

INTERCONNECTIONS ENGINEERING  
TEST LABORATORY

TEST PROCEDURE: # 3006

TEST PROCEDURE TITLE: **Wet Arc Track Resistance Test**

SPECIFICATION(S)/REVISION: MIL-W-22759E SLASH SHEETS: /80-/92

REQUIREMENT PARAGRAPH: As per Slash Sheet Initial Qualification

**1.0 PURPOSE-** The wet arc-propagation resistance test for wire insulation provides an assessment of the ability of an insulation to prevent damage in an electrical arc environment. The test also evaluates the ability of the insulation to prevent further arc-propagation when the electrical arc is re-energized.

**2.0 TEST EQUIPMENT-** The Wet Arc Track Resistance Test is performed on the Lectromec Wet and Dry Arc Track Resistance Test System, model 113094- 01, with the Wet Test Module, located along the south wall of Rm. 16, B/5000. This procedure is to be supplemented with the Lectromec Installation Operations Maintenance Manual.

Materials needed for bundle preparation/\*testing:

1. \*Isopropyl alcohol.
2. \*Cloth.
3. Calipers.
4. Razor blades or razor knife.
5. Marking labels with felt tip marker.
6. Wire strippers.
7. \*Ohmmeter or continuity tester.
8. \*6-12" ruler.
9. Lacing Tape.
10. \*Allen wrenches.
11. \*Straight blade screwdriver.
12. \*Replacement micro-bore (drip feed) tubing.
13. \*Wire samples (15 bundles of 7 wires 17" length, 150 feet required, 200' preferred).
14. \*Very fine stiff wire to clear drip feed needle.
15. \*The Lectromec Installation Operations Maintenance Manual.
16. \*Flashlight.
17. \*(1)Liter (per 15 bundles) of Sodium chloride (NaCl) solution 3% by weight in distilled water (made by Mat'1 Lab).
18. \*Eye protection (safety glasses).

See Operations Manual:

Installing the Wet Test Module

1. Place the Wet Test Module into the module position area [Figure 2, Item K] such that the positioning standoffs [Figure 2, Item L] lie in the positioning holes [Figure 4, Item I]. The binding post stands [Figure 4, Item B] provide convenient handles for the Wet Test Module. The Wet Test Module is secured using the plastic, black colored, knurl headed, 10-32 screws.
2. Mate the Wet Test Module circular connectors [Figure 4, Item J] with the Bench Top Test Unit circular connectors [Figure 2, Item H].
3. Connect the enclosure wire to the wet fixture base [Figure 4, Item K] using the screw on the back of the base as a post.

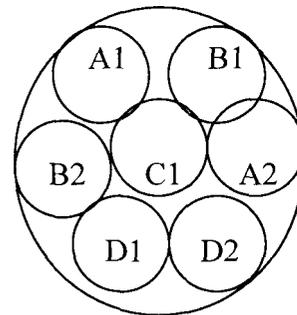
4. Push fit the long end of the electrolyte feed tube from the Wet Test Pump [Figure 2, Item A] into the needle connector (which is screwed into the needle) at the top of the Needle Rod. The other end of the electrolyte feed tube is placed in the Wet Test Fluid Reservoir [Figure 2, Item B], where the 3% Sodium Chloride solution (obtained from the chemistry lab) is to be added.

**3.0 TEST SAMPLE - Bundle Preparation:**

Cut the required wire lengths to be tested into approximate 50' bundles. Conduct a 2500 volt Wet Dielectric test on 100 percent of the wire in accordance with the Dielectric test procedure described in MIL-STD-2223, Method 3005, before the arc propagation resistance test is performed. Discard any failed sections of wire. Cut seven wire segments (17 inches) in length for each of the 15 bundles. (**Note:** Additional wires may be required to replace wires damaged in making the window cuts in A 1 and B1 wires.) Selecting two wires from each bundle (to become A1 & B1), mark the midpoint line of each with a fine felt tip marker and with a caliper, measure and mark an additional line 0.5-1 .0 mm (0.0197-0.0394 inch) from the first line. Using a razor blade knife, cut completely around (360 degrees) at the marks of the two wires, being cautious not to cut into the conductor. Make a lengthwise cut between these cut grooves and remove the insulation to expose the conductor. (**Caution should be taken to avoid any damage to the conductor strands**). Inspect each window cut under a microscope to assure strands are not cut and the window dimensions are correct.

Strip both ends of the seven wire segments. Clean the wires using a cloth with isopropyl alcohol. Five wire segments will be called "Active Wires" and two wire segments will be called "Passive Wires" for each bundle. Form the bundle by laying the seven segments straight and geometrically parallel. Assemble the wires to form six-around-one configuration shown below. The two pre-damaged wires should be placed in the A1 and B 1 positions. Use Mil-T-43435 (type V) or equivalent lacing tapes to hold the test bundle together. Place labels denoting the circuit identification of the wire (A1, B1, etc.) near both ends of each wire, with care being taken to insure the wires are labeled correctly by using an ohmmeter or continuity tester. The two passive wires correspond to the D1 and D2 components shown. Check the bundle and wire orientation against the diagram below. Adjust the position of wires A1 and B1 in the bundle to provide a longitudinal distance of 6.0 mm to 6.5 mm (0.2362 to 0.2560 inch) measured between the inner edges of each stripped window of the two exposed conductors.

Bundle configuration ( side )



Electrical connection (below)

Wire Identification	Power Supply	Bundle Layer
A1	Phase A	Top
B1	Phase B	Top
C1	Phase C	Middle
A2	Phase A	Middle
B2	Phase B	Middle
D1	None      Passive	Lowest
D2	None      Passive	Lowest

**4.0 TEST PROCEDURE-** The Wet Arc Track Resistance Test is performed in accordance with test method 3006 of MIL-STD-2223.

Installing the Wire Bundle in the Wet Test Module

1. Prepare a wire bundle for testing in accordance with MIL-STD-2223 method 3006 (see paragraph D2). Wire lengths of 17 inches are needed. If not previously performed, labels denoting the circuit identification of the wire (A1, A2, etc.) should be placed near both ends of each wire with care being taken to insure wires are labeled correctly. Clean the assembled bundle using a cloth and Isopropyl alcohol prior to installation in the test fixture.

2. Secure the wire bundle to the Wet Test Module using the wire bundle clamps [Figure 4, Item D].

3. Connect each of the five (5) active wires (A 1, A2, B 1, B2, and C2) to the correct binding post [Figure 3, Item C].

**Each wire must be connected with the correct terminal post by matching the terminal post labels and the labels (or stamped identification) denoting the circuit identification of the wire. The wires A1 & B1 must be located on top with care taken to ensure that there is a longitudinal distance of 0.2362 to 0.2560 inch as measured between the inside edges of the stripped windows of the two conductors.** The lacing tapes on the test wire bundle should be positioned such that the innermost ties are a nominal 1.5 inch apart to maintain wire bundle form. Slide the wire bundle into position such that the pre-stripped windows lie in the middle of the test drip zone.

4. Energize the system control power by pushing the Control Power Button on the Electronic Control Unit. When energized, the indicator light in the switch will be illuminated (green colored). Turn the Test selector switch to the “Wet” test position. The “Wet” indicator light (white) should be illuminated. (**Note:** There are two wet test switch positions. Both are equivalent. It does not matter which of these positions is selected.)

5. Locate the stainless steel pan under test sample to collect any excess drippage during test. Turn on the Wet Test Pump (in the forward direction) using the Pump Motor Controller [ Figure 2, Item N]. Ensure that the electrolyte drops are hitting the test wire bundle in accordance with MIL-STD-2223, Method-3006. (It has been found that a setting of around 2 on the Pump Motor Controller achieves the 8- 10 drops per minute to the test specimen; however, the final rate must be checked due to variables of tubing and needle condition). If necessary, adjust the position of the needle by moving the Needle Rod [Figure 4, Item E] and Needle Rod Clamp [Figure 4, Item F]. Turn off the Wet Test Pump.

6. Place the cover on the protective case, closing the interlock switch. When the cover is properly positioned the Interlock Closed light (red) on the Electronic Control Unit will be illuminated.

Executing: the Wet Arc Track Resistance Test:

1. Electronic Control Unit (ECU) Preparation (with Control Power “ON”):

a. Make sure that each of the five (5) circuit breakers (at the top of the front panel) are closed. All five (5) “Closed” lights (white) should be illuminated. Push the momentary hold continuity check on the ECU to assure all 5 active circuits are connected.

b. Select the circuit resistance for the test. This is accomplished by pointing the Circuit Resistance knob to the desired setting.

Perform the test on 3 bundles at each circuit resistance shown below;

Test Number	Circuit Resistance (ohms)
1-3	0.0
4-6	0.5
7-9	1.0
10-12	1.5
13-15	2.0

c. Reset the Test Time to zero by pushing the reset bar on the top front of the Test Time clock.

d. Reset the Elapsed Trip Time to zero by pushing the reset bar on the top front of the Elapsed Trip Time clock.

2. Make sure that the three 50 amp circuit breakers, mounted on the Motor-Generator, are closed then turn on the Motor-Generator by pressing the “ON” button on the motor starter.
3. Start exhaust fan by means of the wall switch located behind the ECU.
4. Start the flow of electrolyte solution by starting, from the Pump Motor Controller panel, the Wet Test Pump in the forward direction.
5. Energize the test power by pressing the Test Power “On” button on the Electronic Control Unit. The test time clock will start now. The Test Power light (red) should illuminate. The five (5) Continuity lights (green) should illuminate and the ammeters will read 1+/- 0.2 amps, in accordance with MIL-STD-2223 method 3006.
- 6.a. If the breaker for circuit A1 or B1 trips -the Closed light (white) will turn “off” and the Open light (blue) will turn “on” for that circuit. The test power is automatically shut off. The Test Timer clock is stopped and Trip Time counter starts.
  - b. If the breaker for circuit C1, A2 or B2 trips, the TEST POWER REMAINS APPLIED TO THE TEST WIRE BUNDLE. After 180 seconds the test power will automatically be shut off and the Test Time clock stopped.
  - c. For circuits that have lost continuity, the Continuity light (green) will not illuminate for that circuit. Test power will not be affected by loss of continuity during the Wet Arc Track Resistance Test.

## 5.0 TEST NOTES

**The following criteria are used to determine the test endpoint and test validity:**

- a. If breakers A1 or B 1 trip, watch the trip time indicator, after 3 minutes reset the tripped breaker and immediately reapply the test power. **(Note: the flow of electrolyte solution continues to drip on the sample and if any extended time is noted between breaker trip and observation, it may be necessary to pad dry the sample prior to reset of test power).** The test time will continue upon power reapplication. Continue the test for a total of eight hours (28,800 seconds) or until either phase A1 or B1 circuit breaker has tripped twice. **CAUTION: DO NOT RESET A CIRCUIT BREAKER THAT TRIPS TWICE. If any breaker trips (A 1 or B 1 for a 2nd time or A2, B2 or C 1 for the 1 st time), a test end point is reached.**
- b. If a loss of continuity in any phase wire occurs (as may be indicated by an open circuit indicator), without tripping phase A 1 or B 1 circuit breaker, continue the test for a total of 8 hours or until a test endpoint is reached, which ever comes first.

When a test end point is reached, turn generator “OFF”, switch pickup tube to fresh water source to purge salt water from tubing and needle (approx. 10 minutes), switch exhaust fan “OFF”, switch Control Power “OFF”, remove protective cover from sample test area, remove bundle from fixture, label the bundle and record test results (i.e. duration, breaker A1 tripped at 18,600 secs, lost continuity on B2, no event in 8 hours). Use deionized or distilled water and a clean flux brush to gently remove excess salt deposits from the wire bundle and with a paper towel pat dry the wire bundle. **(Note: Due to the nature of this test, it must be anticipated that only one test will be performed in the 8 hour potential duration. Thus it is advisable to prepare the next test sample for the next test day. Then all that is required is to switch water source, turn on control power, verify continuity, reset timers, set resistance, start generator and exhaust fan, press Test Power “ON”, check amperage and verify drip rate.)** Checks will be required every half hour to verify drip rate and assure reset of breakers, if necessary, to avoid extending the work day to achieve the 8 hour test as potentially required. Measure length of burn and perform wet dielectric test on all undamaged wires (excludes A1 and B1 and any other wires that have exposed conductors). Perform the 1000 volt Wet dielectric procedure in accordance with MIL-STD-2223, Method 3005. See individual slash **sheets for qualification criteria.**

### Clean-up:

Use a paper towel and a cleaner safe for plexiglass on protective cover and warm water and sponge clean the entire wire holding fixture and the base of the wet arc fixture. Place needle connected to tubing into clean water source, to avoid drying and salt formation in needle until next day use.