

## FLUOROG RIP MxMEMBRANE FOR ACID BRICK: INSTALLATION PROCEDURE

Date: July 17, 2007

Revision: 1.1

### GENERAL INFORMATION

#### Use of this Procedure

This procedure was developed and written to address the installation of Integument's *FluoroGrip MxMembrane* as a protective membrane behind acid-brick used to line sulfuric acid tanks, vessels and equipment. The *MxMembrane* system is designed to enhance and improve the corrosion protection of steel substrates of existing materials, construction techniques and designs commonly used for acid-brick installations. It is not designed to replace current technologies, but improve the resulting product in a manner that minimizes pinholes and metal loss in the short term and extend the long-term service life of the overall brick system. This procedure applies regardless of which *MxMembrane* top film is used (i.e. ECTFE, PTFE, FEP or PVDF).

#### Justification

Current technologies for the design, construction and materials used in acid brick lining systems for sulfuric acid equipment have remained relatively unchanged for the past 25 plus years. Historically the systems have consistently provided adequate long-term service life (over 15 years) for the equipment being lined. However, the incorporation of the *MxMembrane* provides critical justifications:

1. Because of the high initial cost for these systems, every additional year the in-service life of the system is extended, the equipment owners saves substantial revenues and eliminates shutdown (and related costs) for replacement.
2. Many of these systems begin to experience metal loss and pinholes that penetrate the vessel shell and cause leakage. This can occur within a 5-year period and primarily around nozzles and penetrations.
3. Premature pinholing can represent an elevated risk to the health and safety of personnel working in the area of the lined equipment.

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4. Premature pinholing can lead to leakage which can affect the surrounding materials and equipment to promote high corrosion rates of concrete and steel.
5. Leakage may pose a risk to the environment.
6. Repairing of leaks require the equipment be shutdown, the vessel entered and repairs effected. This can be an expensive operation and requires special safety concerns for vessel entry.

### **Affectivity**

Vessels, columns, tanks and pipes constructed of steel and lined with traditional mastic, mortar and brick systems to protect the substrate from corrosion due to hot acid attack.

### **Related Documents**

NACE/SSPC Standards:

*RPO-178-2003: Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service*

*SSPC-SP-1: Solvent Cleaning Surfaces to be Coated*

*RPO-694-2000 (ISO-Sa2): NACE No. 3/SSPC-SP6 Commercial Blast Cleaning*

*RPO-287-2002 (ISO-8503): Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape*

Integument Technologies, Inc:

*MxMembrane: Acid Brick Repair Procedures*

*Sample Installation Guide*

*SB-100 Technical Data Sheet*

*SC-200 Technical Data Sheet*

*NS-6000 Technical Data Sheet*

*MxMembrane Technical Data Sheet*

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**Tools Required**

Materials are based upon installing the film on the interior surface area of a vessel with 1,500 sf. It does not include the materials for blasting and priming the steel prior to film installation.

| <u>Description</u>  | <u>Qty</u>                      |
|---|---------------------------------|
| 4-10' straight edge or chalk line or laser level/marker       | 1                               |
| 4' straight edge (cutting edge) and 4 x 8' min. layout table  | 1                               |
| T-square (2'~)  | 1                               |
| T-Square – Drywall  | 1                               |
| Sharpie Markers   | 2                               |
| Clean Rags and buckets  | as needed                       |
| 12-18" squeegee   | 2                               |
| LS-145 Surface Degreaser (bottle)                             | 3 (or as needed)                |
| LS-155 Prep-N-Treat (bottle)                                  | 3 (or as needed)                |
| Razor Cutting Knives w/ replacement blades                    | 4                               |
| 30-50' tape measure   | 2                               |
| Duct Tape roll  | 6                               |
| Temporary Floor Covering (paper/plastic/cloth)                | as needed to cover primed floor |
| Small Plastic Body Squeegees (3" x 4")                        | 6                               |
| MxMembrane to cover surface & Appurtenances w/ overlaps/waste | as needed                       |

**PROCEDURE**

**Preparation**

Metal Preparation

Tank shall be fabricated per NACE *RPO-178-2003: Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service*. Welds shall be finished to a minimum "E" Grade, having all weld-spatter removed and sharp edges/corners radiused to a minimum ¼" prior to grit-blasting.

Remove surface contaminants such oils, grease, etc., with an appropriate solvent (a solution of 90% water/10% methanol or alcohol may be sufficient depending on the condition of the surface) in accordance with *SSPC-SP-1 Solvent Cleaning Methods*.

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All surface areas to be lined shall be grit-blasted to a minimum as per *RPO-694-2000 (ISO-Sa2): NACE No. 3/SSPC-SP6 Commercial Blast Cleaning* and shall have a surface profile of 1-2.5 mils. All mill scale must be removed prior to the prime coat application.

### Priming

Welds and edges shall be stripe coated with *Integument NS-6000 Resinous 100% solids Epoxy-Novolac* by brush prior to finish coating. Apply two (2) complete coats of *NS-6000 Epoxy-Novolac* to all interior surfaces. Thickness of finish coats shall be 2-3.5 mils DFT per coat for a total system thickness of 4-7 mils DFT.

## **Membrane Installation**

### Stage Work Area

1. Set up a worktable using a straight piece of 4' X 8' plywood or similar. It can be helpful to stage an adjacent table with a pipe support to roll-off film from the roll. This is typically used on larger projects.
2. Make a straight line across the width of the table and at a 90° angle to the edge of the length of the table. This line can be used as a guide to help line up cuts and establish the length of the sheet cuts (once determined – see below “layout”).
3. Keep rolls of film stored in a clean, dry area, with temperatures between 60 ° and 85 °F, until ready to be installed.
4. Cover the tank bottom areas with cloth, plastic or paper as necessary to protect primed surfaces from damage (foot traffic) during the membrane installation.

### General Installation Procedure

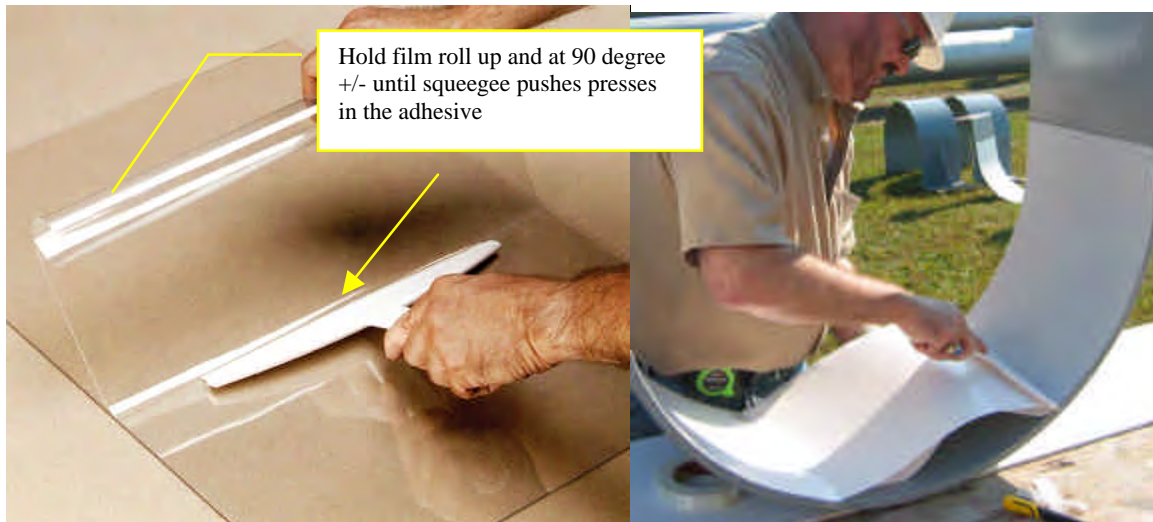
Typically the membrane is applied from the bottom half of the vessel upward in three specific stages: Bottom half of tank heads; bottom half of shell, nozzles/openings, and then repeat the steps for the top half of the vessel (after the brick has been placed on the floor and the scaffolding set). This procedure is specific to horizontal tanks, but may be modified for vertical vessels and pipes.

The membrane consists of a 30-mil Pressure Sensitive Pure Butyl Rubber adhesive, sandwiched between a 5, 10 or 20-mil film and a plastic or paper release liner. The release liner is removed during installation to expose the adhesive -- then discarded. The membrane is typically furnished on a roll measuring 3' wide by 75' long. If a paper release liner is being used, duct tape can be placed along the edges and over any creases/wrinkles in the paper. This will help prevent the paper from tearing when peeling off the release liner during installation.

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After layout (see below) the cut piece has the release liner removed from 2-4” of the starting edge. This edge is then placed onto the previously marked horizontal line. The adhered edge will now hold the sheet vertically. The actual installation requires 2-3 persons. One person holds the sheet at an approximate 90° angle to the surface, while the second person reaches under and pulls back more of the release liner so as to expose 2-3” of adhesive. At the same time a third person uses a rubber edged squeegee (6-12” wide) to press the adhesive down and secure the sheet. The technique involves the squeegee actually pushing against the 90° piece of the sheet (in the crotch of the angle) while the person holding the sheet out at the 90° allows the sheet to adhere as it is being pushed by the squeegee. The squeegee starts at the center of the sheet and works outward toward the edges. Use the small, hard plastic squeegee to work in small, tight areas and corners. Note: After the workmen become more proficient they can typically reduce the number of workmen to two applicators and one assistant, in the tank and one or two layout personnel outside the tank.



**Figure 1 Film Application:** use squeegee to press into the corner while pulling release liner off of back. Take care to hold the balance of film up and away from the surface until the squeegee presses it in.

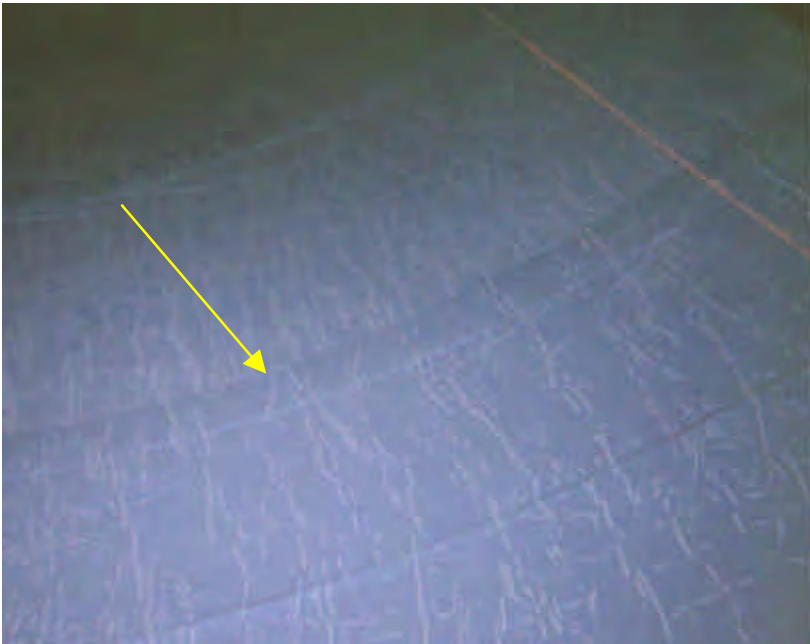
If wrinkles begin to form (resulting from installation – not wrinkles/texture from manufacturer), the sheet should be gently pulled back (do not stretch the film) and repositioned as required. If a wrinkle is unavoidable, then use a stiff plastic squeegee to press out the wrinkle from the center of same, beginning at the apex and pressing down and outward toward the larger, flaired, end. Refer to *Integument's Sample Installation Guide* for additional information.

After the initial application of the membrane with the large squeegee, use a small hard plastic squeegee to burnish the surfaces of the membrane paying particular attention to rub-out the seamed and overlapped areas.

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Layout and install the subsequent sheets making certain to overlap them a minimum of 3-6”.



**Figure 2 Application: Overlap sheets 3-6” minimum**



**Figure 3 Film Application: use small hard plastic squeegee in tight corners and pressing out wrinkles**

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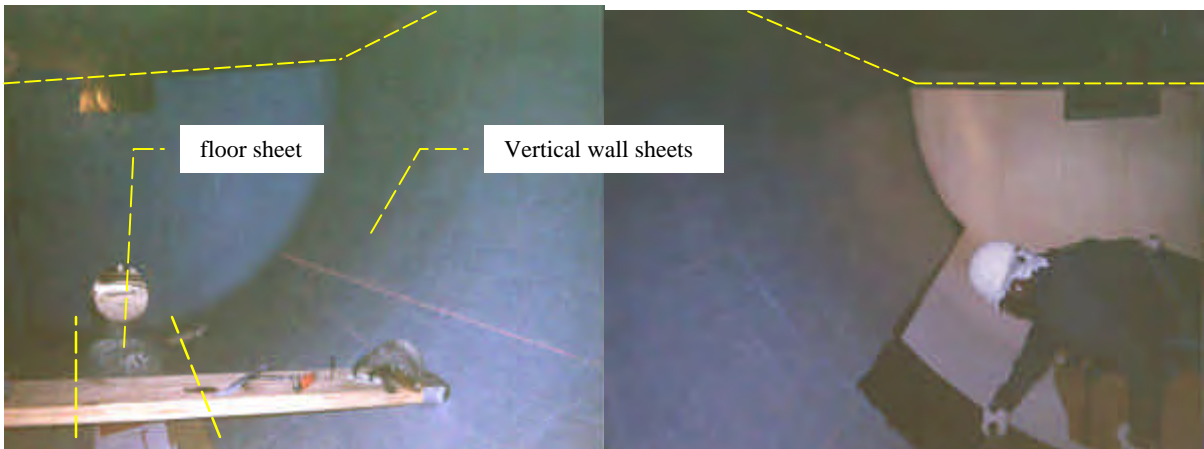
Tank Heads

The head will first have the bottom half covered, then the top (after the brick has been placed on the floor and the scaffolding set to line the top half of tank). Make a horizontal line with chalk or laser approximately 2-4” over the head’s center line. This will serve as a guide to start the end, edge of the membrane sheets. Identify how many vertical sheets will be required at the standard 36” width. Allow for 3-6” overlap on the sheet lengths. Start with the center sheets and cut the first piece (longest) that will be at or near the center of the head. Be certain to cut the length enough so it will meet the center line of the knuckle. Once installed (see above *General Installation Procedure*) the edges extending over the center line of the knuckle can be trimmed back to same. Install the balance of the sheets taking care to overlap 3-6”. Once the head is covered the membrane over the knuckle area can then be installed.

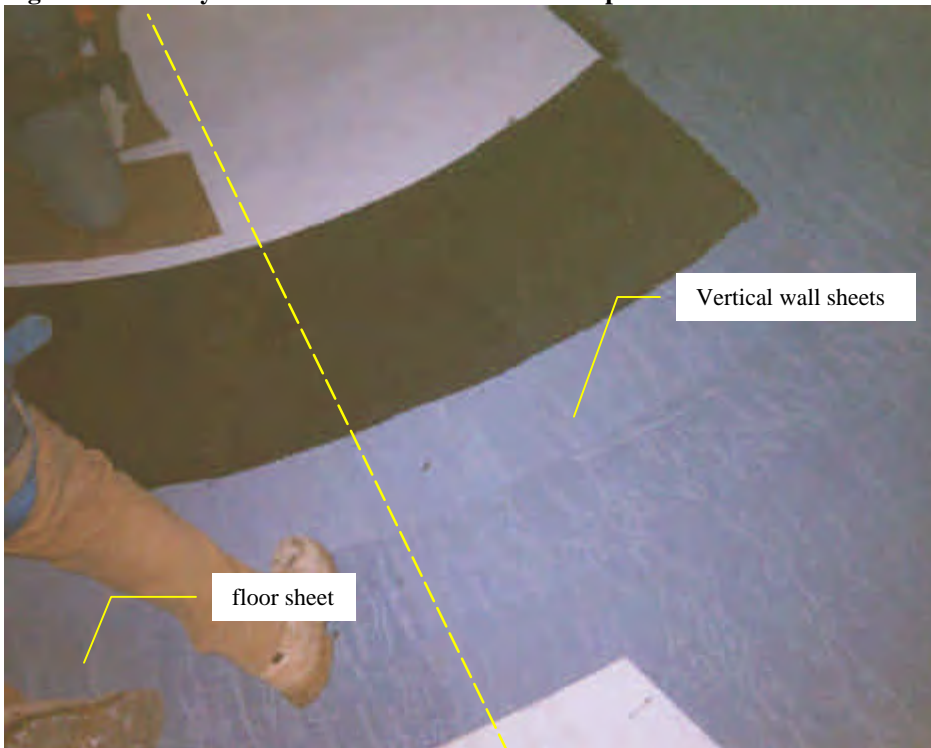
The diameter of the vessel and design of the knuckle will determine the sizes of the pieces to be cut and applied. Generally the pieces will range in sizes from 3-10” wide by 6-20” long. The pieces are cut so that when they are applied they can be gently stretched to fit the geometry of the knuckle without wrinkling. The piece should extend from the center of the knuckle out onto the flat shell and/or flat portion of the knuckle. Round the corners of the piece by cutting a 2” radius on all corners with a razor knife or scissors. Start the application at one end of the piece, centered over the knuckle and work from the center outward as you move down the length. A small plastic squeegee and/or cotton gloved hand is best for this work. As potential wrinkling begins to appear (this is normal), work it out as described in the *General Installation Procedure*. This will require minor stretching of the film by the squeegee as it is slowly worked outward. After the piece is installed, apply the next piece by overlapping the previous 2-4” and repeat the process as you continue to work around the circumference of the knuckle.

Shell Installation

After the head area is installed the walls (bottom half first) of the shell membrane is installed. A horizontal chalk or laser line is made across the length of the shell on both sides segmenting the bottom half of the vessel from the top. This line will serve a guide for hanging the end edge of the vertical sheets. The length of the wall sheets will be such that they extend from the halfway line (chalk/laser) down to the floor. The length of the sheets on the two bottom quadrants of the shell will be long enough so that a final sheet of film (3' wide) can run the horizontal length of the center-bottom of tank in one piece that will overlap lap onto the vertically run side sheets 3-6".



**Figure 4 Shell Layout: Mark horizontal line to start placement of vertical sheets**



**Figure 5 Shell-Floor Layout: One sheet runs the length of vessel**



### Nozzle Installation

The film should be laid out so as to cover the bottom half and the top half of the nozzle in two separate pieces. The length should be such that the ends of the pieces terminate 3-4" back from the outside flange and within the throat of the nozzle while the other end extends into the tank 4-6". The portion of the piece protruding into the tank is then cut in several places and folded back (butterfly style) onto the interior surface of the tank. The top segment is installed in the same manner with an overlap onto the bottom piece of 1-2".

After the nozzle is completely lined a second lining is applied in the same fashion with two exceptions:

1. The overlaps are staggered with respect to the first lining
2. The outside edge of the film starts 1-3" back from the flange side edge of the first lining.

The purpose of terminating inside the nozzle is to allow maximum sealing of the edge with the mastic (furnished by others).

### **Sealing Edges**

Seal all adhesive edges in one or both methods as required:

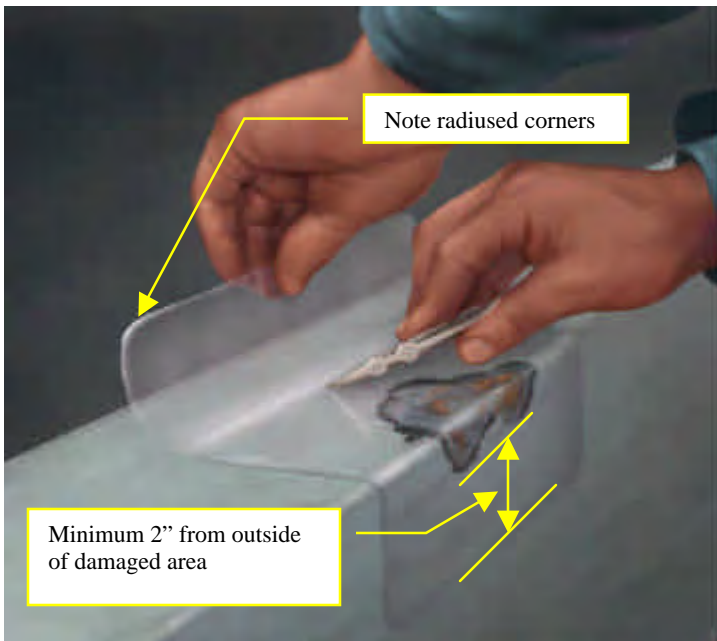
1. Apply two brush coats of *FluoroGrip SB-100 Fluoroelastomer Sealant* at 2.0-5 mils total DFT x ½ to ¾" wide as necessary to seal any adhesive-exposed edges.
2. Apply and smooth out a bead of *SC-200 Fluoroelastomer Caulk* as required to seal any gaps or adhesive-exposed edges.

Refer to the manufacturer's technical data sheet for detailed mixing and application procedures.

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## Inspection

Perform a visual inspection immediately prior to laying in the mastic. The inspection shall identify and reseal any lifted edges/seams or patching any holes and tears that may have occurred during installation. Repair holes and tears by solvent wiping with *LS-155 Prep-n-Treat* using a lint free cloth. Apply a covering piece of membrane that is pre-cut in a round, oval or having radiused corners. The patch should extend a minimum of two inches in all directions from any outside edge of the damaged area. Refer to *Integument's* documents: *MxMembrane: Acid Brick Repair Procedures* and *Sample Installation Guide* for additional details on preparation and application of small patches.



**Figure 6 Patch Application: Use round, oval or piece with radiused corners**

**Troubleshooting:**

| <b>Problem</b>  | <b>Solution</b>  |
|---|--|
| The release paper tears when peeling off the back during installation.  | Apply duct tape to paper on edges, creases and wrinkles before installing.   |
| A small pocket of air (bubble) is trapped under the film.   | Leave it alone.  |
| A large pocket of air (bubble) is trapped under the film.   | Use the provided squeegee to remove press the air pocket out to an edge for dissipation. If this doesn't work, puncture the film in the center of bubble press down. Patch the resulting hole with membrane patch or SC-200 caulk. |
| The film is not smooth. There are wrinkles along the surface – <u>not from original manufactured product.</u> | Pull up the part of the film with the wrinkle and rework the section. If this doesn't work, cut the film. If this is not possible, simply press down the wrinkles with a hard plastic squeegee or hard tool.                       |
| There is a discontinuity (hole) in the adhesive   | Cut out that section and do not use.   |

**Technical Support**

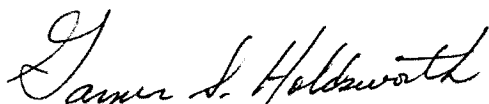
For Questions, Additional Information or Technical Support Contact:

Integument Technologies, Inc.  
 72 Pearce Avenue  
 Tonawanda, NY 14150  
 716-873-1199  
[www.integument.com](http://www.integument.com)

Ask for *“Technical Services Support”*

Prepared by,

Integument Technologies, Inc.



Garner S. Holdsworth, MBA  
 NACE Certified Inspector-Instructor #1288  
 SSPC Certified Coatings & Linings Specialist #558-463-0938

