

# VISUAL COMFORT AND COMPANY TEST REPORT

## SCOPE OF WORK

Performance Testing for Luminaires

## MODEL NUMBER

E3SRF-LO9274A w/ E3SLB-OW

## PROJECT NUMBER

G104622548

## REPORT NUMBER

104622548CRT-009

## ISSUE DATE

9/23/2021

## REVISED DATE

9/24/2021

## TEST DATES

9/18/21 through 9/23/21

## DOCUMENT CONTROL NUMBER

RTTDS-R-AMER-Test-3407

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**REPORT NUMBER**

104622548CRT-009

**MODEL NUMBER(s)**

E3SRF-LO9274A w/ E3SLB-OW

**REPORT RENDERED TO:**

VISUAL COMFORT AND COMPANY  
7400 LINDER AVE  
SKOKIE, IL 60077  
USA

**STATEMENT OF LIMITATION**

NVLAP Lab Code 100402-0. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

**AUTHORIZATION**

The testing performed was authorized by signed quote number Qu-01154433-0.

**TEST STANDARDS**

ENERGY STAR<sup>®</sup> Program Requirements for Luminaires Version 2.2

CEC-400-2018-021-CMF Appendix JA8 - Qualification Requirements for High Efficacy Light Sources

CEC-400-2018-021-CMF Appendix JA10 - Test Method for Measuring Flicker of Lighting Systems

IESNA LM-79 - 2008: Electrical and Photometric Measurements of Solid State Lighting

ANSI NEMA ANSLG C78.377: 2017: Specifications of the Chromaticity of Solid State Lighting Products

UL 1598-2009: Standard for Safety - Luminaires

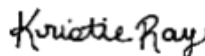
NEMA 77-2017 : Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria

In Charge of Testing:



Gerald Gray  
Associate Engineer  
Lighting Division

Reviewer:



Kristie Ray  
Team Lead, Engineering  
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**SAMPLE INFORMATION**

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**ITEMS RECEIVED**

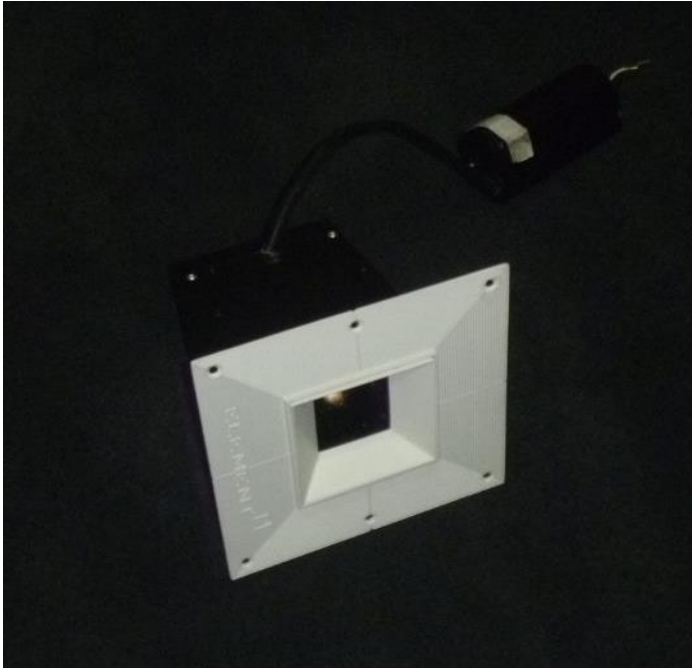
Item No.	Control No.	Model No.	Description	Type	Received
1	CRT2109100744-001-1	--	Housing w/PTB15W-0300-38-VCC	Production	9/10/2021
2	CRT2109100744-001-5	--	40° Lens	Production	9/10/2021
3	CRT2109100744-001-13	--	2700K LED	Production	9/10/2021
4	CRT2109100744-001-19	--	Trim with Lens	Production	9/10/2021

**TESTED SAMPLE CONFIGURATIONS**

Config No.	Tested Model No.	Item Nos. Utilized
1	E3SRF-LO9274A w/ E3SLB-OW	1,2,3,4

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**SAMPLE PHOTOS - TESTED CONFIGURATIONS**



**SUMMARY**

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**PRODUCT INFORMATION AND SUMMARY OF DATA**

Product Model No.:	E3SRF-LO9274A w/ E3SLB-OW
Product Description:	E3 IC REMODEL-927-40DEG-NO LENS
LED Model No.:	Bridgelux® Gen 8 V10 Array Series
Driver Model No.:	Tech Lighting PTB15W-0300-38-VCC
Light Source:	LED
CEC Product Type:	Inseparable
Minimum Claimed Dimming %:	5
Dimmer Make and Model:	Lutron: DIVA DDTV
Dimming Technology:	0-10 Volt DC Controls

Criteria	Results			Compliance
Light Output (lumens)	726.7			--
Input Power (W)	11.50			--
Lumen Efficacy (lm/W)	63.2			Pass
Input Power Factor (I)	0.988			Pass
Correlated Color Temperature (K)	2699			Pass
Color Rendering Index - Ra (I)	91.6			Pass
Color Rendering Index - R9 (I)	68.2			Pass
Duv (I)	-0.0012			--
Chromaticity Coordinate (x)	0.458			--
Chromaticity Coordinate (y)	0.407			--
Chromaticity Coordinate (u')	0.263			--
Chromaticity Coordinate (v')	0.526			--
Max LED Source Temperature (°C)	107.2			Fail
Start Time (ms)	288.0			Pass
Dimming (%)	1.9			Pass
Percent Amplitude Modulation (%)	100% Dim	20% Dim	Min Dim	
Unfiltered	31.9	9.7	21.7	--
1000Hz	14.6	1.1	1.2	--
400Hz	10.9	0.5	0.8	--
200Hz	1.4	0.2	0.3	Pass
90Hz	0.5	0.1	0.1	Pass
40Hz	0.2	0.1	0.1	Pass

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**CEC TITLE 24 APPENDIX JA8 REQUIREMENTS**

Property	Requirements
Luminous Efficacy (JA 8.4.1)	The luminous efficacy of the light source shall be equal to or greater than either the applicable State or federal appliance efficiency standard or 45 lumens/Watt, whichever is higher, when tested at its full light output.
Power Factor (JA 8.4.2)	The light source shall have a power factor equal to or greater than 0.90 when tested at its full light output.
Start Time* (JA 8.4.3)	The light source shall have a start time no greater than 0.5 seconds. (the point where the light source is continuously illuminated, and the light output is either constant or increasing.)
Color Characteristics (JA 8.4.4)	All light sources shall be capable of providing a nominal Correlated Color Temperature (CCT) of 4000 Kelvin or less and shall provide a Color Rendering Index (CRI) of 90 or higher and color rendering R9 value of 50 or higher.
Lumen Maintenance, Rated Life and Survival Rate* (JA 8.4.5)	<p>Lumen Maintenance: The percentage of initial light output shall either be 86.7 percent after 6,000 hours or 93.1 percent after 3,000 hours, based on whether the product is reporting final or interim test data. Light sources tested using LM-80 and TM-21, as specified in the ENERGY STAR product specifications, may use the ENERGY STAR TM-21 calculator to determine lumen maintenance at 3,000 or 6,000 hours.</p> <p>Rated Life: The light source shall have a minimum rated lifetime of 15,000 hours.</p> <p>Survival Rate: For tests using a sample group of ten units, 90 percent of tested units shall be operational for the duration of the test. For tests using a sample size less than ten, all tested units shall be operational for the duration of the test.</p>
Dimming, Reduced Flicker Operation and Audible Noise* (JA 8.4.6)	<p>The light source shall be dimmable down to 10 percent light output where 100 percent full light output is defined as operating the light source at the maximum setting provided by the control.</p> <p>LED-based light sources designed to be connected with or dimmed by forward phase cut dimmers shall meet the requirements of NEMA standard SSL 7A.</p> <p>Light source in combination with specified control shall provide "reduced flicker operation" when tested at full light output as specified in JA10, where reduced flicker operation is defined as having percent amplitude modulation (percent flicker) less than 30 percent at frequencies less than 200Hz.</p> <p>Light source shall not emit audible noise above 24dBA measured at 1 meter from the light source when tested at full light output.</p> <p>Light sources shall also be tested and shown to comply with (c) and (d) while at 20% light output.</p>

\*Not NVLAP Accredited

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## TEST METHODS

### SEASONING IN SAMPLE ORIENTATION - LED PRODUCTS

No seasoning was performed in accordance with IESNA LM-79.

### INTEGRATING SPHERE TESTING

A spectroradiometer and integrating sphere were used to measure the spectral distribution for each EUT resulting in photometric and colorimetric data. Electrical measurements of the unit were measured using a power analyzer. Each EUT was operated at the rated input voltage of the system in its designated orientation. The ambient temperature was measured at a position inside the sphere and stabilization procedures to LM-79 were followed.

### INSITU TEMPERATURE MEASUREMENT TESTING

Thermal measurements were taken on the EUT using a thermocouple and temperature meter. The EUT was allowed to reach thermal equilibrium for three and a half to seven and a half hours before measurements were taken. Temperatures were measured at the TMPps or Ts point as indicated by the included diagram in accordance with manufacturers declared thermal test point location, or at a thermal test point location found with a thermal camera when no diagram from the manufacturer is given. The maximum temperature was recorded for the sample. A simulated ceiling or other enclosure may be used in accordance to UL 1598, UL 153, or UL 1993 as applicable.

### START TIME

An oscilloscope was used to measure the starting time at ambient temperature. Measured start time was the time between supplied voltage and measured light output by a photometer. Each EUT was operated at rated input voltage in its designated orientation during the tests.

### DIMMING AND AUDIBLE NOISE

Dimming tests were performed with a photodetector and oscilloscope. Each EUT was allowed to stabilize at its highest dimming point and a relative light output measurement was taken. The EUT was then dimmed to its lowest point without flickering and another relative light output measurement was taken. The dimming range percentage was then calculated. Noise was conducted at 20% light output at a distance of 1 meter. Six different positions were measured, the maximum was recorded. Noise data is reported separately through our Acoustical Department, Cortland, NY.

### REDUCED FLICKER

An integrating sphere, photodetector, and oscilloscope were used to measure the percent amplitude modulation for each EUT. Measurements were recorded at each dimming level by  $\pm 2\%$  light output. For each dimming level, measurements were recorded in volts from test equipment with readings taken at intervals of no greater than 50 microseconds. These readings were recorded for a test period of no less than one second. The ambient temperature was measured at a position inside the sphere and stabilization procedures to LM-79 were followed. The percent amplitude modulation was calculated at unfiltered frequency, 1000Hz, 400Hz, 200Hz, 90Hz, and 40Hz for each dimming level. The dimming levels per JA10 are 100% light output (on a dimmer, but not dimmed), 20% light output, and the minimum claimed dim level). Industry accepted MATLAB coding was used to calculate the percent amplitude modulation.

### STATEMENTS OF CONFORMITY - DECISION RULE APPLIED

"Simple Acceptance" rule, also called "Shared Risk Approach" of ILAC-G8:09 guide.

The statements of conformity are reported as:

Passed - When the measured values are within the specified limits.

Failed - When one or more measured values are outside the specified limits

**TYPE C GONIOPHOTOMETER DISTRIBUTION TESTING**

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Test Configuration	Tested Model No.	Pass/Fail/NA
1	E3SRF-LO9274A w/ E3SLB-OW	NA

**PHOTOMETRIC AND ELECTRICAL MEASUREMENTS (25°C +/- 1°C)**

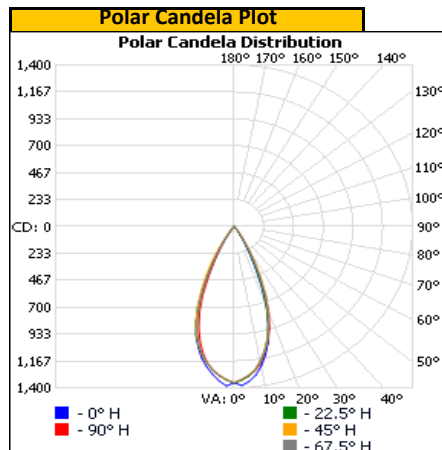
Base Orientation	Input Voltage (Vac)	Input Current (mA)	Input Power (W)	Input Power Factor ( )
Up	120.03	96.5	11.47	0.990

Light Output (lm)	Lumen Efficacy (lm/W)
707.0	61.7

**INTENSITY SUMMARY - CANDELA**

Angle	0	22.5	45	67.5	90
0	1354	1354	1354	1354	1354
5	1348	1302	1292	1294	1302
10	1228	1182	1186	1191	1204
15	1030	1005	1010	1022	1033
20	745	742	774	776	794
25	395	418	500	481	472
30	161	183	255	219	212
35	52	60	83	76	68
40	13	19	30	21	19
45	1	3	7	4	3
50	0	0	0	0	0
55	0	0	0	0	0
60	0	0	0	0	0
65	0	0	0	0	0
70	0	0	0	0	0
75	0	0	0	0	0
80	0	0	0	0	0
85	0	0	0	0	0
90	0	0	0	0	0
95	0	0	0	0	0
100	0	0	0	0	0
105	0	0	0	0	0
110	0	0	0	0	0
115	0	0	0	0	0
120	0	0	0	0	0
125	0	0	0	0	0
130	0	0	0	0	0
135	0	0	0	0	0
140	0	0	0	0	0
145	0	0	0	0	0
150	0	0	0	0	0
155	0	0	0	0	0
160	0	0	0	0	0
165	0	0	0	0	0
170	0	0	0	0	0
175	0	0	0	0	0
180	0	0	0	0	0

Entire luminous intensity matrix found in .IES file





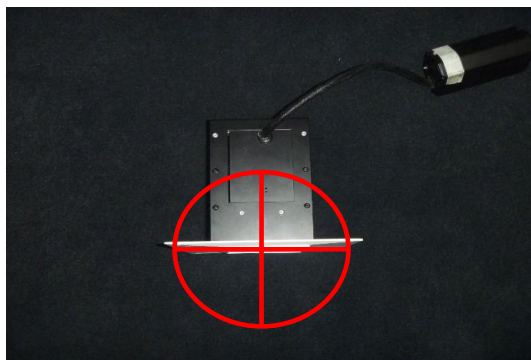
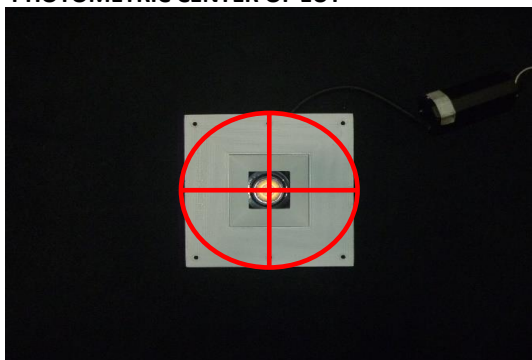
REPORT NO. 104622548CRT-009

ORIENTATION AND ALIGNMENT OF EUT

Luminous Opening		
Length (ft)	Width (ft)	Height (ft)
0.29	0.29	0.00
0°-180° H	90°-270° H	0°-180° V

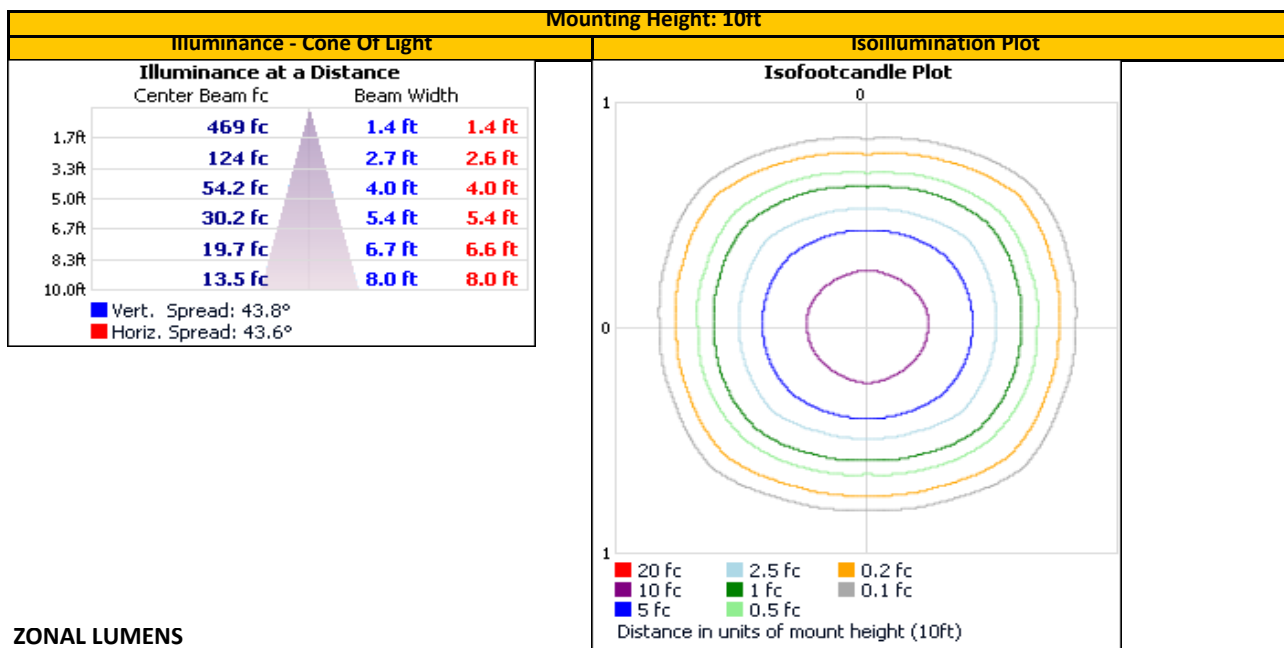
Test Distance (ft)
29.6

PHOTOMETRIC CENTER OF EUT



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## ILLUMINANCE SUMMARY



## ZONAL LUMENS

Zonal Lumen Summary						
Zone 1			Zone 2			
Zone	Lumens	% Lum	Zone	Lumens	% Total	Zone
0-30	637.5	90.2%	0-10	121.1	17.1%	90-100
0-40	700.9	99.1%	10-20	285.4	40.4%	100-110
0-60	707.0	100.0%	20-30	231.0	32.7%	110-120
60-90	0.0	0.0%	30-40	63.4	9.0%	120-130
70-100	0.0	0.0%	40-50	6.1	0.9%	130-140
90-120	0.0	0.0%	50-60	0.0	0.0%	140-150
0-90	707.0	100.0%	60-70	0.0	0.0%	150-160
90-180	0.0	0.0%	70-80	0.0	0.0%	160-170
0-180	707.0	100.0%	80-90	0.0	0.0%	170-180

**INTEGRATING SPHERE TESTING**

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Test Configuration	Tested Model No.	Pass/Fail/NA
1	E3SRF-LO9274A w/ E3SLB-OW	Pass

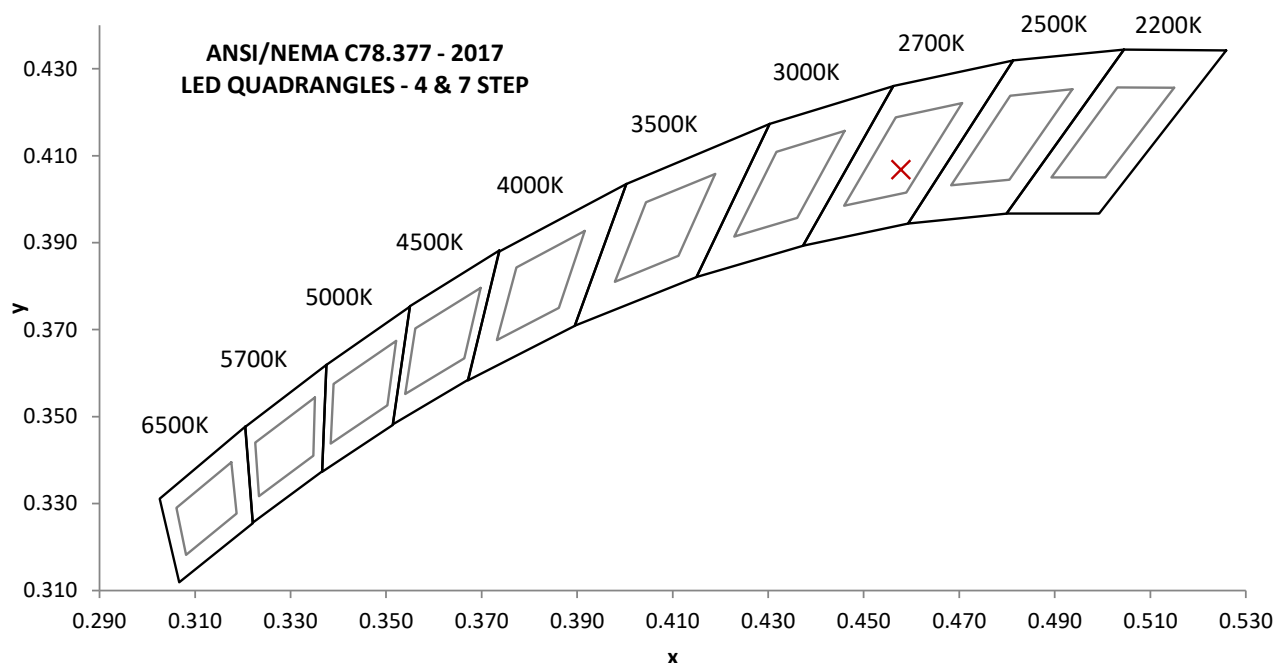
**PHOTOMETRIC, COLORIMETRIC, AND ELECTRICAL MEASUREMENTS (25°C +/- 1°C)**

Base Orientation
Up

Input Voltage (Vac)	Input Current (mA)	Input Power (W)	Input Power Factor ( )	Input ATHD (%)
120.02	96.9	11.50	0.988	10.41
277.04	46.6	11.82	0.915	14.16

Light Output (lm)	Lumen Efficacy (lm/W)	CCT (K)	CRI - Ra ( )	CRI - R9 ( )
726.7	63.2	2699	91.6	68.2

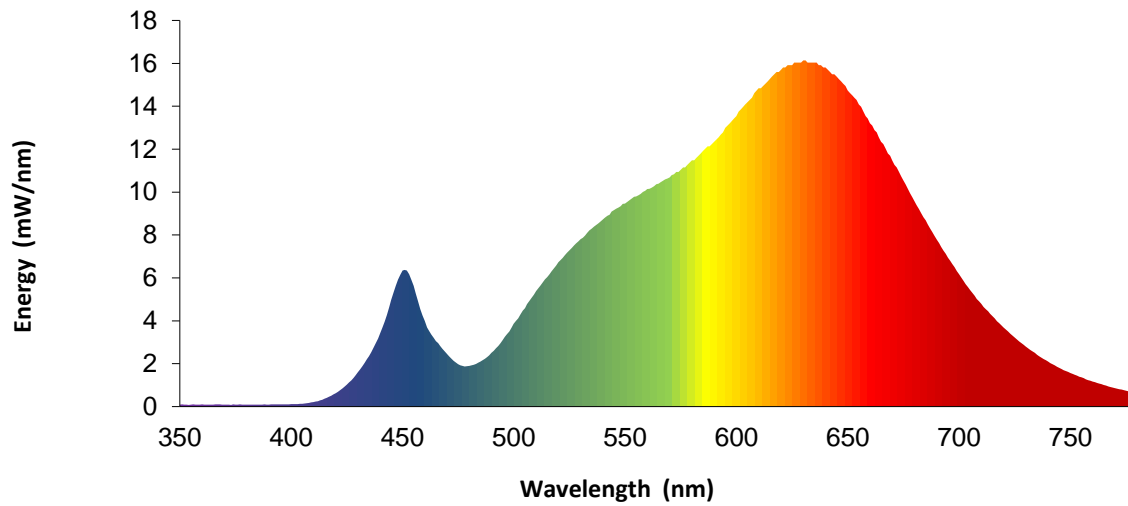
Duv ( )	1931 Chrom (x)	1931 Chrom (y)	1976 Chrom (u')	1976 Chrom (v')
-0.0012	0.458	0.407	0.263	0.526



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**SPECTRAL DISTRIBUTION OVER WAVELENGTHS**

nm	mW/nm		nm	mW/nm		nm	mW/nm		nm	mW/nm
350	0.1		460	4.0		570	10.7		680	9.6
355	0.1		465	3.1		575	11.0		685	8.7
360	0.1		470	2.4		580	11.5		690	7.8
365	0.1		475	2.0		585	11.9		695	6.9
370	0.1		480	1.9		590	12.3		700	6.2
375	0.1		485	2.1		595	13.0		705	5.4
380	0.1		490	2.5		600	13.5		710	4.8
385	0.1		495	3.1		605	14.2		715	4.2
390	0.1		500	3.9		610	14.8		720	3.7
395	0.1		505	4.6		615	15.3		725	3.2
400	0.1		510	5.4		620	15.7		730	2.8
405	0.1		515	6.0		625	15.9		735	2.4
410	0.2		520	6.7		630	16.1		740	2.1
415	0.4		525	7.3		635	16.0		745	1.8
420	0.6		530	7.8		640	15.8		750	1.6
425	1.0		535	8.3		645	15.4		755	1.4
430	1.6		540	8.7		650	14.7		760	1.2
435	2.4		545	9.2		655	14.1		765	1.0
440	3.4		550	9.5		660	13.2		770	0.9
445	5.0		555	9.8		665	12.3		775	0.7
450	6.3		560	10.1		670	11.5		780	0.6
455	5.6		565	10.4		675	10.5		---	---



Portrayed color in graphic is estimated by wavelength (nm) and may not be exact - it is a visual representation only

## INSITU TEMPERATURE MEASUREMENT TESTING

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Test Configuration	Tested Model No.	Pass/Fail/NA
1	E3SRF-LO9274A w/ E3SLB-OW	Fail

## LED MEASUREMENTS AND RATINGS

Mounting Type	Input Voltage (Vac)
Ceiling Recessed (IC)	120.00

LED Model No.	Bridgelux® Gen 8 V10 Array Series
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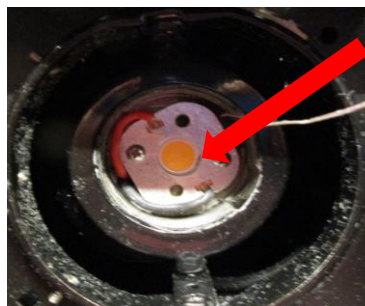
Max Case Temp - Tc (°C)	Max Thermal Resistance - Rth (°C/W)	Max Forward Voltage - Vf (V)
105.0	1.0	40.3

Measured LED Current (mA)	Measured LED Temp - Ts (°C)	Max LED Temp - Ts Max (°C)
302.0	107.2	105.0

### ISTMT Photo - Ts



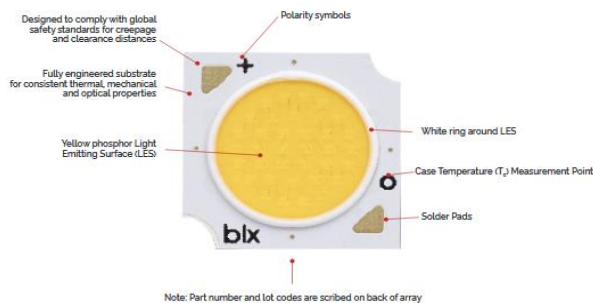
### ISTMT Photo - Ts Location



## LED SOURCE MANUFACTURER'S SUPPORTING DOCUMENTATION

Part Number	Drive Current (mA)	Forward Voltage Pulsed, T <sub>j</sub> = 25°C (V) ±1.5%			Typical Coefficient of Forward Voltage ΔV <sub>f</sub> /ΔT <sub>j</sub> (mV/°C)	Typical Thermal Resistance Junction to Case <sup>1</sup> R <sub>jc</sub> (°C/W)	Driver Selection Voltages <sup>2</sup> (V)	
		Minimum	Typical	Maximum			V <sub>f</sub> Min. Hot T <sub>j</sub> = 105°C (V)	V <sub>f</sub> Max. Cold T <sub>j</sub> = -40°C (V)
BXRE-xxxx00x-B-Bx	200	31.6	34.2	36.8	-11.03	0.62	30.8	37.5
	500	34.7	37.5	40.3	-12.10	0.95	33.7	41.1
BXRE-xxxx00x-C-Bx	300	28.4	30.7	33.0	-9.90	0.38	27.6	33.6
	1000	32.4	35	37.6	-11.29	0.55	31.5	38.4

Parameter	Maximum Rating	
LED Junction Temperature (T <sub>j</sub> )	150°C	
Storage Temperature	-40°C to +105°C	
Operating Case Temperature <sup>1</sup> (T <sub>c</sub> )	105°C	
Soldering Temperature <sup>2</sup>	300°C or lower for a maximum of 6 seconds	
	BXRE-xxxx00x-B-Bx	BXRE-xxxx00x-C-Bx
Maximum Drive Current <sup>3</sup>	500mA	1000mA



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#### DRIVER MEASUREMENTS AND RATINGS

Measured Case Temp - Td (°C)	Max Case Temp (°C)
61.6	90.0

#### ISTMT Photo - Td



#### DRIVER MANUFACTURER'S SUPPORTING DOCUMENTATION

Nominal Input Voltage	Max. Output Power	Efficiency	Max. Case Temperature	THD	Power Factor	Dimming Method	Dimming Range	Startup Time
120 & 277 Vac	30 W	up to 90% typical	90°C (measured at the hot spot)	< 20%	> 0.9	Programmable Forward-Phase, Reverse-Phase & 0 - 10 V	1 - 100% (% of Iout)	300 ms typical

\*Measurement location marked on driver.

**FLICKER TESTING - REDUCED FLICKER**

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Test Configuration	Tested Model No.	Pass/Fail/NA
1	E3SRF-LO9274A w/ E3SLB-OW	Pass

Dimmer Make and Model	Dimming Technology	Minimum Claimed Dim Level (%)
Lutron: DIVA DTVV	0-10 Volt DC Controls	5

**100% DIM LEVEL - FULL LIGHT OUTPUT WITH DIMMER**

Input Voltage (Vac)	Input Current (mA)	Input Power (W)	Input Power Factor (I)	Input ATHD (%)
120.00	96.7	11.47	0.989	10.42

CEC Title 24 JA10 Metrics (% Flicker)					
Unfiltered	1000Hz	400Hz	200Hz	90Hz	40Hz
31.89	14.61	10.93	1.42	0.48	0.21

**20% DIM LEVEL**

Input Voltage (Vac)	Input Current (mA)	Input Power (W)	Input Power Factor (I)	Input ATHD (%)
120.08	21.6	2.19	0.843	30.84

CEC Title 24 JA10 Metrics (% Flicker)					
Unfiltered	1000Hz	400Hz	200Hz	90Hz	40Hz
9.68	1.05	0.51	0.20	0.08	0.06

**MINIMUM CLAIMED DIM LEVEL**

Input Voltage (Vac)	Input Current (mA)	Input Power (W)	Input Power Factor (I)	Input ATHD (%)
120.06	19.6	1.70	0.722	34.72

CEC Title 24 JA10 Metrics (% Flicker)					
Unfiltered	1000Hz	400Hz	200Hz	90Hz	40Hz
21.66	1.24	0.76	0.25	0.10	0.09

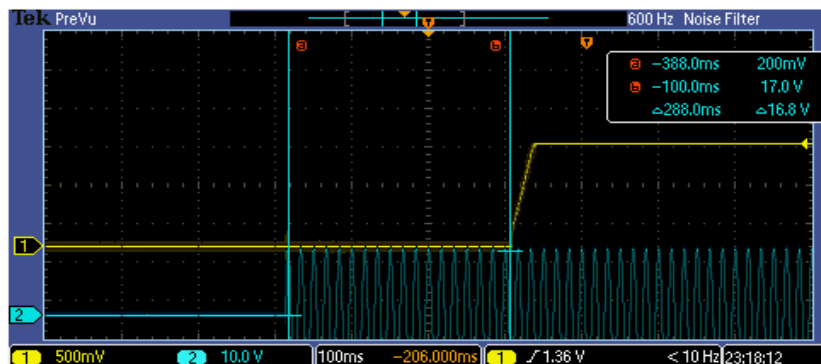
## ELECTRICAL PERFORMANCE TESTS

REPORT NO. 104622548CRT-009

### START TIME

Test Configuration	Tested Model No.	Pass/Fail/NA
1	E3SRF-LO9274A w/ E3SLB-OW	Pass

First Light Output - Start Time (ms)
288.0



### DIMMING

Test Configuration	Tested Model No.	Pass/Fail/NA
1	E3SRF-LO9274A w/ E3SLB-OW	Pass

Dimmer Make and Model	Dimming Technology	Minimum Claimed Dim Level (%)
Lutron: DIVA DTV	0-10 Volt DC Controls	5.0

Max Relative Light Output	Min Relative Light Output	Percent Dimmable (%)
123181	2294	1.9


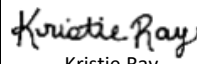


**EQUIPMENT LIST**

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#	Equipment	Model No	Control No.	Last Cal	Cal Due
1	Elgar AC Power Supply	CW1251	---	VBU	VBU
2	Sorenson DC Power Supply	XFR 150-8	---	VBU	VBU
3	Traceable Hygrothermometer	4800	L206	2/12/2021	2/12/2022
4	Yokogawa Power Analyzer	WT1600	E474	6/15/2021	6/15/2022
5	Fluke Thermometer	53 II	D587	2/5/2021	2/5/2022
6	3M Integrating Sphere Spectrometer System	CDS 2600	---	9/3/2021	12/3/2021
7	Fisher Scientific Stopwatch	14-649-9	N1132	3/26/2021	3/26/2022
8	LSI High Speed Mirror Goniophotometer	6440	---	8/16/2021	11/16/2021
9	Elgar AC Power Supply	CW1251	---	VBU	VBU
10	Yokogawa Power Analyzer	WT210	E464	5/11/2021	5/11/2022
11	Traceable Hygrothermometer	4800	L204	2/21/2021	2/21/2022
12	M-D Building Products Digital Level	Smart Tool	L112	5/26/2021	5/26/2022
13	Sorenson DC Power Supply	XG 150-10	---	VBU	VBU
14	Omega Thermometer	DPI8-C24	M263	3/23/2021	3/23/2022
15	Multi Channel Spectroradiometer	OL 770	O230	8/12/2021	11/12/2021
16	Bosch Distance Laser	Pro GLM 20	L211	3/3/2021	3/3/2022
17	Tape Measure	Powerlock	N1342	3/11/2019	3/11/2022
18	Digital Hygrothermometer	Traceable4800	L204	2/12/2021	2/12/2022
19	Tektronix Oscilloscope	DPO 2012	E480	2/13/2021	2/13/2022
20	UDT flexOptometer	S490	O224	VBU	VBU
21	Fluke Multimeter	87V	307-M226	3/29/2021	3/29/2022
22	Digital Thermometer	Fluke 53II	307-N1324	3/26/2021	3/26/2022
23	Keytek Wave Module	E503	W147	11/11/2020	11/11/2021
24	Keytek Coupler/Decoupler	E551	W148	11/11/2020	11/11/2021
25	Keytek Control Center	E504	W145	11/11/2020	11/11/2021
26	2M Integrating Sphere Spectrometer System	CSLMS-LED-7660	2M2	VBU	VBU
27	Tektronix Oscilloscope	DPO 2012	E480	2/13/2021	2/13/2022
28	Yokogawa Power Analyzer	WT1600	E462	5/7/2021	5/7/2022
29	Digital Thermometer	Fluke 53II	307-N1324	3/26/2021	3/26/2022
30	UDT Signal Amplifier	Tramp	---	VBU	VBU
31	Elgar AC power supply	CW1251	---	VBU	VBU
32	UDT flexOptometer	S490	O217	VBU	VBU
33	Digital Stopwatch	181552980	307-M308	12/10/2020	12/10/2021

**REVISION HISTORY**

#	Revision Date	Updated By	Reviewed By	Description of Change
1	9/24/2021	 G Gray	 Kristie Ray	Revised to correct LED chip and Data.
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