



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

ULD63W-##90, ULD63BZ-##90, ULD63BK-##90

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

Project 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

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

(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.	65.75	Pass
Light Output (lm)	IES LM-79-08	Luminous Flux (lm)	508.88	Pass
		Under Cabinet: 125 lm/ft	434.94	
Zonal Lumen Density	IES LM-79-08	For directional luminaires only. (0°~60°C) >60%	80.90%	Pass
CCT (K)	ANSI C78.377-2011	fall within the corresponding 7-step chromaticity quadrangles	2769	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	0.0013	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.	168	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	0.965	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	120.2	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	36.4	Pass
Driver Case Temperature (°C)	ANSI/UL 153:2002 ANSI/UL 1598:2008	≤ TMPC marked on the the driver	47.1	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%	8.48%	Pass
Dimming: Noice	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	ULD63W-0190	Lily Chen
		2107-12-23	ULD63W-2090	Lily Chen
2	Goniophotometer Test	2107-12-12	ULD63W-0190	Lily Chen
3	Color Angular Uniformity	2107-12-15	ULD63W-0190	Lily Chen
4	Source Start Time & Run-Up time	2107-12-13	ULD63W-0190	Lily Chen
5	Operating Frequency Test	2107-12-13	ULD63W-0190	Lily Chen
6	Transient Protection Test	2107-12-18	ULD63W-0190	Lily Chen
7	Standby Power Consumption	2107-12-18	ULD63W-0190	Lily Chen
8	Dimming Test	2107-12-18	ULD63W-0190	Lily Chen
9	In-Situ Temperature Measurement Test	2107-12-18	ULD63W-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 14 inch

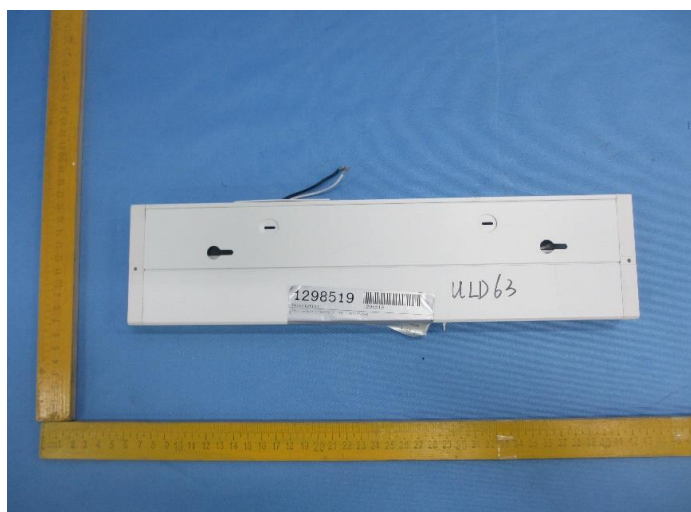
Lighting Source: 2T03X2WWxx000xxx made by Edison Opto Corporation

Mounting: Under Cabinet Mount

LED Driver: ULD6-7

Family Model and Variation: ULD63W-##90, ULD63BZ-##90, ULD63BK-##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.	ULD63W-0190	Sample ID.	1298519-S001	Temperature (°C)	25.1
Operate time (Min.)	50	Stabilization time (Min.)	45		

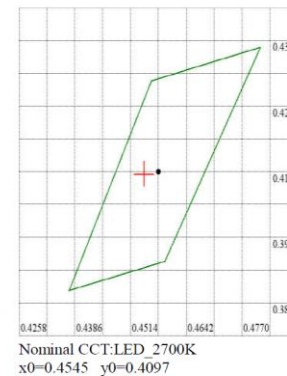
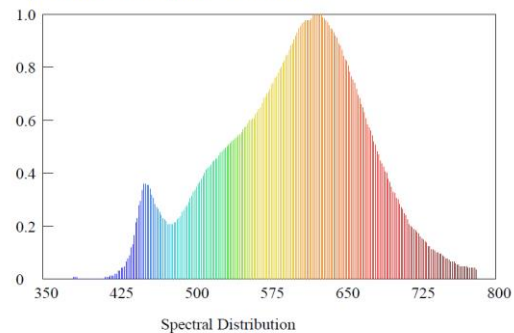
Test Method

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)
ULD63W-0190	Horizontal	120.1	60	0.067	7.74	0.965	2769	93.1	58	508.88	65.75

Spectroradiometric Parameters





4.0 Photometric Measurements

4.2 Integrating Sphere Test

Model No.	ULD63W-2090	Sample ID.	1291147-S001	Temperature (°C)	25.1
Operate time (Min.)	50	Stabilization time (Min.)	45		

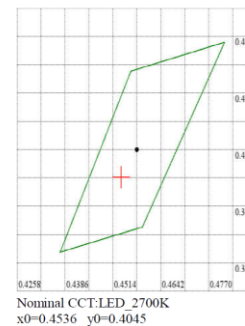
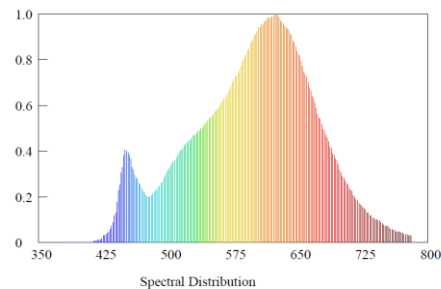
Test Method

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)
ULD63W-2090	Horizontal	119.98	60	0.062	7.05	0.955	2741	92.7	57	562.64	79.8

Spectroradiometric Parameters





5.0 Photometric Measurements

5.1 Goniophotometer Test

Model No.	ULD63W-0190	Sample ID.	1298519-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	120.02	60	0.067	7.75	0.9638	Horizontal

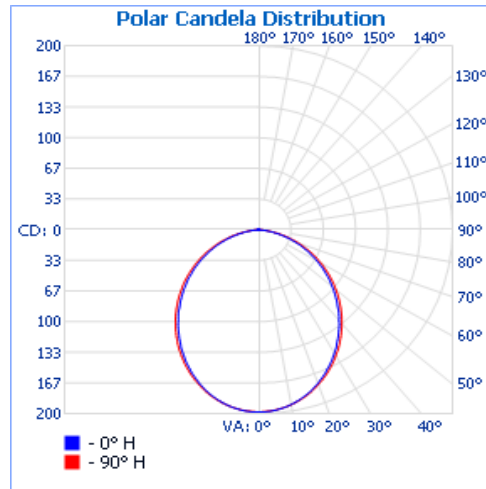
Test Results

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	
499.3	80.90%	157.7	155.9	103.4	101.1	64.4

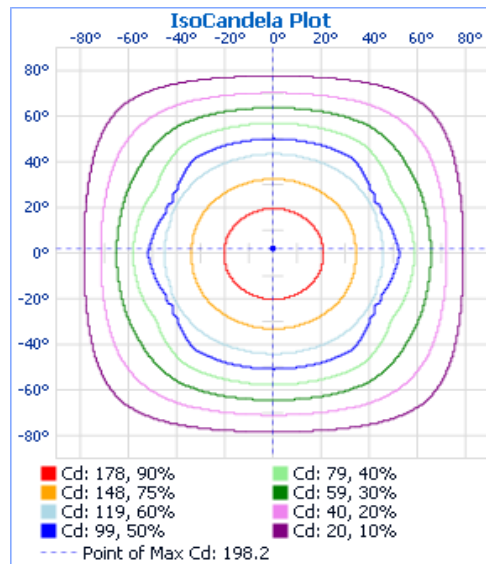


5.1 Goniophotometer Test (Cont'd)

Light Distribution Curve



Isolux Plot





5.1 Goniophotometer Test (Cont'd)

Zonal Lumen Summary

Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	148.8	29.8%
0-40	239.1	47.9%
0-60	404.2	80.9%
60-90	94.7	19%
70-100	38.3	7.7%
90-120	0.3	0.1%
0-90	498.8	99.9%
90-180	0.4	0.1%
0-180	499.3	100%

Lumens Per Zone

Lumens Per Zone

Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	4.7	0.9%	90-95	0.2	0%
5-10	13.9	2.8%	95-100	0.0	0%
10-15	22.5	4.5%	100-105	0.0	0%
15-20	30.1	6.0%	105-110	0.0	0%
20-25	36.4	7.3%	110-115	0.0	0%
25-30	41.2	8.2%	115-120	0.0	0%
30-35	44.4	8.9%	120-125	0.0	0%
35-40	45.9	9.2%	125-130	0.0	0%
40-45	45.9	9.2%	130-135	0.0	0%
45-50	43.2	8.6%	135-140	0.0	0%
50-55	40.0	8.0%	140-145	0.0	0%
55-60	36.1	7.2%	145-150	0.0	0%
60-65	31.2	6.3%	150-155	0.0	0%
65-70	25.5	5.1%	155-160	0.0	0%
70-75	18.9	3.8%	160-165	0.0	0%
75-80	11.9	2.4%	165-170	0.0	0%
80-85	5.7	1.1%	170-175	0.0	0%
85-90	1.5	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	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163
1	164	163	163	163	163	163	163	163	164	163	163	163	163	163	163	163	164
2	164	163	163	163	163	163	163	163	164	163	163	163	163	163	163	163	164
3	163	162	163	163	163	163	163	162	163	162	163	163	163	163	163	162	163
4	163	162	162	162	162	162	162	162	163	162	162	162	162	162	162	162	163
5	163	162	162	162	162	162	162	162	163	162	162	162	162	162	162	162	163
6	162	161	161	161	162	161	161	161	162	161	161	161	162	161	161	161	162
7	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161
8	161	160	160	160	160	160	160	160	161	160	160	160	160	160	160	160	161
9	160	159	159	159	160	160	160	160	160	159	159	159	160	160	159	159	160
10	159	158	158	159	159	159	158	158	159	158	158	159	159	159	158	158	159
11	158	157	157	158	158	158	157	157	158	157	157	158	158	158	157	157	158
12	157	156	156	157	157	157	156	156	157	156	156	157	157	157	156	156	157
13	156	155	155	156	156	156	155	155	156	155	155	156	156	156	155	155	156
14	155	154	154	155	155	155	154	154	155	154	154	155	155	155	154	154	155
15	153	152	153	153	154	153	153	152	153	152	153	153	154	153	153	152	153
16	152	151	152	152	153	152	152	151	152	151	152	152	153	152	152	151	152
17	150	150	150	151	151	151	150	150	150	150	150	151	151	151	150	150	150
18	149	148	149	149	150	149	149	148	149	148	149	149	150	149	149	148	149
19	147	146	147	148	148	148	147	146	147	146	147	148	148	148	147	146	147
20	145	145	146	147	147	147	146	145	145	145	146	147	147	147	146	145	145
25	136	136	137	138	138	138	137	136	136	136	137	138	138	138	137	136	136
30	126	126	127	128	129	128	127	126	126	126	127	128	129	128	127	126	126
35	114	114	116	117	119	117	116	114	114	114	116	117	119	117	116	114	114
40	103	103	104	106	107	106	104	103	103	103	104	106	107	106	104	103	103
45	92	91	92	95	96	95	92	91	92	91	92	95	96	95	92	91	92
50	78	79	81	82	84	82	81	79	78	79	81	82	84	82	81	79	78
55	67	67	69	70	71	70	69	67	67	67	69	70	71	70	69	67	67
60	55	55	57	58	59	58	57	55	55	55	57	58	59	58	57	55	55
65	43	43	45	46	47	46	45	43	43	43	45	46	47	46	45	43	43
70	32	32	34	34	35	34	34	32	32	32	34	34	35	34	34	32	32
75	21	22	22	23	24	23	22	22	21	22	22	23	24	23	22	22	21
80	11	11	12	13	13	13	12	11	11	12	13	13	13	13	12	11	11
85	4	4	5	5	5	5	5	4	4	4	5	5	5	5	5	4	4
90	0	0	1	1	1	1	1	0	0	0	1	1	1	1	1	0	0
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.	ULD63W-0190	Sample ID.	1298519-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	119.99	60	0.067	7.75	0.0013



6.0 Electrical Test

6.1 Source Start Time & Run-Up time

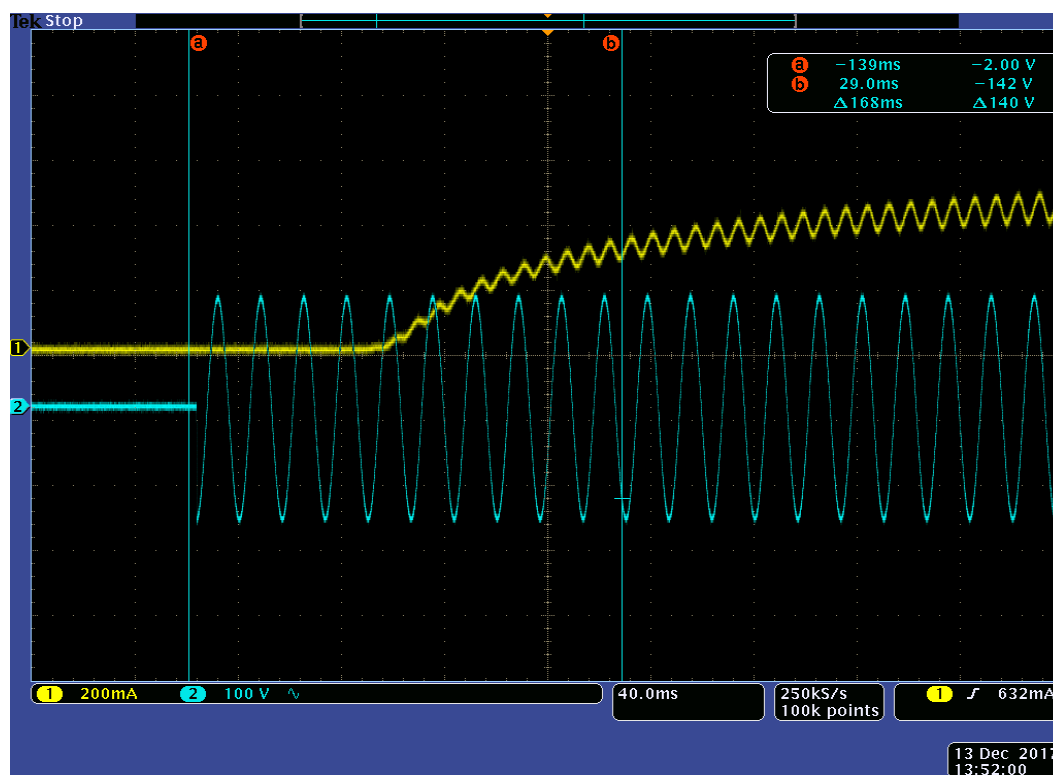
Model No.	ULD63W-0190	Sample ID.	1298519-S001
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Test Method

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	168	N/A





6.0 Electrical Test

6.2 Operating Frequency Test

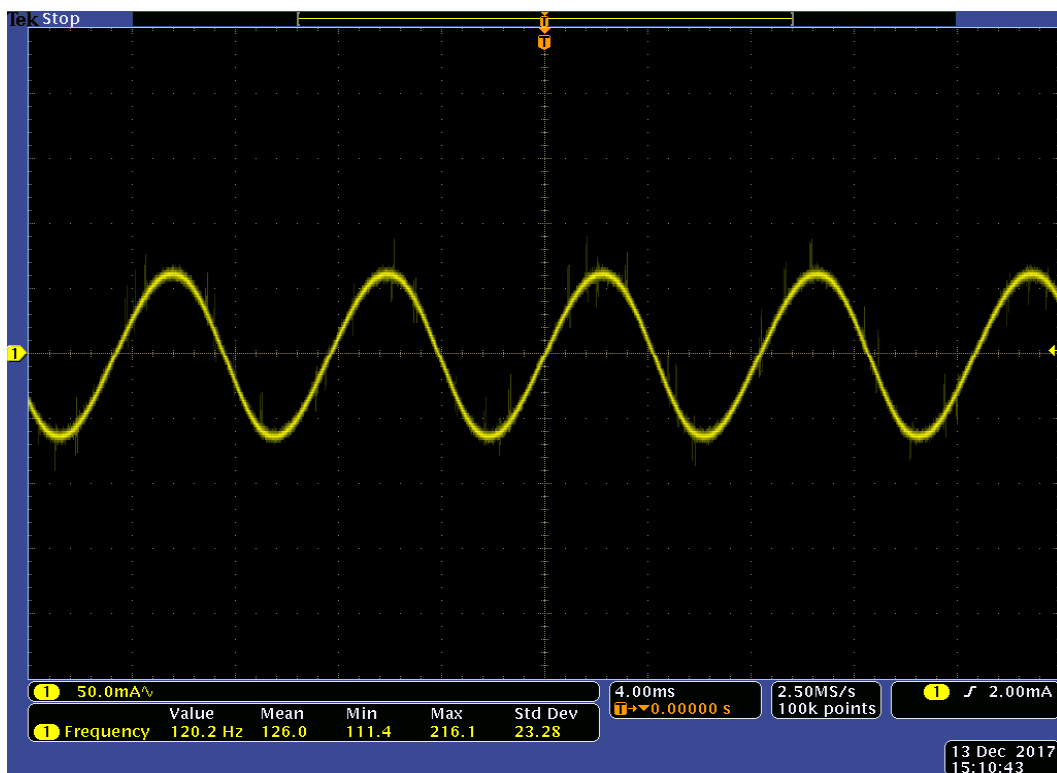
Model No.	ULD63W-0190	Sample ID.	1298519-S001
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Test Method

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	120.2





6.0 Electrical Test

6.3 Transient Protection Test

Model No.	ULD63W-0190	Sample ID.	1298519-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	60	Survival



6.0 Electrical Test

6.4 Standby Power Consumption

Model No.	ULD63W-0190	Sample ID.	1298519-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	60	0.277	0.901	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.	ULD63W-0190	Sample ID.	1298519-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	578		565	49
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	17.8	N/A	97.75%	8.48%



7.0 In-Situ Temperature Measurement Test

Model No.	ULD63W-0190	Sample ID.	1298519-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 $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$. 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
22.6	120.1	60	0.067	7.74	0.965	Face Down

Test Results

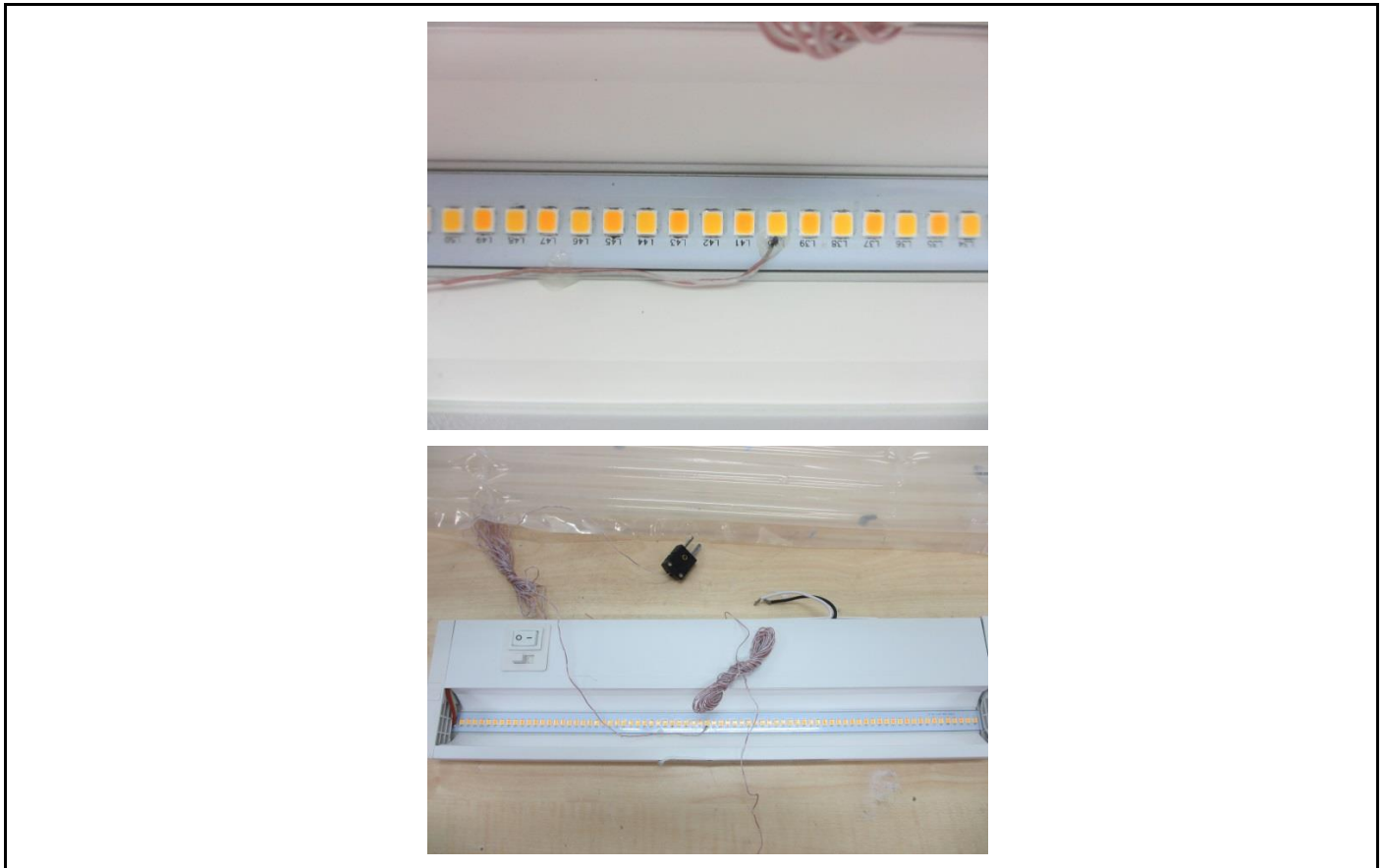
Thermocouple Location	Customer claim Current (mA)	Temperature for Lighting source ($^{\circ}\text{C}$)		LED Model Number	LM-80 Limit Current (mA)	LM-80 Limit Temp. ($^{\circ}\text{C}$)
		Test result column 1	Test result (Correct to 25°C)			
TMP of LEDs	60	34	36.4	2T03X2WWxx00 0xxx	60	85
Ambient temperature	N/A	22.6	25.0			

Thermocouple Location	Temperature for LED driver ($^{\circ}\text{C}$)		LED driver Model Number	LED Driver Tc Temp. ($^{\circ}\text{C}$)
	Test result column 1	Test result (Correct to 25°C)		
TMP of LED drivers	44.7	47.1	ULD6-7	90
Ambient temperature	22.6	25.0		

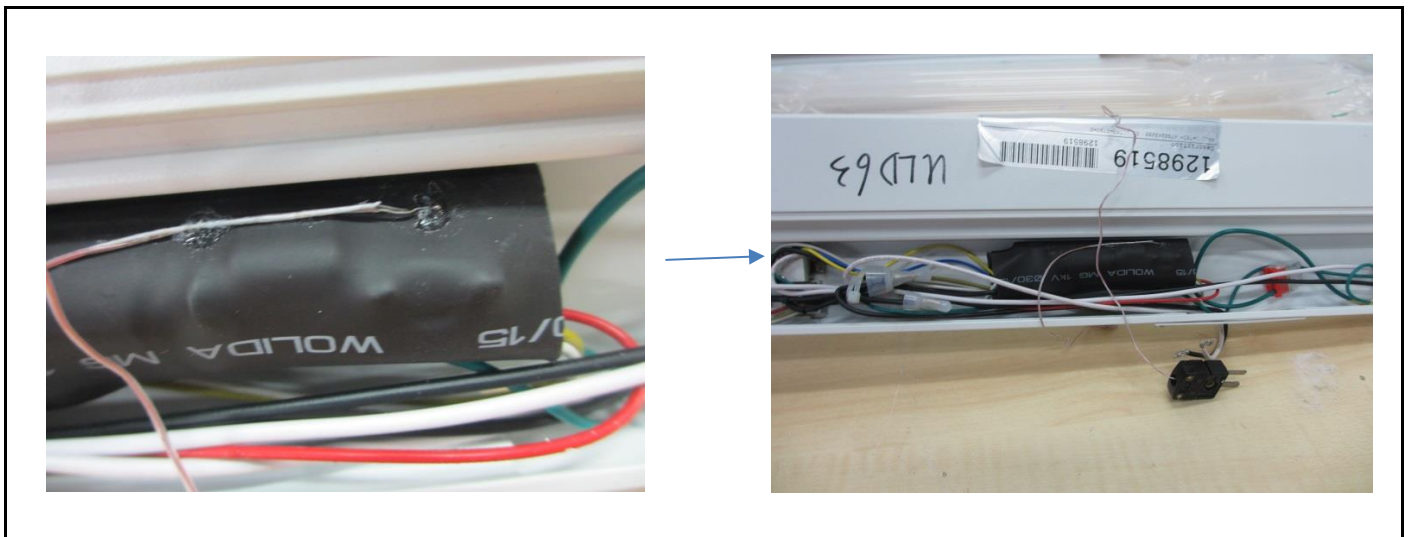


7.0 In-Situ Temperature Measurement Test (Cont'd)

Test Photos for LEDs



Test Photos for LED Drivers





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