



Design Standard

Underground Piping System Insulation

Uninsulated underground thermal piping systems experience significant energy losses to the soil over the course of their operating life. To minimize the heat gain/loss of these piping systems, Texas A&M University has chosen a mineral powder insulation system, similar to Gilsulate 500, as the Campus standard for insulating underground thermal lines. In addition to its insulating properties, this type of insulation system: 1) Is hydrophobic, 2) Has a high electrical resistivity preventing galvanic action between metal pipe and the soil, 3) Has good load bearing properties and 4) Is “green” since it’s made from minerals. Pre-insulated pipe is an acceptable alternative. All HHW thermal lines and CHW lines **12 inch and below** are required to be insulated.

Work Includes:

An underground piping insulation system must be provided to enclose and provide thermal and waterproofing protection for piping specified and shown on Plans, including but not limited to the following:

- Piping insulation including expansion units.
- Miscellaneous materials incidental to complete installation of insulated underground sections.
- Supervision of installation as specified.

Detailed specifications follow.

MINERAL POWDER INSULATION

PART 1 GENERAL

- 1.1 Insulating material which adheres to or becomes joined in any manner to piping during cycle of operation shall not be used.
- 1.2 Contractors are solely responsible to complete work for entire run of piping between points specified and shown on plans.
- 1.3 Adequate space and clearance with insulated underground piping system shall be provided to allow free movement of piping and avoid stress or abrasions to piping. No wood, masonry, metal, or any other abrasive pipe supports or guides, shall be left in contact with piping.
- 1.4 Provide fittings and accessories necessary and incidental to type of system selected.
- 1.5 Store materials and equipment on work site on wood platforms or members; stack and pile in substantial and safe manner so products will not easily dislodge while in storage.



- 1.6 Replace or repair wet or damaged insulation as directed by Engineer or product installation requirements.
- 1.7 Complete hydrostatic tests for all new lines. Perform hydrostatic leak test at 1.5 times maximum operating pressure to ensure piping system is free from leaks before application of field applied insulation and closures. See HDPE Piping Installation Design Standard for testing pressures and acceptance requirements. UES technical staff must be notified in advance of planned hydrostatic test and be present to witness the test. See pipe manufacturer's recommendations for testing procedures.
- 1.8 All parts of system to be intact, undamaged, and free from leaks before backfilling with insulation material. Upon completion of backfilling of insulation material, work must be approved by construction inspector and UES representative before final backfilling is performed. Piping or insulation installation that is deemed to be inadequate or incorrect by Engineer, construction inspector, or UES representative must be corrected to meet specifications prior to backfilling.

PART 2 EXCAVATION, FILLING & BACKFILLING

- 2.1 Final grading for setting pipe units to be performed immediately prior to setting units or concrete supporting pad in trenches; backfilling around completed insulated system to be under direction of supervisor for installation of insulated underground system.
- 2.2 Restore all finished grades and improvements as detailed.

PART 3 TYPE OF CONSTRUCTION

- 3.1 The system for insulating pipes shall keep water and moisture from pipes.
- 3.2 Type of material and construction: The insulation shall be a dry, free flowing granular product formulated from selected inert, inorganic materials. It shall be non-toxic, non-flammable, and completely free of asbestos. It shall require no mixing prior to installation, and no curing. It shall be completely compatible with all materials typically used for piping in the service temperature range of +35°F to +230°F. It shall be of sufficient density so any stones or rocks inadvertently falling on insulation will not penetrate or migrate into or through insulation during placement and back-filling operations.
- 3.3 The insulation shall be composed of granular particles that cohesively bond with each other to form a closed cell compacted mass that effectively isolates pipe surfaces from air, water, moisture and chemicals. The granules shall be surface treated to render it hydrophobic. The compacted insulation shall be capable of withstanding up to 12,000 psf (58,000 kg/M²) at the manufacturer's recommended density.
- 3.4 The insulation shall have a thermal coefficient of heat conductivity (K factor) of no more than 0.60 BTU/hr. /ft²/°F/in. at manufacturer's recommended use density and a mean temperature of 175°F and 0.65 at a mean temperature of 300°F by the guarded hot plate method of ASTM C-277. If an insulation with higher thermal conductivity is proposed, bidding shall be based on the equivalent amount of insulation required to minimize heat



loss/gain to that which would result with the thermal conductivities specified in the proceeding sentence. See Figure No. 1 for required insulation envelope dimensions.

- 3.5 Electrical resistivity of the insulation shall be greater than 10^{12} Ohm-cm.
- 3.6 The insulation shall be mineral powder with characteristics as described above similar to GILSULATE 500 as manufactured by American Thermal Products Inc.
- 3.7 The system shall be installed according to the published recommendations of the insulation manufacturer. The installer shall consult with and arrange for field assistance from the manufacturer's representative prior to placement of the insulation system. Pipes, anchors-guides and expansion shall be in compliance with the recommendations of the insulation manufacturer or as shown on plans and specifications. Backfilling operations shall be performed according to HDPE Piping Installation Design Standard.

PART 4 PLACING MATERIALS

- 4.1 Insulation materials used must be capable of being placed and consolidated to prescribed density prior to any backfilling operation. Use of backfill to provide compaction of the material is not acceptable.
- 4.2 Installation Sequence: (Refer to Insulation Manufacturer's Installation Sequence and notes.)
- 4.3 Excavate trench as near as possible to the required width of piping and insulation and pile backfill all on one side. Install pipes with required guides, supports, and anchors as shown on drawings and specifications. Perform pressure testing.
- 4.4 Grade and compact trench under pipes leaving required space for specified thickness of insulation. Clean any dirt or debris off pipes.
- 4.5 Precut gypsum board with attached spacers on the exterior may be driven into place. Horizontal spacers are used to determine envelope width. Leave forming in place. Forms are held away from pipes by temporary spacers which must be removed as insulation is installed and consolidated. Side forms must not extend above the finished consolidated insulation level of the envelope.
- 4.6 Provide compact sand or clean backfill behind the forms to pipe height.
- 4.7 All standing water shall be removed prior to placing insulation.
- 4.8 To minimize dust, empty the bags near pipes with as little "free fall" as possible. Fill trench to mid pipe height and consolidate. Remove spacers and temporary supports as work progresses.
- 4.9 Add additional layers of insulation and consolidate to specified thickness and density. A rod type concrete vibrator with a $1\frac{1}{2}$ - 2" diameter head is the best and quickest means of consolidating insulation. Insert the head of the vibrator and pull along slowly.



- 4.10 Walk on the consolidated insulation envelope to insure proper density, footprints of approximately 1" deep or less are expected. Insulation coverage shall be according to insulation manufacturer recommendations or as shown on Plans.
- 4.11 An additional 2" of insulation is required over pipes in areas passing under streets or parking.
- 4.12 Complete compaction of sand backfill behind forms. Place a layer of flattened empty bags on top of the insulation envelope. Walk on top of the bags and hand place 6" clean backfill on top of empty bags to protect against damage in case of storms. Complete backfilling to grade level as specified under HDPE Piping Installation as soon as possible. Provide a minimum of 12" earth backfill.

PART 5 GUARANTEE

- 5.1 Contractor shall guarantee installation of insulating system for a period of one (1) year from date of acceptance by Owner against deterioration of insulating value, compaction or water leakage under normal operation conditions. Contractor, however, shall not be responsible for damage or failure of system due to damage caused by other parties.

PRE-INSULATED PIPE INSULATION

PART 1 GENERAL

- 1.1 For underground thermal lines furnish a complete HDPE jacketed system of factory pre-insulated piping for the specified service. The jacket throughout the entire system shall incorporate electric fusion, butt fusion, or extrusion welding at all 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 double lap Raychem Dirax, Canusa GTS-65, or WLNN wrap prohibiting the ingress of water.
- 1.2 All pre-insulated pipe, fittings, insulating materials and support shall be provided by the pre-insulated piping system manufacturer.

PART 2 PRODUCTS

- 2.1 Insulation shall be polyurethane foam either spray applied or injected with one shot into the annular space between carrier pipe and jacket and shall be bonded to both. Insulation shall be rigid, minimum 90% closed cell polyurethane with a minimum of 2.0 lbs per cubic foot density, compressive strength of 30 psi @ 75 degrees F, and coefficient of thermal conductivity (K-Factor) not higher than 0.16 @ 75 degrees F per ASTM C-518. Maximum operating temperature of urethane shall not exceed 250 degrees F. Polyurethane foam shall be CFC free. CHW lines 12" and below shall have 1" of insulation. HHW lines shall have 2-1/2" of insulation.
- 2.2 Jacketing material shall be extruded, black, high density polyethylene (HDPE) having a minimum wall thickness not less than 100 mils for pipe sizes less than or equal to 12",



125 mils for pipe sizes greater than 12" to 24" and 150 mils for pipe sizes greater than 24". No FRP, HDUP or tape jacket allowed. The inner surface of the HDPE jacket shall be oxidized by means of corona treatment or other approved methods. This will ensure a secure bond between the jacket and foam insulation preventing any ingress of water at the jacket/foam interface.

- 2.3** Straight run joints are insulated with flex foam to allow for expansion and contraction of the gasket joint. Straight field joints shall be covered with an HDPE split sleeve and sealed with a heat shrink sleeve to prevent the ingress of moisture or debris.
- 2.4** Any deviations from the requirements of this design standard must be approved by the UES Manager for Engineering and Project Management.