

Light Measurement Report

Print date: 18/03/2024
Measurement date and time: 18/03/2024 16:07:20 – Measurement no. VFR-240318-0203-MS
Measurement tracking No. and Link: [n/a](#)
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 – 17/01/2024 – 3532797498
Spectrometer Manufacturer and Model	Ibsen Photonics, Denmark – Freedom VIS (Custom Viso)

Measurement Conditions

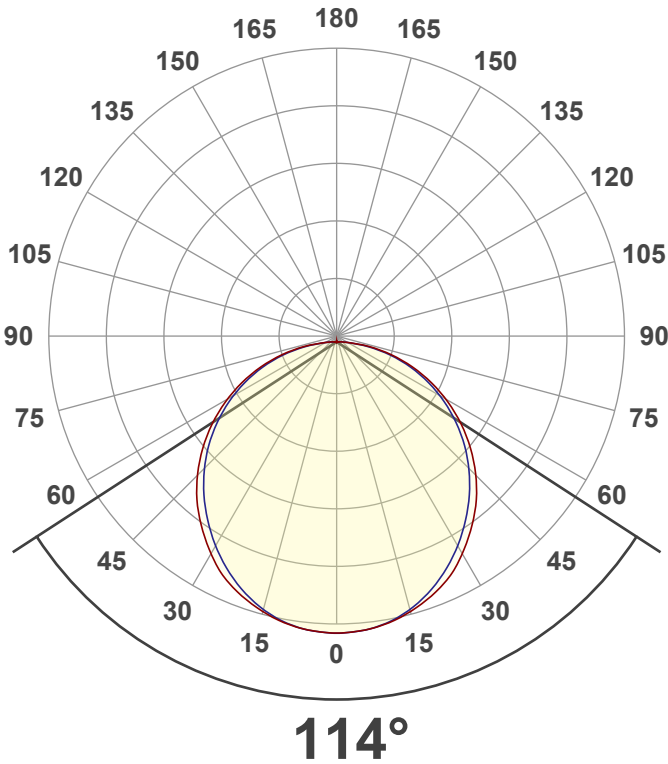
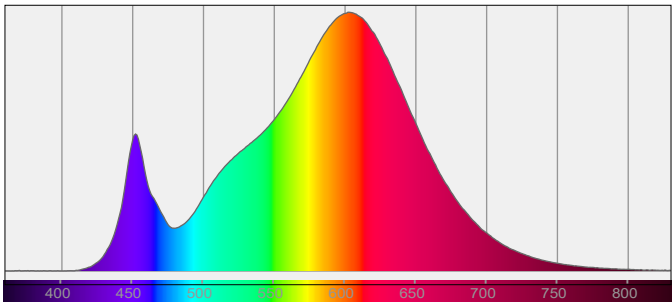
Number of C-planes and Resolution	12 planes – 30°
γ (gamma)-Resolution	5°
Test Distance	3,19 m
Input Power, Power and Displ. Factors	24,4 W – PF 0,92 – DPF 0,93
Input RMS Voltage and Current	226 V – 0,118 A
Frequency of Input Power	50 Hz
Warm-up Time and Variation	Lamp stabilized in 15 min 2 sec – 2,0%

Tested Light Source

Product Name	FUSION ON 24 3000K
Item No. and Manufacturer	21711400309802 – ELECTRUM
Product Description (line 1)	

Main Light Measurement Results

Output – Total Lumen (Up% / Down%)	1838 lm – 0,37% / 99,63%
Efficiency	75 lm/W
Peak Intensity and Beam Angle	623 cd – 114°
Correlated Color Temperature, Target/Measured	CCT = 3000 K / 2921 K
Color Rendering Index	CRI 81,1
Color Rendering TM30-18	R _f 83,5 – R _g 95,6
Color Shift, CIE duv and MacAdam Steps	Duv -0,0007 – SDCM 2,8
Flicker	SVM 0,34 – PstLM 0,7



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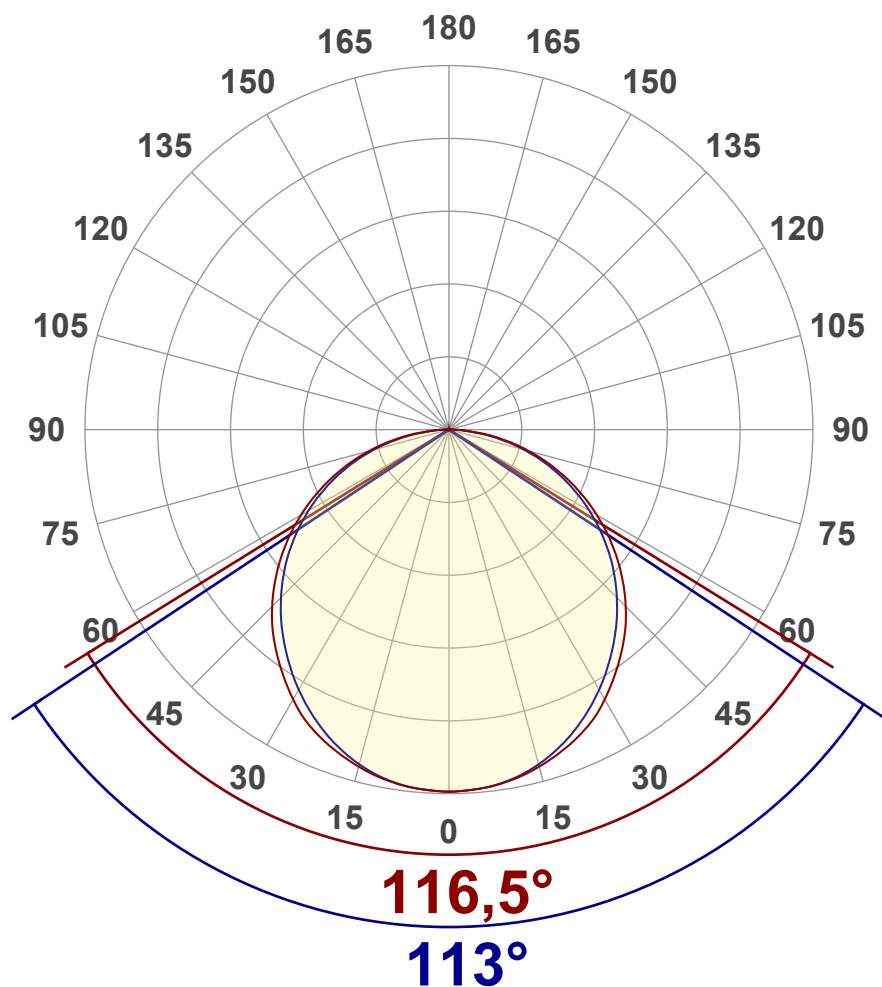
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Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

Output (total Lumen)	1838 lm
Lumen Up% / Down%	0,37% / 99,63%
Peak Intensity	623 cd
Beam Angle (50%)	114°
Beam Angle (90%)	113°
Beam Angle (10%)	116,5°

Cut-off Angle

Average 2,5%	177,6°
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Field Angle

Average 10%	165,2°
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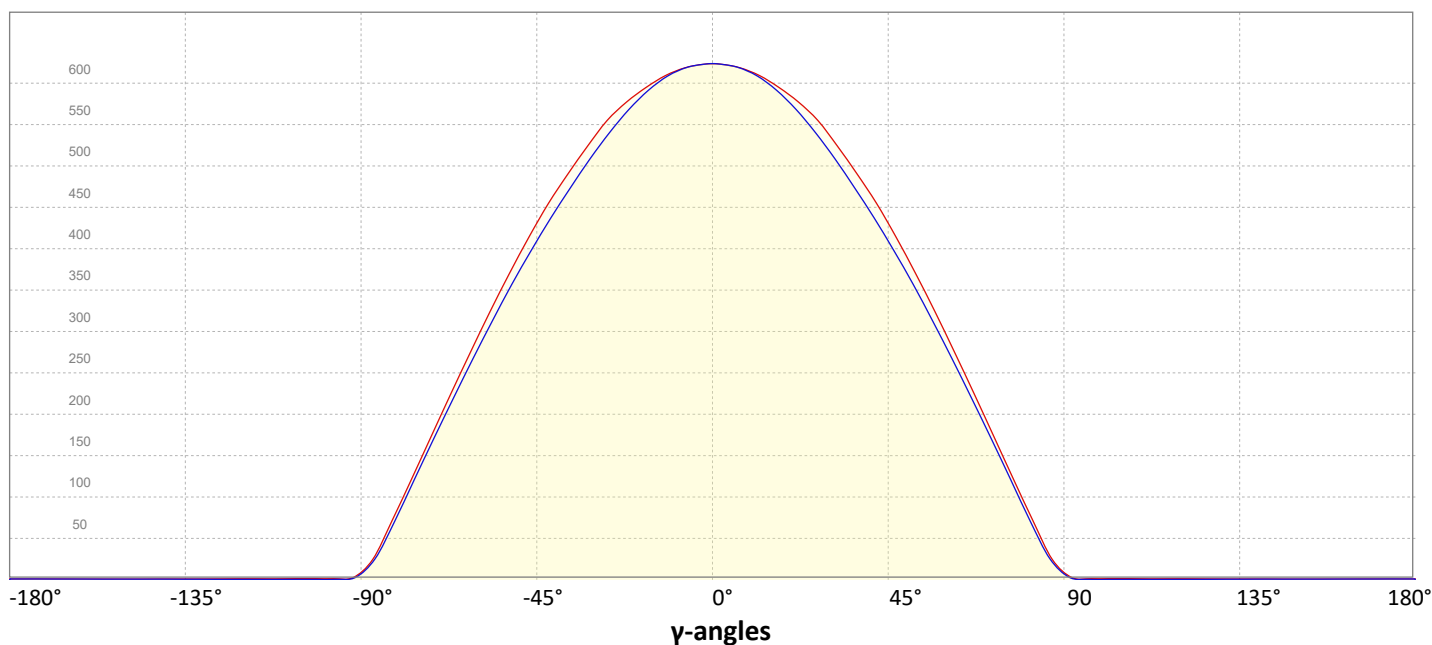
Intensity Ratio

In 120° cone	76,7%
In 90° cone	52,0%

C000-C180

C090-C270

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

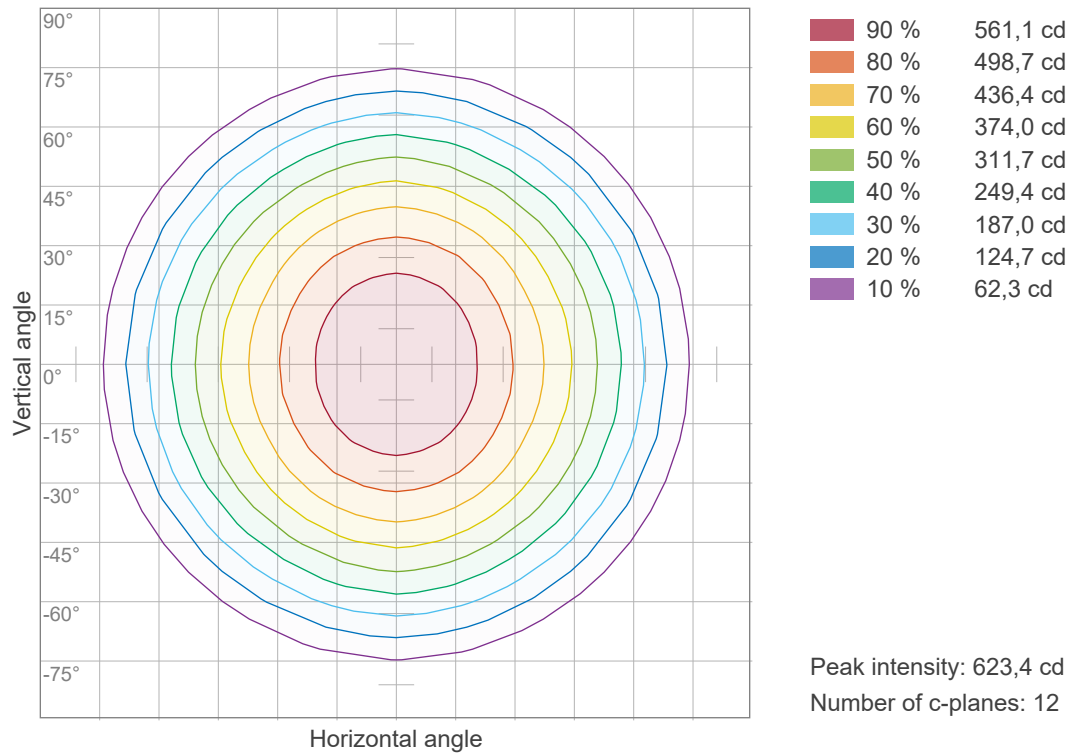


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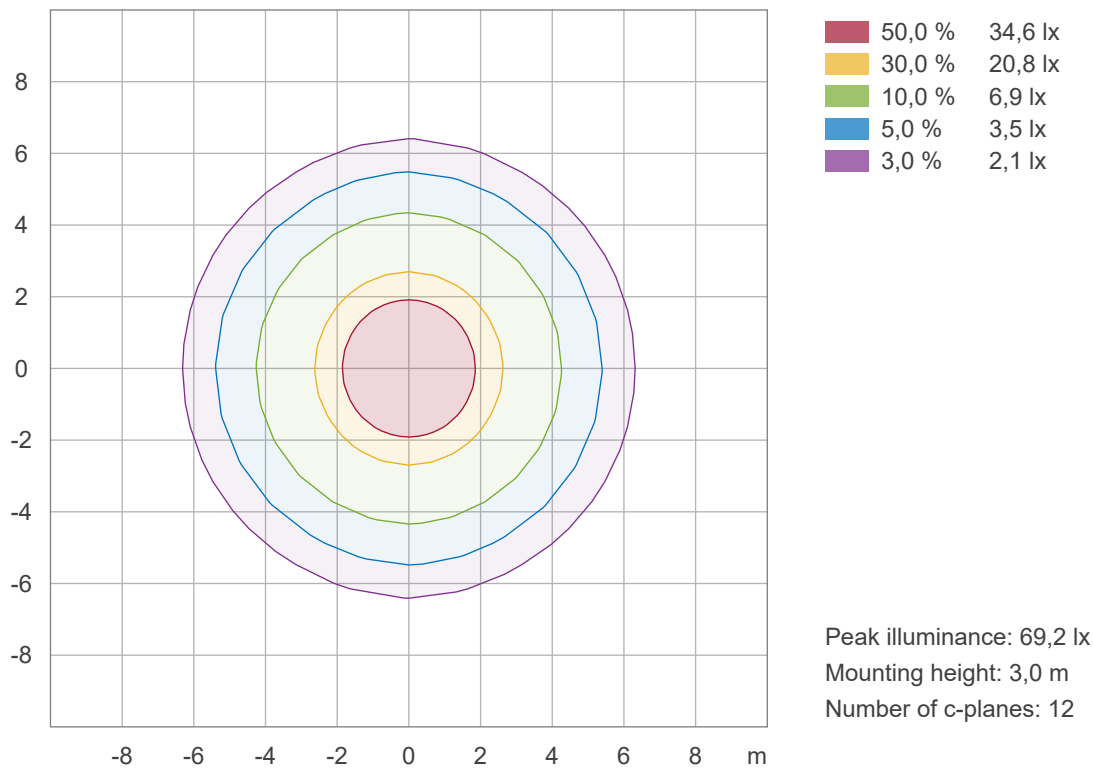
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Iso-intensity Diagram (Iso-candela)



Iso-illuminance Diagram (Iso-lux)



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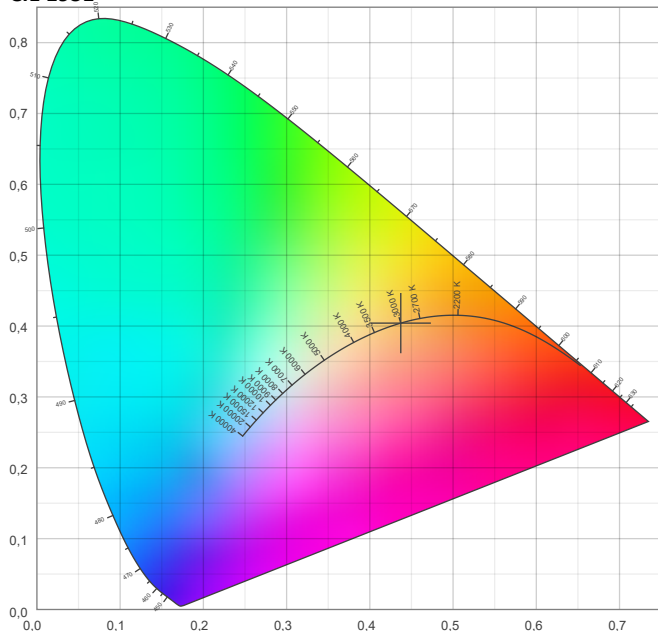


Color details

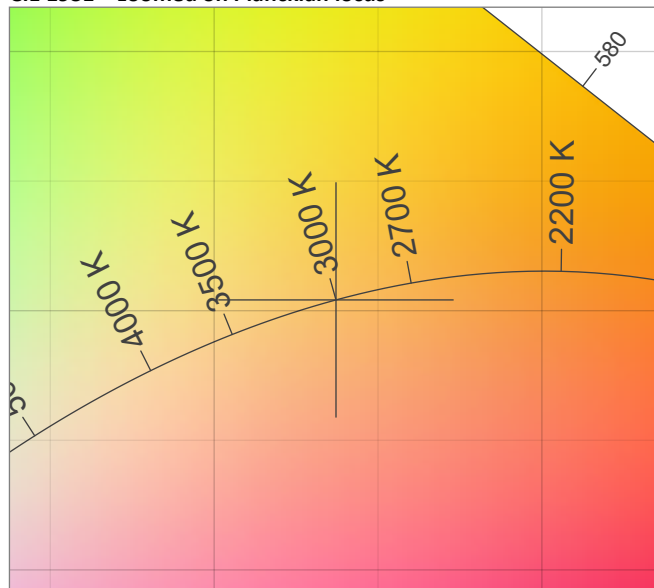
Correlated Color Temperature, Target CCT = 3000 K
Correlated Color Temperature, Measured CCT = 2921 K
Color Rendering Index CRI 81,1
Color Rendering Index, R9 (red component) R9 = 1,6
Color Rendering TM30-18 R_f 83,5 – R_g 95,6
Color Quality Scale CQS = 80,3

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 = -0,0007
Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,251;0,251)

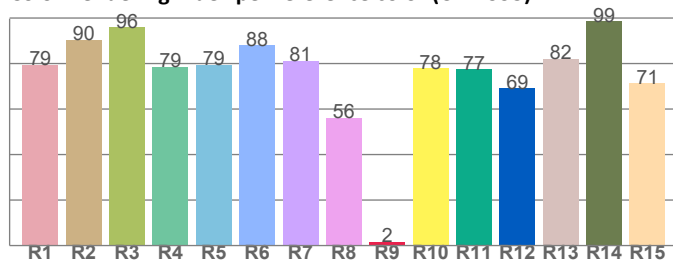
CIE 1931



CIE 1931 – zoomed on Planckian locus



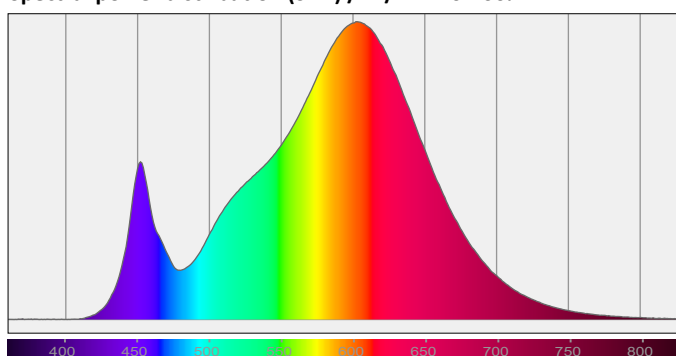
Color Rendering Index per reference color (CIE 1995)



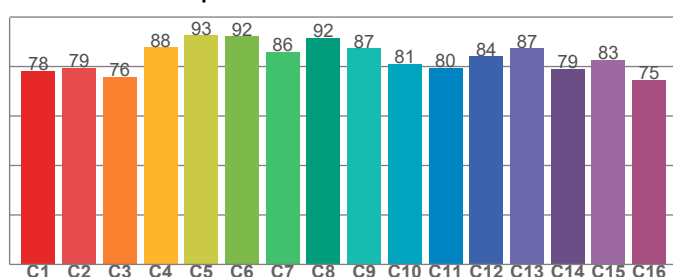
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
79,4	90,3	96,0	78,6	79,3	88,1	81,3	56,1	1,6	78,0	77,4	69,1	82,0	98,5	71,2

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



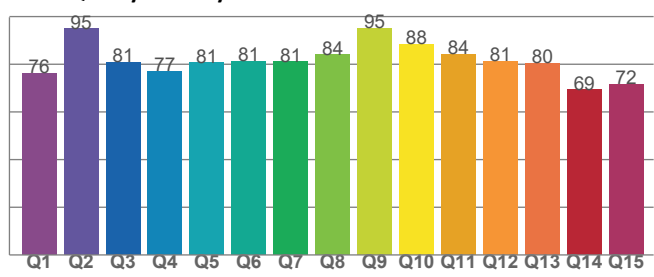
TM30-18 Rf-values per hue bin



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
78,3	79,4	75,8	87,8	92,5	92,2	85,9	91,6	87,3	81,1	79,6	84,1	87,3	79,1	82,8	74,6

Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
76,3	94,9	80,8	77,2	80,6	81,3	81,0	84,0	95,0	88,3	84,3	81,3	80,3	69,3	71,5

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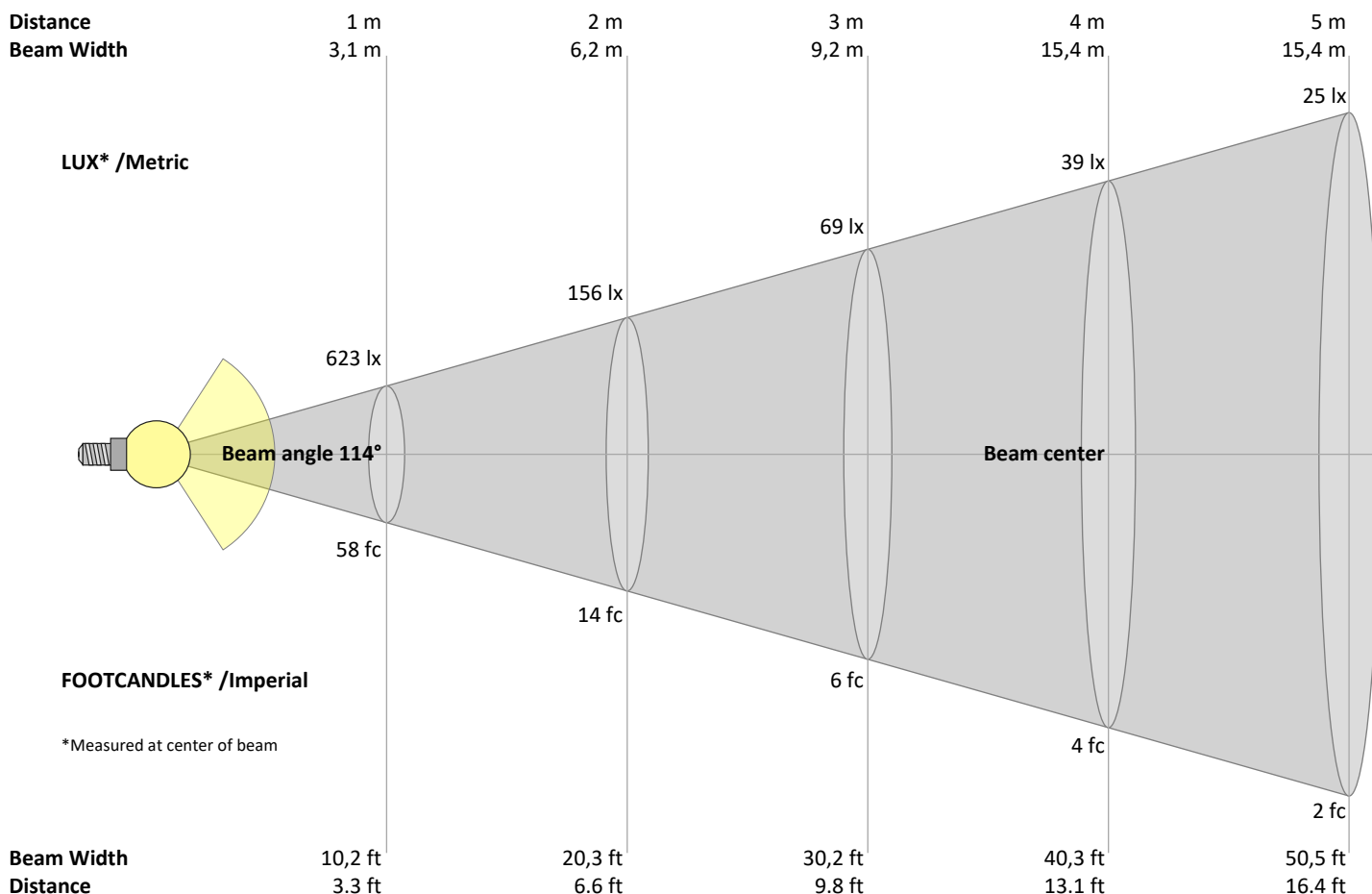
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Beam Details



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
623	156	69	39	25	17	13	10	8	6	5	4	4	3	3	2	2	2	2	2	lux
57,9	14,5	6,4	3,6	2,3	1,6	1,2	0,9	0,7	0,6	0,5	0,4	0,3	0,3	0,3	0,2	0,2	0,2	0,2	0,1	fc

Intensities in 0° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
623	620	613	601	584	564	536	504	469	430	388	342	294	245	194	143	92	44	11	2	cd
100%	100%	98%	96%	94%	90%	86%	81%	75%	69%	62%	55%	47%	39%	31%	23%	15%	7%	2%	0%	of 0°val

Intensities in 90° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
623	620	612	596	575	548	517	483	447	409	368	325	279	232	184	134	84	38	9	1	cd
100%	100%	98%	96%	92%	88%	83%	78%	72%	66%	59%	52%	45%	37%	29%	22%	14%	6%	1%	0%	of 0°val

Intensities in 180° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
623	620	613	601	584	564	536	504	469	430	388	342	294	245	194	143	92	44	11	2	cd
100%	100%	98%	96%	94%	90%	86%	81%	75%	69%	62%	55%	47%	39%	31%	23%	15%	7%	2%	0%	of 0°val

Intensities in 270° c-plane

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	γ
623	620	612	596	575	548	517	483	447	409	368	325	279	232	184	134	84	38	9	1	cd
100%	100%	98%	96%	92%	88%	83%	78%	72%	66%	59%	52%	45%	37%	29%	22%	14%	6%	1%	0%	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		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	18,3	19,5	18,5	19,8	20,1	18,1	19,3	18,3	19,6	19,9
	3H	19,9	21,2	20,3	21,5	21,7	19,7	21,0	20,1	21,3	21,5
	4H	20,7	21,9	21,1	22,2	22,5	20,4	21,7	20,9	21,9	22,2
	6H	21,3	22,4	21,7	22,7	23,1	21,1	22,2	21,4	22,4	22,8
	8H	21,6	22,6	21,9	22,9	23,3	21,3	22,3	21,6	22,6	23,1
	12H	21,7	22,7	22,1	23,1	23,5	21,4	22,4	21,8	22,7	23,2
4H	2H	18,9	20,1	19,3	20,4	20,7	18,7	20,0	19,1	20,2	20,5
	3H	20,8	21,9	21,2	22,2	22,7	20,7	21,7	21,1	22,0	22,5
	4H	21,6	22,6	22,1	23,0	23,6	21,5	22,4	21,9	22,8	23,4
	6H	22,4	23,3	22,9	23,7	24,0	22,2	23,1	22,7	23,4	23,8
	8H	22,7	23,5	23,2	23,9	24,3	22,4	23,2	22,9	23,6	24,0
	12H	22,9	23,6	23,4	24,0	24,5	22,6	23,3	23,1	23,7	24,2
8H	4H	22,0	22,8	22,5	23,2	23,6	21,8	22,6	22,3	23,0	23,4
	6H	22,9	23,5	23,4	24,0	24,6	22,7	23,3	23,2	23,8	24,4
	8H	23,3	23,8	23,8	24,4	25,0	23,1	23,6	23,6	24,2	24,8
	12H	23,6	24,1	24,2	24,6	25,2	23,3	23,8	23,9	24,3	24,9
12H	4H	22,0	22,7	22,5	23,1	23,6	21,8	22,5	22,3	23,0	23,5
	6H	23,0	23,5	23,5	24,1	24,7	22,8	23,4	23,3	23,9	24,5
	8H	23,4	23,9	24,0	24,4	25,0	23,2	23,7	23,8	24,2	24,8
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 / -0,2					0,1 / -0,2				
S = 2.0H		0,3 / -0,4					0,3 / -0,4				

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	111	111	111	106	106	106	102	102	102	100	
1	108	103	99	95	105	101	97	93	97	93	90	93	90	87	89	87	85	82
2	98	90	83	77	95	88	81	76	84	79	74	81	76	72	78	74	70	68
3	89	78	70	63	87	77	69	63	74	67	62	71	65	60	68	63	59	57
4	82	69	60	54	79	68	60	53	65	58	52	63	57	52	61	55	51	49
5	75	62	53	46	73	61	52	46	59	51	45	57	50	45	55	49	44	42
6	69	56	47	40	67	55	46	40	53	45	39	51	44	39	49	43	39	37
7	64	50	42	35	62	50	41	35	48	40	35	47	40	35	45	39	34	32
8	60	46	37	31	58	45	37	31	44	36	31	43	36	31	41	35	31	29
9	56	42	34	28	54	42	34	28	40	33	28	39	33	28	38	32	28	26
10	52	39	31	26	51	38	31	26	37	30	25	36	30	25	35	29	25	23

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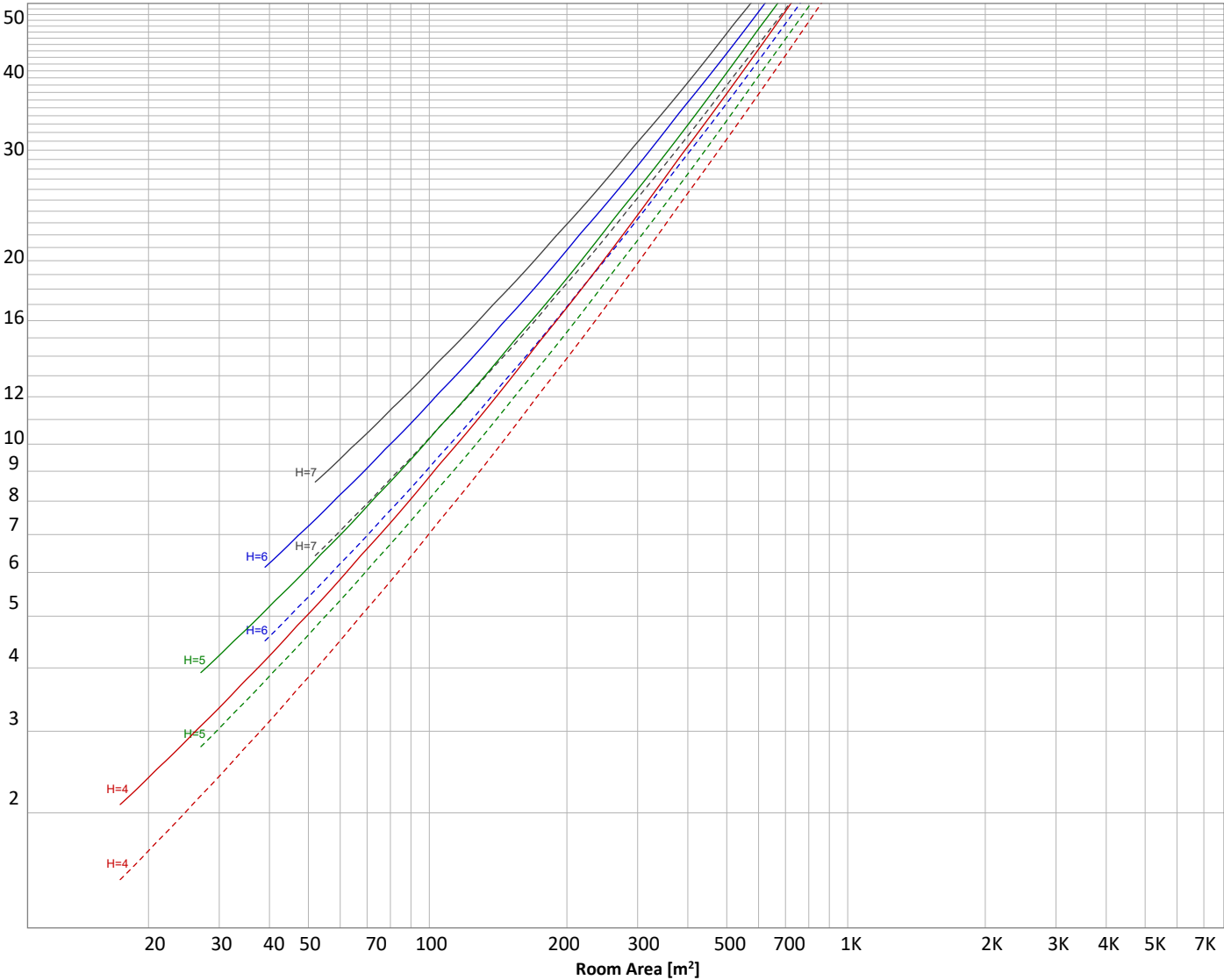
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Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 1838 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°
59,1 lm	169 lm	257 lm	309 lm	322 lm	295 lm	232 lm	143 lm	45,4 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
2,16 lm	0,969 lm	1,10 lm	0,777 lm	0,570 lm	0,489 lm	0,374 lm	0,244 lm	0,083 lm

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Outdoor Light Planning

Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	59 lm	3,2%
10-20°	169 lm	9,2%
20-30°	257 lm	14,0%
30-40°	309 lm	16,8%
40-50°	322 lm	17,5%
50-60°	295 lm	16,0%
60-70°	232 lm	12,6%
70-80°	143 lm	7,8%
80-90°	45 lm	2,5%
90-100°	2 lm	0,1%
100-110°	1 lm	0,1%
110-120°	1 lm	0,1%
120-130°	1 lm	0,0%
130-140°	1 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	1838 lm	100,0%

Intensity peaks

Max intensity	623 cd
Intensity, 90°	11 cd
Intensity, 0°	623 cd

Zonal Lumen summary

Zone (γ)	Lumen	% Total
0-30°	485 lm	26,4%
0-40°	794 lm	43,2%
0-60°	1410 lm	76,7%
60-90°	421 lm	22,9%
70-100°	191 lm	10,4%
90-120°	4 lm	0,2%
0-90°	1831 lm	99,6%
90-180°	7 lm	0,4%
0-180°	1838 lm	100,0%

BUG rating

	Lumen	% Total
Forward light		
Low(0-30°)	242 lm	13,2%
Medium(30-60°)	462 lm	25,1%
High(60-80°)	188 lm	10,2%
Very high(80-90°)	24 lm	1,3%
Back light		
Low(0-30°)	242 lm	13,2%
Medium(30-60°)	462 lm	25,1%
High(60-80°)	188 lm	10,2%
Very high(80-90°)	24 lm	1,3%

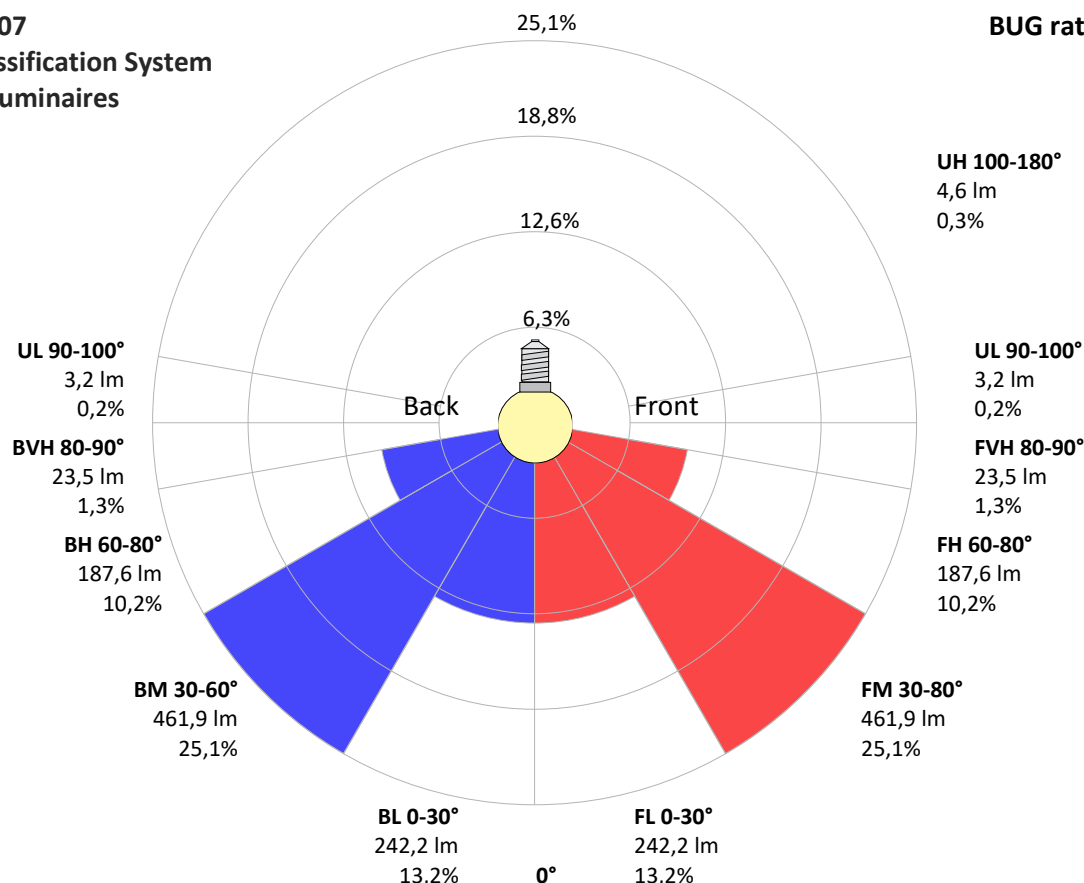
Uplight

Low(90-100°)	3 lm	0,2%
High(100-180°)	5 lm	0,3%

IESNA TM-15-07

Luminaire Classification System For Outdoor Luminaires

BUG rating B1 U1 G1



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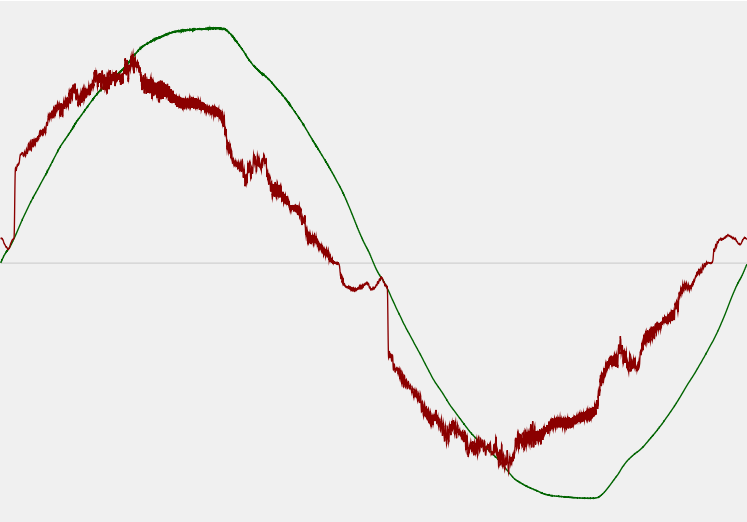


Power Details

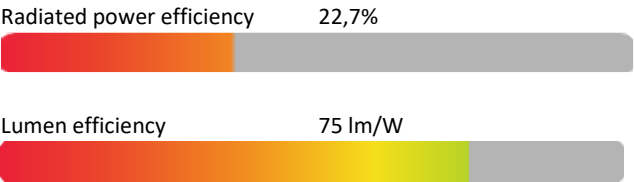
Input Power

Power feed to light source	24,4 W
Frequency of input power	50 Hz
RMS Input voltage feed, V_{RMS}	226 V
RMS Input current feed, I_{RMS}	0,118 A
Volt-Ampere or apparent power = $V_{RMS} \cdot I_{RMS}$	26,61 VA
Displacement factor of AC power feed	0,93
Power factor of AC current feed	0,92
Total harmonic distortion of the current	12,95%
Total harmonic distortion of the voltage	2,4%

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	3000 K
CCT shift	+0 K
CCT end	3000 K

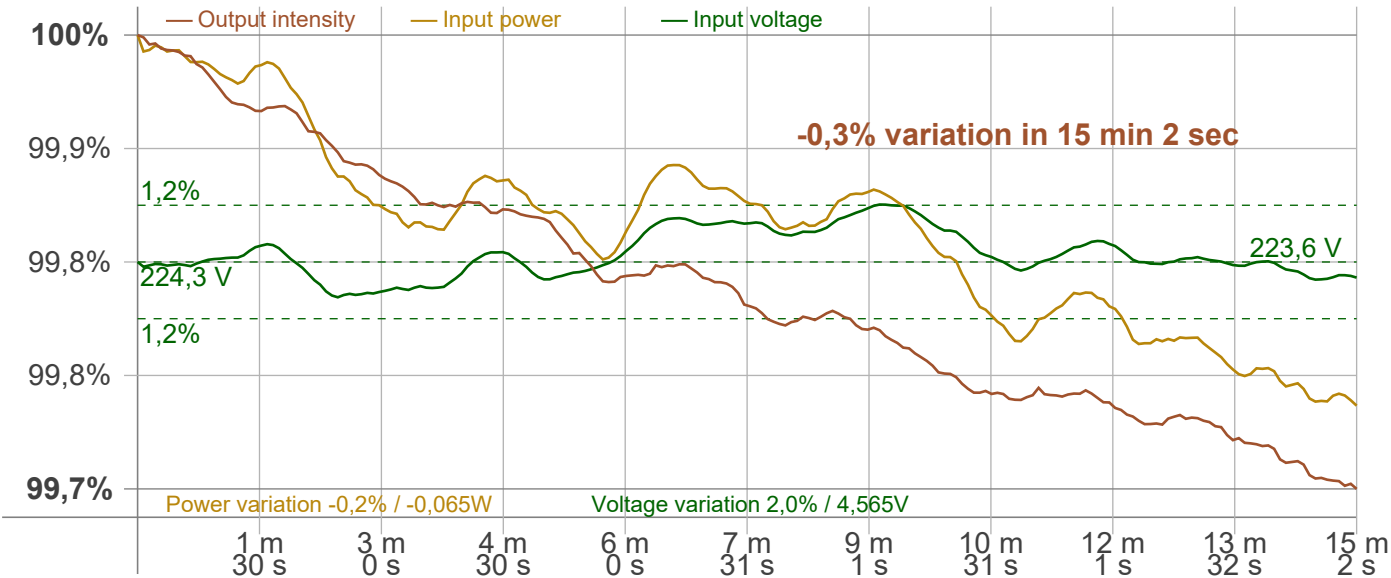
Warmup Result

Total warmup time	Lamp stabilized in 15 min 2 sec
Warmup variation	-0,3%

Output Change

Output start	1843 lm
Output change	-5 lm
Output end	1838 lm

Stabilization Curve



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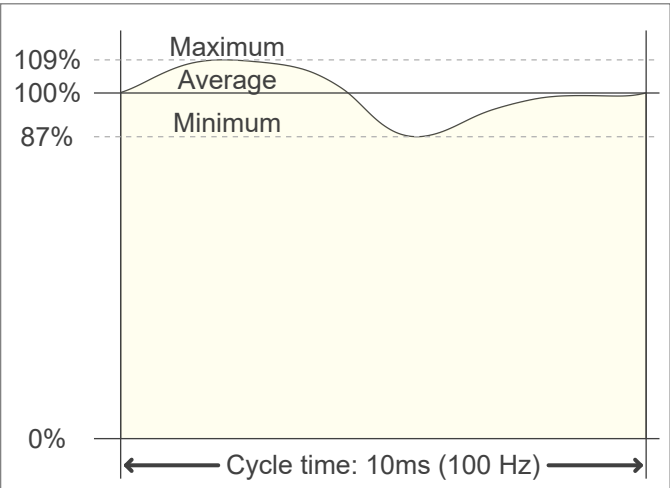
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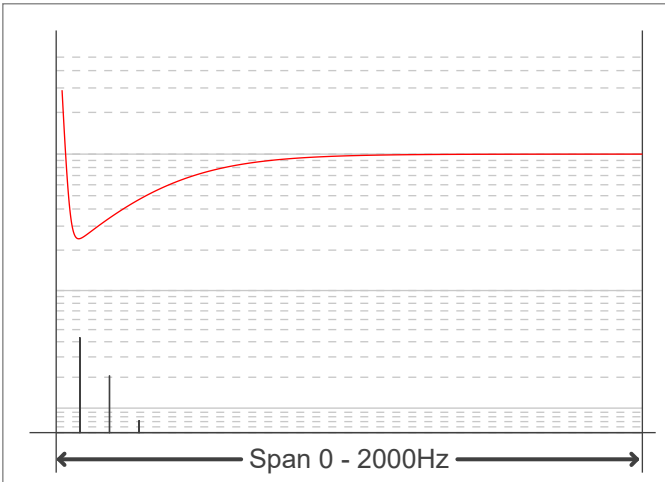
Flicker /TLA details

Flicker Meter Type	Viso Systems LabFlicker	Measurement time	
Frequency of input power	50 Hz	PstLM	180 sec
Flicker/TLA sample rate	20000 samples/s	All other indices	1,2 sec
Flicker indices according to Illuminating Engineering Society (IES)		Flicker indices according to California Energy Commission (CEC) 2016b	
Flicker frequency	100 Hz	JA8/10 40 Hz	0,42 %
Percent Flicker	11,84 %	JA8/10 90 Hz	0,63 %
Flicker index	0,03	JA8/10 200 Hz	10,94 %
TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)		JA8/10 400 Hz	12,02 %
PstLM value (F < 80 Hz)	0,7	JA8/10 1000 Hz	11,83 %
SVM value (80 < F < 2000 Hz)	0,34	Flicker indices according to Lighting Research Center (2015)	
		Perception metric, Assist Mp	0,14

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



Flicker FFT (flicker curve in frequency domain)



IEEE 1789 Frequency/modulation plot

