

# Rilco Manufacturing Co. Inc.

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Subject: Installation Instructions for Rilco Polyurethane Insulated Pipe Supports

Project: Freeport LNG Liquefaction

Customer: CB&I/ Zachry

Rev: 6 (October 09, 2017)

By: RM

Checked: MEB

Approved: JAD

## Description

This procedure describes the method in which Polyurethane Insulated Pipe Supports are to be installed by field personnel. Read through completely before starting installation procedure.

The following documents will need to be referenced during the installation procedure:

- Rilco support detail drawings
- Project specification

## Storage

Cold insulated supports should remain in its crate and its plastic wrapping or bag until it is needed for installation with the shipping crate stored in a dry, shaded area. For specific storage requirements, Rilco's "*Protection, Preservation and Storage Procedures*" should be referenced.

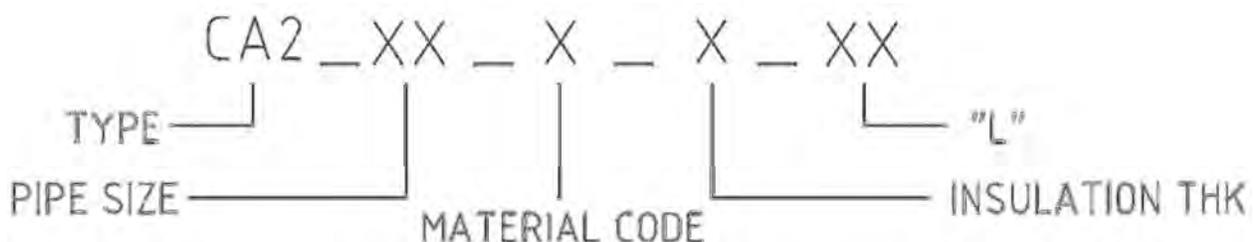
## Tools, Equipment & Material Required (By Field)

- Mechanisms for pipe lifting (chain hoists, motorcycle jacks, hydraulic jacks, forklifts, etc.)
- Adjustable wrenches and/or ratchets
- Wood rasp or sander
- Welding equipment with approved consumables
- 2" wide aluminum tape
- Welding wire or rope
- Vernier Caliper
- Foster 81-84 (Part A and B)
- Foster 90-61

## Support Types

The support mark numbers have a prefix identifying the function of the support. Care should be taken to ensure that the proper support is located and installed in its correct position.

Installer should first identify the correct support design to be installed. Each support has been tagged with a mark number code. This code has also been indicated on Rilco's detail drawings. The mark number coding uses the following format:



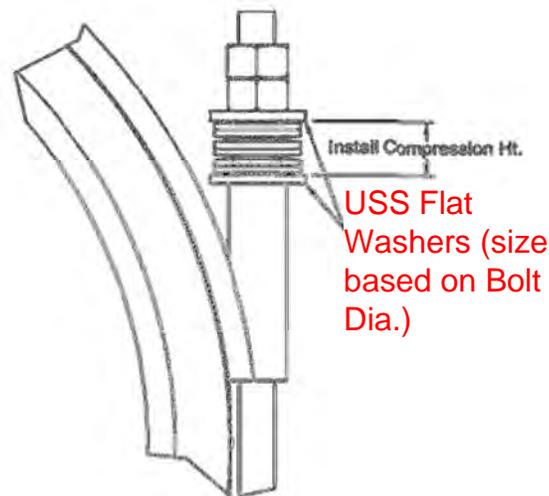
## Rilco PUF Insulated Pipe Supports Major Components

-360° high density polyurethane foam (PUF) insulation (supplied as two halves) with sheet metal outer protective jacket, vapor barrier, and monolar mastic.

-Upper and lower steel cradles

-Bolt Assemblies with Belleville Washers (See Figure 1)

-Housing and pipe axial lug components (anchor supports only)



### **Belleville Washer Assembly**

- See Addendum A For Install Compression Height, Model and Quantity
- Note Orientation Of Washers
- Washers To Be Installed In Series

Figure 1

## Installing the Support on the Pipe

1. Clean pipe to remove moisture, dirt, loose material, oil, grease, or any other contaminants prior to installation of support.
2. Remove upper cradle and top insulation half.
  - a. Loosen and remove the lower nuts and flat washer on each bolt assembly.
  - b. Remove all bolt assemblies from sleeves, keeping Belleville washers intact to prevent having to completely reassemble the washer assembly. Refer to Figure 1 if reassembly is necessary.
  - c. Install the lower nuts and flat washer onto the lower threads and set aside bolt assemblies.
  - d. Remove the upper steel cradle and set aside.
  - e. Remove the upper sheet metal jacket and set aside.
  - f. Remove the upper insulation half and set aside.
    - i. For pipe sizes 12" and less, the vapor barrier is provided as one piece (single seam).
    - ii. For sizes 14" and larger, the vapor barrier is provided separately on the bottom and top insulation (double seam).
    - iii. Do not tear, crumple or damage vapor barrier during the installation process.
  - g. Anchors only: Remove the pipe lug plates and set aside, if shipped together.

3. ANCHORS ONLY (skip to step 4 if installing resting or guided support): Weld the axial pipe lug plates onto the pipe per the support drawing detail.
  - a. Use the upper insulation half as a spacer to determine where the plates need to be welded around the pipe. Set upper insulation on the top of the pipe. Make sure it is in the proper location. Tack weld upper pipe lug plates.
  - b. Rotate upper insulation half to fit snug with bottom half of pipe. Use wire or rope to hold insulation in place. Tack weld lower pipe lug plates.
    - i. To check location of pipe lug plates, rotate upper insulation around pipe. Make sure plates are snug with the insulation's outer faces.
  - c. Set aside upper insulation.
  - d. Weld out pipe lug to the pipe per the indicated weld size on the support drawing.
    - i. Repeat check, rotate upper insulation around pipe. Make sure plates are snug with the insulation's outer faces.
    - ii. If any weld inspection or testing requirement that needs direct access to the axial stop, it should take place before installing the line insulation.

THRUST RING/PAD  
SEE DETAIL ON 1798128-036/037

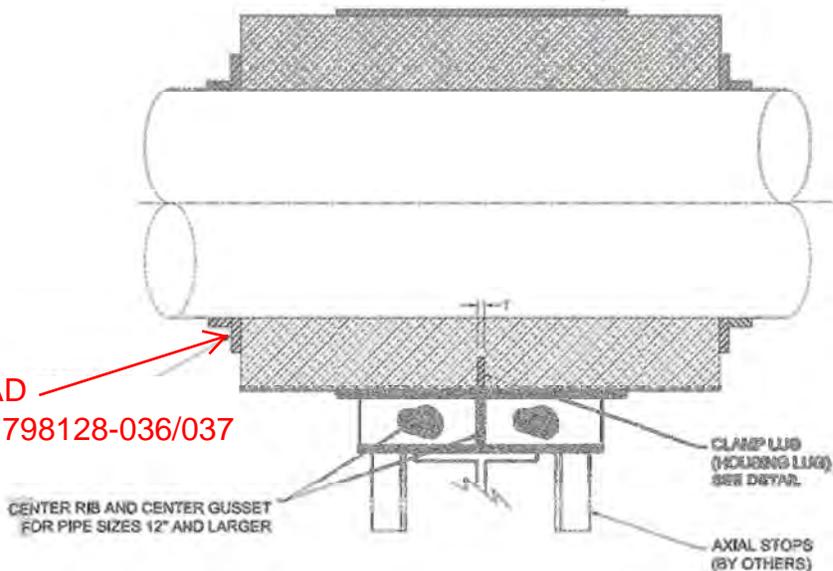


Figure 2 Axial Pipe Lug Detail (ANCHORS ONLY)

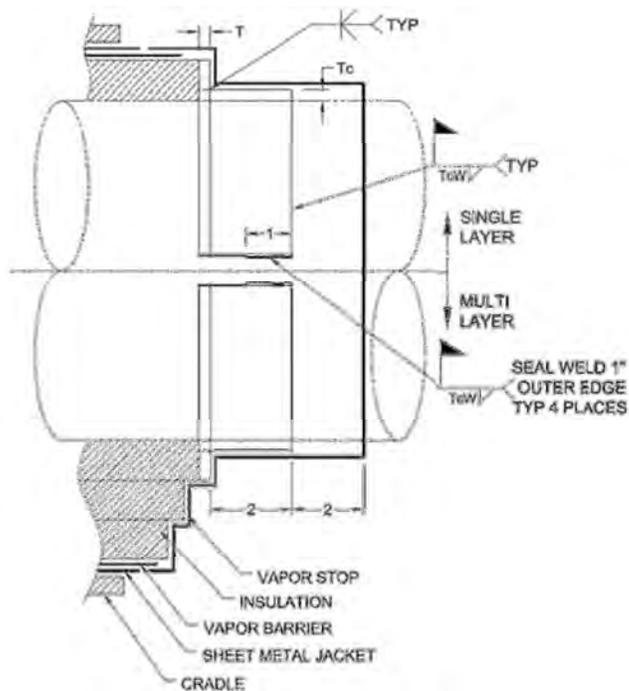


Figure 3 Axial Pipe Lug and Vapor Stop Detail (ANCHORS ONLY)

4. Lift the pipe to a height high enough for the bottom portion of the support to fit underneath.
5. Lower the pipe onto the bottom insulation portion of the support.
6. With the pipe now resting inside the support, trial fit the upper PUF insulation half onto the pipe, aligning the ends with the lower PUF section and verifying the radial gaps are equal on both sides.
  - a. Polyimide foam supplied to be used to fill all gaps at each section whether a single or multilayer insulation.
  - b. Width of gaps should not be less than as specified on support drawings. If insufficient gap exists, carefully trim the PUF surfaces with a flat rasp or sander to achieve minimum gap width. Be sure surface is flat when complete. Note, too much “packing” of the foam material into the seams is not suggested as the joints must remain flexible during operation.
  - c. Trim the number of determined layers of polyimide foam to the exact width and length for the inner seam layer.
  - d. Trim the number of determined layers of polyimide foam to the exact length but 1/4” to 1/2” less width for the outer seam layer. This is done to allow room for a vapor seal bead on the outer edge.
7. Prior to installing the polyimide foam, apply a bead of Fosters 81-84 to the outer edge of the PUF and inner surface of the vapor barrier (once upper half is installed this will be the vapor seal for the longitudinal seam). See Figure below.

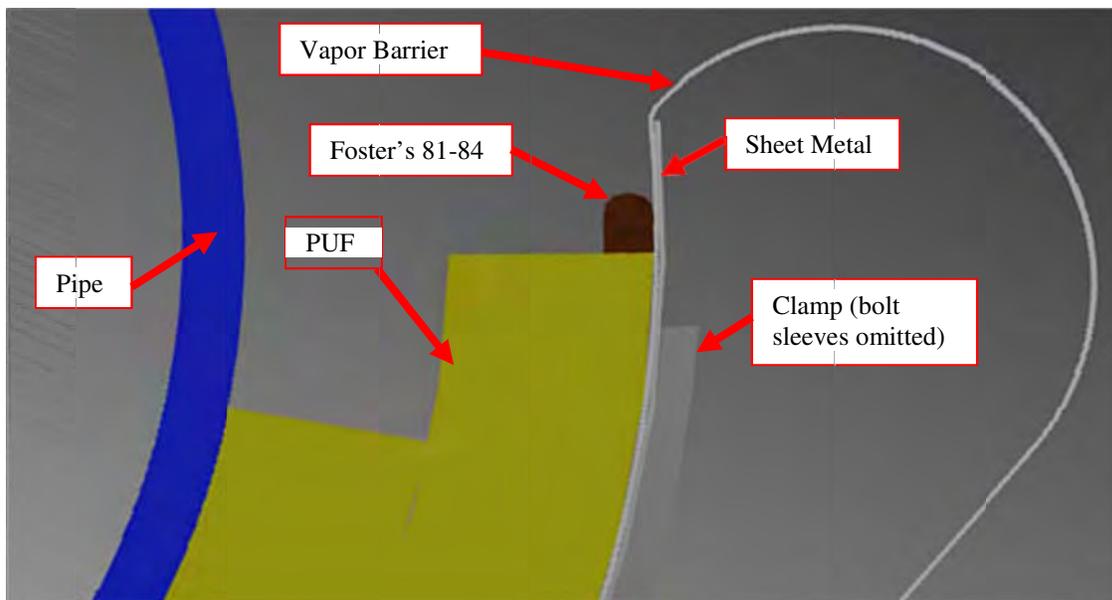


Figure 4 End View Installing Longitudinal Vapor Seal

8. Lay the pre-trimmed strips of polyimide foam on the lower PUF section. See Figure below.

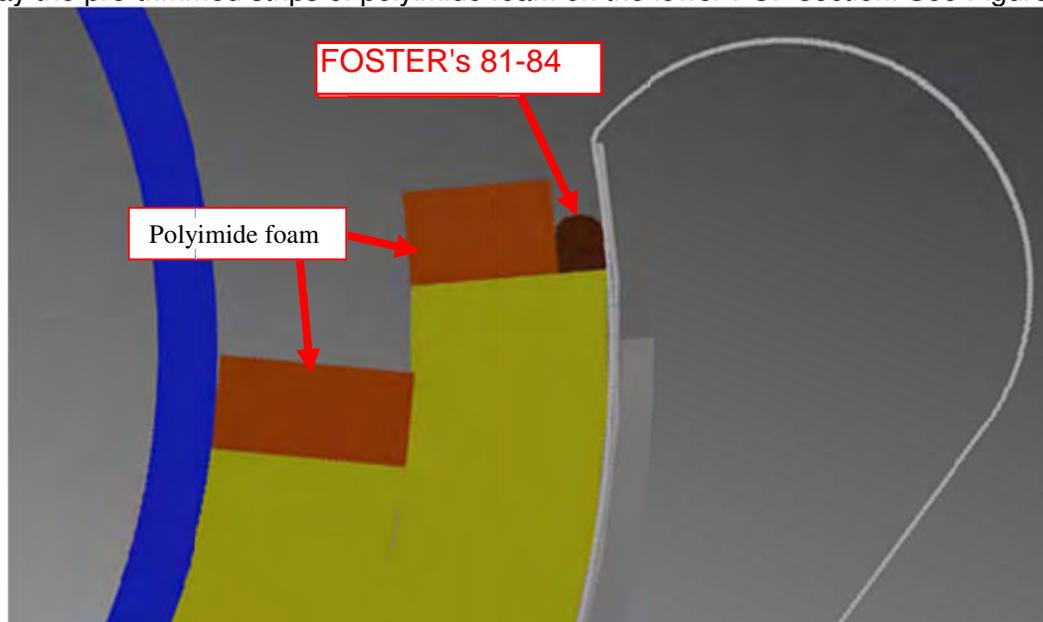


Figure 5 End View Installing polyimide foam

9. Install upper PUF insulation, compressing polyimide foam to approximately half the thickness. See Figure below.

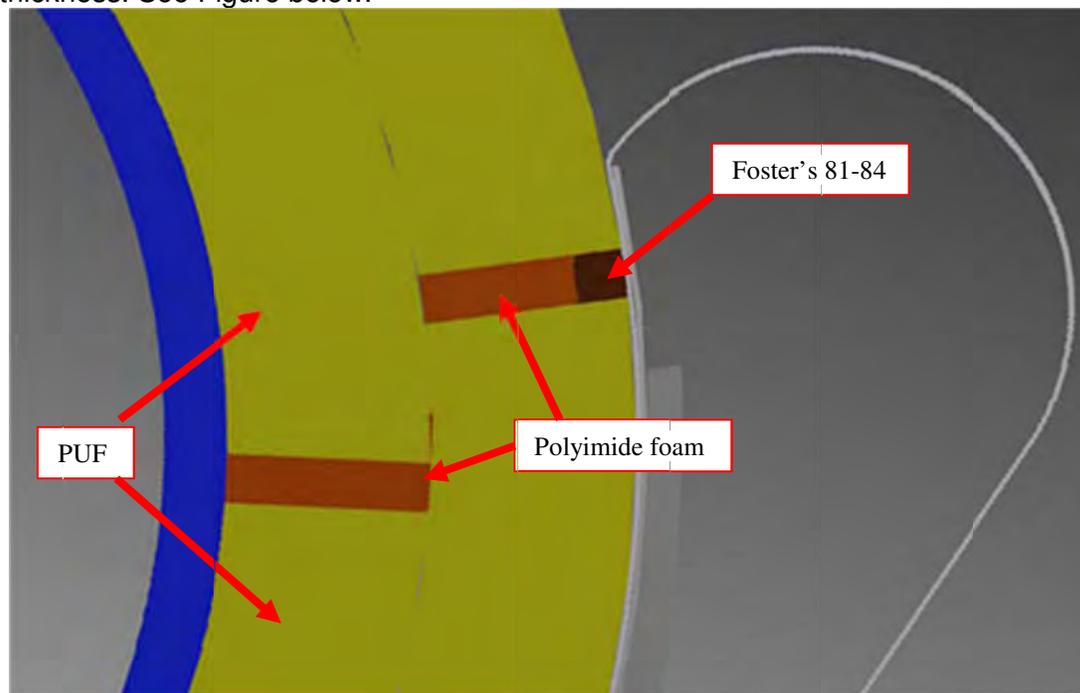


Figure 6 End View Installation of upper insulation

10. For pipe sizes 12" and less, wrap vapor barrier over top insulation.
- Make sure vapor barrier is taut to insulation.
  - Apply aluminum tape to seam.
  - After tightening of bolts, minimal crumpling on support ends is acceptable due to clamping effect on support.
11. For pipe sizes 14" and larger, the vapor barrier is provided in two pieces requiring a seam on both sides of the support to be sealed. Repeat the steps specified for pipe sizes 12" and less but seal the seams on both sides of the support insulation.

12. Install upper sheet metal jacket.
  - a. Make sure jacketing is not rotated. Equal amounts of overlap on each side going over the lower sheet metal jacket with the overlap on both sides evenly positioned.
  - b. Note that after tightening of bolts, minimal crumpling inside the gap between cradles is acceptable due to clamping effect on the support.
13. Install upper steel cradle.
  - a. Align the bolt holes and insert bolts.
    - i. Remove the bottom nut and one flat washer from the bolt assembly, necessary prior to inserting bolts.
      1. Orient bolts where the shorter thread length is on top. Do not invert bolt assembly. The thread lengths on both ends of the bolt are different to ensure proper operation of the Belleville washers.
    - ii. The top nut and top lock nut should be threaded all the way to the bottom of the top thread section of the bolt. See Figure below.

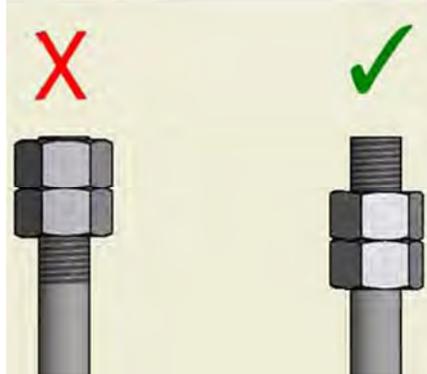


Figure 7 Proper top nut position

- b. With the bolt in place, install the lower washer and nut.
- c. Each bolt should be tightened in stages to evenly apply pressure on all bolts. See Figure below as a suggested sequence for tightening the bolts.

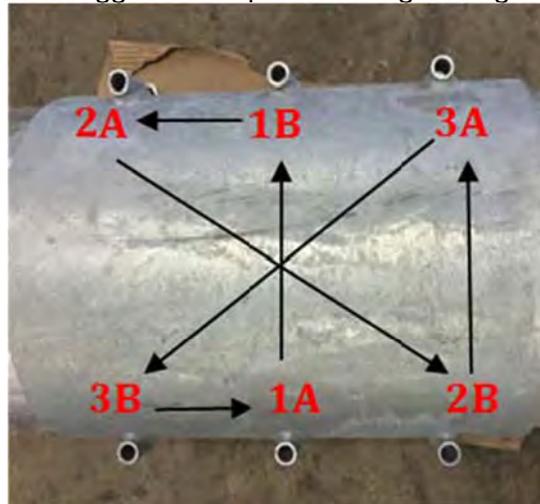


Figure 8 Top View of Cradle excluding bolt assemblies. Recommended alternating tightening sequence.

- i. Start at position 1A and gradually tighten each bolt to apply even pressure on bolt assemblies until final bolt tension is achieved. If possible, tighten pair (A and B) simultaneously to apply uniform pressure on each side of the support.
- d. To set the bolts to their proper tension, the Belleville washers need to be compressed to their specified install compression height. Refer to Rilco support detailed drawings (Appendix A).

- i. The Caliper should be placed between the top and middle washers measuring from the end view centerline of the bolts. See figure below for details.

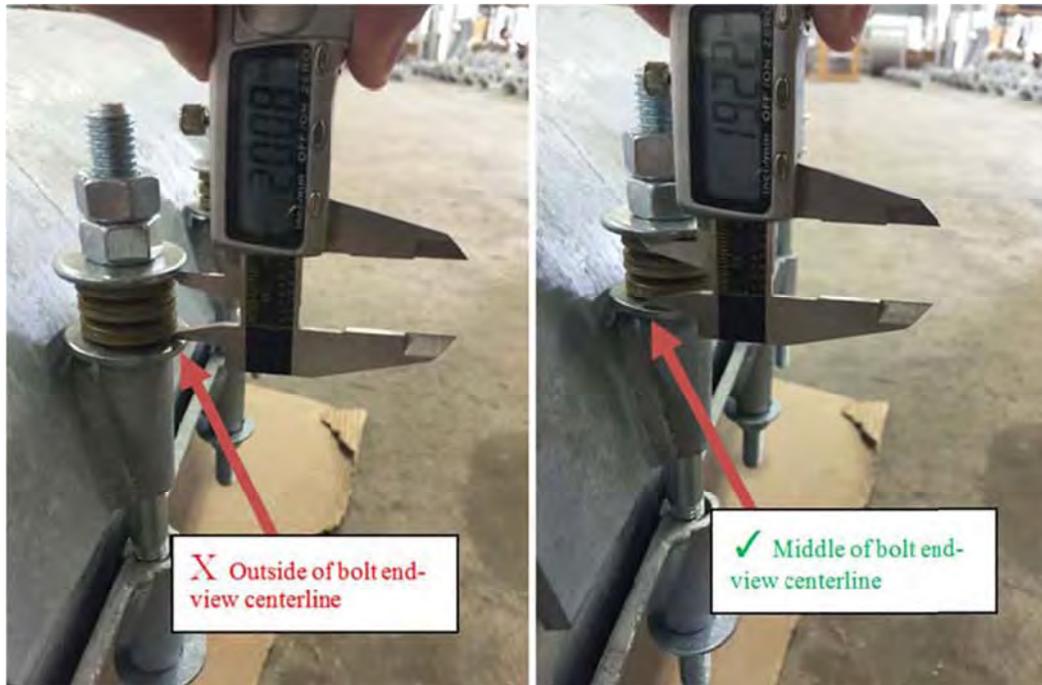


Figure 9 Belleville Washer Measurement; Left = Incorrect, Right = Correct

- ii. After tightening all bolts, recheck the height of each washer assembly.
  - e. Tighten bottom and top lock nuts.
    - i. Use two wrenches, slightly loosen existing nut while tightening lock nut.
14. Once support is correctly installed, immediately apply Foster 90-61 vapor stop sealant on the exposed ends of the shoe to avoid any moisture into the HD PUF and other layers of the shoe. Follow application procedure shown on Foster 90-61 data sheet. Extent of the vapor stop sealant is shown on the cryogenic insulation specification (179812-0809-000-SP-2220-005.0001). Refer to Figure 3 for the vapor stop seal of anchor supports.

### Installation of Guide Components

1. Reference the support drawing and identify the guide component (by others).
  - a. Locate the guide components on the support steel on both sides of the support.
  - b. Tack weld the guide component to the support steel so that the gap dimension is maintained.
  - c. After tack welding, weld out the guide component to the support steel per project specification.
  - d. Repair galvanized/painted finish in the welded area.

### Installation of Stop Components

1. Reference the support drawing and identify the stop component (by others).
  - a. Locate the stop components on the support steel base on both sides of the existing structure.
  - b. Tack weld the stop component to the support steel base so that the gap dimension is maintained.
  - c. After tack welding, weld out the stop component to the support steel base.
  - d. Repair galvanized/painted finish in the welded area.

## Protection of Support after Installation

After the installation, the support insulation components require protection from rain, sun and snow until it is installed with the pipe insulation and jacketing. Exposed ends of the support should be completely wrapped in plastic sheeting and thoroughly taped down around the pipe and sheet metal jacket of the support to prevent moisture from leaking or blowing onto the insulation surfaces. If the black plastic wrapping or bag supplied with the support is in a suitable condition, it can be re-used for this purpose.

## Repair Procedure for Minor Damage to Supports

Repairs to minor damage of supports that may occur during handling or installation process should use the following procedure:

- **Damage to Vapor Barrier:** Areas with small tears to the vapor barrier should be repaired to pressure sensitive aluminum tape or butyl tape (width 1-1/2" to 2"). Clean area of any debris or damaged vapor barrier that may interfere with the taping of damaged area. Along the entire length of tear, apply a strip of aluminum tape while holding down the flaps of the torn area. Taped area should extend slightly beyond torn area (1-1/2" to 2") to prevent propagation of further tearing. Apply additional widths of tape if necessary.
- **Damage to Galvanized Steel:** To repair damage to hot dipped galvanized steel surfaces, remove rust with a power tool per SSPC-SP3. Also remove any loose pieces of galvanizing. Use a brush or roller to apply a cold galvanizing compound such as "ZRC Galvanizing Compound - Galvilit" to the repaired surface. After 12 hours, apply second coat.
- **Damage to Outer mastic:** Exposed PUF surfaces are coated with a white vapor barrier mastic material. Damage to the mastic surface should be repaired by gently sanding the damaged area with a moderately coarse sandpaper (120-200 grit) to eliminate peeling or scraped up mastic. Sand area just enough to prepare damaged area. With a paint brush, apply mastic to an approximate thickness of 1/64" to 1/32" thick.
- **Damage to HD PUF:** For small damaged areas of high density PUF shell (1x1" wide by 3/8 to 5/8" deep), remove debris and loose or compressed foam from damaged area. After cleaning, fill damaged area with a light density polyurethane foam (2-3 lb/ft<sup>3</sup>). Fill area so that the PUF fills and rises slightly above the surface to be repaired. After the replacement foam has cured, trim and sand excess foam to match the surface profile of the surrounding area.

Larger areas of damaged PUF may be repaired if the section of PUF is in the extremities of the PUF section (i.e. in a non-load bearing area). Remove debris and loose or compressed foam from damaged area and gently sand damaged area with moderately coarse sandpaper (120-200 grit). With tape and/or sheet metal, build a form around the damaged area to contain the replacement PUF. After cleaning, fill damaged area with a light density polyurethane foam (2-3 lb/ft<sup>3</sup>). Fill area so that PUF fills and rises slightly above the surface to be repaired. After the replacement foam has cured, trim and sand excess foam to match the surface profile of the surrounding area. If surrounding area is coated with protective mastic, repair as detailed above.

**TIPS/ Suggestions:**

For larger pipe supports follow installation instructions above and tap (rubber hammer) upper insulation section to assist in the fitment of the insulation to the pipe, if necessary, once cradle is in place repeat process, tapping the steel cradle into place.

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