

PERMA-PIPE®

PEX-GARD
Flexible
Factory Insulated
Piping Systems

Installation Manual

ISSUE 1

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NOTICE

This installation manual and the recommendations it contains are reasonably believed to be accurate and reliable. However, due to variations in environment, application or installation, and because the conditions of use are beyond our control, the user of this manual assumes all risk connected with the use thereof. The installer of these piping products is ultimately responsible for his own work and, thus, the integrity of the system. PERMA-PIPE assumes no responsibility for the use of information presented herein and, hereby, expressly disclaims all liability in regard to such use.

Any technical suggestions or advice with respect to storage, handling, installation or use of Seller's materials by or on behalf of Seller is an accommodation to Purchaser for which Seller shall have no responsibility unless responsibility, therefore, has been expressly assumed in writing by the President or a Vice-President of Seller.

GENERAL PRECAUTIONS

These instructions are for general applicability. If they conflict with contract, specifications or drawings specific to the job, the job-specific documents take precedence. If in doubt, check with PERMA-PIPE.

Carefully observe job work sequence to avoid errors and expensive mistakes. **DO NOT skip steps.**

DO NOT complete backfilling the trench until all testing and inspection are completed and accepted by the appropriate authority.

1. INTRODUCTION

The operating success and reliability of the system is greatly dependent upon proper installation. PERMA-PIPE is committed to supporting the installation of a complete and high-quality piping system. This support includes clear installation recommendations and expert field technical assistance, if required.

This manual provides the installer with recommended installation procedures for a PEX-GARD piping system.

The manual has been divided into sections, one section for each phase of the installation process. By following these step by step instructions, the installer should achieve a successful installation.

PEX-GARD is a versatile fluid transportation system for the distribution of fluids up to 190°F at 90 psig.

PEX-GARD has been designed with the installer in mind. PEX-GARD arrives at the project in long coils, meaning less field work, fewer field joints and fewer complications. This significantly reduces the installation cost and increases the integrity of the system.

A series of factors, such as design, construction, delivery, installation and testing, contribute to a reliable high quality piping system with stringent quality control proce-

dures applied at every step. The importance of proper installation practices for any piping system and adherence to this procedure, in particular, cannot be overstated. When installed according to the recommended practices presented in this manual and from PERMA-PIPE technical personnel, PEX-GARD will provide excellent service, meeting or exceeding expectations.

2. SCOPE AND APPLICATION

The scope of this manual is limited to PEX-GARD piping systems.

A factory-trained, experienced field installation instructor will be present during the installation, when the furnishing of such service is included in the customer's purchase order.

Trouble-free, efficient operation will result from close cooperation between the installer and the field installation instructor. PERMA-PIPE is committed to supporting the proper installation of a complete and high quality piping system. Nevertheless, ultimate responsibility for proper installation rests with the installer.

3. EQUIPMENT AND MATERIAL

3.1 Equipment and Materials

In order to install PEX-GARD, PERMA-PIPE has furnished the following:

1. PEX-GARD coils, coupling fittings and tee reducer fittings and accessories
2. Field joint closure materials (see Section 7)

The installer must furnish the following:

1. Lifting and excavation equipment
2. Hand tools including saws, grinders and wire brushes
3. Other materials as described in Section 7

3.2 Receiving, Handling and Storage PEX-GARD Receiving

The pipe coils and accessories were inspected and loaded with due care at the factory. It is the carrier's responsibility to deliver the shipment in good condition. It is the responsibility of the receiver to ensure

there has been no loss or damage.

The following procedures are suggested to minimize problems:

- It is recommended that the PERMA-PIPE field representative be present during receipt of the shipment.

- Obtain the following items from the carrier:

1. Packing Slip
2. Bill of Lading
3. MSDS Sheets

NOTE: Material Safety Data Sheets (MSDS) for each of the components described in this manual should be reviewed for safety precautions and protective equipment requirements.

- Check all shipped materials against the packing slip for shortages.

- Visually inspect the materials of shipment as they are unloaded.

- List all damages and/or shortages on the packing slip and the bill of lading. **DO NOT dispose of any damaged material.**

The carrier will notify you of the necessary procedure to be followed.

- Submit claims to the carrier. Failure to do so will result in loss of compensation for missing or damaged material.

- Notify your PERMA-PIPE representative of these claims or terms if assistance is required. PERMA-PIPE terms are F.O.B. plant, full freight allowed to project site, unless specified differently by contract or purchase order.

- Shortages and damaged materials are normally not reshipped, unless requested to do so. If replacement material is needed, contact a PERMA-PIPE representative.

PEX-GARD Material Handling

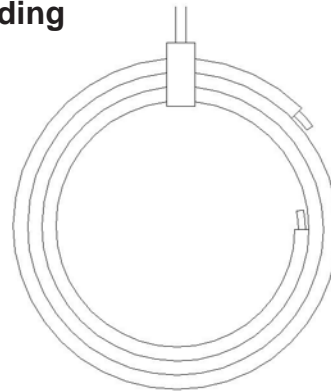
The means by which PEX-GARD is unloaded and handled in the field is the responsibility of the receiver. PEX-GARD PE jackets are extremely durable. However, if damage does occur due to improper

handling, the jacket must be repaired at the customer's expense. The following procedures are suggested to minimize problems:

- Lift coils only with nylon slings during all phases of handling. The nylon slings prevent scratching or damage to the jacket. Nylon slings are provided free by PERMA-PIPE.

DO NOT use hooks, steel cables or chains for handling PEX-GARD coils.

Unloading



PEX-GARD Storage

PEX-GARD coils can deteriorate if not stored properly. Storage of the product is the responsibility of the receiver. The following is suggested to minimize problems:

- If possible, store the coils in a warehouse or heated shelter. If this is not possible, store the coils on high ground to avoid standing water and ingress of water into pipe ends.

- When stacking the PEX-GARD for storage, stack coils flat, no higher than they were when received on the truck and no higher than six feet.

- Wooden shipping braces must be used as runners between the layers of PEX-GARD coils. PERMA-PIPE recommends stacking PEX-GARD no more than 6 feet high.

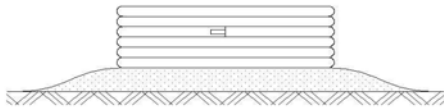
- Use foam or other padding between layers.

- **DO NOT remove plastic covers or end caps from the PEX-GARD.**

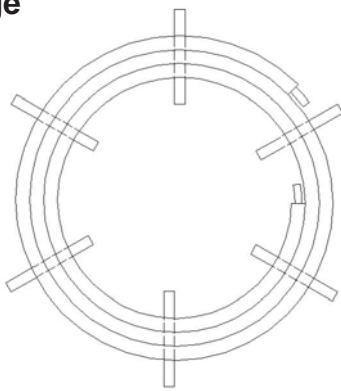
- PERMA-PIPE recommends using a light-colored or opaque tarpaulin to cover stored pipe. This cover will protect it against ultraviolet (UV) rays that will discolor the jacket.

- Store all field joint insulation materials indoors and in a dry area. Keep the materials in their shipping containers. The recommended storage temperature range is 60°-85°F (18°-29°C).

Storage



Storage



4. EXCAVATION

NOTE: All federal, state and local regulations concerning jobsite safety should be observed.

4.1 Trenching

All types of flexible pipe derive some of their strength from the passive soil resistance on the sides of the pipe. Therefore, the proper excavation of the trench is very important to ensure a structurally sound system.

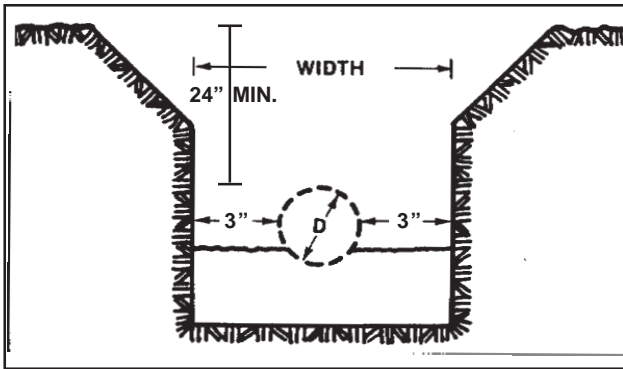
PEX-GARD is designed to handle normal soil and H-20 loading with a minimum 24 inch of cover.

The trench floor should be completely cleared of stones and rocks and covered with a minimum bedding of 4 inches, raked uniformly along the entire length of the run. The bedding material should conform with the recommendations in the **Backfill** Section 8.2 of this manual.

During excavation, unstable soil conditions may be encountered, particularly in installations with deep burials. If this occurs, shore the trench walls before lowering the piping assembly into the trench.

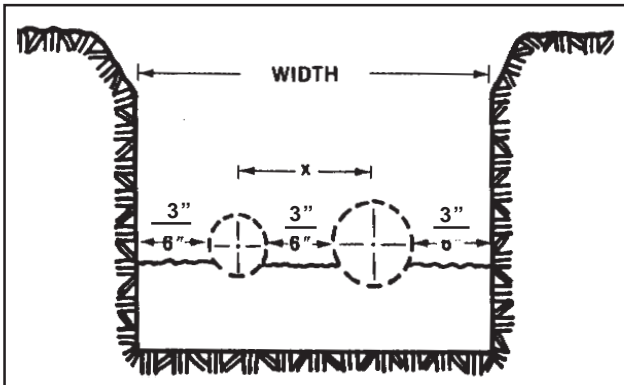
Local, state and federal regulations for shoring should be followed where applicable. As the shoring is removed, it should be replaced with backfill soil.

Organic soils or plastic clays and silts with high liquid limits may be encountered that are incapable of supporting the PEX-GARD. Remove the poor soil and replace it with the proper bedding soil to a depth that will provide a firm stable foundation.



The minimum recommended trench width for single pipe is 6 inches plus the diameter of the conduit.

For multi-pipe installations, PERMA-PIPE recommends computing the width of a multi-pipe trench by adding 3 inches to the combined radii of each pair of pipes (value X in the figure below) and then adding another 6 inches and the combined radii of the two outermost pipes to allow for clearance.



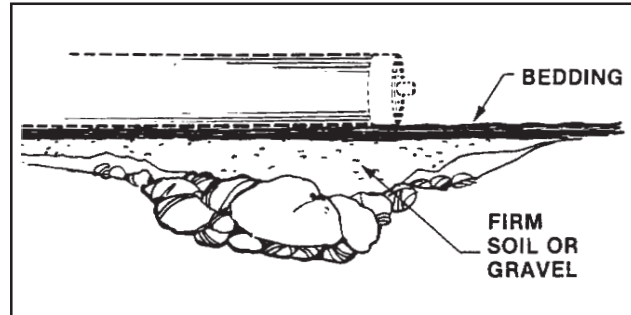
The total trench depth should allow for a 4 inch bedding, the conduit diameter and a minimum 24 inches cover depth above the PEX-GARD. See contract drawings or specification for specific pipe burial depth requirements. For depths less than 24 inches, contact PERMA-PIPE.

4.2 Special Trench Conditions Rock Bottom Trench

- A rocky or uneven trench foundation should be covered with firm soil or gravel before the bedding is put in place.

Unstable Soil

- When trenching in unstable soil, **DO NOT** lay any PEX-GARD until the trench walls are stabilized with staybracing or shoring.



Granular Soil

- In granular soil, the trench wall should be sloped at the natural angle of repose.

Over-excavation

- Any accidental over-excavation should be filled with bedding material and compacted at 90-95% modified proctor.

5. PEX-GARD INSTALLATION

PERMA-PIPE cannot anticipate every circumstance that might involve hazard. The warnings in this manual are, therefore, not all inclusive. The installer must satisfy himself that each procedure, tool, work method or operating technique is safe.

5.1 Layout

When the trench and compacted bedding are complete and ready, move the PEX-GARD coils from the storage location to sites convenient for laying out coils.

DO NOT drag or pull the coils along the ground or use steel grips, chains or hooks. Jacket damage may result.

The coils are tied at several locations around their length. Position the coils vertically and carefully cut the straps of the coil free.

CAUTION: The coils will expand as the straps are cut free. Stand inside or to the side of the coil so the expansion does not strike anyone.

Uncoil PEX-GARD by unrolling the coil along side the trench. Do not drag or try to pull the coils straight. Methods other than unrolling the coils may result in kinks or exceeding the minimum bend radius. Refer to the PEX-GARD data table below for information on minimum bend radius.

PEX-GARD DATA TABLE

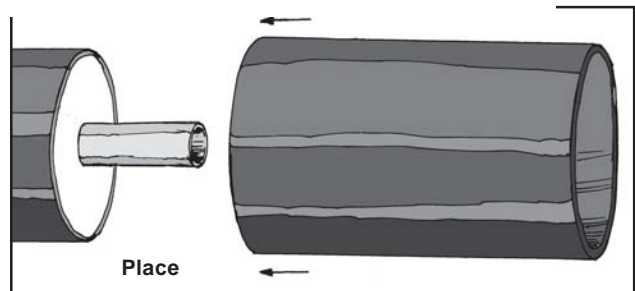
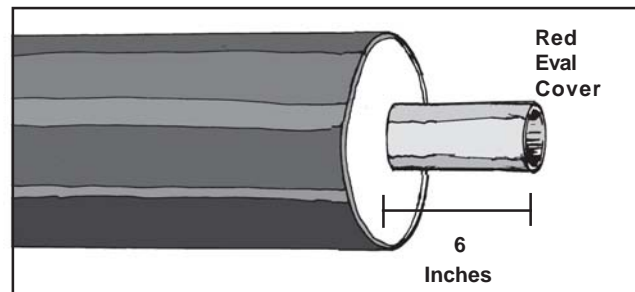
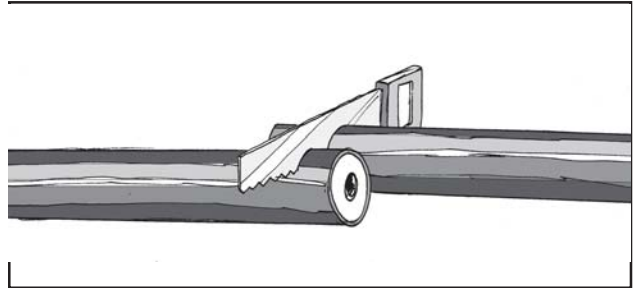
Pipe Size Inches	Outside Diameter Inches / mm	Pipe Wall Thickness Inches / mm	Jacket Diameter Inches / mm	Standard Coil Length Feet / m	Minimum Bending Radius Feet / m	Weight Lb / Ft
1	1.26 / 32	.114 / 2.9	2.95 / 75	1,180 / 360	2.62 / .8	0.7
1.5	1.97 / 50	.145 / 3.7	4.33 / 110	492 / 150	2.95 / .9	1.4
2	2.48 / 63	.228 / 5.8	4.92 / 125	328 / 100	3.28 / 1	1.8
2.5	2.95 / 75	.267 / 6.8	5.5 / 140	328 / 100	3.60 / 1.1	2.4
3	3.54 / 90	.332 / 8.2	6.30 / 160	164 / 50	3.94 / 1.2	3.2
4	4.33 / 110	.393 / 10.0	7.0 / 180	164 / 50	4.59 / 1.4	4.2

5.2 PEX-GARD Connections

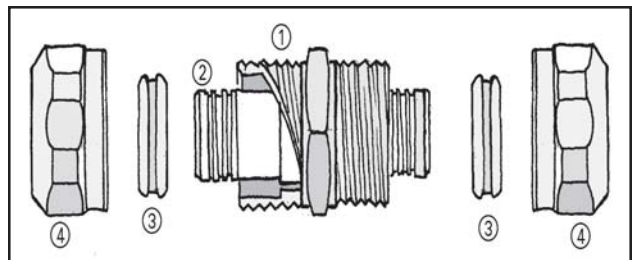
Determine amount which standard units are to be shortened.

Cut PEX-GARD at 90° and carefully remove 6 inches of jacket and insulation.

DO NOT remove or damage red EVAL covering the service pipe.

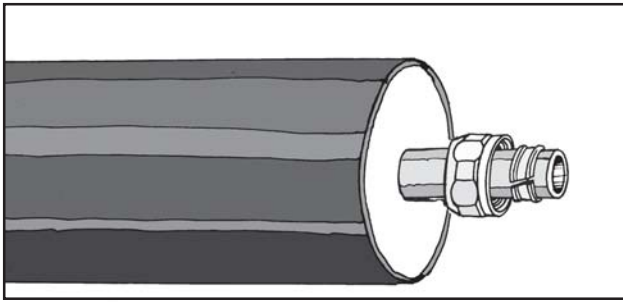


Place the closure sleeves over the jacket before joining the service pipes together.



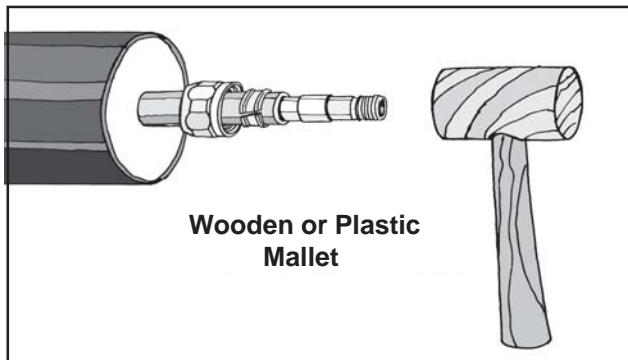
Field Joint Coupling Assembly

1. Outer Coupling (1)
2. Inner Coupling (1)
3. Compression Ring (2)
4. Compression Nut (2)



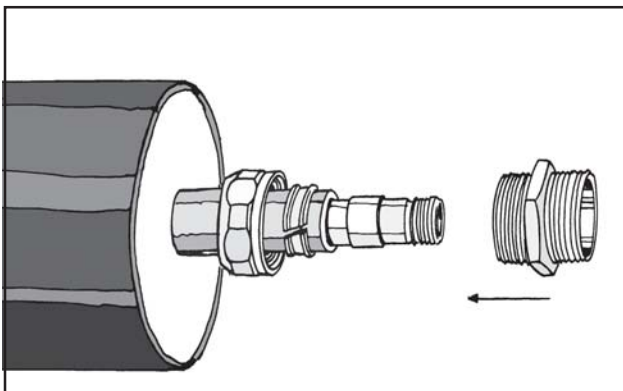
Step 1 • Coupling Installation

Slide one compression nut and one compression ring over the red EVAL cover of the service pipe.



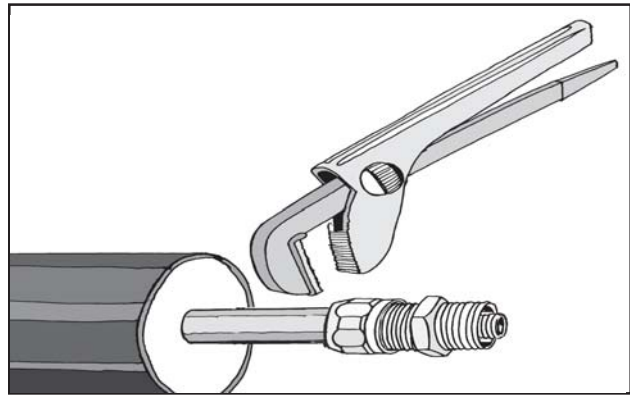
Step 2 • Installing Coupling End Into Service Pipe

Carefully drive one end of the inner coupling into the service pipe bore up to its shoulder.



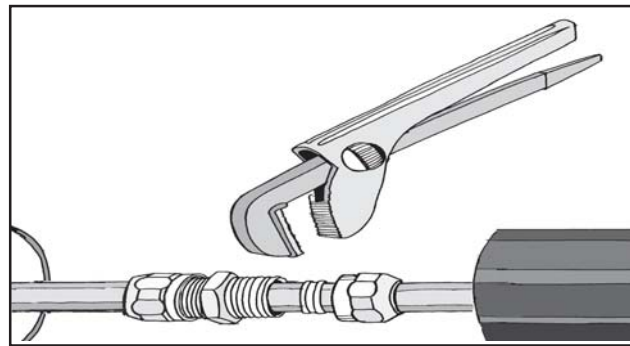
Step 3 • Outer Coupling Installation

Slide the outer coupling over the inner coupling and engage the compression nut threads.



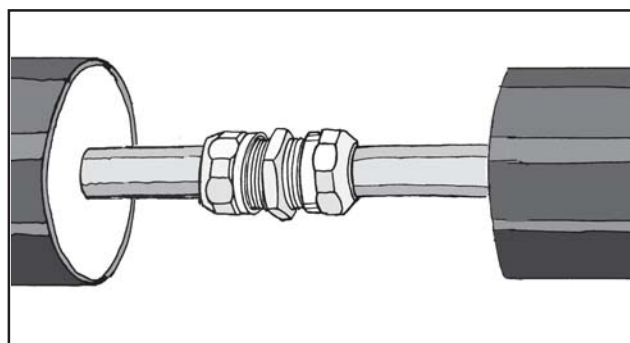
Step 4 • Joint Tightening

Tighten compression nut until snug, completing the seal.



Step 5 • Joint Tightening

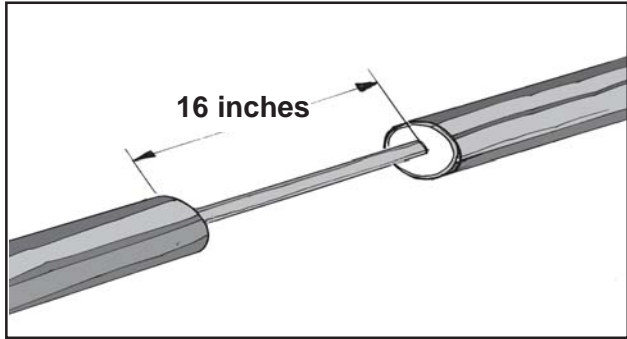
Slide second compression nut and ring pair over the red EVAL cover of the other service pipe end. Repeat steps 2 and 4.



Step 6 • Completed Field Joint Coupling

NOTE: On hot water systems the field joint may require retightening after initial hot water circulation.

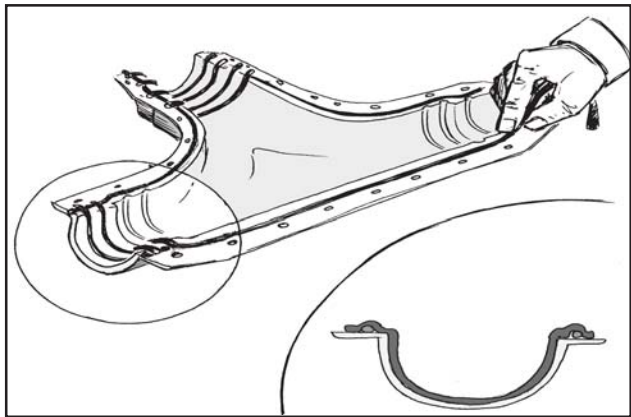
5.3 Tee / Branch Assembly



Step 1 • Cut and remove 16 inches of jacket and insulation at location of branch. **DO NOT remove or damage the red EVAL covering on pipe.**

Step 2 • Install brass compression coupling assembly in the same fashion as the straight pipe field joint (see Section 5.2).

Step 3 • After all service pipe joints have been tightened, install gasket material onto the inside of one-half of the two piece tee jacket.

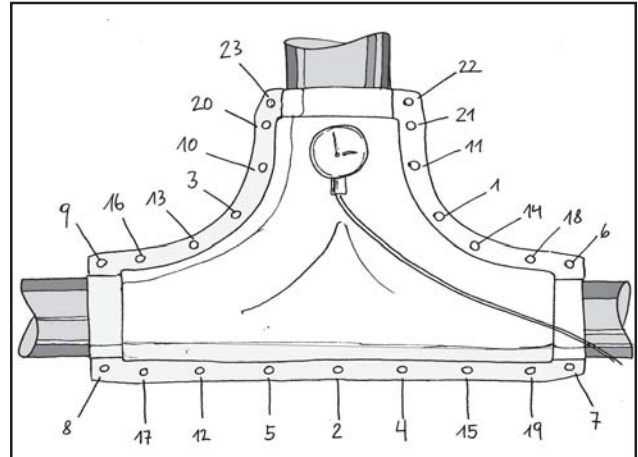


NOTE: To reduce the main or branch run you must install a rubber reducing ring. If the main line increases in size, you can cut the two piece tee assembly to match. Cut only at lines indicating the proper size required.

NOTE: On hot water systems leave tee area exposed until initial hot water circulation is complete . Retighten couplings as required to seal.

Step 4 • Fit the two pieces of jacket tee assembly together over exposed fitting. The hole fitting must be on top.

NOTE: Care should be taken when placing the two piece jacket tee assembly over the exposed carrier fitting. Once the jacket tee is in place and is squeezed down, it can not be removed without damage to the sealing caulk.

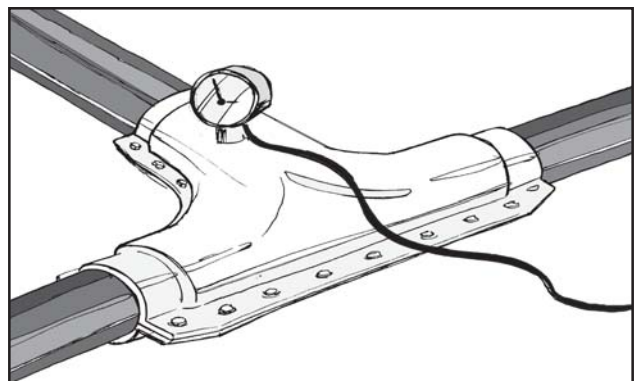


After jacket tee is in place, install the stainless steel nuts and bolts. The caulking material will start to show along the joining lines; this is OK. Tighten bolts in the order shown to pull the halves together evenly. Several rounds of tightening may be necessary to complete the seal.

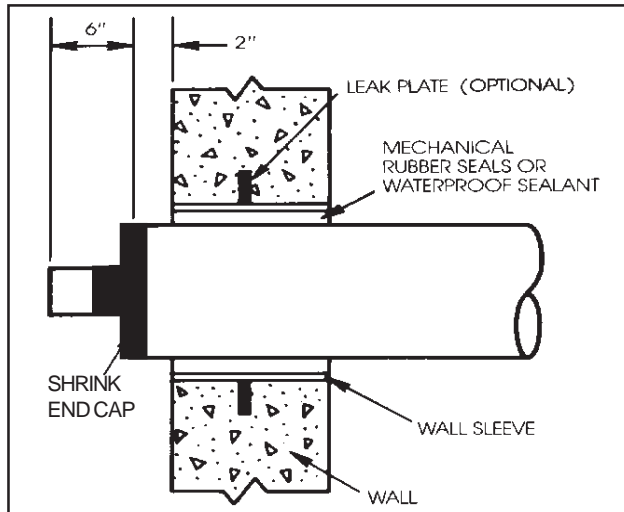
DO NOT over tighten nuts and bolts or jacket tee can crack.

If the jacket tee cracks, it must be removed and replaced.

Step 5 • After completion of the jacket assembly, the fitting must be air tested for tightness. Place testing gauge into threaded hole on jacket tee. Apply 5 psig of air, maintain for 15 minutes. Retighten bolts as required to seal jacket tee and retest.



Step 6 • Mix polyurethane foam as described in Section 6.2 of this manual and pour insulation into hole in jacket tee. Once foam has risen out of hole and is cured, remove excess insulation and install threaded plug and tighten.



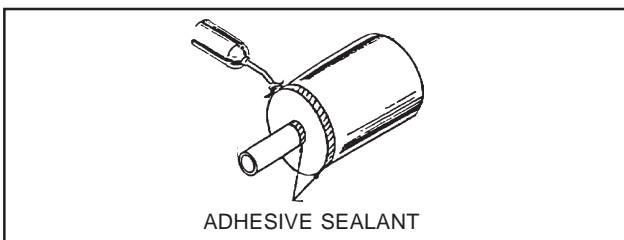
5.4 Building Entries

PERMA-PIPE recommends that all building or manhole entries be sleeved and the annular space between the jacket and sleeve be sealed with a mechanical rubber seal or a waterproof sealant. Seals and sleeves are available from PERMA-PIPE.

5.5 Shrink End Caps

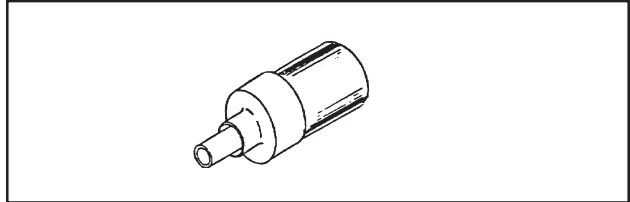
Shrink end caps are required to seal the insulation at the pipe ends.

Step 1 • Abrade the service pipe and heat shrink jacket area to be covered by the end cap. Remove all burrs, rough edges and loose particles with sandpaper or emery cloth. Wipe clean and dry with clean cloth to remove dust.

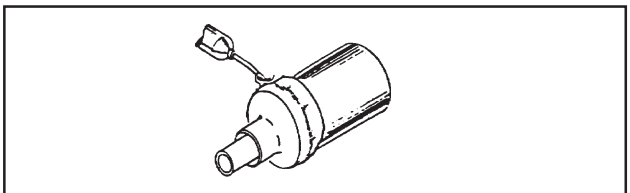


Step 2 • Gently warm jacket end and pipe surface with propane torch using soft orange flame. **DO NOT burn jacket or pipe.**

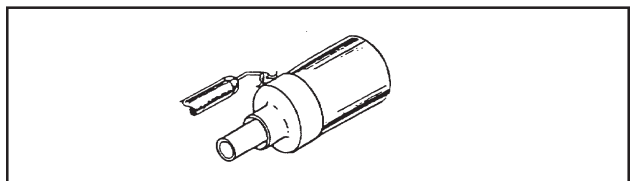
Apply adhesive sealant strip around jacket end and around pipe until it is tight against insulation. Make certain adhesive sealant covers the total circumference. Heat strip gently until it starts to soften.



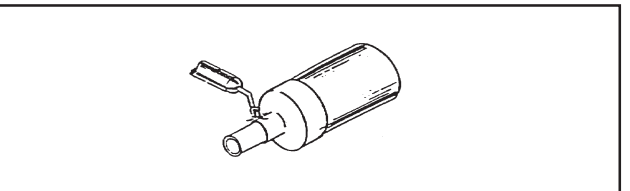
Step 3 • Place the heat shrinkable end cap over the end of the pipe and push it as far as it will go onto the insulation.



Step 4 • Heat the front of the large end of the cap with a small propane or butane torch with the flame angled out toward the casing until it is tight around the pipe casing.



Step 5 • Heat the remainder of the large end until it is uniformly recovered. Ensure that sufficient heat has been applied to bond the adhesive.



Step 6 • Shrink the small end by angling the torch toward the intersection point of the pipe and insulation, then complete by shrinking toward the end of the cap.

6. FIELD JOINT CLOSURE

6.1 Overview.

After completion of the hydrostatic test, each field joint will require a systematic application of insulation and PE sleeve to properly close the joint. The standard PEX-GARD field closure is completed in two parts:

1. Sleeve and Tapecoat Tape application
2. Insulation of the service pipe

6.2 Insulation of the Service Pipe

PERMA-PIPE provides the following materials for insulation of the service pipe at the field joint:

1. Insulation components A and B
2. Jacket sleeve

The customer furnishes:

1. Disposal paper mixing pails
2. Heavy duty gloves
3. Dry rags
4. Safety clothing
5. Stir sticks

• **DO NOT attempt insulating field closures in wet bell holes.** If the bell hole is wet, pump dry before attempting field joint closure.

• Store insulating components A and B in the 60° to 85° range before use. Insulation stored below 60° will not react properly. Insulation stored above 85° may result in spoiling.

• Each day before opening a shipping container of foam components, turn them upside down for about 15 minutes. This ensures that each component is properly mixed prior to being used.

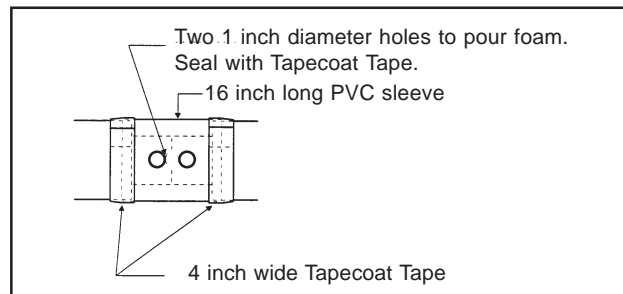
When all tools and materials have been staged, proceed as follows:

- Center the PE sleeve over the joint area.
- Shrink PE sleeve down to pipe jacket.

Seal both circumferential seams with the 4 inch wide Tapecoat Tape (one wrap with the overlap covering the underlap by 4 inches). Ensure tape is smooth and without any air bubbles.

• Drill or cut two 1 inch diameter holes in the top of the sleeve to allow for pouring the

polyurethane foam and the escape of air as the joint cavity is being filled.



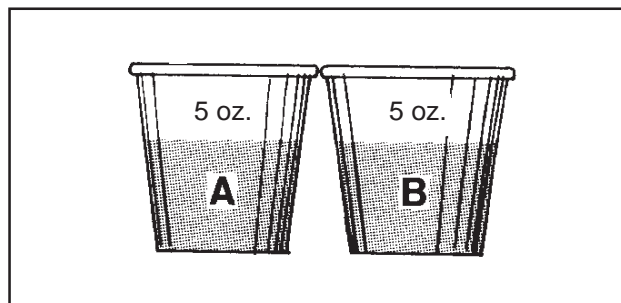
Refer to the following chart for the insulation component amounts.

QUANTITIES OF FOAM PARTS A AND B

NOMINAL PIPE SIZE	OZ. A OZ. B	TOTAL
1	2	4
1.5	3	6
2	4	8
2.5	5	10
3	6	12
4	6	12

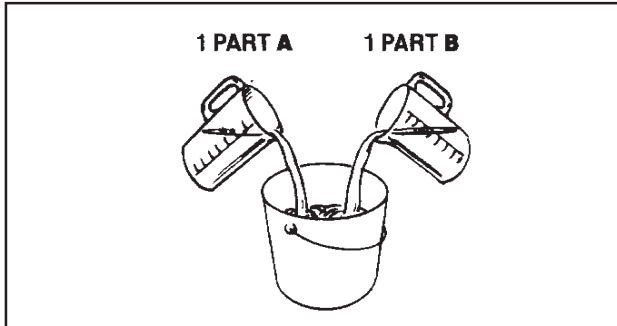
NOTE: Refer to the Material Safety Data Sheets (MSDS) for handling and emergency procedures and for safety precautions and protective equipment requirements.

Use a 1:1 mixing ratio. For example, if the amount given is 5 ounces, the mixture requires 5 ounces of Type A and 5 ounces of Type B. Two containers, each large enough to hold the given quantity, are required. Mark one "A" and the other "B."



DO NOT combine the two mixtures until you are ready to begin insulating the field joint.

Pour the required amount of Type A into a measuring cup. Pour an equal amount of Type B into a second measuring cup. Combine the contents of both measuring cups into a measuring pail.



Immediately begin stirring the mixture. Stir vigorously for about 15 seconds. The insulation will begin rising in 15-30 seconds.

After 15 seconds of stirring, pour the mixture into the joint cavity. The mixture will turn to foam and rise to the top filling the cavity. The excess foam will push out through the top.

If the joint cavity does not fill completely, remix small amounts of foam until it does. Also, adjust the amount of the mixture now needed for the remaining field closures.

After the foam stops rising, cut the excess foam from the top of the jacket.

7. JACKET REPAIRS

Cut completely through unit at 90 degrees. Measure back a dimension equal to a factory-prepared pipe end 6 inches and cut through jacket only. **DO NOT cut inner pipe. DO NOT damage or nick red EVAL diffusion barrier.**

If cracked or damaged, that section of pipe must be removed and a field joint procedure completed.

8. BACKFILL PROCEDURES

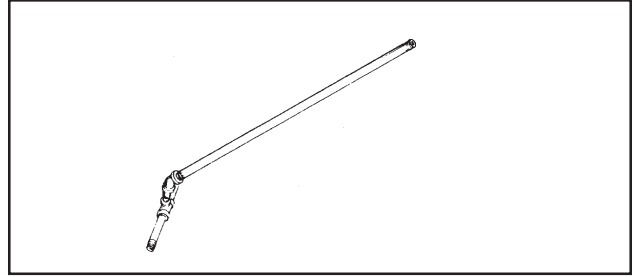
8.1 Materials

The most crucial part of the backfill process is the compaction of soil underneath and alongside the PEX-GARD. A hand tamping device can be constructed easily and economically by joining small diameter pipes. This tool will compact the soil firmly and evenly around the PEX-GARD and should be used instead of mechanical tampers when compacting, to prevent damage to the jacket.

The PEX-GARD jacket is a flexible material capable of withstanding deflections of its geometric shape without structural damage. As the jacket deforms because of surface (live) loads and soil loads, the sides move outward against the soil, developing passive resistance pressure from the soil. This passive soil pressure can be great enough to significantly increase the load-carrying capacity of the PEX-GARD. The extent of this increase is dependent on many conditions, particularly the type of soil and the degree of compaction. If PERMA-PIPE's recommended procedures are followed, a minimum burial depth of 2 feet can be established. It should be noted that shallower burial depths slightly increase heat losses.

Special analysis of minimum burial depths is required at taxiways, runways, railways and other areas of high surface loading conditions. It is recommended that the customer contact both PERMA-PIPE and the local authority for more specific instructions.

8.2 Backfill Description



1. Sand or a sand-gravel mixture in which the gravel is either pea gravel or crushed stone without sharp edges.
2. Particles not larger than a half-inch in diameter.
3. 90% of the soil passing a No. 4 sieve.
4. 90% of the remainder retained by a No. 200 sieve.
5. Separate all unsuitable soil from the backfill soil.

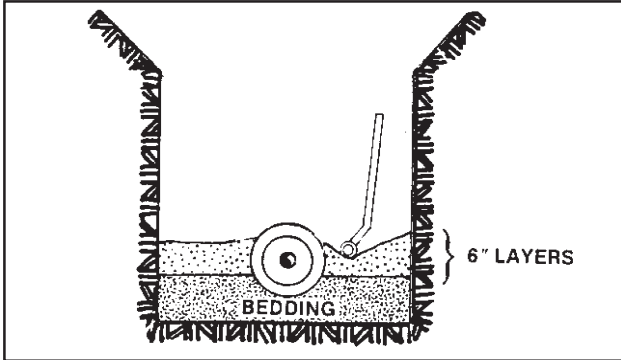
8.3 Initial Backfill

- Prior to backfilling, remove any foreign materials, such as shoring, braces and support blocks.

NOTE: DO NOT use frozen fill, sod, cinders or stones greater than a quarter inch in diameter as primary backfill.

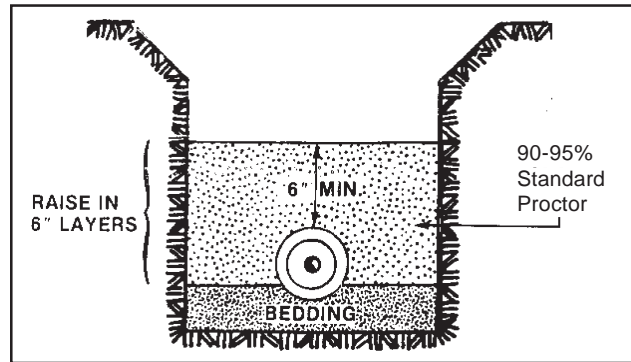
- Carefully compact the area directly around the PEX-GARD in 6 inch layers.
 - Proper compaction of the haunching materials (that section of the embedment extending from the bottom of the pipe to the springline) should be performed to provide soil densities as specified by the design engineer.
 - Primary backfilling of selected earth should be packed and tamped to 6 inches minimum over the top of the jacket.
 - Compact in 6 inch layers at 90-95% standard proctor. If surface loading conditions exist, backfill to grade in this manner.
- NOTE: DO NOT use wheeled or tracked vehicles for tamping.**

8.4 Final Backfill (85%) Compaction



The backfill operation can now be completed by any convenient means. Remainder of backfill should be free of large boulders and rocks larger than 6 inches in diameter, frozen earth or foreign matter.

After placement and compaction of pipe embedment materials, the balance of backfill materials may be machine placed. Provide compaction to required soil densities. Use of mechanical compaction equipment to complete the final backfill is suggested, but, **DO NOT use mechanical compactors until the PEX-GARD is covered with at least 12 inches of firmly compacted soil.**



Under normal conditions, backfill to grade in 1 foot lifts and compact to 85% standard proctor. Native soil can be used, provided it is non-organic and all particles are less than 1 inch in size.

