Pre-insulated HDPE-Jacketed Steel Piping Systems *suitable for Steam, Condensate Return, and High Temperature Heating Water.*

Part 1 - General

1.1 Pre-insulated Piping - Furnish a complete HDPE jacketed system of factory pre-insulated steel piping for the specified service. The jacket throughout the entire system shall incorporate electric fusion, butt fusion, or extrusion welding at all HDPE fittings, joint closures, or other points of connection. This shall create a jacket that is seamless throughout the entire system with the exception of anchors, whose water shed rings are sealed with a Canusa GTS-65 or WLNN wrap, prohibiting the ingression of water. All pre-insulated pipe, fittings, insulating materials, and technical support shall be provided by the Pre-insulated Piping System manufacturer.

1.2 A complete layout of the system, showing anchors, expansion provisions, and building entrance details, shall be provided by the pre-insulated pipe manufacturer. Means for expansion must be made in pipe offsets or loops.

1.3 The system shall be **HT-406** as manufactured by **Thermacor Process Inc.** of Fort Worth, Texas, or prior approved equal.

Part 2 - Products

2.1 Carrier pipe shall be steel ASTM A-53, Grade B**,** ERW (Type E) or seamless (Type S), standard weight for sizes 2" and larger, and shall be ASTM A-106, Grade B, standard weight for sizes 1-1/2" and smaller (Std. Wt. is the same as Sch. 40 through 10"). Condensate return piping shall be extra strong (XS is the same as Sch. 80 through 8"). When practical, piping shall be provided in 40-foot double-random lengths. All carbon steel pipe shall have ends cut square and beveled for butt-welding. Straight sections of factory insulated pipe shall have 6" of exposed pipe at each end for field joint fabrication.

2.2 Insulation shall be polyisocyanurate foam insulation bonded to both the jacketing and carrier pipe and either spray applied or high pressure injected with one shot into the annular space between carrier pipe and jacket with a minimum thickness of 2-1/2" for systems operating at or below 366°F. Insulation shall be rigid, 85% closed cell foam insulation with not less than 2.4 pounds per cubic foot density, having a compressive strength of not less than 30 psi @ 75°F and a coefficient of thermal conductivity (K-Factor) not higher than 0.17 @ 75°F and 0.30 @ 366°F. Maximum operating temperature of the system shall not exceed 366°F.

2.3 Water Stops: Thermacor's HT 406 product with operation temperatures above 212°F shall come standard with a patented water stop system. At each spool piece and length of pipe, a steel disk shall be welded to the carrier pipe and extend into the high temperature foam, embedded between the foam insulation and HDPE jacket. The longitudinal length of the water stop will be determined by Thermacor based on project design conditions to sufficiently dissipate the heat from the carrier pipe protecting the integrity of the high temperature insulation. The water stop shall have been tested and proved to contain for a period of at minimum 5 months the spread of groundwater that is capable of flashing to steam when in contact with the hot carrier pipe. This spread of moisture shall be contained in the immediate area of a field joint and not allowed to spread further.

2.4 Jacketing material shall be extruded, black, high density polyethylene (HDPE), having a minimum wall thickness of 125 mils for jacket sizes less than or equal to 12", 150 mils for jacket sizes greater than 12" to 20", and 175 mils for jacket sizes larger than 20". The jacket throughout the entire system shall incorporate electric fusion, butt fusion, or extrusion welding at all HDPE fittings, joint closures, or other points of connection. This shall create a jacket that is seamless throughout the entire system with the exception of anchors, whose water shed rings are sealed with a Canusa GTS-65 or WLNN wrap, prohibiting the ingression of water. The inner surface of the HDPE jacket shall be oxidized by means of corona treatment, flame treatment (patent pending), or other approved methods. This will ensure a secure bond between the jacket and foam insulation.

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2.5 Straight run joints are insulated using high temperature foam to the thickness specified and jacketed with a pressure testable joint closure, either an electro-fusion welded split sleeve HDPE joint closure, Canusa Supercase, or Raychem Rayjoint. No joints will be made unless the person(s) making the joint have been trained by a factory representative. The joint will be pressure tested at 5 psi for 5 minutes while simultaneously soap tested at the joint closure's seams for possible leaks. After passing the pressure test, the field joint is insulated and closure patches are welded (as per specified joint closure instructions) over the foaming holes. All joint closures and insulation shall occur at straight sections of pipe. A log will be made showing who made the joint, the amount of time for the fusion, and that the joint was inspected. **This is a permanent record and will be furnished as a close-out document.**

2.6 Terminations inside of manholes shall have a corrosion coated steel sleeve protecting the foam. This steel sleeve shall be fillet welded onto the carrier pipe and come up and extend back on the jacket a distance of 16". A high temperature shrink sleeve 4" wide shall be used to seal the steel sleeve to the HDPE jacket. The pipe shall penetrate the manhole a distance of 9", the first 6" is exposed pipe, followed by the 16" steel sleeve, then the 2" overlap of the heat shrink sleeve, and finally 1" of bare jacket just before the inside of the manhole wall.

2.7 Fittings are factory pre-fabricated and pre-insulated with polyisocyanurate to the thickness specified and jacketed with a one piece seamless molded HDPE fitting cover, a butt fusion welded, or an extrusion welded and mitered HDPE jacket. **NO TAPING OR HOT AIR WELDING SHALL BE ALLOWED**. All fitting jackets/covers shall be connected to the straight lengths of pipe by electro-fusion, butt fusion, or extrusion welding. Carrier pipe fittings shall be butt-welded, except for sizes smaller than 2", which shall be socket-welded. Fittings include expansion loops, elbows, tees, reducers, and anchors. Elbows, loops, offsets, or any other direction changes shall conform to the standards set by ASME B31.1, Code for Power Piping.

2.8 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. Flexible expansion pads shall be utilized for external expansion compensation on all fittings having expansion in excess of 1/2". Expansion pads shall be a minimum one inch thick and shall extend to cover both the inside and outside radius of the fittings. Anchors shall be 1/2" thick steel plates welded to the carrier pipe and shall incorporate a steel water shed ring, sized to allow the jacket to slide underneath, that shall be sealed to the HDPE jacket with a Canusa GTS-65 or WLNN wrap. Anchors are located per manufacturer's recommendations.

2.9 The ERM Leak Detection System is a mandatory requirement for all HT- 406 systems operating above 250°F. The ERM system consists of a copper wire embedded in the foam of each piece of pre-insulated pipe and fittings. The piping system manufacturer shall install the wire in a manner that prevents touching the steel carrier pipe. The contractor shall connect the wire together at each field joint with a recommended crimping tool. After crimping the wire at a joint, the contractor shall check the joined pieces for continuity of the wire and electrical isolation from the carrier pipe by use of a standard analog ohmmeter. This check shall be repeated after each crimp, until the entire system is connected. After the piping system is installed, the owner at any time may check the system for a leak by using a standard analog ohmmeter. If a leak is detected (a leak is signaled by a drastic drop in the electrical resistance of the circuit), the panel will alarm, and the owner should contact the system manufacturer for a TDR instrument to determine the location of the leak. One or more alarm panels are furnished with each ERM system, designed to monitor up to 2000', which will provide continuous leak detection monitoring.

No warranty will be issued until the PTC & ERM Log Sheets are completed and returned to the manufacturer.

(Continued)

Part 3 - Execution

3.1 Pre-engineered systems shall be provided with all straight pipe and fittings factory pre-insulated and pre-fabricated to job dimensions.

3.2 Underground systems shall be buried in a trench 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 placed 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 is required and will be provided by a certified manufacturer's representative or company field service technician. The technician will be available at the job a minimum of one day (or more if required by job size) to check unloading, storing, and handling of pipe, pipe installation, pressure testing, field joint insulation, and backfilling techniques.

3.6 A Final ERM Panel Test is required with the owner's representative present, along with the contractor and the Thermacor field service representative.

THERMACOR

HT-406
Specification Guide

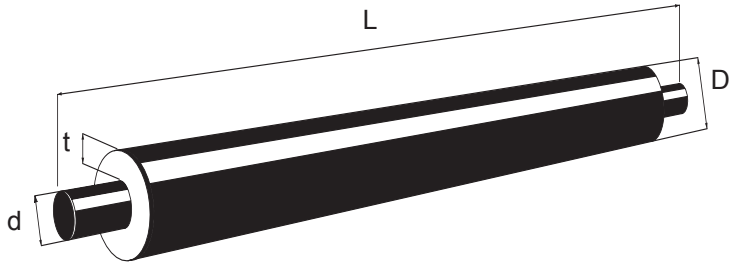
POLYISOCYANURATE FOAM IN HDPE JACKET

HTSG
2.104
1.14.11

Carrier Pipe:
d ≥ 2" - A53 ERW Grade B, Std. Wt. Black Steel
d < 2" - A106 SML, Std. Wt. Black Steel
- Seamless and Schedule 80 pipe available for all sizes
- Std. Wt. is the same as Schedule 40 for all sizes thru 10"
- XS is the same as Schedule 80 for all sizes thru 8"

Jacketing Material:
High Density Polyethylene (HDPE)

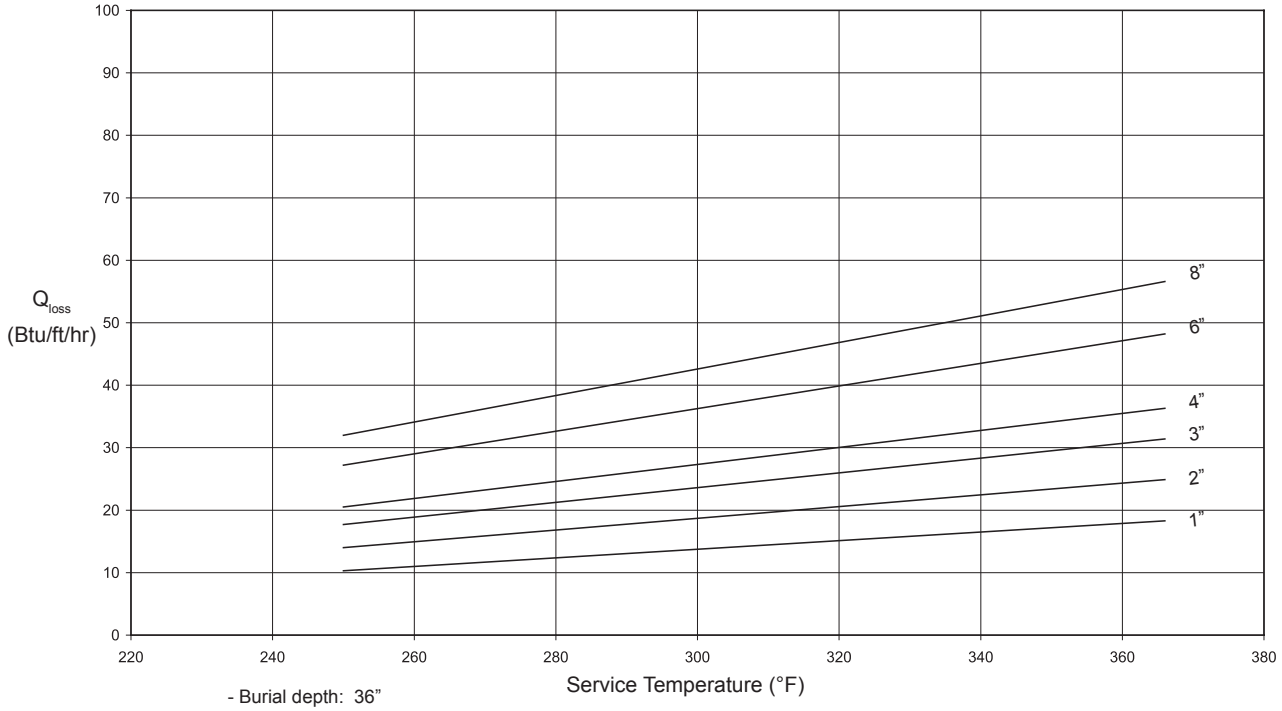
Insulation:
Polyisocyanurate Foam



Pipe Size	Jacket Size	Standard Length L	Insulation Thickness t	External Diameter D	Weight Per Foot (lbs.)
1/2" IPS	6.7"	20'	2.77"	6.68"	2.93
3/4" IPS	6.7"	20'	2.67"	6.68"	3.21
1" IPS	6.7"	20'	2.53"	6.68"	3.74
1-1/4" IPS	8.7"	20'	3.36"	8.68"	5.29
1-1/2" IPS	8.7"	20'	3.24"	8.68"	5.72
2" IPS	8.7"	40'	3.00"	8.68"	6.62
2-1/2" IPS	8.7"	40'	2.75"	8.68"	8.71
3" IPS	8.7"	40'	2.50"	8.68"	12.00
4" IPS	10.9"	40'	3.03"	10.85"	15.06
5" IPS	10.9"	40'	2.49"	10.85"	18.68
6" IPS	12.9"	40'	2.96"	12.85"	23.96
8" IPS	14.1"	40'	2.55"	14.13"	34.49
10" IPS	16.1"	40'	2.50"	16.14"	47.82
12" IPS	18.2"	40'	2.54"	18.23"	57.97
14" IPS	20.3"	40'	2.94"	20.28"	65.70

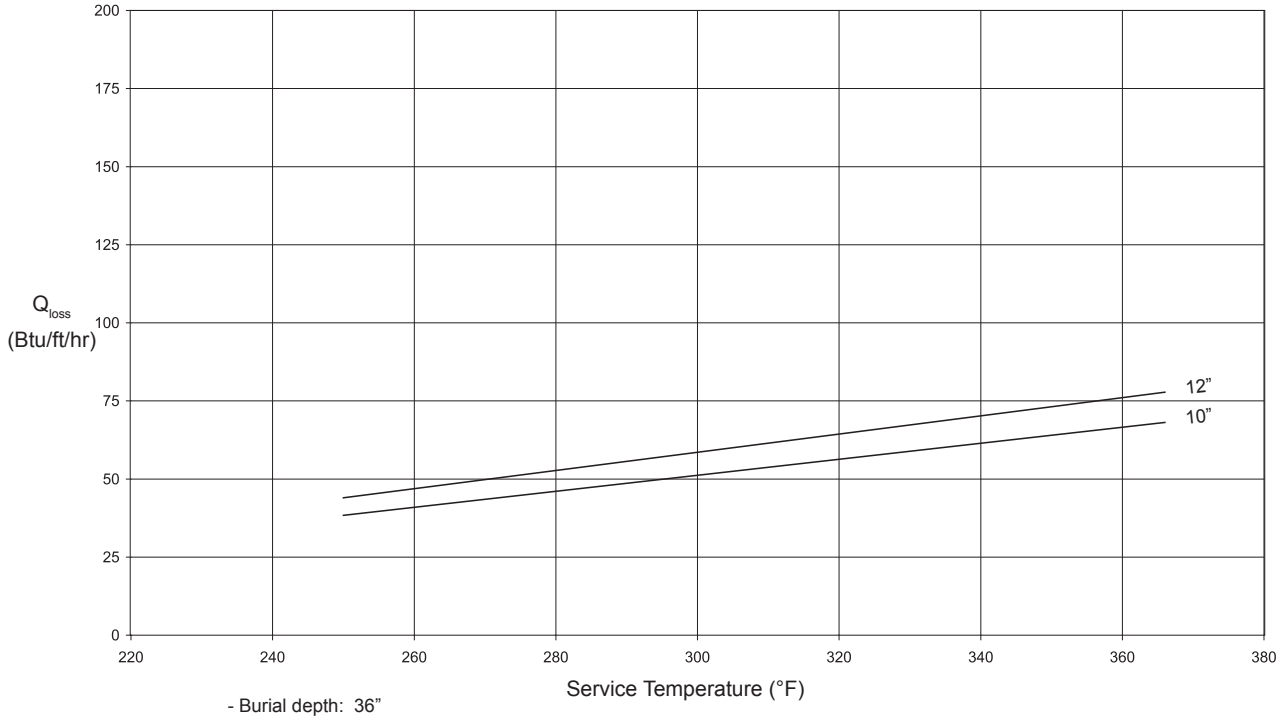
* Other pipe sizes and pipe and jacket combinations are available.
** Insulation thickness is calculated using minimum wall thickness. Actual wall thickness may be greater than stated, thereby minimally decreasing actual foam thickness.

HEAT LOSS FOR 3” OF POLYISOCYANURATE FOAM*



- Burial depth: 36”
- Soil conductivity: 12 (Btu/h.ft^2.°F/ft)
- Soil temperature: 50°F

HEAT LOSS FOR 3” OF POLYISOCYANURATE FOAM*



- Burial depth: 36”
- Soil conductivity: 12 (Btu/h.ft^2.°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.