



DesignLights Consortium Test Report

Reference Standards

UL1598-2008

ANSI C82.77-10-2014

IES LM-79-2008

Prepared For

P.Q.L., Inc.

2285 Ward Avenue

Simi Valley, CA 93065

Test Laboratory:

UL-CCIC Company Limited

Test Laboratory Address:

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Catalog Number

55093

55090, 55092 was selected as the representative models.

All measurements are the same except CCT.

Project Number

4790484044

Report Number

4790484044_5

Test Date

2022-08-02~2022-08-04

Issue Date

2022-08-06

Revision Date

N/A

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Wu, Elvis

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

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Test Summary

DLC Technical Requirements V5.1- issued 2020-02-14

Requirement Category	Test Method	Requirements	Tolerance	Test Result
Minimum Light Output (lm)-Luminaires	IES LM-79-2008	≥3000	-10%	4322.5
Minimum Luminaire Efficacy (lm/W)-Luminaires	IES LM-79-2008	≥110	-3%	127.81
Spacing Criteria (0-180°)	IES LM-79-2008	1.0-2.0	±0.1	1.24
Spacing Criteria (90-270°)	IES LM-79-2008	1.0-2.0	±0.1	1.28
Zonal Lumen Requirement 1(0°-60°)	IES LM-79-2008	≥75%	-3%	76.30%
Allowable CCT (3500K)	IES LM-79-2008/ANSI C78.377-2015	3465±245	N/A	3494
Allowable CCT (5000K)	IES LM-79-2008/ANSI C78.377-2015	5029±283	N/A	5043
Minimum CRI	IES LM-79-2008/CIE 13.3-1995	≥80	-1	82
Minimum R9	IES LM-79-2008	≥0	-1	5.0
Minimum Rg	IES LM-79-2008	≥89	-1	95
Minimum Rf	IES LM-79-2008	≥70	-1	82
Rcs,h1	IES LM-79-2008	-12%-23%	-1%	-12%
Unified Glare Rating (UGR)	IES LM-79-2008	≤22	N/A	20.8
L70 Lumen maintenance (Hours)	N/A	≥50000	N/A	≥50000
L90 Lumen maintenance (Hours)	N/A	≥36000	N/A	≥36000
Power Factor	ANSI C82.77-10-2014	≥0.9	-0.03	0.9742
Total Harmonic Distortion (A%)	ANSI C82.77-10-2014	≤20%	5%	10.48%
In-Situ Temperature Measurement Test for LED 1 (°C)	UL1598-2008	≤105	N/A	46.5
In-Situ Temperature Measurement Test for Driver 1 (°C)	UL1598-2008	≤90	N/A	56.5
Max Chromaticity Shift (1000-6000h)	N/A	≤0.004	0.0004	0.0024
Minimum Luminaire Warranty (Years)	N/A	≥5	N/A	≥5



Test List

Sample Received Date: 2022-07-21

Test Item	Test Date	Model Number	Tests Conducted By
Integrating Sphere Test	2022-08-02	55090	Yang, Gavin X
Integrating Sphere Test	2022-08-02	55092	Yang, Gavin X
Goniophotometer Test	2022-08-02	55090	Yang, Gavin X
THD and PF Test	2022-08-02	55090	Yang, Gavin X
THD and PF Test	2022-08-02	55092	Yang, Gavin X
In-Situ Temperature Measurement Test	2022-08-04	55092	Yang, Gavin X

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.



Product Description

Lamp/Luminaire Description: 2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces

Model Number: 55090

Electrical Parameter: 120-277V, 50/60Hz

LED Package: STW8A2PD-XX

Family Model and Variation: 55093, 55092

Dimming Information: Continuous dimming capability

Products Scaled Value

Model Number	CCT	Luminous Flux	Power	Luminous Efficacy
55090	3500K	4445	35	127
55093	4000K	4480	35	128
55092	5000K	4515	35	129

Photos of Products Characteristics





Integrating Sphere Test

Model No.	55090	Sample ID.	5162668
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 assumed 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 $25\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$. The reference standard lamp is rated current 2.679A omni-directional Incandescent lamp and was calibrated by National Institute of Metrology P.R.China.

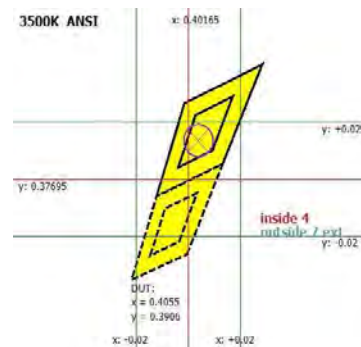
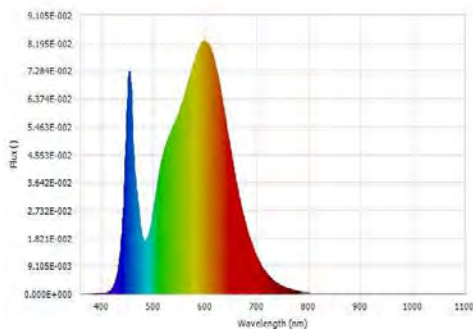
3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%. Photometric measurement conditions were using 4π geometry. The self-absorption 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 Test Conditions

Temperature ($^{\circ}\text{C}$)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Orientation
25.2	120.12	60	0.2839	33.801	0.9911	Horizontal

Test Results

CCT (K)	CRI (Ra)	R9	Duv	Flux (lm)	Luminous Efficacy (lm/W)	Efficacy(lm/ft)
3494	82	5.0	-0.0001	4345.83	128.57	N/A

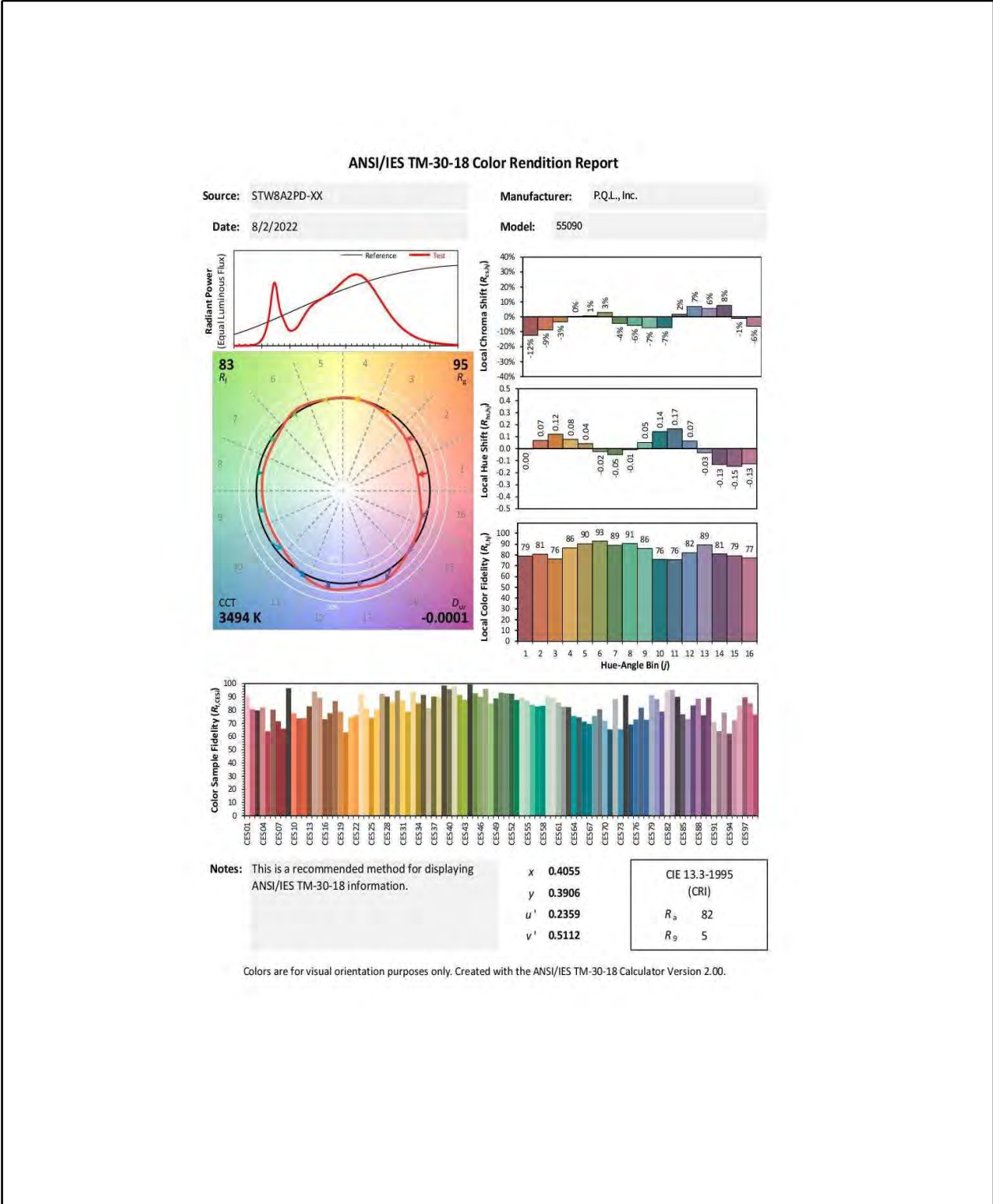


Luminous Flux (lm)	4345.83	Chrom x	0.4055
Chrom y	0.3906	Chrom u	0.2359
Chrom v	0.3408	Duv	-0.0001
Chrom u'	0.2359	Chrom v'	0.5112
CCT (K)	3494	Luminous Efficacy (lm/W)	128.57
Ra	82	R1	80.0
R2	89.0	R3	95.0
R4	80.0	R5	80.0
R6	84.0	R7	85.0
R8	61.0	R9	5.0
R10	73.0	R11	78.0
R12	60.0	R13	82.0
R14	97.0	R15	74.0
Rf	83	Rg	95
Rcs,h1	-12%		



Integrating Sphere Test (Cont'd)

TM-30 Report





Integrating Sphere Test

Model No.	55092	Sample ID.	5162672
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 assumed 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 $25\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$. The reference standard lamp is rated current 2.679A omni-directional Incandescent lamp and was calibrated by National Institute of Metrology P.R.China.

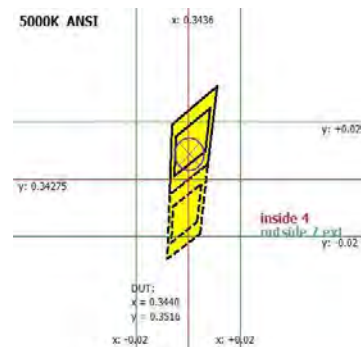
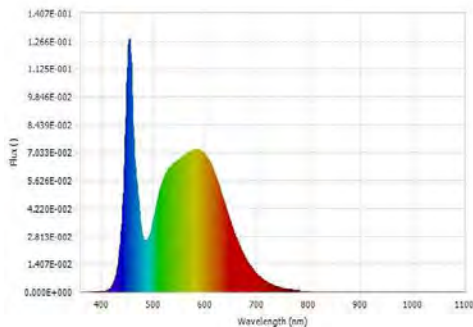
3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%. Photometric measurement conditions were using 4π geometry. The self-absorption 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 Test Conditions

Temperature ($^{\circ}\text{C}$)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Orientation
25.2	120.11	60	0.2838	33.77	0.9909	Horizontal

Test Results

CCT (K)	CRI (Ra)	R9	Duv	Flux (lm)	Luminous Efficacy (lm/W)	Efficacy(lm/ft)
5043	83	9.0	0.0005	4484.98	132.81	N/A



Luminous Flux (lm)	4484.98	Chrom x	0.3440
Chrom y	0.3516	Chrom u	0.2107
Chrom v	0.3230	Duv	0.0005
Chrom u'	0.2107	Chrom v'	0.4845
CCT (K)	5043	Luminous Efficacy (lm/W)	132.81
Ra	83	R1	81.0
R2	88.0	R3	91.0
R4	82.0	R5	81.0
R6	82.0	R7	87.0
R8	68.0	R9	9.0
R10	70.0	R11	81.0
R12	57.0	R13	83.0
R14	95.0	R15	77.0
Rf	82	Rg	96
Rcs,h1	-12%		



Integrating Sphere Test (Cont'd)

TM-30 Report

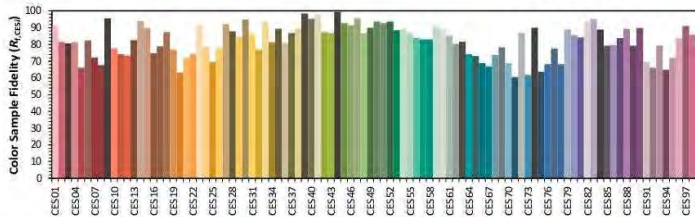
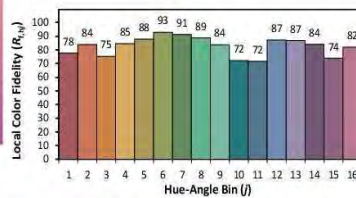
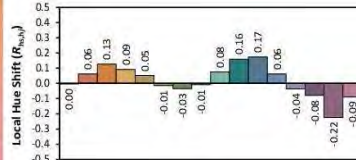
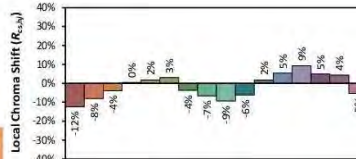
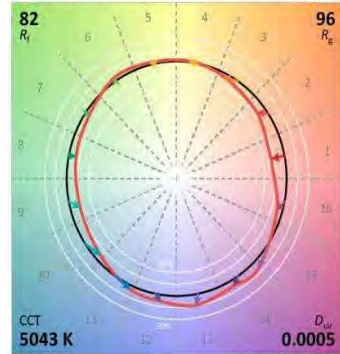
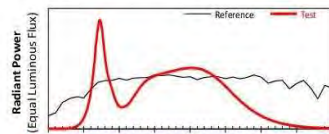
ANSI/IES TM-30-18 Color Rendition Report

Source: STW8A2PD-XX

Manufacturer: P.Q.L., Inc.

Date: 8/2/2022

Model: 55092



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x 0.3440
 y 0.3516
 u' 0.2107
 v' 0.4845

CIE 13.3-1995
 (CRI)
 R_a 83
 R_9 9

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.



Goniophotometer Test

Model No.	55090	Sample ID.	5162668
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 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 3.8581A, 3.8558A, 3.8466A omni-directional Incandescent lamp and was calibrated by National Institute of Metrology P.R.China.
- 4.The samples were operated at rated voltage and was stabilized before measurement. Luminous flux, luminaire efficacy, zonallumen were calculated from the software taken at 1° 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	Current THD	Orientation
24.6	120.07	60	0.2839	33.821	0.9922	10.43%	Horizontal

Test Results

Luminous Flux (lm)	Zonal Lumen Requirement 1	Zonal Lumen Requirement 2	Beam Angle (50%)		Luminous Efficacy (lm/W)
	0°-60°	N/A	Horizontal Spread	Vertical Spread	
4322.5	76.30%	N/A	116.2	106.3	127.81

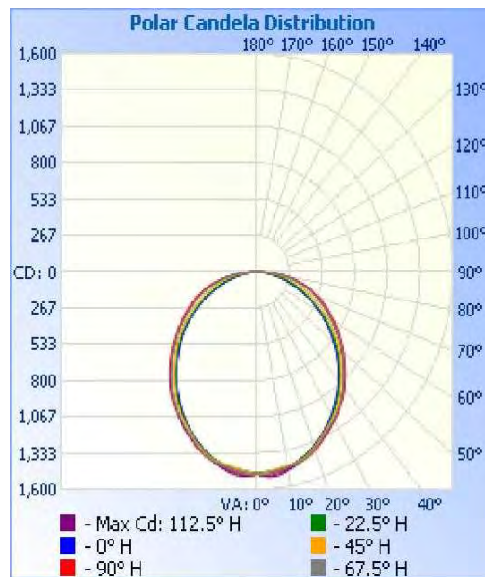
Backlight	Uplight	Glare
N/A	N/A	N/A

UGR		Spacing Criteria (0-180°)	Spacing Criteria (90°-270°)
Crosswise	Endwise		
18.2	20.8	1.24	1.28

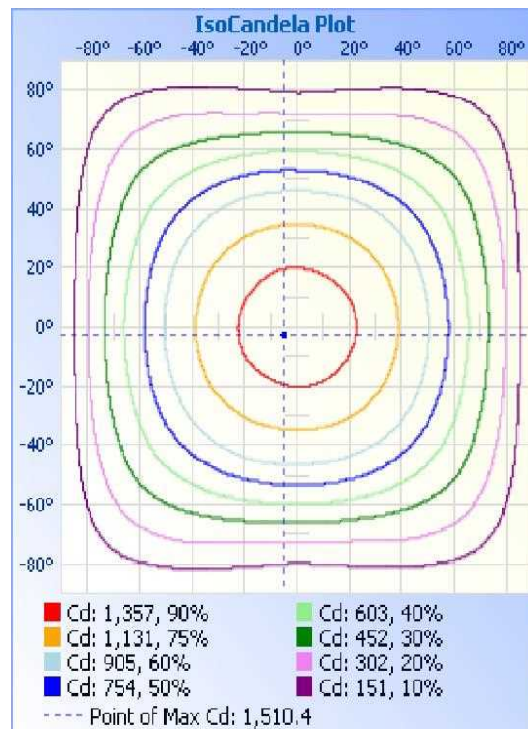


Goniophotometer Test (Cont'd)

Polar Candela Distribution



IsoCandela Plot





Goniophotometer Test (Cont'd)
Zonal Lumen Summary

Zonal Lumen Summary		
Zone	Lumens	% Luminaire
0-30	1145.5	26.50%
0-40	1869.2	43.20%
0-60	3299.8	76.30%
60-90	1011.1	23.40%
70-100	474.9	11.00%
90-120	4.4	0.10%
0-90	4310.9	99.70%
90-180	11.6	0.30%
0-180	4322.5	100.00%

Lumens Per Zone

Lumens Per Zone					
Zone	Lumens	%Total	Zone	Lumens	%Total
0-5	35.6	0.80%	90-95	1.1	0.00%
5-10	105.5	2.40%	95-100	0.8	0.00%
10-15	171.5	4.00%	100-105	0.7	0.00%
15-20	230.5	5.30%	105-110	0.6	0.00%
20-25	280.7	6.50%	110-115	0.6	0.00%
25-30	321.6	7.40%	115-120	0.6	0.00%
30-35	352.4	8.20%	120-125	0.6	0.00%
35-40	371.3	8.60%	125-130	0.6	0.00%
40-45	377.2	8.70%	130-135	0.7	0.00%
45-50	371.7	8.60%	135-140	0.7	0.00%
50-55	354.8	8.20%	140-145	0.7	0.00%
55-60	326.9	7.60%	145-150	0.7	0.00%
60-65	290.3	6.70%	150-155	0.7	0.00%
65-70	248.0	5.70%	155-160	0.7	0.00%
70-75	201.6	4.70%	160-165	0.6	0.00%
75-80	149.9	3.50%	165-170	0.5	0.00%
80-85	92.2	2.10%	170-175	0.3	0.00%
85-90	29.2	0.70%	175-180	0.1	0.00%



THD and PF Test

Model No.	55090	Sample ID.	5162668
Operate time (Min.)	90	Stabilization time (Min.)	45

Test Method

1. The samples were tested according to the ANSI C82.77-10-2014.
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	Orientation
24.6	120.07	60	0.2839	33.82	0.9922	10.43%	Horizontal
24.6	277.05	60	0.1277	34.50	0.9752	8.28%	Horizontal



THD and PF Test

Model No.	55092	Sample ID.	5162672
Operate time (Min.)	90	Stabilization time (Min.)	45

Test Method

1. The samples were tested according to the ANSI C82.77-10-2014.
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	Orientation
24.6	120.05	60	0.2838	33.80	0.9921	10.48%	Horizontal
24.6	277.08	60	0.1273	34.35	0.9742	8.41%	Horizontal



In-Situ Temperature Measurement Test

Model No.	55090	Sample ID.	5162668
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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 (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD	Orientation
23.4	120.07	60	0.2839	33.82	0.9922	10.43%	Horizontal

Test Results (LEDs)

Thermocouple Location	Declared Light Source Current (mA)	Temperature for Light Source (°C)		Max Chromaticity Shift (1000-6000h)	LED Model Number	LM-80 Limit Current (mA)	LM-80 Limit Temp (°C)
		Test Result	Test Result (Correct to 25 °C)				
Ambient TEMP	N/A	23.4	25.0				
TMP of Location 1	125	44.9	46.5	0.0024	STW8A2PD-XX	200	105

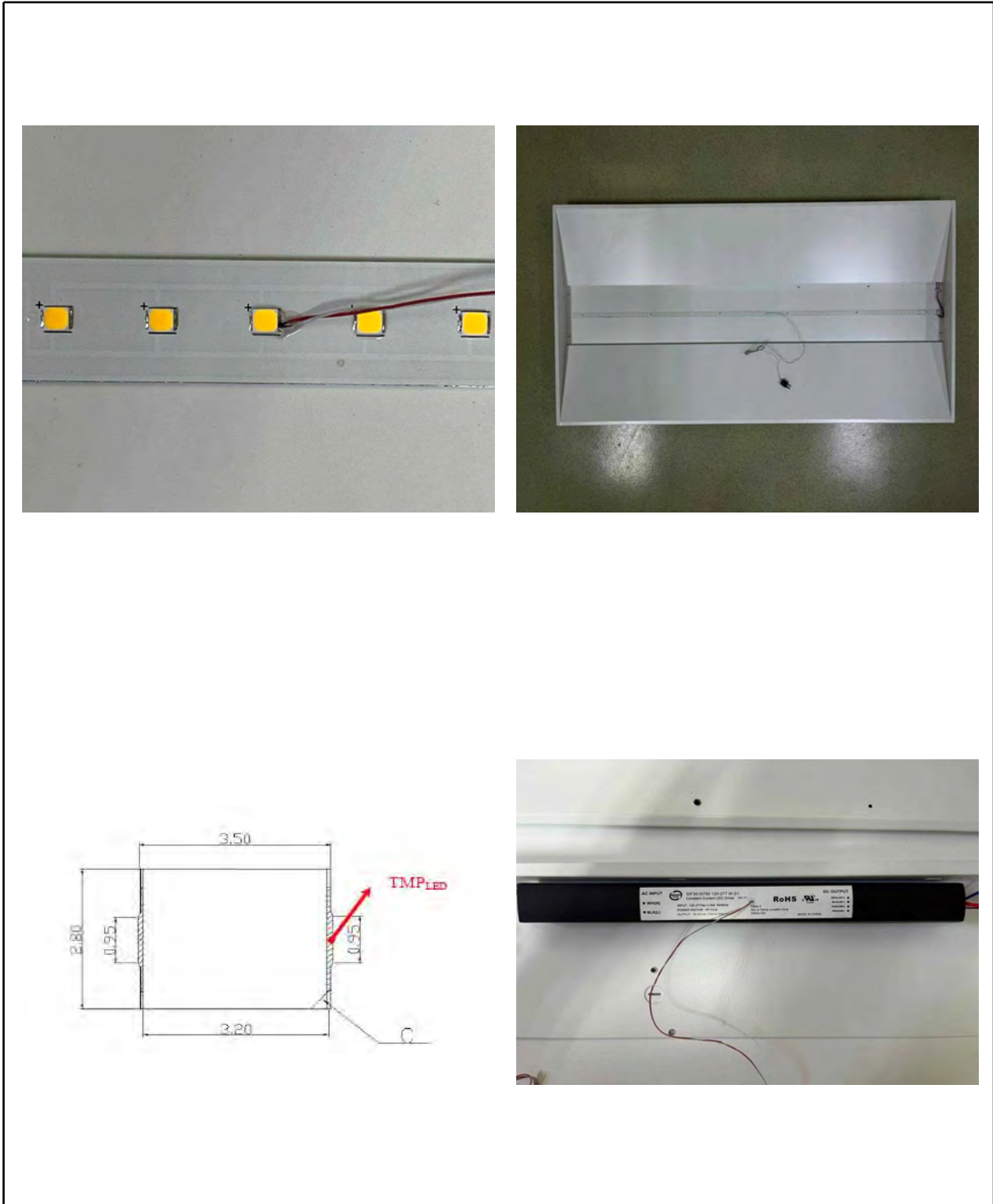
Test Results (Drivers)

Thermocouple Location	Temperature for Driver (°C)		Driver Model Number	Driver Limit Temp (°C)
	Test Result	Test Result (Correct to 25 °C)		
Ambient TEMP	23.4	25.0		
TMP of Location 1	54.9	56.5	SIF 30-I0750 120-277 W D1	90



In-Situ Temperature Measurement Test (Cont'd)

Test Photos for Ts Point of Light Sources & Tc Point of Drivers





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