

# Photometric Test Report

## Relevant Standards

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

## Prepared For

**RAB Lighting Inc.**

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## Project Number

**DLF2211104**

## Report Number

**DLF2211104-14a**

## Test Date

**2022/11/23**

## Issue Date

**2022/11/29**

## 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	-		411
Lumen/ft (Goniophotometer - Section 4.2)	IES LM-79-2008	$\geq 375$		314
Minimum Luminaire Efficacy (lm/W) (Goniophotometer - Section 4.2)	IES LM-79-2008	-		85.7
Power (Input Wattage) (W) (Goniophotometer - Section 4.2)	IES LM-79-2008	Worst Case		4.8
Total Harmonic Distortion (A%) (THD & PF - section 4.3)	ANSI C82.77:2014	20.00%		6.02%
Power Factor (THD & PF - section 4.3)	ANSI C82.77:2014	0.9		0.994
Allowable CCTs* (K) (Integrating Sphere - Section 4.1)	IES LM-79-2008	7 step	3985 $\pm$ 275	3921
		4 step	3985 $\pm$ 154	
Minimum CRI (Integrating Sphere - Section 4.1)	IES LM-79-2008 CIE 13.3-1995	$\geq 80$		97
Minimum R9 (Integrating Sphere - Section 4.1)	IES LM-79-2008 CIE 13.3-1995	$\geq 0$		85
Minimum Rf (Integrating Sphere - Section 4.1)	ANSI/IES TM-30-18	$\geq 70$		91
Minimum Rg (Integrating Sphere - Section 4.1)	ANSI/IES TM-30-18	$\geq 89$		100
Minimum IES Rcs,h1 (Integrating Sphere - Section 4.1)	ANSI/IES TM-30-18	-12% $\leq$ IES Rcs,h1 $\leq$ +23%		-2%
Zonal Lumen Requirement (0°-60°) (Goniophotometer - Section 4.2)	IES LM-79-2008	$\geq 40\%$		79.36%
Corrected UGR (X=4H, Y=8H, 70/50/20%) (Goniophotometer - Section 4.2)	CIE 190-2010	<22		23.9

## 2.0 Test List

Test Item	Test	Test Date	Model Number	Sample No.
1	Integrating Sphere Test	2022/11/23	KNOOKFA16 / 5W / 4000K	N1
2	Goniophotometer Test	2022/11/23	KNOOKFA16 / 5W / 4000K	N1
3	THD and PF Test	2022/11/23	KNOOKFA16 / 5W / 4000K	N1

### Remark(If any)

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## 3.0 Production Description

**Luminaire Description:** KNOOKFA16 / 5W / 4000K

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

### Photos of Luminaire Characteristics



## 4.0 LM-79 Measurement and Test Results

### 4.1 Integrating Sphere Test

Model No.	KNOOKFA16 / 5W / 4000K	Sample ID.	N1
Operate time (Min.)	90	Stabilization time (Min.)	45
Temperature (°C)	25.3	Humidity (%RH)	55.4

#### 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
119.96	60	0.040	4.8	0.994

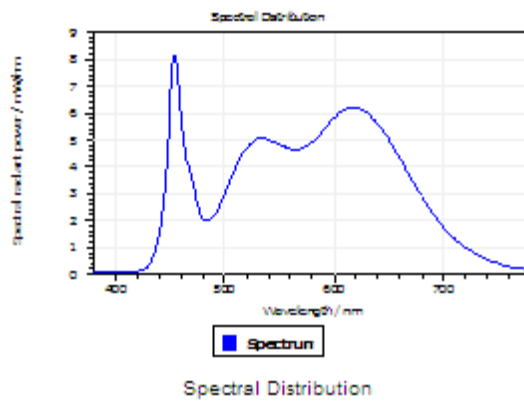
#### Test Result

CCT (K)	CRI	R9	Duv
3921	97	85	0.002

Rf	Rg	IES Rcs,h1
91	100	-2%

## 4.1 Integrating Sphere Test

### Results

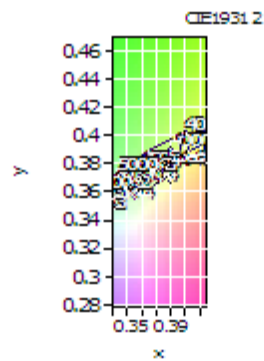


#### Spectral values

DominantWavelength 580.47 nm  
Purity 0.270  
PeakWavelength 454.34 nm  
Radiant Power 1.228 W  
Width50%:

#### Color Coordinates

Correlated Color Temperat 3921 K  
x: 0.3825 u: 0.2276 u': 0.2276  
y: 0.3739 v: 0.3337 v': 0.5006  
CRI01 98.1 CRI09 84.8  
CRI02 98.9 CRI10 95.1  
CRI03 94.9 CRI11 95.2  
CRI04 99.0 CRI12 70.4  
CRI05 97.6 CRI13 98.9  
CRI06 95.4 CRI14 96.1  
CRI07 96.4 CRI15 97.2  
CRI08 93.7 CRI16 90.6  
ResultsCRI 96.7



PlanckDistance 2.0E-003

## 4.1 Integrating Sphere Test

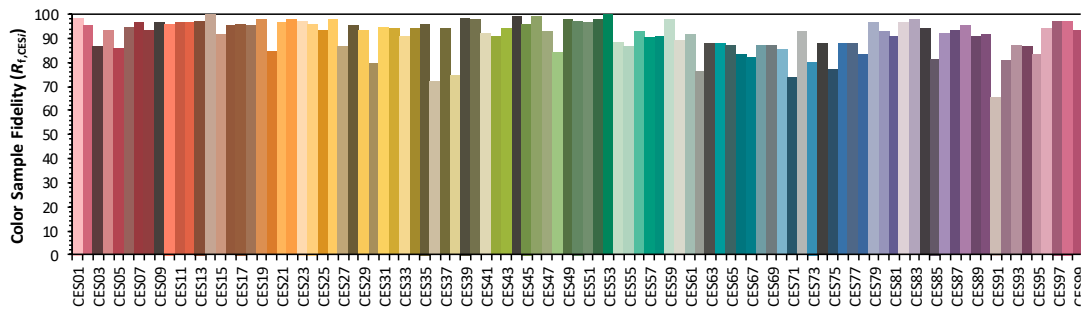
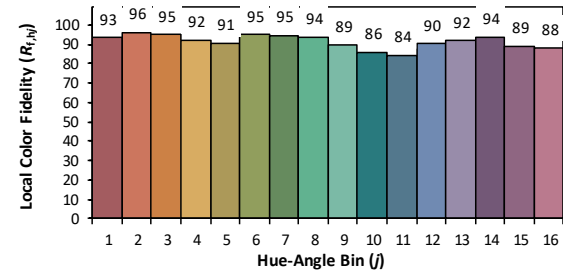
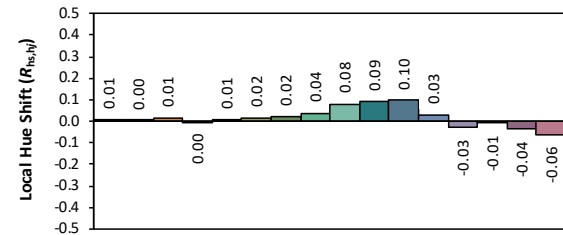
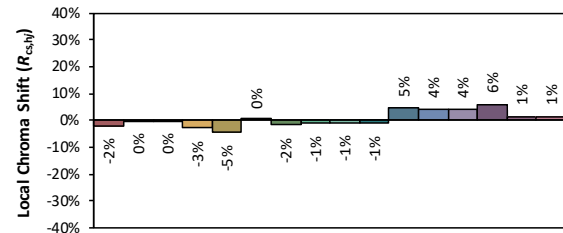
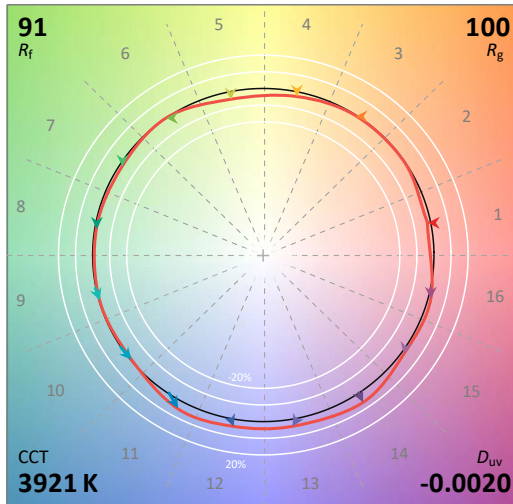
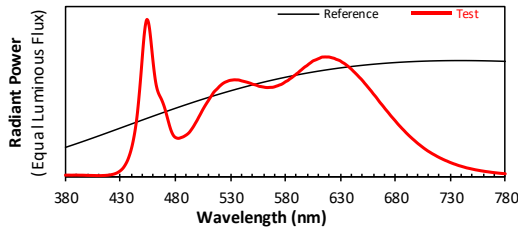
### IES TM-30-18 Color Rendition Report

Source: DLF2211104-14a

Manufacturer: RAB Lighting Inc.

Date: 2022/11/23

Model: KNOOKFA16 / 5W / 4000K



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

$x$  0.3825  
 $y$  0.3739  
 $u'$  0.2276  
 $v'$  0.5006

CIE 13.3-1995  
(CRI)

$R_a$  97  
 $R_g$  87

## 4.0 LM-79 Measurement and Test Results

### 4.2 Goniophotometer Test

Model No.	KNOOKFA16 / 5W / 4000K	Sample ID.	N1
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° C ± 1° 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 ±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° vertical intervals and 10° horizontal intervals.

#### Test Conditions

Condition	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
WORST CASE	119.96	60	0.040	4.8	0.994

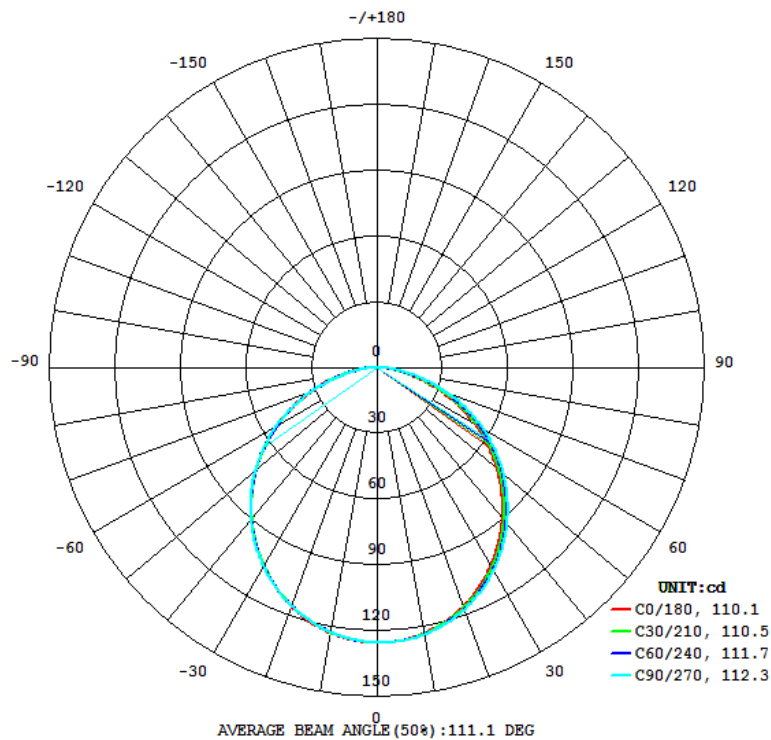
#### Test Result

Flux (lm)	Field Angle(10%)		Beam Angle(50%)		Luminous Efficacy (lm/W)
	C0-180	C90-270	C0-180	C90-270	
411	159.2	160.4	110.1	112.3	85.7

Zonal Lumen Requirement (0°-60°)	UGR (X=4H, Y=8H, 70/50/20%)	Length(ft)	Lumen/ft
79.36%	23.9	1.31	314

## 4.2 Goniophotometer Test

### Light Distrubtion Curve



### 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										
X=2H Y=2H	UGR Viewed Crosswise					UGR Viewed Endwise				
	19.7	21.4	20.1	21.7	22.0	19.4	21.0	19.8	21.4	21.7
3H	21.5	23.0	21.9	23.4	23.7	21.2	22.7	21.6	23.0	23.4
4H	22.2	23.6	22.6	24.0	24.3	21.9	23.3	22.3	23.6	24.0
6H	22.7	24.0	23.1	24.3	24.7	22.3	23.6	22.7	24.0	24.4
8H	22.8	24.0	23.2	24.4	24.8	22.5	23.7	22.9	24.1	24.5
12H	22.9	24.1	23.3	24.4	24.9	22.5	23.7	22.9	24.1	24.5
4H	20.3	21.7	20.7	22.1	22.4	20.1	21.5	20.5	21.8	22.2
3H	22.4	23.5	22.8	23.9	24.3	22.1	23.2	22.5	23.6	24.0
4H	23.2	24.2	23.6	24.6	25.1	22.9	23.9	23.3	24.3	24.8
6H	23.7	24.7	24.2	25.1	25.6	23.4	24.3	23.9	24.8	25.2
8H	23.9	24.8	24.4	25.2	25.7	23.6	24.5	24.0	24.9	25.4
12H	24.0	24.8	24.5	25.3	25.7	23.7	24.5	24.2	25.0	25.4
8H	23.4	24.3	23.9	24.7	25.2	23.1	24.0	23.6	24.5	24.9
6H	24.1	24.8	24.6	25.3	25.8	23.8	24.6	24.3	25.0	25.5
8H	24.4	25.0	24.9	25.5	26.0	24.1	24.7	24.6	25.2	25.7
12H	24.5	25.1	25.0	25.6	26.1	24.2	24.8	24.7	25.3	25.9
12H	23.5	24.2	23.9	24.7	25.2	23.2	24.0	23.7	24.4	24.9
6H	24.2	24.8	24.7	25.3	25.8	23.9	24.6	24.4	25.0	25.5
8H	24.4	25.0	24.9	25.5	26.1	24.2	24.7	24.7	25.2	25.8

Maximum UGR = 26.1



## 4.2 Goniophotometer Test

### ZONAL LUMEN SUMMARY

	Zonal (lm)		Total (lm)	Percent
0-10	13.89	0 - 10	13.89	3.38%
10-20	39.67	0 - 20	53.56	13.02%
20-30	59.88	0 - 30	113.44	27.58%
30-40	71.89	0 - 40	185.33	45.06%
40-50	74.28	0 - 50	259.61	63.11%
50-60	66.82	0 - 60	326.43	79.36%
60-70	50.40	0 - 70	376.83	91.61%
70-80	27.71	0 - 80	404.54	98.35%
80-90	6.26	0 - 90	410.80	99.87%
90-100	0.08	0 - 100	410.88	99.89%
100-110	0.06	0 - 110	410.94	99.90%
110-120	0.06	0 - 120	411.00	99.92%
120-130	0.07	0 - 130	411.07	99.93%
130-140	0.08	0 - 140	411.15	99.95%
140-150	0.08	0 - 150	411.23	99.97%
150-160	0.06	0 - 160	411.29	99.99%
160-170	0.04	0 - 170	411.33	100.00%
170-180	0.01	0 - 180	411.34	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	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102	100
1	109	104	100	96	106	102	98	95	98	94	92	94	91	89	90	88	86	84
2	99	91	84	78	96	89	83	77	85	80	76	82	78	74	79	75	72	70
3	90	80	72	65	88	78	71	64	75	69	63	72	67	62	70	65	61	59
4	83	71	62	55	80	69	61	55	67	60	54	64	58	53	62	57	52	50
5	76	63	54	47	74	62	53	47	60	52	47	58	51	46	56	50	46	43
6	70	57	48	41	68	56	47	41	54	46	41	52	46	40	51	45	40	38
7	65	51	43	37	63	51	42	36	49	42	36	48	41	36	46	40	36	34
8	61	47	38	33	59	46	38	32	45	38	32	44	37	32	42	36	32	30
9	57	43	35	29	55	42	35	29	41	34	29	40	34	29	39	33	29	27
10	53	40	32	27	52	39	32	27	38	31	26	37	31	26	36	30	26	24

## 4.0 LM-79 Measurement and Test Results

### 4.3 THD and PF Test

Model No.	KNOOKFA16 / 5W / 4000K	Sample ID.	N1
Temperature (°C)	25.3	Humidity (%RH)	55.4

#### 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
119.96	60	0.040	4.8	0.994	6.02%

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