Light Measurement Report

Print date: 22/08/2023
Measurement date and time: 22/08/2023 13:27:47 – Measurement no. VFR-230822-0123-MS
Measurement tracking No. and Link: VT230822-008801
Operator: TT

Laboratory and Equipment

Laboratory Owner and Location	Viso Systems, Copenhagen V, Denmark
Goniospectrometer System and Type	LabSpion – Type C, horizontal
Sensor Name, Calibr. Date and Serial No.	LabSensor Model2 – 07/12/2022 – 3532797498
Spectrometer Manufacturer and Model	Ibsen Photonics, Denmark – Freedom VIS (Custom Viso)

Measurement Conditions

Number of C-planes and Resolution	72 planes – 5°
γ (gamma)-Resolution	1°
Test Distance	1,16 m
Input Power, Power and Displ. Factors	8,2 W – PF 0,86 – DPF 0,93
Input RMS Voltage and Current	238 V – 0,040 A
Frequency of Input Power	50 Hz
Warm-up Time and Variation	Lamp stabilized in 15 min 2 sec – 2,0%

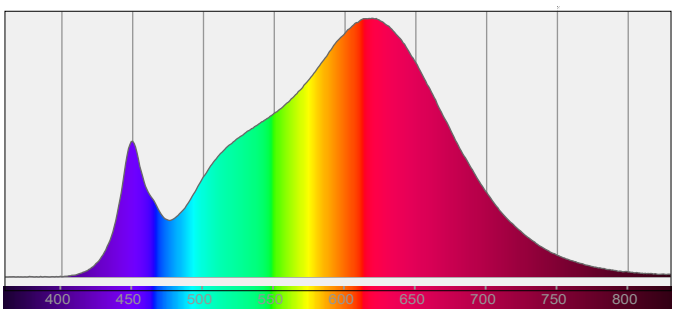
Tested Light Source

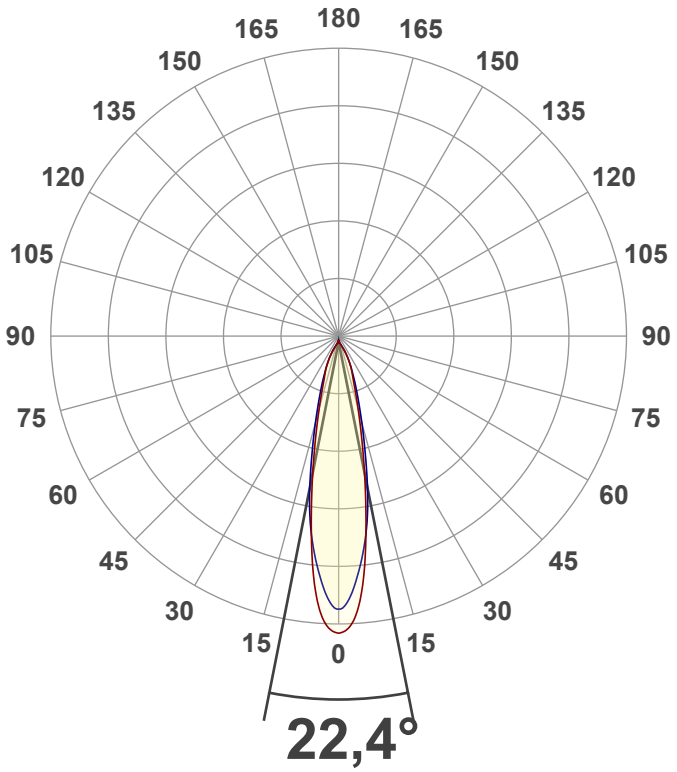
Product Name	MULTITUBE 7.5 3000K 20D BLACK
Item No. and Manufacturer	0100070030200302 – ELECTRUM
Product Description (line 1)	With driver 350mA

Main Light Measurement Results

Output – Total Lumen (Up% / Down%)	326 lm – 0,32% / 99,68%
Efficiency	40 lm/W
Peak Intensity and Beam Angle	1407 cd – 22,4°
Correlated Color Temperature, Target/Measured	CCT = 3000 K / 3013 K
Color Rendering Index	CRI 92,9
Color Rendering TM30-18	R_f 92,0 – R_g 100,2
Color Shift, CIE duv and MacAdam Steps	Duv -0,0011 – SDCM 1,2
Flicker	SVM 0 – PstLM 0,01



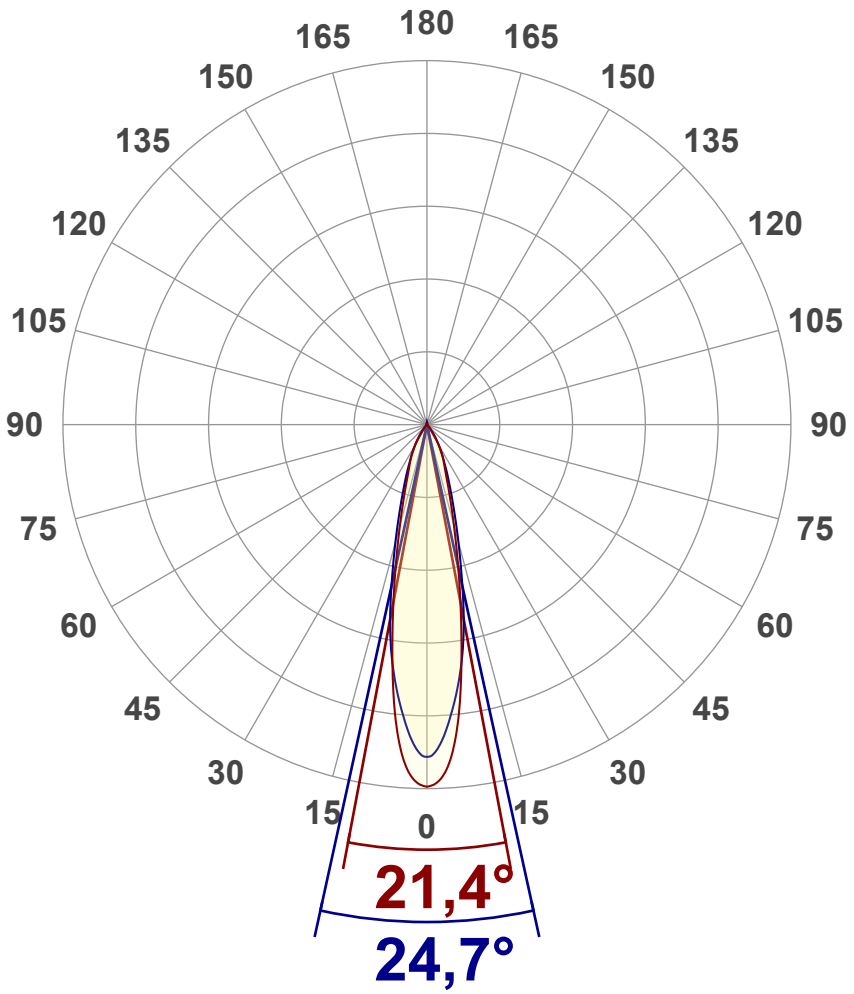




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Luminous Intensity diagram Unit: 0-100% of peak intensity



Main Values

Output (total Lumen)	326 lm
Lumen Up% / Down%	0,32% / 99,68%
Peak Intensity	1407 cd
Beam Angle (50%)	22,4°
Beam Angle (90%)	24,7°
Beam Angle (10%)	21,5°

Cut-off Angle

Average 2,5%	70,9°

Field Angle

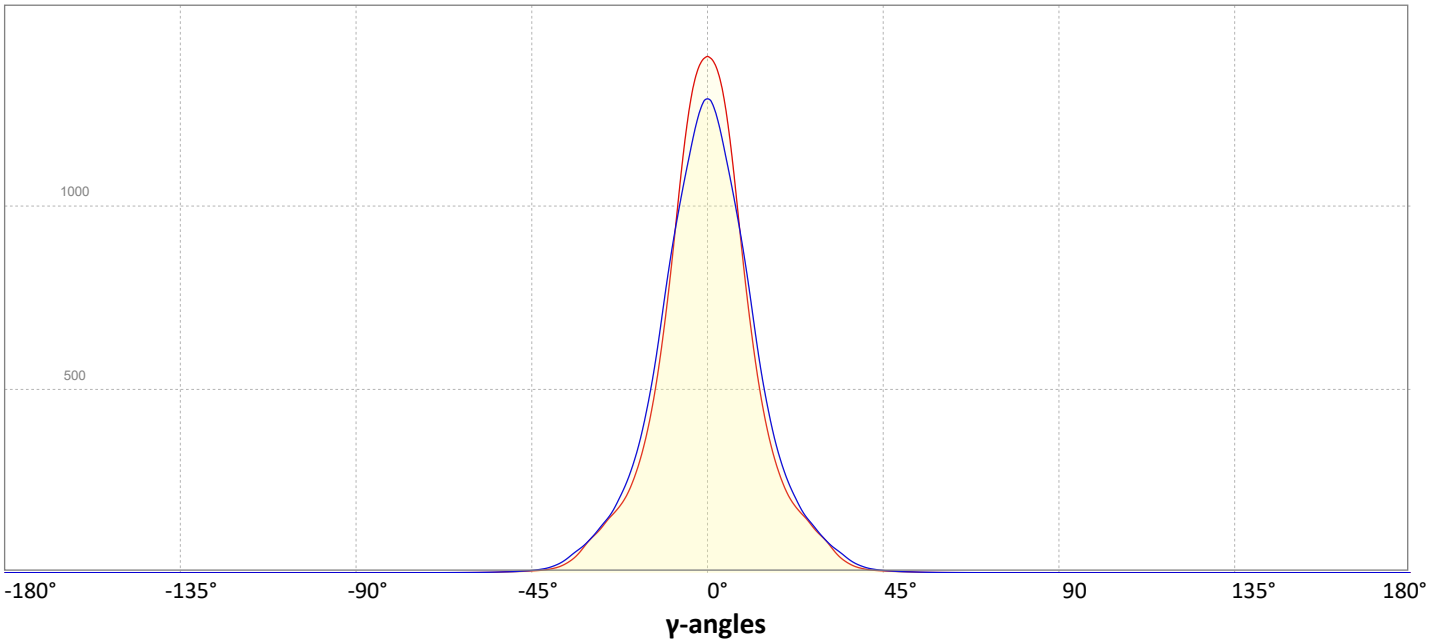
Average 10%	52,4°

Intensity Ratio

In 120° cone	99,4%
In 90° cone	98,5%

C000-C180
C090-C270

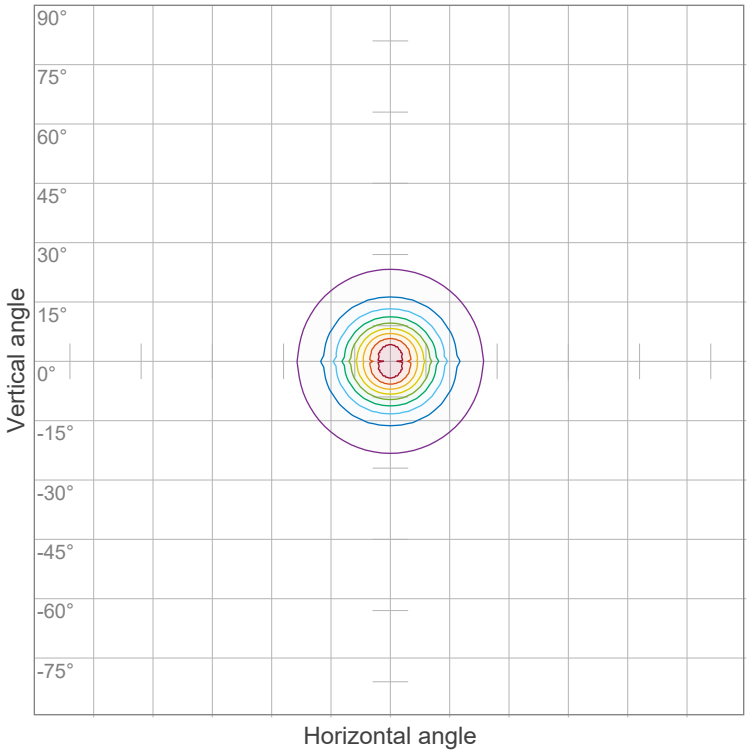
Linear distribution diagram - Intensity (candela) vs γ-angle



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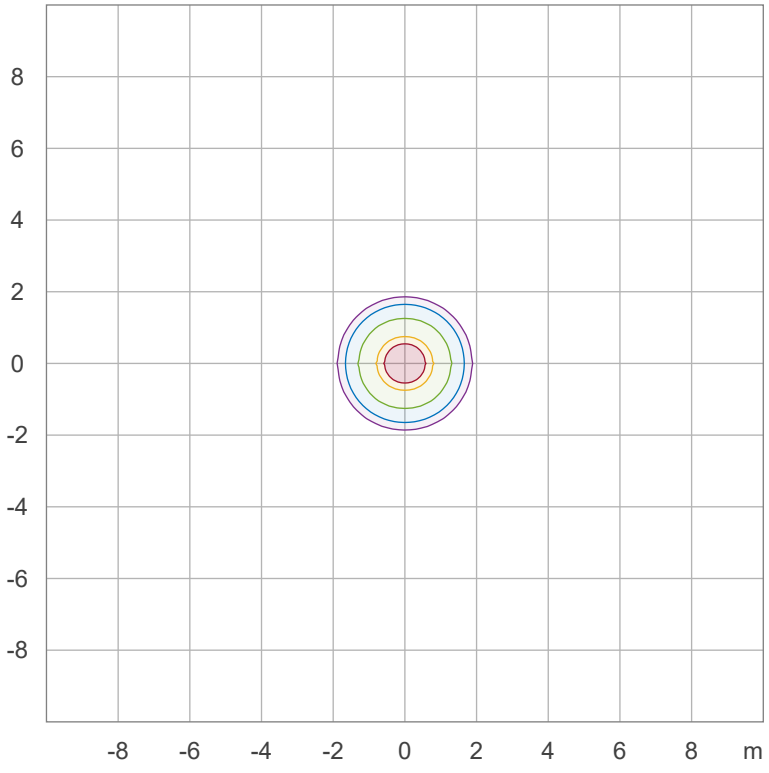
Iso-intensity Diagram (Iso-candela)



90 %	1261,6 cd
80 %	1121,4 cd
70 %	981,2 cd
60 %	841,0 cd
50 %	700,9 cd
40 %	560,7 cd
30 %	420,5 cd
20 %	280,3 cd
10 %	140,2 cd

Peak intensity: 1401,7 cd
Number of c-planes: 72

Iso-illuminance Diagram (Iso-lux)



50,0 %	77,8 lx
30,0 %	46,7 lx
10,0 %	15,6 lx
5,0 %	7,8 lx
3,0 %	4,7 lx

Peak illuminance: 155,7 lx
Mounting height: 3,0 m
Number of c-planes: 72

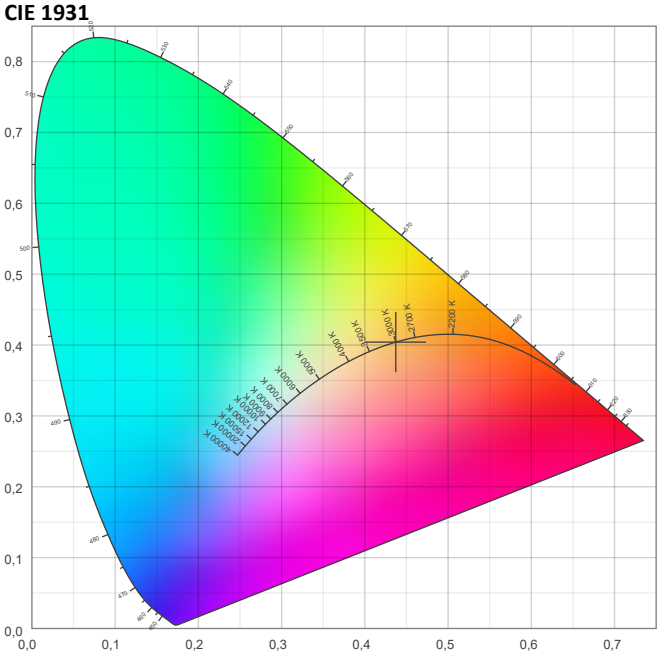
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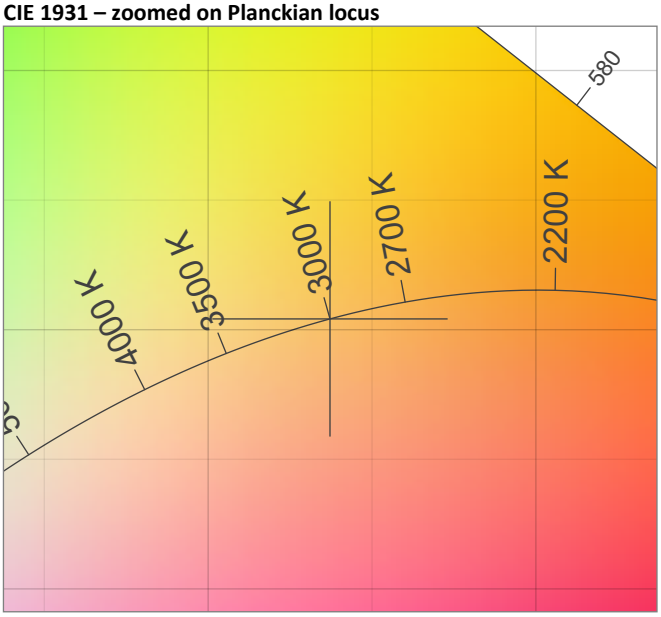
Color details

Correlated Color Temperature, Target	CCT = 3000 K
Correlated Color Temperature, Measured	CCT = 3013 K
Color Rendering Index	CRI 92,9
Color Rendering Index, R9 (red component)	R9 = 57,8
Color Rendering TM30-18	R_f 92,0 – R_g 100,2
Color Quality Scale	CQS = 90,7
MacAdam Steps	SDCM = 1,2
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 = -0,0011
Color coordinate CIEs 1976 (CIELUV)	(u';v') = (0,251;0,251)

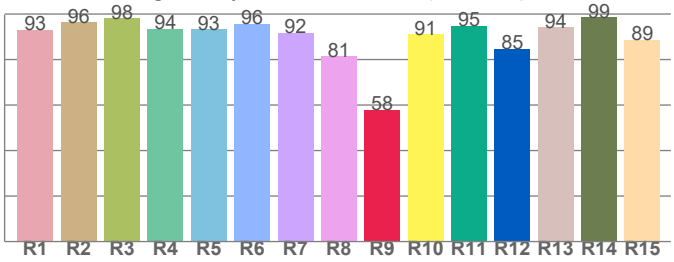
CIE 1931



CIE 1931 – zoomed on Planckian locus



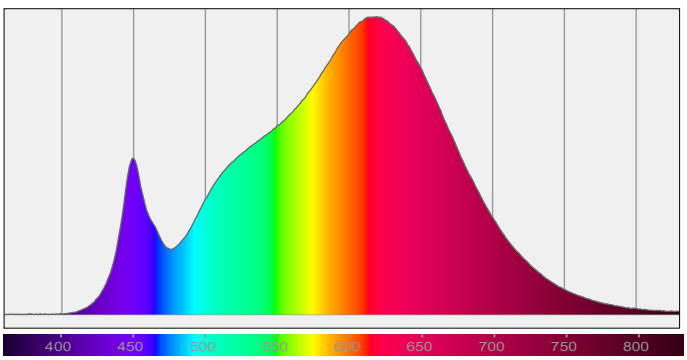
Color Rendering Index per reference color (CIE 1995)



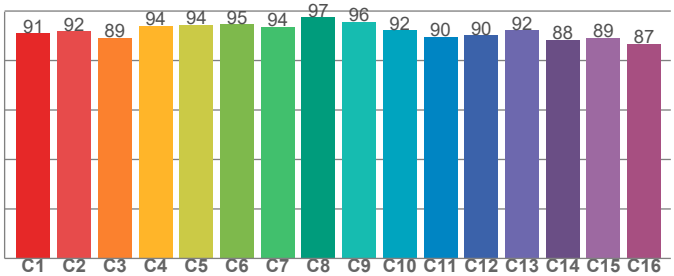
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
93,1	96,3	98,2	93,5	93,2	95,6	91,7	81,4	57,8	91,0	94,8	84,6	94,1	98,6	88,6

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



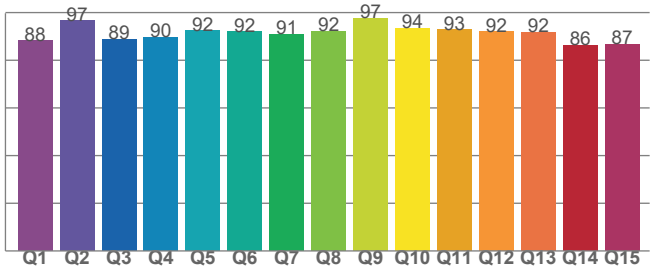
TM30-18 Rf-values per hue bin



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
91,0	91,9	89,2	94,1	94,4	94,7	93,6	97,4	95,6	92,3	89,7	90,2	92,3	88,3	89,2	86,8

Color Quality Scale by reference color



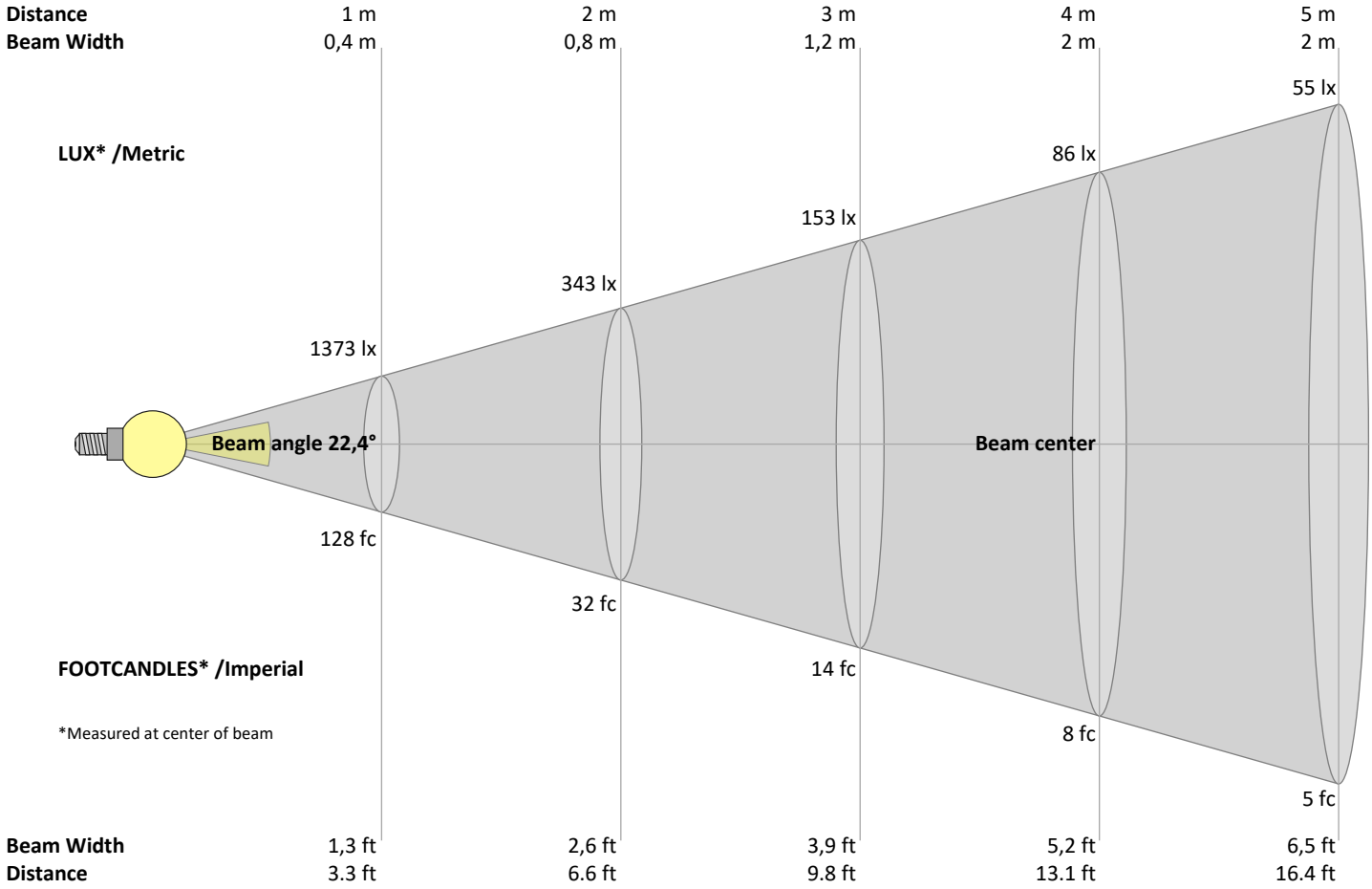
CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
88,1	96,6	88,8	89,6	92,3	92,0	90,9	92,3	97,5	93,5	92,8	92,0	91,7	86,2	86,7

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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
1373	343	153	86	55	38	28	21	17	14	11	10	8	7	6	5	5	4	4	3	lux
127,6	31,9	14,2	8	5,1	3,5	2,6	2	1,6	1,3	1,1	0,9	0,8	0,7	0,6	0,5	0,4	0,4	0,4	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
1373	1383	1304	1158	961	765	597	462	359	283	227	188	162	138	112	91	65	42	27	16	cd
100%	101%	95%	84%	70%	56%	43%	34%	26%	21%	17%	14%	12%	10%	8%	7%	5%	3%	2%	1%	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
1373	1256	1170	1065	951	821	673	533	422	333	266	216	174	143	117	92	71	55	38	25	cd
100%	91%	85%	78%	69%	60%	49%	39%	31%	24%	19%	16%	13%	10%	8%	7%	5%	4%	3%	2%	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
1373	1383	1304	1158	961	765	597	462	359	283	227	188	162	138	112	91	65	42	27	16	cd
100%	101%	95%	84%	70%	56%	43%	34%	26%	21%	17%	14%	12%	10%	8%	7%	5%	3%	2%	1%	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
1373	1256	1170	1065	951	821	673	533	422	333	266	216	174	143	117	92	71	55	38	25	cd
100%	91%	85%	78%	69%	60%	49%	39%	31%	24%	19%	16%	13%	10%	8%	7%	5%	4%	3%	2%	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		**Viewed Crosswise** (Viewing direction orthogonal to lamp length axis)					**Viewed Endwise** (Viewing direction parallel to lamp length axis)				
X	**Y**										
2H	2H	12,9	13,4	13,0	13,6	13,8	13,4	13,8	13,5	14,0	14,2
	3H	12,6	13,2	13,0	13,4	13,6	13,1	13,7	13,5	13,9	14,1
	4H	12,5	13,1	12,9	13,4	13,6	13,0	13,6	13,4	13,8	14,1
	6H	12,6	13,0	12,9	13,3	13,7	13,0	13,5	13,3	13,8	14,2
	8H	12,5	13,0	12,8	13,3	13,7	13,0	13,5	13,3	13,8	14,2
	12H	12,5	12,9	12,8	13,3	13,7	12,9	13,4	13,3	13,8	14,2
4H	2H	12,5	13,1	12,9	13,4	13,6	13,0	13,6	13,4	13,8	14,1
	3H	12,5	12,9	12,8	13,3	13,7	12,9	13,4	13,3	13,7	14,2
	4H	12,3	12,7	12,7	13,2	13,7	12,8	13,2	13,2	13,6	14,2
	6H	12,3	12,7	12,8	13,1	13,4	12,7	13,2	13,2	13,5	13,9
	8H	12,2	12,6	12,7	13,0	13,4	12,7	13,1	13,2	13,5	13,8
	12H	12,2	12,5	12,7	12,9	13,4	12,6	13,0	13,1	13,4	13,8
8H	4H	12,2	12,6	12,7	13,0	13,3	12,7	13,1	13,2	13,4	13,8
	6H	12,1	12,4	12,7	12,9	13,4	12,6	12,9	13,1	13,4	13,9
	8H	12,2	12,4	12,7	12,9	13,5	12,6	12,8	13,2	13,4	14,0
	12H	12,1	12,3	12,7	12,8	13,4	12,6	12,8	13,2	13,3	13,9
12H	4H	12,1	12,5	12,6	12,9	13,3	12,6	12,9	13,1	13,3	13,8
	6H	12,2	12,4	12,7	12,9	13,5	12,6	12,8	13,1	13,4	14,0
	8H	12,1	12,3	12,7	12,8	13,4	12,6	12,8	13,2	13,3	13,9

Variations with the observer position for the luminaire spacings, S:		
S = 1.0H	5,9 / -8,2	5,9 / -8,2
S = 1.5H	8,6 / -9,1	8,6 / -9,3
S = 2.0H	10,6 / -9,7	10,6 / -9,9

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	115	112	110	108	112	110	108	107	106	105	103	102	101	100	99	98	97	96
2	110	106	103	101	108	105	102	99	102	99	97	99	97	95	96	94	93	92
3	106	101	97	94	105	100	96	94	97	95	92	95	93	91	93	91	89	88
4	103	97	93	89	101	96	92	89	94	90	88	92	89	87	90	88	86	84
5	99	93	88	85	98	92	88	85	90	87	84	89	86	83	87	84	82	81
6	96	89	84	81	95	88	84	81	87	83	80	86	82	80	84	82	79	78
7	93	86	81	78	92	85	81	78	84	80	77	83	79	77	82	79	76	75
8	90	83	78	75	89	82	78	75	81	77	74	80	77	74	79	76	74	73
9	87	80	75	72	86	79	75	72	78	75	72	78	74	72	77	74	71	70
10	84	77	73	70	84	77	73	70	76	72	70	75	72	69	75	71	69	68

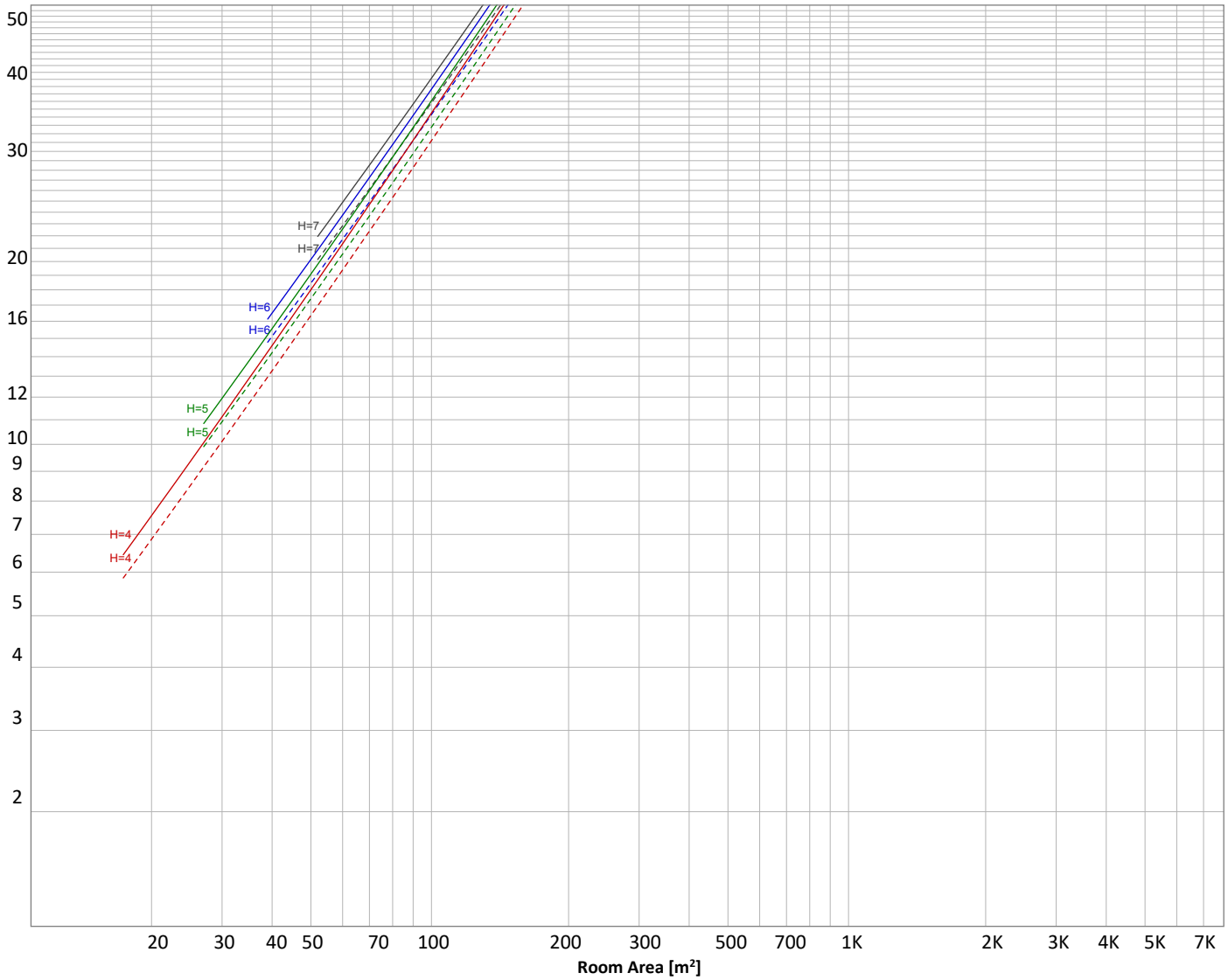
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Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 326 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°
101 lm	121 lm	70,3 lm	26,0 lm	4,61 lm	1,37 lm	0,431 lm	0,216 lm	0,167 lm

90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
0,158 lm	0,151 lm	0,145 lm	0,137 lm	0,131 lm	0,122 lm	0,108 lm	0,068 lm	0,021 lm

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Outdoor Light Planning

Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	101 lm	30,9%
10-20°	121 lm	37,1%
20-30°	70 lm	21,6%
30-40°	26 lm	8,0%
40-50°	5 lm	1,4%
50-60°	1 lm	0,4%
60-70°	0 lm	0,1%
70-80°	0 lm	0,1%
80-90°	0 lm	0,1%
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	326 lm	100,0%

Zonal Lumen summary

Zone (γ)	Lumen	% Total
0-30°	292 lm	89,6%
0-40°	318 lm	97,6%
0-60°	324 lm	99,4%
60-90°	1 lm	0,3%
70-100°	1 lm	0,2%
90-120°	0 lm	0,1%
0-90°	325 lm	99,7%
90-180°	1 lm	0,3%
0-180°	326 lm	100,0%

Intensity peaks

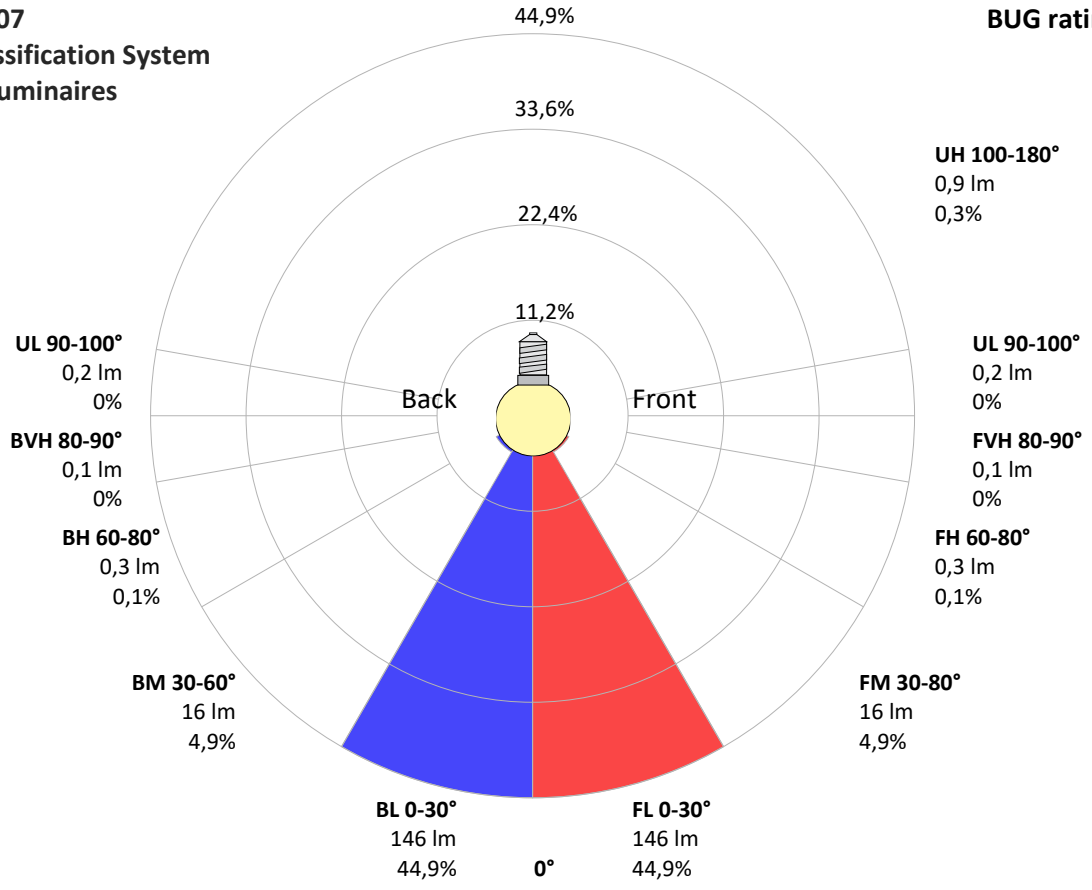
Max intensity	1407 cd
Intensity, 90°	0 cd
Intensity, 0°	1373 cd

BUG rating

	Lumen	% Total
Forward light		
Low(0-30°)	146 lm	44,9%
Medium(30-60°)	16 lm	4,9%
High(60-80°)	0 lm	0,1%
Very high(80-90°)	0 lm	0,0%
Back light		
Low(0-30°)	146 lm	44,9%
Medium(30-60°)	16 lm	4,9%
High(60-80°)	0 lm	0,1%
Very high(80-90°)	0 lm	0,0%
Uplight		
Low(90-100°)	0 lm	0,0%
High(100-180°)	1 lm	0,3%

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

BUG rating B1 U1 G0



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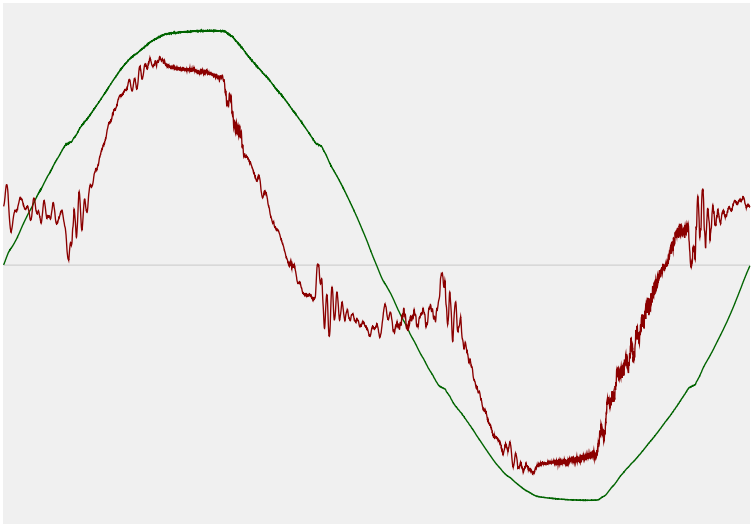
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Power Details

Input Power

Power feed to light source	8,2 W
Frequency of input power	50 Hz
RMS Input voltage feed, V_{RMS}	238 V
RMS Input current feed, I_{RMS}	0,040 A
Volt-Ampere or apparent power = V_{RMS}*I_{RMS}	9,56 VA
Displacement factor of AC power feed	0,93
Power factor of AC current feed	0,86
Total harmonic distortion of the current	41,05%
Total harmonic distortion of the voltage	2,5%

Input Power Curve

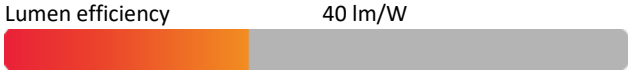


Efficiency

Radiated power efficiency 13,8%



Lumen efficiency 40 lm/W



Stabilization Details

Warmup Conditions

Stable period	15 min
Stable change max	2,0%
Minimum time	15 min

Color Temperature Change

CCT start	3000 K
CCT shift	+0 K
CCT end	3000 K

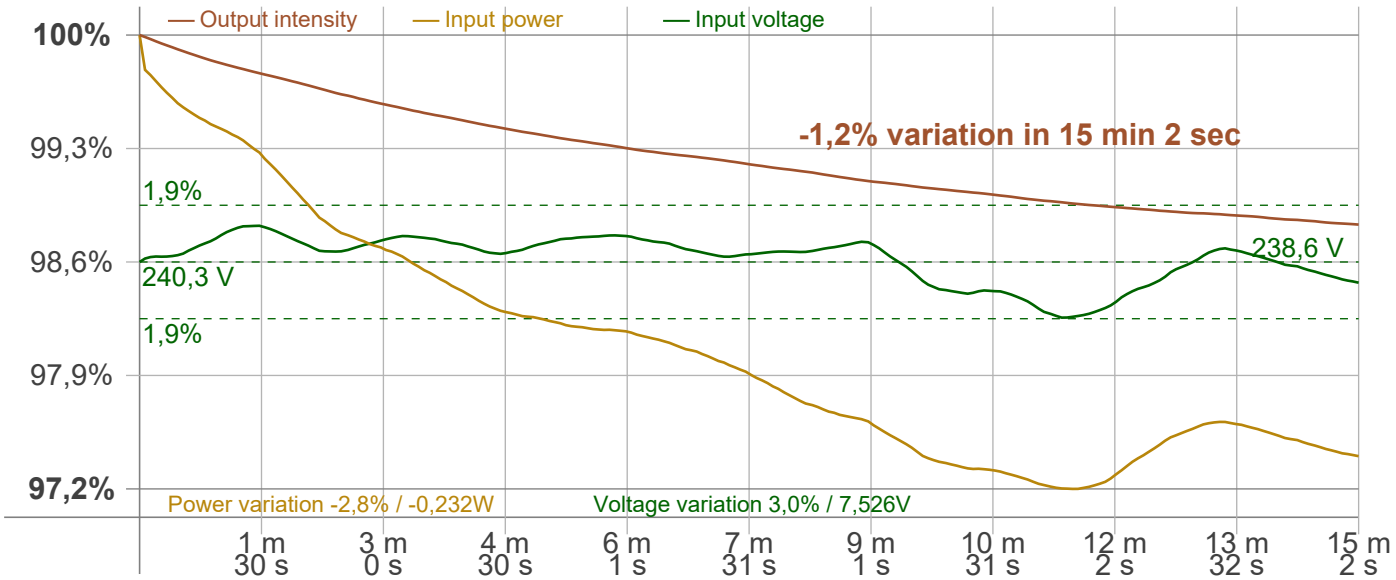
Warmup Result

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

Output Change

Output start	329 lm
Output change	-4 lm
Output end	326 lm

Stabilization Curve



Light Measurement Report

Print date: 22/08/2023
Measurement date and time: 22/08/2023 13:27:47 – Measurement no. VFR-230822-0123-MS
Measurement tracking No. and Link: VT230822-008801
Operator: TT

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	200 Hz
Percent Flicker	0,11 %
Flicker index	0

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

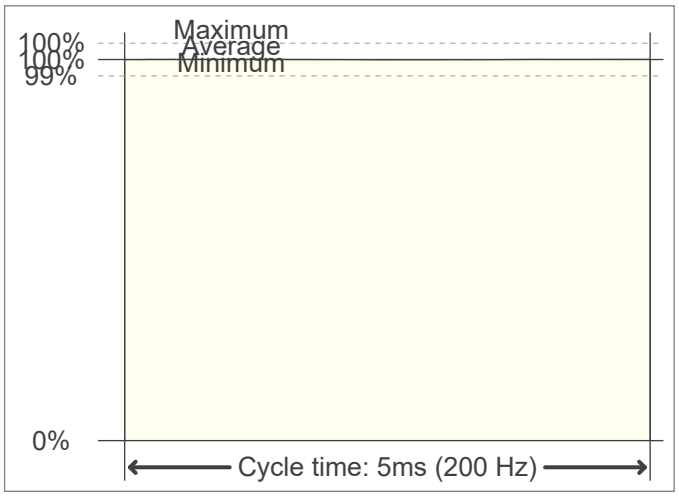
Flicker indices according to California Energy Commission (CEC) 2016b

JA8/10 40 Hz	0,01 %
JA8/10 90 Hz	0,03 %
JA8/10 200 Hz	0,08 %
JA8/10 400 Hz	0,08 %
JA8/10 1000 Hz	0,09 %

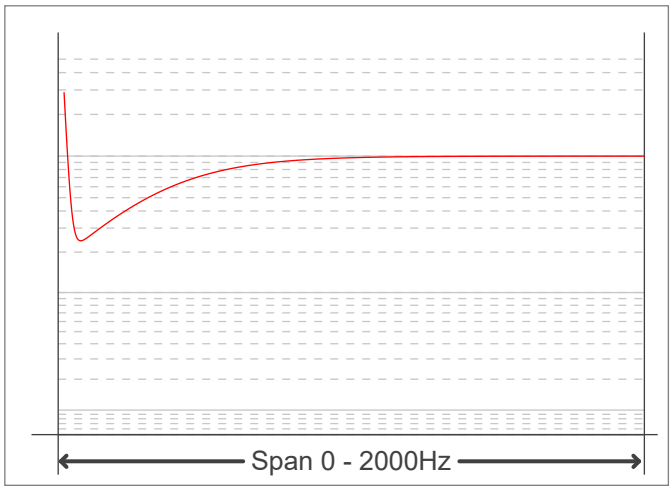
Flicker indices according to Lighting Research Center (2015)

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

