

# Photometric Test Report

## Relevant Standards

- ☒ IES LM-79-2008
- ☒ ANSI C82.77:2017

## Prepared For RAB Lighting Inc.

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## Project Number

**DLF2305110**

## Report Number

**DLF2305110-5a**

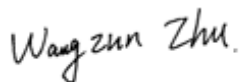
## Test Date

**2023/5/23**

## Issue Date

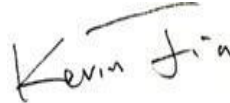
**2023/5/25**

## Prepared By



Wangzun Zhu

## Approved By



Kevin Jia

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## 1.0 Test Summary

DLC Technical Requirements v5.1

Indoor - Linear Ambient - Direct Linear Ambient Luminaires				
Requirement Category	Test Method	Requirements		Test value
Luminaire Output (lm) (Goniophotometer - Section 4.2)	IES LM-79-2008	750		3040
Lumen/ft (Goniophotometer - Section 4.2)	IES LM-79-2008	≥375		1520
Minimum Luminaire Efficacy (lm/W) (Goniophotometer - Section 4.2)	IES LM-79-2008	Standard 115	Premium 130	133.4
Power (Input Wattage) (W) (Goniophotometer - Section 4.2)	IES LM-79-2008	Wrost Case		22.8
Total Harmonic Distortion (A%) (THD & PF - section 4.3)	ANSI C82.77:2014	20.00%	120V	1.29%
		20.00%	277V	9.10%
Power Factor (THD & PF - section 4.3)	ANSI C82.77:2014	0.9	120V	0.998
		0.9	277V	0.966
Allowable CCTs* (K) (Integrating Sphere - Section 4.1)	IES LM-79-2008	7 step	3985±275	4057
		4 step	3985±154	
Minimum CRI (Integrating Sphere - Section 4.1)	IES LM-79-2008 CIE 13.3-1995	≥80		86
Minimum R9 (Integrating Sphere - Section 4.1)	IES LM-79-2008 CIE 13.3-1995	≥0		19
Minimum Rf (Integrating Sphere - Section 4.1)	ANSI/IES TM-30-18	≥70		85
Minimum Rg (Integrating Sphere - Section 4.1)	ANSI/IES TM-30-18	≥89		95
Minimum IES Rcs,h1 (Integrating Sphere - Section 4.1)	ANSI/IES TM-30-18	-12%≤IES Rcs,h1≤+23%		-11%
Zonal Lumen Requirement (0°-60°) (Goniophotometer - Section 4.2)	IES LM-79-2008	≥40%		74.05%
Corrected UGR (X=4H, Y=8H, 70/50/20%) (Goniophotometer - Section 4.2)	CIE 190-2010	<22		23.7
Input Voltage (V)				
(Goniophotometer - Section 4.2)	IES LM-79-2008	Wrost Case		277
(Goniophotometer - Section 4.2)		Non-Wrost Case		120
Input Current (A)				
(Goniophotometer - Section 4.2)	IES LM-79-2008	Wrost Case		0.085
(Goniophotometer - Section 4.2)		Non-Wrost Case		0.190
Power (Input Wattage - W)				
(Goniophotometer - Section 4.2)	IES LM-79-2008	Wrost Case		22.8
(Goniophotometer - Section 4.2)		Non-Wrost Case		22.8

## 2.0 Test List

Test Item	Test	Test Date	Model Number	Sample No.
1	Integrating Sphere Test	2023/5/23	CW2/22W/4000K	E1
2	Goniophotometer Test	2023/5/23	CW2/22W/4000K	E1
3	THD and PF Test	2023/5/23	CW2/22W/4000K	E1

### Remark(If any)

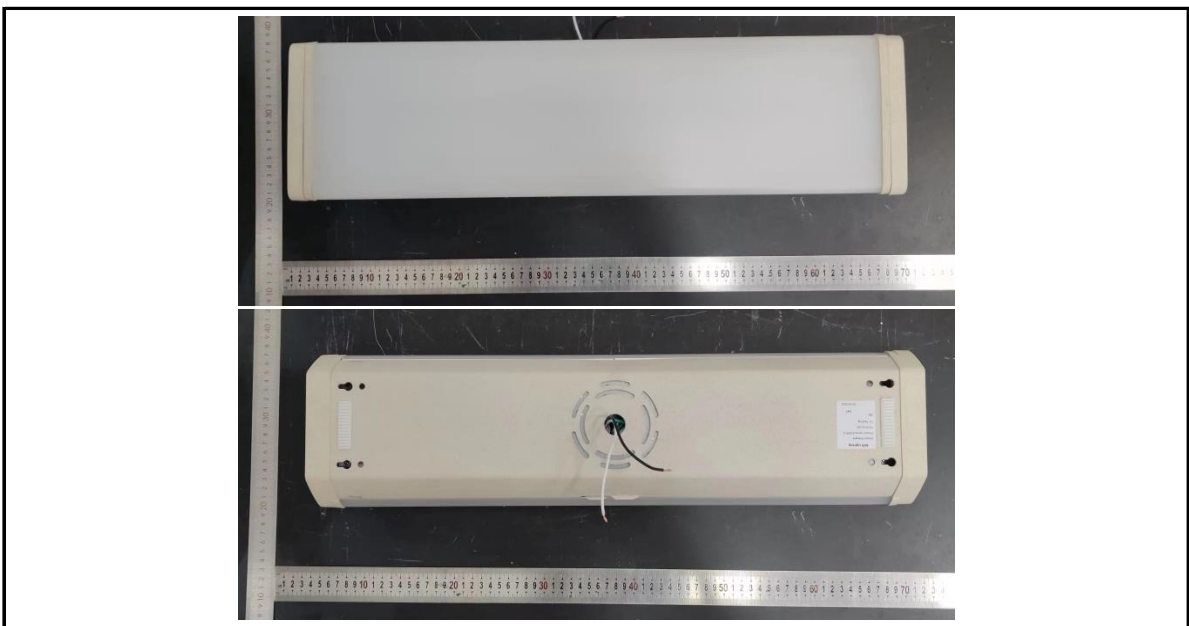
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## 3.0 Production Description

**Luminaire Description:** CW2/22W/4000K

**Electrical Specification:** 120V-277V,50/60HZ

### Photos of Luminaire Characteristics



## 4.0 LM-79 Measurement and Test Results

### 4.1 Integrating Sphere Test

Model No.	CW2/22W/4000K	Sample ID.	E1
Operate time (Min.)	90	Stabilization time (Min.)	45
Temperature (°C)	25.3	Humidity (%RH)	56.0

#### Test Method

The samples were tested according to the IES LM-79-2008.

Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ .

The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere.

The voltage of an AC power supply (RMS voltage) or DC power supply (instantaneous voltage) applied to the device under test shall be regulated to within  $\pm 0.2$  percent under load.

The sample was measured using  $4\pi$  geometry and operated at rated voltage and was stabilized before measurement. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 1 nm intervals over the range of 380 to 780 nm.

#### Test Result

Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
120.02	60	0.190	22.7	0.998
276.98	60	0.085	22.7	0.966

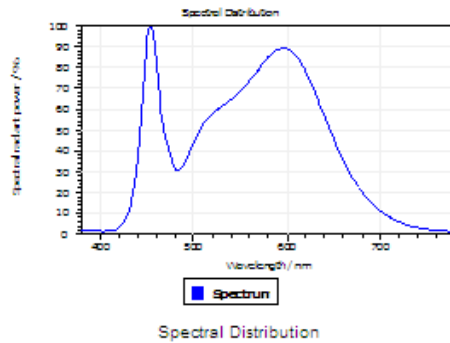
#### Test Result

CCT (K)	CRI	R9	Duv
4057	86	19	0.0023

Rf	Rg	IES Rcs,h1
85	95	-11%

## 4.1 Integrating Sphere Test

### Results

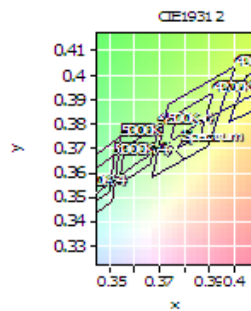


#### Spectral values

DominantWavelength 580.26 nm  
Purity 0.239  
PeakWavelength 453.97 nm  
Radiant Power 8.533 W  
Width50%:

#### Color Coordinates

Correlated Color Temperat 4057 K  
x: 0.3765 u: 0.2254 u': 0.2254  
y: 0.3695 v: 0.3318 v': 0.4978  
CRI01 84.8 CRI09 18.6  
CRI02 92.8 CRI10 81.9  
CRI03 96.2 CRI11 83.4  
CRI04 83.9 CRI12 64.6  
CRI05 84.9 CRI13 87.2  
CRI06 88.6 CRI14 98.6  
CRI07 85.9 CRI15 79.6  
CRI08 67.5 CRI16 75.7  
ResultsCRI 85.6



PlanckDistance 2.3E-003

## 4.1 Integrating Sphere Test

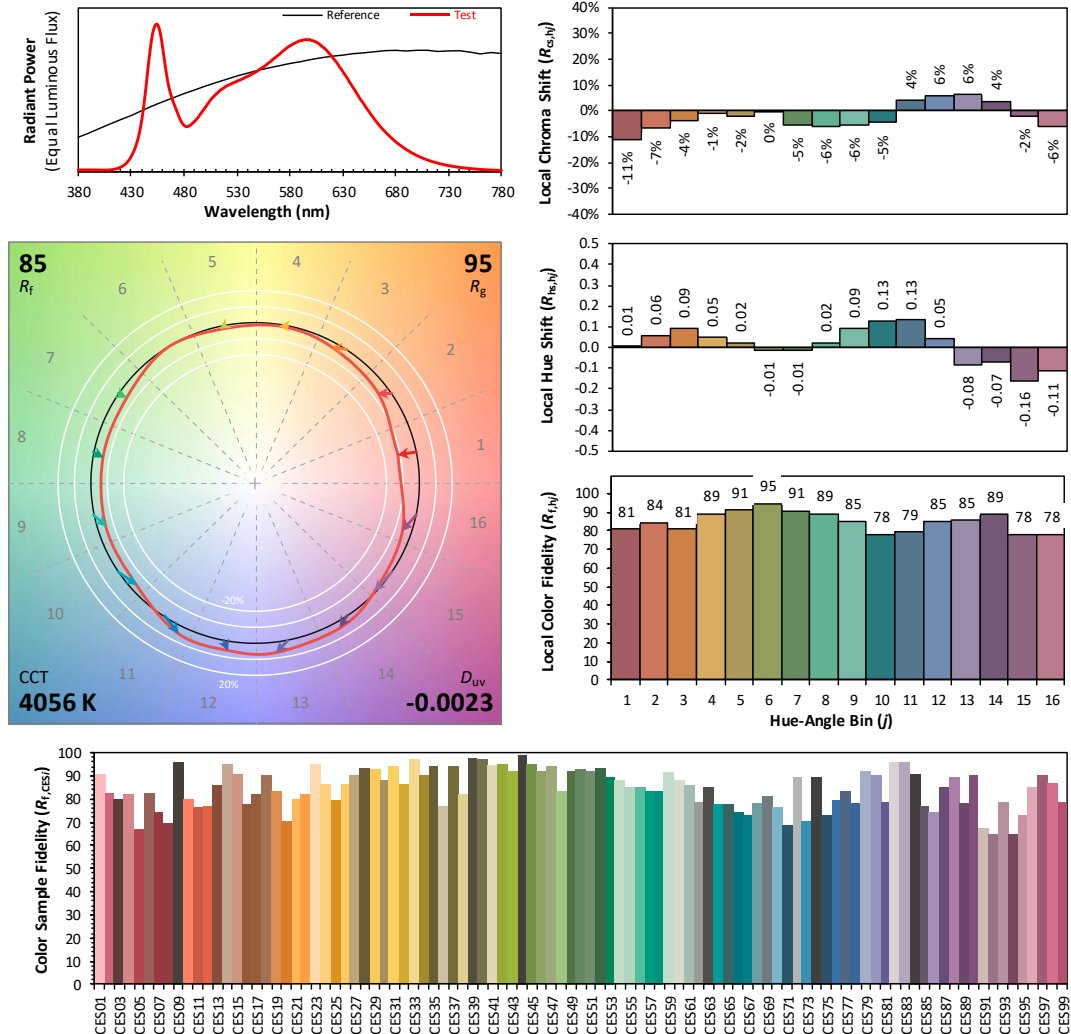
### IES TM-30-18 Color Rendition Report

Source: DLF2305110-5a

Manufacturer: RAB Lighting Inc.

Date: 2023/5/23

Model: CW2/22W/4000K



Notes: This is a recommended method for displaying IES TM-30-18 information.

$x$  0.3765  
 $y$  0.3695  
 $u'$  0.2254  
 $v'$  0.4978

CIE 13.3-1995  
(CRI)

$R_a$  86

$R_g$  21

#### 4.1 Integrating Sphere Test

Spectral Distribution over Visible Wavelength							
WL (nm)	Radiant (Watts/nm)	WL (nm)	Radiant (Watts/nm)	WL (nm)	Radiant (Watts/nm)	WL (nm)	Radiant (Watts/nm)
380	7.64E-04	485	1.69E-02	590	4.81E-02	695	7.04E-03
385	7.35E-04	490	1.85E-02	595	4.85E-02	700	6.03E-03
390	7.53E-04	495	2.09E-02	600	4.82E-02	705	5.13E-03
395	7.18E-04	500	2.36E-02	605	4.75E-02	710	4.37E-03
400	6.57E-04	505	2.63E-02	610	4.61E-02	715	3.73E-03
405	6.59E-04	510	2.84E-02	615	4.44E-02	720	3.19E-03
410	7.53E-04	515	3.01E-02	620	4.21E-02	725	2.73E-03
415	1.05E-03	520	3.14E-02	625	3.96E-02	730	2.32E-03
420	1.71E-03	525	3.23E-02	630	3.68E-02	735	1.97E-03
425	3.05E-03	530	3.32E-02	635	3.38E-02	740	1.69E-03
430	5.61E-03	535	3.40E-02	640	3.08E-02	745	1.45E-03
435	1.02E-02	540	3.50E-02	645	2.76E-02	750	1.25E-03
440	1.90E-02	545	3.60E-02	650	2.48E-02	755	1.08E-03
445	3.47E-02	550	3.72E-02	655	2.19E-02	760	9.31E-04
450	5.01E-02	555	3.84E-02	660	1.93E-02	765	8.03E-04
455	5.39E-02	560	3.99E-02	665	1.68E-02	770	6.91E-04
460	4.49E-02	565	4.15E-02	670	1.47E-02	775	5.91E-04
465	3.23E-02	570	4.31E-02	675	1.28E-02	780	5.10E-04
470	2.54E-02	575	4.47E-02	680	1.10E-02		
475	2.04E-02	580	4.62E-02	685	9.58E-03		
480	1.70E-02	585	4.73E-02	690	8.20E-03		

## 4.0 LM-79 Measurement and Test Results

### 4.2 Goniophotometer Test

Model No.	CW2/22W/4000K	Sample ID.	E1
Opreate time (Min.)	90	Stabilization time (Min.)	45
Temperature (°C)	25.3	Humidity (%RH)	54.0

#### Test Method

The samples were tested according to the IES LM-79-2008.

Photometric paramters were measured using a type C goniophotometer and software.

The ambient temperature shall be maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ , measured at a point not more than 1 m from the sample and at the same height as the sample.

The voltage of an AC power supply (RMS voltage) or DC power supply (instantaneous voltage) applied to the device under test shall be regulated to within  $\pm 0.2$  percent under load.

The samples were operated at rated voltage and was stabilized before measurement. Luminous flux, luminaire efficacy, zonal lumen were calculated from the software taken at  $0.5^{\circ}$  vertical intervals and  $10^{\circ}$  horizontal intervals.

#### Test Conditions

Condition	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
WROST CASE	277.00	60	0.085	22.8	0.966
NON-WROST CASE	120.01	60	0.190	22.8	0.998

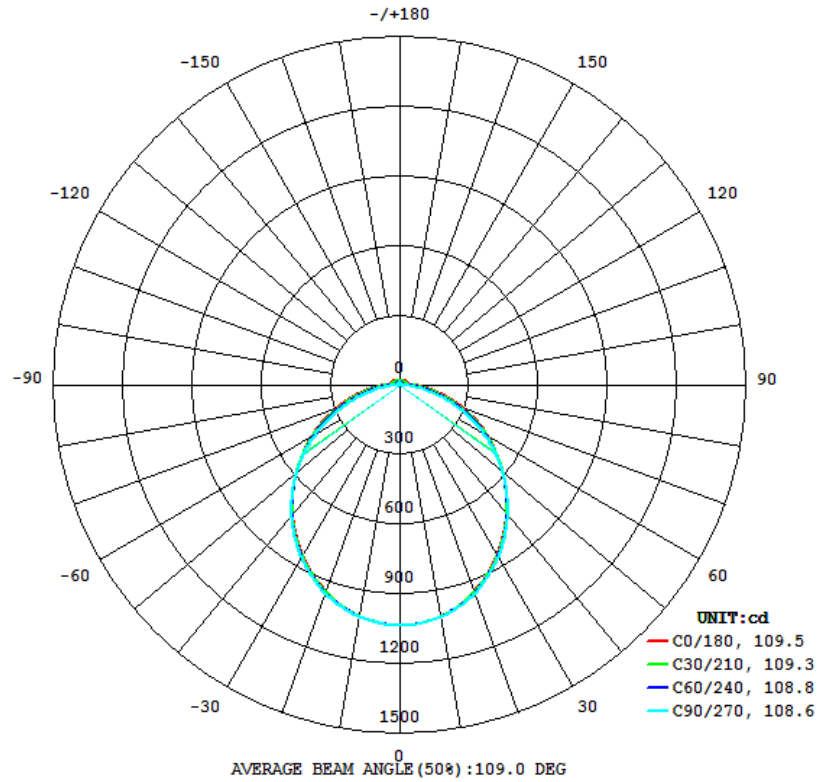
#### Test Result

Flux (lm)	Field Angle(10%)		Beam Angle(50%)		Luminous Efficacy (lm/W)
	C0-180	C90-270	C0-180	C90-270	
3040	168.4	158.8	109.5	108.6	133.4

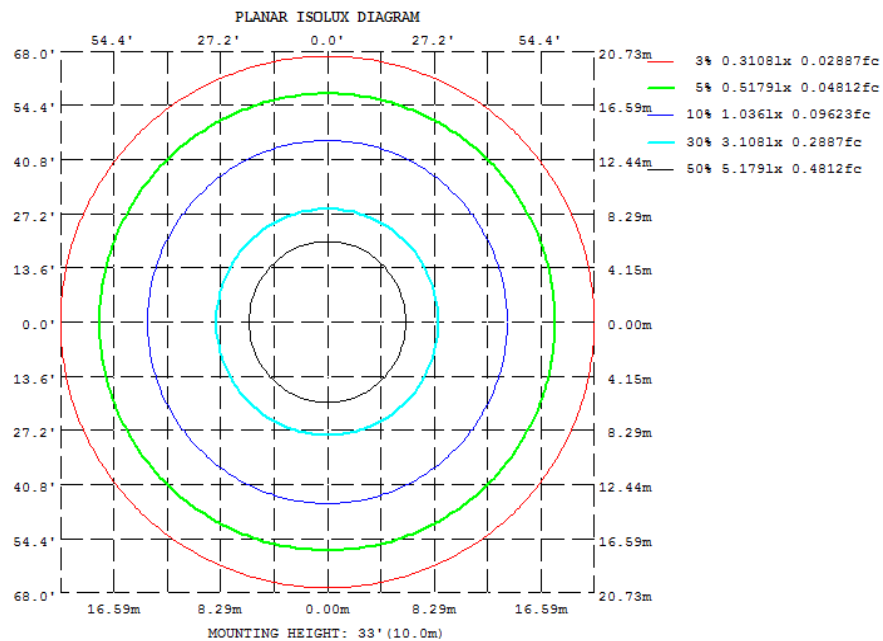
Zonal Lumen Requirement ( $0^{\circ}$ - $60^{\circ}$ )	UGR (X=4H, Y=8H, 70/50/20%)	Length(ft)	Lumen/ft
74.05%	23.7	2.00	1520

## 4.2 Goniophotometer Test

### Light Distrubtion Curve



### Isolux Plot



## 4.2 Goniophotometer Test

### Zonal Lumen Summary

γ	C0	C45	C90	C135	C180	C225	C270	C315
10	1013	1014	1015	1014	1013	1014	1015	1014
20	946.0	949.8	952.2	949.8	946.0	949.8	952.2	949.8
30	845.7	850.9	855.7	850.9	845.7	850.9	855.7	850.9
40	723.8	726.3	730.4	726.3	723.8	726.3	730.4	726.3
50	587.1	585.1	585.0	585.1	587.1	585.1	585.0	585.1
60	440.7	433.9	425.3	433.9	440.7	433.9	425.3	433.9
70	293.0	277.4	256.5	277.4	293.0	277.4	256.5	277.4
80	154.7	131.1	94.89	131.1	154.7	131.1	94.89	131.1
90	55.79	33.83	1.152	33.83	55.79	33.83	1.152	33.83
100	45.96	27.70	1.155	27.70	45.96	27.70	1.155	27.70
110	42.36	26.45	3.869	26.45	42.36	26.45	3.869	26.45
120	38.88	25.29	7.098	25.29	38.88	25.29	7.098	25.29
130	34.77	23.86	10.33	23.86	34.77	23.86	10.33	23.86
140	30.21	22.51	13.29	22.51	30.21	22.51	13.29	22.51
150	26.05	20.92	15.73	20.92	26.05	20.92	15.73	20.92
160	22.00	19.25	16.85	19.25	22.00	19.25	16.85	19.25
170	18.73	15.83	12.98	15.83	18.73	15.83	12.98	15.83
180	3.704	9.990	11.36	9.990	3.704	9.990	11.36	9.990
DEG	LUMINOUS INTENSITY:cd							

### UGR Table - Corrected

<b>UGR Table - Corrected</b>										
Reflectances										
Ceiling Cavity	70	70	50	50	30	70	70	50	50	30
Walls	50	30	50	30	30	50	30	50	30	30
Floor Cavity	20	20	20	20	20	20	20	20	20	20
Room Size										
X=2H Y=2H		UGR Viewed Crosswise					UGR Viewed Endwise			
		18.5	20.1	19.0	20.5	20.9	19.0	20.5	19.5	21.0
3H		20.1	21.5	20.6	21.9	22.4	20.9	22.3	21.4	22.7
4H		20.6	21.9	21.1	22.4	22.9	21.7	23.0	22.2	23.5
6H		20.9	22.1	21.4	22.6	23.1	22.4	23.6	22.8	24.0
8H		21.0	22.1	21.5	22.6	23.1	22.6	23.8	23.1	24.3
12H		21.0	22.1	21.5	22.6	23.1	22.9	24.0	23.4	24.4
4H	2H	19.2	20.5	19.7	20.9	21.4	19.5	20.9	20.0	21.3
	3H	21.0	22.1	21.5	22.6	23.1	21.7	22.8	22.2	23.3
	4H	21.6	22.6	22.1	23.1	23.6	22.6	23.6	23.1	24.1
	6H	22.0	22.9	22.5	23.4	24.0	23.4	24.3	23.9	24.8
	8H	22.1	22.9	22.6	23.4	24.0	23.7	24.5	24.3	25.1
8H	12H	22.1	22.8	22.7	23.4	24.0	24.0	24.8	24.6	25.3
	4H	21.9	22.7	22.5	23.3	23.9	22.8	23.6	23.4	24.2
	6H	22.4	23.1	23.0	23.7	24.3	23.7	24.4	24.3	25.0
	8H	22.6	23.2	23.2	23.8	24.4	24.2	24.8	24.7	25.4
	12H	22.6	23.2	23.2	23.8	24.4	24.6	25.1	25.1	25.7
12H	4H	22.0	22.7	22.5	23.3	23.9	22.8	23.6	23.4	24.1
	6H	22.5	23.1	23.1	23.7	24.3	23.8	24.4	24.4	24.9
	8H	22.7	23.3	23.3	23.8	24.5	24.2	24.8	24.8	25.4
Maximum UGR = 26.4										

## 4.2 Goniophotometer Test

### ZONAL LUMEN SUMMARY

	Zonal (lm)		Total (lm)	Percent
0-10	97.80	0 - 10	97.80	3.22%
10-20	278.17	0 - 20	375.97	12.37%
20-30	416.48	0 - 30	792.45	26.06%
30-40	495.15	0 - 40	1287.60	42.35%
40-50	507.50	0 - 50	1795.10	59.04%
50-60	456.31	0 - 60	2251.41	74.05%
60-70	350.97	0 - 70	2602.38	85.59%
70-80	211.16	0 - 80	2813.54	92.54%
80-90	77.88	0 - 90	2891.42	95.10%
90-100	29.84	0 - 100	2921.26	96.08%
100-110	26.87	0 - 110	2948.13	96.96%
110-120	24.46	0 - 120	2972.59	97.77%
120-130	21.31	0 - 130	2993.90	98.47%
130-140	17.53	0 - 140	3011.43	99.04%
140-150	13.39	0 - 150	3024.82	99.48%
150-160	9.28	0 - 160	3034.10	99.79%
160-170	5.08	0 - 170	3039.18	99.96%
170-180	1.30	0 - 180	3040.48	100.00%

## 4.2 Goniophotometer Test

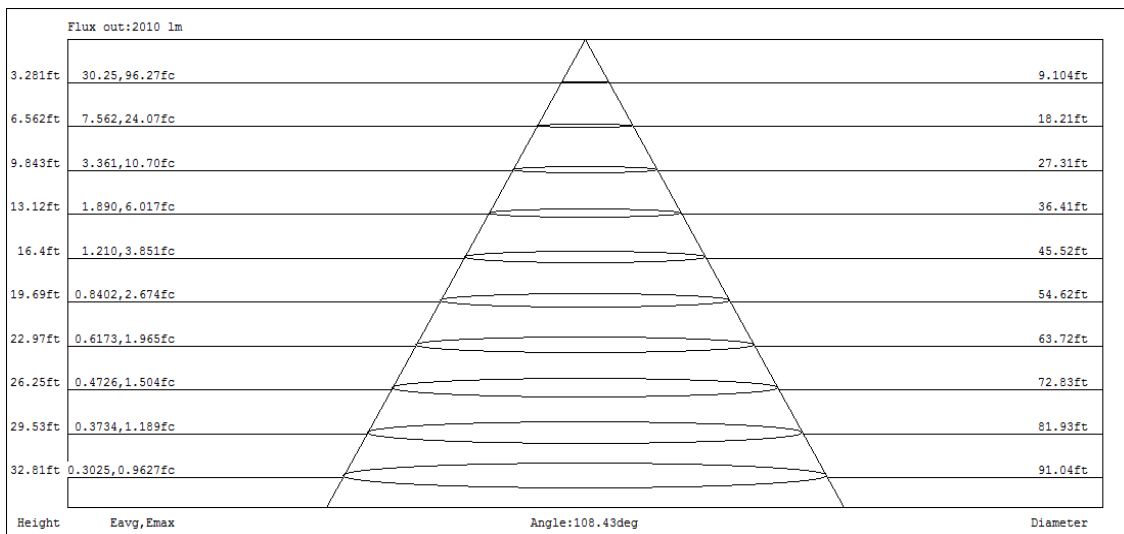
### COEFFICIENTS OF UTILIZATION - ZONAL CAVITY METHOD

#### Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance 0.20

RC	80				70				50			30			10			0
R/W	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
0	118	118	118	118	115	115	115	115	108	108	108	103	103	103	98	98	98	95
1	107	102	98	94	104	100	96	92	94	91	88	90	87	85	85	83	81	79
2	97	89	82	76	94	87	80	75	82	77	73	78	74	70	75	71	68	66
3	89	78	70	63	86	76	69	63	73	66	61	69	64	59	66	61	58	55
4	81	69	60	54	79	68	59	53	64	57	52	62	55	51	59	54	49	47
5	75	62	53	46	72	60	52	46	58	50	45	55	49	44	53	47	43	41
6	69	56	47	40	67	54	46	40	52	45	39	50	43	38	48	42	38	36
7	64	50	42	36	62	49	41	35	47	40	35	46	39	34	44	38	34	31
8	60	46	38	32	58	45	37	31	43	36	31	42	35	31	40	34	30	28
9	56	42	34	29	54	41	34	28	40	33	28	39	32	28	37	31	27	25
10	52	39	31	26	51	38	31	26	37	30	25	36	29	25	35	29	25	23

### CONE OF LIGHT DIAGRAM



## 4.0 LM-79 Measurement and Test Results

### 4.3 THD and PF Test

Model No.	CW2/22W/4000K	Sample ID.	E1
Temperature (°C)	25.3	Humidity (%RH)	56.0

#### Test Method

The samples were tested according to the ANSI C82.77:2002.

The total harmonic distortion shall be measured to the 40th order.

The ambient temperature condition was maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ . The sample measurements were made using a digital power meter and power supply. The sample was operated at rated voltage and was stabilized before measurement. The total harmonic distortion were calculated.

#### Test Results

Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	THD
120.02	60	0.190	22.7	0.998	1.29%
276.98	60	0.085	22.7	0.966	9.10%

## 5.0 Equipment Information

Test Equipment			
Equipment ID	Equipment Name	Last Calibration Date	Calibration Due Date
DLF107	Integrating Sphere System	2022/12/24	2023/12/23
DLF108	Auxiliary Lamp	2022/12/24	2023/12/23
DLF122	Measurement Standard Lamp Standard Lamp Type: 220 V, 0.4720 A, Tungsten, Omni-directional	2022/12/24	2023/12/23
DLF116	AC Power Source	2022/12/16	2023/12/15
DLF516	Power Meter	2022/12/16	2023/12/15
DLF112	Temperature Recorder	2022/12/28	2023/12/27
DLF114	Temperature & Humidity Datalogger	2022/12/28	2023/12/27
DLF101	Goniophotometer	2022/12/24	2023/12/23
DLF511	AC Power Source	2022/12/16	2023/12/15
DLF512	AC Power Source	2022/12/16	2023/12/15
DLF513	AC Power Source	2022/12/16	2023/12/15
DLF507	DC Power Source	2022/12/16	2023/12/15
DLF111	Temperature & Humidity Datalogger	2022/12/28	2023/12/27
DLF119	Power Meter	2022/12/16	2023/12/15
DLF031	Temperature data logger	2022/6/22	2023/6/21
DLF073	Power Analyzer	2022/6/22	2023/6/21
DLF003	Temperature & Humidity Datalogger	2022/6/22	2023/6/21

\*\*\*\*\* End of Test Report\*\*\*\*\*