



UL-CCIC Company Limited  
No.2 Chengwan Road,  
Suzhou Industrial Park  
Suzhou 215122, China  
86-512-68086400



## Photometric Test Report

### Relevant Standards

- IES LM-79-2008
- ANSI C82.77-2002
- UL1598-2008/ UL1993-2012

### Prepared For

**P.Q.L., Inc.**

2285 Ward Avenue  
Simi Valley, CA 93065

### Catalog Number

55232

### Project Number

4787668865

### Report Number

4787668865\_37

### Test Date

11/16/2016-11/21/2016

### Issue Date

12/5/2016

### Prepared By

Jonathan Xu

### Approved By

Duff Yang

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

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## 1.0 Test Summary

DLC Technical Requirements v4.1

<i>High-bay Luminaires for Commercial and Industrial Buildings</i>				
Requirement Category	Test Method	Requirements	Test value	Results (Fail/Pass)
Minimum Light Output (lm)	IES LM-79-2008	10000lm	39946.40	Pass
Minimum Lamp Output (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%	52.70%	Pass
Zonal Lumen Requirement 2	IES LM-79-2008	N/A	N/A	N/A
Minimum Luminaire Efficacy (lm/W)	IES LM-79-2008	130lm/W	127.71	Pass
Minimum Lamp Efficacy (lm/ft)	IES LM-79-2008	N/A	N/A	N/A
Allowable CCTs* (K)	IES LM-79-2008	≤5700	5247	Pass
Minimum CRI	IES LM-79-2008 CIE 13.3-1995	≥80	84.26	Pass
L70 Lumen maintenance (hours)	IES LM-80-2015 IES TM-21-2011	≥50000	≥50000	Pass
L90 Lumen maintenance (hours)	IES LM-80-2015 IES TM-21-2011	N/A	N/A	N/A
Power Factor	ANSI C82.77-2002	≥0.9	0.9668	Pass
Total Harmonic Distortion (A%)	ANSI C82.77-2002	≤20%	14.40%	Pass
In-Situ Temperature Measurement Test for LED (°C)	UL1598-2008/ UL1993-2012	≤105	62.2	Pass
In-Situ Temperature Measurement Test for Driver (°C)	UL1598-2008/ UL1993-2012	81	58.3	N/A
Minimum Luminaire Warranty (years)	N/A	5	5	Pass

\*Defined by ANSI C78.377-2011‡

‡ANSI C78.377-2015 also referred to for Duv and (x,y) chromaticity coordinates tolerances for indoor categories.



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### 3.0 Test List

Test Item	Test	Test Date	Model Number	Tests Conducted By
1	Integrating Sphere Test for the Lower CCT	11/21/2016	LED FLAT 4' HIGH BAY 321W 4000K	Elvis Wu
2	Integrating Sphere Test for the Higher CCT	11/17/2016	55232	Elvis Wu
3	Goniophotometer Test	11/16/2016	LED FLAT 4' HIGH BAY 321W 4000K	Elvis Wu
4	THD and PF Test	11/21/2016	LED FLAT 4' HIGH BAY 321W 4000K	Elvis Wu
5	In-Situ Temperature Measurement Test	11/17/2016	LED FLAT 4' HIGH BAY 321W 4000K	Elvis Wu

#### Remark (if any)

1. UL test equipment information is recorded on Meter Use in UL's Laboratory Project Management (LPM) database.



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#### 4.0 Production Description

**Luminaire Description:** High-bay Luminaires for Commercial and Industrial Buildings

**Model Number:** LED FLAT 4' HIGH BAY 321W 4000K 4000K

**Rated Voltage:** 120~277V

**Frequency:** 50/60 Hz

**LED Package:** STWxA2PD-xx

**Family Model and Variation:** 55232

#### Photos of Luminaire Characteristics





## 5.0 LM-79 Measurement and Test Results

### 5.1 Integrating Sphere Test for the lower CCT

Model No.	LED FLAT 4' HIGH BAY 321W 4000K	Sample ID.	644070-004
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° C ± 1° C.
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. 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.

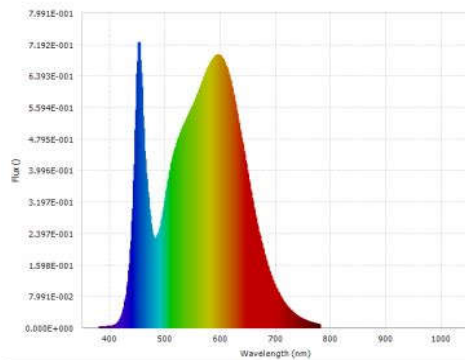
#### Integrating Sphere Test Conditions

Temperature (°C)	Voltage (Vac)	Frequency(Hz)	Current (A)	Power (W)	Power Factor	Current THD
24.9	120.07	60	2.6173	312.8	0.9968	7.00%

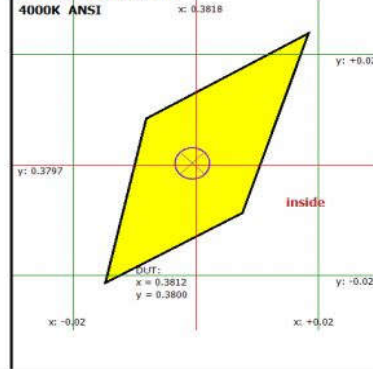
#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)
3999	84.26	0.0013	39946.4	127.71

Spectral Flux Graph



Chromaticity Diagram 4000K ANSI



Spectral Result

Luminous Flux $\Phi(v)$	39946.4 (lm)	Chrom x	0.3812
Chrom y	0.3800	Chrom u	0.2244
Chrom v	0.3354	Duv	0.0013
Chrom u'	0.2244	Chrom v'	0.5031
CCT	3999.0 (K)	Luminous Efficacy $\eta$	127.71 (lm/W)
Ra	84.26	R1	82.6
R2	90.2	R3	95.4
R4	82.8	R5	82.4
R6	86.1	R7	87.2
R8	67.2	R9	15.8
R10	76.3	R11	81.6
R12	63.1	R13	84.6
R14	97.6	R15	77.0
Rf	83	Rg	95



## 5.0 LM-79 Measurement and Test Results

### 5.2 Integrating Sphere Test for the higher CCT

Model No.	55232	Sample ID.	644070-005
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  $25^{\circ}C \pm 1^{\circ}C$ .
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. 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.

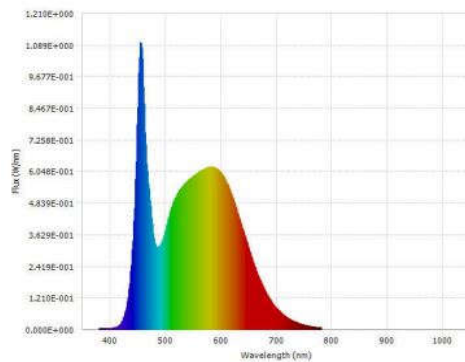
#### Integrating Sphere Test Conditions

Temperature (°C)	Voltage (Vac)	Frequency(Hz)	Current (A)	Power (W)	Power Factor	Current THD
25.5	120.09	60	2.6245	314.29	0.9972	6.40%

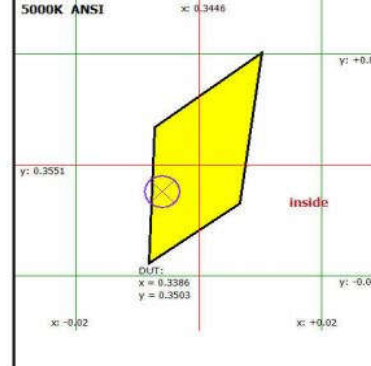
#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)
5247	85.39	0.002	40192.8	127.88

Spectral Flux Graph



Chromaticity Diagram



Spectral Result

Luminous Flux $\Phi(v)$	40192.8 (lm)	Chrom x	0.3386
Chrom y	0.3503	Chrom u	0.2075
Chrom v	0.3220	Duv	0.002
Chrom u'	0.2075	Chrom v'	0.4831
CCT	5247.0 (K)	Luminous Efficacy $\eta$	127.88 (lm/W)
Ra	85.39	R1	84.3
R2	91.9	R3	94.7
R4	83.2	R5	84.1
R6	86.8	R7	87.7
R8	70.4	R9	19.3
R10	79.2	R11	82.3
R12	62.4	R13	86.9
R14	97.6	R15	79.9
Rf	82	Rg	94



## 5.0 LM-79 Measurement and Test Results

### 5.3 Goniophotometer Test

<b>Model No.</b>	LED FLAT 4' HIGH BAY 321W 4000K	<b>Sample ID.</b>	644070-004
<b>Operate time (Min.)</b>	90	<b>Stabilization time (Min.)</b>	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  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ , measured at a point not more than 1 m from the sample and at the same height as the sample.
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  $0.5^{\circ}$  vertical intervals and  $22.5^{\circ}$  horizontal intervals.

#### Goniophotometer Test Conditions

Temperature (°C)	Voltage (Vac)	Frequency	Current (A)	Power (W)	Power Factor	Orientation
25.5	120.01	60	2.6296	314.57	0.9968	horizontal

#### Test Result

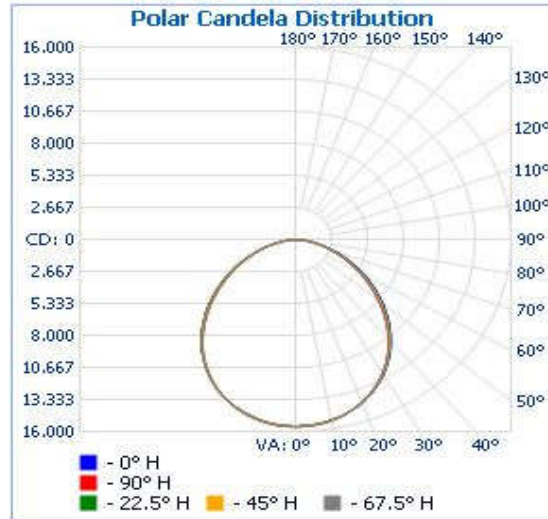
Flux (lm)	Zonal Lumen Requirement (20°-50°)	Field Angle (10%)		Beam Angle (50%)		Luminous Efficacy (lm/W)
		Horizontal Spread	Vertical Spread	Horizontal Spread	Vertical Spread	
40205.1	52.7%	154.6	156.3	102.3	104.8	127.81



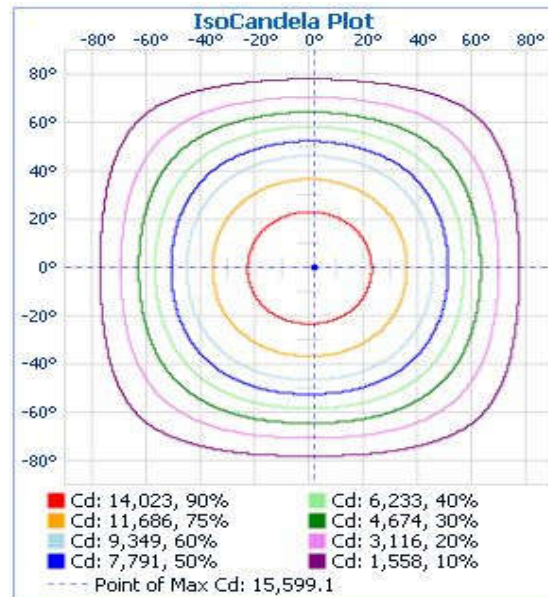


## 5.2 Goniophotometer Test (Cont'd)

### Light Distribution Curve



### IsoCandela Plot







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## 5.2 Goniophotometer Test (Cont'd)

### Zonal Lumen Summary

Zonal Lumen Summary		
Zone	Lumens	% Luminaire
0-30	12,013.7	29.9%
0-40	19,479.3	48.5%
0-60	33,070.9	82.3%
60-90	7,047.1	17.5%
70-100	2,731.0	6.8%
90-120	29.6	0.1%
0-90	40,118.0	99.8%
90-180	82.6	0.2%
0-180	40,200.7	100%

### Lumens Per Zone

Lumens Per Zone					
Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	371.4	0.9%	90-95	6.7	0%
5-10	1,101.2	2.7%	95-100	5.2	0%
10-15	1,792.2	4.5%	100-105	4.6	0%
15-20	2,418.6	6.0%	105-110	4.2	0%
20-25	2,954.2	7.3%	110-115	4.2	0%
25-30	3,376.2	8.4%	115-120	4.7	0%
30-35	3,663.9	9.1%	120-125	5.3	0%
35-40	3,801.6	9.5%	125-130	5.4	0%
40-45	3,780.8	9.4%	130-135	5.5	0%
45-50	3,606.6	9.0%	135-140	5.8	0%
50-55	3,304.4	8.2%	140-145	5.9	0%
55-60	2,899.8	7.2%	145-150	5.7	0%
60-65	2,424.6	6.0%	150-155	5.1	0%
65-70	1,903.5	4.7%	155-160	4.5	0%
70-75	1,366.0	3.4%	160-165	3.8	0%
75-80	851.5	2.1%	165-170	3.1	0%
80-85	404.6	1.0%	170-175	2.1	0%
85-90	97.0	0.2%	175-180	0.7	0%



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## 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	15570	15570	15570	15570	15570	15570	15570	15570	15570	15570	15570	15570	15570	15570	15570	15570	15570
1	15532	15537	15568	15599	15590	15589	15545	15532	15538	15532	15545	15589	15590	15599	15568	15537	15532
2	15516	15540	15554	15597	15581	15576	15560	15523	15533	15523	15560	15576	15581	15597	15554	15540	15516
3	15514	15522	15545	15573	15582	15568	15539	15510	15515	15510	15539	15568	15582	15573	15545	15522	15514
4	15512	15509	15527	15567	15566	15537	15508	15492	15503	15492	15508	15537	15566	15567	15527	15509	15512
5	15465	15463	15495	15517	15538	15519	15489	15468	15472	15468	15489	15519	15538	15517	15495	15463	15465
6	15439	15456	15472	15502	15507	15486	15452	15432	15447	15432	15452	15486	15507	15502	15472	15456	15439
7	15417	15405	15425	15461	15461	15458	15405	15390	15415	15390	15405	15458	15461	15461	15425	15405	15417
8	15352	15364	15390	15426	15434	15404	15365	15368	15356	15368	15365	15404	15434	15426	15390	15364	15352
9	15326	15315	15326	15384	15388	15364	15333	15306	15304	15306	15333	15364	15388	15384	15326	15315	15326
10	15281	15249	15278	15330	15327	15313	15270	15253	15241	15253	15270	15313	15327	15330	15278	15249	15281
11	15200	15197	15228	15274	15253	15244	15215	15193	15183	15193	15215	15244	15253	15274	15228	15197	15200
12	15165	15138	15153	15188	15196	15185	15144	15128	15099	15128	15144	15185	15196	15188	15153	15138	15165
13	15116	15079	15092	15126	15122	15109	15079	15061	15030	15061	15079	15109	15122	15126	15092	15079	15116
14	15018	15003	15004	15034	15048	15033	14995	14977	14948	14977	14995	15033	15048	15034	15004	15003	15018
15	14942	14912	14919	14948	14963	14948	14914	14896	14884	14896	14914	14948	14963	14948	14919	14912	14942
16	14855	14838	14844	14842	14844	14861	14830	14810	14784	14810	14830	14861	14844	14842	14844	14838	14855
17	14759	14748	14735	14761	14753	14757	14738	14716	14695	14716	14738	14757	14753	14761	14735	14748	14759
18	14675	14635	14640	14636	14658	14654	14641	14636	14596	14636	14641	14654	14658	14636	14640	14635	14675
19	14585	14530	14528	14534	14539	14544	14524	14521	14500	14521	14524	14544	14539	14534	14528	14530	14585
20	14452	14428	14419	14418	14420	14404	14416	14401	14399	14401	14416	14404	14420	14418	14419	14428	14452
25	13819	13784	13750	13731	13718	13727	13737	13749	13749	13749	13737	13727	13718	13731	13750	13784	13819
30	13035	12972	12938	12897	12864	12887	12923	12954	12940	12954	12923	12887	12864	12897	12938	12972	13035
35	12093	12034	11982	11913	11864	11908	11930	11968	11964	11968	11930	11908	11864	11913	11982	12034	12093
40	11013	10938	10876	10767	10711	10743	10821	10874	10875	10874	10821	10743	10711	10767	10876	10938	11013
45	9812	9724	9610	9495	9440	9485	9585	9658	9674	9658	9585	9485	9440	9495	9610	9724	9812
50	8533	8418	8292	8151	8103	8152	8270	8374	8369	8374	8270	8152	8103	8151	8292	8418	8533
55	7220	7091	6943	6803	6768	6807	6922	7036	7043	7036	6922	6807	6768	6803	6943	7091	7220
60	5898	5780	5651	5503	5448	5469	5603	5726	5723	5726	5603	5469	5448	5503	5651	5780	5898
65	4630	4487	4375	4257	4205	4246	4355	4477	4442	4477	4355	4246	4205	4257	4375	4487	4630
70	3409	3274	3170	3087	3054	3076	3148	3250	3215	3250	3148	3076	3054	3087	3170	3274	3409
75	2273	2164	2080	2023	1995	2003	2051	2128	2107	2128	2051	2003	1995	2023	2080	2164	2273
80	1279	1199	1132	1086	1068	1072	1109	1169	1158	1169	1109	1072	1068	1086	1132	1199	1279
85	501	450	405	374	355	366	391	426	423	426	391	366	355	374	405	450	501
90	27	19	20	19	17	18	16	16	15	16	16	18	17	19	20	19	27
95	13	12	11	9	8	9	10	10	11	10	10	9	8	9	11	12	13
100	10	10	9	9	7	9	9	10	10	10	9	9	7	9	9	10	10
105	8	12	7	7	7	7	8	14	8	14	8	7	7	7	7	12	8
110	9	10	9	7	6	8	9	8	8	8	9	8	6	7	9	10	9
115	8	8	11	7	6	7	12	9	9	9	12	7	6	7	11	8	8
120	9	9	10	12	7	13	11	12	10	12	11	13	7	12	10	9	9
125	10	12	11	13	14	14	12	11	12	11	12	14	14	13	11	12	10
130	10	12	12	13	10	14	14	13	13	13	14	14	10	13	12	12	10
135	14	14	14	15	11	17	16	16	14	16	16	17	11	15	14	14	14
140	16	17	17	15	13	16	20	18	19	18	20	16	13	15	17	17	16
145	18	20	20	18	15	17	22	20	20	20	22	17	15	18	20	20	18
150	21	21	21	17	16	18	22	21	22	21	22	18	16	17	21	21	21
155	21	22	22	17	16	18	22	24	25	24	22	18	16	17	22	22	21
160	25	24	23	20	19	20	24	25	24	25	24	20	19	20	23	24	25
165	25	27	25	25	23	22	22	24	26	24	22	22	23	25	25	27	25
170	25	29	32	32	31	27	27	25	23	25	27	27	31	32	32	29	25
175	26	28	31	33	36	35	30	29	27	29	30	35	36	33	31	28	26
180	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32



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## 6.0 THD and PF Test

<b>Model No.</b>	LED FLAT 4' HIGH BAY 321W 4000K	<b>Sample ID.</b>	644070-004
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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° C ± 1° 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	Current (A)	Power (W)	Power Factor	Current THD
24.9	277.05	60	1.1325	303.43	0.9668	14.40%



## 7.0 In-Situ Temperature Measurement Test

<b>Model No.</b>	LED FLAT 4' HIGH BAY 321W 4000K	<b>Sample ID.</b>	644070-004
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### Test Method

- In-Situ Temperature Measurement Test is conducted according to the UL1598-2008, Section 14 or UL1993-2012, Section 8.5.
- The testing was conducted in a room with ambient temperature of 25°C ± 5°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	Current (A)	Power (W)	Power Factor	Orientation
26.3	120.07	60	2.6173	312.8	0.9968	horizontal

### 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	63.5	62.2	STWxA2PD-xx	300	85
Ambient temperature	N/A	26.3	25.0			

### Test Results(Driver1)

Thermocouple Location	Temperature for Driver (°C)		Driver Model Number	Driver Limit Temp. (°C)
	Test result column 1	Test result (Correct to 25 °C)		
TMP of Driver	59.6	58.3	VPL100-240	81
Ambient temperature	26.3	25.0		



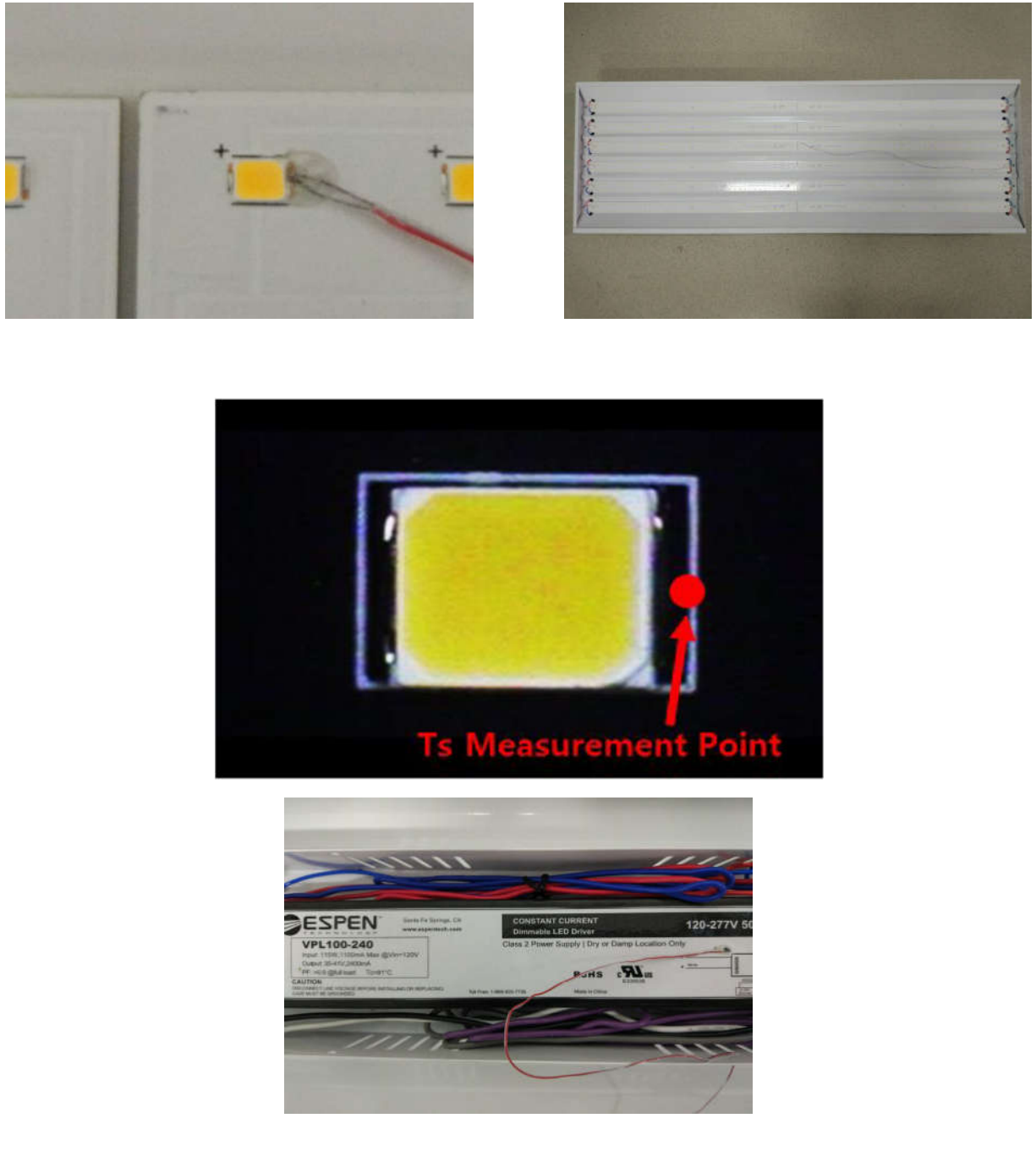
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## 7.0 In-Situ Temperature Measurement Test (Cont'd)

### Test Photos for Tc Point of LED Packages





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