Goniophotometric Test Report

TEST ARTEFACT
The DUT worked fine during the calibration and no defects were observed.
The DUT was mounted on the goniometer i.e. the AC input cable of the DUT was located in the direction of the C270 plane.
Company: Secto Design Oy

MEASUREMENT METHOD
The measurements were made by a goniospectrophotometer DECO 50. The spectral radiant intensities of a light source at different directions were measured with a calibrated spectrometer
located at a known distance from the light source.

MEASUREMENT UNCERTAINTY
The photometer of type - is traceable to national standard at NIST (Certificate of calibration CR-0067 signed on 10.6.2019).The photometer head of type - is traceable to national standard at PTB (Certificate of calibration CR-0072 signed on 12.6.2019).
The power meter of type - is traceable to national standard at NIST.
The expanded uncertainties of the Luminous flux and efficacy are ±15.0% and ±16.0% (k = 2), respectively.

MEASUREMENTS
Table below describes the measurement conditions. The luminaire under test and photometer/spectrometer were mounted onto the same optical axis and perpendicular by an alignment laser. The measurement distance from the rotation axis to the photometer optical receiving surface was measured by laser distance meter. 0.0000 and 0.0000, respectively.

Table - Measurement information

Ambient temperature of the laboratory	25.0 degC
Power supply	232.4 Vac
Measurement distance	2440 mm
Location of the rotation axis (behind the outermost surface of the optics)	0 mm
Angular step, C plane	22.5 deg
Angular step, gamma angle	5.0 deg
Maximum gamma angle	170.0 deg
Stabilization time	30 min

Table. Luminous Intesity (cd) in horizontal (rows) and vertical planes (columns).

	0.0	**22.5**	**45.0**	**67.5**	**90.0**	**112.5**	**135.0**	**157.5**	**180.0**	**202.5**	**225.0**	**247.5**	**270.0**	**292.5**	**315.0**	**337.5**
0	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331
5	330	331	331	331	331	331	331	331	331	331	331	331	331	330	330	330
10	325	327	326	327	327	328	327	328	328	327	327	326	327	325	326	325
15	318	320	319	321	320	321	320	322	321	320	321	319	320	318	319	318
20	304	309	306	310	308	312	309	312	310	306	309	304	308	303	307	303
25	275	281	278	285	281	287	282	286	282	277	280	274	278	273	278	272
30	241	248	245	253	248	255	249	254	250	243	247	240	245	238	244	238
35	204	212	208	217	212	219	212	218	213	206	211	203	208	202	207	201
40	168	175	171	180	175	182	175	181	176	169	173	166	171	164	170	164
45	133	140	136	144	140	145	139	144	137	134	136	132	135	130	134	130
50	104	110	106	112	109	114	108	113	107	104	106	103	105	102	104	101
55	89	90	89	92	91	92	90	92	89	89	88	89	88	88	88	88
60	80	81	81	84	83	84	82	84	81	80	81	80	81	78	80	78
65	67	69	68	71	69	72	69	71	69	67	69	66	68	65	67	65
70	52	55	53	56	55	57	54	57	54	52	54	51	53	51	52	51
75	37	40	38	41	39	42	39	42	39	37	39	36	38	36	37	36
80	23	26	24	26	25	27	25	27	26	23	26	23	24	22	24	22
85	11	13	11	14	12	14	13	14	13	11	13	11	12	10	12	10
90	7	7	7	7	7	7	7	7	7	7	7	6	6	7	7	7
95	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	6
100	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
105	5	6	6	5	5	5	5	6	5	5	5	5	5	5	5	5
110	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
115	3	3	3	3	3	3	3	3	3	2	3	2	2	2	2	2
120	2	2	2	2	2	2	2	2	1	1	2	1	2	2	2	2
125	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1
130	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1
135	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
140	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
145	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1
150	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2
155	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
160	3	3	3	3	3	3	3	3	2	2	2	2	2	3	2	3
165	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
170	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Table. Measurement results of the main luminous parameters

Luminous flux	Input power	Luminous efficacy	LOR	DWFF	Luminous intensity (g=0)
709.4 lm	12.22 W	58.1 lm/W	100.0 %	97.1 %	331 cd

Table. Electrical parameters during the light measurements.

	Pin	PF	Vin	If
Value	12.22 W	0.8729	232.4 V	0.0602 A
St.dev.	0.08 %	0.14 %	0.31 %	0.11 %

Table. Maximum Luminous Intesity and its direction

Iv	g	C plane
331 cd	5.0°	90.0°

Table. Beam widths at two perpendicular planes

	Beam angle, FWHM, 50% (deg)	Beam angle, 10% (deg)	Effective beam direction from g=0
C0-180	81.7°	153.7°	-0.0°
C90-270	82.2°	153.9°	0.0°

Figure. Polar curve of the angular Luminous Intesity distribution at two perpendicular C planes and at C plane with maximum Luminous Intesity.

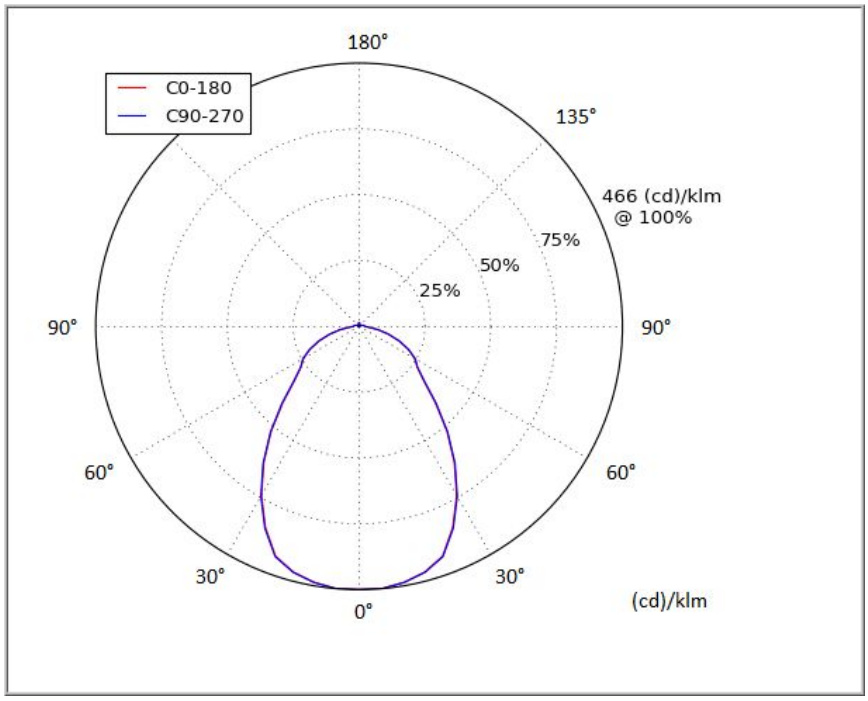


Figure. Luminous Intesity distribution in cartesian diagram at all measured C planes.

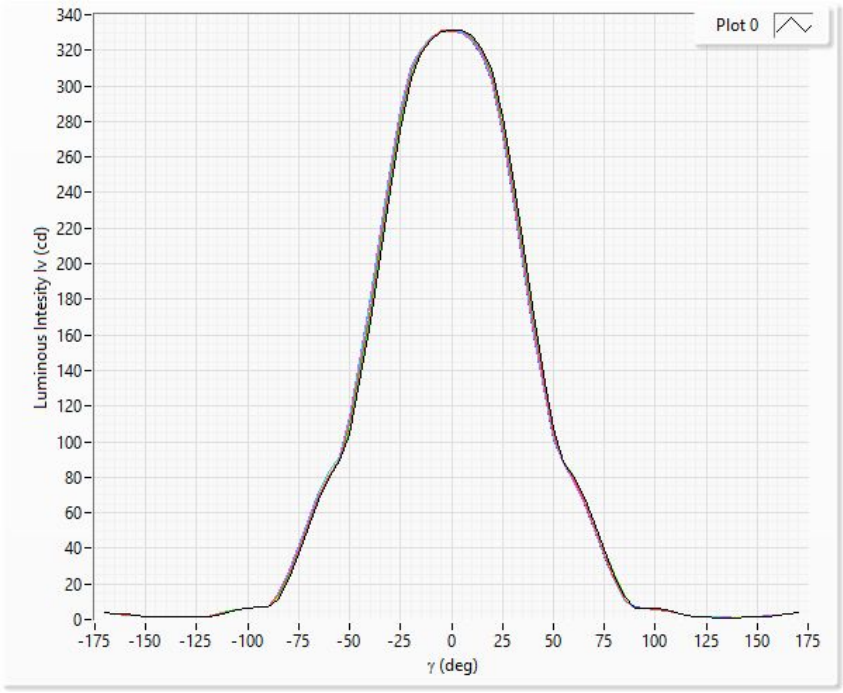


Figure. Isocandela as a function of C plane at gamma angle with maximum luminous intensity

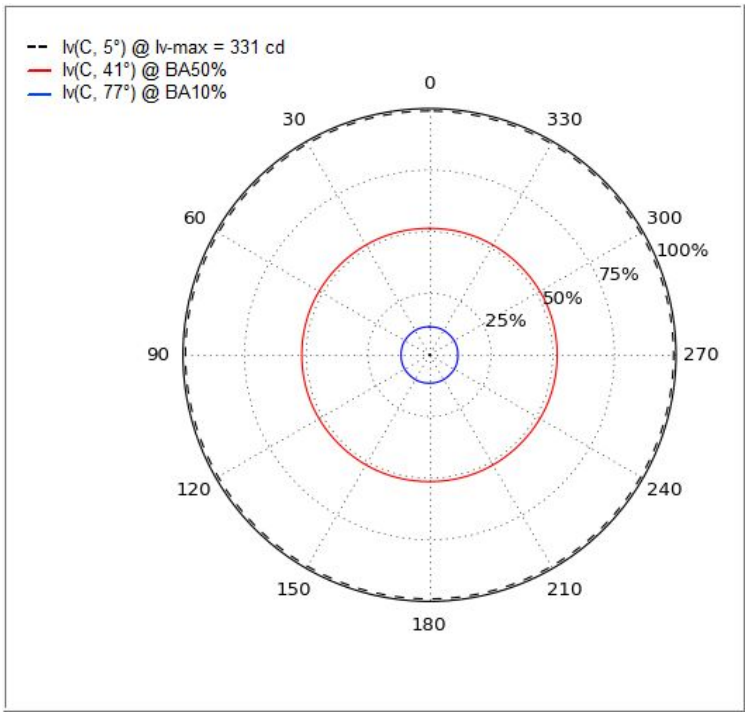


Table. Zonal lumen summary

	Lumens	Relative lumens (%)
0-20	121.10	17.07
0-30	248.30	35.01
0-40	378.30	53.33
0-60	565.90	79.78
0-80	673.80	95.00
0-90	688.90	97.12
10-90	657.60	92.71
20-40	257.20	36.26
20-50	363.00	51.18
40-70	254.60	35.89
40-90	310.60	43.79
60-80	107.90	15.21
60-90	123.00	17.34
70-80	40.90	5.77
80-90	15.10	2.13
90-110	12.60	1.78
90-120	15.30	2.16
90-130	16.70	2.35
90-150	18.60	2.62
90-180	20.40	2.88
110-180	7.80	1.10
0-180	709.30	100.00

Table. Cumulative and Zonal luminous flux

gamma (deg)	Zone Flux (lm)	Sum Flux (lm)	Zone Flux (%)	Sum Flux (%)
0.0	0.0	0.0	0.0	0.0
5.0	15.8	7.9	2.2	1.1
10.0	31.1	31.3	4.4	4.4
15.0	45.4	69.6	6.4	9.8
20.0	57.6	121.1	8.1	17.1
25.0	64.7	182.2	9.1	25.7
30.0	67.4	248.3	9.5	35.0
35.0	65.9	315.0	9.3	44.4
40.0	60.8	378.3	8.6	53.3
45.0	53.0	435.2	7.5	61.3
50.0	44.9	484.1	6.3	68.2
55.0	40.2	526.6	5.7	74.2
60.0	38.5	565.9	5.4	79.8
65.0	33.9	602.2	4.8	84.9
70.0	27.6	632.9	3.9	89.2
75.0	20.4	657.0	2.9	92.6
80.0	13.3	673.8	1.9	95.0
85.0	6.6	683.8	0.9	96.4
90.0	3.7	688.9	0.5	97.1
95.0	3.6	692.6	0.5	97.6
100.0	3.3	696.1	0.5	98.1
105.0	2.7	699.1	0.4	98.5
110.0	2.1	701.5	0.3	98.9
115.0	1.3	703.2	0.2	99.1
120.0	0.8	704.2	0.1	99.3
125.0	0.7	705.0	0.1	99.4
130.0	0.6	705.6	0.1	99.5
135.0	0.5	706.1	0.1	99.5
140.0	0.5	706.6	0.1	99.6
145.0	0.5	707.1	0.1	99.7
150.0	0.5	707.5	0.1	99.7
155.0	0.5	708.0	0.1	99.8
160.0	0.5	708.5	0.1	99.9
165.0	0.5	708.9	0.1	99.9
170.0	0.2	709.3	0.0	100.0

Figure. Cumulative luminous flux

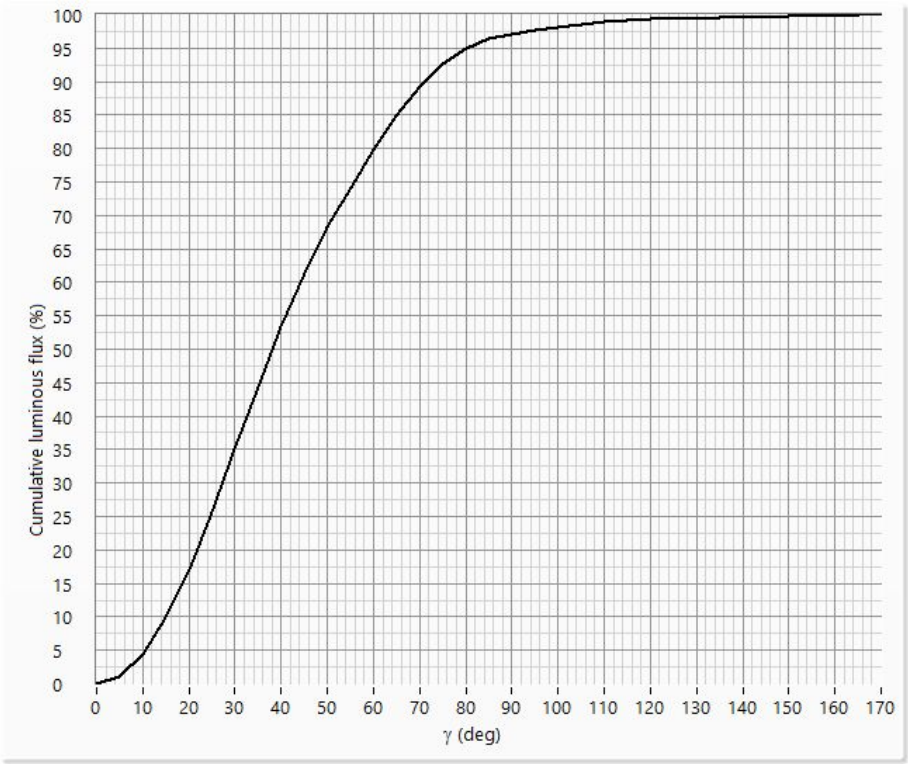


Table. Luminance at different angles based on the defined luminous areas and measured luminous intensities.

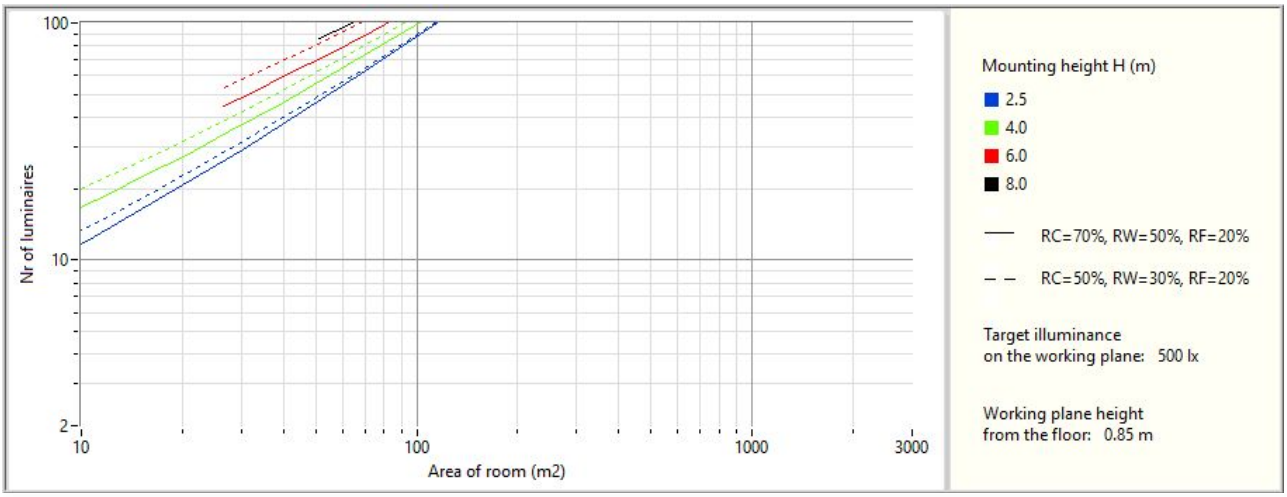
	C 0	C 45	C 90
g 0	12993	12993	12993
g 45	4590	4626	4657
g 55	3193	3197	3218
g 65	2673	2679	2698
g 75	1718	1728	1732
g 85	657	663	655

Table. Unified Glare Rating (UGR) Index in different types of indoor spaces.

Ceiling		70	70	50	50	30	70	70	50	50	30
Walls		50	30	50	30	30	50	30	50	30	30
Floor		20	20	20	20	20	20	20	20	20	20
Room size		**Viewing direction at right angles to lamp axis**					**Viewing direction parallel to lamp axis**				
X	Y										
2H	2H	17.4	18.9	17.8	19.3	19.6	17.5	18.9	17.9	19.3	19.7
	3H	19.5	20.8	19.9	21.2	21.6	19.6	20.9	20.0	21.3	21.7
	4H	20.3	21.5	20.7	21.9	22.4	20.3	21.6	20.8	22.0	22.4
	6H	20.9	22.0	21.3	22.4	22.9	20.9	22.1	21.4	22.5	23.0
	8H	21.1	22.2	21.6	22.6	23.1	21.1	22.2	21.6	22.7	23.1
	12H	21.2	22.3	21.7	22.7	23.2	21.3	22.3	21.8	22.8	23.3
4H	2H	18.1	19.4	18.6	19.8	20.2	18.2	19.4	18.6	19.8	20.3
	3H	20.4	21.4	20.9	21.9	22.4	20.5	21.5	20.9	21.9	22.4
	4H	21.3	22.2	21.8	22.7	23.2	21.4	22.3	21.8	22.8	23.3
	6H	22.0	22.9	22.5	23.4	23.9	22.1	22.9	22.6	23.4	23.9
	8H	22.3	23.1	22.8	23.6	24.1	22.4	23.1	22.9	23.6	24.2
	12H	22.5	23.2	23.1	23.7	24.3	22.6	23.3	23.1	23.8	24.3
8H	4H	21.6	22.4	22.2	22.9	23.4	21.7	22.5	22.2	23.0	23.5
	6H	22.5	23.2	23.1	23.7	24.2	22.6	23.2	23.1	23.7	24.3
	8H	22.9	23.5	23.4	24.0	24.6	22.9	23.5	23.5	24.1	24.6
	12H	23.2	23.7	23.8	24.3	24.9	23.2	23.8	23.8	24.3	24.9
12H	4H	21.7	22.4	22.2	22.9	23.4	21.7	22.4	22.3	22.9	23.5
	6H	22.6	23.2	23.2	23.7	24.3	22.7	23.2	23.2	23.7	24.3
	8H	23.0	23.5	23.6	24.1	24.7	23.1	23.6	23.6	24.1	24.7

RC	**80**				**70**				**50**			**30**			**10**		
RW	**70**	**50**	**30**	**10**	**70**	**50**	**30**	**10**	**50**	**30**	**10**	**50**	**30**	**10**	**50**	**30**	**10**
RF / RCR	**20**				**20**				**20**			**20**			**20**		
0	118	118	118	118	115	115	115	115	110	110	110	104	104	104	99	99	99
1	89	85	82	79	89	86	83	81	88	86	83	90	88	86	92	90	88
2	85	79	74	69	85	79	74	70	80	76	72	81	77	74	82	78	75
3	81	72	66	61	80	73	66	61	73	67	63	73	68	64	73	69	65
4	76	67	59	54	76	66	60	54	66	60	55	66	60	56	66	61	57
5	72	61	54	48	71	61	54	49	61	54	49	60	54	50	60	55	50
6	68	57	49	44	67	56	49	44	56	49	44	55	49	45	55	49	45
7	64	52	45	39	63	52	45	40	51	45	40	51	45	40	50	45	40
8	60	49	41	36	59	48	41	36	48	41	36	47	41	37	47	41	37
9	57	45	38	33	56	45	38	33	44	38	33	44	38	33	43	38	34
10	54	42	35	30	53	42	35	31	41	35	31	41	35	31	40	35	31

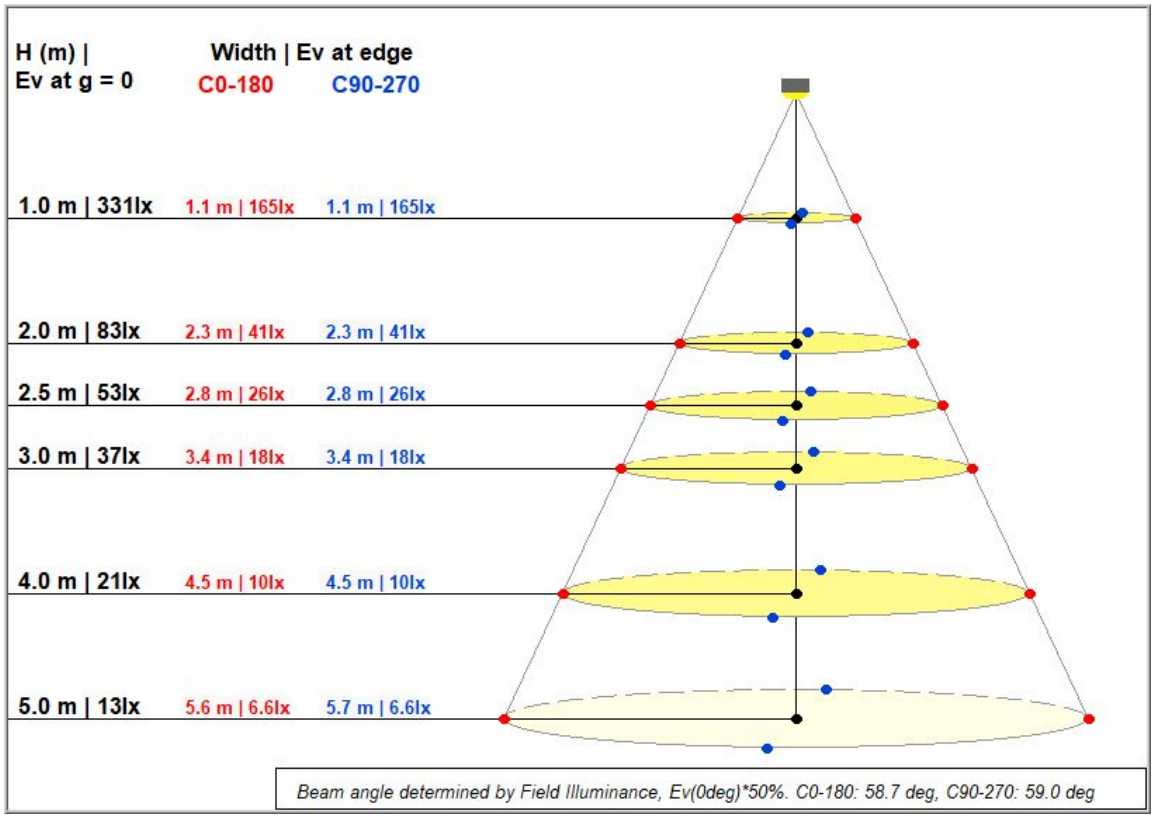
Figure. Number of luminaires in diffeent sizes of rectangular spaces.



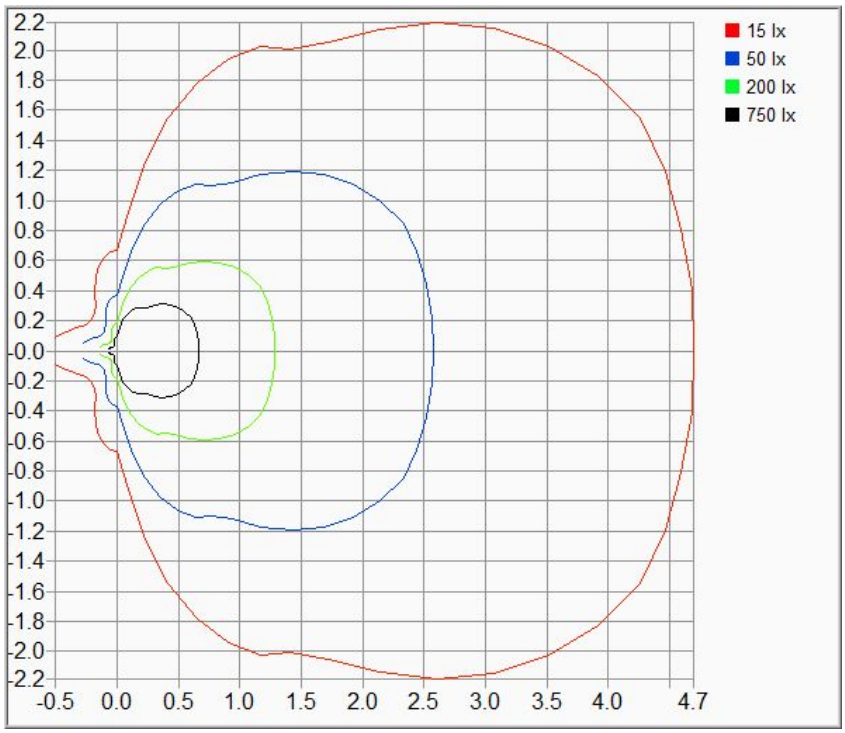
RC	80				70				50			30			10		
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10
RF / RCR	20				20				20			20			20		
1	43.1	29.1	16.6	5.3	41.8	28.3	16.2	5.2	26.8	15.4	4.9	25.4	14.6	4.7	23.9	13.9	4.5
2	42.1	27.3	15.0	4.6	40.8	26.6	14.7	4.5	25.3	14.1	4.4	23.9	13.5	4.2	22.6	12.8	4.0
3	40.5	25.4	13.6	4.1	39.2	24.7	13.3	4.0	23.5	12.8	3.9	22.3	12.3	3.8	21.1	11.7	3.6
4	38.7	23.6	12.3	3.7	37.5	23.0	12.1	3.6	21.9	11.7	3.5	20.8	11.2	3.4	19.7	10.7	3.3
5	37.0	22.0	11.3	3.3	35.8	21.4	11.1	3.3	20.4	10.7	3.2	19.4	10.3	3.1	18.4	9.8	3.0
6	35.4	20.5	10.4	3.0	34.2	20.0	10.2	3.0	19.1	9.9	2.9	18.2	9.5	2.8	17.2	9.1	2.7
7	33.8	19.3	9.7	2.8	32.7	18.8	9.5	2.7	17.9	9.2	2.7	17.1	8.8	2.6	16.2	8.4	2.5
8	32.4	18.2	9.0	2.6	31.3	17.7	8.9	2.5	16.9	8.5	2.5	16.1	8.2	2.4	15.3	7.9	2.3
9	31.0	17.2	8.5	2.4	30.0	16.8	8.3	2.4	16.0	8.0	2.3	15.2	7.7	2.2	14.5	7.4	2.1
10	29.8	16.3	8.0	2.3	28.9	15.9	7.8	2.2	15.2	7.6	2.2	14.5	7.2	2.1	13.7	6.9	2.0

RC	80				70				50			30			10		
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10
RF / RCR	20				20				20			20			20		
1	47.2	43.0	39.3	35.9	25.5	22.9	20.5	18.4	11.6	10.3	9.1	6.2	5.6	4.9	2.0	1.8	1.6
2	47.1	39.7	33.5	28.3	26.0	21.3	17.4	14.0	11.0	8.8	6.8	5.9	4.8	3.7	1.9	1.5	1.2
3	46.5	36.5	28.7	22.6	26.1	19.8	14.9	10.9	10.3	7.6	5.3	5.6	4.2	2.9	1.8	1.3	1.0
4	45.4	33.5	24.8	18.1	25.9	18.4	12.8	8.5	9.7	6.6	4.1	5.4	3.7	2.3	1.7	1.2	0.8
5	43.9	30.7	21.4	14.6	25.4	17.0	11.1	6.6	9.2	5.8	3.2	5.1	3.3	1.9	1.6	1.1	0.6
6	42.3	28.0	18.5	11.7	24.7	15.8	9.6	5.2	8.6	5.2	2.6	4.8	3.0	1.5	1.6	1.0	0.5
7	40.5	25.6	16.0	9.2	24.0	14.6	8.4	4.0	8.1	4.6	2.1	4.6	2.7	1.3	1.5	0.9	0.5
8	38.7	23.4	13.8	7.2	23.1	13.5	7.3	3.0	7.7	4.1	1.6	4.4	2.5	1.1	1.4	0.8	0.4
9	36.8	21.3	11.9	5.4	22.3	12.5	6.3	2.2	7.2	3.7	1.3	4.1	2.3	0.9	1.4	0.8	0.3
10	35.0	19.5	10.2	4.0	21.4	11.5	5.5	1.5	6.8	3.4	1.0	3.9	2.1	0.8	1.3	0.7	0.3

CONE DIAGRAM
- Cone is limited by the beam angle at the planes of C0 and C90
- H = Mounting Height
- D = Cone diameter
- Ev Edge = Illuminance at the edge of the cone of the C0/90 plane
- Ev Center = Illuminance at the center of the cone



Vertical isolux

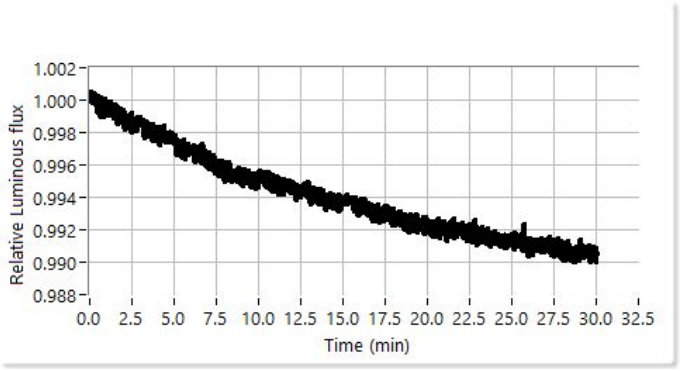


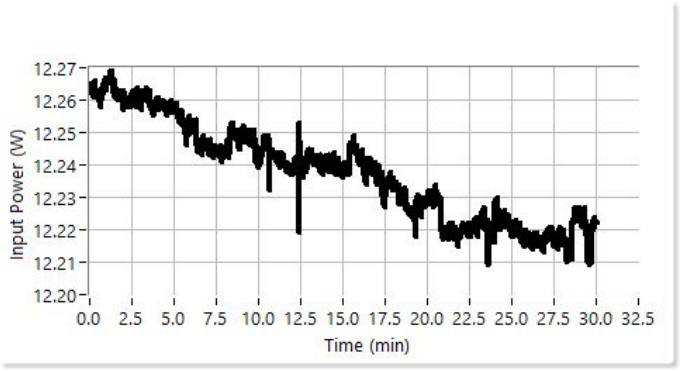
Horizontal isolux

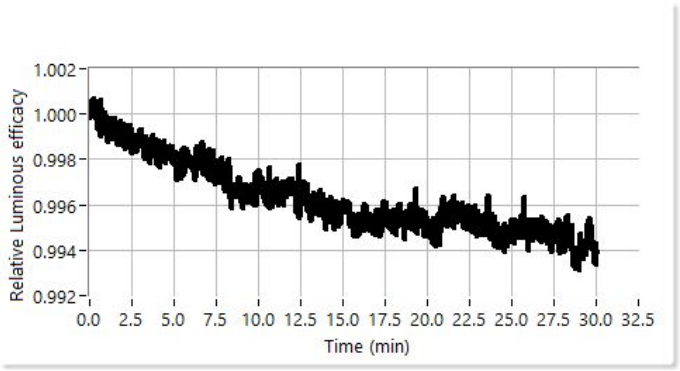
Stabilization curve

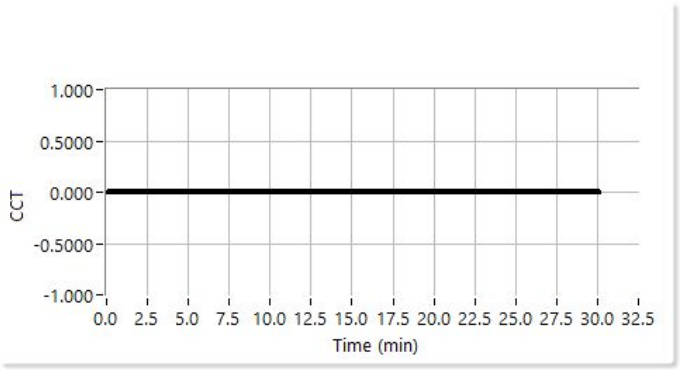
Lumen drift: -0.95 %
Input Power drift: -0.34 %
Lumen per watt drift: -0.61 %

Stabilization time: 30 min









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