

COPPER-THERM

COPPER PIPING SYSTEM



COPPER-THERM

THERMACOR'S COPPER-THERM is a factory-fabricated, pre-insulated piping system for below ground distribution of heating water, domestic hot water, chilled water, condensate return, process fluids, and cryogenic services. The system is designed with Copper Tubing (type to be specified), closed cell polyurethane foam insulation, and a Type 1, Class 1 PVC or High Density Polyethylene (HDPE) jacket. O-ring couplings are also available for joining straight lengths of pipe to compensate for thermal expansion.

Carrier Pipe

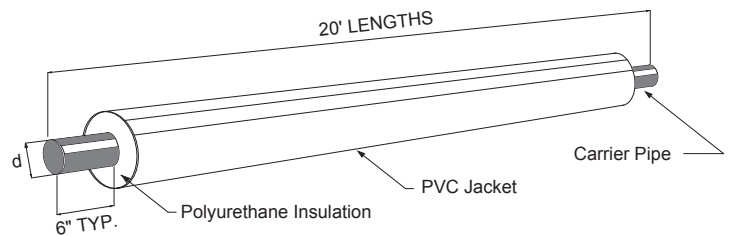
- Type "K" Copper
- Type "L" Copper
- Type "M" Copper

Polyurethane Insulation

- Density
- "K" Factor
- Compressive Strength
- Closed Cell Content

Jacket

- Type 1, Class 1, PVC
- High Density Polyethylene (HDPE)



> 2.0 lbs/ft³
 ≤ 0.16 @ 75°F
 > 30 psi
 ≥ 90% @ 75°F

SPECIFICATION GUIDE *

GENERAL

All underground and above ground piping materials transporting heating water, domestic hot water, chilled water, condensate return, process fluids, and cryogenic services shall be **COPPER-THERM** as manufactured by **THERMACOR PROCESS INC.** All straight pipe, fittings, anchors, insulating materials, and technical support shall be provided by the manufacturer.

SERVICE PIPE

The carrier or service pipe shall be Type K Copper tube, conforming to ASTM B-88. (*At the Engineer's option*, Type L or Type M is acceptable.) Cleaned and capped Type K, and ACR Type L copper tube may be used for cryogenic and refrigeration applications. All copper tubing shall have ends cut square for socket brazing. Straight sections shall be supplied in 20 foot lengths with cutbacks to allow for brazing at the field joints. Field joining of piping shall utilize approved methods of silver soldering or brazing with alloys melting at or above 1100°F; 50-50 tin-lead solder is not acceptable. (O-ring couplings may be used to join straight pipe lengths.)

INSULATION

Insulation of the service pipe shall be rigid polyurethane foam with a minimum 2.0 lbs/ft³ density, 90% minimum closed cell content, and a "K" factor not higher than .16 @ 75°F per ASTM C518. The polyurethane foam shall be CFC-free. The polyurethane foam shall completely fill the annular space between the service pipe and jacket, and shall be bonded to both. Insulation shall be provided to the minimum insulation thickness specified.

JACKET

The outer protective jacket shall be either extruded white polyvinyl chloride, consisting of clean, virgin NSF approved Class 12454-B PVC compound, conforming to ASTM D-1784, Type 1, Grade 1 or high density polyethylene (HDPE). No FRP, HDUP, or tape jacket allowed. PVC jacket shall have a wall thickness in mils equal to ten times the nominal jacket diameter and shall not be less than 60 mils.

FITTINGS

All straight sections, fittings, anchors, and other components shall be factory-fabricated and pre-insulated. Fittings shall be jacketed with a molded fitting cover or with a PVC fitting cover and wrapped with polyethylene backed, pressure sensitive rubberized bitumen adhesive tape, 30 mils thick. Carrier pipe fittings shall be silver soldered or brazed with alloys melting at or above 1100°F; 50-50 tin-lead solder is not acceptable. Fittings include expansion loops, elbows, tees, reducers, and anchors. (*At the Engineer's option*, fittings may be field insulated with liquid urethane foam insulation, jacketed with a PVC fitting cover and then wrapped with polyethylene backed, pressure sensitive rubberized bitumen adhesive tape, 30 mils thick.) Above ground installations shall use white, pressure sensitive PVC tape. (In systems utilizing O-ring couplings, fittings are not insulated and are thrust blocked at all changes in direction. Expansion compensation occurs at couplings between straight lengths of pipe, therefore expansion loops and elbows are not required.)

FIELD JOINTS

Service pipe shall be hydrostatically tested as per the Engineer's specification with a factory recommendation of 1.5 times the specified pressure of the system. Straight joint sections shall be insulated using urethane foam to the thickness specified, jacketed with an HDPE or PVC sleeve and sealed with pressure sensitive, polyethylene backed, rubberized bitumen adhesive tape, 30 mils thick, or a heat shrink sleeve or tape. Above ground installations shall use white, pressure sensitive PVC tape. All insulation and jacketing materials shall be furnished by THERMACOR. (In systems utilizing O-ring couplings, straight run joints are not insulated to allow for expansion and contraction of the gasketed joint. At the Engineer's option, straight joint sections may be jacketed as above to prevent the ingress of moisture or debris.)

INSTALLATION

Installation of the piping system shall be in accordance with the manufacturer's instructions. Factory trained field technicians shall be provided for critical periods of installation, unloading, field joint instruction, and testing.

* For alternate specifications, please contact THERMACOR.

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The information contained in this document is subject to change without notice. THERMACOR PROCESS INC. believes the information contained herein to be reliable, but makes no representations as to its accuracy or completeness.

THERMACOR PROCESS INC. sole and exclusive warranty is as stated in the Standard Terms and Conditions of Sale for these products. In no event will THERMACOR PROCESS INC. be liable for any direct, indirect, or consequential damage.



COPPER-THERM

Specification Guide

CUSG
6.101

STANDARD SPECIFICATION

2.08.2021

Pre-insulated Copper Piping Systems suitable for Heating Water, Domestic Hot Water, Chilled Water, Condensate Return, Process Fluids, and Cryogenic services.

Part 1 – General

1.1 Pre-insulated Piping - Furnish a complete system of factory pre-insulated copper piping for the specified service. All pre-insulated pipe, fittings, insulating materials, and technical support shall be provided by the Pre-insulated Piping System manufacturer.

1.2 The system shall be **COPPER-THERM** manufactured by **Thermacor Process Inc.** of Fort Worth, Texas.

Part 2 – Products

2.1 Carrier pipe shall be Type K Copper tube, conforming to ASTM B-88. (*At the Engineer's option*, Type L or Type M is acceptable.) Cleaned and Capped Type K, and ACR Type L copper tube may be used for cryogenic and refrigeration applications. All copper piping shall have ends cut square for socket brazing. Straight sections of factory insulated pipe shall be 20-foot in length and shall have 6" of exposed pipe at each end for field joint fabrication. Field joining of piping shall utilize approved methods of brazing with alloys melting at or above 1100°F; 50-50 tin-lead solder is not acceptable.

2.2 Insulation shall be polyurethane foam either spray applied or injected with one shot into the annular space between carrier pipe and jacket. Insulation shall be rigid, 90% minimum closed cell polyurethane with a minimum 2.0 lbs per cubic foot density, compressive strength of 30 psi @ 75°F, and coefficient of thermal conductivity (K-Factor) of not higher than 0.18 @ 75°F per ASTM C-518. Maximum operating temperature shall not exceed 250°F. Insulation thickness shall be specified by calling out appropriate carrier pipe and jacket size combinations as listed on drawing CUSG 6.103 or 6.104.

2.3 Jacketing material shall be either high density polyethylene (HDPE). HDPE shall have a minimum wall thickness of 125 mils for jacket sizes less than or equal to 12", 100 mils for jacket sizes larger than 12" to 24", and 175 mils for jacket sizes larger than 24". No FRP, HDUP, or tape jacket allowed.

2.4 Straight run joints are insulated using urethane foam to the thickness specified, jacketed with either an HDPE or PVC sleeve and sealed with pressure sensitive, polyethylene backed, rubberized bitumen adhesive tape, 30 mils thick, or a heat shrink sleeve. Above ground installations shall use white, pressure sensitive PVC tape.

2.5 Fittings are Thermacor SC (standard components) factory pre-fabricated and pre-insulated with urethane to the thickness specified, jacketed with a molded fitting cover or a PVC fitting cover wrapped with polyethylene backed, pressure sensitive rubberized bitumen adhesive tape, 30 mils thick. Carrier pipe fittings shall be brazed with alloys melting at or above 1100°F; 50-50 tin-lead solder is not acceptable. Fittings include expansion loops, elbows, tees, reducers, and anchors. (*At the Engineer's option*, system may be pre-engineered.)

2.6 Expansion/contraction compensation will be accomplished utilizing factory pre-fabricated and pre-insulated expansion elbows, Z-bends, expansion loops, and anchors specifically designed for the intended application. External expansion compensation utilizing flexible expansion pads minimum one inch thick extending on either side, both inside and outside the radius of the fittings, is used with all fittings having expansion in excess of 3/4".

(Continued)



COPPER-THERM

Specification Guide

CUSG

6.102

STANDARD SPECIFICATION

2.08.2021

Part 3 – Execution

3.1 Pre-fabricated systems shall be provided as SC (standard components) fittings and factory insulated straight pipe sections for field engineering per the contract drawings. *(At the Engineer's option, system may be pre-engineered with spool piece numbers marked for installation per manufacturer's drawings.)*

3.2 Underground systems shall be buried in a trench of not less than two feet deeper than the top of the pipe and not less than eighteen inches wider than the combined O.D. of all piping systems. A minimum thickness of 24 inches of compacted backfill over the top of the pipe will meet H-20 highway loading.

3.3 Trench bottom shall have a minimum of 6" of sand as a cushion for the piping. All field cutting of the pipe shall be performed in accordance with the manufacturer's installation instructions.

3.4 A hydrostatic pressure test of the carrier pipe shall be performed per the engineer's specification with a factory recommendation of one and one-half times the normal system operating pressure for not less than two hours. Care shall be taken to insure all trapped air is removed from the system prior to the test. *Appropriate safety precautions shall be taken to guard against possible injury to personnel in the event of a failure.*

3.5 Field service, if required by project specifications, will be provided by a certified manufacturer's representative or company field service technician. The technician will be available at the job to check unloading, storing, and handling of pipe, joint installation, pressure testing, and backfilling techniques. This service will be added into the cost as part of the project technical services required by the pre-insulated pipe manufacturer.



COPPER-THERM

Specification Guide

CUSG
6.103

POLYURETHANE FOAM IN HDPE JACKET

2.08.2021

Carrier Pipe:

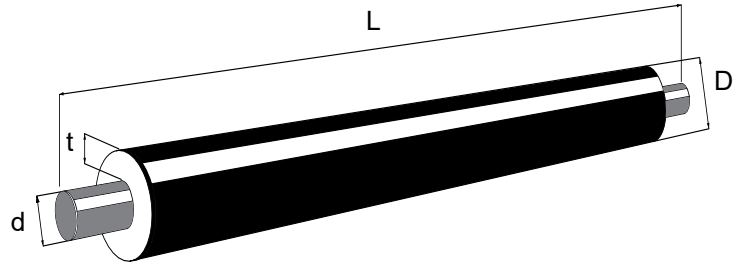
- Type K, L, or M Hard Copper (ASTM B-88)
- $d \geq 3"$ - 9" Cut Back
- $d \leq 2"$ - 6" Cut Back

Jacketing Material:

High Density Polyethylene (HDPE)

Insulation:

Polyurethane Foam



Pipe Size	Jacket Size	Standard Length L	Insulation Thickness t	External Diameter D
1/2"	5.4"	20'	2.29"	5.40"
3/4"	5.4"	20'	2.16"	5.40"
1"	5.4"	20'	2.04"	5.40"
1-1/4"	5.4"	20'	1.91"	5.40"
	6.7"	20'	2.56"	6.68"
1-1/2"	5.4"	20'	1.79"	5.40"
	6.7"	20'	2.44"	6.68"
2"	5.4"	20'	1.54"	5.40"
	6.7"	20'	2.19"	6.68"
2-1/2"	5.4"	20'	1.29"	5.40"
	6.7"	20'	1.93"	6.68"
3"	5.4"	20'	1.04"	5.40"
	6.7"	20'	1.69"	6.68"
	8.7"	20'	2.69"	8.68"
4"	6.7"	20'	1.19"	6.68"
	8.7"	20'	2.19"	8.68"
6"	8.7"	20'	1.19"	8.68"
	10.9"	20'	2.26"	10.85"

* Other pipe and jacket combinations are available.

** Insulation thickness is calculated using minimum wall thickness. Actual wall thickness may be greater than stated, thereby minimally decreasing actual foam thickness.



COPPER-THERM

Specification Guide

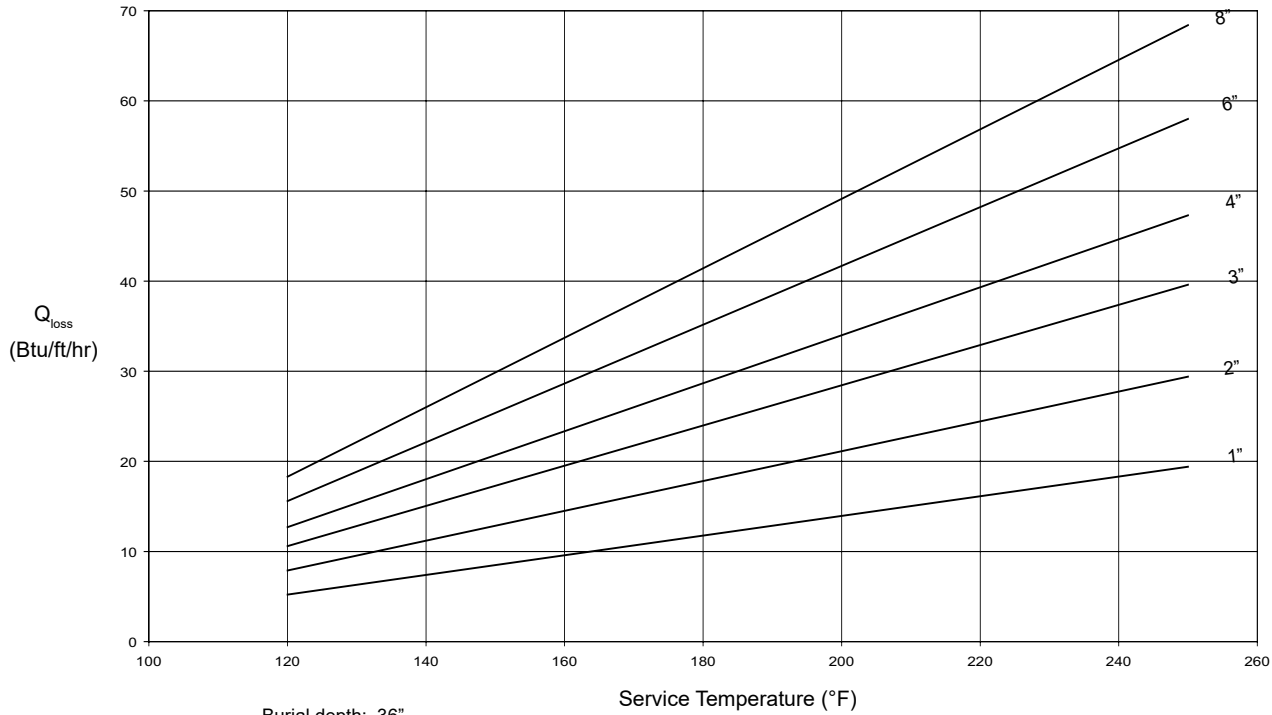
CUSG

6.104

HEAT LOSS DIAGRAM (1" - 6" PIPE)

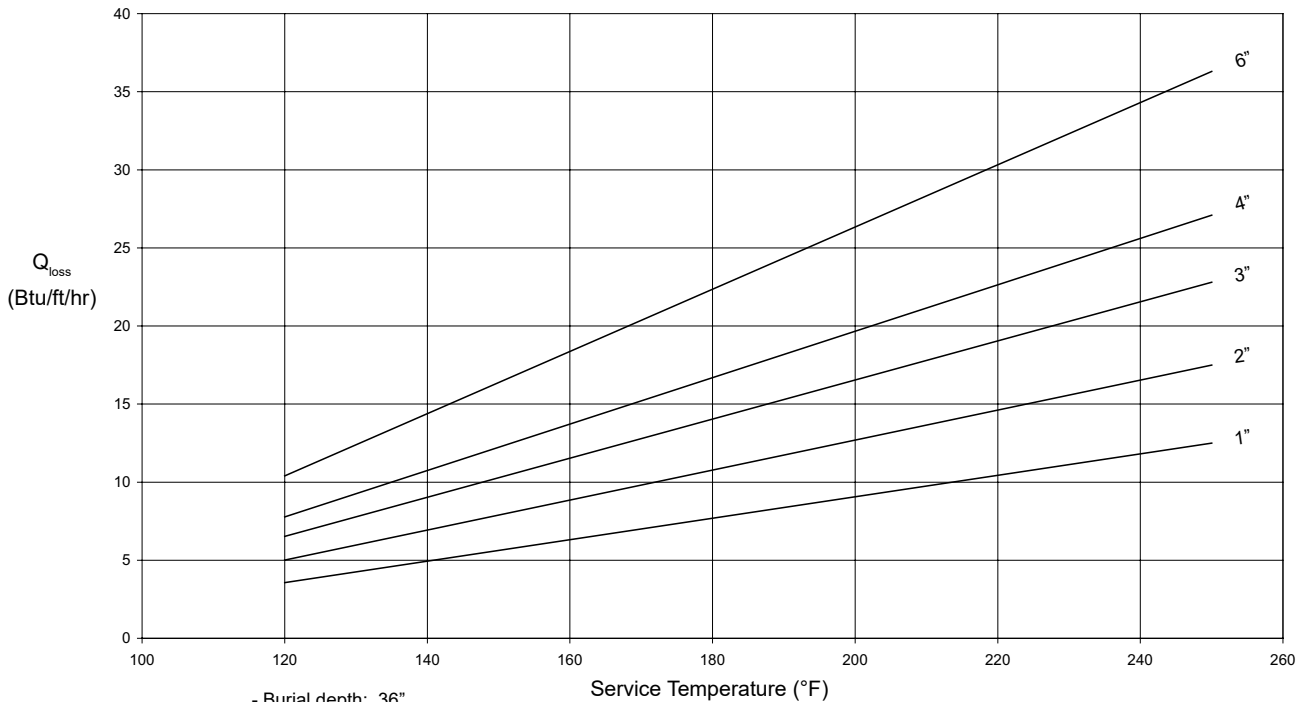
2.08.2021

HEAT LOSS FOR 1" OF POLYURETHANE FOAM*



- Burial depth: 36"
- Soil conductivity: 12 (Btu/h.ft².°F/ft)
- Soil temperature: 50°F

HEAT LOSS FOR 2" OF POLYURETHANE FOAM*



- Burial depth: 36"
- Soil conductivity: 12 (Btu/h.ft².°F/ft)
- Soil temperature: 50°F

* Values are calculated using 3E Plus in accordance with ASTM C680 and are subject to the terms and limitations stated in the software. Actual heat loss may vary.



COPPER-THERM

Installation Manual

CUIM
6.201

GENERAL INSTALLATION INSTRUCTIONS

3.14.07

INSTALLATION INSTRUCTIONS

UNLOADING & HANDLING

Lift joints from trucks. DO NOT DROP SHARP OR HEAVY OBJECTS ON INSULATED UNITS. DO NOT use chains or other devices which might puncture insulation jacket.

STORAGE

Pipe is stockpiled off the ground. Do not exceed a stacking height of 6'. Prevent dirt and debris from entering pipe. Fittings, joining materials, etc. must be stored indoors to protect them from freezing, overheating, moisture, or loss.

LAYING OF PIPE UNITS – TRENCHING

All sharp rocks, roots, and other abrasive material must be removed from the trench. The trench bed should be 6" of sand or backfill as specified by the engineer, providing a smooth and uniform stabilizing surface (sandbags may be used as a means to keep the pipe off the ground until backfilling is started). The trench width should provide a minimum of 6" from trench wall to jacket O.D. and a minimum of 6" between pipe units. Trench depths will be indicated on the contract drawing and in line with good construction practices. Trench depth should allow for a minimum cover of 24" on top of the insulated unit.

FIELD JOINING METHODS

K, L, or M copper piping and fittings shall be joined in the field using approved methods of silver soldering or brazing alloys melting at or above 1100°F; 50-50 tin-lead solder is not acceptable.

FIELD ALTERATIONS

Pipe will be cut in the field, based on the appropriate field measurements for fabrication of loops, fittings, and/ or making manhole or wall entries unless the system is pre-engineered with piece mark sections and/ or with pre-fabricated/ pre-insulated fittings. If special short pieces are required, measure distance needed for field alteration and cut through unit with saw. Using factory insulated pipe as guide, cut back insulation and bevel pipe (simultaneously removing burrs, cuts, nicks, and scratches). Apply end seal to the clean, dry, exposed insulation surface, if required.

HYDROSTATIC TESTING

Anchor blocks shall be poured and cured, prior to testing. Bleed all air from lines to eliminate possible incorrect readings. The hydrostatic pressure test shall be performed per the engineer's specification with a factory recommendation of one and one-half times the normal operating pressure for not less than two hours. Inspect all fittings, valves, and couplings at this time. *Appropriate safety precautions shall be taken to guard against possible injury to personnel in the event of a failure.*

FIELD JOINT & FITTING INSULATION

See Drawings furnished with job material.

BACKFILL FINAL

Before backfilling is started, the trench should be cleaned of any trench wall cave-ins and general trash, especially metal. Backfilling should be done with sand or other engineer-approved material 6" below the casing to 1' above. Engineer-approved backfill may be used to fill the rest of the trench. This material should be free of rocks, roots, large clods, or anything that could cause damage to the jacket. Jacket should have a minimum of 2' cover.

WHEELED OR TRACKED VEHICLES SHALL NOT BE USED FOR TAMPING!

SHIPPING & HANDLING INSTRUCTIONS

HANDLE COATED PIPE WITH EXTRA CARE! THIS PIPE CAN DAMAGE WHEN HANDLED, MOVED, OR STORED IMPROPERLY!

UPON RECEIPT OF MATERIALS

Make an overall inspection of the load, checking all bands and braces to see if they are intact. Also, check the load for shifting. If the load has shifted, or if the braces and bands are broken, examine each pipe for damage. **HAVE THE TRUCK DRIVER MAKE AN ITEMIZED NOTATION OF ANY DAMAGE ON THE DELIVERY RECEIPT AND HAVE IT SIGNED BY THE DRIVER.**

CHECK PACKING LIST

Compare materials received with those listed on the packing list. Count all pipe and boxes. **NOTE ANY SHORTAGES ON DRIVER'S DELIVERY RECEIPT.**

CHECK BOXES

Open all boxes and inspect for damages, shortages, and correct size. **REPORT ANY DISCREPANCIES WITHIN 30 DAYS AFTER RECEIPT.**

CLAIMS FOR DAMAGES

Claims for damages in transit or lost goods must be made within 30 days. The filing of any claim is the Purchaser's Responsibility. Thermacor will file any claim on Purchaser's behalf upon receipt of the following:

1. Written authority to file such a claim.
2. Written notice of loss or damage (signed and noted Bill of Lading) by truck driver or carrier freight agent.

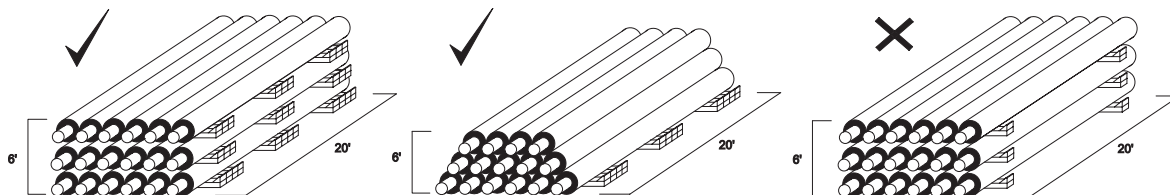
UNLOADING PIPE

Pipe may be unloaded by hand or with fork lifts*, cherry pickers, or cranes. **DO NOT HOOK** pipe ends. Minimum 4" wide straps or slings should be used.

*Fork Lift – When using Fork Lift, wide tines or a large surface covering the fork tines must be used to prevent coating damage. Fork Lift must be able to handle the weight of the insulated pipe length.

PIPE STOCKPILING

Pipe should be stored on level ground, elevated to be as dry as possible, and in such a way that the pipe ends do not lie in water or on the ground. To prevent deformation of the jacket and insulation due to the weight of the pipe, place a series of supports (3 for 20' or 5 for 40') of ample size generally constructed from 2" x 4"s under the pipe as shown below. Supports should increase in width as weight load increases so that the top supports of a fully loaded stockpile should be approximately 10" wide, gradually increasing to the bottom level, approximately 18" wide. Pipe can be pyramided (within reasonable and safe limits) approximately 6' high after a properly braced or chocked base is formed. Pipe stored outside for long periods of time can be covered with blue mesh tarpaulin (plywood can also be used). **Do not prevent airflow as jacket can be deformed from heat buildup.**



BE VERY CAREFUL NOT TO DROP THE PIPE!

NOTE: Thermacor does not approve of the practice of installing pipe and fittings, and backfilling the pipe before testing. Thermacor will not allow or pay claims for charges which arise in locating and digging up leaks regardless of cause.



COPPER-THERM O-RING

Specification Guide

COSG
6.301

STANDARD SPECIFICATION

2.08.2021

Pre-insulated Copper O-Ring Piping Systems suitable for Heating Water, Domestic Hot Water, Chilled Water, Condensate Return, Process Fluids, and Cryogenic services.

Part 1 – General

1.1 Pre-insulated Piping - Furnish a complete system of factory pre-insulated copper piping for the specified service. All pre-insulated pipe, fittings, insulating materials, and technical support shall be provided by the Pre-insulated Piping System manufacturer.

1.2 The system shall be **COPPER-THERM O-Ring** manufactured by **Thermacor Process Inc.** of Fort Worth, Texas.

Part 2 – Products

2.1 Carrier pipe shall be Type K Copper tube, conforming to ASTM B-88. (*At the Engineer's option*, Type L or Type M is acceptable). All copper piping shall have ends cut square for socket brazing. Straight sections of factory insulated pipe shall be 20-foot in length and shall have 2" of exposed pipe at each end for field joint assembly, or 6" for brazed connection.

2.2 Insulation shall be polyurethane foam either spray applied or injected with one shot into the annular space between carrier pipe and jacket. Insulation shall be rigid, 90% minimum closed cell polyurethane with a minimum 2.0 lbs per cubic foot density, compressive strength of 30 psi @ 75°F, and coefficient of thermal conductivity (K-Factor) of not higher than 0.18 @ 75°F per ASTM C-518. Maximum operating temperature shall not exceed 250°F. Insulation thickness shall be specified by calling out appropriate carrier pipe and jacket size combinations as listed on drawing COSG 6.303 or 6.304.

2.3 Jacketing material shall be high density polyethylene (HDPE). HDPE shall have a minimum wall thickness of 100 mils for jacket sizes less than or equal to 12", 125 mils for jacket sizes larger than 12" to 20", and 150 mils for jacket sizes larger than 24". No FRP, HDUP, or tape jacket allowed.

2.4 Straight run joints are not insulated to allow for expansion and contraction of the gasketed joint. At the Engineer's option, straight field joints may be jacketed with either an HDPE or PVC sleeve and sealed with pressure sensitive, polyethylene backed, rubberized bitumen adhesive tape, 30 mils thick or heat shrink wrap to prevent the ingress of moisture or debris.

2.5 Fittings shall be cast bronze or wrought copper. Carrier pipe fittings shall be silver soldered or brazed with alloys melting at or above 1100°F; 50-50 tin-lead solder is not acceptable. Fittings are not insulated and are poured in concrete thrust blocks at all changes on direction. Thrust block design and sizing is the responsibility of the design engineer.

2.6 Expansion/ contraction compensation will be accomplished utilizing O-ring couplings to join straight pipe sections. The couplings shall consist of a machined coupling housing two EPDM sealing rings, and at the Engineer's option, jacketed with either an HDPE or PVC sleeve and sealed with polyethylene backed, pressure sensitive bituminous rubber tape, 30 mils thick. Couplings are required for distances between fittings of five feet or greater.

(Continued)



COPPER-THERM O-RING

Specification Guide

COSG

6.302

STANDARD SPECIFICATION

2.08.2021

Part 3 – Execution

3.1 Underground systems shall be buried in a trench of not less than two feet deeper than the top of the pipe and not less than eighteen inches wider than the combined O.D. of all piping systems. A minimum thickness of 24 inches of compacted backfill over the top of the pipe will meet H-20 highway loading.

3.2 Trench bottom shall have a minimum of 6" of sand as a cushion for the piping. All field cutting of the pipe shall be performed in accordance with the manufacturer's installation instructions.

3.3 A hydrostatic pressure test of the carrier pipe shall be performed per the engineer's specification with a factory recommendation of one and one-half times the normal system operating pressure for not less than two hours. Care shall be taken to insure all trapped air is removed from the system prior to the test. *Appropriate safety precautions shall be taken to guard against possible injury to personnel in the event of a failure.*

3.4 Field service, if required by project specifications, will be provided by a certified manufacturer's representative or company field service technician. The technician will be available at the job to check unloading, storing, and handling of pipe, joint installation, pressure testing, and backfilling techniques. This service will be added into the cost as part of the project technical services required by the pre-insulated pipe manufacturer.



COPPER-THERM O-RING

Specification Guide

COSG
6.303

POLYURETHANE FOAM IN HDPE JACKET

2.08.2021

Carrier Pipe:

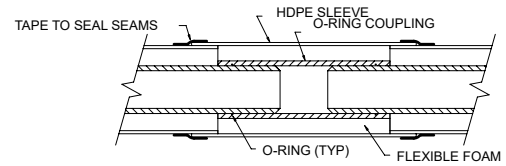
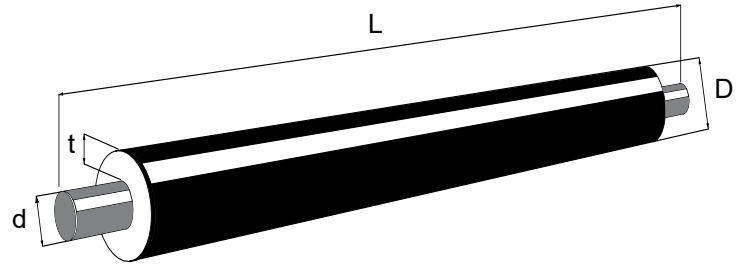
- Type K, L, or M Hard Copper (ASTM B-88)
- $d \geq 3"$ - 9" Cut Back
- $d \leq 2"$ - 6" Cut Back

Jacketing Material:

High Density Polyethylene (HDPE)

Insulation:

Polyurethane Foam



Pipe Size	Jacket Size	Standard Length L	Insulation Thickness t	External Diameter D
1/2"	5.4"	20'	2.29"	5.40"
3/4"	5.4"	20'	2.16"	5.40"
1"	5.4"	20'	2.04"	5.40"
1-1/4"	5.4"	20'	1.91"	5.40"
	6.7"	20'	2.56"	6.68"
1-1/2"	5.4"	20'	1.79"	5.40"
	6.7"	20'	2.43"	6.68"
2"	5.4"	20'	1.54"	5.40"
	6.7"	20'	2.18"	6.68"
2-1/2"	5.4"	20'	1.29"	5.40"
	6.7"	20'	1.93"	6.68"
3"	5.4"	20'	1.04"	5.40"
	6.7"	20'	1.68"	6.68"
	8.7"	20'	2.68"	8.68"
4"	6.7"	20'	1.18"	6.68"
	8.7"	20'	2.18"	8.68"

* Other pipe and jacket combinations are available.

** Insulation thickness is calculated using minimum wall thickness. Actual wall thickness may be greater than stated, thereby minimally decreasing actual foam thickness.

INSTALLATION INSTRUCTIONS

UNLOADING & HANDLING

Lift joints from trucks. **DO NOT DROP SHARP OR HEAVY OBJECTS ON INSULATED UNITS.** **DO NOT** use chains or other devices which might puncture insulation jacket.

STORAGE

Pipe is stockpiled off the ground. Do not exceed a stacking height of 6'. Prevent dirt and debris from entering pipe. Fittings, joining materials, etc. must be stored indoors to protect them from freezing, overheating, moisture, or loss.

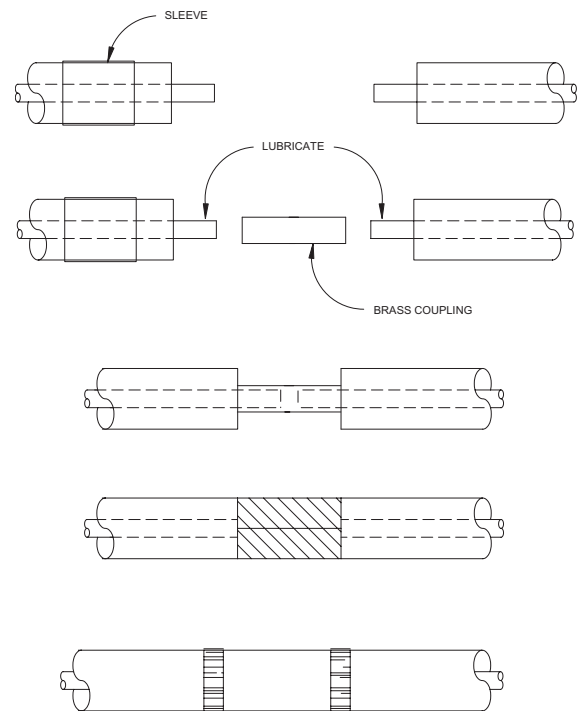
LAYING OF PIPE UNITS – TRENCHING

All sharp rocks, roots, and other abrasive material must be removed from the trench. The trench bed should be 6" of sand or backfill as specified by the engineer, providing a smooth and uniform stabilizing surface (sandbags may be used as a means to keep the pipe off the ground until backfilling is started). The trench width should provide a minimum of 6" from trench wall to jacket O.D. and a minimum of 6" between pipe units. Trench depths will be indicated on the contract drawing and in line with good construction practices. Trench depth should allow for a minimum cover of 24" on top of the insulated unit.

FIELD JOINING METHODS

Pipe should be laid straight and level. Installation that results in cocking of coupling or pinching of "o-ring" is unacceptable. **Distance without a coupling between thrust blocked fittings SHALL NOT exceed 5'.**

1. Inspect carrier pipe ends for proper bevel. Any burrs or scratches should be touched up with up with emery cloth (180 grit or finer) or fine tooth file. Slide sleeve cover over one end of jacket.
2. Rub a thin layer of lubricant over carrier pipe end and "o-ring". Use silicone-based lubricant supplied by Thermacor. Do NOT use petroleum-based lubricant.
3. Insert pipe ends into brass coupling.** Take care not to damage pipe ends during installation. Partially backfill (see TESTING) and pressure test as per specifications.
4. Insulate brass coupling and slide sleeve over coupling so that there is equal overlap.
5. Wrap tape around each end of sleeve with overlap at the top. Rub out any tape wrinkles with knife hilt.



** Coupling must be cleaned before assembly. Be sure "o-ring" groove is clean and that the "o-ring" is seated properly. Lubricate smooth pipe spigot with Thermacor provided lubricant. Insert pipe spigot carefully to prevent cutting or rolling of "o-ring". Coupling should fit tightly against factory insulation.

FIELD ALTERATIONS

Pipe will be cut in the field, based on the appropriate field measurements for fittings and/ or making manhole or wall entries unless the system is pre-engineered with piece mark sections. If special short pieces are required, measure distance needed for field alteration and cut through unit with saw. Using factory insulated pipe as guide, cut back insulation and bevel pipe (simultaneously removing burrs, cuts, nicks, and scratches). Apply end seals to the clean, dry, exposed insulation surface. Where fittings are required, they must be brazed, using approved brazing methods with appropriate copper or brass fittings.

BACKFILL INITIAL

After pipe is installed, specified backfill shall be tamped around the conduit in 6" layers to insure proper compaction. One foot on either side of each joint and fitting shall be left bare for visual inspection during testing.

TESTING

Sufficient backfill must be placed on pipe, and anchor blocks poured and cured, prior to testing. Bleed all air from lines to eliminate possible incorrect readings. The hydrostatic pressure test shall be performed per the engineer's specification with a factory recommendation of one and one-half times the normal operating pressure for not less than two hours. Inspect all fittings, valves, and couplings at this time. *Appropriate safety precautions shall be taken to guard against possible injury to personnel in the event of a failure.*

BACKFILL FINAL

Before backfilling is started, the trench should be cleaned of any trench wall cave-ins and general trash, especially metal. Backfilling should be done with sand or other engineer-approved material 6" below the casing to 1' above. Engineer-approved backfill may be used to fill the rest of the trench. This material should be free of rocks, roots, large clods, or anything that could cause damage to the jacket. Jacket should have a minimum of 2' cover.

WHEELED OR TRACKED VEHICLES SHALL NOT BE USED FOR TAMPING!

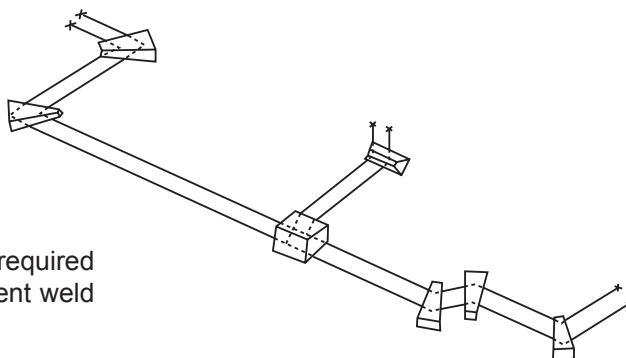
THRUST BLOCK INSTALLATION

The engineer who designs the system has the responsibility for designing and sizing the thrust blocks. A knowledge of site soil conditions is essential for proper design. Thermacor will not accept or assume responsibility for thrust blocks, and intends to provide basic data only.

WHY THRUST BLOCKS?

A Copper-Therm system must include thrust blocks to prevent the O-ring joints from separating under pressure. To prevent separation, thrust blocks must be located at:

1. All major changes in direction; i.e., tees and elbows (both horizontal and vertical).
2. All changes in size.
3. All terminal ends.
4. All Valves, so as to support the body weight and prevent excessive torque on pipe connections.
5. IMPORTANT: Any connecting brazed copper tube must be anchored at the point of connection to the Copper-Therm tube to prevent excessive stresses from being transferred to the brass couplings.



NOTE: Thrust blocks are required with gasket pipe and solvent weld fittings.

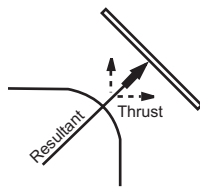
INSTALLATION

As thrust blocks are an essential part of the system, they should be poured before hydrostatic testing. Temporary thrust blocking may be used with extreme caution if absolutely necessary. The system must be retested after the permanent thrust blocks are poured and cured to verify that the thrust blocks will resist the thrust.

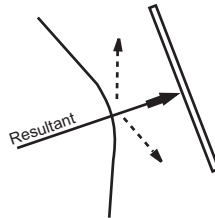
DESIGN

The design of the thrust blocks depend on test pressure, size, number of pipes, soil conditions, and types of fittings involved. Three conditions must be met for the thrust blocks to function properly.

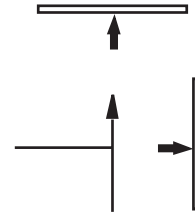
1. The bearing area must be adequate to resist the pressure force.
2. The bearing surface must rest directly against undisturbed soil.
3. The face of the block bearing surface in the soil must be perpendicular to the resultant direction of thrust.



90° ELBOW



45° ELBOW



REDUCING TEE

If the thrust blocks have not been designed by the engineer, they must be sized by the following procedure:

Example: Design a thrust block to resist the horizontal thrust of two 4" chilled water lines (supply and return) at a 90° elbow. The test pressure is 150 psi and the soil is soft clay.

TABLE 1 POUNDS OF THRUST AT FITTING FOR 100 POUNDS/ SQ. INCH OPERATING PRESSURE				TABLE 2 SAFE BEARING LOADS	
PIPE SIZE	TEE	90°	45°	SOIL	LB. PER SQ. FT.
1/2"	40	50	30	Muck, Peat	0
3/4"	70	90	50	Soft Clay	1,000
1"	100	150	80	Sand	2,000
1 1/4"	150	210	120	Sand & Gravel	3,000
1 1/2"	210	300	160	Sand & Gravel cemented with clay	4,000
2"	360	510	280	Hard Shale	10,000
2 1/2"	550	770	420		
3"	770	1,090	590		
4"	1,340	1,890	1,030		

STEP 1

FINDING THRUST:

From Table 1, the resultant thrust of a 4" x 90° elbow is 1890 lbs. at 100 psi.

At 150 psi, the thrust is:

$$1890 \text{ lbs.} \times \frac{150 \text{ psi}}{100 \text{ psi}} = 2835 \text{ lbs. elbow}$$

2835 lbs. x 2 = 5670 lbs. thrust for two elbows.

STEP 2

FINDING BEARING AREA OF BLOCK:

From Table 2, soft clay has a bearing strength of 1000 lbs./ sq. ft. therefore:

$$\frac{5670 \text{ lbs.}}{1000 \text{ lbs./ sq. ft.}} = 5.67 \text{ sq. ft. bearing area required}$$

or a block face of 3' x 2' (6 sq. ft.) is adequate.

THRUST BLOCK TYPES

Examples of thrust blocks for normal fittings are illustrated.

For vertical risers the trench bottom must be undercut and the entire trench bottom should be covered with concrete. The thrust blocks must bear against firm, stable soil.

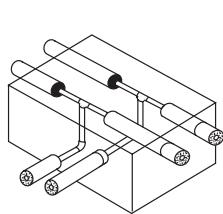


FIGURE II

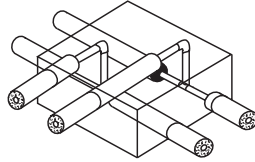


FIGURE I

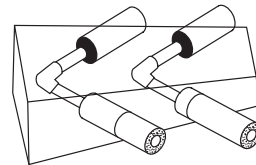


FIGURE III

CONSTRUCTION

Thrust blocks are made of concrete.

An acceptable concrete is 1 part Portland cement, 2 parts washed sand, and 3 parts washed gravel with enough water for a relatively dry mix. The dry mix is easier to shape and offers higher strength.

The concrete should be worked thoroughly around the elbows for maximum surface contact. Make sure the entire area between the fittings and the trench wall is filled with concrete and free of voids.

The blocks should be shaped with the designed bearing area against the trench wall. Smaller blocks should be shaped by hand. Larger blocks require simple forms.

The trench should be undercut under the pipes at least six inches to give added thrust resistance and to provide adequate concrete around the fittings. Six inches of concrete should be over the top of the pipe.

The center of the thrust blocks bearing surface should coincide with the horizontal center line of the pipes. (See figures I and II).

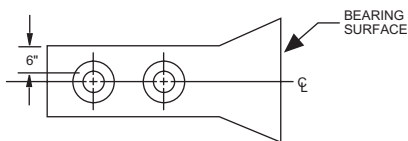


FIGURE I

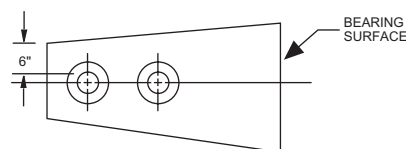


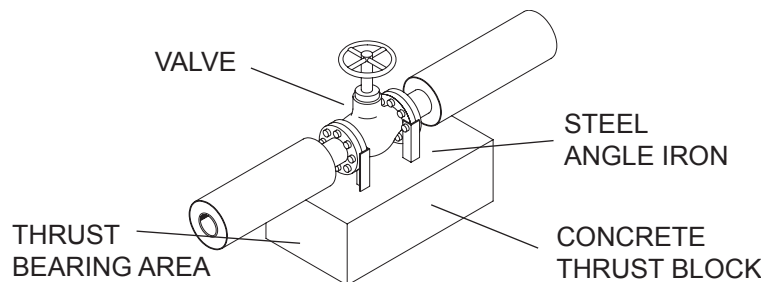
FIGURE II

UNSTABLE SOIL

If the soil is unstable in the area of a thrust block, it will be necessary for the engineer to make special provisions. This is considered a civil engineering matter and a project civil engineer should be consulted for professional advice.

VALVE BLOCKS

Blocks must be poured beneath valves with sufficient steel for valve connections. This supports the valve weight and prevents any torque or twisting action caused by opening and closing the valve.



SHIPPING & HANDLING INSTRUCTIONS

HANDLE COATED PIPE WITH EXTRA CARE! THIS PIPE CAN DAMAGE WHEN HANDLED, MOVED, OR STORED IMPROPERLY!

UPON RECEIPT OF MATERIALS

Make an overall inspection of the load, checking all bands and braces to see if they are intact. Also, check the load for shifting. If the load has shifted, or if the braces and bands are broken, examine each pipe for damage. HAVE THE TRUCK DRIVER MAKE AN ITEMIZED NOTATION OF ANY DAMAGE ON THE DELIVERY RECEIPT AND HAVE IT SIGNED BY THE DRIVER.

CHECK PACKING LIST

Compare materials received with those listed on the packing list. Count all pipe and boxes. NOTE ANY SHORTAGES ON DRIVER'S DELIVERY RECEIPT.

CHECK BOXES

Open all boxes and inspect for damages, shortages, and correct size. REPORT ANY DISCREPANCIES WITHIN 30 DAYS AFTER RECEIPT.

CLAIMS FOR DAMAGES

Claims for damages in transit or lost goods must be made within 30 days. The filing of any claim is the Purchaser's Responsibility. Thermacor will file any claim on Purchaser's behalf upon receipt of the following:

1. Written authority to file such a claim.
2. Written notice of loss or damage (signed and noted Bill of Lading) by truck driver or carrier freight agent.

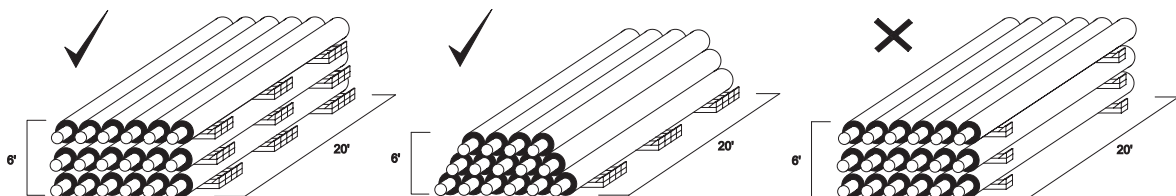
UNLOADING PIPE

Pipe may be unloaded by hand or with fork lifts*, cherry pickers, or cranes. DO NOT HOOK pipe ends. Minimum 4" wide straps or slings should be used.

*Fork Lift – When using Fork Lift, wide tines or a large surface covering the fork tines must be used to prevent coating damage. Fork Lift must be able to handle the weight of the insulated pipe length.

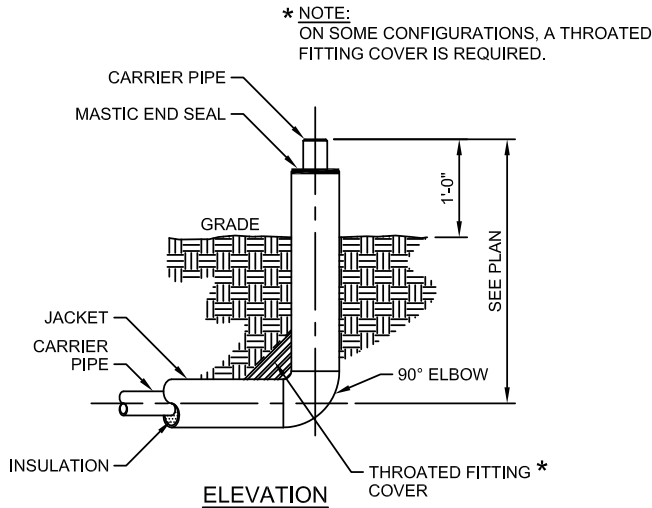
PIPE STOCKPILING

Pipe should be stored on level ground, elevated to be as dry as possible, and in such a way that the pipe ends do not lie in water or on the ground. To prevent deformation of the jacket and insulation due to the weight of the pipe, place a series of supports (3 for 20' or 5 for 40') of ample size generally constructed from 2" x 4"s under the pipe as shown below. Supports should increase in width as weight load increases so that the top supports of a fully loaded stockpile should be approximately 10" wide, gradually increasing to the bottom level, approximately 18" wide. Pipe can be pyramided (within reasonable and safe limits) approximately 6' high after a properly braced or chocked base is formed. Pipe stored outside for long periods of time can be covered with blue mesh tarpaulin (plywood can also be used). **Do not prevent airflow as jacket can be deformed from heat buildup.**

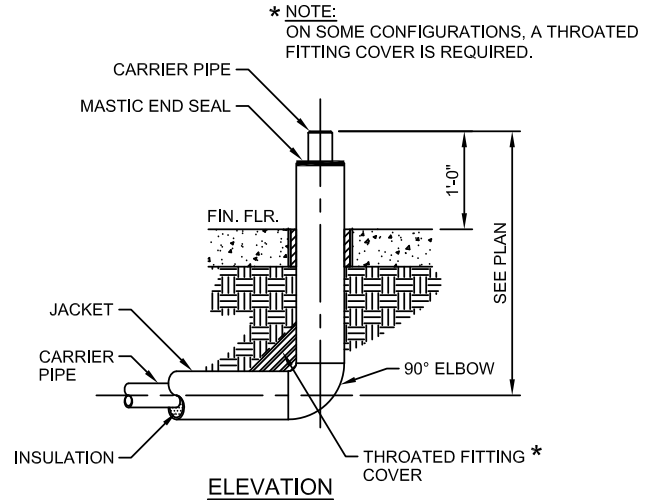


BE VERY CAREFUL NOT TO DROP THE PIPE!

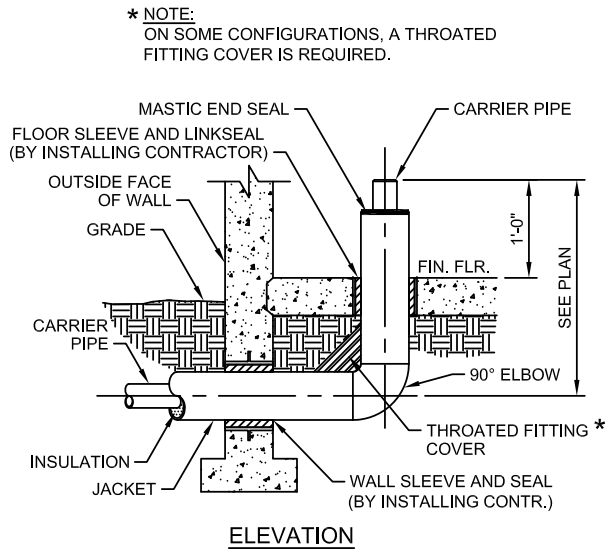
NOTE: Thermacor does not approve of the practice of installing pipe and fittings, and backfilling the pipe before testing. Thermacor will not allow or pay claims for charges which arise in locating and digging up leaks regardless of cause.



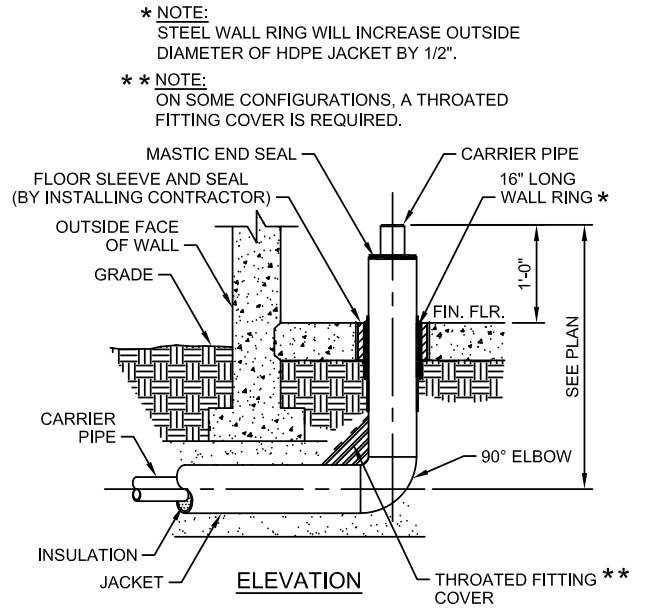
RISER DETAIL
SCALE: NONE



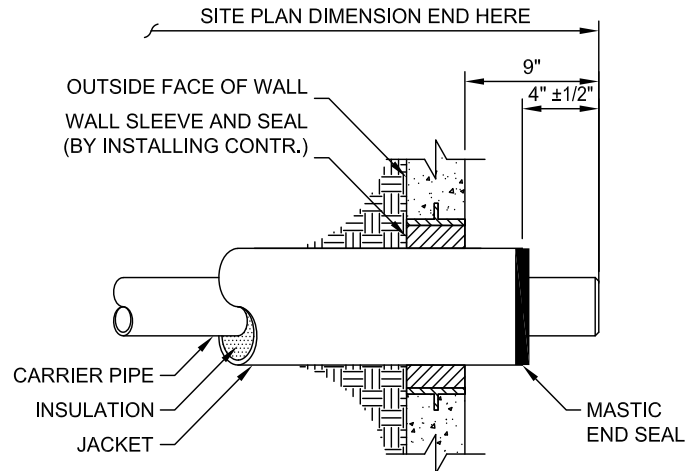
RISER DETAIL
SCALE: NONE



BUILDING RISER DETAIL
SCALE: NONE



BUILDING RISER DETAIL
SCALE: NONE



GENERAL NOTES:

- (1) FOR SYSTEMS WHICH ARE ANCHORED, A MECHANICAL COMPRESSIVE SEAL ASSEMBLY CAN BE UTILIZED FOR WATERPROOFING THE WALL PENETRATION.
- (2) IF EXPANSION THRU THE WALL IS ANTICIPATED, WE RECOMMEND THE FOLLOWING SEALING MECHANISM:
 - A. WRAP THE EXTERIOR OF THE JACKET WITH AN OILED OAKUM MATERIAL FROM THE INSIDE OF THE WALL TO ABOUT HALFWAY THRU THE WALL.
 - B. WRAP THE EXTERIOR OF THE JACKET WITH ARMAFLEX MATERIAL TO THE OUTER WALL.
 - C. COAT THE ARMAFLEX WITH A BITUMASTIC SEALANT.

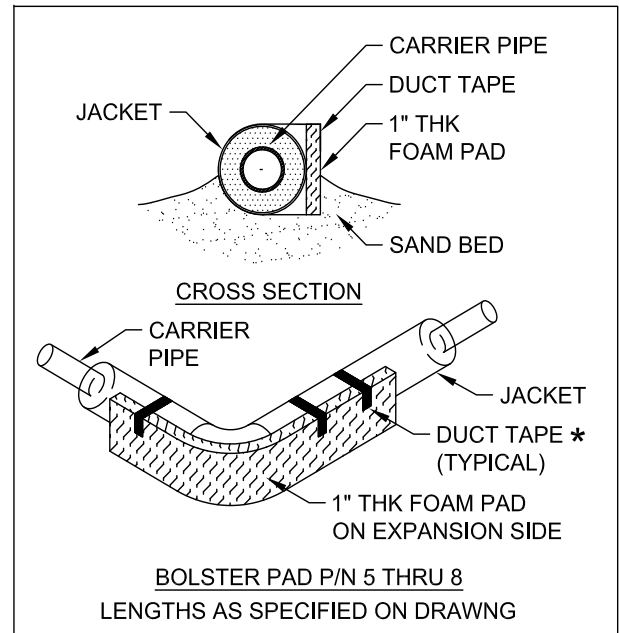
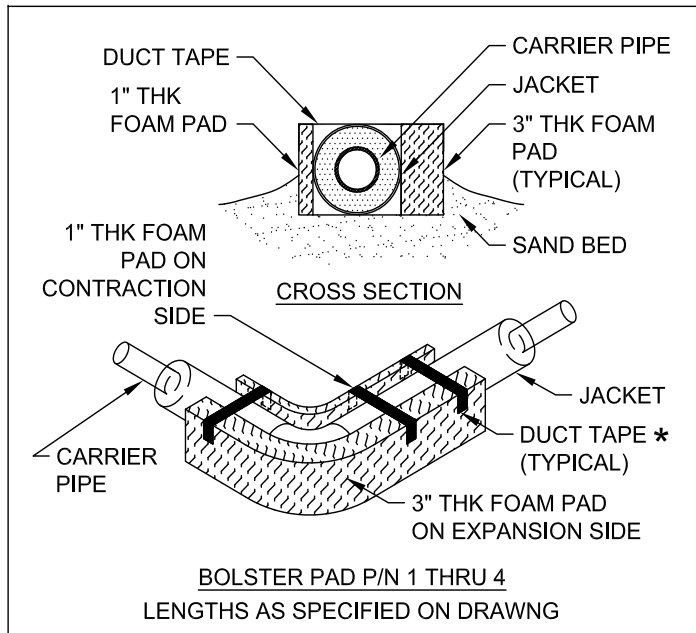
WALL PENETRATION DETAIL

SCALE: NONE

1. PLACE BOLSTER PADS AGAINST JACKET AND CURVE AROUND ELBOW AS SHOWN. HOLD IN PLACE BY ATTACHING PADS TO JACKET WITH DUCT TAPE OR EQUIVALENT ON TOP AND BEDDING SAND ON THE BOTTOM. BE CERTAIN THAT THE BOLSTER PADS FITS SNUG TO JACKET.

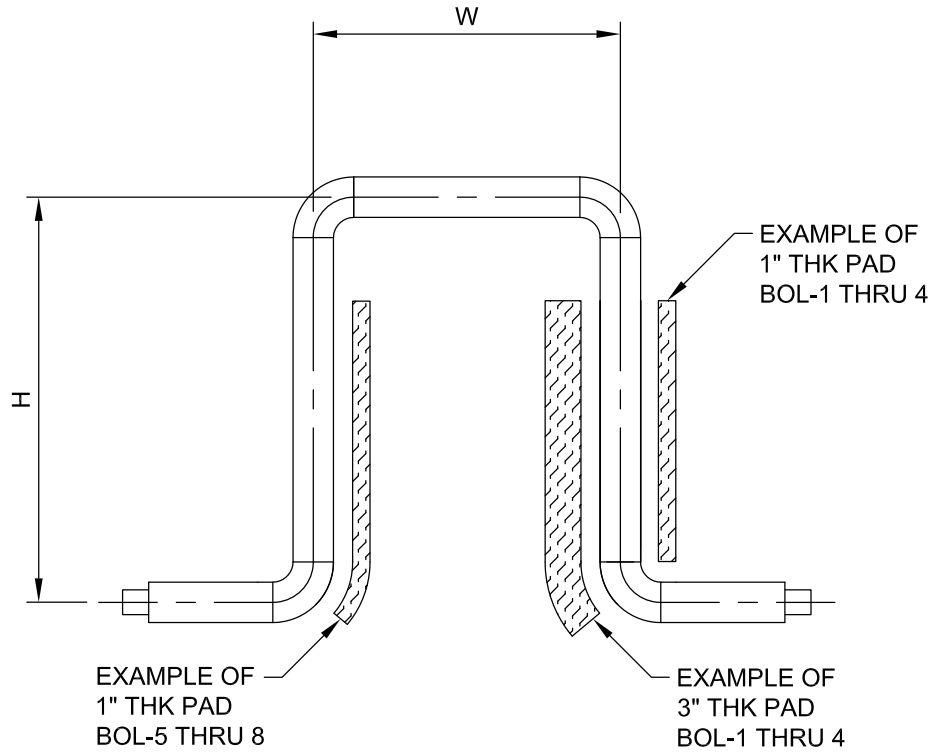
JACKET SIZE (OD)	PAD HEIGHTS	DUAL PADS	SINGLE PADS
JACKET OD < 10"	7"	BOL-1	BOL-5
10" ≤ JACKET OD < 16"	13"	BOL-2	BOL-6
16" ≤ JACKET OD < 22"	17"	BOL-3	BOL-7
JACKET OD ≥ 22"	25"	BOL-4	BOL-8

* NOTE:
DUCT TAPE TO BE 1'-0" ON CENTERS.



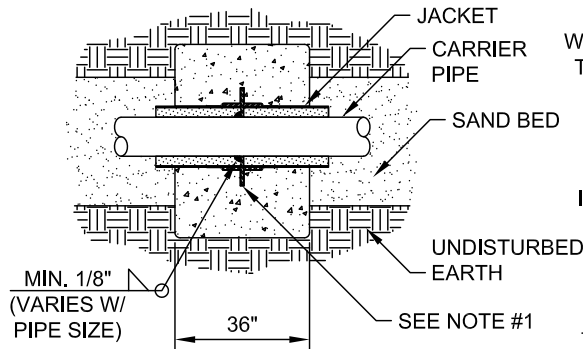
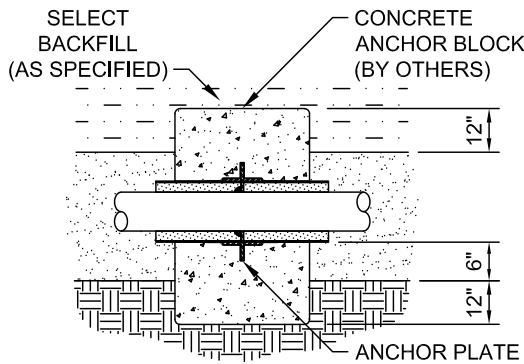
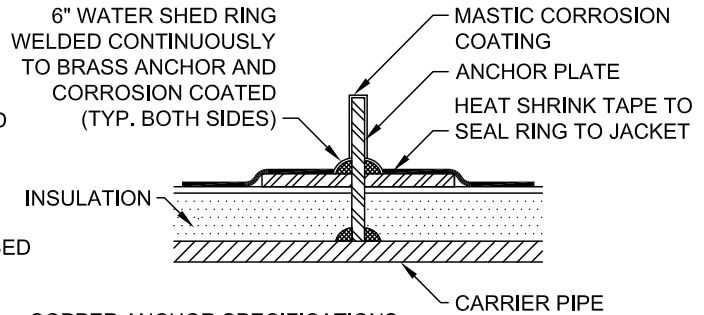
BOLSTER PAD DETAIL

SCALE: NONE



EXPANSION LOOP DETAIL

SCALE: NONE


TOP VIEW

SIDE VIEW

COPPER ANCHOR SPECIFICATIONS

1. BRASS ANCHOR PLATE AND WELDED RINGS FURNISHED BY THERMACOR. ANCHOR PLATE SHALL MEET ASTM A36 AND ON ALL SIZES SHALL BE A MINIMUM 1/4" THICK. ANCHOR PLATE SHALL EXTEND 2-1/2" BEYOND THE CASING DIAMETER ON ALL SIDES. ANCHOR PLATE SHALL BE CORROSION COATED WITH A MASTIC MATERIAL AFTER WATERSHED RINGS HAVE BEEN SEALED TO CASING BY HEAT SHRINK TAPE.
2. ANCHOR ASSEMBLY SHALL BE POURED IN A CONCRETE BLOCK BY THE CONTRACTOR IN THE FIELD. (MINIMUM 3000 psi) GENERALLY, THE ANCHOR BLOCK EXTENDS A MINIMUM OF 12" IN ALL DIRECTIONS BEYOND THE ANCHOR O.D. AND HAS A OVERALL LENGTH OF 36". THE JOB SITE CONDITIONS SHALL BE THE FINAL DETERMINING FACTOR FOR ANCHOR BLOCK SIZING.
3. DEPENDING ON ANCHOR BLOCK SIZE, STEEL REINFORCEMENT BARS MAY BE REQUIRED.

NOTE:

IT IS THE RESPONSIBILITY OF THE **ENGINEER OF RECORD** TO DESIGN THE ANCHOR BLOCKS APPROPRIATELY.

ANCHOR DETAIL

SCALE: NONE

