Light Measurement Report

Print date: 4-11-2024
Measurement date and time: 4-11-2024 09:45:55 – Measurement no. VFR-241104-1843-MS
Measurement tracking No. and Link: VT241104-005204
Operator:

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 – 11-1-2024 – 3130191315
Spectrometer Manufacturer and Model	Ibsen Photonics, Denmark – Freedom VIS (Custom Viso)

Measurement Conditions

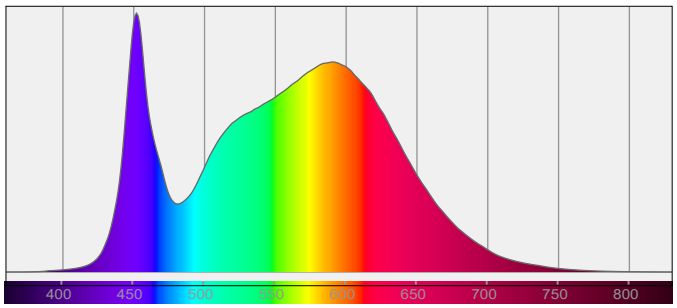
Number of C-planes and Resolution	12 planes – 30°
γ (gamma)-Resolution	5°
Test Distance	2,40 m
Input Power, Power and Displ. Factors	18,0 W – PF 0,96 – DPF 0,97
Input RMS Voltage and Current	230 V – 0,081 A
Frequency of Input Power	50 Hz
Warm-up Time and Variation	Lamp stabilized in 15 min 1 sec – 2,0%

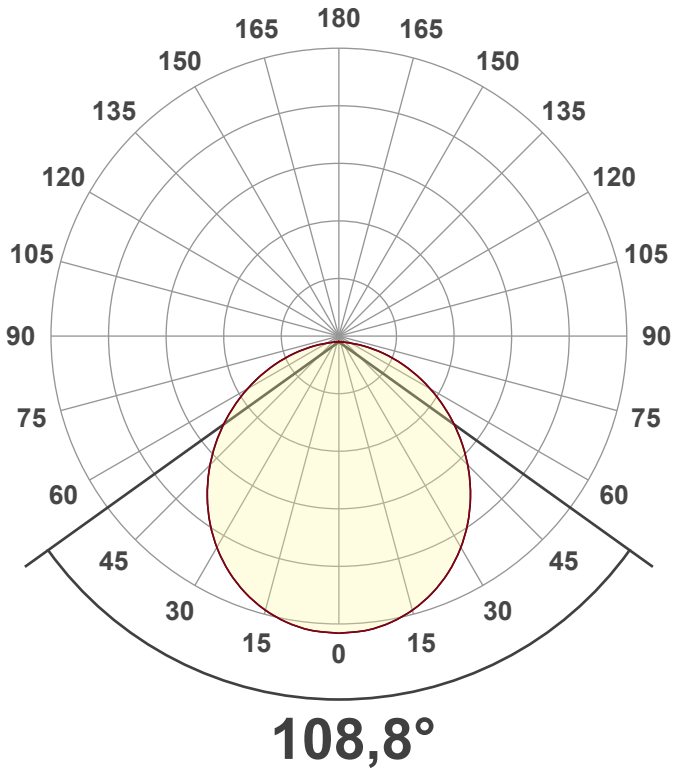
Tested Light Source

Product Name	274013-4000K
Item No. and Manufacturer	274013-4000K – Dutchfulfillment
Product Description (line 1)	LED DOWNLIGHT | UMBRIEL | SLIM | Ø205 | 18W | ZWART

Main Light Measurement Results

Output – Total Lumen (Up% / Down%)	1633 lm – 0,14% / 99,86%
Efficiency	91 lm/W
Peak Intensity and Beam Angle	594 cd – 108,8°
Correlated Color Temperature, Target/Measured	CCT = 4000 K / 4294 K
Color Rendering Index	CRI 81,8
Color Rendering TM30-18	R_f 83,0 – R_g 93,8
Color Shift, CIE duv and MacAdam Steps	Duv 0,0028 – SDCM 6,3
Flicker	SVM 0,02 – PstLM 0,11





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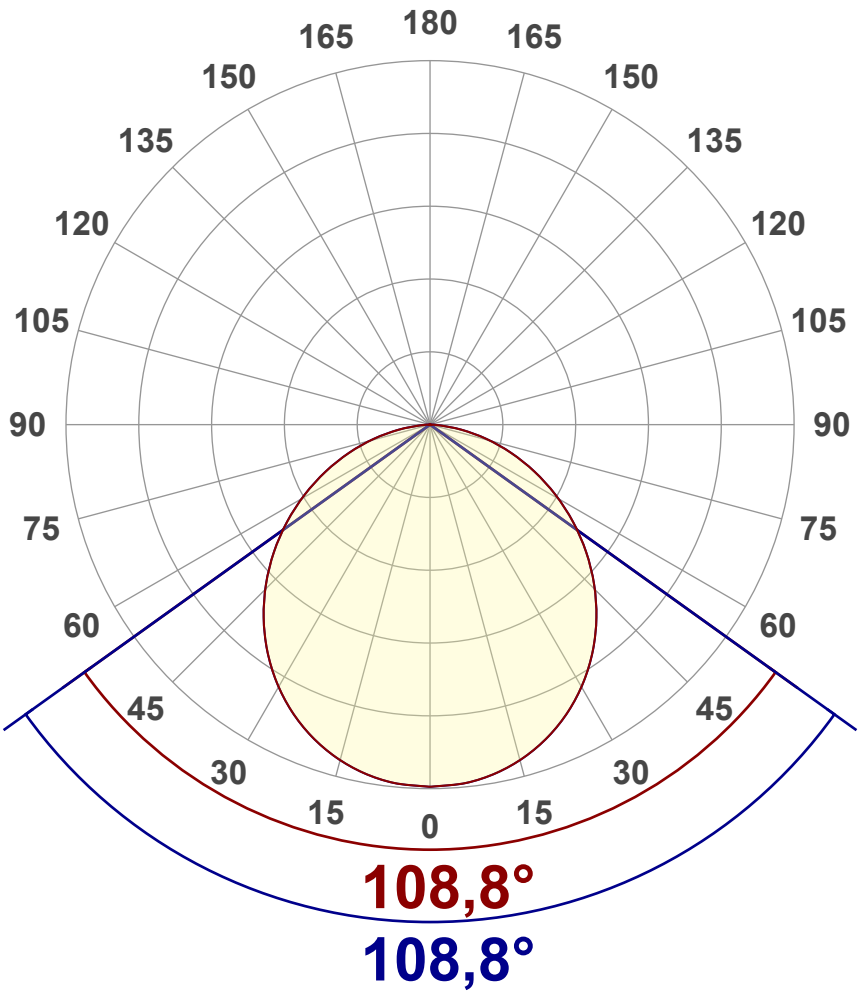
Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

Output (total Lumen)	1633 lm
Lumen Up% / Down%	0,14% / 99,86%
Peak Intensity	594 cd
Beam Angle (50%)	108,8°
Beam Angle (90%)	108,8°
Beam Angle (10%)	108,8°

Cut-off Angle

Average 2,5%	171,9°

Field Angle

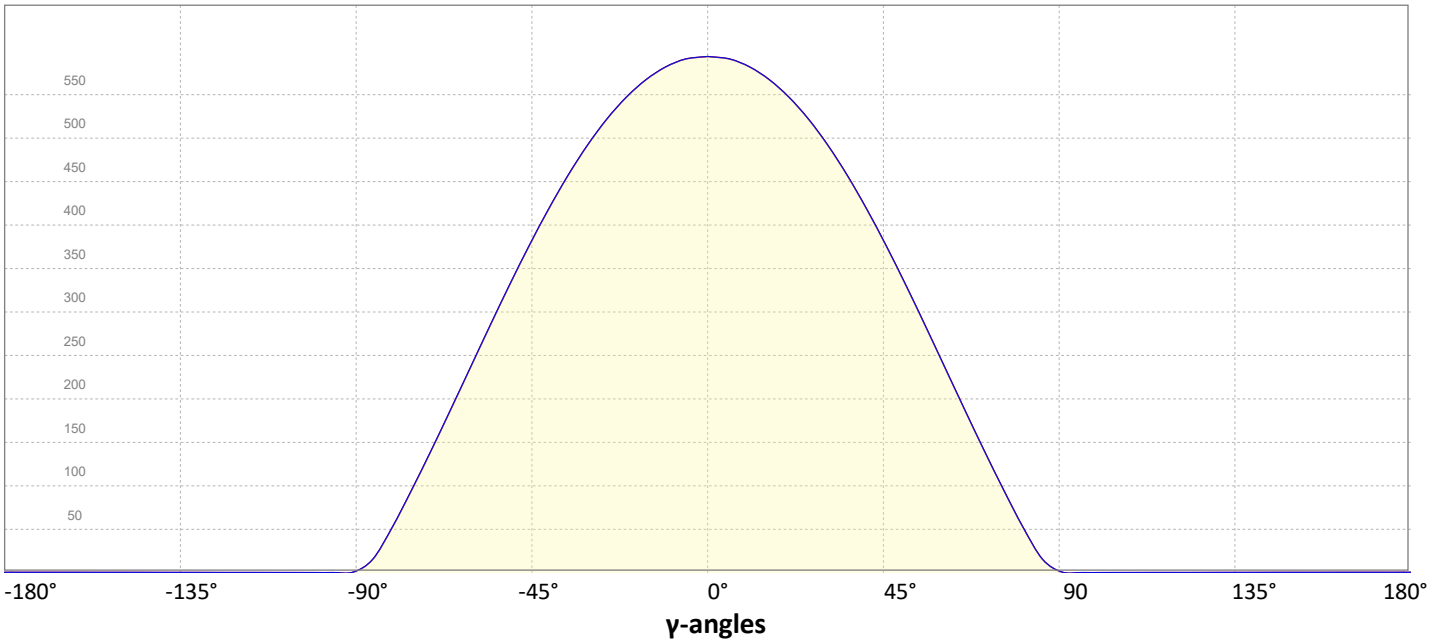
Average 10%	159,9°

Intensity Ratio

In 120° cone	79,7%
In 90° cone	54,9%

C000-C180
C090-C270

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



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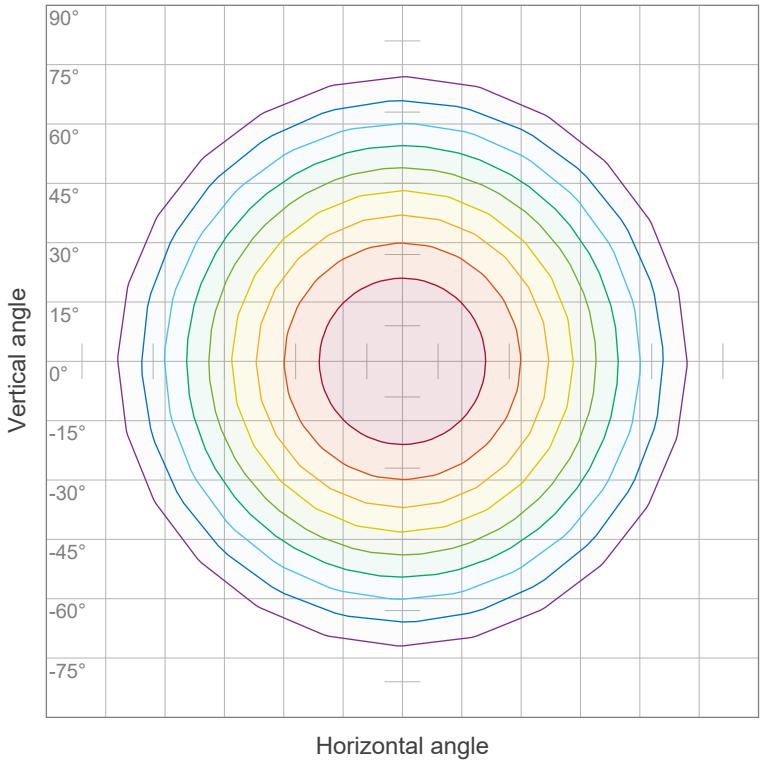
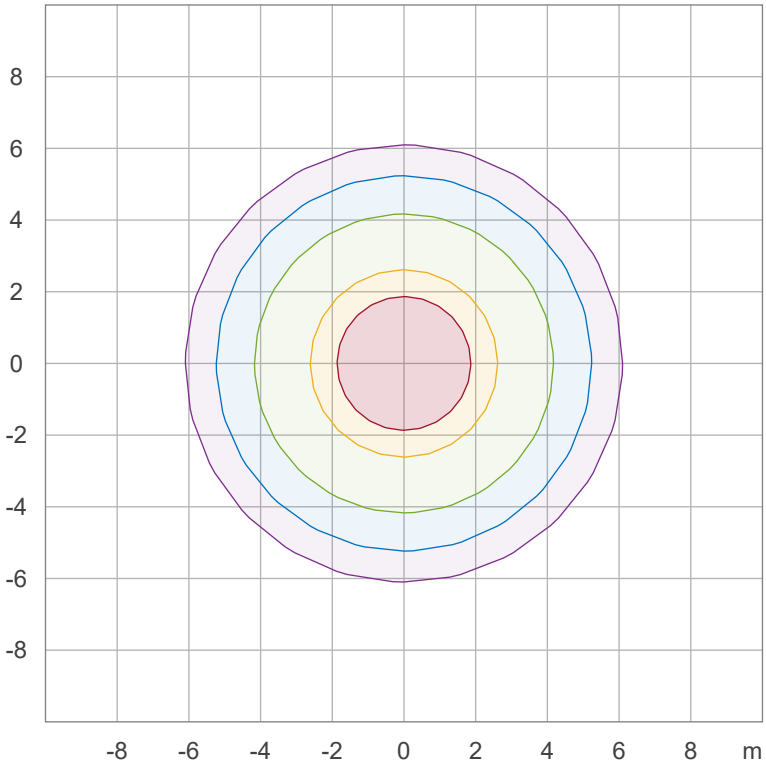
Iso-intensity Diagram (Iso-candela)



90 %	534,2 cd
80 %	474,8 cd
70 %	415,5 cd
60 %	356,1 cd
50 %	296,8 cd
40 %	237,4 cd
30 %	178,1 cd
20 %	118,7 cd
10 %	59,4 cd

Peak intensity: 593,6 cd
Number of c-planes: 12

Iso-illuminance Diagram (Iso-lux)



50,0 %	33,0 lx
30,0 %	19,8 lx
10,0 %	6,6 lx
5,0 %	3,3 lx
3,0 %	2,0 lx

Peak illuminance: 66,0 lx
Mounting height: 3,0 m
Number of c-planes: 12

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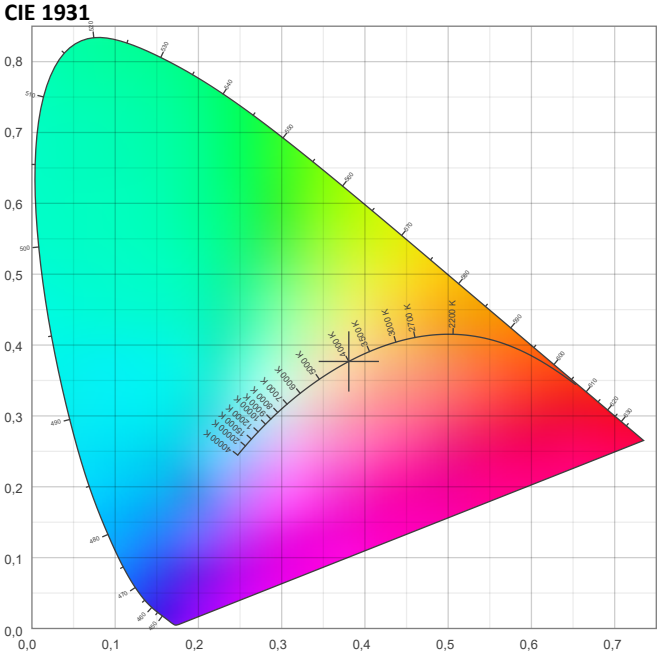
Color details

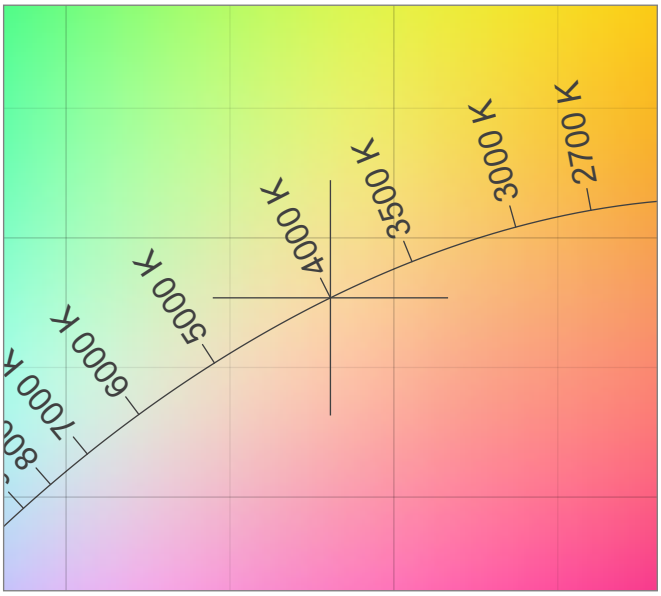
Correlated Color Temperature, Target	CCT = 4000 K
Correlated Color Temperature, Measured	CCT = 4294 K
Color Rendering Index	CRI 81,8
Color Rendering Index, R9 (red component)	R9 = 0,7
Color Rendering TM30-18	R_f 83,0 – R_g 93,8
Color Quality Scale	CQS = 81,1

MacAdam Steps	SDCM = 6,3
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 = 0,0028
Color coordinate CIEs 1976 (CIELUV)	(u';v') = (0,225;0,502)

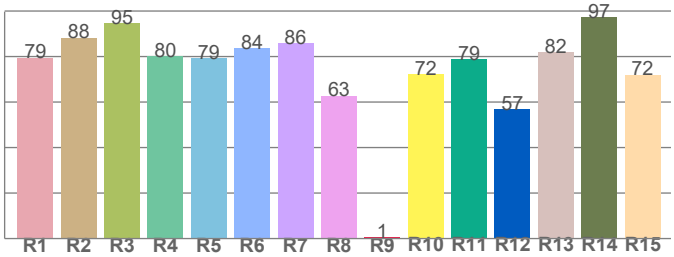
CIE 1931



CIE 1931 – zoomed on Planckian locus



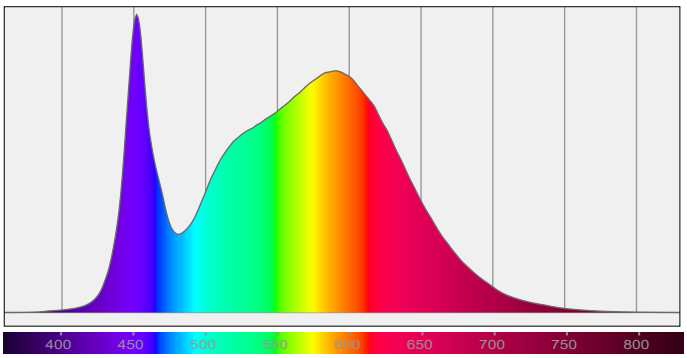
Color Rendering Index per reference color (CIE 1995)



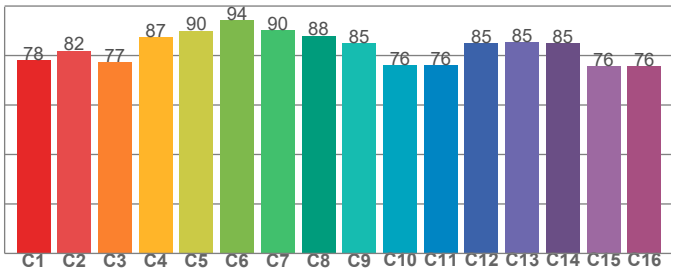
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
79,4	88,3	94,7	80,1	79,3	83,5	85,9	62,8	0,7	72,2	78,8	56,7	81,8	97,3	72,0

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



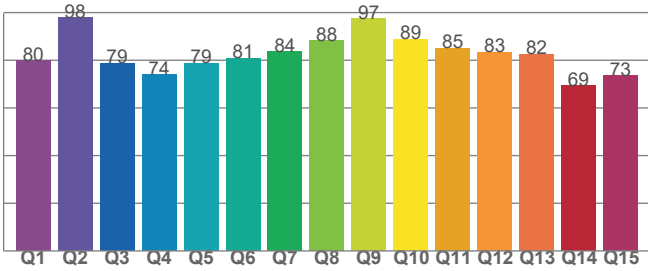
TM30-18 Rf-values per hue bin



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
78,0	81,9	77,4	87,3	90,1	94,3	90,3	88,0	84,8	76,0	76,1	84,9	85,3	84,9	75,8	75,7

Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
79,9	97,8	78,8	74,0	78,8	80,8	83,5	88,2	97,4	88,9	85,0	83,4	82,4	69,4	73,4

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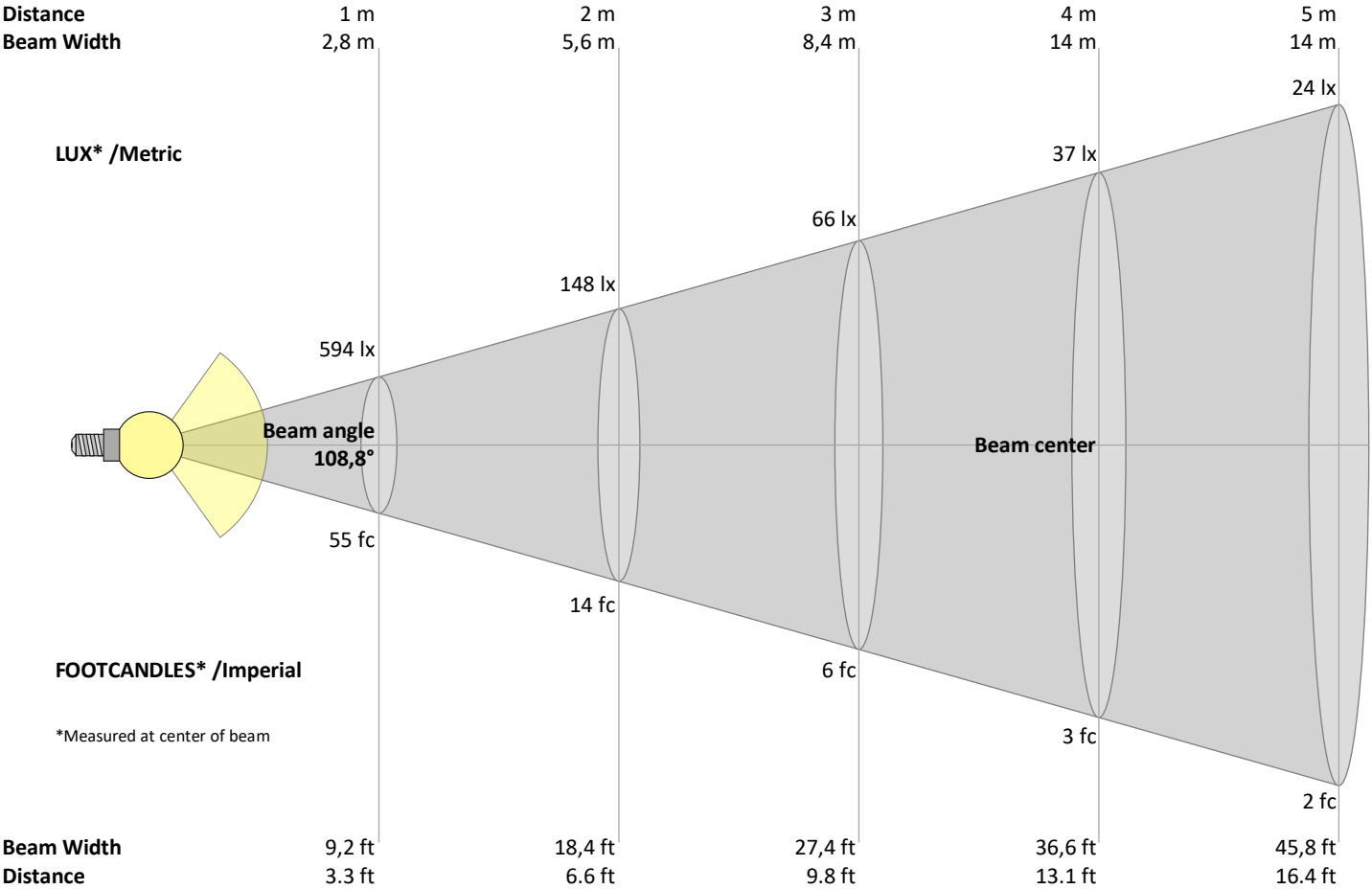
Beam Details



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
594	148	66	37	24	16	12	9	7	6	5	4	4	3	3	2	2	2	2	1	lux
55,1	13,8	6,1	3,4	2,2	1,5	1,1	0,9	0,7	0,6	0,5	0,4	0,3	0,3	0,2	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
594	591	583	570	550	526	496	462	424	382	338	291	243	195	148	102	59	21	3	0	cd
100%	100%	98%	96%	93%	89%	84%	78%	71%	64%	57%	49%	41%	33%	25%	17%	10%	4%	0%	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
594	591	583	570	550	526	496	462	424	382	338	291	243	195	148	102	59	21	3	0	cd
100%	100%	98%	96%	93%	89%	84%	78%	71%	64%	57%	49%	41%	33%	25%	17%	10%	4%	0%	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
594	591	583	570	550	526	496	462	424	382	338	291	243	195	148	102	59	21	3	0	cd
100%	100%	98%	96%	93%	89%	84%	78%	71%	64%	57%	49%	41%	33%	25%	17%	10%	4%	0%	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
594	591	583	570	550	526	496	462	424	382	338	291	243	195	148	102	59	21	3	0	cd
100%	100%	98%	96%	93%	89%	84%	78%	71%	64%	57%	49%	41%	33%	25%	17%	10%	4%	0%	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 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	23,0	24,2	23,2	24,5	24,7	23,0	24,2	23,2	24,5	24,7
	3H	24,3	25,6	24,7	25,8	26,0	24,3	25,6	24,7	25,8	26,0
	4H	24,8	26,0	25,3	26,3	26,6	24,8	26,0	25,3	26,3	26,6
	6H	25,3	26,3	25,6	26,6	27,0	25,3	26,3	25,6	26,6	27,0
	8H	25,3	26,3	25,7	26,6	27,1	25,3	26,3	25,7	26,6	27,1
	12H	25,3	26,3	25,7	26,7	27,1	25,3	26,3	25,7	26,7	27,1
4H	2H	23,6	24,7	24,0	25,0	25,3	23,6	24,7	24,0	25,0	25,3
	3H	25,2	26,2	25,5	26,5	27,0	25,2	26,2	25,5	26,5	27,0
	4H	25,7	26,6	26,2	27,1	27,6	25,7	26,6	26,2	27,1	27,6
	6H	26,2	27,1	26,7	27,4	27,8	26,2	27,1	26,7	27,4	27,8
	8H	26,3	27,1	26,8	27,5	27,8	26,3	27,1	26,8	27,5	27,8
	12H	26,3	27,0	26,8	27,4	27,9	26,3	27,0	26,8	27,4	27,9
8H	4H	26,0	26,8	26,5	27,1	27,5	26,0	26,8	26,5	27,1	27,5
	6H	26,6	27,2	27,1	27,6	28,2	26,6	27,2	27,1	27,6	28,2
	8H	26,8	27,3	27,3	27,8	28,4	26,8	27,3	27,3	27,8	28,4
	12H	26,8	27,3	27,4	27,8	28,4	26,8	27,3	27,4	27,8	28,4
12H	4H	26,0	26,6	26,5	27,1	27,5	26,0	26,6	26,5	27,1	27,5
	6H	26,6	27,1	27,1	27,7	28,3	26,6	27,1	27,1	27,7	28,3
	8H	26,8	27,3	27,4	27,8	28,4	26,8	27,3	27,4	27,8	28,4

Variations with the observer position for the luminaire spacings, S:		
S = 1.0H	0,1 / -0,1	0,1 / -0,1
S = 1.5H	0,2 / -0,3	0,2 / -0,3
S = 2.0H	0,5 / -0,6	0,5 / -0,6

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	109	104	100	96	106	102	98	95	98	94	92	94	91	89	90	88	86	84
2	99	91	84	78	96	89	83	78	85	80	76	82	78	74	79	75	72	70
3	90	80	72	65	88	78	71	65	75	69	64	73	67	62	70	65	61	59
4	83	71	62	55	80	70	61	55	67	60	54	65	58	53	62	57	53	51
5	76	63	54	48	74	62	54	48	60	53	47	58	52	46	56	51	46	44
6	70	57	48	42	68	56	48	42	54	47	41	53	46	41	51	45	40	38
7	65	52	43	37	64	51	43	37	49	42	36	48	41	36	47	41	36	34
8	61	47	39	33	59	47	38	33	45	38	33	44	37	32	43	37	32	30
9	57	43	35	30	55	43	35	30	42	34	29	41	34	29	40	33	29	27
10	53	40	32	27	52	40	32	27	39	32	27	38	31	27	37	31	26	25

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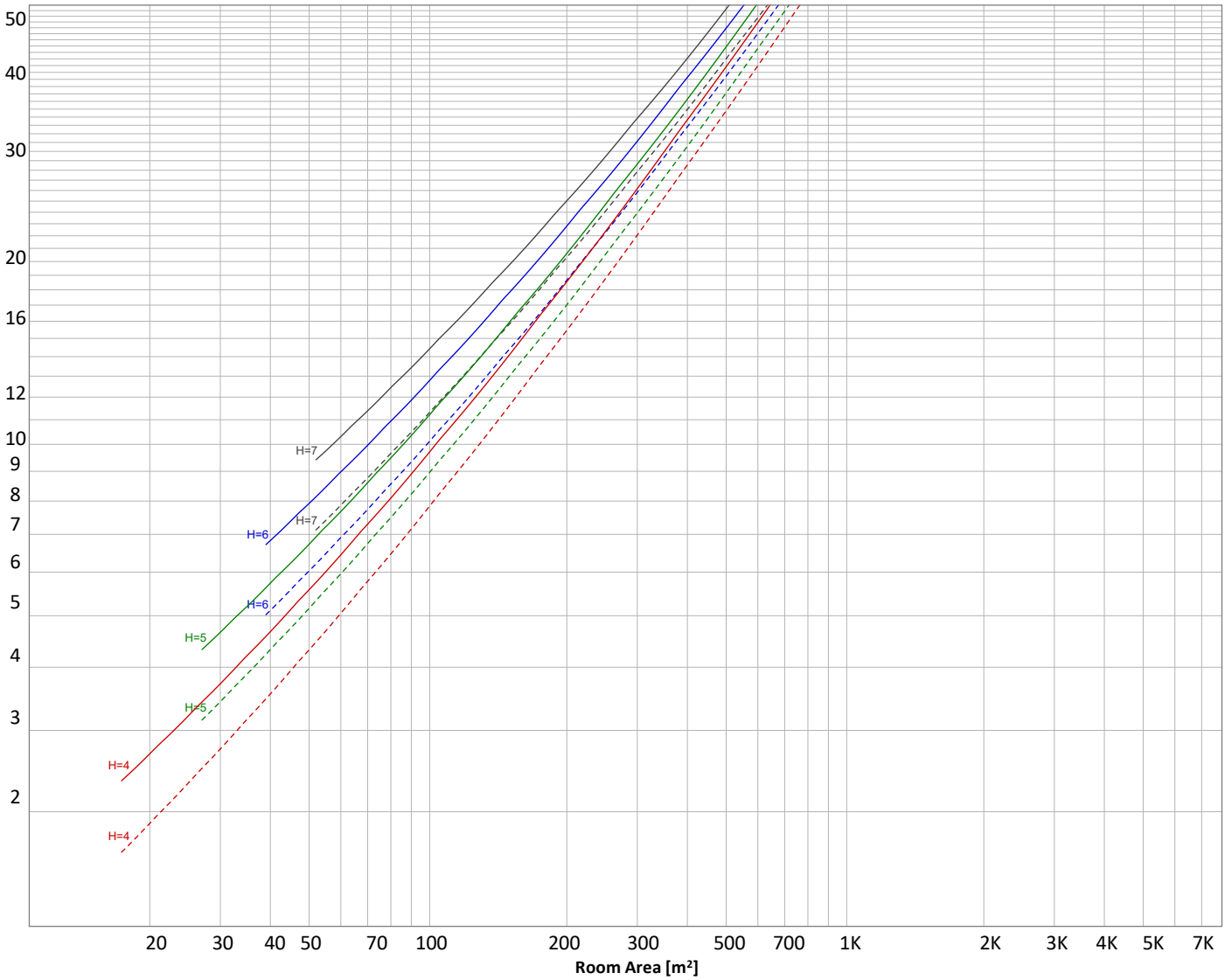
Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



Conditions

H = Room height	Flux = 1633 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°
56,2 lm	161 lm	242 lm	289 lm	295 lm	260 lm	193 lm	108 lm	27,0 lm

90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
0,417 lm	0,246 lm	0,289 lm	0,287 lm	0,301 lm	0,284 lm	0,224 lm	0,147 lm	0,051 lm

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Outdoor Light Planning

Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	56 lm	3,4%
10-20°	161 lm	9,8%
20-30°	242 lm	14,8%
30-40°	289 lm	17,7%
40-50°	295 lm	18,0%
50-60°	260 lm	15,9%
60-70°	193 lm	11,8%
70-80°	108 lm	6,6%
80-90°	27 lm	1,7%
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	1633 lm	100,0%

Intensity peaks

Max intensity	594 cd
Intensity, 90°	3 cd
Intensity, 0°	594 cd

Zonal Lumen summary

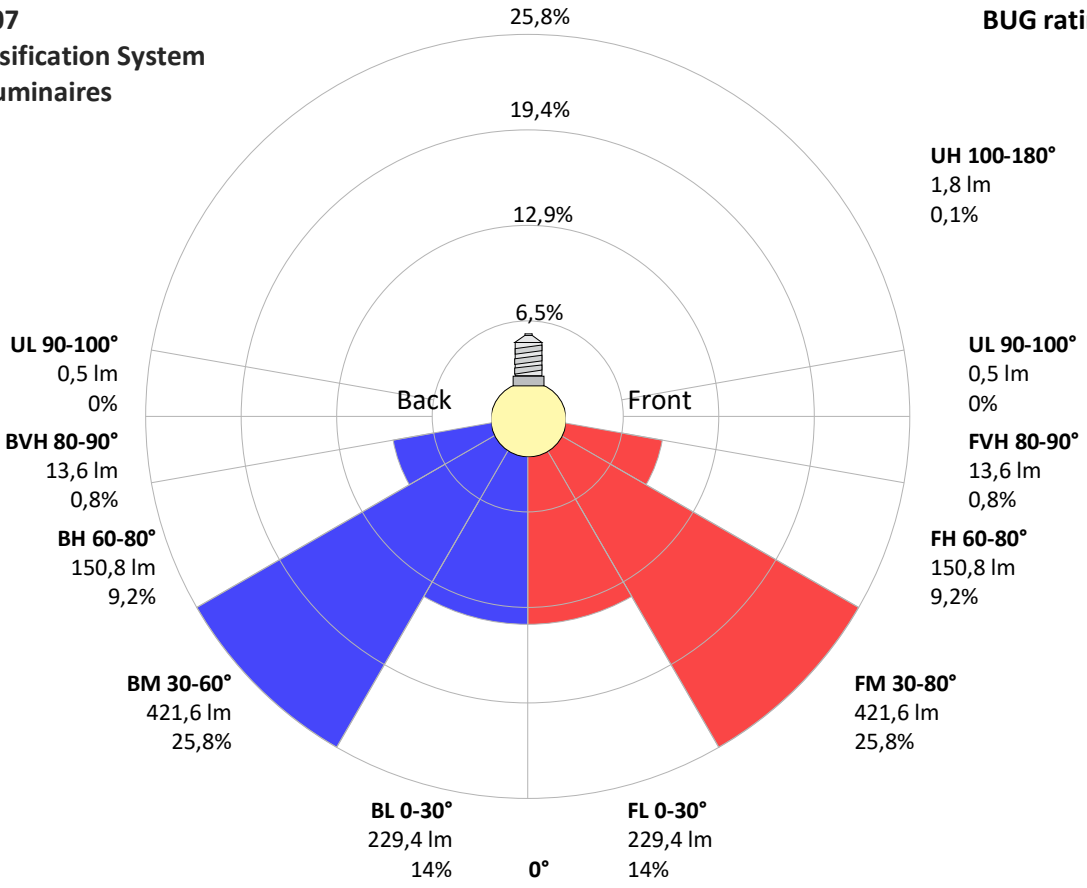
Zone (γ)	Lumen	% Total
0-30°	459 lm	28,1%
0-40°	748 lm	45,8%
0-60°	1302 lm	79,7%
60-90°	329 lm	20,1%
70-100°	136 lm	8,3%
90-120°	1 lm	0,1%
0-90°	1631 lm	99,9%
90-180°	2 lm	0,1%
0-180°	1633 lm	100,0%

BUG rating

	Lumen	% Total
Forward light		
Low(0-30°)	229 lm	14,0%
Medium(30-60°)	422 lm	25,8%
High(60-80°)	151 lm	9,2%
Very high(80-90°)	14 lm	0,8%
Back light		
Low(0-30°)	229 lm	14,0%
Medium(30-60°)	422 lm	25,8%
High(60-80°)	151 lm	9,2%
Very high(80-90°)	14 lm	0,8%
Uplight		
Low(90-100°)	1 lm	0,0%
High(100-180°)	2 lm	0,1%

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

BUG rating B1 U1 G1



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Power Details

Input Power

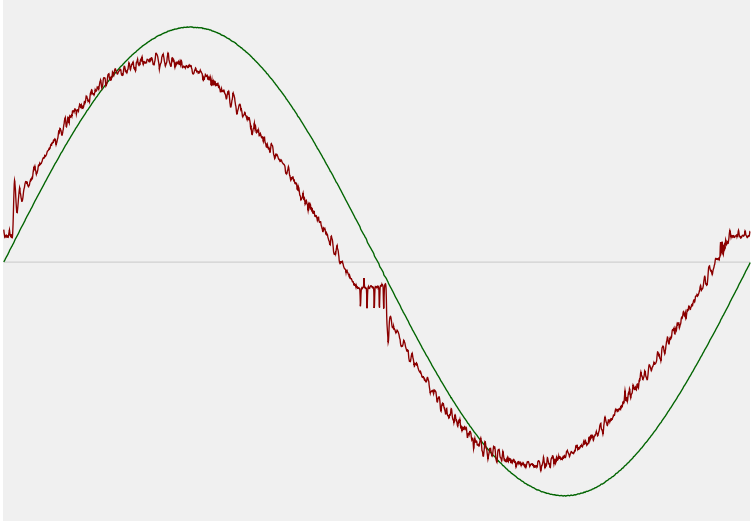
Power feed to light source	18,0 W
Frequency of input power	50 Hz
RMS Input voltage feed, V_{RMS}	230 V
RMS Input current feed, I_{RMS}	0,081 A
Volt-Ampere or apparent power = $V_{RMS}*I_{RMS}$	18,68 VA
Displacement factor of AC power feed	0,97
Power factor of AC current feed	0,96
Total harmonic distortion of the current	4,94%
Total harmonic distortion of the voltage	0,07%

Efficiency

Radiated power efficiency 27,1%

Lumen efficiency 91 lm/W

Input Power Curve



Stabilization Details

Warmup Conditions

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

Color Temperature Change

CCT start	3978 K
CCT shift	+22 K
CCT end	4000 K

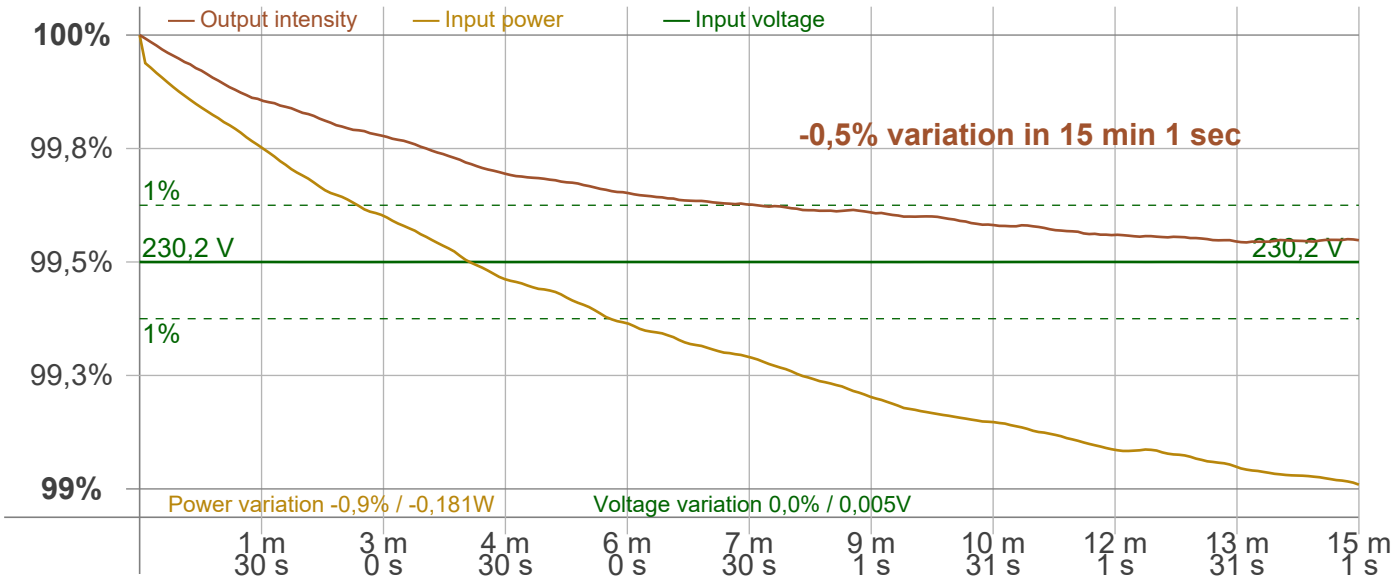
Warmup Result

Total warmup time	Lamp stabilized in 15 min 1 sec
Warmup variation	-0,5%

Output Change

Output start	1641 lm
Output change	-8 lm
Output end	1633 lm

Stabilization Curve



Light Measurement Report

Print date: 4-11-2024
Measurement date and time: 4-11-2024 09:45:55 – Measurement no. VFR-241104-1843-MS
Measurement tracking No. and Link: VT241104-005204
Operator:

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	1,5 %
Flicker index	0

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

PstLM value (F < 80 Hz)	0,11
SVM value (80 < F < 2000 Hz)	0,02

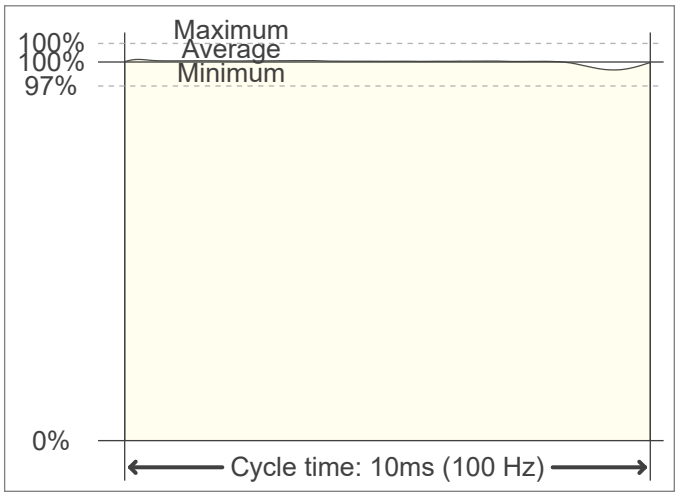
Flicker indices according to California Energy Commission (CEC) 2016b

JA8/10 40 Hz	0,09 %
JA8/10 90 Hz	0,11 %
JA8/10 200 Hz	0,65 %
JA8/10 400 Hz	1,14 %
JA8/10 1000 Hz	1,49 %

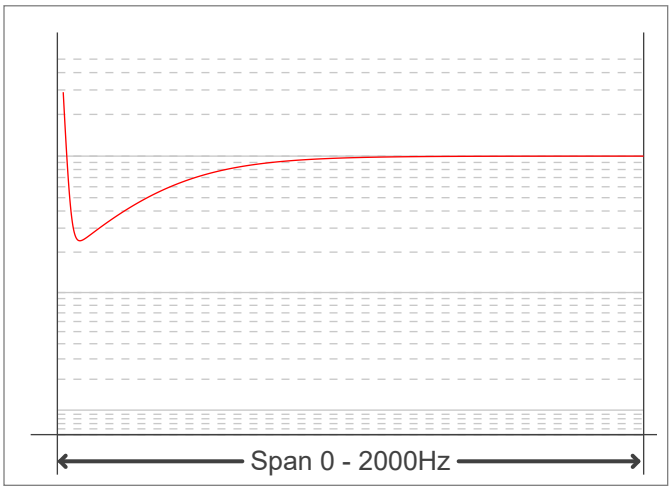
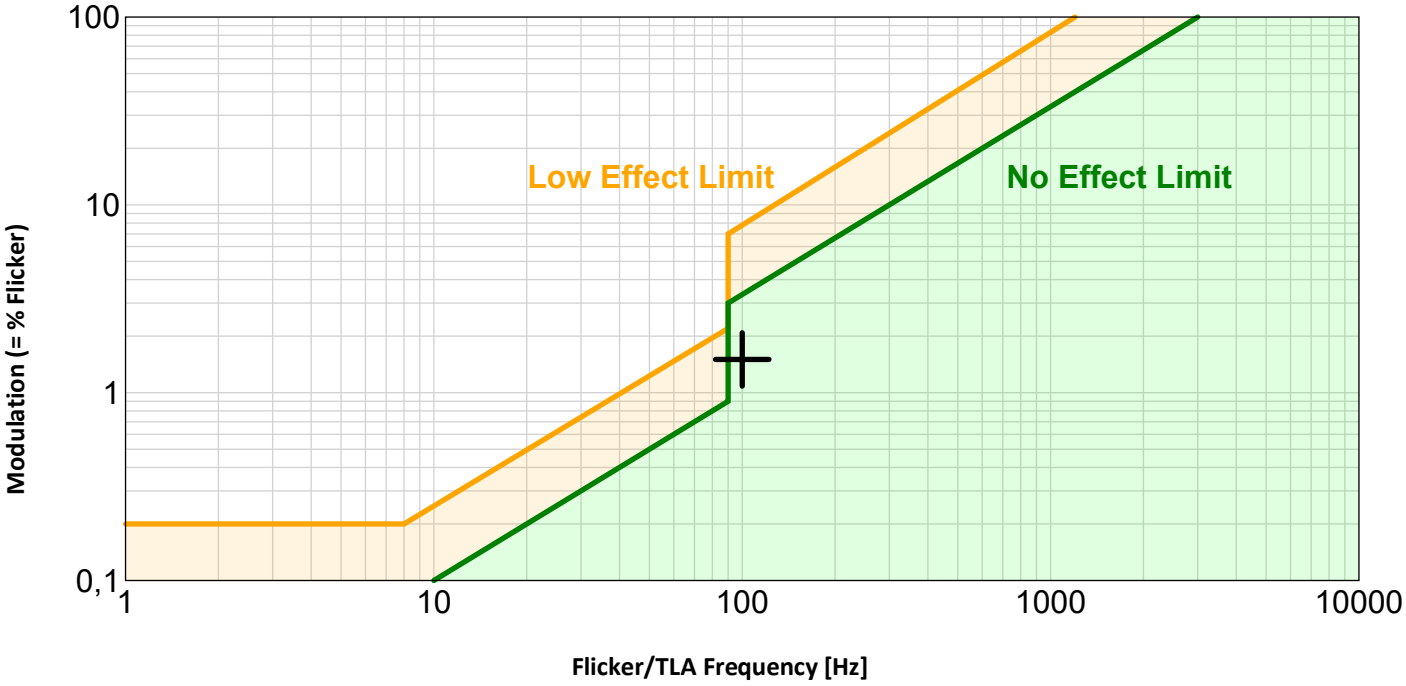
Flicker indices according to Lighting Research Center (2015)

Perception metric, Assist Mp	0,07

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



Flicker FFT (flicker curve in frequency domain)



IEEE 1789 Frequency/modulation plot