

# Light Measurement Report

Print date: 5-11-2024

Measurement date and time: 5-11-2024 14:11:59 – Measurement no. VFR-241105-1933-MS

Measurement tracking No. and Link: [n/a](#)

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  
 $\gamma$  (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°  
2,40 m  
17,6 W – PF 0,93 – DPF 0,96  
230 V – 0,082 A  
50 Hz  
Lamp stabilized in 15 min 1 sec – 2,0%

## Tested Light Source

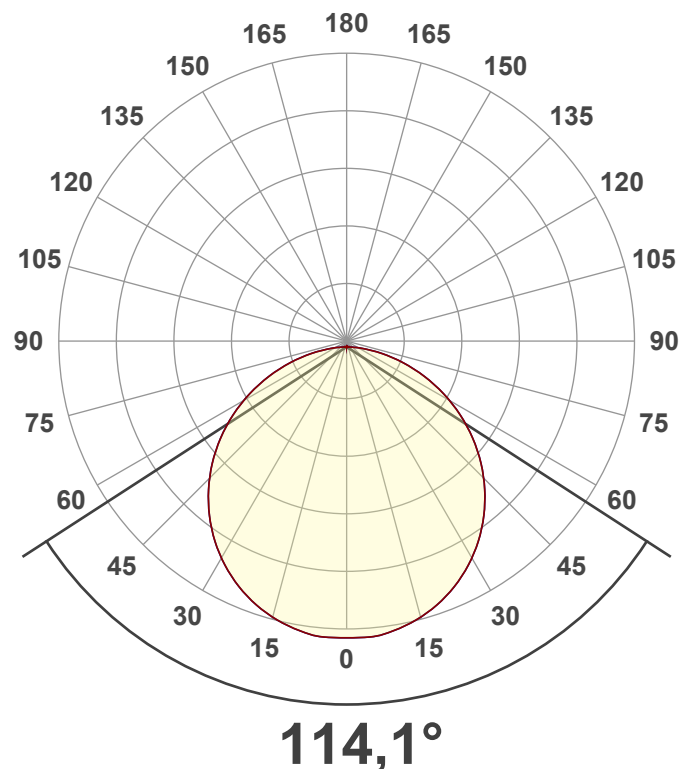
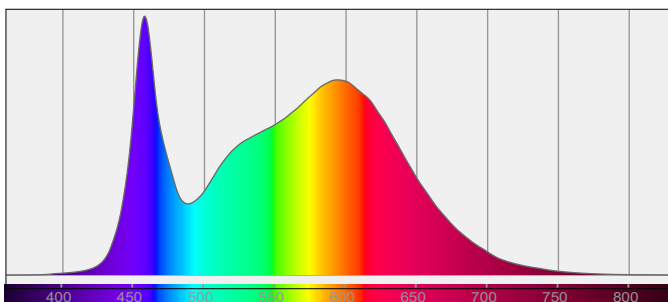
Product Name  
Item No. and Manufacturer  
Product Description (line 1)

800925-4000K  
800925-4000K – Dutchfulfillment  
LED IN/OPBOUW | DOWNLIGHT | OPHELIA | CCT SWITCH+WATT SWITCH

## 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

1942 lm – 0,17% / 99,83%  
110 lm/W  
664 cd – 114,1°  
CCT = 4000 K / 4175 K  
CRI 85,0  
 $R_f$  82,7 –  $R_g$  93,1  
Duv -0,0034 – SDCM 4,8  
SVM 0,02 – PstLM 0,26



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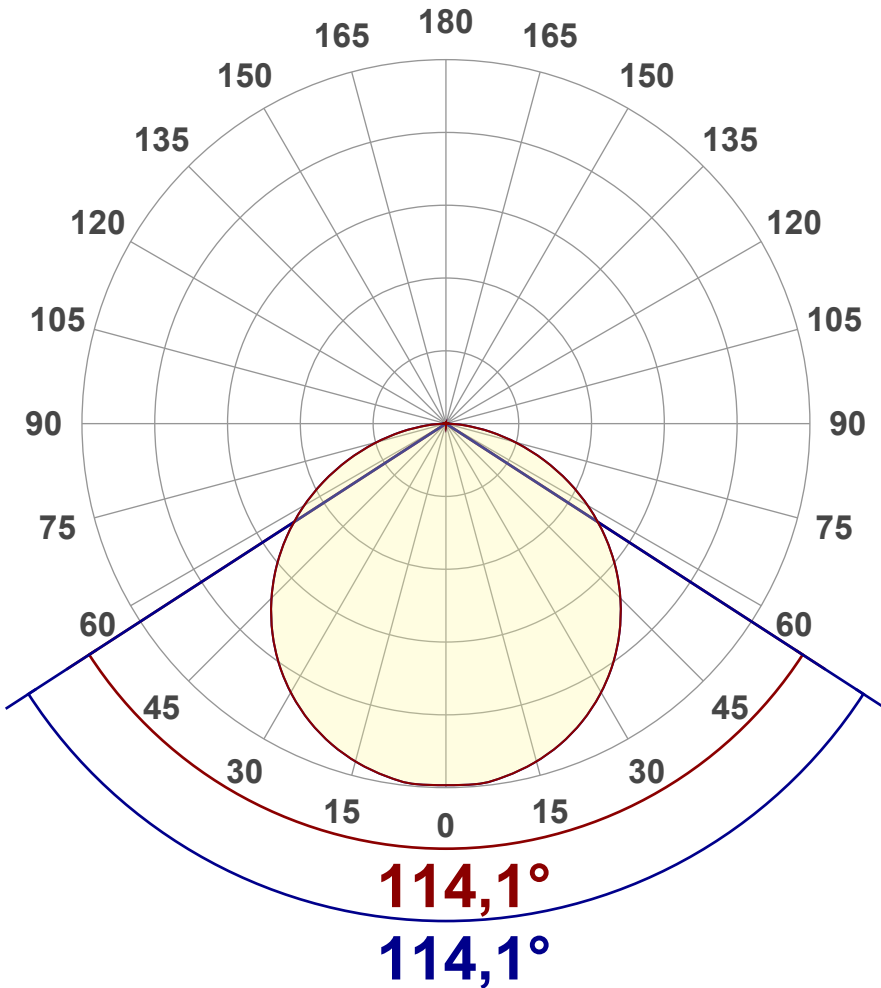
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## Luminous Intensity diagram

Unit: 0-100% of peak intensity



## Main Values

Output (total Lumen)	1942 lm
Lumen Up% / Down%	0,17% / 99,83%
Peak Intensity	664 cd
Beam Angle (50%)	114,1°
Beam Angle (90%)	114,1°
Beam Angle (10%)	114,1°

## Cut-off Angle

Average 2,5%	175,3°
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## Field Angle

Average 10%	162,7°
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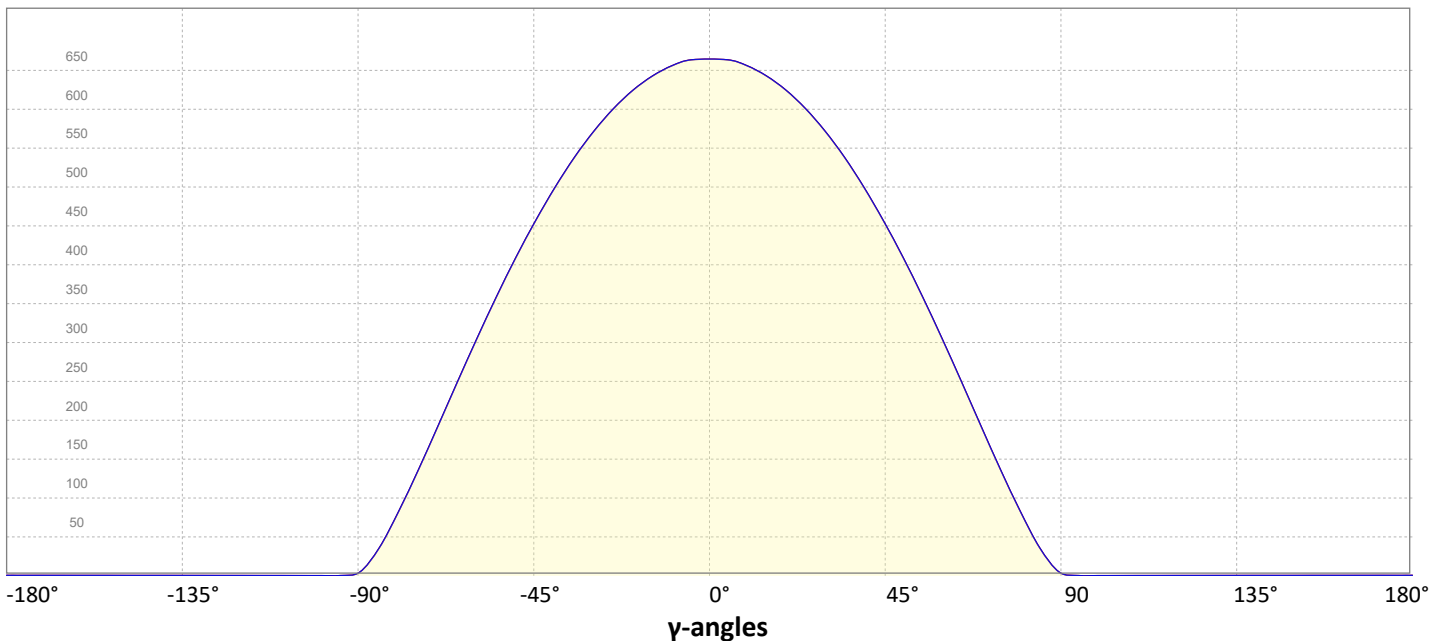
## Intensity Ratio

In 120° cone	78,2%
In 90° cone	53,0%

**C000-C180**

**C090-C270**

## Linear distribution diagram - Intensity (candela) vs $\gamma$ -angle



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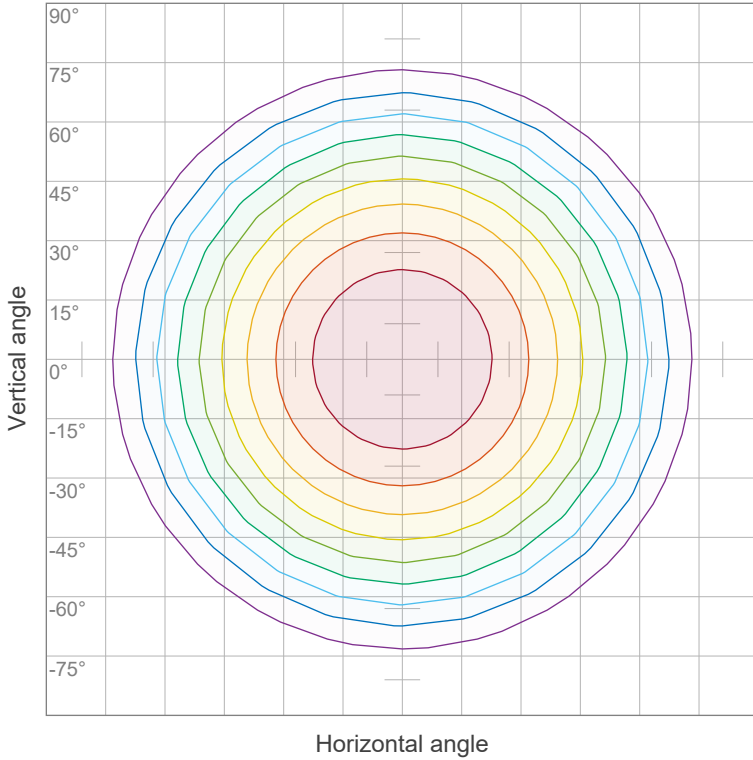
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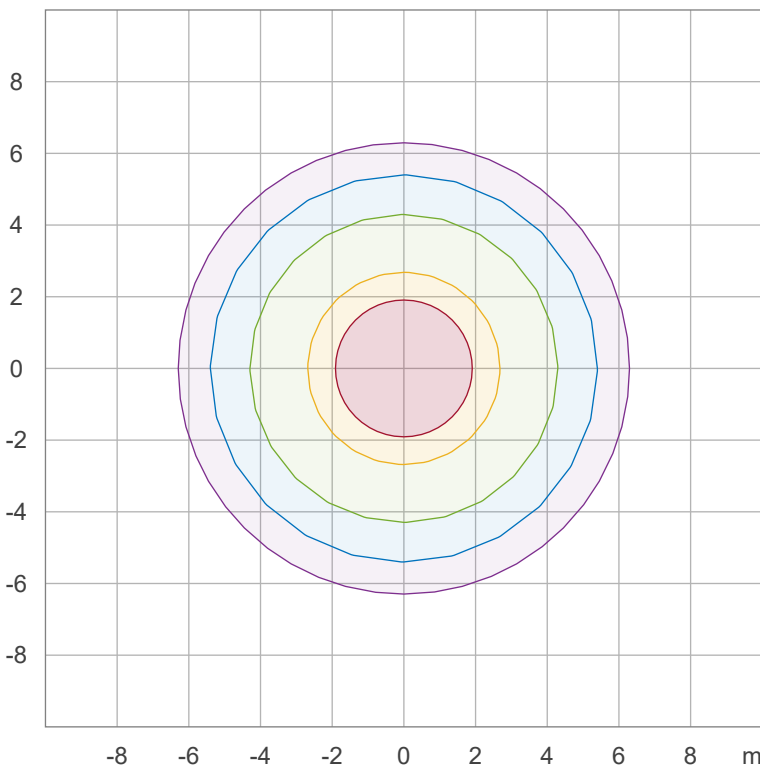
## Iso-intensity Diagram (Iso-candela)



90 %	597,2 cd
80 %	530,9 cd
70 %	464,5 cd
60 %	398,2 cd
50 %	331,8 cd
40 %	265,4 cd
30 %	199,1 cd
20 %	132,7 cd
10 %	66,4 cd

Peak intensity: 663,6 cd  
Number of c-planes: 12

## Iso-illuminance Diagram (Iso-lux)



50,0 %	36,9 lx
30,0 %	22,1 lx
10,0 %	7,4 lx
5,0 %	3,7 lx
3,0 %	2,2 lx

Peak illuminance: 73,7 lx  
Mounting height: 3,0 m  
Number of c-planes: 12

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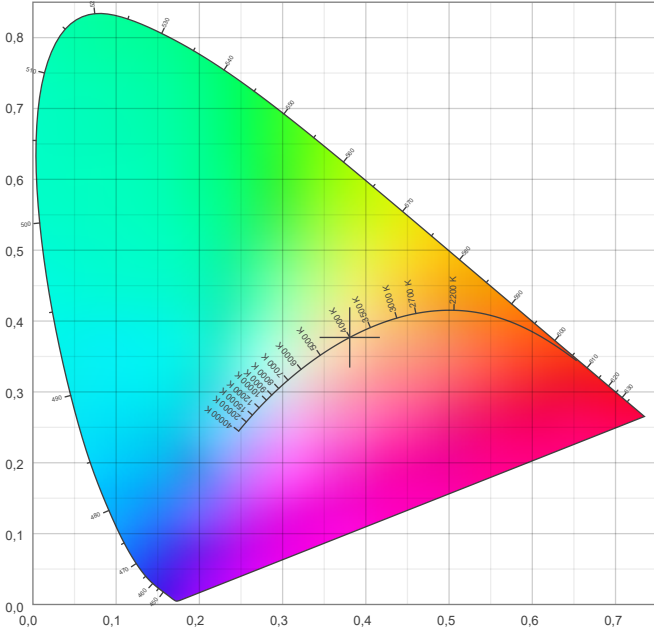


## Color details

Correlated Color Temperature, Target CCT = 4000 K  
 Correlated Color Temperature, Measured CCT = 4175 K  
 Color Rendering Index CRI 85,0  
 Color Rendering Index, R9 (red component) R9 = 19,1  
 Color Rendering TM30-18 R<sub>f</sub> 82,7 – R<sub>g</sub> 93,1  
 Color Quality Scale CQS = 81,9

MacAdam Steps SDCM = 4,8  
 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 = -0,0034  
 Color coordinate CIEs 1976 (CIELUV) (u';v') = (0,225;0,502)

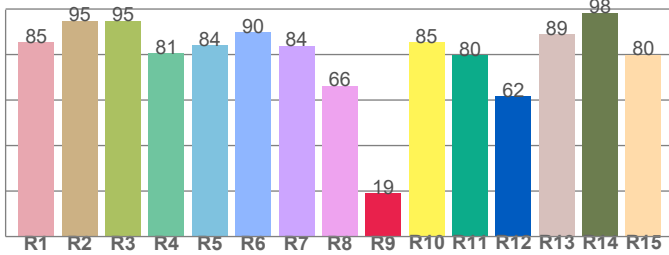
### CIE 1931



### CIE 1931 – zoomed on Planckian locus



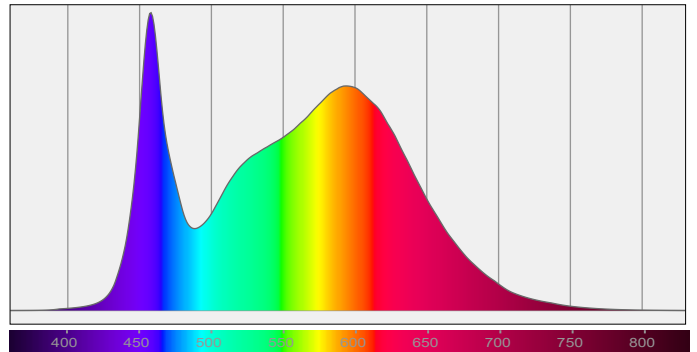
### Color Rendering Index per reference color (CIE 1995)



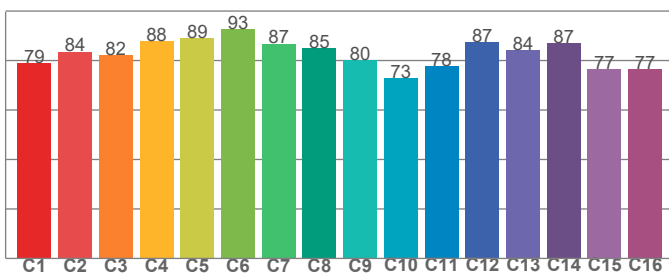
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
85,4	94,9	94,8	80,7	84,0	89,7	83,8	66,4	19,1	85,5	79,6	61,7	88,9	98,4	80,0

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



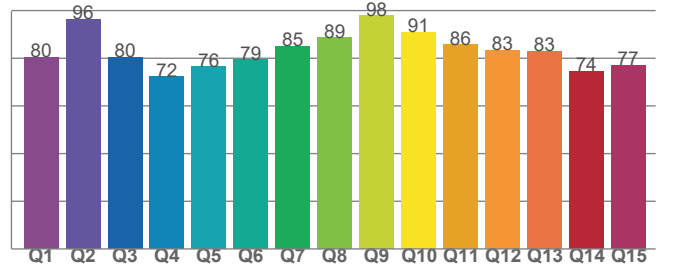
### TM30-18 R<sub>f</sub>-values per hue bin



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
79,0	83,6	82,1	87,8	89,0	92,5	86,9	84,9	80,1	72,8	77,6	87,4	84,2	87,0	76,5	76,6

### Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
80,4	96,4	80,4	72,3	76,4	79,5	85,1	88,6	97,9	90,9	85,6	83,4	83,0	74,4	77,1

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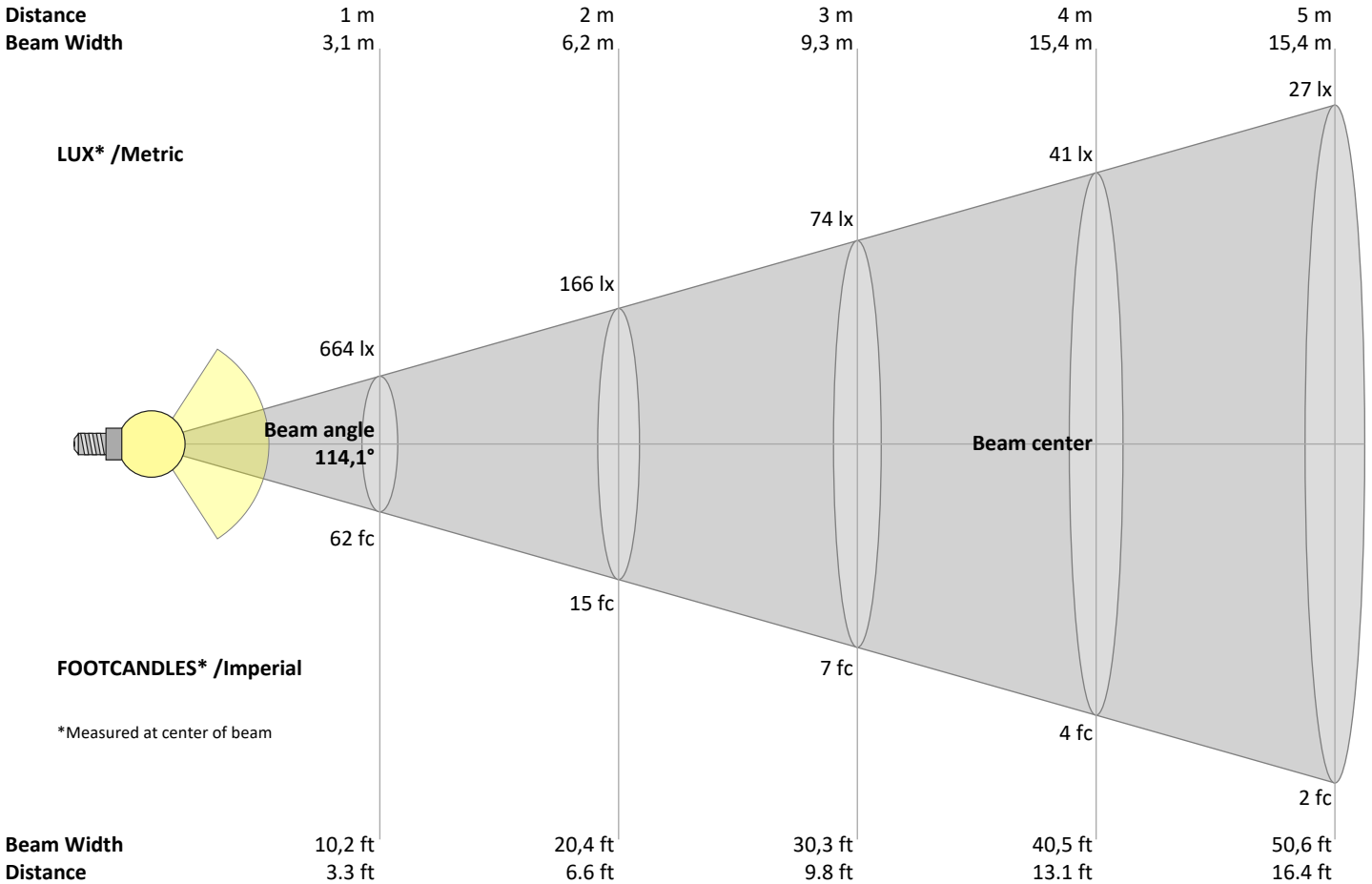
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## Beam Details



### 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
664	166	74	41	27	18	14	10	8	7	5	5	4	3	3	3	2	2	2	2	lux
61,7	15,4	6,9	3,9	2,5	1,7	1,3	1	0,8	0,6	0,5	0,4	0,4	0,3	0,3	0,2	0,2	0,2	0,2	0,2	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
664	663	655	641	623	598	569	535	496	452	405	354	300	244	187	131	79	33	4	0	cd
100%	100%	99%	97%	94%	90%	86%	81%	75%	68%	61%	53%	45%	37%	28%	20%	12%	5%	1%	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
664	663	655	641	623	598	569	535	496	452	405	354	300	244	187	131	79	33	4	0	cd
100%	100%	99%	97%	94%	90%	86%	81%	75%	68%	61%	53%	45%	37%	28%	20%	12%	5%	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
664	663	655	641	623	598	569	535	496	452	405	354	300	244	187	131	79	33	4	0	cd
100%	100%	99%	97%	94%	90%	86%	81%	75%	68%	61%	53%	45%	37%	28%	20%	12%	5%	1%	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
664	663	655	641	623	598	569	535	496	452	405	354	300	244	187	131	79	33	4	0	cd
100%	100%	99%	97%	94%	90%	86%	81%	75%	68%	61%	53%	45%	37%	28%	20%	12%	5%	1%	0%	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	23,8	25,0	24,0	25,3	25,5	23,8	25,0	24,0	25,3	25,5
	3H	25,1	26,4	25,6	26,7	26,9	25,1	26,4	25,6	26,7	26,9
	4H	25,7	26,9	26,1	27,2	27,5	25,7	26,9	26,1	27,2	27,5
	6H	26,2	27,2	26,5	27,5	27,9	26,2	27,2	26,5	27,5	27,9
	8H	26,3	27,3	26,6	27,6	28,0	26,3	27,3	26,6	27,6	28,0
	12H	26,3	27,3	26,7	27,7	28,1	26,3	27,3	26,7	27,7	28,1
4H	2H	24,3	25,6	24,7	25,8	26,1	24,3	25,6	24,7	25,8	26,1
	3H	26,0	27,0	26,4	27,4	27,8	26,0	27,0	26,4	27,4	27,8
	4H	26,7	27,6	27,1	28,0	28,5	26,7	27,6	27,1	28,0	28,5
	6H	27,2	28,0	27,7	28,4	28,8	27,2	28,0	27,7	28,4	28,8
	8H	27,3	28,1	27,8	28,5	28,9	27,3	28,1	27,8	28,5	28,9
	12H	27,4	28,1	27,9	28,5	29,0	27,4	28,1	27,9	28,5	29,0
8H	4H	26,9	27,7	27,4	28,1	28,5	26,9	27,7	27,4	28,1	28,5
	6H	27,6	28,2	28,1	28,6	29,2	27,6	28,2	28,1	28,6	29,2
	8H	27,8	28,3	28,3	28,9	29,5	27,8	28,3	28,3	28,9	29,5
	12H	27,9	28,4	28,5	28,9	29,5	27,9	28,4	28,5	28,9	29,5
12H	4H	26,9	27,6	27,4	28,0	28,5	26,9	27,6	27,4	28,0	28,5
	6H	27,6	28,2	28,1	28,7	29,3	27,6	28,2	28,1	28,7	29,3
	8H	27,9	28,3	28,5	28,8	29,5	27,9	28,3	28,5	28,8	29,5

### 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	106	106	106	102	102	102	100	100
1	109	104	99	95	106	101	97	94	97	94	91	93	90	88	89	87	85	83
2	99	90	83	77	96	88	82	76	85	79	75	81	77	73	78	75	71	69
3	90	79	71	64	87	77	70	64	74	68	62	72	66	61	69	64	60	58
4	82	70	61	54	80	69	60	54	66	59	53	64	57	52	61	56	52	49
5	75	62	53	47	73	61	53	46	59	52	46	57	50	45	55	49	45	43
6	70	56	47	41	68	55	47	40	53	46	40	52	45	40	50	44	39	37
7	65	51	42	36	63	50	42	36	48	41	35	47	40	35	46	39	35	33
8	60	46	38	32	58	46	37	32	44	37	32	43	36	31	42	36	31	29
9	56	43	34	29	55	42	34	29	41	33	28	40	33	28	39	33	28	26
10	53	39	31	26	51	39	31	26	38	31	26	37	30	26	36	30	25	24

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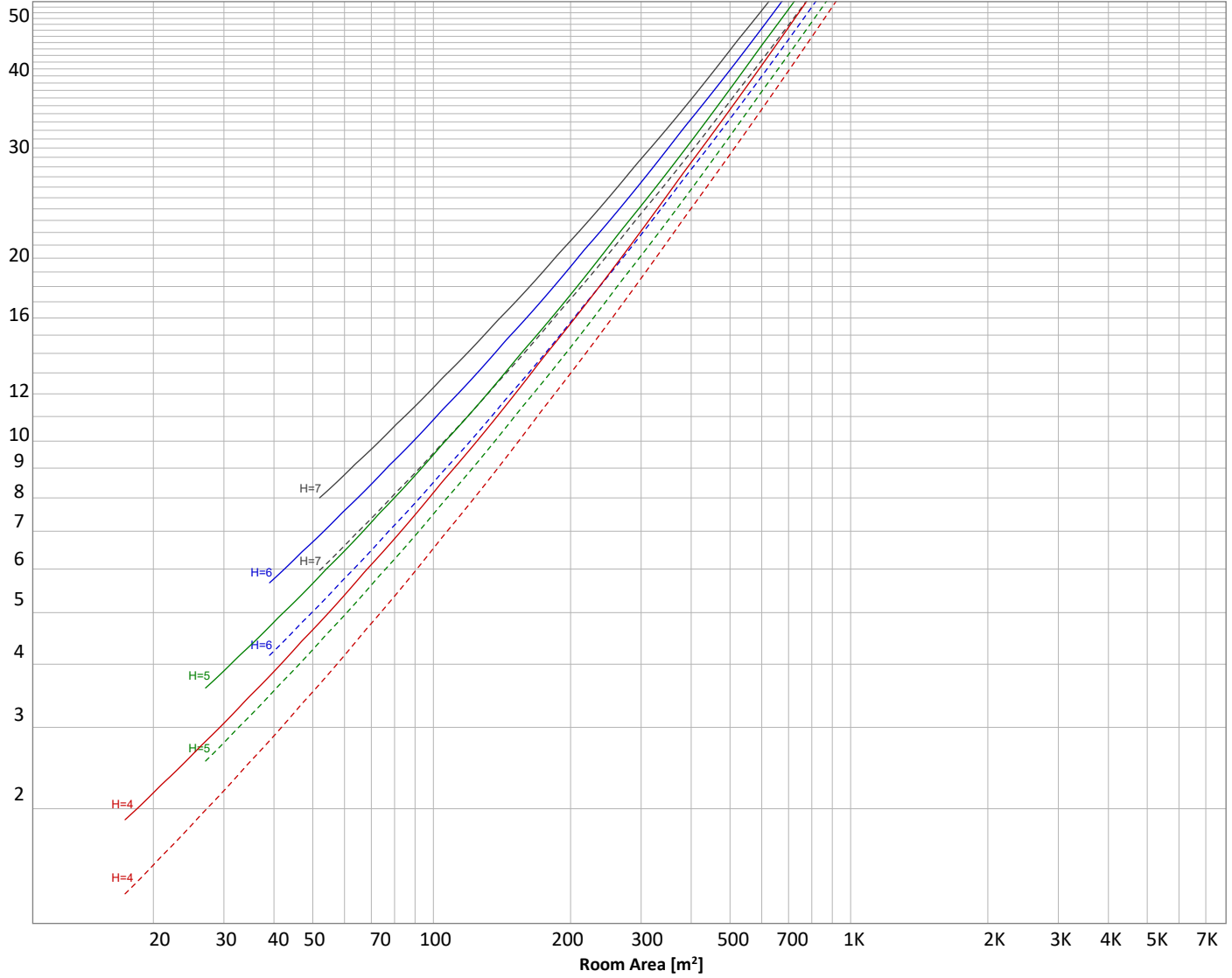
Operator:



## Luminaire budgetary diagram

Uncorrected, comprehensive UGR table according to 117-1995

LAMPS (number of lamps)



### Conditions

H = Room height	Flux = 1942 lm				
H <sub>down</sub> = Lamp distance from ceiling =	0.00 m	Line type	Ceiling reflectance	ρ(%) Wall reflectance	Floor reflectance
H <sub>work</sub> = Work area height from floor =	0.00 m	-----	70	50	30
E <sub>work</sub> = 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°
63,0 lm	181 lm	276 lm	334 lm	349 lm	316 lm	241 lm	139 lm	39,7 lm
90°-100°	100°-110°	110°-120°	120°-130°	130°-140°	140°-150°	150°-160°	160°-170°	170°-180°
1,29 lm	0,264 lm	0,326 lm	0,350 lm	0,341 lm	0,293 lm	0,237 lm	0,153 lm	0,053 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

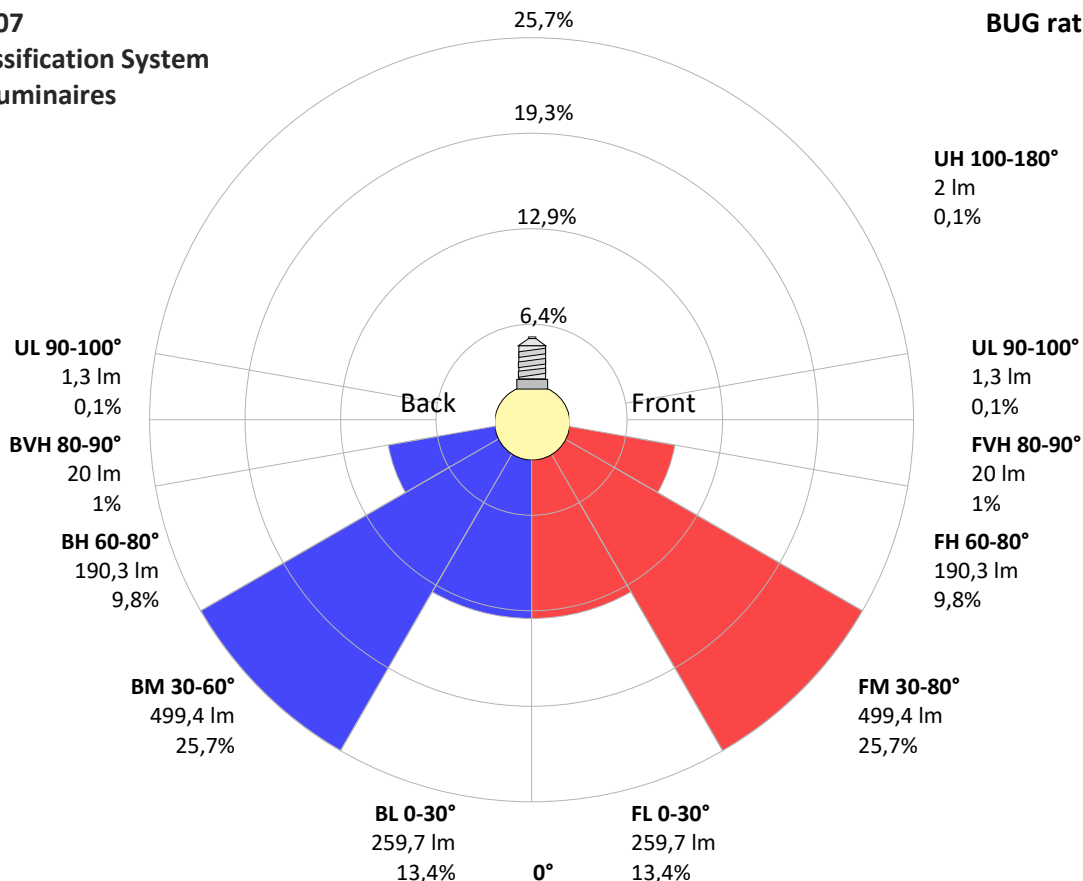
Zone (γ)	Lumen	% Total
0-30°	{LUM00-30} lm	#VALUE!
0-40°	{LUM00-40} lm	#VALUE!
0-60°	{LUM00-60} lm	#VALUE!
60-90°	{LUM60-90} lm	#VALUE!
70-100°	{LUM70-100} lm	#VALUE!
90-120°	{LUM90-120} lm	#VALUE!
0-90°	{LUM00-90} lm	#VALUE!
90-180°	{LUM90-180} lm	#VALUE!
0-180°	{LUM00-180} lm	#VALUE!

### BUG rating

	Lumen	% Total
<b>Forward light</b>		
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!
<b>Back light</b>		
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!
<b>Uplight</b>		
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 G1



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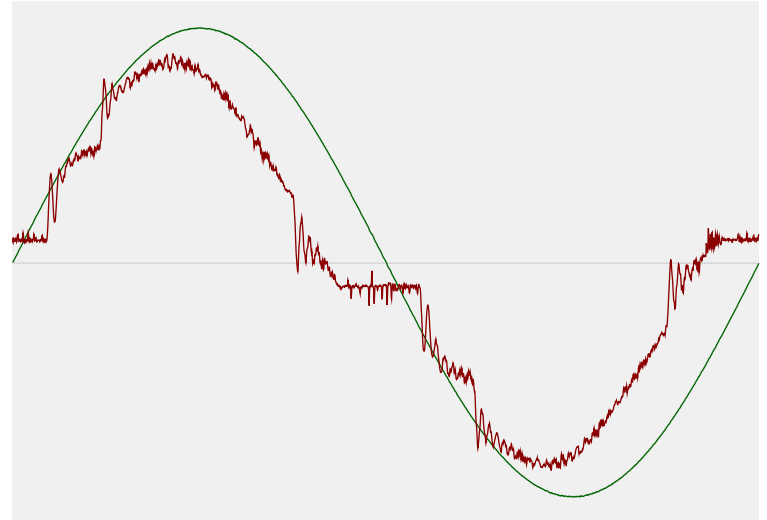


## Power Details

### Input Power

Power feed to light source	17,6 W
Frequency of input power	50 Hz
RMS Input voltage feed, $V_{RMS}$	230 V
RMS Input current feed, $I_{RMS}$	0,082 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	18,87 VA
Displacement factor of AC power feed	0,96
Power factor of AC current feed	0,93
Total harmonic distortion of the current	23,15%
Total harmonic distortion of the voltage	0,07%

### Input Power Curve



### Efficiency

Radiated power efficiency 34,3%



Lumen efficiency 110 lm/W



## Stabilization Details

### Warmup Conditions

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

### Color Temperature Change

CCT start	4001 K
CCT shift	-1 K
CCT end	4000 K

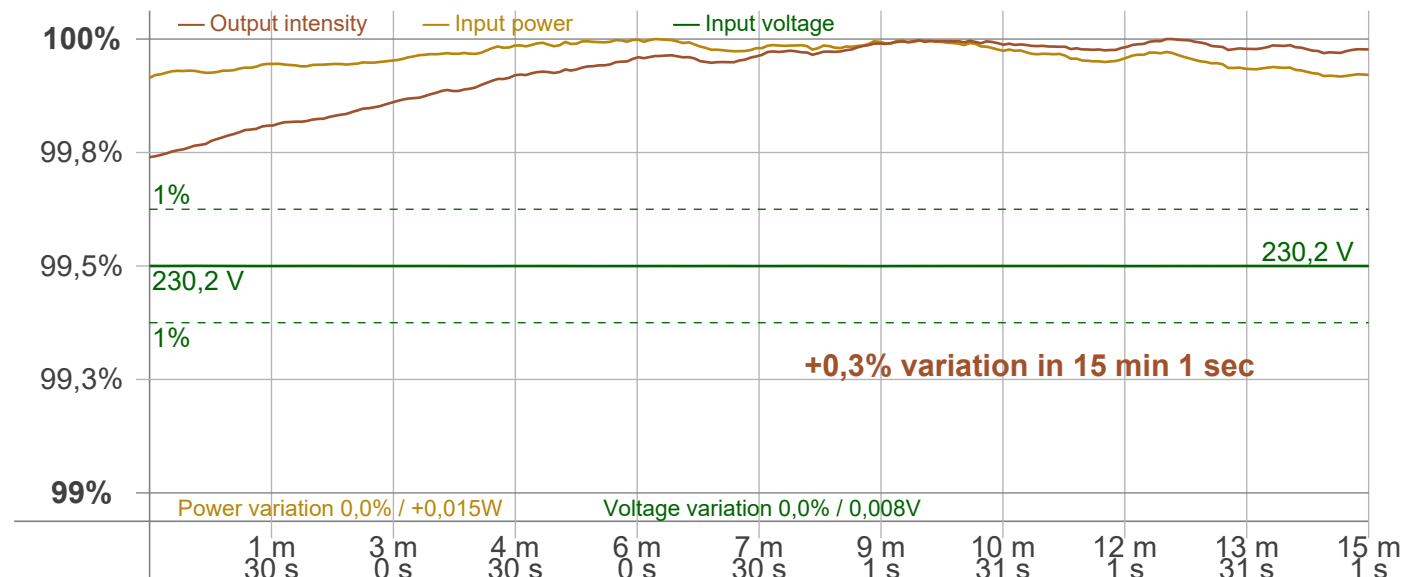
### Warmup Result

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

### Output Change

Output start	1937 lm
Output change	+5 lm
Output end	1942 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 97,09 Hz  
 Percent Flicker 0,79 %  
 Flicker index 0

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

JA8/10 40 Hz 0,18 %  
 JA8/10 90 Hz 0,2 %  
 JA8/10 200 Hz 0,8 %  
 JA8/10 400 Hz 0,79 %  
 JA8/10 1000 Hz 0,78 %

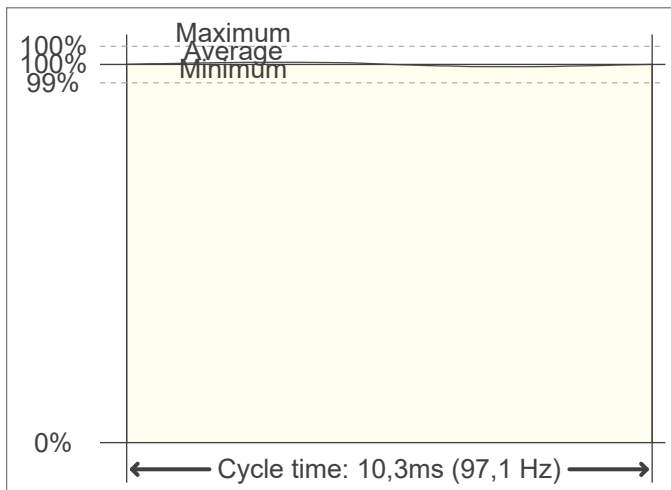
### TLA indices (re IEC TR 61547-1, IEC 61000-3-3 and IEC 61000-4-15)

PstLM value (F < 80 Hz) 0,26  
 SVM value (80 < F < 2000 Hz) 0,02

### Flicker indices according to Lighting Research Center (2015)

Perception metric, Assist Mp 0,09

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



### Flicker FFT (flicker curve in frequency domain)



### IEEE 1789 Frequency/modulation plot

