PERMA-PIPE®

POLY-THERM
Fiberglass Jacketed
Insulated Piping Systems

Installation Manual

ISSUE 1

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POLY-THERM Table of Contents

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.

PREFACE

The consulting engineer has been provided with information on what to expect from a PERMA-PIPE POLY-THERM system once it is installed. However, the true operating success of the system is greatly dependent upon proper installation. PERMA-PIPE is committed to supporting the proper installation of a complete and high-quality piping system. This support includes clear and concise installation recommendations and expert field technical assistance.

The objective of this manual is to aid the installer on recommended installation procedures of a POLY-THERM piping system. This booklet contains information on all aspects of the installation process, from initial receiving and storage through final backfill.

The manual has been divided into sections, one section for each phase of the installation process. Each section contains an explanation and illustrations on proper installation procedures.

By following these step by step instructions, the installing contractor should achieve a successful installation.

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 your project engineer or your PERMA-PIPE field technical representative.

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 is completed and accepted by the appropriate authority.

1.0 INTRODUCTION

POLY-THERM is a versatile fluid transportation system for low-temperature service up to 250°F. Application flexibility is achieved through PERMA-PIPE's integrated engineered system design utilizing state-of-the-art CAD technology.

The POLY-THERM system has been designed with the installer in mind. POLY-THERM arrives at the project site partially assembled. In-plant fabrication means less field work and fewer complications. This significantly reduces the installation cost while maintaining the integrity of the system. The features that make POLY-THERM unique extend beyond the product itself. An expert project design staff tailors each system to meet the needs of the customer. Also, an experienced technical service staff is available to provide assistance that will assure a quick and smooth installation.

A series of factors contribute to a reliable, high quality piping system, such as design, construction, delivery, installation and testing, with stringent quality control procedures applied at every step. The importance of proper installation practices for any piping system and adherance to this procedure, in particular, cannot be overstated. When installed according to the recommended practices presented in this manual and from PERMA-PIPE technical service, POLY-THERM will provide excellent service, meeting or exceeding expectations.

2.0 SCOPE AND APPLICATION

The scope of this procedure is limited to POLY-THERM piping systems.

This procedure applies to the customer-designated contractor who will perform the installation. A factory-trained, experienced field installation instructor will be present at critical periods during the installation, when required by the specifications, and/or where the furnishing of such service is included as a part of the customer's purchase order.

Trouble-free, efficient operation will result from close cooperation between the installing contractor 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 installing contractor.

3.0 EQUIPMENT AND MATERIAL

3.01 Equipment and Materials.

In order to install POLY-THERM, PERMA-PIPE has furnished the following:

1. Pipe assemblies, fittings, accessories
2. Field joint closure materials (see Sections **7.02** and **7.03**)

Installing contractor must furnish the following:

1. Crane and excavation equipment
2. Welding equipment
3. Saws, grinders and wire brushes
4. Additional material as required per Sections **7.02** and **7.03**.

3.02 Receiving, Handling and Storage.

3.02.1 Receiving.

The piping was inspected and loaded with 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. Part Drawing Layout (PDL)
  2. X-Ray Film (if applicable)
  3. Packing slip
  4. Bill of Lading
  5. MSDS Sheets

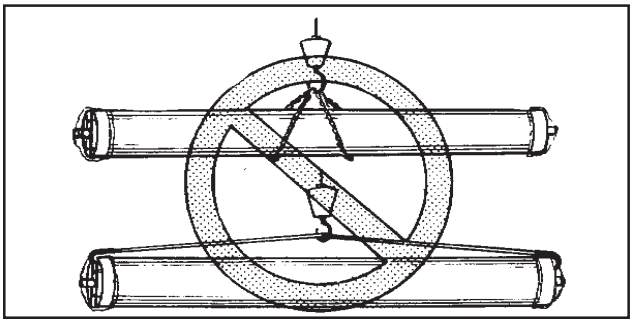
NOTE: Material Safety Data Sheets (MSDS) for each of the components described in this manual should be reviewed for safety precautions and protective equipment requirements.

- 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 field representative of these claims if assistance is required. PERMA-PIPE terms are F.O.B. our 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. If replacement material is needed, contact a PERMA-PIPE sales representative.

3.02.2 Material Handling.

The means by which POLY-THERM is unloaded and handled in the field is the decision and responsibility of the receiver. PERMA-PIPE's urethane polymer jacket is designed to resist corrosion and is strong enough to withstand heavy soil loads and system pressures. The jacket is 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:

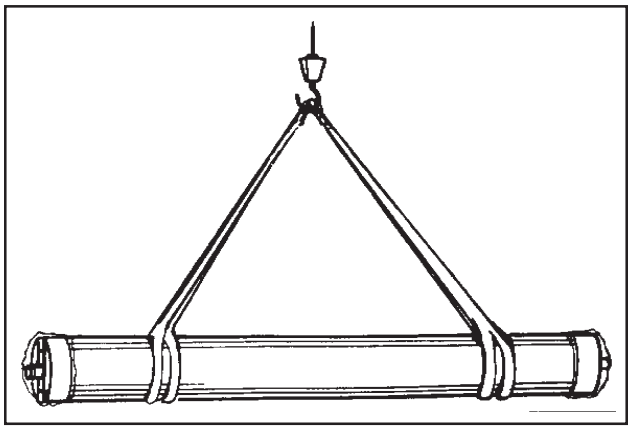
- Support each assembly with nylon slings during all phases of handling. The nylon slings prevent severe scratching and/or chipping of the outer coating. Nylon slings are provided free of charge by PERMA-PIPE.
- **DO NOT use hooks, steel cables or chains for handling POLY-THERM assemblies.**



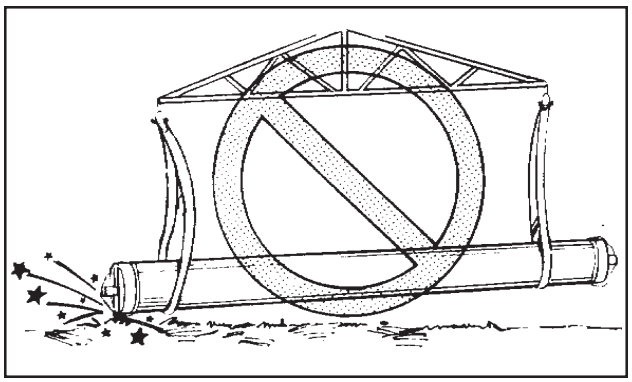
• Use two slings where possible. The use of two slings provides much more control of the pipe movement. A 40-foot section of pipe suspended by a single line is extremely likely to swing out of control. This greatly increases the chances of personal injury and/or damage to the pipe from contact with the truck, nearby buildings and equipment.

• Use a spreader bar, if available, for maximum control of the pipe assemblies during handling.

• If a spreader bar is not available, choke the slings together as shown. Space the slings about 20 feet apart. Again, a spreader bar is recommended.



• **DO NOT drop the POLY-THERM assemblies or strike them against hard surfaces at any time.**



• If an accident occurs, inspect the jacket for damages. Repair if necessary (see Section **8.02**).

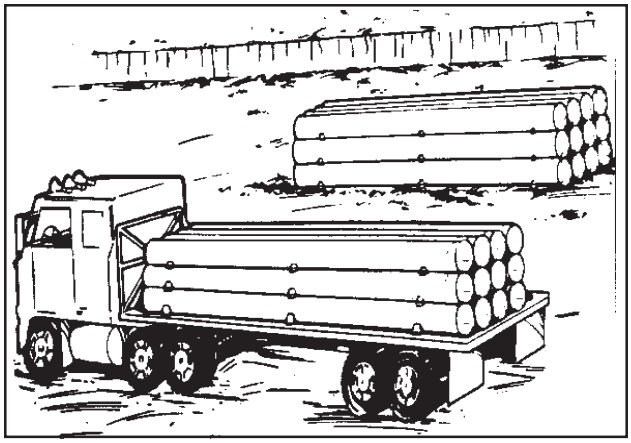
3.02.3 Pipe Storage.

POLY-THERM assemblies can deteriorate and sustain damage if not stored properly. Proper storage of the product is the responsibility of the receiver. The following procedures are suggested to minimize problems:

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

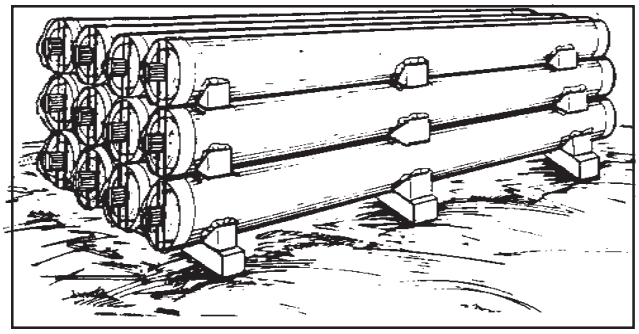
• POLY-THERM can be stored during the winter months (or for prolonged periods of time) with minimal special handling.

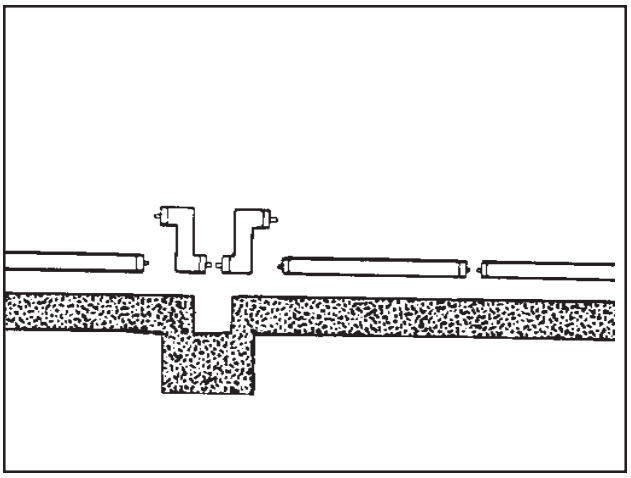
• When stacking the POLY-THERM for storage, stack it in the same fashion that it was received.



• Wooden shipping braces must be used as runners between the layers of pipe. PERMA-PIPE recommends stacking pipe no more than three tiers high.

• Use foam or other padding between layers.





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

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

4.0 PREPARATION AND SET UP

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

PERMA-PIPE recommends that only qualified personnel perform all steps of the installation procedure. Any deviation must be approved by PERMA-PIPE's field service representative.

Proper implements, tools and equipment should be used for placement of the pipe in the trench to prevent damage. In no case should pipe or accessories be dropped into the trench. Additional handling and joining procedures are covered elsewhere in this manual. Pipe laying generally should commence at the lowest elevation and terminate at manholes, services branches or clean outs. Use the Pipe Drawing Layout to place the assemblies in correct order.

5.0 EXCAVATION

5.01 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. Usually, the centerline dimensions for the placement of the pipe in the trench can be found in the drawings.

POLY-THERM is designed to handle normal soil and H-20 loading. If PERMA-PIPE's recommended procedures are followed, a minimum burial depth is required at taxiways, runways, railroads 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 burial instructions.

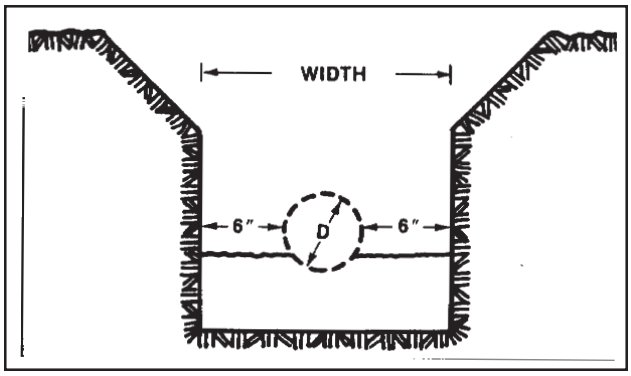
The trench floor should be completely cleared of stones and rocks and covered with a 4-inch compacted bedding. The bedding soil should correspond with the soil description.

During excavation, an unstable soil condition 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.

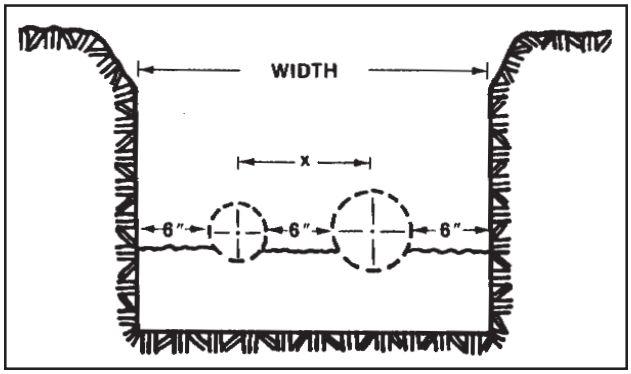
Organic soils or plastic clays and silts with high liquid limits may be encountered that are incapable of supporting the pipe. Remove the poor soil and replace it with the proper bedding soil to a depth that will provide a firm stable foundation.

The minimum recommended trench width for single pipe is 12 inches plus the diameter of the conduit.

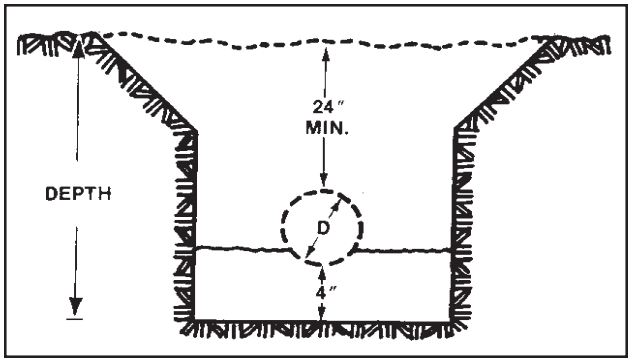


For multi-pipe installations, centerline dimensions can usually be found in the drawings.

If the centerline dimensions are not specified in the drawings, PERMA-PIPE recommends computing the width of a multi-pipe trench by adding 6 inches to the combined radii of each pair of pipes (value X in the figure below) and, then, adding another 12 inches and the combined radii of the two outermost pipes to allow for clearance.



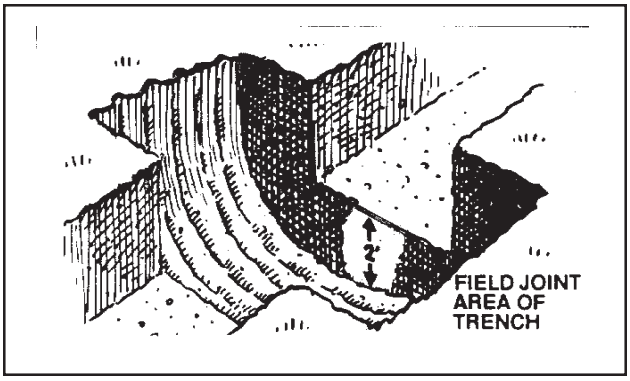
The total trench depth should allow for a 4-inch bedding, the conduit diameter and a minimum 24 inches cover depth above the conduit. See contract drawings for specific pipe burial depths. For depths less than 24 inches, contact PERMA-PIPE.



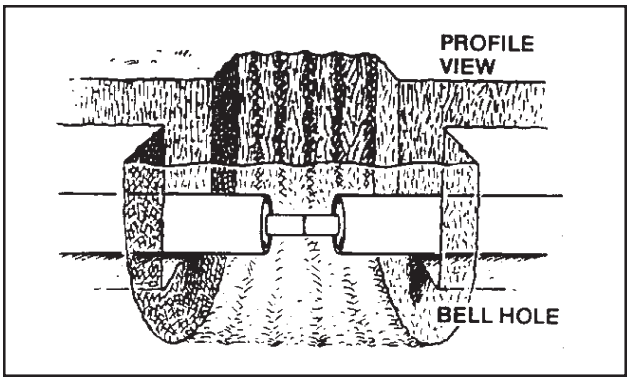
A minimum bedding of 4 inches must be raked uniformly along the entire length of the run. The bed of the run must be graded to a minimum slope of 1 inch per 40 feet. The bedding material should conform with the recommendations in the **Backfill** section of this manual (see Section **9.0**).

5.02 Bell Holes.

Digging bell holes at field joint locations allows room for welding, field joint closure and testing. Field joint locations are marked on the part drawing layout (PDL). A common way to dig bell holes is to cut across the trench with a backhoe:



• Cut into the side of the trench and 1½ to 2 feet below the system grade.

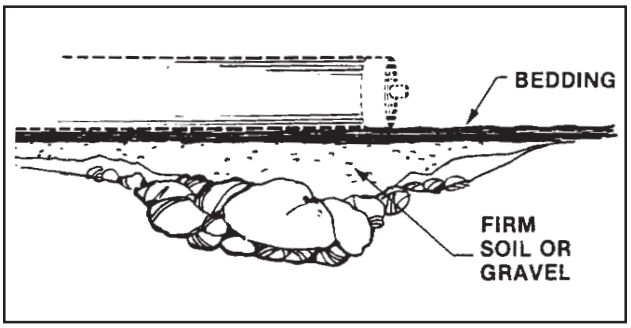


• Dig the bell holes before lowering POLY-THERM into the trench.

5.03 Special Trench Conditions.

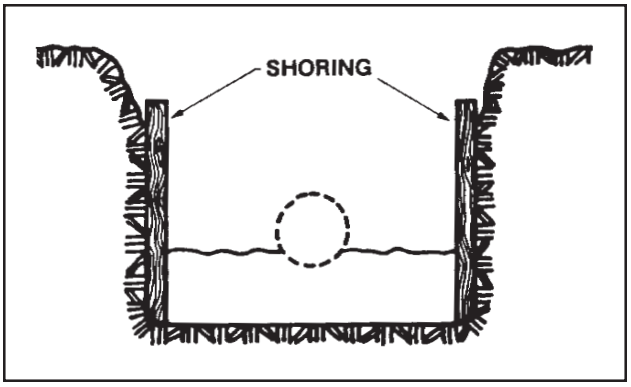
5.03.1 Rock Bottom Trench.

• A rocky or uneven trench foundation should be covered with a firm soil or gravel before bedding is constructed.



5.03.2 Unstable Soil.

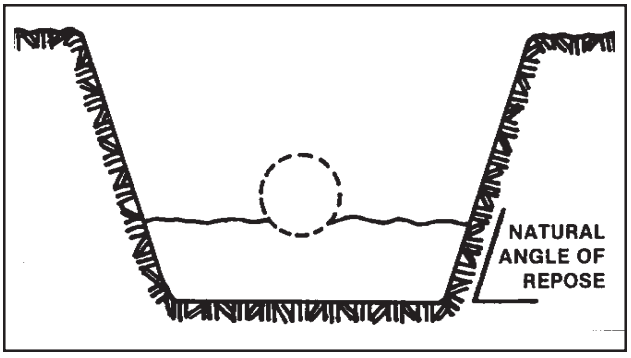
• When trenching in unstable soil, **DO NOT lay any POLY-THERM until the trench walls are stabilized with staybracing or shoring.**



• Replace and compact the soil as the shoring is removed.

5.03.3 Granular Soil.

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



5.03.4 Over-excavation.

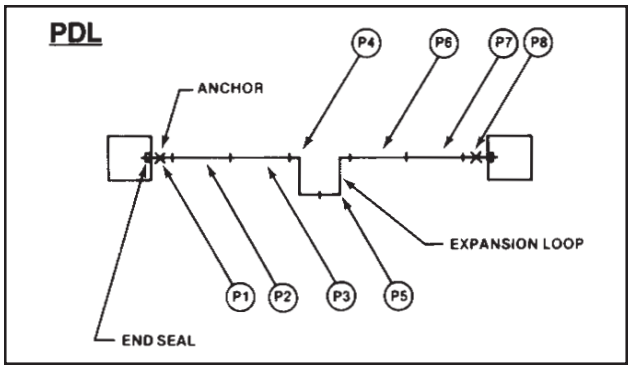
• Any accidental over-excavation should be filled with bedding material and compacted to 90-95% modified proctor.

6.0 POLY-THERM ASSEMBLY

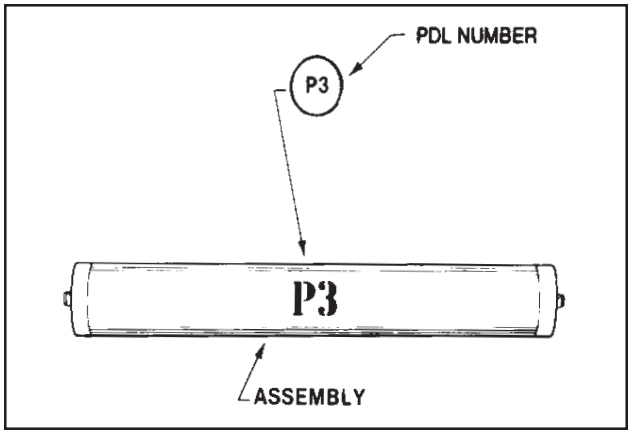
NOTE: When installing pipe in ambient temperatures below 60°F, contact your PERMA-PIPE field representative for special cold weather procedures.

6.01 Layout.

After trench excavation is complete and installation of the pipe is to start, the POLY-THERM assemblies should be distributed along the trench top. Installation can be simplified by laying the assemblies in order along the trench according to the part-drawing layout (PDL).



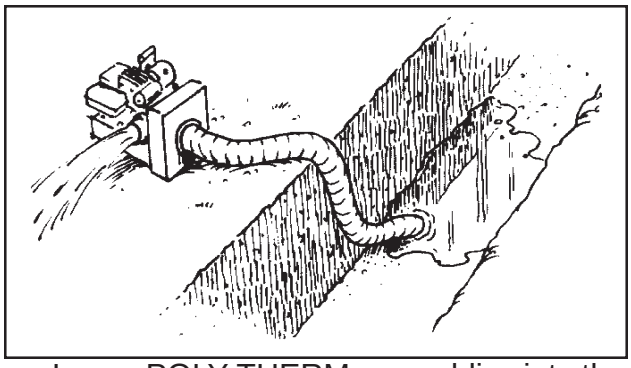
The part-drawing layout shows the location for each POLY-THERM assembly. Each assembly is marked with a number matching the number on the PDL drawing.



Laying assemblies in order next to the trench will simplify installation.

6.02 Lowering of the Piping.

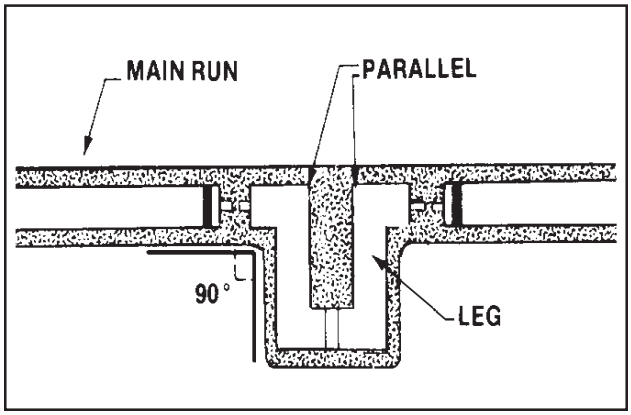
• Remove free-standing water in the bell hole and trench before lowering assemblies. Bell holes and bedding must be dry during pipe assembly installation.



• Lower POLY-THERM assemblies into the trench. **DO NOT drop piping.**

6.03 Pipe Connections.

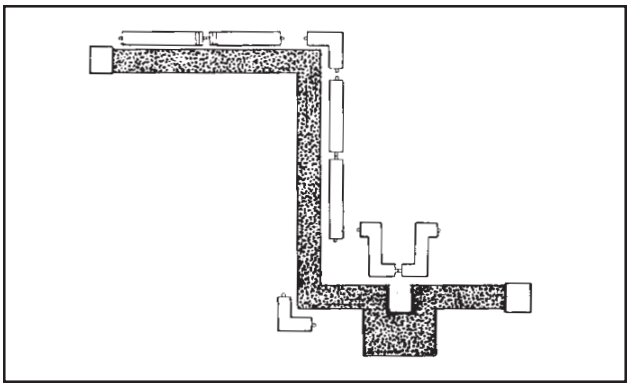
• Before continuing, verify the legs of the expansion loops are perpendicular to the rest of the run and parallel to each other. If the legs of the loop are not positioned correctly, it will affect the length of the run.



6.04 Welding Procedure.

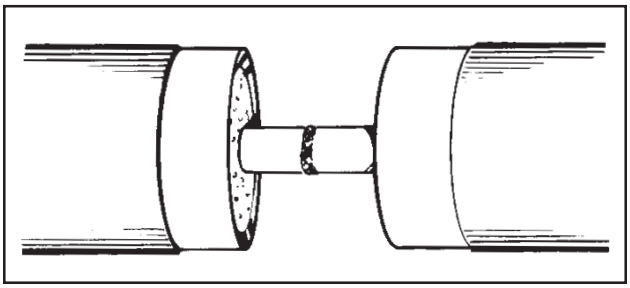
If sufficient lowering equipment is available, it may be easier to complete some field joints outside the trench.

NOTE: Joining sections of pipe outside of the trench may result in the need for two cranes to lower the joined piping into the trench. Joining more than two 40' sections in this manner is **NOT** recommended. **DO NOT allow the piping to bow.**



Otherwise, proceed as follows:

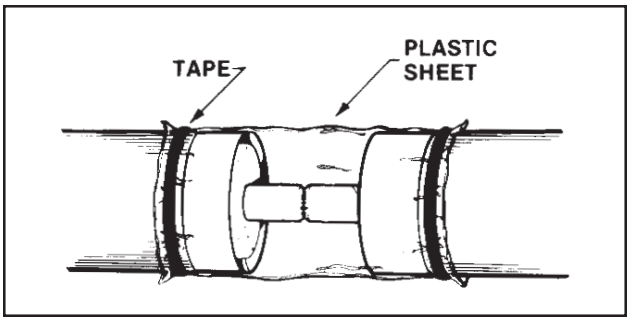
- Butt weld steel pipe joints. Solder or braze copper pipe joints, according to approved procedures specified in the contract documents.



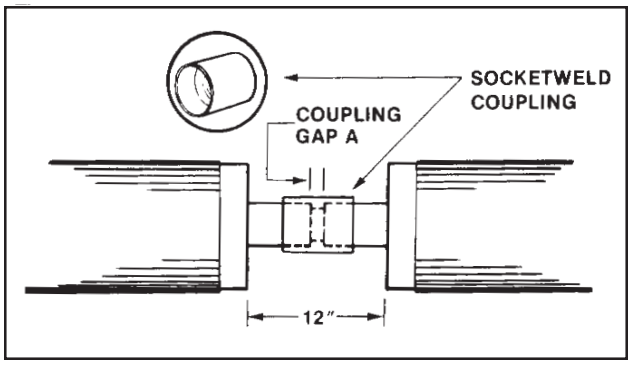
NOTE: When service pipe is FRP, PVC or ductile iron, follow the service pipe manufacturer's recommended connection instructions which will be supplied by PERMA-PIPE in addition to this manual.

- Inspect welded joint for damage. Repair if necessary.
- Weld/join all straight assembly joints.
- Weld/join all expansion loop joints.

NOTE: If field joint closures are not completed immediately after the carrier pipe connections, use a temporary covering such as plastic sheeting and seal it with tape to keep moisture and dirt out of the assembly.



For 2-inch diameter and smaller steel pipe, socketweld couplings (provided by installing contractor) are required at the joints.



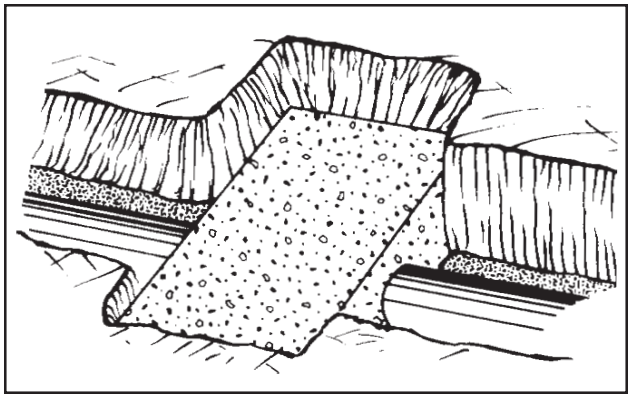
Refer to Table A for required coupling gap (gap A) between carrier pipes.

TABLE A
SOCKETWELD COUPLING GAP (INCHES)

Nom. Pipe Size	Gap A	Nom. Pipe Size	Gap A
1/4"	1/4"	1"	1/2"
3/8"	1/4"	1-1/4"	1/2"
1/2"	3/8"	1-1/2"	1/2"
3/4"	3/8"	2"	3/4"

6.05 Concrete Anchor Blocks.

Poured concrete is the preferred method of anchoring the POLY-THERM assemblies.



• Pour concrete anchor blocks at each anchor point detailed in the PDL.

• The following are the recommended dimensions for concrete anchor blocks:

Single pipe trench

Length: 30”

Height: Nominal Casing Size + 14”

Width: Same as height

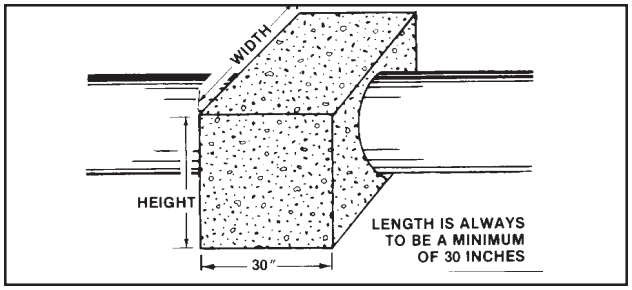
Nominal Casing Size: Outer diameter of the POLY-THERM assembly in inches

Multiple pipe trench

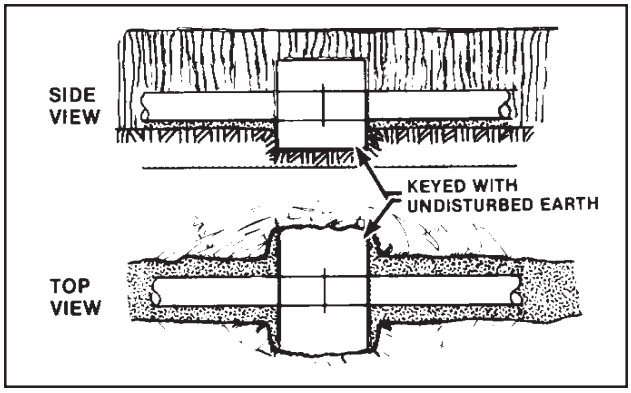
Height: Largest nominal casing size + 14”

Width: For each additional pipe, add its nominal casing size + 6”

• Length of each anchor block will always be a minimum of 30 inches.



• Pour the concrete anchor through the bedding material into undisturbed earth in the base foundation or trench walls.



6.06 Hydrostatic Test of Carrier Pipe.

• After the carrier pipes are welded together, connect test caps at the ends of the pipe run. Pipe test caps are provided by others.

• Set all valves so the entire line can be tested.

• Completely fill the pipe with water.

• Vent all air from the carrier pipe.

• Bring the hydrostatic pressure up to 1½ times the operating pressure, unless otherwise stated by the pipe line specifications.

• Maintain the pressure for a minimum of two hours, allowing for temperature changes, unless otherwise stated by the pipe line specifications.

• Any faulty welds must be repaired and retested.

7.0 FIELD JOINT CLOSURE

7.01 Overview.

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

1. Insulation of the carrier pipe
2. Application of the shrink sleeve.

7.02 Insulation of the Carrier Pipe.

NOTE: Tenting and heating may be required in cool ambient temperatures to ensure proper foaming of joints.

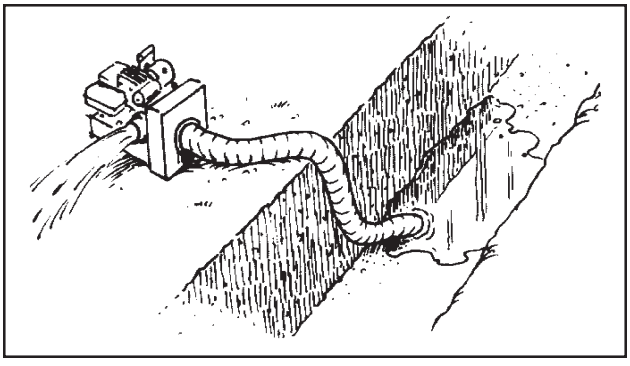
PERMA-PIPE provides the following materials for insulation of the carrier pipe at the field joint:

1. Insulation components A and B
2. Metal mold

The customer furnishes:

1. Disposal paper mixing pails
2. Heavy duty gloves
3. Dry rags
4. Banding wire or rope
5. Mold release
6. Safety clothing
7. Tin snips
8. Wood rasp
9. Stir sticks

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



NOTE: Insulation components A and B must be stored in the 60°F to 85°F range before use. Insulation stored below 60°F will not react properly. Insulation stored above 85°F may result in spoiling. The metal molds provided by PERMA-PIPE can be used for insulating at least 10 field joints given proper maintenance.

When all tools and materials are staged, proceed as follows:

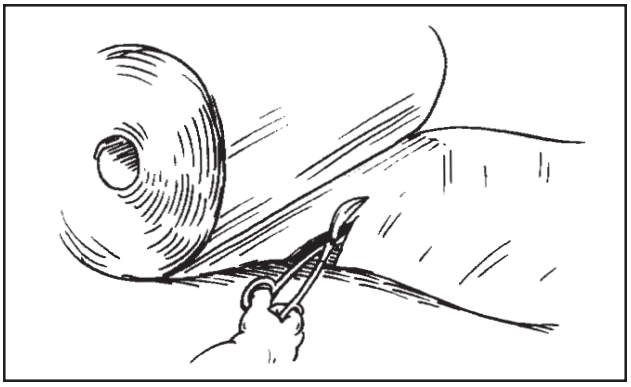
Cut the metal mold form material to the correct length from the bulk roll. Measure and cut, using tin snips, the metal mold material to a length (L) equal to 1¼ times the circumference of the containment sleeve.

Example: 10-3/4" Dia. Pipe

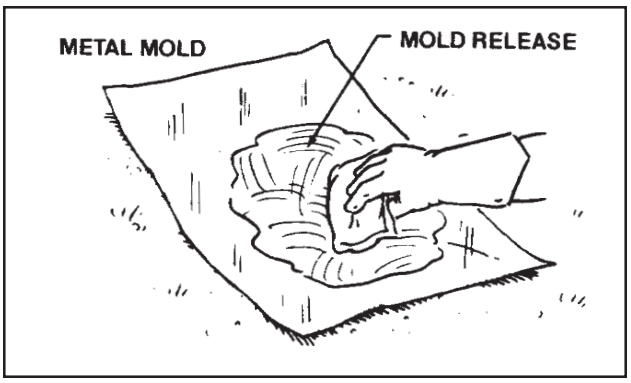
where: $C = \Pi \times Dia.$

$L = 1.25 \times C$

$L = 1.25 \times 3.14 \times 10.75" = 42"$

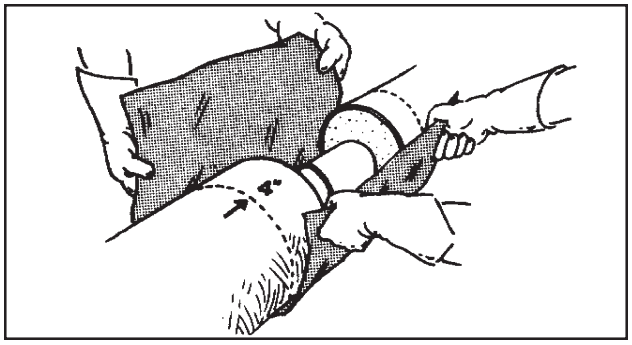


Prior to each use, coat the mold with a mold release. This is commonly found in fiberglass supply houses. Non-stick coating sprays, such as PAM™, can also be used. The entire inside surface of the mold must be coated. Insulation may stick to uncoated

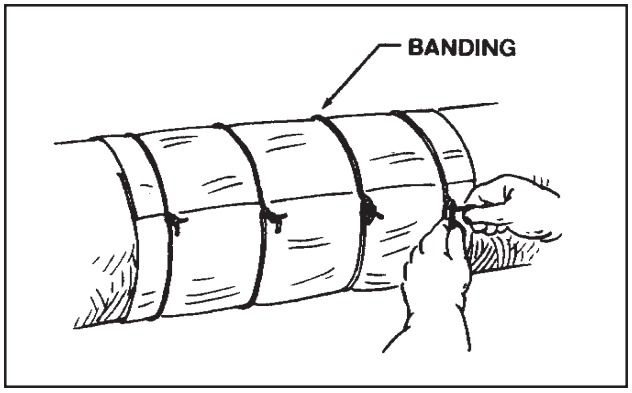


portions of the mold and cause damage to both the insulation and the mold when the mold is removed from the joint.

Wrap the mold material around the pipe. Center it around the field joint so that the mold extends 4 inches past each edge.

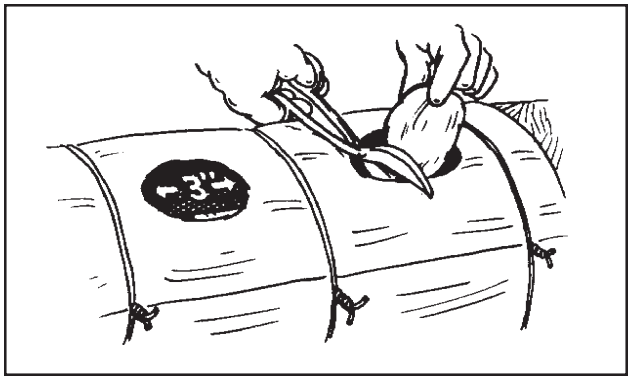


Tie a wire or rope band around the mold 2 inches from each edge. Use two more bands in the middle, evenly spacing all four.



NOTE: It is important to fasten the mold tightly around the field joint. Gaps between the mold and the urethane polymer jacket will allow some of the rising insulation to escape. This could result in an incomplete pour and require mixing another small batch of insulation.

Using tin snips, cut three holes in the top of the mold between the banding. Make each hole about 3 inches in diameter.



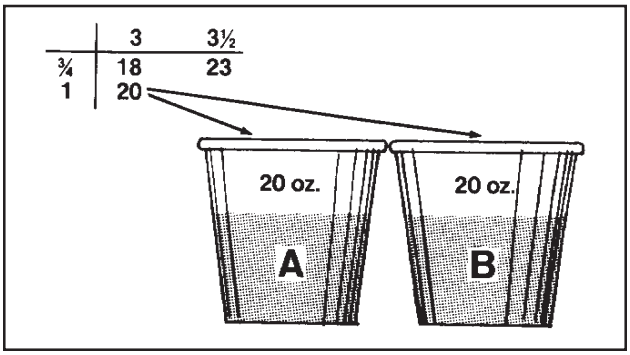
NOTE: Each day before opening a shipping container of foam components, turn them upside down for about 15 minutes. This ensures that each component is properly mixed prior to being used.

Refer to Table B for the insulation component amounts.

TABLE B
INSULATION QUANTITIES (OZ) PER COMPONENT

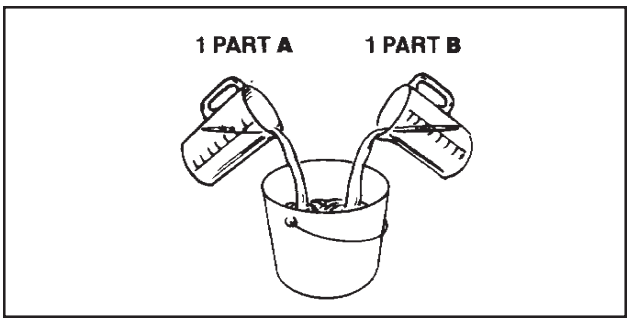
NOMINAL PIPE SIZE	INSULATION SIZE (in)		
	1	1-½	2
3	4	6	9
4	4	7	10
5	5	8	12
6	6	9	13
8	8	12	16
10	9	14	19
12	11	16	22
14	12	18	24
16	13	20	27
18	15	22	30
20	16	24	33
22	18	27	36
24	19	29	39
26	20	31	42
28	22	33	45
30	23	36	48
32	25	38	51
34	27	40	54
36	29	43	57

Use a 1:1 mixing ratio. For example, if the amount given is 20 ounces, the mixture requires 20 ounces of Type A and 20 ounces of Type B. Two containers, each large enough to hold the given quantity, are required. Mark one of the containers “A” and the other “B.”

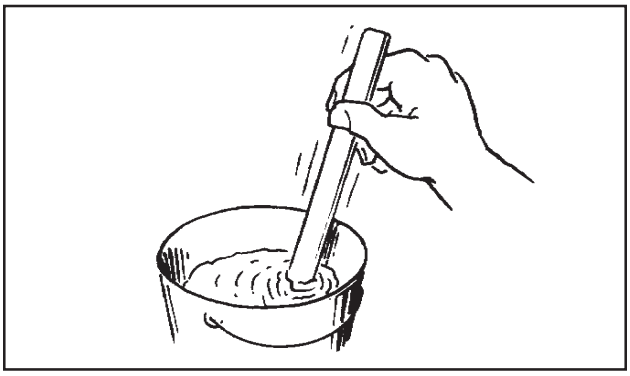


DO NOT combine the two mixtures until you are ready to begin insulating the field joint.

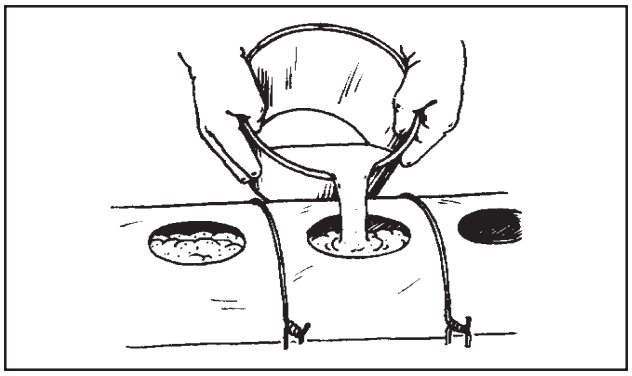
Pour the required amount of Type A into a measuring cup. Pour an equal amount of Type B into a second measuring cup. Combine the contents of both measuring cups into a mixing pail.



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

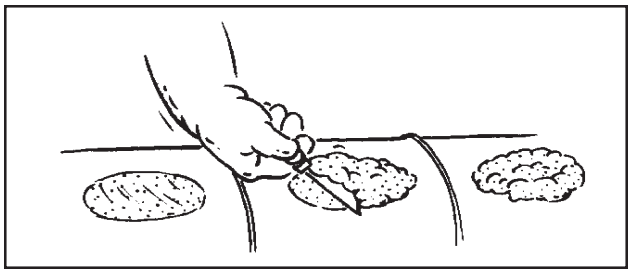


After 15 seconds of stirring, pour the mixture into the three holes at the top of the mold. The mixture will turn to foam and rise to the top filling the entire mold. The excess foam will push out through the top holes.



If the mold 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.

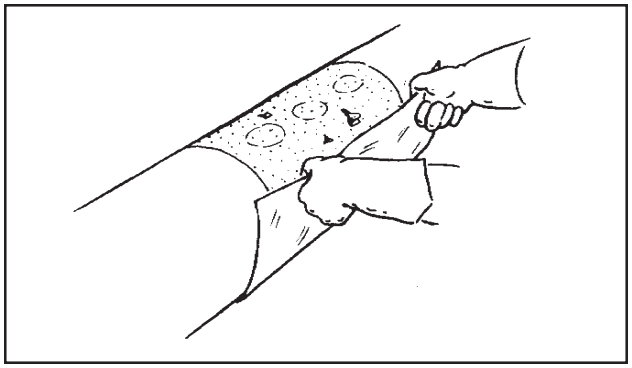
After the foam stops rising, cut the excess foam from the top of the mold.



Let the mold cool for about 10 minutes after the foam rises out of the top holes.

Discard the paper mixing pail.

Remove the banding and carefully peel the mold off the insulation. Tearing the mold off may rip the insulation and require a repair procedure.

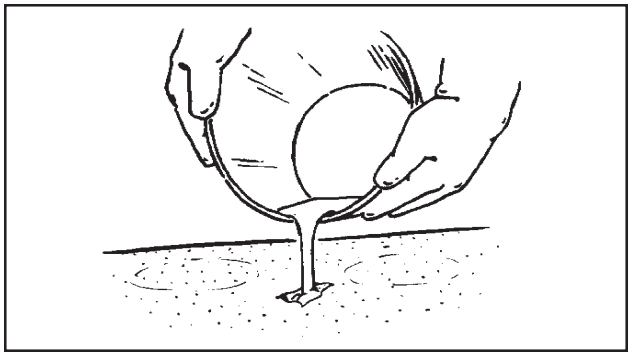


NOTE: The mold will be extremely hot. After removing the banding, peel the mold carefully off the insulation. If this is not done with care, the mold and the insulation will probably get damaged. If the mold sticks repeatedly, use additional mold

release on the mold for the next pour.

After each use, clean the inside of the mold with denatured alcohol or a similar cleaning solvent to remove any dirt or insulation.

Patch any voids in the surface of the insulation by mixing another small batch of foam. As soon as it begins to rise in the



container, apply to the void areas.

NOTE: If the shrink sleeve application is not completed immediately after insulating, plastic sheeting should be sealed around the field joint. If any of the insulation in the field joint or pre-insulated assembly becomes wet it must be removed and replaced. Water contaminated insulation cannot be dried out. This may require replacement of the entire assembly at the customer's expense.

7.03 Application of the Shrink Sleeve.

The POLY-THERM system shrink sleeve offers a superb method of providing complete protection at field joint closures with a minimum amount of labor. The shrink sleeve simultaneously forms a seal in two ways. The recovery (shrinking) of the sleeve is due to the heat that it absorbs. As the sleeve recovers, an adhesive sealant softens and forms a bond with the conduit insulation. The effectiveness of the seal is dependent upon how well these processes are completed.

NOTE: Before the start of shrink sleeve installation, review the following:

- When using the torch, the flame should be kept at least 6 inches away from the shrink sleeve and at an angle to the surface. Holding the torch at an angle allows the flame to bounce off the sleeve and decreases the local intensity of the heat. If the flame is held too close to the surface, the material will burn and the sleeve may tear around the burned areas.
- Stay within the chalk guidelines when wrapping to shrink the sleeve uniformly.
- When wrapping the shrink sleeve, leave a gap of approximately 1 inch between the sleeve and the bottom of the conduit. This gives the sleeve room to shrink properly. If the sleeve is wrapped snugly without a gap, it may pull apart or tear during heating.
- After wrapping the shrink sleeve, the closure tape should be preheated for about 5 seconds. **DO NOT overheat the lap because will soften too much.** Apply the closure tape directly over the seam of the overlap and press down firmly. **DO NOT try to smooth the patch out.**
- Use your body as a shield to protect the flame from the wind. Keep the torch at an angle to the sleeve and pointed in the direction the wind is blowing to maintain a fairly even flame. **DO NOT increase the size of the flame**--this could overheat the shrink sleeve.

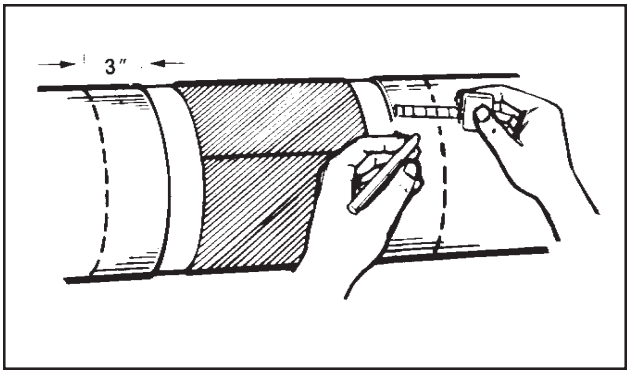
PERMA-PIPE provides the shrink sleeve material. In order to heat the sleeve correctly, the proper propane equipment must be used, and PERMA-PIPE provides the necessary propane torch head, as well. The LP tank, hose fittings, unions, valve regulators, hand roller and gloves are provided by the installing contractor. If the installer supplies the propane torch head, it must be approved by PERMA-PIPE or meet the following specifications:

1. Heavy-duty hose for LP torch use
2. High capacity flame nozzle. For applications on outside diameters less than 18 inches, the minimum torch size is 150,000 BTU/hr. For applications on outside diameters greater than 18 inches, the mini-

mum torch size is 300,000 BTU/hr.

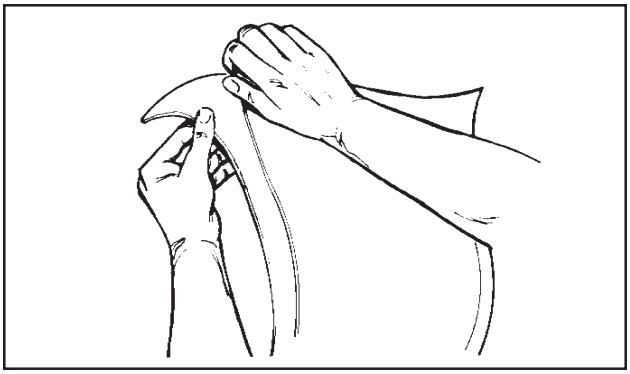
When all tools and materials have been staged, proceed as follows:

- Wipe off the field joint area.
- With a measuring tape, chalk mark a guideline on the coating 3 inches from each



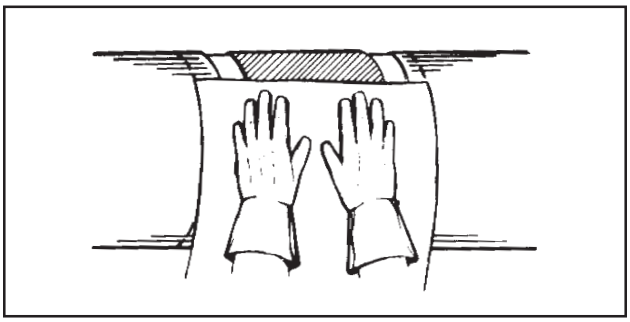
edge of the coating.

- Identify the correct sleeve size by the conduit size label on the backing material. One edge will measure 24 inches. Hold this starting edge up and remove the first 6-10



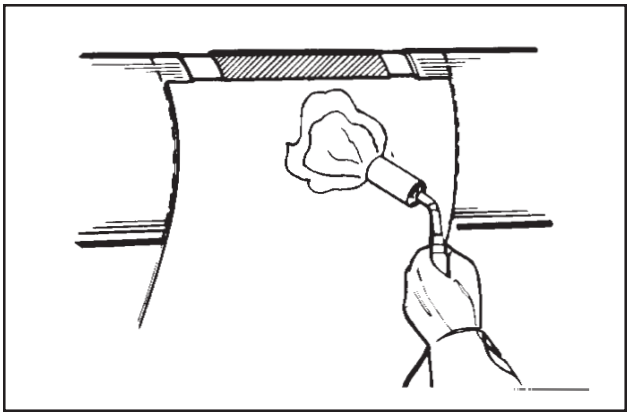
inches of backing material.

- Continue to hold the shrink sleeve right-side up. Press the top edge into place just below the top of the conduit so that the



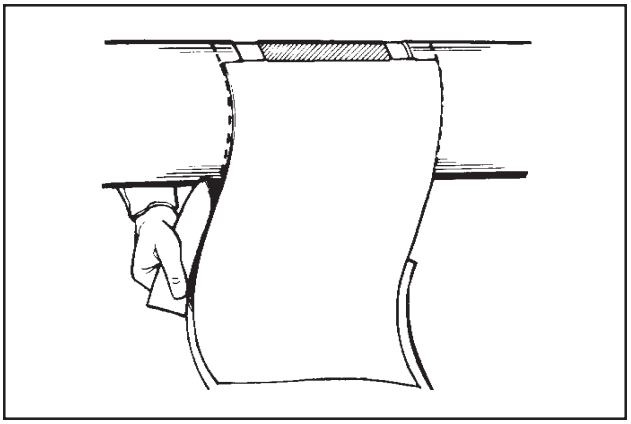
sleeve is centered between the chalk lines.

- Heat the top 2 inches of the sleeve with the torch until it becomes soft and adheres to the conduit insulation. Only use the torch provided or an approved substitute. Keep the torch in constant motion. **DO NOT burn**



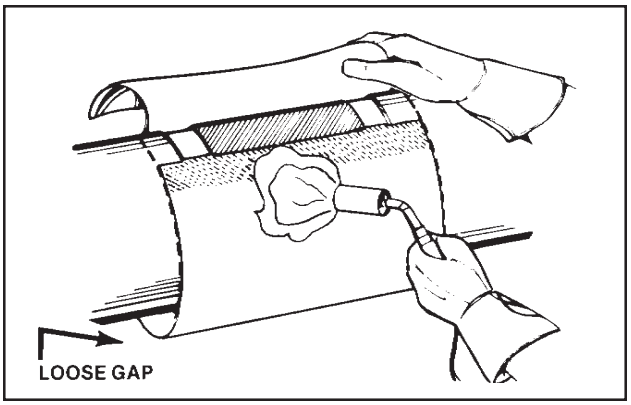
the surface.

- Pull the remaining backing material off

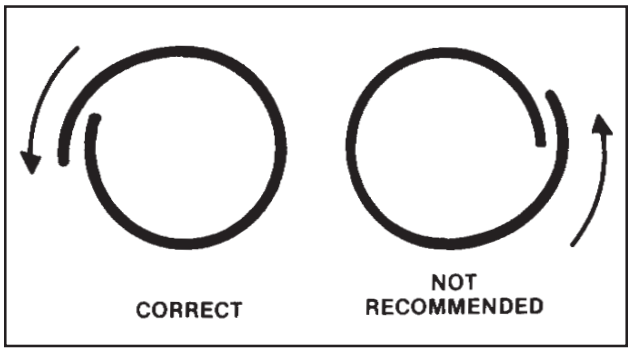


as the sleeve is wrapped around the joint.

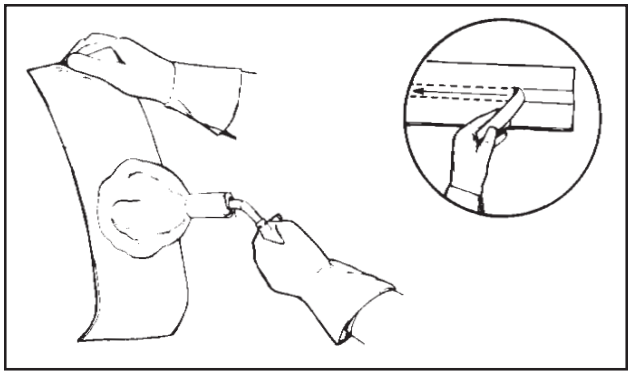
- Wrap the sleeve around the conduit so the lower portion hangs about 1 inch from the bottom of the conduit. Stay within the chalk guidelines. Reheat the top 2 inches of



the sleeve before overlapping. Keep the torch in constant motion. **DO NOT burn the surface.**

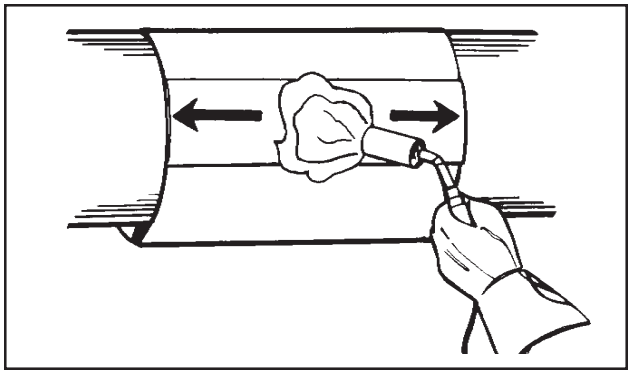


- Be sure to overlap downward.
- Peel the back strip off the closure tape.
- Preheat the tape until it becomes limp.

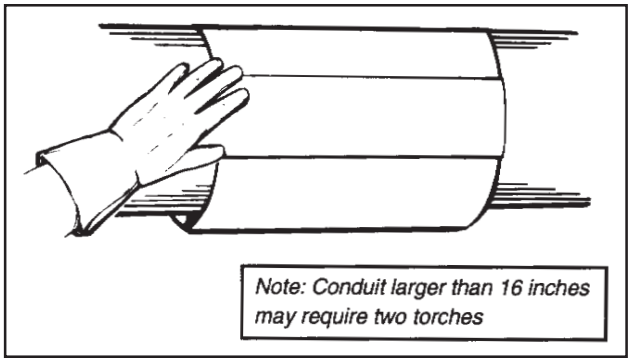


DO NOT heat longer than 5 seconds.

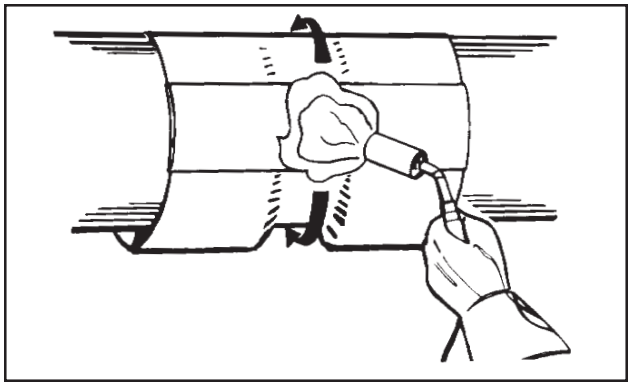
- Apply the tape across the seam made by the overlap. The sticky back strip should be face down.
- Heat the closure tape with a torch until it sticks to the rest of the sleeve. Keep the torch in constant motion. **DO NOT burn the surface.**



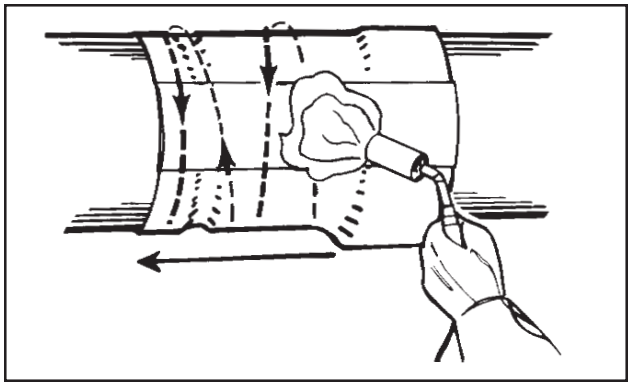
- Pat the tape down to achieve a good bond. Wear hot gloves while performing this operation.



- Heat the <u>center</u> section of the sleeve all the way around until it shrinks. Keep the torch in constant motion. **DO NOT burn the surface.**

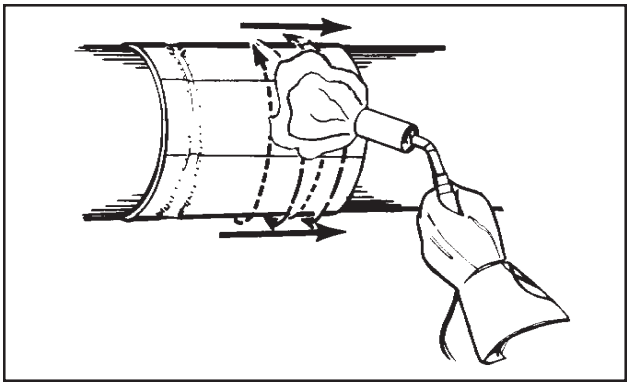


- When the center of the sleeve has shrunk, begin to move the torch with an up-and-down spiral motion around the sleeve



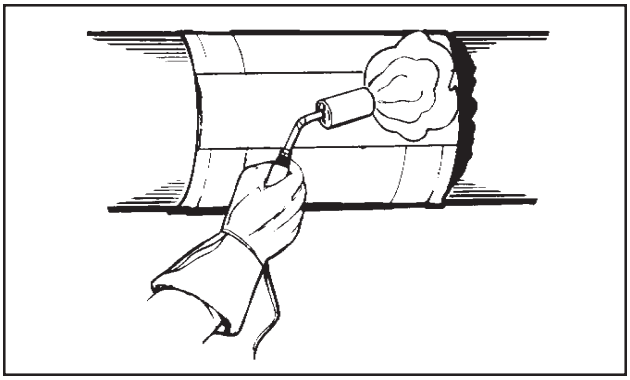
toward the left edge.

• When the left side has shrunk, heat the right side in the same up-and-down spiral manner. Keep the torch in constant motion.



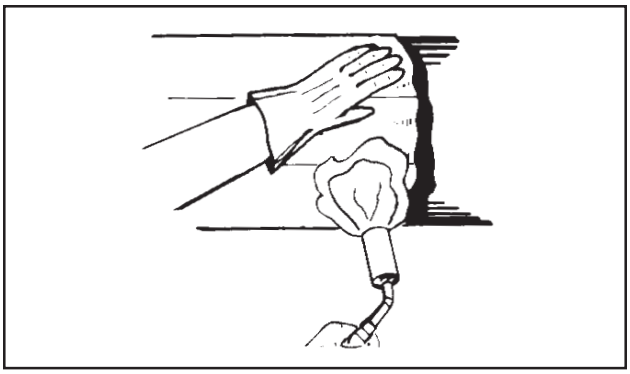
DO NOT burn the surface.

• Reduce the flame slightly and shrink the edges of the sleeve onto the conduit. Black adhesive escaping at the edges indicates a



good bond.

• If the sleeve edge raises up, reheat and press down firmly. Keep the torch in con-



stant motion. **DO NOT burn the surface.**

• While the sleeve is still hot and soft, use a hand roller to gently roll the sleeve surface and push any trapped air up and out of the sleeve. Reheat, if necessary.

7.04 Expansion Pad Installation.

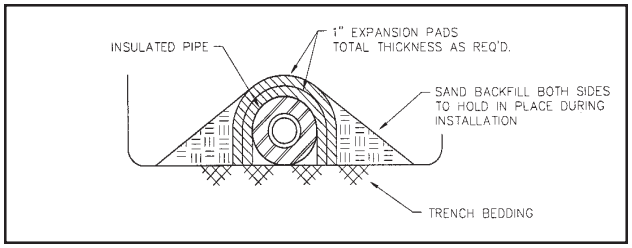
Some elbows in the piping system will require the installation of expansion pads to allow for expansion of the carrier pipe due to change in fluid temperature. Expansion padding is available from PERMA-PIPE.

For systems designed by PERMA-PIPE, refer to engineering drawings to ascertain the exact measurement, padding thickness and necessary location for the required expansion pads.

If no drawings have been provided, expansion pad requirements can be calculated using the following steps:

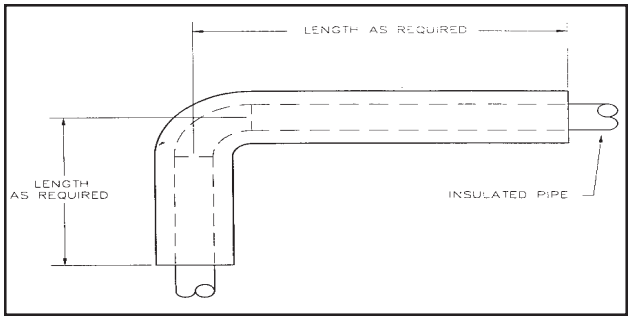
• Cut the expansion pad material to the rectangular dimensions required by the piping application:

1. Determine width from the measured circumference of the conduit. The expansion pad must cover the top and sides of the



conduit as shown.

2. Determine length of the expansion pad from the length of the run entering the



elbow joint.

3. Determine expansion pad total thickness required by calculating the expansion of the carrier pipe.

• Consult the PERMA-PIPE field representative to resolve problems with expansion pad calculation.

8.0 ALTERATIONS AND REPAIRS

8.01 Alterations.

All field modifications to the POLY-THERM system must be cleared with PERMA-PIPE. Changing the length or direction of the system may result in a faulty installation, requiring costly repairs in the future.

Every installation should have field verification of the submittal drawings. This will eliminate most dimension problems and will also allow PERMA-PIPE engineers time to modify the system design, if needed.

Even with field verification, there will occasionally be an installation that does not run true to plan. If additional materials are required, the PERMA-PIPE field representative should be contacted immediately.

If it is necessary to lengthen or shorten a run, the field representative will specify where to make the modifications. The position of the modification will depend on the nature and location of the problem.

The PERMA-PIPE field representative must also be contacted before altering the direction of a run.

8.02 Fiberglass Jacket Repair.

The piping jacket requires repair if insulation is exposed or the jacket has been chipped or penetrated. Consult your PERMA-PIPE field representative, and perform the following repair procedure, if necessary:

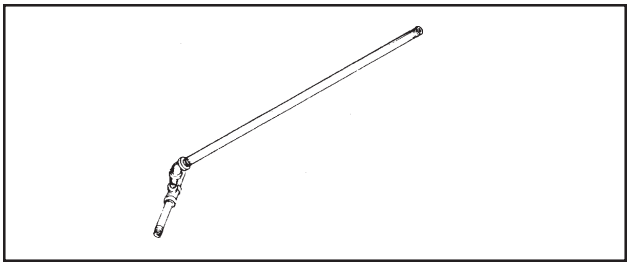
- Mark a line 3 inches on either side of the damaged area. Measure the distance between the two lines.
- Mark a line lengthwise on one of the spare shrink sleeves, equal to the required width as determined in the previous step.
- Cut the shrink sleeve along the line.
- Press the top edge into place just below the top of the assembly so that the area to be repaired is in the center of the shrink sleeve. Follow the heating instructions for shrink sleeve application (Section **7.03**).

NOTE: The shrink sleeve must cover the damaged area and extend 360° around the pipe with overlap.

9.0 BACKFILL PROCEDURES

9.01 Materials.

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



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.

9.02 Backfill Description.

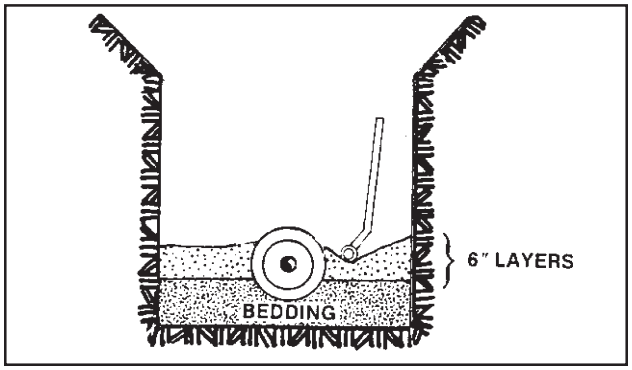
1. Sand or a sand-gravel mixture in which the gravel is either pea gravel or crushed stone without sharp edges.
2. Particles not larger than a half-inch in diameter.
3. 90% of the soil passing a No. 4 sieve.
4. 90% of the remainder retained by a No. 200 sieve.
5. Separate all unsuitable soil from the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

9.03 Initial Backfill.

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

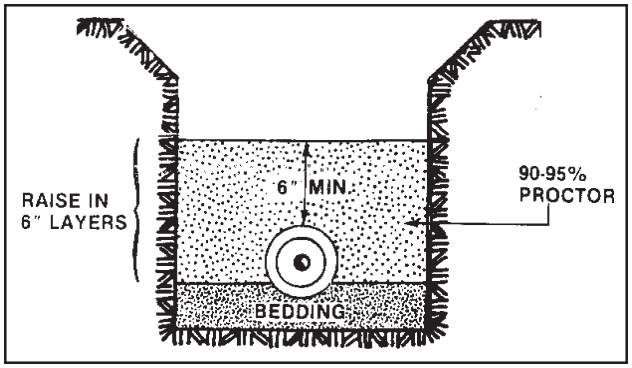
NOTE: DO NOT use frozen fill, sod, cinders or stones greater than a quarter inch in diameter as primary backfill.

• Carefully compact the area directly around the conduit 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.



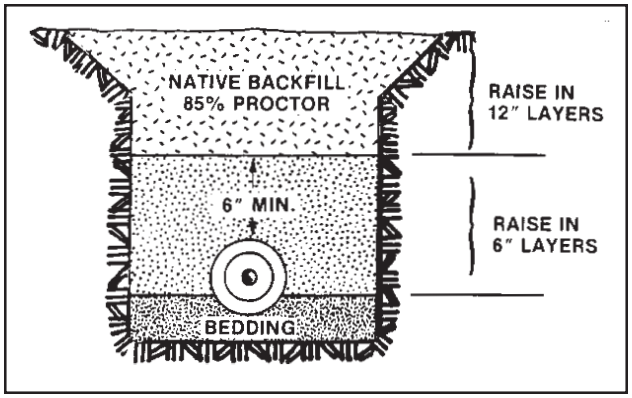
• Compact in 6 inch layers to 90-95% proctor. If surface loading conditions exist, backfill to grade in this manner.

NOTE: DO NOT use wheeled or tracked vehicles for tamping.

9.04 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 conduit 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% proctor. Native soil can be used, provided it is non-organic and all particles are less than 1 inch in size.