

Eco Electrical Systems

Tracking and Erosion Resistance Testing: Incline Plane Tests ASTM D2303 and ASTM D2132

The tracking and erosion resistance tests were performed in accordance with ASTM D-2303 and D-2132 using molded plaques cut from molded products of our flame retardant proprietary material.

The tracking and erosion resistance was determined according to the ***Variable Voltage Method, Time to Track and the Dust Fog Test Methods.***

What is the difference between Variable Voltage Method and Time to Track; ASTM D2303

5.3 The time-to-track a 1-in. (25 mm) distance at a specified voltage between electrodes separated 2 in. (50 mm) has also been found useful in categorizing insulating materials for indoor and protected outdoor applications, such as metal-clad switchgear.

5.4 The initial tracking voltage has been found useful for evaluating insulating materials to be used at high voltages or outdoors and unprotected, as well as for establishing (see 11.1) the test voltage for the time-to-track test.

The variable voltage method, initial tracking method, specifies that the applied voltage, the contaminant solution flow rate is varied over specified time periods, incremental periods of 60 minutes, and the voltage increased 250 volts every 60 minutes (See Table 1). The surface of the material was abraded under tap water with a 400A grit prior to testing. The conductivity solution was maintained between 2500 and 2600 micro-Siemens at 23° C. The voltage and time at which the test specimens began to track and erode was recorded. The maximum test period was 365 minutes for Eco's proprietary material. ***A material that has good to excellent TERT resistance will last some 200+ minutes under the variable voltage method. This material is highly track resistant and has the highest flame rating classification, 5VA, under UL 94. Eco's material 365 minutes.***

This material has also been tested under ASTM D-2303: Incline Plane Test, Time to Track at 2.5 kV.

Total time under Time to Track; 1500 minutes (25 hours), no tracking, no erosion, and it was UV aged for 1,000 hours according to ASTM D-4329 prior to testing under Time to Track.

The material was also subjected to ASTM D-2132 Dust and Fog Tracking and Erosion Resistance of Electrical Insulating Materials: **Total time under test 200 hours, no tracking and no failure by erosion.**

Table 1 Test Conditions-Voltage and Contaminant Flow Rates: Variable Voltage Method

Time (min)	Voltage (kV)	Contaminant Flow Rate (ml/min)	Series Resistor (Ω)
0-60	2.50	0.15 \pm 0.01	10,000
60-120	2.75	0.15 \pm 0.01	10,000
120-180	3.00	0.30 \pm 0.02	50,000
180-240	3.25	0.30 \pm 0.02	50,000
240-300	3.50	0.30 \pm 0.02	50,000
300-360	3.75	0.30 \pm 0.02	50,000
360-365	4.00	0.60 \pm 0.03	50,000

The highly track resistant proprietary material with the highest flame retardant classification for UL 94 of 5VA has been developed and offered exclusively by Eco Electrical Systems for our molded avian protection products.

IEEE 1656 “Guide for Testing the Electrical, Mechanical, and Durability Performance of Wildlife Protective Devices on Overhead Power Distribution Systems Rated up to 38 kV”

Eco Electrical Systems has recently tested two cutout covers to the IEEE 1656 Guide, ECC-UHC-FR and ECC-10UC-FR. Both cutout covers EXCEED the requirements for the Wet Withstand Test Clause 5.2.1 Option 1 Moving Electrode. The IEEE 1656 Guide states that the grounded electrode is to be moved across all surfaces APPROACHING TO WITHIN 5 cm (1.968 inches) OF THE EXPOSED, BARE ENERGIZED #6 AWG CONDUCTOR (-0 cm, +2 cm) at the test voltage 18.7 kV, 120% of the rated line to ground voltage for the test setup. The independent lab conducting the test performed the test to the IEEE 1656 Guide maintaining 5 cm of clearance from energized parts, the uninsulated #6 conductor and the front of the cutout cover with the energized upper contact assembly below the cutout cover. Then the lab was instructed to touch all surfaces with an insulated jumper installed, typical field application, and to move the grounded electrode over all surfaces, front, top, and sides, PASS. I don’t think a bird or animal is going to maintain 5 cm of clearance from energized parts. The covers were tested with the optional extension and without. The IEEE 1656 guide should include the TERT test, Variable Voltage Method, Time to Track Test at 2.5 kV and the Dust and Fog Tracking and Erosion Resistance Test to ensure these insulating barriers will perform as intended.

See tables 2 and 3; Wet Withstand Test Option 1 Moving Electrode

Table 2 ECC-UHC-FR

Extension	Pins	Conductor	Surfaces Touched	Result
In Place	Regular	Bare #6 AWG	Up to 5 cm	PASS
Removed	Regular	Bare #6 AWG	Up to 5 cm	PASS
Removed	Ribbed	Bare #6 AWG	Up to 5 cm	PASS
Removed	Regular	Insulated #6 AWG	ALL	PASS

Table 3 ECC-10UC-FR

Extension	Pins	Conductor	Surfaces Touched	Result
In Place	Regular	Bare #6 AWG	Up to 5 cm	PASS
Removed	Regular	Bare #6 AWG	Up to 5 cm	PASS
Removed	Ribbed	Bare #6 AWG	Up to 5 cm	PASS
Removed	Regular	Insulated #6 AWG	ALL	PASS

The ECC-UHC-FR and ECC-10UC-FR also PASS the following IEEE 1656 Tests

Clause 5.2 Wet Withstand Option 1 Moving Electrode

Clause 5.3 - Wet Power Frequency Flashover

Clause 5.4 - Lightning Impulse Withstand

Clause 5.9.3 - High Current (Power Arc) Tests

And the proprietary material is also UL 94 5VA, the highest classification of the UL 94 Standard.

A V0 material is tested with a 50 watt flame.

A 5VA material is tested with a 500 watt flame.

To date, this is the only known material that meets and exceeds all of these parameters, highly track resistant, UL 94 5VA classification (the highest classification under UL 94), and UV resistant. If another manufacturer has it we have not been made aware of it. All testing completed at independent labs.

Our HDPE material, variable voltage method, made it 213 minutes.

We have another material that went the full distance, 6 kV, 960 minutes, the maximum voltage under ASTM D2303 and the maximum time under test, no tracking, and it's UL 94 5VA!

References

TE Connectivity-Energy Division

IEEE 1656: Flame Retardancy and Electrical Tracking

Observations from the Field

Steve Parker, Business Development Manager 7-23-19

[IEEE-1656: Flame Retardancy and Electrical Tracking \(tsdos.org\)](http://tsdos.org)