

# Photometric Test Report

## Relevant Standards

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

## Prepared For

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## Project Number

**DLF2207103**

## Report Number

**DLF2207103-3a**

## Test Date

**2022/7/11**

## Issue Date

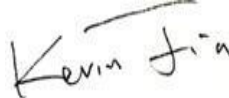
**2022/7/15**

## 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		3098
Lumen/ft (Goniophotometer - Section 4.2)	IES LM-79-2008	≥375		774
Minimum Luminaire Efficacy (lm/W) (Goniophotometer - Section 4.2)	IES LM-79-2008	Standard 115	Premium 130	134.1
Power (Input Wattage) (W) (Goniophotometer - Section 4.2)	IES LM-79-2008	Wrost Case		23.1
Total Harmonic Distortion (A%) (THD & PF - section 4.3)	ANSI C82.77:2014	20.00%	120V	8.12%
		20.00%	277V	9.88%
Power Factor (THD & PF - section 4.3)	ANSI C82.77:2014	0.9	120V	0.992
		0.9	277V	0.922
Allowable CCTs* (K) (Integrating Sphere - Section 4.1)	IES LM-79-2008	7 step	3985±275	4024
		4 step	3985±154	
Minimum CRI (Integrating Sphere - Section 4.1)	IES LM-79-2008 CIE 13.3-1995	≥80		84
Minimum R9 (Integrating Sphere - Section 4.1)	IES LM-79-2008 CIE 13.3-1995	≥0		14
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		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%		48.00%
Corrected UGR (X=4H, Y=8H, 70/50/20%) (Goniophotometer - Section 4.2)	CIE 190-2010	<22		21.4
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		0.091
(Goniophotometer - Section 4.2)		Non-Wrost Case		0.189
Power (Input Wattage - W)				
(Goniophotometer - Section 4.2)	IES LM-79-2008	Wrost Case		23.1
(Goniophotometer - Section 4.2)		Non-Wrost Case		22.4

## 2.0 Test List

Test Item	Test	Test Date	Model Number	Sample No.
1	Integrating Sphere Test	2022/7/11	TOMO-4/24W/4000K	C1
2	Goniophotometer Test	2022/7/11	TOMO-4/24W/4000K	C1
3	THD and PF Test	2022/7/11	TOMO-4/24W/4000K	C1

### Remark(If any)

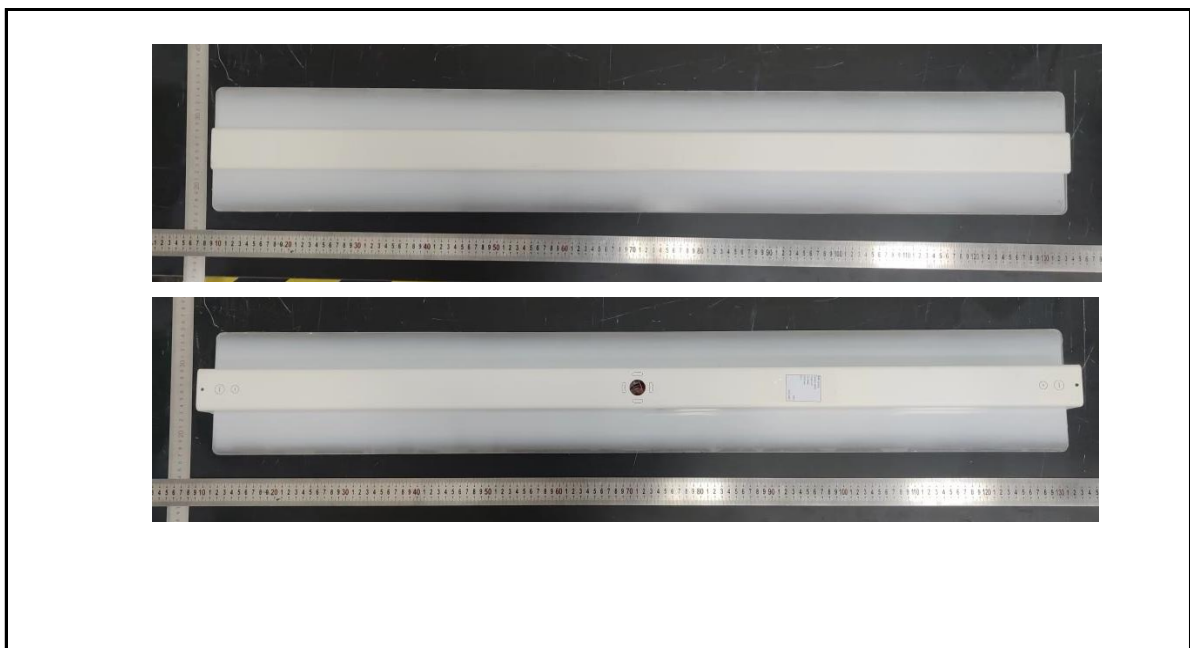
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## 3.0 Production Description

**Luminaire Description:** TOMO-4/24W/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.	TOMO-4/24W/4000K	Sample ID.	C1
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

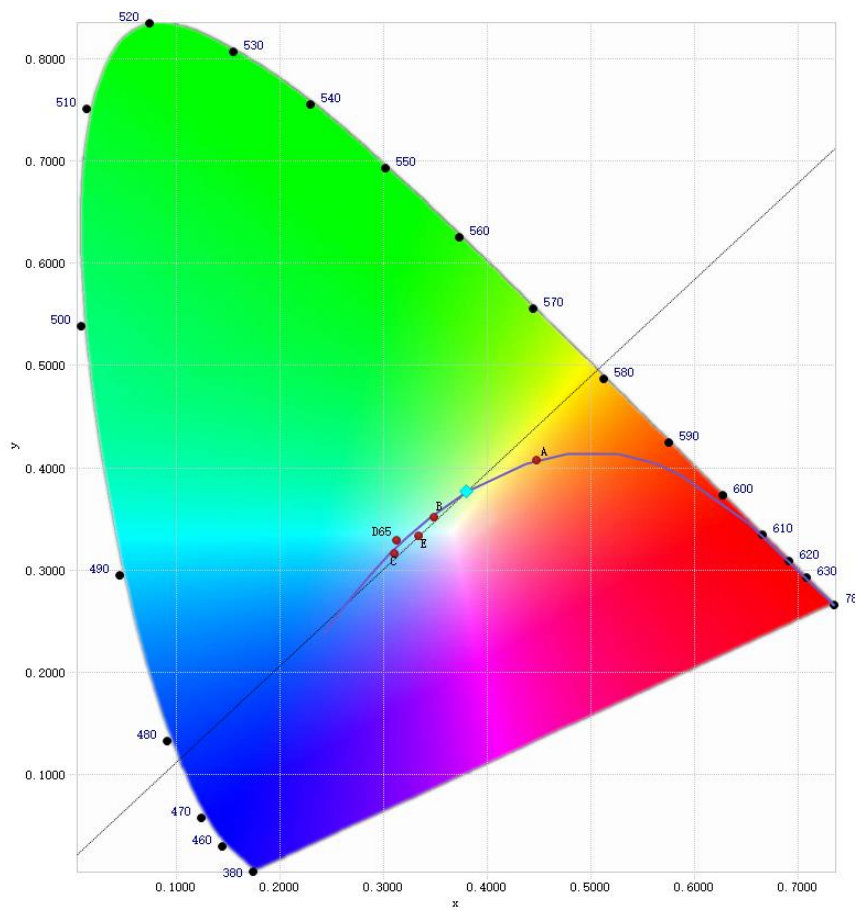
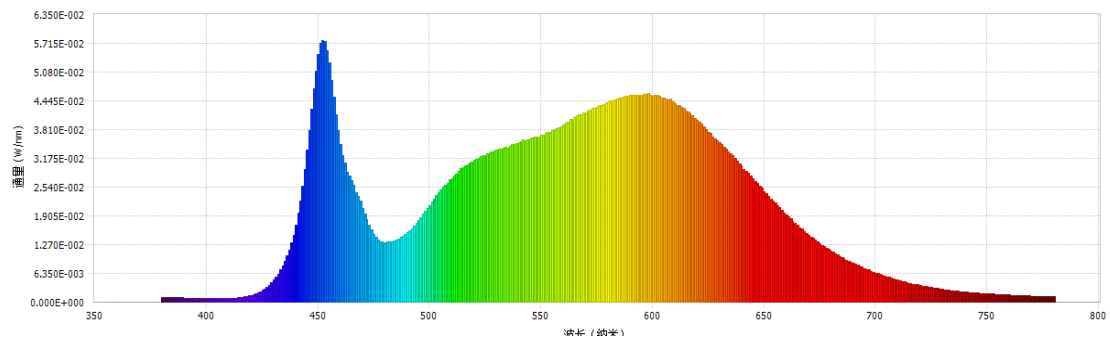
Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
120.05	60	0.185	22.0	0.992
276.98	60	0.089	22.7	0.922

#### Test Result

CCT (K)	CRI	R9	Duv
4024	84	14	0.0003

Rf	Rg	IES Rcs,h1
84	95	-11%

## 4.1 Integrating Sphere Test



## 4.1 Integrating Sphere Test

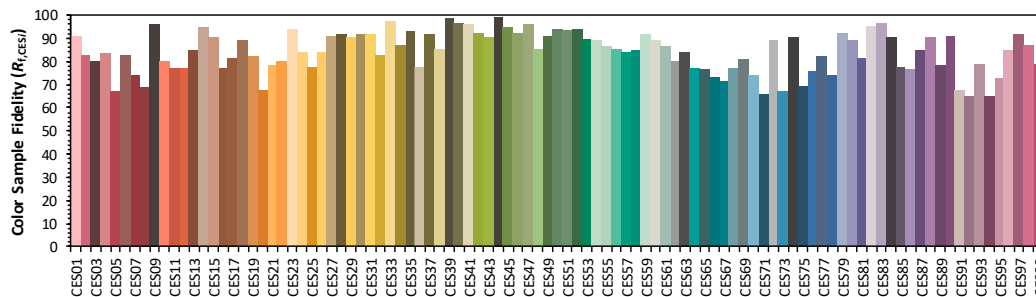
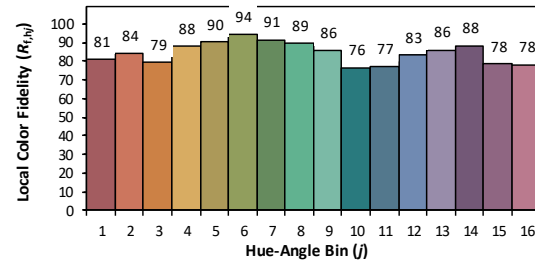
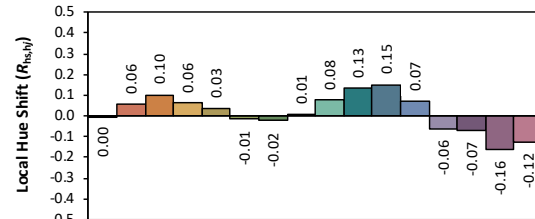
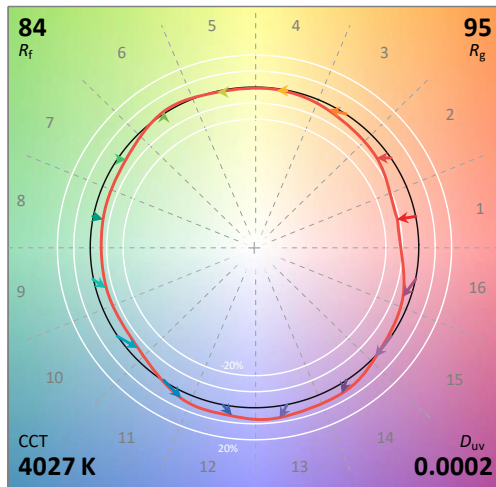
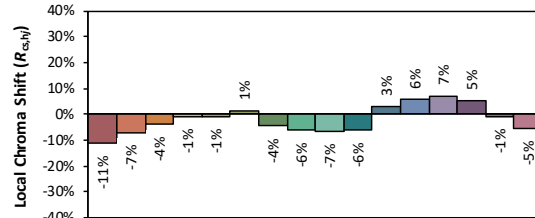
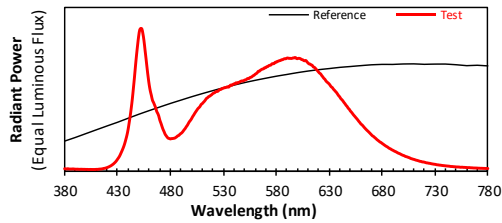
### IES TM-30-18 Color Rendition Report

Source: DLF2207103-3a

Manufacturer: RAB Lighting Inc.

Date: 2022/7/11

Model: TOMO-4/24W/4000K



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

$x$  0.3794  
 $y$  0.3767  
 $u'$  0.2245  
 $v'$  0.5014

CIE 13.3-1995  
(CRI)

$R_a$  85  
 $R_g$  19

## 4.0 LM-79 Measurement and Test Results

### 4.2 Goniophotometer Test

Model No.	TOMO-4/24W/4000K	Sample ID.	C1
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	277.02	60	0.091	23.1	0.918
NON-WROST CASE	120.04	60	0.189	22.4	0.988

#### Test Result

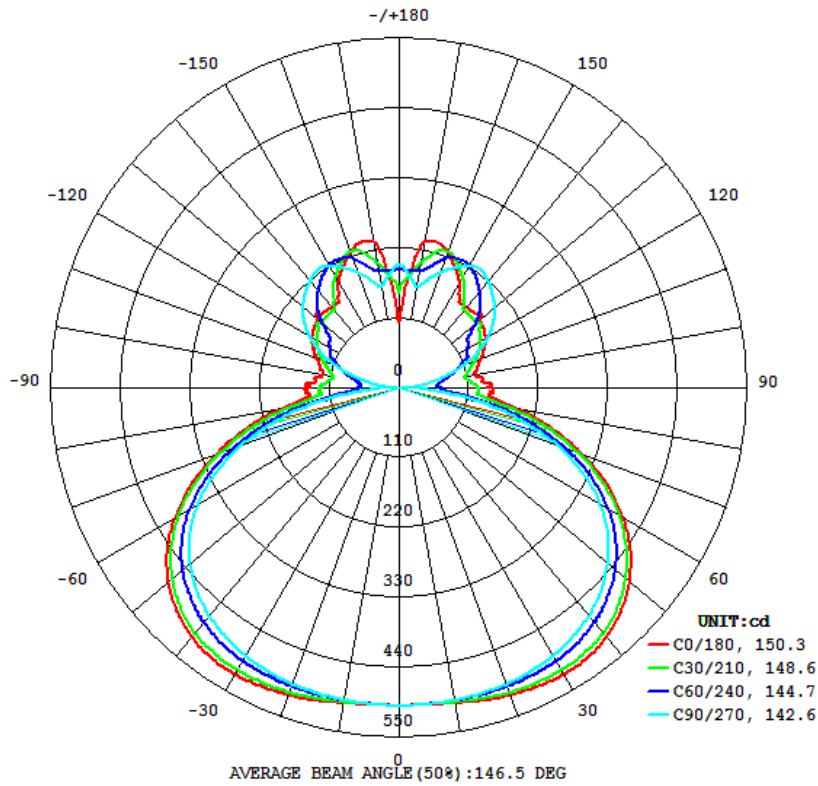
Flux (lm)	Field Angle(10%)		Beam Angle(50%)		Luminous Efficacy (lm/W)
	C0-180	C90-270	C0-180	C90-270	
3098	360.0	360.0	150.3	142.6	134.1

Zonal Lumen Requirement ( $0^{\circ}$ - $60^{\circ}$ )	UGR (X=4H, Y=8H, 70/50/20%)	Length(ft)	Lumen/ft
48.00%	21.4	4.00	774

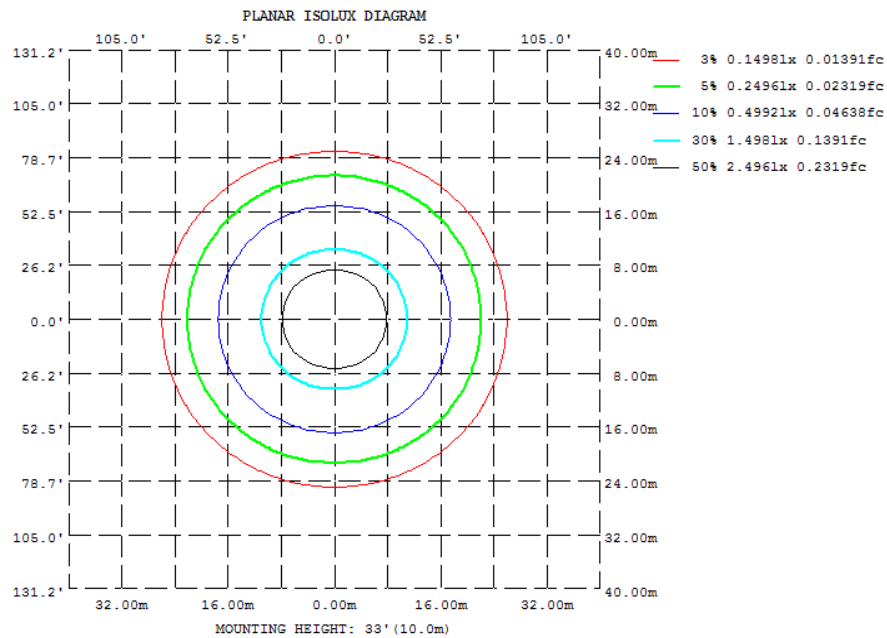


## 4.2 Goniophotometer Test

### Light Distrubtion Curve



### Isolux Plot





## 4.2 Goniophotometer Test

### Zonal Lumen Summary

γ	C0	C45	C90	C135	C180	C225	C270	C315
10	504.2	500.7	498.6	500.7	504.2	500.7	498.6	500.7
20	514.3	504.9	495.9	504.9	514.3	504.9	495.9	504.9
30	520.3	505.0	486.4	505.0	520.3	505.0	486.4	505.0
40	511.1	492.3	467.3	492.3	511.1	492.3	467.3	492.3
50	475.7	458.9	431.3	458.9	475.7	458.9	431.3	458.9
60	409.2	393.5	367.5	393.5	409.2	393.5	367.5	393.5
70	309.6	292.0	266.3	292.0	309.6	292.0	266.3	292.0
80	187.2	163.1	128.2	163.1	187.2	163.1	128.2	163.1
90	146.2	100.5	5.925	100.5	146.2	100.5	5.925	100.5
100	123.9	90.29	44.44	90.29	123.9	90.29	44.44	90.29
110	139.0	117.2	110.0	117.2	139.0	117.2	110.0	117.2
120	158.8	140.7	163.6	140.7	158.8	140.7	163.6	140.7
130	167.9	151.4	198.5	151.4	167.9	151.4	198.5	151.4
140	167.1	179.3	220.4	179.3	167.1	179.3	220.4	179.3
150	193.4	212.8	222.2	212.8	193.4	212.8	222.2	212.8
160	227.3	222.7	193.4	222.7	227.3	222.7	193.4	222.7
170	234.7	193.9	163.4	193.9	234.7	193.9	163.4	193.9
180	106.5	173.9	193.1	173.9	106.5	173.9	193.1	173.9
DEG	LUMINOUS INTENSITY:cd							

### UGR Table - Corrected

#### UGR Table - Corrected

Reflectances

Ceiling Cavity

Walls

Floor Cavity

70

70

50

50

30

70

70

50

50

30

50

30

50

30

20

50

30

50

30

20

20

20

20

20

20

20

20

20

20

20

Room Size

X=2H Y=2H

3H

4H

6H

8H

12H

UGR Viewed Crosswise

14.5

15.7

15.3

16.5

17.4

UGR Viewed Endwise

15.1

16.3

15.8

17.0

18.0

16.8

17.9

17.5

18.7

19.6

17.5

18.6

18.2

19.4

20.3

17.7

18.7

18.5

19.5

20.5

18.6

19.6

19.3

20.4

21.4

18.4

19.4

19.2

20.2

21.1

19.6

20.5

20.3

21.3

22.3

18.6

19.5

19.4

20.4

21.3

20.0

20.9

20.8

21.7

22.7

18.8

19.6

19.6

20.5

21.5

20.5

21.4

21.3

22.2

23.2

4H

2H

15.4

16.4

16.1

17.2

18.2

15.8

16.8

16.5

17.6

18.6

3H

17.9

18.7

18.6

19.6

20.5

18.4

19.3

19.2

20.1

21.1

4H

18.9

19.7

19.7

20.5

21.5

19.7

20.5

20.5

21.3

22.3

6H

19.7

20.4

20.5

21.3

22.3

20.8

21.5

21.6

22.4

23.4

8H

20.0

20.7

20.8

21.5

22.5

21.4

22.0

22.2

22.9

23.9

12H

20.2

20.8

21.0

21.7

22.7

22.0

22.6

22.8

23.4

24.5

8H

4H

19.4

20.1

20.2

20.9

22.0

20.1

20.7

20.9

21.6

22.6

6H

20.4

21.0

21.3

21.9

22.9

21.4

22.0

22.3

22.9

23.9

8H

20.8

21.3

21.7

22.2

23.2

22.1

22.6

23.0

23.5

24.5

12H

21.1

21.5

22.0

22.4

23.5

22.9

23.4

23.8

24.2

25.3

12H

4H

19.5

20.1

20.3

21.0

22.0

20.1

20.7

21.0

21.6

22.6

6H

20.6

21.1

21.5

22.0

23.0

21.5

22.0

22.4

22.9

24.0

8H

21.1

21.5

21.9

22.4

23.5

22.3

22.7

23.2

23.6

24.7

Maximum UGR = 25.

## 4.2 Goniophotometer Test

### ZONAL LUMEN SUMMARY

	Zonal (lm)		Total (lm)	Percent
0-10	47.74	0 - 10	47.74	1.54%
10-20	142.62	0 - 20	190.36	6.15%
20-30	233.67	0 - 30	424.03	13.69%
30-40	313.14	0 - 40	737.17	23.80%
40-50	367.79	0 - 50	1104.96	35.67%
50-60	381.98	0 - 60	1486.94	48.00%
60-70	340.20	0 - 70	1827.14	58.99%
70-80	239.12	0 - 80	2066.26	66.71%
80-90	121.05	0 - 90	2187.31	70.61%
90-100	93.79	0 - 100	2281.10	73.64%
100-110	106.53	0 - 110	2387.63	77.08%
110-120	130.76	0 - 120	2518.39	81.30%
120-130	141.79	0 - 130	2660.18	85.88%
130-140	136.94	0 - 140	2797.12	90.30%
140-150	123.68	0 - 150	2920.80	94.29%
150-160	99.78	0 - 160	3020.58	97.51%
160-170	59.40	0 - 170	3079.98	99.43%
170-180	17.58	0 - 180	3097.56	100.00%

## 4.2 Goniophotometer Test

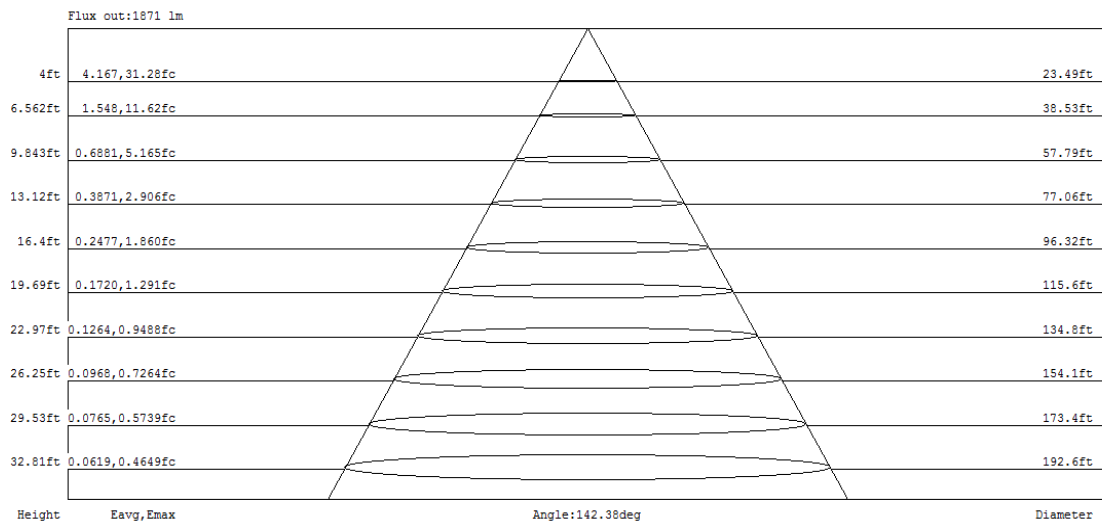
### COEFFICIENTS OF UTILIZATION - ZONAL CAVITY METHOD

#### Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance 0.20

RC	80				70				50			30			10			0
Rw	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	84	84	84	75	75	75	71
1	100	95	90	86	95	90	86	82	80	77	74	71	69	66	63	61	59	55
2	90	81	74	68	85	77	70	65	69	63	59	61	57	53	54	51	48	44
3	82	70	62	55	77	67	59	53	59	53	48	53	48	44	47	43	39	36
4	74	62	53	46	69	58	50	44	52	45	40	46	41	36	41	37	33	30
5	68	55	45	39	63	52	43	37	46	39	34	41	35	31	36	32	28	25
6	62	49	40	33	58	46	38	32	41	34	29	37	31	27	33	28	24	21
7	57	44	35	29	54	41	33	28	37	30	25	33	27	23	30	25	21	19
8	53	39	31	25	50	38	30	24	34	27	22	30	25	20	27	22	19	16
9	49	36	28	22	46	34	27	21	31	24	20	28	22	18	25	20	17	14
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-4/24W/4000K	Sample ID.	C1
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
120.05	60	0.185	22.0	0.992	8.12%
276.98	60	0.089	22.7	0.922	9.88%

## 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\*\*\*\*\*