

## **Spark Testing of Rubber Lined Vessels**

Before and after the rubber lining is cured, it must be tested with a spark tester. The purpose of the test is to determine the presence of pinhole leaks, punctures, cuts, etc., that expose passages to the base metal. Refer to Practice ASTM D5162 or NACE Standard Practice SP0188 for general practices. Please note that a spark test is not complete without a full and thorough visual inspection of the entire lining completed at the same time as the spark test itself. Spark testing is not an absolute test, meaning that it is not 100% fail safe. Technique, visual inspection, equipment maintenance and rubber lining application experience are all essential in reducing errors, misinterpreting results and completing the spark test with meaningful results.

### **1. Test Equipment**

- 1.1 High frequency AC spark testers are capable of producing sufficient voltages (a voltage range of 15,000 – 45,000) to insure the proper calibration for rubber lining inspection. There are several brand name pieces of equipment available on the markets which are all suitable. DC spark testers are also suitable for use however maximum voltage is restricted to 30,000 by the manufacturer. These units are also bulky and can be difficult to maneuver. These units should only be considered where AC units are not practical for use.
- 1.2 Probes with T shaped, L shaped or brush electrodes should be suitable for the size, geometry and type of lining being inspected. The T shaped spring loaded probe provides the most complete and accurate results and should be used where possible.
- 1.3 Steel calibration coupon 12” x 12” with a known leak. The coupon shall be lined with the same material and thickness of that material to be tested. The coupon shall be cured using the same method as the material to be tested.

### **2. Leak Verification**

- 2.1 The material on the coupon shall have a leak to the metal substrate made by puncturing the material with a 22 gauge hypodermic needle or comparable piercing equipment or tool. Multiple punctures should be considered at differing angles.

- 2.2 Using the same probe that will be used for testing, pass over the surface of the test coupon in a constant uninterrupted manner until the fabricated leak paths are detected. Tester should be verified if equipment (probe) is changed and before and after testing.
- 2.3 Keeping the electrode in light contact with the lining surface, move the probe over the test area in one slow stroke at a rate of approximately 12 inches/second. Overlap passes to ensure 100% coverage. The stroke rate (inches per second) should be recorded.

### 3. Verification of Output Voltage by Using a Mechanical Type of Peak Reading Voltmeter

- 3.1 Adjust voltmeter to the voltage required for the type of lining being tested.
- 3.2 Polycorp recommends the use of 45,000 volts for Polycorp soft natural rubber linings (such as those used in HCl equipment) and a minimum of 15,000 volts for all other materials. In general 30,000 volts is considered safe for linings however, consideration to Neoprene and graphite filled linings should be made and reduced. 15,000 to 30,000 volt tests should be completed to ensure linings are not damaged. It is the responsibility of the person performing the spark test to complete sample test coupons on linings prior to the actual test to ensure damage does not occur.
- 3.3 Using the same power source, cable length and probe make a proper spark tester to meter connection. Refer to manufacturers specifications where necessary.
- 3.4 Output voltage is verified when a continuous spark is obtained across the gap on the voltmeter and should be recorded.

### 4. Test Procedure

- 4.1 No moisture should be present at the time of testing and all surfaces must be free of grit, dirt or foreign matter. Moisture can skew the results and “false positive” readings can occur.
- 4.2 Low lighting will assist in identifying a leak but exercise caution to ensure 100% coverage of the test area. A blue corona, continuous in nature, around the probe is normal and does not indicate a leak.
- 4.3 Using the same stroke rate and technique for leak verification (section 2) move the electrode over the entire test area. If evidence (a bright blue spark in conjunction with a change in pitch of the spark noise and/or indicated by an audio signal on some testers) suggests a lining defect. Move the electrode over the area in alternate

directions to verify and locate the defect. To prevent a dialectical breakdown of the lining, in particular for soft natural rubber, do not hold the electrode in one position for any longer than a few seconds. Multiple passes over a suspect area will not cause any lining damage.

- 4.4 Because a spark tester will only detect and/or verify a leak in the lining material, an enhanced visual inspection (with the aid of proper lighting) of the leak should be performed to detect other conditions (enlarged opening, cracking, discoloration etc.)

## 5. Information about Spark Testing

- 5.1 Spark testers may lose spark intensity after 15 to 30 minutes of use in which case they should be turned off and allowed to cool. Before proceeding with the test the unit must be verified on a test coupon per section 2.
- 5.2 AC voltage definition should be established. Spark test manufacturers refer to peak voltage and AC voltmeters use RMS, which means effective volts.

$$\text{RMS Volts} = 0.707 \text{ Peak Volts}$$

- 5.3 A continuous dark blue or purple spark indicates a leak free lining. If a leak is present, a white or light blue spark will form and the sound of the arc/spark will change slightly. Specks of dust, depressions and other foreign matter will change the color of a spark. Dampness will result in brightened sparks.
- 5.4 When establishing spark length based on lining thickness it is critical that the spark length is twice the thickness of the lining. i.e. a ¼" thick lining requires a ½" length spark to reach through the lining. Reduced thickness linings (such as 3/16" or 1/8") can be tested with shorter spark lengths but must continue to be at least twice the lining thickness. Longer spark lengths are OK.

## 6. Caution:

**The spark test will not find any leak where the path to the steel is longer than the spark length. A visual inspection of overlaps and the lining panels is critical to assure a leak free lining.**

## 7. Contact Polycorp for more information about spark testers, test methods and obtained results.