

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:

L48T8/840/12P-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:	L48T8/840/12P-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:	4000K
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:	201212011-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.:	NTCLR21010189
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 °C ± 1°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 °C ± 1°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:

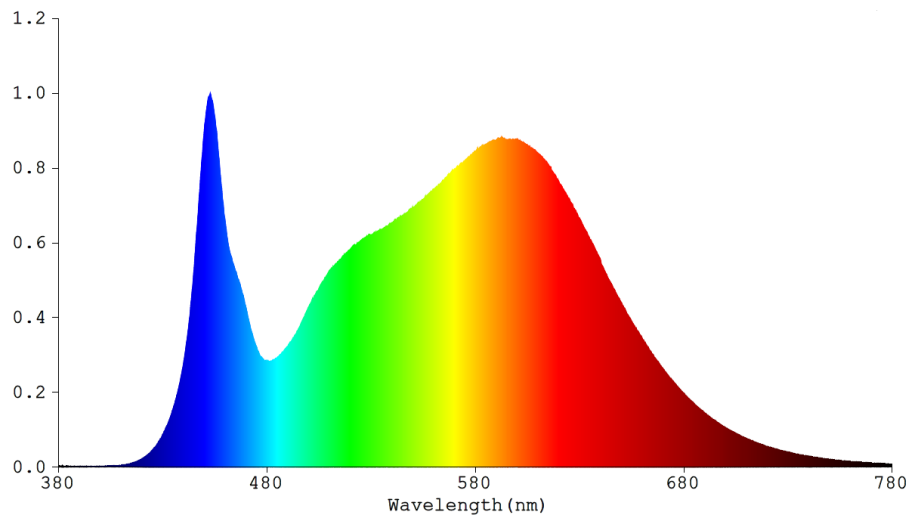
Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor
120.0	60	0.1031	12.06	0.9747

Color Data:

Parameter	Result
CCT(K)	3984
R _a	83.6
R _f	84
R _g	94
R _{cs, h1}	-12%
Chromaticity, (x, y)	(0.3824, 0.3819)
Chromaticity, (u', v')	(0.2244, 0.5041)
Duv	0.0018

Special Color Rendering			
R1	82	R9	8
R2	91	R10	78
R3	96	R11	81
R4	81	R12	61
R5	82	R13	84
R6	87	R14	98
R7	86	R15	75
R8	64	-	-

Spectrum Diagram:



IES TM-30-18 Color Rendition Result:

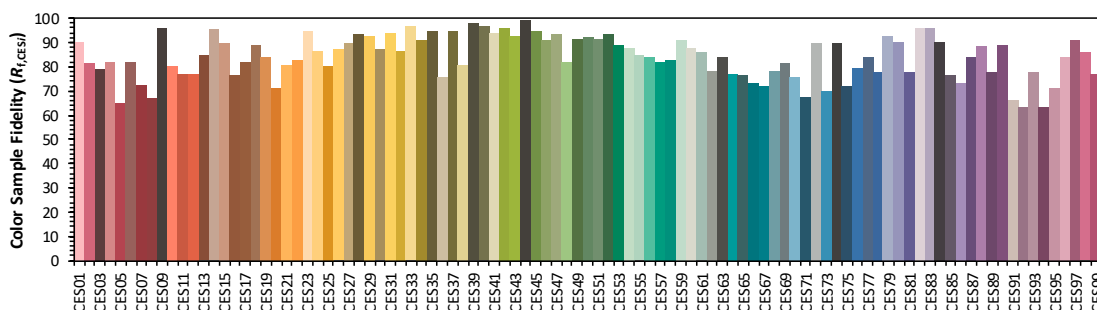
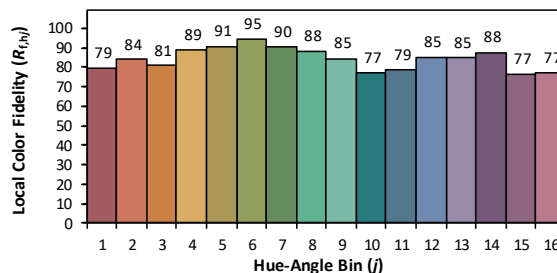
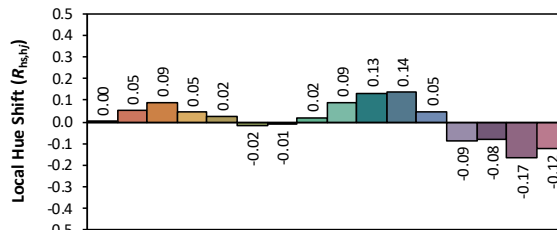
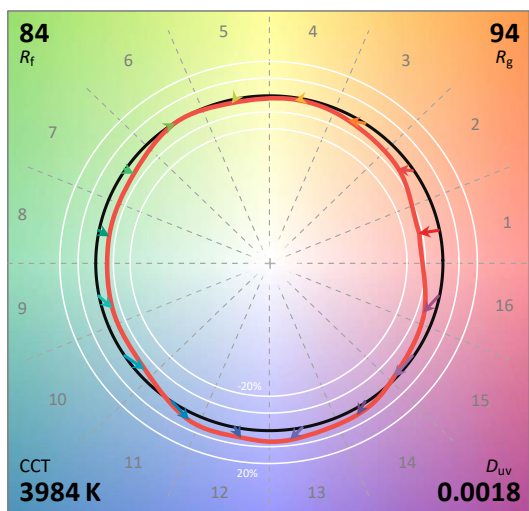
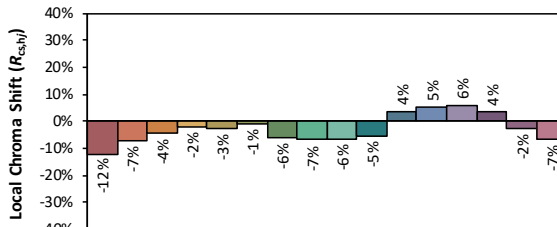
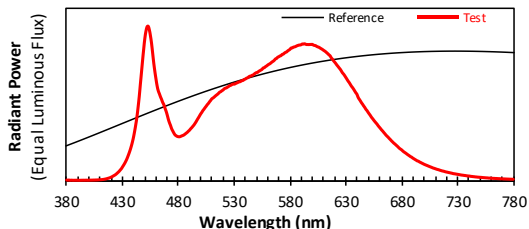
ANSI/IES TM-30-18 Color Rendition Report

Source: 1 CIE F1

Date: 2021/3/29

Manufacturer: ESPEN TECHNOLOGY INC

Model: L48T8/840/12P-ID DE RF



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

x 0.3824
 y 0.3818
 u' 0.2244
 v' 0.5041

CIE 13.3-1995
(CRI)

R_a 84
 R_9 8

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	0.0036	447	0.6979	514	0.5502	581	0.8543	648	0.4594	715	0.0653
381	0.0027	448	0.7759	515	0.5557	582	0.8547	649	0.4509	716	0.0630
382	0.0036	449	0.8494	516	0.5622	583	0.8596	650	0.4397	717	0.0613
383	0.0019	450	0.9167	517	0.5697	584	0.8614	651	0.4295	718	0.0596
384	0.0027	451	0.9625	518	0.5730	585	0.8639	652	0.4195	719	0.0573
385	0.0023	452	0.9910	519	0.5791	586	0.8678	653	0.4081	720	0.0555
386	0.0019	453	0.9947	520	0.5834	587	0.8705	654	0.3994	721	0.0541
387	0.0021	454	0.9727	521	0.5905	588	0.8729	655	0.3896	722	0.0522
388	0.0023	455	0.9342	522	0.5954	589	0.8738	656	0.3806	723	0.0508
389	0.0022	456	0.8851	523	0.5972	590	0.8755	657	0.3720	724	0.0490
390	0.0019	457	0.8211	524	0.6020	591	0.8803	658	0.3636	725	0.0476
391	0.0018	458	0.7568	525	0.6065	592	0.8795	659	0.3534	726	0.0453
392	0.0018	459	0.7020	526	0.6117	593	0.8815	660	0.3447	727	0.0442
393	0.0022	460	0.6540	527	0.6141	594	0.8789	661	0.3361	728	0.0431
394	0.0022	461	0.6100	528	0.6185	595	0.8766	662	0.3270	729	0.0417
395	0.0025	462	0.5789	529	0.6221	596	0.8770	663	0.3192	730	0.0405
396	0.0023	463	0.5602	530	0.6213	597	0.8763	664	0.3103	731	0.0393
397	0.0026	464	0.5400	531	0.6244	598	0.8774	665	0.3020	732	0.0379
398	0.0027	465	0.5232	532	0.6283	599	0.8769	666	0.2932	733	0.0366
399	0.0023	466	0.5035	533	0.6310	600	0.8778	667	0.2859	734	0.0353
400	0.0025	467	0.4897	534	0.6354	601	0.8732	668	0.2789	735	0.0346
401	0.0028	468	0.4676	535	0.6366	602	0.8710	669	0.2708	736	0.0333
402	0.0029	469	0.4480	536	0.6399	603	0.8692	670	0.2635	737	0.0326
403	0.0031	470	0.4242	537	0.6442	604	0.8645	671	0.2555	738	0.0313
404	0.0035	471	0.3965	538	0.6456	605	0.8614	672	0.2487	739	0.0302
405	0.0035	472	0.3737	539	0.6516	606	0.8588	673	0.2413	740	0.0295
406	0.0039	473	0.3555	540	0.6542	607	0.8541	674	0.2357	741	0.0288
407	0.0040	474	0.3343	541	0.6598	608	0.8497	675	0.2289	742	0.0272
408	0.0045	475	0.3201	542	0.6621	609	0.8454	676	0.2226	743	0.0267
409	0.0049	476	0.3063	543	0.6680	610	0.8400	677	0.2155	744	0.0256
410	0.0057	477	0.2951	544	0.6724	611	0.8354	678	0.2083	745	0.0250
411	0.0060	478	0.2893	545	0.6736	612	0.8300	679	0.2030	746	0.0238
412	0.0068	479	0.2849	546	0.6782	613	0.8234	680	0.1980	747	0.0233
413	0.0078	480	0.2830	547	0.6804	614	0.8170	681	0.1911	748	0.0223
414	0.0091	481	0.2824	548	0.6867	615	0.8097	682	0.1851	749	0.0218
415	0.0106	482	0.2845	549	0.6920	616	0.8035	683	0.1803	750	0.0212
416	0.0125	483	0.2879	550	0.6958	617	0.7908	684	0.1752	751	0.0208
417	0.0146	484	0.2906	551	0.6978	618	0.7831	685	0.1696	752	0.0201
418	0.0168	485	0.2942	552	0.7040	619	0.7722	686	0.1645	753	0.0193
419	0.0193	486	0.2995	553	0.7081	620	0.7637	687	0.1596	754	0.0188
420	0.0227	487	0.3054	554	0.7126	621	0.7547	688	0.1544	755	0.0181
421	0.0265	488	0.3110	555	0.7169	622	0.7446	689	0.1508	756	0.0176
422	0.0308	489	0.3183	556	0.7256	623	0.7359	690	0.1450	757	0.0172
423	0.0350	490	0.3248	557	0.7276	624	0.7264	691	0.1407	758	0.0162
424	0.0399	491	0.3337	558	0.7339	625	0.7176	692	0.1360	759	0.0160
425	0.0462	492	0.3410	559	0.7384	626	0.7063	693	0.1318	760	0.0153
426	0.0530	493	0.3498	560	0.7442	627	0.6946	694	0.1271	761	0.0151
427	0.0598	494	0.3585	561	0.7492	628	0.6865	695	0.1250	762	0.0144
428	0.0686	495	0.3692	562	0.7530	629	0.6761	696	0.1202	763	0.0142
429	0.0767	496	0.3804	563	0.7588	630	0.6648	697	0.1168	764	0.0136
430	0.0883	497	0.3932	564	0.7648	631	0.6536	698	0.1129	765	0.0135
431	0.0996	498	0.4049	565	0.7694	632	0.6418	699	0.1094	766	0.0129
432	0.1118	499	0.4170	566	0.7757	633	0.6321	700	0.1056	767	0.0125
433	0.1256	500	0.4293	567	0.7840	634	0.6206	701	0.1025	768	0.0123
434	0.1411	501	0.4394	568	0.7872	635	0.6088	702	0.0995	769	0.0116
435	0.1595	502	0.4512	569	0.7950	636	0.5997	703	0.0966	770	0.0114
436	0.1789	503	0.4603	570	0.7981	637	0.5890	704	0.0935	771	0.0110
437	0.2004	504	0.4706	571	0.8032	638	0.5774	705	0.0905	772	0.0107
438	0.2249	505	0.4798	572	0.8053	639	0.5656	706	0.0877	773	0.0104
439	0.2525	506	0.4900	573	0.8131	640	0.5559	707	0.0849	774	0.0100
440	0.2848	507	0.4979	574	0.8148	641	0.5370	708	0.0816	775	0.0097
441	0.3236	508	0.5083	575	0.8214	642	0.5249	709	0.0793	776	0.0095
442	0.3655	509	0.5171	576	0.8262	643	0.5142	710	0.0770	777	0.0091
443	0.4145	510	0.5271	577	0.8292	644	0.5022	711	0.0743	778	0.0090
444	0.4753	511	0.5318	578	0.8359	645	0.4924	712	0.0720	779	0.0087
445	0.5426	512	0.5376	579	0.8408	646	0.4812	713	0.0702	780	0.0087
446	0.6211	513	0.5441	580	0.8458	647	0.4713	714	0.0676	N/A	N/A

Goniophotometer Test Results:

Test Condition:

Test Ambient (°C)	Test Humidity (%)	Orientation	Stabilization Time (minute)	Test Time (minute)
25.2	52.3	Face Down	90	25

Electrical Data:

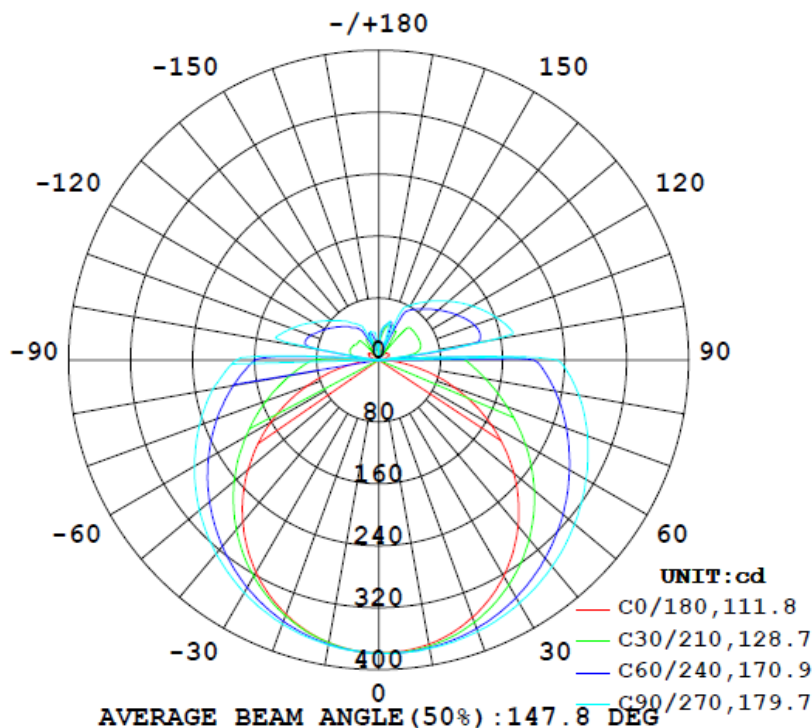
Voltage (V)	Frequency (Hz)	Current (A)	Wattage (W)	Power Factor
120.0	60	0.1031	12.06	0.9747

Goniophotometer Data:

Parameter	Results
Total Luminous (lm)	1886.8
Luminous Efficacy (lm/w)	156.45
Zonal Lumens Distribution (0-60°)	50.7%
Beam Angle (°)	179.7

Luminous Intensity Distribution Diagram:

LUMINOUS INTENSITY DISTRIBUTION DIAGRAM

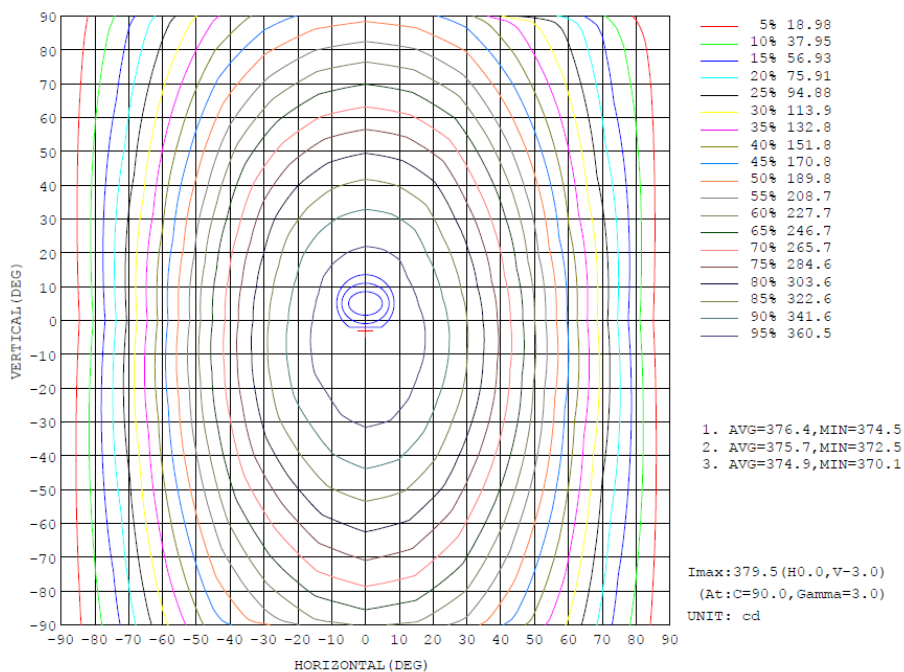


Zonal Flux Diagram:

ZONAL FLUX DIAGRAM:

γ	C0	C45	C90	C135	C180	C225	C270	C315	γ	zone	total	%lum, lamp
10	372.8	376.4	378.3	375.2	370.8	372.3	373.7	372.0	0- 10	35.91	35.91	1.9,1.9
20	353.7	364.4	373.1	363.2	349.7	356.2	363.0	356.0	10- 20	104.0	139.9	7.42,7.42
30	322.6	344.2	362.8	342.9	316.8	332.3	347.0	331.7	20- 30	161.4	301.3	16,16
40	279.7	317.4	347.9	316.0	272.9	302.1	326.4	300.9	30- 40	202.7	503.9	26.7,26.7
50	227.7	286.4	330.0	284.9	220.2	267.3	302.1	265.6	40- 50	224.8	728.8	38.6,38.6
60	168.0	253.1	308.9	251.5	160.8	230.7	274.6	228.3	50- 60	227.5	956.3	50.7,50.7
70	104.5	220.6	286.8	219.1	98.60	193.9	246.2	190.9	60- 70	213.3	1170	62,62
80	43.97	191.2	262.3	189.8	40.54	160.2	217.4	156.9	70- 80	187.6	1357	71.9,71.9
90	0.7671	159.4	230.9	162.4	0.6770	129.4	183.6	93.44	80- 90	156.3	1514	80.2,80.2
100	4.149	91.87	146.0	79.10	3.831	63.22	71.31	68.24	90-100	55.58	1569	83.2,83.2
110	12.50	99.70	161.2	96.54	11.80	68.10	119.5	67.57	100-110	83.36	1652	87.6,87.6
120	15.52	92.25	139.5	91.03	14.53	60.96	97.32	58.06	110-120	74.02	1726	91.5,91.5
130	14.17	82.39	118.2	82.17	13.13	53.56	79.38	50.89	120-130	58.75	1785	94.6,94.6
140	8.463	73.23	98.68	73.54	7.453	44.61	65.41	43.05	130-140	44.95	1830	97,97
150	7.070	13.86	81.58	39.61	3.086	11.10	52.79	7.819	140-150	29.18	1859	98.5,98.5
160	8.374	49.81	4.419	52.19	1.221	35.01	12.76	36.46	150-160	15.34	1875	99.4,99.4
170	8.542	41.91	44.70	35.39	2.512	23.52	36.55	35.29	160-170	9.821	1885	99.9,99.9
180	0.0000	0.0000	0.0000	0	0.0000	0.0000	0.0000	0.0000	170-180	2.263	1887	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
γ (DEG)	0	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379	379
5	377	378	379	379	379	379	379	379	378	378	377	377	376	376	376	377	377	377	377
10	373	374	375	376	378	378	378	377	376	375	373	372	371	370	371	372	373	373	374
15	365	367	369	372	374	376	377	375	372	370	367	364	362	361	363	365	367	368	369
20	354	357	361	364	369	372	373	371	366	363	358	353	350	349	352	356	359	362	363
25	340	344	349	355	362	367	369	365	359	354	346	339	335	335	338	345	350	354	356
30	323	327	336	344	354	361	363	359	350	343	332	323	317	317	323	332	339	345	347
35	302	309	320	332	345	354	356	351	340	330	315	304	296	298	305	318	327	334	337
40	280	287	302	317	334	345	348	342	329	316	297	282	273	276	286	302	314	323	326
45	255	264	283	302	323	336	339	333	317	301	278	259	248	252	265	285	300	310	315
50	228	239	262	286	310	326	330	322	305	285	257	234	220	226	243	267	285	297	302
55	198	212	241	270	298	315	320	312	292	268	236	207	191	199	221	249	270	283	288
60	168	184	219	253	284	304	309	300	278	252	214	180	161	171	198	231	254	269	275
65	136	156	197	236	271	292	298	289	265	235	193	153	130	144	176	212	238	254	260
70	104	129	177	221	258	280	287	277	252	219	172	126	98.6	117	154	194	222	240	246
75	72.8	102	157	206	245	268	275	265	239	204	153	100	68.2	91.6	134	177	206	225	232
80	44.0	79.2	140	191	231	255	262	252	226	190	136	77.5	40.5	69.4	116	160	191	209	217
85	19.4	61.3	125	177	217	241	248	238	211	176	121	59.9	17.1	51.4	99.9	144	175	194	200
90	0.77	48.2	111	159	200	224	231	219	186	162	108	47.0	0.68	35.3	83.1	129	159	178	184
95	0.82	3.93	19.6	85.2	4.02	34.2	4.08	1.96	39.2	78.6	21.2	5.27	1.16	4.55	26.8	2.54	11.5	12.4	6.87
100	4.15	13.2	44.5	91.9	128	140	146	147	124	79.1	41.3	12.7	3.83	9.36	35.4	63.2	78.7	69.5	71.3
105	8.61	23.4	55.1	100	135	162	172	158	130	94.6	50.7	21.7	7.90	14.3	38.4	71.4	97.8	120	131
110	12.5	27.2	57.6	99.7	132	153	161	150	128	96.5	54.0	26.2	11.8	15.8	39.3	68.1	93.5	111	120
115	14.7	29.9	58.4	96.6	125	143	150	141	122	94.5	55.0	29.0	13.9	16.5	38.5	65.0	86.0	101	108
120	15.5	32.0	58.5	92.3	117	133	140	131	114	91.0	55.2	30.5	14.5	17.6	37.6	61.0	79.6	92.1	97.3
125	14.4	20.0	58.3	87.3	109	123	129	121	106	86.9	55.0	20.8	15.7	11.4	34.8	57.0	73.0	84.0	87.9
130	14.2	37.0	58.4	82.4	101	113	118	112	98.9	82.2	55.3	33.0	13.1	19.2	35.3	53.6	66.8	76.6	79.4
135	11.5	36.1	58.1	77.8	93.2	104	108	103	91.9	77.8	55.3	35.0	10.1	24.6	35.5	48.1	61.8	69.3	71.7
140	8.46	35.0	40.1	73.2	86.3	95.3	98.7	94.6	85.3	73.5	34.7	38.3	7.45	27.5	15.8	44.6	54.8	63.1	65.4
145	6.47	35.2	10.9	68.6	79.8	87.1	89.9	86.7	79.2	69.3	10.8	32.5	3.55	25.3	13.2	41.4	51.3	57.2	57.7
150	7.07	40.4	43.2	13.9	73.1	79.5	81.6	79.3	73.0	39.6	43.8	38.4	3.09	27.1	31.1	11.1	44.2	51.3	52.8
155	7.66	41.4	47.6	37.4	18.8	59.6	71.7	58.4	13.2	10.4	41.3	38.6	1.81	27.9	32.0	28.6	23.8	28.2	40.9
160	8.37	40.0	47.0	49.8	48.8	21.3	4.42	22.1	48.9	52.2	46.0	35.8	1.22	19.8	29.9	35.0	37.1	22.4	12.8
165	8.80	35.0	45.4	46.5	49.1	51.1	50.6	52.5	51.8	49.6	41.3	33.9	2.93	7.34	23.4	31.2	35.0	38.9	37.8
170	8.54	27.2	38.8	41.9	44.8	45.3	44.7	42.5	38.4	35.4	31.0	24.8	2.51	4.37	14.1	23.5	26.0	30.4	36.5
175	13.4	23.2	27.6	30.8	35.1	38.5	39.5	28.6	25.6	28.6	30.2	25.5	2.39	2.56	4.35	12.0	20.8	22.2	24.0
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														
γ (DEG)	0	379	379	379	379														
5	377	377	377	376	376														
10	374	374	372	371	371														
15	369	368	365	364	363														
20	363	361	356	353	352														
25	355	352	345	340	338														
30	346	342	332	325	321														
35	336	330	317	307	301														
40	324	317	301	288	279														
45	312	303	284	268	255														
50	299	288	266	245	230														
55	285	273	247	223	202														
60	271	257	228	199	174														
65	256	241	209	177	145														
70	241	225	191	155	118														
75	226	208	174	134	91.4														
80	211	193	157	116	68.5														
85	195	177	141	98.8	49.9														
90	178	161	93.4	70.9	25.4														
95	11.6	12.4	22.3	20.9	2.94														
100	80.4	87.7	68.2	32.6	12.1														
105	121	97.7	70.4	36.1	16.4														
110	112	93.7	67.6	34.5	16.7														
115	102	86.0	62.6	33.8	16.4														
120	92.1	79.1	58.1	33.1	14.6														
125	83.1	72.4	54.1	31.7	20.5														
130	75.5	66.2	50.9	31.2	24.3														
135	68.7	61.2	47.2	23.3	23.8														
140	62.7	54.9	43.1	5.34	24.4														
145	55.6	50.3	33.6	30.0	27.9														
150	51.2	44.7	7.82	33.8	27.6														
155	34.3	9.85	33.8	36.2	29.5														
160	15.9	27.4	36.5	36.7	28.5														
165	37.1	37.0	36.6	37.3	28.5														
170	36.1	36.6	35.3	30.6	15.9														
175	33.6	24.9	12.4	8.49	3.07														
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	0.0452	11.48	0.9179	17.54

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*******