



ENERGY STAR® Luminaire Test Report

ENERGY STAR® Program Requirements Product Specification for Luminaires - Version 2.0 - Issued 2015-05-29

Prepared For

L-TECH CORPORATION

Address: Shaogangtou District, Qiaotou Town, Dongguan City, Guangdong, China

Contact Person: Zhenglong Jin, Email: ltech@vip.163.com, phone: 13925742768

Test Laboratory: UL Verification Services (Guangzhou) Co., Ltd.

Test Laboratory Address: Building A1, 1F & 2F, Nansha Science and Technology Innovation Center, No. 25,
South Huanshi Avenue, Nansha District, Guangzhou 511458, China

Catalog Number

ULD73W-##90, ULD73BZ-##90, ULD73BK-##90

(##=00-11 intends CCT 2700K, 3000K and 3500K, ##=20-30 intends CCT 2700K, 3000K and 4000K.)

Project Number

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Report Number

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Prepared By

Alvin Xie

Approved By

Dendi Lin

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

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1.0 Test Summary

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(Under Cabinet Mount)				
Requirement Category	Test Method	Requirement	Test Value	Results (Pass/Fail)
Efficacy (lm/W)	IES LM-79-08	Non-directional: 65 lm/W; Directional: 50 lm/W; Inseparable SSL Luminaire: 70 lm/W.	68.70	Pass
Light Output (lm)	IES LM-79-08	Luminous Flux (lm)	633.40	Pass
		Under Cabinet: 125 lm/ft	422.27	
Zonal Lumen Density	IES LM-79-08	For directional luminaires only. (0°~60°C) >60%	81.00%	Pass
CCT (K)	ANSI C78.377-2011	fall within the corresponding 7-step chromaticity quadrangles	2778	Pass
CRI	IES LM-79-08, CIE 13.3-1995	Ra ≥ 80	93.1	Pass
R9	IES LM-79-08, CIE 13.3-1995	R9 > 0	58	Pass
Color Angular Uniformity	IES LM-79-08, CIE 15: 2004	≤ 0.006 on the CIE 1976 (u',v') diagram	0.00141	Pass
Lumen Maintenance & Light Source Life (hours)	IES LM-80-08*, IES TM-21-11*	L70 ≥ 25,000 hours for indoor; L70 ≥ 35,000 hours for outdoor; L70 ≥ 50,000 h for inseparable luminaires	60000	Pass
Color Maintenance	IES LM-80-08*, IES LM-84-14	≤ 0.007 on the CIE 1976 (u',v') diagram	0.0031	Pass
Source Start Time (ms)	ENERGY STAR Start Time Test Method	1 s for connected luminaires; 750 ms for other luminaires.	132	Pass
Source Run-Up Time (s)	ENERGY STAR Run Up Time Test Method	≤ 45 seconds	N/A	N/A
Power Factor	C82.77-10:2014	power ≤ 5 watts: PF ≥ 0.5; power > 5 watts: PF ≥ 0.7	0.976	Pass
Transient Protection	IEEE C62.41.2-2002	Survival	Validated	Pass
Standby Power Consumption (W)	IEC 62301 ED.2.0 B	Shall not draw power in the off state.	0.03	Pass
Operating Frequency (Hz)	N/A	Frequency ≥ 120 Hz	120.8	Pass

* The standards are NOT covered by the NVLAP scope of test laboratory UL Verification Services (Guangzhou) Co., Ltd.



1.0 Test Summary (Cont'd)

Requirement Category	Test Method	Requirement	Test Value	Results (Pass/Fail)
Light Source Replaceability	N/A	Fluorescent & Directional LED luminaire	Validated	Pass
LED Tc Temperature (°C)	ANSI/UL 153:2002 ANSI/UL 1598:2008	Within the highest test temperature in LM-80 report	42.1	Pass
Driver Case Temperature (°C)	ANSI/UL 153:2002 ANSI/UL 1598:2008	≤ TMPC marked on the the driver	45	Pass
Recessed Downlight Thermal Performance	ANSI/UL 1598-2008 ASTM E283-04*	Insulation contact & Airtight construction	N/A	N/A
SAFETY REQUIREMENTS for luminaire and driver	UL Safety standards	Safety documentation	Validated	Pass
Dimming: Range (Minimum)	N/A	≤20%	8.58%	Pass
Dimming: Noise	N/A	24dBA at 1 meter	17.9	Pass
Labeling & Packaging	N/A	Relevant document	Validated	Pass
WARRANTY REQUIREMENTS	N/A	no less than 3 years	Validated	Pass
Lighting Toxics Reduction Requirements	RoHS Directive, 2003*	Relevant Documentations	Validated	Pass

* The standards are NOT covered by the NVLAP scope of test laboratory UL Verification Services (Guangzhou) Co., Ltd.



2.0 Test List

Test Item	Test	Test Date	Test Model	Tests Conducted By
1	Integrating Sphere Test	2107-12-13	ULD73W-0190	Lily Chen
		2107-12-23	ULD73W-2090	Lily Chen
2	Goniophotometer Test	2107-12-12	ULD73W-0190	Lily Chen
3	Color Angular Uniformity	2107-12-15	ULD73W-0190	Lily Chen
4	Source Start Time & Run-Up time	2107-12-13	ULD73W-0190	Lily Chen
5	Operating Frequency Test	2107-12-13	ULD73W-0190	Lily Chen
6	Transient Protection Test	2107-12-18	ULD73W-0190	Lily Chen
7	Standby Power Consumption	2107-12-18	ULD73W-0190	Lily Chen
8	Dimming Test	2107-12-18	ULD73W-0190	Lily Chen
9	In-Situ Temperature Measurement Test	2107-12-18	ULD73W-0190	Lily Chen

Remark (if any)

1, UL test equipment information is recorded on Meter Use in UL's Aurora database.
2, The product belong to Color Tunable, where ##=00-11 intends CCT 2700K, 3000K and 3500K, ##=20-30 intends CCT 2700K, 3000K and 4000K. The default settings and maximum power are at 2700K color temperature states.



3.0 Production Description

Luminaire Description: Indoor Directional Luminaires, LED Under cabinet for Color Tunable
120Vac, 60Hz, 9W, CRI 90, CCT 2700K - 4000K, Length 18 inch

Lighting Source: 2T03X2WWxx000xxx made by Edison Opto Corporation

Mounting: Under Cabinet Mount

LED Driver: ULD6-7

Family Model and Variation: ULD73W-##90, ULD73BZ-##90, ULD73BK-##90, W, BZ and BK intends the color of product appearance, W=White, BZ=Brown, BK=Black, ##=00-11 intends CCT 2700K, 3000K and 3500K; ##=20-30 intends CCT 2700K, 3000K and 4000K. All of the CCT corresponding LED is 0.2 W series model 2T03X2WWxx000xxx except the model name with ##=20-30 of CCT 2700K products use LED is 0.5W series model 2T03X5WWxx000xxx.

Photos of Luminaire Characteristics





4.0 Photometric Measurements

4.1 Integrating Sphere Test

Model No.	ULD73W-0190	Sample ID.	1298520-S001	Temperature (°C)	25.1
Operate time (Min.)	50	Stabilization time (Min.)	45		

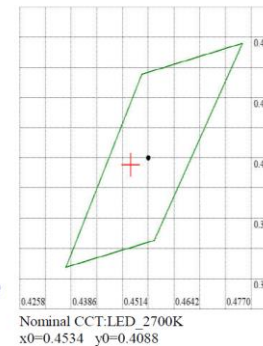
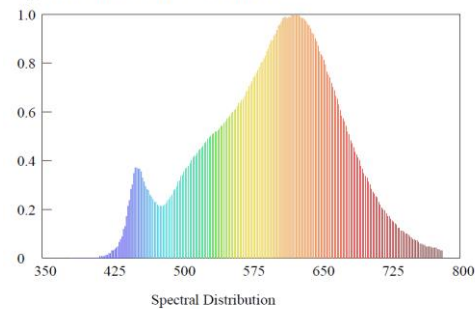
Test Method

1. The sample was tested according to the IES LM-79-2008.
2. Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature inside the sphere was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$.
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. The sample was operated at 120 Volts AC, 60Hz. It was stabilized before measurement was made. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 5 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)
ULD73W-0190	Horizontal	120.08	60	0.079	9.22	0.976	2778	93.1	58	633.4	68.70

Spectroradiometric Parameters





4.0 Photometric Measurements

4.2 Integrating Sphere Test

Model No.	ULD73W-2090	Sample ID.	1291148-S001	Temperature (°C)	25.1
Operate time (Min.)	50	Stabilization time (Min.)	45		

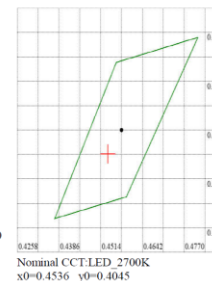
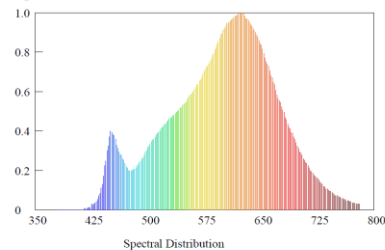
Test Method

1. The sample was tested according to the IES LM-79-2008.
2. Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature inside the sphere was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$.
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. The sample was operated at 120 Volts AC, 60Hz. It was stabilized before measurement was made. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 5 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)
ULD73W-2090	Horizontal	119.96	60	0.074	8.6	0.97	2727	92.6	56	699.83	81.38

Spectroradiometric Parameters





5.0 Photometric Measurements

5.1 Goniophotometer Test

Model No.	ULD73W-0190	Sample ID.	1298520-S001
Operate time (Min.)	90	Stabilization time (Min.)	45

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 $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$, measured at a point not more than 1 m from the sample and at the same height as the sample.
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	Current (A)	Power (W)	Power Factor	Orientation
25	120.01	60	0.0789	9.23	0.9424	Horizontal

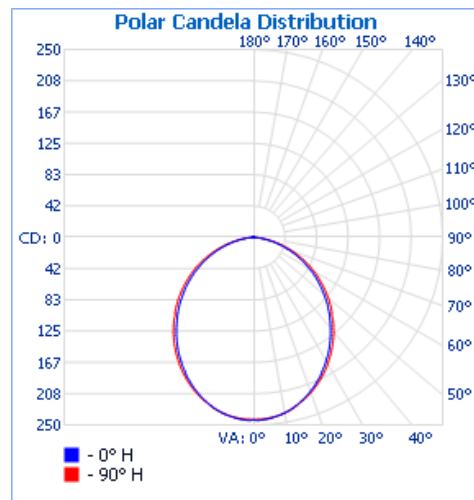
Test Results

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	
618.1	81.00%	157.7	156.2	104.5	100.8	67.0

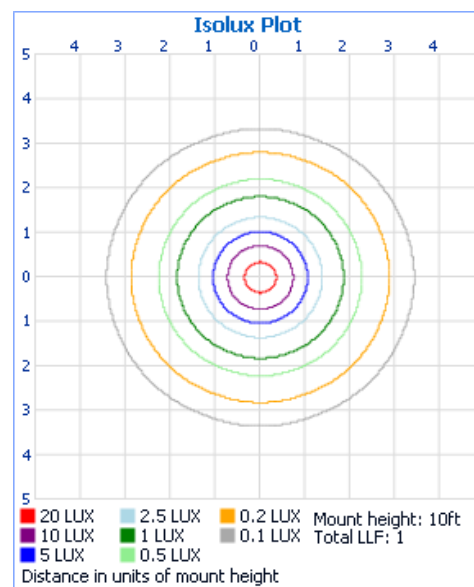


5.1 Goniophotometer Test (Cont'd)

Light Distribution Curve



Isolux Plot





5.1 Goniophotometer Test (Cont'd)

Zonal Lumen Summary

Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	182.5	29.5%
0-40	293.3	47.5%
0-60	500.4	81%
60-90	117.1	18.9%
70-100	46.8	7.6%
90-120	0.4	0.1%
0-90	617.5	99.9%
90-180	0.5	0.1%
0-180	618.1	100%

Lumens Per Zone

Lumens Per Zone

Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	5.8	0.9%	90-95	0.2	0%
5-10	17.1	2.8%	95-100	0.1	0%
10-15	27.6	4.5%	100-105	0.0	0%
15-20	36.9	6.0%	105-110	0.0	0%
20-25	44.6	7.2%	110-115	0.0	0%
25-30	50.5	8.2%	115-120	0.0	0%
30-35	54.4	8.8%	120-125	0.0	0%
35-40	56.4	9.1%	125-130	0.0	0%
40-45	56.3	9.1%	130-135	0.0	0%
45-50	54.4	8.8%	135-140	0.0	0%
50-55	50.8	8.2%	140-145	0.0	0%
55-60	45.6	7.4%	145-150	0.0	0%
60-65	39.1	6.3%	150-155	0.0	0%
65-70	31.5	5.1%	155-160	0.0	0%
70-75	23.1	3.7%	160-165	0.0	0%
75-80	14.6	2.4%	165-170	0.0	0%
80-85	7.0	1.1%	170-175	0.0	0%
85-90	1.8	0.3%	175-180	0.0	0%



5.1 Goniophotometer Test (Cont'd)

Candela Table - Type C

	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	243	243	243	243	243	243	243	243	243	243	243	243	243	243	243	243	243
1	244	242	243	243	242	243	243	242	244	242	243	243	242	243	243	242	244
2	244	242	242	242	242	242	242	242	244	242	242	242	242	242	242	242	244
3	243	242	242	242	242	242	242	242	243	242	242	242	242	242	242	242	243
4	243	241	242	242	242	242	242	241	243	241	242	242	242	242	242	241	243
5	242	241	241	241	241	241	241	241	242	241	241	241	241	241	241	241	242
6	241	240	240	240	241	240	240	240	241	240	240	240	241	240	240	240	241
7	241	239	240	240	240	240	240	239	241	239	240	240	240	240	240	239	241
8	240	238	239	239	239	239	239	238	240	238	239	239	239	239	239	238	240
9	238	237	238	238	238	239	239	239	238	237	238	238	238	237	236	236	238
10	237	236	236	237	237	237	236	236	237	236	236	237	237	237	236	236	237
11	236	234	235	235	236	235	235	234	236	234	235	235	235	235	235	234	236
12	234	233	234	234	235	234	234	233	234	233	234	234	234	235	234	233	234
13	233	231	232	233	234	233	232	231	233	231	232	233	234	233	232	231	233
14	231	230	231	231	232	231	231	230	231	230	231	231	232	231	231	230	231
15	229	228	229	230	230	230	229	228	229	228	229	230	230	230	229	228	229
16	227	226	227	228	228	228	227	226	227	226	227	228	228	228	227	226	227
17	225	224	225	226	226	226	225	224	225	224	225	226	226	226	225	224	225
18	223	222	223	224	225	224	223	222	223	222	223	224	225	224	223	222	223
19	221	219	221	222	223	222	221	219	221	219	221	222	223	222	221	219	221
20	219	217	219	220	220	220	219	217	219	217	219	220	220	220	219	217	219
25	206	205	207	208	209	208	207	205	206	205	207	208	209	208	207	205	206
30	191	190	193	194	196	194	193	190	191	190	193	194	196	194	193	190	191
35	175	174	177	179	181	179	177	174	175	174	177	179	181	179	177	174	175
40	159	158	161	163	165	163	161	158	159	158	161	163	165	163	161	158	159
45	141	140	143	146	146	146	143	140	141	140	143	146	146	146	143	140	141
50	123	123	126	128	130	128	126	123	123	123	126	128	130	128	126	123	123
55	105	105	108	110	112	110	108	105	105	105	108	110	112	110	108	105	105
60	87	87	90	92	94	92	90	87	87	87	90	92	94	92	90	87	87
65	69	68	72	73	75	73	72	68	69	68	72	73	75	73	72	68	69
70	51	51	53	55	56	55	53	51	51	51	53	55	56	55	53	51	51
75	34	33	36	37	38	37	36	33	34	33	36	37	38	37	36	33	34
80	18	18	20	20	20	20	20	18	18	18	20	20	20	20	20	18	18
85	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
90	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



5.0 Photometric Measurements

5.2 Color Angular Uniformity

Model No.	ULD73W-0190	Sample ID.	1298520-S001
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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 $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$, measured at a point not more than 1 m from the sample and at the same height as the sample.
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	Current (A)	Power (W)	Maximum $\Delta u'v'$
25.1	120.03	60	0.079	9.27	0.00141



6.0 Electrical Test

6.1 Source Start Time & Run-Up time

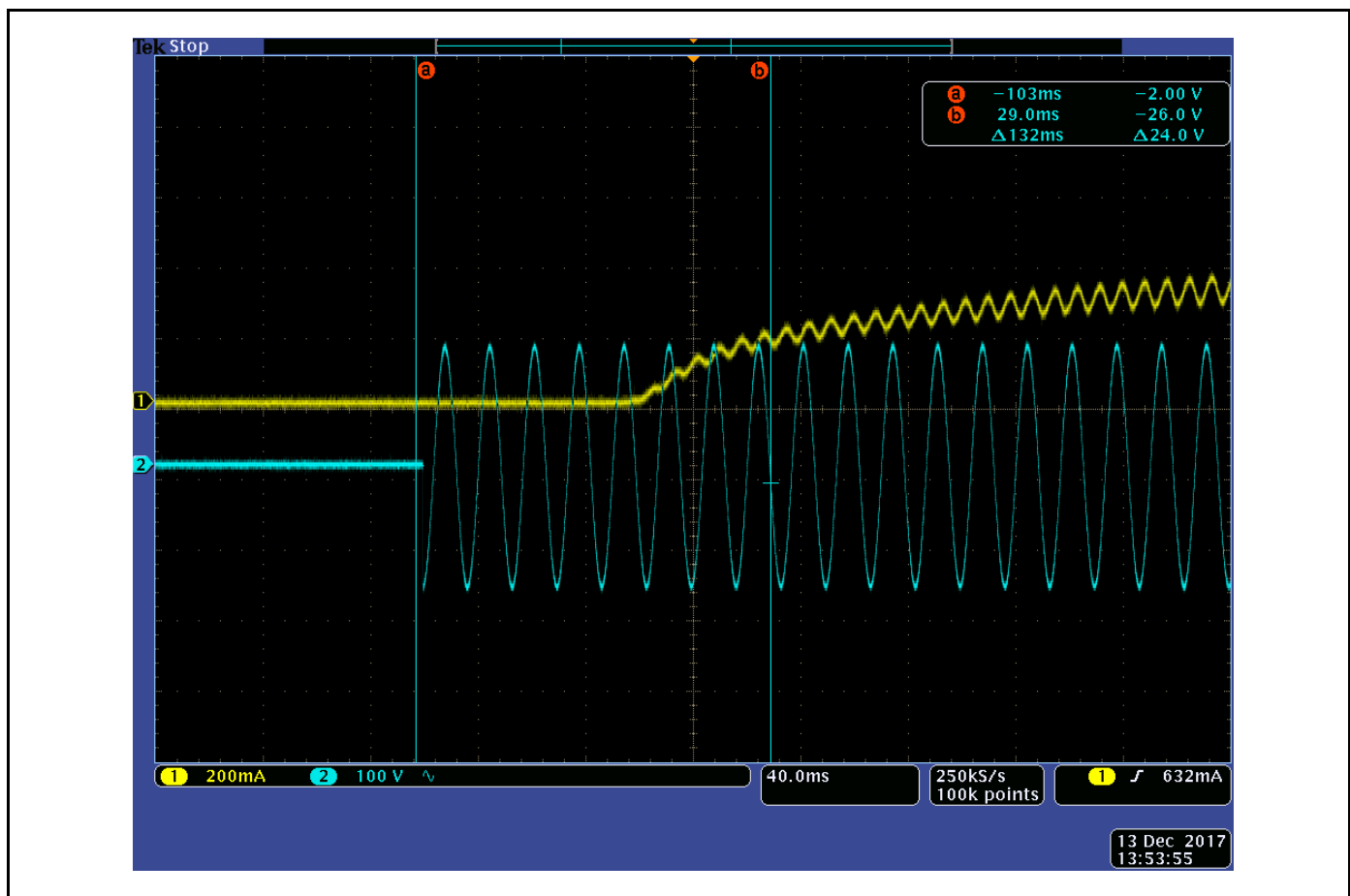
Model No.	ULD73W-0190	Sample ID.	1298520-S001
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Test Method

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	Start Time (ms)	Run-Up time (s)
25.2	120	60	132	N/A





6.0 Electrical Test

6.2 Operating Frequency Test

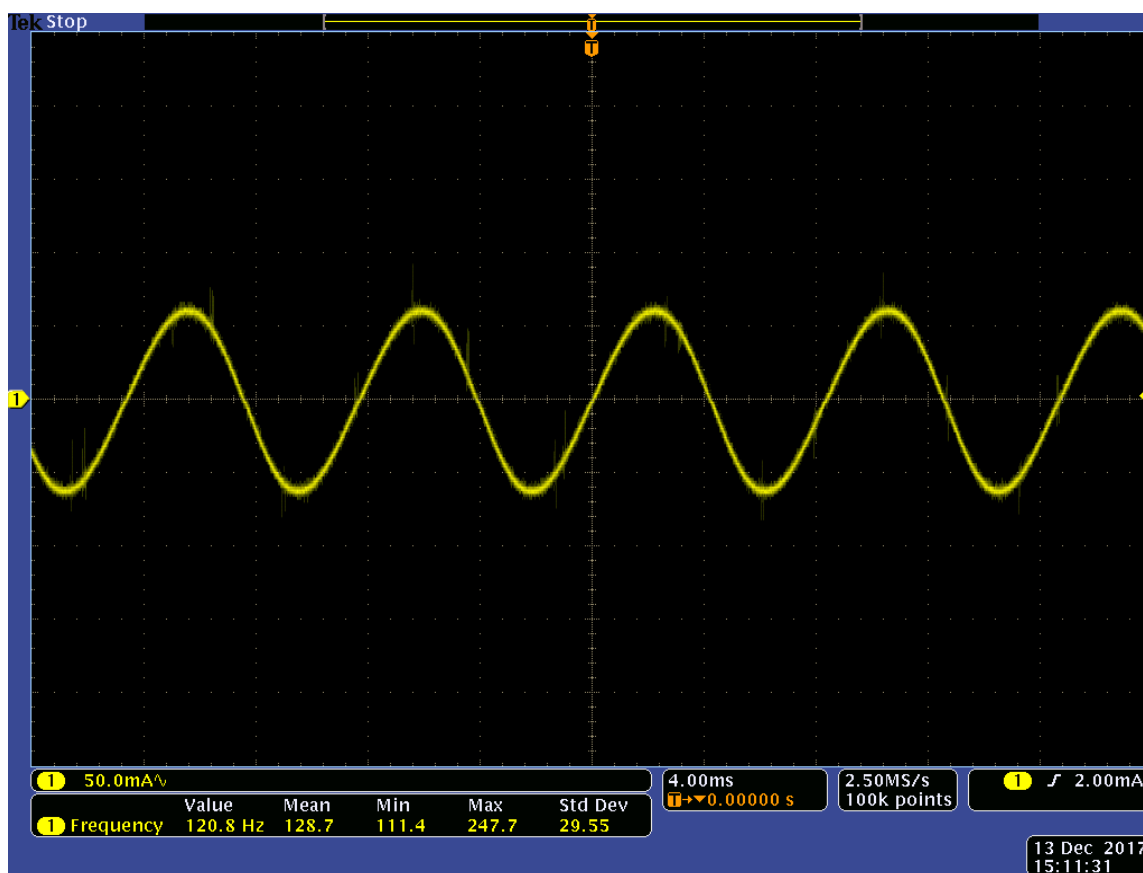
Model No.	ULD73W-0190	Sample ID.	1298520-S001
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Test Method

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	Operating Frequency (Hz)
25.1	120	60	120.8





6.0 Electrical Test

6.3 Transient Protection Test

Model No.	ULD73W-0190	Sample ID.	1298520-S001
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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 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	After Test - Seven Strikes (Survival/Dead)
25	120.1	60	Survival



6.0 Electrical Test

6.4 Standby Power Consumption

Model No.	ULD73W-0190	Sample ID.	1298520-S001
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Test Method

A sample was tested according to the IEC 62301-2011 Edition 2. The sample was operated at rated voltage and frequency, working in the active and standby mode*. For loads greater than or equal to 10 W, at least three significant figures shall be reported. After stability, the electrical parameter would be measured using proper method** and the value of U_e *** was calculated according to the Annex D. The test results shall be compliant with the relative requirements#.

Test Results

Temperature (°C)	Mode	Voltage (Vac)	Frequency	Current (mA)	Power Factor	Standby Power (W)
25.1	Standby mode	120.1	60	0.278	0.897	0.03

* The working mode is controlled stably by the light sensor. When environment gets dim, it works in active mode. If not, it works in standby mode. The sample was tested under different illuminance to change mode.

** The sample was tested with direct meter reading method according to IEC 62301-2011 Section 5.3.4.

*** The uncertainty of the test equipment (Power Analyzer) U_e is equal to 0.2% ($K=2$, at the 95% confidence level).

As U_e is no greater than the permitted value U_{ma} specified in IEC 62301-2011 Section 4.4.1, the measurement is acceptable.



6.0 Electrical Test

6.5 Dimming Test

Model No.	ULD73W-0190	Sample ID.	1298520-S001
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Dimmer Information

Manufacture	Lutron	Model Number	DVCL-153P
Rated for CFL / LED	LED	Technology / Features	Forward phase-cut

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	Baseline Light Output (lx)		Maximum Light Output (lx)	Minimum Light Output (lx)
25.1	120	60	705		700	60.5
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 (%)
17.7	17.8	17.9	17.9	N/A	99.29%	8.58%



7.0 In-Situ Temperature Measurement Test

Model No.	ULD73W-0190	Sample ID.	1298520-S001
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Test Method

1. In-Situ Temperature Measurement Test is conducted according to the UL1598-2008, Section 14 or UL 153-2002, Sections 124.
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. The temperature was recorded after the lamp was operating for a minimum of 7.5 hours.

In-Situ Temperature Measurement Test Conditions

Temperature	Voltage (Vac)	Frequency	Current (A)	Power (W)	Power Factor	Orientation
22.4	120.08	60	0.079	9.22	0.976	Face Down

Test Results

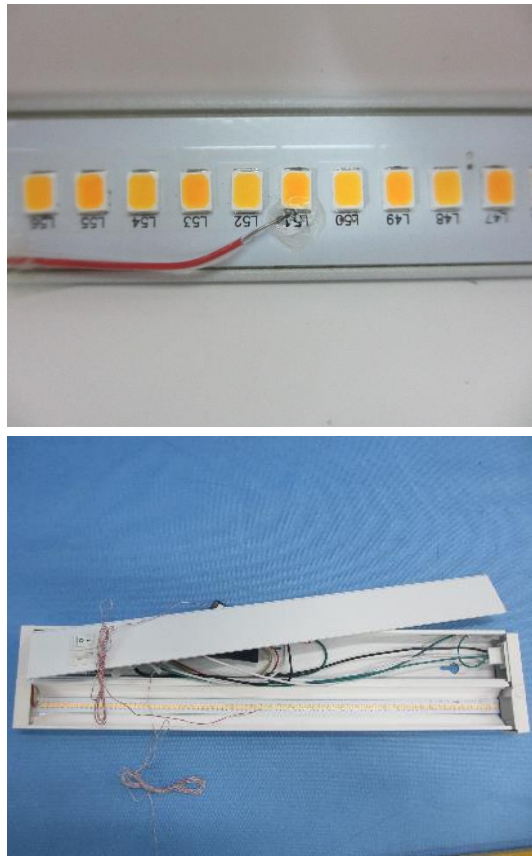
Thermocouple Location	Customer claim Current (mA)	Temperature for Lighting source (°C)		LED Model Number	LM-80 Limit Current (mA)	LM-80 Limit Temp. (°C)
		Test result column 1	Test result (Correct to 25 °C)			
TMP of LEDs	60	39.5	42.1	2T03X2WWxx00 0xxx	60	85
Ambient temperature	N/A	22.4	25.0			

Thermocouple Location	Temperature for LED driver (°C)		LED driver Model Number	LED Driver Tc Temp. (°C)
	Test result column 1	Test result (Correct to 25 °C)		
TMP of LED drivers	42.4	45.0	ULD6-7	90
Ambient temperature	22.4	25.0		

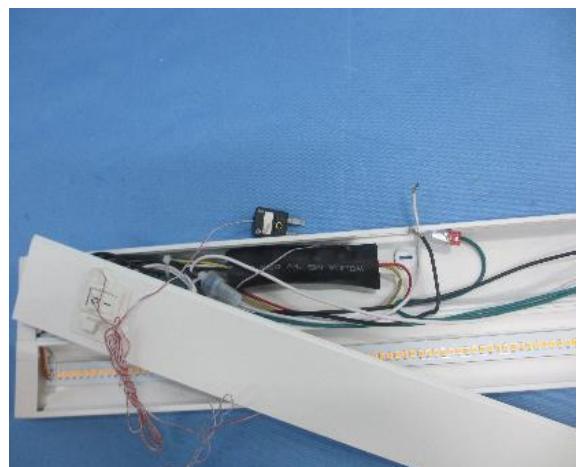
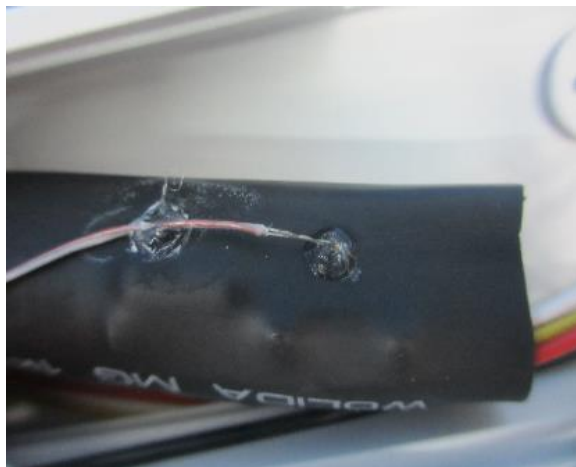


7.0 In-Situ Temperature Measurement Test (Cont'd)

Test Photos for LEDs



Test Photos for LED Drivers





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