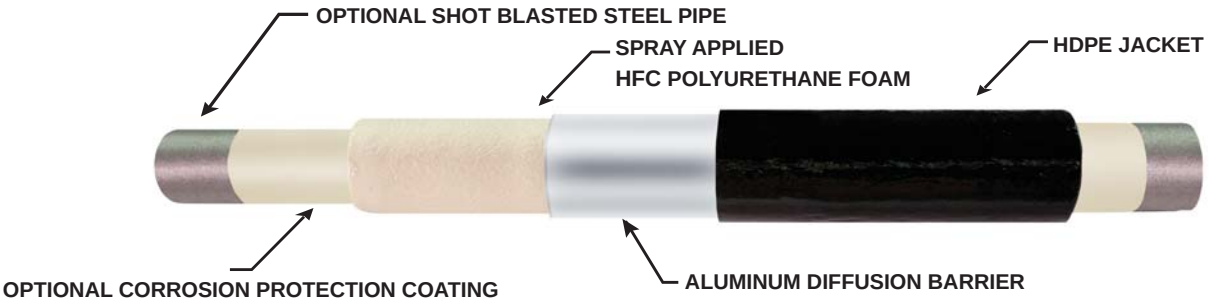
XTRU-THERM PLUS

The Energy Saving Green Pipe

The greenest piping system available for the distribution of hot and chilled water.

PERMA-PIPE® *"SOLUTIONS FOR A GREENER ENVIROMENT."*

GREEN FOAM = GREEN PRODUCT = GREEN ENVIRONMENT



GREEN FOAM

PERMA-PIPE's spray process for applying polyurethane foam results in the most uniform cell structure and therefore the lowest possible insulating value (K). Our blowing agent is an HFC which has no ozone depleting chemicals. Green foam with the lowest K value results in the lowest heat loss and the most energy efficient piping system.

ANTI-AGING

Don't be fooled by initial K factor. Polyurethane foam ages as the blowing agent diffuses out of the cells and through the outer HDPE jacket. The blowing agent is replaced by air which diffuses into the foam and raises the K value. The graph below shows the difference between non-aging foam and aged foam.

PERMA-PIPE's spray process allows us to add an aluminum diffusion barrier on the foam before application of the outer HDPE jacket. This metallic barrier prevents diffusion of the blowing agent and results in an improved long term thermal efficiency of over 30%.

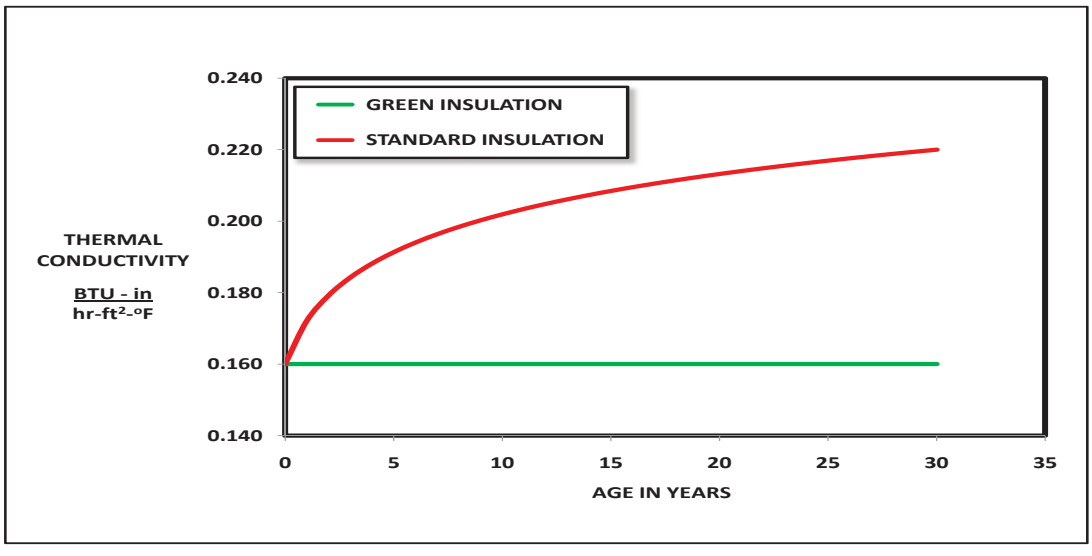
GREENER THAN NATURE

PERMA-PIPE's energy efficient piping results in lower Btu losses and thus fuel savings. Fuel savings means less carbon dioxide released into the atmosphere. It is estimated that one mature tree can absorb about 50 pounds of CO_2 per year.

Using an example of 300 feet of underground 8 inch hot water pipe, operating at 200°F and insulated with 2 inches of polyurethane foam, we find the following:

Pipe with aged foam: heat loss is 12,600 Btu/Hr which equals 18,396 CO_2 lb/yr.
Pipe with non-aged foam: heat loss is 9,900 Btu/Hr which equals 14,454 CO_2 lb/yr.

In this one example, just 300 feet of hot water piping insulated with PERMA-PIPE's XTRU-THERM® PLUS instead of standard polyurethane insulation is equivalent to planting 78 trees.



XTRU-THERM® PLUS FEATURES

Optional Corrosion Protection Coating
Seamless Extruded HDPE Jacket
Low Thermal Conductivity Polyurethane Insulation
Insulation Thickness to Meet Application Needs
Fully Bonded Jacket / Diffusion Barrier Insulation / Service Pipe System
Pre-engineered Components

After being approached by some of the world's most prominent LEED Engineering and Design firms, PERMA-PIPE is proud to present our latest product development suited for your LEED project specifications.

Our part of "Sustainable Energy" is "Energy Efficiency". PERMA-PIPE brings XTRU-THERM® PLUS to the energy infrastructure market as a product that can deliver longevity in service life and sustained energy efficiency while helping to reduce the CO_2 emissions from your district heating or cooling plant. This results in greater life cycle cost efficiency and a Greener environment.

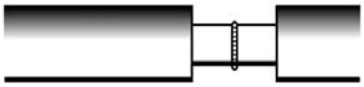
FULLY ENGINEERED
The XTRU-THERM® PLUS piping system is completely engineered by PERMA-PIPE's experienced engineering staff. Straight lengths, elbows, tees, anchors and end seals are all pre-engineered components.

Thermal stress and displacement, heat loss/gain, soil loading calculations and layout drawings can be provided. The XTRU-THERM® PLUS system is engineered to reduce field costs by providing factory fabricated fittings and components to reduce field connections, as compared to the field kit method.

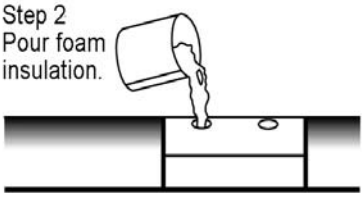
FULLY BONDED SYSTEM
PERMA-PIPE treats the HDPE jacket so that it bonds to the polyurethane foam insulation. This bonding, along with the insulation bond to the service pipe, results in a completely bonded system. All components expand and contract as a system. There are no gaps for water to travel through, which can degrade the insulation or service pipe.

FIELD JOINT CLOSURE

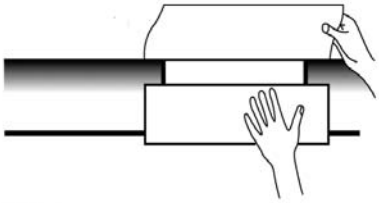
Step 1
Complete service pipe joint.



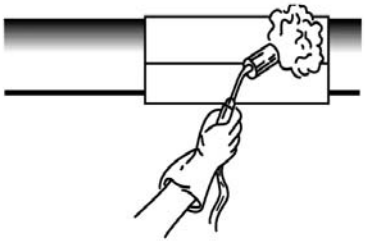
Step 2
Pour foam insulation.

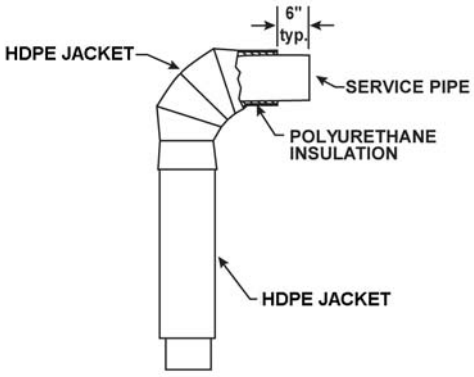


Step 3
Wrap shrink sleeve around field joint area after applying diffusion barrier.

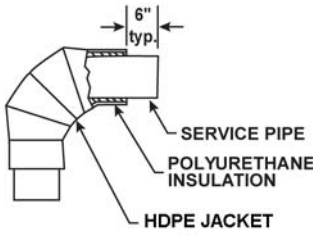


Step 4
Shrink sleeve using propane torch.

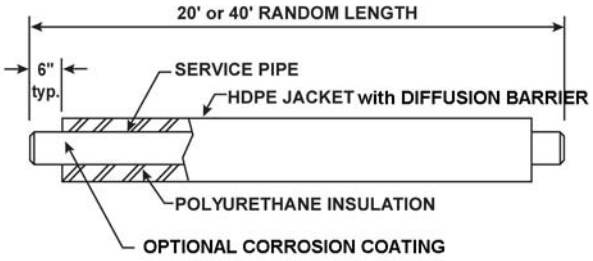




90° ELBOW WITH EXPANSION LEG FOR EXPANSION LOOPS



STANDARD 90° ELBOW FOR DIRECTION CHANGES



STRAIGHT STANDARD LENGTH

SPECIFICATION GUIDE

GENERAL

All underground and aboveground chilled water, condensate return and hot water lines shall be XTRU-THERM® PLUS, as manufactured by PERMA-PIPE. All straight sections, fittings, anchors and other accessories shall be factory fabricated, insulated and jacketed. Field insulation of fittings shall not be allowed. The piping system layout shall be analyzed by the piping system manufacturer, to determine the stresses and displacements of the service pipe. The piping system design and manufacture shall be in strict conformance with ASME B31.1, latest edition. Installation of the piping system shall be in accordance with the manufacturer's instructions.

SERVICE PIPE

The service pipe shall be standard weight ASTM A53 Gr. B, ERW carbon steel, except for condensate return lines, which shall be Schedule 80. All joints shall be butt welded for 2.5 inches and larger, and socket welded for 2 inches and smaller. Where possible, straight sections shall be supplied in 40 foot random lengths, with piping exposed at each end for field joint fabrication.

SERVICE PIPE COATING

The exterior steel pipe surface shall be abrasive blast-cleaned to a minimum of a near white surface, SSPC-SP10-63T. Profile must be a minimum of 1.5 mil peak to valley range. Any areas of rust bloom or oil shall be wiped and reblasted.

After blasting, the steel service pipe shall be coated with (choose one option) (Epoxy) (Urethane Elastomer) (Zinc)

The epoxy coating shall be a two part coating consisting of a base material and curing agent spray applied to a minimum thickness of 8-12 mil. The coated pipe shall be holiday tested at 1,000 volts to ensure a void free coating. Areas of the conduit not passing the holiday test shall be patch coated and retested.

The urethane elastomer coating shall be a sprayable two component, aromatic, corrosion protection elastomeric coating applied to a minimum thickness of 20 mil. The coated pipe shall be holiday tested at 2,500 volts to ensure a void free coating. Areas of the pipe not passing the holiday test shall be patch coated and retested.

The zinc coating shall be a high solids inorganic zinc rich coating that protects the steel galvanically, thus eliminating subfilm corrosion. The zinc coating shall be a two part sprayable coating consisting of a liquid base portion and a dry powdered metal. The two components when mixed together can be spray applied. The dry film thickness shall be in a range of 2 to 4 mil.

INSULATION

The service pipe insulation shall be polyurethane foam with 2 lb/ft^3 minimum density, 90% minimum closed cell content and average initial thermal conductivity of 0.16 Btu-in/hr-ft^2-°F. The insulation shall completely fill the annular space between the service pipe and jacket and shall be bonded to both. Systems using open cell insulation or a nonbonded design shall not be allowed. The insulation shall be provided to the minimum thickness specified below:

Pipe Size (in)	Insulation Thickness (in)	
	Chilled Water - Hot Water	
1 - 8	1	1
10 - 12	1	1.5
14 - 36	1.5	2

DIFFUSION BARRIER

An aluminum diffusion barrier shall be applied on the outside of the insulation before application of the outer jacket. The barrier shall prevent the diffusion of the blowing agent out of the foam to prevent the foam from aging.

INSULATION JACKET

The outer protective insulation jacket shall be seamless high density polyethylene (HDPE) in accordance with ASTM D3350 minimum cell classification PE 345444 C. PVC or tape materials are not allowed. The thickness of the HDPE jacket shall be as follows:

Jacket OD (in)	Jacket Thickness (in)
OD ≤ 12	.100
12 < OD ≤ 24	.125
OD > 24	.150

ACCESSORIES

Elbows, tees, reducers, anchors, field joints and end seals shall be designed and factory fabricated to prevent the ingress of moisture into the system.

FITTINGS

All fittings shall be factory prefabricated and pre-insulated. Straight tangent lengths shall be added to all ends, so that all field joints are at straight sections of pipe. Elbow insulation jackets shall be molded HDPE. Tee insulation jackets shall be extrusion welded or butt fusion welded HDPE. Gluing, taping or hot air welding of the insulation jacket shall not be allowed.

FIELD JOINTS

The service pipe shall be hydrostatically tested to 150 psig or 1.5 times the design pressure whichever is greater. Insulation shall then be poured in place into the field joint area. All field applied insulation shall be placed only in straight sections of pipe. An aluminum diffusion barrier shall then be wrapped around the insulation. Field insulation of fittings is not acceptable. The installer shall seal the field joint area with a heat shrinkable adhesive backed sleeve. Backfilling shall not begin until the heat shrink sleeve has cooled. All insulation and jacketing materials for the field joint shall be furnished by PERMA-PIPE.

PERMA-PIPE®

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