



ENERGY STAR® Luminaire Test Report

ENERGY STAR® Program Requirements Product Specification for Luminaires - Version 2.2 August 15, 2019

Prepared For

P.Q.L., Inc.

2285 Ward Avenue
Simi Valley, CA 93065

Test Laboratory: UL-CCIC Company Limited

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

Catalog Number

90897

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4789880982.52

Report Number

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Test Date

1/7/2022 -1/12/2022

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1/13/2022

Revision Date

N/A

Prepared By

Zoe Guo

Handler signature

Approved By

Duff Yang

Reviewer signature

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ENERGY STAR® Program Requirements Product Specification for Luminaires - Version 2.2 - Issued 2019-08-15

| SSL Downlight Retrofit Kits | | | |
|--|-------------------------------------|--|-------------------|
| Requirement Category | Test Method | Requirement | Test Value |
| Efficacy (lm/W) | IES LM-79-08 | Downlights: • Recessed • Surface • Pendant: 55 lm/W, Downlights retrofits: 60lm/w | 73.3 |
| Light Output (lm) | IES LM-79-08 | ≤ 4.5" aperture: 345 lumens > 4.5" aperture: 575 lumens | 695.9 |
| Zonal Lumen Density | IES LM-79-08 | For directional luminaires only. | 84.8% |
| CCT (K) | ANSI C78.377-2011 | fall within the corresponding 7-step chromaticity quadrangles | 2696 |
| CRI | IES LM-79-08, CIE 13.3-1995 | Ra ≥ 90 | 91 |
| R9 | IES LM-79-08, CIE 13.3-1996 | R9 > 0 | 46 |
| Color Angular Uniformity | IES LM-79-08, CIE 15: 2004 | ≤ 0.006 on the CIE 1976 (u',v') diagram | 0.002 |
| Lumen Maintenance & Light Source Life (hours) | N/A | L70 ≥ 25,000 hours for indoor; L70 ≥ 35,000 hours for outdoor; L70 ≥ 50,000 h for inseparable luminaires | 50000 |
| Color Maintenance | IES LM-84-14 | ≤ 0.007 on the CIE 1976 (u',v') diagram | 0.003 |
| Source Start Time (ms) | ENERGY STAR Start Time Test Method | 1 s for connected luminaires; 750 ms for other luminaires. | 43.76 |
| Source Run-Up Time (s) | ENERGY STAR Run Up Time Test Method | ≤ 45 seconds | N/A |
| Power Factor | C82.77-10:2014 | power ≤ 5 watts: PF ≥ 0.5; power ≥ 5 watts: PF ≥ 0.7 | 0.9494 |
| Transient Protection | IEEE C62.41.2-2002 | Survival | Survival |
| Standby Power Consumption (W) | IEC 62301 ED.2.0 B | Shall not draw power in the off state. | N/A |
| Operating Frequency (Hz)* | N/A | Frequency ≥ 120 Hz | 120.8 |

* The data are not covered by the NVLAP accreditation.



Test Summary (Cont'd)

| Requirement Category | Test Method | Requirement | Test Value |
|---|---------------------------------------|---|------------|
| Flicker: Short Term Flicker Indicator (Pst)* | NEMA 77-2017 | Optional: meet NEMA 77-2017 for temporal light modulation limits. | 0.868 |
| Flicker: Stroboscopic Visibility Measure (SVM)* | NEMA 77-2017 | Optional: meet NEMA 77-2017 for temporal light modulation limits. | 1.055 |
| Light Source Replaceability | N/A | Fluorescent & Directional LED luminaire | N/A |
| LED Tc Temperature (°C) | ANSI/UL 1598:2008 ANSI/UL 153-2002 | Within the highest test temperature in LM-80 report | 69.4 |
| Driver Case Temperature (°C) | ANSI/UL 1598:2008 ANSI/UL 153-2002 | ≤ TMPC marked on the the driver | 57.4 |
| Recessed Downlight Thermal Performance | N/A | Insulation contact & Airtight construction | Type IC |
| SAFETY REQUIREMENTS for luminaire and driver | UL Safety standards | Safety documentation | Vatidated |
| Dimming: Range (Minimum) | N/A | ≤20% | 14.2% |
| Dimming: Noise* | N/A | 24dBA at 1 meter | 18.2 |
| Labeling & Packaging | N/A | Relevant document | N/A |
| WARRANTY REQUIREMENTS | N/A | no less than 3 years | 5 |
| Lighting Toxics Reduction Requirements | N/A | Relevant Documentations | N/A |

* The data are not covered by the NVLAP accreditation.



Test List

Sample Receive Date: 2022/1/7

| Test Item | Test | Test Date | Test Model | Equipment ID. | Tests Conducted By |
|-----------|--------------------------------------|-----------|------------|---------------|--------------------|
| 1 | Integrating Sphere Test | 1/7/2022 | 90897 | N/A | Zoe Guo |
| 2 | Goniophotometer Test | 1/7/2022 | 90897 | N/A | Zoe Guo |
| 3 | Color Angular Uniformity | 1/7/2022 | 90897 | N/A | Zoe Guo |
| 4 | Source Start Time & Run-Up time | 1/11/2022 | 90897 | N/A | Zoe Guo |
| 5 | Operating Frequency Test | 1/11/2022 | 90897 | N/A | Zoe Guo |
| 6 | Transient Protection Test | 1/11/2022 | 90897 | N/A | Zoe Guo |
| 7 | Standby Power Consumption | N/A | N/A | N/A | N/A |
| 8 | Flicker Test | 1/11/2022 | 90897 | N/A | Zoe Guo |
| 9 | Dimming Test | 1/11/2022 | 90897 | N/A | Zoe Guo |
| 10 | In-Situ Temperature Measurement Test | 1/12/2022 | 90897 | N/A | Zoe Guo |

Remark (if any)

1. UL test equipment information is recorded on Meter Use in UL's Aurora database.
2. The accuracy method decision rule is applied when the compliance or verdict is made to the results of this report.



Production Description

Luminaire Description: SSL Downlight Retrofit Kits

Lighting Source: 9.2835W3V32F-S02

LED Driver: 90897

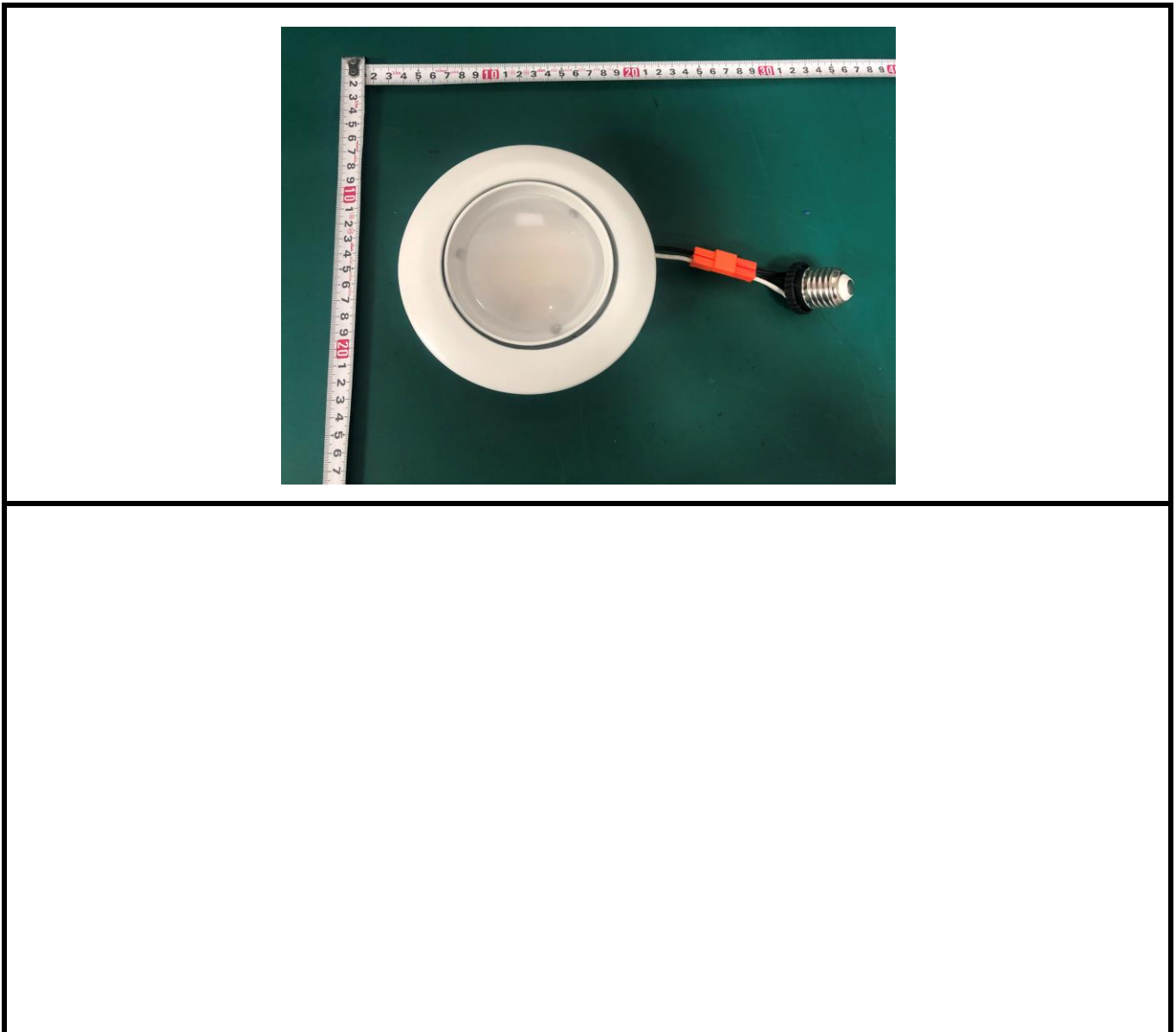
Electrical Parameter: 120VAc,50/60Hz

Family model: 90897

The Product is color tunable and dimmable. The CCT can be 2700k, 3000K, 3500K, 4000K, 5000K;

Least Efficient white light setting and Default setting are 2700K, Most Consumptive white light setting is 5000K.

Photos of Luminaire Characteristics





Integrating Sphere Test

| | | | | | |
|---------------------|-------|---------------------------|---------|------------------|------|
| Model No. | 90897 | Sample ID. | 4410503 | Temperature (°C) | 25.4 |
| Operate time (Min.) | 90 | Stabilization time (Min.) | 45 | | |

Test Method

1.The sample was tested according to the IES LM-79-2008, and the product is assume to be brand new without seasoning.

2.Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at 25 °C ± 1 °C. The reference standard lamp is rated current 2.679A omni-directional Incandescent lamp and was calibrated by National Institute of Metrology P.R.China.

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 4π 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 Conditions and Results

| Model Number | Orientation | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | CCT (K) | CRI (Ra) | R9 | Luminous Flux (lm) | Luminous Efficacy (lm/W) |
|--------------|-------------|---------------|----------------|-------------|-----------|--------------|---------|----------|----|--------------------|--------------------------|
| 90897(2700k) | Horizontal | 119.95 | 59.98 | 0.0838 | 9.54 | 0.9494 | 2696 | 91 | 46 | 708.8 | 74.30 |
| 90897(5000K) | Horizontal | 119.93 | 59.98 | 0.0839 | 9.56 | 0.9495 | 4953 | 95 | 85 | 823.8 | 86.19 |



Goniophotometer Test

| | | | |
|----------------------------|-------|----------------------------------|---------|
| Model No. | 90897 | Sample ID. | 4410503 |
| 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° C ± 1° 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 1° vertical intervals and 22.5° horizontal intervals.

Goniophotometer Test Conditions

| Temperature (°C) | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | Orientation |
|------------------|---------------|----------------|-------------|-----------|--------------|-------------|
| 24.9 | 120.03 | 60.00 | 0.0833 | 9.49 | 0.9495 | Horizontal |

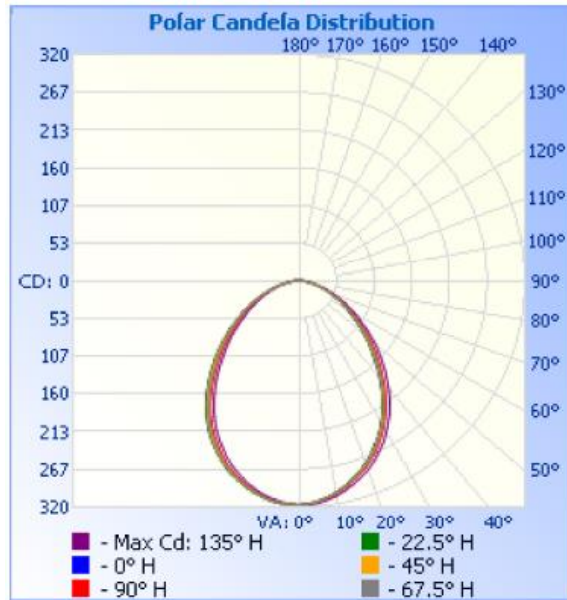
Test Results

| Flux (lm) | Zonal Lumen Requirement (0-60°) | Field Angle (10%) | | Beam Angle (50%) | | Luminous Efficacy (lm/W) |
|----------------------------------|---------------------------------|-------------------|-----------------|-------------------|-----------------|--------------------------|
| | | Horizontal Spread | Vertical Spread | Horizontal Spread | Vertical Spread | |
| 695.9 | 84.8% | 149.1 | 148.9 | 90.6 | 91 | 73.3 |
| Zonal Lumen Requirement 2 | | | | | | |
| N/A | | | | | | |

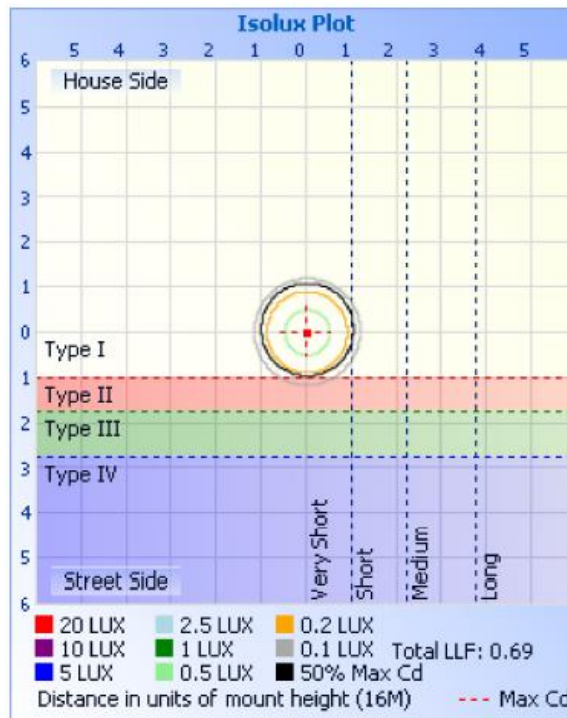


Goniophotometer Test (Cont'd)

Light Distribution Curve



Isolux Plot





Goniophotometer Test (Cont'd)

Zonal Lumen Summary

Zonal Lumen Summary

| Zone | Lumens | % Luminaire |
|--------|--------|-------------|
| 0-30 | 233.8 | 33.6% |
| 0-40 | 369.1 | 53% |
| 0-60 | 589.9 | 84.8% |
| 60-90 | 104.3 | 15% |
| 70-100 | 40.4 | 5.8% |
| 90-120 | 0.4 | 0.1% |
| 0-90 | 694.2 | 99.7% |
| 90-180 | 1.8 | 0.3% |
| 0-180 | 695.9 | 100% |

Lumens Per Zone

Lumens Per Zone

| Zone | Lumens | % Total | Zone | Lumens | % Total |
|-------|--------|---------|---------|--------|---------|
| 0-5 | 7.5 | 1.1% | 90-95 | 0.1 | 0% |
| 5-10 | 22.2 | 3.2% | 95-100 | 0.1 | 0% |
| 10-15 | 35.7 | 5.1% | 100-105 | 0.1 | 0% |
| 15-20 | 47.5 | 6.8% | 105-110 | 0.1 | 0% |
| 20-25 | 57.1 | 8.2% | 110-115 | 0.1 | 0% |
| 25-30 | 63.9 | 9.2% | 115-120 | 0.0 | 0% |
| 30-35 | 67.6 | 9.7% | 120-125 | 0.1 | 0% |
| 35-40 | 67.7 | 9.7% | 125-130 | 0.1 | 0% |
| 40-45 | 64.6 | 9.3% | 130-135 | 0.1 | 0% |
| 45-50 | 59.4 | 8.5% | 135-140 | 0.1 | 0% |
| 50-55 | 52.5 | 7.5% | 140-145 | 0.2 | 0% |
| 55-60 | 44.3 | 6.4% | 145-150 | 0.2 | 0% |
| 60-65 | 36.2 | 5.2% | 150-155 | 0.2 | 0% |
| 65-70 | 27.8 | 4.0% | 155-160 | 0.2 | 0% |
| 70-75 | 19.8 | 2.8% | 160-165 | 0.1 | 0% |
| 75-80 | 12.5 | 1.8% | 165-170 | 0.1 | 0% |
| 80-85 | 6.3 | 0.9% | 170-175 | 0.1 | 0% |
| 85-90 | 1.6 | 0.2% | 175-180 | 0.0 | 0% |



Color Angular Uniformity

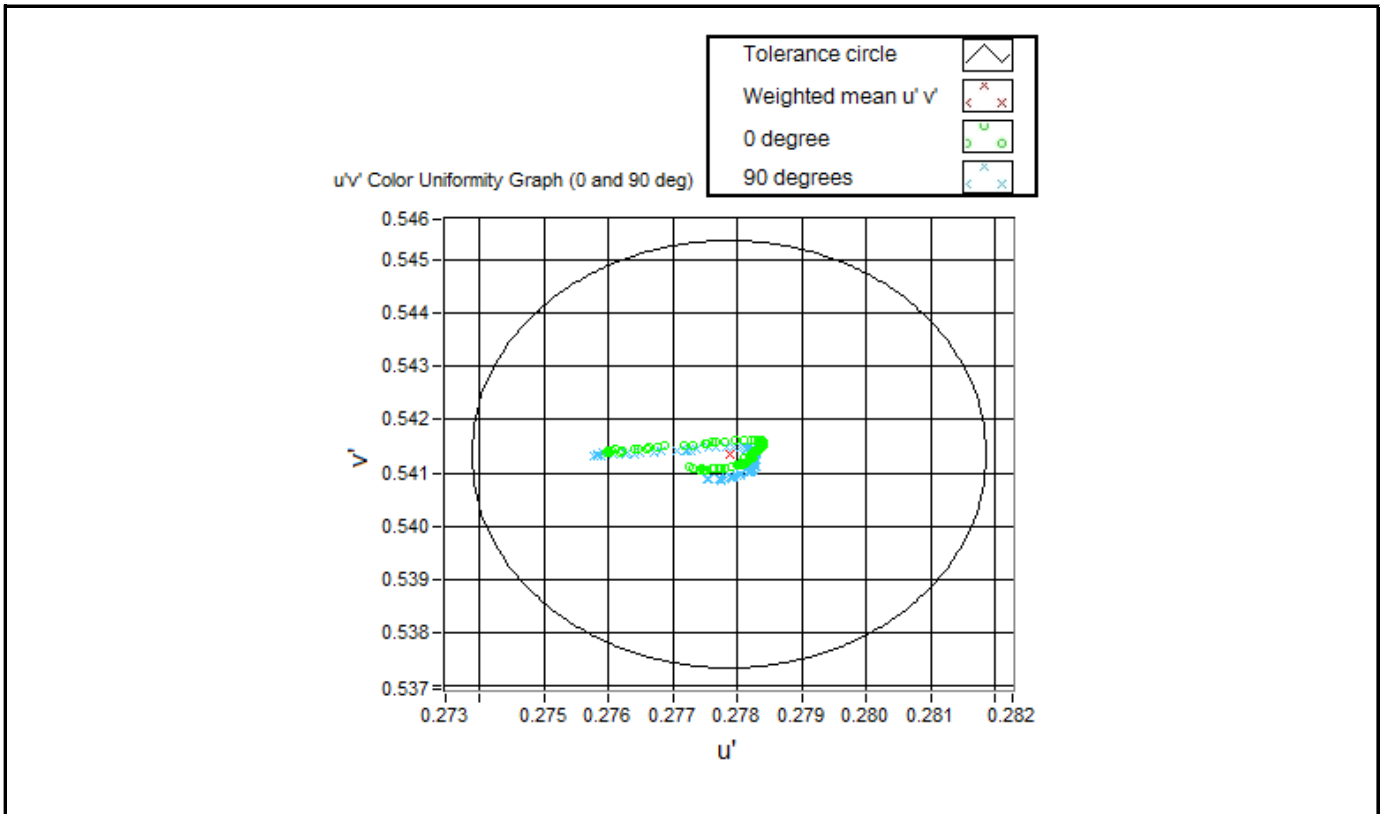
| | | | |
|------------------|-------|-------------------|---------|
| Model No. | 90897 | Sample ID. | 4410503 |
|------------------|-------|-------------------|---------|

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.
4. The sample was operated at 120 Volts AC, 60Hz. It was stabilized before measurement was made. Color spatial uniformity was calculated from the software taken at 1° vertical intervals and 90° horizontal intervals.

Test Results

| Temperature (°C) | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Maximum $\Delta u'v'$ |
|------------------|---------------|----------------|-------------|-----------|-----------------------|
| 24.9 | 120.03 | 60.00 | 0.0833 | 9.49 | 0.002 |





Source Start Time & Run-Up time

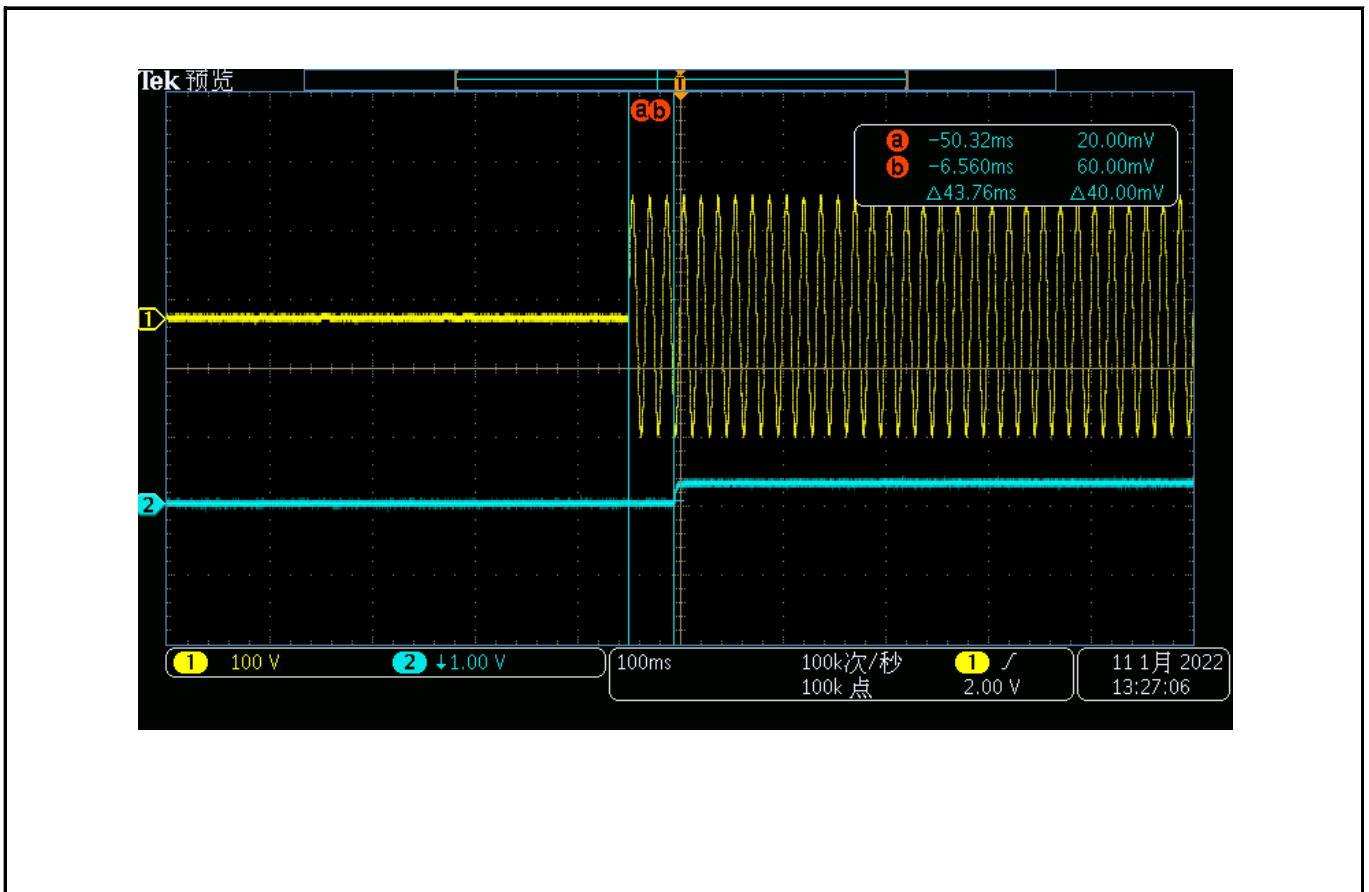
| | | | |
|------------------|-------|-------------------|---------|
| Model No. | 90897 | Sample ID. | 4410503 |
|------------------|-------|-------------------|---------|

Test Method

1. The sample was tested according to ENERGY STAR Start Time Test and ENERGY STAR Run-Up Time Test for fluorescent luminaires only.
2. Each test sample was operated in its designated orientation at rated input voltage in a $25 \pm 5^\circ\text{C}$ ambient. A photodetector is used to monitor the luminaire light output. Time was recorded when the sample was fully illuminated and reached 90% of stabilized lumen output.

Test Results

| Temperature (°C) | Voltage (Vac) | Frequency (Hz) | Start Time (ms) | Run-Up time (s) |
|------------------|---------------|----------------|-----------------|-----------------|
| 24.9 | 120.05 | 60.00 | 43.76 | N/A |





Operating Frequency Test

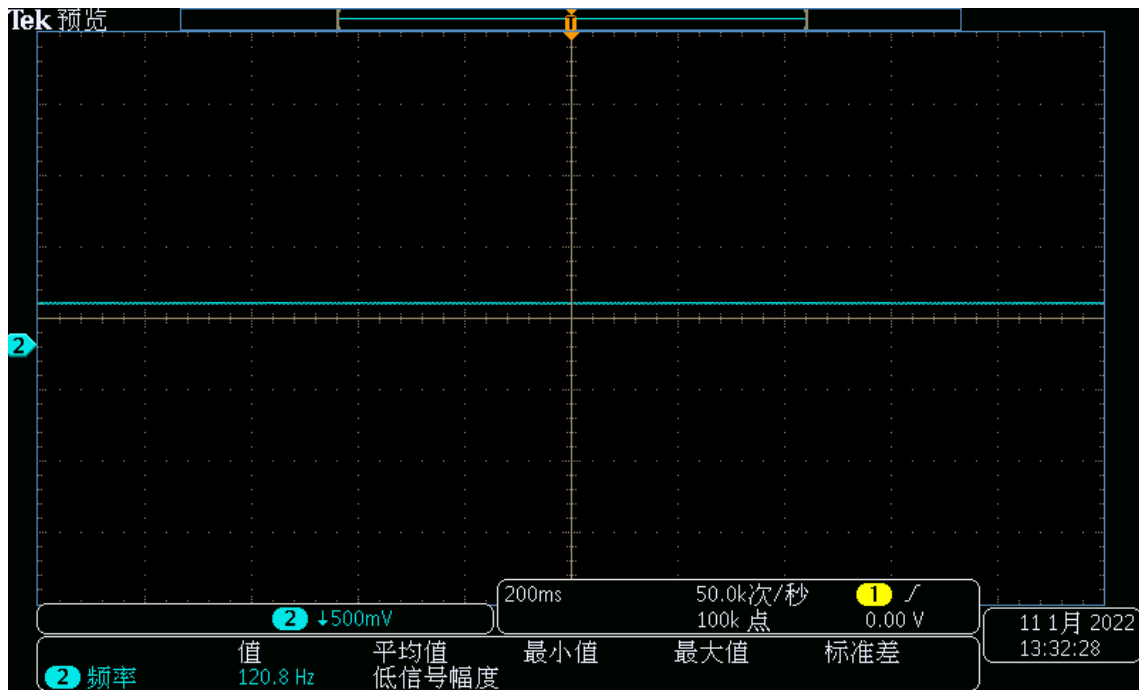
| | | | |
|------------------|-------|-------------------|---------|
| Model No. | 90897 | Sample ID. | 4410503 |
|------------------|-------|-------------------|---------|

Test Method

1. The sample was tested according to ANSI C82.2-2002 for fluorescent luminaires.
 2. Each test sample was operated at rated input voltage. Light output waveform shall be measured with a photodetector, transimpedance amplifier and oscilloscope. The AC ripple on the output DC line was measured and recorded by the oscilloscope according to Energy Star directions.

Test Results

| Temperature (°C) | Voltage (Vac) | Frequency (Hz) | Operating Frequency (Hz) |
|------------------|---------------|----------------|--------------------------|
| 24.9 | 120.01 | 60 | 120.8 |





Transient Protection Test

| | | | |
|------------------|-------|-------------------|---------|
| Model No. | 90897 | Sample ID. | 4410503 |
|------------------|-------|-------------------|---------|

Test Method

The transient protection tests at ambient temperature were performed on one sample. Each sample was operated at rated input voltage in the specific orientation during the tests. A Model PSVAGE8000 test system with an 100kHz Ring Wave Module and a Coupler/Decoupler Module was used to generate the 2500 volt ring wave transient strike across the luminaire contacts. Each wave consisted of a 0.5 microsecond rise time. Seven strikes were performed on each sample in accordance with ANSI/IEEE C62.41 (Category A): Recommended Practice on Surge Voltages in Low – Voltage AC Circuits.

Test Results

| Temperature (°C) | Voltage (Vac) | Frequency (Hz) | After Test - Seven Strikes (Survival/Dead) |
|-------------------------|----------------------|-----------------------|---|
| 25.1 | 120.02 | 60 | Survival |



Flicker Test

Dimmer Information

| Dimmable/Non-dimmable | Dimmer | | Dimming Type | Prodcut Model No. | Sample ID | Temperature (°C) |
|-----------------------|--------------|--------|--------------------|-------------------|-----------|------------------|
| Dimmable | Manufacture | LUTRON | Continuous dimming | 90897 | 4410503 | 24.3 |
| | Model Number | DVSTV | | | | |

Test Method

1. The test was performed using a relative photometry method, according to NEMA 77-2017.
2. The measurement was taken one test sample combined with the dimmers. The sample was tested at the rated electrical parameter, and allowed to stabilize and verify by taking light output measurements every minute with interval 0.00004 seconds and equipment period 2 seconds, until consecutive measurements are no more than 0.5% apart.

Test Results

| Test Condition | | Input Voltage (V) | Input Current (A) | Power (W) | Power Factor | THDi (%) | Light Output (lx) | Pst | SVM |
|------------------------------|----------------------|-------------------|-------------------|-----------|--------------|----------|-------------------|-------|-------|
| Dimmable | Full lighting output | 120.08 | 0.0869 | 9.89 | 0.9491 | 22.19 | 712.0 | 0.110 | 0.609 |
| Non-phase cut (Phase cut) | MaxLO (130°) | 120.04 | 0.0994 | 9.14 | 0.7857 | 45.17 | 667.0 | 0.131 | 0.790 |
| | 50% (90°) | 120.05 | 0.1061 | 4.79 | 0.3741 | 114.9 | 335.0 | 0.352 | 1.055 |
| | MinLO (40°) | 120.07 | 0.0789 | 1.74 | 0.1827 | 191.3 | 101.1 | 0.868 | 0.853 |
| Maximum Reading | | | | | | | | 0.868 | 1.055 |



Dimming Test

| | | | |
|------------------|-------|-------------------|---------|
| Model No. | 90897 | Sample ID. | 4410503 |
|------------------|-------|-------------------|---------|

Dimmer Information

| | | | |
|----------------------------|--------|------------------------------|-------|
| Manufacture | LUTRON | Model Number | DVSTV |
| Rated for CFL / LED | N/A | Technology / Features | N/A |

Test Method

1. The test was performed using a relative photometry method, according to ENERGY STAR Recommended Practice - Light Output on a Dimmer and ENERGY STAR® Recommended Practice - Noise.
2. The measurement was taken one test sample combined with the dimmers. The sample was tested at the rated electrical parameter, and allowed to stabilize and verify by taking light output measurements every minute, until consecutive measurements are no more than 0.5% apart.
3. The noise test shall be conducted on sample in the sound chamber with one microphone. The microphone was located in six position to get the peak noise.

Test Results

| Temperature (°C) | Voltage (Vac) | Frequency (Hz) | Baseline Light Output (lx) | | Maximum Light Output (lx) | Minimum Light Output (lx) |
|---------------------|-------------------------|---------------------------|----------------------------|-------------------|--------------------------------|--------------------------------|
| 24.3 | 120.05 | 60 | 712.0 | | 667.0 | 101.10 |
| Ambient Sound (dBA) | Peak Noise at BLO (dBA) | Peak Noise at MaxLO (dBA) | Peak Noise at MinLO (dBA) | Position (degree) | Maximum Light Output Ratio (%) | Minimum Light Output Ratio (%) |
| 18.2 | 18.0 | 18.2 | 18.1 | 0 | 93.68 | 14.20 |



In-Situ Temperature Measurement Test

| | | | |
|------------------|-------|-------------------|---------|
| Model No. | 90897 | Sample ID. | 4410503 |
|------------------|-------|-------------------|---------|

Test Method

1. In-Situ Temperature Measurement Test is conducted according to the UL 1598-2008, Section 14.
 2. 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.
 Thermocouples were placed on the LED driver case in the locations specified by the manufacture if necessary. The temperature was recorded after the lamp was operated by 7.5 hours.
 3. The data and photos in LM-80 test report is provided by the customer/ The data and photos in driver specification is provided by the customer.

In-Situ Temperature Measurement Test Conditions

| Temperature | Voltage (Vac) | Frequency (Hz) | Current (A) | Power (W) | Power Factor | Orientation |
|-------------|---------------|----------------|-------------|-----------|--------------|-------------|
| 25.2 | 120.03 | 60.00 | 0.0833 | 9.49 | 0.9495 | Horizontal |

Test Results

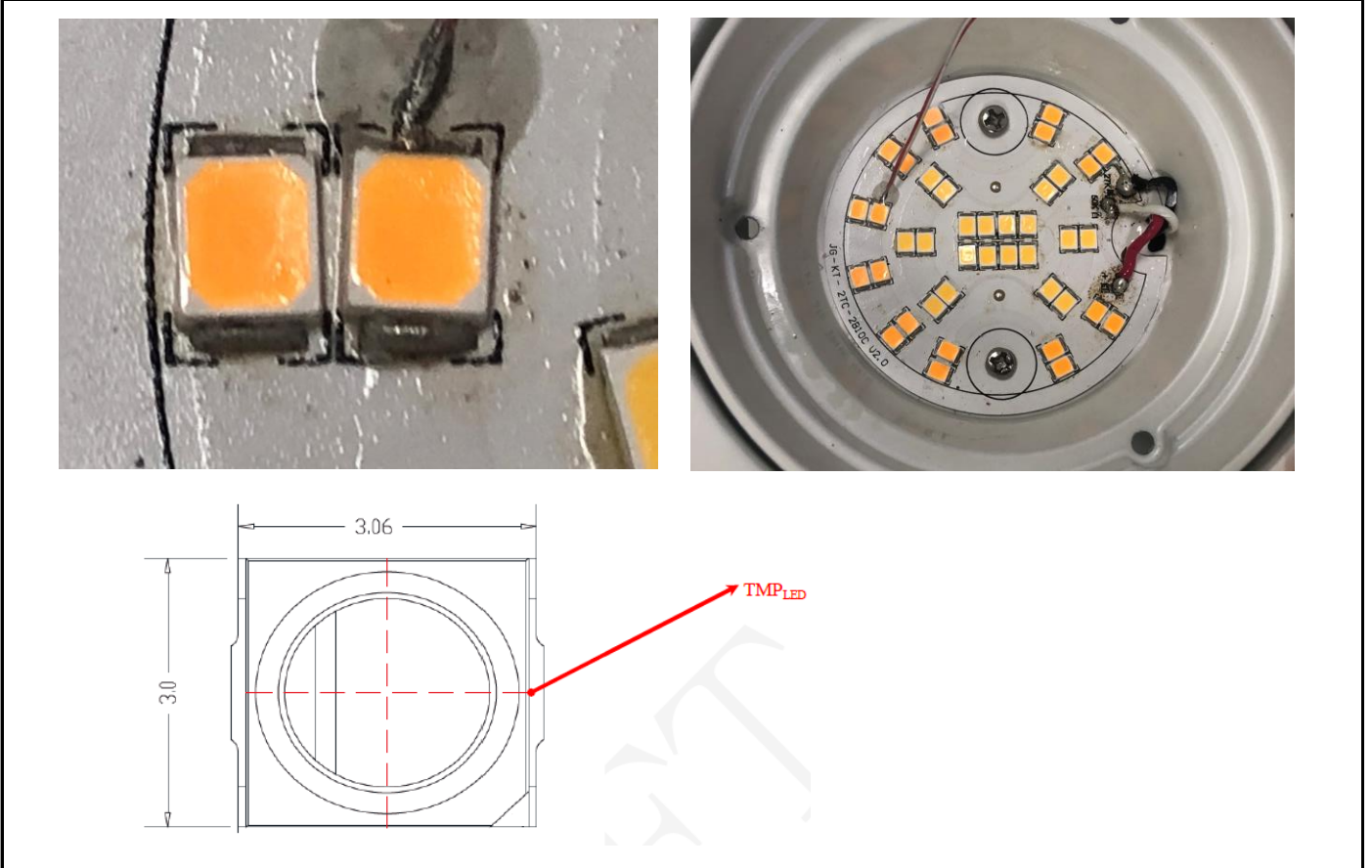
| Thermocouple Location | Measured Current (mA) | Temperature for Lighting source (°C) | | LED Model Number | LM-80 Limit Current (mA) | LM-80 Limit Temp. (°C) |
|-----------------------|-----------------------|--------------------------------------|--------------------------------|------------------|--------------------------|------------------------|
| | | Test result | Test result (Correct to 25 °C) | | | |
| TMP of LEDs | 75 | 69.6 | 69.4 | 9.2835W3V32F-S02 | 150 | 105 |
| Ambient temperature | N/A | 25.2 | 25.0 | | | |

| Thermocouple Location | Temperature for LED driver (°C) | | LED driver Model Number | LED Driver Tc Temp. (°C) |
|-----------------------|---------------------------------|--------------------------------|-------------------------|--------------------------|
| | Test result | Test result (Correct to 25 °C) | | |
| TMP of LED drivers | 57.6 | 57.4 | 90897 | 125 |
| Ambient temperature | 25.2 | 25.0 | | |

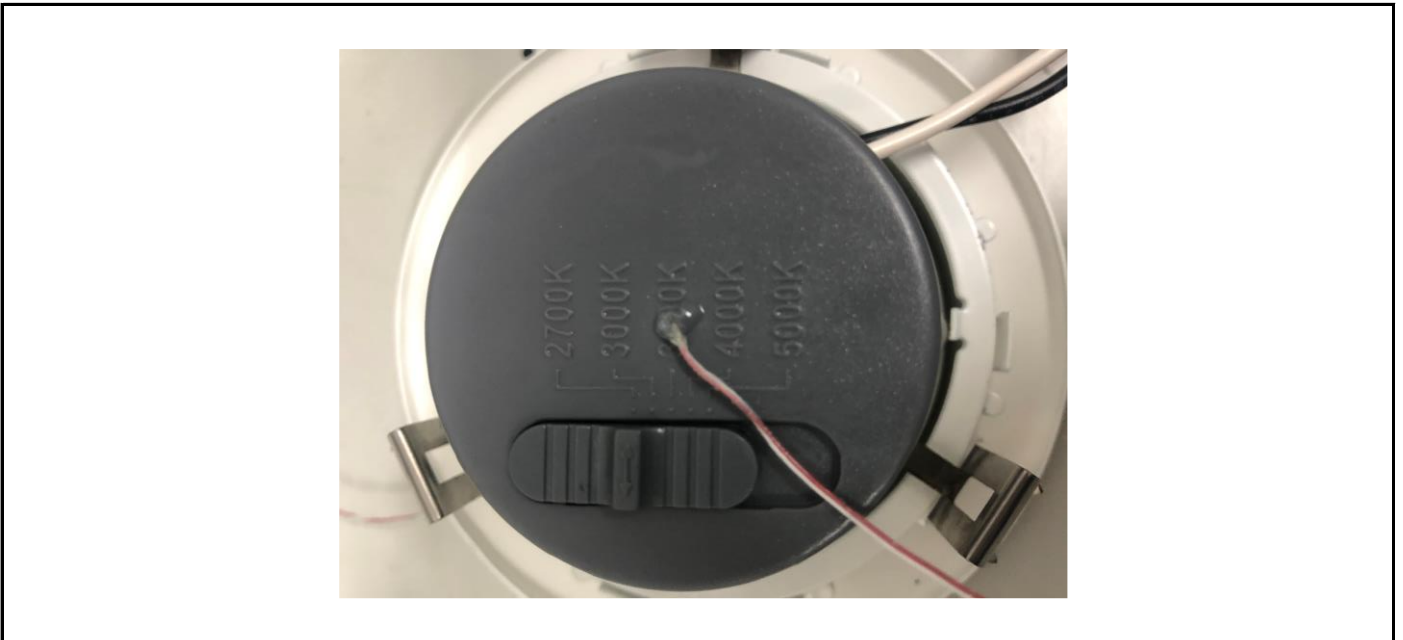


In-Situ Temperature Measurement Test (Cont'd)

Test Photos for LEDs



Test Photos for LED Drivers





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