

# Photometric Test Report

## Relevant Standards

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

## Prepared For

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## Project Number

**DLF2207110**

## Report Number

**DLF2207110-9a**

## Test Date

**2022/7/30**

## Issue Date

**2022/7/31**

## 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	1500		3016
Lumen/ft (Goniophotometer - Section 4.2)	IES LM-79-2008	≥375		1508
Minimum Luminaire Efficacy (lm/W) (Goniophotometer - Section 4.2)	IES LM-79-2008	Standard 115	Premium 130	122.6
Power (Input Wattage) (W) (Goniophotometer - Section 4.2)	IES LM-79-2008	Wrost Case		24.6
Total Harmonic Distortion (A%) (THD & PF - section 4.3)	ANSI C82.77:2014	20.00%	120V	7.30%
		20.00%	277V	10.11%
Power Factor (THD & PF - section 4.3)	ANSI C82.77:2014	0.9	120V	0.997
		0.9	277V	0.990
Allowable CCTs* (K) (Integrating Sphere - Section 4.1)	IES LM-79-2008	7 step	3045±175	2912
		4 step	3045±100	
Minimum CRI (Integrating Sphere - Section 4.1)	IES LM-79-2008 CIE 13.3-1995	≥80		81
Minimum R9 (Integrating Sphere - Section 4.1)	IES LM-79-2008 CIE 13.3-1995	≥0		0
Minimum Rf (Integrating Sphere - Section 4.1)	ANSI/IES TM-30-18	≥70		84
Minimum Rg (Integrating Sphere - Section 4.1)	ANSI/IES TM-30-18	≥89		96
Minimum IES Rcs,h1 (Integrating Sphere - Section 4.1)	ANSI/IES TM-30-18	-12%≤IES Rcs,h1≤+23%		-12%
Zonal Lumen Requirement (0°-60°) (Goniophotometer - Section 4.2)	IES LM-79-2008	≥40%		48.79%
Corrected UGR (X=4H, Y=8H, 70/50/20%) (Goniophotometer - Section 4.2)	CIE 190-2010	<22		24.3
Input Voltage (V)				
(Goniophotometer - Section 4.2)	IES LM-79-2008	Wrost Case		120
(Goniophotometer - Section 4.2)		Non-Wrost Case		277
Input Current (A)				
(Goniophotometer - Section 4.2)	IES LM-79-2008	Wrost Case		0.206
(Goniophotometer - Section 4.2)		Non-Wrost Case		0.088
Power (Input Wattage - W)				
(Goniophotometer - Section 4.2)	IES LM-79-2008	Wrost Case		24.6
(Goniophotometer - Section 4.2)		Non-Wrost Case		24.1

## 2.0 Test List

Test Item	Test	Test Date	Model Number	Sample No.
1	Integrating Sphere Test	2022/7/30	TOMO-2/24W/3000K	I1
2	Goniophotometer Test	2022/7/30	TOMO-2/24W/3000K	I1
3	THD and PF Test	2022/7/30	TOMO-2/24W/3000K	I1

### Remark(If any)

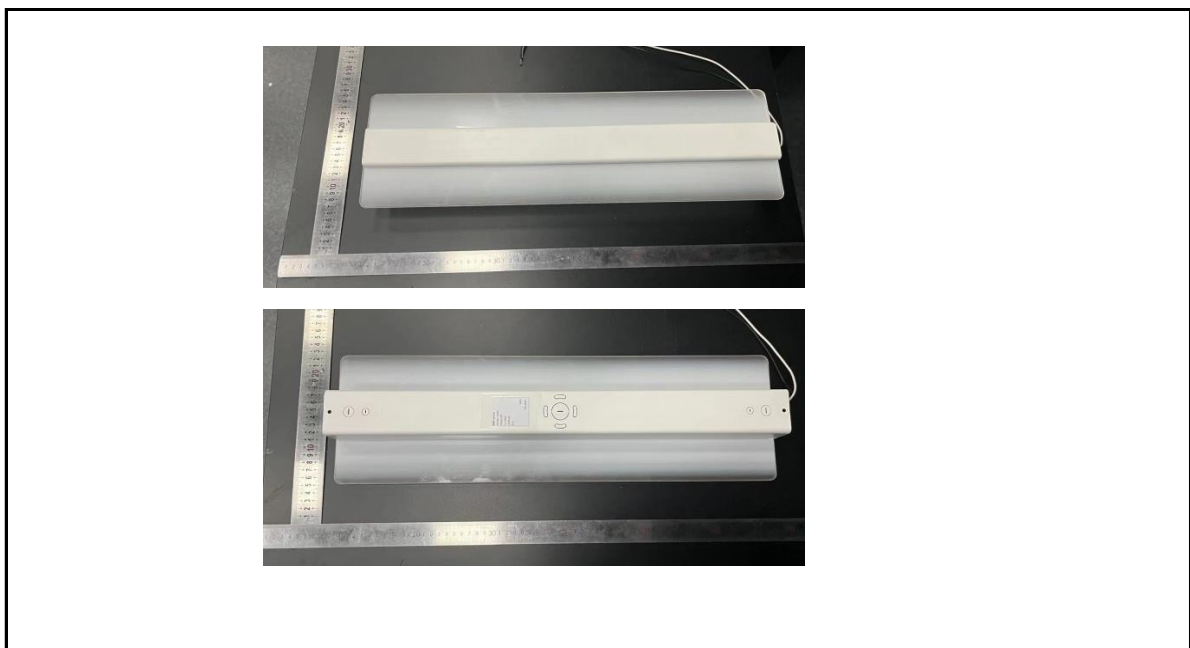
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## 3.0 Production Description

**Luminaire Description:** TOMO-2/24W/3000K

**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.	TOMO-2/24W/3000K	Sample ID.	I1
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
119.99	60	0.204	24.4	0.997
276.99	60	0.088	24.0	0.990

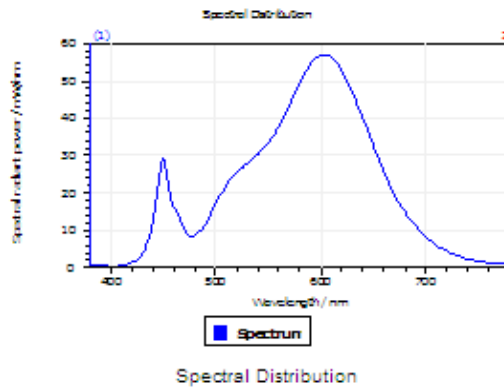
#### Test Result

CCT (K)	CRI	R9	Duv
2912	81	0	0.00087

Rf	Rg	IES Rcs,h1
84	96	-12%

## 4.1 Integrating Sphere Test

### Results



#### Spectral values

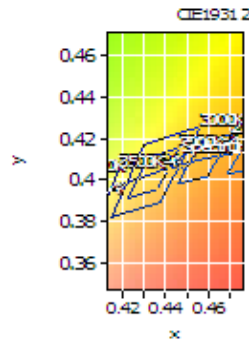
DominantWavelength 582.91 nm  
Purity 0.562  
PeakWavelength 602.93 nm  
Radiant Power 8.208 W  
Width50%:

#### Color Coordinates

Correlated Color Temperat 2912 K  
x: 0.4446 u: 0.2535 u': 0.2535  
y: 0.4088 v: 0.3496 v': 0.5244

CRI01	79.3	CRI09	0.4
CRI02	89.9	CRI10	77.4
CRI03	96.2	CRI11	78.7
CRI04	79.0	CRI12	69.7
CRI05	79.2	CRI13	81.8
CRI06	87.8	CRI14	98.5
CRI07	81.9	CRI15	70.9
CRI08	56.0	CRI16	68.5

ResultsCRI 81.2



PlanckDistance 8.7E-004

## 4.1 Integrating Sphere Test

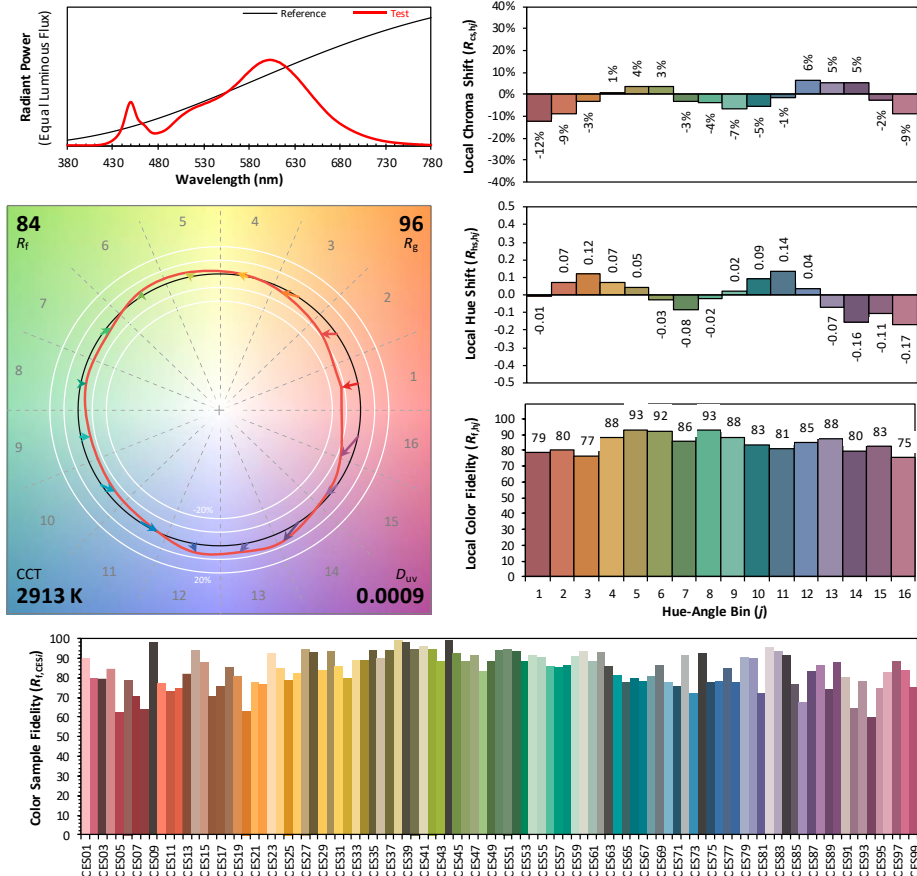
### IES TM-30-18 Color Rendition Report

Source: DLF2207110-9a

Manufacturer: RAB Lighting Inc.

Date: 2022/7/30

Model: TOMO-2/24W/3000K



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

$x$  0.4446  
 $y$  0.4088  
 $u'$  0.2535  
 $v'$  0.5244

CIE 13.3-1995  
(CRI)

$R_a$  81  
 $R_g$  1

lors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.0

## 4.0 LM-79 Measurement and Test Results

### 4.2 Goniophotometer Test

Model No.	TOMO-2/24W/3000K	Sample ID.	I1
Operate 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 parameters 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	120.01	60	0.206	24.6	0.996
NON-WROST CASE	277.04	60	0.088	24.1	0.991

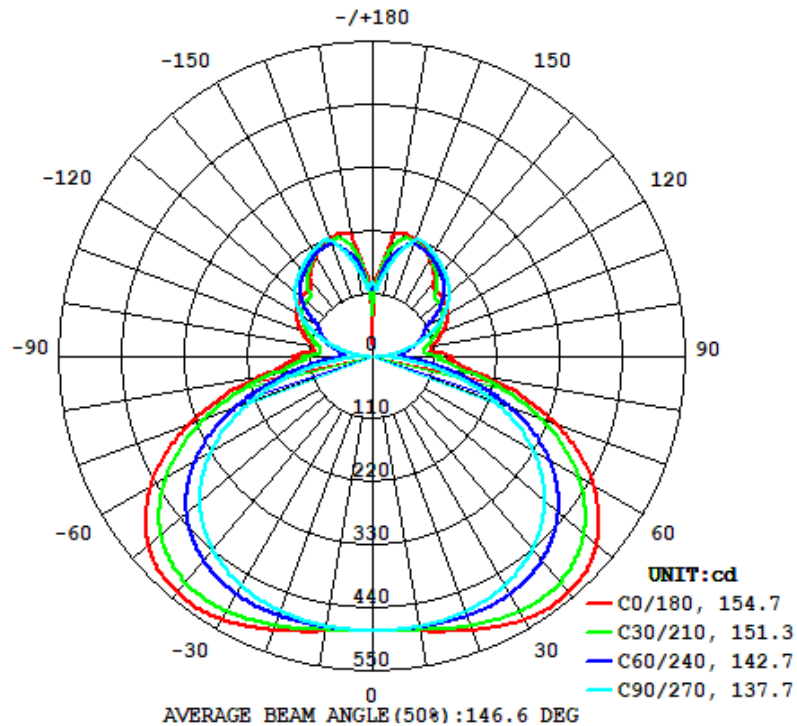
#### Test Result

Flux (lm)	Field Angle(10%)		Beam Angle(50%)		Luminous Efficacy (lm/W)
	C0-180	C90-270	C0-180	C90-270	
3016	358.1	360.0	154.7	137.7	122.6

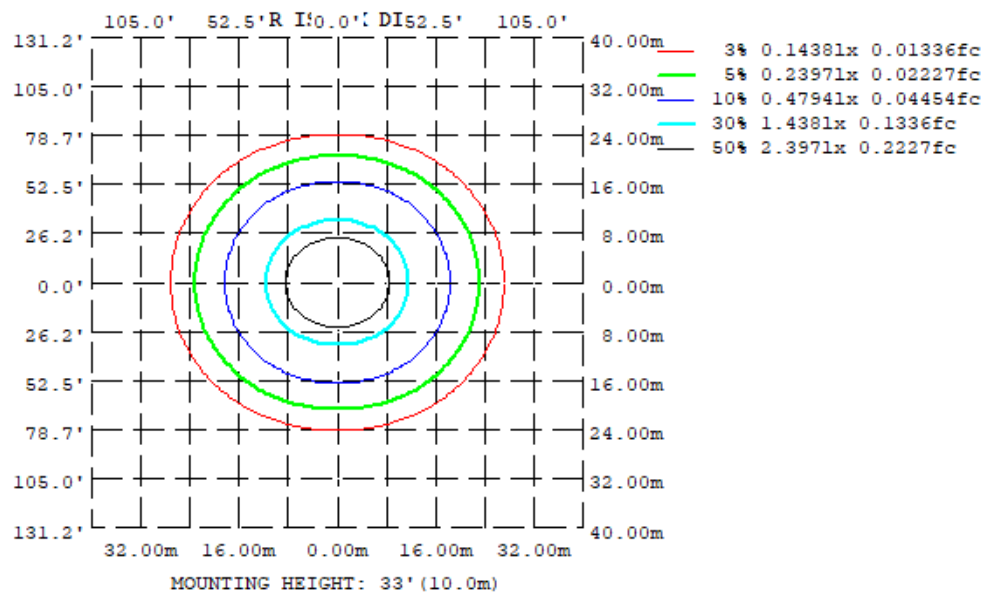
Zonal Lumen Requirement ( $0^{\circ}$ - $60^{\circ}$ )	UGR (X=4H, Y=8H, 70/50/20%)	Length(ft)	Lumen/ft
48.79%	24.3	2.00	1508

## 4.2 Goniophotometer Test

### Light Distrubtion Curve



### Isolux Plot





## 4.2 Goniophotometer Test

### Zonal Lumen Summary

$\gamma$	C0	C45	C90	C135	C180	C225	C270	C315
10	487.9	482.8	478.7	482.8	487.9	482.8	478.7	482.8
20	509.0	491.8	474.0	491.8	509.0	491.8	474.0	491.8
30	531.3	496.9	463.0	496.9	531.3	496.9	463.0	496.9
40	537.0	489.5	438.9	489.5	537.0	489.5	438.9	489.5
50	513.9	456.0	395.9	456.0	513.9	456.0	395.9	456.0
60	448.9	388.0	326.4	388.0	448.9	388.0	326.4	388.0
70	341.8	284.9	227.3	284.9	341.8	284.9	227.3	284.9
80	197.8	159.7	105.8	159.7	197.8	159.7	105.8	159.7
90	141.5	87.64	7.519	87.64	141.5	87.64	7.519	87.64
100	105.9	79.61	39.09	79.61	105.9	79.61	39.09	79.61
110	132.4	106.3	96.78	106.3	132.4	106.3	96.78	106.3
120	155.2	128.8	145.7	128.8	155.2	128.8	145.7	128.8
130	163.6	145.1	177.4	145.1	163.6	145.1	177.4	145.1
140	169.3	185.9	197.8	185.9	169.3	185.9	197.8	185.9
150	202.4	205.5	213.3	205.5	202.4	205.5	213.3	205.5
160	219.9	216.2	215.5	216.2	219.9	216.2	215.5	216.2
170	215.7	180.4	157.9	180.4	215.7	180.4	157.9	180.4
180	25.01	103.2	131.7	103.2	25.01	103.2	131.7	103.2
DEG	LUMINOUS INTENSITY:cd							

### UGR Table - Corrected

#### UGR Table - Corrected

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		UGR Viewed Crosswise					UGR Viewed Endwise				
X=2H	Y=2H	16.4	17.6	17.1	18.4	19.3	18.0	19.3	18.8	20.0	20.9
	3H	18.5	19.6	19.3	20.4	21.3	20.6	21.7	21.3	22.4	23.4
	4H	19.4	20.4	20.1	21.2	22.1	21.6	22.7	22.4	23.5	24.4
	6H	20.0	20.9	20.7	21.7	22.7	22.6	23.6	23.4	24.4	25.3
	8H	20.2	21.1	21.0	21.9	22.9	23.0	24.0	23.8	24.8	25.7
	12H	20.3	21.2	21.1	22.0	23.0	23.5	24.4	24.3	25.2	26.2
4H	2H	17.4	18.5	18.2	19.2	20.2	18.6	19.7	19.4	20.4	21.4
	3H	19.7	20.6	20.5	21.4	22.4	21.4	22.3	22.2	23.1	24.1
	4H	20.7	21.5	21.4	22.3	23.3	22.6	23.5	23.4	24.3	25.3
	6H	21.4	22.1	22.2	23.0	24.0	23.8	24.5	24.6	25.3	26.3
	8H	21.7	22.3	22.5	23.2	24.2	24.3	25.0	25.1	25.8	26.8
	12H	21.8	22.4	22.6	23.3	24.3	24.9	25.5	25.7	26.4	27.4
8H	4H	21.3	22.0	22.1	22.8	23.8	23.0	23.6	23.8	24.5	25.5
	6H	22.2	22.8	23.0	23.7	24.7	24.3	24.9	25.1	25.7	26.8
	8H	22.6	23.1	23.4	23.9	25.0	25.0	25.5	25.8	26.3	27.4
	12H	22.8	23.3	23.7	24.1	25.2	25.8	26.2	26.6	27.1	28.2
12H	4H	21.4	22.0	22.2	22.9	23.9	23.0	23.6	23.8	24.4	25.5
	6H	22.4	22.9	23.3	23.8	24.9	24.4	24.9	25.2	25.7	26.8
	8H	22.9	23.3	23.7	24.2	25.3	25.1	25.6	26.0	26.4	27.5

Maximum UGR = 28.2

## 4.2 Goniophotometer Test

### ZONAL LUMEN SUMMARY

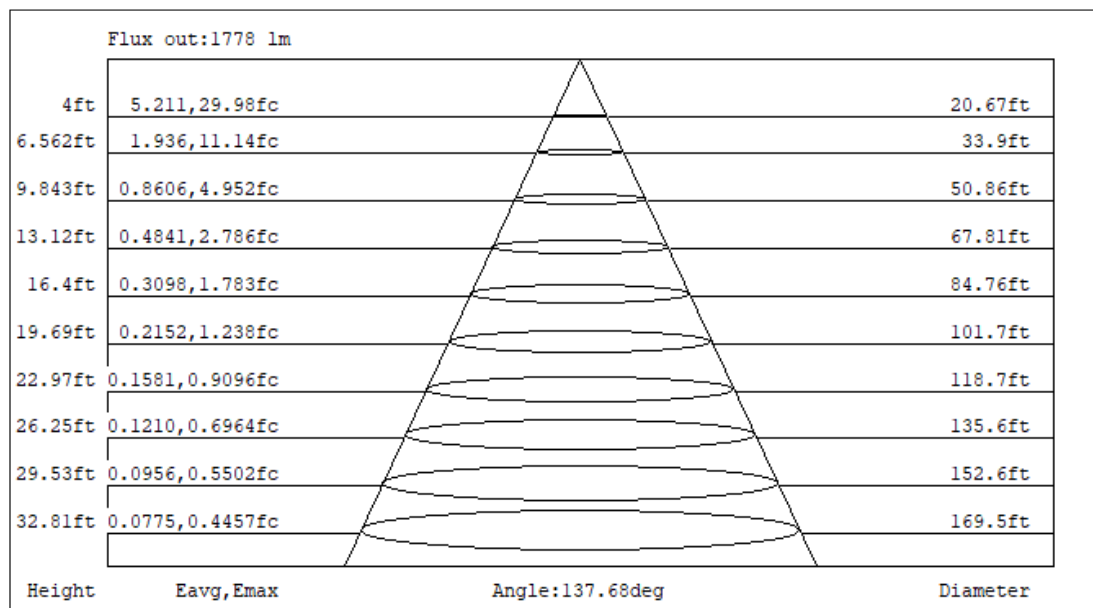
	Zonal (lm)		Total (lm)	Percent
0-10	45.91	0 - 10	45.91	1.52%
10-20	138.21	0 - 20	184.12	6.11%
20-30	229.15	0 - 30	413.27	13.70%
30-40	310.47	0 - 40	723.74	24.00%
40-50	367.02	0 - 50	1090.76	36.17%
50-60	380.45	0 - 60	1471.21	48.79%
60-70	336.22	0 - 70	1807.43	59.94%
70-80	233.09	0 - 80	2040.52	67.67%
80-90	117.19	0 - 90	2157.71	71.55%
90-100	80.01	0 - 100	2237.72	74.21%
100-110	95.60	0 - 110	2333.32	77.38%
110-120	122.52	0 - 120	2455.84	81.44%
120-130	134.66	0 - 130	2590.50	85.91%
130-140	132.45	0 - 140	2722.95	90.30%
140-150	122.29	0 - 150	2845.24	94.35%
150-160	97.52	0 - 160	2942.76	97.59%
160-170	58.23	0 - 170	3000.99	99.52%
170-180	14.53	0 - 180	3015.52	100.00%

## 4.2 Goniophotometer Test

### COEFFICIENTS OF UTILIZATION - ZONAL CAVITY METHOD

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	112	112	112	112	106	106	106	106	95	95	95	85	85	85	76	76	76	72
1	101	95	90	86	95	90	86	82	81	77	74	72	69	67	64	62	60	56
2	90	82	74	68	85	77	71	65	69	64	59	61	57	54	55	51	48	45
3	82	71	62	55	77	67	59	53	60	53	48	53	48	44	47	43	40	36
4	74	62	53	46	70	59	50	44	52	46	40	47	41	37	41	37	33	30
5	68	55	45	39	64	52	43	37	46	39	34	41	36	31	37	32	28	25
6	62	49	40	33	58	46	38	32	41	34	29	37	31	27	33	28	24	22
7	57	44	35	29	54	42	33	28	37	30	25	34	28	23	30	25	21	19
8	53	40	31	25	50	38	30	24	34	27	22	30	25	20	27	22	19	16
9	49	36	28	22	47	34	27	21	31	24	20	28	22	18	25	20	17	15
10	46	33	25	20	43	31	24	19	28	22	18	26	20	16	23	18	15	13

### CONE OF LIGHT DIAGRAM



## 4.0 LM-79 Measurement and Test Results

### 4.3 THD and PF Test

Model No.	TOMO-2/24W/3000K	Sample ID.	I1
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
119.99	60	0.204	24.4	0.997	7.30%
276.99	60	0.088	24.0	0.990	10.11%

## 5.0 Equipment Information

Test Equipment			
Equipment ID	Equipment Name	Last Calibration Date	Calibration Due Date
DLF107	Integrating Sphere System	2021/12/26	2022/12/25
DLF108	Auxiliary Lamp	2021/12/26	2022/12/25
DLF122	Measurement Standard Lamp Standard Lamp Type: 220 V, 0.4720 A, Tungsten, Omni-derectional	2021/12/26	2022/12/25
DLF116	AC Power Source	2021/12/26	2022/12/25
DLF113	Power Meter	2021/12/26	2022/12/25
DLF112	Temperature Recorder	2021/12/26	2022/12/25
DLF114	Temperature & Humidity Datalogger	2021/12/26	2022/12/25
DLF101	Goniophotometer	2021/12/26	2022/12/25
DLF125	Standard Lamp Standard Lamp Type: 76.58 V, 6.7875 A, Tungsten, Omni-derectional	2021/12/26	2022/12/25
DLF104	AC Power Source	2021/12/26	2022/12/25
DLF507	DC Power Source	2021/12/26	2022/12/25
DLF102	Power Meter	2021/12/26	2022/12/25
DLF111	Temperature & Humidity Datalogger	2021/12/26	2022/12/25
DLF119	Power Meter	2021/12/26	2022/12/25
DLF031	Temperature data logger	2021/12/26	2022/12/25
DLF022	Digital power meter	2021/12/26	2022/12/25
DLF003	Temperature & Humidity Datalogger	2021/12/26	2022/12/25

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