

Goniophotometric Test Report

TEST ARTEFACT

Company: Karlux Oy

MEASUREMENT METHOD

The measurements were made by a goniophotometer of type DECO 50. Goniometer was operated in vertical axis. The DUT was rotated around its vertical axis (horizontal C planes), photometer was rotated around the DUT (vertical gamma angles). The goniometer type is 2.1 (EN13032-1:2004 clause 6.1.1.2). The burning position stayed unchanged during the measurements. The Luminous Intensity of the DUT at different directions were measured with a calibrated photometer located at a known far-field position of the DUT. Measurement is accordance with the standard EN13032, CIE S025, IES LM79-08.

MEASUREMENT UNCERTAINTY

The photometer of type SSL L40-007 is traceable to national standard at NIST (Certificate of calibration CR-0068 signed on 01.2022).The photometer head of type LH66-012 is traceable to national standard at PTB (Certificate of calibration CR-0173 signed on 08.2021).

The power meter of type Chroma 66205 is traceable to national standard at NIST.

The expanded uncertainties of the Luminous flux and efficacy are $\pm 3.8\%$ and $\pm 4.0\%$ ($k = 2$), 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	229.8 Vac
Measurement distance	2494 mm
Location of the rotation axis (behind the outermost surface of the optics)	165 mm
Angular step, C plane	15.0 deg
Angular step, gamma angle	2.5 deg
Maximum gamma angle	160.0 deg
Stabilization time	36 min

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

	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	2	1	2	1	2	1	2	1	2
5.0	5	2	4	1	3	1	3	1	3	2	6	3	10	24	12	25	12	28	12	24	11	22	8	15
7.5	41	19	33	17	35	17	31	15	34	20	44	34	63	88	63	92	66	88	62	90	61	82	52	71
10.0	115	82	111	75	95	73	108	77	102	84	135	99	145	198	164	215	153	202	160	206	149	185	141	184
12.5	248	180	234	191	229	185	225	189	217	201	270	235	301	364	300	358	308	358	303	347	294	358	287	318
15.0	408	330	366	325	380	320	363	313	387	334	383	366	459	525	449	492	468	521	443	495	465	504	424	450
17.5	542	487	513	457	526	476	502	463	529	482	528	506	592	640	609	670	612	653	610	664	609	648	577	602
20.0	679	618	682	630	655	613	689	612	666	631	714	657	719	771	768	816	748	794	770	834	744	754	725	780
22.5	799	754	827	779	791	752	825	779	786	755	848	821	848	896	873	900	879	926	895	913	859	888	867	885
25.0	934	883	897	881	928	884	895	872	925	884	908	903	980	1003	929	947	998	1029	954	958	977	999	930	937
27.5	1013	983	937	933	1020	986	938	925	1007	976	944	948	1041	1052	965	980	1055	1074	990	989	1038	1050	967	971
30.0	1051	1034	971	970	1057	1034	969	959	1041	1020	974	980	1067	1073	998	1016	1081	1090	1020	1019	1071	1070	1000	1003
32.5	1063	1056	1003	1002	1070	1058	1000	994	1051	1043	998	1010	1075	1089	1024	1029	1089	1096	1040	1039	1082	1079	1028	1025
35.0	1074	1072	1019	1021	1080	1068	1012	1015	1066	1056	1008	1020	1089	1096	1033	1035	1099	1100	1044	1044	1095	1091	1036	1034
37.5	1075	1081	1023	1030	1084	1079	1017	1021	1067	1066	1014	1024	1084	1083	1032	1032	1091	1088	1043	1041	1088	1077	1037	1035
40.0	1061	1071	1018	1026	1069	1069	1011	1019	1052	1054	1007	1020	1065	1064	1021	1016	1073	1069	1032	1025	1071	1059	1026	1022
42.5	1042	1051	999	1011	1049	1049	993	1005	1031	1036	984	1000	1043	1033	997	989	1049	1039	1008	999	1047	1032	1004	998
45.0	1007	1021	970	987	1016	1023	965	976	998	1006	955	972	1007	998	966	956	1013	1003	977	966	1012	996	975	966
47.5	969	986	937	954	978	986	931	944	961	970	920	938	967	959	929	919	972	963	940	928	973	956	939	930
50.0	931	946	899	917	938	947	894	907	920	930	882	901	928	915	892	881	931	920	903	890	933	916	899	893
52.5	890	905	860	878	895	906	855	868	878	889	844	861	886	873	853	840	888	876	862	851	889	873	861	852
55.0	847	869	822	838	851	863	813	826	835	847	803	820	839	827	812	797	842	829	819	813	846	825	819	810
57.5	813	854	798	794	804	816	769	785	789	799	760	777	792	779	766	751	794	780	774	764	805	779	775	764
60.0	791	830	780	749	754	768	723	739	740	754	713	731	744	728	718	701	743	728	727	715	759	728	725	714
62.5	752	776	739	701	703	717	674	690	690	704	664	682	693	676	669	651	691	675	677	664	711	675	675	664
65.0	698	720	686	657	651	665	624	641	639	652	615	632	640	622	618	600	637	620	625	611	655	621	625	613
67.5	639	660	631	626	595	611	573	591	585	598	565	580	592	564	566	547	580	562	604	557	598	563	573	560
70.0	576	602	573	565	541	554	521	539	528	543	543	528	544	504	512	501	520	518	558	499	538	511	518	504
72.5	502	537	509	491	485	496	479	484	468	488	490	473	485	443	453	430	458	464	453	437	475	449	460	444
75.0	415	472	411	441	425	434	409	425	408	444	395	413	409	380	392	368	394	378	387	374	411	380	399	382
77.5	351	403	350	369	361	371	345	364	346	375	334	353	343	316	331	307	330	308	326	311	344	318	338	322
80.0	290	311	288	309	297	311	285	304	285	300	275	294	279	256	269	247	269	250	265	251	279	258	278	262
82.5	234	252	230	250	238	252	227	245	228	242	222	236	222	203	212	195	215	195	208	198	222	204	220	206
85.0	183	200	180	196	185	199	177	191	181	190	171	183	169	155	163	148	164	147	159	151	169	155	169	158
87.5	137	151	137	150	138	151	134	146	134	142	127	140	126	114	123	108	122	108	120	110	125	113	126	116
90.0	100	110	101	108	100	108	98	107	98	102	93	101	92	86	91	85	89	84	88	84	91	85	92	87
92.5	83	84	81	83	80	83	80	82	80	81	80	82	82	82	81	81	81	81	81	81	81	81	81	81
95.0	81	80	79	78	78	78	78	78	78	78	79	80	82	82	81	81	81	81	81	80	81	81	80	80
97.5	81	80	79	78	78	79	78	78	79	78	79	80	82	82	81	81	81	81	80	80	81	81	80	80
100.0	81	80	79	78	79	79	79	79	79	79	79	79	81	81	81	80	80	80	80	80	80	80	80	80
102.5	80	79	79	78	79	79	79	79	78	78	79	79	80	80	80	80	80	80	80	79	79	79	79	79
105.0	79	79	78	78	78	78	78	78	78	78	78	78	79	79	79	79	79	79	79	78	79	79	79	78
107.5	78	78	78	77	78	78	78	78	77	77	77	78	79	79	78	78	78	78	78	78	78	78	78	78
110.0	78	78	77	77	77	78	77	77	77	77	77	77	78	78	78	77	78	78	78	78	78	78	77	77
112.5	78	77	77	77	77	77	77	77	77	77	77	77	78	78	77	77	77	77	78	77	77	77	77	77
115.0	77	77	77	77	77	77	77	77	77	77	77	77	78	78	77	77	77	77	78	78	77	77	77	77
117.5	77	77	77	77	77	77	77	77	77	77	77	77	78	78	78	77	77	77	78	78	77	77	77	77
120.0	77	77	78	77	77	78	78	77	77	77	77	77	78	78	78	77	77	78	78	78	77	77	77	77
122.5	78	78	78	78	78	78	78	78	77	77	78	78	78	78	78	78	78	78	78	78	78	78	78	78
125.0	78	78	78	78	78	78	78	78	78	78	78	78	79	79	78	78	78	78	79	79	78	78	78	78
127.5	79	79	79	79	79	79	79	79	78	78	78	79	79	79	79	79	78	79	79	79	79	79	79	79
130.0	79	79	79	79	80	80	80	79	79	79	79	79	80	80	79	79	79	79	80	80	79	79	79	79
132.5	80	80	80	80	80	80	80	80	80	79	80	80	80	80	80	80	79	80	80	80	80	80	80	80
135.0	80	80	80	81	81	81	81	80	80	80	80	80	80	81	80	80	80	80	80	80	80	80	80	80
137.5	80	80	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
140.0	80	80	81	81	81	81	81	80	80	80	80	80	80	80	80	79	79	79	80	80	80	80	80	80
142.5	80	80	80	80	80	81	81	80	79	79	79	79	79	79	79	78	78	78	79	79	79	79	80	79
145.0	79	79	79	79	80	80	80	79	78	78	78	78	78	78	78	77	77	78	77	78	78	78	79	78
147.5	77	77	78	78	78	78	78	78	77	76	76	76	76	76	76	75	75	75	76	75	76	76	77	76
150.0	75	75	75	76	76	76	76	75	75	74	74	74	74	73	73	72	73	71	73	72	74	73	75	74
152.5	72	71	72	72	72	73	72	72	71	70	70	70	69	67	68	66	6							

Table. Measurement results of the main luminous parameters

Luminous flux	Input power	Luminous efficacy	LOR	DWFF	Luminous intensity (g=0)
4435.6 lm	47.54 W	93.3 lm/W	100.0 %	89.6 %	570 cd

Table. Electrical parameters during the light measurements.

	Pin	PF	Vin	If
Value	47.54 W	0.9641	229.8 V	0.2145 A
St.dev.	0.13 %	0.01 %	0.00 %	0.13 %

Table. Maximum Luminous Intesity and its direction

Iv	g	C plane
1100 cd	35.0°	75.0°

Table. Beam widths at two perpendicular planes

	Beam angle, FWHM, 50 % (deg)	Beam angle, 10 % (deg)	Effective beam direction from g=0
C0-180	325.0°	325.0°	0.4°
C90-270	325.0°	325.0°	-0.2°

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

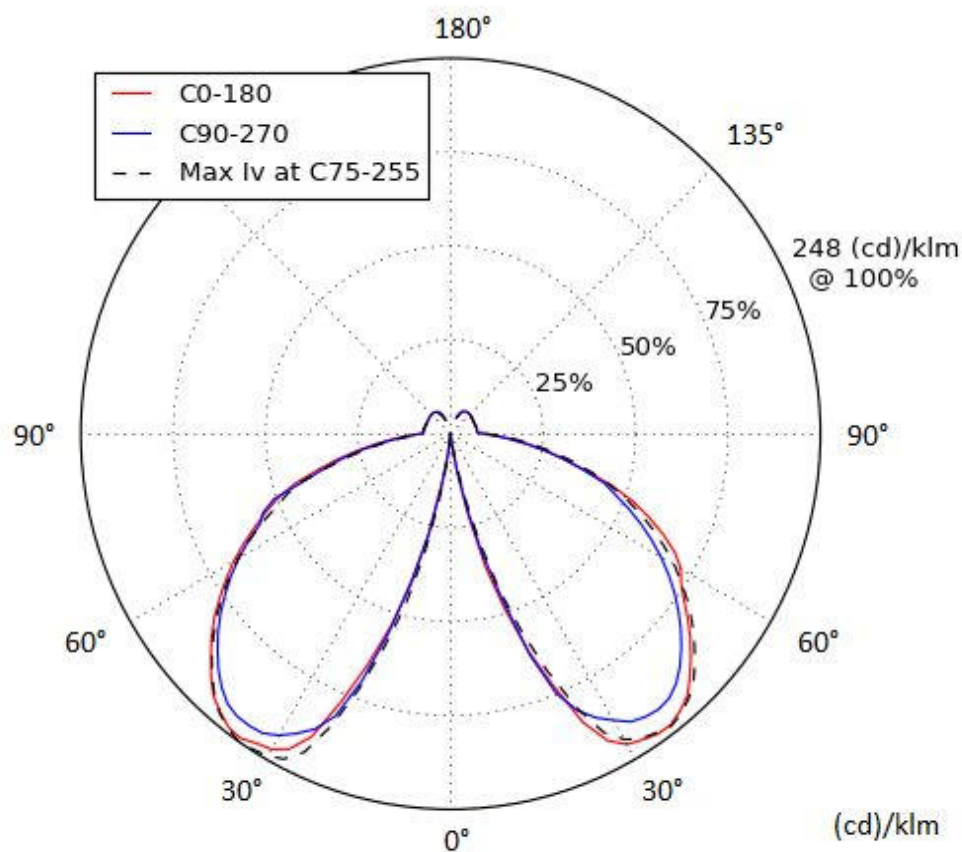


Figure. Luminous Intesity distribution in cartesian diagram at all measured C planes.

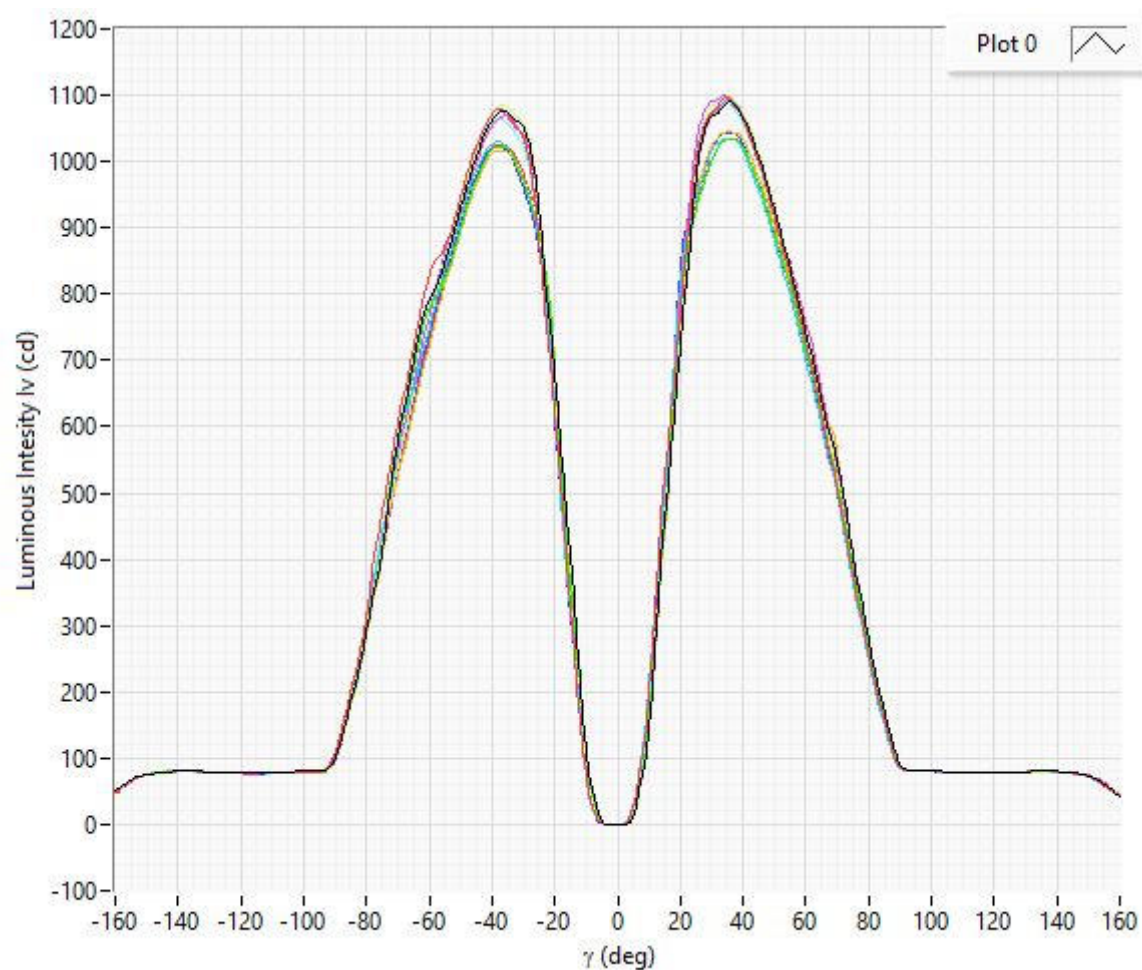


Figure. Isocandela as a function of C plane at gamma angle with maximum luminous intensity

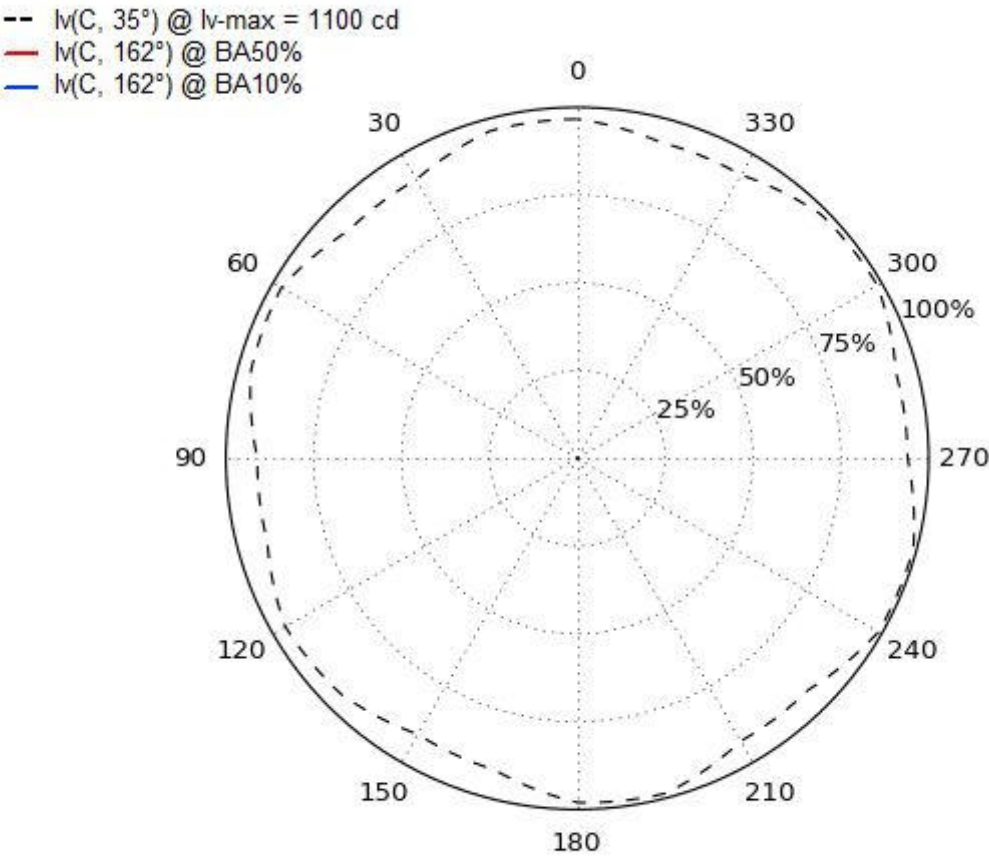


Table. Zonal lumen summary

	Lumens	Relative lumens (%)
0-20	133.80	3.02
0-30	559.10	12.61
0-40	1216.60	27.43
0-60	2719.20	61.32
0-80	3782.10	85.29
0-90	3976.00	89.66
10-90	3970.70	89.54
20-40	1082.80	24.42
20-50	1843.50	41.57
40-70	2136.00	48.17
40-90	2759.40	62.23
60-80	1062.90	23.97
60-90	1256.80	28.34
70-80	429.50	9.69
80-90	193.90	4.37
90-110	172.70	3.89
90-120	249.40	5.62
90-130	319.60	7.21
90-150	430.60	9.71
90-180	458.50	10.34
110-180	285.80	6.44
0-180	4434.50	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
2.5	0.0	0.0	0.0	0.0
5.0	0.2	0.1	0.0	0.0
7.5	1.8	1.2	0.0	0.0
10.0	6.5	5.3	0.1	0.1
12.5	16.1	16.6	0.4	0.4
15.0	29.5	39.3	0.7	0.9
17.5	46.4	77.2	1.0	1.7
20.0	66.7	133.8	1.5	3.0
22.5	88.1	211.1	2.0	4.8
25.0	108.3	309.3	2.4	7.0
27.5	125.4	426.2	2.8	9.6
30.0	140.3	559.1	3.2	12.6
32.5	153.7	706.1	3.5	15.9
35.0	165.8	865.8	3.7	19.5
37.5	176.0	1036.7	4.0	23.4
40.0	183.7	1216.6	4.1	27.4
42.5	189.0	1402.9	4.3	31.6
45.0	191.7	1593.2	4.3	35.9
47.5	192.4	1785.3	4.3	40.2
50.0	191.7	1977.3	4.3	44.6
52.5	189.7	2168.1	4.3	48.9
55.0	186.3	2356.1	4.2	53.1
57.5	181.9	2540.2	4.1	57.3
60.0	176.1	2719.2	4.0	61.3
62.5	168.3	2891.4	3.8	65.2
65.0	159.1	3055.1	3.6	68.9
67.5	149.0	3209.2	3.4	72.3
70.0	137.8	3352.6	3.1	75.6
72.5	123.7	3483.3	2.8	78.5
75.0	107.5	3598.9	2.4	81.1
77.5	91.6	3698.5	2.1	83.4
80.0	75.5	3782.1	1.7	85.3
82.5	60.6	3850.2	1.4	86.8
85.0	47.1	3904.1	1.1	88.0
87.5	35.3	3945.3	0.8	88.9
90.0	26.1	3976.0	0.6	89.6
92.5	22.3	4000.2	0.5	90.2

gamma (deg)	Zone Flux (lm)	Sum Flux (lm)	Zone Flux (%)	Sum Flux (%)
95.0	21.8	4022.2	0.5	90.7
97.5	21.7	4044.0	0.5	91.2
100.0	21.5	4065.6	0.5	91.7
102.5	21.2	4087.0	0.5	92.1
105.0	20.8	4108.0	0.5	92.6
107.5	20.4	4128.6	0.5	93.1
110.0	20.0	4148.7	0.4	93.5
112.5	19.6	4168.5	0.4	94.0
115.0	19.2	4187.9	0.4	94.4
117.5	18.8	4206.8	0.4	94.8
120.0	18.4	4225.4	0.4	95.3
122.5	18.0	4243.6	0.4	95.7
125.0	17.6	4261.4	0.4	96.1
127.5	17.1	4278.7	0.4	96.5
130.0	16.7	4295.6	0.4	96.8
132.5	16.2	4312.0	0.4	97.2
135.0	15.6	4327.9	0.4	97.6
137.5	14.9	4343.1	0.3	97.9
140.0	14.1	4357.6	0.3	98.2
142.5	13.2	4371.3	0.3	98.6
145.0	12.3	4384.1	0.3	98.8
147.5	11.3	4395.8	0.3	99.1
150.0	10.2	4406.6	0.2	99.3
152.5	8.8	4416.0	0.2	99.6
155.0	7.3	4424.1	0.2	99.7
157.5	5.7	4430.6	0.1	99.9
160.0	2.2	4434.5	0.0	100.0

Figure. Cumulative luminous flux

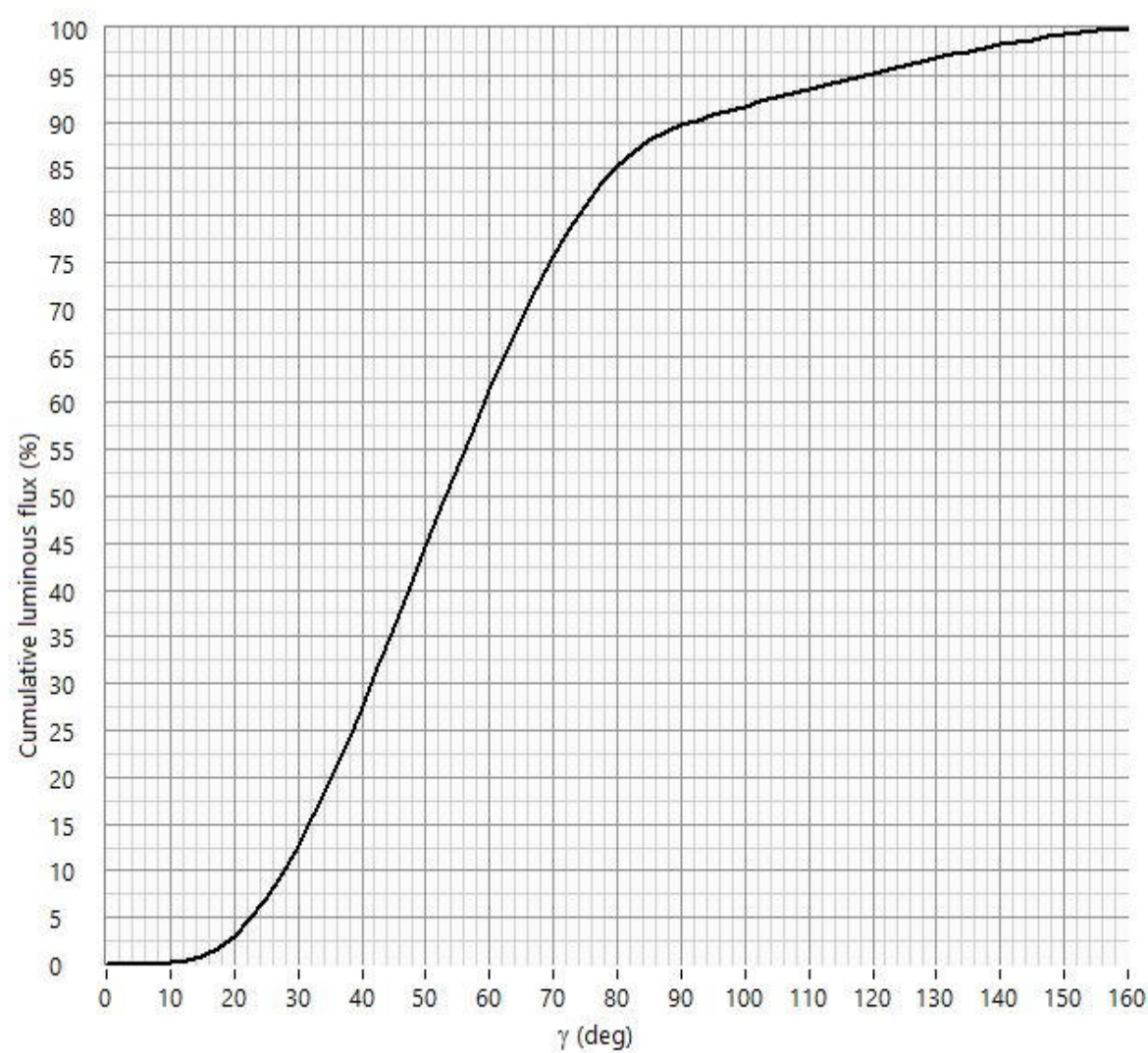
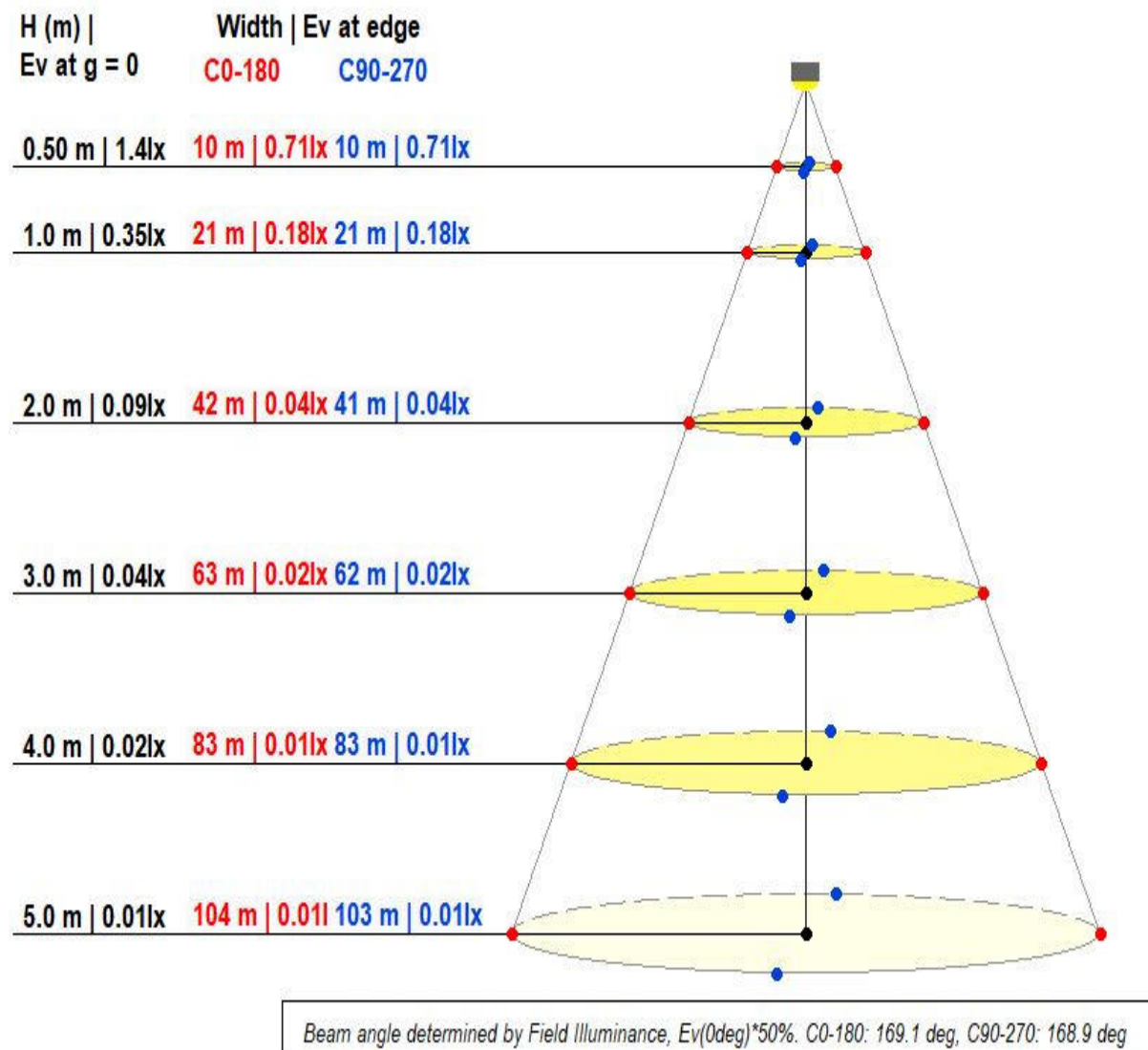


Table. Luminance at different angles based on the defined luminous areas and measured luminous intensities.

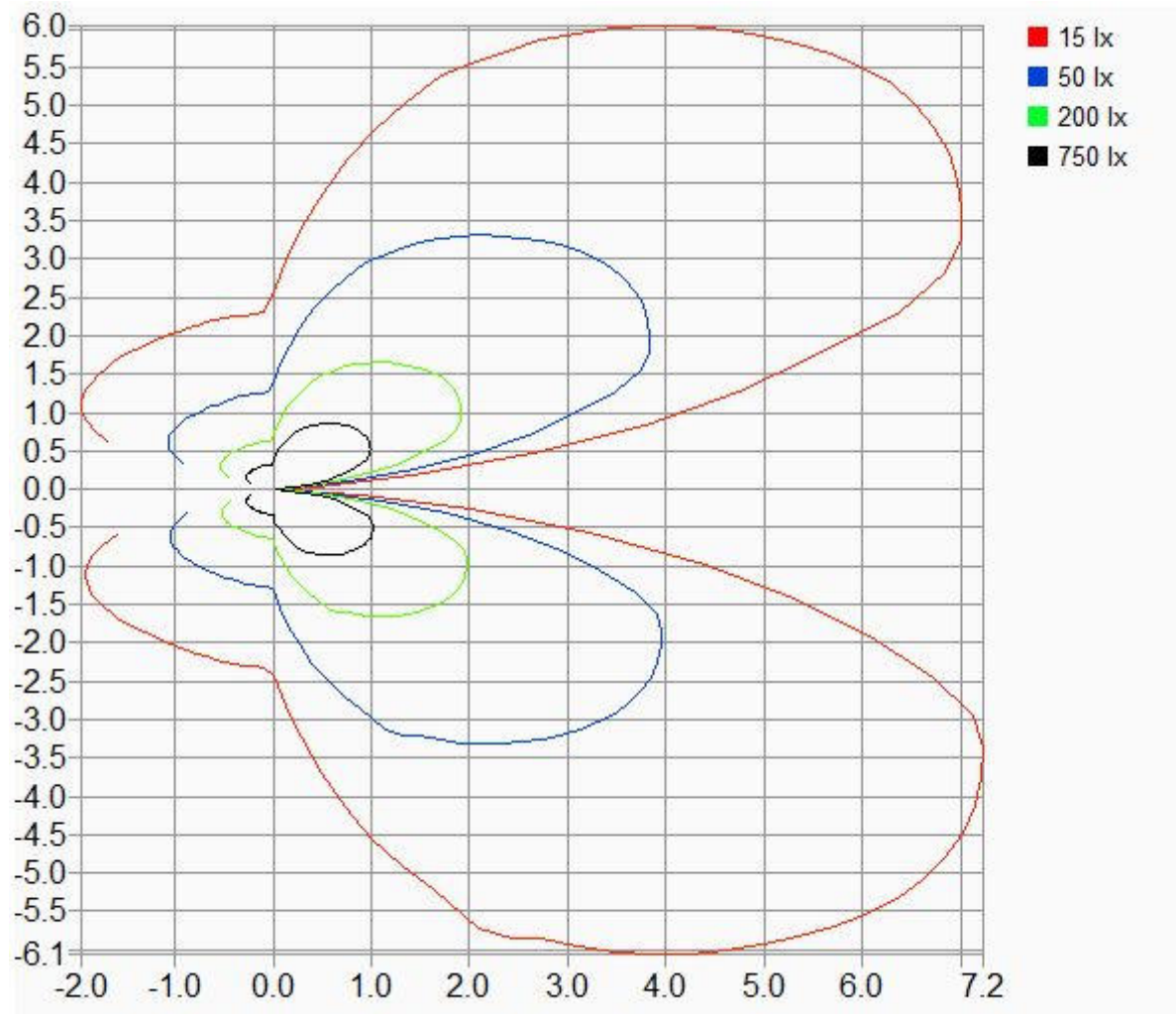
	C 0	C 45	C 90
g 0	17	12	15
g 45	34168	33460	32928
g 55	30212	29637	29255
g 65	26286	24844	24537
g 75	18524	18337	17885
g 85	9574	9362	9147

CONE DIAGRAM

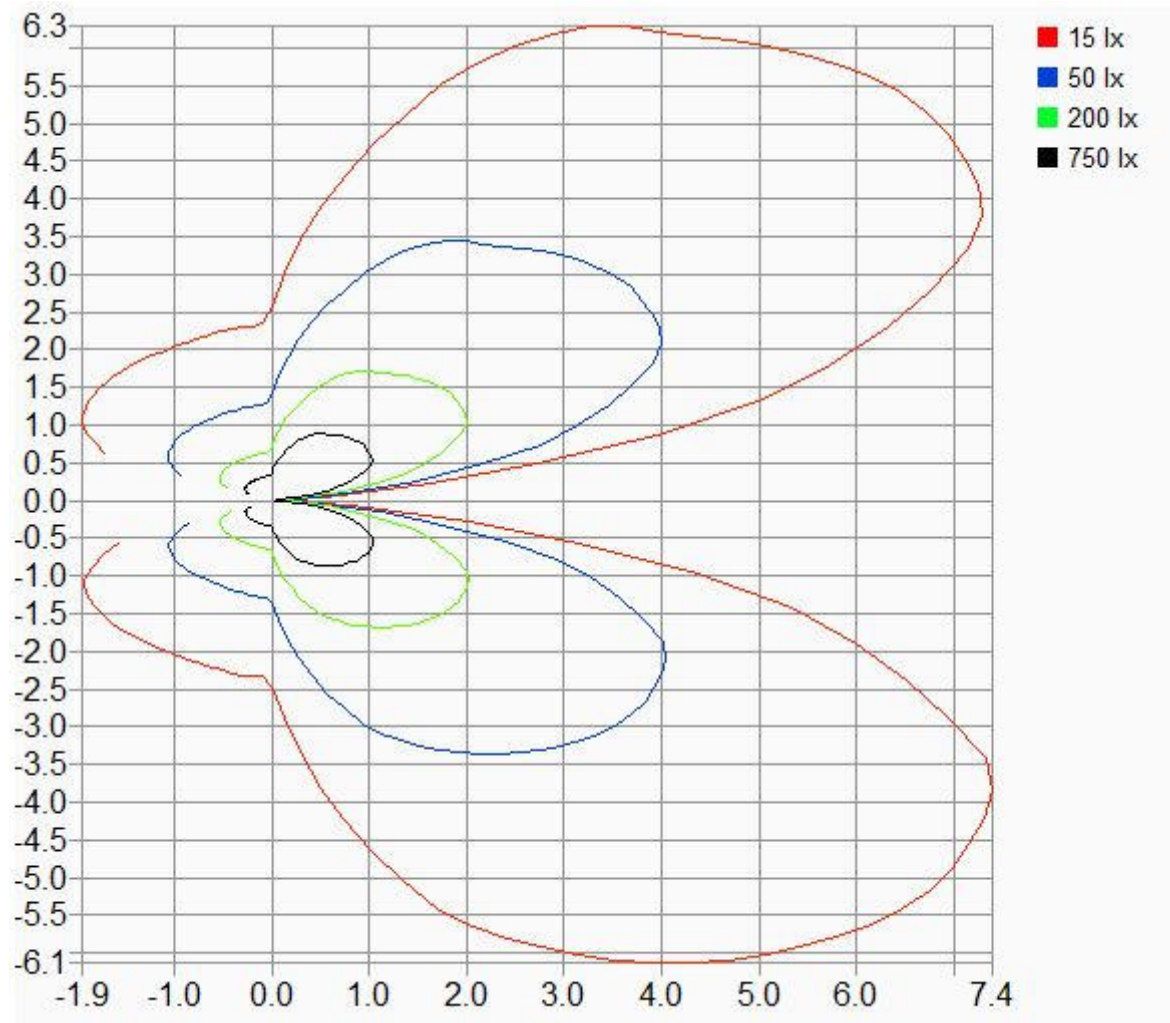
- Cone is limited by the beam angle at the planes of C0 and C90
- H = Mounting Height
- D = Cone diameter
- Ev Edge = Illuminance at the edge of the cone of the C0/90 plane
- Ev Center = Illuminance at the center of the cone



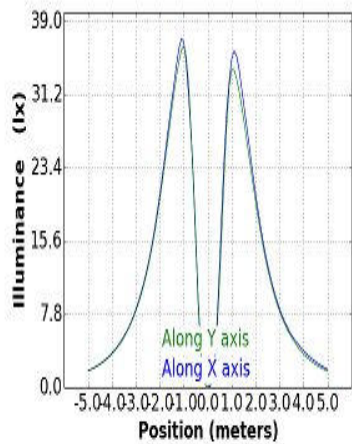
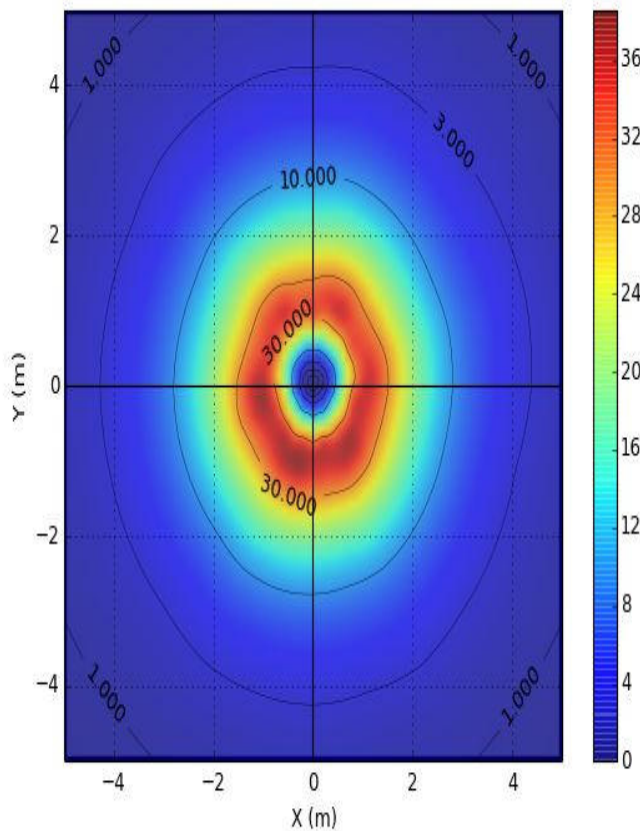
Vertical isolux



Horizontal isolux



Floor illuminance figures at mounting height of 2.5 meters
with C rotation of 0.0 degrees and with gamma rotation of 0.0 degrees.
Degradation factor of installation was 1.00.



Average Ev:	0.00 lx
Uniformity:	0.00 %
Max Ev:	0.00 lx
Min Ev:	0.00 lx
Power Consumption:	0.00 kW

