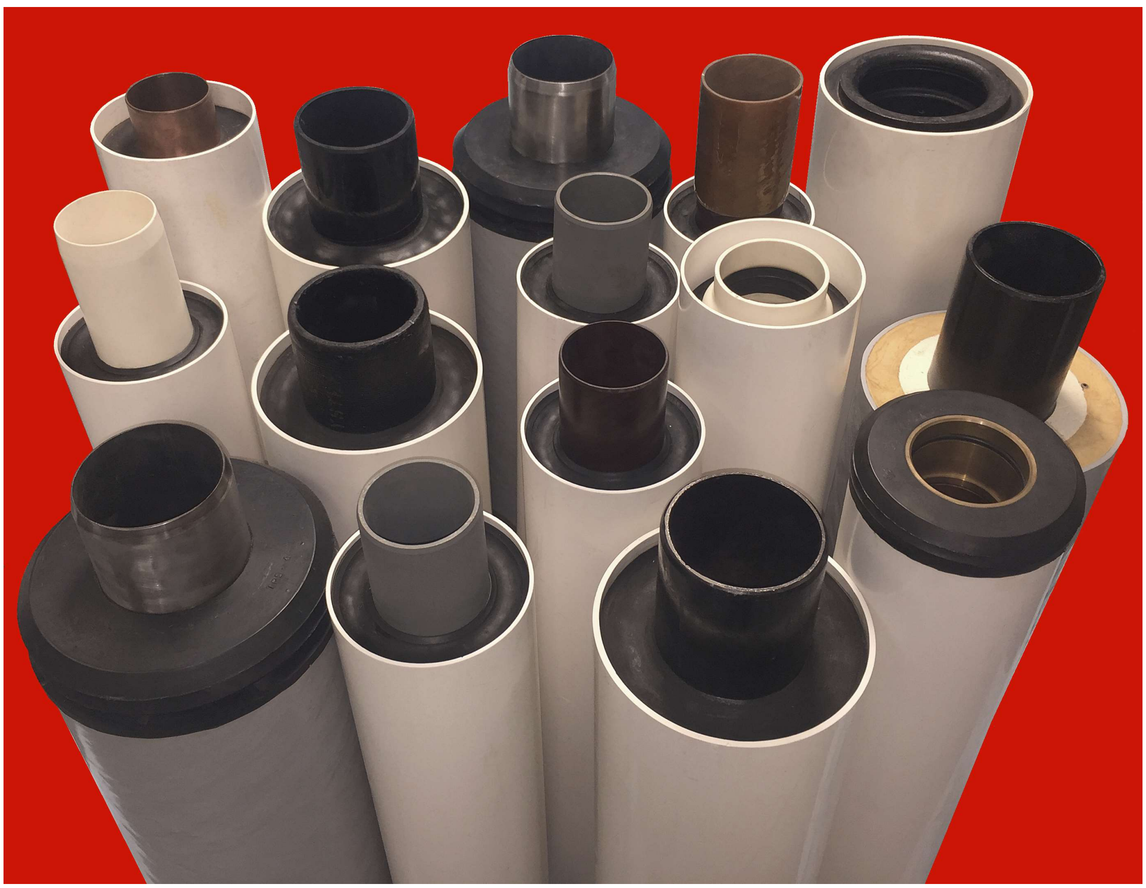
Thermal Pipe Systems, Inc.

Product Catalog

visit www.thermalpipesystems.com



Thermal Pipe Systems Product Line Offering

Thermal Pipe Systems has a full product line offering solutions engineered to meet your specific requirements. We offer our unique Water Spread Limiting and mechanical push-on connections for steam, hot water and chilled water service. FRP, PVC and HDPE casings are tailored to each service and offer excellent resistance to external corrosion. These products provide a modular system that avoids systemic failures from a localized event, integrated expansion provisions and significantly reduced installation time and cost.

Applications Include:

Steam
Condensate
High Temperature Hot Water
Hot Water
Chilled Water
Glycol
Geothermal
Cryogenics

Customized Solutions

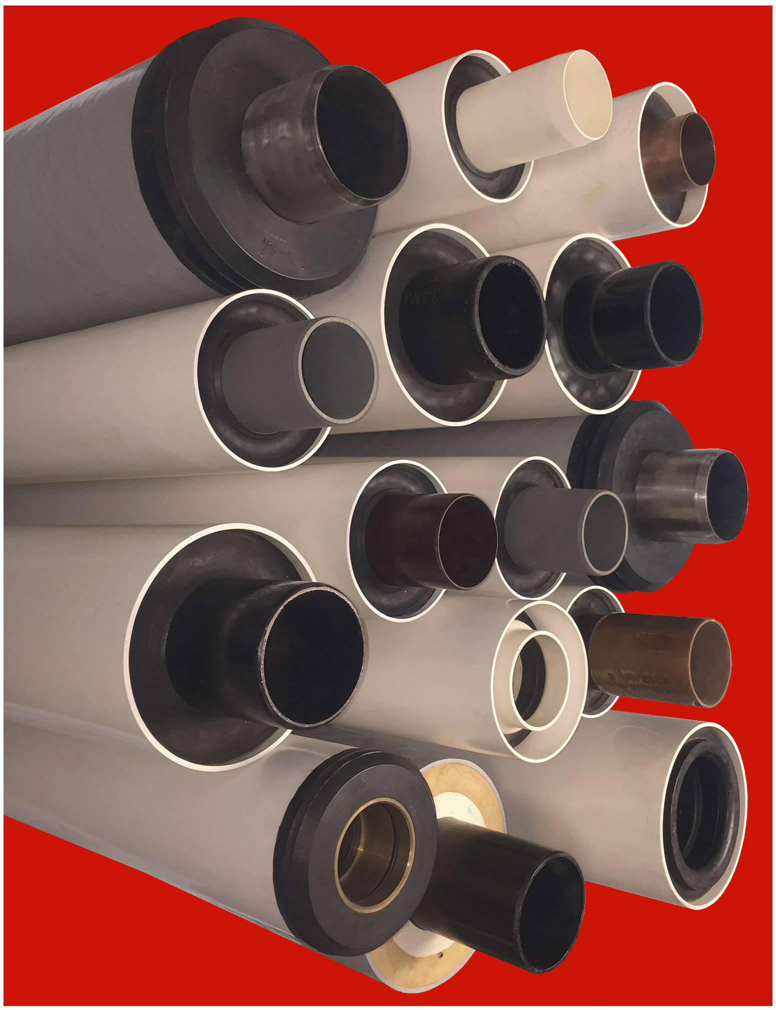
The items shown in this catalog are Thermal Pipe Systems, Inc. standard products. Other casing and carrier pipe sizes, casing and carrier pipe material, casing and insulation thicknesses, and various joining methods are available to meet your projects needs. Please consult with your nearest Manufacturers Representative for more information.

Contents – Products

Thermal Pipe Systems, Inc.

PRE-INSULATED UNDERGROUND PIPING

FOR HEATING AND COOLING SYSTEMS



40 years of proven performance.

Unique push joints …

- *reduce installation cost*
- *eliminate expansion loops*
- *lower energy and operational costs*

Complete line of carrier pipes:

- *ductile iron*
- *steel*
- *copper*
- *PVC*
- *FRP*

Insulation:

- *polyurethane*
- *calcium silicate*
- *Foamglas®*
- *mineral wool*

Casings:

- *PVC*
- *FRP*
- *HDPE*

National Representation:

- *Regional Managers*
- *Independent Sales Agency Network*
- *Technical Services*

REPRESENTED BY:

Thermal Pipe Systems, Inc.

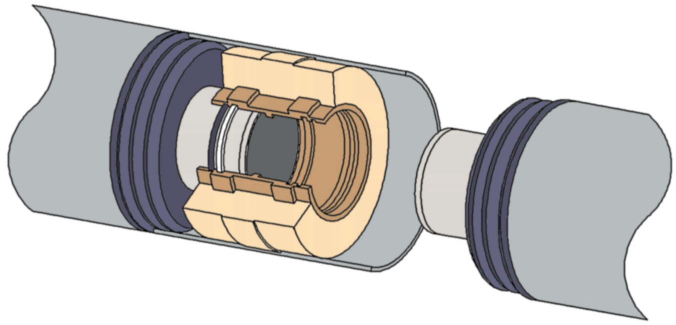
5205 W. Woodmill Dr. Suite 33 – Wilmington, DE 19808

Tel: 302-999-1588 – Fax: 302-999-8861

website: www.thermalpipesystems.com

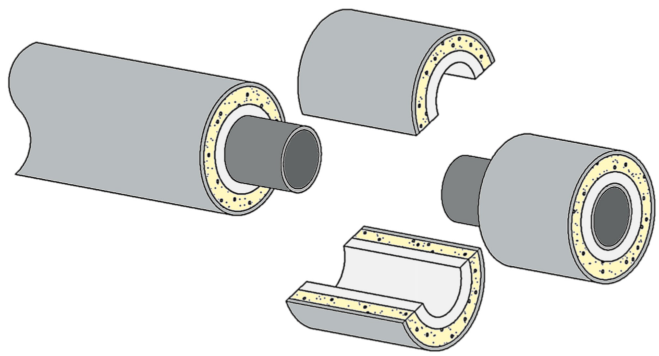
SUPER TEMP-TITE .... *For high pressure steam (up to 250 psi & 400ºF)*

Super Temp-Tite is the most advanced steam transfer system available today. It combines steel pipe with calcium silicate and polyurethane insulation inside a corrosion resistant fiberglass casing. A unique slip-joint provides quick and easy installation and a “built-in” expansion system. The “thermofoam” insulation increases energy saving over conventional systems. Super Temp-Tite meets Federal Guide Specifications for steam and is supplied in sizes 3”, 4”, 6”, 8”, 10” and 12” for use in temperatures up to 400ºF and 250 psi.



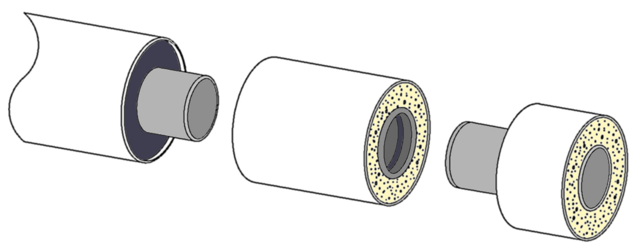
SUPER WELD-TITE .... *For high temperature hot water, steam, and condensate*

Super Weld-Tite is dual insulated, welded pipe system for high temperature hot water, steam, and condensate. Steel pipe and fittings are insulated with combination of calcium silicate or Foamglas® and polyurethane insulation inside a corrosion resistant fiberglass casing. Insulation of field joints is accomplished with half shells with FRP casing and FRP overwrap kits. Super Weld-Tite is supplied in sizes 1½” - 16” and is suitable for temperatures up to 450ºF.

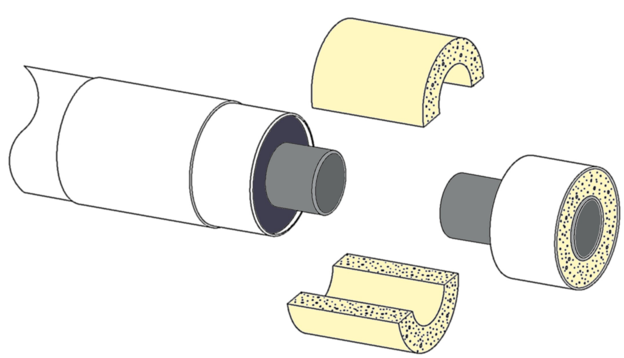


HEAT-TITE & WELD-TITE .... *For condensate & low temperature hot water*

Heat-Tite pipe features a gasketed coupling with built in expansion control. It is a pre-insulated steel pipe designed for use in condensate, low temperature hot water, and chilled water application. The system is insulated with polyurethane foam in a tough PVC or HDPE jacket. It is joined with a grooved iron coupling with rubber sealing rings. The coupling is pre-insulated to save installation time. Heat-Tite meets Federal Guide Specifications for condensate and hot water and is supplied in sizes 1½”–12” for use in temperatures to 250ºF.

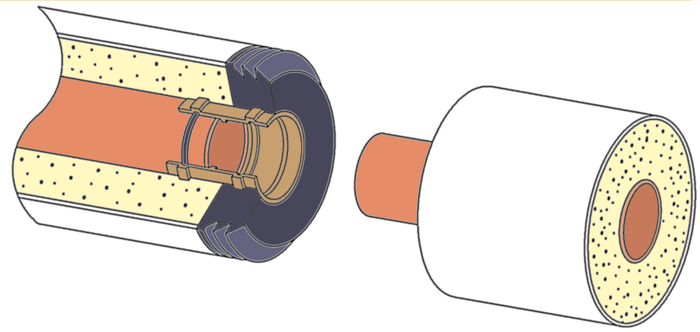


Weld-Tite is a similar product to use where welded pipe joint is desired. A slip over casing sleeve and insulation half shells are supplied. Weld-Tite is available in sizes 1½” – 24”.



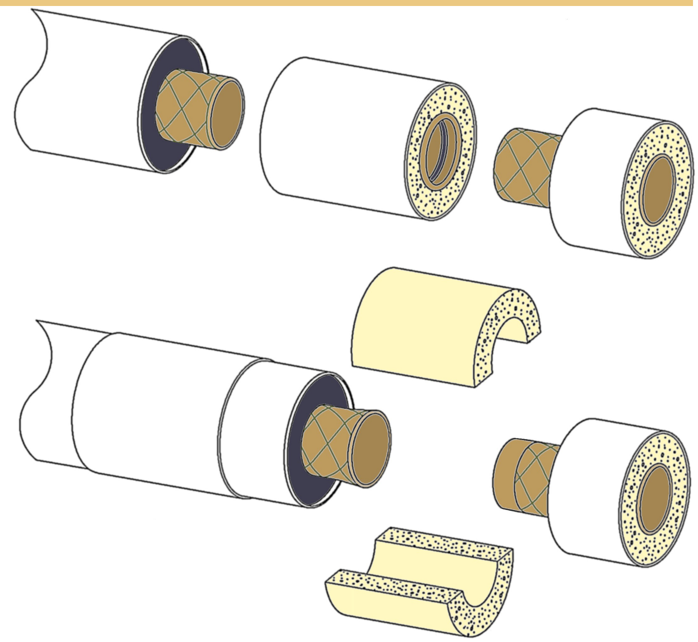
COPPER-CORE .... *For domestic & heating hot water systems*

Copper-Core is a pre-insulated copper pipe designed for chilled water and low temperature hot water service. Insulation is polyurethane foam in a PVC or HDPE casing. The pipe has a unique factory prepared one-step rubber ring joining system which results in a fast, efficient fully insulated installation. Copper-Core is supplied in sizes 1"-6" for temperatures from 35ºF to 250ºF.



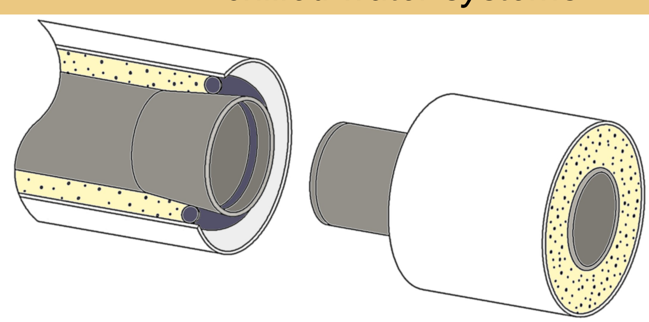
VEE-TITE 230 & TAPER-TITE 230……... *High flow, corrosion free service for condensate & low temperature hot water*

These fiberglass reinforced resin pipes are ideally suited for steam condensate return lines and other hot water heating applications. Fiberglass, with high flow characteristics, offers an alternative to steel piping. The carrier pipe is engineered to solve tough corrosion problems. **Vee-Tite** system has separate gasketed couplings for ease of installation and provides a leak free system without adhesives or heat curing the pipe joints. **Taper-Tite** utilizes a matching tapered bell and spigot design with an adhesive bonded joint. These FRP systems are insulated using polyurethane foam and a heavy wall PVC or HDPE casing. They meet Federal Guide Specifications for condensate and hot water and are supplied in sizes 2"–12" for use in temperatures to 230ºF.



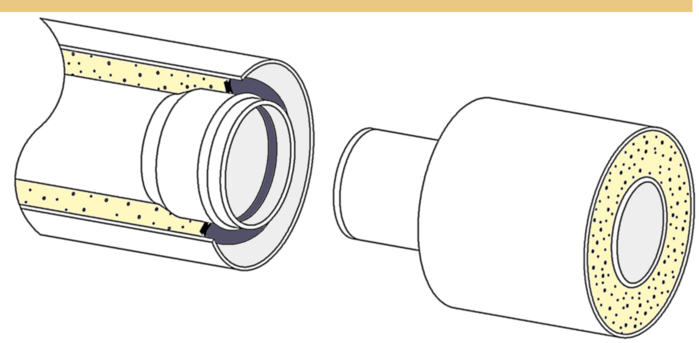
DUC-TITE .... *For low temperature hot and/or chilled water systems*

Duc-Tite is a pre-insulated ductile iron, gasketed pipe system with polyurethane insulation and a PVC or HDPE casing. The joint system eliminates the need for expansion devices. Duct-Tite is available in sizes 3"–18" and can be used for temperatures from 35ºF to 250ºF service at pressures up to 150 psi.



KOOL-KORE .... *PVC pipe with high flow, corrosion free service for chilled water*

Kool-Kore is an economical pre-insulated polyvinyl chloride pipe for underground chilled water distribution systems. This product consists of a PVC carrier pipe surrounded by polyurethane foam insulation inside a PVC or HDPE casing. Kool-Kore combines the corrosion resistance and high flow characteristics of PVC with polyurethane insulation. Kool-Kore is supplied in sizes 1½"–16" for temperatures from 35ºF to 120ºF.



Thermal Pipe Systems, Inc.

APPLICATION AND PRODUCT SELECTION

APPLICATION	CARRIER/CASING	PRODUCT	JOINT	SIZES	TEMPERATURE RANGE	MAXIMUM OPERATING PRESSURE, PSI
Steam	Steel / FRP	Super Temp-Tite	Push	3" - 12"	212ºF-400ºF	250
High temperature hot water and condensate	Steel / FRP	Super Weld-Tite	Welded	1 1/2" -16"	250ºF-450ºF	250
Low temperature, including condensate	FRP / PVC or HDPE	Vee-Tite	Push	2"-12"	35ºF-230ºF	150
	FRP / PVC or HDPE	Taper-Tite	Bonded	2"-12"	35ºF-230ºF	150
	Steel / PVC or HDPE	Heat-Tite	Push	1 1/2"-12"	35ºF-250ºF	150
	Steel / PVC or HDPE	Weld-Tite	Welded	1 1/2"-24"	35ºF-250ºF	150
Low temperature, excluding condensate	Copper / PVC or HDPE	Copper-Core	Push	1"-6"	35ºF-250ºF	150
	Ductile Iron / PVC or HDPE	Duc-Tite	Push	3"-18"	35ºF-250ºF	150
Chilled Water*	PVC / PVC or HDPE	Kool-Kore	Push	1 1/2"-16"	35ºF-120ºF	150

* All low temperature products can be used for chilled water.

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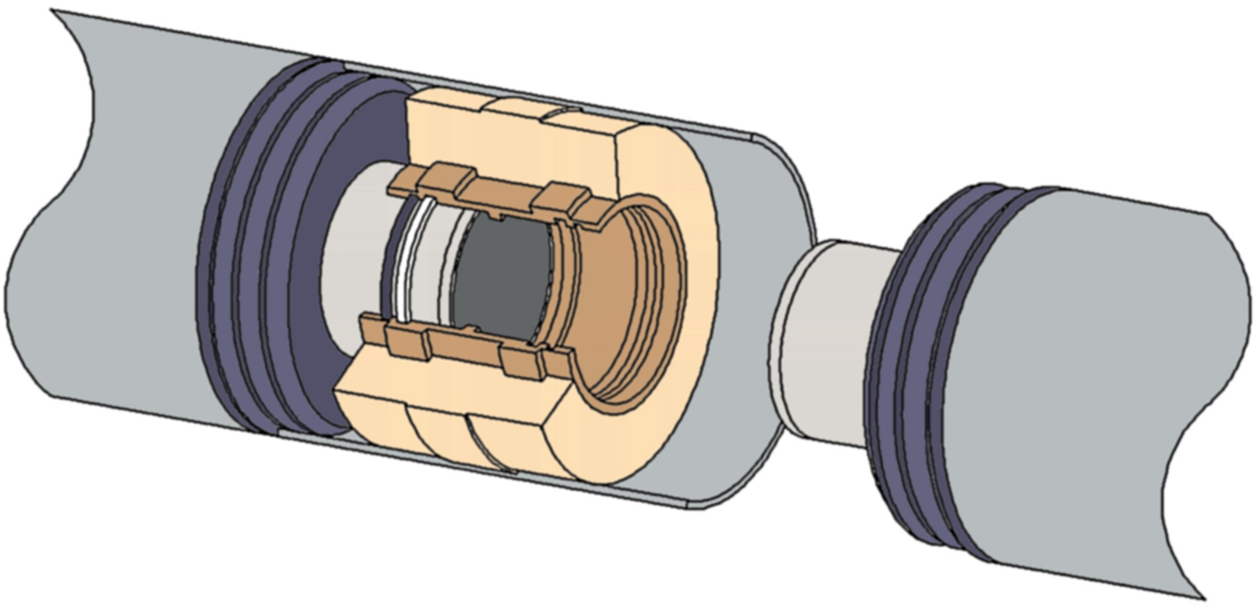
Thermal Pipe Systems, Inc.

SUPER TEMP-TITE®

SPECIFICALLY DESIGNED PIPING SYSTEM FOR
UNDERGROUND DISTRIBUTION OF HIGH-PRESSURE STEAM
(UP TO 250 PSI AND 400ºF)



CUTS ENERGY COSTS UP TO 50%

Composite insulation fills the annulus between the core pipe and casing. This combination of calcium silicate and polyurethane foam offers the best thermal efficiency available in a pre-insulated system. A computer-generated heat loss analysis will show the savings.

ELIMINATE EXTERNAL GALAVANIC CORROSION:

Non-metallic fiberglass casing eliminates corrosion from ground water, stray electrical currents, and corrosive soil. No external coating or cathodic protection required.

REDUCES INSTALLATION COST UP TO 75%:

Positive slip joint assembly requires no welding, insulating or coating of joints in the trench. Simply lubricate the spigot ends and push them into coupling. Pipe runs are straight – no digging for expansion loops. Thermal efficiency may eliminate some manholes. Save time, labor and equipment costs.

ISOLATED SECTIONS:

No through metal contact between lengths isolates carrier pipe corrosion. Annuls sealing rings and fiberglass pipe casing minimizes the probability of groundwater infiltration. Conforms to Federal "Water Spread Limiting requirements.

CONTINUOUS PIPE SUPPORT:

No internal supports needed. Insulation continuously supports carrier pipe and minimizes stress.

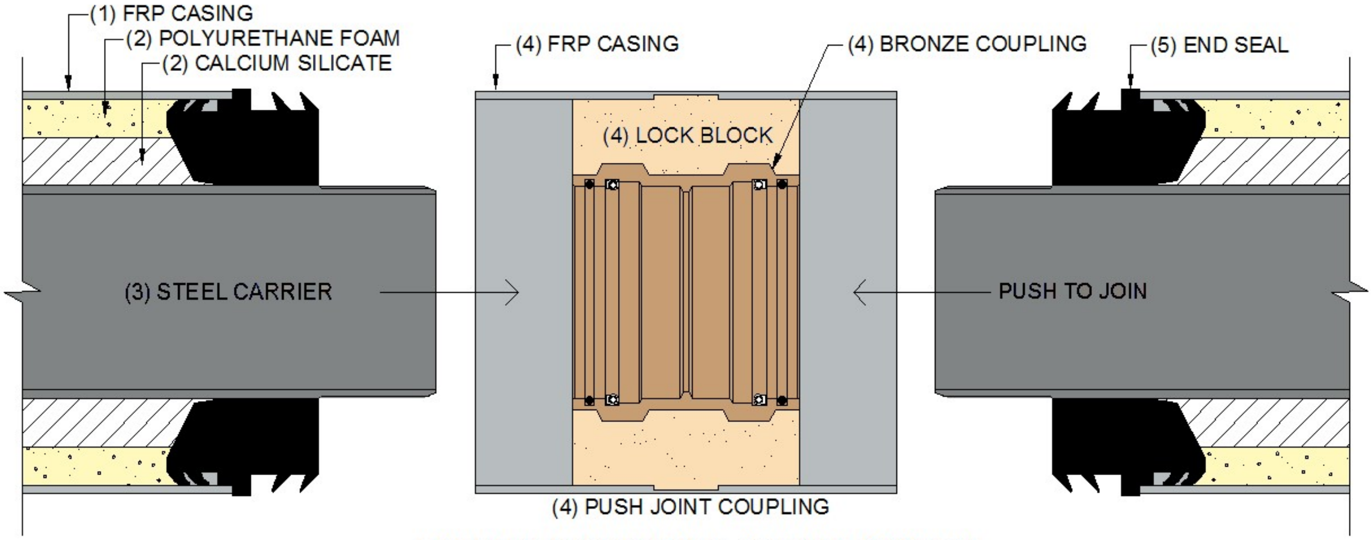
NO EXPANSION LOOPS OR DEVICES:

Expansion and contraction automatically provides for in each coupling. Relieves pipe stress as well as expansion anchors and guides.

MEETS FEDERAL SPECIFICATIONS:

Complies with Army Corps of Engineers CEGS 02552. Meets Power Piping code ANSI/ASME B31.1.

SUPER TEMP-TITE®



PATENTED SLIP-TYPE JOINING SYSTEM

(1) **OUTSIDE CASING**: Heavy wall fiberglass pipe to protect the insulation from ground water and earth loads.

(2) **INSULATION:**
Primary insulation is high temperature calcium silicate rated a 1200ºF.

Secondary insulation is polyurethane foam to provide highly efficient insulation and support for the carrier pipe along the entire length.

Insulation in the coupling is refractory cement.

(3) **CARRIER PIPE:** Carbon steel with metalized ends to convey saturated steam.

(4) **PUSH JOINT COUPLING:**
Casing: Heavy wall FRP pipe to stabilize coupling during expansion and to protect the lock block and coupling area from earth loads.

Lock Block: Reinforced refractory composite to lock bronze coupling into casing and provide insulation to the coupling.

Bronze Coupling: Machined bronze casting to join two sections of carrier pipe with sealing rings contained in grooves.

(5) **SEALS:**
End Seal: High temperature elastomer at each end of the pipe lengths to protect insulation from ground water infiltration.

Primary Seals: Teflon V-Ring supported by stainless steel to provide seal between carrier pipe and bronze coupling.

Secondary Seal: High temperature elastomer o-ring on the bronze coupling to align pipe and provide backup pressure seal.

External Seal: 30 mil High Temperature Tape applied circumferentially around the pipe and coupling casing joint as an additional seal where ground water is severe. Tape not shown.

NOMINAL PIPE SIZE (IN.)	CARRIER O.D. (IN.)	CASING O.D. (IN.)	THICKNESS			WEIGHT (LBS./20 FT.)
			CALCIUM SILICATE (IN.)	FOAM (IN.)	CASING (IN.)	
3	3.50	8.38	1.00	1.25	0.185	268
4	4.50	9.38	1.00	1.25	0.185	358
6	6.63	12.50	1.50	1.19	0.250	638
8	8.63	16.50	2.00	1.69	0.250	930
10	10.75	18.50	2.50	1.13	0.250	1286
12	12.75	20.50	2.50	1.13	0.250	1554

NOTE: All dimensions are in inches unless otherwise noted. Standard lengths are 20'-0", special lengths are available. Weights are approximate.

SUPER TEMP-TITE®

Super Temp-Tite® is a pre-insulated piping system for conveying high pressure steam underground. It may be used in steam distribution at temperatures to 400ºF and pressures to 250 psi.

The standard carrier pipe is schedule 40, ASTM A-53 steel pipe. Other grades of steel are available if specified. The sealing surface is metalized with a nickel alloy to prevent corrosion. Composite insulation consists of an inner layer of high temperature calcium silicate and an outer layer of energy-efficient polyurethane foam. This combination cuts energy cost up to 50% over conventional conduit insulations.

The fiberglass casing eliminates external galvanic corrosion, the principal cause of failure in metallic conduits.

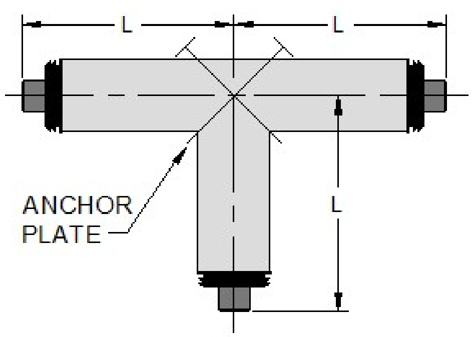
Fittings manufactured in the same fashion as the pipe. Any fitting configuration is available, making changes in directions and adaptations to existing systems simple.

The Super Temp-Tite® system is joined by a bronze coupling containing a Teflon seal and a high temperature elastomer o-ring. The seals and rings are restrained in machined grooves on both sides of the coupling. A refractory composite block, bonded to the casing, locks the coupling into place.

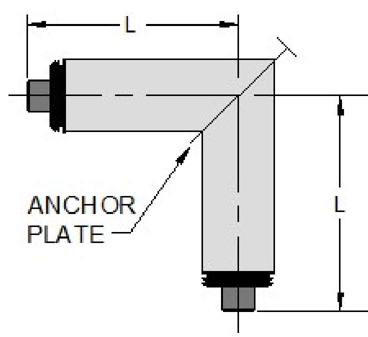
Expansion or contraction is automatically provided for at each coupling, eliminating the need for loops and other expansion devices.

The heavy wall non-corrosive casing pipe and high temperature heavy-duty elastomer annulus seals prevent infiltration of ground water. These seals have proven tight in over 20 feet of water.

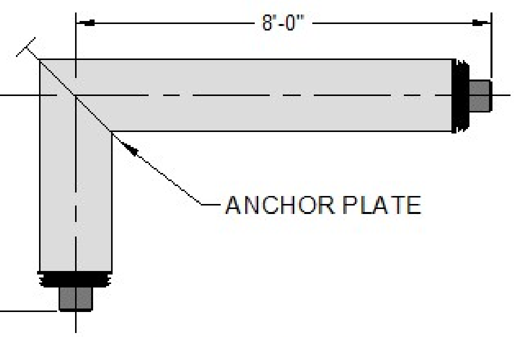
Super Temp-Tite® is the answer to your underground high temperature steam requirements. It is in full compliance with the Army Corps of Engineers CEGS 02552 and meets the Power Piping Code ANSI/ASME B31.1.



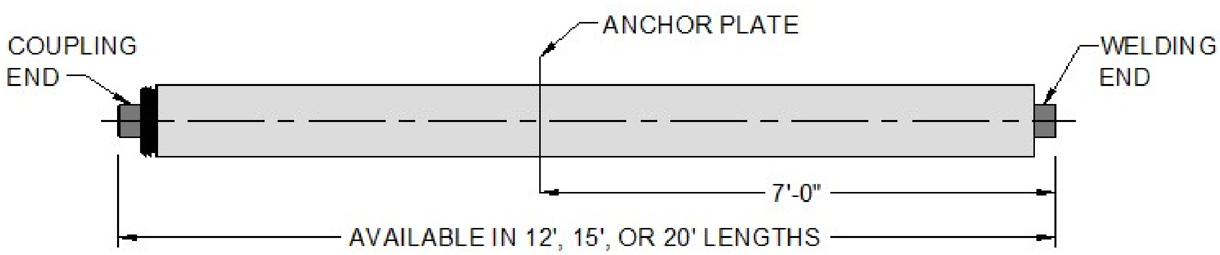
TEE



90° ELBOW



BUILDING ENTRY 90° ELBOW

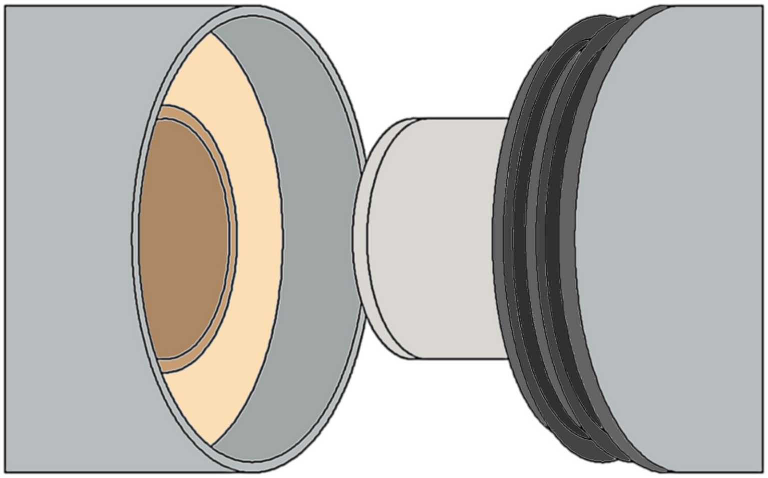


BUILDING ENTRY

SIZE / FITTING	3"	4"	6"	8"	10"	12"
90º Elbow (L dim.)	29"	30"	33"	36"	39"	42"
45º Elbow (L dim.)	26"	27"	28"	29"	30"	32"
Tee (L dim.)	27"	26"	30"	31"	33"	34"

NOTE: These lengths are nominal. Fittings above are standard, special fittings are available.

SUPER TEMP-TITE®



A factory fabricated, insulated piping system for conveying high pressure saturated steam up to 250 psi and 400ºF.

SHORT FORM SPECIFICATIONS

1.1 All underground pre-insulated steam pipe 3" – 12" shall be Thermal Pipe Systems, Inc. Super Temp-Tite® piping with Ring-Tite joints.

1.2 Steel carrier pipe shall meet the requirements of ASTM A-53 or A-106, Grade B. Each end of the carrier pipe shall be machined and metalized to provide a non-corrosive surface for the sealing rings. The metalizing shall be high nickel alloy applied to an excess thickness and then machined to the required outside diameter.

1.3 Each joint shall automatically provide for expansion and contraction through the sealing rings in the grooves of the bronze joining coupling. The sealing rings shall be stainless steel spring loaded molded and machined Teflon. Pipe must be assembled with the lubricant supplied by Thermal Pipe Systems, Inc.

1.4 Casing pipe shall be fiberglass Reinforced Thermosetting Resin Pipe (RTRP) manufactured by a filament winding process. The pipe shall be wound to meet ASTM D2310 classified RTRP-12E.

1.5 The composite insulation shall be a two-component system. The initial insulation shall be Calcium Silicate satisfactory for temperatures to 1200ºF and shall conform to ASTM C-533 and MIL SPEC Mil-1-2781. The secondary insulation shall be polyurethane foam completely filling the void between the Calcium Silicate and casing.

1.6 The rubber end seals shall be a Highly Saturated Hitrile (HSN) or Ethylene Propylene Diene Monomer (EPDM) heat resistant compound.

1.7 Fittings shall be pre-insulated by Thermal Pipe Systems, Inc. using the same carrier pipe, insulation thickness, and casing as the straight lengths of pipe.

Thermal Pipe Systems, Inc.

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Thermal Pipe Systems, Inc.

SUPER TEMP-TITE® PIPING SYSTEM

FOR STEAM SERVICE

SPECIFICATIONS & DRAWINGS

5205 W. WOODMILL DRIVE, SUITE 33
WILMINGTON, DELAWARE 19808
PHONE: 302.999.1588
WWW.THERMALPIPESYSTEMS.COM

SUPER TEMP-TITE PIPING SYSTEMS SPECIFICATIONS

STEEL CARRIER PIPE: Carrier pipe shall be black steel per ASTM A-53, Grade B **[welded][seamless]** or ASTM A-106 **[seamless]**, schedule **[40]** (std. weight for 12"∅) or schedule **[80]** (extra heavy weight for 10"∅ and 12"∅). The pipe shall be machined and metalized to provide a satisfactory sealing surface for the sealing rings. The metallizing shall be a high nickel alloy applied to an excess thickness and then machined to the required OD.

BRONZE COUPLING: The bronze coupling shall meet ASTM B62 for 3"∅ - 6"∅ and ASTM B61 for 8"∅ - 12"∅.

TEFLON SEALING RINGS: The molded and machined Teflon sealing rings shall consist of stainless steel spring-loaded TFE seals.

RUBBER SEALING RINGS: The secondary rubber sealing rings for SUPER TEMP-TITE shall be a special molded high temperature elastomer. The ring surfaces shall be smooth and free from all porosity and internal voids.

FIBERGLASS CASING PIPE: The casing for the SUPER TEMP-TITE piping system shall be Reinforced Thermosetting Resin Plastic (RTRP) pipe manufactured by the filament winding process. The casing pipe shall be wound to meet ASTM D2310 classification RTRP-12E.

RUBBER END SEALS: The end seals shall be Ethylene Propylene Diene Monomer (EPDM) heat resistant compound for 212°F to 300°F steam service or Highly Saturated Nitrile (HSN) for 212°F to 406°F steam service. The seals shall be molded using a properly vulcanized compound. The seal surface shall be smooth and free from all porosity and internal voids.

CALCIUM SILICATE INSULATION: The calcium silicate insulation shall be a hydrous material satisfactory for temperatures to 1200°F. Insulation shall conform to ASTM C-533 and Mil Spec Mil-1-2781.

POLYURETHANE FOAM INSULATION: The insulation shall be Polyurethane Foam conforming and shall meet the following specifications:

Type:	Two component urethane.
Compressive Strength:	40 psi parallel minimum at 5% comp.
Shrinkage:	None at 70°F
Free Rise Density:	2.0 to 3.0 lbs/cubic foot
Aged "K" (70°F - 72 hours):	0.160 BTU•in/hr•ft^2•°F
Closed Cell Content:	90%

The urethane foam insulation shall completely fill the annular space between the inner insulation and the exterior casing. The carrier pipe shall be concentric to the casing pipe providing uniform thickness of the insulation.

INSULATED FITTINGS: Fittings shall be pre-insulated by Thermal Pipe Systems, Inc. using the same insulation thickness and casing as the pipe.

WALL PENETRATION SLEEVES: Provide where piping passes through masonry or concrete walls, floors, and roofs. Sleeves in outside walls below and above grade, in floor, or in roof slabs, shall be schedule 40 or standard weight coated black steel pipe or shall be as specified by the Design Engineer. Space between piping or insulation casing, and the sleeve shall be sufficient to allow proper water tight sealing, but never less than 1/2". Sleeves shall be held securely in proper position and location during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Refer to typical detail of wall penetration as shown. In existing concrete manholes or building wall penetrations may be made using the "core drilling" method providing proper care is taken to drill the holes to the size needed and square to the line of the pipe.

WALL PENETRATION SEALS: All wall penetrations shall be sealed to prevent water from entering the building or manhole. The sealing material shall be as specified by the engineer.

SUPER TEMP-TITE APPLICATION ENGINEERING

PIPE SYSTEM DESIGN: Standard design techniques and practices for SUPER TEMP-TITE shall be used. Thermal Pipe Systems, Inc. Engineering Department may, on request, provide certain detailed design aspects of the piping for each project based on the project documents and drawings provided by the Design Engineer. It is understood that the project specifications and layout drawings will specify the type of service, location of the site, temperature and pressure classifications, soil conditions, general path and elevations of the system, location and design of manholes, known obstacles, size of the carrier pipe, and the maximum permissible heat losses. It is further understood that other requirements such as the type of pipe, the location, size, and capacity of valves, traps, pumps, anchors, controls, expansion devices and special structural elements will be provided by the Design Engineer. The design provided by Thermal Pipe Systems, Inc. and their engineers for the piping will be in accordance with ANSI B31.1 and good engineering practices.

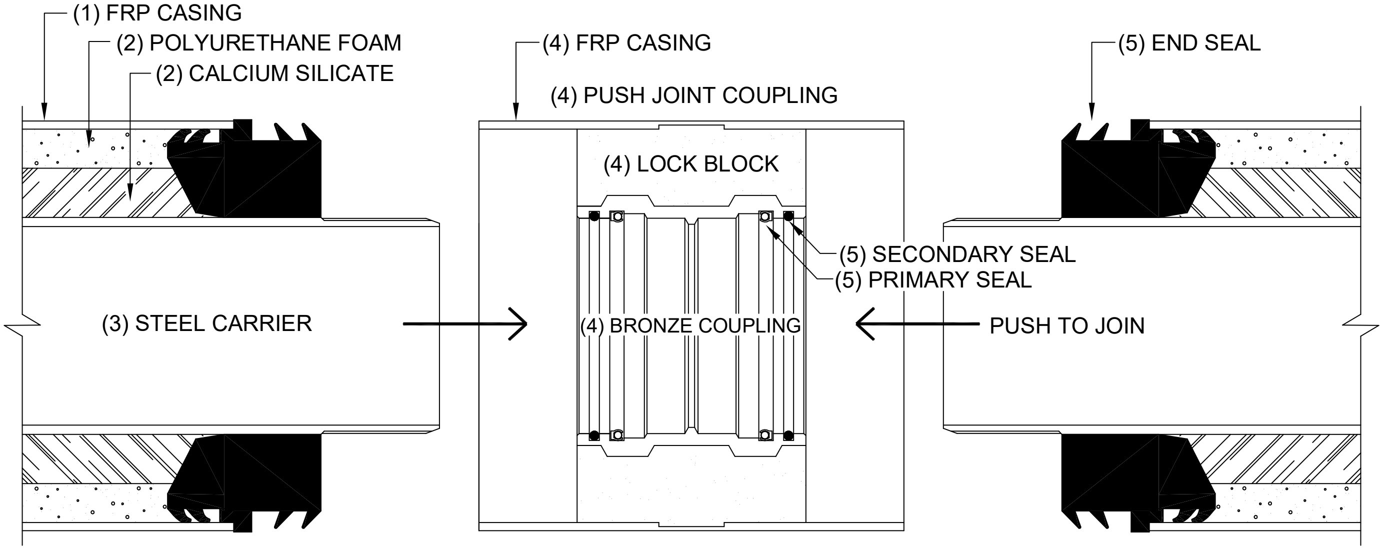
INSULATION: Thickness of insulation for SUPER TEMP-TITE pipe and fittings shall be as shown on page four.

TEMPERATURE AND PRESSURE: The SUPER TEMP-TITE piping system and all its components are designed to operate up to 250 psig at 400°F, plus typical surges.

DIMENSIONS AND WEIGHTS of insulated SUPER TEMP-TITE piping and fittings are as shown on pages four and six. The standard lengths for SUPER TEMP-TITE piping will be furnished in 20-foot sections. Special lengths are available.

SPECIAL DESIGN: Since the SUPER TEMP-TITE system components are not changed from one project to another; each component and the system are designed to function under most conditions. Therefore, special design is most unusual. Thermal Pipe Systems, Inc. will review all jobs to be sure the standard design is adequate.

PRE-INSULATED SUPER TEMP-TITE® PIPE



PATENTED SLIP-TYPE JOINING SYSTEM

1) OUTSIDE CASING: Heavy wall fiberglass pipe to protect the insulation from groundwater and underground earth loads.

2) INSULATION:
Primary is high temperature calcium silicate rated at 1200° Fahrenheit.

Secondary is polyurethane foam to provide highly efficient insulation and support carrier pipe along entire length.

Insulation in the coupling is refractory composite.

3) CARRIER PIPE: Carbon steel with metalized ends to convey saturated steam.

4) PUSH JOINT COUPLING:
Casing; heavy wall FRP pipe to stabilize coupling during expansion and protect the lock block and coupling area from earth loads.

Lock Block; reinforced refractory composite to lock bronze coupling into casing and provide insulation to the coupling.

Bronze Coupling; machined bronze casting to join two sections of carrier pipe with sealing rings contained in grooves.

5) SEALS:
End Seal; high temperature elastomer at each end of the pipe lengths to protect insulation from ground water infiltration.

Primary Seal; teflon V-Ring supported by stainless steel to provide seal between carrier pipe and bronze coupling.

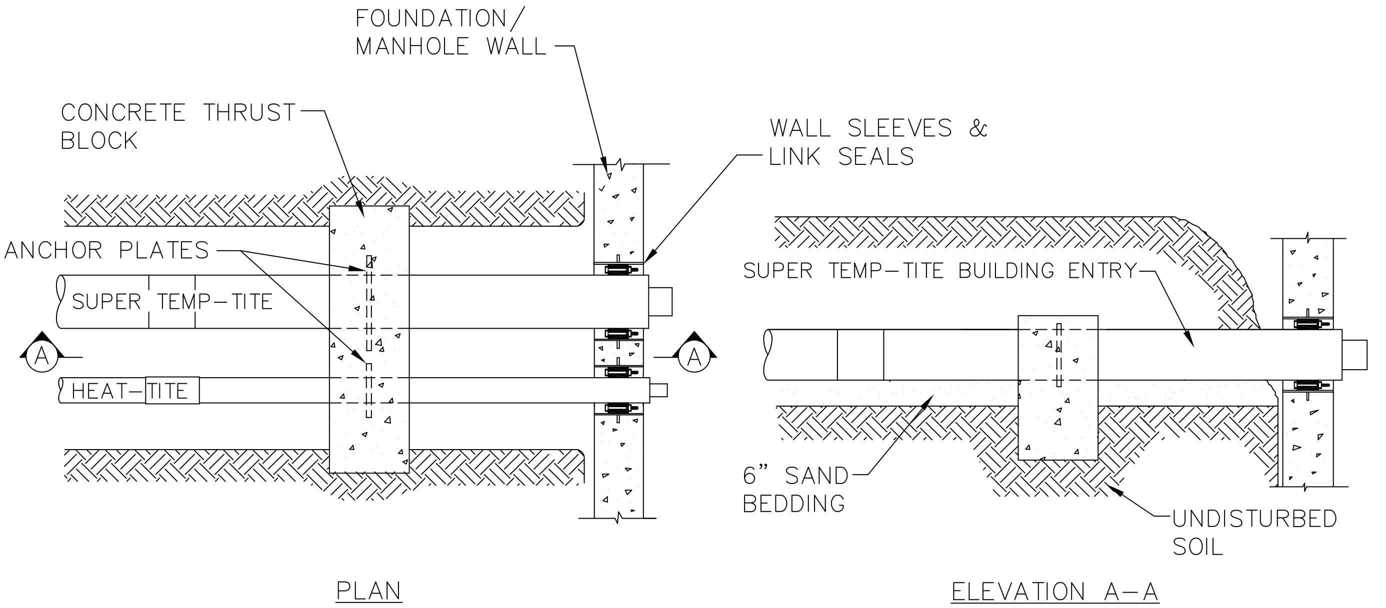
Secondary Seal; high temperature elastomer O-Ring on the bronze coupling to align pipe and provide a back-up pressure seal.

External Seal; 30 mil H.T. Tape applied circumferentially around the pipe and coupling casing joint as an additional seal where ground water is severe. Not shown.

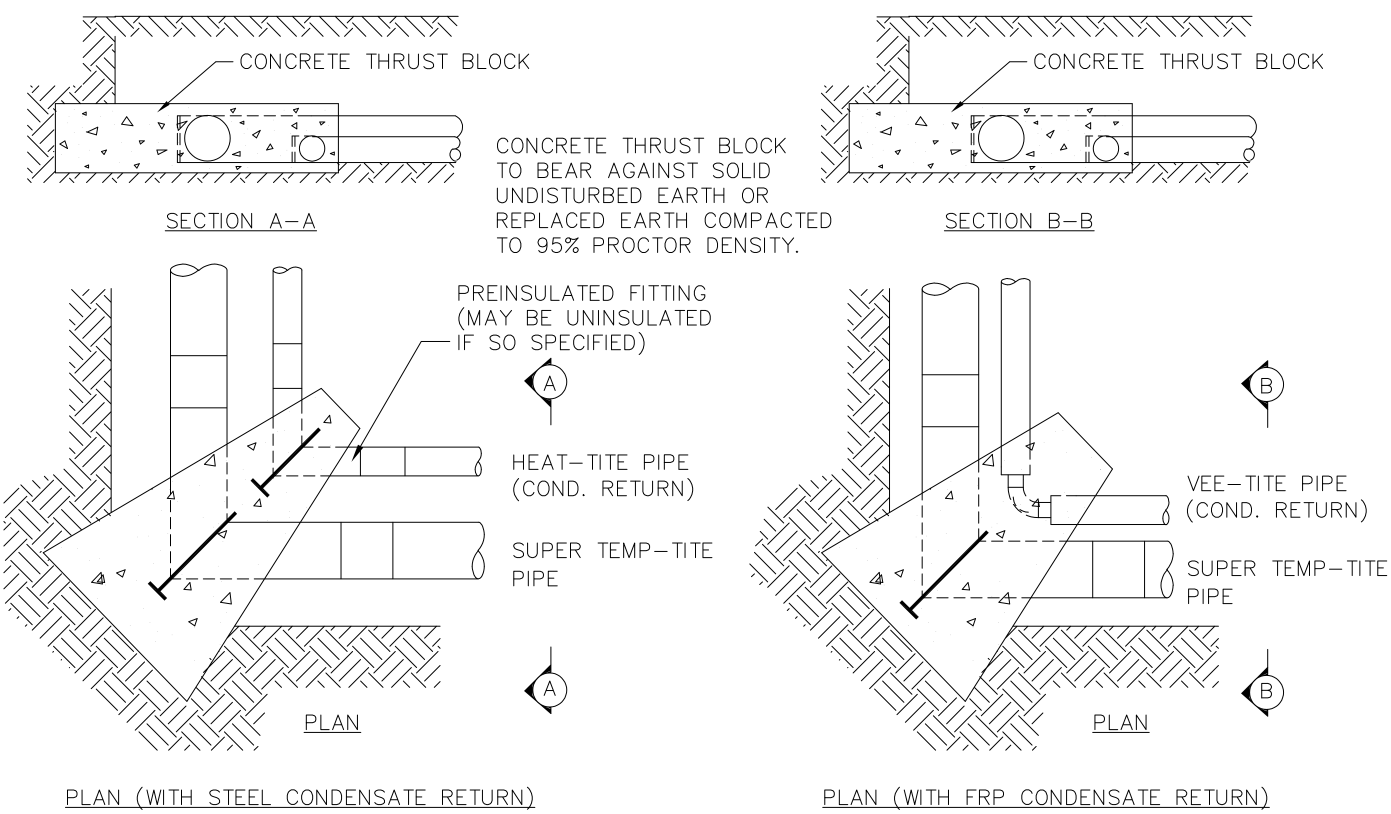
NOM. PIPE SIZE	CARRIER O.D.	CASING O.D.	THICKNESS			WEIGHT (LBS./20 FT.)
			CALCIUM SILICATE	FOAM	CASING	
3	3.50	8.38	1.00	1.25	.185	268
4	4.50	9.38	1.00	1.25	.185	358
6	6.63	12.50	1.50	1.19	.250	638
8	8.63	16.50	2.00	1.69	.250	930
10	10.75	18.50	2.50	1.13	.250	1,286
12	12.75	20.50	2.50	1.13	.250	1,554

NOTES:
1.) ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.
2.) STANDARD LENGTHS ARE 20'-0". SPECIAL LENGTHS ARE AVAILABLE.
3.) WEIGHTS ARE APPROXIMATE.

PRE-INSULATED SUPER TEMP-TITE® PIPE

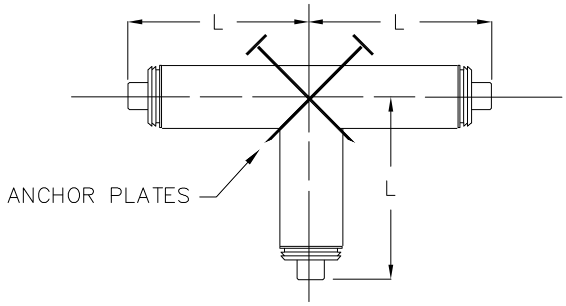


TYPICAL THRUST BLOCK AT WALL PENETRATIONS
NO SCALE

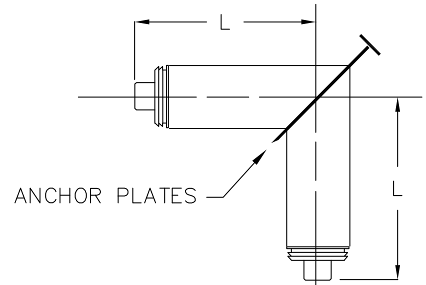


TYPICAL THRUST BLOCK AT ELBOWS
NO SCALE

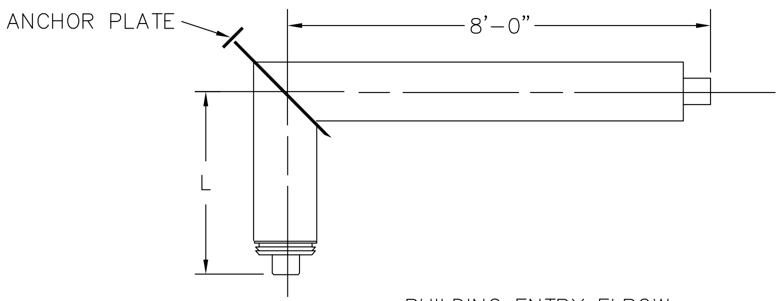
PRE-INSULATED SUPER TEMP-TITE® PIPE



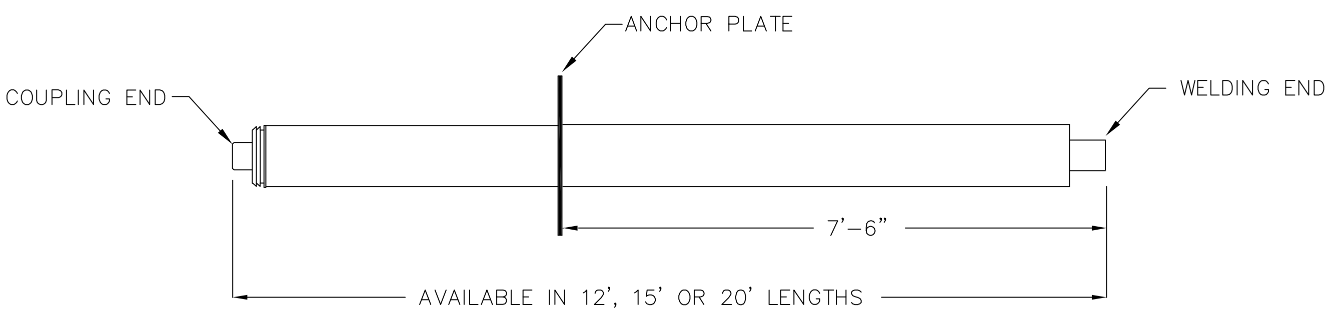
TEE



ELBOW
(90°& 45°)



BUILDING ENTRY ELBOW
(90°& 45°)



BUILDING ENTRY

SIZE / FITTING	3"	4"	6"	8"	10"	12"
90° ELBOW (L DIM.)	29"	30"	33"	36"	39"	42"
45° ELBOW (L DIM.)	26"	27"	28"	29"	30"	32"
TEE (L DIM.)	27"	26"	30"	31"	33"	34"

NOTES:
1.) THESE LENGTHS ARE NOMINAL.
2.) ABOVE FITTINGS ARE STANDARD.
3.) SPECIAL FITTINGS ARE AVAILABLE

SUPER TEMP-TITE FITTINGS

NO SCALE

SUPER TEMP-TITE INSTALLATION SPECIFICATION

GENERAL: Installation of the SUPER TEMP-TITE piping system shall be done in accordance with the appropriate publications including ANSI B31.1 and the following specifications and instructions. A Thermal Pipe Systems, Inc. field representative will conduct an installation clinic to pre-qualify contract personnel in the proper procedures for the installation. Good workmanlike procedures shall be followed.

All piping, unless otherwise indicated, shall be pitched with a grade of not less than 1 inch in 20 feet in the direction of steam flow.

Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign matter out of the system.

RECEIVING AND HANDLING SHIPMENTS

INSPECTION: Each Shipment shall be inspected with care on its arrival. The products are carefully loaded at the plant using methods acceptable to the carrier and it is their responsibility to deliver the pipe in good condition. It is the responsibility of the installation contractor to ascertain whether there has been any loss or damage. The carrier is the contractor's agent. Any pipe or equipment that arrives damaged or is lost in shipment shall be reported by the contractor.

Perform an overall inspection of the load. If load is intact, ordinary inspection while unloading should be enough to make sure that the pipe has arrived in good condition. It is the responsibility of the receiver to make certain that there has been no loss or damage. Note specifically that any end packaging should not show signs of damage. If the load has shifted, or end packing damaged, then each piece must be carefully inspected for damage. Specifically, the ends should be inspected for scars, nicks, etc. Other obvious defects are also reason for rejection. Check total quantities of each item against the tally sheet (pipe, fittings, etc.). Any damaged or missing items are to be noted on the delivery receipt and the receipt returned to the carrier. Notify the carrier immediately and make claim in accordance with the carrier’s instructions. Thermal Pipe Systems, Inc. will assist, if necessary, in handling this claim. Do not dispose of damaged material - the carrier will notify you of the procedure to follow.

UNLOADING INSTRUCTIONS: The means by which the pipes are unloaded in the field is the decision and responsibility of the installing contractor. The pipe is loaded at the factory by forklift from the side. The use of a large fork lift or other mechanical equipment frequently simplifies and speeds up the unloading of larger sizes and usually provides extra protection against damage in handling. To prevent the possibility of the core pipe from shifting within the casing pipe, do not stand a length on one end or raise it vertically. Under no condition should a pipe be dragged along the ground. Do not lift fittings or pipe by inserting a bar, pipe, etc., inside of the core. Damage to the pipe may result. If any pipe is damaged in unloading and handling, mark the damaged area and set it aside. Thermal Pipe Systems, Inc. Representative will determine whether damaged casing can be repaired in the field and will determine exact method for repair and instruct contractor in making repair.

STORAGE: Store pipe on a flat surface to support the barrel evenly. Store random lengths separately where they will be readily available. Individual lengths of pipe should be stacked in piles no higher than 5 feet.

LOADING TRANSFER TRUCKS: Use trucks with long bodies so that pipe lengths do not overhang. Make certain truck bed is smooth, without cross-strips, bolt heads, or other protrusions that could damage the pipe. Short body trucks may be used if fitted with racks that properly support the pipe in a horizontal position. The rack should support the pipe with supports spaced every 3 feet or less along the pipe lengths. Pad the contact areas to avoid damage to the pipe.

DISTRIBUTING PIPE ALONG TRENCH: Pipe lengths may be strung along the line of the trench to minimize additional handling during installation. Do not remove protection materials from the pipe ends until the pipe is lowered into the trench and ready for assembly.

EXCAVATION: Excavation should consider the need for the thrust blocks at all fittings which are direct buried in the ground. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines, generally a minimum of 6" in pipe sizes up to 6" diameter, and 12" minimum in sizes 8" and up. The excavation should be in a straight line except where fittings are located.

TRENCHING: Trenching shall follow the elevations provided by the Design Engineer. Keep excavations free of water during construction. If the Contractor determines it is necessary to remove unsuitable material to a depth greater than specified, refill excavations carried below the depths indicated or directed with specified bedding material and compact in 6 inch lifts to 95 percent of maximum density in accordance with ASTM D1557, Method D. Excavate and replace soil disturbed and weakened by the Contractor's operations or soils which have softened from exposure to weather, with bedding material and compact with a plate-type vibratory compactor.

TRENCH WIDTHS: The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation. The reason for this is to keep the earth load on the pipe as small as possible, since, in general, the wider the trench at the top of the pipe, the greater the load on the pipe. But note that an increase in trench width above the top of the pipe, by sloping the sides or digging a wider offset trench, does not affect the earth load on the pipe. On the other hand, a trench that is too narrow will make assembly difficult and may reduce the rate and quality of installation. In addition, lack of ample room will limit the capability to properly backfill and tamp around the pipe. Although each job or portion of a job must be considered on an individual basis, as a rule, the following minimum trench widths at the top of the pipe are recommended: Minimum: one foot greater than the outside diameter of the casing. Where two or more pipes are in the same trench, use the distance between outside casing of the outer pipes plus one foot. Maximum: Use above method for minimum plus two feet.

PLACING PIPE IN THE TRENCH: The SUPER TEMP-TITE pipe shall be mechanically passed into the trench. The latest state and federal safety regulations should be understood and observed. If slings are necessary use only canvas straps, no cable or chain slings shall be used.

BEDDING: Bedding material should be sand or other materials free of sharp objects, heavy clods, boulders or frozen lumps as specified by the Design Engineer. The approved bedding should be used 6” under, around and over the pipe. Utilize good practices that apply to buried pressure piping.

ASSEMBLY OF THE SUPER TEMP-TITE COUPLING:

1) Remove the end protection and check the pipe spigot end to be sure it is clean, and wipe with a clean, dry rag if necessary. Be certain that all the protective coating applied at the factory end cap is removed. Most solvents can be used to clean the metalized surface.

2) Be sure there is no soil around the joint which might be pushed into the joint during assembly. Dig a slight bell hole if necessary to keep the joint clean.

3) It is usually desirable to assemble the coupling onto the pipe on top of the trench, and then assemble the spigot end of the coupled pipe into the coupling end of the pipe already in the trench.

4) Apply a very thin coat of silicone lubricant to the steel pipe bevel and machine surface, back to the rubber end seal. It is not necessary to apply lubricant to the rings. Also apply a thin coating of lubricant to the rubber end seal fins so they will easily slide inside the coupling. **Do not use any lubricant except that supplied by Thermal Pipe Systems, Inc.**

5) Immediately following the application of the lubricant, start the coupling on the lubricated pipe end by hand. Insert a thin wire to depress the end seal fins and allow air to escape at this point. Hold the coupling straight and push it with a bar and a wooden block until the coupling "homes" against the rubber flange. It is imperative the coupling be maintained straight-not cocked or crooked-while it is being pushed home on the pipe, to prevent damage to the joint. **When joint is complete, remove wire.**

6) In larger sizes it will be necessary to assemble the pipe with a lever puller or "come-along". It can be used to pull the coupling onto the pipe, in which case it pulls against the coupling. It can also be used to pull the pipe into a coupling on an installed length.

TESTING: All carrier pipe joints shall be tested in accordance with the contract specifications. If no test is specified, it should consist of a hydrostatic test of 150 psi or 1 ½ times working pressure, whichever is greater, for a period of two hours.

BACKFILLING: Backfilling of trenches shall progress as rapidly as construction, testing, and acceptance of work permits. Uniformly compact and grade bottom of trenches. After installation of bedding material and pipe, place backfill as follows: place initial backfill by hand to a depth of 12 inches over the top of pipe or casing. Compact the material to a density equivalent to the surrounding undisturbed soil or to 90 percent of maximum density (ASTM D1557, Method D), whichever is greater. Backfill remainder of trench in one-foot lifts and compact as above. For trenches excavated in roads, streets, or located under structures, place backfill in 6-inch layers to top of trench and compact each layer to at least 95 percent maximum density (ASTM D1557, Method D).

FLANGED JOINTS: Flanged joints shall be faced true, provided with gaskets, and made perfectly square and tight.

THRUST BLOCKS: Thrust blocks must be installed wherever the pipeline changes direction as at tees and elbows, changes size as at reducers and tees, stops as a dead end, or develops thrust as at a valve or similar equipment. The above situations may occur either where the fittings, dead ends, or valves, are directly buried in the soil, or are in a manhole.

Thrust blocks must be designed for maximum anticipated operating or test pressure. If it is anticipated that pressures higher than normal operating pressures will be used at some later date, thrust blocks to accommodate such pressures should be installed initially. Size and type of thrust blocks depend on pressure, pipe size, and the type of soil. This information shall be supplied by the Design Engineer. Where a thrust block serves more than one line, the block must be designed to resist the sum of the thrusts of all the lines involved.

Thrust blocks shall be installed using a concrete having a compressive strength of not less than 3,000 psi minimum ultimate 28 days compressive strength, air entrained, with water reducing admixture. Where the soil bearing value is less than 1,000 pounds per square foot, Thermal Pipe Systems, Inc. will make the necessary calculations and recommendations as to how the fitting should be thrusted. Where special thrust provisions are needed, Thermal Pipe Systems, Inc. will recommend the necessary design. The table below gives the thrust load at any fitting. Thrust blocks should be poured on and against undisturbed soil or soil tamped to 95% proctor density.

SUPER TEMP-TITE FITTINGS

Thrust at fittings (for concrete thrust blocks) in lbs. at 100 psi* pressure:

Size (in.)	Tee	90° Elbow	45° Elbow	Reducer**	
3	985	1,395	755		
4	1,620	2,295	1,245	4x3	680
6	3,500	4,950	2,680	6x4	2,060
8	5,930	8,375	4,540	8x6	2,700
10	9,076	12,833	6,963	10x8	3,680
12	12,765	18,000	9,700	12x10	4,360

*For pressure other than 100 psi increase loads proportionately (example: for 150 psi multiply by 1.5; for 200 psi multiply by 2.0: etc.)

**This is for the size difference indicated (ex. 4x3 = 680 lbs)

NOTE: Dead End and Anchor loads are equal to TEE shown above.

The approximate safe bearing loads of various soils given in the following table are for horizontal thrusts when the depth of cover over the top of the pipe exceeds two feet.

SOIL	SAFE BEARING LOAD lbs./sq. ft.
Muck, Peat etc.*	0
Soft Clay	1,000
Sand	2,000
Sand & Gravel	3,000
Sand & Gravel Cemented with Clay	4,000
Hard Shale	10,000

* All thrusts are resisted by piles or tie rods to solid foundations, or by removal of muck or peat and replacement with ballast of sufficient stability.

Pre-insulated SUPER TEMP-TITE fittings are provided with thrust plates designed to transfer thrust from the steel pipe to the concrete thrust blocks. The entire surface of the steel plates shall be coated. Steel plates shall be sealed during manufacture with fiberglass.

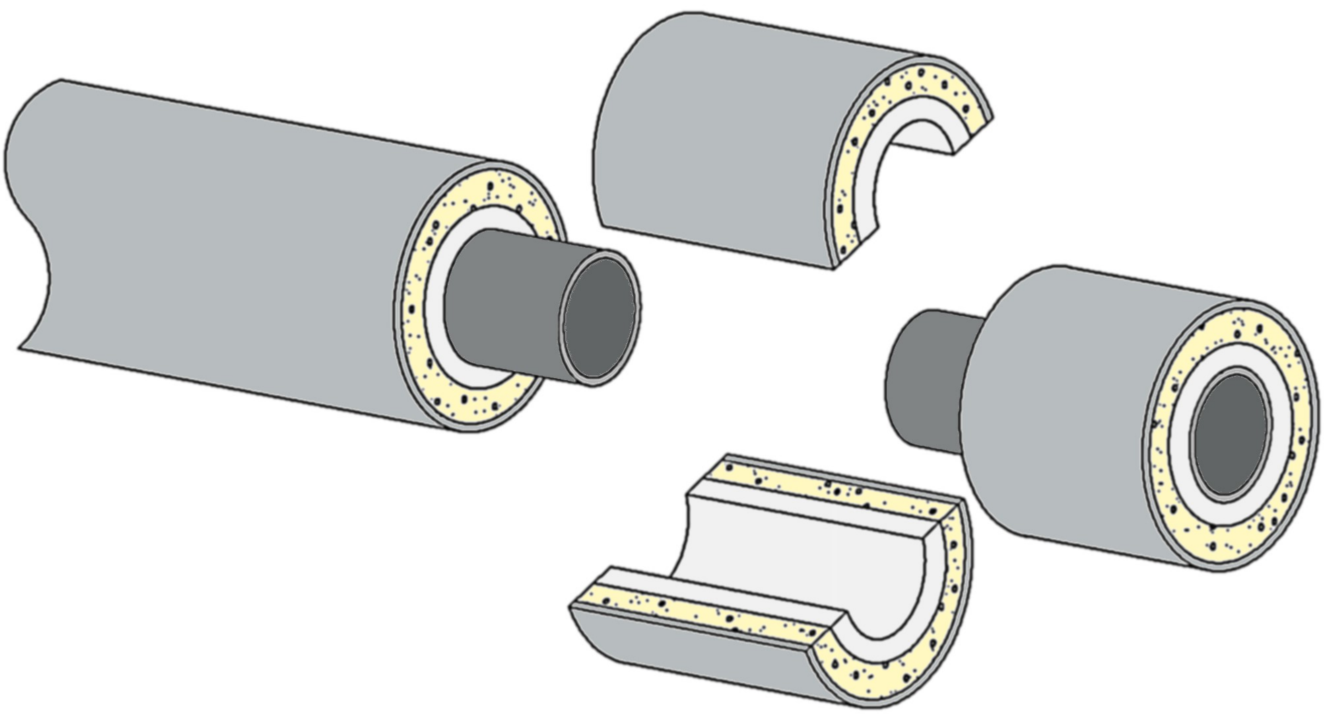
START UP PROCEDURE: Start up procedure shall conform to generally accepted practices and be done in a workman-like manner. Improper start-up of steam lines may damage the piping system and attached equipment. **Piping inside of manholes should be checked to make sure that the end seals are in-place at pipe penetration points so that moisture or water does not enter pipe insulation.**

MANUFACTURERS WRITTEN CERTIFICATION: After testing and prior to start-up of the system, the manufacturer must certify in writing that the system was installed per the manufacturers installation instructions.

Thermal Pipe Systems, Inc.

SUPER WELD-TITE®

with Composite Insulation and FRP Casing
For
High Temperature Hot Water and Condensate



Super Weld-Tite is a dual insulated pipe system with a filament wound fiberglass casing. The insulation combines calcium silicate with polyurethane foam. As an alternative, Foamglas® may be substituted for calcium silicate to insure protection against moisture absorption.

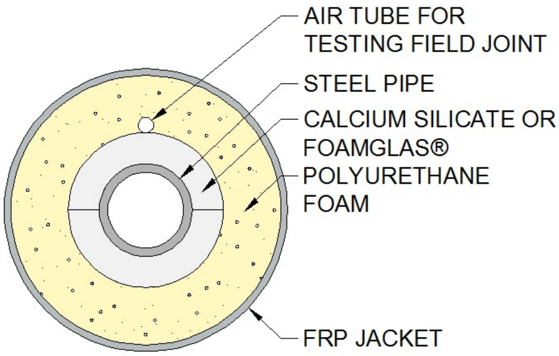
The fiberglass casing provides a high strength, corrosion resistant jacket that is much more durable than PVC. The result is a thermally efficient product for use in high temperature hot water and condensate service.

This welded product can be designed with expansion loops or inline expansion joints. All fittings are pre-insulated. Field joints closures include insulated half shells with FRP casing and FRP overwrap kits.

A tube for air testing field joints is pre-installed. No external coating or cathodic protection is required.

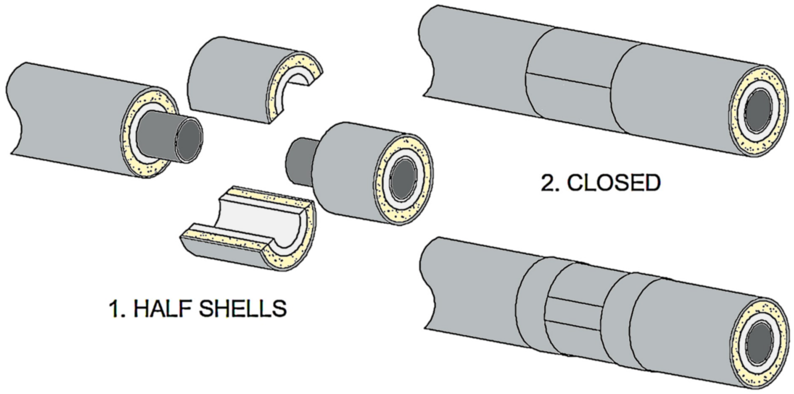
Super Weld-Tite is available in sizes 1-1/2” through 16” and is suitable for temperatures to 450ºF.

SUPER WELD-TITE®



CROSS SECTION

FIELD JOINTS



NOMINAL PIPE SIZE (IN.)	CARRIER O.D. (IN.)	CASING O.D. (IN.)	THICKNESS			WEIGHT (LBS./20 FT.)
			CALCIUM SILICATE (IN.)	FOAM (IN.)	CASING (IN.)	
1 1/2	1.90	8.38	1.00	2.05	0.185	144
2	2.38	8.38	1.00	1.81	0.185	165
2 1/2	2.88	8.38	1.50	1.56	0.185	210
3	3.50	8.38	1.00	1.25	0.185	248
4	4.50	9.38	1.00	1.25	0.185	335
5	5.56	12.38	1.50	1.72	0.185	335
6	6.63	12.38	1.50	1.19	0.185	615
8	8.63	16.50	2.00	1.69	0.250	925
10	10.75	18.50	2.50	1.13	0.250	1252
12	12.75	20.50	2.50	1.13	0.250	1570
14	14.00	22.50	2.50	1.50	0.250	1822
16	16.00	24.50	2.50	1.50	0.250	2266

NOTE: All dimensions are in inches unless otherwise noted. Standard lengths are 20'-0" or 40'-0". Weights are approximate.

SHORT FORM SPECIFICATIONS

1.1 All underground pre-insulated hot water and condensate piping shall be Thermal Pipe Systems, Inc. Super Weld-Tite® Pipe with welded joints.

1.2 Steel carrier pipe shall meet the requirements of ASTM A-53 or A-106, Grade B.

1.3 Joints shall be welded by the contractor in accordance with the contract specifications.

1.4 Casing pipe shall be fiberglass Reinforced Thermosetting Resin Pipe (RTRP) manufactured by a filament winding process. The pipe shall be wound to meet ASTM D2310 classified RTRP-12E.

1.5 The composite insulation shall be a two-component system. The initial insulation shall be Calcium Silicate satisfactory for temperatures to 1200ºF and shall conform to ASTM C-533 and MIL SPEC Mil-1-2781 or Foamglas® suitable for temperatures up to 900º conforming to ASTM C-552. The secondary insulation shall be polyurethane foam completely filling the void between the initial insulation and casing.

1.6 Fittings shall be pre-insulated by Thermal Pipe Systems, Inc. using the same carrier pipe, insulation thickness, and casing as the straight lengths of pipe.

1.7 All field joints of the casing pipe and fittings shall be air tested according to specifications provided by Thermal Pipe Systems, Inc.

WARRANTY

We warrant that our products are manufactured with the applicable material specifications and are free from defects in the workmanship and material using our specifications as a standard. Every claim under this warranty shall be deemed waved unless in writing received by Thermal Pipe systems, Inc. within (30) days of the date the defect was discovered and within (1) year of the date of shipment of the product. Thermal Pipe Systems, Inc. MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY OR THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN THE LIMITED WARRANTY SET FORTH ABOVE.

LIMITATIONS AND LIABILTY

It is expressly understood and agreed that the limit of Thermal Pipe Systems, Inc. liability shall be the resupply of a like quantity of non-defective product and that Thermal Pipe Systems, Inc. shall have no such liability except where the damage or claim results solely from the breach of the Thermal Pipe Systems, Inc. warranty. IT IS ALSO AGREED THAT THERMAL PIPE SYSTEMS, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES FOR ANY ALLEGED NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILTY OR ANY OTHER THEORY, OTHER THAN THE LIMITED LIABILTY SET FORTH.

Thermal Pipe Systems, Inc.
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Thermal Pipe Systems, Inc.

SUPER WELD-TITE® PIPING SYSTEM

FOR STEAM, HIGH TEMPERATURE HOT WATER, AND CONDENSATE SERVICE

SPECIFICATIONS & DRAWINGS

5205 W. WOODMILL DRIVE, SUITE 33
WILMINGTON, DELAWARE 19808
PHONE: 302.999.1588
WWW.THERMALPIPESYSTEMS.COM

SUPER WELD-TITE PIPING SYSTEMS SPECIFICATIONS

SUPER WELD-TITE shall be used where specified for steam, high temperature hot water, and condensate service. All straight sections, fittings, anchors, terminal end caps, field kits, and other accessories shall be factory prefabricated to job dimensions and designed to allow for thermal expansion and minimize the number of field welds. The pipe sections shall be joined by welding. The systems design shall be in strict conformance with ANSI B 31.1 latest addition.

STEEL CARRIER PIPE: Carrier pipe shall be black steel per ASTM A-53, Grade B **[welded][seamless]** or ASTM A-106 **[seamless]**, schedule **[40]** (std. weight for 12”∅ - 16” ∅) or schedule **[80]** (extra heavy weight for 10”∅ - 16”∅).

INSULATION: The inner layer of insulation shall be **[CALCIUM SILICATE]**, a rigid material satisfactory for temperatures to 1200°F conforming to ASTM C-533 and Mil Spec Mil-1-2781, or **[FOAMGLAS®]** a closed cell material satisfactory for temperatures to 900°F conforming to ASTM C-522 and Mil Spec Mil-1-24244B. Foamglas® shall be bore coated with Hydrocal B-11 to prevent abrasion of the insulation on the pipe.

The outer layer of insulation shall be POLYURETHANE FOAM and shall meet the following specifications:

Type:	Two component urethane
Compressive Strength:	40 psi parallel min at 5% comp
Shrinkage:	None at 70°F
Free Rise Density:	2.0 to 3.0 lbs/cubic foot
Aged "K" (70°F - 72 hrs)	0.160 BTU•inch/hour•°F•ft^2
Closed Cell Content:	90%

The urethane foam insulation shall completely fill the annular space between the inner insulation and the exterior casing. The carrier pipe shall be concentric to the casing pipe providing uniform thickness of the insulation.

FIBERGLASS CASING PIPE: The casing for Super Weld-Tite shall be reinforced thermosetting resin plastic (RTRP) pipe manufactured by the filament wound process per ASTM D-2310 (RTRP-12E).

INSULATED FITTINGS: Fittings shall be pre-insulated by Thermal Pipe Systems, Inc. using the same insulation thickness and casing as the pipe.

EXPANSION: Expansion may be accommodated by means of pre-fabricated and pre-insulated expansion loops and bends or with in-line expansion joints. Expansion loops and bends shall be pre-fabricated in an oversized configuration to accommodate lateral movement of piping. No area or part of the piping shall be uninsulated due to pipe growth. The space provided for lateral movement shall be at least 1 1/2 times greater than the indicated piping movement. Support guides shall be installed where required to facilitate proper movement of the carrier pipe. The length of the oversized conduit shall not be less than that required to produce carrier pipe flexibility within the stress limits indicated by the ANSI B31.1 Code Pressure Piping. Carrier pipe shall be accurately centered inside the oval conduit at the factory and held in place with stays. Installer shall not remove stays before conduit is placed in its final location, backfill material is placed on both sides of oval conduit, and carrier pipe joints are made in oval conduit sections.

WALL PENETRATION SLEEVES: Provide wall penetration sleeves where piping passes through masonry or concrete walls, floors, and roofs. Sleeves in outside walls below and above grade, in floor, or in roof slabs, shall be Schedule 40 or standard weight coated black steel pipe or shall be as specified by the Design Engineer. Space between piping or insulation casing, and the sleeve shall be sufficient to allow proper water tight sealing, but never less than ½". Sleeves shall be held securely in proper position and location during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls or slabs. Sleeves in floor slabs shall extend 2" above the finished floor. In existing concrete manholes or building walls, penetrations may be made using the “core drilling” method providing proper care is taken to drill the holes to the size needed and square to the line of pipe.

VENTING IN MANHOLES: Where manholes are required, it is the responsibility of the installer to utilize the N.P.T. outlet on pipe end cap with a gooseneck to the atmosphere above the manhole.

FIELD JOINTS: Field joints shall be made with a FRP sleeve, insulation half shells, FRP wrap kits, and a wrap around heat-shrinkable sleeve. The circumferential joint between the FRP sleeve and outer FRP jacket shall be covered with layers of pre-cut fiberglass mat and polyester resin provided by the system supplier. The FRP wrap material shall extend over the adjacent casing to form a homogeneous airtight closure. The joint shall be air tested at 5 psi for a period of 2 hours after the cure is complete utilizing the factory installed air tube running through the entire system. Backfilling shall not be started until the joint has passed the air test. After testing, joint shall be sealed with wrap around heat-shrinkable sleeve. The complete joint shall be installed in accordance with the manufacturer’s requirements.

ACCESSORIES: System manufacturer shall provide all required accessories to make the system watertight. This shall include all end terminations, end seals, and gland seals.

INSTALLATION: A 6-inch layer of sand or fine gravel shall be placed and tamped in the trench bottom to provide uniform bedding for the pipe. The entire trench width shall be evenly backfilled with a similar material to the bedding in 6-inch compacted layers to a minimum height of 6 to 12 inches above the top of the insulated piping system. The remaining trench shall be evenly and continuously backfilled in uniform layers with suitable excavated soil to a minimum depth of 30".

The entire piping system installation shall be engineered by the system manufacturer. Complete installation drawings showing all expansion compensation, anchors, thrust blocks, insulation, and dimensions will be provided to the engineer for approval before fabrication commences. The contractor shall include any and all offsets that may be required to provide a complete installation in accordance with the existing conditions at the site and/or the requirements of the manufacturer's final installation drawings.

SUPER WELD-TITE APPLICATION ENGINEERING

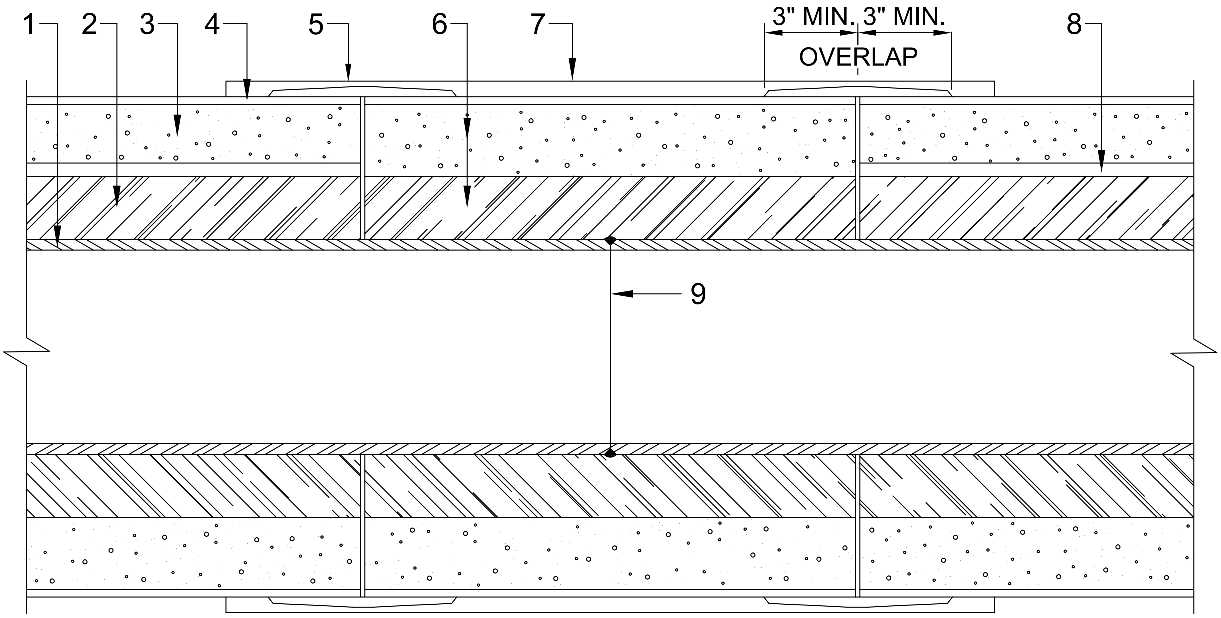
PIPE SYSTEM DESIGN: Standard design techniques and practices for Super Weld-Tite shall be used. Thermal Pipe Systems, Inc. Engineering Department may, on request, provide certain detailed design aspects of the piping for each project based on the project documents and drawings provided by the Design Engineer. It is understood that the project specifications and layout drawings will specify the type of service, location of the site, temperature and pressure classifications, soil conditions, general path and elevations of the system, location and design of manholes, known obstacles, size of the carrier pipe, and the maximum permissible heat losses. It is further understood that other requirements, such as the type of pipe, the location size and capacity of valves, traps, pumps, anchors, controls, expansion devices and special structural elements will be provided by the Design Engineer. The design provided by Thermal Pipe Systems, Inc. and their engineers for the piping will be in accordance with ANSI B31.1 and good engineering practices.

INSULATION: Thicknesses of insulation for Super Weld-Tite pipe, as shown on the page four, are for temperatures up to 450ºF.

DIMENSIONS AND WEIGHTS: Dimensions and weights of insulated Super Weld-Tite piping and fittings are as shown on the following pages. The piping may be furnished in 20 ft. and/or 40 ft. lengths.

SPECIAL DESIGN: Special design of the Super Weld-Tite system components is the responsibility of the Design Engineer.

PRE-INSULATED SUPER WELD-TITE® PIPE



1. CARRIER PIPE: Black Steel as specified.

2. INITIAL INSULATION: Calcium Silicate or Foamglas® to provide high temperature insulation and reduce temperature to below limits of foam.

3. SECONDARY INSULATION: Polyurethane Foam to provide highly efficient insulation and support for carrier pipe along entire length.

4. OUTSIDE CASING: Fiberglass to protect the insulation from ground water and underground loads.

5. FIBERGLASS WRAP: Provides water tight seal at field joints.

6. FIELD JOINT HALF SHELLS: Provide the same efficient insulation and casing along the entire pipe run.

7. FIELD JOINT SEAL: Wraparound heat-shrinkable sleeve.

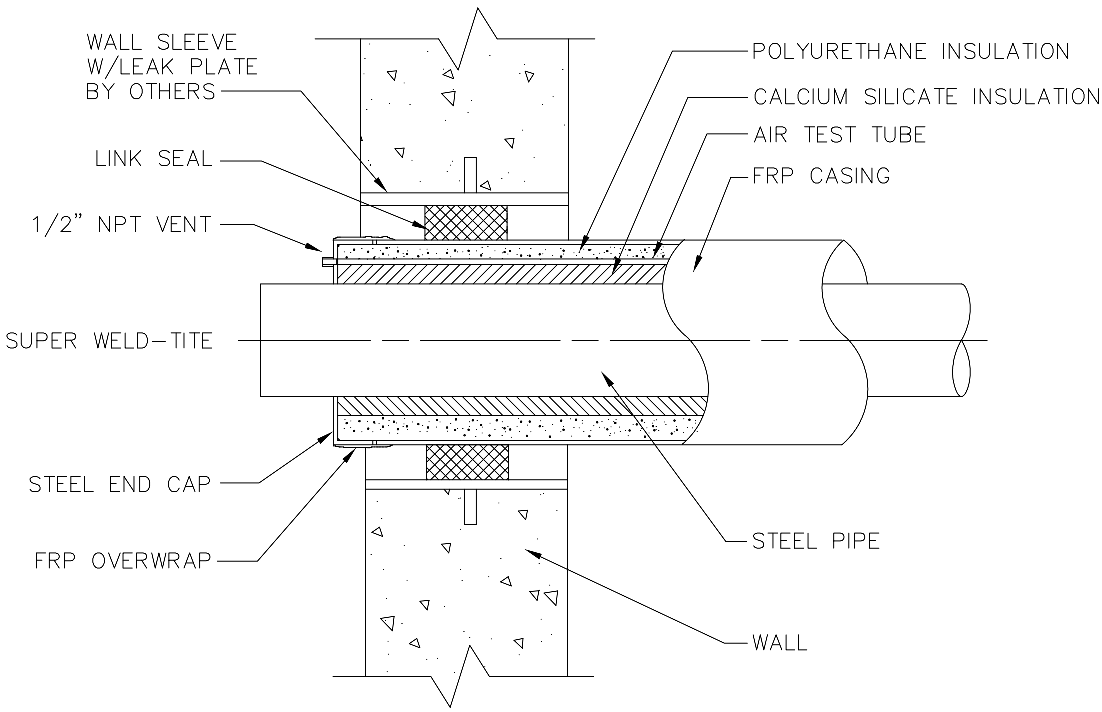
8. AIR TUBE: Copper tube for testing field joints.

9. WELD

NOM. PIPE SIZE	CARRIER O.D.	CASING O.D.	THICKNESS			WEIGHT (LBS./20 FT.)
			CASING	CALCIUM SILICATE or FOAMGLAS®	FOAM	
1 1/2	1.90	8.38	.185	1.00	2.05	144
2	2.38	8.38	.185	1.00	1.81	165
2 1/2	2.88	8.38	.185	1.00	1.56	210
3	3.50	8.38	.185	1.00	1.25	248
4	4.50	9.38	.185	1.00	1.25	335
5	5.56	12.38	.185	1.50	1.72	523
6	6.63	12.38	.185	1.50	1.19	615
8	8.63	16.50	.250	2.00	1.69	925
10	10.75	18.50	.250	2.50	1.13	1,252
12	12.75	20.50	.250	2.50	1.13	1,570
14	14.00	22.50	.250	2.50	1.50	1,822
16	16.00	24.50	.250	2.50	1.50	2,266

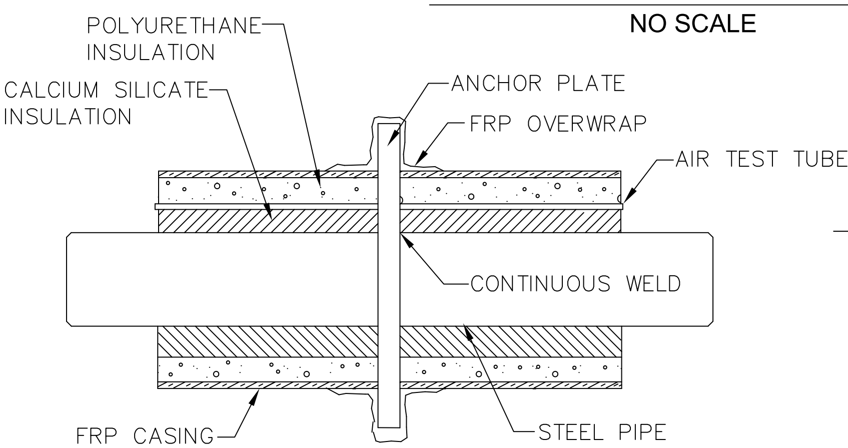
NOTE: All dimensions are in inches unless noted.

PRE-INSULATED SUPER WELD-TITE® PIPE



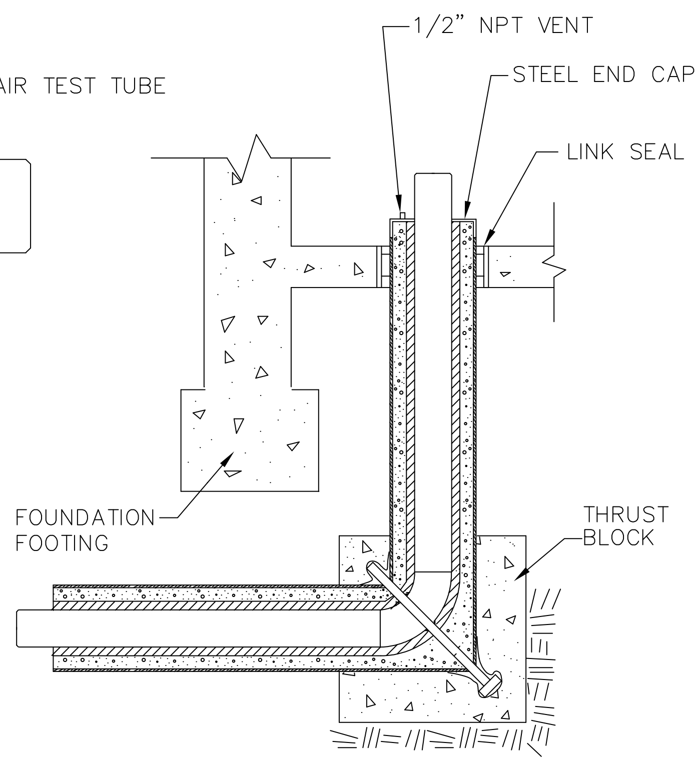
WALL PENETRATION DETAIL

NO SCALE



IN-LINE ANCHOR DETAIL

NO SCALE

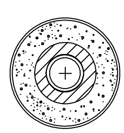


TYPICAL RISER AT BUILDING ENTRANCE

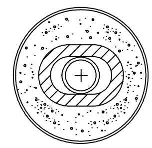
NO SCALE

PRE-INSULATED SUPER WELD-TITE® PIPE

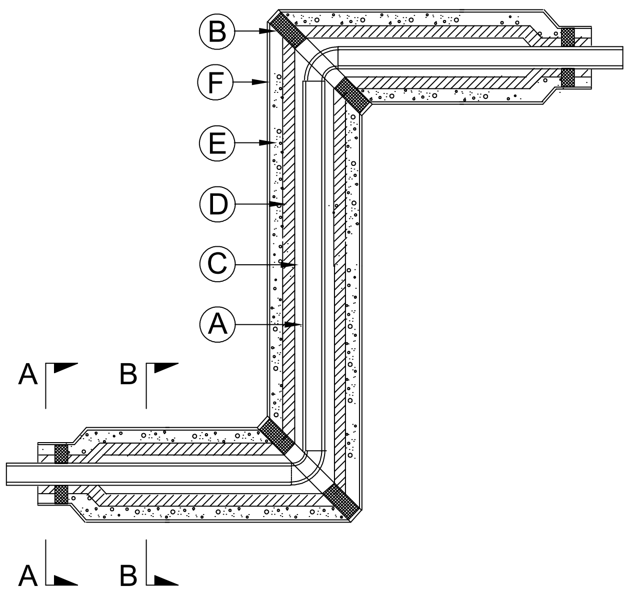
(A) STEEL CARRIER PIPE
(B) GUIDE
(C) AIR SPACE
(D) CALCIUM SILICATE INSULATION
(E) POLYURETHANE INSULATION
(F) FRP CASING



SECTION A-A

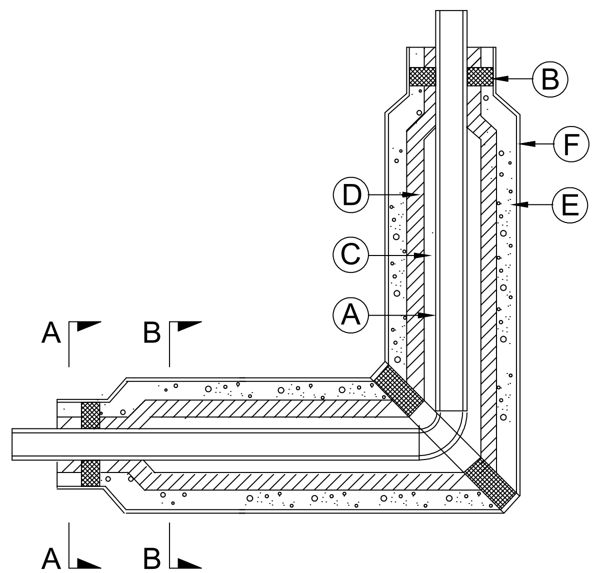


SECTION B-B



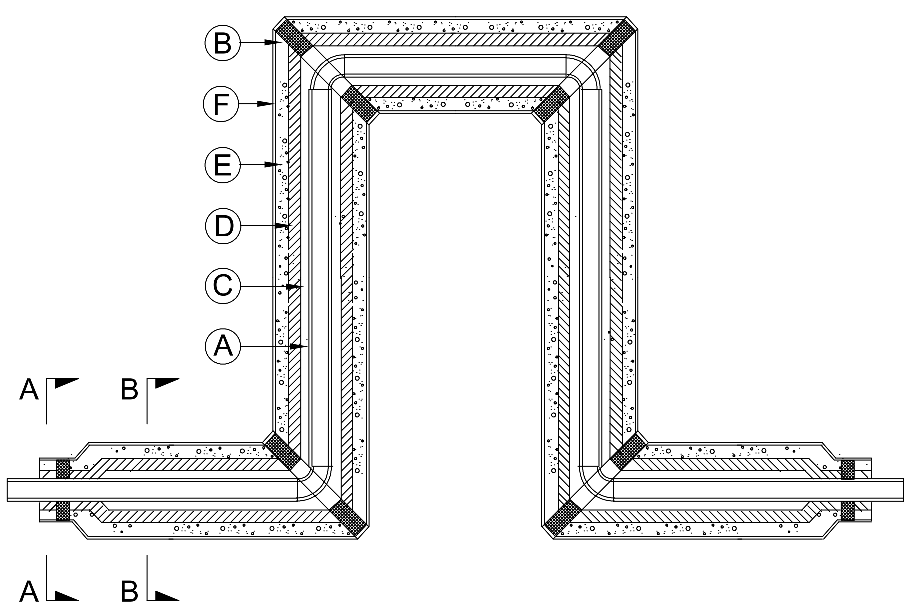
EXPANSION "Z" BEND DETAIL

NO SCALE



EXPANSION ELBOW DETAIL

NO SCALE



EXPANSION LOOP DETAIL

NO SCALE

SUPER WELD-TITE PIPING INSTALLATION SPECIFICATION

GENERAL: Installation of the Super Weld-Tite piping system shall be done in accordance with the appropriate publications including ANSI B31.1 and the following specifications and instructions. A Thermal Pipe Systems, Inc. field representative will conduct an installation clinic to pre-qualify contract personnel in the proper procedures for the installation. Good workmanlike procedures shall be followed.

All piping, unless other wise indicated, shall be pitched with a grade of not less than 1 inch in 40 feet toward the drain points when applicable.

Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign matter out of the system.

RECEIVING AND HANDLING SHIPMENTS

INSPECTION: Each shipment shall be inspected with care on its arrival. The products are carefully loaded at the plant using methods acceptable to the carrier and it is their responsibility to deliver the pipe in good condition. It is the responsibility of the Installation Contractor to ascertain whether there has been any loss or damage. The carrier is the contractor’s agent. Any pipe or equipment that arrives damaged or is lost in shipment shall be reported by the contractor.

Perform an overall inspection of the load. If load is intact, ordinary inspection while unloading should be enough to make sure that the pipe has arrived in good condition. It is the responsibility of the receiver to make certain that there has been no loss or damage. Note specifically that any end packaging should not show signs of damage. If the load has shifted, or end packing damaged, then each piece must be carefully inspected for damage. Check total quantities of each item against the tally sheet (pipe, fittings, etc.) Any damaged or missing items are to be noted on the delivery receipt and the receipt returned to the carrier. Notify the carrier immediately and make claim in accordance with the carrier’s instructions. Thermal Pipe Systems, Inc. will assist, if necessary, in handling this claim. Do not dispose of damaged material - the carrier will notify you of the procedure to follow.

UNLOADING INSTRUCTIONS: The means by which the pipes are unloaded in the field is the decision and responsibility of the installing contractor. The use of mechanical equipment frequently simplifies and speeds up the unloading of larger sizes and usually provides extra protection against damage in handling. To prevent the possibility of the core pipe from shifting within the casing pipe, do not stand a length on one end or raise it vertically. Under no condition should a pipe be dragged along the ground. Do not lift fittings or pipe by inserting a bar, pipe, etc., inside of the core. Damage to the pipe may result. Care should be taken not to crack the material covering the anchor plates since this could possibly cause an air leak when testing the field joints. If any pipe is damaged in unloading and handling, mark the damaged area and set it aside. A Thermal Pipe Systems, Inc. representative will determine whether damaged casing can be repaired in the field and will determine exact method for repair and instruct the contractor in making the repair.

STORAGE: Store pipe on a flat surface so as to support the barrel evenly. Store random lengths separately where they will be readily available. Individual lengths of pipe should be stacked in piles no higher than 5 feet.

> **PLEASE NOTE:** All pipe will be shipped with factory sealed ends to protect the insulation from moisture infiltration. It is Imperative that the installer keeps these seals in place until final field joint is complete. Under no circumstances should water be allowed to enter the insulation before the FRP casing joint overwrap is complete.

LOADING TRANSFER TRUCKS: Use trucks with long bodies so that pipe lengths do not overhang. Make certain truck bed is smooth, without cross-strips, bolt heads, or other protrusions that could damage the pipe. Short body trucks may be used if fitted with racks that properly support the pipe in a horizontal position. The rack should support the pipe with supports spaced every 3 feet or less along the pipe lengths. Pad the contact areas to avoid damage to the pipe.

DISTRIBUTING PIPE ALONG TRENCH: Pipe lengths may be strung along the line of the trench to minimize additional handling during installation. Do not remove protection materials from the pipe ends until the pipe is lowered into the trench and ready for assembly.

EXCAVATION: Excavation should consider the need for the concrete anchors at required fittings that are directly buried in the ground. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines, generally a minimum of 6" in pipe sizes up to 6" diameter, and 12" minimum in sizes 8" and up. The excavation should be in a straight line except where fittings are located.

TRENCHING: Trenching shall follow the elevations provided by the Design Engineer. Keep excavations free of water during construction. If the contractor determines it is necessary to remove unsuitable material to a depth greater than specified, refill excavations carried below the depths indicated or directed with specified bedding material and compact in 6 inch lifts to 95 percent of maximum density in accordance with ASTM D1557, Method D. Excavate and replace soil disturbed and weakened by the contractor’s operations or soils permitted to soften from exposure to weather, with bedding material and compact with a plate-type vibratory compactor. The minimum burial depth shall be a 30" cover over the pipe casing. Lesser depths could result in undesirable ground surface temperatures.

TRENCH WIDTHS: The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation. The reason for this is to keep the earth load on the pipe as small as possible, since, in general, the wider the trench at the top of the pipe, the greater the load on the pipe. Note that an increase on trench width above the top of the pipe, by sloping the sides or digging a wider offset trench, does not affect the earth load on the pipe. On the other hand, a trench that is too narrow will make assembly difficult and may reduce the rate and quality of installation. In addition, lack of ample room will limit the capability to properly backfill and tamp around the pipe. Although each job or portion of a job must be considered on an individual basis, as a rule, the following minimum trench widths at the top of the pipe are recommended: Minimum: One foot greater than the outside diameter of the casing. Where two or more pipes are in the same trench, use the distance between outside casing of the outside pipes plus one foot. Maximum: Use above method for minimum plus two feet.

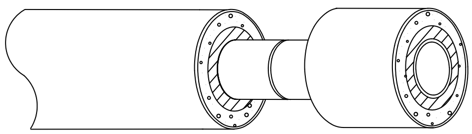
PLACING PIPE IN THE TRENCH: The Super Weld-Tite pipe shall be mechanically passed into the trench. The latest state and federal safety regulations should be understood and observed. If slings are necessary use only canvas straps, no cable or chain slings shall be used.

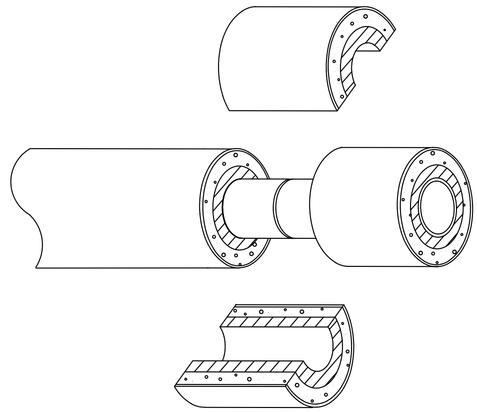
BEDDING: The pipe should be bedded in accordance with basic good practices that apply to all buried pressure pipelines.

WELDING: End covers should remain in place until welding operations are ready to begin. System sections including fittings and loops should first be laid out and aligned. Welding procedures shall be in accordance with contract specifications, ANSI B31.1 and good welding practices.

TESTING: All carrier pipe joints shall be tested in accordance with the contract specifications before applying field joints. If no test is specified, it should consist of a hydrostatic test of 150 psi or 1 1/2 times working pressure, which ever is greater, for a period of two hours.

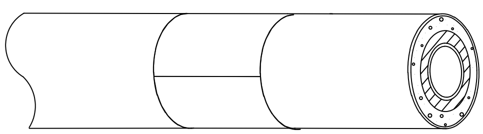
INSULATE FIELD JOINTS: After successful testing of carrier pipe joints, the welded joints should be insulated using the insulation kits supplied by Thermal Pipe Systems, Inc.

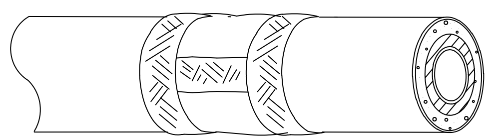




1. Weld pipe 2. Apply field joint half shell

First weld carrier pipes together. Then attach field joint half shells. Next sand the circumferential and horizontal joints. Apply FRP wrap first to the two horizontal joints and then to the two circumferential joints. The field applied FRP wrap should extend 3” on each side of joint. After FRP wrap is cured and hardened apply wraparound heat-shrinkable sleeve on field joint. Detailed field joint procedures are to be supplied by Thermal Pipe Systems, Inc.





3. Close joint 4. Apply FRP wrap and shrink sleeve

TESTING OF FIELD JOINTS: All field joints are to be air tested at 5 psi for 2 hours before backfilling commences.

BACKFILLING: Backfilling of trenches shall progress as rapidly as construction, testing, and acceptance of work permits. Uniformly compact and grade bottom of trenches. After installation of bedding material and pipe, place backfill as follows:

Place initial backfill by hand to a depth of 12 inches over the top of the pipe or casing. Compact the material to a density equivalent to the surrounding undisturbed soil or to 90 percent of maximum density (ASTM D1557, Method D), whichever is greater. Backfill remainder of trench in one-foot lifts and compact as above. For trenches excavated in roads, streets, or located under structures, place backfill in 6-inch layers to the top of the trench and compact each layer to at least 95 percent maximum density (ASTM D1557, Method D).

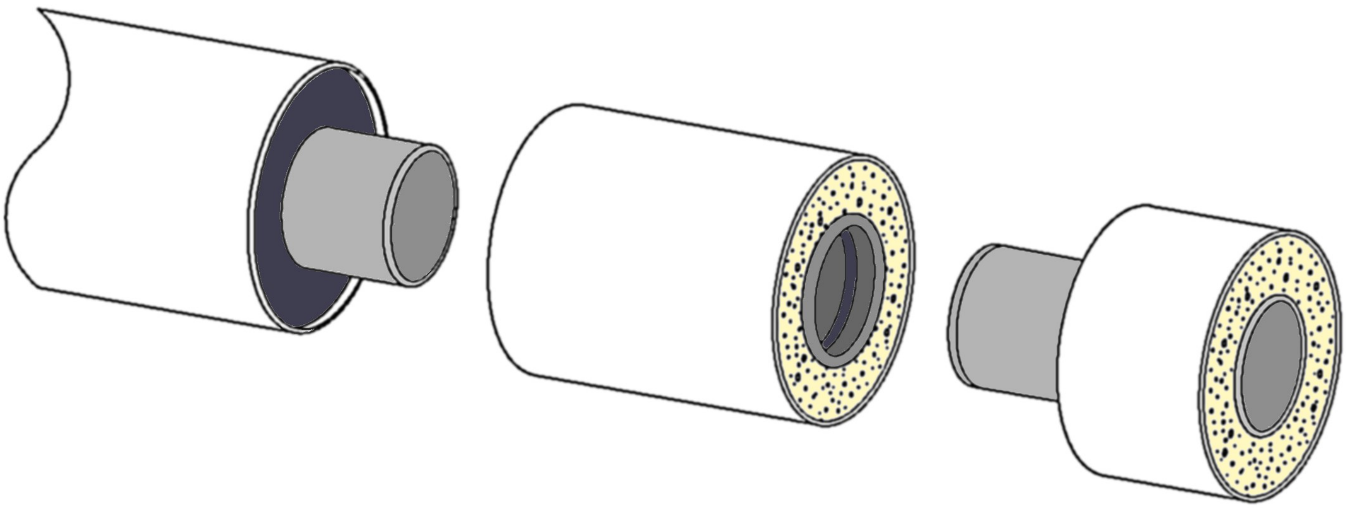
START-UP PROCEDURE: Start-up procedure shall conform to generally accepted practices and be done in a workman-like manner. Improper start-up of high temperature lines may damage the piping system and attached equipment.

MANUFACTURERS WRITTEN CERTIFICATION: After testing and prior to start-up of the system, the manufacturer must certify in writing that the system was installed per the manufacturer's installation instructions.

Thermal Pipe Systems, Inc.

HEAT-TITE®

Steel Piping System Featuring Gasketed Coupling
with Built-In Expansion Control
For
Low Temperature Hot Water and Dual Temperature Service



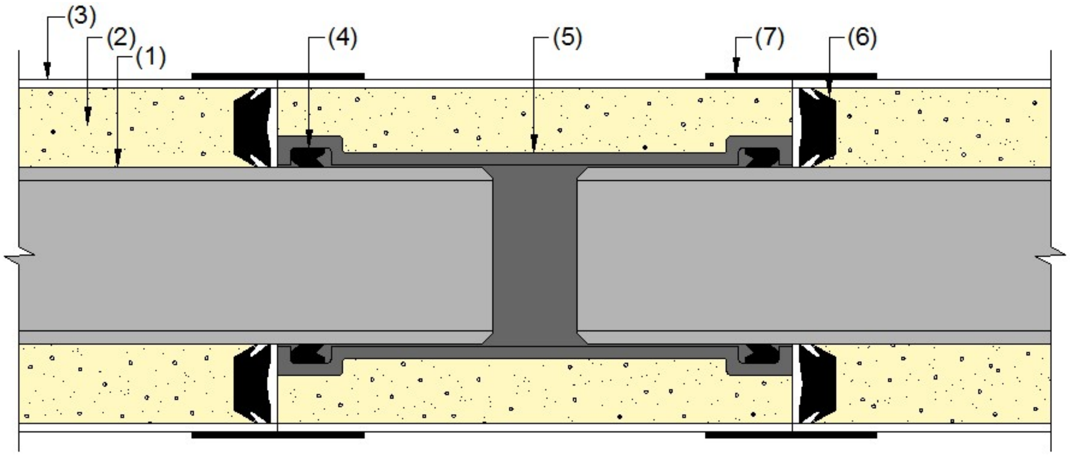
Heat-Tite is energy efficient piping system that is easy to install. It is used in hot water service to 250ºF at pressures to 150psi.

The standard carrier pipe is schedule 40, A-53 steel pipe the sealing surface protected to prevent corrosion. The system is produced with a Ductile Iron double grooved coupling containing high temperature rubber 'V' rings. Insulation is thermally efficient polyurethane foam with a 'K' factor of 0.16 at 70ºF. The heavy wall PVC or HDPE casing and heat resistant end seals keep the insulation dry. Pre-insulated fittings are available.

To join Heat-Tite, simply push the spigot end into the coupling. A lubricant is supplied for ease of installation. The rubber ring joint compensates for thermal movement without additional stress on the pipe. There is no need for loops or other expansion devices. The coupling is factory pre-insulated to further expedite installation.

Heat-Tite meets Federal Guide Specifications for condensate and hot water.

HEAT-TITE®



(1) CARRIER: Black steel as specified
(2) INSULATION: Polyurethane Foam
(3) CASING: PVC or HDPE
(4) CARRIER SEALING RING: EPDM
(5) COUPLING: Ductile iron
(6) END SEAL: EPDM
(7) CASING-TITE SEAL: 30 mil High Temperature Tape

NOMINAL PIPE SIZE (IN.)	NOMINAL CASING SIZE (IN.)	CARRIER O.D. (IN.)	CASING O.D. (IN.)	THICKNESS		WEIGHT (LBS./ 20 FT.)
				FOAM (IN.)	PVC CASING (IN.)	
1 1/2	4	1.90	4.50	1.16	0.140	83
2	4	2.38	4.50	0.92	0.140	101
2 1/2	6	2.88	6.14	1.51	0.120	153
3	6	3.50	6.14	1.20	0.120	188
4	8	4.50	8.16	1.67	0.160	281
6	10	6.63	10.20	1.59	0.200	478
8	12	8.63	12.24	1.57	0.240	708
10	14	10.75	14.28	1.49	0.280	998
12	16	12.75	16.00	1.38	0.250	1176

NOTE: Standard lengths are 20'-0" or 40'-0". Weights are approximate. Consult manufacturer for HDPE dimensional data.

SHORT FORM SPECIFICATIONS

1.1 All underground pre-insulated pipe 1 1/2" – 12" shall be Thermal Pipe Systems, Inc. Heat-Tite® piping with Ring-Tite joints.

1.2 Steel carrier pipe shall be black steel of the type, grade, and class specified by the design engineer. The pipe shall be suitable for use at maximum hydrostatic working pressure of 150 psi at 250ºF.

1.3 Each joint shall automatically provide for expansion and contraction through the Ethylene Propylene Diene Monomer (EPDM) sealing rings in the grooves of the pre-insulated ductile iron coupling.

1.4 Casing pipe shall be [Polyvinyl Chloride (PVC) meeting the minimum classification requirements of ASTM D-1784] or [High Density Polyethylene (HDPE)]. The thickness shall be in accordance with the Thermal Pipe Systems published data.

1.5 The insulation shall be polyurethane foam completely encapsulated on each end by a compression rubber end seal.

1.6 The rubber end seals shall be an Ethylene Propylene Diene Monomer (EPDM) heat resistant compound.

1.7 Fittings may be uninsulated using welded steel or ductile iron class 150 fitting with a groove and rubber ring. Fittings may also be pre-insulated by Thermal Pipe Systems, Inc. using the same carrier pipe, insulation thickness, and casing as the straight lengths of pipe.

1.8 After completion of hydrostatic testing, joints shall be closed using factory supplied 30 mil high temperature tape. It shall be applied circumferentially around the seam between the coupling and pipe casing.

Thermal Pipe Systems, Inc.
5205 W. Woodmill Dr. Suite 33 – Wilmington, DE 19808
Tel: 302-999-1588 – Fax: 302-999-8861
Website: www.thermalpipesystems.com

Thermal Pipe Systems, Inc.

HEAT-TITE® PIPING SYSTEM

FOR LOW TEMPERATURE HOT WATER AND DUAL TEMPERATURE SERVICE

SPECIFICATIONS & DRAWINGS

5205 W. WOODMILL DRIVE, SUITE 33
WILMINGTON, DELAWARE 19808
PHONE: 302.999.1588
WWW.THERMALPIPESYSTEMS.COM

HEAT-TITE PIPING SYSTEMS SPECIFICATIONS

HEAT-TITE shall be used where specified for condensate, low temperature hot water, chilled water, or dual temperature service, using a rubber ring joining method. Unless otherwise specified, all pipe, fittings, valves, and accessories shall conform to the requirements of ANSI B31.1 and shall be of the proper type for pressure and temperature of the heating or cooling water.

STEEL CARRIER PIPE: Carrier pipe shall be black steel per ASTM A-53, Grade B, **[welded]** or **[seamless]** or ASTM A-106 **[seamless]**, schedule **[40]** (standard weight for 12"Ø) or schedule **[80]** (extra heavy for 10"Ø and 12"Ø). The spigot ends shall be sand blasted and zinc coated for corrosion protection.

HEAT-TITE COUPLING: The HEAT-TITE coupling shall be Ductile Iron. The Ductile Iron coupling shall be Grade 65-45-12 in accordance with ASTM A-536. The coupling shall have a deep bell push-on configuration with sealing rings meeting ASTM F-477. The length of the coupling shall be such that, when correctly assembled, it will give the proper end separation. Sealing rings shall be EPDM and supplied by the coupling manufacturer. The coupling shall be factory insulated using the same casing and insulation as the straight length of pipe.

POLYURETHANE FOAM INSULATION: The insulation shall be Polyurethane Foam and shall meet the following specifications:

Type:	Two component urethane
Compressive Strength:	40 psi parallel min at 5% comp
Shrinkage:	None at 70°F
Free Rise Density:	2.0 to 3.0 lbs./cubic foot
Aged "K" (70°F - 72 hrs)	0.16 BTU-in./hour-°F-ft.^{2}
Closed Cell Content:	90%

Insulation Concentricity: Carrier Pipe shall be concentric to casing pipe. The allowable maximum deviation from centerline of carrier pipe shall be plus or minus 1/4 inch at the casing center point and plus or minus 1/16 inch at the end seals.

CASING PIPE: The casing shall be **[Polyvinyl Chloride (PVC)]** pipe shall be of virgin PVC resin meeting the minimum classification requirements of ASTM D1784 or **[High Density Polyethylene (HDPE)]**. The thickness for PVC casing shall be as shown on page four. Consult manufacturer for HDPE dimensional data.

RUBBER END SEALS: Rubber end seals for insulated HEAT-TITE shall be a high temperature (HT) heat resistant Ethylene Propylene Diene Monomer (EPDM) molded rubber compound. All surfaces shall be smooth and free of voids. End seals for 1-1/2”Ø and 2-1/2”Ø shall be a high temperature (HT) rubber compound with compression type seal.

CASING-TITE SEAL: Casing seal shall be made with high temperature 30 mil tape.

INSULATED FITTINGS: Fittings may be pre-insulated by Thermal Pipe Systems, Inc. using the same insulation thickness and casing as the pipe. An anchor plate of the proper size shall be provided. End seals on fittings shall be the same as used on the pipe.

UNINSULATED FITTINGS: Where fittings are specified to be uninsulated, they shall be manufactured of ductile iron with a push-on configuration similar to the pipe joint or welded steel. Rubber rings shall be supplied by the fitting manufacturer.

WALL PENETRATION SLEEVES: Provide where piping passes through masonry or concrete walls, floors, and roofs. Sleeves in outside walls below and above grade, in floor, or in roof slabs, shall be schedule 40 or standard weight coated black steel pipe or shall be as specified by the Design Engineer. Space between the casing OD and the sleeve ID shall never be less than ½". Sleeves shall be held securely in the proper position and location during construction. Sleeves shall be of sufficient length to pass through the entire thickness of walls or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Refer to typical detail of wall penetration as shown. In existing concrete manholes or building wall penetrations may be made using the "core drilling" method providing proper care is taken to drill the holes to the size needed and square to the line of the pipe.

WALL PENETRATION SEALS: All wall penetrations shall be sealed to prevent water from entering the building or manhole. The sealing material shall be as specified by the engineer.

HEAT-TITE APPLICATION ENGINEERING

PIPE SYSTEM DESIGN: Standard design techniques and practices for HEAT-TITE shall be used. Thermal Pipe Systems, Inc. Engineering Department may on request provide certain detailed design aspects of the piping for each project based on the project documents and drawings provided by the Design Engineer. It is understood that the project specifications and layout drawings will specify the type of service, location of the site, temperature and pressure classifications, soil conditions, general path and elevations of the system, location and design of manholes, known obstacles, size of the carrier pipe, and the maximum permissible heat losses. It is further understood that other requirements such as the type of pipe, the location, size, and capacity of valves, traps, pumps, anchors, controls, expansion devices and special structural elements will be provided by the Design Engineer. The design provided by Thermal Pipe Systems, Inc. and their engineers for the piping will be in accordance with ANSI B31.1 and good engineering practices.

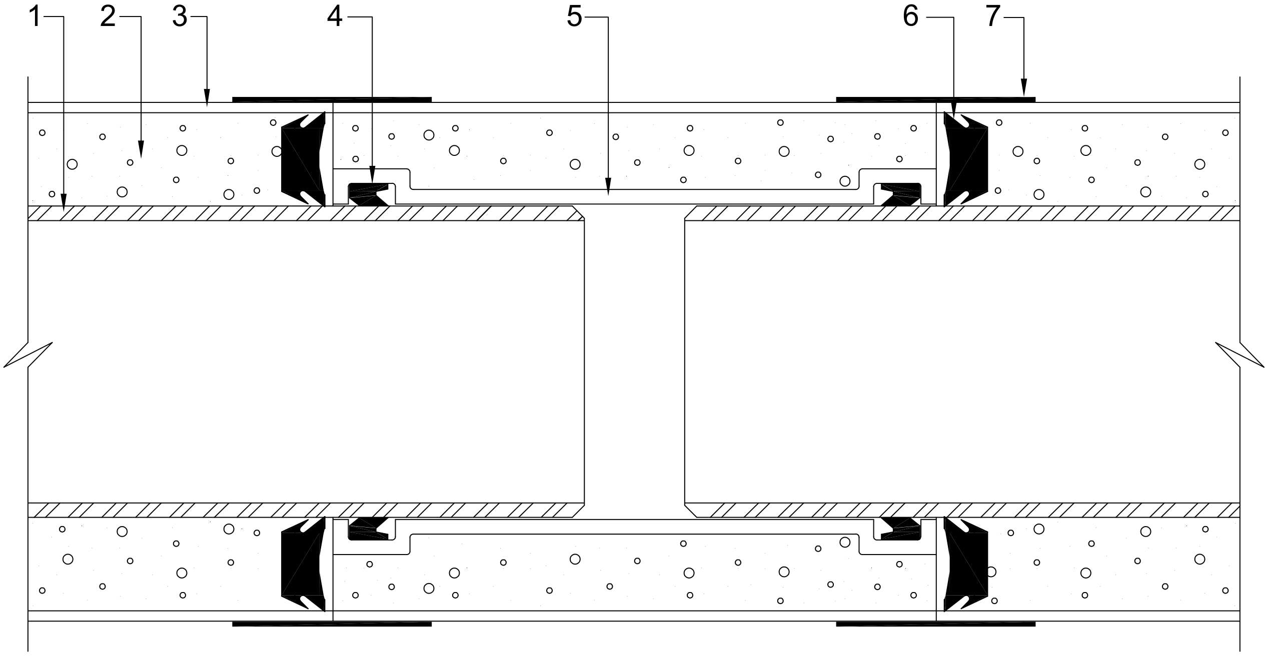
Fluid flow design will be based on Hazen-Williams formula with "C" Factor of 100, or a variation of the Euler formula for water flow.

INSULATION: Thickness of insulation for HEAT-TITE pipe and fittings shall be as shown on the drawing on page 4.

TEMPERATURE AND PRESSURE: The HEAT-TITE piping system and all its components are designed to operate up to 150 psig at 250°F, plus typical surges.

DIMENSIONS AND WEIGHTS of insulated HEAT-TITE piping and fittings are as shown on the following pages. The HEAT-TITE piping may be furnished in 20 ft. and/or 40 ft. lengths. Note: 40 ft. lengths are only available for pipe sizes 2-1/2”Ø - 12”Ø.

PRE-INSULATED HEAT-TITE® PIPE

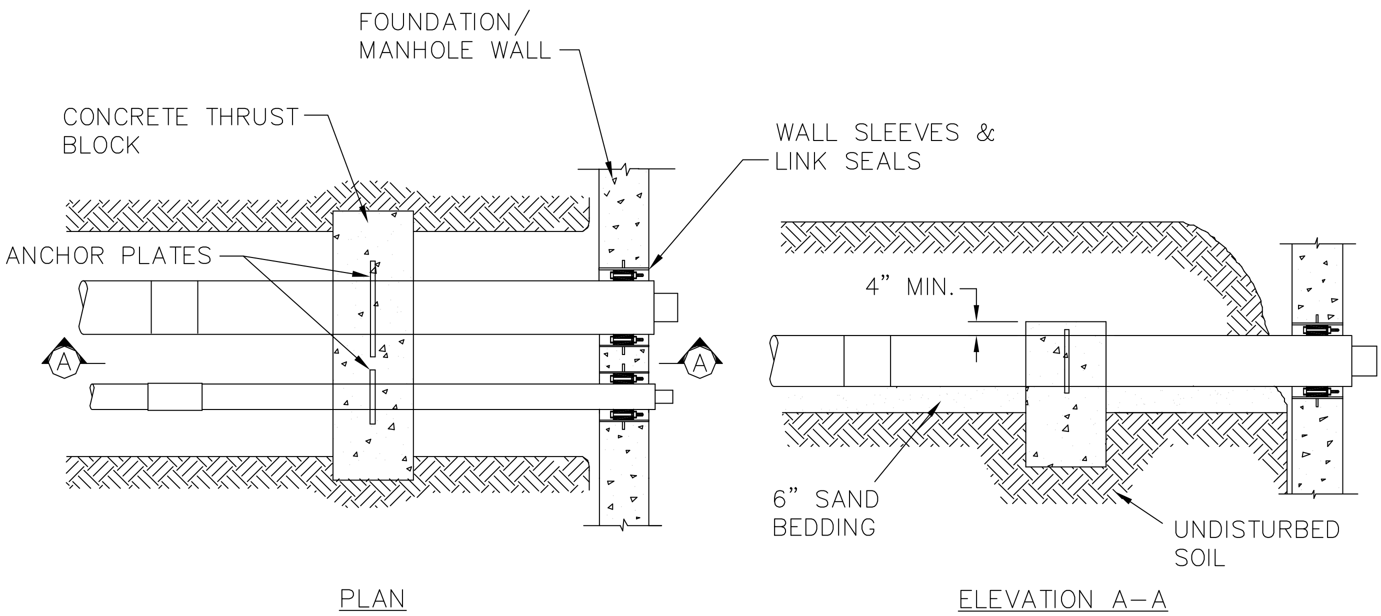


1) CARRIER: Black Steel as specified
2) INSULATION: Polyurethane Foam
3) CASING: PVC or HDPE
4) CARRIER SEALING RING: EPDM
5) COUPLING: Ductile Iron (Preinsulated)
6) END SEAL: EPDM
7) CASING-TITE SEAL: 30 Mil H.T. Tape

NOM. PIPE SIZE	CARRIER O.D.	CASING O.D.	THICKNESS		WEIGHT (LBS./20 FT.)
			PVC CASING	FOAM	
1 1/2	1.90	4.50	.14	1.16	83
2	2.38	4.50	.14	0.92	101
2 1/2	2.88	6.14	.12	1.51	153
3	3.50	6.14	.12	1.20	188
4	4.50	8.16	.16	1.67	281
6	6.63	10.20	.20	1.59	478
8	8.63	12.24	.24	1.57	708
10	10.75	14.28	.28	1.49	998
12	12.75	16.00	.25	1.38	1,176

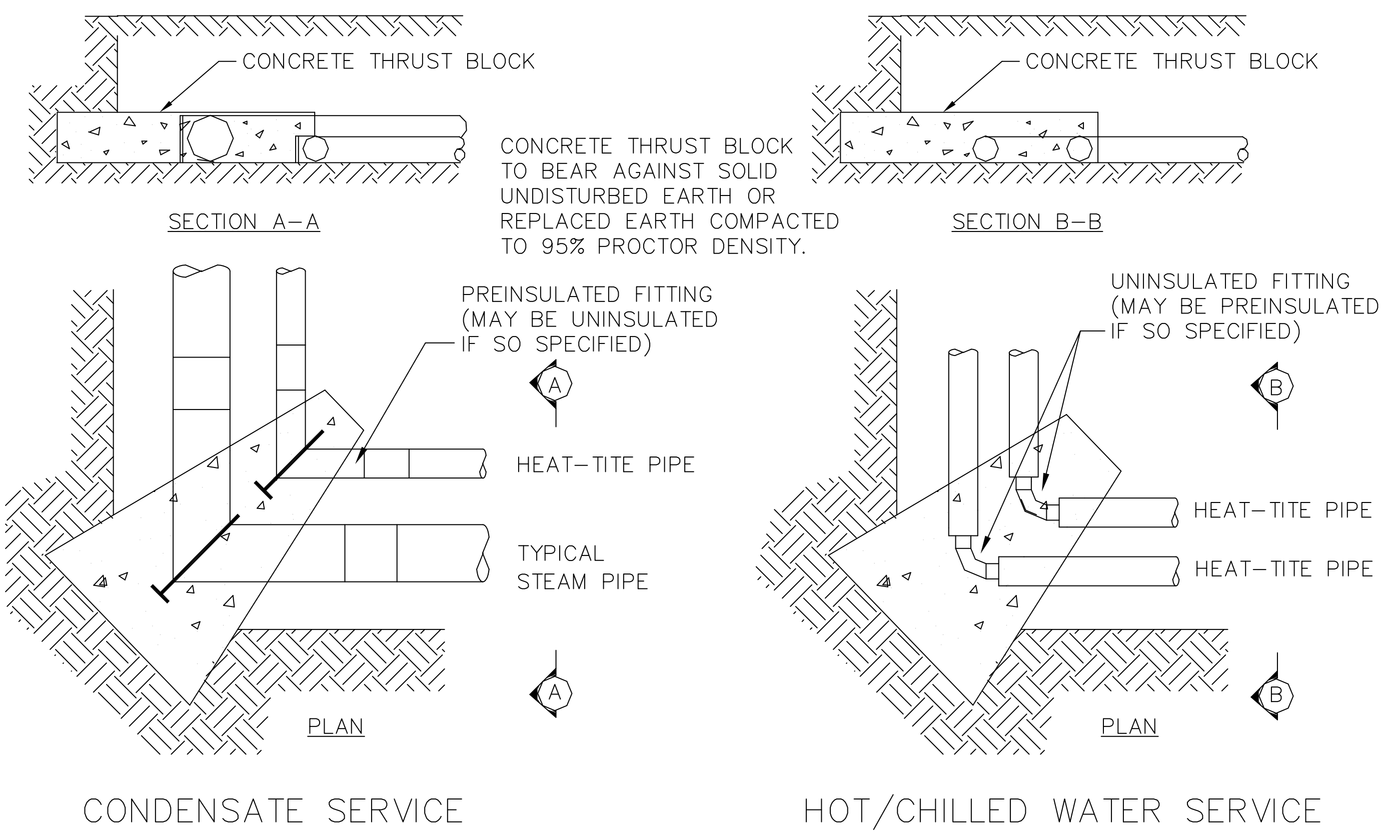
NOTE: All dimensions are in inches unless noted. Consult manufacturer for HDPE dimensional data.

PRE-INSULATED HEAT-TITE® PIPE



TYPICAL THRUST BLOCK AT WALL PENETRATIONS

NO SCALE

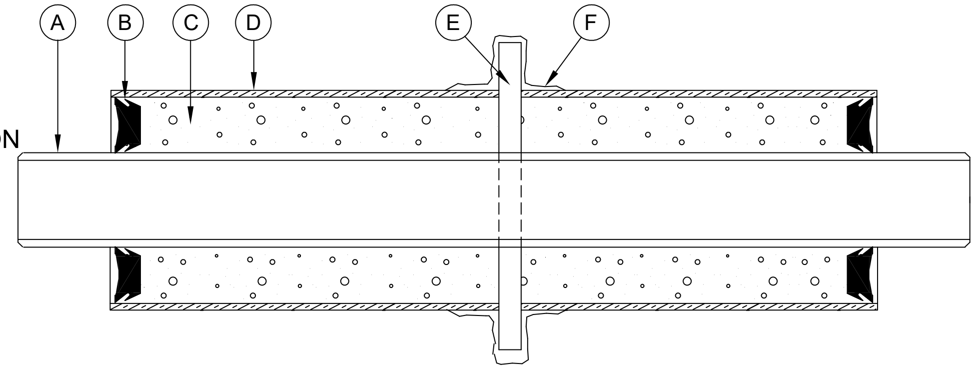


TYPICAL THRUST BLOCK AT ELBOWS

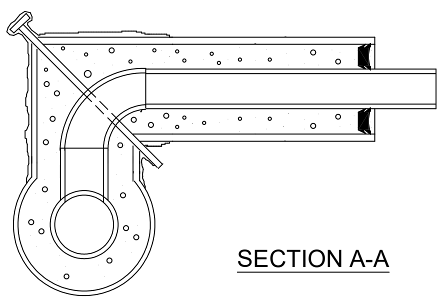
NO SCALE

PRE-INSULATED HEAT-TITE® PIPE

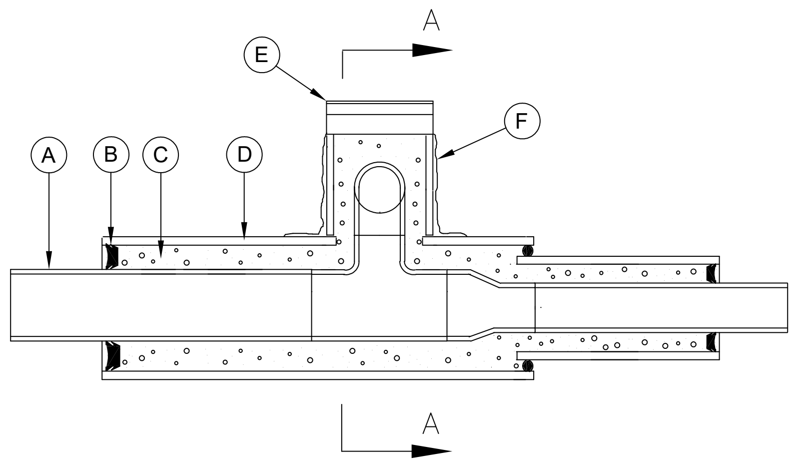
- (A) STEEL CARRIER PIPE
- (B) END SEAL
- (C) POLYURETHANE INSULATION
- (D) PVC OR HDPE CASING
- (E) ANCHOR PLATE
- (F) FRP OVERWRAP



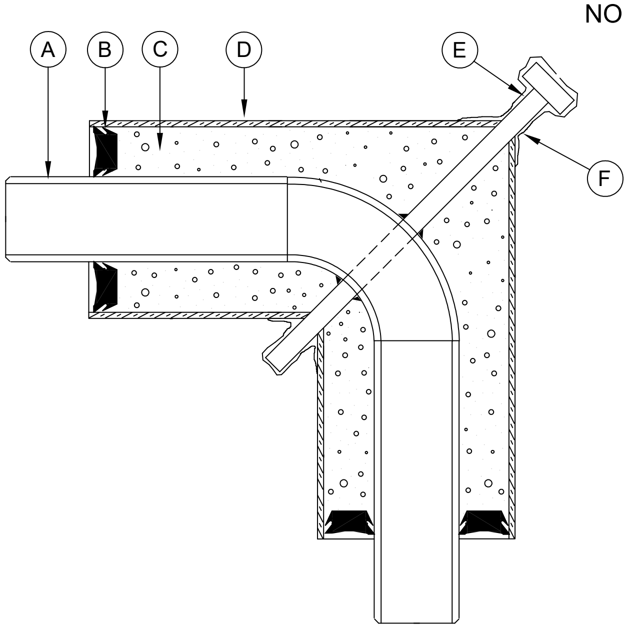
MID-POINT ANCHOR
NO SCALE

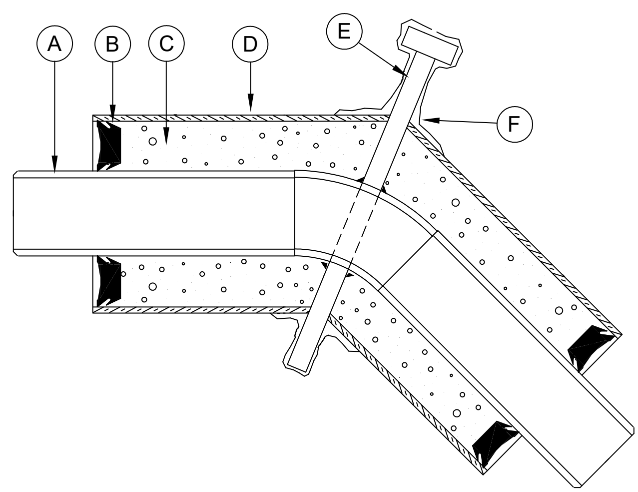


SECTION A-A



CROSSOVER TEE
NO SCALE





90° ELBOW WITH ANCHOR
NO SCALE

45° ELBOW WITH ANCHOR
NO SCALE

HEAT-TITE INSTALLATION SPECIFICATION

GENERAL: Installation of the HEAT-TITE piping system shall be done in accordance with the appropriate publications including ANSI B31.1 and the following specifications and instructions. A Thermal Pipe Systems, Inc. field representative may conduct an installation clinic to pre-qualify contract personnel in the proper procedures for the installation.

Piping shall be accurately cut to dimensions established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation shall not be permitted. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints. Good workmanlike procedures shall be followed.

All piping, unless otherwise indicated, shall be pitched with a grade of not less than 1 inch in 40 feet toward the drain points when applicable.

Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign matter out of the system.

RECEIVING AND HANDLING SHIPMENTS

INSPECTION: Each shipment shall be inspected upon its arrival at the site. The products are carefully loaded at the plant using methods acceptable to the carrier and it is his responsibility to deliver the pipe in good condition. It is the responsibility of the installation contractor to ascertain whether there has been any loss or damage. The carrier is the contractor's agent. Any pipe or equipment that arrives damaged or is lost in shipment shall be reported by the contractor.

Make overall inspection of the load. If load is intact, ordinary inspection while unloading should be enough to make sure that the pipe has arrived in good condition. It is the responsibility of the receiver to make certain that there has been no loss or damage. Note specifically that any end packaging should not show signs of damage. If the load has shifted, or end packing is damaged, then each piece must be carefully inspected for damage. Specifically, the ends should be inspected for scars, nicks, etc. Other obvious damage is also cause for rejection. Check total quantities of each item against the tally sheet (pipe, fittings, etc.). Any damaged or missing items are to be noted on the delivery receipt and the receipt returned to the carrier. Notify the carrier immediately and make claim in accordance with the carrier's instructions. Thermal Pipe Systems, Inc. will assist, if necessary, in handling this claim. Do not dispose of damaged material

- the carrier will notify you of the procedure to follow.

UNLOADING INSTRUCTIONS: The means by which the pipes are unloaded in the field is the decision and responsibility of the installing contractor. The use of forklift type equipment frequently simplifies and speeds up the unloading of larger sizes and usually provides extra protection against damage in handling. To prevent the possibility of the core pipe from shifting within the casing pipe, do not stand a length on one end or raise it vertically. Under no condition should a pipe be dragged along the ground. Do not lift fittings or pipe by inserting a bar, pipe, etc., inside of the core. Damage to the pipe may result. If any pipe is damaged in unloading and handling, mark the damaged area and set it aside. Thermal Pipe Systems, Inc. Representative will determine whether damaged casing can be repaired in the field and will determine exact method for repair and instruct contractor in making repair.

COLD WEATHER HANDLING FOR PVC CASED PIPE: As the temperature approaches freezing, the flexibility and impact resistance of HEAT-TITE pipe is reduced. PVC casing becomes hard and brittle in cold weather and will crack more readily if dropped or hit. Therefore, extra care should be used in handling during cold weather. Pipe at the bottom of a stack may become out-of-round due to the weight of material above it. At normal application temperatures, this corrects itself soon after the load is removed. Under freezing conditions, this recovery to full initial roundness may take several hours.

STORAGE: Store pipe on dunnage in a flat area. Support the barrel of the casing evenly. Bell and spigot ends should overhang dunnage. Individual lengths of pipe should be stacked in piles no higher than five (5) feet. It should be noted that when PVC pipe is stored outside and exposed to sunlight for prolonged periods, a slight discoloration of pipe can occur. This coloration is a surface layer of hardened plastic and does not inhibit the long-term properties and performance of the pipe. A method of protecting the pipe during long exposures (several months) to sunlight is to cover it with canvas or other opaque material. Do not use clear plastic sheets and be sure to provide for air circulation under the sheets.

LOADING TRANSFER TRUCKS: Use trucks with long bodies so that pipe lengths do not overhang. Make certain truck bed is smooth, without cross-strips, bolt heads, or other protrusions that could damage the pipe. Short body trucks may be used if fitted with racks that properly support the pipe in a horizontal position. The rack should support the pipe with supports spaced every 3 feet or less along the pipe lengths. Pad the contact areas to avoid damage to the pipe.

EXCAVATION: Excavation should consider the need for the thrust blocks at all fittings that are directly buried in the ground. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines, generally a minimum of 6" in pipe sizes up to 6" diameter, and 12" minimum in sizes 8" and larger. The excavation should be in a straight line.

TRENCHING: Trenching shall follow the elevations provided by the Design Engineer on the contract drawings. The trench depth should always allow for a minimum cover height of 24" over the top of the casing pipe. Keep excavations free of water during construction. If the contractor determines it is necessary to remove unsuitable material to a depth greater than specified, refill over excavated area to the proper depth with specified bedding material compacted in 6 inch lifts to 95 percent of maximum density in accordance with ASTM D1557, Method D. Excavate and replace soil disturbed and weakened by the contractor’s operations or soils permitted to soften from exposure to weather, with bedding material and compact with a plate-type vibratory compactor.

TRENCH WIDTHS: The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation. The reason for this is to keep the earth load on the pipe as small as possible. The wider the trench at the top of the pipe, the greater the load on the pipe. Note that an increase in trench width above the top of the pipe, by stepping the sides or digging a wider offset trench, does not affect the earth load on the pipe. On the other hand, a trench that is too narrow will make assembly difficult and may reduce the rate and quality of installation. In addition, lack of ample room will limit the capability to properly backfill and tamp around the pipe. Although each job, or portion of a job must be considered on an individual basis, as a rule, the following minimum trench widths at the top of the pipe are recommended: Minimum: one foot greater than the outside diameter of the casing. Where two or more pipes are in the same trench, use the distance between outside casing of the outside pipes plus one foot. Maximum: Use above method for minimum plus 2'.

DISTRIBUTING PIPE ALONG TRENCH: Pipe lengths may be strung along the line of the trench so as to minimize additional handling during installation.

PLACING PIPE IN THE TRENCH: The HEAT-TITE pipe may be hand or mechanically passed into the trench. The latest state and federal safety regulations should be understood and observed. If slings are necessary use only canvas straps, do not use cable or chain slings. A backhoe or boom truck provides an excellent way of lowering the pipe into the trench.

BEDDING: Bedding material should be sand or other materials free of sharp objects, heavy clods, boulders or frozen lumps as specified by the Design Engineer. The approved bedding should be used 6" under, around, and over the pipe. Utilize good practices that apply to buried pressure piping.

ASSEMBLY:

1) Check to make sure rings are in coupling grooves and make certain they are faced properly and completely seated.

2) Check the pipe end to be sure it is clean, and wipe with a clean, dry rag if necessary.

3) Dig a slight bell hole to keep the joint area clean and free of loose soil during assembly.

4) Lubricate pipe ends - soap lubricant supplied by Thermal Pipe Systems, Inc. should be applied to the entire outside circumference of the pipe back to the end seal.

5) Start the coupling onto the end of the pipe by hand, then holding the coupling straight, push it home against the pipe casing with a bar and block.

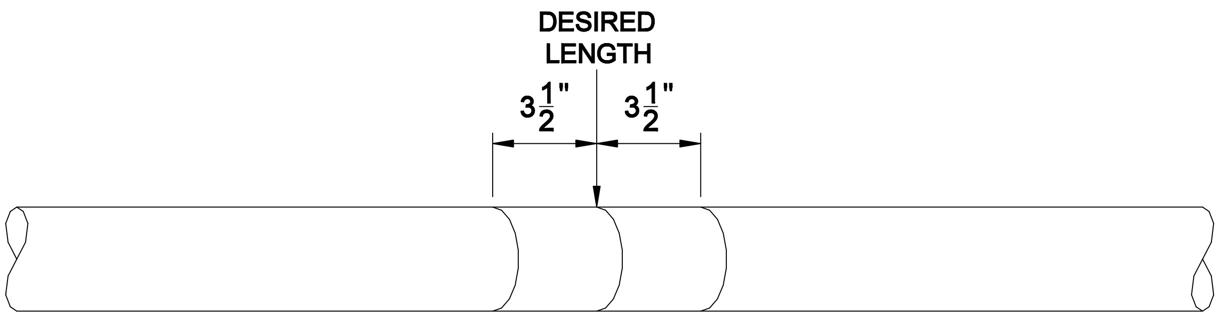
TESTING: All carrier pipe joints shall be tested in accordance with the contract specifications. If no test is specified, it should consist of a hydrostatic test of 150 psi or 1½ times working pressure, which ever is greater, for a period of two hours.

CLOSURE OF JOINTS: After completion of testing, apply factory supplied Casing-Tite Seal circumferentially around the seam between coupling and pipe casings. Overlap seal 3 inches.

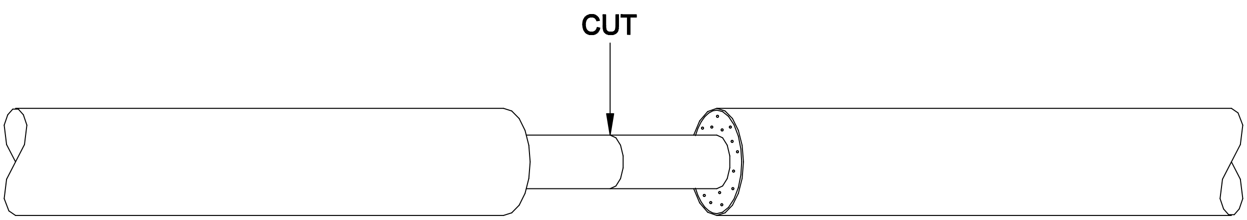
BACKFILLING: Backfilling of trenches shall progress as rapidly as construction, testing, and acceptance of work permits. Uniformly compact and grade bottom of trenches. After installation of pipe and bedding material, backfill as follows: Place initial backfill in layers to a depth of 12 inches over the top of the initial bedding. Compact the material to a density equivalent to the surrounding undisturbed soil or to 90 percent of maximum density (ASTM D1557, Method D), whichever is greater. Backfill remainder of trench in one-foot lifts and compact to 90 percent maximum density (ASTM D1557, Method D). For trenches excavated in roads, streets, or located under structures, place backfill in 6-inch layers to top of trench and compact each layer to at least 95 percent maximum density (ASTM D1557, Method D).

FIELD CUTTING PIPE TO A SPECIFIC LENGTH

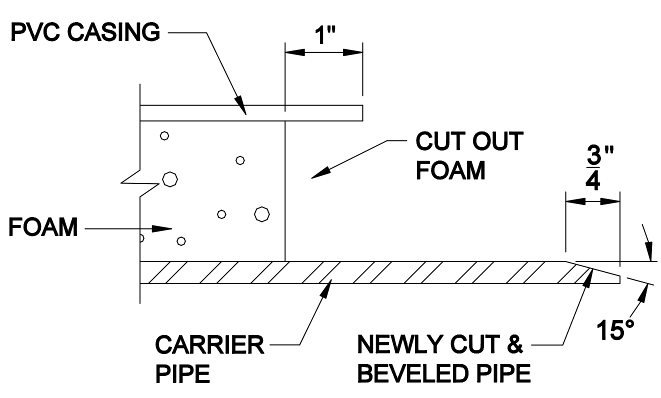
Determine the exact length of carrier pipe needed. Mark the casing at this point. Measure back 3 1/2 inches on both sides and mark the casing at these points using a wrap-around.

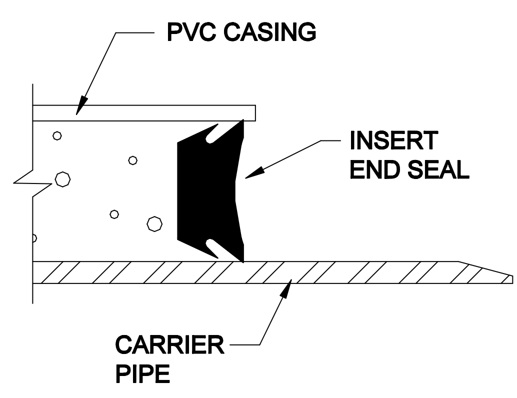


Use a carpenters handsaw or PVC saw to cut the PVC or HDPE casing. Remove the casing and cut off the insulation. Be careful not to damage steel carrier pipe during this operation. See illustration below.



Mark, cut, and bevel the steel pipe at the desired length. Make sure cut is square and the bevel is approximately 15° and 3/4" long. Remove any burrs and ridges on the pipe. Using a utility knife, remove the insulation between the casing and the carrier pipe one inch in from the face of the casing as shown below. Insert the rubber end seal between the casing and the carrier pipe using the handle of a hammer or screwdriver to push the seal all the way. Silicone caulking may be used in lieu of the rubber end seal.





THRUST BLOCKS: Thrust blocks must be installed wherever the pipeline changes direction or size as at tees, elbows, and reducers or at any point that develops thrust such as at a valve or similar equipment. The above situations may occur either where the fittings etc., are directly buried in the soil, or are in a manhole.

Thrust blocks must be designed for maximum anticipated operating or test pressure. If it is anticipated that pressures higher than normal operating pressures will be used at some later date, thrust blocks to accommodate such pressures should be installed initially. Size and type of thrust blocks depend on pressure, pipe size, and the type of soil. This information shall be supplied by the Design Engineer. Where a thrust block serves more than one line, the block must be designed to resist the sum of the thrusts of all the lines involved. Thrust blocks should be poured on and against undisturbed soil or soil tamped to 95% proctor density.

Thrust blocks shall be installed using a concrete having a compressive strength of not less than 3,000 psi minimum ultimate 28 days compressive strength, air entrained, with water reducing admixture. Where the soil bearing value is less than 1000 pounds per square foot, Thermal Pipe Systems, Inc. will make the necessary calculations and recommendations as to how the fitting should be thrusted. Where special thrust provisions are needed, Thermal Pipe Systems, Inc. will recommend the necessary design.

HEAT-TITE FITTINGS:

The table below gives the thrust load at any fitting in lbs. at 100 psi* pressure.

Size (in.)	Tee	90° Elbow	45° Elbow	Reducer**	
1 1/2	291	411	222		
2	455	645	350		
2 1/2	665	941	509		
3	985	1,395	755		
4	1,620	2,295	1,245	4x3	635
6	3,500	4,950	2,680	6x4	1,880
8	5,930	8,375	4,540	8x6	2,430
10	9,076	12,833	6,963	10x8	3,146
12	12,765	18,000	9,700	12x10	3,689

*For pressure other than 100 psi increase loads proportionately (example: for 150 psi multiply by 1.5; for 200 psi multiply by 2.0: etc.)

**This is for size difference indicated, (example: 4x3 = 635 lbs).

NOTE: Dead end and anchor loads are equal to tee shown above.

The approximate safe bearing loads of various soils given in the following table are for horizontal thrusts when the depth of cover over the top of the pipe exceeds two feet. These loads are estimates only. Actual soil and safe bearing loads should be determined by the Design Engineer.

SOIL	SAFE BEARING LOAD lbs./sq. ft.
Muck, Peat etc.*	0
Soft Clay	1,000
Sand	2,000
Sand & Gravel	3,000
Sand & Gravel Cemented with Clay	4,000
Hard Shale	10,000

* All thrusts are resisted by piles or tie rods to solid foundations, or by removal of muck or peat and replacement with ballast of sufficient stability.

If pre-insulated HEAT-TITE fittings are specified, they shall be provided with anchor plates designed to transfer thrust from the steel pipe to the concrete thrust blocks. The entire surface of the steel plates shall be coated with epoxy and glass overwrap. Steel plates shall be sealed during manufacture against PVC casing.

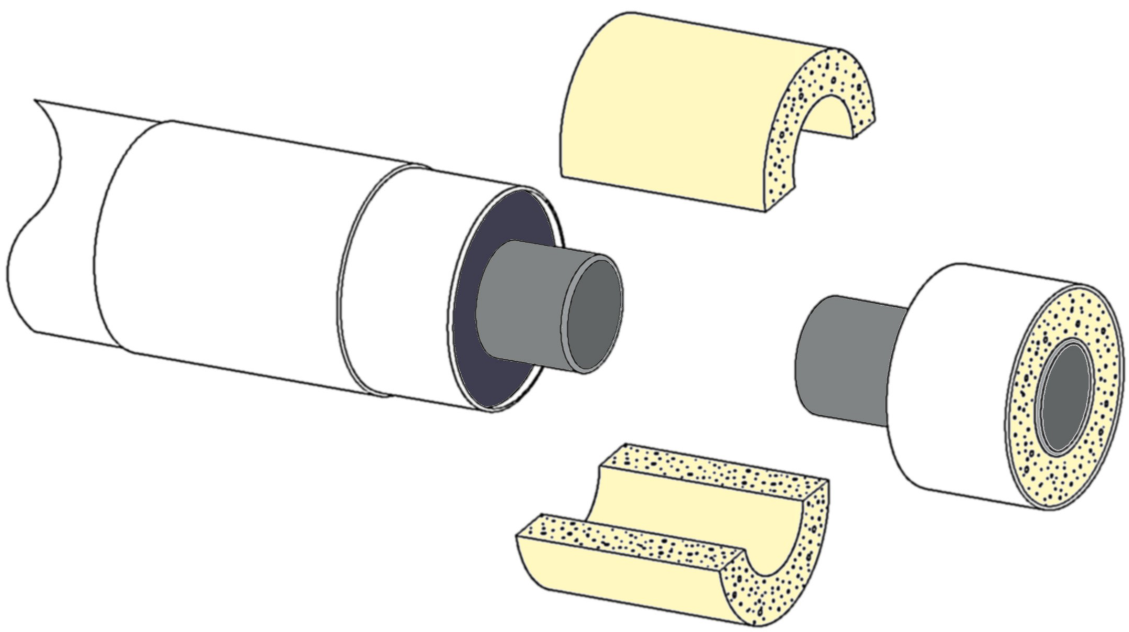
START UP PROCEDURE: Start up procedure shall conform to generally accepted practices and be done in a workmanlike manner. The line shall be filled slowly from any available low-pressure source. The water can be introduced from lines in service directly through valved connections, or by temporary connections to taps made in the new line. If possible all such connections should be made at the lowest point in the line to avoid air entrapment. All valves and other control points in the line that are open as the line filling begins should be closed gradually to avoid the possibility of water hammer.

MANUFACTURERS WRITTEN CERTIFICATION: After testing and prior to startup of the system, the manufacturer must certify in writing that the system was installed per the manufacturers installation instructions.

Thermal Pipe Systems, Inc.

WELD-TITE®

Steel Piping System
For
Low Temperature Hot Water and Chilled Water



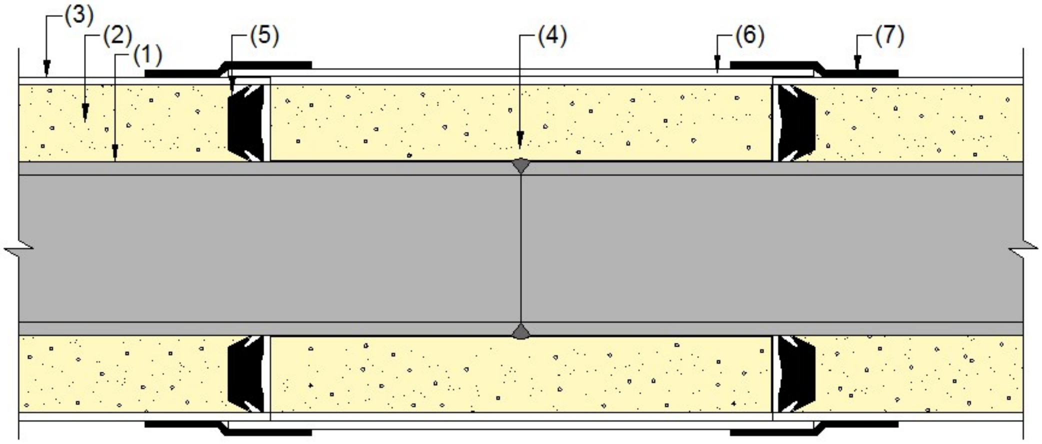
Weld-Tite is energy efficient piping system that is easy to install. It is used in hot water service to 250ºF at pressures to 150psi.

The standard carrier pipe is schedule 40 A-53 steel pipe. Other grades of steel are available if specified.

Insulation is thermally efficient polyurethane foam with a ‘K’ factor of 0.16 at 70ºF. The heavy wall PVC or HDPE casing and heat resistant end seals keep the insulation dry. Pre-insulated fittings are available, or if specified, insulation kits can be supplied to field insulate the fittings.

The Thermal Pipe Systems Casing-Tite Sleeve provides an easy and efficient means of insulating the joints.

WELD-TITE®



(1) CARRIER: Black steel as specified.
(2) INSULATION: Polyurethane Foam
(3) CASING: PVC or HDPE
(4) WELD
(5) END SEAL: EPDM
(6) CASING-TITE SLEEVE: PVC or HDPE
(7) CASING-TITE SEAL: 30 mil High Temperature Tape

NOMINAL PIPE SIZE (IN.)	NOMINAL CASING SIZE (IN.)	CARRIER O.D. (IN.)	CASING O.D. (IN.)	THICKNESS		WEIGHT (LBS./ 20 FT.)
				FOAM (IN.)	PVC CASING (IN.)	
1 1/2	4	1.90	4.50	1.16	0.140	83
2	4	2.38	4.50	0.92	0.140	101
2 1/2	6	2.88	6.14	1.51	0.120	153
3	6	3.50	6.14	1.20	0.120	188
4	8	4.50	8.16	1.67	0.160	281
5	8	5.56	8.16	1.14	0.160	355
6	10	6.63	10.20	1.59	0.200	478
8	12	8.63	12.24	1.57	0.240	708
10	14	10.75	14.28	1.49	0.280	998
12	16	12.75	16.00	1.38	0.250	1176
14	18	14.00	18.70	1.98	0.370	1412
16	21	16.00	22.05	2.59	0.430	1681
18	21	18.00	22.05	1.60	0.430	1843
20	24	20.00	24.80	1.92	0.480	2135
24	27	24.00	27.95	1.43	0.550	2504

NOTE: Standard lengths are 20'-0" or 40'-0". Weights are approximate. Consult manufacturer for HDPE dimensional data.

SHORT FORM SPECIFICATIONS

1.1 All underground pre-insulated pipe 1-1/2" – 24" shall be Thermal Pipe Systems, Inc. Weld-Tite® piping with welded joints.

1.2 Steel carrier pipe shall be black steel of the type, grade, and class specified by the design engineer. The pipe shall be suitable for use at maximum hydrostatic working pressure of 150 psi at 250ºF.

1.3 Joints shall be welded by the contractor in accordance with contract specifications.

1.4 Casing pipe shall be [Polyvinyl Chloride (PVC) meeting the minimum classification requirements of ASTM D-1784] or [High Density Polyethylene (HDPE)]. The thickness shall be in accordance with the Thermal Pipe Systems published data.

1.5 The insulation shall be polyurethane foam completely encapsulated on each end by a compression rubber end seal. Pipe joints shall be insulated using polyurethane foam half shells and protected with a Casing-Tite Sleeve.

1.6 The rubber end seals shall be an Ethylene Propylene Diene Monomer (EPDM) heat resistant compound.

1.7 Fittings may be uninsulated using welded steel fittings. Fittings may also be pre-insulated by Thermal Pipe Systems, Inc. using the same carrier pipe, insulation thickness, and casing as the straight lengths of pipe.

1.8 After completion of hydrostatic testing, joints shall be closed using factory supplied 30 mil high temperature tape. It shall be applied circumferentially around the seam between the coupling and pipe casing.

WARRANTY

We warrant that our products are manufactured with the applicable material specifications and are free from defects in the workmanship and material using our specifications as a standard. Every claim under this warranty shall be deemed waved unless in writing received by Thermal Pipe systems, Inc. within (30) days of the date the defect was discovered and within (1) year of the date of shipment of the product. Thermal Pipe Systems, Inc. MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY OR THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN THE LIMITED WARRANTY SET FORTH ABOVE.

LIMITATIONS AND LIABILTY

It is expressly understood and agreed that the limit of Thermal Pipe Systems, Inc. liability shall be the resupply of a like quantity of nondefective product and that Thermal Pipe Systems, Inc. shall have no such liability except where the damage or claim results solely from the breach of the Thermal Pipe Systems, Inc. warranty. IT IS ALSO AGREED THAT THERMAL PIPE SYSTEMS, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES FOR ANY ALLEGED NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILTY OR ANY OTHER THEORY, OTHER THAN THE LIMITED LIABILTY SET FORTH.

Thermal Pipe Systems, Inc.
5205 W. Woodmill Dr. Suite 33 – Wilmington, DE 19808
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Website: www.thermalpipesystems.com

Thermal Pipe Systems, Inc.

WELD-TITE® PIPING SYSTEM

FOR LOW TEMPERATURE HOT WATER AND CHILLED WATER SERVICE

SPECIFICATIONS & DRAWINGS

5205 W. WOODMILL DRIVE, SUITE 33
WILMINGTON, DELAWARE 19808
PHONE: 302.999.1588
WWW.THERMALPIPESYSTEMS.COM

WELD-TITE PIPING SYSTEMS SPECIFICATIONS

WELD-TITE shall be used where specified for condensate, low temperature hot water, or chilled water service, using a welded joining method. Unless otherwise specified, all pipe, fittings, valves, and accessories shall conform to the requirements of ANSI B31.1 and shall be of the proper type for pressure and temperature of the heating or cooling system.

STEEL CARRIER PIPE: Carrier pipe shall be black steel per ASTM A-53, Grade B **[welded][seamless]** or ASTM A-106 **[seamless]**, schedule **[40]** (standard weight for 12”∅ - 24”∅) or schedule **[80]** (extra heavy weight for 10”∅ - 24”∅).

CASING PIPE: The casing shall be **[Polyvinyl Chloride (PVC)]** pipe shall be of virgin PVC resin meeting the minimum classification requirements of ASTM D1784 or **[High Density Polyethylene (HDPE)]**. The thickness for PVC casing shall be as shown on page three. Consult manufacturer for HDPE dimensional data.

RUBBER END SEALS: Rubber end seals for insulated WELD-TITE shall be a high temperature (HT) heat resistant Ethylene Propylene Diene Monomer (EPDM) molded rubber compound. All surfaces shall be smooth and free of voids.

POLYURETHANE FOAM INSULATION: The insulation shall be Polyurethane Foam and shall meet the following specifications:

Type:	Two component urethane
Compressive Strength:	40 psi parallel min at 5% comp
Shrinkage:	None at 70ºF
Free Rise Density:	2.0 to 3.0 lbs/cubic foot
Aged "K" (70ºF - 72 hrs)	0.160 BTU•inch/hour•ºF•ft^2
Closed Cell Content:	90%

Insulation concentricity: Carrier Pipe shall be concentric to casing pipe. The allowable maximum deviation from the centerline of the carrier pipe shall be plus or minus 1/4 inch at the casing center point and plus or minus 1/16 inch at the end seals.

CASING-TITE SLEEVE: The Casing-Tite sleeve shall be of virgin PVC Resin meeting classification requirements of ASTM D1784.

CASING-TITE SEAL: The Casing-Tite seal shall be a 30-mil high temperature tape.

INSULATED FITTINGS: Fittings may be pre-insulated by Thermal Pipe Systems, Inc. using the same insulation thickness and casing as the pipe. Where necessary, laid-up fiberglass casing will be substituted on all or part of the fitting. End seals on fittings shall be the same as used on the pipe. If specified, fittings may also be field insulated using formed urethane sections and high temperature tape.

WALL PENETRATION SLEEVES: Provide where piping passes through masonry or concrete walls, floors, and roofs. Sleeves in outside walls below and above grade, in floor, or in roof slabs, shall be schedule 40 or standard weight coated black steel pipe or as specified by the Design Engineer. Space between the casing OD and the sleeve ID shall never be less than ½". Sleeves shall be held securely in proper position and location during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Refer to typical detail of wall penetration as shown. In existing concrete manholes or building walls, penetrations may be made using the "core drilling" method providing proper care is taken to drill the holes to the size needed and square to the line of the pipe.

WALL PENETRATION SEALS: All wall penetrations shall be sealed to prevent water from entering the building or manhole. The sealing material shall be as specified by the engineer.

WELD TITE APPLICATION ENGINEERING

PIPE SYSTEM DESIGN: Standard design techniques and practices for WELD-TITE shall be used. Thermal Pipe Systems, Inc. Engineering Department may provide the detailed design of the piping for each project based on the project documents and drawings provided by the Design Engineer. It is understood that the project specifications and layout drawings will specify the type of service, location of the site, temperature and pressure classifications, soil conditions, general path and elevations of the system, location and design of manholes, known obstacles, size of the carrier pipe, and the maximum permissible heat losses. It is further understood that other requirements such as the type of pipe, the location, size, and capacity of valves, traps, pumps, anchors, controls, expansion devices and special structural elements will be provided by the Design Engineer. The design provided by Thermal Pipe Systems, Inc. and their engineers for the piping will be in accordance with ANSI B31.1 and good engineering practices.

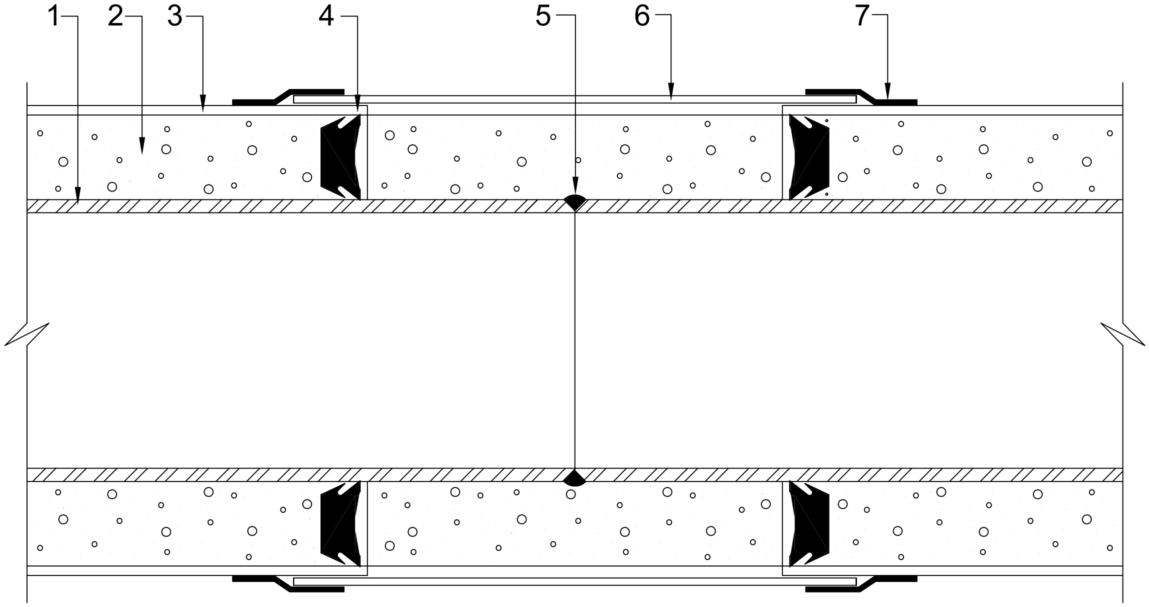
Fluid flow design will be based on Hazen-Williams formula with "C" Factor of 100, or a variation of the Euler formula for water flow.

INSULATION: Thickness of insulation for WELD-TITE pipe shall be as shown on page three.

TEMPERATURE AND PRESSURE: Weld-Tite piping system and all of its components are designed to operate up to 150psig at 250°F, plus typical surges.

DIMENSIONS AND WEIGHTS of insulated WELD-TITE piping are as shown on page three. The WELD-TITE piping may be furnished in 20 ft. and/or 40 ft. lengths.

PRE-INSULATED WELD-TITE® PIPE



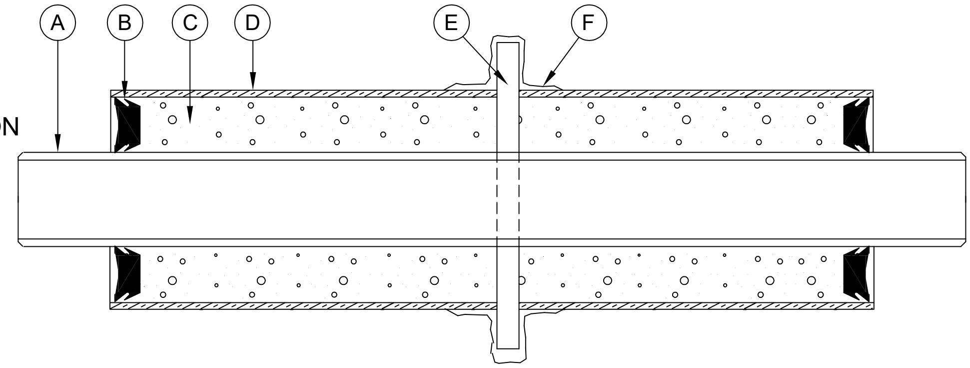
1) CARRIER: Black Steel as Specified
2) INSULATION: Polyurethane Foam
3) CASING: PVC or HDPE
4) END SEAL: EPDM
5) WELD
6) CASING-TITE SLEEVE: PVC or HDPE
7) CASING-TITE SEAL: 30 Mil H.T. Tape

NOM. PIPE SIZE	CARRIER O.D.	CASING O.D.	THICKNESS		WEIGHT (LBS./20 FT.)
			PVC CASING	FOAM	
1 1/2	1.90	4.50	.14	1.16	83
2	2.38	4.50	.14	0.92	101
2 1/2	2.88	6.14	.12	1.51	153
3	3.50	6.14	.12	1.20	188
4	4.50	8.16	.16	1.67	281
5	5.56	8.16	.16	1.14	355
6	6.63	10.20	.20	1.59	478
8	8.63	12.24	.24	1.57	708
10	10.75	14.28	.28	1.49	998
12	12.75	16.00	.25	1.38	1,176
14	14.00	18.70	.37	1.98	1,412
16	16.00	22.05	.43	2.59	1,681
18	18.00	22.05	.43	1.60	1,844
20	20.00	24.80	.48	1.92	2,135
24	24.00	27.95	.55	1.43	2,504

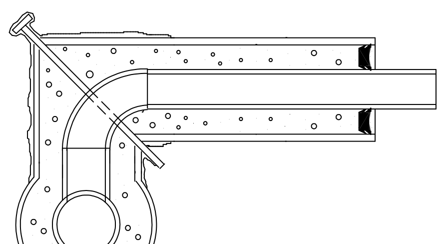
NOTE: All dimensions are in inches unless noted. Consult manufacturer for HDPE dimensional data.

PRE-INSULATED WELD-TITE® PIPE

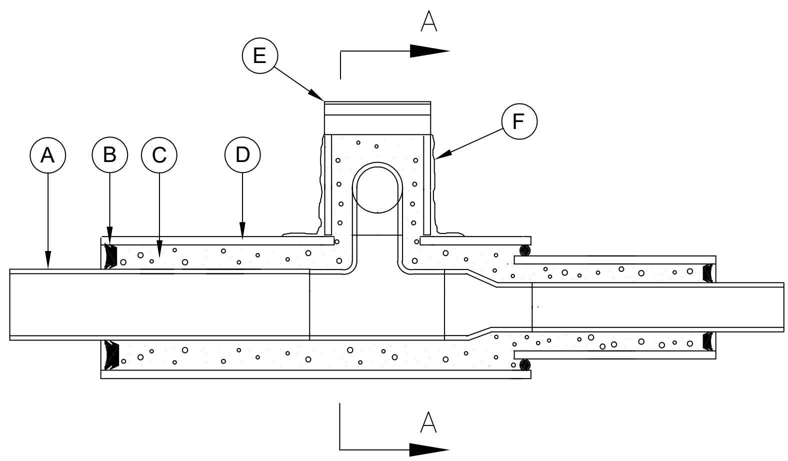
- (A) STEEL CARRIER PIPE
- (B) END SEAL
- (C) POLYURETHANE INSULATION
- (D) PVC OR HDPE CASING
- (E) ANCHOR PLATE
- (F) FRP OVERWRAP



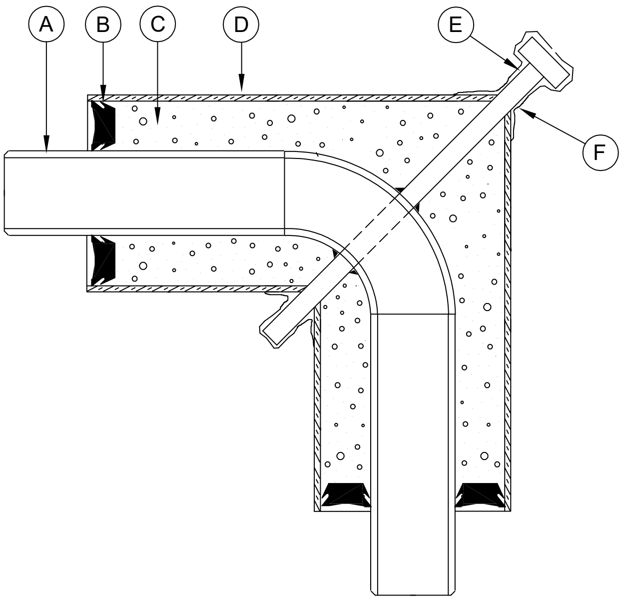
MID-POINT ANCHOR
NO SCALE

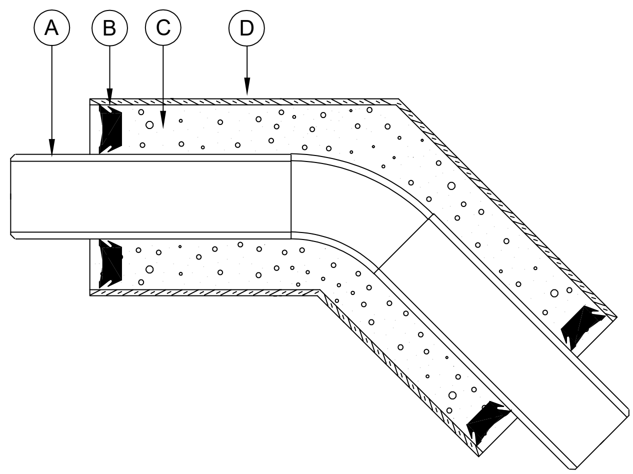


SECTION A-A



CROSSOVER TEE
NO SCALE



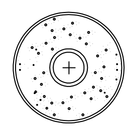


90° ELBOW WITH ANCHOR
NO SCALE

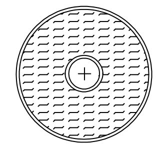
45° ELBOW WITHOUT ANCHOR
NO SCALE

PRE-INSULATED WELD-TITE® PIPE

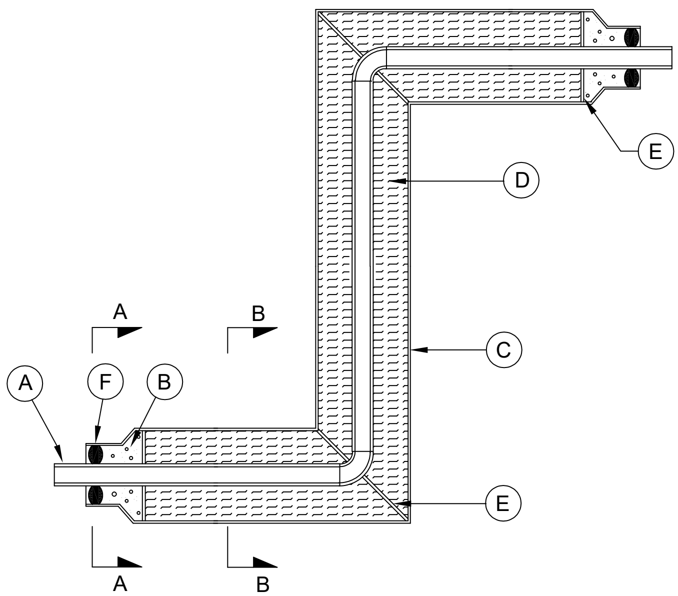
- A STEEL CARRIER PIPE
- B POLYURETHANE INSULATION
- C PVC OR HDPE CASING
- D MINERAL WOOL OR ECOTHERM INSULATION
- E GUIDE
- F END SEAL



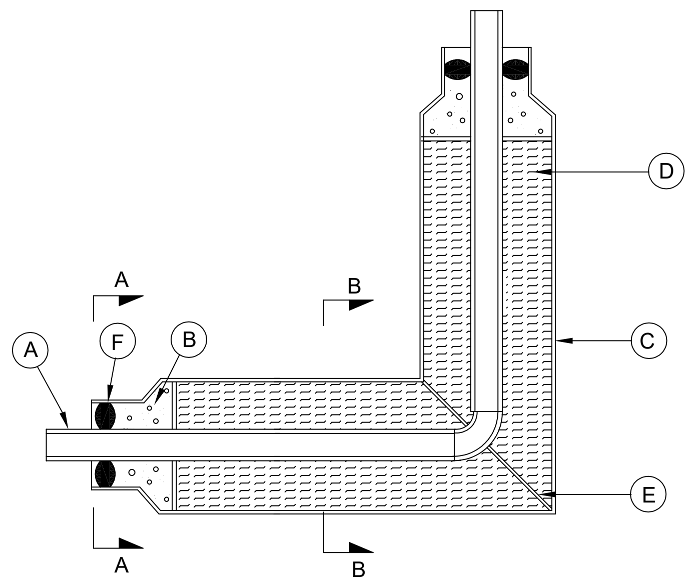
SECTION A-A



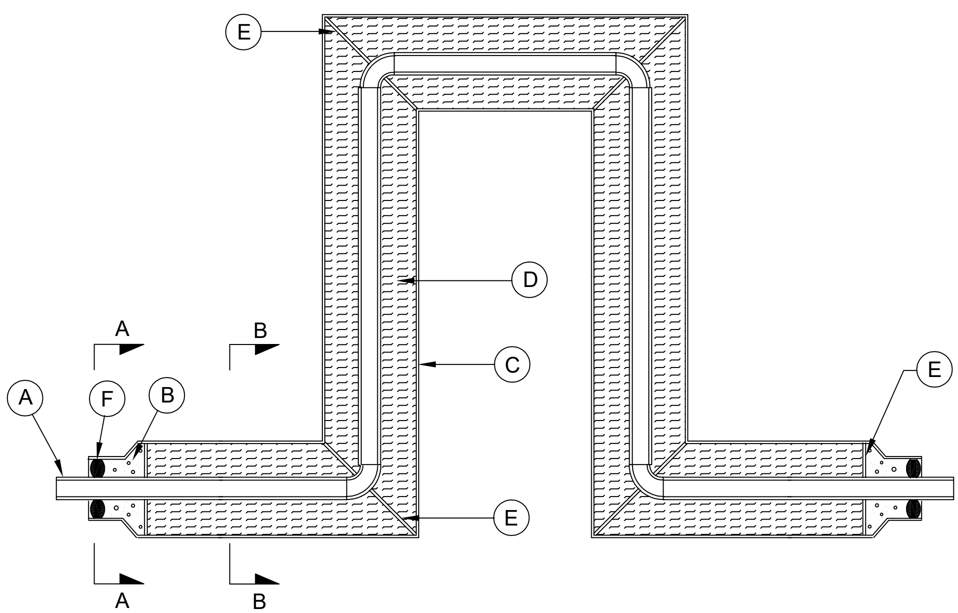
SECTION B-B



EXPANSION 'Z' BEND DETAIL
NO SCALE



EXPANSION ELBOW DETAIL
NO SCALE



EXPANSION LOOP DETAIL
NO SCALE

WELD-TITE INSTALLATION SPECIFICATION

GENERAL: Installation of the WELD-TITE piping system shall be done in accordance with the appropriate publications including ANSI B31.1 and the following specifications and instructions. A Thermal Pipe Systems, Inc. field representative may conduct an installation clinic to pre-qualify contract personnel in the proper procedures for the installation.

Piping shall be accurately cut to dimensions established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation shall not be permitted. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints. Good workmanlike procedures shall be followed.

All piping, unless otherwise indicated, shall be pitched with a grade of not less than 1 inch in 40 feet toward the drain points where applicable.

Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign matter out of the system.

RECEIVING AND HANDLING SHIPMENTS

INSPECTION: Each shipment shall be inspected upon its arrival at the site. The products are carefully loaded at the plant using methods acceptable to the carrier and it is his responsibility to deliver the pipe in good condition. It is the responsibility of the installation contractor to ascertain whether there has been any loss or damage. The carrier is the contractor's agent. The contractor shall report any pipe or equipment that arrives damaged or is lost in shipment.

Make overall inspection of the load. If load is intact, ordinary inspection while unloading should be enough to make sure that the pipe has arrived in good condition. It is the responsibility of the receiver to make certain that there has been no loss or damage. Note specifically that any end packaging should not show signs of damage. If the load has shifted, or end packing is damaged, then each piece must be carefully inspected for damage. Specifically, the ends should be inspected for scars, nicks, etc. Other obvious damage is also cause for rejection. Check total quantities of each item against the tally sheet (pipe, fittings, etc.) Any damaged or missing items are to be noted on the delivery receipt and the receipt returned to the carrier. Notify the carrier immediately and make claim in accordance with the carrier’s instructions. Thermal Pipe Systems, Inc. will assist, if necessary, in handling this claim. Do not dispose of damaged material - the carrier will notify you of the procedure to follow.

UNLOADING INSTRUCTIONS: The means by which the pipes are unloaded in the field is the decision and responsibility of the installing contractor. The use of forklift type equipment frequently simplifies and speeds up the unloading of larger sizes and usually provides extra protection against damage in handling. To prevent the possibility of the core pipe from shifting within the casing pipe, do not stand a length on one end or raise it vertically. Under no condition should a pipe be dragged along the ground. Do not lift fittings or pipe by inserting a bar, pipe, etc., inside of the core. Damage to the pipe may result. If any pipe is damaged in unloading and handling, mark the damaged area and set it aside. Thermal Pipe Systems, Inc. Representative will determine whether damaged casing can be repaired in the field and will determine exact method for repair and instruct contractor in making repair.

COLD WEATHER HANDLING FOR PVC CASED PIPE: As the temperature approaches freezing, the flexibility and impact resistance of WELD-TITE piping is reduced. PVC casing becomes hard and brittle in cold weather and will crack more readily if dropped or hit. Therefore, extra care should be used in handling during cold weather. Pipe at the bottom of a stack may become out-of-round due to the weight of material above it. At normal application temperatures, this corrects itself soon after the load is removed. Under freezing conditions, this recovery to full initial roundness may take several hours.

STORAGE: Store pipe on dunnage in a flat area. Support the barrel of the casing evenly. Spigot ends should overhang dunnage. Store random lengths separately where they will be readily available. Individual lengths of pipe should be stacked in piles no higher than 5 feet. It should be noted that when PVC pipe is stored outside and exposed to prolonged periods of sunlight, an obvious discoloration of pipe can occur. This coloration is a surface layer of hardened plastic and does not inhibit the long-term properties and performance of the pipe. A method of protecting pipe during long exposures (several months) to sunlight is to cover it with canvas or other opaque material. Do not use clear plastic sheets and be sure to provide for air circulation under the sheets.

LOADING TRANSFER TRUCKS: Use trucks with long bodies so that pipe lengths do not overhang. Make certain truck bed is smooth, without cross-strips, bolt heads, or other protrusions that could damage the pipe. Short body trucks may be used if fitted with racks that properly support the pipe in a horizontal position. The rack should support the pipe with supports spaced every 3 feet or less along the pipe lengths. Pad the contact areas to avoid damage to the pipe.

EXCAVATION: Excavation should consider the need for the thrust blocks at all fittings, which are directly buried in the ground. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines, generally a minimum of 6" in pipe sizes up to 6" diameter, and 12" minimum in sizes 8" and larger. The excavation should be in a straight line.

TRENCHING: Trenching shall follow the elevations provided by the Design Engineer on the contract drawings. The trench depth should always allow for a minimum cover height of 24" over the top of the casing. Keep excavations free from water during construction. If the contractor determines it is necessary to remove unsuitable material to a depth greater than specified, refill over excavated area to the proper depth with specified bedding material and compact in 6 inch lifts to 95 percent of maximum density in accordance with ASTM D1557, Method D. Excavate and replace soil disturbed and weakened by the contractor's operations or soils permitted to soften from exposure to weather, with bedding material and compact with a plate-type vibratory compactor.

TRENCH WIDTHS: The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation. The reason for this is to keep the earth load on the pipe as small as possible. The wider the trench at the top of the pipe, the greater the load on the pipe. Note that an increase in trench width above the top of the pipe, by stepping the sides or digging a wider offset trench, does not affect the earth load on the pipe. On the other hand, a trench that is too narrow will make assembly difficult and may reduce the rate and quality of installation. In addition, lack of ample room will limit the capability to properly backfill and tamp around the pipe. Although each job or portion of a job must be considered on an individual basis, as a rule, the following minimum trench widths at the top of the pipe are recommended: Minimum: one foot greater than the outside diameter of the casing. Where two or more pipes are in the same trench, use the distance between outside casing of the outside pipes plus one foot. Maximum: Use above method for minimum plus two feet.

DISTRIBUTING PIPE ALONG TRENCH: Pipe lengths may be strung along the line of the trench to minimize additional handling during installation.

PLACING PIPE IN THE TRENCH: The WELD-TITE pipe can be hand or mechanically passed into the trench. The latest state and federal safety regulations should be understood and observed. If slings are necessary use only canvas straps, do not use cable or chain slings. A backhoe or boom truck provides an excellent way of lowering the pipe into the trench.

BEDDING: Bedding material should be sand or other materials free of sharp objects, heavy clods, boulders or frozen lumps as specified by the Design Engineer. The approved bedding should be used 6" under, around, and over the pipe. Utilize good practices that apply to buried pressure piping.

ASSEMBLY OF CASING-TITE SLEEVE: Prior to installing the next section of pipe, the Casing-Tite Sleeve should be installed onto this piece. Simply position the sleeve over the casing and slide it all the way on by hand.

WELDING: End covers should remain in place until welding operations are ready to begin. Welding in trenches should be minimized. System sections including fittings and loops should be laid out first and aligned. Welding procedures shall be in accordance with contract specifications, ANSI B31.1, and good welding practices.

TESTING: All carrier pipe welds shall be tested in accordance with the contract specifications. If no test is specified, test should consist of a hydrostatic test of 150 psi or 1½ times working pressure, which ever is greater, for a period of two hours.

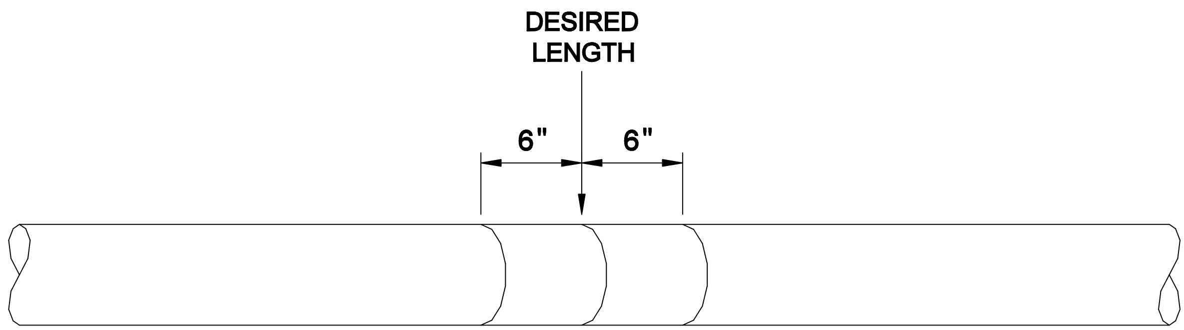
INSULATION OF JOINTS: After completion of testing, attach preformed polyurethane insulation onto the joint using 32-gauge stainless steel straps. Push Casing-Tite sleeve over the insulated joint so that it is positioned evenly.

CLOSURE OF JOINTS: Apply the factory supplied Casing-Tite seal circumferentially around the seam between the sleeve and the casing pipe. Overlap seal 3 inches.

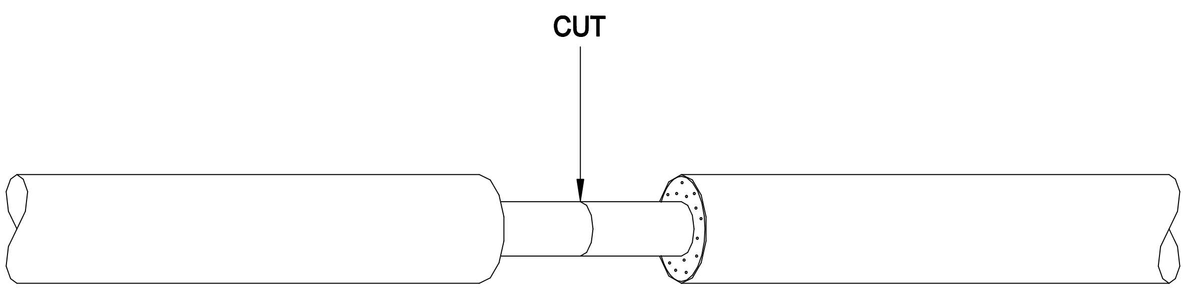
BACKFILLING: Backfilling of trenches shall progress as rapidly as construction, testing, and acceptance of work permits. Uniformly compact and grade bottom of trenches. After installation of pipe and bedding material, backfill as follows: place initial backfill in layers to a depth of 12 inches over the top of the initial bedding. Compact the material to a density equivalent to the surrounding undisturbed soil or to 90 percent of maximum density (ASTM D1557, Method D), whichever is greater. Backfill remainder of trench in one-foot lifts and compact to 90 percent maximum density (ASTM D1557, Method D). For trenches excavated in roads, streets, or located under structures, place backfill in 6-inch layers to top of trench and compact each layer to at least 95 percent maximum density (ASTM D1557, Method D).

FIELD CUTTING PIPE TO A SPECIFIC LENGTH

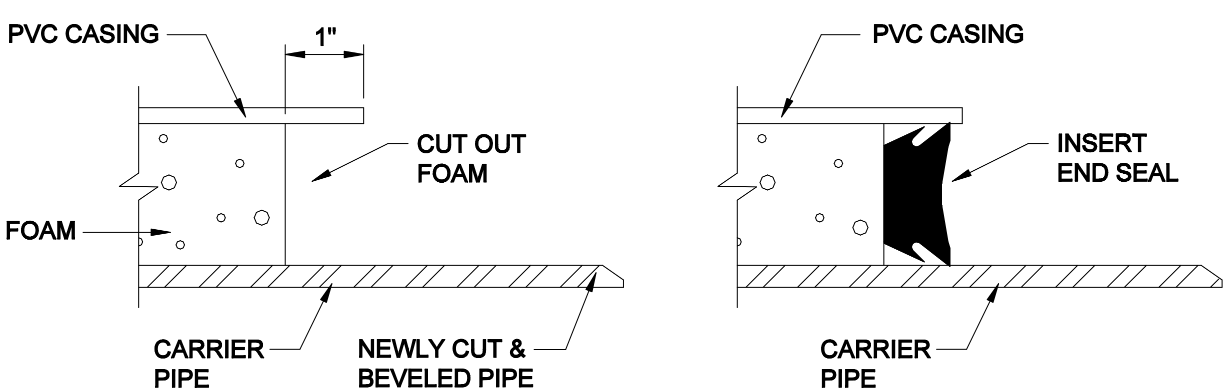
Determine the exact length of carrier pipe needed. Mark the casing at this point. Measure back 6 inches on both sides and mark the casing at these points using a wrap-around.



Use a carpenters handsaw or PVC saw to cut the PVC or HDPE casing. Remove the casing and cut off the insulation. Be careful not to damage steel carrier pipe during this operation. See illustration below.



Mark, cut, and bevel the steel pipe at the desired length. Make sure cut is square. Remove any burrs and ridges on the pipe. Using a utility knife, remove the insulation between the casing and the carrier pipe one inch in from the face of the casing as shown below. Insert the rubber end seal between the casing and the carrier pipe using the handle of a hammer or screwdriver to push the seal all the way. Silicone caulking may be used in lieu of the rubber end seal.

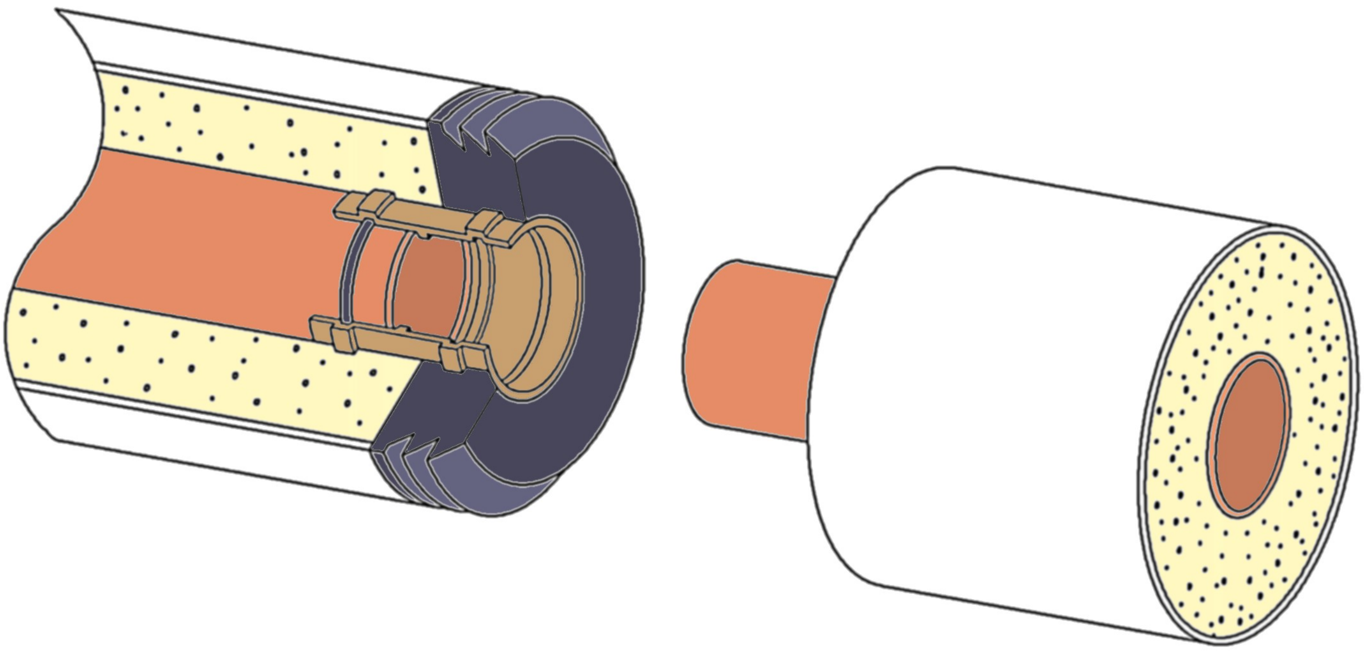


START UP PROCEDURE: Start up procedure shall conform to generally accepted practices and be done in a workman like manner. The line shall be filled slowly from any available low-pressure source. The water can be introduced from lines in service directly through valved connections or by temporary connections to taps made in the new line. If possible, all such connections should be made at the lowest point in the line to avoid air entrapment. All valves and other control points in the line that are open as the line filling begins should be closed gradually to avoid the possibility of water hammer.

Thermal Pipe Systems, Inc.

COPPER-CORE®

Specially Designed Copper Piping System with Integral Gasketed Joint For Domestic and Heating Hot Water



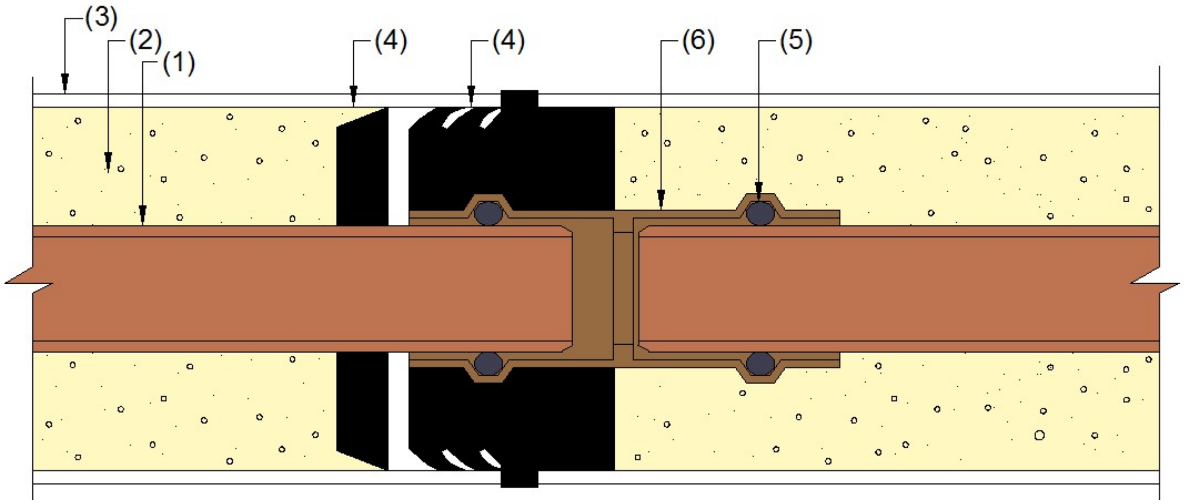
Copper-Core is a lightweight, easy to install, energy efficient piping system for use in low temperature and domestic hot water service. This system may be used for water only in temperatures to 250ºF at pressures to 150psi.

The standard carrier pipe is type 'K' copper. The system is produced with an integral grooved bronze coupling containing two high temperature heat resistant rubber 'O' rings.

Insulation is thermally efficient polyurethane foam with a 'K' factor of 0.16 at 70ºF. The heavy wall PVC or HDPE casing and heat resistant end seals keep the insulation dry. Fittings are standard copper solder joint fittings.

Assembly of Copper-Core is a simple one step procedure. Lubricate the joint and push the piping home. No additional steps are required to insulate the joint. This specially engineered joint compensates for thermal expansion, contraction, and earth movement without additional stress on the pipe. The pipe system is corrosion resistant and maintains high flow characteristics.

COPPER-CORE®



(1) CARRIER: Type 'K' Copper.
(2) INSULATION: Polyurethane Foam
(3) CASING: PVC or HDPE
(4) END SEAL: EPDM
(5) SEALING RINGS: EPDM
(6) COUPLING: Grooved Bronze

NOMINAL PIPE SIZE (IN.)	NOMINAL CASING SIZE (IN.)	CARRIER O.D. (IN.)	CASING O.D. (IN.)	THICKNESS		WEIGHT (LBS./20 FT.)
				FOAM (IN.)	PVC CASING (IN.)	
1	4	1.125	3.50	1.13	0.060	35
1 1/4	4	1.375	3.50	1.00	0.060	40
1 1/2	4	1.625	4.21	1.17	0.120	54
2	4	2.125	4.21	0.92	0.120	68
2 1/2	6	2.625	6.14	1.64	0.120	97
3	6	3.125	6.14	1.39	0.120	98
4	6	4.125	6.14	0.89	0.120	158
6	10	6.125	10.20	1.84	0.200	360

NOTE: 6" Copper-Core will have a separate bronze coupling. The joint will be sealed with 30 mil high temperature tape. Standard lengths are 20'-0". Weights are approximate. Consult manufacturer for HDPE dimensional data.

SHORT FORM SPECIFICATIONS

1.1 All underground pre-insulated pipe 1" – 6" shall be Thermal Pipe Systems, Inc. Copper-Core® piping with Ring-Tite joints.

1.2 Copper carrier pipe shall be type 'K' copper. The pipe shall be suitable for use at maximum hydrostatic working pressure of 150 psi at 250ºF.

1.3 Each joint shall automatically provide for expansion and contraction through the Ethylene Propylene Diene Monomer (EPDM) sealing rings in the grooves of the integral bronze coupling. Pipe must be assembled with lubricant supplied by Thermal Pipe systems.

1.4 Casing pipe shall be [Polyvinyl Chloride (PVC) meeting the minimum classification requirements of ASTM D-1784] or [High Density Polyethylene (HDPE)]. The thickness shall be in accordance with the Thermal Pipe Systems published data.

1.5 The insulation shall be polyurethane foam completely encapsulated on each end by a compression rubber end seal. Pipe joints shall be insulated using polyurethane foam half shells and protected with a Casing-Tite Sleeve.

1.6 The rubber end seals shall be an Ethylene Propylene Diene Monomer (EPDM) heat resistant compound.

1.7 Fittings shall be uninsulated using type 'K' copper brazed fittings.

WARRANTY

We warrant that our products are manufactured with the applicable material specifications and are free from defects in the workmanship and material using our specifications as a standard. Every claim under this warranty shall be deemed waved unless in writing received by Thermal Pipe systems, Inc. within (30) days of the date the defect was discovered and within (1) year of the date of shipment of the product. Thermal Pipe Systems, Inc. MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY OR THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN THE LIMITED WARRANTY SET FORTH ABOVE.

LIMITATIONS AND LIABILTY

It is expressly understood and agreed that the limit of Thermal Pipe Systems, Inc. liability shall be the resupply of a like quantity of non-defective product and that Thermal Pipe Systems, Inc. shall have no such liability except where the damage or claim results solely from the breach of the Thermal Pipe Systems, Inc. warranty. IT IS ALSO AGREED THAT THERMAL PIPE SYSTEMS, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES FOR ANY ALLEGED NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILTY OR ANY OTHER THEORY, OTHER THAN THE LIMITED LIABILTY SET FORTH.

Thermal Pipe Systems, Inc.
5205 W. Woodmill Dr. Suite 33 – Wilmington, DE 19808
Tel: 302-999-1588 – Fax: 302-999-8861
Website: www.thermalpipesystems.com

Thermal Pipe Systems, Inc.

COPPER-CORE® PIPING SYSTEM

FOR DOMESTIC AND HEATING HOT WATER SERVICE

SPECIFICATIONS & DRAWINGS

5205 W. WOODMILL DRIVE, SUITE 33
WILMINGTON, DELAWARE 19808
PHONE: 302.999.1588
WWW.THERMALPIPESYSTEMS.COM

COPPER-CORE PIPING SYSTEMS SPECIFICATIONS

COPPER-CORE shall be used where specified for low temperature hot water, chilled water, or dual-temp services using a rubber ring joining method. Unless otherwise specified, all pipe, fittings, valves and accessories shall conform to the requirements of ANSI B31.1 and shall be of the proper type for pressure and temperature of the heating or cooling water.

COPPER CARRIER PIPE: Carrier pipe shall be Type "K" hard drawn Copper and comply with ASTM B-88.

COPPER CORE COUPLING: The coupling shall be a grooved bronze coupling installed at the factory, as shown on page three.

RUBBER SEALING RINGS: The sealing rings shall be molded high temperature (HT) heat resistant Ethylene Propylene Diene Monomer (EPDM) using a properly vulcanized compound. The ring surfaces shall be smooth and free from all porosity and internal voids.

CASING PIPE: The casing shall be **[Polyvinyl Chloride (PVC)]** pipe of virgin PVC resin meeting the minimum classification requirements of ASTM D1784 or **[High Density Polyethylene (HDPE)].** The thickness for PVC casing shall be as shown on page three. Consult manufacturer for HDPE dimensional data.

RUBBER END SEALS: Rubber end seals for insulated COPPER-CORE shall be a high temperature (HT) heat resistant Ethylene Propylene Diene Monomer (EPDM) molded rubber compound. All surfaces shall be smooth and free of voids. End seals for 6”Ø shall be high temperature (HT) rubber with a compression type seal.

POLYURETHANE FOAM INSULATION: The insulation shall be Polyurethane Foam and shall meet the following specifications:

Type:	Two component urethane
Compressive Strength:	40 psi parallel min at 5% comp
Shrinkage:	None at 70°F
Free Rise Density:	2.0 to 3.0 lbs./cubic foot
Aged "K" (70°F - 72 hrs)	0.16 BTU-in./hour-°F-ft.2
Closed Cell Content:	90%

Insulation concentricity: Carrier Pipe shall be concentric to casing pipe. The allowable maximum deviation from centerline of carrier pipe shall be plus or minus 1/4 inch at the casing center point and plus or minus 1/16 inch at the end seals.

WALL PENETRATION SLEEVES: Provide where piping passes through masonry or concrete walls, floors, and roofs. Sleeves in outside walls below and above grade, in floor, or in roof slabs, shall be schedule 40 or standard weight coated black steel pipe or as specified by the Design Engineer. Space between the pipe OD and sleeve ID shall never be less than 1/2". Sleeves shall be held securely in proper position and location during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Refer to typical detail of wall penetration as shown. In existing concrete manholes or building wall, penetrations may be made using the "core drilling" method providing proper care is taken to drill the holes to the size needed and square to the line of the pipe.

WALL PENETRATION SEALS: All wall penetrations shall be sealed to prevent water from entering the building or manhole. The sealing material shall be as specified by the engineer.

COPPER-CORE APPLICATION ENGINEERING

PIPE SYSTEM DESIGN: Standard design techniques and practices for COPPER-CORE shall be used. Thermal Pipe Systems, Inc. Engineering Department may on request provide certain detailed design aspects of the piping for each project based on the project documents and drawings provided by the Design Engineer. It is understood that the project specifications and layout drawings will specify the type of service, the site and temperature and pressure classifications, soil conditions, and general path and elevations of the system, location and design of manholes, known obstacles, the size of the carrier pipe, and the maximum permissible heat losses. It is further understood that other requirements such as the type of pipe, the location size and capacity of valves, traps, pumps, anchors, controls, expansion devices and special structural elements will be provided by the design engineer. The design provided by Thermal Pipe Systems, Inc. and their engineers for the piping will be in accordance with ANSI B31.1 and good engineering practices.

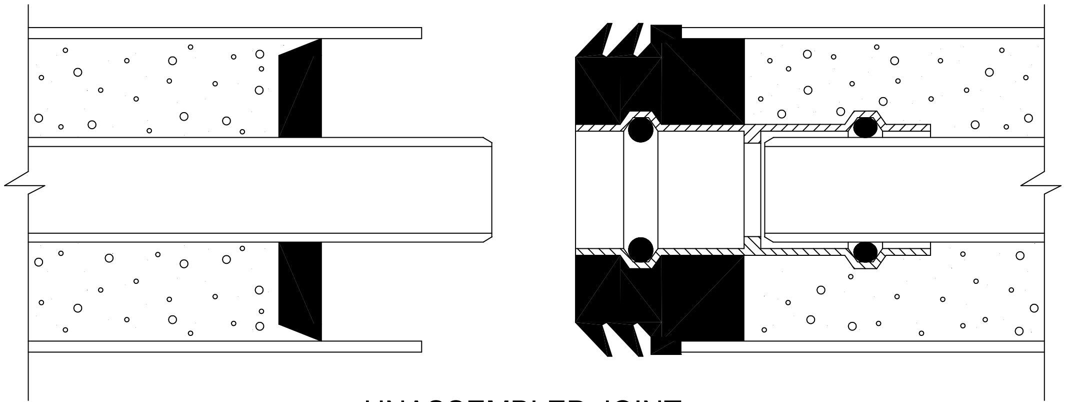
Fluid flow design will be based on Hazen-Williams formula with "C" Factor of 150, or a variation of the Euler formula for water flow.

INSULATION: Thickness of insulation for COPPER-CORE pipe shall be as shown on the drawings on page three.

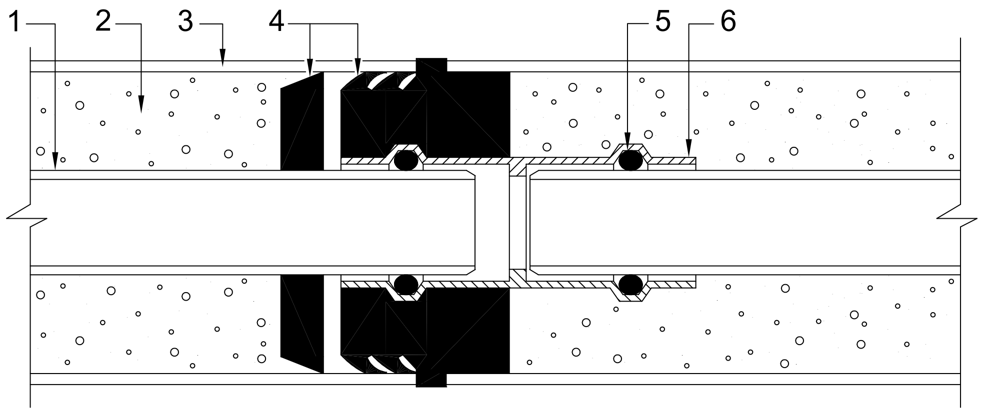
TEMPERATURE AND PRESSURE: The COPPER-CORE piping system and all its components are designed to operate up to 150 psig at 250°F, plus typical surges.

DIMENSIONS AND WEIGHTS of insulated COPPER-CORE piping system are as shown on page three. The COPPER-CORE piping will be furnished in 20 ft. lengths.

PRE-INSULATED COPPER-CORE® PIPE



UNASSEMBLED JOINT



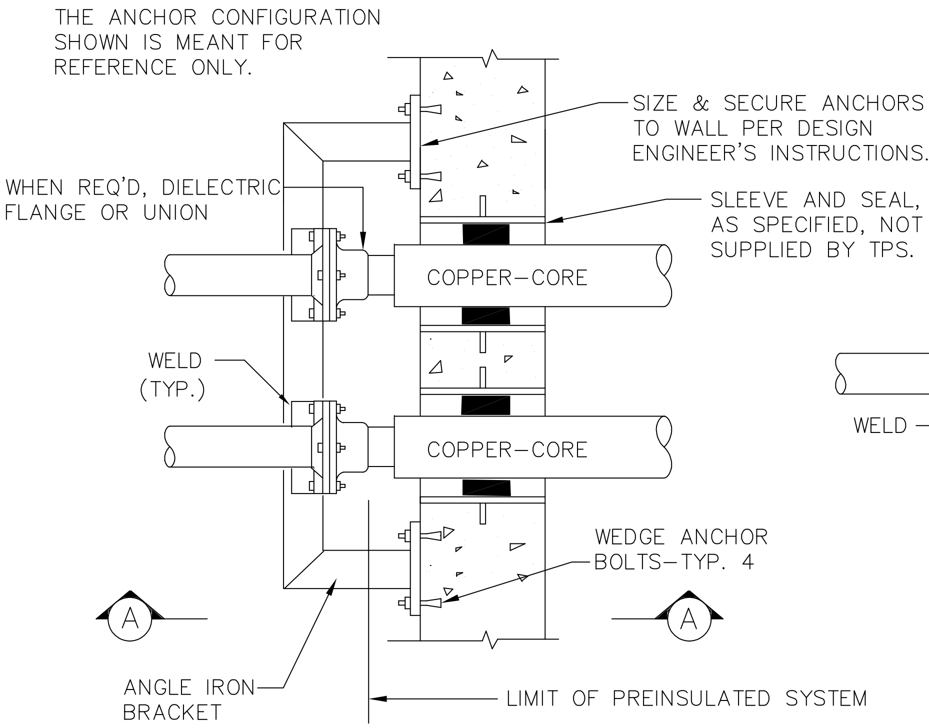
ASSEMBLED JOINT

1) CARRIER: Type 'K' Copper
2) INSULATION: Polyurethane Foam
3) CASING: PVC or HDPE
4) END SEALS: EPDM
5) SEALING RINGS: EPDM
6) COUPLING: Grooved Bronze

NOM. PIPE SIZE	CARRIER O.D.	CASING O.D.	THICKNESS		WEIGHT (LBS./20 FT.)
			PVC CASING	FOAM	
1	1.12	3.50	.06	1.13	35
1 1/4	1.37	3.50	.06	1.00	40
1 1/2	1.62	4.21	.12	1.17	54
2	2.12	4.21	.12	0.92	68
2 1/2	2.62	6.14	.12	1.64	97
3	3.12	6.14	.12	1.39	98
4	4.12	6.14	.12	0.89	158
6	6.12	10.20	.20	1.84	360

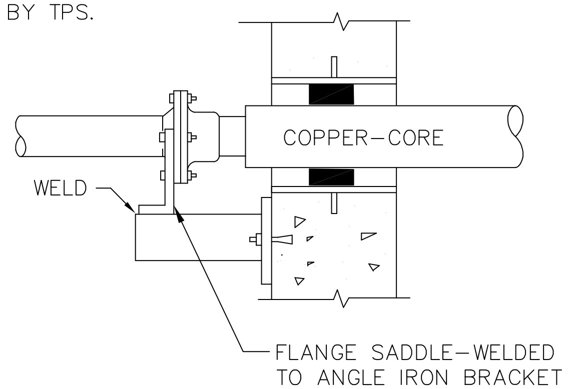
NOTE: 6" Copper-Core will have a seperate preinsulated bronze coupling. All dimensions are in inches unless noted. Consult manufacturer for HDPE dimensional data.

PRE-INSULATED COPPER-CORE® PIPE



PLAN

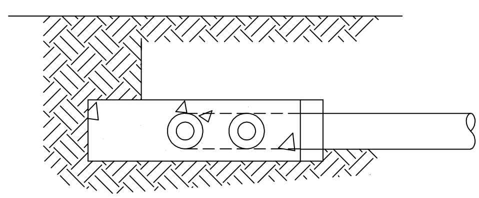
NOTE: THE INTERIOR ANCHOR MUST BE DESIGNED TO ISOLATE THE EXTERIOR SYSTEM FROM ALL INTERIOR PIPING EXPANSION AND/OR CONTRACTION. IT SHOULD ALSO SUFFICIENTLY ANCHOR THE SYSTEM DURING THE HYDROSTATIC TESTING OF THE PREINSULATED LINES.



SECTION A-A

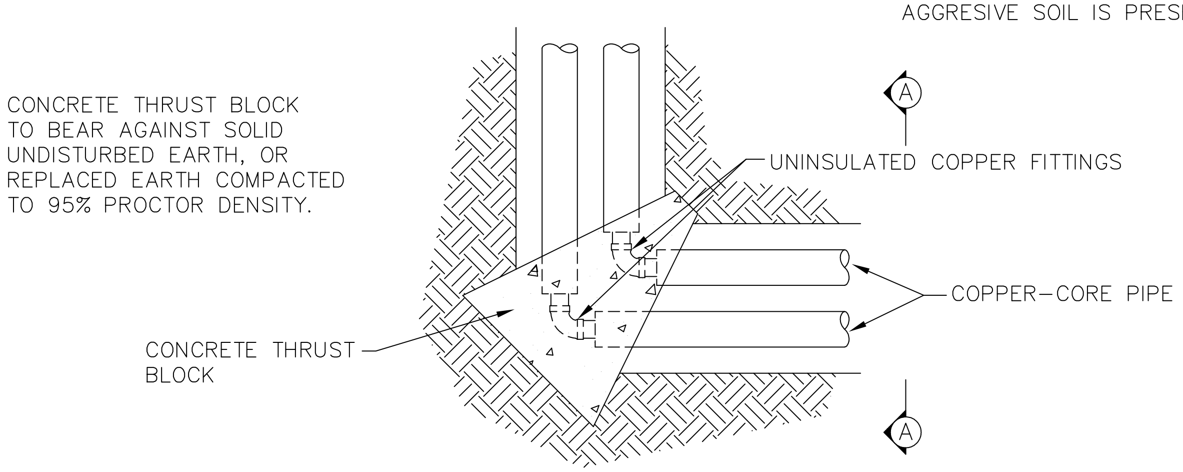
TYPICAL ANCHOR AT WALL PENETRATIONS

NO SCALE



ELEVATION A-A

NOTE: A PVC TAPE MUST BE SPIRALLY WRAPPED ONTO FITTINGS AND EXPOSED SPIGOTS WHERE AGGRESIVE SOIL IS PRESENT.

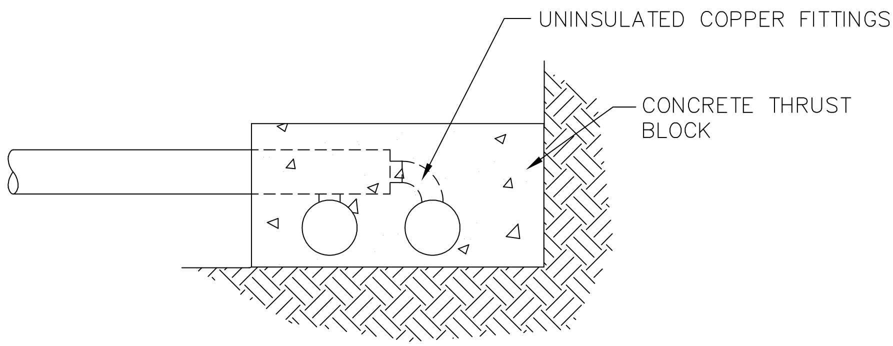


PLAN

TYPICAL THRUST BLOCK AT ELBOWS

NO SCALE

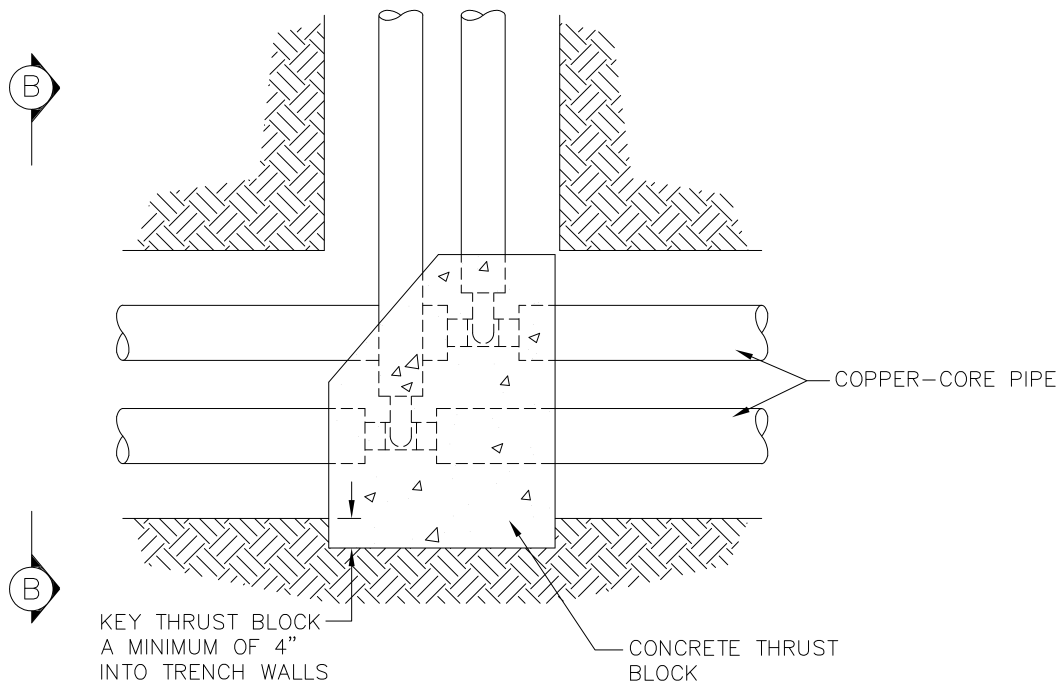
PRE-INSULATED COPPER-CORE® PIPE



ELEVATION B–B

CONCRETE THRUST BLOCK TO BEAR AGAINST SOLID UNDISTURBED EARTH, OR REPLACED EARTH COMPACTED TO 95% PROCTOR DENSITY.

NOTE: A PVC TAPE MUST BE SPIRALLY WRAPPED ONTO FITTINGS AND EXPOSED SPIGOTS WHERE AGGRESIVE SOIL IS PRESENT.



PLAN

TYPICAL THRUST BLOCK AT TEES

NO SCALE

COPPER-CORE INSTALLATION SPECIFICATION

GENERAL: Installation of the COPPER-CORE piping system shall be done in accordance with the appropriate publications including ANSI B31.1 and the following specifications and instructions. A Thermal Pipe Systems, Inc. Field Representative may conduct an installation clinic to pre-qualify contract personnel in the proper procedures for the installation.

Piping shall be accurately cut to dimensions established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation shall not be permitted. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints. Good workmanlike procedures shall be followed.

All piping unless otherwise indicated, shall be pitched with a grade of not less than 1 inch in 40 feet toward the drain points when applicable.

Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign matter out of the system.

RECEIVING AND HANDLING SHIPMENTS

INSPECTION: Each Shipment shall be inspected upon its arrival at the site. The products were carefully loaded at the plant using methods acceptable to the carrier and it is his responsibility to deliver the pipe in good condition. It is the responsibility of the installing contractor to ascertain whether there has been any loss or damage. The carrier is the contractor's agent. Any pipe or equipment that arrives damaged or is lost in shipment shall be reported by the contractor.

Make overall inspection of the load. If load is intact, ordinary inspection while unloading should be enough to make sure that the pipe has arrived in good condition. It is the responsibility of the receiver to make certain that there has been no loss or damage. Note specifically that any end packaging should not show signs of damage. If the load has shifted, or end packing damaged, then each piece must be carefully inspected for damage. Specifically, the ends should be inspected for scars, nicks, etc. Other obvious damage is also cause for rejection. Check total quantities of each item against tally sheet (pipe, fittings, etc.) Any damaged or missing items are to be noted on delivery receipt and the receipt returned to the carrier. Notify the carrier immediately and make claim in accordance with the carrier’s instructions. Thermal Pipe Systems, Inc. will assist, if necessary, in handling this claim. Do not dispose of damaged material - the carrier will notify you of the procedure to follow.

UNLOADING INSTRUCTIONS: The means by which the pipes are unloaded in the field is the decision and responsibility of the installing contractor. The use of forklift type equipment frequently simplifies and speeds up the unloading of larger sizes and usually provides extra protection against damage in handling. To prevent the possibility of the core pipe from shifting within the casing pipe, do not stand a length on one end or raise it vertically. Under no condition should a pipe be dragged along the ground. Do not lift fittings or pipe by inserting a bar, pipe, etc., inside of the core. Damage to the pipe may result. If any pipe is damaged in unloading and handling, mark the damaged area and set it aside. A Thermal Pipe Systems, Inc. representative will determine whether damaged casing can be repaired in the field and will determine exact method for repair and instruct contractor in making repair.

COLD WEATHER HANDLING FOR PVC CASED PIPE: As the temperature approaches freezing, the flexibility and impact resistance of COPPER-CORE pipe is reduced. PVC casing becomes hard and brittle in cold weather and will crack more readily if dropped or hit. Therefore, extra care should be used in handling during cold weather. Pipe at the bottom of a stack may become out-of-round due to the weight of material above it. At normal application temperatures, this corrects itself soon after the load is removed. Under freezing conditions, this recovery to full initial roundness may take several hours.

STORAGE: Store pipe on dunnage in a flat area. Support the barrel of the casing evenly. Bell and spigot ends should overhang dunnage. Store random lengths separately where they will be readily available. Individual lengths of pipe should be stacked in piles no higher than 5 feet. It should be noted that when PVC pipe is stored outside and exposed to prolonged periods of sunlight, an obvious discoloration of pipe can occur. This coloration is a surface layer of hardened plastic and does not inhibit the long-term properties and performance of the pipe. A method of protecting pipe during long exposures (several months) to sunlight is to cover it with canvas or other opaque material. Do not use clear plastic sheets and be sure to provide for air circulation under the sheets.

LOADING TRANSFER TRUCKS: Use trucks with long bodies so that pipe lengths do not overhang. Make certain truck bed is smooth, without cross-strips, bolt heads, or other protrusions that could damage the pipe. Short body trucks may be used if fitted with racks that properly support the pipe in a horizontal position. The rack should have supports spaced every 3 feet or less along the pipe lengths. Pad the contact areas to avoid damage to the pipe.

EXCAVATION: Excavation should consider the need for the thrust blocks at all fittings that are direct buried in the ground. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines, generally a minimum of 6" is sufficient. The excavation should be in a straight line.

TRENCHING: Trenching shall follow the elevations provided by the design engineer on the contract drawings. The trench depth should always allow for a minimum cover height of 24" over the top of the casing pipe. Keep excavations free of water during construction. If the Contractor determines it is necessary to remove unsuitable material to a depth greater than specified, refill over excavated area to the proper depth with specified bedding material compacted in 6 inch lifts to 95 percent of maximum density in accordance with ASTM D1557, Method D. Excavate and replace soil disturbed and weakened by the contractor's operations or soils permitted to soften from exposure to weather, with bedding material and compact with a plate-type vibratory compactor.

TRENCH WIDTHS: The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation. The reason for this is to keep the earth load on the pipe as small as possible. The wider the trench at the top of the pipe, the greater the load on the pipe. Note that an increase in trench width above the top of the pipe, by stepping the sides or digging a wider offset trench, does not affect the earth load on the pipe. On the other hand, a trench that is too narrow will make assembly difficult and may reduce the rate and quality of installation. In addition, lack of ample room will limit the capability to properly backfill and tamp around the pipe.

Although each job or portion of a job must be considered on an individual basis, as a rule, the following minimum trench widths at the top of the pipe are recommended: Minimum: one foot greater than the outside diameter of the casing. Where two or more pipes are in the same trench, use the distance between outside casing of the outside pipes plus one foot. Maximum: Use above method for minimum plus two feet.

DISTRIBUTING PIPE ALONG TRENCH: Pipe lengths may be strung along the line of the trench to minimize additional handling during installation.

PLACING PIPE IN THE TRENCH: The COPPER-CORE pipe may be hand or mechanically passed into the trench. The latest state and federal safety regulations should be understood and observed. If slings are necessary use only canvas straps, do not use cable or chain slings.

BEDDING: Bedding material should be sand or other materials free of sharp objects, heavy clods, boulders or frozen lumps as specified by the design engineer. The approved bedding should be used 6" under, around and over the pipe. Utilize good practices that apply to buried pressure piping.

ASSEMBLY:

1) Be sure all surfaces are clean and that the "o"-ring is properly seated in the bronze coupling.

2) Check that the exposed end of copper pipe is clean and does not have any nicks, burrs or scratches that could damage the rubber ring during assembly. The packaging is designed to protect these ends and should not be removed until pipe is ready to be installed.

3) Dig a slight bell hole to keep the joint area clean and free of loose soil during assembly.

4) Apply the lubricant supplied to the copper ends and to the inside of the casing pipe just enough so it will slide easily together.

5) Before assembling the joint, lay a small wire across the fins and hold in place while the joint is being assembled. This will permit the escape of air in the joint cavity.

6) Start the spigot end into the bell by hand, and then holding the length straight, push it home until the casings butt with a bar and block. After assembly is complete, withdraw the wire.

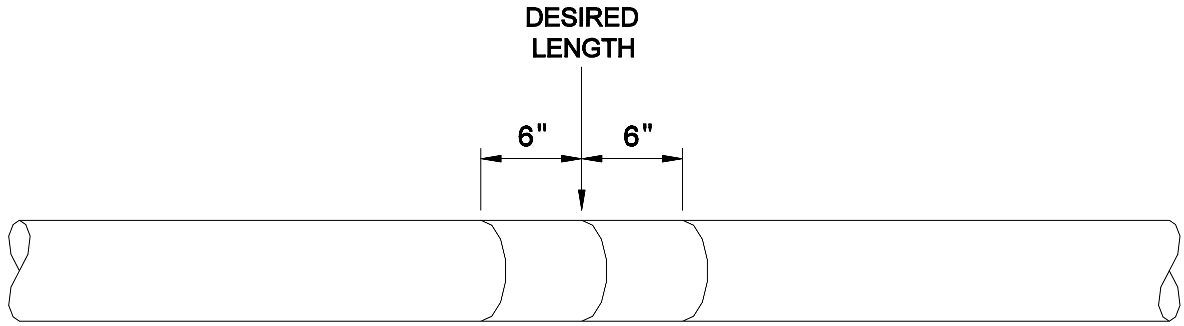
TESTING: All carrier pipe joints shall be tested in accordance with the contract specifications. If no test is specified, it should consist of a hydrostatic test of 150 psi or 1½ times working pressure, which ever is greater, for a period of two hours. It should be noted that the diameters involved with COPPER-CORE are comparatively small and the volume of water involved in testing may be small. Therefore, entrapped air, temperature changes and slight movements of the pipe can cause great variations in test pressures. These factors should be taken into consideration and care should be taken to minimize their influence on the test results.

BACKFILLING: Backfilling of trenches shall progress as rapidly as construction, testing, and acceptance of work permits. Uniformly compact and grade bottom of trenches. After installation of pipe and bedding material, backfill as follows: Place initial backfill in layers to a depth of 12 inches of the initial bedding. Compact the material to a density equivalent to the surrounding undisturbed soil or to 90 percent of maximum density (ASTM D1557, Method D), whichever is greater. Backfill remainder of trench in one-foot lifts and compact to 90 percent maximum density (ASTM D1557, Method D). For trenches excavated in roads, streets, or located under structures, place backfill in 6-inch layers to top of trench and compact each layer to at least 95 percent maximum density (ASTM D1557, Method D).

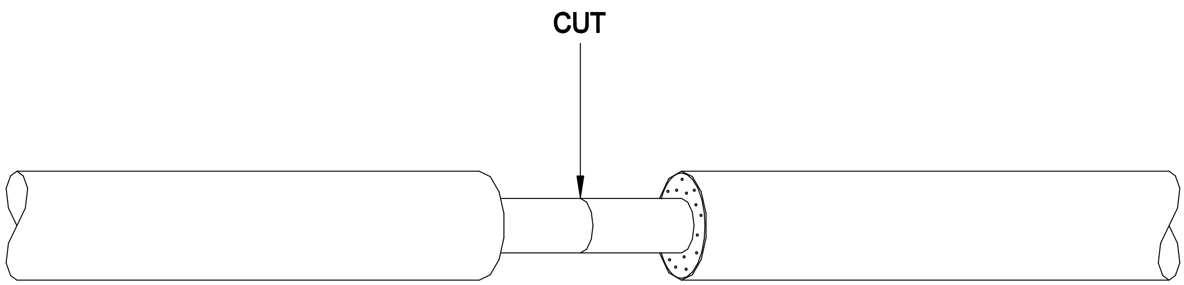
FLANGED JOINTS: Flanged joints shall be faced true, provided with gaskets, and made perfectly square and tight.

FIELD CUTTING PIPE TO A SPECIFIC LENGTH

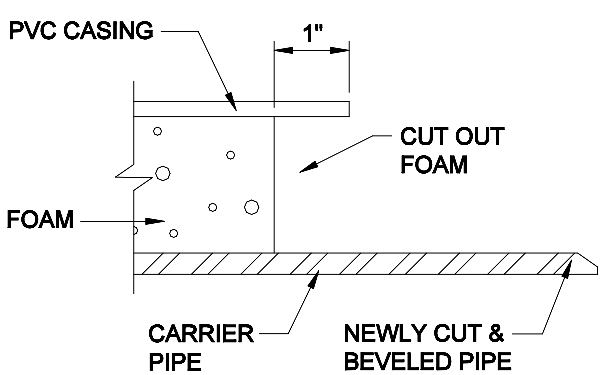
Determine the exact length of carrier pipe needed. Mark the casing at this point. Measure back 6 inches on both sides and mark the casing at these points using a wrap-around.

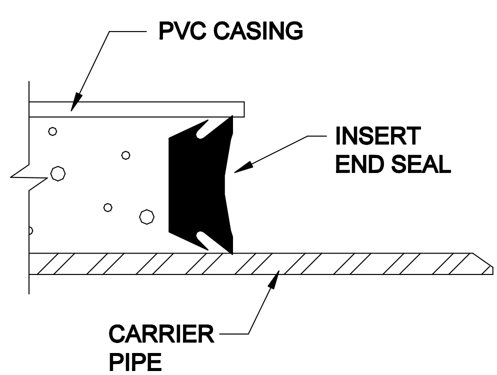


Use a carpenters handsaw or PVC saw to cut the PVC or HDPE casing. Remove the casing and cut off the insulation. Be careful not to damage copper carrier pipe during this operation. See illustration below.



Mark, cut, and bevel the copper pipe at the desired length. Make sure cut is square. Remove any burrs or ridges on the pipe. Using a utility knife, remove the insulation between the casing and the carrier pipe one inch in from the face of the PVC or HDPE casing as shown below. Insert the rubber end seal between the casing and the carrier pipe using the handle of a hammer or screwdriver to push the seal all the way. Silicone caulking may be used in lieu of the rubber end seal.





THRUST BLOCKS: Thrust blocks must be installed wherever the pipeline changes direction or size as at tees, elbows and reducers or at any point that develops thrust such as at a valve or similar equipment. The above situations may occur either where the fittings etc., are directly buried in the soil, or are in a manhole.

Thrust blocks must be designed for maximum anticipated operating or test pressure. If it is anticipated that pressures higher than normal operating pressures will be used at some later date, thrust blocks to accommodate such pressures should be installed initially. Size and type of thrust blocks depend on pressure, pipe size, and the type of soil. This information shall be supplied by the Design Engineer. Where a thrust block serves more than one line, the block must be designed to resist the sum of the thrusts of all of the lines involved. Thrust blocks should be poured on and against undisturbed soil or soil tamped to 95% proctor density.

Thrust blocks shall be installed using a concrete having a compressive strength of not less than 3000 psi minimum ultimate 28 days compressive strength, air entrained, with water reducing admixture. Where the soil bearing value is less than 1000 pounds per square foot, Thermal Pipe Systems, Inc. will make the necessary calculations and recommendations as to how the fitting should be thrusted. Where special thrust provisions are needed, Thermal Pipe Systems, Inc. will recommend the necessary design.

COPPER CORE FITTINGS:

The table below gives the thrust load at any fitting in lbs. at 100 psi* pressure.

Size (in.)	90° Elbow	45° Elbow	Tee
1	115	60	80
1 1/4	175	95	125
1 1/2	250	135	175
2	425	230	300
2 1/2	675	370	480
3	960	525	680
4	1695	925	1200
6	3998	2165	2828

*For pressure other than 100 psi increase loads proportionately (example: for 150 psi multiply by 1.5; for 200 psi multiply by 2.0: etc.)

NOTE: Dead End and Anchor loads are equal to tee shown above.

The approximate safe bearing loads of various soils given in the following table are for horizontal thrusts when the depth of cover over the top of the pipe exceeds two feet. These loads are estimates only. Actual soil and safe bearing loads should be determined by the Design Engineer.

SOIL	SAFE BEARING LOAD lbs./sq. ft.
Muck, Peat etc.*	0
Soft Clay	1,000
Sand	2,000
Sand & Gravel	3,000
Sand & Gravel Cemented with Clay	4,000
Hard Shale	10,000

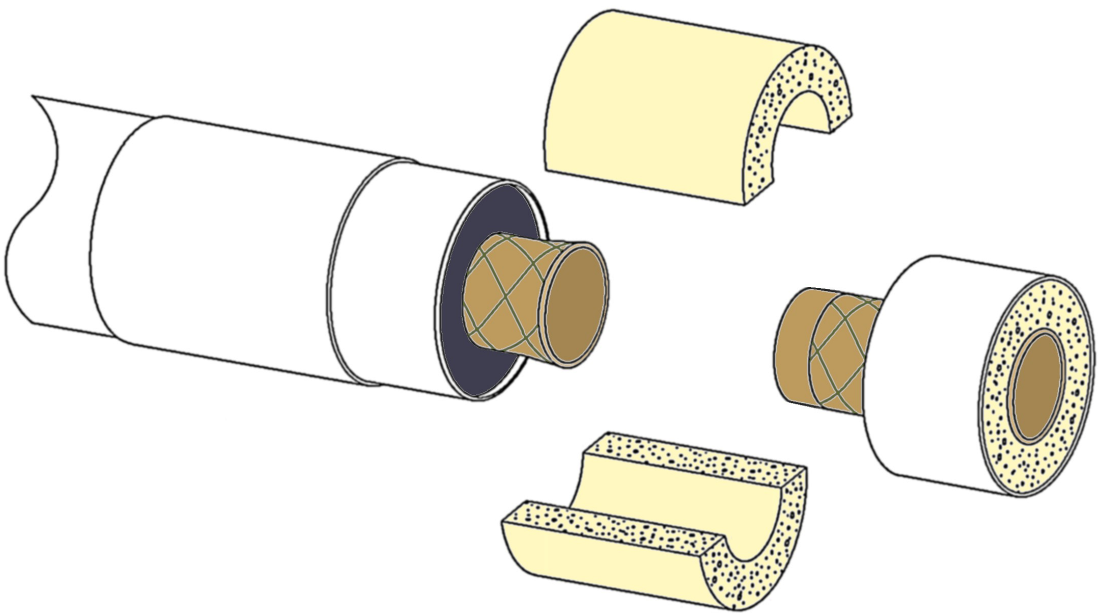
* All thrusts are resisted by piles or tie rods to solid foundations, or by removal of muck or peat and replacement with ballast of sufficient stability.

START UP PROCEDURE: Start up procedure shall conform to generally accepted practices and be done in a workman-like manner. The line shall be filled slowly from any available low-pressure source. The water can be introduced from lines in service directly through valved connections, or by temporary connections to taps made in the new line. If possible, all such connections should be made at the lowest point in the line to avoid air entrapment. All valves and other control points in the line that are open as the line filling begins should be closed gradually to avoid the possibility of water hammer.

Thermal Pipe Systems, Inc.

TAPER-TITE® 230

A Proven Tapered and Bonded FRP System
Featuring High Flow, Corrosion Free Service
For
Condensate and Low Temperature Hot Water



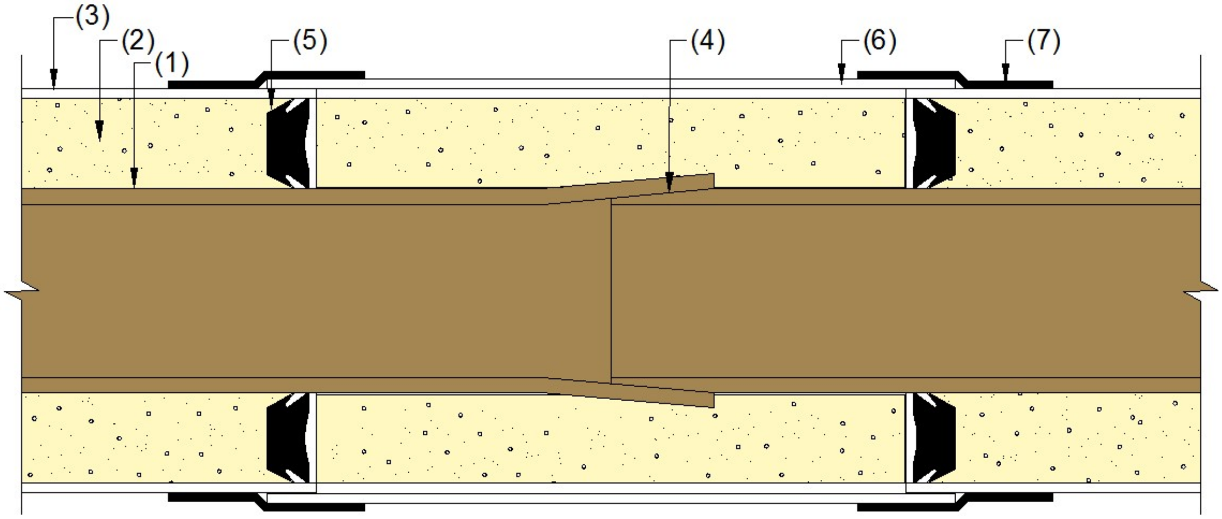
Taper-Tite is a lightweight, easy to install, energy efficient piping system for use in low temperature hot water and condensate return service. This system may be used for water only in temperatures to 230ºF at pressures to 150psi.

The carrier pipe is filament wound epoxy pipe with a resin rich liner. The system is produced with matching tapers on bell and spigot ends. Insulation is thermally efficient polyurethane foam with a ‘K’ factor of 0.16 at 70ºF. The heavy wall PVC or HDPE casing and heat resistant end seals keep the insulation dry. A complete line of fittings is available for this system.

To join Taper-Tite apply the adhesive and push the matched tapered bell and spigot ends together, heat curing may be required. Thermal expansion and contraction are taken up by the pipe itself. The piping system is non-corrosive and maintains very high flow characteristics. It is an excellent choice for underground condensate return lines, district heating systems, dual temperature lines, and geothermal heating systems. The piping system is approved for use by Federal Agencies for condensate, hot and chilled water.

The Thermal Pipe systems Casing-Tite Sleeve provides an easy and efficient means of insulating the joints.

TAPER-TITE® 230



(1) CARRIER: FRP Pipe.
(2) INSULATION: Polyurethane Foam
(3) CASING: PVC or HDPE
(4) ADHESIVE BOND
(5) END SEAL: EPDM
(6) CASING-TITE SLEEVE: PVC or HDPE
(7) CASING-TITE SEAL: 30 mil High Temperature Tape

NOMINAL PIPE SIZE (IN.)	NOMINAL CASING SIZE (IN.)	CARRIER O.D. (IN.)	CASING O.D. (IN.)	THICKNESS		WEIGHT (LBS./ 20 FT.)
				FOAM (IN.)	PVC CASING (IN.)	
2	4	2.38	4.50	0.92	0.140	40
3	6	3.50	6.14	1.20	0.120	55
4	8	4.50	8.16	1.67	0.160	89
6	10	6.63	10.20	1.59	0.200	146
8	12	8.63	12.24	1.57	0.240	205
10	14	10.75	14.28	1.49	0.280	288
12	16	12.75	16.00	1.38	0.250	326

NOTE: Standard lengths are 20'-0". Weights are approximate. Consult manufacturer for HDPE dimensional data.

SHORT FORM SPECIFICATIONS

1.1 All underground pre-insulated pipe 2" – 12" shall be Thermal Pipe Systems, Inc. Taper-Tite® piping with adhesive bonded joints.

1.2 FRP carrier pipe shall be Fiberglass Reinforced Plastic (FRP) with resin-rich liner and shall comply with ASTM D2310 and D2996. Resin Designation Codes shall be RTRP-11FX1: 3110 for all sizes. The pipe shall be suitable for use at maximum hydrostatic working pressure of 150 psi at 230ºF.

1.3 The pipe shall be joined with adhesive using matching tapered bell and spigot ends. This matching taper is designed to mechanically 'lock' the pipe when assembled properly, using the instructions supplied by Thermal Pipe Systems.

1.4 Casing pipe shall be [Polyvinyl Chloride (PVC) meeting the minimum classification requirements of ASTM D-1784] or [High Density Polyethylene (HDPE)]. The thickness shall be in accordance with the Thermal Pipe Systems published data.

1.5 The insulation shall be polyurethane foam completely encapsulated on each end by a compression rubber end seal. Pipe joints shall be insulated using polyurethane foam half shells and protected with a Casing-Tite Sleeve.

1.6 The rubber end seals shall be an Ethylene Propylene Diene Monomer (EPDM) heat resistant compound.

1.7 Fittings shall be uninsulated FRP designed to be used with the carrier pipe. Fittings shall have a bell to match the tapered spigot end of the pipe. The fittings shall be joined with adhesive supplied by Thermal Pipe Systems.

1.8 After completion of hydrostatic testing, joints shall be closed using factory supplied 30 mil high temperature tape. It shall be applied circumferentially around the seam between the coupling and pipe casing.

WARRANTY

We warrant that our products are manufactured with the applicable material specifications and are free from defects in the workmanship and material using our specifications as a standard. Every claim under this warranty shall be deemed waved unless in writing received by Thermal Pipe systems, Inc. within (30) days of the date the defect was discovered and within (1) year of the date of shipment of the product. Thermal Pipe Systems, Inc. MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY OR THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN THE LIMITED WARRANTY SET FORTH ABOVE.

LIMITATIONS AND LIABILTY

It is expressly understood and agreed that the limit of Thermal Pipe Systems, Inc. liability shall be the resupply of a like quantity of nondefective product and that Thermal Pipe Systems, Inc. shall have no such liability except where the damage or claim results solely from the breach of the Thermal Pipe Systems, Inc. warranty. IT IS ALSO AGREED THAT THERMAL PIPE SYSTEMS, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES FOR ANY ALLEGED NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILTY OR ANY OTHER THEORY, OTHER THAN THE LIMITED LIABILTY SET FORTH.

Thermal Pipe Systems, Inc.
5205 W. Woodmill Dr. Suite 33 – Wilmington, DE 19808
Tel: 302-999-1588 – Fax: 302-999-8861
Website: www.thermalpipesystems.com

Thermal Pipe Systems, Inc.

TAPER-TITE® 230 PIPING SYSTEM

FOR CONDENSATE AND
LOW TEMPERATURE HOT WATER SERVICE

SPECIFICATIONS & DRAWINGS

5205 W. WOODMILL DRIVE, SUITE 33
WILMINGTON, DELAWARE 19808
PHONE: 302.999.1588
WWW.THERMALPIPESYSTEMS.COM

TAPER-TITE 230 PIPING SYSTEMS SPECIFICATIONS

TAPER-TITE 230 shall be used where specified for condensate, low temperature hot water, chilled water, or dual temp service. The pipe shall be joined with adhesive using matching tapered bell and spigot ends. Unless otherwise specified, all pipe, fittings, valves and accessories shall conform to the requirements of ANSI B31.1 and shall be of the proper type for pressure and temperature of the heating or cooling water.

FRP CARRIER PIPE: Carrier Pipe shall be Fiberglass Reinforced Plastic (FRP) and shall be filament wound using epoxy resins. Pipe shall have a resin-rich, reinforced liner and comply with ASTM D2310, D2996, and D5686. Resin Designation Codes shall be RTRP-11FX1: 3110 for all sizes. The pipe shall be bell and spigot design in all sizes.

CASING PIPE: The casing shall be **[Polyvinyl Chloride (PVC)]** pipe shall be of virgin PVC resin meeting the minimum classification requirements of ASTM D1784 or **[High Density Polyethylene (HDPE)].** The thickness for PVC casing shall be as shown on page four. Consult manufacturer for HDPE dimensional data.

RUBBER END SEALS: Rubber end seals for insulated TAPER-TITE shall be a high temperature heat resistant Ethylene Propylene Diene Monomer (EPDM) molded rubber compound. All surfaces shall be smooth and free of voids.

POLYURETHANE FOAM INSULATION: The insulation shall be Polyurethane Foam and shall meet the following specifications:

Type:	Two component urethane
Compressive Strength:	40 psi parallel min at 5% comp.
Shrinkage:	None at 70°F
Free Rise Density:	2.0 to 3.0 lbs./cubic foot
Aged "K" (70°F - 72 hrs)	0.16 BTU-in./hour-°F-ft.2
Closed Cell Content:	90%

Insulation concentricity: Carrier Pipe shall be concentric to casing pipe. The allowable maximum deviation from centerline of carrier pipe shall be plus or minus 1/4 inch at the casing center point and plus or minus 1/16 inch at the end seals.

CASING-TITE SLEEVE: The Casing-Tite Sleeve shall be of virgin PVC Resin meeting classification requirements of ASTM D1784.

CASING-TITE SEAL: The Casing-Tite Seal shall be 30 mil high temperature tape.

FITTINGS: All FRP fittings shall be uninsulated and shall be compression molded or filament wound. All fittings shall be designed to be used with the carrier pipe. Fittings shall have a bell with a taper to match a properly tapered spigot end of the pipe. The adhesive shall meet the requirements of the operating conditions of the system.

FLANGES: All FRP flanges shall be uninsulated and may be compression molded or filament wound. All flanges shall be designed to be used with the carrier pipe and meet ANSI B 16.5 with a 150-pound bolt hole circle and number of bolts. Full-face gaskets 1/8" thick with a durometer rating of 60-70 are recommended.

WALL PENETRATION SLEEVES: Provide where piping passes through masonry or concrete walls, floors, and roofs. Sleeves in outside walls below and above grade, in floor, or in roof slabs, shall be schedule 40 or standard weight coated black steel pipe or shall be as specified by the Design Engineer. Space between pipe OD and sleeve ID shall never be less than ½". Sleeves shall be held securely in proper position and location during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Refer to typical detail of wall penetration as shown. In existing concrete manholes or building walls, penetrations may be made using the "core drilling" method providing proper care is taken to drill the holes to the size needed and square to the line of the pipe.

WALL PENETRATION SEALS: All wall penetrations shall be sealed to prevent water from entering the building or manhole. The sealing material shall be as specified by the engineer.

TAPER-TITE APPLICATION ENGINEERING

PIPE SYSTEM DESIGN: Standard design techniques and practices for TAPER-TITE shall be used. Thermal Pipe Systems, Inc. Engineering Department may on request provide certain detailed design aspects of the piping for each project based on the project documents and drawings provided by the design engineer. It is understood that the project specifications and layout drawings will specify the following: type of service, site classification, temperature and pressure classifications, soil conditions, general path and elevations of system, location and design of manholes, known obstacles, size of carrier pipe, and maximum permissible heat losses. It is further understood that other requirements such as the type of pipe, the location size and capacity of valves, traps, pumps, anchors, controls, expansion devices and special structural elements will be provided by the design engineer. The design provided by TPS and their engineers for the piping will be in accordance with ANSI B31.1 and good engineering practices.

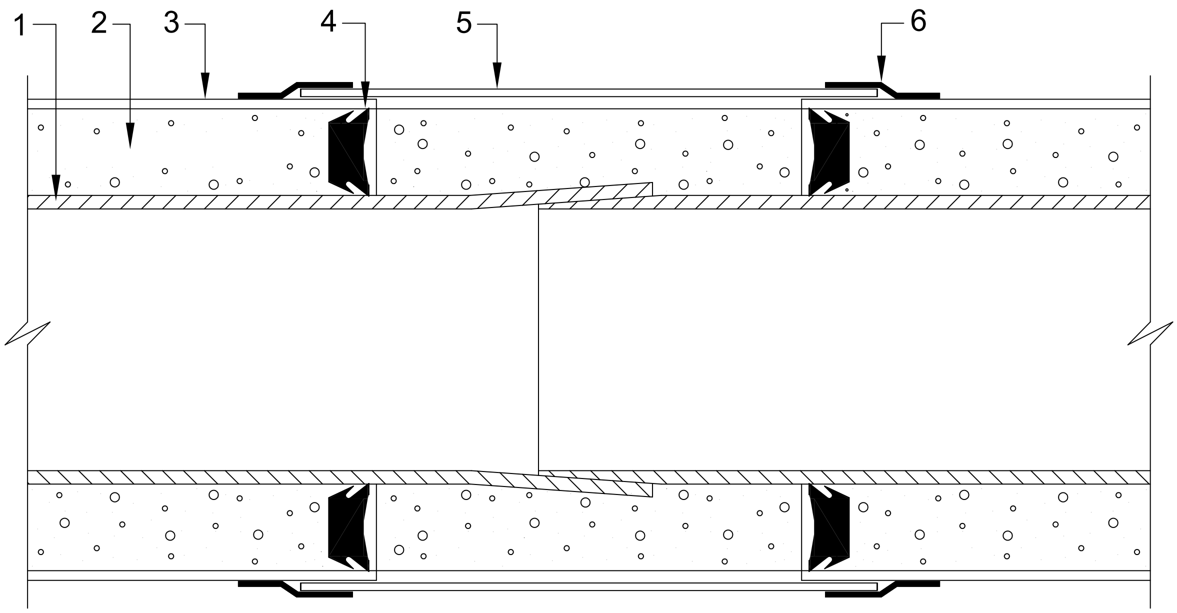
Fluid flow design will be based on Hazen-Williams formula with "C" Factor of 150, or a variation of the Euler formula for water flow.

INSULATION: Thickness of insulation for TAPER-TITE pipe and fittings shall be as shown on the drawings on page four.

TEMPERATURE AND PRESSURE: The TAPER-TITE piping system and all its components are designed to operate up to 150 psig at 250°F, plus typical surges.

DIMENSIONS AND WEIGHTS of insulated TAPER-TITE piping are as shown on page four. The TAPER-TITE piping will be furnished in 20-foot lengths.

PRE-INSULATED TAPER-TITE® 230 PIPE



1. CARRIER: FRP Pipe
2. INSULATION: Polyurethane Foam
3. CASING: PVC or HDPE
4. END SEAL: EPDM
5. CASING-TITE SLEEVE: PVC or HDPE
6. CASING-TITE SEAL: 30 mil H.T. Tape

NOM. PIPE SIZE	CARRIER O.D.	CASING O.D.	THICKNESS		WEIGHT (LBS./20 FT.)
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3	3.50	6.14	.12	1.20	55
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10	10.75	14.28	.28	1.49	288
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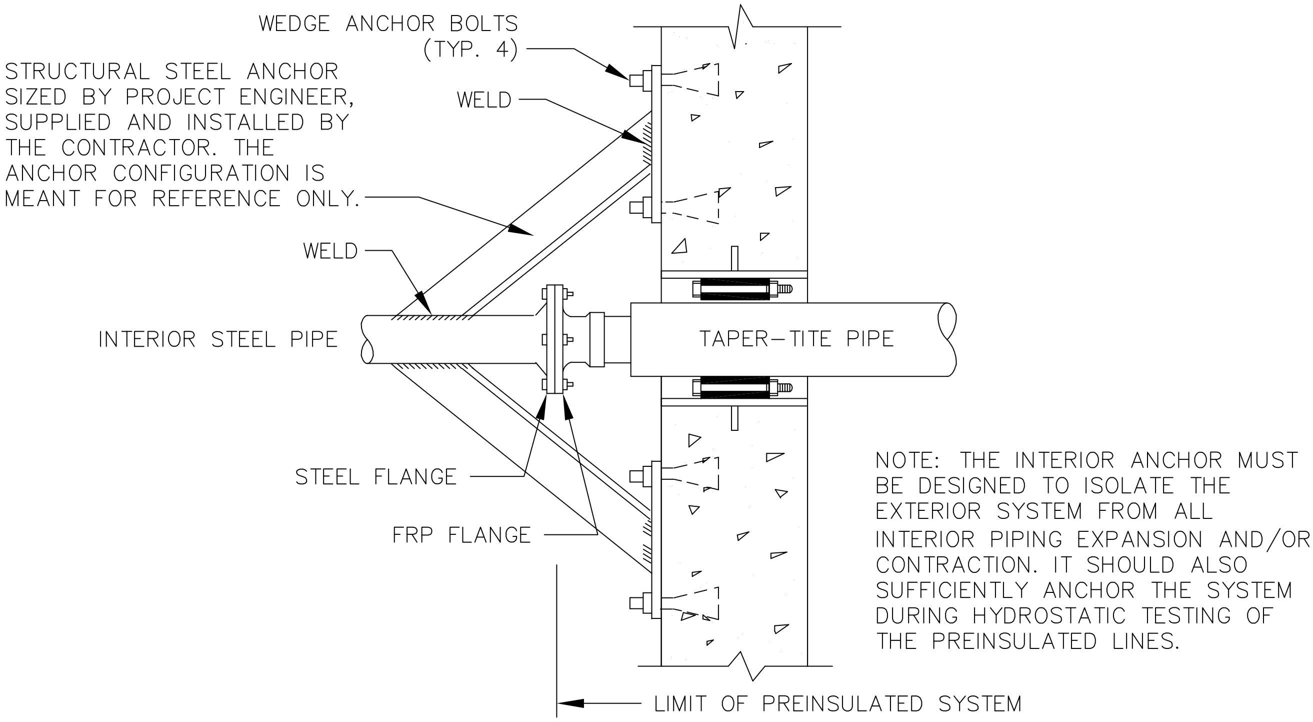
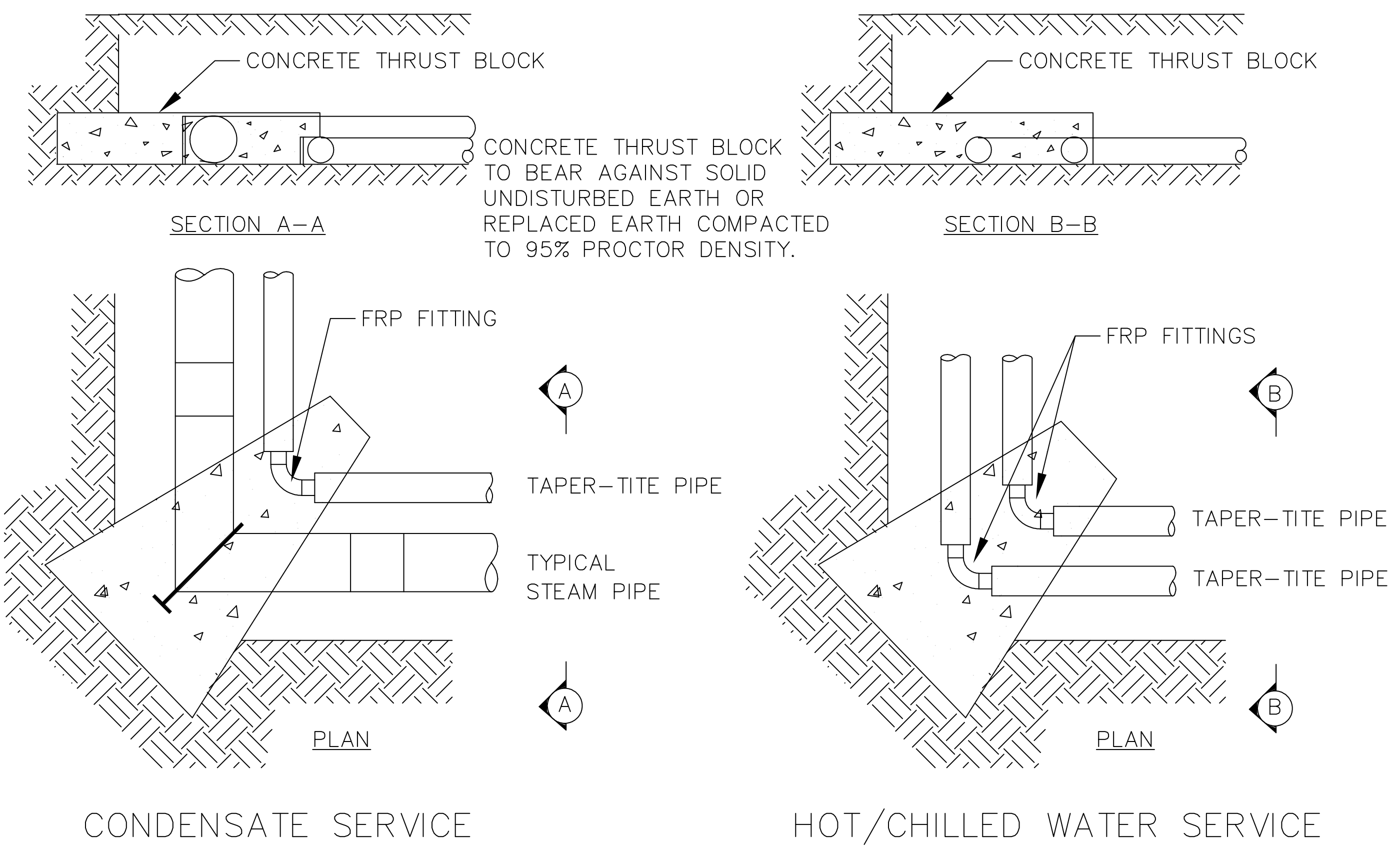


TYPICAL ANCHOR AT WALL PENETRATIONS

NO SCALE



TYPICAL THRUST BLOCK AT ELBOWS

NO SCALE

TAPER-TITE INSTALLATION SPECIFICATION

GENERAL: Installation of the TAPER-TITE piping system shall be done in accordance with the appropriate publications including ANSI B31.1 and the following specifications and instructions. A Thermal Pipe Systems, Inc. field representative may conduct an installation clinic to pre-qualify contract personnel in the proper procedures for the installation.

Piping shall be accurately cut to dimensions established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation shall not be permitted. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints. Good workmanlike procedures shall be followed.

All piping unless otherwise indicated, shall be pitched with a grade of not less than 1 inch in 40 feet toward the drain points when applicable.

Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign matter out of the system.

RECEIVING AND HANDLING SHIPMENTS

INSPECTION: Each Shipment shall be inspected upon arrival at the jobsite. The products were carefully loaded at the plant using methods acceptable to the carrier and it is his responsibility to deliver the pipe in good condition. It is the responsibility of the installing contractor to ascertain whether there has been any loss or damage. The carrier is the contractor's agent. Any pipe or equipment that arrives damaged or is lost in shipment shall be reported by the contractor.

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necessary, in handling this claim. Do not dispose of damaged material - the carrier will notify you of the procedure to follow.

UNLOADING INSTRUCTIONS: The means by which the pipes are unloaded in the field is the decision and responsibility of the installing contractor. The use of forklift type equipment frequently simplifies and speeds up the unloading of larger sizes and usually provides extra protection against damage in handling. To prevent the possibility of the core pipe from shifting within the casing pipe, do not stand a length on one end or raise it vertically. Under no condition should a pipe be dragged along the ground. Do not lift fittings or pipe by inserting a bar, pipe, etc., inside of the core. Damage to the pipe may result. If any pipe is damaged in unloading and handling, mark the damaged area and set it aside. A Thermal Pipe Systems, Inc. representative will determine whether damaged casing can be repaired in the field and will determine exact method for repair and instruct contractor in making repair.

COLD WEATHER HANDLING FOR PVC CASED PIPE: As the temperature approaches freezing, the flexibility and impact resistance of TAPER-TITE pipe is reduced. PVC casing becomes hard and brittle in cold weather and will crack more readily if dropped or hit. Therefore, extra care should be used in handling during cold weather. Pipe at the bottom of a stack may become out-of-round due to the weight of material above it. At normal application temperatures, this corrects itself soon after the load is removed. Under freezing conditions, this recovery to full initial roundness may take several hours.

STORAGE: Store pipe on dunnage in a flat area. Support the barrel of the casing evenly. Bell and spigot ends should overhang dunnage. Store random lengths separately where they will be readily available. Individual lengths of pipe should be stacked in piles no higher than 5 feet. It should be noted that when PVC pipe is stored outside and exposed to prolonged periods of sunlight, an obvious discoloration of pipe can occur. This coloration is a surface layer of hardened plastic and does not inhibit the long-term properties and performance of the pipe. A method of protecting pipe during long exposures (several months) to sunlight is to cover it with canvas or other opaque material. Do not use clear plastic sheets and be sure to provide for air circulation under the sheets.

LOADING TRANSFER TRUCKS: Use trucks with long bodies so that pipe lengths do not overhang. Make certain truck bed is smooth, without cross-strips, bolt heads, or other protrusions that could damage the pipe. Short body trucks may be used if fitted with racks that properly support the pipe in a horizontal position. The rack should have supports spaced every 3 feet or less along the pipe lengths. Pad the contact areas to avoid damage to the pipe.

EXCAVATION: Excavation should consider the need for the thrust blocks at all fittings that are direct buried in the ground. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines, generally, a minimum of 6" in pipe sizes up to 6" diameter, and 12" minimum in sizes 8" and larger. The excavation should be in a straight line.

TRENCHING: Trenching shall follow the elevations provided by the design engineer on the contract drawings. The trench depth should always allow for a minimum cover height of 24" over the top of the casing pipe. Keep excavations free of water during construction. If the Contractor determines it is necessary to remove unsuitable material to a depth greater than specified, refill over excavated area to the proper depth with specified bedding material and compact in 6 inch lifts to 95 percent of maximum density in accordance with ASTM D 1557, Method D. Excavate and replace soil disturbed and weakened by the Contractor's operations or soils permitted to soften from exposure to weather, with bedding material and compact with a plate-type vibratory compactor.

TRENCH WIDTHS: The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation. The reason for this is to keep the earth load on the pipe as small as possible. The wider the trench at the top of the pipe, the greater the load on the pipe. Note that an increase in trench width above the top of the pipe, by stepping the sides or digging a wider offset trench, does not affect the earth load on the pipe. On the other hand, a trench that is too narrow will make assembly difficult and may reduce the rate and quality of installation. In addition, lack of ample room will limit the capability to properly backfill and tamp around the pipe. Although each job or portion of a job must be considered on an individual basis, as a rule, the following minimum trench widths at the top of the pipe are recommended: Minimum: one foot greater than the outside diameter of the casing. Where two or more pipes are in the same trench, use the distance between outside casing of the outside pipes plus one foot. Maximum: Use above method for minimum plus two feet.

DISTRIBUTING PIPE ALONG TRENCH: Pipe lengths may be strung along the line of the trench to minimize additional handling during installation.

PLACING PIPE IN THE TRENCH: The TAPER-TITE pipe may be hand or mechanically passed into the trench. The latest state and federal safety regulations should be understood and observed. If slings are necessary use only canvas straps, do not use cable or chain slings. A backhoe or boom truck is an excellent way of lowering the pipe into the trench.

BEDDING: Bedding material should be sand or other materials free of sharp objects, heavy clods, boulders or frozen lumps as specified by the design engineer. The approved bedding should be used 6" under, around and over the pipe. Utilize good practices that apply to buried pressure piping.

ASSEMBLY OF CASING-TITE SLEEVE: Prior to installing the next section of pipe, the Casing-Tite Sleeve should be installed onto this piece. Simply position the sleeve over the casing and slide it all the way on by hand. Proceed with joint assembly as below.

ASSEMBLY OF PIPE AND FITTINGS:

1) Lightly sand both the bell and spigot with emery paper. All surfaces must be clean and dry.

2) Pre-warm bonding surfaces after cleaning.

3) Use epoxy adhesive supplied for joining the pipe and fittings. When assembly is ready to be made, add the contents of the small container (hardener) to the large container (resin) and stir thoroughly until a uniform consistency is reached. Never attempt to split a kit. Rubber gloves should be used when handling adhesive and components.

4) With the brush supplied, apply a thin layer of adhesive to the tapered surface on the spigot and bell end of the pipe.

5) Without delay, insert the spigot slowly into the bell using a twisting motion until the pipe locks. Hold for 30 seconds to allow flow of adhesive. Mechanical force such as a shop hammer and block must be used to insure proper locking of the joints in sizes 2"-4". In sizes 6"-12" a come-along must be used to insure a proper locking of the joint. A properly assembled joint will show a small bead of adhesive around the entire circumference of the joint.

6) Place the heating blanket on the joint. For Mil Spec adhesive and ambient air temperatures below 70°F cure the pipe joint for 1 hour and the fittings for 1½ hours. For ambient air temperatures above 70°F cure pipe joints and fittings for 30 minutes. Cure all other adhesives for 30 minutes.

TESTING: All carrier pipe joints shall be tested in accordance with the contract specifications. Test shall be performed prior to insulating the joints. If no test is specified, it should consist of a hydrostatic test of 150 psi or 1½ times working pressure, which ever is greater, for a period of two hours.

INSULATION OF JOINTS: After completion of test attach preformed polyurethane insulation half shells using fiberglass tape. Push Casing-Tite Sleeve over the insulated joint so that it is positioned evenly.

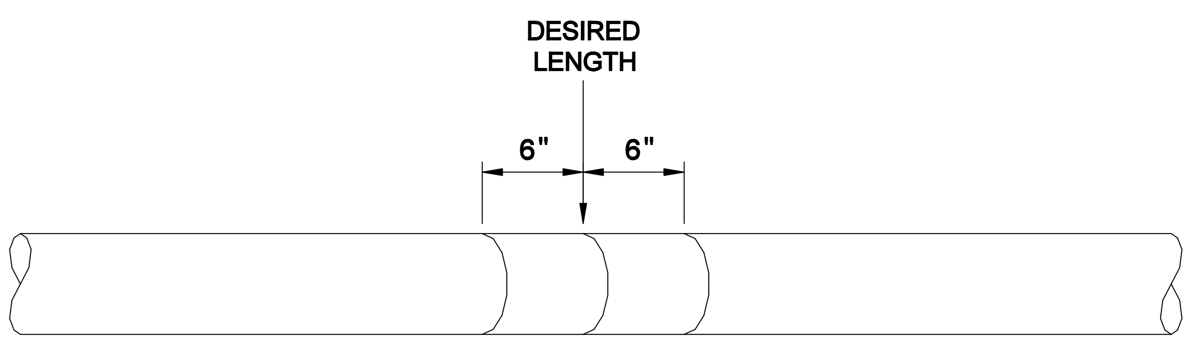
CLOSURE OF JOINTS: Apply the factory supplied Casing-Tite Seal circumferentially around the seam between the sleeve and the casing pipe. Overlap seal 3 inches.

BACKFILLING: Backfilling of trenches shall progress as rapidly as construction, testing, and acceptance of work permits. Uniformly compact and grade bottom of trenches. After installation of pipe and bedding material, backfill as follows: Place initial backfill in layers to a depth of 12 inches of the initial bedding. Compact the material to a density equivalent to the surrounding undisturbed soil or to 90 percent of maximum density (ASTM D1557, Method D), whichever is greater. Backfill remainder of trench in one-foot lifts and compact to 90 percent maximum density (ASTM D1557, Method D). For trenches excavated in roads, streets, or located under structures, place backfill in 6-inch layers to top of trench and compact each layer to at least 95 percent maximum density (ASTM D 1557, Method D).

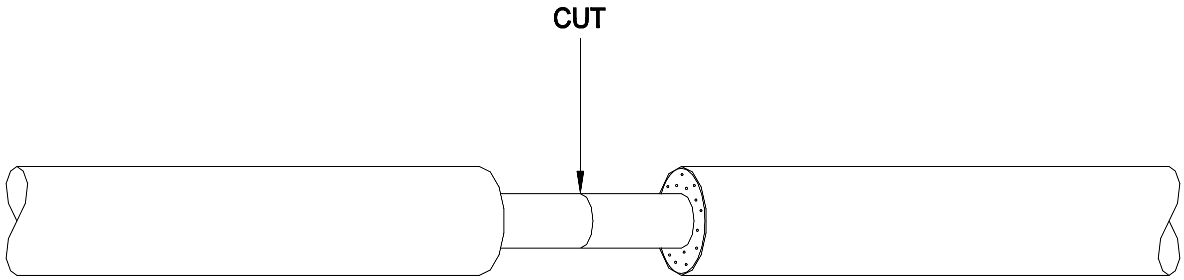
FLANGED JOINTS: Flanged joints shall be faced true, provided with gaskets, and made perfectly square and tight.

FIELD CUTTING PIPE TO A SPECIFIC LENGTH

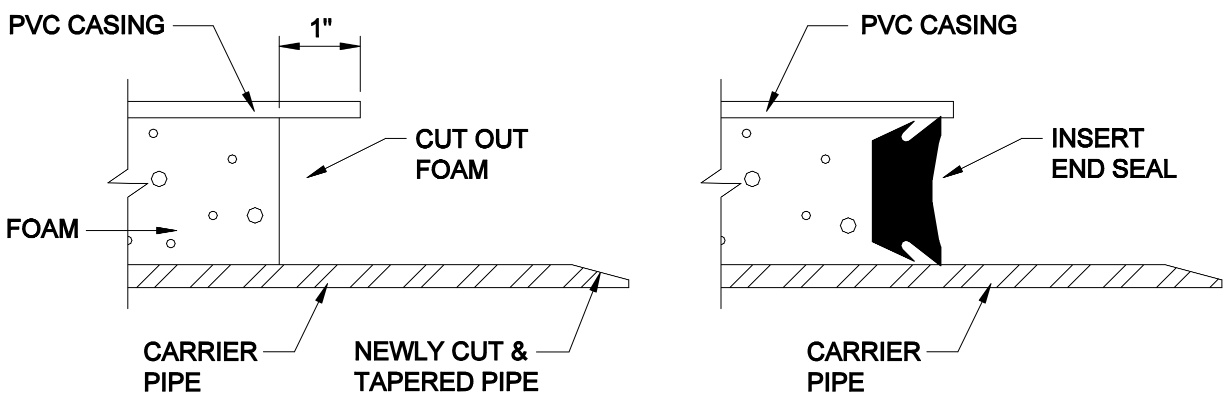
Determine the exact length of carrier pipe needed. Mark the casing at this point. Measure back 6 inches on both sides and mark the casing at these points using a wrap-around.



Use a carpenter handsaw or PVC saw to cut the PVC or HDPE casing. Be careful not to damage the FRP carrier pipe during this cutting operation. Remove the casing and cut off the insulation. See illustration below.



Mark and cut the FRP pipe at the desired length using a fine-toothed hacksaw. Make sure cut is square. If a FRP fitting is to be installed at this point, taper the cut ends using the tapering tool. Using a utility knife, remove the insulation between the casing and the carrier pipe one inch in from the face of the casing as shown below. Insert the rubber end seal between the casing and the carrier pipe using the handle of a hammer or screwdriver to push the seal all the way. Silicone caulking may be used in lieu of the rubber end seal.



THRUST BLOCKS: Thrust blocks must be installed wherever the pipe line changes direction or size as at tees, elbows and reducers or at any point that develops thrust such as at a valve or similar equipment. The above situations may occur either where the fittings etc., are directly buried in the soil, or are located in a manhole.

Thrust blocks must be designed for maximum anticipated operating or test pressure. If it is anticipated that pressures higher than normal operating pressures will be used at a later date. Thrust blocks to accommodate such pressures should be installed initially. Size and type of thrust blocks depend on pressure, pipe size, and the type of soil. This information shall be supplied by the Design Engineer. Where a thrust block serves more than one line, the block must be designed to resist the sum of the thrusts of all of the lines involved. Thrust blocks should be poured on and against undisturbed soil or soil tamped to 95% proctor density.

Thrust blocks shall be installed using a concrete having a compressive strength of not less than 3,000 psi minimum ultimate 28 days compressive strength, air entrained, with water reducing admixture. Where the soil bearing value is less than 1,000 pounds per square foot, Thermal Pipe System, Inc. will make the necessary calculations and recommendations as to how the fitting should be thrusted. Where special thrust provisions are needed, Thermal Pipe System, Inc. will recommend the necessary design. The table on the following page gives the thrust load at any fitting in lbs. at 100 psi* pressure.

Size (in.)	90° Elbow	45° Elbow	Tee
2	510	276	361
3	1,187	642	839
4	2,025	1,096	1,432
6	4,458	2,413	3,152
8	7,763	4,201	5,489
10	11,922	6,452	8,430
12	16,750	9,065	11,844

*For pressure other than 100 psi increase loads proportionately (example: for 150 psi multiply by 1.5; for 200 psi multiply by 2.0: etc.)

NOTE: Dead End and Anchor loads are equal to TEE shown above.

The approximate safe bearing loads of various soils given in the following table are for horizontal thrusts when the depth of cover over the top of the pipe exceeds two feet. These loads are estimates only. Actual soil and safe bearing loads should be determined by the Design Engineer.

SOIL	SAFE BEARING LOAD lbs./sq. ft.
Muck, Peat etc.*	0
Soft Clay	1,000
Sand	2,000
Sand & Gravel	3,000
Sand & Gravel Cemented with Clay	4,000
Hard Shale	10,000

* All thrusts are resisted by piles or tie rods to solid foundations, or by removal of muck or peat and replacement with ballast of sufficient stability.

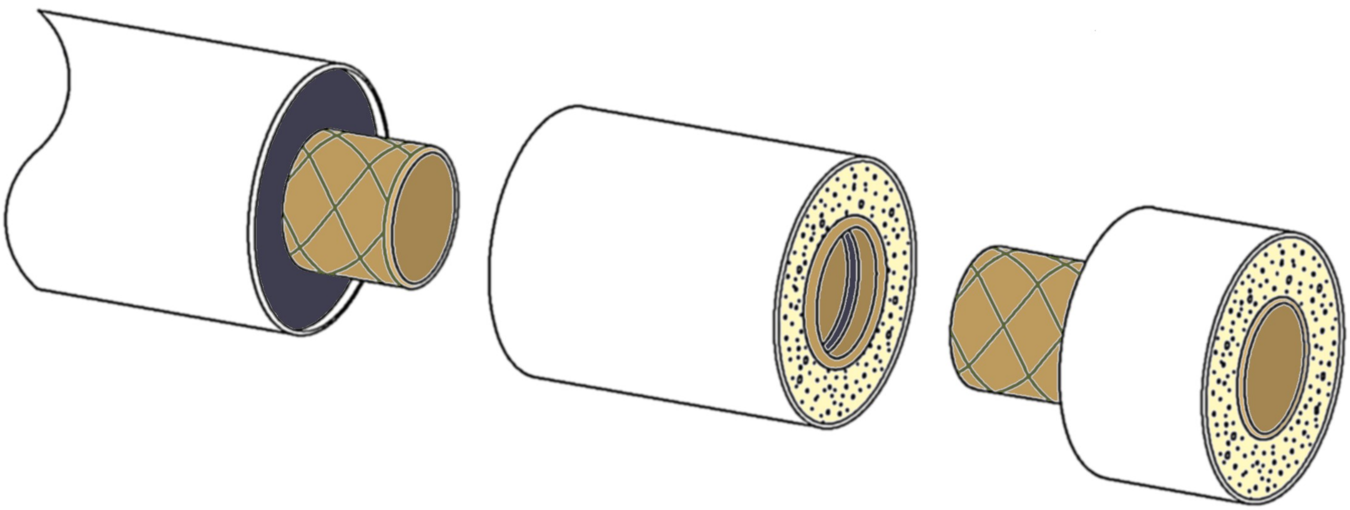
START UP PROCEDURE: Start up procedure shall conform to generally accepted practices and be done in a workman-like manner. The line shall be filled slowly from any available low-pressure source. The water can be introduced from lines in service directly through valved connections, or by temporary connections to taps made in the new line. If possible, all such connections should be made at the lowest point in the line to avoid air entrapment. All valves and other control points in the line that are open as the line filling begins should be closed gradually to avoid the possibility of water hammer.

MANUFACTURERS WRITTEN CERTIFICATION: After testing and prior to start-up of the system, the manufacturer must certify in writing that the system was installed per the manufacturers installation instructions.

Thermal Pipe Systems, Inc.

VEE-TITE® 230

Gasketed Coupling FRP System
Featuring High Flow, Corrosion Free Service
For
Condensate and Low Temperature Hot Water



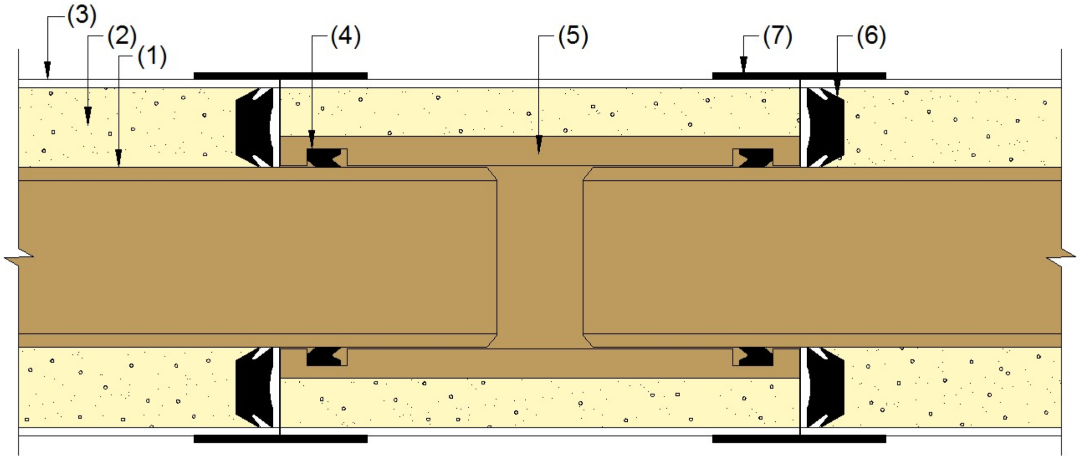
Vee-Tite is a lightweight, easy to install, energy efficient piping system for use in low temperature hot water and condensate return service. This system may be used for water only in temperatures to 230ºF at pressures to 150psi.

The carrier pipe is filament wound epoxy pipe with a resin rich liner. The system is produced with a grooved FRP coupling containing high temperature rubber 'V' rings. Insulation is thermally efficient polyurethane foam with a 'K' factor of 0.16 at 70ºF. The heavy wall PVC or HDPE casing and heat resistant end seals keep the insulation dry. A complete line of fittings is available for this system.

To join Vee-Tite simply push the spigot ends into the couplings. A lubricant is provided for ease of installation. The rubber ring joint compensates for expansion, contraction, and earth movement. The piping system is non-corrosive and maintains very high flow characteristics. It is an excellent choice for underground condensate return lines, district heating systems, dual temperature lines, and geothermal heating systems. The piping system is approved for use by Federal Agencies for condensate, hot and chilled water.

The coupling comes preinsulated for ease of installation.

VEE-TITE® 230



(1) CARRIER: FRP Pipe.
(2) INSULATION: Polyurethane Foam
(3) CASING: PVC or HDPE
(4) CARRIER SEALING RING: EPDM
(5) COUPLING: Grooved FRP.
(6) END SEAL: EPDM
(7) CASING-TITE SEAL: 30 mil High Temperature Tape

NOMINAL PIPE SIZE (IN.)	NOMINAL CASING SIZE (IN.)	CARRIER O.D. (IN.)	CASING O.D. (IN.)	THICKNESS		WEIGHT (LBS./ 20 FT.)
				FOAM (IN.)	PVC CASING (IN.)	
2	4	2.38	4.50	0.92	0.140	40
3	6	3.50	6.14	1.20	0.120	55
4	8	4.50	8.16	1.67	0.160	89
6	10	6.63	10.20	1.59	0.200	146
8	12	8.63	12.24	1.57	0.240	205
10	14	10.75	14.28	1.49	0.280	288
12	16	12.75	16.00	1.38	0.250	326

NOTE: Standard lengths are 20'-0". Weights are approximate. Consult manufacturer for HDPE dimensional data.

SHORT FORM SPECIFICATIONS

1.1 All underground pre-insulated pipe 2" – 12" shall be Thermal Pipe Systems, Inc. Vee-Tite® piping with Ring-Tite joints.

1.2 FRP carrier pipe shall be Fiberglass Reinforced Plastic (FRP) with resin-rich liner and shall comply with ASTM D2310 and D2996. Resin Designation Codes shall be RTRP-11FX1: 3110 for all sizes. The pipe shall be suitable for use at maximum hydrostatic working pressure of 150 psi at 230ºF.

1.3 Each joint shall automatically provide for expansion and contraction through the Ethylene Propylene Diene Monomer (EPDM) sealing rings in the grooves of the integral bronze coupling. Pipe must be assembled with lubricant supplied by Thermal Pipe Systems.

1.4 Casing pipe shall be [Polyvinyl Chloride (PVC) meeting the minimum classification requirements of ASTM D-1784] or [High Density Polyethylene (HDPE)]. The thickness shall be in accordance with the Thermal Pipe Systems published data.

1.5 The insulation shall be polyurethane foam completely encapsulated on each end by a compression rubber end seal. Pipe joints shall be insulated using polyurethane foam half shells and protected with a Casing-Tite Sleeve.

1.6 The rubber end seals shall be an Ethylene Propylene Diene Monomer (EPDM) heat resistant compound.

1.7 Fittings shall be uninsulated FRP designed to be used with the carrier pipe. Fittings may be configured with spigot ends to match pipe and connect with Vee-Tite couplings or have a bell end with a taper to match a properly tapered spigot end, or a flanged end. Where adhesives are used, it shall be supplied by Thermal Pipe Systems.

1.8 After completion of hydrostatic testing, joints shall be closed using factory supplied 30 mil high temperature tape. It shall be applied circumferentially around the seam between the coupling and pipe casing.

WARRANTY

We warrant that our products are manufactured with the applicable material specifications and are free from defects in the workmanship and material using our specifications as a standard. Every claim under this warranty shall be deemed waved unless in writing received by Thermal Pipe systems, Inc. within (30) days of the date the defect was discovered and within (1) year of the date of shipment of the product. Thermal Pipe Systems, Inc. MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY OR THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN THE LIMITED WARRANTY SET FORTH ABOVE.

LIMITATIONS AND LIABILTY

It is expressly understood and agreed that the limit of Thermal Pipe Systems, Inc. liability shall be the resupply of a like quantity of nondefective product and that Thermal Pipe Systems, Inc. shall have no such liability except where the damage or claim results solely from the breach of the Thermal Pipe Systems, Inc. warranty. IT IS ALSO AGREED THAT THERMAL PIPE SYSTEMS, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES FOR ANY ALLEGED NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILTY OR ANY OTHER THEORY, OTHER THAN THE LIMITED LIABILTY SET FORTH.

Thermal Pipe Systems, Inc.
5205 W. Woodmill Dr. Suite 33 – Wilmington, DE 19808
Tel: 302-999-1588 – Fax: 302-999-8861
Website: www.thermalpipesystems.com

Thermal Pipe Systems, Inc.

VEE-TITE® 230 PIPING SYSTEM

FOR CONDENSATE AND
LOW TEMPERATURE HOT WATER SERVICE

SPECIFICATIONS & DRAWINGS

5205 W. WOODMILL DRIVE, SUITE 33
WILMINGTON, DELAWARE 19808
PHONE: 302.999.1588
WWW.THERMALPIPESYSTEMS.COM

VEE-TITE 230 PIPING SYSTEM SPECIFICATIONS

VEE-TITE shall be used where specified for condensate, low temperature hot water, chilled water, or dual temperature line service using a rubber ring joining method. Unless otherwise specified, all pipe, fittings, valves and accessories shall conform to the requirements of ANSI B31.1 and shall be of the proper type for pressure and temperature of the heating or cooling water.

FRP CARRIER PIPE: Carrier Pipe shall be Fiberglass Reinforced Plastic (FRP) and shall be filament wound using epoxy resins. Pipe shall have a resin-rich, reinforced liner and comply with ASTM D2310, D2996, and D5686. Resin Designation Codes shall be RTRP-11FX1: 3110 for all sizes. The pipe shall be of spigot by spigot design and a separate two-ring coupling shall be provided. The coupling shall be made of the same material as the pipe and shall have machined grooves into which the sealing rings are inserted.

RUBBER SEALING RING: The sealing rings shall be molded high temperature (HT) heat resistant Ethylene Propylene Diene Monomer (EPDM) using a properly vulcanized compound. The ring surfaces shall be smooth and free from all porosity and internal voids.

CASING PIPE: The casing shall be **[Polyvinyl Chloride (PVC)]** pipe shall be of virgin PVC resin meeting the minimum classification requirements of ASTM D1784 or **[High Density Polyethylene (HDPE)]**. The thickness for PVC casing shall be as shown on page three. Consult manufacturer for HDPE dimensional data.

RUBBER END SEALS: Rubber end seals for insulated VEE-TITE shall be a high temperature (HT) heat resistant Ethylene Propylene Diene Monomer (EPDM) molded rubber compound. All surfaces shall be smooth and free of voids.

POLYURETHANE FOAM INSULATION: The insulation shall be Polyurethane Foam and shall meet the following specifications:

Type:	Two component urethane
Compressive Strength:	40 psi parallel min at 5% comp.
Shrinkage:	None at 70°F
Free Rise Density:	2.0 to 3.0 lbs./cubic foot
Aged "K" (70°F - 72 hrs)	0.16 BTU-in./hour-°F-ft.2
Closed Cell Content:	90%

INSULATION CONCENTRICITY: Carrier Pipe shall be concentric to casing pipe. The allowable maximum deviation from centerline of carrier pipe shall be plus or minus 1/4 inch at the casing center point and plus or minus 1/16 inch at the end seals.

CASING-TITE SEAL: The Casing-Tite Seal shall be 30 mil high temperature tape.

FITTINGS: All FRP fittings shall be uninsulated and shall be compression molded or filament wound. All fittings shall be designed to be used with the carrier pipe. Fittings may be configured with spigot ends to match pipe and connect with Vee-Tite couplings or have a bell end with a taper to match a properly tapered spigot end, or a flanged end. Adhesive where required shall meet the requirements of the operating conditions of the system. Fittings shall be un-insulated for encasement in concrete thrust blocks.

FLANGES: All FRP flanges shall be uninsulated and may be compression molded or filament wound. All flanges shall be designed to be used with the carrier pipe and meet ANSI B 16.5 with a 150-pound bolt hole circle and number of bolts. Full-face gaskets 1/8" thick with a durometer rating of 60-70 are recommended.

WALL PENETRATION SLEEVES: Provide where piping passes through walls below and above grade, in floor, or in roof slabs, shall be schedule 40 or standard weight coated black steel pipe or shall be as specified by the Design Engineer. Space between the pipe OD and the sleeve ID shall never be less than 1/2". Sleeves shall be held securely in proper position and location during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Refer to typical detain of wall penetration as shown. In existing concrete manholes or building walls, penetrations may be made using the "core drilling" method providing proper care is taken to drill the holes to the size needed and square to the line of the pipe.

WALL PENETRATION SEALS: All wall penetrations shall be sealed to prevent water from entering the building or manhole. The sealing material shall be specified by the engineer.

VEE-TITE APPLICATION ENGINEERING

PIPE SYSTEM DESIGN: Standard design techniques and practices for VEE-TITE shall be used. Thermal Pipe Systems, Inc. Engineering Department may on request provide certain detailed design aspects of the piping for each project based on the project documents and drawings provided by the Design Engineer. It is understood that the project specifications and layout drawings will specify the type of service, location of the site, temperature and pressure classifications, soil conditions, general path and elevations of the system, location and design of manholes, known obstacles, size of the carrier pipe, and the maximum permissible heat losses. It is further understood that other requirements such as the type of pipe, the location size and capacity of valves, traps, pumps, anchors, controls, expansion devices and special structural elements will be provided by the Design Engineer. The design provided by Thermal Pipe Systems, Inc. and their engineers for the piping will be in accordance with ANSI B31.1 and good engineering practices.

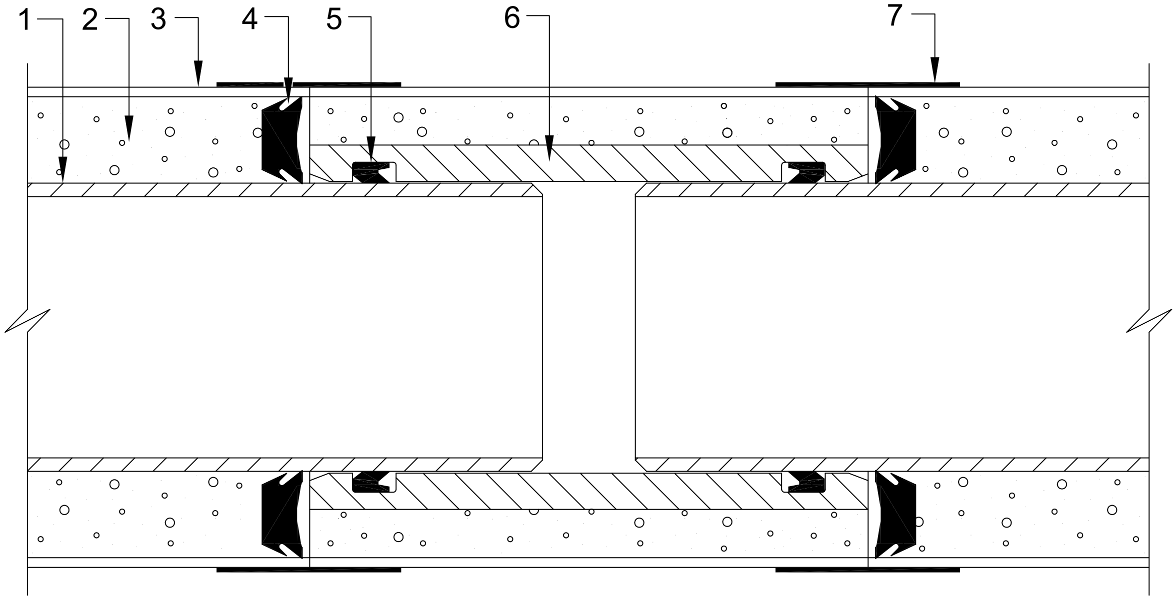
Fluid flow design will be based on Hazen-Williams formula with "C" Factor of 150, or a variation of the Euler formula for water flow.

INSULATION: Thickness of insulation for VEE-TITE pipe and fittings shall be as shown on page four.

TEMPERATURE AND PRESSURE: The VEE-TITE piping system and all its components are designed to operate up to 150 psig at 230ºF plus typical surges.

DIMENSIONS AND WEIGHTS of insulated VEE-TITE piping are as shown on page four. The VEE-TITE piping will be furnished in 20-foot lengths.

PRE-INSULATED VEE-TITE® 230 PIPE

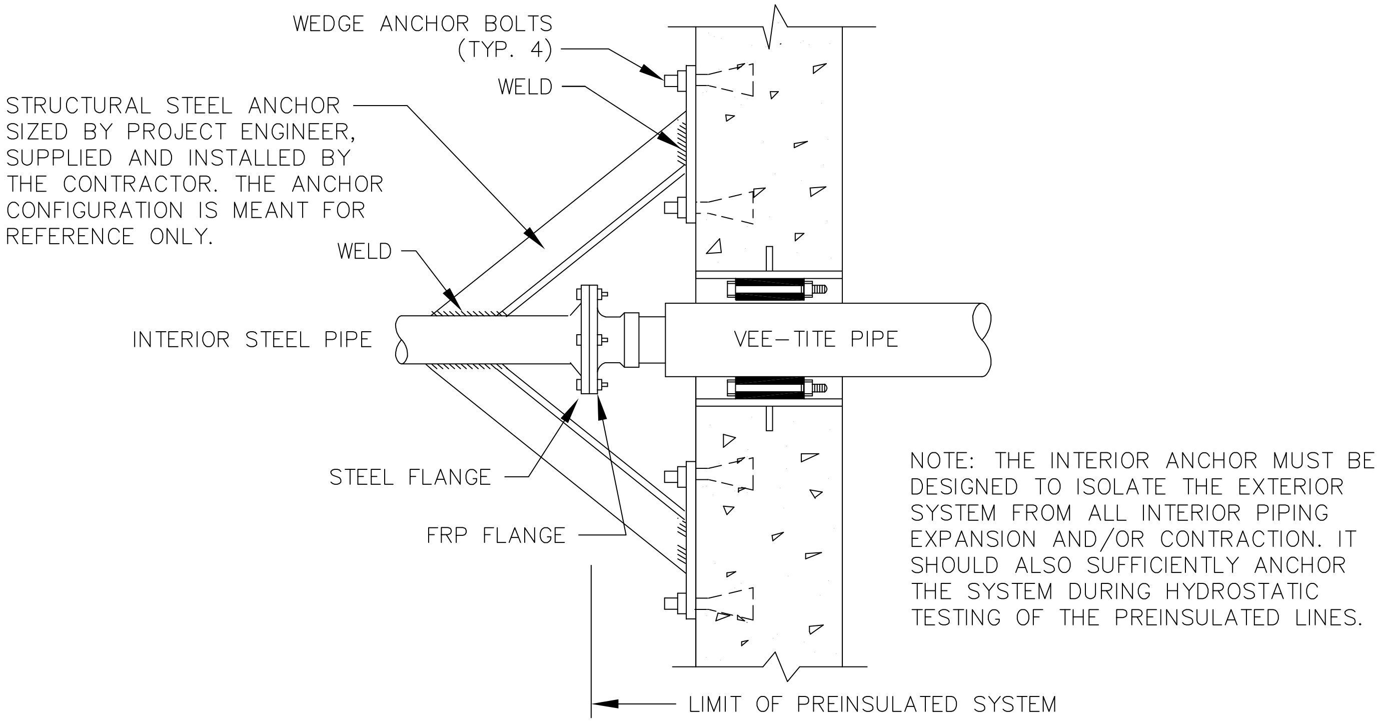


1. CARRIER: FRP Pipe
2. INSULATION: Polyurethane Foam
3. CASING: PVC or HDPE
4. END SEAL: EPDM
5. CARRIER SEALING RING: EPDM
6. COUPLING: Grooved FRP (Preinsulated)
7. CASING-TITE SEAL: 30 mil H.T. Tape

NOM. PIPE SIZE	CARRIER O.D.	CASING O.D.	THICKNESS		WEIGHT (LBS./20 FT.)
			PVC CASING	FOAM	
2	2.38	4.50	.14	0.92	40
3	3.50	6.14	.12	1.20	55
4	4.50	8.16	.16	1.67	89
6	6.63	10.20	.20	1.59	146
8	8.63	12.24	.24	1.57	205
10	10.75	14.28	.28	1.49	288
12	12.75	16.00	.25	1.38	326

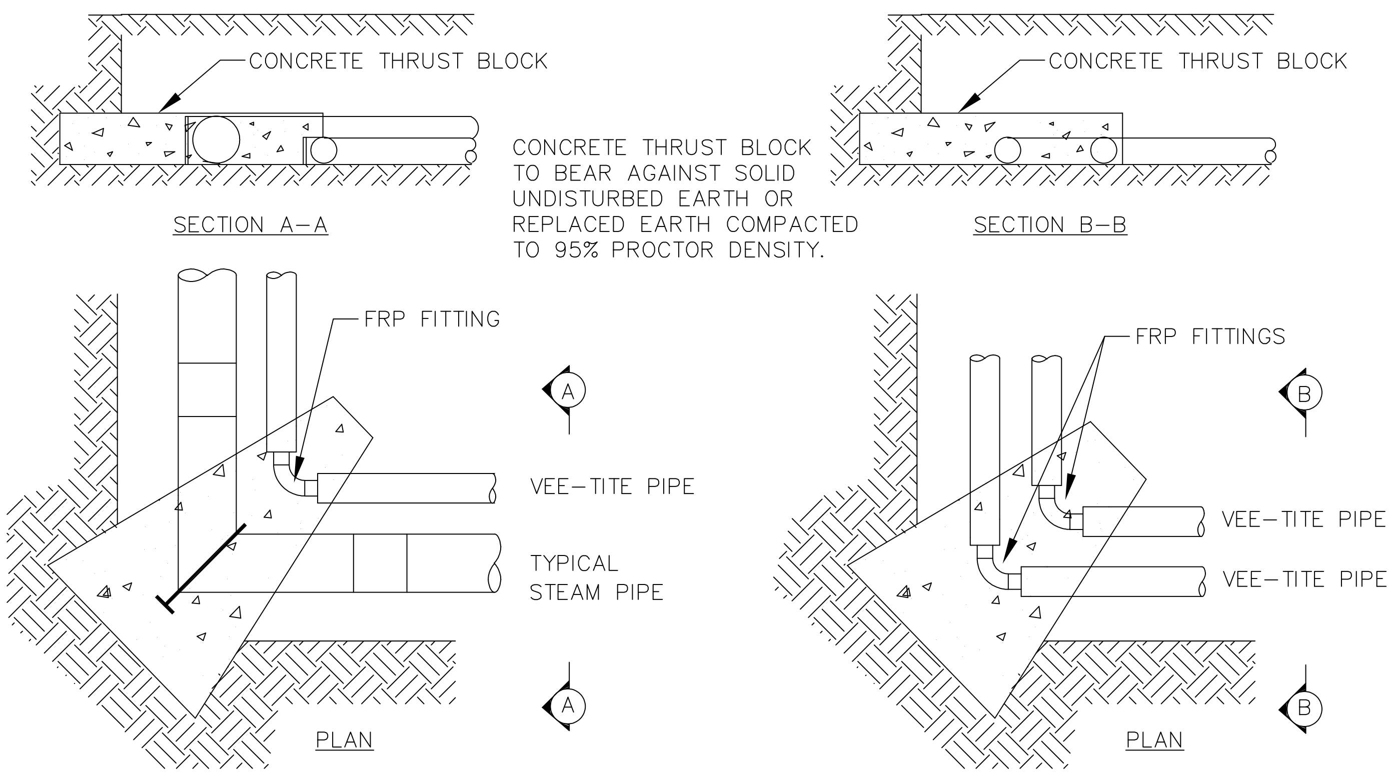
NOTE: All dimensions are in inches unless noted. Consult manufacturer for HDPE dimensional data.

PRE-INSULATED VEE-TITE® 230 PIPE



TYPICAL ANCHOR AT WALL PENETRATIONS

NO SCALE



CONDENSATE SERVICE

HOT/CHILLED WATER SERVICE

TYPICAL THRUST BLOCK AT ELBOWS

NO SCALE

VEE-TITE INSTALLATION SPECIFICATION

GENERAL: Installation of the VEE-TITE piping system shall be done in accordance with the appropriate publications including ANSI B31.1 and the following specifications and instructions. A Thermal Pipe Systems, Inc. field representative may conduct an installation clinic to pre-qualify contract personnel in the proper procedures for the installation.

Piping shall be accurately cut to dimensions established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation shall not be permitted. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints. Good workmanlike procedures shall be followed.

All piping, unless otherwise indicated, shall be pitched with a grade of not less than 1 inch in 40 feet toward the drain points when applicable.

Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign matter out of the system.

RECEIVING AND HANDLING SHIPMENTS

INSPECTION: Each shipment shall be inspected upon its arrival at the jobsite. The products are carefully loaded at the plant using methods acceptable to the carrier and it is their responsibility to deliver the pipe in good condition. It is the responsibility of the installing contractor to ascertain whether there has been any loss or damage. The carrier is the contractor's agent. Any pipe or equipment that arrives damaged or is lost in shipment shall be reported by the contractor.

Make overall inspection of the load. If load is intact, ordinary inspection while unloading should be enough to make sure that the pipe has arrived in good condition. It is the responsibility of the receiver to make certain that there has been no loss or damage. Note specifically that any end packaging should not show signs of damage. If the load has shifted, or end packing damaged, then each piece must be carefully inspected for damage. Specifically, the ends should be inspected for scars, nicks, etc. Other obvious damage is cause for rejection. Check total quantities of each item against the tally sheet (pipe, fittings, etc.). Any damaged or missing items are to be noted on the delivery receipt and the receipt returned to the carrier. Notify the carrier immediately and make claim in accordance with the carrier’s instructions. Thermal Pipe Systems, Inc. will assist, if

necessary, in handling this claim. Do not dispose of damaged material - the carrier will notify you of the procedure to follow.

UNLOADING INSTRUCTIONS: The means by which the pipes are unloaded in the field is the decision and responsibility of the installing contractor. The use of forklift type equipment frequently simplifies and speeds up the unloading of larger sizes and usually provides extra protection against damage in handling. To prevent the possibility of the core pipe from shifting within the casing pipe, do not stand a length on one end or raise it vertically. Under no condition should a pipe be dragged along the ground. Do not lift fittings or pipe by inserting a bar, pipe, etc., inside of the core, damage to the pipe may result. If any pipe is damaged in unloading and handling, mark the damaged area and set it aside. A Thermal Pipe Systems, Inc. representative will determine whether the damaged casing can be repaired in the field and will determine exact method for repair and instruct the contractor in making the repair.

COLD WEATHER HANDLING FOR PVC CASED PIPE: As the temperature approaches and drops below freezing, the flexibility and impact resistance of VEE-TITE piping is reduced. PVC casing becomes hard and brittle in cold weather and will crack more readily if dropped or hit. Therefore, extra care should be used when handling during cold weather. Pipe at the bottom of a stack may become out-of-round due to the weight of material above it. At normal application temperatures, this corrects itself soon after the load is removed. Under freezing conditions, this recovery to full initial roundness may take several hours.

STORAGE: Store pipe on dunnage in a flat area. Support the barrel of the casing evenly. Spigot ends should overhang dunnage. Store random lengths separately where they will be readily available. Individual lengths of pipe should be stacked in piles no higher than 5 feet. It should be noted that when PVC pipe is stored outside and exposed to prolonged periods of sunlight, an obvious discoloration of the pipe can occur. This coloration is a surface layer of hardened plastic and does not inhibit the long-term properties and performance of the pipe. A method of protecting pipe during long exposures (several months) to sunlight is to cover it with canvas or other opaque material. Do not use clear plastic sheets and be sure to provide for air circulation under the sheets.

LOADING TRANSFER TRUCKS: Use trucks with long bodies so that pipe lengths do no overhang. Make certain truck bed is smooth, without cross-strips, bolt heads, or other protrusions that could damage the pipe. Short body trucks may be used if fitted with racks that properly support the pipe in a horizontal position. The rack should have supports spaced every 3 feet or less along the pipe lengths. Pad the contact areas to avoid damage to the pipe.

EXCAVATION: Excavation should consider the need for the thrust blocks at all fittings that are directly buried in the ground. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines, generally a minimum of 6" in pipe sizes up to 6" diameter, and 12" minimum in sizes 8" and larger. The excavation should be in a straight line except where fittings are located.

TRENCHING: Trenching shall follow the elevations provided by the Design Engineer on the contract drawings. The trench depth should always allow for a minimum cover height of 24" over the top of the casing. Keep excavations free of water during construction. If the contractor determines it is necessary to remove unsuitable material to a depth greater than specified, refill excavations carried below the depths indicated or directed with specified bedding material and compact in 6" lifts to 95% of maximum density in accordance with ASTM D1557, Method D. Excavate and replace soil disturbed and weakened by the contractors operations or soils permitted to soften from exposure to weather, with bedding material and compact with a plate-type vibratory compactor.

TRENCH WIDTHS: The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation. The reason for this is to keep the earth load on the pipe as small as possible. The wider the trench at the top of the pipe, the greater the load on the pipe. Note that an increase in trench width above the top of the pipe, by stepping the sides or digging a wider offset trench, does not affect the earth load on the pipe. On the other hand, a trench that is too narrow will make assembly difficult and may reduce the rate and quality of installation. In addition, lack of ample room will limit the capability to properly backfill and tamp around the pipe. Although each job or portion of a job must be considered on an individual basis, as a rule, the following minimum trench widths at the top of the pipe are recommended: Minimum: one foot greater than the outside diameter of the casing. Where two or more pipes are in the same trench, use the distance between outside casing of the outside pipes plus one foot. Maximum: Use above method for minimum plus two feet.

DISTRIBUTING PIPE ALONG TRENCH: Pipe lengths may be strung along the line of the trench to minimize additional handling during installation.

PLACING PIPE IN THE TRENCH: The VEE-TITE pipe may be hand or mechanically passed into the trench. The latest state and federal safety regulations should be understood and observed. If slings are necessary use only canvas straps, do not use cable or chain slings. A backhoe or boom truck provide an excellent way of lowering the pipe into the trench.

BEDDING: Bedding material should be sand or other materials free of sharp objects, heavy clods, boulders or frozen lumps as specified by the Design Engineer. The approved bedding should be used 6" under, around, and over the pipe. Utilize good practices that apply to buried pressure piping.

ASSEMBLY:

1. Check to make sure rings are in coupling grooves and make certain they are faced properly and completely seated.

2. Check the pipe ends to be sure it is clean, and wipe with a clean, dry rag if necessary.

3. Dig a slight bell hole to keep the joint area clean and free of loose soil during assembly.

4. Lubricate the pipe ends - soap lubricant supplied by Thermal Pipe Systems, Inc. should be applied to the entire outside circumference of the pipe back to the end seal.

5. Start the coupling on by hand, and then holding it straight push the coupling home against the pipe casing using a bar and block. In larger sizes a come-along may be used.

TESTING: All carrier pipe joints shall be tested in accordance with the contract specifications. If no test is specified, it should consist of a hydrostatic test of 150 psi or 1 ½ times working pressure, which ever is greater, for a period of two hours.

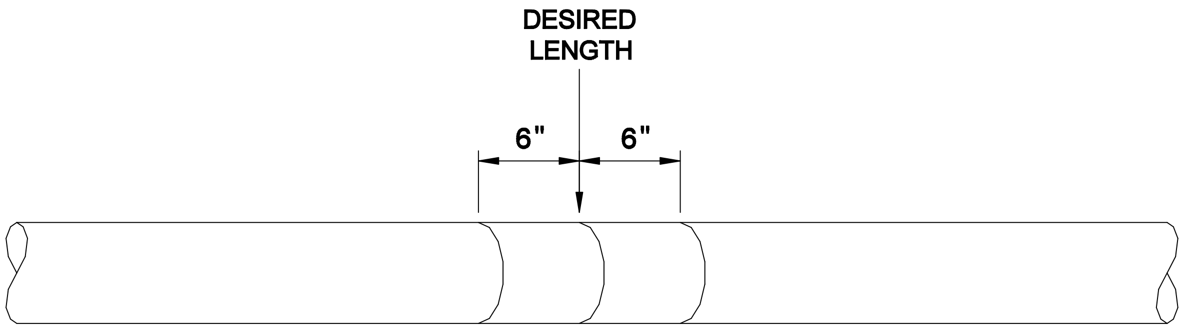
CLOSURE OF JOINTS: After completion of testing, apply the factory supplied Casing-Tite Seal circumferentially around the seam between the coupling and pipe casings. Overlap seal 3 inches.

BACKFILLING: Backfilling of trenches shall progress as rapidly as construction, testing, and acceptance of work permits. Uniformly compact and grade bottom of trenches. After installation of pipe and bedding material, backfill as follows: Place initial backfill in layers to a depth of 12" over the top of the initial bedding. Compact the material to a density equivalent to the surrounding undisturbed soil or to 90% of maximum density (ASTM D1557, Method D). For trenches excavated in roads, streets, or located under structures, place backfill in 6" layers to top of trench and compact each layer to at least 95% maximum density (ASTM D1557, Method D).

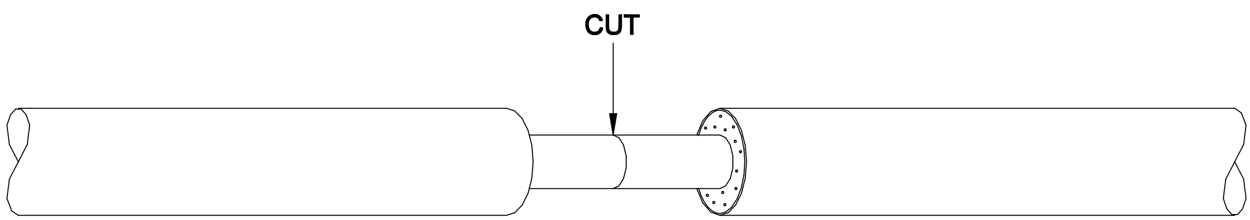
FLANGED JOINTS: Flanged joints shall be faced true, provided with gaskets and made perfectly square and tight.

FIELD CUTTING PIPE TO A SPECIFIC LENGTH

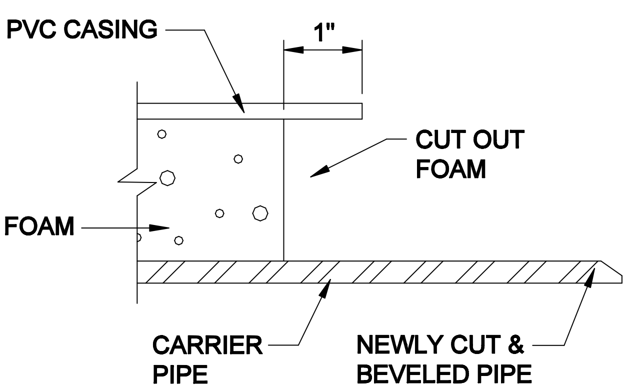
Determine the exact length of carrier pipe needed. Mark the casing at this point. Measure back 6" on both sides and mark the casing at these points using a wrap-around.

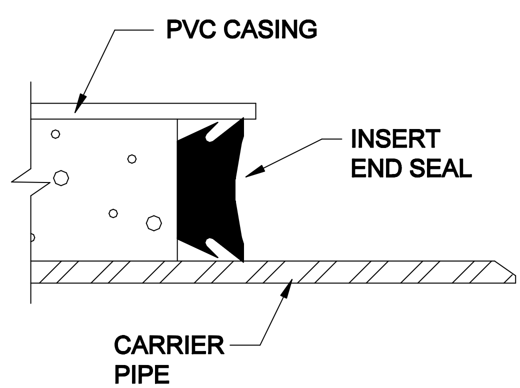


Use a carpenters handsaw or a PVC saw to cut the PVC or HDPE casing. Be careful not to damage the FRP carrier pipe during this cutting operation. Remove the casing and cut off the insulation. See illustration below.



Mark and cut the FRP pipe at the desired length using a fine-toothed hacksaw. Make sure cut is square. If a FRP fitting is to be installed at this point, taper the cut ends using the tapering tool. Using a utility knife, remove the insulation between the casing and the carrier pipe one inch in from the face of the casing as shown below. Insert the rubber end seal between the casing and the carrier pipe using the handle of a hammer or screwdriver to push the seal all the way. Silicone caulking may be used in lieu of the rubber end seal.





INSTALLING RTRP FITTINGS (IF USING ADHESIVE):

1. Lightly sand both the bell of the fitting and spigot of pipe with emery cloth. All surfaces must be clean and dry.

2. Pre-warm bonding surfaces after cleaning.

3. Use epoxy adhesive supplied for joining the pipe and fittings. When assembly is ready to be made, add the contents of the small container (hardener) to the large container (resin) and stir thoroughly until a uniform consistency is reached. Rubber gloves should be used when handling adhesive components & cleaner.

4. With the brush supplied, apply a thin layer of adhesive to the tapered surface on the spigot end of the pipe and to the bell of the fitting.

5. Without delay, insert the spigot slowly into the bell using a twisting motion until the fitting locks. Hold for 30 seconds to allow flow of adhesive.

6. Place the heating blanket of fitting and cure for 1 1/2 hours for Mil Spec adhesive installed when ambient air temperatures are less that 70°F. When ambient air temperatures are above 70°F, and for all other adhesives, cure for 30 minutes.

Mechanical force such as a rubber hammer and block must be used to insure proper locking of the joints in sizes 2"-6". In sizes 8"-12" a come-along must be used to insure a proper locking of the joint. A properly assembled joint will show a small bead of adhesive around the entire circumference of the joint.

THRUST BLOCKS: Thrust blocks must be installed wherever the pipeline changes direction or size as at tees, elbows and reducers or at any point that develops thrust such as at a valve or similar equipment. The above situations may occur either where the fittings etc., are directly buried in the soil, or are in a manhole.

Thrust blocks must be designed for maximum anticipated operating or test pressure. If it is anticipated that pressures higher than normal operating pressures will be used at some later date, thrust blocks to accommodate such pressures should be installed initially. Size and type of thrust blocks depend on pressure, pipe size, and the type of soil. This information shall be supplied by the Design Engineer. Where a thrust block serves more than one line, the block must be designed to resist the sum of the thrusts of all the lines involved. Thrust blocks should be poured on and against undisturbed soil or soil tamped to 95% proctor density.

Thrust blocks shall be installed using concrete having a compressive strength of 3,000 psi minimum ultimate 28 days compressive strength, air entrained, with water reducing admixture. Where the soil bearing value is less than 1,000 pounds per square foot, Thermal Pipe Systems, Inc. will make the necessary calculations and recommendations as to how the fitting should be thrusted. Where special thrust provisions are needed, Thermal Pipe Systems, Inc. will recommend the necessary design. The table below gives the thrust load at any fitting in lbs. at 100 psi* pressure.

Size (in.)	90° Elbow	45° Elbow	Tee
2	510	276	361
3	1,187	642	839
4	2,025	1,096	1,432
6	4,458	2,413	3,152
8	7,763	4,201	5,489
10	11,922	6,452	8,430
12	16,750	9,065	11,844

*For pressure other than 100 psi increase loads proportionately (example: for 150 psi multiply by 1.5; for 200 psi multiply by 2.0: etc.)

NOTE: Dead End and Anchor loads are equal to TEE shown above.

The approximate safe bearing loads of various soils given in the following table are for horizontal thrusts when the depth of cover over the top of the pipe exceeds two feet. These loads are estimates only. Actual soil & safe bearing loads should be determined by the Design Engineer.

SOIL	SAFE BEARING LOAD lbs./sq. ft.
Muck, Peat etc.*	0
Soft Clay	1,000
Sand	2,000
Sand & Gravel	3,000
Sand & Gravel Cemented with Clay	4,000
Hard Shale	10,000

*All thrusts are resisted by piles or tie rods to solid foundations, or by removal of muck or peat and replacement with ballast of sufficient stability.

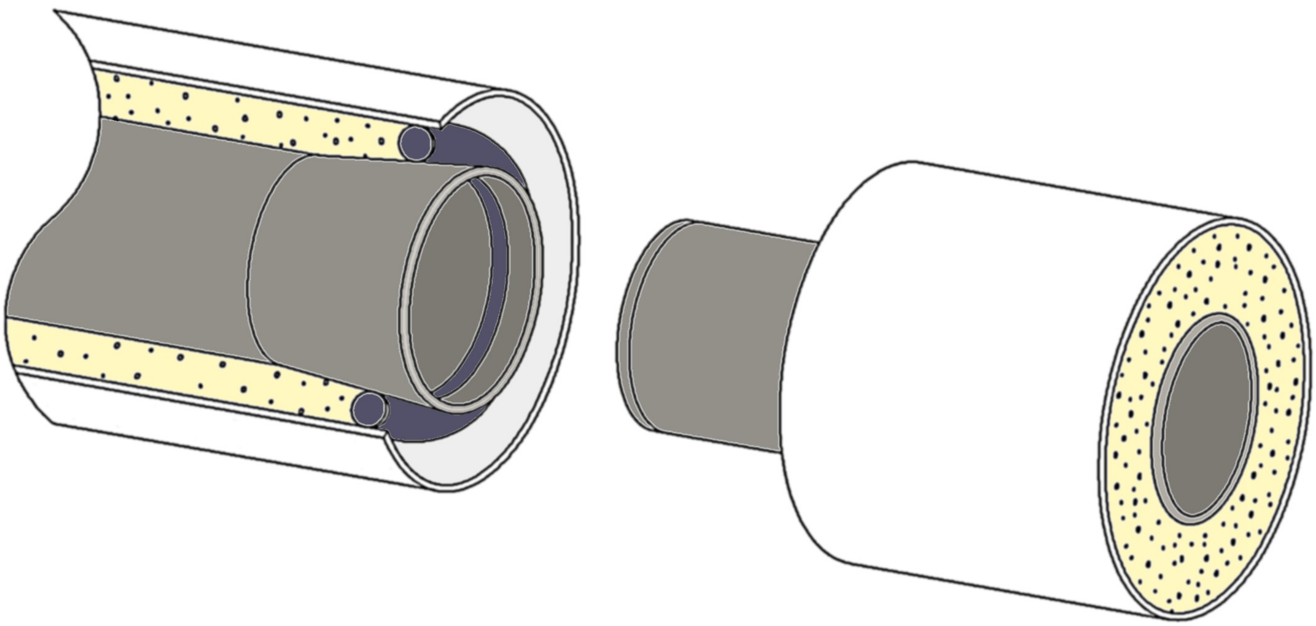
START UP PROCEDURE: Start up procedure shall conform to generally accepted practices and be done in a workman-like manner. The water can be introduced from the lines in the service directly through valved connections, or by temporary connections to taps made in the new line. If possible, all such connections should be made at the lowest point in the line to avoid air entrapment. All valves and other control points in the line that are open as the line filling begins should be closed gradually to avoid the possibility of water hammer.

MANUFACTURERS WRITTEN CERTIFICATION: After testing and prior to start-up of the system, the manufacturer must certify in writing that the system was installed per the manufacturers installation instructions.

Thermal Pipe Systems, Inc.

DUC-TITE®

Rugged Ductile Iron Gasketed Piping System
For
Low Temperature Hot Water and/or Chilled Water Service



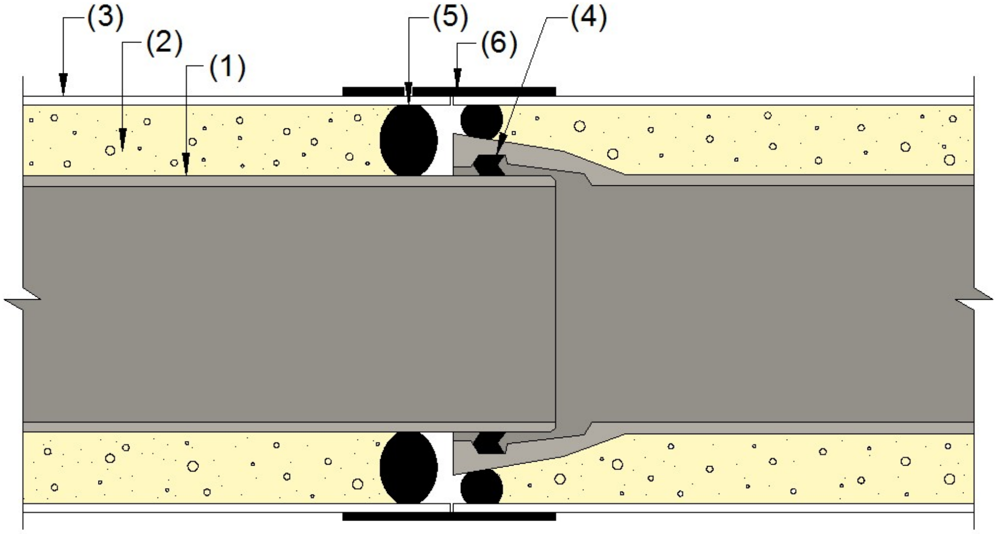
Duc-Tite is energy efficient piping system that is easy to install. It is used in hot water service to 250ºF at pressures to 150psi. I may be used at higher pressures for chilled water.

The carrier pipe is Class 51 for 3” & 4” and Class 50 for 6” through 20” ductile iron pipe. Insulation is a thermally efficient polyurethane foam with a ‘K’ factor of 0.16 at 70ºF. The heavy wall PVC or HDPE casing and heavy-duty compression end seals prevent ground water infiltration.

To join Duc-Tite, lubricate the spigot end and push it home into the bell. The joint compensates for thermal movement without additional stress on the pipe. There is no need for loops or other expansion devices. In the field the system is easily adaptable to other materials with commercially available fittings. Rubber ring ‘push-on’ type fittings make changes in direction simple.

This product combines the high strength of ductile iron with the efficiency of polyurethane foam to create an excellent choice for underground distribution systems.

DUC-TITE®



(1) CARRIER: Ductile Iron.
(2) INSULATION: Polyurethane Foam
(3) CASING: PVC or HDPE
(4) CARRIER SEALING RING: Rubber
(5) END SEAL: Compression Rubber
(6) CASING-TITE SEAL: 30 mil High Temperature Tape (optional for chilled water)

NOMINAL PIPE SIZE (IN.)	NOMINAL CASING SIZE (IN.)	CARRIER O.D. (IN.)	CASING O.D. (IN.)	THICKNESS		WEIGHT (LBS./20 FT.)
				FOAM (IN.)	PVC CASING (IN.)	
3	6	3.96	6.14	0.97	0.120	220
4	8	4.80	8.16	1.52	0.160	265
6	10	6.90	10.20	1.45	0.200	379
8	12	9.05	12.24	1.36	0.240	538
10	14	11.10	14.28	1.31	0.280	716
12	16	13.20	16.00	1.15	0.250	872
14	18	15.30	18.70	1.33	0.370	1159
16	22	17.40	22.05	1.90	0.430	1446
18	24	19.50	24.80	2.04	0.490	1740

NOTE: Standard lengths are 18'-0" or 20'-0". Weights are approximate. Consult manufacturer for HDPE dimensional data

SHORT FORM SPECIFICATIONS

1.1 All underground pre-insulated pipe 3" – 18" shall be Thermal Pipe Systems, Inc. Duc-Tite® piping with Ring-Tite joints.

1.2 Carrier pipe shall be ductile iron pipe conforming to ANSI A21.51 and AWWA C151. Pipe shall be Class 51 in sizes 3" and 4", and Class 50 in sizes 6" through 18". Rubber sealing rings shall be provided with the pipe and shall be as specified under AWWA C104. The pipe shall be suitable for use at maximum hydrostatic working pressure of 150 psi at 250ºF.

1.3 Each joint shall automatically provide for expansion and contraction through the rubber sealing rings placed in the groove of the bell. Pipe and fittings must be assembled with a non-toxic lubricant supplied by Thermal Pipe Systems.

1.4 Casing pipe shall be [Polyvinyl Chloride (PVC) meeting the minimum classification requirements of ASTM D-1784] or [High Density Polyethylene (HDPE)]. The thickness shall be in accordance with the Thermal Pipe Systems published data.

1.5 The insulation shall be polyurethane foam completely encapsulated on each end by a compression rubber end seal.

1.6 The end seals shall be compression rubber.

1.7 Fittings shall be 'push-on' ductile iron.

WARRANTY

We warrant that our products are manufactured with the applicable material specifications and are free from defects in the workmanship and material using our specifications as a standard. Every claim under this warranty shall be deemed waved unless in writing received by Thermal Pipe systems, Inc. within (30) days of the date the defect was discovered and within (1) year of the date of shipment of the product. Thermal Pipe Systems, Inc. MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY OR THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN THE LIMITED WARRANTY SET FORTH ABOVE.

LIMITATIONS AND LIABILTY

It is expressly understood and agreed that the limit of Thermal Pipe Systems, Inc. liability shall be the resupply of a like quantity of nondefective product and that Thermal Pipe Systems, Inc. shall have no such liability except where the damage or claim results solely from the breach of the Thermal Pipe Systems, Inc. warranty. IT IS ALSO AGREED THAT THERMAL PIPE SYSTEMS, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES FOR ANY ALLEGED NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILTY OR ANY OTHER THEORY, OTHER THAN THE LIMITED LIABILTY SET FORTH.

Thermal Pipe Systems, Inc.
5205 W. Woodmill Dr. Suite 33 – Wilmington, DE 19808
Tel: 302-999-1588 • Fax: 302-999-8861
website: www.thermalpipesystems.com

Thermal Pipe Systems, Inc.

DUC-TITE® PIPING SYSTEM

FOR LOW TEMPERATURE HOT WATER
AND CHILLED WATER SERVICE

SPECIFICATIONS & DRAWINGS

5205 W. WOODMILL DRIVE, SUITE 33
WILMINGTON, DELAWARE 19808
PHONE: 302.999.1588
WWW.THERMALPIPESYSTEMS.COM

DUC-TITE PIPING SYSTEMS SPECIFICATIONS

DUC-TITE shall be used where specified for chilled water or low temperature hot water service using a rubber ring joining method. Unless otherwise specified, all pipe, fittings, valves and accessories shall conform to the requirements of ANSI B31.1 and shall be of the proper type for pressure and temperature of the cooling or heating water.

DUCTILE IRON CARRIER PIPE: Carrier pipe shall be Ductile Iron Pipe conforming to ANSI A21.51, and AWWA C151. Pipe shall be class 51 in sizes 3"∅ and 4"∅ and class 50 in sizes 6"∅ - 18"∅.

RUBBER SEALING RINGS: Rubber sealing rings for DUC-TITE Piping shall be as specified under AWWA C104.

CASING PIPE: The casing shall be **[Polyvinyl Chloride (PVC)]** pipe shall be of virgin PVC resin meeting the minimum classification requirements of ASTM D1784 or **[High Density Polyethylene (HDPE)].** The casing and insulation system shall be suitable for H-20 wheel loading at three feet of cover. A two-foot burial depth may be acceptable when bedding and backfill materials meet highway requirements for stability and compaction. The casing thickness shall be as shown on page four.

END SEALS: End seals for insulated DUC-TITE shall be compressed rubber.

POLYURETHANE FOAM INSULATION: The insulation shall be Polyurethane Foam conforming and shall meet the following specifications:

Type:	Two component urethane
Compressive Strength:	40 psi parallel min at 5% comp
Shrinkage:	None at 70°F
Free Rise Density:	2.0 to 3.0 lbs/cubic foot
Aged "K" (70°F - 72 hrs)	0.160 BTU•inch/hour•°F•ft2
Closed Cell Content:	90%

Insulation concentricity: Carrier Pipe shall be concentric to casing pipe. The allowable maximum deviation from centerline of carrier pipe shall be +\- 1\4 inch at the casing center point and +\- 1\16 inch at the end seals.

CASING-TITE SEAL: The Casing-Tite seal shall be a 30 mil high temperature tape. The Casing-Tite seal is required on low temperature hot water service and optional on chilled water service.

FITTINGS: Fittings shall be uninsulated and conform to the requirements of the latest revisions of ANSI/AWWA C153/A21.53 (compact type), ANSI/AWWA C110/A21.10 (conventional type) for push-on or restrained joint fittings, or ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11 for mechanical joint fittings. Fitting sealing rings shall be furnished by the manufacturer.

WALL PENETRATION SLEEVES: Provide where piping passes through masonry or concrete walls, floors, and roofs. Sleeves in outside walls below and above grade, in floor, or in roof slabs, shall be schedule 40 or standard weight coated black steel pipe or as specified by the Design Engineer. Space between piping or insulation casing, and the sleeve shall be sufficient to allow proper water tight sealing, but never less than 1/2". Sleeves shall be held securely in proper position and location during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Refer to typical detail of wall penetration as shown. In existing concrete manholes or building wall penetrations may be made using the "core drilling" method providing proper care is taken to drill the holes to the size needed and square to the line of the pipe.

WALL PENETRATION SEALS: All wall penetrations shall be sealed to prevent water from entering the building or manhole. The sealing material shall be as specified by the engineer.

DUC-TITE APPLICATION ENGINEERING

PIPE SYSTEM DESIGN: Standard design techniques and practices for DUC-TITE shall be used. Thermal Pipe Systems, Inc. Engineering Department may on request provide certain detailed design aspects of the piping for each project based on the project documents and drawings provided by the Design Engineer. It is understood that the project specifications and layout drawings will specify the type of service, the site and temperature and pressure classifications, soil conditions, and general path and elevations of the system, location and design of manholes, known obstacles, the size of the carrier pipe, and the maximum permissible heat losses. It is further understood that other requirements such as the type of pipe, the location size and capacity of valves, traps, pumps, anchors, controls, expansion devices and special structural elements will be provided by the design engineer. The design provided by Thermal Pipe Systems, Inc. and their engineers for the piping will be in accordance with ANSI B31.1 and good engineering practices.

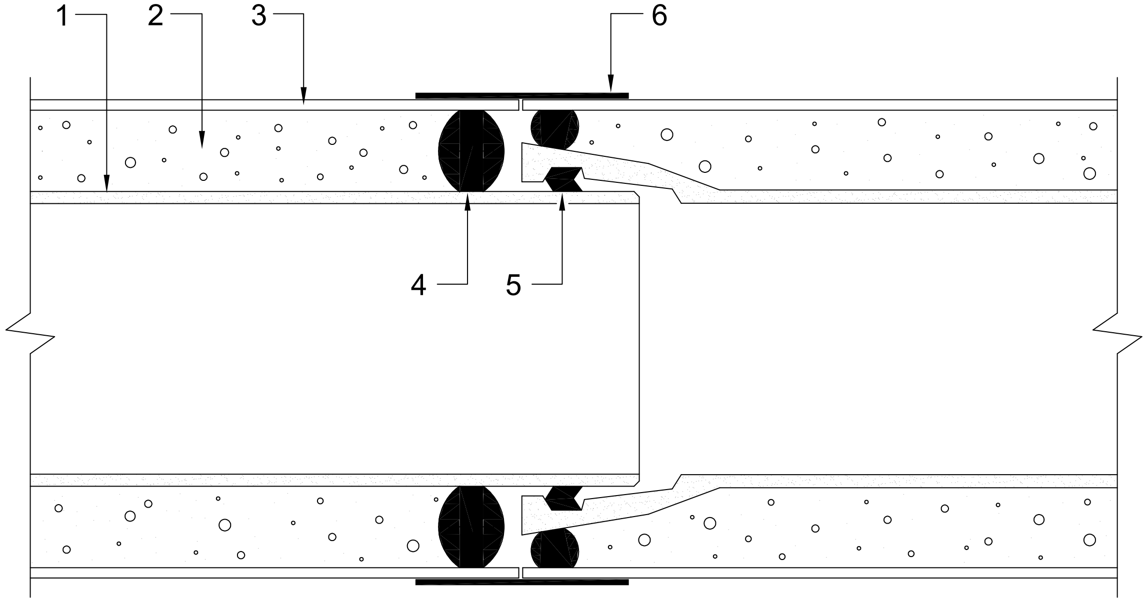
Fluid flow design will be based on Hazen-Williams formula with "C" Factor of 100, or a variation of the Euler formula for water flow.

INSULATION: Thickness of insulation for DUC-TITE pipe shall be as shown on the drawing on page four.

TEMPERATURE AND PRESSURE: The DUC-TITE piping system and all its components can be designed to operate up to 150 psig at 250°F, plus typical surges. It should be noted that at these temperatures and pressures, the pipe must be specified unlined and the sealing rings must be EPDM. It is the Design Engineer's responsibility to ensure the lining and ring specified will function properly at the temperatures and pressures used for a given project.

DIMENSIONS AND WEIGHTS of insulated DUC-TITE piping and fittings are as shown on page four. The DUC-TITE piping will be furnished in 18 or 20-foot lengths.

PRE-INSULATED DUC-TITE® PIPE

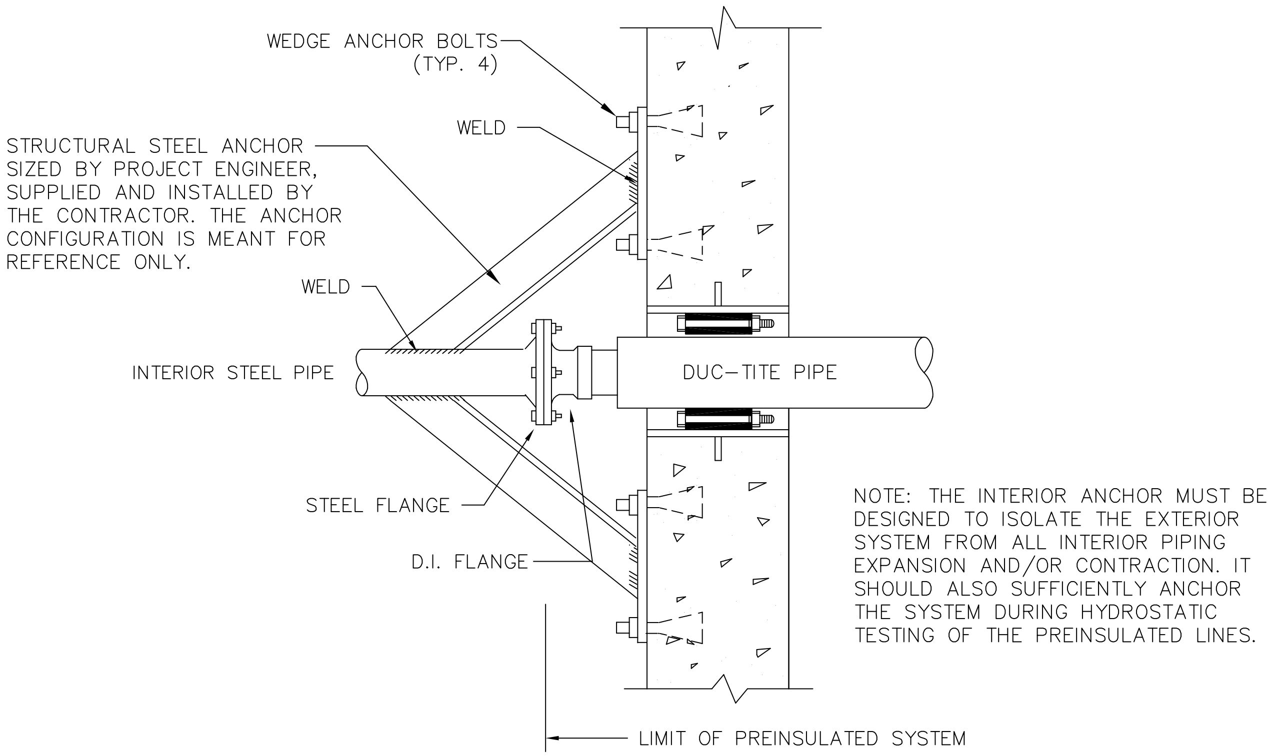


1) CARRIER: Ductile Iron
2) INSULATION: Polyurethane Foam
3) CASING: PVC or HDPE
4) END SEAL: Compression Rubber
5) SEALING RING: EPDM or SBR
6) CASING-TITE SEAL: 30mil H.T. Tape (optional for chilled water)

NOM. PIPE SIZE	CARRIER O.D.	CASING O.D.	THICKNESS		WEIGHT (LBS./18 FT.)
			PVC CASING	FOAM	
3	3.96	6.14	.12	.97	220
4	4.80	8.16	.16	1.52	265
6	6.90	10.20	.20	1.45	379
8	9.05	12.24	.24	1.36	538
10	11.10	14.28	.28	1.31	716
12	13.20	16.00	.25	1.15	872
14	15.30	18.70	.37	1.33	1,159
16	17.40	22.05	.43	1.90	1,446
18	19.50	24.80	.49	2.04	1,740

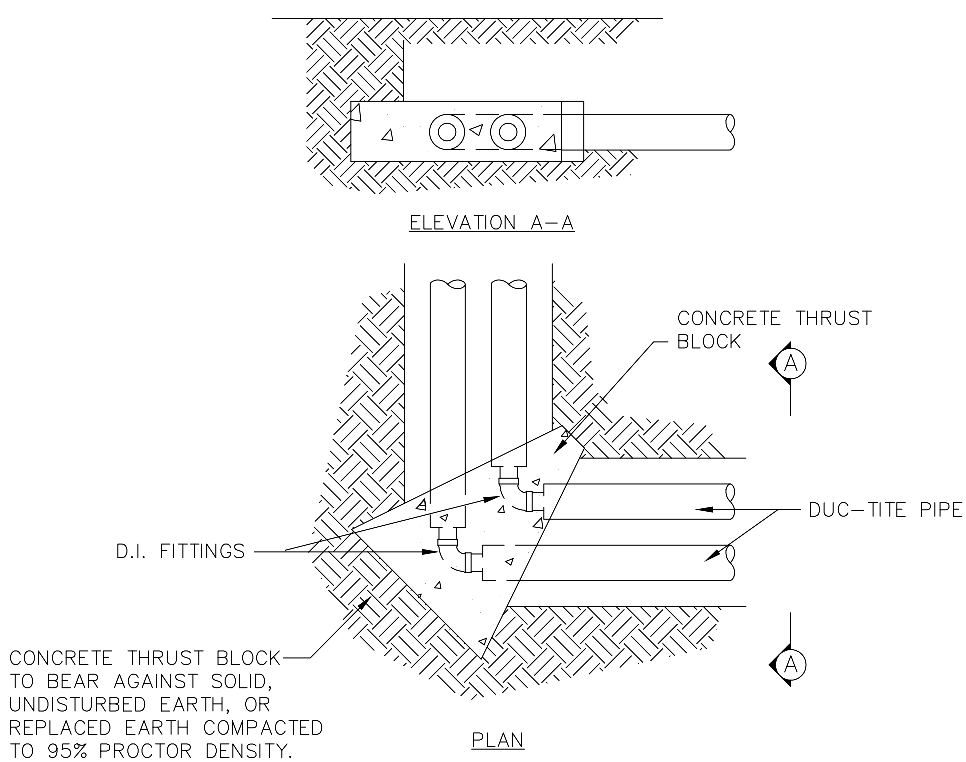
NOTE: Standard lengths are 18'-0" or 20'-0" for all sizes. All dimensions are in inches unless noted. Consult manufacturer for HDPE dimensional data.

PRE-INSULATED DUC-TITE® PIPE



TYPICAL ANCHOR AT WALL PENETRATIONS

NO SCALE



TYPICAL CONCRETE THRUST BLOCK AT ELBOWS

NO SCALE

DUC-TITE INSTALLATION SPECIFICATION

GENERAL: Installation of the DUC-TITE piping system shall be done in accordance with the appropriate publications including ANSI B31.1 and the following specifications and instructions. A Thermal Pipe Systems, Inc. field representative may conduct an installation clinic to pre-qualify contract personnel in the proper procedures for the installation.

Piping shall be accurately cut to dimensions established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation shall not be permitted. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints. Good workmanlike procedures shall be followed.

All piping, unless otherwise indicated, shall be pitched with a grade of not less than 1 inch in 40 feet toward the drain points when applicable.

Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign matter out of the system.

RECEIVING AND HANDLING SHIPMENTS

INSPECTION: Each Shipment shall be inspected upon its arrival at the site. The products are carefully loaded at the plant using methods acceptable to the carrier and it is their responsibility to deliver the pipe in good condition. It is the responsibility of the installing contractor to ascertain whether there has been any loss or damage. The carrier is the contractor's agent. Any pipe or equipment that arrives damaged or is lost in shipment shall be reported by the contractor.

Make overall inspection of the load. If load is intact, ordinary inspection while unloading should be enough to make sure that the pipe has arrived in good condition. It is the responsibility of the receiver to make certain that there has been no loss or damage. Note specifically that any end packaging should not show signs of damage. If the load has shifted, or end packing damaged, then each piece must be carefully inspected for damage. Specifically, the ends should be inspected for scars, nicks, etc. Other obvious damage is also cause for rejection. Check total quantities of each item against the tally sheet (pipe, fittings, etc.). Any damaged or missing items are to be noted on delivery receipt and the receipt returned to the carrier. Notify the carrier immediately and make claim in accordance with the carrier's instructions. Thermal Pipe Systems, Inc. will assist, if

necessary, in handling this claim. Do not dispose of damaged material - the carrier will notify you of the procedure to follow.

UNLOADING INSTRUCTIONS: The means by which the pipes are unloaded in the field is the decision and responsibility of the installing contractor. The use of forklift type equipment frequently simplifies and speeds up the unloading of larger sizes and usually provides extra protection against damage in handling. To prevent the possibility of the core pipe from shifting within the casing pipe, do not stand a length on one end or raise it vertically. Under no condition should a pipe be dragged along the ground. Do not lift fittings or pipe by inserting a bar, pipe, etc., inside of the core. Damage to the pipe may result. If any pipe is damaged in unloading and handling, mark the damaged area and set it aside. Thermal Pipe Systems, Inc. representative will determine whether damaged casing can be repaired in the field and will determine exact method for repair and instruct contractor in making repair.

COLD WEATHER HANDLING FOR PVC CASED PIPE: As the temperature approaches freezing, the flexibility and impact resistance of Duc-Tite pipe is reduced. PVC casing becomes hard and brittle in cold weather and will crack more readily if dropped or hit. Therefore, extra care should be used in handling during cold weather. Pipe at the bottom of a stack may become out-of-round due to the weight of material above it. At normal application temperatures, this corrects itself soon after the load is removed. Under freezing conditions, this recovery to full initial roundness may take several hours.

STORAGE: Store pipe on dunnage in a flat area. Support the barrel of the casing evenly. Bell and spigot ends should overhang dunnage. Store random lengths separately where they will be readily available. Individual lengths of pipe should be stacked in piles no higher than 5 feet. If pipe is to be stored outside for periods longer than 30 days, the pipe must be covered to protect it from prolonged exposure to the sun's rays. Cover with canvas or other opaque material. Do not use clear plastic sheets. Provide for natural air circulation under the sheets.

LOADING TRANSFER TRUCKS: Use trucks with long bodies so that pipe lengths do not overhang. Make certain truck bed is smooth, without cross-strips, bolt heads, or other protrusions that could damage the pipe. Short body trucks may be used if fitted with racks that properly support the pipe in a horizontal position. The rack should have supports spaced every 3 feet or less along the pipe lengths. Pad the contact areas to avoid damage to the pipe.

DISTRIBUTING PIPE ALONG TRENCH: Pipe lengths may be strung along the line of the trench to minimize additional handling during installation.

EXCAVATION: Excavation should consider the need for the thrust blocks at all fittings that are directly buried in the ground. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines, generally a minimum of 6" in pipe sizes up to 6" diameter, and 12" minimum in sizes 8" and larger. The excavation should be in a straight line.

TRENCHING: Trenching shall follow the elevations provided by the Design Engineer on the contract drawings. The trench depth should always allow for a minimum cover height of 24" over the top of the casing pipe. Keep excavations free of water during construction. If the contractor determines it is necessary to remove unsuitable material to a depth greater than specified, refill over excavated area to the proper depth with specified bedding material compacted in 6 inch lifts to 95 percent of maximum density in accordance with ASTM D1557, Method D. Excavate and replace soil disturbed and weakened by the contractor's operations or soils permitted to soften from exposure to weather, with bedding material and compact with a plate-type vibratory compactor.

TRENCH WIDTHS: The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation. The reason for this is to keep the earth load on the pipe as small as possible. The wider the trench at the top of the pipe, the greater the load on the pipe. But note that an increase in trench width above the top of the pipe, by stepping the sides or digging a wider offset trench, does not affect the earth load on the pipe. On the other hand, a trench that is too narrow will make assembly difficult and may reduce the rate and quality of installation. In addition, lack of ample room will limit the capability to properly backfill and tamp around the pipe. Although each job or portion of a job must be considered on an individual basis, as a rule, the following minimum trench widths at the top of the pipe are recommended: Minimum: one foot greater than the outside diameter of the casing. Where two or more pipes are in the same trench, use the distance between outside casing of the outside pipes plus one foot. Maximum: Use above method for minimum plus two feet.

PLACING PIPE IN THE TRENCH: The DUC-TITE pipe may be hand or mechanically passed into the trench. The latest state and federal safety regulations should be understood and observed. If slings are necessary use only canvas straps, do not use cable or chain slings.

BEDDING: Bedding material should be sand or other materials free of sharp objects, heavy clods, boulders or frozen lumps as specified by the Design Engineer. The approved bedding should be used 6" under, around, and over the pipe. Utilize good practices that apply to all buried pressure pipes.

ASSEMBLY:

1) Thoroughly clean out the bell. Remove all dirt, sand, mud, ice, excess paint or lining and any other foreign matter from the joint.

2) Clean off the spigot end, removing any dirt, foreign matter or excess paint. Make sure the plain end is beveled. File smooth any sharp edges which might damage the sealing ring.

3) Insert the sealing ring in its recess in the bell, with the large end of the gasket entering first. Make sure that the gasket faces in the correct direction and is properly seated. The sealing ring may be installed using a v-shaped fold. Use one hand to hold a loop in the ring, the other to tuck the bottom portion into its recess. After the ring is in place at the bottom, press the top portion into the recess. Pull the ring forward against the bell lip and check to be sure that it is completely seated all the way around.

4) Apply a thin coating of lubricant to the inside surface of the installed ring just prior to joint assembly. Make certain the entire inner surface of the gasket is coated. Also apply a thin coating of lubricant to the beveled portion of the plain end.

5) Guide the spigot end into the bell and compress the sealing ring by pushing the spigot into the bell socket. Keep the bell and spigot end in reasonably straight alignment during assembly. Use the spigot end marking stripe(s) to ensure proper spigot insertion into the bell.

6) Care must be taken during assembly to ensure that no dirt, sand, or other foreign matter enters the joint. Dig a bell hole if necessary.

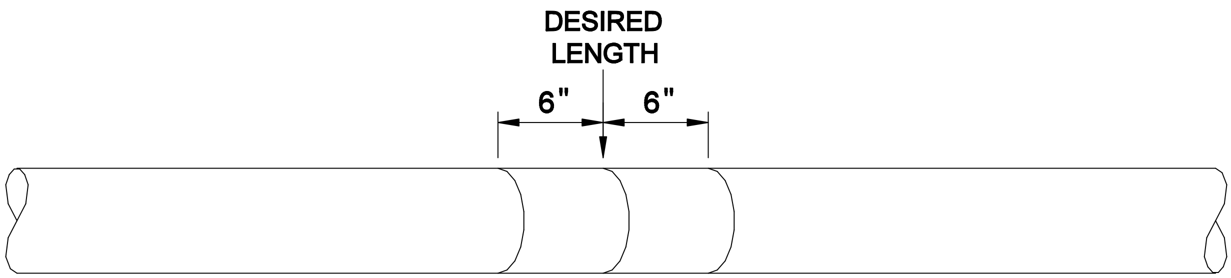
TESTING: All carrier pipe joints shall be tested in accordance with the contract specifications. If no test is specified, it should consist of a hydrostatic test of 150 psi or 1 1/2 times working pressure, which ever is greater, for a period of two hours.

BACKFILLING: Backfilling of trenches shall progress as rapidly as construction, testing, and acceptance of work permits. Uniformly compact and grade bottom of trenches. After installation of pipe and bedding material, backfill as follows: place initial backfill in layers to a depth of 12 inches over the top of the initial bedding. Compact the material to a density equivalent to the surrounding undisturbed soil or to 88 percent of maximum density (ASTM D1557, Method D), whichever is greater. Backfill remainder of trench in one-foot lifts and compact to 90 percent maximum density (ASTM D1557, Method D). For trenches excavated in roads, streets, or located under structures, place backfill in 6-inch layers to top of trench and compact each layer to at least 95 percent maximum density (ASTM D1557, Method D).

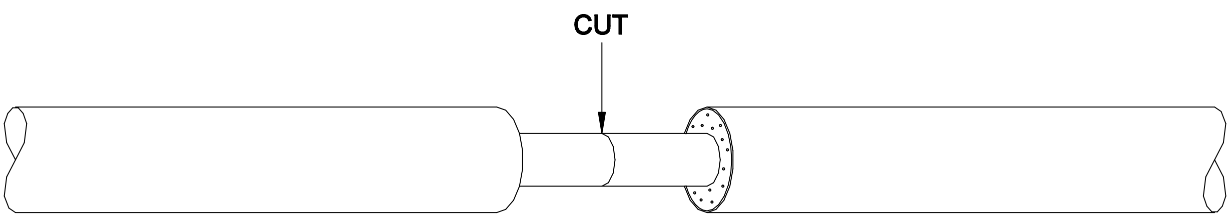
FLANGED JOINTS: Flanged joints shall be faced true, provided with gaskets, and made perfectly square and tight.

FIELD CUTTING PIPE TO A SPECIFIC LENGTH

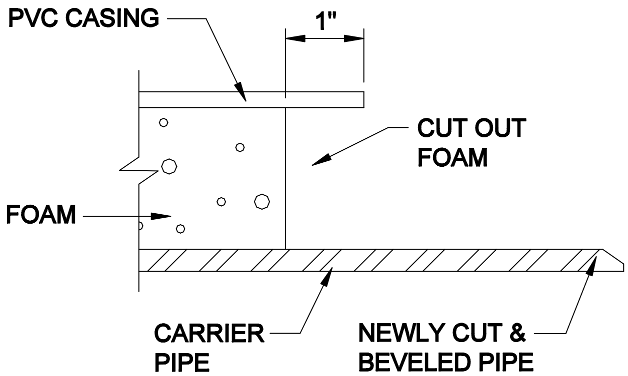
Determine the exact length of carrier pipe needed. Mark the casing at this point. Measure back 6 inches on both sides and mark the casing at these points using a wrap-around.

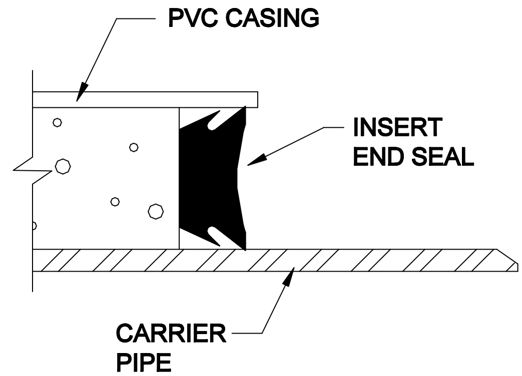


Use a fine-tooth carpenters handsaw or PVC saw to cut the PVC or HDPE casing. Remove the casing and cut off the insulation. Be careful not to damage ductile iron carrier pipe during this operation. See illustration below.



Mark, cut, and bevel the Ductile Iron pipe at the desired length. Remove any burrs. Make sure cut is square. Thoroughly clean all insulation from the spigots. Remove the insulation between the casing and the carrier pipe to a distance of one inch. Insert the rubber end seal between the casing and the carrier pipe using the handle of a hammer or screwdriver to push the seal all the way. Silicone caulking may be used in lieu of the rubber end seal.





THRUST BLOCKS: Thrust blocks must be installed wherever the pipeline changes direction or size as at tees, elbows or reducers or at any point that develops thrust such as at a valve or similar equipment. The above situations may occur either where the fittings etc., are directly buried in the soil, or are in a manhole.

Thrust blocks must be designed for maximum anticipated operating or test pressure. If it is anticipated that pressures higher than normal operating pressures will be used at some later date, thrust blocks to accommodate such pressures should be installed initially. Size and type of thrust blocks depend on pressure, pipe size, and the type of soil. This information shall be supplied by the Design Engineer. Where a thrust block serves more than one line, the block must be designed to resist the sum of the thrusts of all the lines involved. Thrust blocks should be poured on and against undisturbed soil or soil tamped to 95% proctor density.

Thrust blocks shall be installed using concrete having a compressive strength of 3,000 psi minimum ultimate 28 days compressive strength, air entrained, with water reducing admixture. Where the soil bearing value is less than 1000 pounds per square foot, Thermal Pipe Systems, Inc. will make the necessary calculations and recommendations as to how the fitting should be thrusted. Where special thrust provisions are needed, Thermal Pipe Systems, Inc. will recommend the necessary design.

CAST IRON FITTINGS:

The table below gives the thrust load at any fitting in lbs. at 100 psi* pressure:

Size (in.)	Tee	90° Elbow	45° Elbow
3	1,232	1,742	943
4	1,810	2,559	1,385
6	3,739	5,288	2,862
8	6,433	9,097	4,923

10	9,677	13,685	7,406
12	13,685	19,353	10,474
14	18,385	26,001	14,072

*For pressure other than 100 psi increase loads proportionately (example: for 150 psi multiply by 1.5; for 200 psi multiply by 2.0; etc.)

NOTE: Dead End and Anchor loads are equal to tee shown above.

The approximate safe bearing loads of various soils given in the following table are for horizontal thrusts when the depth of cover over the top of the pipe exceeds two feet.

These loads are estimates only. Actual soil and safe bearing loads should be determined by the Design Engineer.

SOIL	SAFE BEARING LOAD lbs./sq. ft.
Muck, Peat etc.*	0
Soft Clay	1,000
Sand	2,000
Sand & Gravel	3,000
Sand & Gravel Cemented with Clay	4,000
Hard Shale	10,000

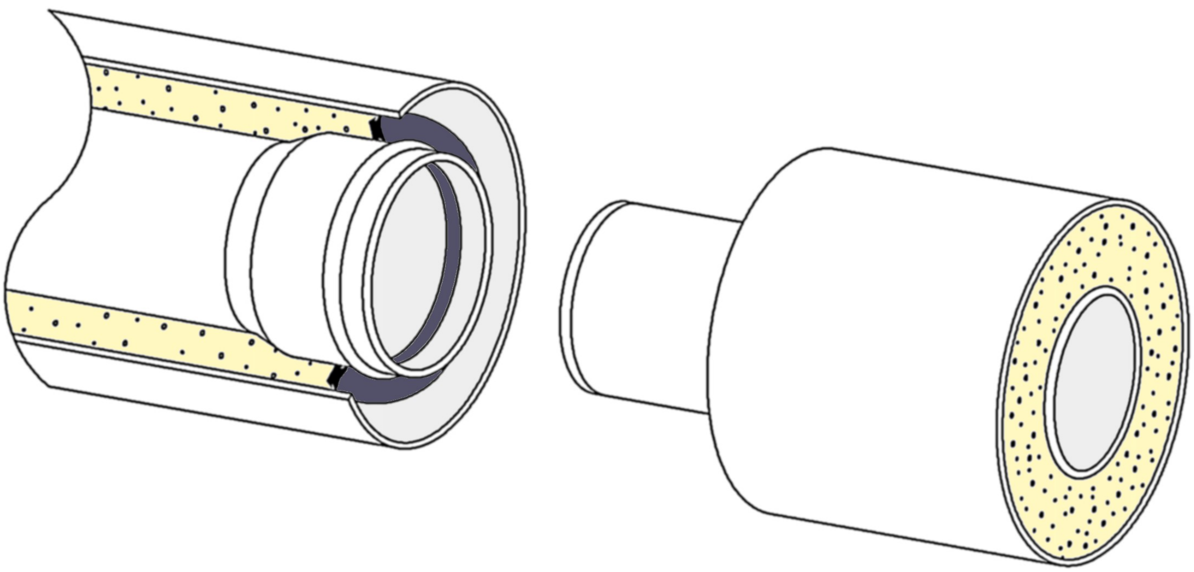
*All thrusts are resisted by piles or tie rods to solid foundations, or by removal of muck or peat and replacement with ballast of sufficient stability.

START UP PROCEDURE: Start up procedure shall conform to generally accepted practices and be done in a workman-like manner. The line shall be filled from any available low-pressure source. The water can be introduced from lines in service directly through valved connections, or temporary connections to taps made in the new line. If possible all such connections should be made at the lowest point in the line to avoid air entrapment. All valves and other control points in the line that are open as the line filling begins should be closed gradually to avoid the possibility of water hammer.

Thermal Pipe Systems, Inc.

KOOL-KORE®

Economical Gasketed PVC Piping System
Featuring High Flow, Corrosion Free Service
For
Chilled Water Service



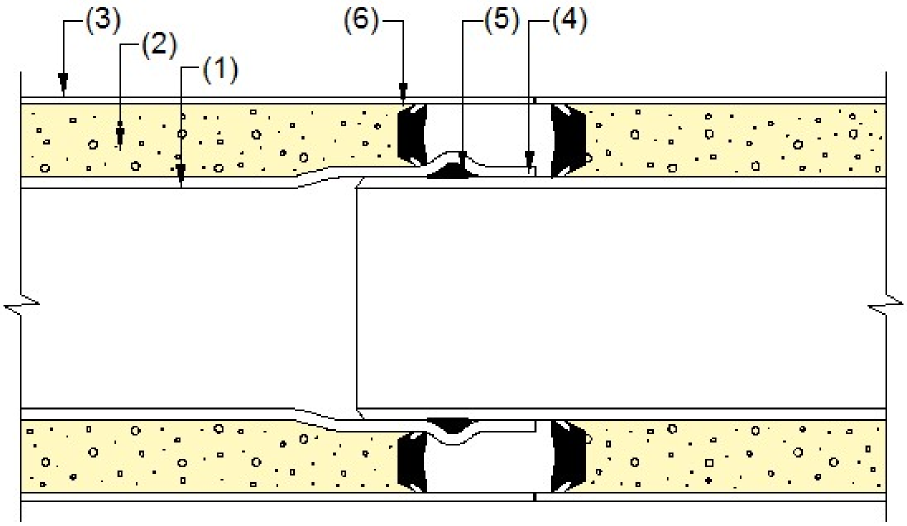
Kool-Kore is a factory pre-insulated, low cost polyvinyl chloride piping system for underground chilled water system. It may only be used in for water only in temperatures to 70ºF and a pressure of 150 psi, or up to 120ºF if pressure is reduced to 60 psi. I may be used at higher pressures for chilled water.

The carrier pipe is a lightweight, corrosion resistant, Class 160 PVC with a grooved bell end containing a flexible rubber ring. Insulation is a thermally efficient polyurethane foam with a 'K' factor of 0.16 at 70ºF. The heavy wall PVC or HDPE casing and heavy-duty compression end seals prevent ground water infiltration.

To join Kool-Kore, lubricate the spigot end and push it home into the bell. The joint compensates for thermal movement without additional stress on the pipe. There is no need for loops or other expansion devices. In the field the system is easily adaptable to other materials with commonly available tools. Standard solvent-weld fittings or rubber ring fittings are used to make changes in direction with this product.

Kool-Kore combines corrosion resistant features of PVC and its ability to maintain high flow characteristics with the thermal efficiency of polyurethane insulation to make this pipe and excellent choice for chilled water systems.

KOOL-KORE®



(1) CARRIER: PVC Pipe.
(2) INSULATION: Polyurethane Foam
(3) CASING: PVC or HDPE
(4) BELL: Grooved PVC
(5) CARRIER SEALING RING: Rubber
(6) END SEAL: Compression Rubber

NOMINAL PIPE SIZE (IN.)	NOMINAL CASING SIZE (IN.)	CARRIER O.D. (IN.)	CASING O.D. (IN.)	THICKNESS		WEIGHT (LBS./ 20 FT.)
				FOAM (IN.)	PVC CASING (IN.)	
1 1/2	4	1.90	4.50	1.16	0.140	34
2	4	2.38	4.50	0.92	0.140	36
2 1/2	6	2.88	6.14	1.51	0.120	50
3	6	3.50	6.14	1.20	0.120	55
4	8	4.50	8.16	1.67	0.160	96
6	10	6.63	10.20	1.59	0.200	166
8	12	8.63	12.24	1.57	0.240	253
10	14	10.75	14.28	1.49	0.280	313
12	16	12.75	16.00	1.38	0.250	438
14	18	14.00	18.70	1.98	0.370	629
16	21	16.00	22.05	2.59	0.430	857

NOTE: Standard lengths are 20'-0". Weights are approximate. Consult manufacturer for HDPE dimensional data.

SHORT FORM SPECIFICATIONS

1.1 All underground pre-insulated pipe 1 1/2" – 16" shall be Thermal Pipe Systems, Inc. Kool-Kore® piping with gasketed joints.

1.2 Carrier pipe shall be suitable for use at maximum hydrostatic working pressure of 160 psi at 73ºF. All core pipe must meet requirements as set forth in ASTM D2241 with standard dimension ratio SDR 26 and bearing National Sanitation Foundation seal for potable water pipe.

1.3 Each joint shall automatically provide for expansion and contraction through the rubber sealing rings placed in the groove of the integral bell. Pipe and fittings must be assembled with a non-toxic lubricant supplied by Thermal Pipe Systems.

1.4 Casing pipe shall be [Polyvinyl Chloride (PVC) meeting the minimum classification requirements of ASTM D-1784] or [High Density Polyethylene (HDPE)]. The thickness shall be in accordance with the Thermal Pipe Systems published data.

1.5 The insulation shall be polyurethane foam completely encapsulated on each end by a compression rubber end seal.

1.6 The rubber end seals shall be a compression rubber.

1.7 Fittings may be solvent weld or slip-on type PVC or ductile iron slip-on type.

WARRANTY

We warrant that our products are manufactured with the applicable material specifications and are free from defects in the workmanship and material using our specifications as a standard. Every claim under this warranty shall be deemed waved unless in writing received by Thermal Pipe systems, Inc. within (30) days of the date the defect was discovered and within (1) year of the date of shipment of the product. Thermal Pipe Systems, Inc. MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY OR THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN THE LIMITED WARRANTY SET FORTH ABOVE.

LIMITATIONS AND LIABILTY

It is expressly understood and agreed that the limit of Thermal Pipe Systems, Inc. liability shall be the resupply of a like quantity of nondefective product and that Thermal Pipe Systems, Inc. shall have no such liability except where the damage or claim results solely from the breach of the Thermal Pipe Systems, Inc. warranty. IT IS ALSO AGREED THAT THERMAL PIPE SYSTEMS, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES FOR ANY ALLEGED NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILTY OR ANY OTHER THEORY, OTHER THAN THE LIMITED LIABILTY SET FORTH.

Thermal Pipe Systems, Inc.
5205 W. Woodmill Dr. Suite 33 – Wilmington, DE 19808
Tel: 302-999-1588 – Fax: 302-999-8861
Website: www.thermalpipesystems.com

Thermal Pipe Systems, Inc.

KOOL-KORE® PIPING SYSTEM

FOR CHILLED WATER SERVICE

SPECIFICATIONS & DRAWINGS

5205 W. WOODMILL DRIVE, SUITE 33
WILMINGTON, DELAWARE 19808
PHONE: 302.999.1588
WWW.THERMALPIPESYSTEMS.COM

KOOL-KORE PIPING SYSTEMS SPECIFICATIONS

KOOL-KORE shall be used where specified for chilled water service, using a rubber ring joining method.

PVC CARRIER PIPE: Carrier pipe shall be Polyvinyl Chloride (PVC) 160 psi pipe - SDR 26 in accordance with ASTM D2241. Pipe shall be extruded from clean, virgin approved class 12454A PVC compound conforming to ASTM D1784.

CASING PIPE: The casing shall be **[Polyvinyl Chloride (PVC)]** pipe shall be of virgin PVC resin meeting the minimum classification requirements of ASTM D1784 or **[High Density Polyethylene (HDPE)].** The thickness for PVC casing shall be as shown on page three. Consult manufacturer for HDPE dimensional data. The casing ends shall butt when pipe is pushed together. This automatically sets the insertion depth of the carrier pipe.

RUBBER SEALING RINGS: Sealing rings for the PVC carrier pipe shall be a molded solid compression type rubber compound suitable for the service and pressure of the system.

RUBBER END SEALS: End seals for insulated KOOL-KORE shall be rubber with a compression type seal.

POLYURETHANE FOAM INSULATION: The insulation shall be Polyurethane Foam and shall meet the following specifications:

Type:	Two component urethane
Compressive Strength:	40 psi parallel min at 5% comp
Shrinkage:	None at 70°F
Free Rise Density:	2.0 to 3.0 lbs./cubic foot
Aged "K" (70°F - 72 hrs)	0.16 BTU-in./hour-°F-ft.2
Closed Cell Content:	90%

Insulation concentricity: Carrier Pipe shall be concentric to casing pipe. The allowable maximum deviation from centerline of carrier pipe shall be plus or minus 1/4 inch at the casing center point and plus or minus 1/16 inch at the end seals.

WALL PENETRATION SLEEVES: Provide where piping passes through masonry or concrete walls, floors, and roofs. Sleeves in outside walls below and above grade, in floor, or in roof slabs, shall be schedule 40 or standard weight coated black steel pipe or shall be as specified by the Design Engineer. Space between pipe OD and sleeve ID shall never be less than ½". Sleeves shall be held securely in proper position and location during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Refer to typical detail of wall penetration as shown. In existing concrete manholes or building wall penetrations may be made using the "core drilling" method providing proper care is taken to drill the holes to the size needed and square to the line of the pipe.

WALL PENETRATION SEALS: All wall penetrations shall be sealed to prevent water from entering the building or manhole. The sealing material shall be as specified by the engineer.

KOOL-KORE APPLICATION ENGINEERING

PIPE SYSTEM DESIGN: Standard design techniques and practices for KOOL-KORE shall be used. Thermal Pipe Systems, Inc. Engineering Department may on request provide certain detailed design aspects of the piping for each project based on the project documents and drawings provided by the Design Engineer. It is understood that the project specifications and layout drawings will specify the type of service, temperature and pressure classifications, soil conditions, and general path and elevations of the system, location and design of manholes, known obstacles, the size of the carrier pipe, and valves and the maximum permissible heat gains. The design provided by Thermal Pipe Systems, Inc. and their engineers for the piping will be in accordance with good engineering practices.

Fluid flow design will be based on Hazen-Williams formula with "C" Factor of 150, or a variation of the Euler formula for water flow.

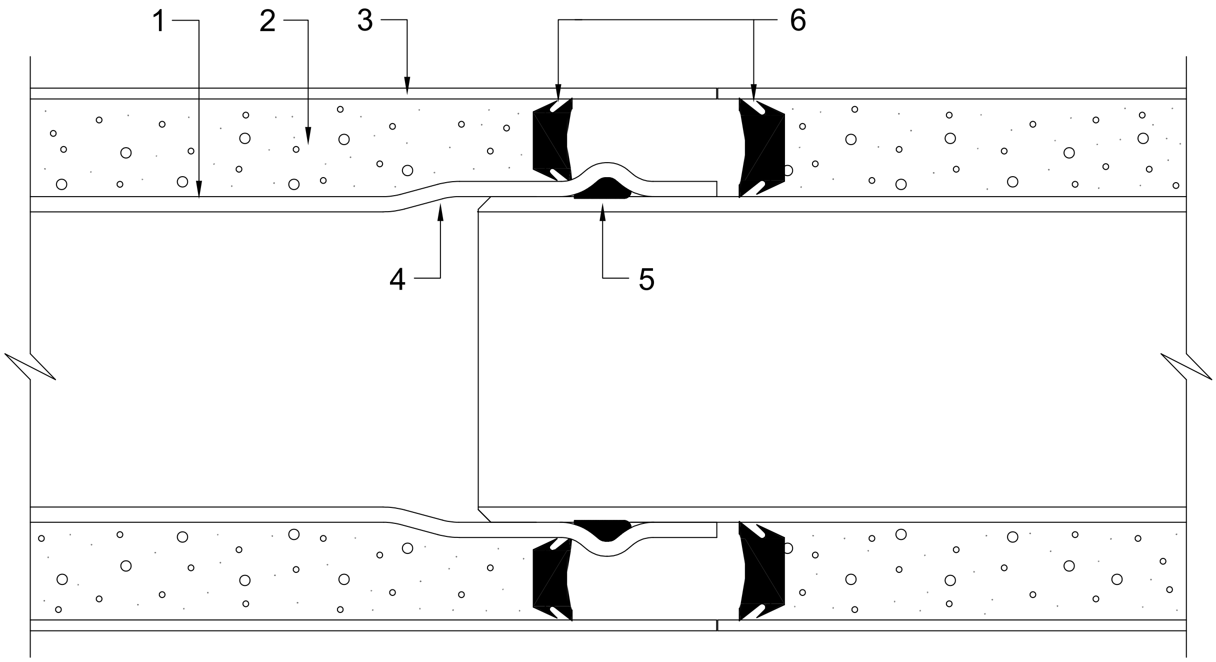
INSULATION: Thickness of insulation for KOOL-KORE pipe shall be as shown on the drawing on page three.

TEMPERATURE AND PRESSURE: The KOOL-KORE piping system and all its components are designed to operate at temperatures up to 70°F at 160 psig or at reduced pressures for elevated temperatures, as follows:

TEMPERATURE (°F)	PRESSURE (psig)
80	144
90	121
100	102
110	80
120	64
130	49

DIMENSIONS AND WEIGHTS of insulated KOOL-KORE piping system are as shown on page three. The KOOL-KORE piping will be furnished in 20-foot lengths.

PRE-INSULATED KOOL-KORE® PIPE



1. CARRIER: Polyvinyl Chloride (PVC)
2. INSULATION: Polyurethane Foam
3. CASING: PVC or HDPE
4. BELL: Grooved PVC
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6. END SEAL: Rubber

NOM. PIPE SIZE	CARRIER O.D.	CASING O.D.	THICKNESS		WEIGHT (LBS./20 FT.)
			PVC CASING	FOAM	
1 1/2	1.90	4.50	.14	1.16	34
2	2.38	4.50	.14	0.92	36
2 1/2	2.88	6.14	.12	1.51	50
3	3.50	6.14	.12	1.20	55
4	4.50	8.16	.16	1.67	96
6	6.63	10.20	.20	1.59	166
8	8.63	12.24	.24	1.57	253
10	10.75	14.28	.28	1.49	313
12	12.75	16.00	.25	1.38	438
14	14.00	18.70	.37	1.98	629
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NOTE: All dimensions are in inches unless noted. Consult manufacturer for HDPE dimensional data.

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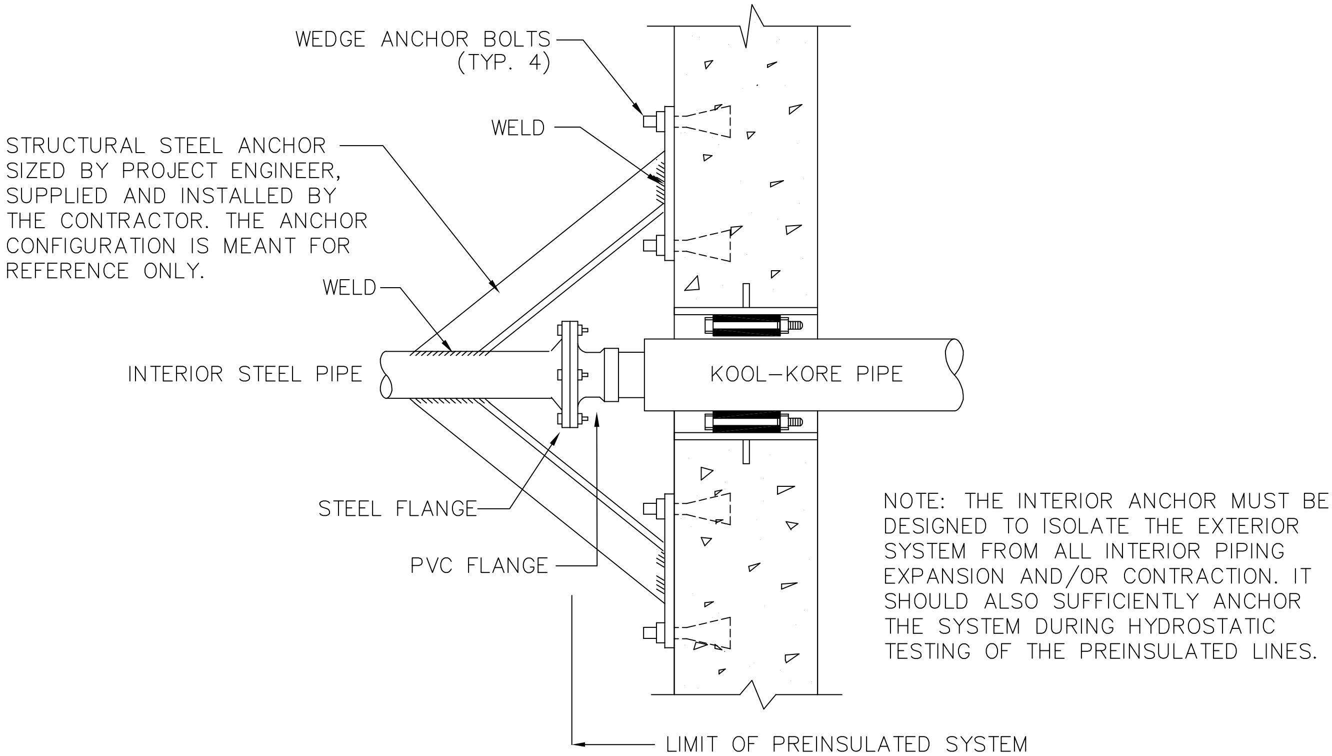
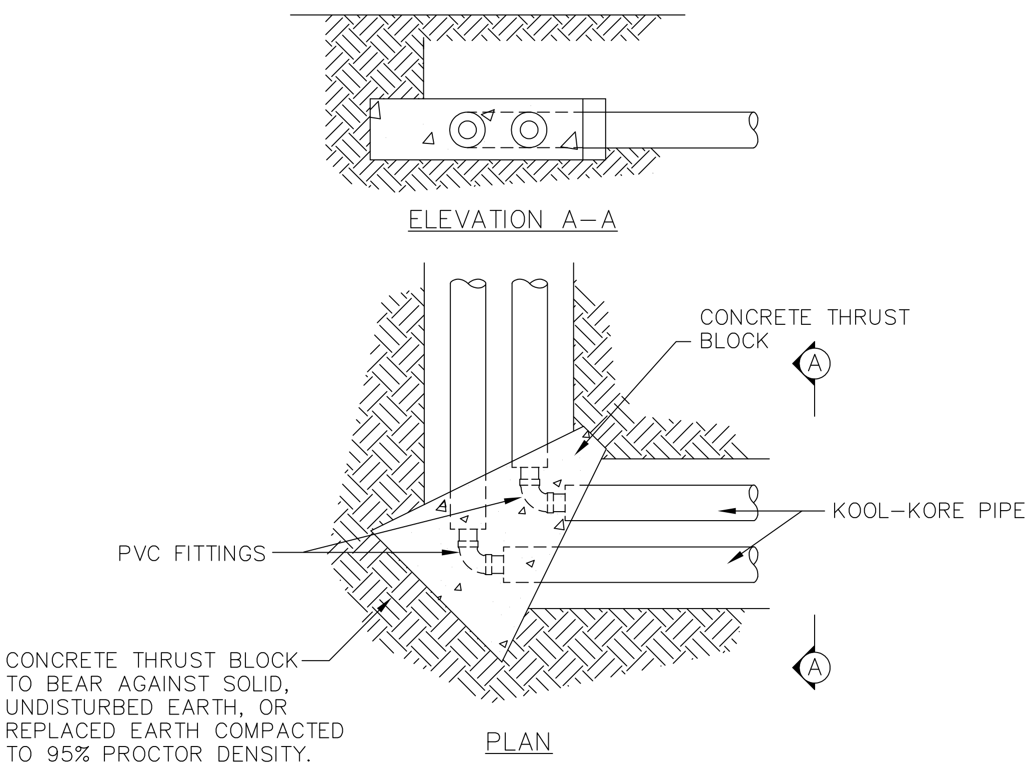


TYPICAL ANCHOR AT WALL PENETRATIONS

NO SCALE



TYPICAL CONCRETE THRUST BLOCK AT ELBOWS

NO SCALE

KOOL-KORE INSTALLATION SPECIFICATION

GENERAL: Installation of the KOOL-KORE piping system shall be done in accordance with the following specifications and instructions. A Thermal Pipe Systems, Inc. field representative may conduct an installation clinic to pre-qualify contract personnel in the proper procedures for the installation.

Piping shall be accurately cut to dimensions established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation shall not be permitted. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints. Good workmanlike procedures shall be followed.

All piping unless otherwise indicated, shall be pitched with a grade of not less than 1 inch in 40 feet toward the drain points when applicable.

Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign matter out of the system.

RECEIVING AND HANDLING SHIPMENTS

INSPECTION: Each Shipment shall be inspected upon its arrival at the job site. The products are carefully loaded at the plant using methods acceptable to the carrier and it is his responsibility to deliver the pipe in good condition. It is the responsibility of the installing contractor to ascertain whether there has been any loss or damage. The carrier is the contractor's agent. Any pipe or equipment that arrives damaged or is lost in shipment shall be reported by the contractor.

Make overall inspection of the load. If load is intact, ordinary inspection while unloading should be enough to make sure that the pipe has arrived in good condition. It is the responsibility of the receiver to make certain that there has been no loss or damage. Note specifically that any end packaging should not show signs of damage. If the load has shifted, or end packing damaged, then each piece must be carefully inspected for damage. Specifically, the ends should be inspected for scars, nicks, etc. Other obvious damage is also cause for rejection. Check total quantities of each item against the tally sheet (pipe, fittings, etc.). Any damaged or missing items are to be noted on delivery receipt and the receipt returned to the carrier. Notify the carrier immediately and make claim in accordance with the carrier’s instructions. Thermal Pipe Systems, Inc. will assist, if necessary, in handling this claim. Do not dispose of damaged material - the carrier will notify you of the procedure to follow.

UNLOADING INSTRUCTIONS: The means by which the pipes are unloaded in the field is the decision and responsibility of the installing contractor. The use of forklift type equipment frequently simplifies and speeds up the unloading of larger sizes and usually provides extra protection against damage in handling. To prevent the possibility of the core pipe from shifting within the casing pipe, do not stand a length on one end or raise it vertically. Under no condition should a pipe be dragged along the ground. Do not lift fittings or pipe by inserting a bar, pipe, etc., inside of the core. Damage to the pipe may result. If any pipe is damaged in unloading and handling, mark the damaged area and set it aside. A Thermal Pipe Systems, Inc. representative will determine whether damaged casing can be repaired in the field and will determine the exact method for repair and instruct the contractor in making the repair.

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EXCAVATION: Excavation should consider the need for the thrust blocks at all fittings that are directly buried in the ground. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines; generally a minimum of 6" is sufficient. The excavation should be in a straight line.

TRENCHING: Trenching shall follow the elevations provided by the Design Engineer on the contract drawings. The trench depth should always allow for a minimum cover height of 24" over the top of the casing pipe. Keep excavations free of water during construction. If the contractor determines it is necessary to remove unsuitable material to a depth greater than specified, refill over excavated area to the proper depth with specified bedding material compacted in 6 inch lifts to 95 percent of maximum density in accordance with ASTM D1557, Method D. Excavate and replace soil disturbed and weakened by the contractor's operations or soils permitted to soften from exposure to weather, with bedding material and compact with a plate-type vibratory compactor.

TRENCH WIDTHS: The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation. The reason for this is to keep the earth load on the pipe as small as possible, since, in general, the wider the trench at the top of the pipe, the greater the load on the pipe. But note that an increase in trench width above the top of the pipe, by sloping the sides or digging a wider offset trench, does not affect the earth load on the pipe. On the other hand, a trench that is too narrow will make assembly difficult and may reduce the rate and quality of installation. In addition, lack of ample room will limit the capability to properly backfill and tamp around the pipe. Although each job or portion of a job must be considered on an individual basis, as a rule, the following minimum trench widths at the top of the pipe are recommended: Minimum: One foot greater than the outside diameter of the casing. Where two or more pipes are in the same trench, use the distance between outside casing of the outside pipes plus one foot. Maximum: Use above method for minimum plus two feet.

DISTRIBUTING PIPE ALONG TRENCH: Pipe lengths may be strung along the line of the trench to minimize additional handling during installation.

PLACING PIPE IN THE TRENCH: The KOOL-KORE pipe may be hand or mechanically passed into the trench. The latest state and federal safety regulations should be understood and observed. If slings are necessary use only canvas straps, do not use cable or chain slings. A backhoe or boom truck is an excellent way of lowering the pipe into the trench.

BEDDING: Bedding material should be sand or other materials free of sharp objects, heavy clods, boulders or frozen lumps as specified by the Design Engineer. The approved bedding should be used 6" under, around and over the pipe. Utilize good practices that apply to buried pressure piping.

PIPE ASSEMBLY:

Be sure the sealing ring is correctly and completely seated in the groove of each pipe bell.

1. Make certain that the ring and ring groove in the bell is clean, with no dirt or foreign material that could interfere with proper seating of the ring.

2. Make sure the spigot end is clean. Wipe with a clean dry cloth around the entire circumference of the exposed carrier spigot.

3. Lubricate the spigot end of the pipe, using only Thermopipe Lubricant supplied. Be sure to cover the entire circumference. The coating should be the equivalent of a brush coat of enamel paint. It can be applied by hand, cloth, pad, sponge, or glove. Do not lubricate the rubber ring or the ring groove in the bell because such lubrication could cause ring displacement.

4. Insert the bevel end into the bell so that it is in contact with the ring. Hold the pipe lengths being joined close to the ground to keep the lengths in proper alignment. Brace the bell while the bevel end is pushed in under the ring. Push the spigot end all the way home. The casing of the bell must butt against the casing of the spigot end. If undue resistance to insertion or pushing home is encountered, disassemble the joint and check the position of the ring. If it is twisted or pushed out of its seat, clean the ring, bell and beveled end, and repeat the assembly steps.

NOTE: if a spigot or bell end has become deformed due to a load on the pipe while in the stock pile during hot weather, it will be necessary to exercise more care in assembling the joint to prevent fishmouthing of the rubber ring.

USE OF DOUBLE BELL COUPLINGS FOR REPAIRS AND ADAPTION TO STEEL

The double bell coupling is used for joining spigot ends, for making repairs and for adapting to steel pipe in sizes 1-1/2" through 12". Other methods of adaptation, such as Ductile Iron and PVC flanges are available, and may be specified by the design engineer.

NOTE: In all cases be sure that the steel end is beveled, smooth, and free of burrs.

To insure proper assembly of the double bell coupling with beveled ends of pipe, follow the instructions for rubber ring joint assembly steps as given above. Then, if one beveled end is in a fixed position, such as the end length of a pipeline, mount the coupling on the fixed length first. Then, while holding the coupling firmly in this position, insert the beveled end of the free length into the coupling.

TESTING: After all concrete thrust blocks have adequately cured, a hydrostatic test is applied to determine the soundness of the line. A test pressure of 50 psi over working pressure for one hour is generally used unless other requirements are specified. Joints should be visually inspected and proved tight.

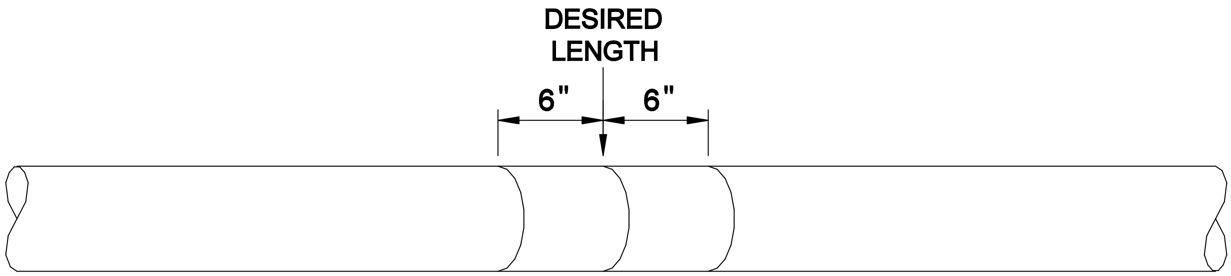
It should be noted that, entrapped air, temperature changes and slight movement of the pipe can cause variations in test pressures. These factors should be taken into consideration when testing and care taken to minimize their influence on the test results.

BACKFILLING: Backfilling of trenches shall progress as rapidly as construction, testing, and acceptance of work permits. Uniformly compact and grade bottom of trenches. After installation of pipe and bedding material, backfill as follows: Place initial backfill in layers to a depth of 12 inches of the initial bedding. Compact the material to a density equivalent to the surrounding undisturbed soil or to 90 percent of maximum density (ASTM D1557, Method D), whichever is greater. Backfill remainder of trench in one-foot lifts and compact to 90 percent maximum density (ASTM D1557, Method D). For trenches excavated in roads, streets, or located under structures, place backfill in 6-inch layers to top of trench and compact each layer to at least 95 percent maximum density (ASTM D1557, Method D).

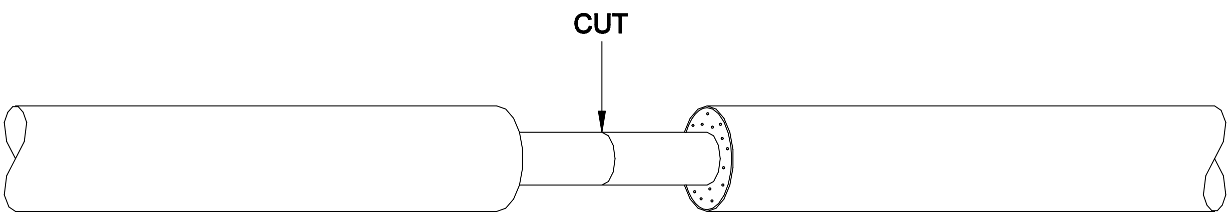
FLANGED JOINTS: Flanged joints shall be faced true, provided with gaskets, and made perfectly square and tight. It should be noted that flanged joints are not recommended underground.

FIELD CUTTING PIPE TO A SPECIFIC LENGTH

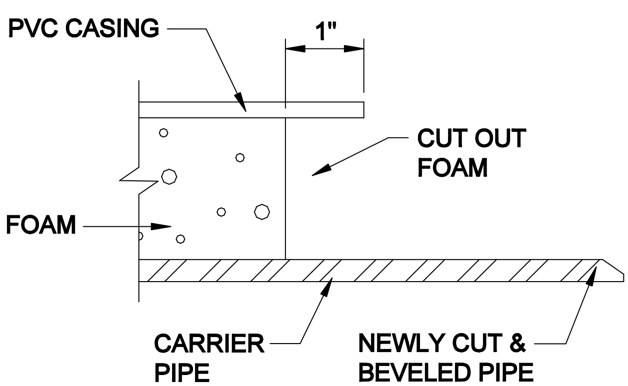
Determine the exact length of carrier pipe needed. Mark the casing at this point. Measure back 6 inches on both sides and mark the casing at these points using a wrap-around.

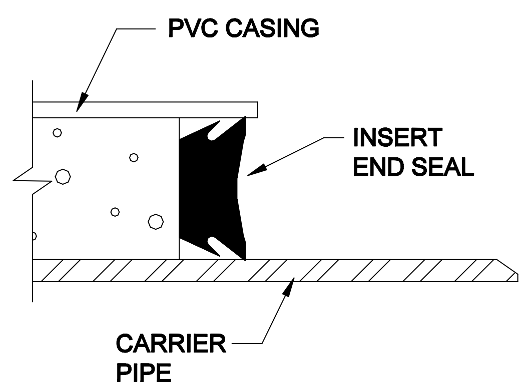


Use a carpenters handsaw or PVC saw to cut the PVC or HDPE casing. Remove the casing and cut off the insulation. Be careful not to damage PVC carrier pipe during this operation. See illustration below.



Mark, cut, and bevel the PVC pipe at the desired length. Make sure cut is square. Using a utility knife, remove the insulation between the casing and the carrier pipe one inch in from the face of the casing as shown below. Insert the rubber end seal between the casing and the carrier pipe using the handle of a hammer or screwdriver to push the seal all the way. Silicone caulking may be used in lieu of the rubber end seal.





THRUST BLOCKS: Thrust blocks must be installed wherever the pipeline changes direction or size as at tees, elbows and reducers or at any point that develops thrust such as at a valve or similar equipment. The above situations may occur either where the fittings etc., are directly buried in the soil, or are in a manhole.

Thrust blocks must be designed for maximum anticipated operating or test pressure. If it is anticipated that pressures higher than normal operating pressures will be used at some later date, thrust blocks to accommodate such pressures should be installed initially. Size and type of thrust blocks depend on pressure, pipe size, and the type of soil. The Design Engineer shall supply this information. Where a thrust block serves more than one line, the block must be designed to resist the sum of the thrusts of all the lines involved. Thrust blocks should be poured on and against undisturbed soil or soil tamped to 95% proctor density.

Thrust blocks shall be installed using a concrete having a compressive strength of not less than 3,000 psi minimum ultimate 28 days compressive strength, air entrained, with water reducing admixture. Where the soil bearing value is less than 1,000 pounds per square foot, Thermal Pipe Systems, Inc. will make the necessary calculations and recommendations as to how the fitting should be thrusted. Where special thrust provisions are needed, Thermal Pipe Systems, Inc. will recommend the necessary design.

The table below gives the thrust load at any fitting in lbs. at 100 psi* pressure.

Size (in.)	90° Elbow	45° Elbow	Tee
1 1/2	415	225	295
2	645	350	455
2 1/2	935	510	660
3	1,395	755	985
4	2,295	1,245	1,620
6	4,950	2,680	3,500
8	8,375	4,540	5,930
10	12,833	6,963	9,076
12	18,000	9,700	12,765
14	21,780	11,790	15,400
16	28,440	15,490	20,110
18	36,000	19,600	25,450
20	44,430	24,195	31,420
24	63,970	34,840	45,240

*For pressure other than 100 psi increase loads proportionately (example: for 150 psi multiply by 1.5; for 200 psi multiply by 2.0: etc.)

NOTE: Dead End and Anchor loads are equal to TEE shown on previous page.

The approximate safe bearing loads of various soils given in the following table are for horizontal thrusts when the depth of cover over the top of the pipe exceeds two feet. These loads are estimates only. Actual soil and safe bearing loads should be determined by the design engineer.

SOIL	SAFE BEARING LOAD lbs./sq. ft.
Muck, Peat etc.*	0
Soft Clay	1,000
Sand	2,000
Sand & Gravel	3,000
Sand & Gravel Cemented with Clay	4,000
Hard Shale	10,000

* All thrusts are resisted by piles or tie rods to solid foundations, or by removal of muck or peat and replacement with ballast of sufficient stability.

START UP PROCEDURE: Start up procedure shall conform to generally accepted practices and be done in a workman-like manner. The line shall be filled slowly from any available low-pressure source. The water can be introduced from lines in service directly through valved connections, or by temporary connections to taps made in the new line. If possible, all such connections should be made at the lowest point in the line to avoid air entrapment. All valves and other control points in the line that are open as the line filling begins should be closed gradually to avoid the possibility of water hammer.

THERMAL PIPE SYSTEMS, INC. TERMS AND CONDITIONS

1. The term "Seller" shall mean Thermal Pipe Systems, Inc. and "Buyer" shall mean the party listed on the reverse side hereof to whom this confirmation of a sale has been made.
2. Payment Terms. Standard payment terms are net cash 30 days with acceptable credit. All orders subject to final approval by Seller, which may require full or partial pre-payment before acceptance of order. A service charge of 1 1/2% per month will be added to the unpaid balance of all past due accounts, subject to a minimum charge of $2.00 per month. All invoices will be dated the date of shipment, and all prices are F.O.B. Seller's Shipping point.
3. Charges and Claims. All transportation charges to Buyer's jobsite shall be prepaid by Seller for the account of Buyer and shall be included in Seller's invoice and repaid by Buyer, unless otherwise noted on the reverse side hereof. The method and route of shipment are at Seller's discretion, unless Buyer shall have given written instructions. All claims against the carrier for shortages, delays or damage to goods are for the account of the Buyer, and it is Buyer's sole responsibility to pursue such claims.
4. Taxes. Any tax imposed by federal, state or other governmental authority on the production, sale of shipment of the items referred to in this confirmation shall be paid by Buyer in addition to the quoted purchase price.
5. Warranties. Seller warrants that its products are manufactured in accordance with applicable material specifications and are free from defects in workmanship and materials using the manufacturer's specifications as a standard. Every claim under this warranty shall be deemed waived unless in writing and received by Seller within 30 days of the date the defect was discovered or should have been discovered, but in no event later than 1 year from the date of shipment of the product. SELLER MAKES NO OTHER REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR WARRANTIES AS TO FITNESS FOR A PARTICULAR PURPOSE.
6. Limitation of Liability. The limit of Seller's liability shall be the resupply of a like quantity of non-defective product, and Seller shall have no such liability except where damage or claim results solely from a breach of warranty. SELLER SHALL NOT BE LIABEL FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMGES, OR FOR ANY CAUSE OF ACTION WHATSOEVER, INCLUDING NEGLIGENCE, BREACH OF WARRANTY OR STRICT LIABILITY, OTHER THAN THE LIMITED LIABILITY SET FORTH ABOVE.
7. Risk of Loss. All risk of loss as to the products being sold hereunder passes to Buyer upon delivery of the same to the carrier at the Seller's shipping point, subject to the rights of the Seller to stop delivery of goods in transit under the Uniform Commercial Code.
8. Credit. This agreement is contingent on the continued good credit of Buyer. If during the term of this agreement the financial responsibility of Buyer becomes impaired or unsatisfactory to Seller, cash payments of satisfactory security may be demanded of Buyer by Seller and upon default of such payments or failure to furnish such security, deliveries hereunder may be discontinued at the option of Seller.
9. Cancellation of Order. Buyer will be charged 50% of the selling price of cancellation of any items which the Seller normally stocks provided cancellation notice is received in writing at the business office of the Seller prior to shipment. Upon cancellation any special items not normally stocked by Seller, Buyer will be charged the costs incurred by the Seller, determined solely by the Seller. Such costs shall not exceed the selling price.
10. Returned Goods. All goods herein sold are nonreturnable, except upon express written approval of Seller. Any unauthorized returns will be scrapped with no credit to Buyer's account.
11. Field Representatives. The services of Seller's field representatives to its customers are subject to the condition that Seller shall not in any manner be deemed to have approved of or to have assumed responsibility for the engineering design of any job, or for the supervision, inspection or quality of the workmanship of products or other materials recommended by such field representatives (other than those here warranted.)
12. Controlling Provisions. These terms and conditions shall supersede any provisions, terms and conditions contained in any purchase order, confirmation or writing Buyer had given or may give, and Seller's rights shall be governed exclusively by the provisions hereof. This confirmation constitutes the entire contract between Buyer and Seller and may be modified only in writing by Seller.
13. Retainage. Retainage of a portion of the selling price, by the Buyer, until the completion of the project is unacceptable. Payment terms as stated above in item #2 will prevail.