



## Product Test Reference: CALiPER 09-67 2'x4' Troffer Fluorescent Benchmark

### DOE TEST REPORT 09-67 – SUMMARY PAGE

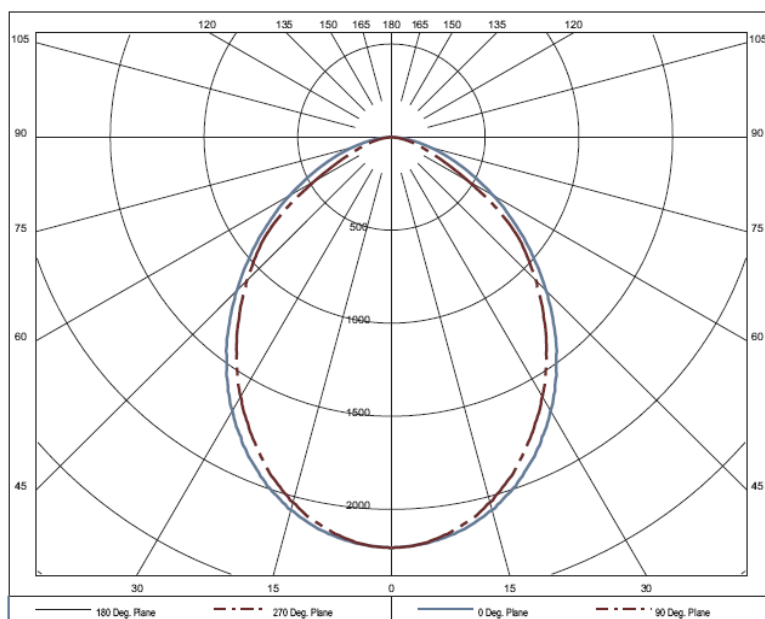
Product Category	2'x4' Troffer Benchmark Fluorescent
Product Description	Daybrite Attune 2x4 Architectural Troffer with 2 Philips F32T8/ADV835/ALTO lamps
Date of Test(s)	August 17, 2009 August 10, 2009
Laboratory Performing Testing	Luminaire Testing Laboratory, Inc. (LTL)
List of Tests Performed	Spectroradiometry following IESNA LM-9-99 at rated lamp power & Goniophotometry following IESNA LM-41-98, Temperature
Light Output Bare Lamp	
09-67-01A	3227 lm
09-67-01B	3266 lm
Efficacy Bare Lamp	
09-67-01A	100.8 lm/W
09-67-01B	102.0 lm/W
Total Luminaire Light Output	
09-67-02AB in Troffer	4767 lm
Total Luminaire Efficacy	
09-67-02AB in Troffer	69 lm/W

#### Product Photo



Photo credit: [www.daybritelighting.com](http://www.daybritelighting.com)

#### Luminaire Candela Distribution Plot: 09-67-02AB



**Product Test References**

CALiPER Test Number	09-67
Manufacturer's name	Daybrite Lighting, Inc.
Product Category	2'x4' Troffer Benchmark Fluorescent
Product Description	Daybrite Attune 2x4 Architectural Troffer with 2 Philips F32T8/ADV835/ALTO lamps
Catalog Number	2ATNGA232-D-UNV-1/2-EB10I-LPT835HL
Ballast	ONE ADVANCE "OPTANIUM" IOP-2P32HL-SC Ballast Factor = 1.18
Acquisition Notes	Purchased from distributor 5/2009

**Lamp/Package References** (www.philips.com spec sheet)

Lamp Type	T8 Fluorescent
Lamp CCT	3500K
Lamp CRI	85
Lamp Power Rating	32 W
Lamp Initial Lumens	3100 lm
Manufacturer Published Lamp Life	24,000 hours (3 hour start) 30,000 hours (12 hour start) "Warranty period: 36 months"

**Luminaire References** (www.daybritelighting.com spec sheet 2009)

Luminaire number of Lamps	2
Luminaire Voltage Rating	120V
Luminaire Power Rating	59 W
Luminaire System Efficacy	85 lm/W
Luminaire Manufacturer Description	"Attune Air is a recessed air-handling architectural luminaire that combines sophisticated aesthetics, visual comfort, application flexibility and outstanding energy efficiency."

### Description of Lamp Tested



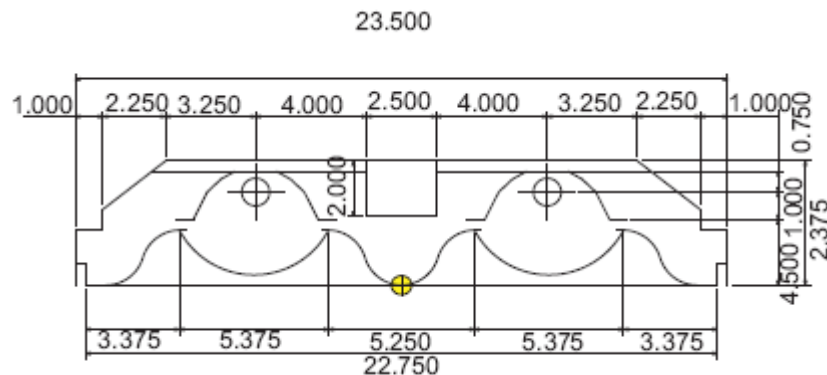
### Test Configuration Description

Comments regarding product geometry and mounting:

Testing in integrating sphere (09-67-01 A & B) was performed on each lamp separately using 32.00 W (using reference ballast).

Testing in goniophotometry was performed with lamps mounted in the troffer with the provided Advance "Optanium" IOP-2P32HL-SC ballast using 120V. (09-67-02AB)

#### CALiPER 09-67-02AB



### Measured Photometric Quantities -- Test Results: Light Output & Efficacy

#### Light Output & Efficacy Values

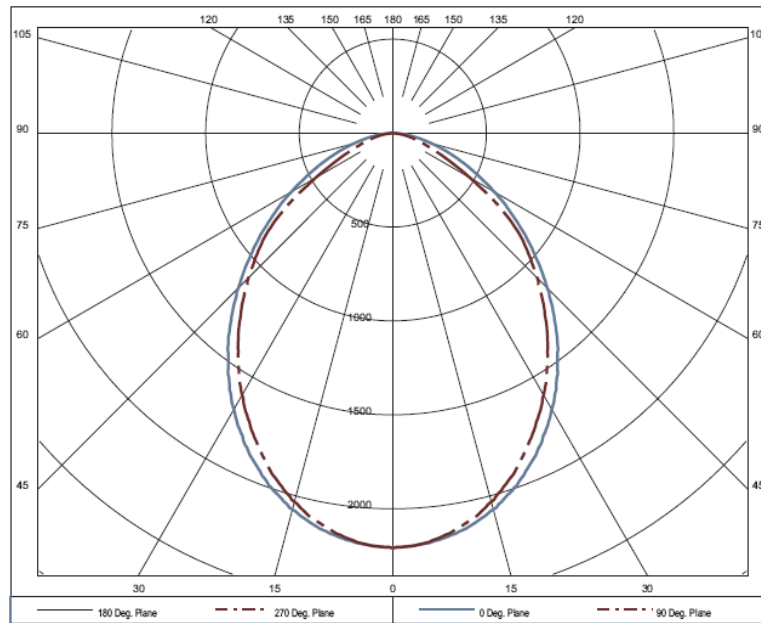
Test identifier	Measured Radiant Flux (milliwatts)	Measured Power (Watts)	Total Measured Light Output (lumens)	Calculated Luminaire Efficacy (lumens/Watt)
CALiPER 09-67-01A	8865 mW	32.0 W	3227 lm	100.8 lm/W
CALiPER 09-67-01B	9005 mW	32.0 W	3266 lm	102.0 lm/W
CALiPER 09-67-02AB	--	69.1 W	4767 lm	69.0 lm/W

#### Measured Power Factor

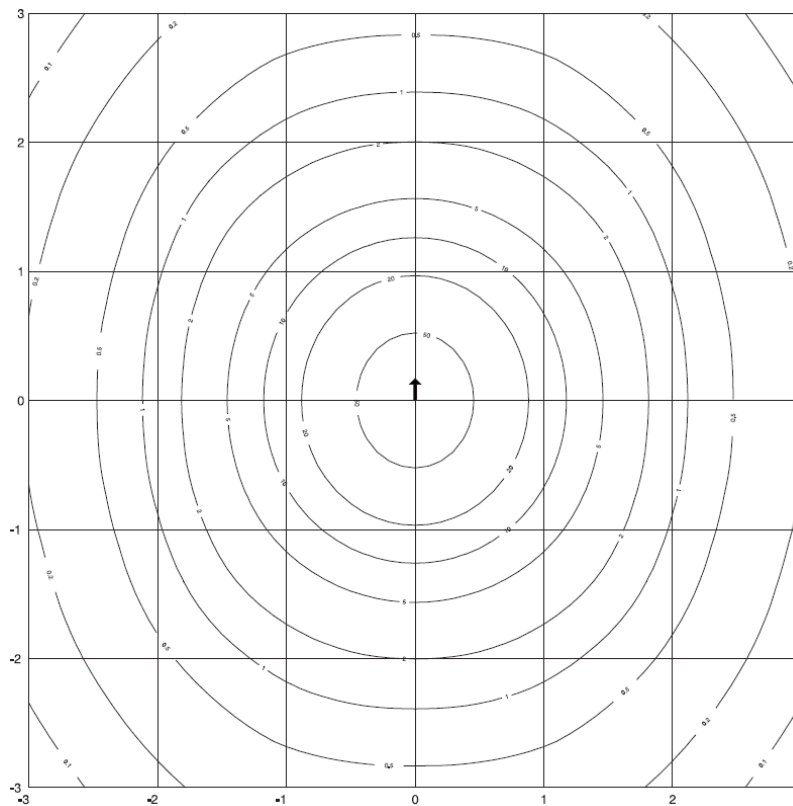
CALiPER 09-67-01A	0.99
CALiPER 09-67-01B	0.99
CALiPER 09-67-02AB	1.00

## Intensity Distribution Plots

CALiPER 09-67-02AB "In Situ" (2 lamps in Housing)



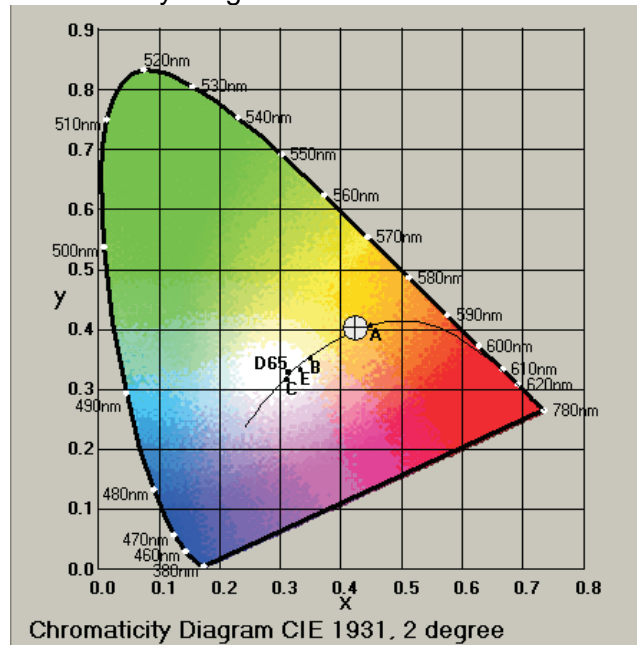
Isofootcandle plot Mounting height 5 feet



LTL REPORT NUMBER 16133 – Isofootcandle values are based on a mounting height of 5', with the luminaire located at 0,0. Isofootcandle values are calculated from the direct contribution from the luminaire only. Wall, ceiling, and floor contribution is not included.

**Measured Photometric Quantities -- Test Results: Color Metrics**

Test identifier: CALiPER 09-67-01A

**Chromaticity Diagram**Correlated Color  
Temperature-CCT (K) <sup>1</sup>

3246

Duv

0.002

Chromaticity Coordinates

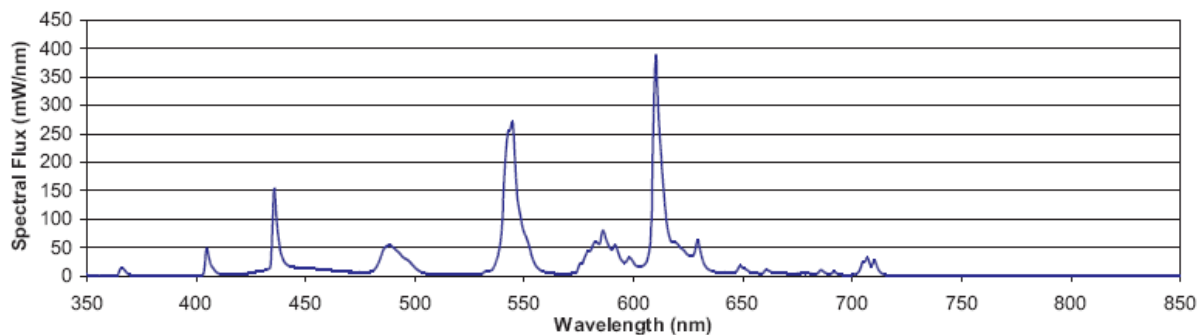
x	y
0.4227	0.4033

Chromaticity Coordinates

u'	v'
0.2417	0.5190

CRI<sup>2</sup>

82.6

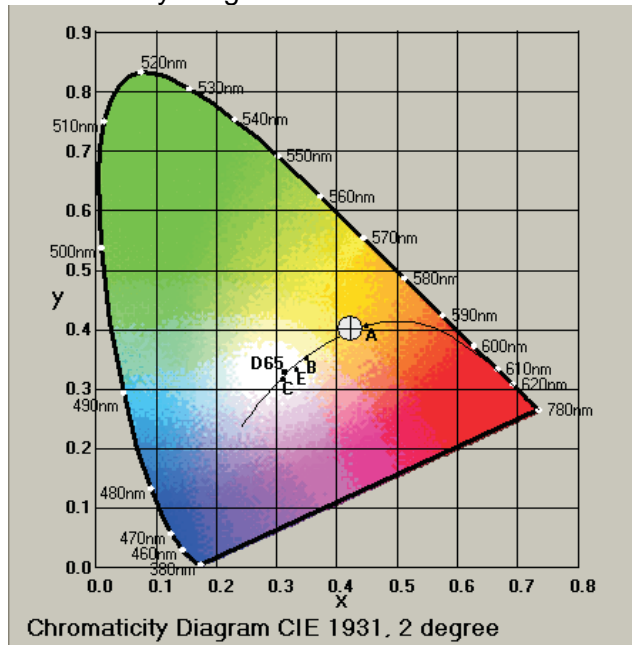
**Spectral Power Distribution Curve**CALiPER 09-67-01A

<sup>1</sup> Specifications for the chromaticity of solid state lighting products are defined in ANSI\_NEMA\_ANSLG C78.377-2008.

<sup>2</sup> Readers are urged to be aware of the complexities of assessing color quality and the limitations of CRI with regard to SSL technologies. Alternative metrics are under development. In the meantime, qualitative visual assessment by human observers may provide additional insight regarding the suitability of color quality of a luminaire for a given application. See: Protzman, J. Brent and Kevin W. Houser. October 2006. LEDs for General Illumination: The State of the Science. Leukos. Vol. 3, No. 2, pp. 121-142. Narendran N, Deng L. 2002. Color rendering properties of LED light sources. Proc. of SPIE: Solid State Lighting II.

**Measured Photometric Quantities -- Test Results: Color Metrics**

Test identifier: CALiPER 09-67-01B

**Chromaticity Diagram**Correlated Color  
Temperature-CCT (K)<sup>3</sup>

3250

Duv

0.002

Chromaticity Coordinates

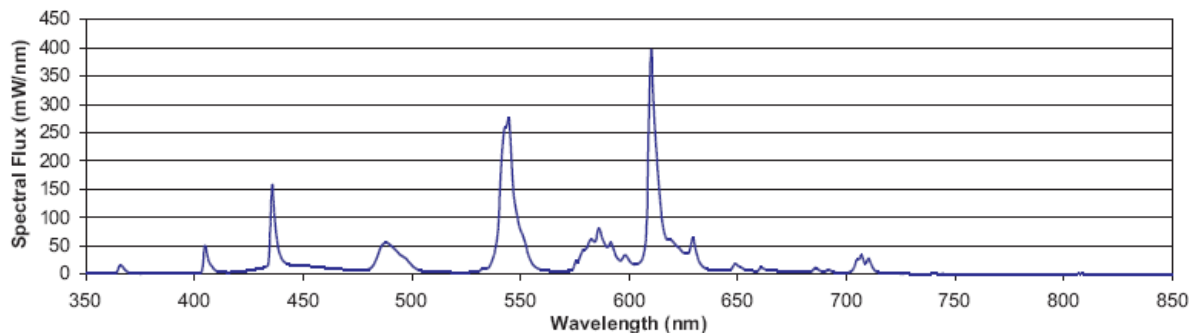
x	y
0.4223	0.4028

Chromaticity Coordinates

u'	v'
0.2417	0.5187

CRI<sup>4</sup>

82.6

**Spectral Power Distribution Curve**CALiPER 09-67-01B

<sup>3</sup> Specifications for the chromaticity of solid state lighting products are defined in ANSI\_NEMA\_ANSLG C78.377-2008.

<sup>4</sup> Readers are urged to be aware of the complexities of assessing color quality and the limitations of CRI with regard to SSL technologies. Alternative metrics are under development. In the meantime, qualitative visual assessment by human observers may provide additional insight regarding the suitability of color quality of a luminaire for a given application. See: Protzman, J. Brent and Kevin W. Houser. October 2006. LEDs for General Illumination: The State of the Science. Leukos. Vol. 3, No. 2, pp. 121-142. Narendran N, Deng L. 2002. Color rendering properties of LED light sources. Proc. of SPIE: Solid State Lighting II.

**Appendix A: Description of Test Conditions, Test Configuration, Test Procedures****Summary of Luminaire Tests Conducted**

<b>References</b>	CALiPER 09-67-01A&B
<b>Test Lab References</b>	LTL #16131, #16132 (A,B) – August 17, 2009
List of Tests Performed	Spectroradiometry following IESNA LM-9-99 at rated lamp power

<b>References</b>	CALiPER 09-67-02AB
<b>Test Lab References</b>	LTL #16133 (AB) – August 10, 2009
List of Tests Performed	Goniophotometry in luminaire following IESNA LM-41-98

## Photometric equipment used

CALiPER 09-67-01A&B Integrating sphere with spectroradiometer  
Spectroradiometer

CALiPER 09-67-02AB This test was conducted using photometry techniques according to  
Goniophotometer standard IESNA procedures. The user must therefore use caution in the following situations: 1) This test was performed using a specific ballast/lamp combination. Extrapolation of these data for other ballast/lamp combinations may produce erroneous results. 2) This test was conducted in a controlled laboratory environment where the ambient temperature was held at 25°C ±1°C. Field performance may differ particularly in regards to change in luminous output as a result of difference in ambient temperature and method of mounting the luminaire.

## Verification of test conditions

	<u>09-67-01A</u>	<u>09-67-01B</u>	<u>09-67-02AB</u>
Measured ambient temperature	25.0°C	25.0°C	25.0°C
Measured voltage during testing	128.85VAC	128.14VAC	120.0VAC
Measured current during testing	0.2512 A	0.2527 A	0.5764 A
Measured power during testing	32.00 W	32.00 W	69.08 W
Measured power factor	0.989	0.988	0.999



**Appendix B: Tabulated Spectral Power Distribution**

(CALiPER 09-67-01A)

Wavelength (nm)	Spectral Flux (mW/nm)	Wavelength (nm)	Spectral Flux (mW/nm)
350	2.0701	610	379.3800
360	0.5440	620	57.1610
370	1.9678	630	56.0100
380	0.4586	640	6.4937
390	0.1323	650	14.3670
400	0.6731	660	8.8618
410	5.0537	670	4.7905
420	3.5535	680	4.9177
430	9.1662	690	3.1196
440	27.5150	700	1.7303
450	14.4340	710	27.0840
460	10.7330	720	0.7293
470	7.5326	730	0.2391
480	7.7521	740	0.6569
490	51.0010	750	0.0000
500	15.1930	760	0.0000
510	3.3405	770	0.0000
520	2.4721	780	0.0000
530	3.4053	790	0.0000
540	96.3530	800	0.0000
550	76.9540	810	0.0000
560	6.9777	820	0.0000
570	4.0070	830	0.0000
580	43.3000	840	0.0000
590	46.2540	850	0.0000
600	23.8940		

## (CALiPER 09-67-01B)

Wavelength (nm)	Spectral Flux (mW/nm)	Wavelength (nm)	Spectral Flux (mW/nm)
350	2.1467	610	389.1400
360	0.5642	620	57.7710
370	2.0406	630	56.4890
380	0.9512	640	6.6409
390	0.4196	650	14.6360
400	0.6980	660	8.9892
410	5.2409	670	4.9679
420	3.6126	680	4.8570
430	9.4693	690	3.3783
440	27.9580	700	1.7806
450	14.7690	710	27.1820
460	10.9420	720	0.7563
470	7.6772	730	0.0000
480	7.9154	740	0.4606
490	51.4780	750	0.0000
500	15.3640	760	0.0000
510	3.3435	770	0.0000
520	2.5636	780	0.0000
530	3.4529	790	0.0000
540	97.6590	800	0.0000
550	77.8390	810	0.0000
560	7.0530	820	0.0000
570	4.0587	830	0.0000
580	43.9660	840	0.0000
590	46.7630	850	0.0000
600	24.1740		

**APPENDIX C: IES Summary Data**CALiPER 09-67-02AB

LTL NUMBER: 16133

DATE: 08-10-2009

CATALOG NUMBER: CALiPER BK 09-67A&amp;B IN ATTUNE TROFFER

LUMINAIRE: FORMED STEEL HOUSING, FORMED SPECULAR ALUMINUM REFLECTORS ABOVE FROSTED PLASTIC LENSES IN EXTRUDED WHITE ENAMEL.

LAMP: TWO 32 WATT T8 LINEAR FLUORESCENT LAMPS

LAMP CATALOG NUMBER: TWO PHILIPS F32T8/ADV835 ALTO II

BALLAST: ONE ADVANCE "OPTANIUM" IOP-2P32HL-SC

MOUNTING: RECESSED

ELECTRICAL VALUES: 120.0VAC, 0.5764A, 69.08, PF=0.999

NOTE: THIS TEST WAS PERFORMED USING THE CALIBRATED PHOTODETECTOR METHOD OF ABSOLUTE PHOTOMETRY. THIS REPORT BASED ON LM-41 AND OTHER PERTINENT IESNA PROCEDURES.

LUMINANCE IN CANDELA PER SQUARE METER

VER ANG	LATERAL ANGLE		
	0-DEG	45-DEG	90-DEG
0	3765	3765	3765
45	2811	2752	2632
55	2368	2377	2112
65	1889	1847	1227
75	1427	1114	769
85	931	452	255

ZONAL LUMEN SUMMARY DATA IN MAJOR ZONES

Zone	Lumens	%Luminaire
0-30	1619.0	34.0%
0-40	2552.7	53.5%
0-60	4123.6	86.5%
0-90	4767.0	100.0%
90-180	0.0	0.0%
0-180	4767.0	100.0%

5 DEG LUMEN VALUES

ZONE	LUMENS
0-5	52.6
5-10	154.9
10-15	248.8
15-20	329.9
20-25	393.9
25-30	439.0
30-35	464.6
35-40	469.0
40-45	454.4
45-50	422.6
50-55	378.0
55-60	316.0
60-65	243.7
65-70	175.4
70-75	118.0
75-80	70.2
80-85	31.2
85-90	4.9

Total lumen Output: 4767.0 Lumens

Luminaire efficacy: 69.0 Lumens per Watt

CIE Type Direct

Spacing Criterion: 0 deg: 1.15 90 deg: 1.10  
180 deg: 1.15 270 deg: 1.10

## LUMINAIRE CANDELA DISTRIBUTION

	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5	Flux
0	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	
5	2191	2195	2191	2190	2186	2190	2191	2195	2191	2195	2191	2190	2186	2190	2191	2195	207.4
15	2075	2075	2056	2040	2032	2040	2056	2075	2075	2075	2056	2040	2032	2040	2056	2075	578.7
25	1846	1844	1808	1779	1766	1779	1808	1844	1846	1844	1808	1779	1766	1779	1808	1844	832.9
35	1533	1531	1495	1458	1441	1458	1495	1531	1533	1531	1495	1458	1441	1458	1495	1531	933.7
45	1167	1167	1142	1108	1092	1108	1142	1167	1167	1167	1142	1108	1092	1108	1142	1167	877.0
55	797	803	800	756	711	756	800	803	797	803	800	756	711	756	800	803	694.0
65	469	485	458	345	304	345	458	485	469	485	458	345	304	345	458	485	419.1
75	217	236	169	128	117	128	169	236	217	236	169	128	117	128	169	236	188.2
85	48	39	23	16	13	16	23	39	48	39	23	16	13	16	23	39	36.1
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

## CANDELA DISTRIBUTION (5 degree vertical increments)

	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5
0	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209	2209
5	2191	2195	2191	2190	2186	2190	2191	2195	2191	2195	2191	2190	2186	2190	2191	2195
10	2146	2151	2140	2133	2124	2133	2140	2151	2146	2151	2140	2133	2124	2133	2140	2151
15	2075	2075	2056	2040	2032	2040	2056	2075	2075	2075	2056	2040	2032	2040	2056	2075
20	1973	1975	1947	1924	1913	1924	1947	1975	1973	1975	1947	1924	1913	1924	1947	1975
25	1846	1844	1808	1779	1766	1779	1808	1844	1846	1844	1808	1779	1766	1779	1808	1844
30	1698	1699	1659	1625	1610	1625	1659	1699	1698	1699	1659	1625	1610	1625	1659	1699
35	1533	1531	1495	1458	1441	1458	1495	1531	1533	1531	1495	1458	1441	1458	1495	1531
40	1355	1351	1320	1284	1263	1284	1320	1351	1355	1351	1320	1284	1263	1284	1320	1351
45	1167	1167	1142	1108	1092	1108	1142	1167	1167	1167	1142	1108	1092	1108	1142	1167
50	978	980	966	935	916	935	966	980	978	980	966	935	916	935	966	980
55	797	803	800	756	711	756	800	803	797	803	800	756	711	756	800	803
60	625	632	636	533	476	533	636	632	625	632	636	533	476	533	636	632
65	469	485	458	345	304	345	458	485	469	485	458	345	304	345	458	485
70	333	355	292	214	191	214	292	355	333	355	292	214	191	214	292	355
75	217	236	169	128	117	128	169	236	217	236	169	128	117	128	169	236
80	122	124	83	65	60	65	83	124	122	124	83	65	60	65	83	124
85	48	39	23	16	13	16	23	39	48	39	23	16	13	16	23	39
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

UTILIZATION OF LUMENS - ZONAL CAVITY METHOD<sup>5</sup>  
EFFECTIVE FLOOR CAVITY REFLECTANCE 20%

RC	90				80				70			
RW	70	50	30	10	70	50	30	10	70	50	30	10
RCR	** Values are expressed as Lumens delivered to the task surface **											
0	5813	5813	5813	5813	5675	5675	5675	5675	5543	5543	5543	5543
1	5386	5166	4970	4794	5253	5054	4876	4715	5127	4947	4786	4639
2	4955	4568	4252	3989	4828	4476	4186	3941	4707	4388	4121	3895
3	4558	4058	3677	3377	4438	3982	3629	3347	4325	3908	3581	3318
4	4201	3628	3216	2905	4090	3564	3179	2885	3985	3503	3144	2866
5	3883	3265	2842	2533	3781	3212	2814	2520	3685	3160	2786	2506
6	3600	2957	2535	2235	3507	2912	2512	2226	3419	2868	2490	2216
7	3347	2694	2279	1992	3263	2655	2261	1985	3183	2618	2244	1978
8	3122	2468	2065	1791	3046	2435	2050	1786	2974	2403	2036	1781
9	2922	2273	1883	1623	2853	2244	1871	1619	2788	2216	1859	1615
10	2743	2103	1727	1481	2680	2078	1717	1477	2621	2054	1708	1474

RC	50				30				10			
RW	70	50	30	10	50	30	10	50	30	10	50	0
RCR	** Values are expressed as Lumens delivered to the task surface **											
0	5297	5297	5297	5297	5071	5071	5071	4864	4864	4864	4767	
1	4893	4747	4615	4494	4564	4456	4357	4394	4309	4229	4133	
2	4485	4223	3999	3806	4070	3884	3720	3929	3776	3639	3542	
3	4117	3770	3490	3260	3642	3404	3205	3523	3323	3151	3054	
4	3793	3387	3075	2827	3279	3009	2790	3178	2946	2754	2657	
5	3509	3062	2732	2480	2970	2681	2454	2885	2632	2429	2334	
6	3259	2784	2448	2197	2706	2407	2179	2633	2368	2161	2068	
7	3037	2546	2210	1965	2479	2177	1951	2417	2145	1938	1848	
8	2842	2341	2008	1771	2284	1981	1761	2229	1955	1751	1664	
9	2667	2163	1836	1607	2113	1814	1599	2066	1792	1592	1509	
10	2512	2008	1688	1468	1964	1670	1462	1923	1652	1456	1376	

<sup>5</sup> Traditionally, a Coefficient of Utilization (CU) table combines luminaire efficiency and distribution to evaluate a luminaire's ability to deliver lumens to the workplane. In relative photometry, CU is typically expressed as a percentage, providing values which can be scaled for different lamp+ballast combinations. In absolute photometry (as used for LM-79 testing), conventions for determining and expressing CU are not clearly defined. CALiPER reports provide CU tables when they are reported by testing labs with a caution for readers, to be wary that interpretation of the results may differ somewhat from CU tables generated from relative photometry.