Thermal Pipe Systems, Inc.

SUPER TEMP-TITE® PIPING SYSTEM

FOR STEAM SERVICE

SPECIFICATIONS & DRAWINGS

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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•ft²•°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.

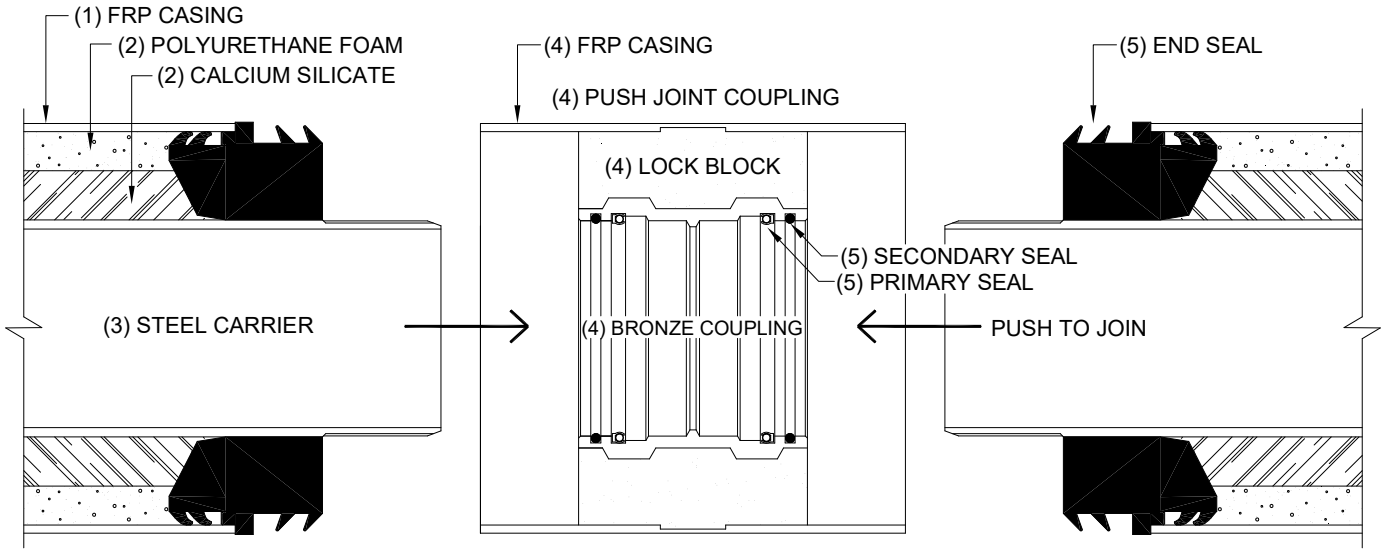
INSULATION: Thickness of insulation for SUPER TEMP-TITE pipe and fittings shall be as shown on page four.

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.

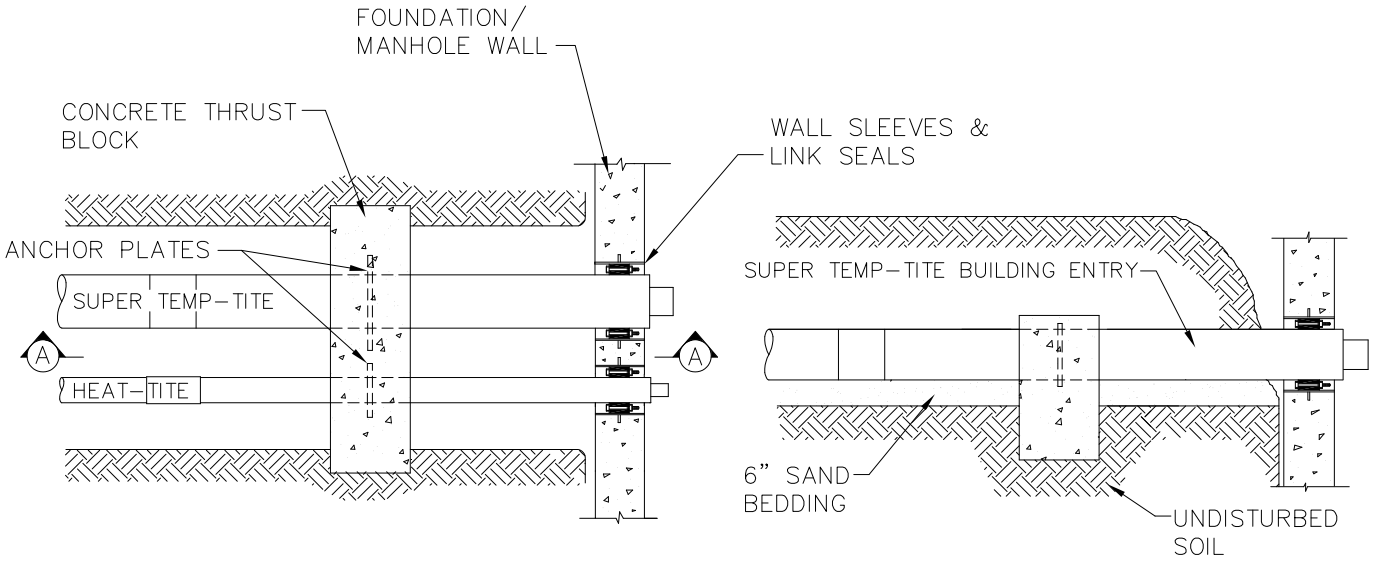
Secondary Seal; high temperature elastomer O-Ring on the bronze coupling to align pipe and provide a back-up pressure seal.

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

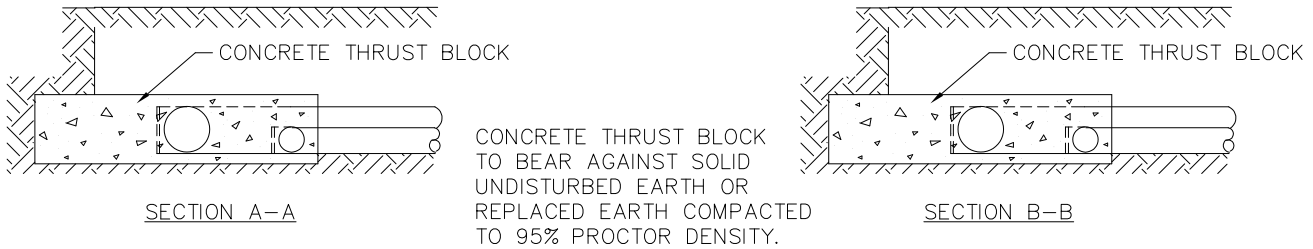


PLAN

ELEVATION A–A

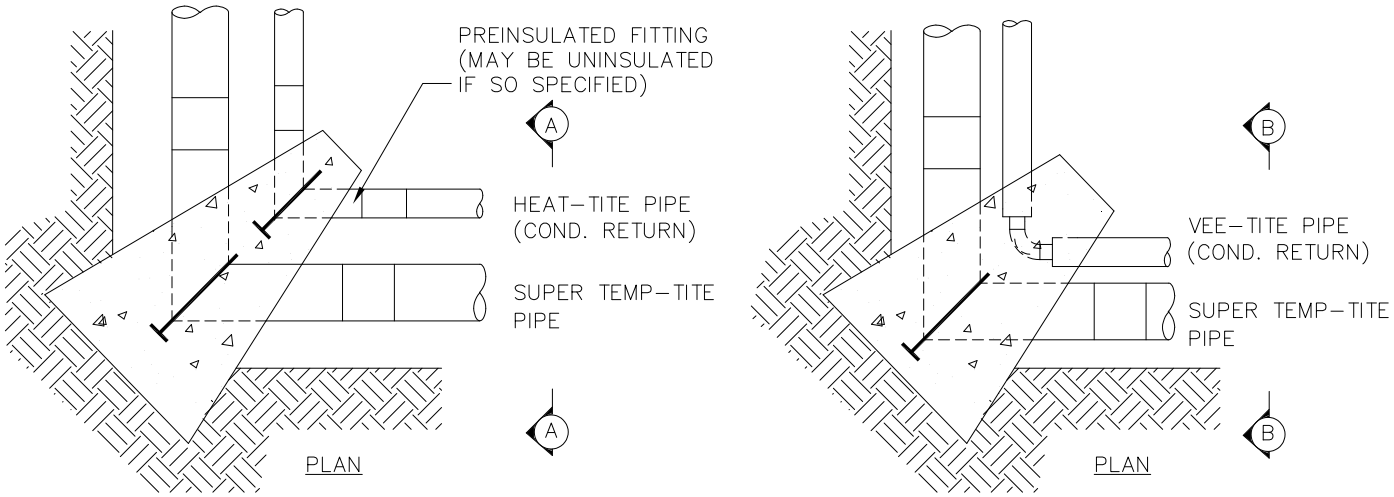
TYPICAL THRUST BLOCK AT WALL PENETRATIONS

NO SCALE



SECTION A–A

SECTION B–B



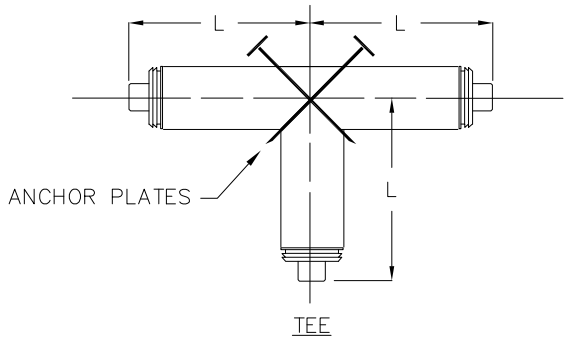
PLAN (WITH STEEL CONDENSATE RETURN)

PLAN (WITH FRP CONDENSATE RETURN)

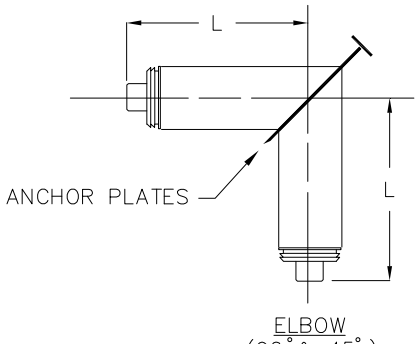
TYPICAL THRUST BLOCK AT ELBOWS

NO SCALE

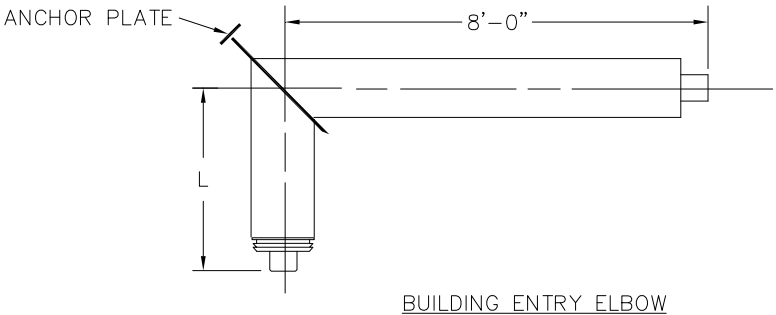
PRE-INSULATED SUPER TEMP-TITE® PIPE



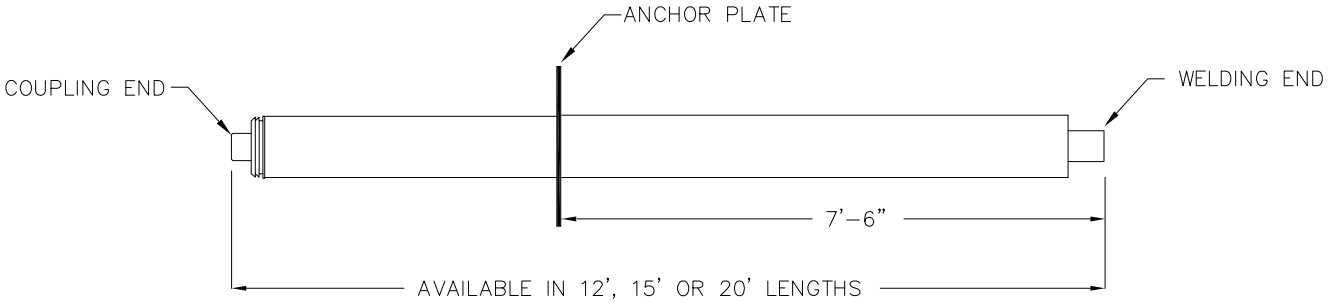
TEE



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.