

# QUALITY ASSURANCE MANUAL FOR APPLICATORS OF ELASTOMERIC SHEET LININGS

## 1.0 PURPOSE

To establish a recommended quality assurance program for applicators of elastomeric sheet linings.

## 2.0 SCOPE

This bulletin describes the systems, methods and techniques for assuring the quality required by contractual obligations.

## 3.0 APPLICABLE DOCUMENTS

ARPM Protective Linings Technical Bulletins.

## 4.0 RECEIVING INSPECTION - MATERIALS

### 4.1 EQUIPMENT TO BE LINED

1. Part identification - serial numbers
2. Document receiving/inspection

All items to be lined are inspected according to the applicable plant inspection procedures and visually inspected for:

Shipping damage

Compliance with ARPM Protective Linings Bulletins:

1. Specifications for Welded Steel Tanks, Stacks, Ducts or other Welded Parts for Protective Lining and/or Coating.
2. Specification for Pipe and Fittings for Protective Lining and/or Covering.

### 4.2 ELASTOMERIC RAW MATERIALS

All elastomeric raw materials are inspected according to the applicable plant inspection procedures and left in the original unopened containers. If damage to the container is found, the package is to be opened to determine the degree of damage. These materials are visually inspected and documented using the following checklist.

- Shipping damage
- Proper identification
- Approved source/supplier
- Proper packaging
- Proper size - i.e. thickness, width, length
- Complete or partial quantity received
- Material is within shelf life recommended by manufacturer, if applicable.

### 4.3 DOCUMENTATION

Any discrepancies found are to be noted on the receiving report at the time of receiving inspection and reported to the applicable quality control supervisor for disposition. The material will be tagged "on hold" until approved for use or returned to manufacturer. When applicable or required, the receiving date will be marked on original containers to facilitate age and inventory control.

### 4.4 STORAGE

All elastomeric raw materials shall be stored under cover, away from heat and light sources, in a cool, dry storage area in conjunction with the materials manufacturers recommended practices. During extremely hot weather, refrigerated storage may be required and is recommended. During periods of storage the conditions must be recorded.

### 5.0 INSPECTION PRIOR TO BLASTING

#### 5.1 SURFACE CONTAMINATION

The grit in the blast unit shall be inspected for contamination on a periodic basis and a record of these inspections is maintained. The inspection is accomplished by depositing a representative sample of grit in a beaker of clean water. If an oil slick is formed on the surface of the water, or other contamination is found, the grit should be replaced or properly cleaned.

### 5.2 COMPRESS AIR QUALITY

Compressed air that is used for blasting and grit removal shall be kept free of oil and water contamination. Cleanliness of the air shall be determined by discharging air against a clean white blotter. Contamination will be seen as a darkened circle. This test shall be conducted at the start of every shift and results must be recorded.

### 5.3 TEMPERATURE AND HUMIDITY

Extreme care must be taken to prevent sweating of the metal surface. The relative humidity should at no time be high enough to produce a dew point during blasting, cementing, and lining and cause moisture to deposit on the cemented surface. To prevent condensation it is important that the substrate be a minimum of 5°F (3°C) above the dew point or wet bulb temperature. Record temperature and humidity every four hours or as conditions change.

### 6.0 INSPECTION AFTER BLASTING

#### 6.1 BLASTING

All metal surfaces to be lined should be a clean grey-white metal blasted surface finish in accordance with ARPM IP-4 Protective Lining Bulletin. Note: In contrast with grit or sand, the slag blasting agents produce a somewhat darker blasted surface appearance.

#### 6.2 REMOVAL OF BLASTING MATERIAL

All blasting materials should be cleaned from the surface of the metal by brushing, vacuuming, or blowing with filtered compressor air before applying the metal primer.

#### 7.0 PRIMING AND CEMENTING

After blast clean-up, primer shall then be applied before any "flash rusting" can occur. If flash rusting does occur, the surface shall be reblasted as previously specified. Articles removed from blast area shall be protected in a manner as not to contaminate the blasted surface. In the event of the article being completely lined, the supporting surface shall be protected from contamination. Record the elapsed time between blasting and the application of primer.

7.1 Technique of cement applications shall be in accordance with manufacturer's instructions, as to ensure a complete and uniform wetting of the surface. A separate set of brushes and rollers shall be maintained for each type of primer or tack cement.

7.2 Drying time of cement should be in accordance with manufacturer's instructions. Cemented parts should be kept free from all contamination during the drying and layover period. Cemented surfaces should not be exposed to sunlight and/or weather. Temperatures should be 60°F (15°C) to 90°F (32°C) for best results.

### 8.0 APPLICATION OF ELASTOMERIC SHEET LINING

8.1 After cementing, the metal shall be inspected to determine the best method of lining. Because equipment to be lined vary as to size, shape and the location of projections, irregularities and flanges, there is no set method of lining.

8.2 Prior to application, the uncured elastomeric lining should be examined to verify that it is clean and free of any functional defects as outlined in ARPM IP-4-6 - Standard for Surface Appearance of Elastomeric Sheet Lining Materials.

8.3 The joint selected is usually determined by the elastomeric material used. There are primarily two types, although there are variations of each, the 2" lap joint and the butt joint with cap strip.

8.4 Cut sheet to desired size and shape. The type of material used may dictate the skive used. Warm on hot table. Homogeneous or single part construction may utilize either open or closed skives. Multiple layers of dissimilar stocks require a closed skive. When cutting material, allowances should be made for a minimum 2" lap unless restricted by dimensional tolerance, specifications or lining manufacturers' recommended joint construction.

**8.5** The lining must be rolled tightly against the substrate to remove any trapped air to assure complete contact between the elastomeric and metal. Joints should be examined to determine that the seams are straight and all edges are stitched down tightly. Rubber fillets should be used in corners to prevent stretching.

**8.6** Before pre-cure spark testing, the lining should be visually examined to assure that the lining is clean, free of trapped air, and all seams are straight and tightly stitched.

**8.7** Air blisters that are found shall be punctured, vented and stitched down. Overlay the area with the same material of the same gauge.

References:

1. ARPM IP-4-4 - General Procedures for Applications of Elastomeric Sheet Lining.
2. ARPM IP-4-6 - Standard for Surface Appearance of Elastomeric Sheet Lining.
3. ARPM IP-4-5 - Elastomeric Sheet Lining Inspection Before and After Vulcanization.
4. ARPM IP-4-11 - General Procedure for Applying Elastomeric Sheet Lining in Pipe.

### **9.0 PRECURE INSPECTION**

**9.1** Check customer drawings, if available, to assure lining has been applied to the proper areas and with correct thickness, and type.

**9.2** Check any dimensional tolerances and drawings, if available, against finished lining dimensions.

**9.3** Determine that all components associated with the job are together and complete.

**9.4** Closely observe the general appearance of lining surfaces for imperfections.

- A. Check splices for looseness and uniformity.
- B. Check for trapped air or blisters, pinholes, and other imperfections requiring rework.
- C. Mark unacceptable areas with chalk.

### **9.5 SPARK TESTING - BEFORE CURE**

- A. Calibrate spark tester per ARPM IP-4-13.
- B. Spark test to voltage indicated by the lining manufacturer.
- C. Mark any pinhole leaks found in spark testing with chalk for rework before cure.

References:

1. ARPM IP-4-5 - Elastomeric Sheet Lining Inspection Before and After Vulcanization.
2. ARPM IP-4-19 - Repairs to Elastomeric Sheet Linings.

### **10.0 CURING**

#### **10.1 STEAM CURING**

**WARNING:** Make certain that an appropriate vacuum break device is installed to prevent a vacuum collapse of the vessel when any steam method of cure is used.

- A. If pressure or atmospherically steam cured, check chart recorder or thermometers against the recommended time and temperature and compare to the manufacturer's specification. Monitor outside skin temperature every 10-12 feet of width or height and every 30° of circumference on an hourly basis.
- B. Check vessel to determine if any condensate can collect without draining, make provision to drain same.
- C. While on cure, monitor the external temperatures at the top, middle and bottom of vessel and record findings hourly. compare to the recommended time and temperature (minimum 150°F(66°C)). Also field vessels must be insulated from the elements to ensure a thorough cure.
- D. When pressure cured and cooled under air pressure and water spray, record the temperature, time and pressure during the cooling procedure.
- E. When test plate samples are to be cured with the vessel, make sure they are placed at several levels in the vessel. Record their position.

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### 10.2 CHEMICAL CURING

- A. Record type and number of coats of curing agent used.
- B. Before releasing vessel for use, check durometer daily until proper hardness is attained.

### 10.3 HOT WATER CURING

- A. This special cure should be done only under the direction of Blair Rubber Company's Technical Department.

### 11.0 POST CURE INSPECTION

- 11.1 Closely observe the general appearance of all rubber surfaces for imperfections.
  - A. Check splices for looseness and uniformity.
  - B. Check for trapped air or blisters, pinholes and other imperfections requiring rework.
  - C. Mark with chalk any areas that require corrections.
  - D. Record on drawings any post cure repairs.
- 11.2 Check durometer of cured lining at various locations, high and low, 24 hours after cool down. One reading per 100 square feet should be taken and recorded. Compare to the recommended durometer in manufacturers specifications. See ARPM IP-4-18 (in preparation).
- 11.3 **SPARK TESTING - AFTER CURE**
  - A. Calibrate spark tester per ARPM IP-4-13.
  - B. Spark test to voltage indicated by the rubber manufacturer.
  - C. Mark any pinhole leaks found in spark testing with chalk for rework after cure.
- 11.4 Do not perform destructive adhesion tests on vessel lining. If test sample plates have to be made, the adhesion test will be based on ASTM D413. Results are to be recorded.
- 11.5 Post cure repairs are to be noted on vessel drawings, if available. These repairs are to be inspected and spark tested the same as the original lining.

### 12.0 REPAIRS TO ELASTOMERIC LININGS - AFTER CURE

- 12.1 Regardless of the precautions taken prior to cure, repairs may be necessary.
- 12.2 Remove all loose or defective elastomeric lining.
- 12.3 There are many variables in selecting the material to repair, such as time available to return equipment to use; the availability of a heat source. The manufacturer should be consulted when selecting the method and type of material with which to repair the lining.
- 12.4 There are four methods of cure for repairs:
  - A. Autoclave Cure - After repair, the entire piece of equipment shall be re-cured in an autoclave.
  - B. Internal Pressure Cure - The vessel itself shall be pressurized.
  - C. Exhaust Steam Cure - The area itself is isolated, or the entire vessel is exposed to atmospheric steam.
  - D. Chemical Cure - The existing lining shall be repaired with a stock which does not require an additional heat source. The repair material requires the application of a chemical curing agent to activate it.Reference:
  1. ARPM IP-4-16 - Chemical Cure-Elastomeric Sheet Linings.
- 13.0 **FINISHING**
  - 13.1 All gasket surfaces are to be ground reasonably flat.
  - 13.2 Bolt holes reamed to size of holes in metal.
  - 13.3 All edges should be ground flush with contour of metal.

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### 14.0 POST FINISHING - PRE-SHIPMENT INSPECTION

Prior to release for shipment, elastomeric lined equipment shall be inspected for, but not limited to the following. (The purchase order or customer specifications shall govern this section):

1. All documentation completed.
2. All openings properly protected.
3. All required labeling properly applied.
4. Customer inspection, if required, has been completed.
5. Tank exterior to be stenciled in a conspicuous location in letters at least 2" high "Rubber Lined - Do Not Weld, Cut or Burn."
6. Complete "Quality Assurance Certificate" (Paragraph 15.0 Exhibit A).

**15.0 EXHIBIT A**

**QUALITY ASSURANCE CERTIFICATE**

It is hereby certified that the rubber lining applied to \_\_\_\_\_  
has been inspected and is in strict accordance with the specification cited below.

Tank hydro tested at \_\_\_\_\_ psi prior to lining.

Minimum thickness of lining \_\_\_\_\_

Lining specification number \_\_\_\_\_

Manufacturer of lining \_\_\_\_\_

Date lining installed \_\_\_\_\_

Spark Test \_\_\_\_\_

Durometer \_\_\_\_\_

Roll # \_\_\_\_\_

Batch # \_\_\_\_\_

Lot # \_\_\_\_\_

Method of Cure \_\_\_\_\_

Lining Applicator: (Company) \_\_\_\_\_

(By) \_\_\_\_\_

(Title) \_\_\_\_\_

(Date) \_\_\_\_\_

(Place) \_\_\_\_\_