

TEST REPORT

Prepared For

Shenzhen Brilloop Lighting Co., Ltd

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Model: BLP-HBL220W04-3000

| | |
|-----------------------|---|
| Report Type: | Report is prepared for the client above to present the result of measured temperature of samples and projected lumen maintenance life of LED lighting product according to projecting method from IES: IES TM-21-11 |
| Test Engineer: | Daniel Duan <i>Daniel Duan</i> |
| Report Number: | R2DG160822056-10 |
| Test Date: | 2016-08-23 |
| Report Date: | 2016-08-29 |
| Reviewed By: | Jeanne Han / EE Manager <i>Jeanne Han</i> |
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Note: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan)
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1. General Description

Information of Final Products:

One sample was received on 2016-08-22 and used for testing.

| | |
|----------------|--------------------------------------|
| Model Number: | BLP-HBL220W04-3000 |
| Model Name: | LED High Bay Light |
| Manufacturer: | Shenzhen Brillloop Lighting Co., Ltd |
| Rated Voltage: | 100-240V,50Hz |
| Test Voltage: | 240V,50Hz |
| Rated Power: | 220W |

Information of LED Light Source:

| | |
|-----------------------------------|------------------------------------|
| Model Number of LED Light Source: | LUXEON 3030 2D: L130-2780003000W21 |
| Manufacturer: | Philips Lumileds |

Family Declaration:

The manufacture applied declaration to our Lab on Aug. 29th 2016 and declare that there are some differences between Multiple Models and testing products. Details as below:

| Testing Model | Multiple Models | Differences | Details |
|--------------------|--------------------|-------------|--|
| BLP-HBL220W04-3000 | BLP-HBL220W04-XXXX | CCT | XXXX is CCT, it can be 3000=3000K, 4000=4000K, 5700=5700K. |

2. Standards Used

- IES TM-21-11 Projecting Long Term Lumen Maintenance of LED Light Sources
- ANSI/UL 1598-2008: Standard for Safety of Luminaires
- Annex A of IES LM-84-14 Recommendations for measurement of IN-SITU conditions LED case temperature

3. Test Method

Lumen maintenance life of LED light source and LED lamp or luminaire (if any) is the elapsed operating time over which an LED light source maintains a given percentage of its initial light output. L_{70} in this report is the time (in hours) when the light output from the LED has dropped to 70% of its initial output.

The LED light source is LED package, array, or module which is tested in IES LM-80-08 test report. Final product means LED lamp or luminaire which the LED light source will be included. TMP_{LED} is the temperature of the thermocouple attachment point on the LED light source package as defined by the manufacturer of the LED light source. The *in situ* temperature of LED light source used in final product was used to calculate the lumen maintenance life of final product, if any.

The *in situ* temperature is measured according to ANSI/UL 1598 and IES LM-84 Annex A. The LED which has the highest temperature was measured at the location of LED case which is specified by LED source manufacturer and detailed by LM-80 report. The hottest LED was found by the following procedure:

An IR thermography may be used to find the hottest LEDs. Or if the layout of PCB is symmetrical, the hottest LED should be at the center or close to the center of the array. Or in question, more than one TMP should be measured to find out the hottest LED. The case temperature of the hottest LED source at *in situ* condition is reported and is used to project L_{70} life time.

The reported temperature value for each point should be the readings of the hybrid recorder after the temperature of each point is stabilized and constant. A temperature is considered constant if the test has been running for at least 3 hours; and three successive readings, taken at 15-minute intervals, are within 1 degree C of one another and are not

rising. Or the test was run for a minimum of 7.5 h. Ambient temperature variations above or below 25 °C have been respectively subtracted from or added to temperatures recorded at points on the device.

The drive current of LED package/module/ array was calculated as the total output current of the driver measured by multimeter, divided by the number of branches in parallel of LEDs.

The calculation of the L₇₀ life is according to IES TM-21-11.

FINAL

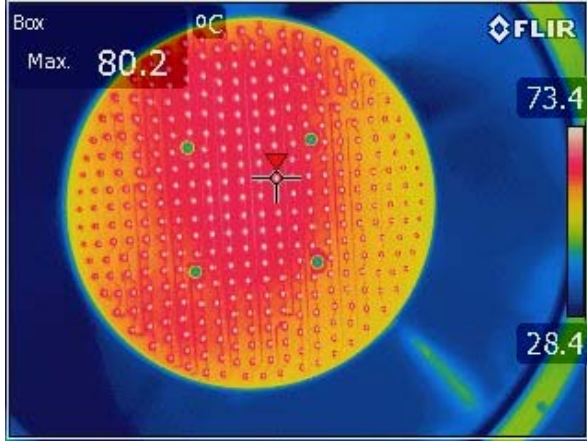
4. Test Equipment

| Device | Manufacture | Model No | Serial No | Test Range | Calibration date | Calibration due date |
|-----------------|-------------|----------|-----------|----------------------------|------------------|----------------------|
| Multimeter | FLUKE | 17B | 1573 1328 | 400nV~4000nV, 4V~1000V | 2016-03-04 | 2017-03-03 |
| Hybrid Recorder | YOKOGAWA | DR240 | 10# | N/A | 2016-03-04 | 2017-03-03 |
| Power Supply | HengPu | HPA 1103 | 0003394 | 3KVA | 2016-03-04 | 2017-03-03 |
| Thermography | FLIR | E60 | 49037877 | -20°C-120 °C 0°C-650 °C | N/A | N/A |

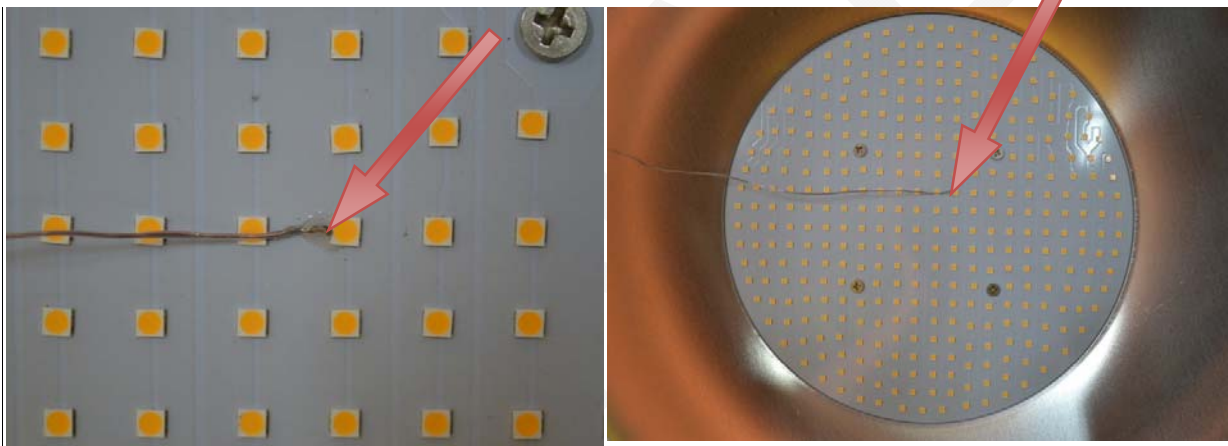
Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

5. In situ Temperature and Driver Current Measurements of Final Product

IR thermograph from hot PCBAs of Sample



Temperature measurement point on TMPLED



Temperature Measurement Data

Test Condition

| | |
|------------------------|-------------|
| Ambient Temperature: | 25°C±5°C |
| Relative Humidity: | 54.6 % |
| Supply voltage: | 240 V 50 Hz |
| Type of thermocouples: | T |
| Test Duration | ≥3.5Hours |

Test Result

| | |
|-----------------------------------|----------|
| Hottest TMP _{LED} : | 87.2°C |
| Forward Current(I _F): | 101.2 mA |

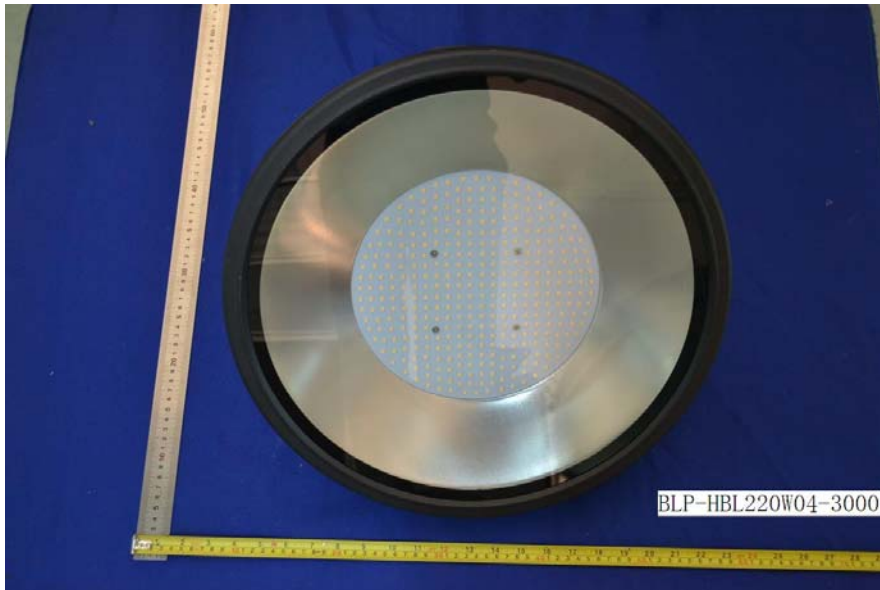
6. Lumen Maintenance Data of LED Light Source from LM-80 Report

| Test Data for 55°C Case Temperature | | Test Data for 85°C Case Temperature | | Test Data for 105°C Case Temperature | |
|-------------------------------------|-----------------------|-------------------------------------|-----------------------|--------------------------------------|-----------------------|
| Time (hours) | Lumen Maintenance (%) | Time (hours) | Lumen Maintenance (%) | Time (hours) | Lumen Maintenance (%) |
| 1000 | 99.26 | 1000 | 98.97 | 1000 | 98.91 |
| 2000 | 98.64 | 2000 | 98.43 | 2000 | 98.15 |
| 3000 | 98.36 | 3000 | 98.01 | 3000 | 97.68 |
| 4000 | 97.69 | 4000 | 97.28 | 4000 | 96.74 |
| 5000 | 97.25 | 5000 | 96.71 | 5000 | 96.27 |
| 6000 | 96.81 | 6000 | 96.24 | 6000 | 95.73 |
| 7000 | 96.34 | 7000 | 95.77 | 7000 | 95.36 |
| 8000 | 95.84 | 8000 | 95.66 | 8000 | 95.25 |
| 9000 | 95.49 | 9000 | 95.19 | 9000 | 94.56 |

7. Calculate Result of Life Time Projection

| Temperature Interpolation at 87.2°C (projection based on in-situ temperature entered) | |
|--|------------------|
| $T_{s,1}$ (°C) | 85.00 |
| $T_{s,1}$ (K) | 358.15 |
| α_1 | 4.178E-06 |
| B_1 | 0.988 |
| $T_{s,2}$ (°C) | 105.00 |
| $T_{s,2}$ (K) | 378.15 |
| α_2 | 4.280E-06 |
| B_2 | 0.983 |
| E_a/k_b | 1.63E+02 |
| A | 6.577E-06 |
| B_0 | 0.986 |
| $T_{s,i}$ (°C) | 87.20 |
| $T_{s,i}$ (K) | 360.35 |
| α_i | 4.190E-06 |
| Reported $L_{70}(9k)$ at 87.2°C (hours) | >54000 |

8. Final Product Photo



*****END OF REPORT*****