





# **DesignLights Consortium Test Report**

Refference 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

**Prepared By** 

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Approved By

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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 (Im)-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)

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





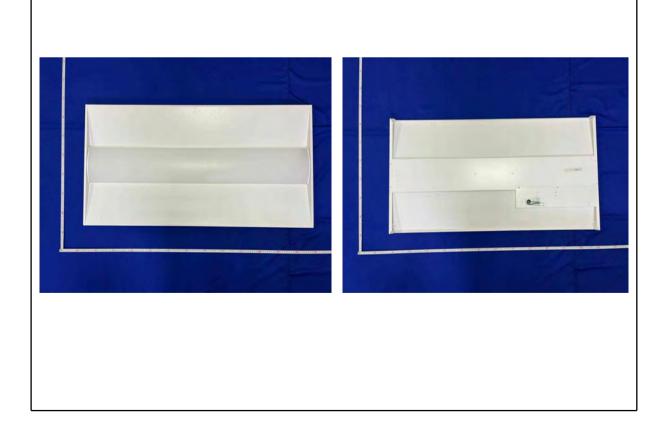
### **Product Description**

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

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

### **Products Scaled Value**

### Photos of Products Characteristics









# **Integrating Sphere Test**

Model No.		55090		Sample ID.	5162668
Operate time	e (Min.)	90	Stabilizatio	on time (Min.)	45

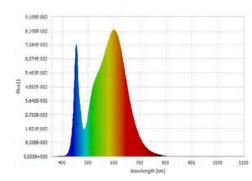
#### **Test Method**

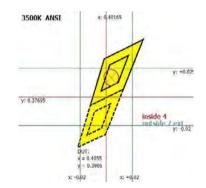
1. The sample was tested according to the IES LM-79-2008, and the product is assume to be brand new without seasoning. 2. Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at 25 °C  $\pm$  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  $4\pi$  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 (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	r (W) Power Factor Or			
25.2	120.12	60	0.2839	33.801	0.9911	Horizontal		
Test Results								

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





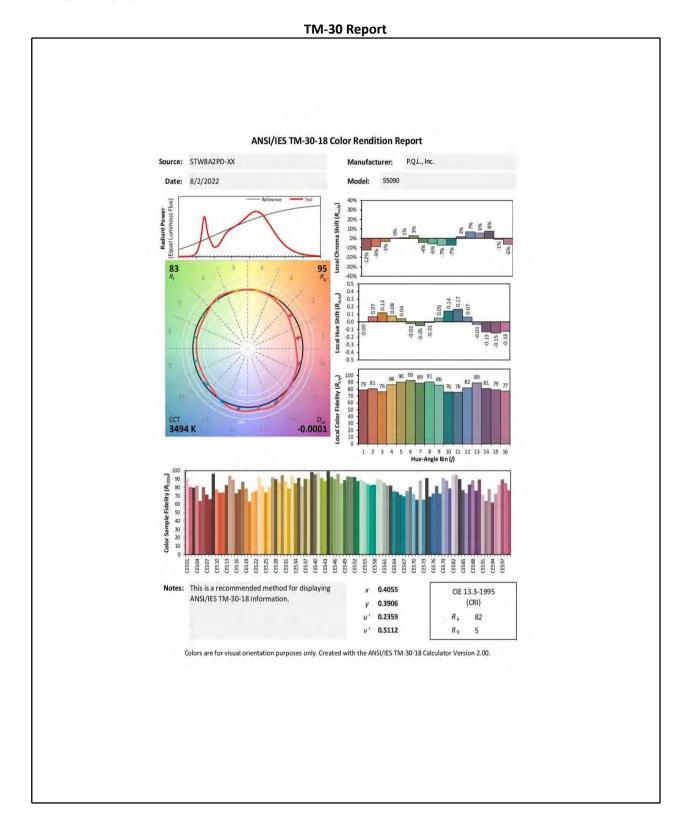
Luminous Flux (lm)	4345.83	Chrom x	0.4055
Chrom y	0.3906	Chrom u	0.2359
Chrom v	0.3408	Duv	-0.0001
Chrom u'	0.2359	Chrom v'	0.5112
CCT (K)	3494	Luminous Efficacy (Im/W)	128.57
Ra	82	R1	80.0
R2	89.0	R3	95.0
R4	80.0	R5	80.0
R6	84.0	R7	85.0
R8	61.0	R9	5.0
R10	73.0	R11	78.0
R12	60.0	R13	82.0
R14	97.0	R15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







# Integrating Sphere Test (Cont'd)









# **Integrating Sphere Test**

Model No.		55092		Sample ID.	5162672
Operate time	e (Min.)	90	Stabilizatio	on time (Min.)	45

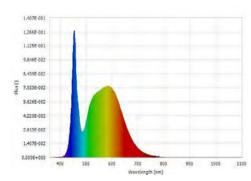
#### **Test Method**

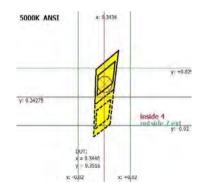
1. The sample was tested according to the IES LM-79-2008, and the product is assume to be brand new without seasoning. 2. Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at 25 °C  $\pm$  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  $4\pi$  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 (°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								

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





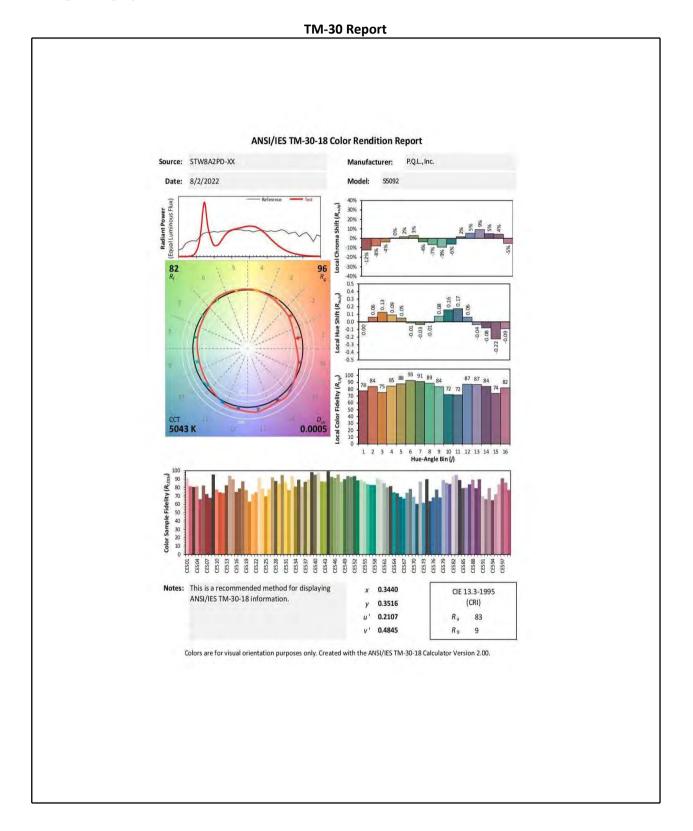
Luminous Flux (lm)	4484.98	Chrom x	0.3440
Chrom y	0.3516	Chrom u	0.2107
Chrom v	0.3230	Duv	0.0005
Chrom u'	0.2107	Chrom v'	0.4845
CCT (K)	5043	Luminous Efficacy (Im/W)	132.81
Ra	83	R1	81.0
R2	88.0	R3	91.0
R4	82.0	R5	81.0
R6	82.0	R7	87.0
R8	68.0	R9	9.0
R10	70.0	R11	81.0
R12	57.0	R13	83.0
R14	95.0	R15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







# Integrating Sphere Test (Cont'd)









# **Goniophotometer Test**

Model No.		55090		Sample ID.	5162668
Operate tin	ne (Min.)	90	Stabilizatio	n 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									

_			Test n	esuits			
ſ		Zonal Lumen	Zonal Lumen	Beam Ar	ngle (50%)	· · ·	
	Luminous Flux (lm)	Requirement 1	Requirement 2	Horizontal	Vertical	Luminous Efficacy (lm/W)	
		0°-60°	N/A	Spread	Spread		
	4322.5	76.30%	N/A	116.2	106.3	127.81	

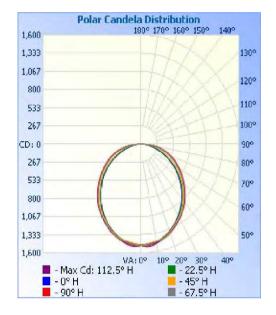
Dealdicht	Unlight	Clara		U	GR	Spacing Criteria	Spacing Criteria	
Backlight	cklight Uplight	Glare	Glare	Crosswise	Endwise	(0-180°)	(90°-270°)	
N/A	N/A	N/A		18.2	20.8	1.24	1.28	



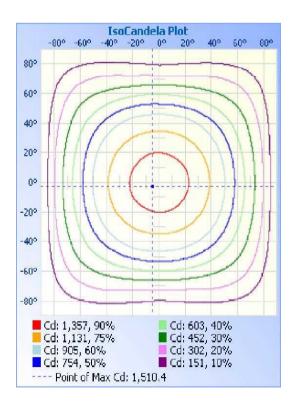




**Goniophotometer Test (Cont'd)** Polar Candela Distribution



#### IsoCandela Plot









# Goniophotometer Test (Cont'd) Zonal Lumen Summary

	<b>Zonal Lumen</b>	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%







# Goniophotometer Test (Cont'd) Intensity Data(cd)

		e - Typ															
_	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	1484	1484	1484	1484	1484	1484	1484	1484	1484	1484	1484	1484	1484	1484	1484	1484	1484
1	1481	1479	1483	1497	1501	1494	1484	1482	1479	1476	1482	1493	1498	1489	1486	1484	1481
2	1480	1476	1481	1495	1502	1500	1490	1486	1480	1474	1478	1492	1499	1497	1490	1488	1480
3	1480	1472	1477	1491	1503	1505	1496	1489	1478	1471	1474	1489	1499	1503	1497	1489	1480
4	1480	1469	1470	1486	1500	1509	1502	1491	1478	1468	1467	1485	1497	1506	1502	1491	1480
5	1478	1466	1465	1482	1495	1510	1504	1492	1477	1463	1462	1479	1494	1506	1504	1492	1478
6	1477	1464	1461	1477	1492	1509	1503	1490	1474	1460	1457	1475	1490	1505	1501	1491	1477
7	1474	1463	1455	1472	1487	1504	1500	1488	1470	1457	1452	1469	1486	1500	1499	1489	1474
8	1470	1461	1451	1467	1483	1497	1495	1484	1468	1454	1448	1465	1482	1495	1496	1484	1470
9	1466	1458	1449	1462	1478	1490	1490	1478	1462	1452	1445	1459	1478	1489	1489	1478	1466
10	1458	1454	1446	1457	1474	1480	1481	1472	1456	1448	1440	1453	1471	1480	1482	1472	1458
11	1452	1451	1444	1452	1467	1472	1473	1464	1449	1444	1440	1449	1466	1471	1472	1464	1452
-								10	1.1			ALL VE	-				
12	1444	1443	1443	1449	1462	1462	1461	1454	1441	1437	1436	1447	1458	1463	1462	1454	1444
13	1436	1438	1439	1446	1453	1452	1450	1444	1433	1430	1433	1442	1451	1453	1451	1446	1436
14	1428	1428	1436	1443	1446	1443	1437	1432	1426	1422	1429	1439	1443	1444	1438	1434	1428
15	1417	1420	1429	1439	1438	1434	1424	1420	1414	1413	1421	1433	1434	1433	1425	1422	1417
16	1408	1410	1420	1433	1430	1423	1412	1406	1403	1403	1413	1428	1427	1423	1414	1410	1408
17	1396	1400	1410	1425	1423	1412	1400	1393	1390	1393	1402	1419	1418	1412	1401	1397	1396
18	1384	1389	1398	1415	1415	1402	1388	1381	1378	1382	1392	1410	1410	1402	1390	1384	1384
19	1373	1379	1385	1404	1406	1391	1376	1367	1366	1371	1379	1395	1401	1393	1379	1373	1373
20	1361	1367	1373	1389	1397	1383	1365	1355	1353	1358	1367	1381	1390	1382	1367	1360	1361
25	1293	1300	1305	1318	1329	1326	1308	1289	1285	1290	1296	1310	1322	1322	1309	1296	1293
30	1217	1227	1240	1258	1266	1257	1240	1215	1204	1213	1227	1245	1256	1252	1239	1223	1217
35	1130	1142	1166	1190	1197	1183	1156	1130	1119	1129	1151	1175	1184	1175	1156	1138	1130
40	1037	1048	1070	1102	1118	1104	1070	1039	1024	1032	1054	1084	1100	1094	1068	1044	1037
45	935	950	975	1007	1022	1005	976	943	922	932	957	988	1004	994	971	946	935
50	829	848	880	916	929	906	868	836	815	831	860	895	907	892	862	838	829
55	714	736	773	816	830	807	760	721	707	722	754	793	807	791	753	722	714
60	595	617	662	712	730	706	653	607	586	602	641	687	706	687	645	607	595
65	475	496	550	610	633	604	546	493	464	482	529	585	608	585	536	492	475
70	356	381	445	511	536	509	443	378	350	371	425	487	512	489	431	378	356
75	244	276	348	406	427	404	346	272	241	264	330	384	406	387	336	271	244
80	142	179	243	289	306	286	239	177	137	170	228	269	285	270	230	173	142
85	53	88	125	152	162	150	120	86	52	82	111	134	144	136	113	83	53
90	2	3	3	3	3	3	3	2	3	2	2	3	3	3	3	3	2
95	2	1	1	2	2	2	2	1	1	1	2	2	2	2	2	2	2
100	1	1	1	2	1	2	1	1	2	1	1	1	2	1	1	2	1
105	1	1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	1
110	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1
115	1	1	2	1	2	1	1	1	1	1	2	2	1	1	2	1	1
120	1	1	2	1	1	1	1	1	1	2	1	2	1	1	1	1	1
	1	2	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1
125	-											-					-
130	1	2	1	2	1	2	2	1	2	2	2	2	2	2	1	1	1
135	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
140	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2
145	2	3	3	2	2	2	3	2	2	3	3	2	2	2	2	2	2
150	2	3	2	3	2	3	3	3	3	3	3	3	2	3	2	2	2
155	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
160	4	3	3	4	4	3	3	4	3	3	4	4	3	3	3	3	4
165	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
170	5	5	5	5	4	5	5	5	5	4	5	5	5	5	5	5	5
175	5	5	5	5	5	5	5	5	4	4	5	5	5	4	5	5	5
1017	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5







# **THD and PF Test**

Model No.		55090		Sample ID.	5162668
Operate time	e (Min.)	90	Stabilizatio	on 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  $\pm$  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.

#### Power (W) Temperature (°C) Voltage (Vac) Frequency (Hz) Current (A) **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 Horizontal 34.50 0.9752 8.28%

### **Test Results**







# **THD and PF Test**

Model No.		55092		Sample ID.	5162672
Operate time	e (Min.)	90	Stabilizatio	on 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  $\pm$  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.

#### Power (W) Temperature (°C) Voltage (Vac) Frequency (Hz) Current (A) **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 Horizontal 8.41%

### **Test Results**







## In-Situ Temperature Measurement Test

Model No.     55090     Sample ID.     5162668
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#### **Test Method**

In-Situ Temperature Measurement Test is conducted according to the UL 1598-2008, Section 14.
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.
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					
Thermocouple	Declared Light Source	•	for Light Source °C)	Max Chromaticity		LM-80 Limit Current (mA)	LM-80 Limit Temp (°C)	
Location	Current (mA)	Test Result	Test Result (Correct to 25 °C)	Shift	LED Model Number			
Ambient TEMP	N/A	23.4	25.0	000011				
TMP of Location 1	125	44.9	46.5	0.0024	STW8A2PD- XX	200	105	

## Test Results (LEDs)

### Test Results (Drivers)

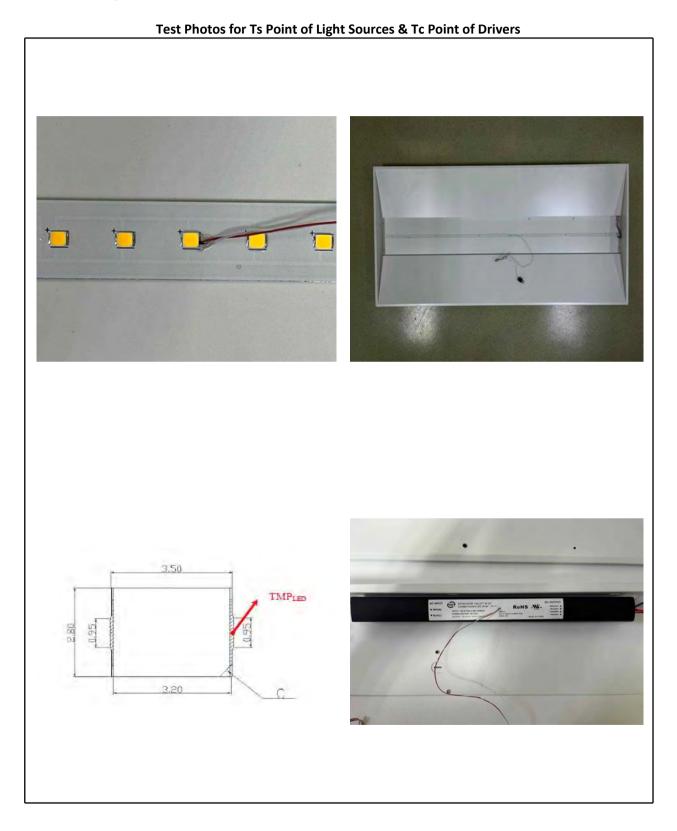
Thermony de Location	•	emperature for Driver (°C)		Driver	
Thermocouple Location	Test Result	Test Result (Correct to 25 °C)	Driver Model Number	Limit Temp (°C)	
Ambient TEMP	23.4	25.0			
TMP of Location 1	54.9	56.5	SIF 30-10750 120-277 W D1	90	







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









## \*\*\*\*\*\* END OF REPORT. THIS PAGE INTENTIONALLY LEFT BLANK \*\*\*\*\*\*