

INSPECTION & SPARK TESTING PROCEDURES

1. PRE-CURE INSPECTION

- A. A complete check against all rubber lining details on customer prints and specifications should be made to assure the rubber lining has been applied to the proper areas and with the correct gauge stock.
- B. General appearance should be observed and noted.
- C. All laps should be closely inspected for looseness and uniformity.
- D. Detection of trapped air can be accomplished by holding a light near the surface while looking down the stock face for shadowed areas. If these are found they need to be rolled down while bleeding the air with a hypodermic needle or cut out to remove all trapped air and patched, refer to Section 16 "Repair Procedures".
- E. Spark testing should be performed by qualified persons with a high frequency spark tester set at the recommended voltage, depending on the lining being tested. See the section on "Spark Testing Rubber Lining" below.
- F. If a leak is detected, this area should be marked and patched prior to curing. When a rubber lining is patched prior to being cured it is considered an overlay. Overlays can be considered identical to a lap seam in integrity. See ARPM IP-4-13.

2. POST-CURE INSPECTION

- A. Repeat Steps A through E of pre-cure inspection.
- B. Check the durometer of the rubber lining to ensure the rubber is cured in accordance with the rubber lining specification. For accurate durometer readings the following conditions apply:
 - 1. A minimum of 24 hours after cure and lining has cooled to ambient temperature (70°F (21°C)). Higher temperatures will give lower durometer readings and lower temperatures will give higher readings than specified. The 24 hour period is necessary to ensure cooling and allow the rubber to rest.
 - 2. Durometer readings must be taken on a flat surface.
 - 3. The durometer instrument must be within the right scale: A for soft and semi- hard, and D for hard rubber.
 - 4. The instrument must be calibrated.
 - 5. The operator must use a calibration block to get the right feel for the right amount of pressure to be applied to indicate the proper durometer.
 - 6. We recommend taking an average of 5 readings per rubber panel this will result in less error. These readings must be done in a variety of locations on the rubber lined part or vessel particularly at the top and bottom.
 - 7. Keep a record that includes the durometer and location of each reading.
 - 8. The reading of 1/8" thick rubber will be different than on the same rubber that is 1/4" gauge. Durometer specifications are based on the lab results which are taken on 1/4" thick rubber in accordance with ASTM D 2240.

Durometer readings do not produce consistent reliable results except under very controlled conditions. However, experience and good judgment in taking durometer readings, even under a variety of conditions, can produce reliable decisions as to the proper state of cure.

- C. All blows (trapped air), blisters, lifted seams, leaks and other defects that are detrimental to the integrity of the rubber lining must be repaired. See Section 16 “Repair Procedures”.

3. SPARK TESTING RUBBER LINING

Spark testing can cause more damage and leaks than it may discover if done improperly. One of the biggest mistakes is done when specifying the voltage. The proper way to spark test is to calibrate the voltage to a known leak. This procedure is detailed below. The purpose of spark testing is to determine if there are leaks in the rubber lining, and if so, their locations. The purpose is not to test the conductivity of the rubber lining. In testing, one must be careful not to cause pinhole damage to the rubber. There are many variables to be considered and controlled during voltage testing. Listed below are the conditions one must be aware of:

1. Spark equipment conditions and wand configuration.
2. Tester calibration and stabilization.
3. Rubber lining complexity
 - a. Flat surface
 - b. Contoured ID and OD
 - c. Corner angles, etc.
 - d. Wrapped and stretched radii
4. Lining gauges
 - a. 1/8” through 1/2”
5. Environmental conditions
 - a. Curing water impurities
 - b. Condensation or humidity
6. Spark testing frequency
7. Rubber surface contamination

In spark testing, it is recommended that the equipment be calibrated for testing. The spark tester is to be calibrated using a test calibration block, the same power source, probe, and cable length to assure the setting on the probe is unchanged. To calibrate the spark tester, use a steel calibration block with a known leak, equivalent to a puncture caused by a 22 gauge hypodermic needle, lined with the same materials as those to be tested (Crist Jr.). Move the spark tester with the wand lying flat across the rubber section, about 1/2” over the lining. A pinhole leak will be seen as a sharp white or blue arc jumping from the spark tester wand through the lining to the metal. It is essential that the tester be adjusted to allow for ample spark discharge for that lining thickness. The voltage of the spark tester should be adjusted to the lowest setting that will produce a minimum 1/2 inch spark measured from the top of the lining to the probe. A general white or blue luminous corona of current may be observed; this is not an indication of a leak. This control test plate can be used throughout the entire procedure to insure the tester retains its calibration.



SECTION 15: INSPECTION



Note: Rubber linings will not be damaged by spark testers when calibrated and properly maintained. Tests by researchers at Northwestern University as well as The Chlorine Institute found that normal usage of spark testers on 1/8 inch and thicker rubber sheets does not cause dielectric breakdown (Bailey,2008).

The probe shape is very important. The wand should be “L” shaped, measuring 12” on both sides of the “L.” This will allow coverage of 12” per pass with the wand. The wire diameter should be approximately 3/32”, with a 1/2” radius at the bend. Also, the tip should be turned up to eliminate the end discharge. On the intricate parts of the configuration, a fan probe is recommended, similar to a snare drum brush. Care should be exercised not to stop and concentrate on any one area. The wand should be passed over the rubber in a continuous sweeping stroke, approximately 10 inches per second.

Always remember to keep the spark testing equipment moving constantly, as it could burn through the lining and leave leaks if left in one place.

REFERENCES

1. Crist Jr., Buckley. High Voltage used to Leak-test tank linings. Modern Bulk Transporter. Retrieved April 23, 2012, from www.electrotechnicproduct.com/get_technical/pinholeleakdetection.pdf
2. Bailey, Richard. (2008). Bailey’s Rubber Lining Application Handbook.