



## Photometric Test Report

### Relevant Standards

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

### Prepared For

### ATG Electronics Corp.

10700 7th Street, Rancho Cucamonga

Owen He, (877) 461-5333, owenh@atgelectronics.com

Test Laboratory: UL-CCIC Company Limited

Test Laboratory Address: 2, Chengwan Road, Suzhou Industrial Park, Suzhou 21522 China

### Catalog Number

HBEL-4FT-321-40-F-XX

### Project Number

4788965897

### Report Number

4788965897\_3a

### Test Date

1/12/2018-1/26/2018

### Issue Date

4/16/2019

### Revision Date

N/A

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 v4.2- issued 2017-04-28

Requirement Category	Test Method	Requirements	Test value	Results (Fail/Pass)
Minimum Light Output (lm)	IES LM-79-2008	10000	41816.70	Pass
Minimum Bare 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 1 (20°-50°)	IES LM-79-2008	30%	52.8%	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	131.26	Pass
Minimum Bare 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	5029±283	5100	Pass
Minimum CRI	IES LM-79-2008 CIE 13.3-1995	≥70	82.02	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	0.9671	Pass
Total Harmonic Distortion (A%)	ANSI C82.77-10-2014	≤20%	8.61%	Pass
In-Situ Temperature Measurement Test for LED (°C)	UL1598-2008	≤105	64.3	Pass
In-Situ Temperature Measurement Test for Driver (°C)	UL1598-2008	≤90	57.7	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	1/17/2018	HBEL-4FT-321-40-F-XX	Gavin Yang
2	Integrating Sphere Test for the Higher CCT	1/17/2018	HBEL-4FT-321-50-F-XX	Gavin Yang
3	Goniophotometer Test	1/12/2018	HBEL-4FT-321-40-F-XX	Gavin Yang
4	THD and PF Test	1/12/2018	HBEL-4FT-321-40-F-XX	Gavin Yang
5	In-Situ Temperature Measurement Test	1/26/2018	HBEL-4FT-321-40-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-4FT-321-40-F-XX

**Rated Voltage:** 120-277V

**Frequency:** 50/60Hz

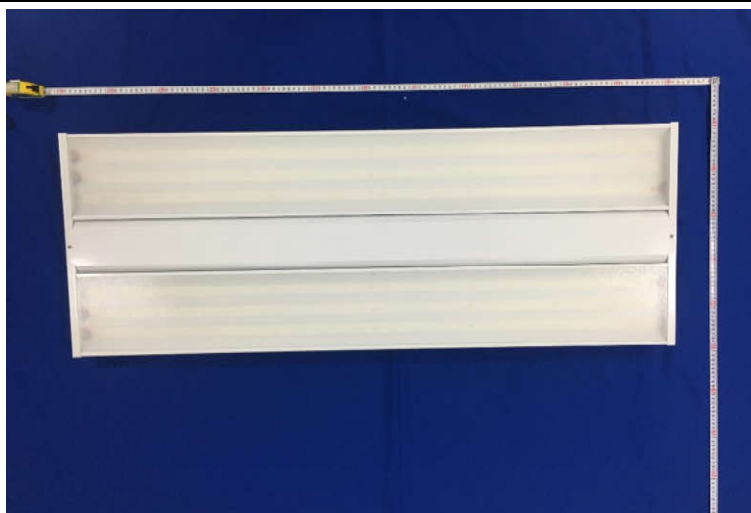
**LED Package:** STW8A2PD-XX

**Family Model and Variation:** HBEL-4FT-321-50-F-XX

**Remark:**

Photos of Luminaire Characteristics

Model Number	CCT (K)	Light Output (lm)	Power (W)	Luminous Efficacy (lm/W)
HBEL-4FT-321-40-F-XX	4000	41730	321	130
HBEL-4FT-321-50-F-XX	5000	42051	321	131





## 4.0 LM-79 Measurement and Test Results

### 4.1 Integrating Sphere Test for the lower CCT

Model No.	HBEL-4FT-321-40-F-XX	Sample ID.	1347935
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.

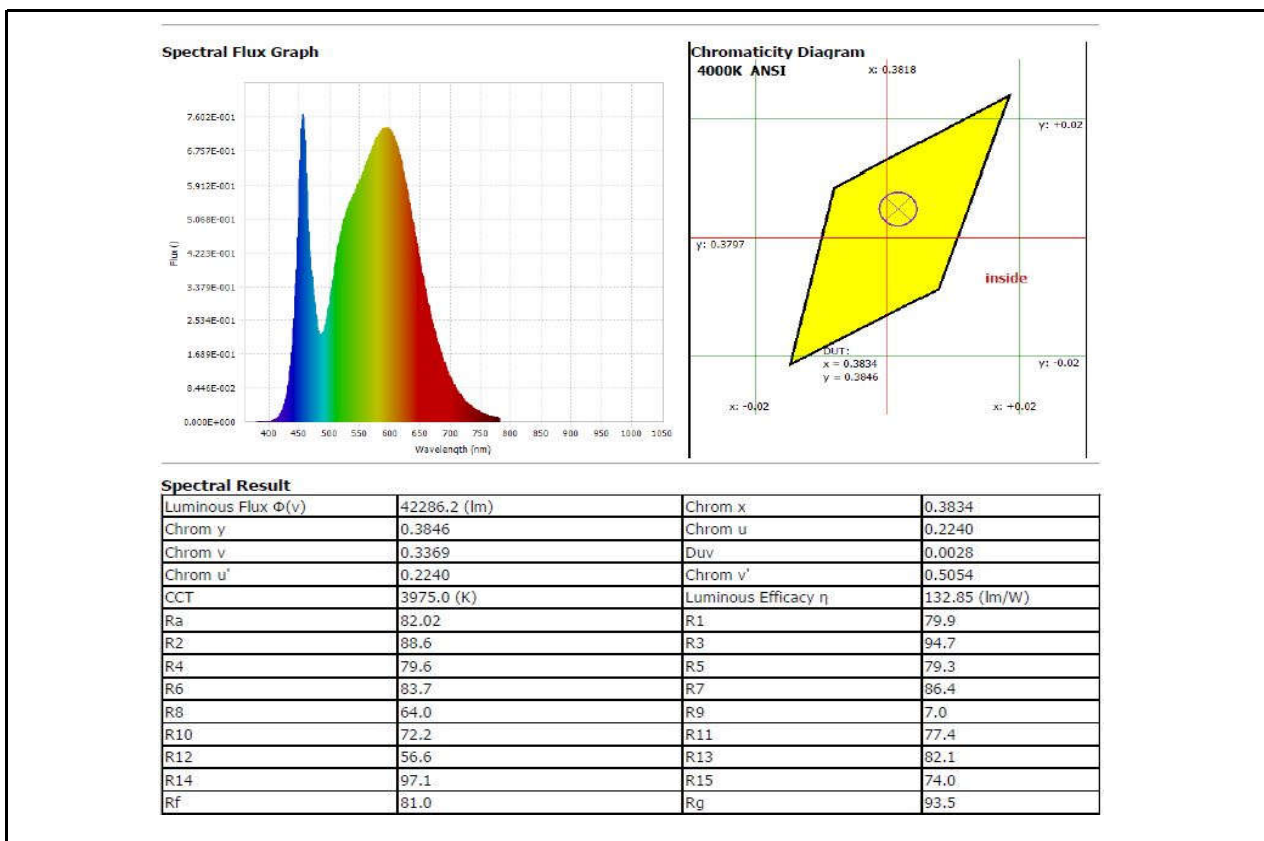
3.The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%.Photometric measurement conditions was using  $4\pi$  geometry.The self-absorption 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	Current THD
25.1	119.98	60	2.6703	318.3	0.9935	9.00%

#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
3975	82.02	0.0028	42286.2	132.85	N/A





## 4.0 LM-79 Measurement and Test Results

### 4.2 Integrating Sphere Test for the higher CCT

Model No.	HBEL-4FT-321-50-F-XX	Sample ID.	1347936
Operate time (Min.)	90	Stabilization time (Min.)	45

#### Test Method

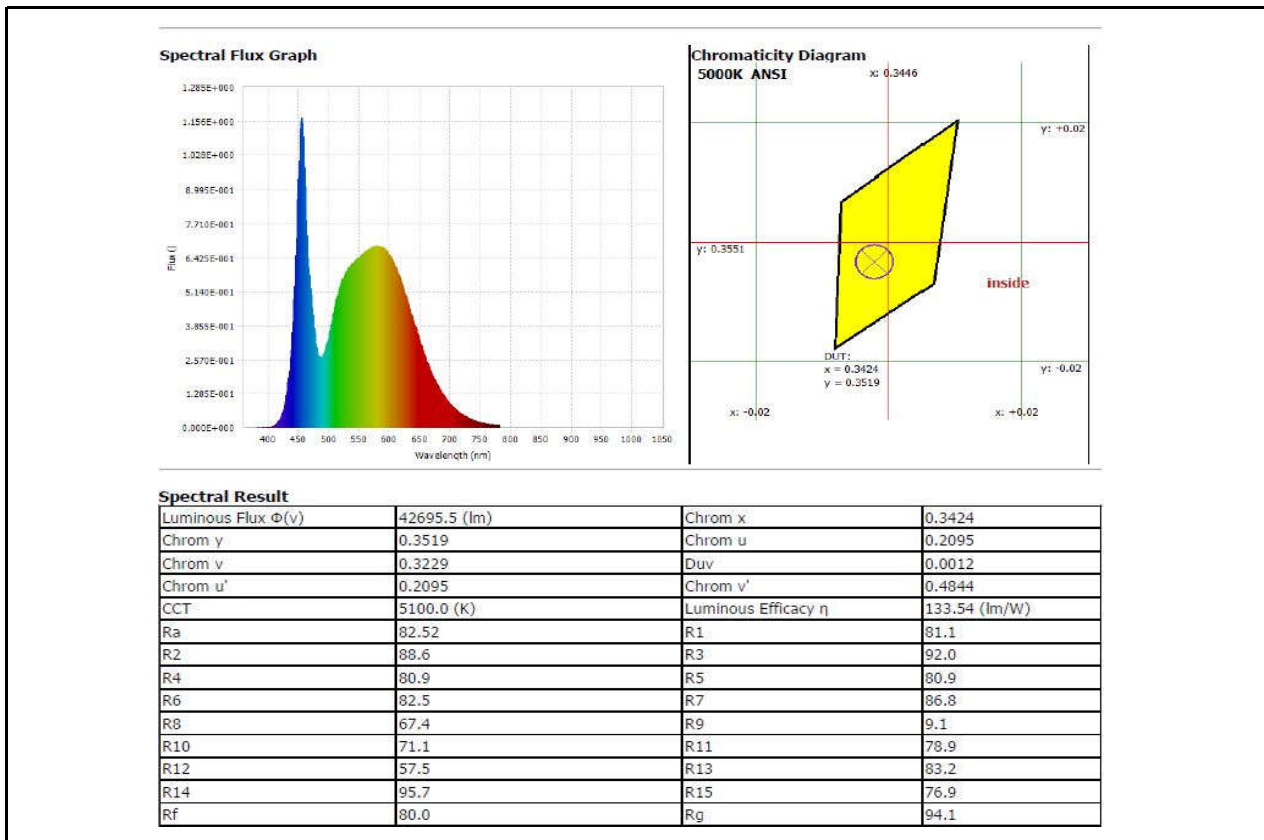
- 1.The sample was tested according to the IES LM-79-2008.
- 2.Photometric paramters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ .The reference standard lamp is rated current 2.6A 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	Current THD
25.1	119.98	60	2.6825	319.71	0.9934	9.10%

#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
5100	82.52	0.0012	42695.5	133.54	N/A





## 5.0 LM-79 Measurement and Test Results

Model No.	HBEL-4FT-321-40-F-XX			Sample ID.	1347935
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 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.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  $1^{\circ}$  vertical intervals and  $22.5^{\circ}$  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	Current THD	Orientation
25.1	119.96	60	2.673	318.58	0.9935	9.00%	Horizontal

### Test Result

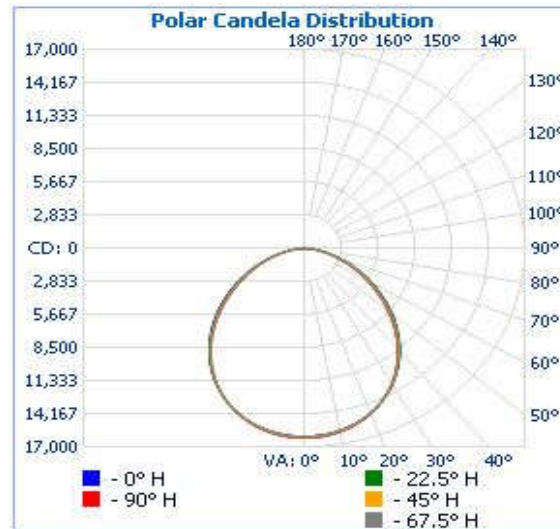
Flux (lm)	Zonal Lumen Requirement 1 (20°-50°)	Zonal Lumen Requirement 2	Field Angle (10%)		Beam Angle (50%)		Luminous Efficacy (lm/W)
			Horizontal Spread	Vertical Spread	Horizontal Spread	Vertical Spread	
41816.7	52.8%	N/A	153.9	155.8	102.4	105.1	131.26
SC	SC						
0~180°	90°~270°						
N/A	N/A						



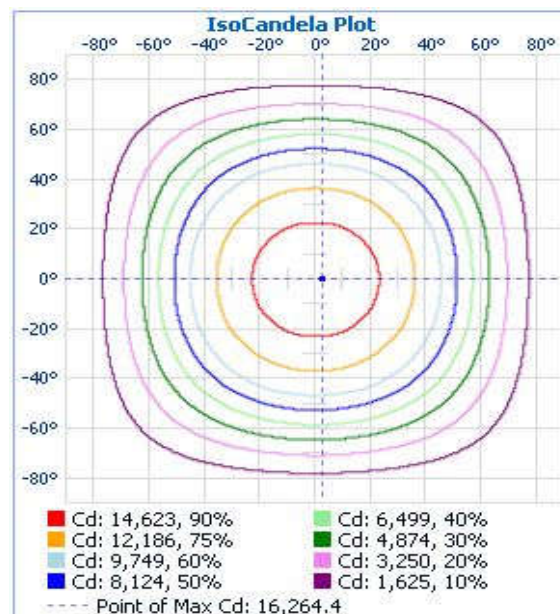


## 5.0 Goniophotometer Test (Cont'd)

### Light Distribution Curve



### IsoCandela Plot







5.0 Goniophotometer Test (Cont'd)  
Zonal Lumen Summary

Zonal Lumen Summary		
Zone	Lumens	% Luminaire
0-30	12,506.0	29.9%
0-40	20,291.6	48.5%
0-60	34,491.2	82.5%
60-90	7,241.6	17.3%
70-100	2,771.3	6.6%
90-120	24.7	0.1%
0-90	41,732.8	99.8%
90-180	79.2	0.2%
0-180	41,812.0	100%

Lumens Per Zone

Lumens Per Zone					
Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	385.9	0.9%	90-95	6.1	0%
5-10	1,144.7	2.7%	95-100	4.6	0%
10-15	1,864.0	4.5%	100-105	3.8	0%
15-20	2,517.0	6.0%	105-110	3.5	0%
20-25	3,076.5	7.4%	110-115	3.3	0%
25-30	3,518.0	8.4%	115-120	3.5	0%
30-35	3,820.0	9.1%	120-125	4.0	0%
35-40	3,965.5	9.5%	125-130	4.7	0%
40-45	3,948.8	9.4%	130-135	5.3	0%
45-50	3,773.9	9.0%	135-140	5.8	0%
50-55	3,454.9	8.3%	140-145	5.9	0%
55-60	3,022.0	7.2%	145-150	5.9	0%
60-65	2,514.8	6.0%	150-155	5.5	0%
65-70	1,966.2	4.7%	155-160	5.0	0%
70-75	1,405.4	3.4%	160-165	4.5	0%
75-80	867.2	2.1%	165-170	3.9	0%
80-85	400.0	1.0%	170-175	2.7	0%
85-90	88.0	0.2%	175-180	1.0	0%



5.0 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	16182	16182	16182	16182	16182	16182	16182	16182	16182	16182	16182	16182	16182	16182	16182	16182	16182
1	16104	16153	16155	16219	16264	16234	16147	16150	16098	16150	16147	16234	16264	16219	16155	16153	16104
2	16088	16146	16140	16218	16250	16214	16142	16149	16091	16149	16142	16214	16250	16218	16140	16146	16088
3	16073	16130	16117	16199	16244	16202	16120	16125	16073	16125	16120	16202	16244	16199	16117	16130	16073
4	16041	16106	16100	16186	16220	16175	16116	16104	16056	16104	16116	16175	16220	16186	16100	16106	16041
5	16036	16088	16072	16156	16192	16157	16079	16076	16040	16076	16079	16157	16192	16156	16072	16088	16036
6	16005	16054	16049	16121	16168	16122	16041	16046	15994	16046	16041	16122	16168	16121	16049	16054	16005
7	15950	16017	16012	16083	16115	16072	16009	16020	15968	16020	16009	16072	16115	16083	16012	16017	15950
8	15923	15969	15964	16049	16082	16043	15975	15962	15932	15962	15975	16043	16082	16049	15964	15969	15923
9	15878	15924	15922	15996	16028	15993	15920	15924	15883	15924	15920	15993	16028	15996	15922	15924	15878
10	15816	15871	15859	15943	15964	15930	15861	15856	15825	15856	15861	15930	15964	15943	15859	15871	15816
11	15760	15816	15810	15882	15911	15870	15811	15818	15768	15818	15811	15870	15911	15882	15810	15816	15760
12	15700	15750	15740	15817	15837	15805	15731	15736	15695	15736	15731	15805	15837	15817	15740	15750	15700
13	15614	15682	15678	15733	15764	15728	15665	15672	15626	15672	15665	15728	15764	15733	15678	15682	15614
14	15550	15614	15595	15657	15686	15652	15568	15592	15556	15592	15568	15652	15686	15657	15595	15614	15550
15	15469	15522	15507	15576	15592	15558	15494	15511	15472	15511	15494	15558	15592	15576	15507	15522	15469
16	15375	15435	15426	15478	15497	15466	15410	15422	15373	15422	15410	15466	15497	15478	15426	15435	15375
17	15287	15341	15321	15373	15402	15362	15312	15329	15279	15329	15312	15362	15402	15373	15321	15341	15287
18	15188	15248	15214	15281	15288	15254	15199	15222	15181	15222	15199	15254	15288	15281	15214	15248	15188
19	15078	15132	15117	15164	15167	15134	15097	15116	15078	15116	15097	15134	15167	15164	15117	15132	15078
20	14966	15022	14995	15050	15044	15021	14978	15007	14958	15007	14978	15021	15044	15050	14995	15022	14966
25	14309	14364	14319	14337	14324	14301	14288	14323	14316	14323	14288	14301	14324	14337	14319	14364	14309
30	13520	13552	13482	13465	13435	13438	13439	13499	13490	13499	13439	13438	13435	13465	13482	13552	13520
35	12560	12577	12478	12424	12380	12390	12433	12510	12508	12510	12433	12390	12380	12424	12478	12577	12560
40	11429	11449	11331	11234	11179	11206	11271	11372	11377	11372	11271	11206	11179	11234	11331	11449	11429
45	10179	10199	10064	9944	9857	9902	9986	10107	10156	10107	9986	9902	9857	9944	10064	10199	10179
50	8874	8852	8699	8552	8464	8506	8620	8755	8817	8755	8620	8506	8464	8552	8699	8852	8874
55	7485	7462	7298	7120	7018	7069	7204	7345	7434	7345	7204	7069	7018	7120	7298	7462	7485
60	6093	6063	5903	5716	5619	5671	5812	5952	6041	5952	5812	5671	5619	5716	5903	6063	6093
65	4735	4722	4557	4394	4307	4346	4476	4606	4699	4606	4476	4346	4307	4394	4557	4722	4735
70	3456	3441	3311	3172	3102	3126	3230	3332	3416	3332	3230	3126	3102	3172	3311	3441	3456
75	2271	2272	2169	2064	2011	2026	2095	2165	2235	2165	2095	2026	2011	2064	2169	2272	2271
80	1233	1248	1178	1105	1070	1070	1108	1148	1191	1148	1108	1070	1070	1105	1178	1248	1233
85	434	446	403	364	342	341	360	379	410	379	360	341	342	364	403	446	434
90	14	20	18	15	15	13	13	12	13	12	13	13	15	15	18	20	14
95	10	10	12	9	9	8	11	9	11	9	11	8	9	9	12	10	10
100	6	8	8	8	8	7	7	7	10	7	7	7	8	8	8	8	6
105	6	7	7	7	8	6	6	6	7	6	6	6	8	7	7	7	6
110	6	7	6	8	6	6	6	8	6	8	6	6	6	8	6	7	6
115	6	7	7	6	8	7	7	6	6	6	6	7	7	8	6	7	6
120	6	9	8	8	8	8	7	10	7	10	7	8	8	8	8	9	6
125	9	9	10	10	10	10	9	10	10	10	9	10	10	10	10	9	9
130	10	12	12	12	14	12	12	12	13	12	12	12	14	12	12	12	10
135	14	13	14	16	15	15	14	15	14	15	14	15	15	16	14	13	14
140	16	17	17	16	18	18	17	17	18	17	17	18	18	16	17	17	16
145	18	18	19	19	19	20	20	19	18	19	20	20	19	19	19	18	18
150	19	20	21	22	23	22	21	20	20	20	21	22	23	22	21	20	19
155	21	22	23	23	23	23	23	22	21	22	23	23	23	23	23	22	21
160	26	25	28	26	26	24	25	24	24	24	25	24	26	26	28	25	26
165	31	31	34	32	30	28	28	28	29	28	28	28	30	32	34	31	31
170	33	35	39	41	40	36	34	31	30	31	34	36	40	41	39	35	33
175	35	37	41	44	45	44	41	36	35	36	41	44	45	44	41	37	35
180	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43



6.0 THD and PF Test

Model No.	HBEL-4FT-321-40-F-XX	Sample ID.	1347935
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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 (Hz)	Current (A)	Power (W)	Power Factor	Current THD
25.1	276.94	60	1.1512	308.39	0.9671	8.61%



## 7.0 In-Situ Temperature Measurement Test

Model No.	HBEL-4FT-321-40-F-XX	Sample ID.	1347935
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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	Orientation
25.0	119.96	60	2.673	318.580	0.9935	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	Test Result (Correct to 25 °C)			
TMP of LEDs	100	64.3	64.3	STW8A2PD-XX	200	105
Ambient Temperature	N/A	25.0	25.0			

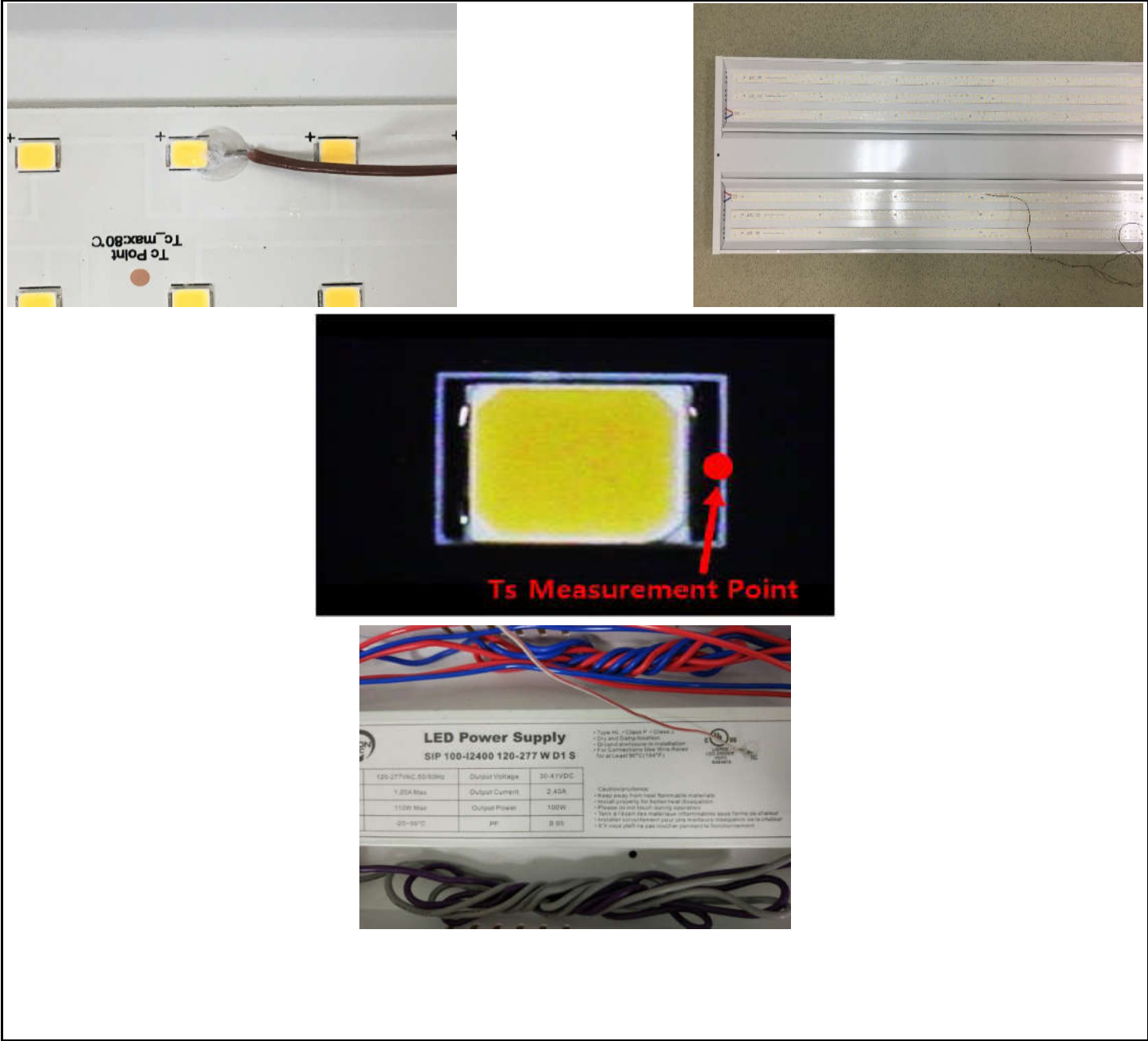
### Test Results(Driver)

Thermocouple Location	Temperature for Driver (°C)		Driver Model Number	Driver Limit Temp (°C)
	Test result Column	Test result (Correct to 25 °C)		
TMP of Driver	57.7	57.7	SIP100-I2400 120-277 W D1 S	90
Ambient Temperature	25.0	25.0		



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

Test Photos for Ts Point of LED Packages & Tc Point of Driver





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