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Final Report

9/15/2023

**ASTM D2303-20e1: Liquid-Contaminant, Inclined-Plane Tracking
and Erosion of Insulating Materials, Section 10: Initial Tracking
Voltage**
**UL94-7th Edition: Tests for Flammability of Plastic Materials for
Parts in Devices and Appliances-Section 8: 50 W (20 mm) Vertical
Burning Test**
**UL94-7th Edition: Tests for Flammability of Plastic Materials for
Parts in Devices and Appliances-Section 9: 500 W (125 mm) Test
5 VA-5 VB Section 9**

ELTEK Labs Project #: 230807-2 CW Mod 1

SUBMITTED TO

**7365 Rocky Flats Ct.
Reno, NV
89502**

Attention: Michael Lynch



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Test Data Sheet - ASTM D2303-20 e1: Liquid Contaminant, Inclined-Plane Tracking and Erosion of Insulating Materials
Initial Tracking Voltage Test Method

ELTEK Project #:	230807-2-CW	Technician Name:	Turner, Jessie	Technician Signature:	Jessien Turner
Company:	Eco Electrical Systems, LLC	Designation:	EAR0011-0271-01FR	Composition of Contaminant:	Ammonium Chloride with Triton X-100 surfactant per ASTM D-2303 section 9.3
Contact:	Michael Lynch	Type:		Contaminant Resistivity Range:	370 to 400 Ω-cm (2.5 to 2.6 mS)
Address:	7365 Rocky Flats Ct. Reno, NV 89502	Size:	2 in x 5 in	Temperature of Contaminant:	23 ± 1°C
		Thickness:	0.150 in	Measurements within Tolerance:	Yes
		Surface Finishing:	Sanded under tap water with 400A grit wipe with isopropyl alcohol, rinse with distilled water	Test Voltage Range:	2.5 to 6.0
		Cleaning Procedure:		Contaminant Flow Rate Range:	0.15 mL/min to 0.90 mL/min
		Preconditioning:	24 - 48 hours in contaminant solution prior to test	Series Resistance Range:	10 kΩ to 50 kΩ
		Specimen Orientation:	molded	Initial / Final Contaminant Flow Rate:	0.15 mL/min / 0.90 mL/min
		Test Date:	8/15/2023	Initial / Final Contaminant Flow Rate:	0.90 mL/min / 0.90 mL/min
		Test Date:	8/23/2023		

Voltage was applied to each specimen in increments of 250-V from the starting voltage to the initial tracking voltage. Contaminant flow rate and series resistance were adjusted to correspond with each applied voltage increment.

Specimen	Thickness (in)	Starting Voltage	Initial Tracking Voltage (kV)	Minutes to Progressive Tracking (min)	Number of Voltage Steps	Observations	Max. Erosion Depth (in)	Next Voltage Adjustment
1	0.14370 in	2.5 kV	6.0 kV**	n/a min	15	1,3,6,13,19	0.020 in	increase voltage
2	0.14385 in	5.5 kV	6.0 kV**	n/a min	3	1,6,3,19	0.000 in	no change
3	0.14415 in	5.5 kV	6.0 kV**	n/a min	3	1,6,3,19	0.000 in	no change
4	0.14370 in	5.5 kV	6.0 kV**	n/a min	3	1,6,3,19	0.000 in	no change
5	0.14390 in	5.5 kV	6.0 kV**	n/a min	3	1,6,3,19	0.000 in	no change
6	0.14380 in	5.5 kV	6.0 kV**	n/a min	3	1,6,3,19	0.000 in	no change

Observation Codes

Total Number of Test Days: 2

General Observations:	Description of Tracking:	Tracking Residue:
1. Specimen Discolored	7. Broad Track	15. Hard Residue
2. Deep Erosion	8. Narrow Track	16. Tough Residue
3. Shallow Erosion	9. Filamentary Track	17. Brittle Residue
4. Delamination [Tracking Between Layers]	10. Dendritic (tree-like) Track	18. Powdery Residue
5. Fire ignited	11. Tracking Occurred Along Fiber Bundles	19. Fluffy Residue
6. Specimen Did not Track	12. Black Track	
	13. Brown Track	
	14. White Track	

Notes: Specimen 1 did not track. Went from 2.5 kV to 6.0 kV. 15 hrs. total.

** None of the specimens tracked.

ELTEK International Labs
Test Data Sheet - UL 94 7th Ed., Section 8 - Vertical Burning Test
For Classifying Materials UL 94 V-0, V-1, or V-2

ELTEK Project #: 230807-2-CW Technician Name: Palmer, Jennifer Technician Signature: Jennifer Palmer

Company: <u>Eco Electrical Systems, LLC</u>	Conditioning Start Date/Time: <u>8/14/2023 @ 8:00</u>	Conditioning Start Date/Time: <u>8/14/2023 @ 8:00</u>
Contact: <u>Michael Lynch</u>	Conditioning End Date/Time: <u>8/21/2023 @ 12:30</u>	Conditioning End Date/Time: <u>8/21/2023 @ 8:00</u>
Address: <u>7365 Rocky Flats Ct.</u>	Cotton Conditioning Start Date/Time: <u>8/14/2023 @ 8:00</u>	Desiccator in Date/Time: <u>8/21/2023 @ 8:00</u>
<u>Reno, NV 89502</u>	Test Date/Time: <u>8/21/2023 @ 12:30</u>	Desiccator out Date/Time: <u>8/21/2023 @ 12:40</u>
	Lab Conditions: <u>25.8 °C</u>	Cotton Cond. Start Date/Time: <u>8/14/2023 @ 8:00</u>
	<u>71 % R.H.</u>	Test Date/Time: <u>8/21/2023 @ 12:40</u>
		Lab Conditions: <u>25.6 °C</u>
		<u>72 % R.H.</u>

Material: EAR0011-0271-01 FR
Color:

Radius < 1.3 mm: Yes Width 13.0 ± 0.5 mm: Yes

Conditioned 48 Hours at 23 ± 2°C and 50 ± 5% R. H.	Set #1								Set #2							
	#	Thickness (mm)	T ₁ (Seconds)	X ₁	T ₂ (Seconds)	T ₃ (Seconds)	T ₂ + T ₃ (Seconds)	X ₂	#	Thickness (mm)	T ₁ (Seconds)	X ₁	T ₂ (Seconds)	T ₃ (Seconds)	T ₂ + T ₃ (Seconds)	X ₂
	1	3.668 mm	1 sec	2	5 sec	0 sec	5 sec	2	6	No outliers in Set #1; Set #2 not tested.						
	2	3.656 mm	1 sec	2	2 sec	0 sec	2 sec	2	7							
	3	3.667 mm	1 sec	2	5 sec	0 sec	6 sec	2	8							
	4	3.681 mm	1 sec	2	1 sec	0 sec	2 sec	2	9							
	5	3.637 mm	1 sec	2	5 sec	0 sec	5 sec	2	10							
	Total Flame Time, T ₁ + T ₂ (Seconds):							24 sec								
	Flame Class: V-0															

Notes: Burner calibration times: 44.37 sec, 43.15 sec, 44.28 sec

Radius < 1.3 mm: Yes Width 13.0 ± 0.5 mm: Yes

Conditioned 168 ± 2 Hours a 70 ± 1°C	Set #1								Set #2							
	#	Thickness (mm)	T ₁ (Seconds)	X ₁	T ₂ (Seconds)	T ₃ (Seconds)	T ₂ + T ₃ (Seconds)	X ₂	#	Thickness (mm)	T ₁ (Seconds)	X ₁	T ₂ (Seconds)	T ₃ (Seconds)	T ₂ + T ₃ (Seconds)	X ₂
	1	3.682 mm	1 sec	2	2 sec	0 sec	2 sec	2	6	No outliers in Set #1; Set #2 not tested.						
	2	3.672 mm	1 sec	2	2 sec	0 sec	2 sec	2	7							
	3	3.674 mm	1 sec	2	1 sec	0 sec	2 sec	2	8							
	4	3.675 mm	1 sec	2	1 sec	0 sec	2 sec	2	9							
	5	3.685 mm	1 sec	2	1 sec	0 sec	2 sec	2	10							
	Total Flame Time, T ₁ + T ₂ (Seconds):							13 sec								
	Flame Class: V-0															

Notes: n/a

Observations (X₁ & X₂)

- | | |
|---|--|
| (1) Specimen burned up to the holding clamp | (4) Specimen dripped particles, which ignited cotton |
| (2) Specimen did not drip | (5) Fumes from Specimen extinguished flame-burner relit during testing |
| (3) Specimen dripped particles, which did not ignite cotton | (6) Misc.: Specimen dripped flaming particles. |

ELTEK International Labs
Test Data Sheet - UL 94 Section 9 - 500 W (125 mm) Vertical Burning Test
For Classifying Materials UL 5VA or 5VB

ELTEK Project #: 230807-2-CW Mod 1 Technician Name: Palmer, Jennifer Technician Signature: Jennifer Palmer

Company: <u>Eco Electrical</u>	Conditioning Start Date/Time: <u>9/7/2023 @ 8:30 am</u>	Conditioning Start Date/Time: <u>9/7/2023 @ 8:30 am</u>
Contact: <u>Michael Lynch</u>	Conditioning End Date/Time: <u>9/14/2023 @ 2:20 pm</u>	Conditioning End Date/Time: <u>9/14/2023 @ 8:30 am</u>
Address: <u>8365 Rocky Flats Ct.</u>	Cotton Conditioning Start Date/Time: <u>9/7/2023 @ 8:30 am</u>	Desiccator in Date/Time: <u>9/14/2023 @ 8:30 am</u>
<u>Reno, NV 89502</u>	Test Date/Time: <u>9/14/2023 @ 2:20 pm</u>	Desiccator out Date/Time: <u>9/14/2023 @ 2:30 pm</u>
	Lab Conditions: <u>25.4 °C</u>	Test Date/Time: <u>9/14/2023 @ 2:30 pm</u>
	<u>40 % R.H.</u>	Lab Conditions: <u>25.7 °C</u>
		<u>39 % R.H.</u>

Material: 271-ECO Plaque
Color: EAR0011-0271-ECO Plaque
50 W (20 mm) Vertical Burning Classification: V-0
Material meets 5 VB (bar specimen) Criteria: Yes

Conditioned 48 Hours at 23 ± 2° C and 50 ± 5% R. H.	Specimen Length 150 ± 5 mm: Yes					Specimen Length 150 ± 5 mm: Yes				
	Set #1					Set #2				
	#	Thickness (mm)	Burn-through Occurred	Hole Formed	If "Yes", Hole Size (mm)	#	Thickness (mm)	Burn-through Occurred	Hole Formed	
	1	3.630 mm	No	No	n/a	4	All specimens in set 1 passed. Set 2 not tested.			
	2	3.634 mm	No	No	n/a	5				
	3	3.615 mm	No	No	n/a	6				
						Meets 5VA (Plaque Specimen) Criteria: Yes				

Notes: Burner calibration times: 52.79 sec, 53.57 sec, 52.40 sec

Specimen Length 150 ± 5 mm: Yes					Specimen Length 150 ± 5 mm: Yes					
Conditioned 168 ± 2 Hours at 70 ± 1 °C	Set #1					Set #2				
	#	Thickness (mm)	Burn-through Occurred	Hole Formed	If "Yes", Hole Size (mm)	#	Thickness (mm)	Burn-through Occurred	Hole Formed	If "Yes", Hole Size (mm)
	1	3.612 mm	No	No	n/a	4	All specimens in set 1 passed. Set 2 not tested.			
	2	3.645 mm	No	No	n/a	5				
	3	3.645 mm	No	No	n/a	6				
	Meets 5VA (Plaque Specimen) Criteria: Yes									

Notes: n/a

Observations (X₁)

- | | |
|---|--|
| (1) Specimen burned up to the holding clamp | (4) Specimen dripped particles, which ignited cotton |
| (2) Specimen did not drip | (5) Fumes from Specimen extinguished flame-burner relit during testing |
| (3) Specimen dripped particles, which did not ignite cotton | (6) Misc.: |

ELTEK International Labs
Test Data Sheet - UL 94 7th Ed., Section 9 - 500 W (125 mm) Vertical Burning Test
For Classifying Materials UL 5VA or 5VB

ELTEK Project #: 230807-2-CW Technician Name: Palmer, Jennifer Technician Signature: Jennifer Palmer

Company: <u>Eco Electrical Systems, LLC</u> Contact: <u>Michael Lynch</u> Address: <u>7365 Rocky Flats Ct.</u> <u>Reno, NV 89502</u>	Conditioning - 48 hr.		Conditioning - 168 hr.	
	Conditioning Start Date/Time: <u>8/14/2023 @ 8:00</u>	Conditioning End Date/Time: <u>8/22/2023 @ 11:30</u>	Conditioning Start Date/Time: <u>8/14/2023 @ 8:00</u>	Conditioning End Date/Time: <u>8/21/2023 @ 8:00</u>
	Cotton Conditioning Start Date/Time: <u>8/14/2023 @ 8:00</u>	Test Date/Time: <u>8/22/2023 @ 11:30</u>	Desiccator in Date/Time: <u>8/21/2023 @ 8:00</u>	Desiccator out Date/Time: <u>8/22/2023 @ 11:45</u>
	Lab Conditions: <u>23.5 °C</u>	Cotton Conditioning Start Date/Time: <u>8/14/2023 @ 8:00</u>	Test Date/Time: <u>8/22/2023 @ 11:45</u>	Lab Conditions: <u>23.6 °C</u>
	<u>74 % R.H.</u>		<u>70 % R.H.</u>	

Material: EAR0011-0271-01 FR
Color: [Redacted]
50 W (20 mm) Vertical Burning Classification: V-0

Conditioned 48 Hours at 23 ± 2°C and 50 ± 5% R.H.	Radius < 1.3 mm: Yes						Width 13.0 ± 0.5 mm: Yes						
	Set #1						Set #2						
	#	Thickness (mm)	T ₁ (Seconds)	T ₂ (Seconds)	T ₁ + T ₂ (Seconds)	X ₁	#	Thickness (mm)	T ₁ (Seconds)	T ₂ (Seconds)	T ₁ + T ₂ (Seconds)	X ₁	
	1	3.667 mm	1 sec	1 sec	2 sec	(2)	6	No outliers in Set #1; Set #2 not tested.					
	2	3.674 mm	1 sec	1 sec	2 sec	(2)	7						
	3	3.652 mm	1 sec	1 sec	2 sec	(2)	8						
	4	3.675 mm	1 sec	2 sec	3 sec	(2)	9						
	5	3.667 mm	1 sec	1 sec	2 sec	(2)	10						
Meets 5VB (Bar Specimen) Criteria: Yes													

Notes: Burner calibration times: 55.98 sec, 55.36, 55.33

Radius < 1.3 mm:		Yes		Width 13.0 ± 0.5 mm:		Yes							
Conditioned 168 ± 2 Hours at 70 ± 1 °C	Set #1						Set #2						
	#	Thickness (mm)	T ₁ (Seconds)	T ₂ (Seconds)	T ₁ + T ₂ (Seconds)	X ₁	#	Thickness (mm)	T ₁ (Seconds)	T ₂ (Seconds)	T ₁ + T ₂ (Seconds)	X ₁	
	1	3.688 mm	1 sec	1 sec	2 sec	(2)	6	No outliers in Set #1; Set #2 not tested.					
	2	3.668 mm	1 sec	1 sec	2 sec	(2)	7						
	3	3.673 mm	1 sec	1 sec	3 sec	(2)	8						
	4	3.661 mm	1 sec	2 sec	3 sec	(2)	9						
	5	3.663 mm	1 sec	2 sec	3 sec	(2)	10						
	Meets 5VB (Bar Specimen) Criteria:												Yes

Notes: n/a

Observations (X₁)

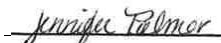
- | | |
|---|--|
| (1) Specimen burned up to the holding clamp | (4) Specimen dripped particles, which ignited cotton |
| (2) Specimen did not drip | (5) Fumes from Specimen extinguished flame-burner relit during testing |
| (3) Specimen dripped particles, which did not ignite cotton | (6) Misc.: |

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ELTEK International Labs
Project Test Equipment Record Sheet

ELTEK Labs Project #: 230807-2-CW Mod 1 **Technician Name:** Palmer, Jennifer

Technician Signature: 

Company: Eco Electrical Systems, LLC

Contact: Michael Lynch

Address: 7365 Rocky Flats Ct.
Reno, NV 89502

ELTEK Equipment		Manufacturer's Information			Function	Range	Last Calibration	Next Calibration
Number	Name	Name	Model	Serial No.				
519	Flame Cabinet	Hemco	21401	H12-3398	Testing UL 94, and can use fume hood for mixing chemicals.	Light Level: <20 lux	4/30/2021	4/30/2026
525	Micrometer	Mitutoyo	293-761-30	6006392	Precise Thickness Measurements.	0 - 1 inch	3/27/2023	3/27/2024
566	Manometer	Dwyer Instruments, Inc.	1230-8-D-B	00566	Measures back pressures of gases used during flammability testing.	0 - 200 mm H2O	4/15/2020	4/15/2024
609	Digital Thermometer	Omega Engineering, Inc.	HH11	852696	Precise Temperature Measurements.	Type K: -50.0C to 1000C	3/22/2023	3/22/2024
61	Oven 838-A-	Fisher Scientific	838F	114	Aging test specimens - samples	30°C - 280°C	6/9/2023	6/9/2024
668	125 mm Flame Height Gauge	Modica Precision Tools Corp.	125mm	FHG00668	1UL 94 Section 9.3.2 - used to verify flame height and specimens on a per test basis.	Flame Height Indicator: 125 mm; Inner Cone Flame Height Indicator: 40 mm; Bar Size Indicator >: 12.5 mm; Bar Size <: 13.5 mm	12/13/2022	12/13/2024
669	20 mm Flame Height Gauge	Modica Precision Tools Corp.	20 mm	FHG00669	1. UL 94 Section 8.3.2 - used to verify flame height and specimens on a per test basis.	Flame Height Indicator: 20 mm; Bar Size Indicator >: 12.5 mm; Bar Size <: 13.5 mm	12/13/2022	12/13/2024

Note: Calibration dates listed reflect the most recent calibration interval. All equipment listed was verified to be within a current calibration interval prior to initiation of testing. Previous calibration records are available upon request.

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Project Test Equipment Record Sheet

ELTEK Labs Project #: 230807-2-CW Mod 1 **Technician Name:** Palmer, Jennifer

Technician Signature: Jennifer Palmer

Company: Eco Electrical Systems, LLC

Contact: Michael Lynch

Address: 7365 Rocky Flats Ct.
Reno, NV 89502

ELTEK Equipment		Manufacturer's Information			Function	Range	Last Calibration	Next Calibration
Number	Name	Name	Model	Serial No.				
759	Digital Thermohygrometer	Cole-Parmer	90080-03	130572800	Measuring temperature and Humidity.	Relative Humidity: 1.0%RH to 99.9%RH; Temperature: -40.0C to 70.0C	11/1/2021	11/1/2023
673	20 mm Flame Barrel	Humboldt Mfg. Co.	H-5025	N/A	Burner used for 20 mm Flame Test	20 mm Flame	12/6/2017	12/6/2027
674	125 mm Flame Barrel	Humboldt Mfg. Co.	H-5025	N/A	Burner used for 125 mm Flame Test	125 mm Flame	2/28/2022	2/28/2032
282	125 mm Flow Meter	Matheson	ME14A101E300	00282-1 & 00282-2	Measure flow rate of methane gas for flame testing.	56 to 1180 sccm of natural gas	2/28/2022	2/28/2024
281	20 mm Flame Flowmeter	Matheson	ME14A101E100	00281-1 & 00281-2	Measure flow rate of methane gas for flame testing.	9 to 270 sccm of natural gas	4/21/2022	4/21/2024
728	24 Inch Stainless Steel Rule	GEI International, Inc.	2020A	C45953	Linear measurements for testing.	0.000 to 24.000 in (0.00 to 600.00 mm)	9/29/2022	9/29/2023
733	Inclined Plane Tester	Eltek Labs	IPT-ASTMD2303	JK01172013	Tracking or erosion resistance testing.	0 to 6kV, 0 to 0.90 mL/min	2/24/2023	2/24/2024

Note: Calibration dates listed reflect the most recent calibration interval. All equipment listed was verified to be within a current calibration interval prior to initiation of testing. Previous calibration records are available upon request.

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Project Test Equipment Record Sheet

ELTEK Labs Project #: 230807-2-CW Mod 1 **Technician Name:** Palmer, Jennifer

Technician Signature: Jennifer Palmer

Company: Eco Electrical Systems, LLC

Contact: Michael Lynch

Address: 7365 Rocky Flats Ct.
Reno, NV 89502

ELTEK Equipment		Manufacturer's Information			Function	Range	Last Calibration	Next Calibration
Number	Name	Name	Model	Serial No.				
788	Dual Range Conductivity Meter	Eutech Instruments	ECTestr11	2232022	Simultaneous measurement of conductivity (or TDS) and temperature readings.	Conductivity: 0 to 2000us/cm or 0 to 20.00mS/cm; Temperature: 0 to 50.0C	6/23/2023	6/23/2024
258	Bench Top Environ-Cap Humidity Chamber	Lab-Line Instruments, Inc.	685A	0702-0004	To provide Standard Laboratory Conditions [23 °C & 50 %RH] for conditioning of test specimens prior to testing.	Temperature: 5C to 60C; Humidity: 30%RH to 90%RH	7/14/2023	7/14/2024
183	Temperature & Humidity Wi-Fi Data Logger	Lascar Electronics	EL-WiFi-TH	98:8B:AD:20:7E:CB	Monitoring Lab Conditions	Temperature [-20°C to 60°C]; Relative Humidity [30 to 95 %RH]	6/21/2022	6/21/2024
169	Digital Stopwatch	Thomas Scientific	8788W75	181477377	Timing of tests.	9 hr, 59 min, 59 sec, 99 hundredths	8/18/2022	8/18/2024
1106	Digital Alarm Timer	Control Company	5020	210330131	Timing of tests.	1 second to 59 minutes, 59 seconds	5/15/2023	5/15/2025
1112	Digital Analytical Balance	Cole-Parmer	PA - 224I	PL9YCN311	Weight Measurements	0-200g	4/13/2023	4/13/2024

Note: Calibration dates listed reflect the most recent calibration interval. All equipment listed was verified to be within a current calibration interval prior to initiation of testing. Previous calibration records are available upon request.



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This report contains the data obtained by the test performed. These are the actual results for the test which ELTEK International Laboratories conducted for: Eco Elcetrical Systems, LLC

Project #: 230807-2-CW Mod 1

The results contained in this report relate to only the specimens tested. These specific values may not be duplicated in all cases.

Report Submitted By:

Jennifer Palmer

Digitally signed by Jennifer
Palmer
Date: 2023.09.15 09:41:48 -05'00'

Reviewed By:

*Corina
Wenzara*

Digitally signed by Corina
Wenzara
Date: 2023.09.15 11:13:13 -05'00'

Laboratory Technician

Date: 9/15/2023

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