INSPECTION & SPARK TESTING PROCEDURES

1. Pre-Cure Inspection

The following guide should be used by a qualified inspector.

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 RMA, Bulletin 6, paragraph 6.4.1.5 in this Section.

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 (70ºF, 21ºC). 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.

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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 ¼" gauge. Durometer specifications are based on the lab results which are taken on ¼" 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. If the voltage is too high it can cause leaks if too low it will not find leaks. 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. To illustrate the complexity of this process, listed below are the conditions one must be aware of:

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

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In spark testing, it is recommended that the equipment be calibrated for testing. To calibrate use a control metal-lined test plate made with a lining thickness equal to that of the liner being tested. For example, 1/8" would have two layers; 3/16" would have two layers or 1/4" would have two layers. The lining material on the coupon shall have a leak to the metal substrate, made with a 22 gauge hypodermic needle or comparable piercing tool. Then, move the spark tester with the wand laying flat across the rubber section, 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. 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.

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.

The spark voltage settings are quite imperative to be proportioned to the thickness of the lining to be tested. The following range of voltage is recommended as a starting point for calibration:

1/8" (3.2 mm)	6,250-8,500 volts minimum
3/16" (4.85 mm)	10,000-12,500 volts minimum
1/4" (6.4 mm)	12,500-15,000 volts minimum

Materials such as neoprene and graphite loaded linings require even lower voltage ranges; 7,500 volts for 1/8" and 3/16", and 10,000 volts maximum, for a 1/4" thickness. Spark testing should be done only when it is considered necessary. Frequent spark testing leads to extensive repair work. Used linings generally have less electrical resistance, especially after several years of service. Where the salts have saturated the surface, or the solution has penetrated the lining, spark testing becomes more sensitive. Cracked linings also have a loss of gauge in the cracked area. Spark testing here must be done with extreme caution, with the lowest voltage necessary to produce a spark.

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.

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