

PRELIMINARY



## Soraa Internal Report: IES LM79-08

Test results reported for:

Customer Reference P/N: SR111-18-09D-940-03

Manufacturing P/N: SR111-18-09D-940-03

**Soraa AR111, GU53/12V, 4000K, 95CRI, 18.5W, 9 degree**

Relevant Standards

IES LM-79

ANSI C78.377

IES PR-16

Soraa Lamp Lab

## 1.0 Description of test sample

Customer reference ID	SR111-18-09D-940-03
Manufacturer reference ID	SR111-18-09D-940-03
Lamp description	Vivid 4000K 95CRI 18.5W 9 degree
Rated voltage	12V
Rated power	18.5W
Nominal CCT	4000K



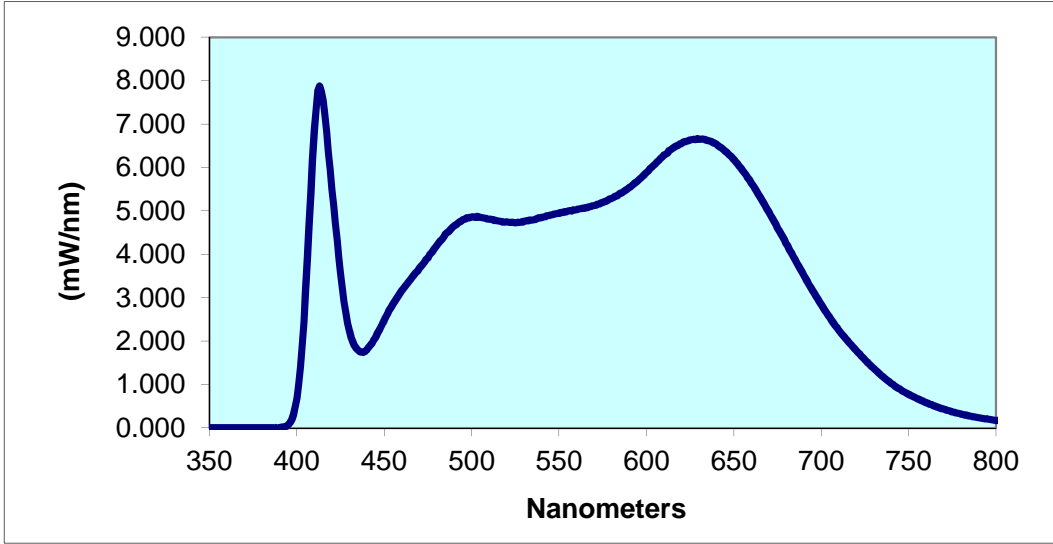
## 2.0 Results - Sphere Measurements

Test conditions	
Orientation	Horizontal
Stabilization time (min)	50-55
Correction factor applied	Self absorption correction
Sphere geometry	65" Sphere
	95% coating reflectance
	2pi geometry
Ambient temperature (°C)	25±1

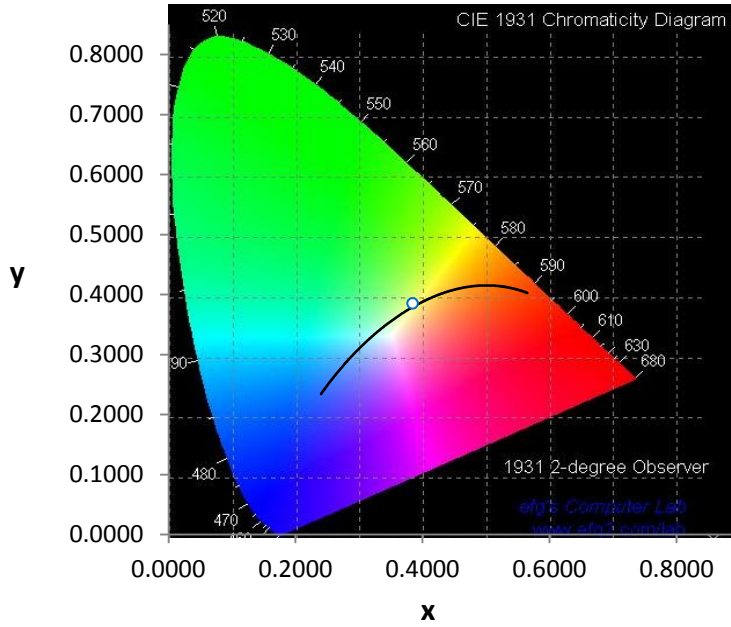
Instrument				
	Instrument	Manufacture	Model	
Photometric	Spectrometer	Instrument systems	CAS 140T	
	Integrating sphere	Labsphere	65"	
	Standard lamp	Labsphere	CSFS-1400 lamp	
Electrical instrument	Power supply for standard lamp	Labsphere	LPS-150-0268	
	Power supply for aux lamp	Labsphere	LPS-100-0833	
	Power supply for test lamps	APT	Variplus 105	
	Power meter for test lamps	Chroma	66202	
Thermometer	Digital multimeter	YOKOGAWA	TY720	

Measurement results				
	Photometric		Electrical	
Total lumen (lm)	1032		Input voltage (V)	12.0
Luminous efficacy (lm/W)	57		Current (A)	1.649
Chromaticity coordinates	$u' = 0.2248$		Power (W)	18.2
	$v' = 0.5058$		pf	0.92
	$x = 0.3850$			
	$y = 0.3849$			
CCT (K)	3900			
CRI	97			
R9	94			
Duv				

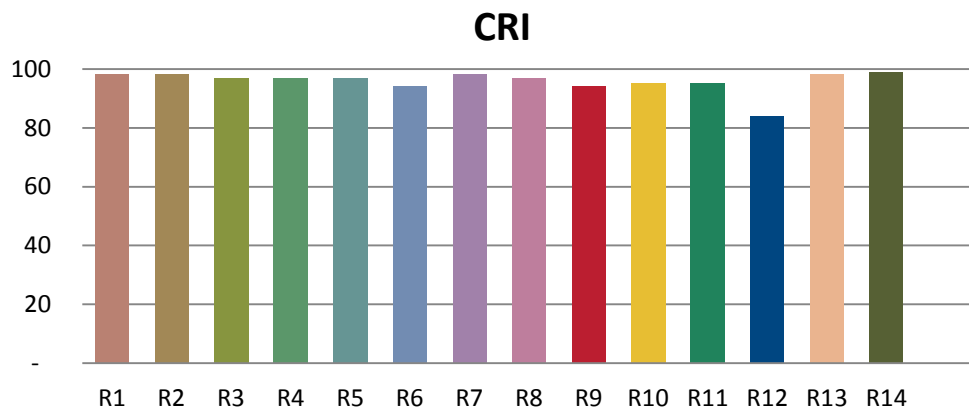
**Spectral Data Over Visible Wavelengths**



**Chromaticity on CIE1931**



CRI	
R1	98
R2	98
R3	97
R4	97
R5	97
R6	94
R7	98
R8	97
R9	94
R10	95
R11	95
R12	84
R13	98
R14	99
Ra	97



Spectral Power Distribution									
WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)
380	1.01E-04	421	9.75E-03	462	3.49E-03	503	9.30E-03	544	1.18E-02
381	1.00E-04	422	8.80E-03	463	3.60E-03	504	9.36E-03	545	1.18E-02
382	1.04E-04	423	7.78E-03	464	3.68E-03	505	9.45E-03	546	1.19E-02
383	1.05E-04	424	6.78E-03	465	3.79E-03	506	9.53E-03	547	1.20E-02
384	1.03E-04	425	5.98E-03	466	3.88E-03	507	9.57E-03	548	1.21E-02
385	1.10E-04	426	5.25E-03	467	3.99E-03	508	9.64E-03	549	1.22E-02
386	1.20E-04	427	4.61E-03	468	4.11E-03	509	9.69E-03	550	1.23E-02
387	1.29E-04	428	4.12E-03	469	4.23E-03	510	9.74E-03	551	1.23E-02
388	1.43E-04	429	3.66E-03	470	4.36E-03	511	9.80E-03	552	1.24E-02
389	1.76E-04	430	3.31E-03	471	4.47E-03	512	9.84E-03	553	1.25E-02
390	2.16E-04	431	3.01E-03	472	4.61E-03	513	9.89E-03	554	1.25E-02
391	2.89E-04	432	2.78E-03	473	4.75E-03	514	9.92E-03	555	1.26E-02
392	3.93E-04	433	2.58E-03	474	4.90E-03	515	9.97E-03	556	1.27E-02
393	5.32E-04	434	2.41E-03	475	5.05E-03	516	1.00E-02	557	1.27E-02
394	7.12E-04	435	2.29E-03	476	5.20E-03	517	1.01E-02	558	1.29E-02
395	9.49E-04	436	2.17E-03	477	5.36E-03	518	1.01E-02	559	1.29E-02
396	1.28E-03	437	2.09E-03	478	5.52E-03	519	1.01E-02	560	1.30E-02
397	1.72E-03	438	2.04E-03	479	5.68E-03	520	1.02E-02	561	1.31E-02
398	2.23E-03	439	2.01E-03	480	5.87E-03	521	1.03E-02	562	1.32E-02
399	2.83E-03	440	2.00E-03	481	6.04E-03	522	1.03E-02	563	1.32E-02
400	3.57E-03	441	2.03E-03	482	6.22E-03	523	1.04E-02	564	1.33E-02
401	4.47E-03	442	2.04E-03	483	6.39E-03	524	1.04E-02	565	1.34E-02
402	5.44E-03	443	2.08E-03	484	6.59E-03	525	1.05E-02	566	1.35E-02
403	6.49E-03	444	2.13E-03	485	6.75E-03	526	1.05E-02	567	1.36E-02
404	7.57E-03	445	2.17E-03	486	6.93E-03	527	1.06E-02	568	1.37E-02
405	8.84E-03	446	2.23E-03	487	7.13E-03	528	1.07E-02	569	1.38E-02
406	9.90E-03	447	2.30E-03	488	7.29E-03	529	1.07E-02	570	1.39E-02
407	1.10E-02	448	2.37E-03	489	7.46E-03	530	1.07E-02	571	1.40E-02
408	1.19E-02	449	2.43E-03	490	7.66E-03	531	1.08E-02	572	1.41E-02
409	1.26E-02	450	2.50E-03	491	7.82E-03	532	1.09E-02	573	1.42E-02
410	1.32E-02	451	2.57E-03	492	7.97E-03	533	1.10E-02	574	1.43E-02
411	1.37E-02	452	2.66E-03	493	8.11E-03	534	1.10E-02	575	1.45E-02
412	1.39E-02	453	2.73E-03	494	8.27E-03	535	1.11E-02	576	1.46E-02
413	1.40E-02	454	2.80E-03	495	8.42E-03	536	1.12E-02	577	1.47E-02
414	1.39E-02	455	2.90E-03	496	8.54E-03	537	1.13E-02	578	1.49E-02
415	1.37E-02	456	2.97E-03	497	8.70E-03	538	1.13E-02	579	1.50E-02
416	1.34E-02	457	3.05E-03	498	8.80E-03	539	1.14E-02	580	1.51E-02
417	1.29E-02	458	3.14E-03	499	8.89E-03	540	1.15E-02	581	1.53E-02
418	1.23E-02	459	3.23E-03	500	9.02E-03	541	1.16E-02	582	1.54E-02
419	1.16E-02	460	3.30E-03	501	9.14E-03	542	1.16E-02	583	1.56E-02
420	1.07E-02	461	3.39E-03	502	9.21E-03	543	1.17E-02	584	1.57E-02

Spectral Power Distribution									
WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)
585	1.59E-02	626	2.37E-02	667	1.94E-02	708	8.95E-03	749	3.07E-03
586	1.61E-02	627	2.38E-02	668	1.91E-02	709	8.75E-03	750	2.98E-03
587	1.62E-02	628	2.39E-02	669	1.89E-02	710	8.55E-03	751	2.91E-03
588	1.65E-02	629	2.39E-02	670	1.86E-02	711	8.35E-03	752	2.84E-03
589	1.66E-02	630	2.40E-02	671	1.83E-02	712	8.16E-03	753	2.75E-03
590	1.68E-02	631	2.41E-02	672	1.81E-02	713	7.97E-03	754	2.68E-03
591	1.70E-02	632	2.41E-02	673	1.78E-02	714	7.78E-03	755	2.61E-03
592	1.72E-02	633	2.41E-02	674	1.76E-02	715	7.60E-03	756	2.54E-03
593	1.74E-02	634	2.41E-02	675	1.73E-02	716	7.44E-03	757	2.46E-03
594	1.76E-02	635	2.41E-02	676	1.71E-02	717	7.24E-03	758	2.39E-03
595	1.79E-02	636	2.41E-02	677	1.68E-02	718	7.08E-03	759	2.33E-03
596	1.80E-02	637	2.41E-02	678	1.65E-02	719	6.89E-03	760	2.26E-03
597	1.83E-02	638	2.41E-02	679	1.62E-02	720	6.74E-03	761	2.21E-03
598	1.85E-02	639	2.41E-02	680	1.60E-02	721	6.58E-03	762	2.14E-03
599	1.87E-02	640	2.40E-02	681	1.57E-02	722	6.41E-03	763	2.07E-03
600	1.89E-02	641	2.39E-02	682	1.55E-02	723	6.25E-03	764	2.03E-03
601	1.92E-02	642	2.39E-02	683	1.52E-02	724	6.08E-03	765	1.97E-03
602	1.94E-02	643	2.38E-02	684	1.49E-02	725	5.95E-03	766	1.90E-03
603	1.96E-02	644	2.37E-02	685	1.46E-02	726	5.79E-03	767	1.86E-03
604	1.98E-02	645	2.36E-02	686	1.44E-02	727	5.64E-03	768	1.80E-03
605	2.01E-02	646	2.35E-02	687	1.41E-02	728	5.48E-03	769	1.75E-03
606	2.03E-02	647	2.34E-02	688	1.38E-02	729	5.34E-03	770	1.69E-03
607	2.05E-02	648	2.32E-02	689	1.36E-02	730	5.22E-03	771	1.64E-03
608	2.07E-02	649	2.31E-02	690	1.33E-02	731	5.08E-03	772	1.61E-03
609	2.10E-02	650	2.30E-02	691	1.30E-02	732	4.92E-03	773	1.56E-03
610	2.11E-02	651	2.28E-02	692	1.28E-02	733	4.81E-03	774	1.51E-03
611	2.14E-02	652	2.26E-02	693	1.25E-02	734	4.67E-03	775	1.46E-03
612	2.16E-02	653	2.25E-02	694	1.23E-02	735	4.54E-03	776	1.42E-03
613	2.18E-02	654	2.23E-02	695	1.20E-02	736	4.42E-03	777	1.38E-03
614	2.20E-02	655	2.21E-02	696	1.18E-02	737	4.29E-03	778	1.33E-03
615	2.21E-02	656	2.19E-02	697	1.15E-02	738	4.18E-03	779	1.30E-03
616	2.24E-02	657	2.17E-02	698	1.13E-02	739	4.07E-03	780	1.27E-03
617	2.25E-02	658	2.15E-02	699	1.10E-02	740	3.93E-03		
618	2.27E-02	659	2.13E-02	700	1.08E-02	741	3.84E-03		
619	2.28E-02	660	2.11E-02	701	1.05E-02	742	3.71E-03		
620	2.30E-02	661	2.08E-02	702	1.03E-02	743	3.63E-03		
621	2.31E-02	662	2.06E-02	703	1.01E-02	744	3.52E-03		
622	2.33E-02	663	2.04E-02	704	9.83E-03	745	3.42E-03		
623	2.34E-02	664	2.01E-02	705	9.61E-03	746	3.33E-03		
624	2.35E-02	665	1.99E-02	706	9.39E-03	747	3.25E-03		
625	2.36E-02	666	1.96E-02	707	9.14E-03	748	3.17E-03		

### 3.0 Results - Goniometric Measurements

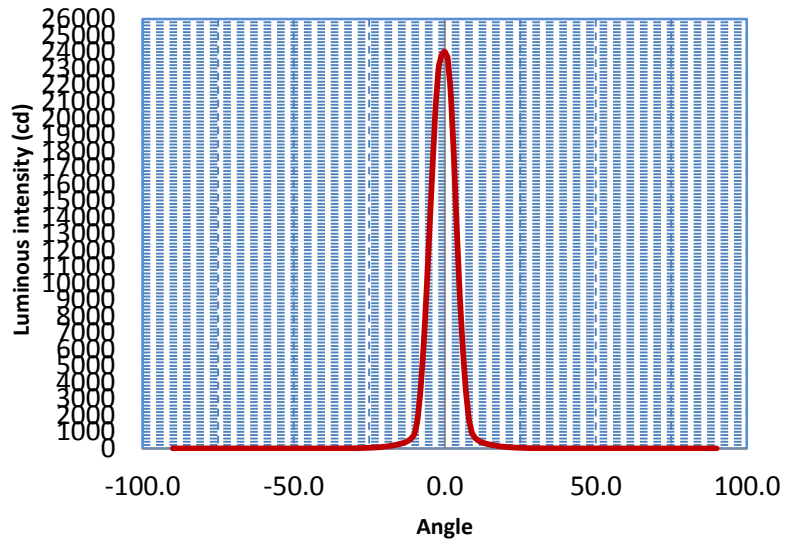
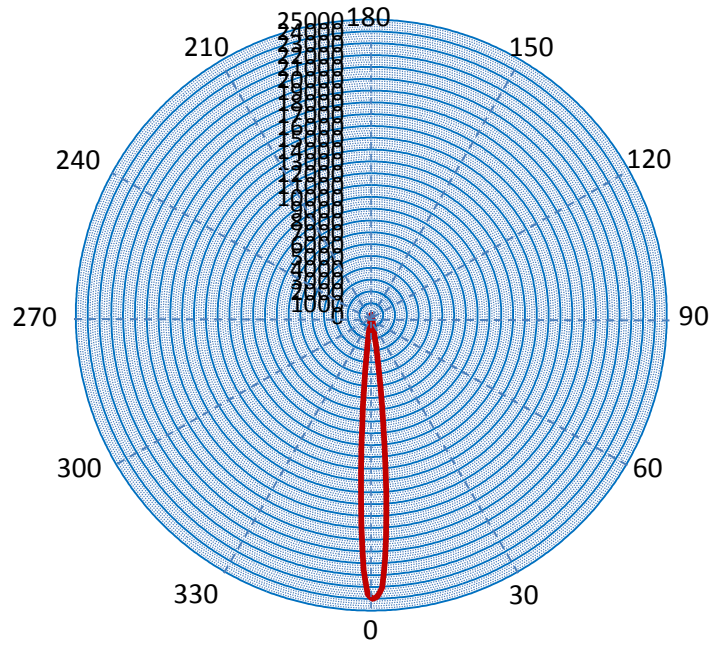
Test conditions	
Goniometer distance (m)	1
Temperature (°C)	25±1
Stabilization time (min)	50

Instrument				
	Instrument	Manufacture	Model	
Photometric	Photometer and color meter	Minolta	CL-200A	
Electrical instrument	Power supply for test lamps	APT	Variplus 105	
	Power meter for test lamps	Chroma	66202	
Thermometer	Digital multimeter	YOKOGAWA	TY720	

Measurement results				
Photometric			Electrical	
Central beam candle power(cd)	24018		Input voltage (V)	12.0
Beam Angle (°)	9.6		Current (A)	1.649
Field Angle (°)	16.3		Power (W)	18.2000
Chromaticity coordinates	u'= 0.2248		pf	0.9200
	v'= 0.5058			
	x = 0.3850			
	y = 0.3849			
CCT (K)	3900			



# Luminous intensity distribution

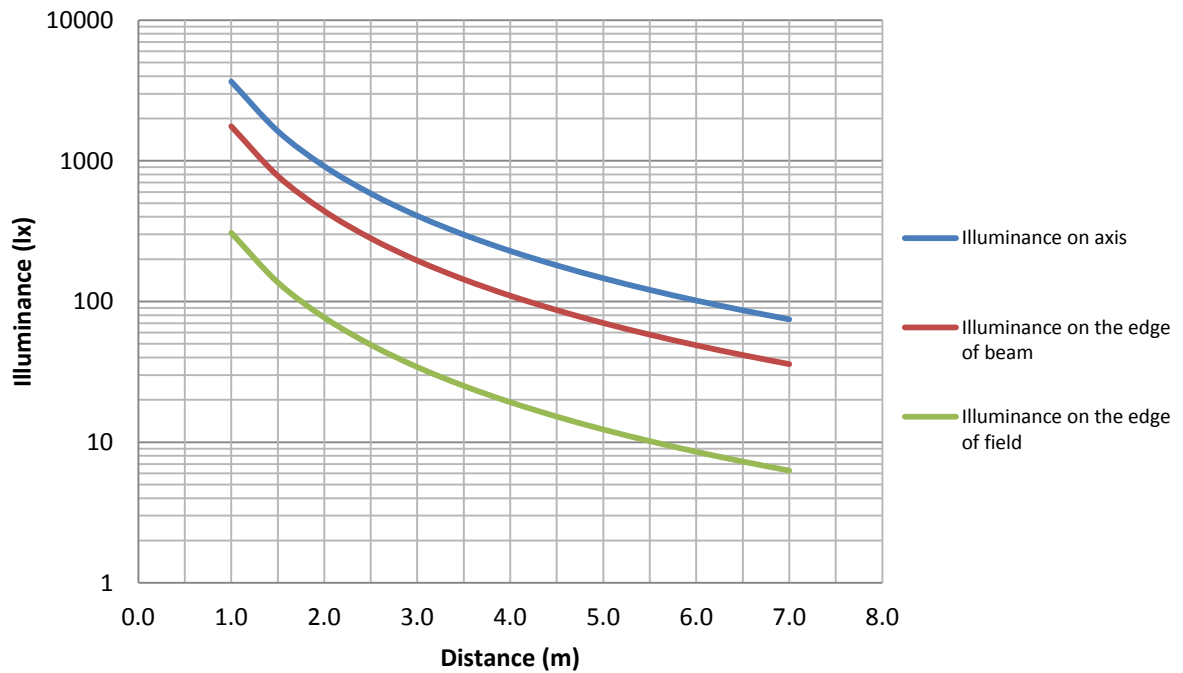


Zonal Lumen Tabulation					
Zones (°)	Lumens	%lamp	Zones (°)	Lumens	%lamp
0-5	650.5	63.1%	45-50	0.0	0.0%
5-10	260.2	25.2%	50-55	0.0	0.0%
10-15	58.8	5.7%	55-60	0.0	0.0%
15-20	33.7	3.3%	60-65	0.0	0.0%
20-25	16.5	1.6%	65-70	0.0	0.0%
25-30	7.6	0.7%	70-75	0.0	0.0%
30-35	3.0	0.3%	75-80	0.0	0.0%
35-40	1.0	0.1%	80-85	0.0	0.0%
40-45	0.2	0.0%	85-90	0.0	0.0%
Total lumen					1032

Accumulated Zonal Lumen Tabulation					
Zones (°)	Lumens	%lamp	Zones (°)	Lumens	%lamp
0-5	650.5	63.1%	0-50	1031.7	100.0%
0-10	910.8	88.3%	0-55	1031.7	100.0%
0-15	969.6	94.0%	0-60	1031.7	100.0%
0-20	1003.3	97.2%	0-65	1031.7	100.0%
0-25	1019.8	98.8%	0-70	1031.7	100.0%
0-30	1027.4	99.6%	0-75	1031.7	100.0%
0-35	1030.5	99.9%	0-80	1031.7	100.0%
0-40	1031.4	100.0%	0-85	1031.7	100.0%
0-45	1031.7	100.0%	0-90	1031.7	100.0%

Center and edge illuminance, beam and field diameter					
Distance (m)	E on axis (lx)	Beam D(m)	E on the edge of beam (lx)	Field D(m)	E on the edge of field (lx)
1.0	3657	0.33	1758	0.7	308
1.5	1626	0.49	781	1.0	137
2.0	914	0.65	440	1.4	77
2.5	585	0.81	281	1.7	49
3.0	406	0.98	195	2.1	34
3.5	299	1.14	144	2.4	25
4.0	229	1.30	110	2.8	19
4.5	181	1.47	87	3.1	15
5.0	146	1.63	70	3.5	12
5.5	121	1.79	58	3.8	10
6.0	102	1.95	49	4.2	9
6.5	87	2.12	42	4.5	7
7.0	75	2.28	36	4.9	6
7.5	65	2.44	31	5.2	5
8.0	57	2.61	27	5.6	5
8.5	51	2.77	24	5.9	4
9.0	45	2.93	22	6.3	4
9.5	41	3.09	19	6.6	3
10.0	37	3.26	18	7.0	3

**Beam illuminance vs. distance**



### Luminous Intensity Distribution

Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)
-90.0	0.0	-69.5	0.0	-49.0	0.1	-28.5	18.4	-8.0	3546.2
-89.5	0.0	-69.0	0.0	-48.5	0.1	-28.0	20.6	-7.5	4831.9
-89.0	0.0	-68.5	0.0	-48.0	0.1	-27.5	22.9	-7.0	6165.3
-88.5	0.0	-68.0	0.0	-47.5	0.1	-27.0	25.4	-6.5	7825.2
-88.0	0.0	-67.5	0.0	-47.0	0.1	-26.5	28.1	-6.0	9534.6
-87.5	0.0	-67.0	0.0	-46.5	0.1	-26.0	31.1	-5.5	11433.1
-87.0	0.0	-66.5	0.0	-46.0	0.2	-25.5	34.4	-5.0	13373.5
-86.5	0.0	-66.0	0.0	-45.5	0.2	-25.0	38.1	-4.5	15251.3
-86.0	0.0	-65.5	0.0	-45.0	0.2	-24.5	42.1	-4.0	17153.7
-85.5	0.0	-65.0	0.0	-44.5	0.3	-24.0	46.5	-3.5	18923.6
-85.0	0.0	-64.5	0.0	-44.0	0.3	-23.5	51.3	-3.0	20700.1
-84.5	0.0	-64.0	0.0	-43.5	0.4	-23.0	56.6	-2.5	21896.6
-84.0	0.0	-63.5	0.0	-43.0	0.5	-22.5	62.3	-2.0	23077.4
-83.5	0.0	-63.0	0.0	-42.5	0.6	-22.0	68.5	-1.5	23460.3
-83.0	0.0	-62.5	0.0	-42.0	0.7	-21.5	75.6	-1.0	23811.9
-82.5	0.0	-62.0	0.0	-41.5	0.8	-21.0	83.2	-0.5	23932.1
-82.0	0.0	-61.5	0.0	-41.0	0.9	-20.5	92.1	0.0	24017.8
-81.5	0.0	-61.0	0.0	-40.5	1.1	-20.0	101.7	0.5	23839.0
-81.0	0.0	-60.5	0.0	-40.0	1.2	-19.5	112.8	1.0	23626.1
-80.5	0.0	-60.0	0.0	-39.5	1.4	-19.0	124.8	1.5	22584.3
-80.0	0.0	-59.5	0.0	-39.0	1.6	-18.5	138.1	2.0	21518.5
-79.5	0.0	-59.0	0.0	-38.5	1.8	-18.0	152.3	2.5	19640.5
-79.0	0.0	-58.5	0.0	-38.0	2.0	-17.5	167.8	3.0	17760.2
-78.5	0.0	-58.0	0.0	-37.5	2.3	-17.0	184.2	3.5	15508.0
-78.0	0.0	-57.5	0.0	-37.0	2.5	-16.5	201.3	4.0	13277.3
-77.5	0.0	-57.0	0.0	-36.5	2.8	-16.0	219.3	4.5	11245.6
-77.0	0.0	-56.5	0.0	-36.0	3.2	-15.5	239.4	5.0	9248.3
-76.5	0.0	-56.0	0.0	-35.5	3.6	-15.0	260.5	5.5	7618.3
-76.0	0.0	-55.5	0.0	-35.0	4.1	-14.5	285.1	6.0	6026.8
-75.5	0.0	-55.0	0.0	-34.5	4.7	-14.0	311.0	6.5	4743.0
-75.0	0.0	-54.5	0.0	-34.0	5.4	-13.5	342.0	7.0	3498.4
-74.5	0.0	-54.0	0.0	-33.5	6.0	-13.0	374.4	7.5	2625.6
-74.0	0.0	-53.5	0.0	-33.0	6.7	-12.5	421.1	8.0	1785.0
-73.5	0.0	-53.0	0.0	-32.5	7.4	-12.0	470.1	8.5	1357.1
-73.0	0.0	-52.5	0.0	-32.0	8.2	-11.5	538.8	9.0	947.1
-72.5	0.0	-52.0	0.0	-31.5	9.1	-11.0	610.8	9.5	794.7
-72.0	0.0	-51.5	0.0	-31.0	10.2	-10.5	740.6	10.0	648.7
-71.5	0.0	-51.0	0.0	-30.5	11.5	-10.0	876.8	10.5	569.6
-71.0	0.0	-50.5	0.0	-30.0	12.9	-9.5	1290.8	11.0	494.0
-70.5	0.0	-50.0	0.0	-29.5	14.6	-9.0	1725.5	11.5	442.6
-70.0	0.0	-49.5	0.0	-29.0	16.4	-8.5	2616.1	12.0	393.5

### Luminous Intensity Distribution

Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)		
12.5	357.8	33.0	6.6	53.5	0.0	74.0	0.0		
13.0	323.7	33.5	5.8	54.0	0.0	74.5	0.0		
13.5	297.2	34.0	5.0	54.5	0.0	75.0	0.0		
14.0	271.9	34.5	4.4	55.0	0.0	75.5	0.0		
14.5	251.4	35.0	3.9	55.5	0.0	76.0	0.0		
15.0	231.7	35.5	3.4	56.0	0.0	76.5	0.0		
15.5	213.3	36.0	3.0	56.5	0.0	77.0	0.0		
16.0	195.8	36.5	2.7	57.0	0.0	77.5	0.0		
16.5	178.6	37.0	2.4	57.5	0.0	78.0	0.0		
17.0	162.3	37.5	2.1	58.0	0.0	78.5	0.0		
17.5	147.5	38.0	1.9	58.5	0.0	79.0	0.0		
18.0	133.6	38.5	1.6	59.0	0.0	79.5	0.0		
18.5	121.2	39.0	1.4	59.5	0.0	80.0	0.0		
19.0	109.6	39.5	1.2	60.0	0.0	80.5	0.0		
19.5	99.6	40.0	1.1	60.5	0.0	81.0	0.0		
20.0	90.1	40.5	0.9	61.0	0.0	81.5	0.0		
20.5	82.2	41.0	0.8	61.5	0.0	82.0	0.0		
21.0	74.8	41.5	0.7	62.0	0.0	82.5	0.0		
21.5	68.4	42.0	0.6	62.5	0.0	83.0	0.0		
22.0	62.3	42.5	0.5	63.0	0.0	83.5	0.0		
22.5	56.9	43.0	0.4	63.5	0.0	84.0	0.0		
23.0	51.7	43.5	0.3	64.0	0.0	84.5	0.0		
23.5	47.1	44.0	0.3	64.5	0.0	85.0	0.0		
24.0	42.8	44.5	0.2	65.0	0.0	85.5	0.0		
24.5	38.9	45.0	0.2	65.5	0.0	86.0	0.0		
25.0	35.3	45.5	0.2	66.0	0.0	86.5	0.0		
25.5	32.1	46.0	0.1	66.5	0.0	87.0	0.0		
26.0	29.1	46.5	0.1	67.0	0.0	87.5	0.0		
26.5	26.5	47.0	0.1	67.5	0.0	88.0	0.0		
27.0	24.1	47.5	0.1	68.0	0.0	88.5	0.0		
27.5	21.8	48.0	0.1	68.5	0.0	89.0	0.0		
28.0	19.7	48.5	0.1	69.0	0.0	89.5	0.0		
28.5	17.7	49.0	0.0	69.5	0.0	90.0	0.0		
29.0	15.9	49.5	0.0	70.0	0.0				
29.5	14.2	50.0	0.0	70.5	0.0				
30.0	12.7	50.5	0.0	71.0	0.0				
30.5	11.4	51.0	0.0	71.5	0.0				
31.0	10.2	51.5	0.0	72.0	0.0				
31.5	9.2	52.0	0.0	72.5	0.0				
32.0	8.3	52.5	0.0	73.0	0.0				
32.5	7.4	53.0	0.0	73.5	0.0				