Test Report

Report No.: EED35H000061

Customer : **ESPEN TECHNOLOGY INC.**
Address : **12257 FLORENCE AVE, SANTA FE SPRINGS CA 90670**

Description of the submitted sample(s):

Sample Name	: LED T8 Tube Series
Model/Type	: L48T8/830/14G-ID
Brand	: ESPEN
LED Package Model/Type	: 2T03X5WW11000003
Ratings	: 120-277V AC, 50/60Hz, 16.5W, 3000K
Test Item	: Total Luminous Flux, Luminous Efficacy, Zonal Lumen Density, Luminous Intensity Distribution, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, In-Situ Temperature Measurement Test, LED Drive Current, THD, Electrical Parameters
State of Sample(s)	: Normal
Sample Quantity	: 2 pcs
Manufacturer	: ESPEN TECHNOLOGY INC.
LED Package Manufacturer	: Edison Opto Corporation

Sample Received Date	: Dec. 09, 2014
Sample Tested Date	: Dec. 12, 2014 to Dec. 20, 2014
Test Requested	: All test items were measured according to

1) IES LM-79-08 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
2) UL 1598:2008 (Secs. 19.7, 19.10-16) Temperature Measurement
3) ANSI C82.77:2002 Harmonic Emission Limits – Related Power Quality Requirements for Lighting Equipment

The test data of this report is derived from the report of No. EASZG12090039-1.

Tested by heqingbo
Tester

Reviewed by Kaiser Lee
Engineer

Approved by
Supervisor

Date Feb. 05, 2014

Check No.: 1702084078

CENTRE TESTING INTERNATIONAL CORPORATION
NO.1996, Xin jin qiao Road, Pudong New District, Shanghai, 201206, China

Test Report

Equipment list:

Test Equipment	Equipment Model	Equipment No.	Calibration Date	Calibration Due Date
Goniophotometer	GO-R5000	ATTEELSH00105	---	---
Standard Lamp	D908	ATTEELSH00106	Jul. 25, 2014	Jul. 24, 2015
Digital Power Meter	WT210	BTTEELSZ10093	Jul. 31, 2014	Jul. 30, 2015
Spectroradiometer	HAAS-2000	TTF20120376	---	---
Integrating Sphere	2.0m	ATTEELSH00007	---	---
Standard Lamp	D204	TTE20141711	Aug. 11, 2014	Aug. 10, 2015
Digital Power Meter	PF2010	ATTEELSH00011	Jun. 23, 2014	Jun. 22, 2015
Digital Recorder	34970A	ATTEELSH00019	Jun. 27, 2014	Jun. 26, 2015
Multimeter	FLUKE189	ATTEELSH00042	Jun. 23, 2014	Jun. 22, 2015
Digital Power Meter	PF2010A	ATTEELSH00107	Jun. 23, 2014	Jun. 22, 2015

1 Test Condition

Ambient Condition : 25.3℃
Photometric Method : Sphere-spectroradiometer, Goniophotometer
Colorimetric Method : Sphere-spectroradiometer
Tested : 120/277V AC, 60Hz
Stabilization Time : 1 hour and 15 minutes
Total Operation Time including Stabilization : 2 hours and 40 minutes

2 Test Method

2.1 Requirements of Ambient Condition

The ambient temperature in which measurements are being taken shall be maintained at 25℃ ± 1℃, measured at a point not more than 1 m from the SSL product and at the same height as the SSL product. Air flow around the SSL product being tested should be such that normal convective air flow induced by device under test is not affected.

2.2 Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning. Therefore, no seasoning was performed.

2.3 Stabilization of SSL Product

Before measurements are taken, the SSL product under test shall be operated long enough to reach stabilization and temperature equilibrium. The time required for stabilization depends on the type of SSL products under test. The stabilization time typically ranges from 30 minutes to 2 or more hours for SSL product. It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 minutes, taken 15 minutes apart, is less than 0.5%.

2.4 Photometric and Electrical Measurements –Sphere-spectroradiometer Method

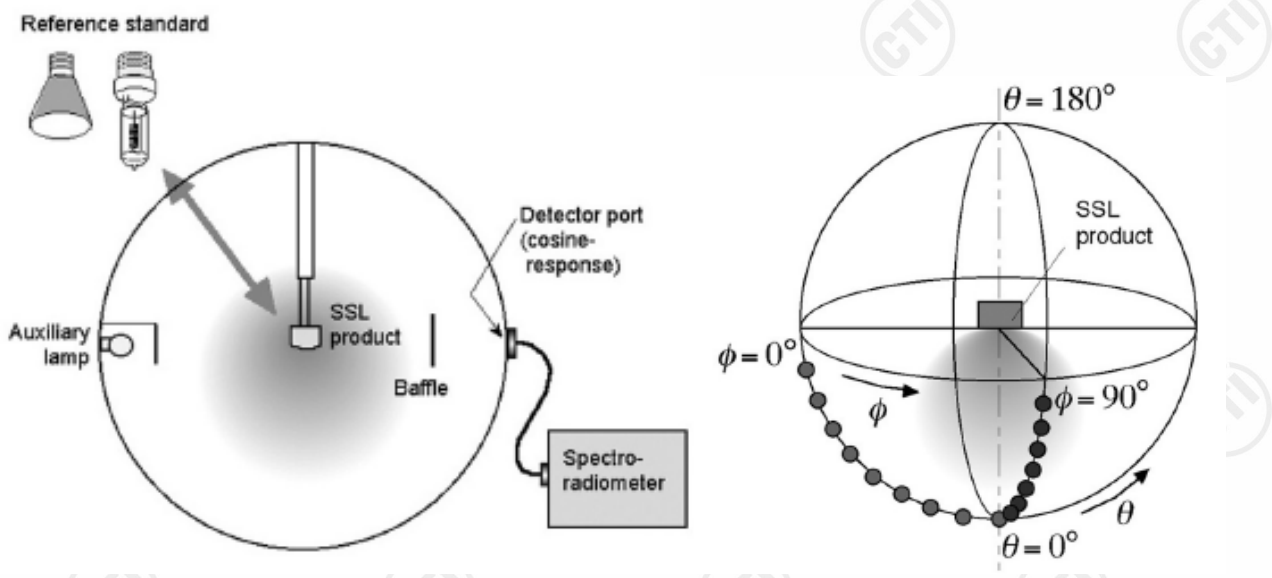
A spectroradiometer and an integrating sphere were used to measure total luminous flux, correlated color temperature, color rendering index, and chromaticity coordinates. The 4π geometry, shown as following, chart (a), is used for measurement. Ambient temperature was measured at a position inside the integrating sphere. Electrical measurements including voltage, current, and power were measured using the digital power meter.
The calibration of the sphere-spectroradiometer system is traceable to the National Institute of Standards and Technology.

2.5 Photometric and Electrical Measurements - Goniophotometer Method

A type C goniophotometer was used to measure total luminous flux and intensity at each angle of distribution. The photometric distance is 2.1m for near-field measurement or 26m for far-field measurement. Ambient temperature was measured at the same height of the sample mounted on the goniophotometer equipment. Electrical measurements including voltage, current, and power were measured using the digital power meter. Some graphics were created with Photometric Plus software. The geometry for the photometric measurement using gonio-photometer is shown as chart (b).

2.6 Other Test Items

Other Test Items include PF, THD of current, LED package current and normal temperature test. PF, THD were performed according to ANSI 82.77:2002 and normal temperature test was performed according to UL 1598:2008 (Secs. 19.7, 19.10-16).



(a) (b)

3 Test Results

3.1 Lamp Level Test, Photometric and Electrical Measurements

Input Voltage (V AC)	Input Current (A)	Input Power (W)	Power Factor	THD of Current (%)
120.0	0.1386	16.51	0.9923	8.87
Total Luminous Flux (lm)	**Luminous Efficacy (lm/W)**	**Correlated Color Temperature (K)**	**Color Rendering Index/R_a**	**Color Rendering Index/R_9**
2034.2	123.21	3097	84.9	18
Chromaticity Coordinate x	**Chromaticity Coordinate y**	**Chromaticity Coordinate u'**	**Chromaticity Coordinate v'**	**Duv**
0.4317	0.4050	0.2468	0.5210	0.0011

Note: According to CIE 1976 (u', v') diagram, u' = u = 4x/(-2x+12y+3), v' = 3v/2 = 9y/(-2x+12y+3).

3.2 Lamp Level Test, Electrical Measurements

Input Voltage (V AC)	Input Current (A)	Input Power (W)	Power Factor	THD of Current (%)
277.0	0.0645	16.28	0.9112	7.67

3.3 Fixture Level Test, Photometric and Electrical Measurements

Input Voltage (V AC)	Input Current (A)	Input Power (W)	Power Factor	Total Luminous Flux (lm)
120.0	0.2746	32.72	0.9927	2890.6
Luminous Efficacy (lm/W)	**Spacing Criteria (C0/180)**	**Spacing Criteria (C90/270)**	**Zonal Lumen Density/0-60° (%)**	**---**
88.34	1.24	1.48	86.5	---

Note: Two lamps were installed in one typical fixture housing, Lithonia 2PM3N 12 cell 2×4 parabolic.

3.4 ISTMT (Ambient Temperature 25.0℃)

Input Voltage (V AC)	LED Package Temperature (℃)	LED Drive Current (mA)
120.0	61.41	86.8
277.0	61.05	86.6

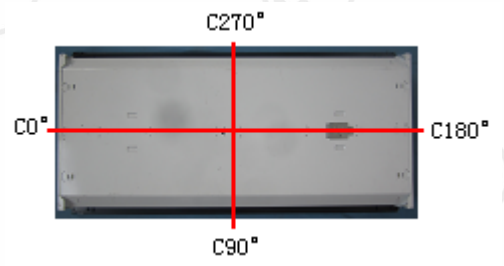
Note: Two lamps were installed in one typical fixture housing, Lithonia 2PM3N 12 cell 2×4 parabolic.

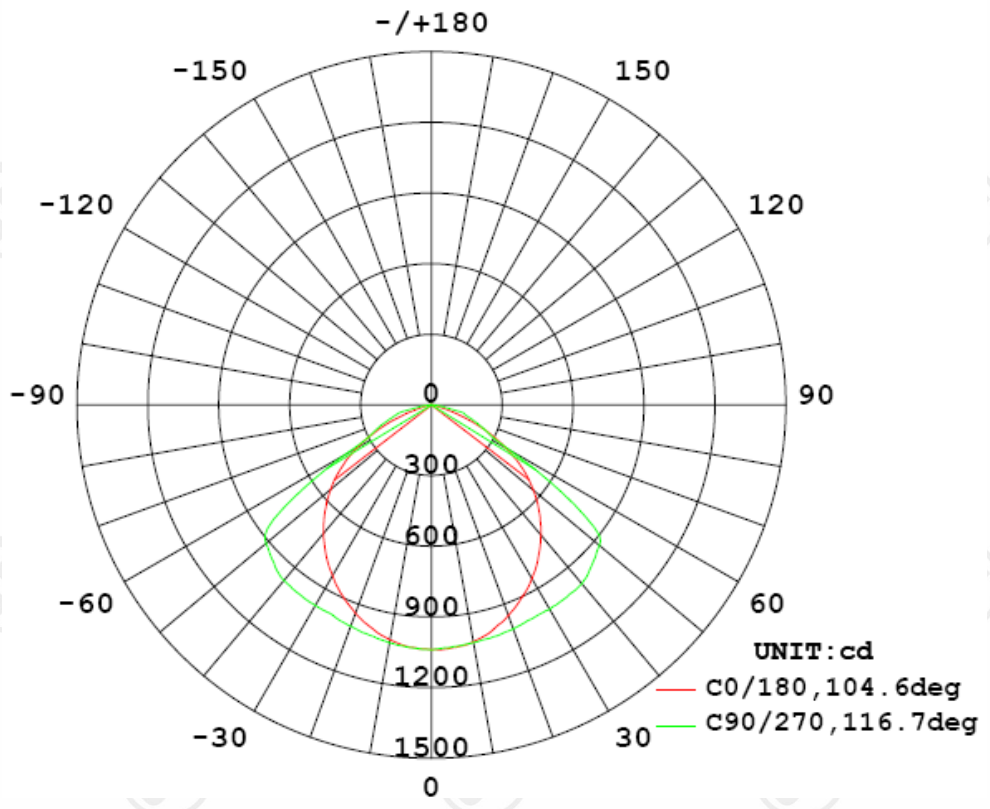
Test Report

3.5 Zonal Lumen Density

γ	C0	C45	C90	C135	C180	C225	C270	C315	γ	Φ zone	Φ total	%lum,lamp
10	1020	1010	1024	1027	1013	1027	1025	1010	0- 10	98.09	98.09	3.39,3.39
20	950.9	962.5	1012	984.8	941.1	980.0	999.1	960.4	10- 20	281.7	379.7	13.1,13.1
30	850.8	889.7	1002	912.6	837.8	899.7	983.4	889.6	20- 30	432.8	812.6	28.1,28.1
40	721.9	813.1	990.3	832.2	711.5	818.2	971.6	810.4	30- 40	542.9	1356	46.9,46.9
50	563.9	711.1	927.9	732.4	556.9	718.1	914.9	716.8	40- 50	600.0	1956	67.7,67.7
60	364.9	501.2	378.4	533.7	365.5	530.0	426.3	521.1	50- 60	543.8	2499	86.5,86.5
70	128.9	134.1	185.7	148.2	134.8	158.7	201.8	146.2	60- 70	280.2	2780	96.2,96.2
80	16.03	25.43	59.25	28.84	20.85	30.48	60.44	26.60	70- 80	91.89	2871	99.3,99.3
90	0.0011	0.0451	0.0013	0.0373	0.0616	0.2253	0.3139	0.5481	80- 90	12.77	2884	99.8,99.8
100	0	0.4827	0.0183	0.4036	1.060	1.437	0.9904	1.530	90-100	0.4009	2885	99.8,99.8
110	0.2594	0.9007	1.100	0.9262	1.537	2.275	2.552	2.497	100-110	1.215	2886	99.8,99.8
120	0.2794	0.5186	0.6653	0.4408	1.237	1.988	2.623	2.179	110-120	1.386	2887	99.9,99.9
130	0.2794	0.5357	0.7310	0.6074	0.7783	1.677	2.879	1.897	120-130	0.9904	2888	99.9,99.9
140	0.2794	0.6228	0.8796	0.6174	0.6791	1.436	2.659	1.614	130-140	0.8287	2889	99.9,99.9
150	0.5583	0.5536	0.9170	0.6439	0.8781	1.211	2.548	1.411	140-150	0.6738	2890	100,100
160	0.5787	0.5187	0.8075	0.6351	0.8781	0.9598	2.292	1.411	150-160	0.4726	2890	100,100
170	0.7980	0.8993	1.980	0.8911	0.9380	0.8640	2.236	1.402	160-170	0.3149	2890	100,100
180	0.9175	0.9080	1.999	0.9174	0.9579	0.7263	2.017	1.279	170-180	0.1152	2891	100,100
DEG	LUMINOUS INTENSITY:cd									UNIT:lm		

3.6 Luminous Intensity Distribution





3.7 Luminous Intensity Distribution Data

Table--1 UNIT: cd

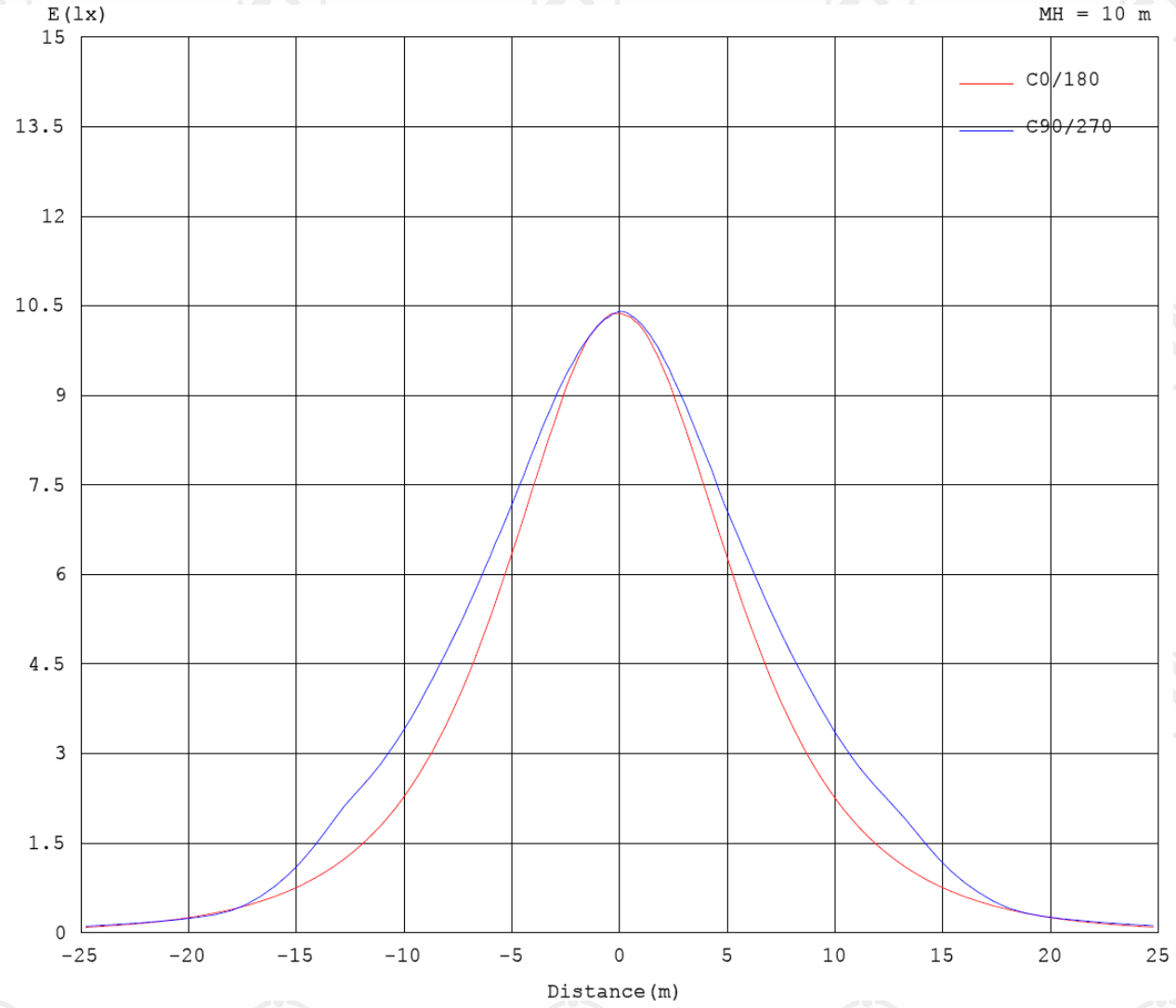
γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038
5	1034	1032	1030	1024	1027	1022	1028	1031	1032	1031	1028	1031	1033	1037	1031	1035	1036	1034	1032
10	1020	1013	1015	1001	1012	1008	1013	1018	1025	1024	1015	1018	1023	1033	1021	1023	1021	1017	1013
15	992	982	987	971	986	992	999	1005	1012	1019	1007	1004	1009	1020	998	1001	998	991	980
20	951	941	951	931	954	971	978	991	998	1012	993	985	994	999	970	970	960	956	941
25	903	891	906	892	916	943	950	967	978	1002	980	965	967	970	937	936	911	911	893
30	851	834	856	849	871	908	925	949	972	1002	974	952	945	927	898	892	853	860	838
35	789	772	794	801	824	877	903	932	963	997	970	937	923	890	854	840	788	802	778
40	722	706	726	746	782	844	874	909	952	990	964	919	898	855	809	778	726	733	712
45	646	635	658	688	731	805	840	876	922	961	937	887	864	815	761	712	661	658	637
50	564	555	585	622	673	749	782	829	886	928	904	849	809	760	704	641	586	573	557
55	471	467	499	538	592	661	704	719	719	741	740	749	732	679	631	564	504	483	468
60	365	365	393	438	481	521	460	407	375	378	390	429	489	546	521	472	408	387	366
65	247	253	270	309	331	268	211	221	235	250	243	232	227	283	366	343	291	271	250
70	129	136	147	170	131	137	149	162	173	186	179	170	158	147	149	196	167	151	135
75	35.9	41.6	42.3	47.5	59.1	74.1	88.1	108	129	144	134	116	97.1	82.7	67.2	56.5	56.4	55.6	45.0
80	16.0	17.3	16.3	18.1	22.2	28.6	36.8	45.4	53.2	59.2	54.9	48.2	40.5	32.0	25.7	21.2	20.9	24.5	20.8
85	4.94	5.36	5.38	5.83	7.00	8.89	10.9	14.0	17.0	19.0	17.3	14.4	11.5	9.72	7.88	6.67	6.17	7.20	6.47
90	0.00	0.06	0.02	0.03	0.04	0.05	0.02	0.00	0.09	0.00	0.04	0.00	0.04	0.05	0.02	0.09	0.02	0.02	0.06
95	0.00	0.04	0.02	0.00	0.03	0.05	0.00	0.00	0.07	0.00	0.02	0.00	0.04	0.02	0.00	0.03	0.00	0.02	0.56
100	0.00	0.04	0.19	0.23	0.52	0.45	0.22	0.19	0.21	0.02	0.16	0.23	0.47	0.45	0.35	0.19	0.18	0.06	1.06
105	0.16	0.07	0.18	0.45	0.85	0.90	0.74	0.77	0.77	0.59	0.74	0.75	1.02	0.91	0.76	0.24	0.15	0.17	1.50
110	0.26	0.20	0.19	0.30	0.61	1.19	1.07	1.26	1.07	1.10	1.08	1.32	1.49	1.27	0.58	0.24	0.21	0.24	1.54
115	0.26	0.26	0.19	0.30	0.47	0.52	1.09	1.34	1.32	1.37	1.37	1.39	1.38	0.51	0.35	0.24	0.22	0.26	1.54
120	0.28	0.26	0.19	0.30	0.52	0.52	0.59	0.60	0.67	0.67	0.65	0.52	0.56	0.53	0.35	0.24	0.25	0.26	1.24
125	0.28	0.22	0.19	0.30	0.50	0.52	0.59	0.58	0.63	0.55	0.61	0.52	0.58	0.51	0.48	0.24	0.23	0.26	0.90
130	0.28	0.22	0.19	0.30	0.50	0.57	0.71	0.72	0.80	0.73	0.79	0.64	0.72	0.70	0.51	0.29	0.23	0.26	0.78
135	0.28	0.24	0.21	0.30	0.50	0.59	0.76	0.76	0.80	0.83	0.81	0.70	0.76	0.76	0.51	0.29	0.23	0.26	0.62
140	0.28	0.24	0.24	0.30	0.50	0.74	0.81	0.81	0.93	0.88	0.83	0.79	0.83	0.79	0.44	0.29	0.23	0.26	0.68
145	0.32	0.24	0.34	0.39	0.52	0.74	1.00	1.00	1.05	0.94	0.90	0.91	1.04	0.77	0.42	0.29	0.25	0.33	0.78
150	0.56	0.43	0.44	0.47	0.52	0.59	0.69	0.77	0.91	0.92	0.90	0.88	0.85	0.79	0.50	0.48	0.28	0.44	0.88
155	0.58	0.52	0.47	0.49	0.52	0.54	0.62	0.65	0.84	0.84	0.88	0.79	0.83	0.81	0.51	0.49	0.50	0.52	0.86
160	0.58	0.52	0.47	0.50	0.52	0.52	0.61	0.63	0.82	0.81	0.88	0.77	0.81	0.74	0.53	0.49	0.48	0.52	0.88
165	0.60	0.52	0.62	0.50	0.69	0.81	1.28	1.42	1.62	1.63	1.64	1.48	1.32	0.95	0.53	0.54	0.50	0.59	0.96
170	0.80	0.67	0.73	0.64	0.76	1.04	1.42	1.62	1.95	1.98	1.93	1.64	1.37	1.04	0.74	0.72	0.61	0.83	0.94
175	0.90	0.76	0.73	0.64	0.76	1.04	1.45	1.64	1.97	2.00	1.97	1.70	1.57	1.06	0.74	0.73	0.63	0.83	0.94
180	0.92	0.74	0.73	0.64	0.78	1.04	1.56	1.67	1.97	2.00	1.97	1.73	1.60	1.07	0.76	0.75	0.63	0.87	0.96

Test Report

Table--2 UNIT: cd

γ (DEG) \ C(DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
0	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038	1038
5	1033	1034	1038	1033	1038	1035	1036	1031	1033	1034	1038	1032	1025	1028	1026	1030	1029
10	1017	1020	1028	1024	1030	1025	1023	1019	1025	1021	1026	1018	1007	1013	1004	1014	1007
15	990	993	1006	1000	1017	1007	1005	1003	1012	1005	1007	996	984	989	970	988	974
20	952	958	977	967	993	986	983	987	999	985	984	970	962	959	931	955	931
25	909	911	938	928	959	960	958	968	986	967	960	942	934	922	887	916	882
30	861	855	891	885	914	932	939	961	983	958	938	913	901	878	846	867	829
35	803	794	837	840	876	907	925	955	979	947	920	892	865	830	801	810	770
40	738	729	773	794	842	879	906	948	972	935	902	867	833	788	751	740	706
45	661	662	708	744	802	845	875	920	945	908	869	833	795	740	694	666	636
50	576	587	637	686	750	792	833	888	915	873	823	783	750	683	630	593	556
55	485	503	559	615	669	717	751	761	769	750	742	709	672	606	549	511	463
60	388	407	470	511	549	505	456	429	426	422	449	494	550	493	443	408	364
65	271	292	342	369	303	245	245	258	268	254	239	233	295	348	313	279	250
70	155	166	195	160	158	169	180	192	202	188	174	158	146	146	178	149	133
75	55.2	52.8	56.9	70.9	88.6	103	121	140	152	137	116	95.7	80.6	64.3	50.1	41.3	38.3
80	21.6	20.0	22.6	27.2	33.8	41.9	49.2	55.8	60.4	53.8	45.9	37.3	29.5	23.7	19.0	16.2	16.4
85	6.37	6.17	7.13	8.25	9.81	11.2	13.1	15.2	16.8	14.7	12.2	9.64	8.29	7.00	5.80	5.32	5.09
90	0.22	0.20	0.25	0.16	0.29	0.21	0.28	0.22	0.31	0.25	0.32	0.25	0.62	0.48	0.51	0.43	0.24
95	0.63	0.70	0.75	0.50	0.71	0.59	0.60	0.49	0.61	0.51	0.66	0.67	0.83	0.81	0.84	0.78	0.63
100	1.13	1.12	1.40	1.50	1.37	0.97	0.97	0.93	0.99	0.88	0.98	0.95	1.33	1.73	1.47	1.31	1.08
105	1.50	1.36	1.61	2.04	2.20	2.05	1.90	1.61	1.65	1.66	2.13	1.97	2.33	2.41	1.77	1.51	1.47
110	1.63	1.42	1.63	1.87	2.68	2.77	2.66	2.41	2.55	2.55	2.81	2.71	2.82	2.18	1.72	1.51	1.55
115	1.43	1.22	1.51	1.88	2.21	2.78	3.04	2.98	3.15	3.08	3.20	2.68	2.40	2.14	1.59	1.23	1.46
120	1.11	0.84	1.26	1.78	2.20	2.30	2.46	2.45	2.62	2.54	2.61	2.46	2.43	1.93	1.28	0.99	1.11
125	0.80	0.50	0.97	1.55	2.13	2.37	2.59	2.57	2.77	2.71	2.82	2.55	2.29	1.79	1.01	0.63	0.74
130	0.63	0.47	0.74	1.33	2.02	2.15	2.51	2.57	2.88	2.80	2.79	2.46	2.17	1.63	0.75	0.61	0.59
135	0.63	0.45	0.66	1.22	1.89	2.11	2.46	2.52	2.88	2.78	2.77	2.25	2.04	1.52	0.73	0.66	0.59
140	0.71	0.52	0.67	1.04	1.83	2.08	2.36	2.50	2.66	2.54	2.56	2.22	1.90	1.33	0.75	0.75	0.69
145	0.80	0.62	0.77	0.86	1.61	1.96	2.29	2.45	2.66	2.56	2.48	2.20	1.85	1.29	0.78	0.75	0.82
150	0.85	0.71	0.77	0.85	1.57	1.87	2.16	2.25	2.55	2.41	2.27	1.97	1.66	1.17	0.78	0.75	0.85
155	0.85	0.71	0.77	0.81	1.38	1.64	2.04	2.20	2.31	2.25	2.23	1.90	1.64	1.15	0.78	0.75	0.85
160	0.87	0.71	0.77	0.81	1.11	1.58	1.95	2.11	2.29	2.24	2.23	1.90	1.62	1.20	0.78	0.75	0.85
165	0.87	0.73	0.77	0.81	1.04	1.32	1.86	1.98	2.29	2.22	2.22	1.90	1.62	1.18	0.78	0.75	0.82
170	0.87	0.71	0.77	0.79	0.93	1.26	1.62	1.95	2.24	2.20	2.16	1.90	1.62	1.18	0.78	0.75	0.83
175	0.87	0.66	0.77	0.67	0.78	1.07	1.62	1.73	2.02	1.98	2.00	1.88	1.60	1.13	0.78	0.75	0.80
180	0.78	0.65	0.69	0.67	0.78	1.00	1.69	1.64	2.02	1.97	1.86	1.79	1.60	0.95	0.78	0.75	0.80

3.8 Planar Illuminance Curve



Photos of the Sample and TMP

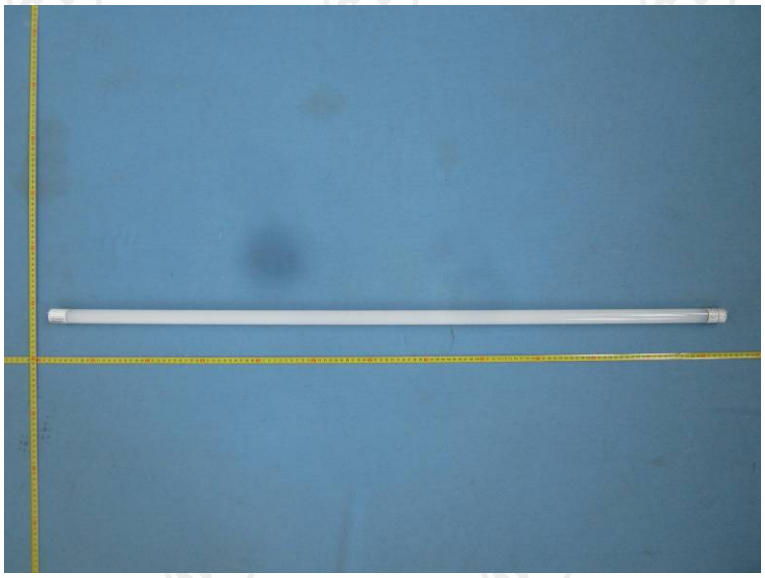


Fig.1- Overall view of bare lamp

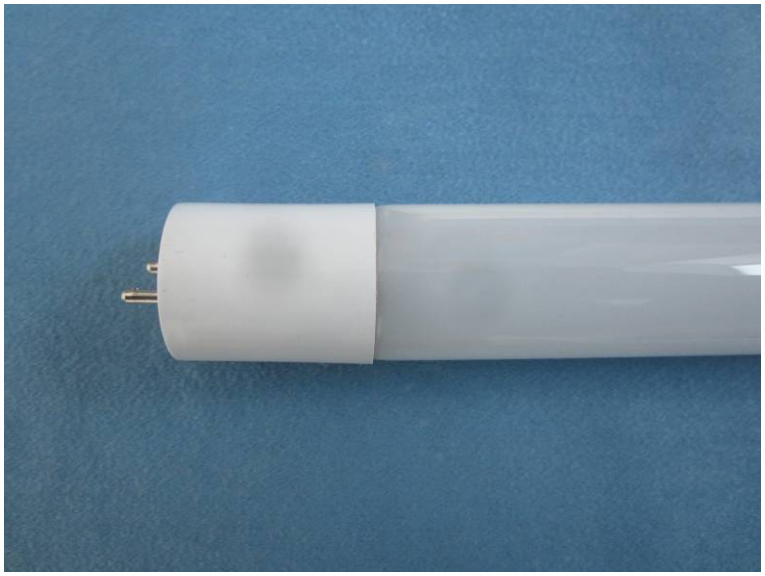


Fig.2- Partial view of bare lamp

Fig.3- Overall view of two lamps in the fixture

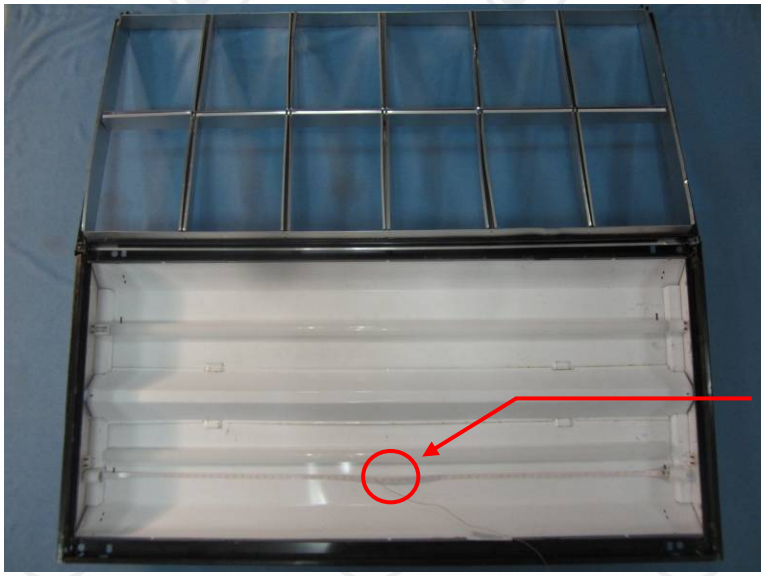


Fig.4- Temperature Measurement Point (LED package)

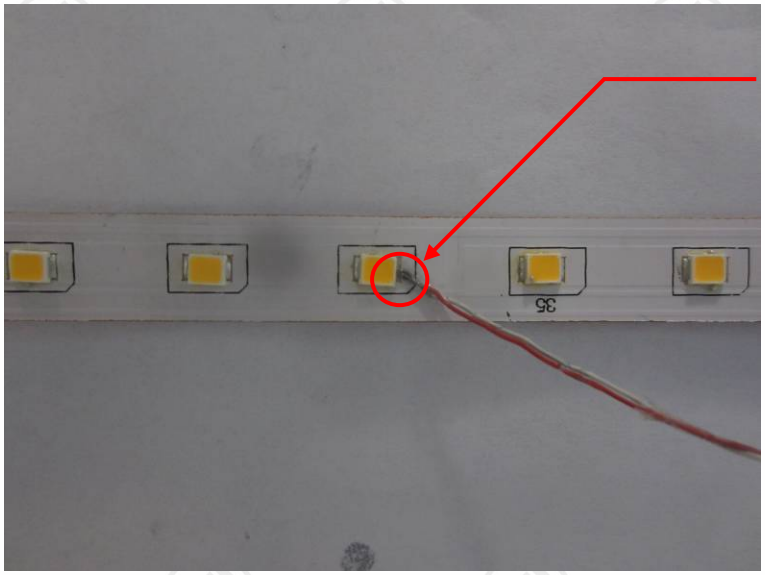


Fig.5- Temperature Measurement Point (LED package)

*** End of Report ***