



Application Procedures for RubberSource Precured Rubber Linings on Vessels

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1.0 GENERAL

- 1.1 This specification covers the procedures necessary to assure that all materials, equipment and operations are in conformance with RubberSource and industry standards.
- 1.2 Hold points may include (but are not limited to):
 - a. Pre-surface preparation
 - b. Ambient conditions/compressed air cleanness
 - c. Immediately following surface preparation
 - d. Adhesion test panels
 - e. Prior to each cement layer application
 - f. Following each material layer
 - g. Spark testing
 - h. Repairs
- 1.3 SSPC refers to specifications and published information of the “Steel Structures Painting Council”, 4400 Fifth Avenue, Pittsburgh, PA 15113, USA.
- 1.4 NACE refers to publications of the “National Association of Corrosion Engineers”, P.O. Box 218340, Houston, TX 77218, USA.
- 1.5 ASTM refers to standards of the “American Society for Testing of Materials”, 1916 Race Street, Philadelphia, PA 19103, USA.
- 1.6 RMA refers to technical bulletins of the “Rubber Manufacturers Association”, 1400 K Street N.W., Washington, D.C. 20005 USA.

SURFACE PREPARATION

- 2.1** Surfaces shall be inspected prior to the start of surface preparation to assure that they are dry and that visible deposits of oil and grease have been removed by “Solvent Cleaning” (SSPC-SP1). In addition, the inspector shall identify surface imperfections (such as weld spatter, porosity, pits, laminations, slivers or crevices) for repair as appropriate. (Ref. RMA Bulletins 1, 2, 3.)
- 2.2** Ambient conditions shall be checked before and during operations which will expose bare steel (e.g. abrasive blasting, power tools) to determine the air and surface temperatures, relative humidity and dew point temperature. These operations shall not be permitted when the surface temperature is less than 5 degrees F. above the dew point, the relative humidity is over 80% and the temperature is not in the range of 50°F (10°C) to 90°F (32°C).

ABRASIVE BLAST CLEANING

- 2.2.1** The compressed air supply for abrasive blasting shall be inspected before and during operations for the presence of oil and/or water by means of the white blotter test. The test shall be performed downstream of separators. The blotter shall be free of visible contaminants of oil or water after being held in the air stream at a distance of 18” (457mm) to 24” (610mm) inches from the source for at least two minutes. (Ref. SSPC Painting Manual Vol.1 Good Painting Practice, Chapter Six, Section VI.A. “Air Compressor and Air Cleanness”.) Air pressure at the nozzle shall be determined using a hypodermic needle pressure gauge according to the procedure outlined in SSPC-Vol. I Good Painting Practice.
- 2.2.2** Chapter VI.E “Blast Cleaning Nozzles and Nozzle Pressure.” A hypodermic needle gauge indicates the pressure at the nozzle, the end of the system.
- 2.2.3** Abrasive shall be inspected to assure that it is clean, dry and the type size capable of producing the desired surface profile. Reference data for determination of the adequacy of abrasive type and size can be found in NACE Publication 6G164 and SSPC-SP COM “Surface Preparation Commentary” Sections 5 and 6 which state the type, grade, and surface condition of the steel to be cleaned, type of blast cleaning system employed the finished surface to be produced. (See coloured chart at the end of this specification).
- 2.2.4** On stainless steel components, special care must be taken to assure that a profile of 2.0 mils (0.05mm) minimum is achieved.

2.2.5 Strict adherence to air temperature, 50°F (10°C) to 90°F (32°C), relative humidity and shell temperature 5°F (2.8°C) above the dew point will be required. At the beginning and middle of every shift, the inspector will record in the area of the tank they will be working, the steel temperature, the air temperature, and calculate the dew point and relative humidity.

RELATIVE HUMIDITY

MINIMUM TIME SPAN

Over 90%	No Application
86 – 90%	1 Hour
80 – 90%	4 Hours
50 – 79%	8 Hours
50% or Below	24 Hours

2.2.6 The entire surface of the tank to be lined is to be white metal blasted clean (SSPC-SP-5) to a profile of 2.0 mils (0.051 mm) minimum. This will be tested and recorded by the contractor using a Testex Press 0 film blast profile gauge (Testex, Inc.) or other suitable method. Applicator shall supply testing materials as specified and make them available for additional inspection.

2.2.7 All areas blasted are to be primed with one coat C-193 primer as soon as possible after blasting. Allow to dry one-hour minimum and preferably 24 hours.

2.2.8 All sandblasted areas are to be vacuumed and wiped to “white glove” clean to remove all contaminating materials prior to applying primers.

2.2.9 A test panel must be made prior to the start of production blasting to establish the proper grade of blast media to be used to achieve the required blast profile. The test and panel must be reviewed and approved. Test panel shall be supplied by the lining applicator.

2.2.10 Upon commencement of sandblasting and continuing for the remainder of the project; no gasoline, kerosene or diesel operated engines will be permitted in or near the tank without venting such equipment to the exterior atmosphere.

3.0 CEMENTING INSTRUCTIONS

3.1 Strict adherence to environmental conditions as in is required for all stages of adhesive application.

3.2 Vacuum primer if dust has accumulated on its’ surface.

3.3.1 Just prior to the application of the rubber, RS-2000 cold bond cement system is comprised of cement and hardener in the ratio of 1 Kg of cement to 50 ml of hardener. These two components must be thoroughly mixed (stirred). The mixed portion should be used within 2 hours apply a second coat of. Allow to dry until tacky – about one hour.

- 3.3.2 Rubber that does not have the CN bonding layer, requires cleaning with solvent and when dry, buffing to a RMA #4 textured finish.
- 3.3.3 The applicator should use a scrubbing-like motion when applying the RS-2000 cement. A scrubbing motion is preferred so that all voids on the buffed surface to be bonded are filled in. After allowing the prime coat to cure or dry for at least 1 hour (overnight is ideal) proceed with bonding procedures.
- 3.3.4 To the properly prepared or primed surfaces apply a tack coat of RS-2000 cement to each surface at the same time so they dry at the same rate. As rapidly as possible, apply a uniform coat with a brush. Avoid heavy builds, puddles, uneven coating. Surfaces must dry uniformly. When surfaces dry to a tack, about 3-6 minutes, they are ready to bond (This tack or bonding time will be about 10-15 minutes, if the surfaces become too dry, apply another tack coat to each). Test the cement with the back of a dry finger, it should feel tacky and not leave any cement on the finger. SURFACES MUST BE TACKY WHEN BONDED. Join surfaces together when the cement is still tacky but not wet to the touch and roll with a 2" wide roller with appropriate pressure to bond surfaces together. Use overlapping roller strokes making sure both surfaces fully contact each other and all air is expelled

4.0 APPLICATION OF RUBBER LINING

- 4.1 Strict adherence to environmental conditions for all stages of lining application.
- 4.2 All layout marks on rubber must be made using chalk or chalk lines. Use of a metal scribe or other device that cuts or scratches the rubber is not permitted.
- 4.3 Rubber is to be cut using a skiving machine with blade set for a 30 degree skive cut or hand skiving knives. Reservoir of water must be kept full during cutting. Rough, wavy, irregular surface of skive cuts will be rejected. All mill edges and mills ends shall be cut off by liner.
- 4.4 Prior to application, rubber is to be protected from dust, grease and oil while lying on the cutting tables by covering with polyethylene sheets. All cutting tables must be smooth and flat and not leave joint impressions on the rubber.
- 4.5 All panel seams are to be 30 degrees closed reversed skives with a two (2) inch minimum (50mm) overlap. All lining personnel must be familiar with skive joint requirements.
- 4.6 Panels of rubber lining shall overlap each other a minimum of two (2) inches (50mm). Use an open-skive on the underneath edge as a closed-skive on the overlapping edge.
- 4.7 The sheet lining shall be rolled and stitched as required to exclude all air between the lining and substrate. Trapped air may be vented with a needle, but the vent opening must be covered with a suitable overlay.
- 4.8 The sheet lining shall extend over the entire outside of flanges.

- 4.9 The ambient temperature during lining application shall be maintained between 50°F (10°C) and 120°F (51°C) and the relative humidity shall not exceed 80%. The temperature of the surface being cemented shall be at least 5°F (2.8°C) above the dew point or wet bulb temperature.
- 4.10 All deficiencies and defects found must be removed and relined prior to cure.
- 4.11 During the installation of the floor lining, all contractors' personnel must wear nail-less soft rubber sole shoes, rubber shoe covers, or work in stocking feet.
- 4.12 All joints and seams will be staggered. No four-corner joints will be permitted. The rubber lining panels on the floor, wall, etc. shall be applied in a manner that will assure complete and uniform adhesion with the steel. There shall be no air trapped behind the lining. There shall be no stretching of the rubber during application. All rubber is to be supported so as not to be stretched during application. The lining shall be free of blisters, porosity, wrinkles, pitting, tears or other deficiencies or defects. After installation, the lining is to be spark tested at 15,000 volts (15kv) and visually inspected for defects and loose edges.

5.0 INSPECTION

- 5.1 After lining, all surfaces are to be thoroughly inspected to the same criteria as the pre-inspection. Blisters (trapped air), loose laps, etc., are to be marked in chalk and numbered for future repairs.
- 5.2 All surfaces are to be spark tested (RMA Bulletin 13).
 - 5.2.1 This spark test and all others shall be the same using Electro-Technic model BD-10AV or BD-50EV model testers operated at 15,000 volts (15kv).
 - 5.2.2 All personnel spark testing shall carry a second spark tester because spark testers are subject to failure from overheating.
 - 5.2.3 All testers are to be operated 15 minutes, and then turned off for 15 minutes. Testers must be allowed to cool down to avoid burnout.
 - 5.2.4 All scaffolding or other equipment will have pneumatic tires and will be rolled on ¾" (18mm) plywood, with rounded corners, at all times.
 - 5.2.5 Monitor adhesion testing (per ASTM D429) on blind flange assembly that contractor has previously lined, and installed. The rubber shall be adhered to the steel so that tests will show strength of adhesion not less than 25 pounds (11.3 kilos) as determined by the standard test in accordance with ASTM D429.
 - 5.2.7 All pinholes indicated by breakthroughs when spark testing shall be repaired. The repair materials, application methods, and lining procedures shall be based upon the type, size and frequency of the defect. Patching with materials other than those recommended by RubberSource is not permitted.

6.0 REPAIRS TO LINING

6.1 Bubbles or Blisters:

All lining material containing bubbles or blisters (air trapped between rubber & steel substrate) shall be removed to an area of good adhesion. Bevel edges of remaining rubber to approximately 45 degree angle to the metal and buff existing rubber back at least 4" (100mm) from the edge of area to be repaired. Repairs are to be made with the same rubber as the parent lining material.

6.2 All exposed steel surfaces shall be prepared by blasting or grinding to a clean bright metal finish.

6.3 Upon completion of surface preparation, adhesives shall be prepared and applied as follows:

One coat C-193 on metal only

Two coats RS-2000 on metal & surrounding 4" (100mm) of parent lining

6.4.1 Upon completion of adhesives systems application, rubber will be applied as follows:

6.4.2 If air is inadvertently trapped during these procedures, puncture blisters with a hypodermic needle and stitch down the stock. The air will bleed out through the needle. Remove needle, dry the area and stitch the needle hole closed. Apply a 2" (50mm) square patch of precured rubber centered over point of needle insertion.

6.4.3 Completed repair shall be re-spark tested at 15,000 volts (15kv) in accordance with established procedures.

6.4.4 Repaired areas will be re-checked in accordance with the spark tests.

6.4.5 Loose seam edges and skives must be corrected.

6.5.1 Loose seam edges and skives shall be repaired by grinding feather edging loose area, if it is possible to maintain a minimum seam overlap of 2" (50mm) upon completion of the repair.

6.5.2 If 2" (50mm) minimum overlap cannot be maintained, an area of 4" (100mm) back from defect on all sides shall be buffed to a rough grainy surface.

6.5.3 Adhesives system shall be applied in accordance with application of adhesives in this procedure.

6.5.4 Upon completing application of adhesive, an overlay will be applied to the cemented area, skives down and stitched in place.

6.5.5 Testing will be in accordance with spark test procedures outlined in this procedure.

*****Note:** The above procedures is based as a guideline, please refer to the NACE Standard Practice / Sheet Rubber Linings for Abrasion and Corrosion Services (SP0298-2007) for in-depth procedures and methods.

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