

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:

L48T8/835/12P-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.
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3. This report does not imply product certification, approval, or endorsement by NVLAP, or any agency of the Federal Government.

Laboratory: Dongguan New Testing Centre Co., Ltd

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Website: <http://www.ntc-cert.com>

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Client Information:

Applicant Name:	ESPEN TECHNOLOGY INC
Brand Name:	ESPEN

Product Information:

Model Number:	L48T8/835/12P-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:	3500K
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:	201212010-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.:	NTCLR21010188
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:

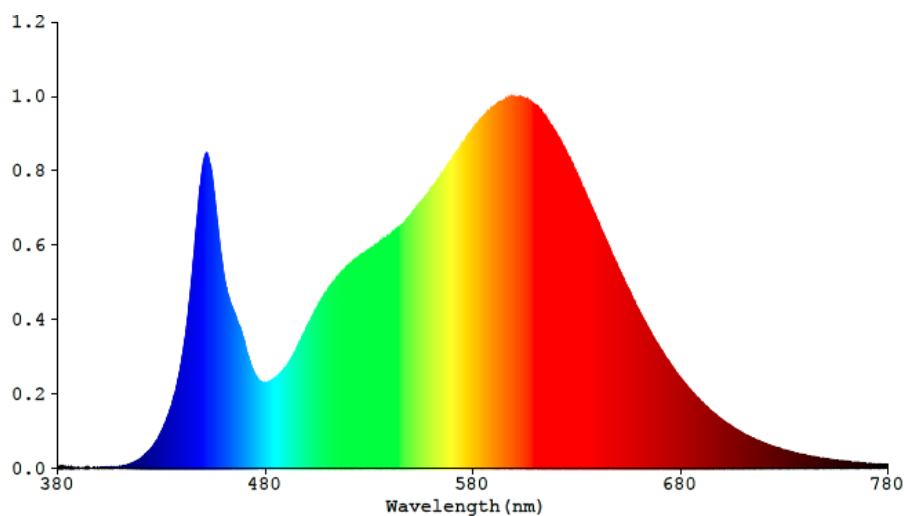
Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor
120.0	60	0.1045	12.22	0.9746

Color Data:

Parameter	Result
CCT(K)	3419
R _a	83.3
R _f	84
R _g	96
R _{cs, hl}	-12%
Chromaticity, (x, y)	(0.4083, 0.3888)
Chromaticity, (u', v')	(0.2385, 0.5109)
Duv	-0.0015

Special Color Rendering			
R1	82	R9	9
R2	91	R10	79
R3	96	R11	81
R4	81	R12	68
R5	82	R13	84
R6	88	R14	98
R7	84	R15	75
R8	62	-	-

Spectrum Diagram:



IES TM-30-18 Color Rendition Result:

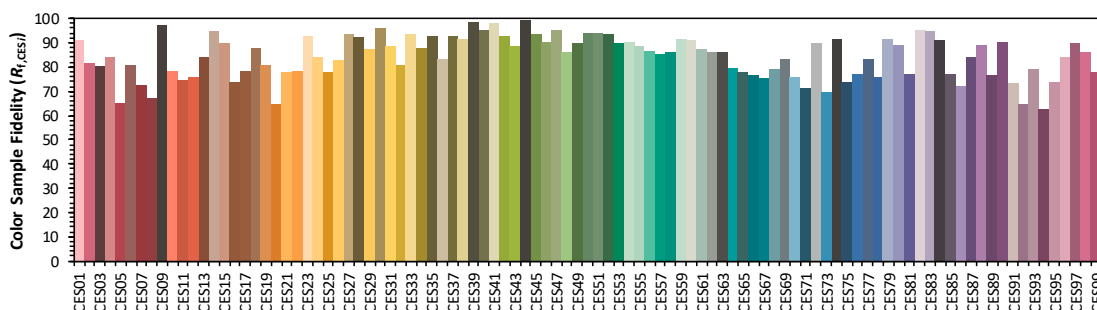
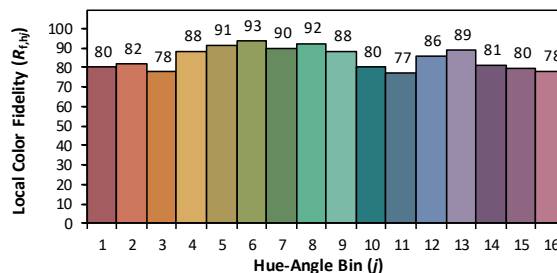
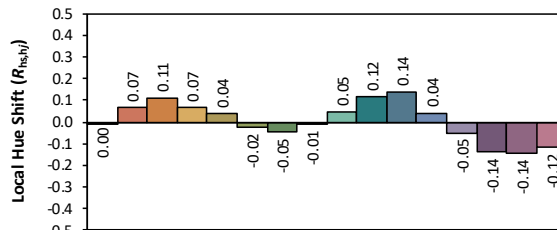
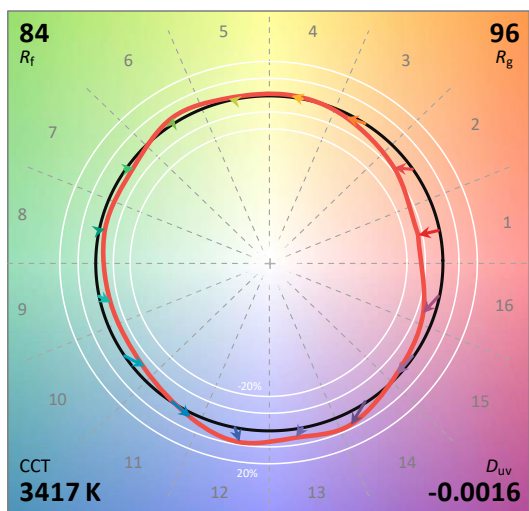
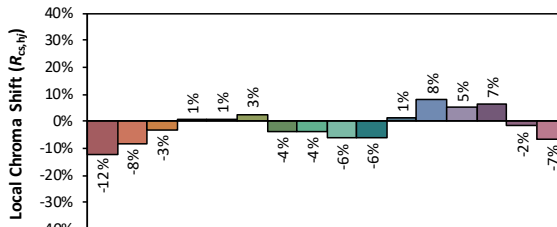
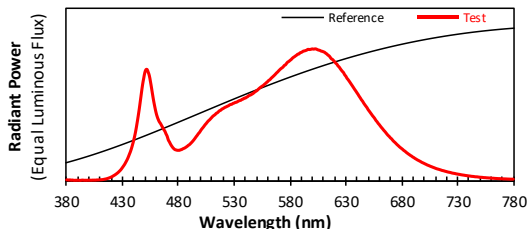
ANSI/IES TM-30-18 Color Rendition Report

Source: 1 CIE F1

Date: 2021/3/29

Manufacturer: ESPEN TECHNOLOGY INC

Model: L48T8/835/12P-ID DE RF



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

x 0.4083
 y 0.3886
 u' 0.2385
 v' 0.5108

CIE 13.3-1995
(CRI)

R_a 83
 R_9 9

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	0.0055	447	0.6685	514	0.5101	581	0.9176	648	0.5642	715	0.0810
381	0.0054	448	0.7284	515	0.5147	582	0.9266	649	0.5529	716	0.0777
382	0.0040	449	0.7762	516	0.5228	583	0.9339	650	0.5381	717	0.0758
383	0.0058	450	0.8198	517	0.5304	584	0.9393	651	0.5270	718	0.0736
384	0.0028	451	0.8409	518	0.5337	585	0.9457	652	0.5150	719	0.0710
385	0.0045	452	0.8426	519	0.5421	586	0.9516	653	0.5035	720	0.0688
386	0.0028	453	0.8220	520	0.5457	587	0.9588	654	0.4914	721	0.0664
387	0.0020	454	0.7966	521	0.5514	588	0.9601	655	0.4813	722	0.0641
388	0.0026	455	0.7524	522	0.5562	589	0.9688	656	0.4699	723	0.0627
389	0.0023	456	0.7022	523	0.5598	590	0.9717	657	0.4560	724	0.0607
390	0.0029	457	0.6489	524	0.5645	591	0.9762	658	0.4464	725	0.0580
391	0.0025	458	0.5997	525	0.5679	592	0.9818	659	0.4340	726	0.0563
392	0.0019	459	0.5563	526	0.5746	593	0.9834	660	0.4244	727	0.0549
393	0.0027	460	0.5171	527	0.5773	594	0.9863	661	0.4129	728	0.0534
394	0.0039	461	0.4868	528	0.5797	595	0.9893	662	0.4023	729	0.0511
395	0.0033	462	0.4636	529	0.5854	596	0.9950	663	0.3925	730	0.0497
396	0.0023	463	0.4454	530	0.5881	597	0.9941	664	0.3816	731	0.0480
397	0.0028	464	0.4333	531	0.5928	598	0.9944	665	0.3725	732	0.0468
398	0.0022	465	0.4175	532	0.5940	599	0.9963	666	0.3620	733	0.0449
399	0.0034	466	0.4022	533	0.5987	600	0.9986	667	0.3512	734	0.0435
400	0.0025	467	0.3865	534	0.6035	601	0.9970	668	0.3417	735	0.0421
401	0.0032	468	0.3740	535	0.6074	602	0.9981	669	0.3339	736	0.0410
402	0.0027	469	0.3535	536	0.6091	603	0.9988	670	0.3235	737	0.0393
403	0.0037	470	0.3367	537	0.6159	604	0.9957	671	0.3167	738	0.0382
404	0.0036	471	0.3087	538	0.6181	605	0.9914	672	0.3060	739	0.0369
405	0.0038	472	0.2940	539	0.6254	606	0.9892	673	0.2969	740	0.0355
406	0.0037	473	0.2769	540	0.6255	607	0.9864	674	0.2895	741	0.0348
407	0.0049	474	0.2630	541	0.6317	608	0.9817	675	0.2810	742	0.0334
408	0.0050	475	0.2511	542	0.6361	609	0.9801	676	0.2723	743	0.0322
409	0.0054	476	0.2420	543	0.6435	610	0.9764	677	0.2649	744	0.0317
410	0.0063	477	0.2352	544	0.6472	611	0.9729	678	0.2567	745	0.0304
411	0.0068	478	0.2325	545	0.6507	612	0.9658	679	0.2495	746	0.0290
412	0.0076	479	0.2301	546	0.6560	613	0.9602	680	0.2431	747	0.0288
413	0.0090	480	0.2299	547	0.6611	614	0.9515	681	0.2362	748	0.0282
414	0.0109	481	0.2299	548	0.6685	615	0.9461	682	0.2284	749	0.0267
415	0.0125	482	0.2336	549	0.6749	616	0.9357	683	0.2230	750	0.0258
416	0.0147	483	0.2357	550	0.6802	617	0.9240	684	0.2153	751	0.0251
417	0.0173	484	0.2409	551	0.6871	618	0.9193	685	0.2087	752	0.0247
418	0.0204	485	0.2444	552	0.6955	619	0.9104	686	0.2023	753	0.0235
419	0.0235	486	0.2487	553	0.7031	620	0.9016	687	0.1965	754	0.0226
420	0.0274	487	0.2545	554	0.7096	621	0.8902	688	0.1904	755	0.0225
421	0.0319	488	0.2603	555	0.7157	622	0.8830	689	0.1854	756	0.0213
422	0.0371	489	0.2677	556	0.7209	623	0.8698	690	0.1786	757	0.0209
423	0.0422	490	0.2730	557	0.7288	624	0.8619	691	0.1742	758	0.0202
424	0.0479	491	0.2816	558	0.7357	625	0.8493	692	0.1678	759	0.0197
425	0.0544	492	0.2903	559	0.7437	626	0.8378	693	0.1632	760	0.0193
426	0.0613	493	0.2998	560	0.7509	627	0.8274	694	0.1575	761	0.0183
427	0.0694	494	0.3103	561	0.7600	628	0.8184	695	0.1533	762	0.0181
428	0.0780	495	0.3215	562	0.7651	629	0.8020	696	0.1488	763	0.0172
429	0.0880	496	0.3335	563	0.7748	630	0.7921	697	0.1442	764	0.0165
430	0.0999	497	0.3442	564	0.7827	631	0.7767	698	0.1388	765	0.0161
431	0.1120	498	0.3567	565	0.7905	632	0.7663	699	0.1350	766	0.0155
432	0.1248	499	0.3658	566	0.7987	633	0.7544	700	0.1310	767	0.0150
433	0.1404	500	0.3792	567	0.8072	634	0.7421	701	0.1267	768	0.0150
434	0.1562	501	0.3912	568	0.8166	635	0.7292	702	0.1228	769	0.0143
435	0.1746	502	0.4012	569	0.8241	636	0.7168	703	0.1183	770	0.0137
436	0.1963	503	0.4123	570	0.8335	637	0.7037	704	0.1151	771	0.0134
437	0.2176	504	0.4238	571	0.8419	638	0.6909	705	0.1115	772	0.0130
438	0.2432	505	0.4333	572	0.8497	639	0.6788	706	0.1078	773	0.0129
439	0.2727	506	0.4443	573	0.8555	640	0.6658	707	0.1047	774	0.0123
440	0.3050	507	0.4537	574	0.8631	641	0.6533	708	0.1012	775	0.0119
441	0.3415	508	0.4609	575	0.8738	642	0.6390	709	0.0981	776	0.0116
442	0.3840	509	0.4702	576	0.8779	643	0.6269	710	0.0946	777	0.0113
443	0.4337	510	0.4795	577	0.8895	644	0.6130	711	0.0913	778	0.0108
444	0.4862	511	0.4886	578	0.8989	645	0.6025	712	0.0885	779	0.0112
445	0.5431	512	0.4948	579	0.9036	646	0.5881	713	0.0863	780	0.0112
446	0.6046	513	0.5012	580	0.9113	647	0.5758	714	0.0835	N/A	N/A

Goniophotometer Test Results:

Test Condition:

Test Ambient (°C)	Test Humidity (%)	Orientation	Stabilization Time (minute)	Test Time (minute)
24.7	52.5	Face Down	90	25

Electrical Data:

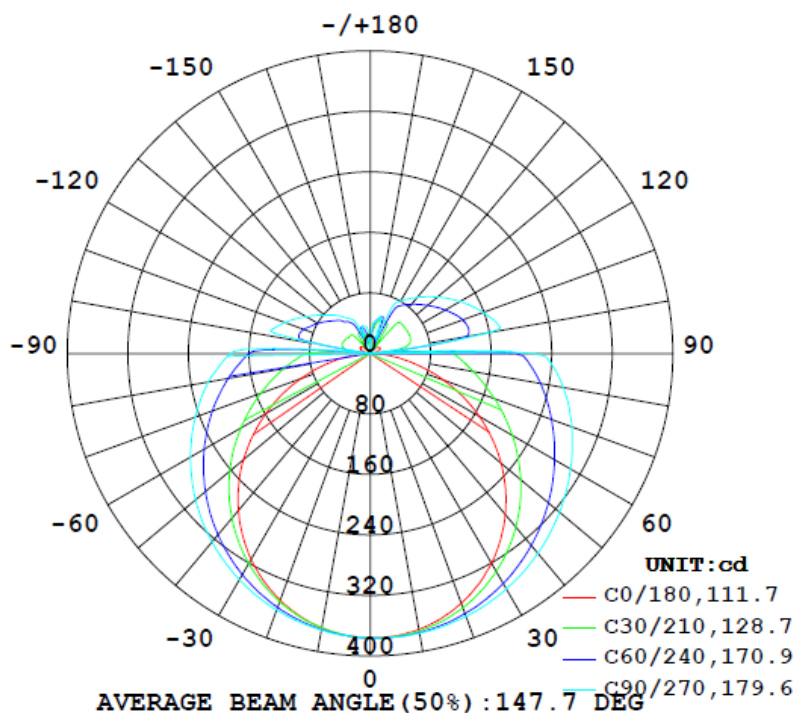
Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor
120.0	60	0.1045	12.22	0.9746

Goniophotometer Data:

Parameter	Results
Total Luminous (lm)	1873.4
Luminous Efficacy (lm/w)	153.31
Zonal Lumens Distribution (0-60°)	50.7%
Beam Angle (°)	179.6

Luminous Intensity Distribution Diagram:

LUMINOUS INTENSITY DISTRIBUTION DIAGRAM

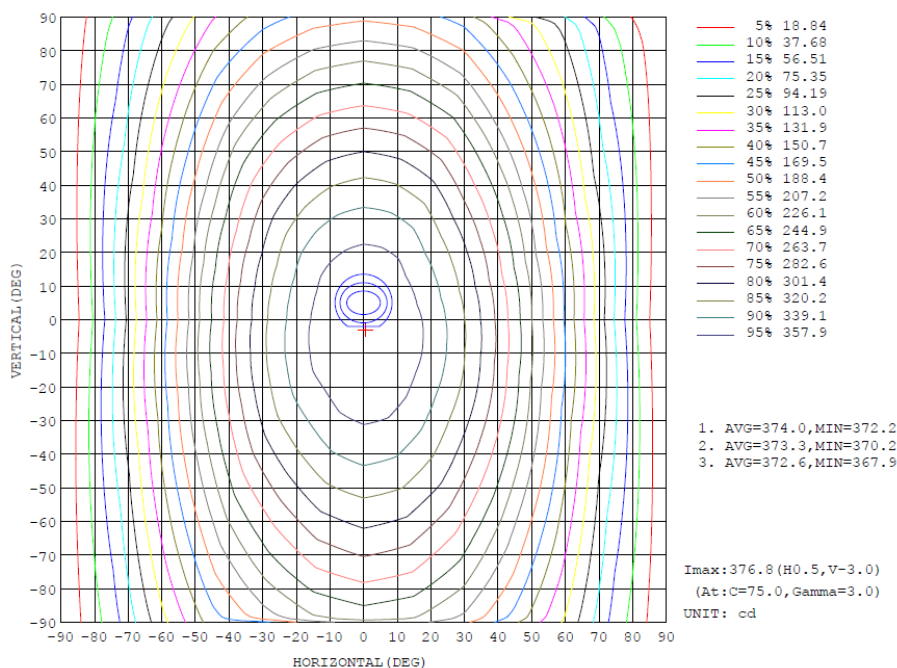


Zonal Flux Diagram:

ZONAL FLUX DIAGRAM:

γ	C0	C45	C90	C135	C180	C225	C270	C315	γ	zone	total	lum, lamp
10	370.5	373.6	375.6	372.5	368.3	369.9	371.4	369.5	0- 10	35.67	35.67	1.9,1.9
20	351.5	361.5	370.0	360.5	347.3	354.1	361.1	353.9	10- 20	103.3	139.0	7.42,7.42
30	320.4	341.3	359.5	340.0	314.6	330.6	345.5	329.9	20- 30	160.3	299.2	16,16
40	277.8	314.6	344.8	313.2	270.9	300.7	325.2	299.4	30- 40	201.3	500.5	26.7,26.7
50	226.0	283.7	326.6	282.2	218.5	266.4	301.2	264.5	40- 50	223.3	723.9	38.6,38.6
60	166.7	250.6	305.7	249.1	159.5	230.0	274.1	227.6	50- 60	226.0	949.9	50.7,50.7
70	103.6	218.3	283.7	216.9	97.69	193.5	245.8	190.5	60- 70	211.9	1162	62,62
80	43.52	189.0	259.2	187.6	40.09	160.0	217.2	156.7	70- 80	186.3	1348	72,72
90	0.7618	154.1	216.5	160.1	0.6722	129.7	184.3	106.9	80- 90	155.2	1503	80.2,80.2
100	4.067	92.57	160.2	80.27	3.833	60.74	46.24	67.13	90-100	55.46	1559	83.2,83.2
110	12.24	98.53	159.0	95.50	11.76	68.16	119.8	67.64	100-110	82.38	1641	87.6,87.6
120	15.10	90.94	137.5	89.77	14.49	61.13	97.61	58.26	110-120	73.45	1715	91.5,91.5
130	13.39	81.12	116.4	80.93	13.18	53.79	79.61	51.14	120-130	58.23	1773	94.6,94.6
140	7.232	71.95	97.05	72.29	8.207	45.65	65.62	44.06	130-140	44.56	1817	97,97
150	4.917	56.77	80.29	58.99	4.448	33.14	53.02	36.40	140-150	28.89	1846	98.6,98.6
160	4.913	49.06	72.34	52.07	2.998	35.30	44.29	36.13	150-160	15.17	1861	99.4,99.4
170	4.752	40.69	63.96	43.38	2.849	24.27	36.32	35.56	160-170	9.745	1871	99.9,99.9
180	0.0000	0.0000	0.0000	0	0.0000	0.0000	0.0000	0.0000	170-180	2.246	1873	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	376	376	376	376	376	376	376	376	376	376	376	376	376	376	376	376	376	376
5	375	376	376	376	376	377	377	376	375	375	375	374	374	374	374	374	374	374	374
10	370	372	373	374	375	376	376	375	373	373	371	370	368	368	368	370	370	371	371
15	363	365	367	369	371	373	374	372	369	367	364	362	360	359	360	363	365	366	367
20	351	354	358	362	366	369	370	368	363	360	355	351	347	347	349	354	357	360	361
25	337	341	347	352	359	364	365	362	356	351	343	337	332	333	336	343	348	352	354
30	320	325	333	341	351	358	359	356	347	340	329	320	315	315	321	331	338	343	345
35	300	306	317	329	342	350	353	348	337	327	313	301	294	296	303	316	326	333	336
40	278	285	300	315	331	342	345	339	326	313	295	280	271	274	284	301	313	322	325
45	253	262	280	300	320	332	336	330	314	298	275	257	246	250	264	284	299	309	314
50	226	237	260	284	307	322	327	319	302	282	255	232	219	225	242	266	284	296	301
55	197	210	238	267	295	312	316	308	289	266	234	206	189	198	220	248	269	283	288
60	167	183	217	251	281	300	306	297	275	249	212	179	159	170	197	230	253	268	274
65	135	155	195	234	268	289	295	286	262	233	191	151	129	143	175	211	238	254	260
70	104	127	175	218	255	277	284	274	249	217	171	124	97.7	116	154	194	222	239	246
75	72.1	101	155	203	242	265	272	262	236	202	152	99.1	67.6	91.2	134	176	206	225	232
80	43.5	78.4	139	189	229	252	259	249	223	188	135	76.7	40.1	69.2	116	160	191	209	217
85	19.2	60.6	123	175	215	238	245	235	209	174	120	59.2	16.9	51.3	99.8	144	175	194	201
90	0.76	47.5	110	154	193	213	216	200	165	160	107	46.4	0.67	36.5	84.4	130	160	178	184
95	0.81	3.39	15.3	83.9	4.93	26.2	3.69	3.03	45.8	77.3	22.3	4.84	1.16	4.56	29.3	3.98	25.3	29.0	27.6
100	4.07	13.3	45.2	92.6	130	152	160	155	124	80.3	41.2	12.8	3.83	9.17	34.8	60.7	62.7	48.6	46.2
105	8.42	23.2	54.6	99.5	134	160	169	157	129	94.1	50.3	21.5	7.90	14.2	38.2	71.0	97.4	120	131
110	12.2	26.8	56.8	98.5	130	151	159	148	126	95.5	53.2	25.8	11.8	15.7	39.3	68.2	93.5	111	120
115	14.4	29.4	57.5	95.3	123	141	148	139	120	93.4	54.1	28.5	13.8	16.4	38.6	65.0	86.1	101	109
120	15.1	31.2	57.5	90.9	115	131	137	129	112	89.8	54.2	29.6	14.5	17.6	37.8	61.1	79.8	92.3	97.6
125	14.2	19.1	57.3	86.0	107	121	127	120	105	85.6	54.0	20.0	15.5	11.2	35.1	57.2	73.2	84.2	88.2
130	13.4	16.5	57.4	81.1	99.1	112	116	110	97.4	80.9	54.3	32.2	13.2	18.9	35.5	53.8	67.1	76.8	79.6
135	10.6	35.2	57.1	76.6	91.7	102	106	101	90.5	76.7	54.2	34.2	10.5	24.8	35.6	48.4	62.0	69.5	71.9
140	7.23	34.7	34.0	72.0	84.9	93.8	97.1	93.1	84.0	72.3	28.4	38.4	8.21	28.0	16.9	45.6	55.4	63.3	65.6
145	4.69	36.6	9.74	67.2	78.5	85.7	88.4	85.3	77.9	68.2	9.40	33.6	4.58	25.9	11.5	42.2	51.5	57.4	57.9
150	4.92	39.5	44.9	9.68	71.6	78.3	80.3	78.1	71.2	29.0	43.9	37.7	4.45	28.2	30.9	13.1	45.6	51.6	53.0
155	4.85	40.4	47.7	42.5	14.5	48.0	66.2	46.7	9.86	14.8	43.0	37.6	3.67	29.3	31.4	25.0	25.0	33.9	44.3
160	4.91	38.7	46.4	49.1	51.1	29.3	12.3	30.5	51.1	52.1	45.1	34.3	3.00	21.7	30.6	35.3	36.1	17.4	14.3
165	4.99	32.9	44.7	45.8	48.2	50.1	49.6	51.3	51.1	48.2	39.4	32.6	3.46	8.09	25.7	31.8	35.5	39.1	37.8
170	4.75	23.8	37.0	40.7	43.7	44.5	44.0	41.4	36.3	33.4	29.9	22.9	2.85	5.00	16.8	24.3	26.7	31.5	36.3
175	7.51	19.9	25.8	28.4	31.9	35.9	37.6	25.5	25.0	29.6	28.9	22.3	2.45	2.80	6.50	16.4	23.6	23.1	25.8
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table--2

UNIT: cd

C (DEG)	285	300	315	330	345														
Y (DEG)	0	376	376	376	376														
5	375	374	374	374	374														
10	372	371	370	369	369														
15	367	366	363	362	361														
20	361	359	354	351	350														
25	353	351	343	338	336														
30	344	340	330	323	319														
35	334	329	315	306	299														
40	323	316	299	287	277														
45	311	302	282	266	254														
50	298	287	264	244	228														
55	284	272	246	222	201														
60	270	256	228	199	173														
65	255	240	209	176	145														
70	241	224	191	154	117														
75	226	208	173	134	91.1														
80	211	193	157	115	68.3														
85	195	177	141	98.7	49.9														
90	179	161	107	75.0	26.6														
95	177.7	161.4	107.3	75.0	26.6														
100	58.8	78.1	67.1	32.1	11.8														
105	120	97.2	70.2	36.0	16.3														
110	112	93.7	67.6	34.5	16.7														
115	102	86.3	62.8	33.8	16.2														
120	92.3	79.3	58.3	33.2	14.6														
125	83.4	72.6	54.3	31.6	20.2														
130	75.7	66.5	51.1	31.2	24.5														
135	68.8	61.4	47.7	24.6	24.2														
140	62.9	55.4	44.1	3.94	24.9														
145	55.6	50.9	35.4	28.5	28.8														
150	51.4	45.8	5.64	33.5	28.9														
155	37.7	12.7	31.4	35.9	31.3														
160	15.7	22.2	36.1	36.6	31.0														
165	37.1	36.9	36.2	37.0	32.4														
170	35.8	36.4	35.6	32.5	20.3														
175	34.6	30.5	15.7	10.8	5.47														
180	0.00	0.00	0.00	0.00	0.00														

THD and PF Measurement Test Results:

Electrical Measurement:

Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor	iTHD (%)
277.0	60	0.0454	11.55	0.9188	17.77

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*******