4	90,3	82,4	81,5	79,5

Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
82,4	97,7	82,7	80,1	84,6	86,9	88,2	90,2	98,1	91,6	88,6	86,6	85,7	75,4	78,0

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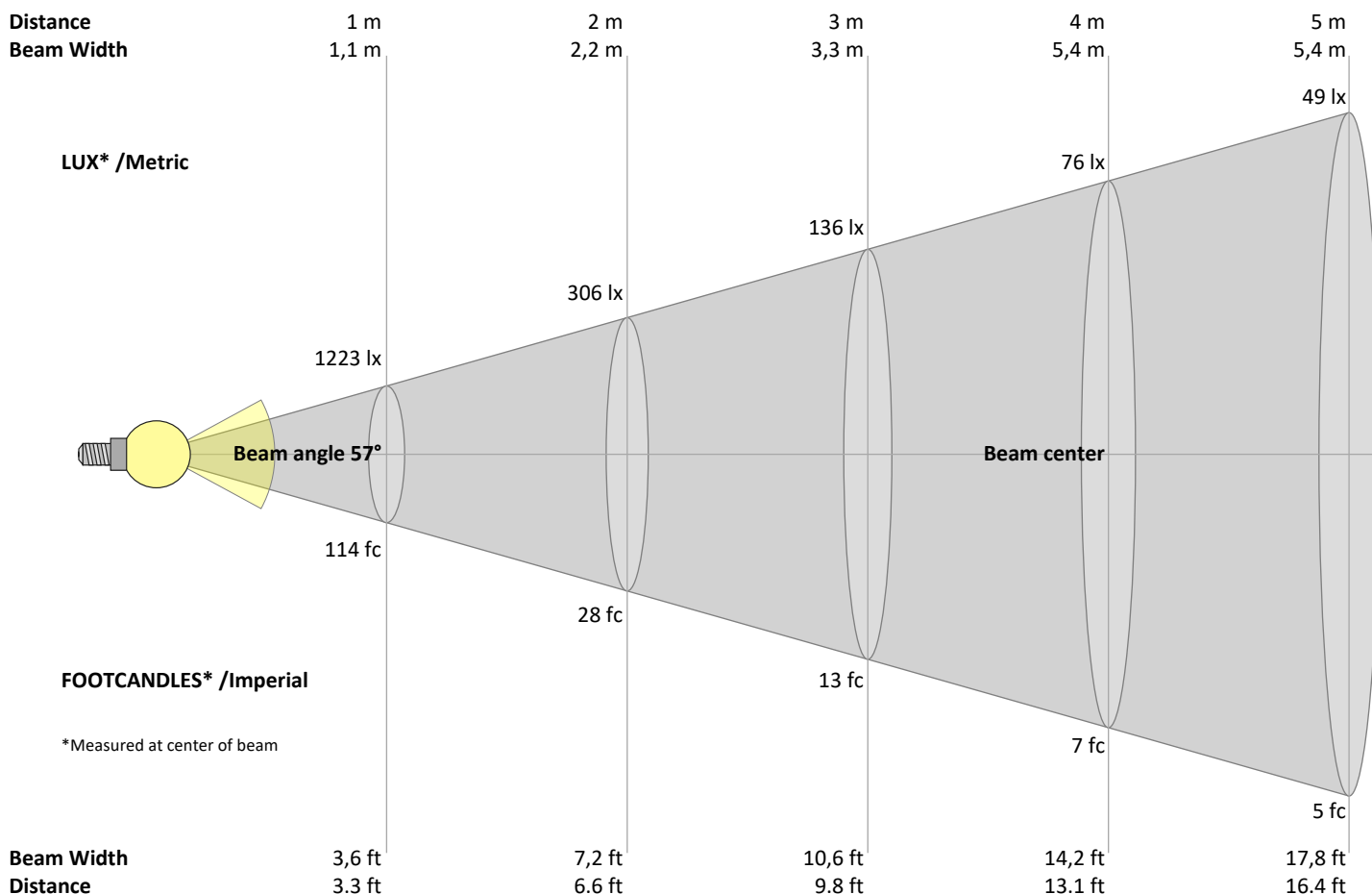
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Beam Details



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
1223	306	136	76	49	34	25	19	15	12	10	8	7	6	5	5	4	4	3	3	lux
113,6	28,4	12,6	7,1	4,5	3,2	2,3	1,8	1,4	1,1	0,9	0,8	0,7	0,6	0,5	0,4	0,4	0,4	0,3	0,3	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
1223	1223	1212	1199	1179	1150	1120	1076	1029	978	918	857	784	710	632	548	465	394	325	263	cd
100%	100%	99%	98%	96%	94%	92%	88%	84%	80%	75%	70%	64%	58%	52%	45%	38%	32%	27%	22%	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
1223	1223	1212	1199	1179	1150	1120	1076	1029	978	918	857	784	710	632	548	465	394	325	263	cd
100%	100%	99%	98%	96%	94%	92%	88%	84%	80%	75%	70%	64%	58%	52%	45%	38%	32%	27%	22%	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
1223	1223	1212	1199	1179	1150	1120	1076	1029	978	918	857	784	710	632	548	465	394	325	263	cd
100%	100%	99%	98%	96%	94%	92%	88%	84%	80%	75%	70%	64%	58%	52%	45%	38%	32%	27%	22%	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
1223	1223	1212	1199	1179	1150	1120	1076	1029	978	918	857	784	710	632	548	465	394	325	263	cd
100%	100%	99%	98%	96%	94%	92%	88%	84%	80%	75%	70%	64%	58%	52%	45%	38%	32%	27%	22%	of 0°val

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Light Planning – UGR table

Uncorrected, comprehensive UGR table according to 117-1995

Reflectances											
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											
H = mounting height above eye level											
X	Y	Viewed Crosswise					Viewed Endwise				
		(Viewing direction orthogonal to lamp length axis)					(Viewing direction parallel to lamp length axis)				
2H	2H	19,7	20,3	19,8	20,5	20,7	19,7	20,3	19,8	20,5	20,7
	3H	19,4	20,1	19,7	20,3	20,5	19,4	20,1	19,7	20,3	20,5
	4H	19,3	20,0	19,7	20,3	20,5	19,3	20,0	19,7	20,3	20,5
	6H	19,3	19,9	19,6	20,2	20,5	19,3	19,9	19,6	20,2	20,5
	8H	19,2	19,8	19,5	20,1	20,5	19,2	19,8	19,5	20,1	20,5
	12H	19,2	19,8	19,5	20,1	20,5	19,2	19,8	19,5	20,1	20,5
4H	2H	19,3	20,0	19,7	20,3	20,5	19,3	20,0	19,7	20,3	20,5
	3H	19,2	19,8	19,5	20,1	20,5	19,2	19,8	19,5	20,1	20,5
	4H	19,0	19,6	19,5	20,0	20,5	19,0	19,6	19,5	20,0	20,5
	6H	19,0	19,5	19,4	19,8	20,2	19,0	19,5	19,4	19,8	20,2
	8H	18,9	19,4	19,4	19,8	20,1	18,9	19,4	19,4	19,8	20,1
	12H	18,8	19,2	19,3	19,6	20,1	18,8	19,2	19,3	19,6	20,1
8H	4H	18,9	19,4	19,4	19,8	20,1	18,9	19,4	19,4	19,8	20,1
	6H	18,8	19,2	19,3	19,6	20,2	18,8	19,2	19,3	19,6	20,2
	8H	18,8	19,1	19,3	19,6	20,2	18,8	19,1	19,3	19,6	20,2
	12H	18,8	19,0	19,4	19,5	20,1	18,8	19,0	19,4	19,5	20,1
12H	4H	18,8	19,2	19,3	19,6	20,1	18,8	19,2	19,3	19,6	20,1
	6H	18,8	19,1	19,3	19,6	20,2	18,8	19,1	19,3	19,6	20,2
	8H	18,8	19,0	19,4	19,5	20,1	18,8	19,0	19,4	19,5	20,1
Variations with the observer position for the luminaire spacings, S:											
S = 1.0H		4,2 / -15,5					4,2 / -15,5				
S = 1.5H		6,7 / -25,2					6,7 / -25,2				
S = 2.0H		8,7 / -26,9					8,7 / -26,9				

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	108	106	111	109	106	104	105	103	101	101	99	98	97	96	95	93
2	108	103	99	96	106	101	98	95	98	95	93	95	93	91	92	90	89	87
3	103	96	91	87	101	95	90	86	92	88	85	90	86	84	87	85	82	81
4	97	90	84	80	95	89	84	80	86	82	79	84	81	78	83	79	77	75
5	92	84	78	74	91	83	78	74	81	77	73	80	75	72	78	74	72	70
6	88	79	73	69	86	78	72	68	76	72	68	75	71	67	74	70	67	65
7	83	74	68	64	82	73	68	64	72	67	63	71	66	63	70	66	63	61
8	79	70	64	60	78	69	63	60	68	63	59	67	62	59	66	62	59	57
9	75	66	60	56	74	65	60	56	64	59	56	63	59	55	63	58	55	54
10	72	62	56	53	71	62	56	52	61	56	52	60	56	52	59	55	52	51

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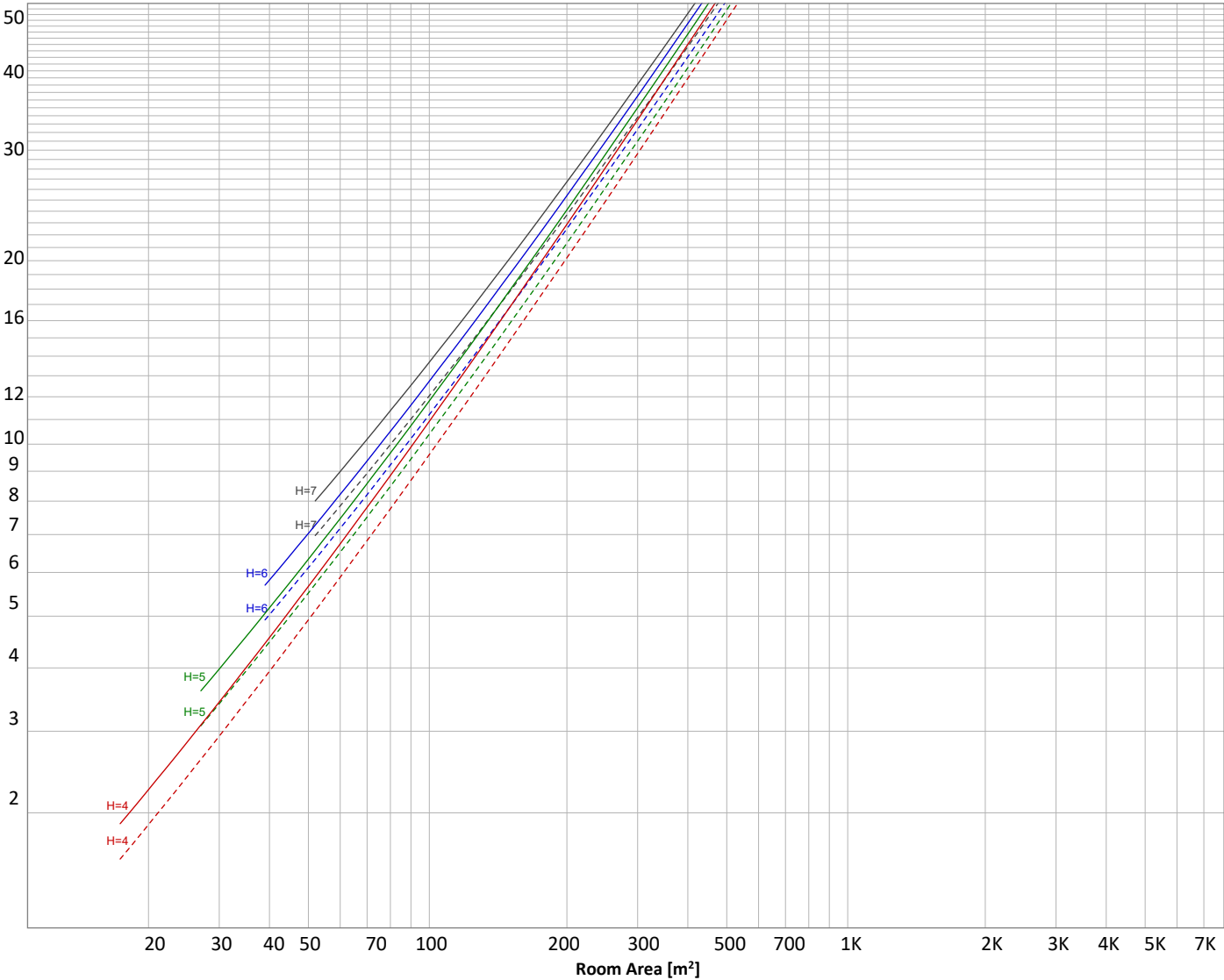
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Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 1065 lm	p(%)		
H _{down} = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	Wall reflectance
H _{work} = Work area height from floor =	0.00 m	-----	70	50
E _{work} = Average lux on work area =	100 lx	-----	50	30
				Floor reflectance
				20

Zonal Lumen Summary

0°-10°	10°-20°	20°-30°	30°-40°	40°-50°	50°-60°	60°-70°	70°-80°	80°-90°
114 lm	295 lm	341 lm	223 lm	81,8 lm	8,02 lm	0,669 lm	0,245 lm	0,128 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
0,102 lm	0,109 lm	0,085 lm	0,083 lm	0,127 lm	0,143 lm	0,137 lm	0,099 lm	0,038 lm

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Outdoor Light Planning

Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	{LUM00-10} lm	#VALUE!
10-20°	{LUM10-20} lm	#VALUE!
20-30°	{LUM20-30} lm	#VALUE!
30-40°	{LUM30-40} lm	#VALUE!
40-50°	{LUM40-50} lm	#VALUE!
50-60°	{LUM50-60} lm	#VALUE!
60-70°	{LUM60-70} lm	#VALUE!
70-80°	{LUM70-80} lm	#VALUE!
80-90°	{LUM80-90} lm	#VALUE!
90-100°	{LUM90-100} lm	#VALUE!
100-110°	{LUM100-110} lm	#VALUE!
110-120°	{LUM110-120} lm	#VALUE!
120-130°	{LUM120-130} lm	#VALUE!
130-140°	{LUM130-140} lm	#VALUE!
140-150°	{LUM140-150} lm	#VALUE!
150-160°	{LUM150-160} lm	#VALUE!
160-170°	{LUM160-170} lm	#VALUE!
170-180°	{LUM170-180} lm	#VALUE!
Total	0 lm	#VALUE!

Intensity peaks

Max intensity	{PEAK} cd
Intensity, 90°	{INT90} cd
Intensity, 0°	{INT0} cd

Zonal Lumen summary

Zone (γ)	Lumen	% Total
0-30°	{LUM00-30} lm	#VALUE!
0-40°	{LUM00-40} lm	#VALUE!
0-60°	{LUM00-60} lm	#VALUE!
60-90°	{LUM60-90} lm	#VALUE!
70-100°	{LUM70-100} lm	#VALUE!
90-120°	{LUM90-120} lm	#VALUE!
0-90°	{LUM00-90} lm	#VALUE!
90-180°	{LUM90-180} lm	#VALUE!
0-180°	{LUM00-180} lm	#VALUE!

BUG rating

	Lumen	% Total
Forward light		
Low(0-30°)	{BUG0} lm	#VALUE!
Medium(30-60°)	{BUG1} lm	#VALUE!
High(60-80°)	{BUG2} lm	#VALUE!
Very high(80-90°)	{BUG3} lm	#VALUE!

Back light

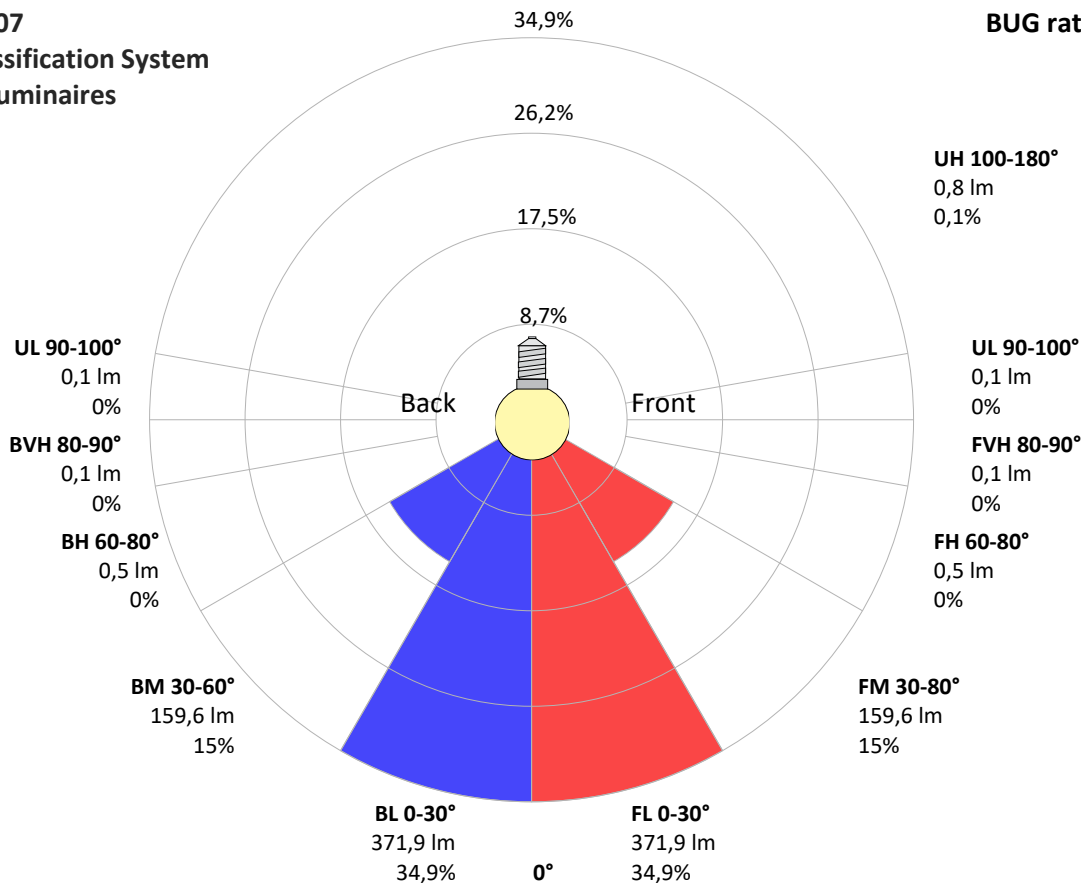
Low(0-30°)	{BUG4} lm	#VALUE!
Medium(30-60°)	{BUG5} lm	#VALUE!
High(60-80°)	{BUG6} lm	#VALUE!
Very high(80-90°)	{BUG7} lm	#VALUE!

Uplight

Low(90-100°)	{BUG8} lm	#VALUE!
High(100-180°)	{BUG9} lm	#VALUE!

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

BUG rating B1 U1 G0



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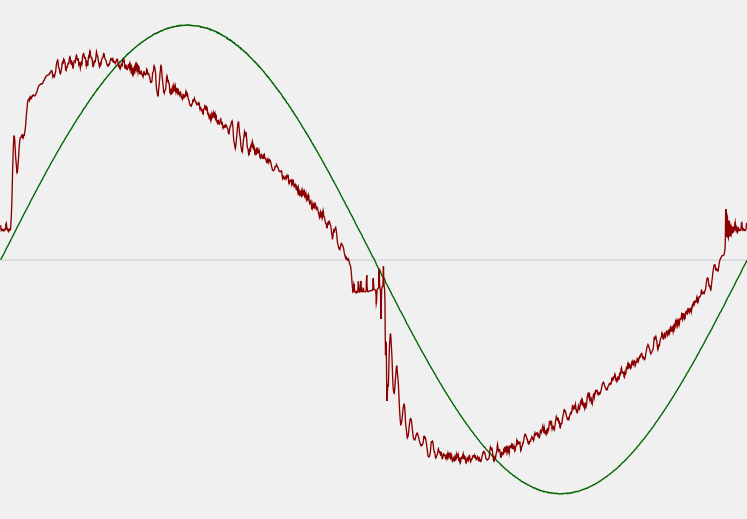


Power Details

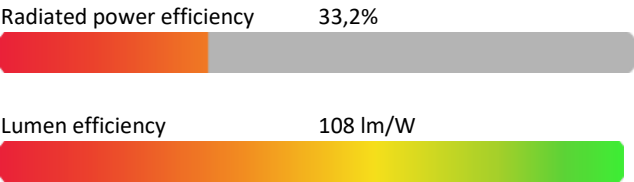
Input Power

Power feed to light source	9,8 W
Frequency of input power	50 Hz
RMS Input voltage feed, V_{RMS}	230 V
RMS Input current feed, I_{RMS}	0,047 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	10,74 VA
Displacement factor of AC power feed	0,93
Power factor of AC current feed	0,92
Total harmonic distortion of the current	17,85%
Total harmonic distortion of the voltage	0,06%

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	4003 K
CCT shift	-3 K
CCT end	4000 K

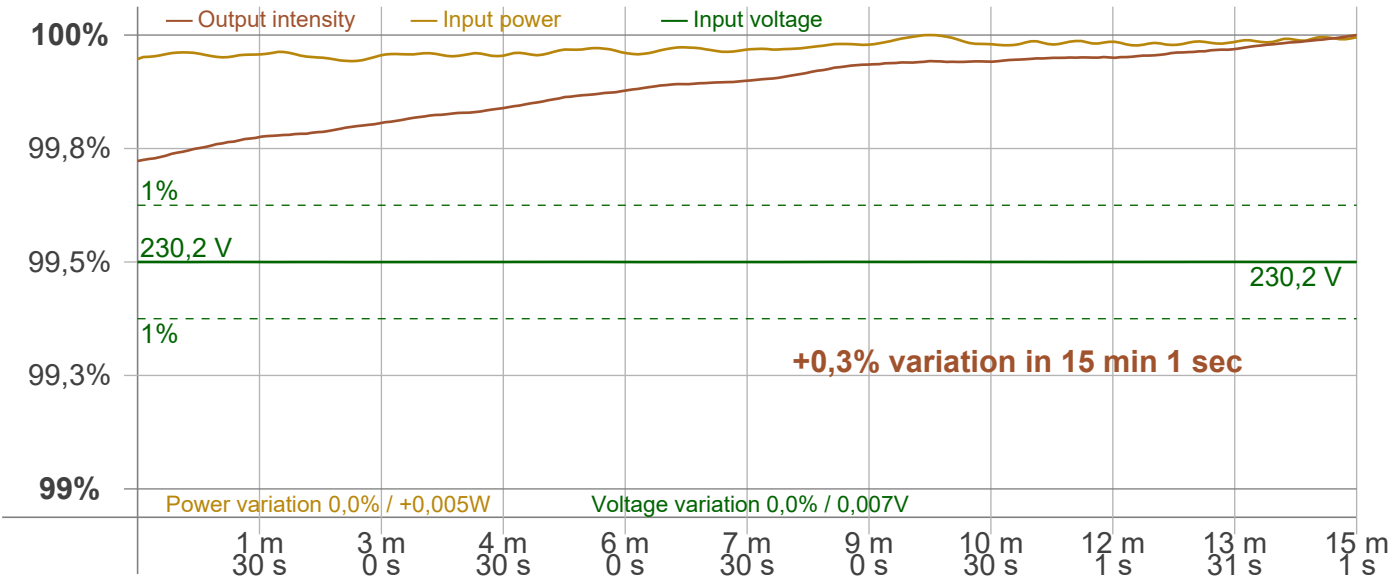
Warmup Result

Total warmup time	Lamp stabilized in 15 min 1 sec
Warmup variation	+0,3%

Output Change

Output start	1062 lm
Output change	+3 lm
Output end	1065 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

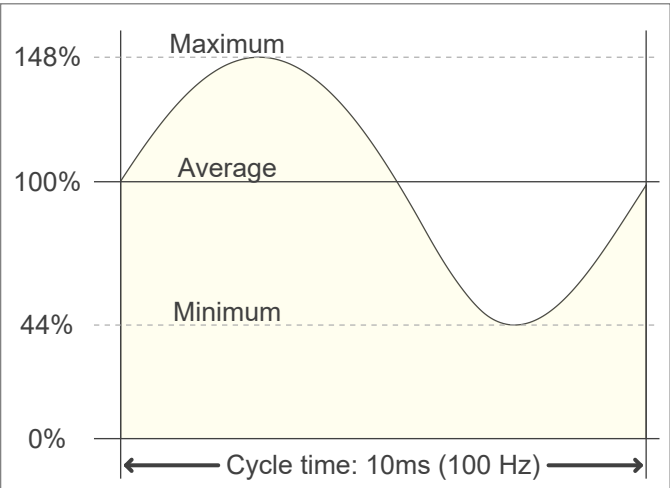
Flicker indices according to Illuminating Engineering Society (IES)
Flicker frequency 100 Hz
Percent Flicker 54,16 %
Flicker index 0,17

Flicker indices according to California Energy Commission (CEC) 2016b
JA8/10 40 Hz 0,13 %
JA8/10 90 Hz 0,48 %
JA8/10 200 Hz 53,31 %
JA8/10 400 Hz 54,28 %
JA8/10 1000 Hz 54,17 %

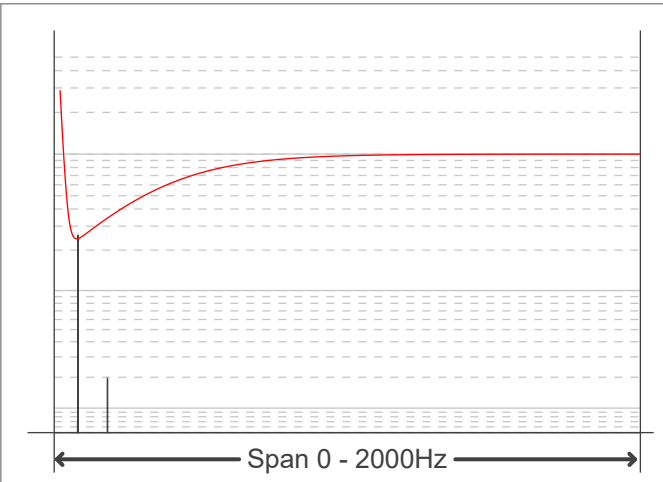
TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)
PstLM value (F < 80 Hz) 0,04
SVM value (80 < F < 2000 Hz) 2,02

Flicker indices according to Lighting Research Center (2015)
Perception metric, Assist Mp 0,02

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



Flicker FFT (flicker curve in frequency domain)



IEEE 1789 Frequency/modulation plot

