

Light Measurement Report

Print date: 1-11-2024

Measurement date and time: 1-11-2024 08:21:19 – Measurement no. VFR-241101-1790-MS

Measurement tracking No. and Link: [VT241101-000141](#)

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°
1,99 m
20,1 W – PF 0,83 – DPF 0,94
230 V – 0,106 A
50 Hz
Lamp stabilized in 16 min 6 sec – 2,0%

Tested Light Source

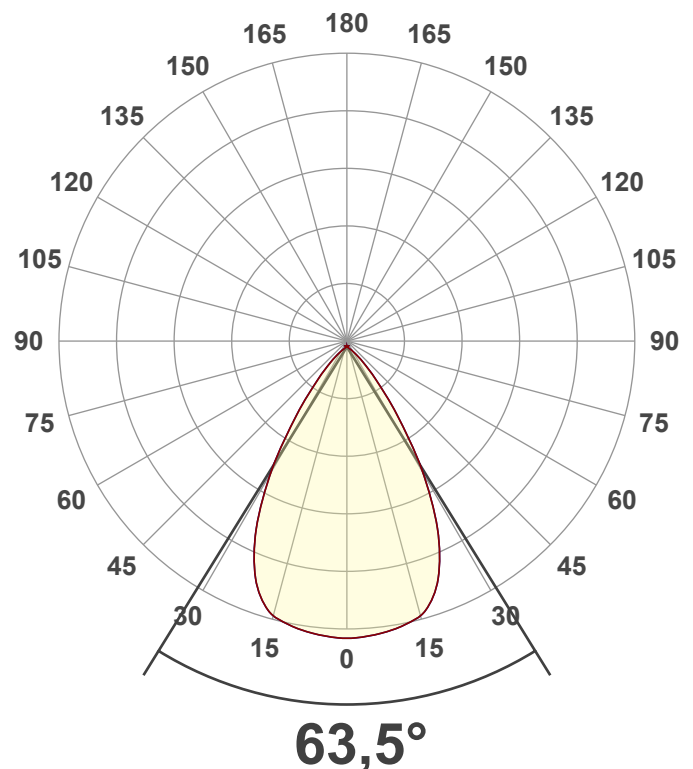
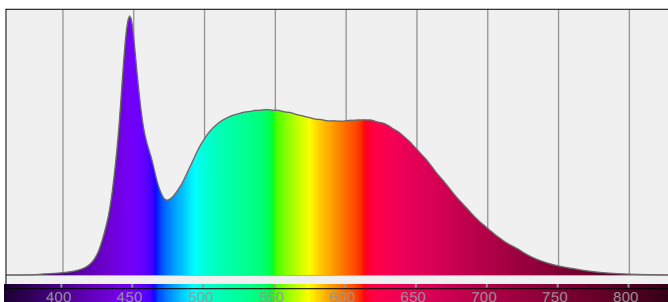
Product Name
Item No. and Manufacturer
Product Description (line 1)

279636-5000K
279636-5000K – Dutchfulfillment
LED DOWNLIGHT | KERBER | CCT-SWITCH | Ø200MM | 20W | ZWART

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

1914 lm – 0,07% / 99,93%
95 lm/W
1835 cd – 63,5°
CCT = 5000 K / 4952 K
CRI 91,6
 R_f 91,6 – R_g 100,4
Duv 0,0044 – SDCM 5,5
SVM 0,02 – PstLM 0,01



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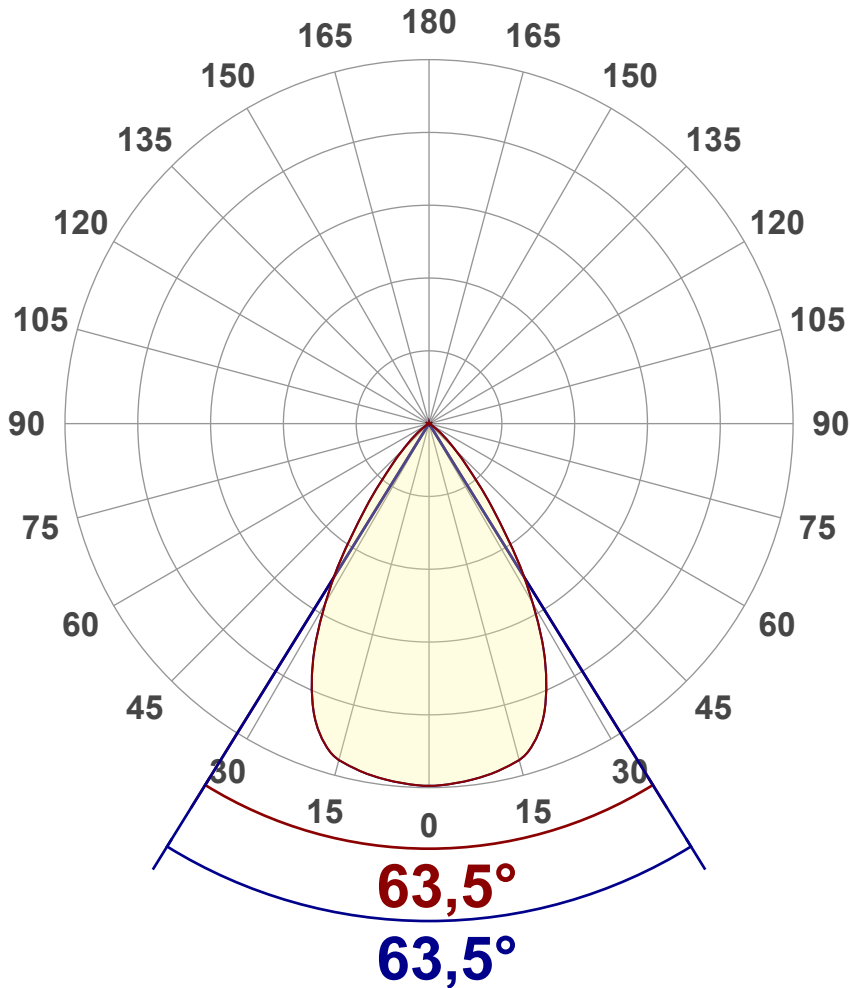
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Operator:



Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

Output (total Lumen)	1914 lm
Lumen Up% / Down%	0,07% / 99,93%
Peak Intensity	1835 cd
Beam Angle (50%)	63,5°
Beam Angle (90%)	63,5°
Beam Angle (10%)	63,5°

Cut-off Angle

Average 2,5%	108,1°
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Field Angle

Average 10%	91°
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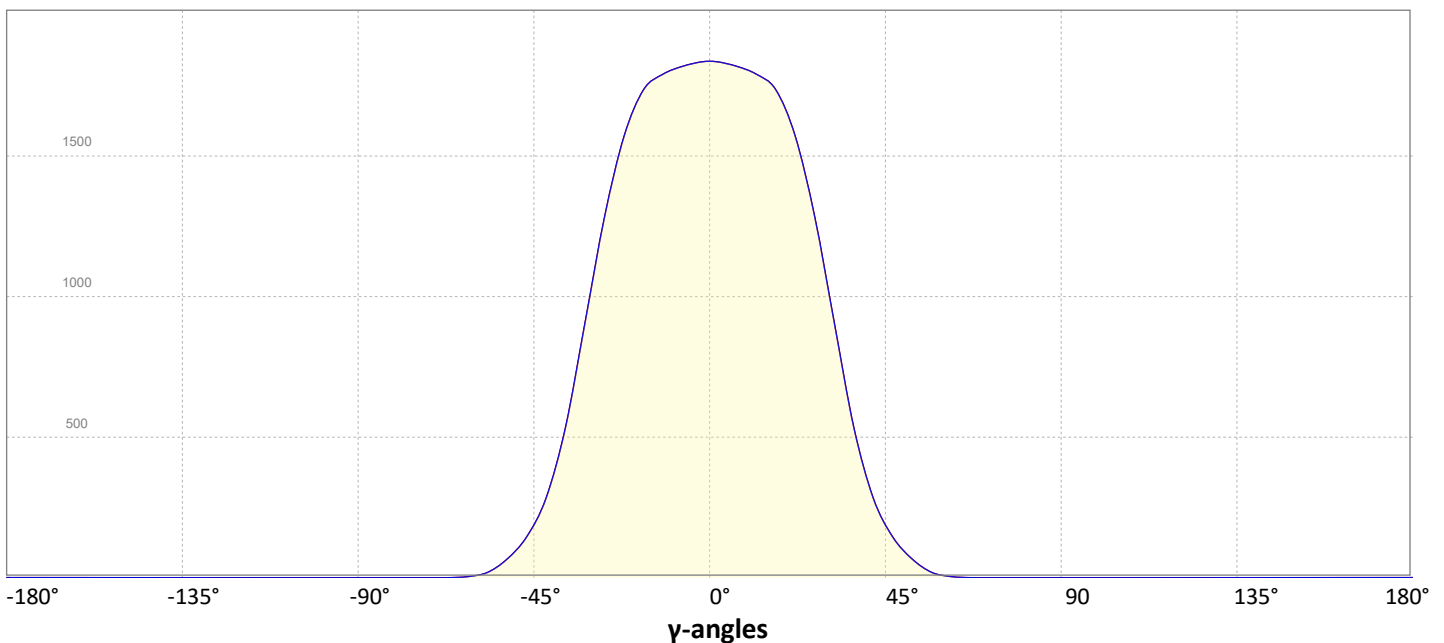
Intensity Ratio

In 120° cone	99,8%
In 90° cone	95,2%

C000-C180

C090-C270

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



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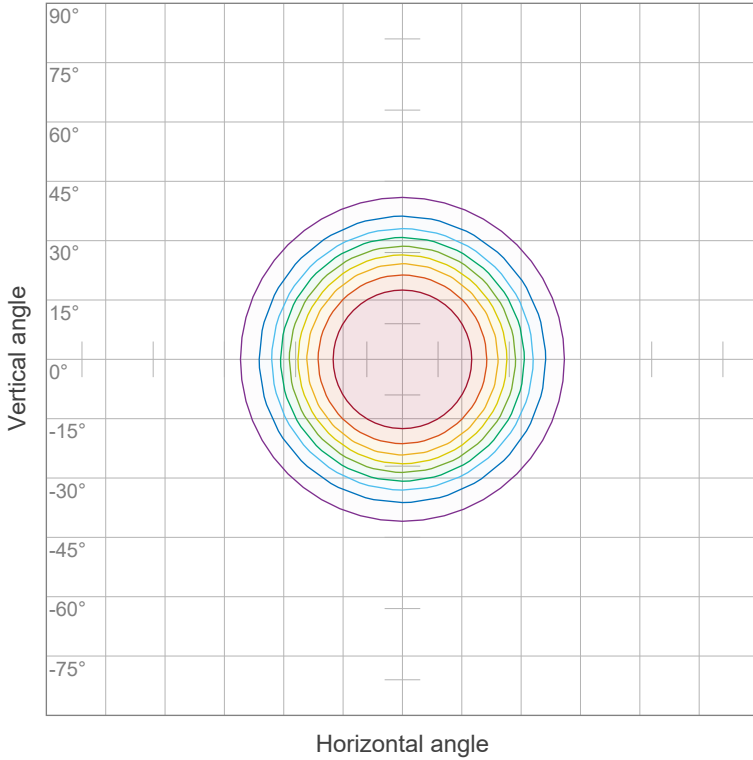
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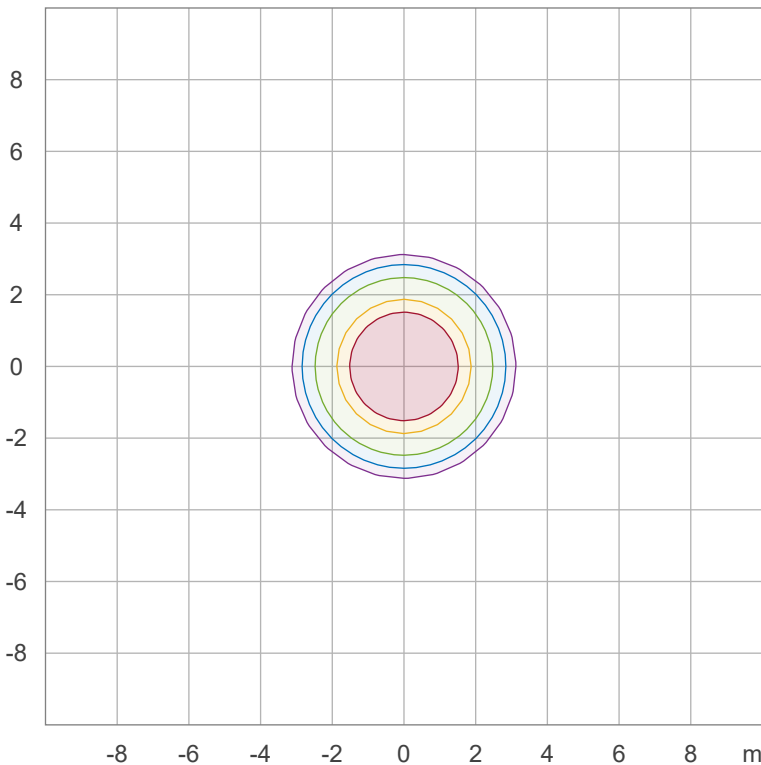
Iso-intensity Diagram (Iso-candela)



90 %	1651,7 cd
80 %	1468,1 cd
70 %	1284,6 cd
60 %	1101,1 cd
50 %	917,6 cd
40 %	734,1 cd
30 %	550,6 cd
20 %	367,0 cd
10 %	183,5 cd

Peak intensity: 1835,2 cd
Number of c-planes: 12

Iso-illuminance Diagram (Iso-lux)



50,0 %	102,0 lx
30,0 %	61,2 lx
10,0 %	20,4 lx
5,0 %	10,2 lx
3,0 %	6,1 lx

Peak illuminance: 203,9 lx
Mounting height: 3,0 m
Number of c-planes: 12

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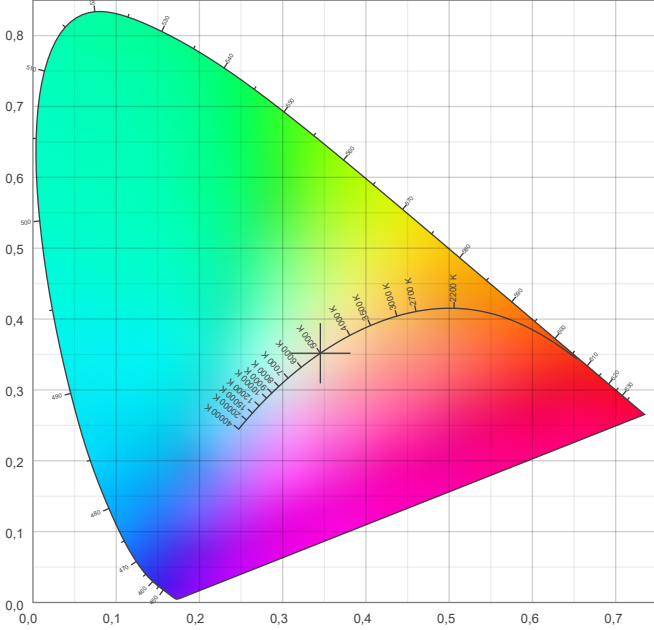


Color details

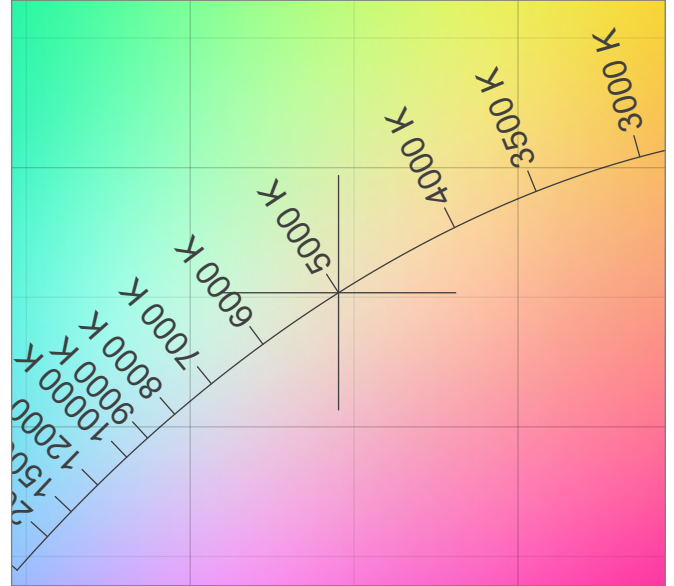
Correlated Color Temperature, Target CCT = 5000 K
 Correlated Color Temperature, Measured CCT = 4952 K
 Color Rendering Index CRI 91,6
 Color Rendering Index, R9 (red component) R9 = 63,6
 Color Rendering TM30-18 R_f 91,6 – R_g 100,4
 Color Quality Scale CQS = 92,9

MacAdam Steps
 Color coordinates CIE 1931 (x;y) = (0,345;0,352)
 Color coordinate CIEs 1960 (u;v) = (0,211;0,323)
 Color deviation from BBL Duv = 0,0044
 Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,211;0,485)

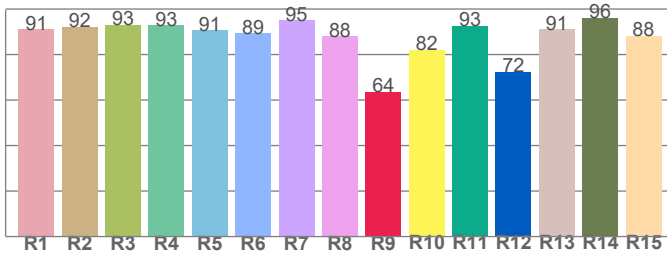
CIE 1931



CIE 1931 – zoomed on Planckian locus



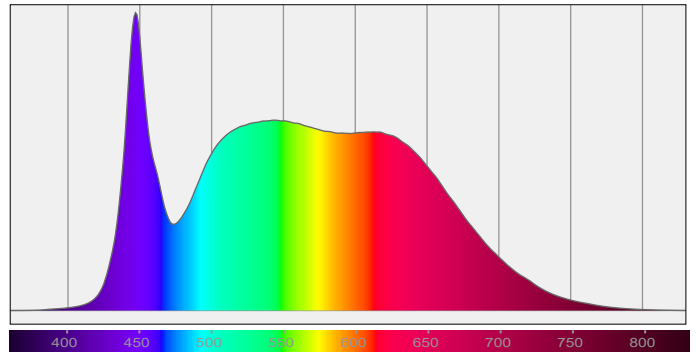
Color Rendering Index per reference color (CIE 1995)



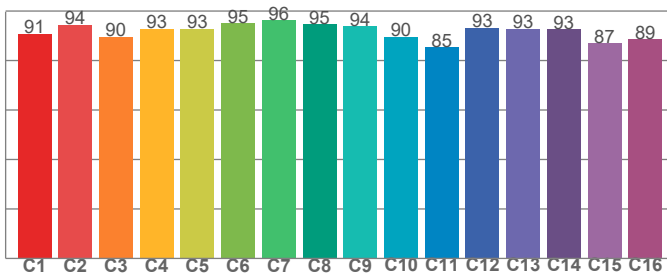
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
91,2	92,2	93,1	92,9	90,8	89,3	95,1	88,0	63,6	82,0	92,7	72,4	91,1	96,2	88,3

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



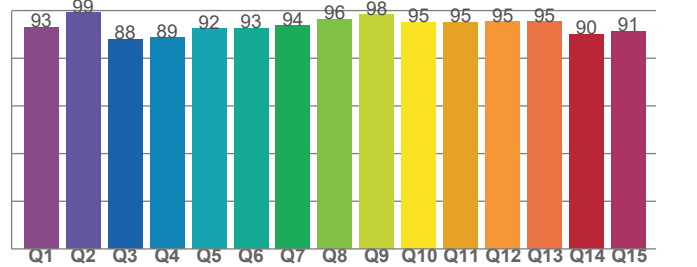
TM30-18 Rf-values per hue bin



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
90,9	94,5	89,6	92,9	92,8	95,0	96,4	94,7	93,8	89,6	85,3	93,2	92,9	92,7	86,9	88,7

Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
93,0	99,2	87,9	88,6	92,4	92,7	93,7	96,4	98,2	95,0	95,2	95,3	95,3	90,1	91,4

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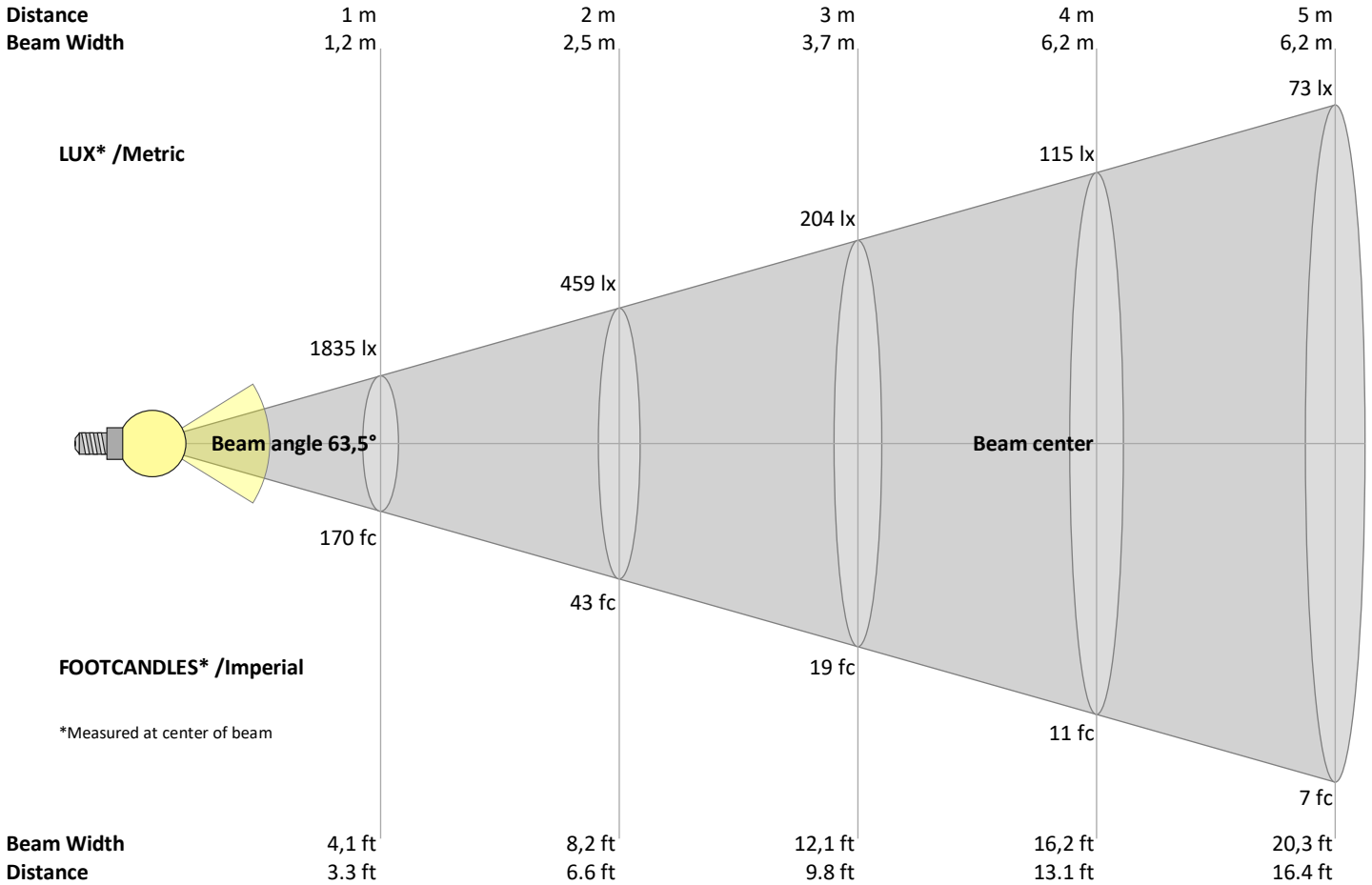
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Beam Details



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
1835	459	204	115	73	51	37	29	23	18	15	13	11	9	8	7	6	6	5	5	lux
170,5	42,6	18,9	10,7	6,8	4,7	3,5	2,7	2,1	1,7	1,4	1,2	1	0,9	0,8	0,7	0,6	0,5	0,5	0,4	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
1835	1835	1828	1822	1813	1802	1790	1768	1746	1700	1634	1565	1450	1336	1201	1051	900	751	602	480	cd
100%	100%	100%	99%	99%	98%	98%	96%	95%	93%	89%	85%	79%	73%	65%	57%	49%	41%	33%	26%	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
1835	1835	1828	1822	1813	1802	1790	1768	1746	1700	1634	1565	1450	1336	1201	1051	900	751	602	480	cd
100%	100%	100%	99%	99%	98%	98%	96%	95%	93%	89%	85%	79%	73%	65%	57%	49%	41%	33%	26%	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
1835	1835	1828	1822	1813	1802	1790	1768	1746	1700	1634	1565	1450	1336	1201	1051	900	751	602	480	cd
100%	100%	100%	99%	99%	98%	98%	96%	95%	93%	89%	85%	79%	73%	65%	57%	49%	41%	33%	26%	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
1835	1835	1828	1822	1813	1802	1790	1768	1746	1700	1634	1565	1450	1336	1201	1051	900	751	602	480	cd
100%	100%	100%	99%	99%	98%	98%	96%	95%	93%	89%	85%	79%	73%	65%	57%	49%	41%	33%	26%	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	21,8	22,5	22,0	22,8	23,0	21,8	22,5	22,0	22,8	23,0
	3H	21,5	22,3	21,9	22,6	22,7	21,5	22,3	21,9	22,6	22,7
	4H	21,5	22,2	21,9	22,5	22,7	21,5	22,2	21,9	22,5	22,7
	6H	21,5	22,1	21,8	22,4	22,8	21,5	22,1	21,8	22,4	22,8
	8H	21,4	22,0	21,7	22,4	22,7	21,4	22,0	21,7	22,4	22,7
	12H	21,4	22,0	21,7	22,3	22,7	21,4	22,0	21,7	22,3	22,7
4H	2H	21,5	22,3	21,9	22,5	22,7	21,5	22,3	21,9	22,5	22,7
	3H	21,4	22,0	21,7	22,3	22,8	21,4	22,0	21,7	22,3	22,8
	4H	21,2	21,8	21,7	22,2	22,7	21,2	21,8	21,7	22,2	22,7
	6H	21,2	21,7	21,7	22,1	22,4	21,2	21,7	21,7	22,1	22,4
	8H	21,1	21,6	21,6	22,0	22,3	21,1	21,6	21,6	22,0	22,3
	12H	21,0	21,5	21,5	21,9	22,3	21,0	21,5	21,5	21,9	22,3
8H	4H	21,1	21,6	21,6	22,0	22,3	21,1	21,6	21,6	22,0	22,3
	6H	21,0	21,4	21,5	21,9	22,4	21,0	21,4	21,5	21,9	22,4
	8H	21,0	21,3	21,5	21,8	22,5	21,0	21,3	21,5	21,8	22,5
	12H	21,0	21,2	21,6	21,7	22,3	21,0	21,2	21,6	21,7	22,3
12H	4H	21,0	21,5	21,5	21,9	22,3	21,0	21,5	21,5	21,9	22,3
	6H	21,0	21,3	21,5	21,8	22,5	21,0	21,3	21,5	21,8	22,5
	8H	21,0	21,2	21,6	21,7	22,3	21,0	21,2	21,6	21,7	22,3

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

S = 1.0H	4,2 / -10,2	4,2 / -10,2
S = 1.5H	6,7 / -21,1	6,7 / -21,1
S = 2.0H	8,7 / -31,1	8,7 / -31,1

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	113	111	108	106	111	108	106	104	104	103	101	101	99	98	97	96	95	93
2	108	103	98	95	105	101	97	94	98	95	92	95	92	90	92	90	88	86
3	102	95	90	86	100	94	89	86	91	87	84	89	86	83	87	84	82	80
4	97	89	83	79	95	88	82	78	85	81	77	83	80	76	82	78	76	74
5	91	83	77	72	90	82	76	72	80	75	71	78	74	71	77	73	70	69
6	87	77	71	67	85	77	71	67	75	70	66	74	69	66	72	68	65	64
7	82	73	66	62	81	72	66	62	71	65	62	69	65	61	68	64	61	59
8	78	68	62	58	77	68	62	58	66	61	57	65	61	57	64	60	57	56
9	74	64	58	54	73	64	58	54	63	57	54	62	57	53	61	57	53	52
10	70	61	55	51	69	60	54	50	59	54	50	58	54	50	58	53	50	49

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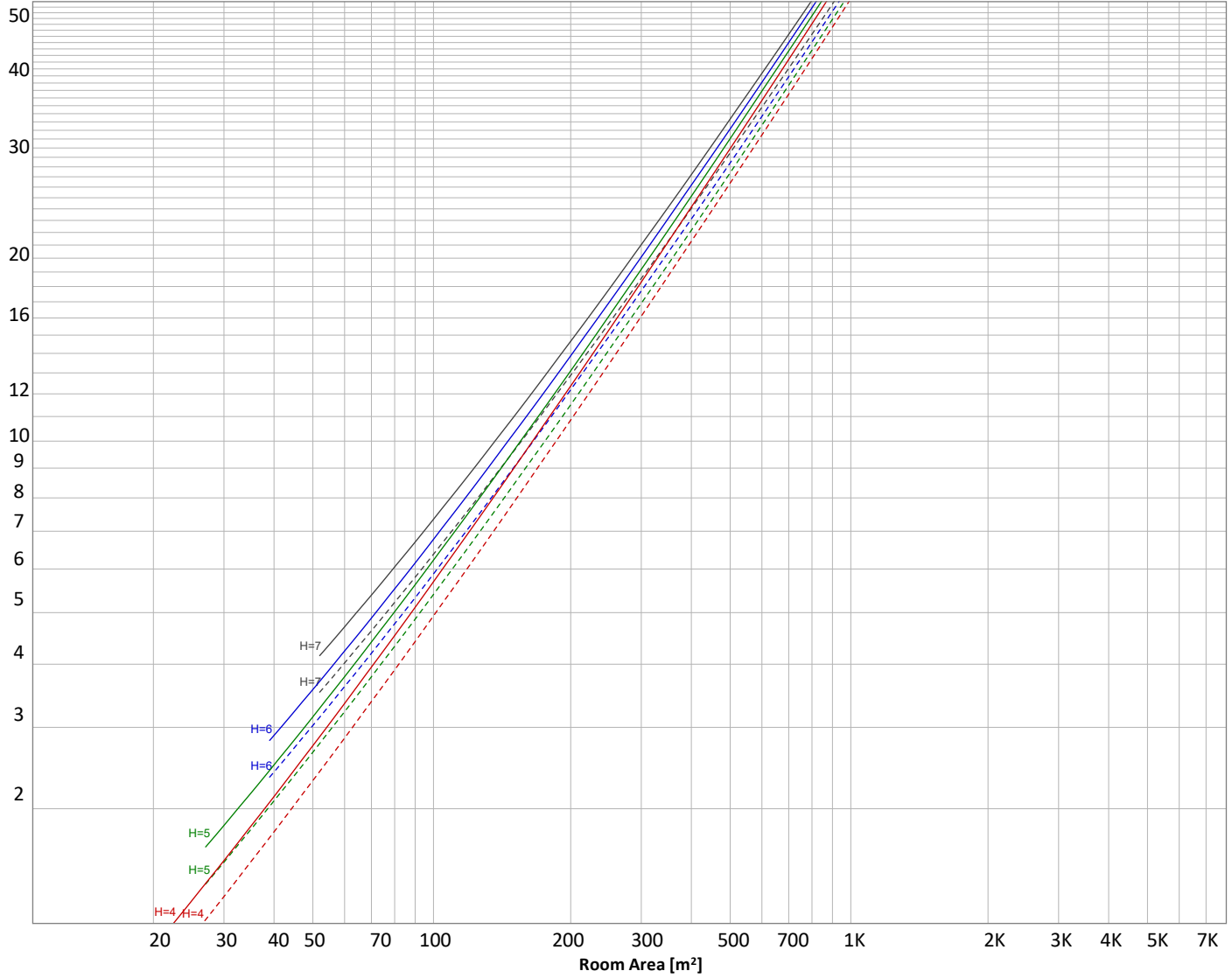
Operator:



Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 1914 lm	ρ(%)			
H _{down} = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	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°
174 lm	494 lm	634 lm	421 lm	153 lm	34,0 lm	1,91 lm	0,126 lm	0,115 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
0,118 lm	0,117 lm	0,132 lm	0,125 lm	0,168 lm	0,239 lm	0,225 lm	0,168 lm	0,062 lm

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Outdoor Light Planning

Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	174 lm	9,1%
10-20°	494 lm	25,8%
20-30°	634 lm	33,1%
30-40°	421 lm	22,0%
40-50°	153 lm	8,0%
50-60°	34 lm	1,8%
60-70°	2 lm	0,1%
70-80°	0 lm	0,0%
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	1914 lm	100,0%

Intensity peaks

Max intensity	1835 cd
Intensity, 90°	0 cd
Intensity, 0°	1835 cd

Zonal Lumen summary

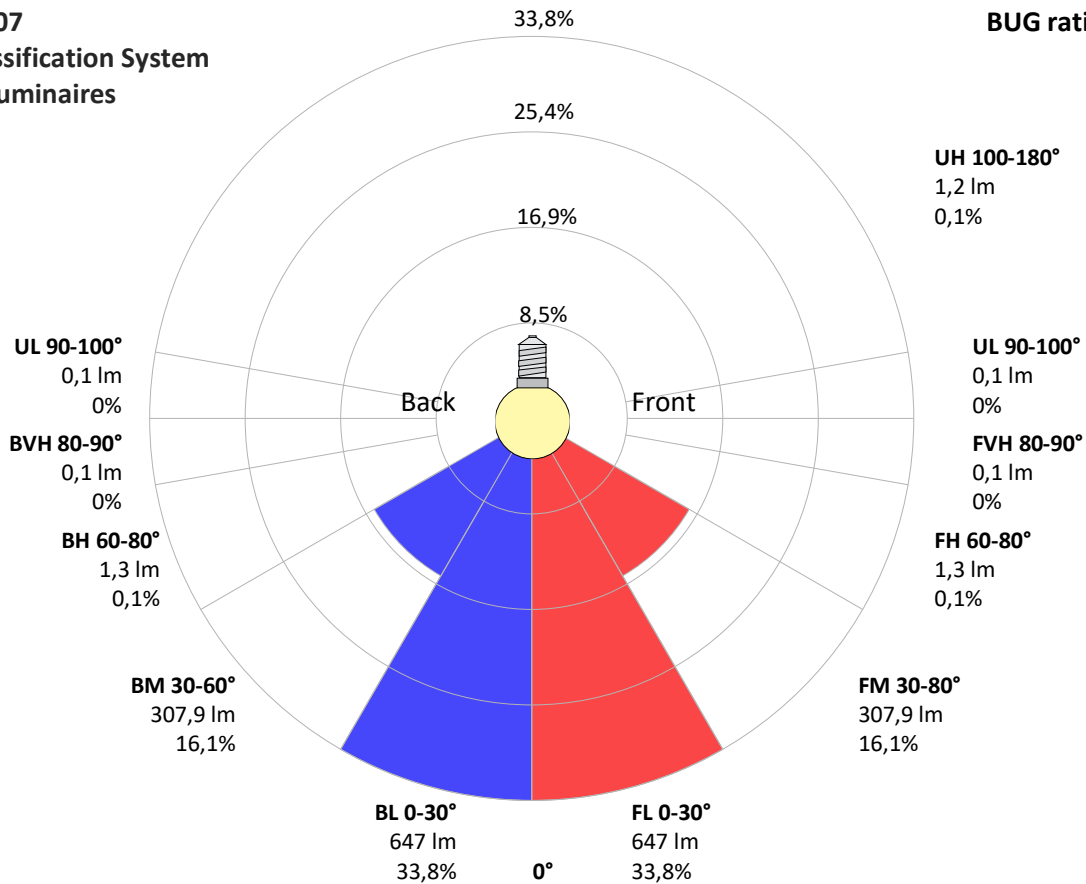
Zone (γ)	Lumen	% Total
0-30°	1302 lm	68,0%
0-40°	1724 lm	90,1%
0-60°	1910 lm	99,8%
60-90°	2 lm	0,1%
70-100°	0 lm	0,0%
90-120°	0 lm	0,0%
0-90°	1912 lm	99,9%
90-180°	1 lm	0,1%
0-180°	1914 lm	100,0%

BUG rating

	Lumen	% Total
Forward light		
Low(0-30°)	647 lm	33,8%
Medium(30-60°)	308 lm	16,1%
High(60-80°)	1 lm	0,1%
Very high(80-90°)	0 lm	0,0%
Back light		
Low(0-30°)	647 lm	33,8%
Medium(30-60°)	308 lm	16,1%
High(60-80°)	1 lm	0,1%
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



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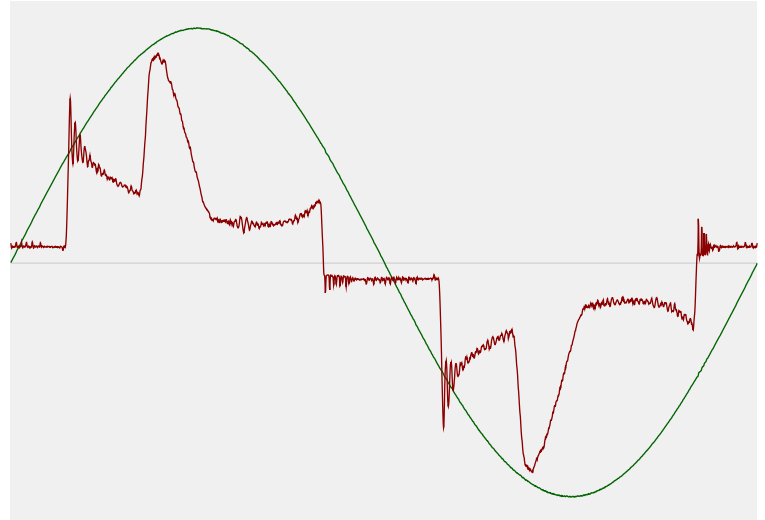


Power Details

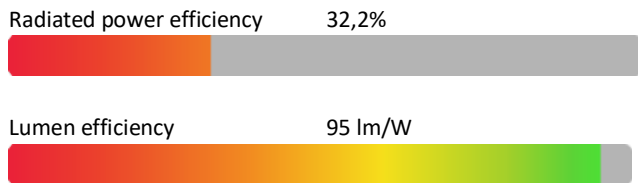
Input Power

Power feed to light source	20,1 W
Frequency of input power	50 Hz
RMS Input voltage feed, V_{RMS}	230 V
RMS Input current feed, I_{RMS}	0,106 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	24,36 VA
Displacement factor of AC power feed	0,94
Power factor of AC current feed	0,83
Total harmonic distortion of the current	52,84%
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	4990 K
CCT shift	+10 K
CCT end	5000 K

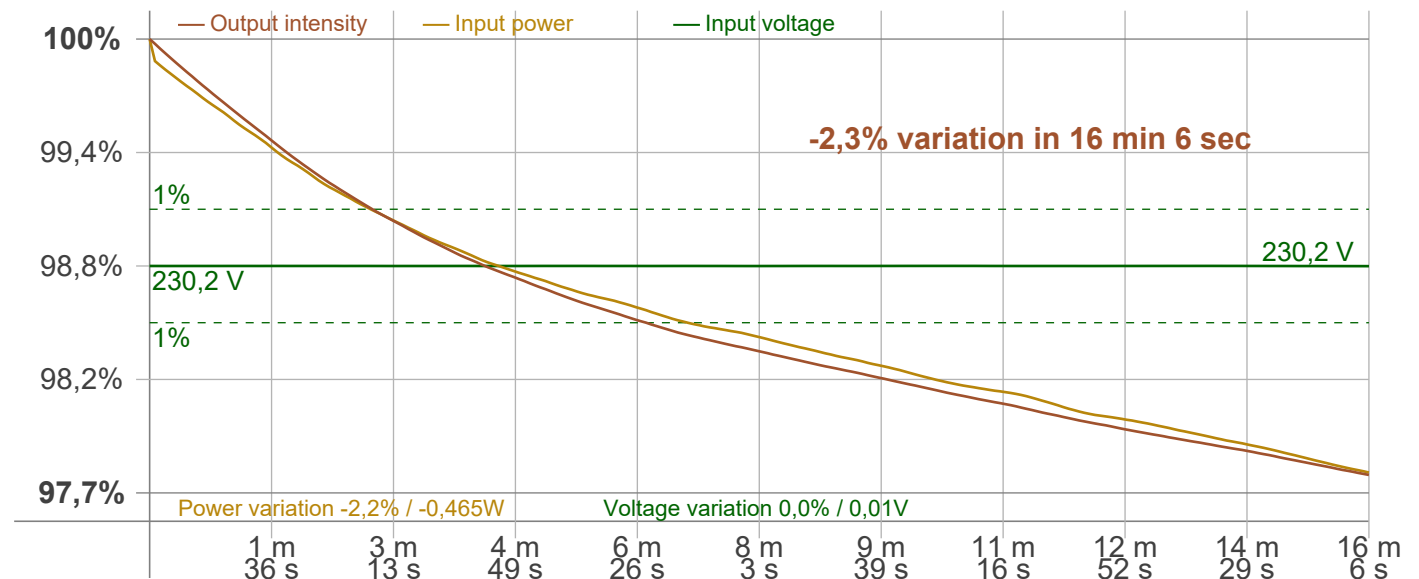
Warmup Result

Total warmup time	Lamp stabilized in 16 min 6 sec
Warmup variation	-2,3%

Output Change

Output start	1959 lm
Output change	-45 lm
Output end	1914 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 100,5 Hz
 Percent Flicker 0,67 %
 Flicker index 0

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

JA8/10 40 Hz 0,01 %
 JA8/10 90 Hz 0,02 %
 JA8/10 200 Hz 0,64 %
 JA8/10 400 Hz 0,67 %
 JA8/10 1000 Hz 0,67 %

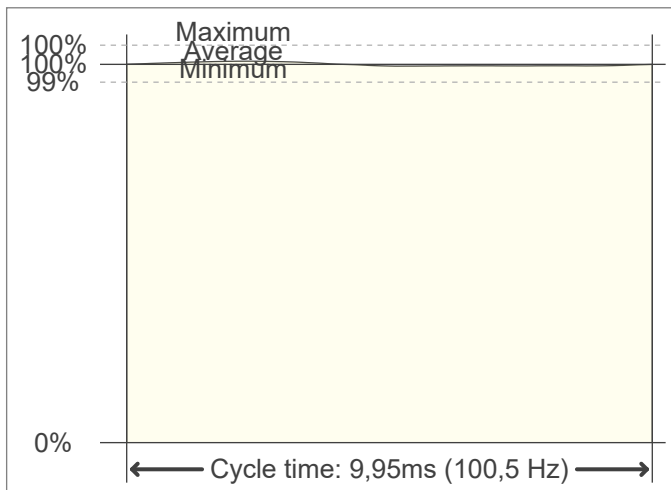
TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

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

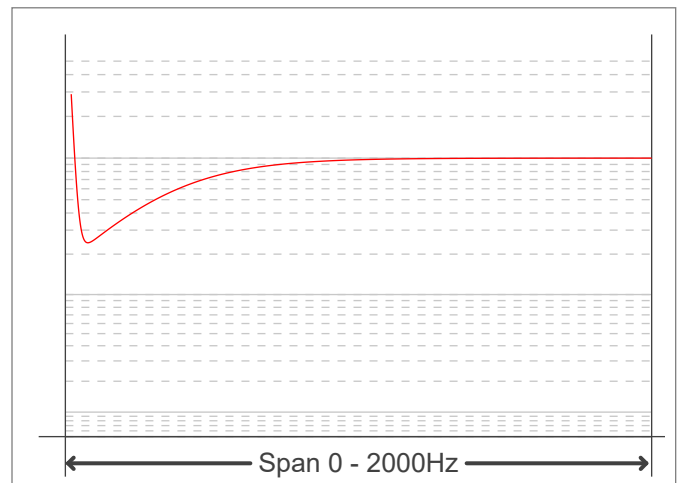
Flicker indices according to Lighting Research Center (2015)

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

