

LM-79-08 Test Report

For

ESPEN TECHNOLOGY INC

12257 FLORENCE AVE SANTA FE SPRINGS, CA 90670 USA

LED Tube

Model Name(s):

L48T8/8XX/12P-ID DE RF

Representative (Tested) Model:

L48T8/850/12P-ID DE RF

Model Difference:

1. XX represents CCT, can be 30 for 3000K, 35 for 3500K, 40 for 4000K and 50 for 5000K;
2. All is the same construction, except CCT.

Prepare by:



Engineer: Alan Wang

Date: 2021-03-29

Review by:



Technical Lead: Vincent Yuan

Issue Date: 2021-04-29

Revised Date: N/A

Note:

1. The results contained in this report pertain only to the tested samples.
2. This report shall not be reproduced, no limited part or full, without approval of Dongguan New Testing Centre Co., Ltd
3. This report does not imply product certification, approval, or endorsement by NVLAP, or any agency of the Federal Government.

Client Information:

Applicant Name:	ESPEN TECHNOLOGY INC
Brand Name:	ESPEN

Product Information:

Model Number:	L48T8/850/12P-ID DE RF
Product Type:	4' T8 Lamp, Internal Driver/Line Voltage (UL Type B) Lamps
Rating Input:	100-277Vac, 50/60Hz, 12W
Declared CCT:	5000K
Declared Light Output:	1800 lm
Declared Beam Angle:	180°
LED Manufacturer:	Shenzhen JuFei Optoelectronics Co., Ltd.
LED Model:	2835 3V 0.5W WhiteSMD LED
LED Quantity:	120 pcs

Test Information:

Standard Lamp:	Total Spectral Radiant Flux Standard Lamp, trace to NIST. 1. D908S for Gonio 2. D215S for Integrating Sphere
Date of Receipt Samples:	2020-12-12
Quantity of Receipt Samples:	1 pc
Sample Number:	201212012-S1

Laboratory Information:

Test Laboratory:	Dongguan New Testing Centre Co., Ltd
Laboratory Address:	3F, No. 1 the 1 st North Industry Road, Songshan Lake Science & Technology Park, Dongguan, Guangdong, China
Laboratory Contact Name:	Neil Zhong
Laboratory Contact E-mail:	Neil_zhong@ntc-cert.com

Report Information:

Issued Date of Test Report:	2021-04-29
Revised Date of Test Report:	N/A
Test Report No.:	NTCLR21010190
Remark (If applicable):	N/A

Test Specification:	
Date of Test	2020-12-18
Test Item	1. Total Luminous Flux 2. Luminous Distribution Intensity 3. Luminous Efficacy 4. Correlated Color Temperature 5. Color Rendering Index 6. Chromaticity Coordinate 7. Fidelity Index 8. Gamut Index 9. Local Chroma Shift 10. THD and PF
Reference Standard	IES LM-79-2008 Electrical and Photometric Measurements of Solid-State Lighting Products ANSI C78.377-2017 Specifications for the Chromaticity of Solid State Lighting Products CIE 13.3-1995 Method of Measuring and Specifying Color Rendering Properties of Light Sources CIE 15-2004 Technical Report Colorimetry ANSI IES TM-30-18 IES Method for Evaluating Light Source Color Rendition ANSI C78.77-10-2014 Harmonic Emission Limits – Related Power Quality Requirements

Test Methods:
1. Photometric and Electrical Measurements – Light Distribution Method: Photometric parameters were measured using the goniophotometer and software. The ambient temperature shall be maintained at $25\text{ }^{\circ}\text{C} \pm 1^{\circ}\text{C}$, measured at a point not more than 1 m from the sample and at the same height as the sample. The sample was operated at required Voltage and Frequency. It was stabilized before measurement was made. Luminous Flux, Luminaire Efficacy and Zonal Lumen were calculated from the software taken at 1° vertical intervals and 15° horizontal intervals.
2. Photometric and Electrical Measurements – Integrating Sphere Method: Photometric parameters were measured using an integrating sphere, as spectroradiometer and software. The ambient temperature condition inside the sphere was measured at $25\text{ }^{\circ}\text{C} \pm 1^{\circ}\text{C}$. 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 sample was operated at require Voltage and Frequency. It was stabilized before measurement was made. Chromaticity Coordinates, Correlated Color Temperature and Color Rendering Index were calculated from the spectral radiant flux measurements taken at least 1 nm intervals over the rage of 380 to 780 nm.
3. THD and PF Measurements: The sample was tested according to the ANSI C82.77-10-2014, the sample was operated at requirement Voltage and Frequency, and was stabilized before measurement. The Total Harmonic Distortion was calculated from the Digital Power Meter.

Integrating Sphere Test Results:

Test Condition:

Test Ambient (°C)	Test Humidity (%)	Orientation	Stabilization Time (minute)	Test Time (minute)
25.4	41.0	Face Down	90	10

Electrical Data:

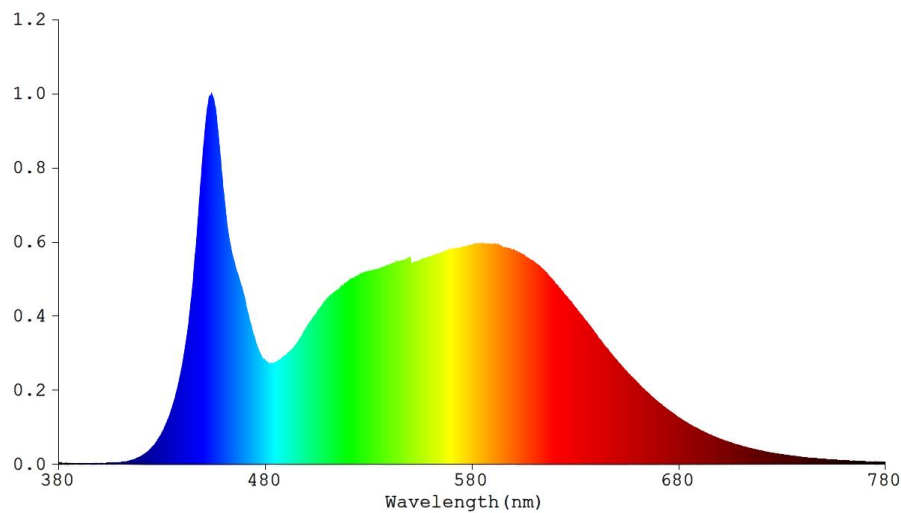
Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor
120.0	60	0.1017	11.90	0.9750

Color Data:

Parameter	Result
CCT(K)	4992
R _a	84.3
R _f	84
R _g	94
R _{cs, hl}	-12%
Chromaticity, (x, y)	(0.3460, 0.3598)
Chromaticity, (u', v')	(0.2089, 0.4888)
Duv	0.0037

Special Color Rendering			
R1	83	R9	13
R2	91	R10	78
R3	95	R11	80
R4	81	R12	56
R5	82	R13	85
R6	86	R14	98
R7	87	R15	77
R8	68	-	-

Spectrum Diagram:



IES TM-30-18 Color Rendition Result:

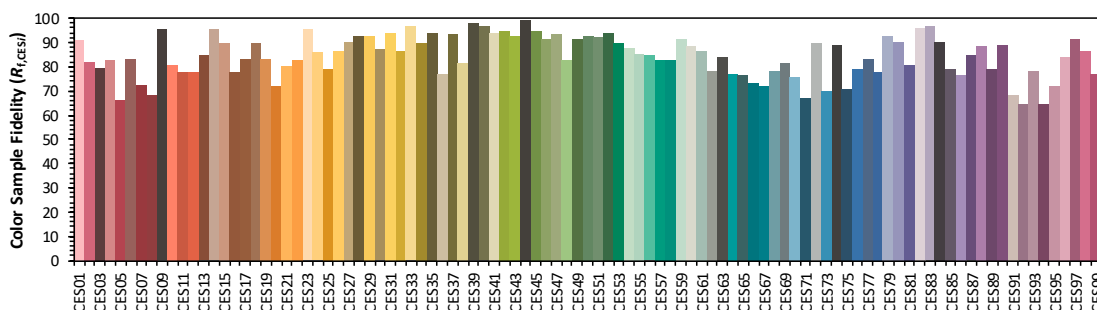
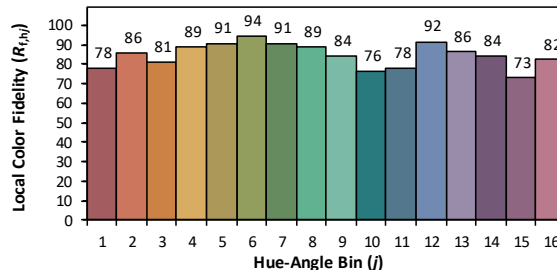
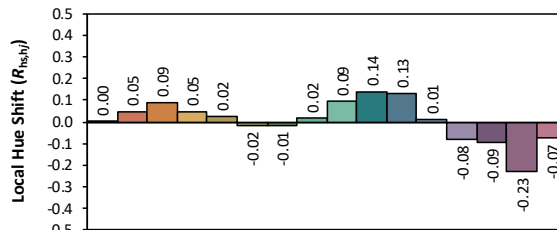
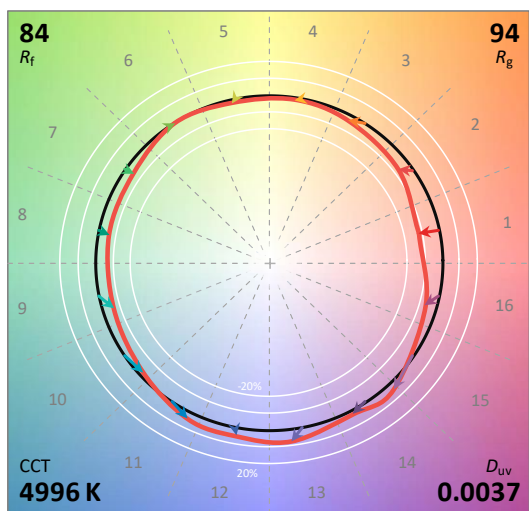
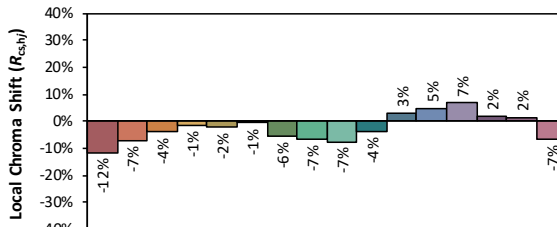
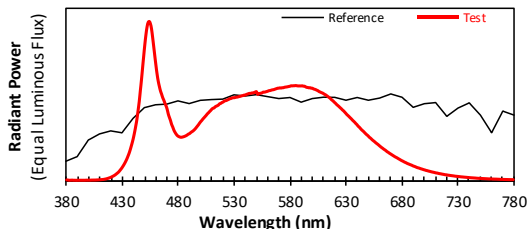
ANSI/IES TM-30-18 Color Rendition Report

Source: 1 CIE F1

Date: 2021/3/29

Manufacturer: ESPEN TECHNOLOGY INC

Model: L48T8/850/12P-ID DE RF



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

x 0.3459
 y 0.3597
 u' 0.2089
 v' 0.4887

CIE 13.3-1995
(CRI)
 R_a 84
 R_9 13

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

Spectrum Data:

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	0.0041	447	0.6334	514	0.4669	581	0.5948	648	0.2928	715	0.0426
381	0.0037	448	0.7089	515	0.4703	582	0.5944	649	0.2864	716	0.0410
382	0.0022	449	0.7830	516	0.4746	583	0.5951	650	0.2807	717	0.0397
383	0.0023	450	0.8548	517	0.4822	584	0.5952	651	0.2726	718	0.0384
384	0.0026	451	0.9160	518	0.4844	585	0.5963	652	0.2673	719	0.0368
385	0.0029	452	0.9650	519	0.4898	586	0.5954	653	0.2606	720	0.0362
386	0.0021	453	0.9929	520	0.4926	587	0.5942	654	0.2539	721	0.0349
387	0.0022	454	0.9984	521	0.4979	588	0.5940	655	0.2485	722	0.0337
388	0.0019	455	0.9840	522	0.5013	589	0.5941	656	0.2427	723	0.0328
389	0.0017	456	0.9517	523	0.5026	590	0.5938	657	0.2364	724	0.0317
390	0.0020	457	0.8972	524	0.5064	591	0.5947	658	0.2311	725	0.0308
391	0.0020	458	0.8385	525	0.5092	592	0.5924	659	0.2257	726	0.0299
392	0.0021	459	0.7781	526	0.5139	593	0.5922	660	0.2195	727	0.0289
393	0.0022	460	0.7199	527	0.5146	594	0.5884	661	0.2135	728	0.0277
394	0.0020	461	0.6668	528	0.5180	595	0.5851	662	0.2079	729	0.0270
395	0.0022	462	0.6235	529	0.5201	596	0.5843	663	0.2029	730	0.0262
396	0.0020	463	0.5916	530	0.5200	597	0.5821	664	0.1973	731	0.0255
397	0.0024	464	0.5629	531	0.5217	598	0.5829	665	0.1927	732	0.0247
398	0.0027	465	0.5428	532	0.5235	599	0.5797	666	0.1876	733	0.0237
399	0.0025	466	0.5205	533	0.5242	600	0.5797	667	0.1814	734	0.0231
400	0.0028	467	0.5046	534	0.5266	601	0.5756	668	0.1774	735	0.0225
401	0.0025	468	0.4854	535	0.5279	602	0.5732	669	0.1721	736	0.0217
402	0.0031	469	0.4686	536	0.5300	603	0.5710	670	0.1677	737	0.0211
403	0.0032	470	0.4478	537	0.5324	604	0.5672	671	0.1633	738	0.0205
404	0.0034	471	0.4179	538	0.5338	605	0.5643	672	0.1587	739	0.0198
405	0.0034	472	0.3965	539	0.5365	606	0.5589	673	0.1542	740	0.0191
406	0.0036	473	0.3766	540	0.5369	607	0.5560	674	0.1497	741	0.0185
407	0.0041	474	0.3524	541	0.5409	608	0.5524	675	0.1460	742	0.0179
408	0.0044	475	0.3362	542	0.5428	609	0.5498	676	0.1423	743	0.0174
409	0.0049	476	0.3172	543	0.5460	610	0.5458	677	0.1378	744	0.0170
410	0.0053	477	0.3034	544	0.5473	611	0.5413	678	0.1340	745	0.0164
411	0.0061	478	0.2923	545	0.5477	612	0.5376	679	0.1297	746	0.0160
412	0.0067	479	0.2834	546	0.5500	613	0.5323	680	0.1256	747	0.0152
413	0.0074	480	0.2779	547	0.5502	614	0.5272	681	0.1223	748	0.0147
414	0.0088	481	0.2746	548	0.5530	615	0.5217	682	0.1184	749	0.0142
415	0.0102	482	0.2722	549	0.5555	616	0.5164	683	0.1148	750	0.0140
416	0.0121	483	0.2723	550	0.5580	617	0.5089	684	0.1118	751	0.0134
417	0.0141	484	0.2739	551	0.5414	618	0.5033	685	0.1078	752	0.0130
418	0.0166	485	0.2759	552	0.5444	619	0.4970	686	0.1050	753	0.0127
419	0.0190	486	0.2788	553	0.5470	620	0.4900	687	0.1021	754	0.0123
420	0.0222	487	0.2821	554	0.5485	621	0.4836	688	0.0991	755	0.0119
421	0.0259	488	0.2865	555	0.5504	622	0.4760	689	0.0967	756	0.0115
422	0.0295	489	0.2917	556	0.5551	623	0.4703	690	0.0929	757	0.0112
423	0.0338	490	0.2947	557	0.5549	624	0.4639	691	0.0902	758	0.0106
424	0.0390	491	0.3008	558	0.5565	625	0.4571	692	0.0878	759	0.0106
425	0.0448	492	0.3060	559	0.5587	626	0.4508	693	0.0846	760	0.0102
426	0.0506	493	0.3105	560	0.5606	627	0.4435	694	0.0816	761	0.0100
427	0.0577	494	0.3169	561	0.5638	628	0.4376	695	0.0797	762	0.0097
428	0.0667	495	0.3238	562	0.5649	629	0.4300	696	0.0776	763	0.0094
429	0.0753	496	0.3323	563	0.5668	630	0.4222	697	0.0747	764	0.0092
430	0.0857	497	0.3413	564	0.5692	631	0.4141	698	0.0728	765	0.0091
431	0.0968	498	0.3502	565	0.5702	632	0.4079	699	0.0704	766	0.0087
432	0.1091	499	0.3604	566	0.5721	633	0.4010	700	0.0681	767	0.0084
433	0.1227	500	0.3696	567	0.5749	634	0.3939	701	0.0662	768	0.0081
434	0.1377	501	0.3774	568	0.5771	635	0.3871	702	0.0637	769	0.0076
435	0.1552	502	0.3864	569	0.5796	636	0.3793	703	0.0623	770	0.0076
436	0.1735	503	0.3941	570	0.5800	637	0.3726	704	0.0600	771	0.0072
437	0.1957	504	0.4020	571	0.5818	638	0.3659	705	0.0584	772	0.0071
438	0.2204	505	0.4099	572	0.5808	639	0.3578	706	0.0564	773	0.0069
439	0.2459	506	0.4188	573	0.5828	640	0.3511	707	0.0546	774	0.0067
440	0.2755	507	0.4254	574	0.5828	641	0.3419	708	0.0530	775	0.0065
441	0.3098	508	0.4332	575	0.5854	642	0.3357	709	0.0516	776	0.0063
442	0.3473	509	0.4401	576	0.5867	643	0.3280	710	0.0496	777	0.0062
443	0.3891	510	0.4482	577	0.5877	644	0.3199	711	0.0480	778	0.0060
444	0.4422	511	0.4537	578	0.5890	645	0.3136	712	0.0471	779	0.0059
445	0.4969	512	0.4559	579	0.5907	646	0.3074	713	0.0451	780	0.0059
446	0.5655	513	0.4629	580	0.5920	647	0.2999	714	0.0437	N/A	N/A

Goniophotometer Test Results:

Test Condition:

Test Ambient (°C)	Test Humidity (%)	Orientation	Stabilization Time (minute)	Test Time (minute)
25.1	52.2	Face Down	90	25

Electrical Data:

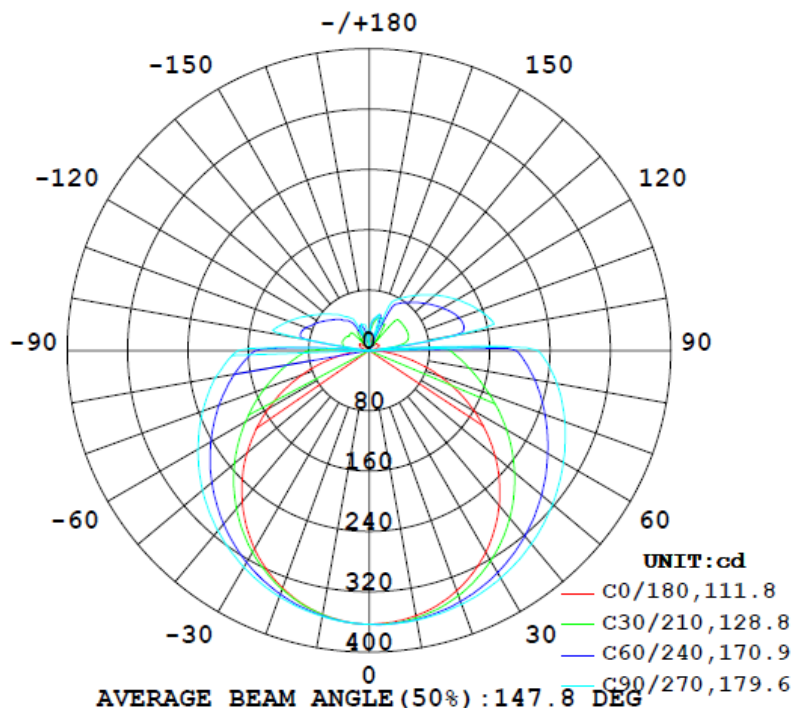
Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor
120.0	60	0.1017	11.90	0.9750

Goniophotometer Data:

Parameter	Results
Total Luminous (lm)	1809.3
Luminous Efficacy (lm/w)	152.04
Zonal Lumens Distribution (0-60°)	50.7%
Beam Angle (°)	179.6

Luminous Intensity Distribution Diagram:

LUMINOUS INTENSITY DISTRIBUTION DIAGRAM

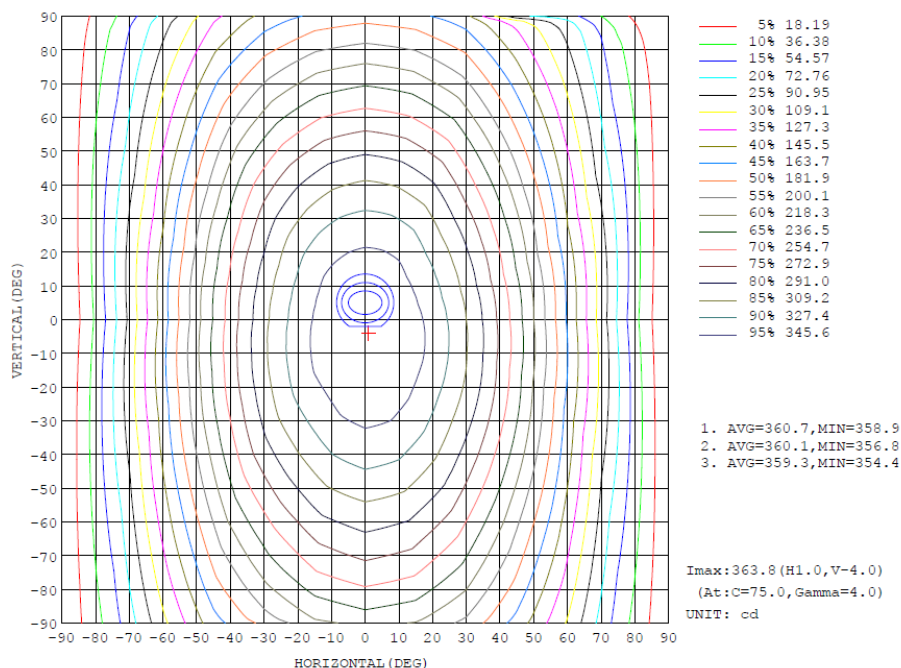


Zonal Flux Diagram:

ZONAL FLUX DIAGRAM:

γ	C0	C45	C90	C135	C180	C225	C270	C315	γ	zone	total	lum, lamp
10	357.1	361.0	362.8	359.9	355.4	356.7	357.9	356.6	0- 10	34.43	34.43	1.9,1.9
20	339.0	349.7	358.1	348.5	335.3	341.2	347.4	341.0	10- 20	99.69	134.1	7.41,7.41
30	309.2	330.5	348.6	329.2	303.8	318.0	331.8	317.6	20- 30	154.7	288.8	16,16
40	268.2	304.9	334.5	303.6	261.7	288.9	311.9	287.8	30- 40	194.3	483.1	26.7,26.7
50	218.3	275.3	317.3	273.8	211.3	255.4	288.4	253.9	40- 50	215.5	698.6	38.6,38.6
60	161.2	243.4	297.2	241.8	154.4	220.3	262.0	218.0	50- 60	218.1	916.7	50.7,50.7
70	100.3	212.2	276.2	210.8	94.75	185.0	234.7	182.1	60- 70	204.5	1121	62,62
80	42.30	184.1	252.7	182.7	39.03	152.6	206.9	149.5	70- 80	179.8	1301	71.9,71.9
90	0.7357	156.4	223.8	156.7	0.6492	122.8	173.6	76.01	80- 90	149.8	1451	80.2,80.2
100	4.030	86.55	116.9	74.15	3.646	62.20	93.92	65.86	90-100	53.45	1504	83.1,83.1
110	12.15	96.03	155.7	92.89	11.27	64.81	113.6	64.23	100-110	79.90	1584	87.6,87.6
120	15.18	89.10	134.9	87.86	13.88	57.88	92.40	55.08	110-120	71.02	1655	91.5,91.5
130	14.24	79.69	114.4	79.42	12.45	50.77	75.36	48.20	120-130	56.44	1712	94.6,94.6
140	9.249	70.95	95.53	71.22	6.369	41.30	62.08	40.06	130-140	43.17	1755	97,97
150	8.010	18.92	78.98	47.01	1.624	9.890	50.05	9.733	140-150	28.07	1783	98.5,98.5
160	11.31	47.73	6.616	49.38	0	33.05	14.78	35.06	150-160	14.82	1798	99.4,99.4
170	11.86	41.05	43.33	35.64	2.067	21.20	35.02	33.17	160-170	9.381	1807	99.9,99.9
180	0.0000	0.0000	0.0000	0	1.328	1.328	1.328	1.328	170-180	2.165	1809	100,100
DEG	LUMINOUS INTENSITY:cd									UNIT:lm		

Isocandela Diagram:



Luminous Distribution Intensity Data:

Table--1

UNIT: cd

C (DEG)	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270
y (DEG)	0	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363
5	361	362	363	363	364	364	364	363	363	362	362	361	361	361	361	361	361	361	361
10	357	359	360	361	362	363	363	362	361	360	359	357	355	355	355	357	357	358	358
15	350	352	354	356	359	361	361	360	357	355	352	349	347	346	348	350	351	353	354
20	339	342	346	350	354	357	358	356	351	348	343	339	335	335	337	341	344	346	347
25	326	329	335	341	348	353	354	351	345	339	332	325	321	321	324	331	335	338	340
30	309	314	322	331	340	347	349	345	337	329	318	309	304	304	309	318	325	330	332
35	290	296	307	319	331	340	342	337	327	317	303	291	284	285	292	304	313	319	322
40	268	276	290	305	321	332	334	329	316	304	286	271	262	264	274	289	300	308	312
45	244	253	272	291	310	323	326	320	305	289	267	248	238	241	254	273	286	296	301
50	218	229	252	275	299	313	317	310	293	274	247	224	211	217	233	255	272	284	288
55	190	204	231	259	286	303	308	300	280	258	227	199	183	190	211	238	257	270	275
60	161	177	210	243	273	292	297	289	268	242	206	173	154	164	189	220	242	257	262
65	131	150	190	227	261	281	287	278	255	226	185	147	125	138	168	202	227	243	248
70	100	124	170	212	248	270	276	266	242	211	166	121	94.7	112	147	185	212	228	235
75	70.0	98.6	151	198	236	258	265	255	230	197	147	96.3	65.6	87.6	128	169	196	215	221
80	42.3	76.3	135	184	223	246	253	243	217	183	131	74.6	39.0	66.3	111	153	182	199	207
85	18.7	59.0	120	171	209	232	239	229	204	169	117	57.6	16.5	49.0	95.2	138	167	184	191
90	0.74	46.5	107	156	195	217	224	214	187	157	104	45.3	0.65	32.5	77.7	123	151	168	174
95	0.79	4.28	24.0	82.3	4.03	40.3	5.03	3.15	30.9	76.1	19.2	5.44	1.10	4.31	23.6	2.10	3.66	3.93	1.70
100	4.03	12.5	41.7	86.5	114	116	117	125	117	74.1	39.4	12.1	3.65	9.10	34.2	62.2	84.3	85.8	93.9
105	8.38	22.5	52.9	96.3	130	156	165	152	125	90.5	48.6	20.9	7.52	13.7	36.7	68.2	93.5	115	124
110	12.2	26.4	55.6	96.0	127	147	156	145	123	92.9	52.1	25.3	11.3	15.1	37.4	64.8	88.9	106	114
115	14.4	29.1	56.5	93.2	121	138	145	136	117	91.1	53.2	28.2	13.3	15.8	36.6	61.8	81.9	95.7	103
120	15.2	31.1	56.6	89.1	113	128	135	127	110	87.9	53.5	29.8	13.9	16.7	35.7	57.9	75.6	87.5	92.4
125	13.9	20.0	56.5	84.5	105	119	125	117	103	83.9	53.4	20.6	15.1	11.0	32.8	54.1	69.3	79.8	83.4
130	14.2	35.5	56.5	79.7	97.4	110	114	108	95.6	79.4	53.7	32.2	12.5	18.6	33.5	50.8	63.5	72.7	75.4
135	11.8	35.4	56.3	75.3	90.2	101	105	99.6	88.9	75.3	53.6	34.1	9.24	23.2	33.7	45.5	58.6	65.8	68.1
140	9.25	33.8	43.5	71.0	83.5	92.2	95.5	91.6	82.5	71.2	39.1	36.5	6.37	25.6	14.1	41.3	51.9	59.9	62.1
145	7.88	32.2	12.0	66.6	77.2	84.3	87.0	83.9	76.6	67.1	12.0	29.9	2.40	23.4	14.2	38.6	48.5	54.3	54.9
150	8.81	39.2	39.8	18.9	71.0	77.0	79.0	76.8	70.9	47.0	42.4	37.3	1.62	24.8	29.8	9.89	40.2	48.6	50.0
155	10.0	40.3	44.7	30.7	22.2	64.0	70.6	63.3	16.1	7.19	37.2	37.7	0.00	25.1	30.9	29.9	21.8	21.4	36.0
160	11.3	39.3	45.4	47.7	41.0	13.2	6.62	13.9	41.2	49.4	44.6	35.4	0.00	17.1	27.6	33.1	35.6	27.1	14.8
165	12.1	35.3	43.8	45.0	47.7	49.6	49.2	51.1	49.8	48.3	41.2	33.5	2.28	6.33	20.1	29.0	32.6	36.7	36.0
170	11.9	29.1	38.3	41.1	43.5	43.9	43.3	41.9	38.7	35.6	30.9	25.1	2.07	3.80	10.8	21.2	24.5	27.8	35.0
175	17.5	24.5	28.0	31.9	35.9	38.3	38.2	30.4	25.7	26.3	29.2	26.6	2.21	2.37	2.82	7.59	16.4	19.6	20.7
180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	1.33	1.33	1.33	1.33	1.33	1.33

Table--2

UNIT: cd

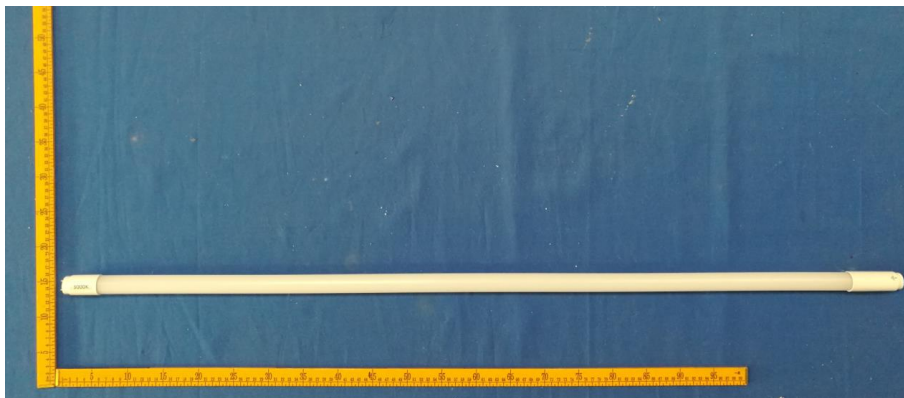
C (DEG)	285	300	315	330	345														
y (DEG)	0	363	363	363	363	363													
5	361	361	361	360	361														
10	358	358	357	356	356														
15	353	353	350	348	348														
20	347	346	341	338	337														
25	340	337	330	326	324														
30	331	327	318	311	307														
35	321	316	303	294	288														
40	310	303	288	276	267														
45	298	290	271	256	244														
50	285	275	254	235	220														
55	272	260	236	213	193														
60	258	245	218	190	166														
65	244	230	200	169	139														
70	230	214	182	148	113														
75	216	199	165	128	87.4														
80	201	184	150	110	65.4														
85	185	168	134	94.1	47.6														
90	169	152	116	63.6	23.0														
95	3.55	6.83	29.2	21.3	3.06														
100	94.5	88.7	65.9	31.5	11.7														
105	115	93.4	67.2	34.5	15.6														
110	106	89.2	64.2	32.9	16.0														
115	96.6	81.7	59.4	32.1	15.7														
120	87.4	75.1	55.1	31.4	14.0														
125	78.8	68.7	51.3	30.3	19.8														
130	71.7	62.9	48.2	29.7	22.9														
135	65.3	58.1	44.2	20.9	22.4														
140	59.4	51.9	40.1	6.51	22.8														
145	53.0	47.1	30.1	29.7	25.6														
150	48.5	41.4	9.73	32.4	25.0														
155	29.8	8.37	33.9	34.6	26.3														
160	17.5	30.4	35.1	35.1	24.7														
165	35.4	35.4	35.1	35.8	23.3														
170	34.8	34.9	33.2	26.8	10.8														
175	29.4	16.7	9.21	5.95	1.07														
180	1.33	1.33	1.33	1.33	1.33														

THD and PF Measurement Test Results:

Electrical Measurement:

Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor	iTHD (%)
277.0	60	0.0443	11.27	0.9180	16.98

Photo of Sample:



Equipment List:

Equipment ID	Equipment Name	Last Cal.	Due Cal.
NTC-F01-001	Goniophotometer System	2020-11-12	2021-11-11
NTC-F01-006	2.0 meter Integrating Sphere	2020-11-12	2021-11-11
NTC-F01-012	Standard Lamp	2020-11-12	2021-11-11
NTC-F01-013	Standard Lamp	2020-11-12	2021-11-11
NTC-F01-031	Digital Power Meter	2020-08-22	2021-08-21
NTC-F01-019	Temperature & Humidity Meter	2020-11-13	2021-11-12

*******End of Report*******