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Test report of

IES LM-79-08

Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

Rendered to:

Espen Technology Inc.
12257 Florence Ave. Santa Fe Springs, CA, 90670 USA

For products:

Linear Replacement Lamps

Models No.:
L48T8/8F/15G-ID DE(-AC)
(10W/12W/15W)

Test Date:	Feb. 4, 2024 to Feb. 4, 2024
Test Lab.:	**LCTECH Guangdong Testing Services Co., Ltd.** 1/F., Building I, & 2, 3, 4/F., Building II, Technology and Enterprise Development Center, Guanqyuan Road, Xiaolan, Zhongshan, Guangdong, China Tel:+86-760-22833366 E-mail:Service@lccert.com http://www.lccert.com
Test Sites:	1/F., Building I, Technology and Enterprise Development Center, Guangyuan Road, Xiaolan, Zhongshan, Guangdong, China
Template No.:	LC-RT-PL-092 Rev.1.1
Test Note:	*This report was based on LCZP24020004 except the applicant and model number.*

Compiled by:	Fish Tan	**Reviewed by:**	Lin Qiu
Fish Tan		**Lin Qiu**	
Mar. 27, 2024		**Mar. 27, 2024**	

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1. General

1.1 Product Information

Brand Name	ESPEN
Category	Linear Replacement Lamps
General Application	4’ T8 Lamps
Primary Use	Internal Driver/Line Voltage (UL Type B) Lamps
Model Number	L48T8/8F/15G-ID DE(-AC)(10W/12W/15W)
Rated Inputs	AC120-277V, 50/60Hz
Rated Power	15W/12W/10W
Rated Light output	15W: 2200lm/12W: 1800lm/10W: 1600lm
Declared CCT	3000K/3500K/4000K/5000K/6500K
Power Supply	Integrated in lamps
LED Package, Array or Module	STW8A2SD-D1-VN, Seoul Semiconductor Co., Ltd.
Dimming	Continuous Dimming
Integral Controls	No
Controls Controllability	No
Receipt Samples	1 unit
Sample Code of lab.	240202104001
Date of Receipt Samples	Feb. 2, 2024
Note	This is a color tunable product, 3000K/3500K/4000K/5000K/6500K on 10W/12W/15W were selected for the test.

1.2 Standards or methods

The following standards are partly or totally used or referenced for test:

No.	Name
ANSI/NEMA/ ANSLG C78.377- 2017	Specifications for the Chromaticity of Solid State Lighting Products
ANSI/IES TM-30-18[1]	IES Method for Evaluating Light Source Color Rendition
ANSI C82.77-2002	Harmonic Emission Limits—Related Power Quality Requirements for Lighting Equipment
CIE Pub. No. 13.3-1995	Method of Measuring and Specifying Color Rendering of Light Sources
CIE Pub. No. 15:2004	Colorimetry
IES LM-79-08	Electrical and Photometric Measurements of Solid-State Lighting Products

Note:

1, For reference only and not in the scope of NVLAP.

1.3 Equipment list

Instrument	ID	Model name	Cal. date	Next cal. Date
AC Power supply	LC-I-987	APW-120N	2023-12-12	2024-12-11
AC Power supply	LC-I-989	APW-120N	2023-12-12	2024-12-11
Power analyzer	LC-I-PL-024	WT310E	2023-12-15	2024-12-14
Power analyzer	LC-I-954	WT210	2023-12-12	2024-12-11
Multimeter	LC-I-972	Fluke	2023-06-28	2024-06-27
Photometric colorimetric electric system[2] (2 meter sphere)	LC-I-956	HAAS-2000	Before use	Before use
Standard lamp[3]	LC-I-963	24V50W	2023-06-29	2024-06-28
Luminous Flux Lamp[4]	LC-I-PL-031	AC220V/200W	2023-06-29	2024-06-28
Goniophotometer(with mirror)	LC-I-902	GMS2000	2023-04-14	2024-04-13
Wireless temperature transmitter	LC-I-PL-009	DWLR-DLR	2023-12-14	2024-12-13
Wireless temperature transmitter	LC-I-PL-008	DWLR-DLR	2023-12-14	2024-12-13

Note:

2, Bandwidth of spectroradiometer is 1 nm.

3, Halogen lamp, 50W, omni-directional type, and its traceability to NIM.

4, Incandescent lamp, 200W, omni-directional type, and its traceability to NIM.

2. Test conducted and method

The lamp was operated at least 2 hours to reach stabilization and temperature equilibrium before test.

2.1 Ambient Condition

The ambient temperature in which measurements are being taken was maintained at 25°C ± 1°C; the air flow around the sample(s) being tested did not affect the performance.

2.2 Power Supply Characteristics

The AC power supply had a sinusoidal voltage wave shape at the prescribed frequency (60 Hz) such that the RMS summation of the harmonic components does not exceed 3 percent of the fundamental during operation of the test item.

The voltage of AC power supply (RMS voltage) applied to the device under test was regulated to within±0.2 percent under load.

2.3 Seasoning and Stabilization

No seasoning was performed in accordance with IESNA LM-79-08. And before the measurement, the sample was stabilized until the light output and power variations were less than 0.5% in 30 minutes intervals (3 readings, 15 minutes apart).

2.4 Electrical Instrumentation

The calibration uncertainties of the instruments for AC voltage and current were less than 0.2 percent, and the calibration uncertainty of the AC power meter was less than 0.5 percent(95 % confidence interval, k=2).

2.5 Color Measurement Method

Spectral radiant flux was measured by a sphere (2 meter)-spectroradiometer system, and the color characteristics (Color rendering index, correlated color temperature, chromaticity coordinate) were calculated from these by software automatically.

2.6 Total Luminous Flux Measurement Method

Total luminous flux was measured by both sphere-spectroradiometer system and type C goniophotometer system.

Light intensity distribution was measured by a type C goniophotometer (with mirror) which can keep the sample in burn position when the tests conduct, and the total luminous flux was calculated from the intensity data by software automatically.

Spectral radiant flux was measured by a sphere (2 meter)-spectroradiometer system, and the total luminous flux was calculated from these by software automatically.

2.7 Luminous Intensity Distribution Measurement Method

Luminous intensity distribution was measured by a mirror-type goniophotometer (Type C) which can keep the sample in burn position when the tests conduct, and the kinds of graph were generated by software automatically.

2.8 Spatial Non-uniformity of Chromaticity

The customer did not require this measurement.

3. Test Result Summary

3.1 Electrical data on 15W

Criteria Item	Result				
	3000K	3500K	4000K	5000K	6500K
Input Voltage & Frequency	120.00V ~60Hz	120.04V ~60Hz	120.01V ~60Hz	120.00V ~60Hz	120.01V ~60Hz
Input Current(A)	0.124	0.124	0.122	0.123	0.123
Total Power(W)	14.42	14.46	14.30	14.40	14.38
Power Factor	0.972	0.973	0.974	0.973	0.973
I-THD	22.14%	22.31%	22.01%	22.21%	22.19%
Off-state Power(W)	-	-	-	-	-

3.2 Photometric data on 15W

Criteria Item		Result				
		3000K	3500K	4000K	5000K	6500K
Lumens(lm)		2047.57	2115.72	2171.05	2191.78	2167.76
Lamp Efficacy(lm/W)		142.00	146.32	151.82	152.21	150.75
Correlated Color Temperature (CCT)(K)		2986	3414	3926	5175	6294
Color Rendering Index (CRI)		82	84	86	86	84
R9		6	15	21	20	12
R_f		84	85	85	84	83
R_g		95	96	95	95	93
$R_{cs,h1}$		-12%	-11%	-11%	-12%	-13%
Chromaticity Coordinate (x,y)		0.4377, 0.4041	0.4075, 0.3862	0.3816, 0.3711	0.3403, 0.3469	0.3162, 0.3329
Chromaticity Coordinate (u',v')		0.2411, 0.5215	0.2390, 0.5097	0.2282, 0.4992	0.2100, 0.4816	0.1988, 0.4709
Duv		-0.0001	-0.0025	-0.0030	-0.0004	0.0034
Beam Angle[2] (50%Imax)	[C0/180]Total	223.6°	-	-	-	-
	[C90/270]Total	110.0°	-	-	-	-

Note:N/A

3.3 Electrical data on 277V on 15W

Criteria Item	Result				
	3000K	3500K	4000K	5000K	6500K
Input Voltage & Frequency	277.02V ~60Hz	277.00V ~60Hz	276.99V ~60Hz	277.00V ~60Hz	276.99V ~60Hz
Power Factor	0.931	0.931	0.929	0.930	0.930
I-THD	19.21%	19.57%	19.33%	19.55%	19.42%

3.4 Color Rendering Details on 15W

CCT	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
3000K	81	91	96	80	81	89	82	58	6	80	79	70	83	99	73
3500K	84	93	96	82	84	90	84	63	15	83	81	69	86	98	78
4000K	86	94	96	83	85	90	85	67	21	84	83	65	88	99	80
5000K	85	93	95	84	85	88	87	70	20	81	84	63	88	98	81
6500K	83	91	94	82	83	85	88	70	12	77	81	57	86	97	78

3.5 Electrical data and Photometric data on 12W

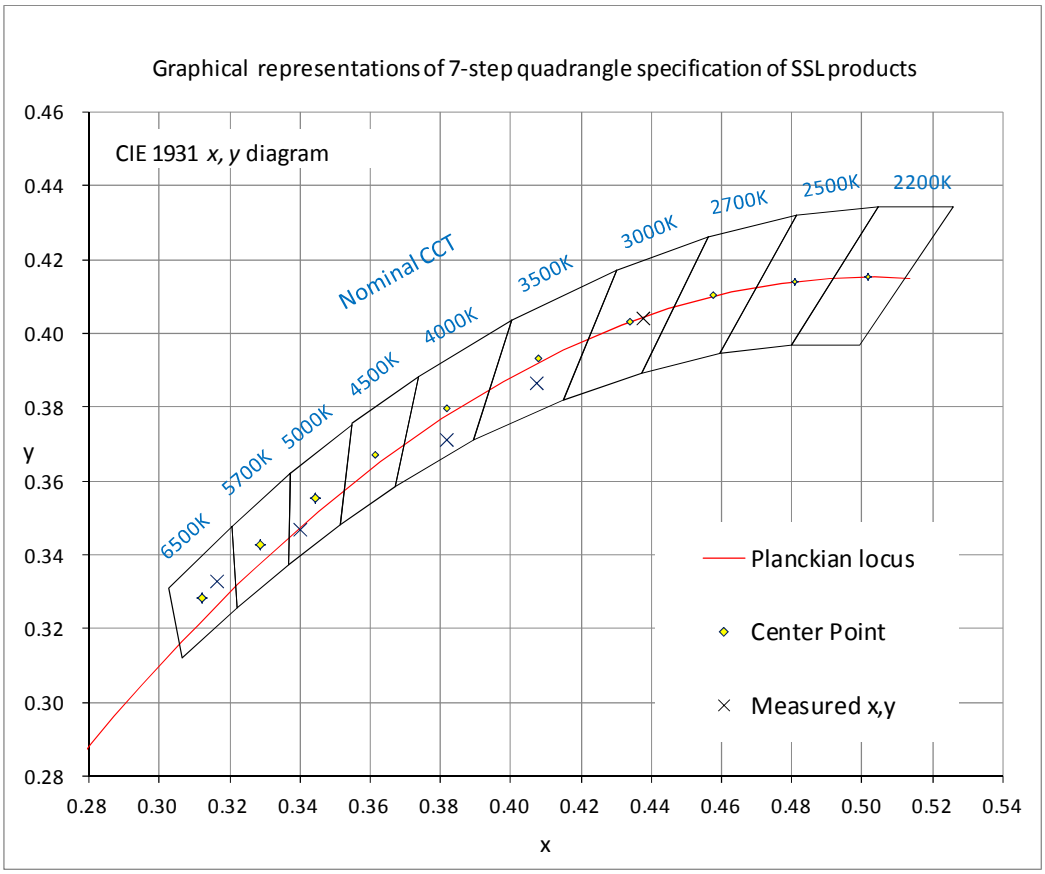
Criteria Item	Result				
	3000K	3500K	4000K	5000K	6500K
Input Voltage & Frequency	120.02V ~60Hz	120.02V ~60Hz	120.03V ~60Hz	120.02V ~60Hz	120.02V ~60Hz
Input Current(A)	0.097	0.097	0.096	0.097	0.097
Total Power(W)	11.30	11.34	11.24	11.30	11.27
Power Factor	0.973	0.973	0.973	0.973	0.973
I-THD	22.53%	22.69%	22.26%	22.53%	22.41%
Lumens(lm)	1676.63	1715.02	1750.12	1769.00	1762.64
Lamp Efficacy(lm/W)	148.37	151.24	155.70	156.55	156.40

3.6 Electrical data and Photometric data on 10W

Criteria Item	Result				
	3000K	3500K	4000K	5000K	6500K
Input Voltage & Frequency	120.04V ~60Hz	120.03V ~60Hz	120.04V ~60Hz	120.03V ~60Hz	120.04V ~60Hz
Input Current(A)	0.080	0.080	0.080	0.080	0.080
Total Power(W)	10.56	10.55	10.46	10.50	10.48
Power Factor	0.975	0.975	0.975	0.976	0.976
I-THD	21.05%	21.19%	20.87%	21.09%	21.03%
Lumens(lm)	1584.59	1623.89	1651.84	1671.63	1674.04
Lamp Efficacy(lm/W)	150.06	153.99	157.99	159.20	159.77

4. Test Data on 15W

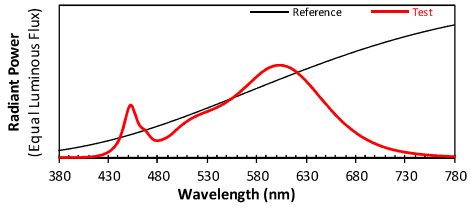
4.1 ANSI Chromaticity Quadrangles Diagram

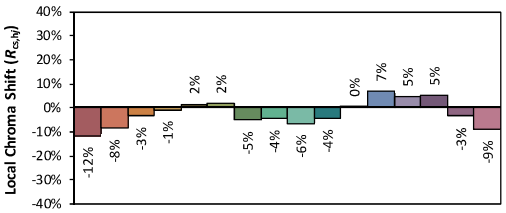


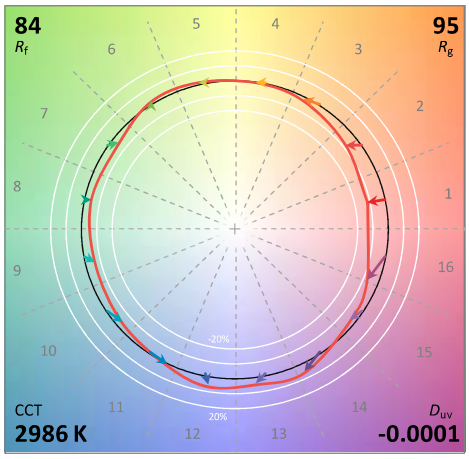
4.2 ANSI/IES TM-30-18 Color Rendition

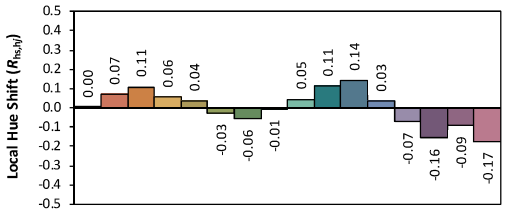
ANSI/IES TM-30-18 Color Rendition Report

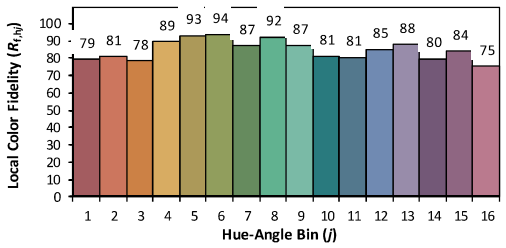
Source: SPD
Manufacturer: Espen Technology Inc.
Date: 2024/3/27
Model: L48T8/8F/15G-ID DE(-AC)(10W/12W/15W) (3000K)

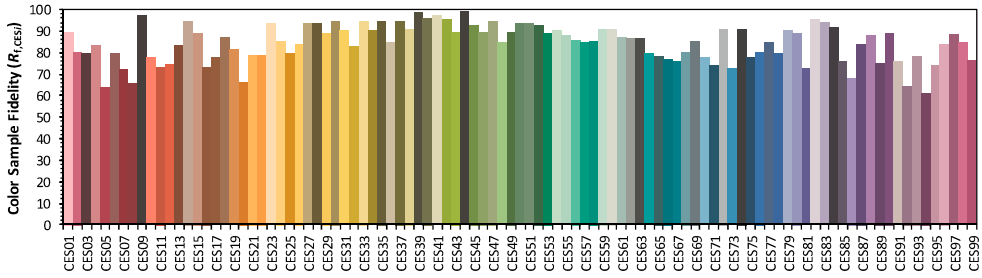












Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x	0.4377
y	0.4041
u'	0.2511
v'	0.5215

CIE 13.3-1995 (CRI)

R_a	82
R_9	6

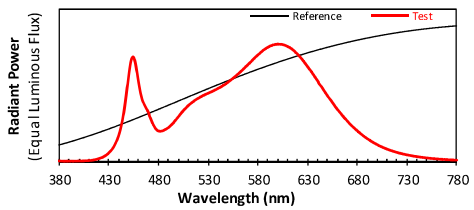
Note:

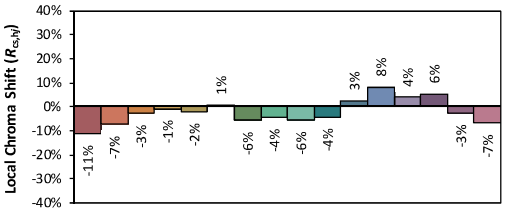
Colors are for visual orientation purposes only. Created with the IES TM-30-18 Calculator Version 2.00.

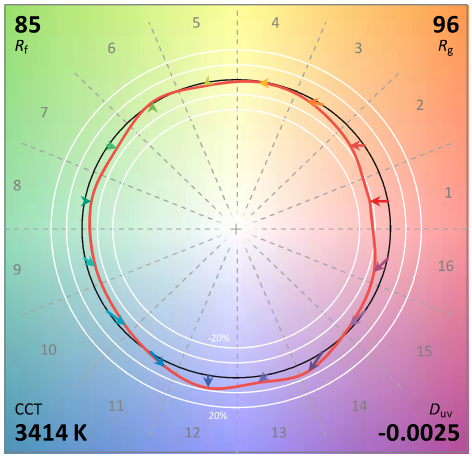
ANSI/IES TM-30-18 Color Rendition Report

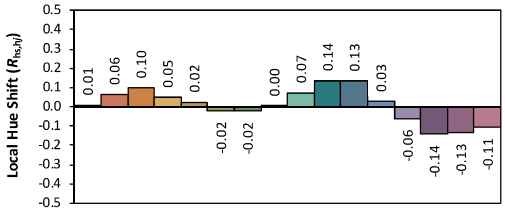
Source: SPD **Manufacturer:** Espen Technology Inc.

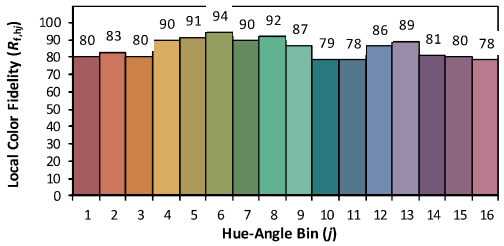
Date: 2024/03/27 **Model:** L48T8/8F/15G-ID DE(-AC)(10W/12W/15W) (3500K)

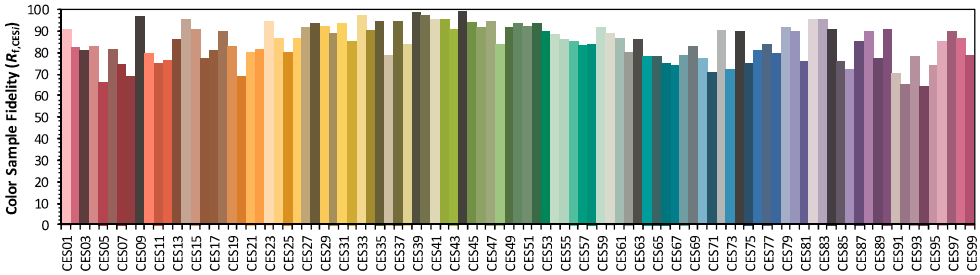












Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x	0.4075
y	0.3862
u'	0.2390
v'	0.5097

CIE 13.3-1995 (CRI)

R_a	84
R_9	15

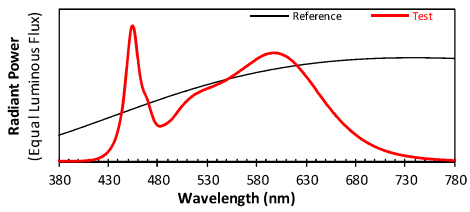
Note:

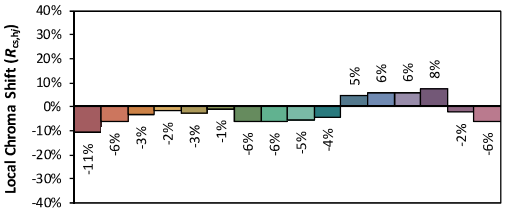
Colors are for visual orientation purposes only. Created with the IES TM-30-18 Calculator Version 2.00.

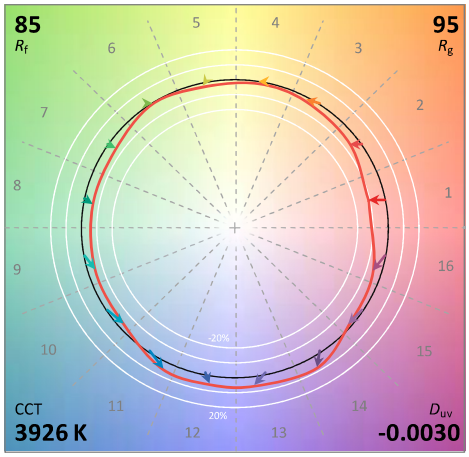
ANSI/IES TM-30-18 Color Rendition Report

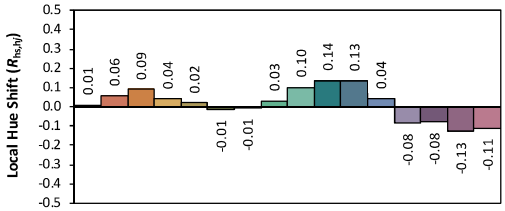
Source: SPD **Manufacturer:** Espen Technology Inc.

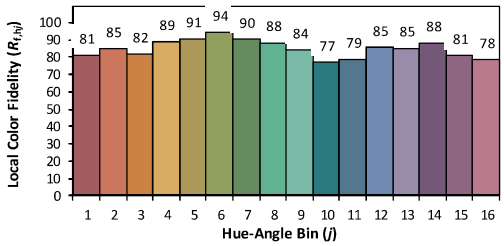
Date: 2024/03/27 **Model:** L48T8/8F/15G-ID DE(-AC)(10W/12W/15W) (4000K)

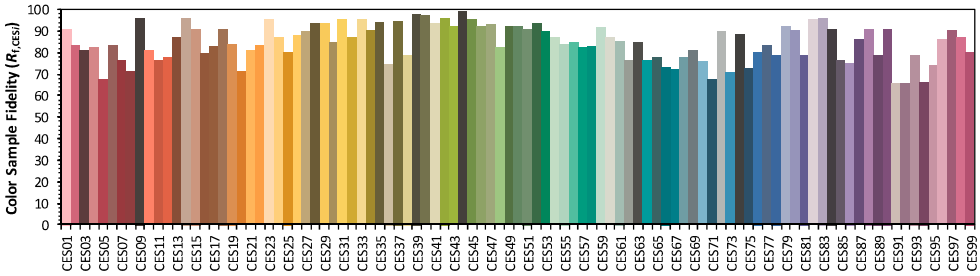












Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x	0.3816
y	0.3711
u'	0.2282
v'	0.4992

CIE 13.3-1995 (CRI)

R_a	86
R_9	21

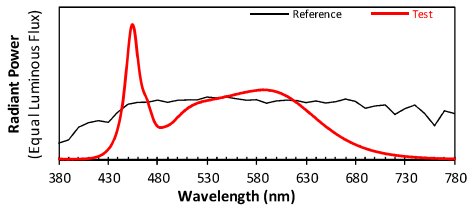
Note:

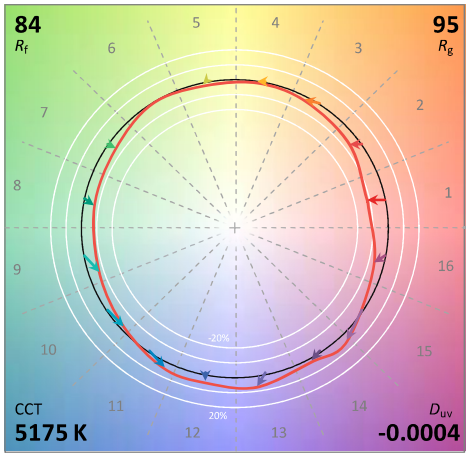
Colors are for visual orientation purposes only. Created with the IES TM-30-18 Calculator Version 2.00.

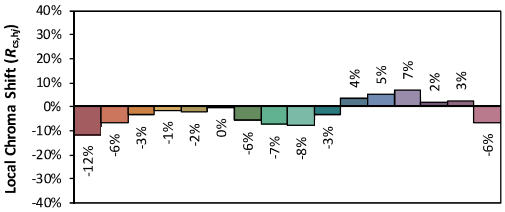
ANSI/IES TM-30-18 Color Rendition Report

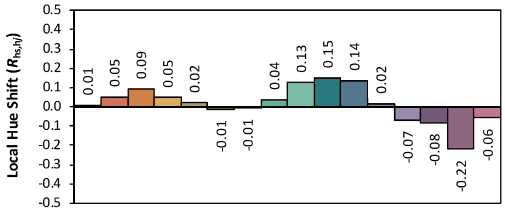
Source: SPD **Manufacturer:** Espen Technology Inc.

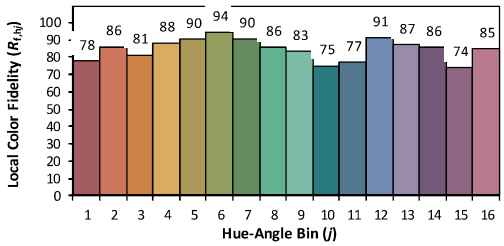
Date: 2024/03/27 **Model:** L48T8/8F/15G-ID DE(-AC)(10W/12W/15W) (5000K)

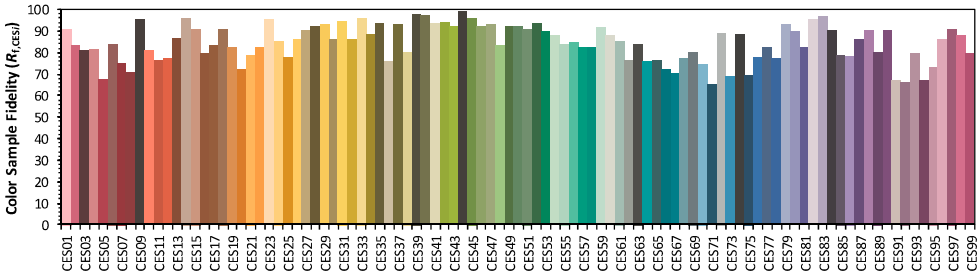












Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x	0.3403
y	0.3469
u'	0.2100
v'	0.4816

CIE 13.3-1995 (CRI)

R_a	86
R_9	20

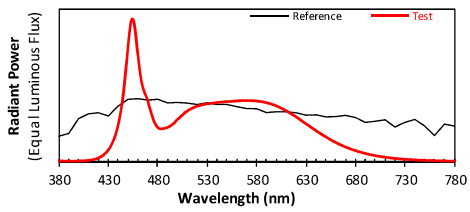
Note:

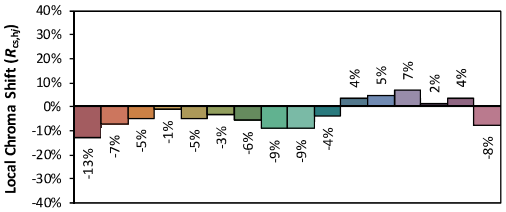
Colors are for visual orientation purposes only. Created with the IES TM-30-18 Calculator Version 2.00.

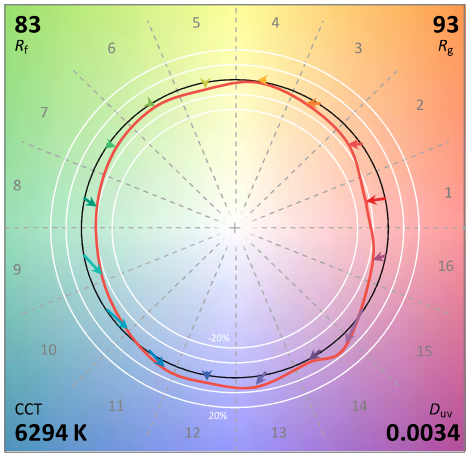
ANSI/IES TM-30-18 Color Rendition Report

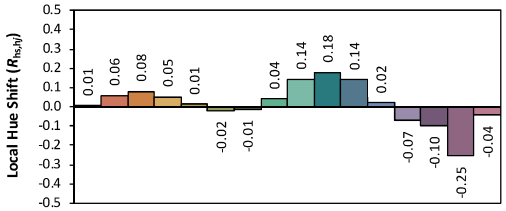
Source: SPD **Manufacturer:** Espen Technology Inc.

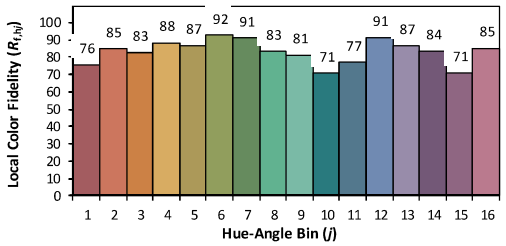
Date: 2024/03/27 **Model:** L48T8/8F/15G-ID DE(-AC)(10W/12W/15W) (6500K)

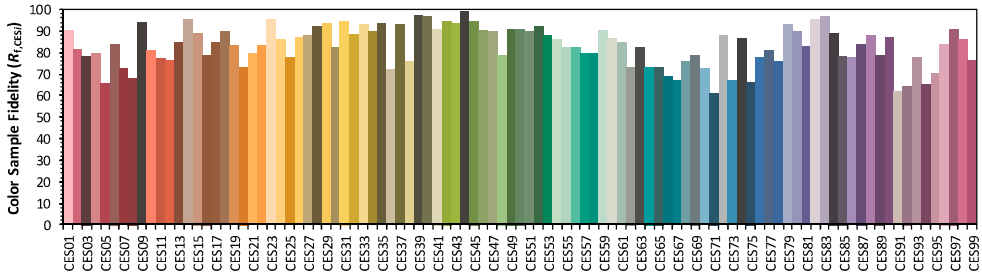












Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x	0.3162
y	0.3329
u'	0.1988
v'	0.4709

CIE 13.3-1995 (CRI)

R_a	84
R_9	12

Note:

Colors are for visual orientation purposes only. Created with the IES TM-30-18 Calculator Version 2.00.

4.3 Goniometry Test Data of 3000K

CIE Type	Semi-Direct	Basic Luminous Shape	Rectangular w/Sides
Spacing Criteria (0-180)	1.24	Luminous Length	1.08 m
Spacing Criteria (90-270)	1.44	Luminous Width	0.03 m
Spacing Criteria (Diagonal)	1.50	Luminous Height	0.03 m
Test Distance	29.97 m		

4.4 Zonal Lumen Summary of 3000K

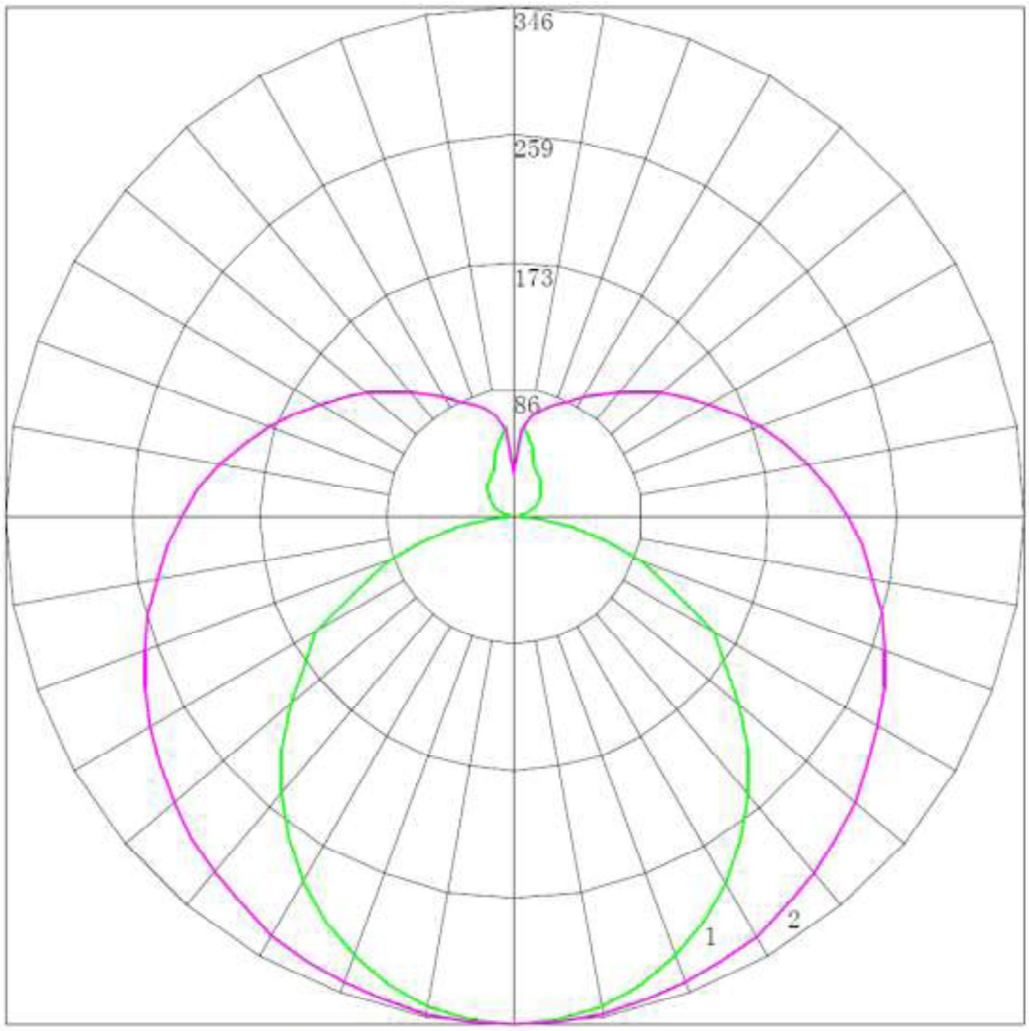
Zone	Lumens	%Lamp	%Fixt
0-20	127.81	6.20	6.20
0-30	275.44	13.50	13.50
0-40	461.55	22.50	22.50
0-60	883.17	43.10	43.10
0-80	1275.44	62.30	62.30
0-90	1439.29	70.30	70.30
10-90	1406.5	68.70	68.70
20-40	333.74	16.30	16.30
20-50	541.75	26.50	26.50
40-70	626.92	30.60	30.60
60-80	392.27	19.20	19.20
70-80	186.97	9.10	9.10
80-90	163.84	8.00	8.00
90-110	262.43	12.80	12.80
90-120	362.96	17.70	17.70
90-130	444.28	21.70	21.70
90-150	554.21	27.10	27.10
90-180	608.27	29.70	29.70
110-180	345.84	16.90	16.90
0-180	2047.56	100.00	100.00

Total Luminaire Efficiency = 100.00%

ZONAL LUMEN SUMMARY

Zone	Lumens
0-10	32.79
10-20	95.02
20-30	147.63
30-40	186.11
40-50	208.01
50-60	213.61
60-70	205.31
70-80	186.97
80-90	163.84
90-100	141.59
100-110	120.84
110-120	100.53
120-130	81.32
130-140	63.17
140-150	46.76
150-160	31.28
160-170	17.49
170-180	5.29

4.5 Polar Curves of 3000K

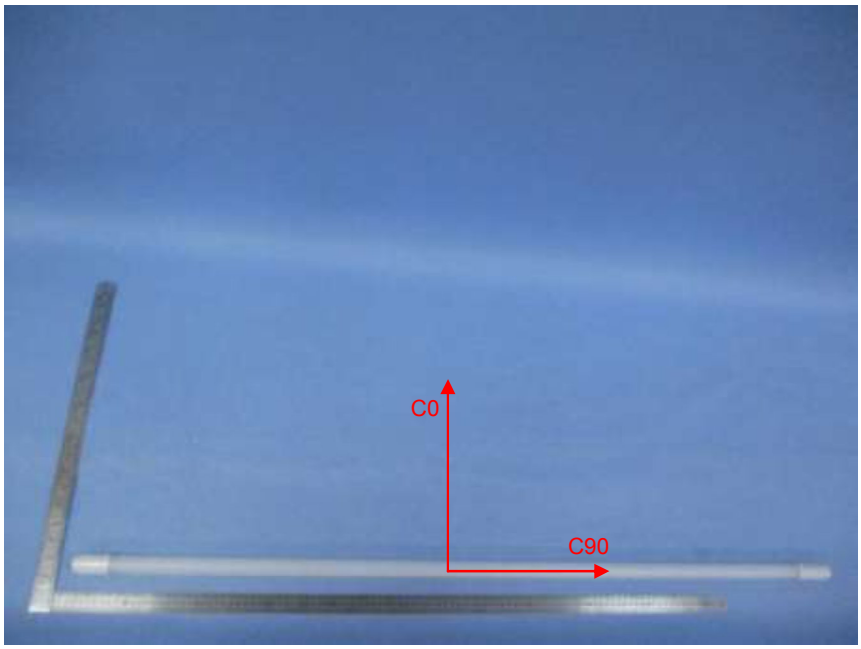


Maximum Candela = 345.68 Located At Horizontal Angle = 0, Vertical Angle = 0
1 - Vertical Plane Through Horizontal Angles (0 - 180)
2 - Vertical Plane Through Horizontal Angles (90 - 270)

4.6 Candela Tabulation of 3000K

	0	15	30	45	60	75	90
0	345.680	345.680	345.680	345.680	345.680	345.680	345.680
5	343.963	343.961	344.533	343.820	344.782	344.920	345.237
10	338.902	339.412	340.726	341.065	342.923	343.420	343.907
15	330.181	331.492	333.613	336.204	338.979	340.913	341.204
20	318.116	320.381	326.666	328.834	333.008	337.646	338.279
25	303.882	306.827	312.427	319.784	327.303	332.856	333.759
30	287.434	290.648	299.118	309.030	320.105	327.683	329.415
35	267.913	272.342	283.424	297.067	311.476	320.721	322.812
40	246.585	256.008	266.694	284.007	301.566	314.027	316.740
45	223.359	230.614	248.658	270.139	291.528	306.326	309.472
50	198.190	207.758	229.178	256.138	281.217	298.358	301.938
55	172.885	183.569	210.151	241.285	270.859	289.761	293.828
60	155.669	159.582	190.510	227.464	259.811	281.163	285.674
65	118.525	135.347	172.474	213.664	249.319	272.364	276.810
70	91.006	111.790	154.818	200.201	238.692	262.223	267.636
75	64.527	90.904	139.053	187.633	227.397	252.932	258.374
80	39.448	75.602	125.068	175.379	216.277	242.073	247.339
85	17.894	57.368	112.728	164.223	205.158	230.767	237.854
90	3.796	46.800	102.256	153.111	193.975	219.305	226.465
95	4.519	40.260	93.382	142.984	182.675	207.952	214.588
100	6.868	36.843	87.271	133.418	171.781	195.929	202.444
105	9.670	35.666	79.643	124.255	160.615	183.660	189.947
110	12.472	36.209	74.913	115.517	149.942	171.817	177.228
115	15.228	37.634	71.533	107.945	139.228	159.526	165.262
120	17.939	40.100	69.326	102.363	129.093	147.592	152.808
125	20.786	42.906	67.681	95.196	119.858	136.105	140.931
130	23.407	44.648	66.623	90.222	111.002	125.359	129.719
135	25.982	45.531	65.855	85.562	103.154	115.015	118.816
140	28.332	46.730	65.854	81.574	97.206	105.948	108.934
145	30.592	48.381	65.741	78.437	90.017	97.731	100.336
150	32.625	48.426	63.713	75.927	84.881	90.948	92.846
155	34.207	48.788	57.405	71.514	80.687	84.858	86.198
160	38.770	50.259	55.244	63.424	75.063	80.465	81.013
165	47.627	52.770	57.295	58.831	64.164	73.548	74.764
170	55.264	55.916	59.093	59.302	57.298	63.100	68.161
175	60.731	60.646	61.254	61.070	59.537	52.363	58.057
180	29.232	29.232	29.232	29.232	29.232	29.232	29.232

Appendix A Product Photo



Picture 1

Picture 2

****End of test report****