



## Photometric Test Report

### Relevant Standards

- ☒ IES LM-79-2008
- ☒ ANSI C82.77-10-2014
- ☒ UL1598-2008

### Prepared For

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### Catalog Number

**HBEL-2FT-223-40-F-XX**

### Project Number

**4788965897**

### Report Number

**4788965897\_2a**

### Test Date

**4/13/2018-4/18/2018**

### Issue Date

**4/16/2019**

### Revision Date

**N/A**

### Prepared By

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The results contained in this report pertain only to the tested sample.

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## 1.0 Test Summary

☒ DLC Technical Requirements v4.3- issued 2018-03-12

Requirement Category	Test Method	Requirements	Test value	Results (Fail/Pass)
Minimum Light Output (lm)	IES LM-79-2008	10000	27926.10	Pass
Minimum Lamp Output in luminaire (lm)	IES LM-79-2008	N/A	N/A	N/A
Spacing Criteria (0-180°)	IES LM-79-2008	N/A	N/A	N/A
Spacing Criteria (90-270°)	IES LM-79-2008	N/A	N/A	N/A
Zonal Lumen Requirement (20°-50°)	IES LM-79-2008	30%	53.0%	Pass
Zonal Lumen Requirement 2	IES LM-79-2008	N/A	N/A	N/A
Minimum Luminaire Efficacy (lm/W)	IES LM-79-2008	126.1	128.26	Pass
Minimum Lamp Efficacy (lm/W)	IES LM-79-2008	N/A	N/A	N/A
Allowable CCTs* (K)	IES LM-79-2008 ANSI C78.377-2015	≤5700	5215	Pass
Minimum CRI	IES LM-79-2008 CIE 13.3-1995	≥70	82.55	Pass
L70 Lumen maintenance (hours)	IES TM-21-2011	≥50000	≥50000	Pass
L90 Lumen maintenance (hours)	IES TM-21-2011	≥36000	≥36000	Pass
Power Factor	ANSI C82.77-10-2014	≥0.9	0.9648	Pass
Total Harmonic Distortion (A%)	ANSI C82.77-10-2014	≤20%	9.92%	Pass
In-Situ Temperature Measurement Test for LED (°C)	UL1598-2008	≤105	69.3	Pass
In-Situ Temperature Measurement Test for Driver (°C)	UL1598-2008	≤90	60.1	Pass
Minimum Luminaire Warranty (years)	N/A	5	5	Pass



## 2.0 Test List

Test Item	Test	Test Date	Model Number	Tests Conducted By
1	Integrating Sphere Test for the Lower CCT	4/18/2018	HBEL-2FT-223-40-F-XX	Gavin Yang
2	Integrating Sphere Test for the Higher CCT	4/13/2018	HBEL-2FT-223-50-F-XX	Gavin Yang
3	Goniophotometer Test	4/17/2018	HBEL-2FT-223-40-F-XX	Gavin Yang
4	THD and PF Test	4/18/2018	HBEL-2FT-223-40-F-XX	Gavin Yang
5	In-Situ Temperature Measurement Test	4/18/2018	HBEL-2FT-223-40-F-XX	Gavin Yang

### Remark (if any)

1. UL test equipment information is recorded on Meter Use in UL's Aurora database.



### 3.0 Production Description

**Luminaire Description:** High Bay Luminaires for Commercial and Industrial Buildings

**Model Number:** HBEL-2FT-223-40-F-XX

**Rated Voltage:** 120-277V

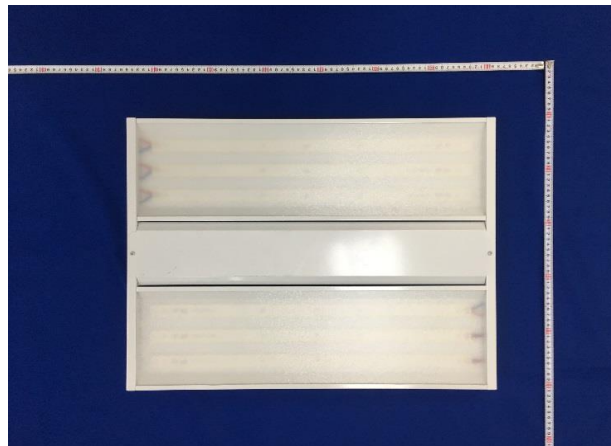
**Frequency:** 50/60Hz

**LED Package:** STW8A2PD-XX

**Family Model and Variation:** HBEL-2FT-223-50-F-XX

**Photos of Luminaire Characteristics**

Model Number	CCT (K)	Light Output (lm)	Power (W)	Luminous Efficacy (lm/W)
HBEL-2FT-223-40-F-XX	4000	28990	223	130
HBEL-2FT-223-50-F-XX	5000	29213	223	131





#### 4.0 LM-79 Measurement and Test Results

Model No.	HBEL-2FT-223-40-F-XX	Sample ID.	1496147
Opreate time (Min.)	90	Stabilization time (Min.)	45

##### Test Method

1.The sample was tested according to the IES LM-79-2008.

2.Photometric paramters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ .The reference standard lamp is rated current 2.6A omni-directional Incandescent lamp and was calibrated by china seprei laboratory.

3.The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%.Photometric measurement conditions was using  $4\pi$  geometry.The self-absorption factor is applied in the final test result.The sample was operated at rated voltage and was stabilized before measurement. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 1 nm intervals over the range of 380 to 780 nm.

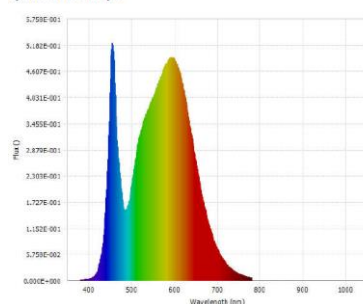
##### Integrating Sphere Test Conditions

Temperature ( $^{\circ}\text{C}$ )	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
25.1	120.08	60	1.8097	215.61	0.9922

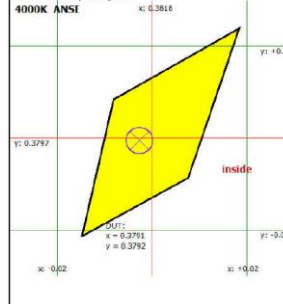
##### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)
4051	82.55	0.0015	27926.1	129.52

Spectral Flux Graph



Chromaticity Diagram



##### Spectral Result

Luminous Flux $\Phi_v$	27926.1 (lm)	Chrom x	0.3791
Chrom y	0.3792	Chrom u	0.2233
Chrom v	0.3350	Duv	0.0015
Chrom u'	0.2233	Chrom v'	0.5025
CCT	4051.0 (K)	Luminous Efficacy $\eta$	129.52 (lm/W)
Ra	82.55	R1	80.7
R2	89.2	R3	94.8
R4	80.3	R5	80.2
R6	84.4	R7	86.3
R8	64.6	R9	8.5
R10	73.5	R11	78.3
R12	59.1	R13	82.8
R14	97.2	R15	74.9
Rf	81.5	Rg	94.1



## 4.0 LM-79 Measurement and Test Results

### 4.2 Integrating Sphere Test for the higher CCT

Model No.	HBEL-2FT-223-50-F-XX	Sample ID.	1496149
Operate time (Min.)	90	Stabilization time (Min.)	45

#### Test Method

1.The sample was tested according to the IES LM-79-2008.

2.Photometric paramters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ .The reference standard lamp is rated current 2.6A omnidirectional Incandescent lamp and was calibrated by china seprei laboratory.

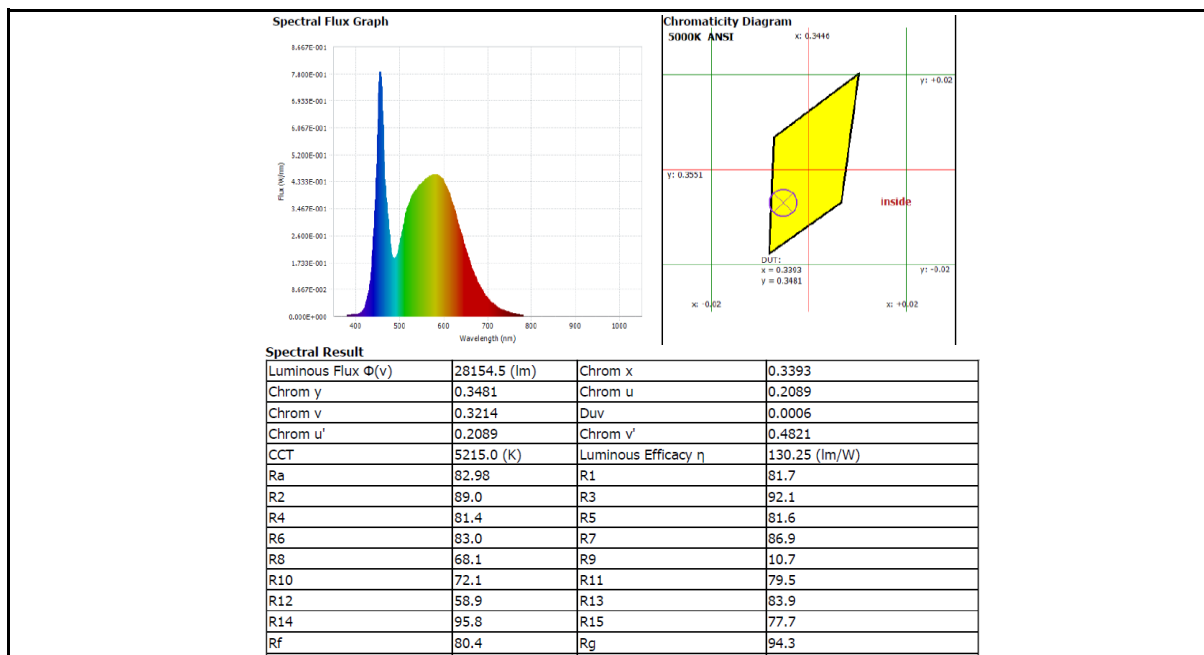
3.The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%.Photometric measurement conditions was using  $4\pi$  geometry.The self-absorption factor is applied in the final test result.The sample was operated at rated voltage and was stabilized before measurement. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 1 nm intervals over the range of 380 to 780 nm.

#### Integrating Sphere Test Conditions

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
25.1	120.02	60	1.8152	216.16	0.9922

#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)
5215	82.98	0.0006	28154.5	130.25





## 5.0 LM-79 Measurement and Test Results

Model No.	HBEL-2FT-223-40-F-XX	Sample ID.	1496147
Operate time (Min.)	90	Stabilization time (Min.)	45

### Test Method

1.The sample was tested according to the IES LM-79-2008.
2.Photometric parameters were measured using a type C goniophotometer and software.
3.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 reference standard lamp is rated current 3.865A omni-directional Incandescent lamp and was calibrated by china seprei laboratory.
4.The samples were operated at rated voltage and was stabilized before measurement. Luminous flux, luminaire efficacy, zonal lumen were calculated from the software taken at 0.5° vertical intervals and 22.5° horizontal intervals..Photometric distance was more than five times of the largest dimension of the test SSL product.

### Goniophotometer Test Conditions

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
24.9	120.13	60	1.8082	215.58	0.9925

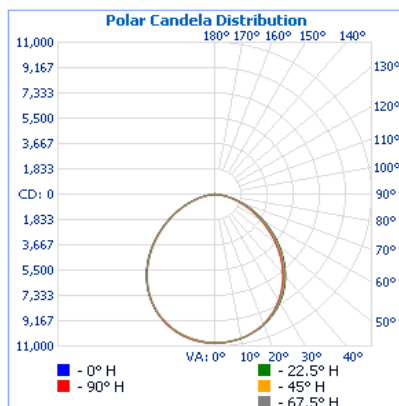
### Test Result

Flux (lm)	Zonal Lumen Requirement (20°-50°)	Field Angle (10%)		Beam Angle (50%)		Luminous Efficacy (lm/W)
		Horizontal Spread	Vertical Spread	Horizontal Spread	Vertical Spread	
27650	53.0%	154	155.2	102.2	104.3	128.26

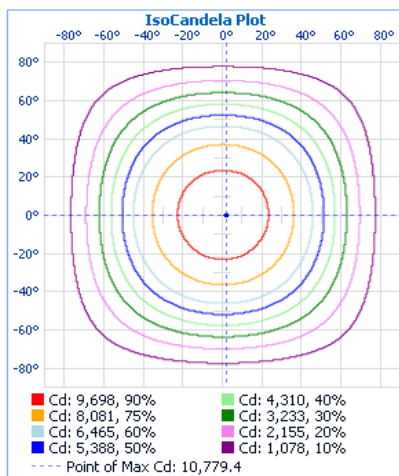


## 5.2 Goniophotometer Test (Cont'd)

### Light Distribution Curve



### IsoCandela Plot







## 5.2 Goniophotometer Test (Cont'd)

### Zonal Lumen Summary

Zonal Lumen Summary		
Zone	Lumens	% Luminaire
0-30	8,313.4	30.1%
0-40	13,480.5	48.8%
0-60	22,837.8	82.6%
60-90	4,748.3	17.2%
70-100	1,833.8	6.6%
90-120	20.5	0.1%
0-90	27,586.1	99.8%
90-180	63.8	0.2%
0-180	27,650.0	100%

### Lumens Per Zone

Lumens Per Zone					
Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	256.7	0.9%	90-95	4.8	0%
5-10	761.2	2.8%	95-100	3.7	0%
10-15	1,239.6	4.5%	100-105	3.2	0%
15-20	1,673.4	6.1%	105-110	3.0	0%
20-25	2,044.9	7.4%	110-115	2.8	0%
25-30	2,337.7	8.5%	115-120	3.0	0%
30-35	2,536.6	9.2%	120-125	3.3	0%
35-40	2,630.5	9.5%	125-130	3.8	0%
40-45	2,614.5	9.5%	130-135	4.2	0%
45-50	2,491.6	9.0%	135-140	4.6	0%
50-55	2,271.6	8.2%	140-145	4.8	0%
55-60	1,979.6	7.2%	145-150	4.7	0%
60-65	1,641.9	5.9%	150-155	4.5	0%
65-70	1,281.1	4.6%	155-160	4.0	0%
70-75	915.9	3.3%	160-165	3.6	0%
75-80	569.4	2.1%	165-170	3.0	0%
80-85	273.9	1.0%	170-175	2.1	0%
85-90	66.1	0.2%	175-180	0.7	0%



## 5.2 Goniophotometer Test (Cont'd)

### Intensity Data(cd)

	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5	360
0	10758	10758	10758	10758	10758	10758	10758	10758	10758	10758	10758	10758	10758	10758	10758	10758	10758
1	10748	10751	10744	10779	10776	10769	10737	10739	10742	10739	10737	10769	10776	10779	10744	10751	10748
2	10752	10744	10740	10768	10779	10770	10746	10734	10732	10734	10746	10770	10779	10768	10740	10744	10752
3	10734	10744	10735	10766	10772	10755	10726	10718	10726	10718	10726	10755	10772	10766	10735	10744	10734
4	10725	10733	10723	10746	10754	10748	10705	10710	10698	10710	10705	10748	10754	10746	10723	10733	10725
5	10714	10714	10709	10729	10734	10717	10679	10697	10683	10697	10679	10717	10734	10729	10709	10714	10714
6	10696	10687	10701	10709	10713	10703	10656	10662	10660	10662	10656	10703	10713	10709	10701	10687	10696
7	10669	10681	10667	10687	10684	10682	10640	10634	10633	10634	10640	10682	10684	10687	10667	10681	10669
8	10639	10656	10640	10673	10658	10645	10596	10605	10610	10605	10596	10645	10658	10673	10640	10656	10639
9	10625	10623	10612	10638	10630	10617	10563	10574	10565	10574	10563	10617	10630	10638	10612	10623	10625
10	10582	10594	10569	10597	10588	10569	10536	10530	10537	10530	10536	10569	10588	10597	10569	10594	10582
11	10551	10552	10557	10571	10550	10526	10489	10488	10484	10488	10489	10526	10550	10571	10557	10552	10551
12	10520	10519	10494	10512	10504	10490	10438	10449	10448	10449	10438	10490	10504	10512	10494	10519	10520
13	10474	10456	10464	10472	10457	10434	10385	10394	10395	10394	10385	10434	10457	10472	10464	10456	10474
14	10423	10411	10405	10411	10398	10369	10332	10337	10337	10337	10332	10369	10398	10411	10405	10411	10423
15	10368	10370	10353	10341	10340	10312	10282	10292	10290	10292	10282	10312	10340	10341	10353	10370	10368
16	10314	10300	10284	10298	10274	10248	10207	10219	10210	10219	10207	10248	10274	10298	10284	10300	10314
17	10258	10249	10241	10231	10206	10178	10142	10152	10166	10152	10142	10178	10206	10231	10241	10249	10258
18	10203	10190	10168	10162	10138	10112	10072	10081	10072	10081	10072	10112	10138	10162	10168	10190	10203
19	10107	10119	10096	10078	10068	10033	9999	9994	9994	9994	9999	10033	10068	10078	10096	10119	10107
20	10041	10030	10012	10002	9983	9944	9925	9922	9922	9922	9925	9944	9983	10002	10012	10030	10041
25	9626	9602	9567	9534	9505	9465	9451	9464	9467	9464	9451	9465	9505	9534	9567	9602	9626
30	9079	9068	9024	8964	8913	8879	8876	8900	8896	8900	8876	8879	8913	8964	9024	9068	9079
35	8428	8433	8366	8280	8209	8180	8182	8219	8223	8219	8182	8180	8209	8280	8366	8433	8428
40	7672	7675	7584	7496	7411	7382	7405	7429	7454	7429	7405	7382	7411	7496	7584	7675	7672
45	6827	6822	6729	6630	6535	6513	6521	6577	6581	6577	6521	6513	6535	6630	6729	6822	6827
50	5932	5920	5822	5687	5597	5572	5597	5645	5662	5645	5597	5572	5597	5687	5822	5920	5932
55	4995	4976	4865	4747	4635	4622	4645	4704	4724	4704	4645	4622	4635	4747	4865	4976	4995
60	4057	4042	3937	3805	3709	3697	3728	3767	3798	3767	3728	3697	3709	3805	3937	4042	4057
65	3149	3144	3046	2927	2838	2827	2854	2886	2910	2886	2854	2827	2838	2927	3046	3144	3149
70	2303	2310	2224	2120	2043	2031	2046	2070	2102	2070	2046	2031	2043	2120	2224	2310	2303
75	1523	1538	1468	1394	1332	1315	1314	1326	1351	1326	1314	1315	1332	1394	1468	1538	1523
80	852	866	823	774	727	710	696	696	703	696	696	710	727	774	823	866	852
85	329	342	323	300	269	255	237	230	230	230	237	255	269	300	323	342	329
90	17	22	14	15	11	11	10	8	8	8	10	11	11	15	14	22	17
95	7	7	7	7	7	8	7	8	7	8	7	8	7	7	7	7	7
100	6	7	6	6	7	7	6	5	6	5	6	7	7	6	6	7	6
105	4	5	4	6	6	5	5	6	5	6	5	5	6	6	4	5	4
110	6	5	6	6	5	6	5	5	6	5	5	6	5	6	6	5	6
115	5	7	5	5	6	6	6	5	5	5	6	6	6	5	5	7	5
120	6	5	6	7	6	6	8	6	5	6	8	6	6	7	6	5	6
125	8	7	8	9	8	9	8	7	7	7	8	9	8	9	8	7	8
130	8	9	9	10	8	10	9	10	11	10	9	10	8	10	9	9	8
135	10	11	12	12	12	13	11	11	13	11	11	13	12	12	12	11	10
140	11	13	12	13	12	13	13	14	13	14	13	13	12	13	12	13	11
145	14	16	16	15	15	15	15	14	14	14	15	15	15	15	16	16	14
150	16	17	19	17	18	17	18	18	18	18	18	17	18	17	19	17	16
155	17	18	19	19	19	18	18	19	18	19	18	18	19	19	19	18	17
160	20	21	21	21	21	19	21	21	20	21	21	19	21	21	21	21	20
165	22	23	24	24	24	24	25	24	22	24	25	24	24	24	24	23	22
170	27	27	28	27	27	27	27	28	26	28	27	27	27	27	28	27	27
175	30	30	31	32	32	32	29	30	28	30	29	32	32	32	31	30	30
180	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32



## 6.0 THD and PF Test

Model No.	HBEL-2FT-223-40-F-XX	Sample ID.	1496147
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### Test Method

1. The samples were tested according to the ANSI C82.77-2002.
2. The ambient temperature condition was maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ . The sample measurement was made using a digital power meter and power supply. The sample was operated at rated voltage and stabilized before measurement. The total harmonic distortion were calculated from the digital power meter.

### Test Results

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD
24.9	276.81	60	0.7857	209.84	0.9648	9.92%



## 7.0 In-Situ Temperature Measurement Test

Model No.	HBEL-2FT-223-40-F-XX	Sample ID.	1496147
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### Test Method

1. In-Situ Temperature Measurement Test is conducted according to the UL1598-2008, Section 14.
2. The testing was conducted in a room with ambient temperature of  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ . The apparatus construction followed those described in UL1598-2008 for normal temperature testing. Thermocouples were placed on the LED package in the locations indicated by LM-80 report. The temperature was recorded after the lamp was operated by 3.5 hours in stability or by 7.5 hours.

### In-Situ Temperature Measurement Test Conditions

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
24.5	120.13	60	1.8082	215.58	0.9925

### Test Results(LED)

Thermocouple Location	Manufacturer Declared Current (mA)	Temperature for Lighting source (°C)		LED Model Number	LM-80 Limit Current (mA)	LM-80 Limit Temp. (°C)
		Test result column 1	Test result (Correct to 25 °C)			
TMP of LEDs	100	68.8	69.3	STW8A2PD-XX	200	105
Ambient temperature	N/A	24.5	25.0			

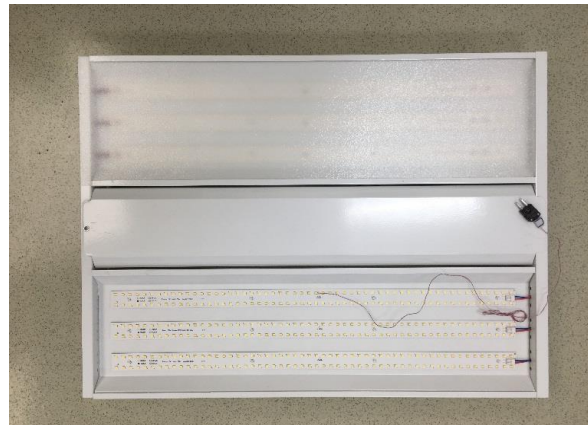
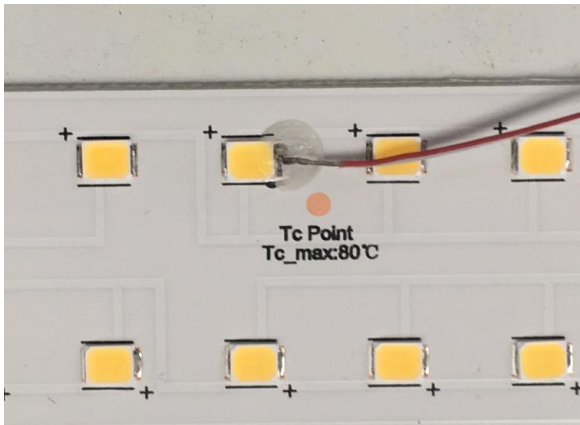
### Test Results(Driver)

Thermocouple Location	Temperature for Lighting source (°C)		Driver Model Number	Driver Limit Temp (°C)
	Test result column 1	Test result (Correct to 25 °C)		
TMP of Driver	59.6	60.1	SIP100-I2400 120-277 W D1 S	90
Ambient temperature	24.5	25.0		

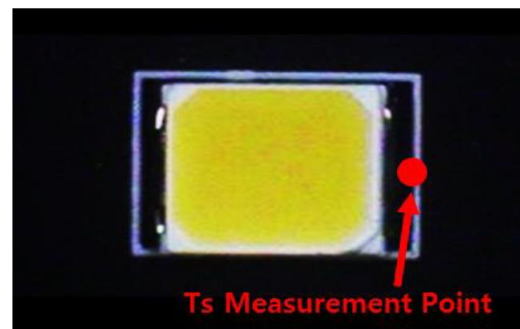


## 7.0 In-Situ Temperature Measurement Test (Cont'd)

Test Photos for Tc Point of LED Packages



Case Temperature Measurement Point





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