SECTION 232113.33 - GROUND-LOOP HEAT-PUMP PIPING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section includes piping for [**horizontal] [vertical**], direct-buried, ground-loop, heat-pump systems.
			2. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.

Pipe and fittings.

Joining method and equipment.

Retain subparagraph below for climates and piping placement that require freeze protection.

Propylene glycol solution.

* + - * 1. Field quality-control reports.
				2. Borehole backfilling and drilling operations reports.
				3. Dimensioned site layout.
				4. Startup performance results.
1. PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products.

* + - 1. PIPES AND FITTINGS

See Evaluations for discussion on various pipe materials.

* + - * 1. HDPE Pipe: ASTM D3035.
				2. Molded PE Fittings: ASTM D2683 or ASTM D3261, ASTM F1055 PE resin, socket, butt-fusion or electro-fusion type, made to match PE pipe dimensions and class.
				3. U-Bend Assembly: Factory fabricated with embossed depth stamp every [**24 inches] [36 inches] <Insert dimension**> from U-bend.

Revise pressure ratings in "Ground-Loop, Heat-Pump Piping Minimum Working Pressure" paragraph below to suit Project. Coordinate with Section 238146.13 "Water-to-Air Heat Pumps."

* + - * 1. Ground-Loop, Heat-Pump Piping Minimum Working Pressure: [**160 psig] [200 psig] <Insert value**>.
				2. Ground-Loop, Heat-Pump Piping Operating Temperature: Between 23 and 104 deg F.
			1. BOREHOLE BACKFILL

Retain this article only for boreholes.

* + - * 1. Seal Material: Bentonite clay with thermal conductivity greater than 1.07 Btu/h x sq. ft. x deg F according to ASTM D5334.
				2. Permeability: Not more than 1 nm/s according to ASTM D5084
			1. ANTIFREEZE SOLUTION

Retain this article if piping is exposed to freezing temperatures.

* + - * 1. Propylene Glycol: Minimum 99 percent propylene glycol with corrosion inhibitors and environmental stabilizer additives to be mixed with water to protect piping circuit and connected equipment from physical damage caused by freezing or corrosion.
				2. Quantity: Sufficient solution for initial system startup and for preventive maintenance for one year from date of Substantial Completion.
				3. Dilution Water: Chloride content shall be less than 25 ppm, sulfate content less than 25 ppm, and hardness less than 100 ppm.
1. EXECUTION
	* + 1. HORIZONTAL PIPING INSTALLATION
				1. Separate trenches by 10 feet minimum unless otherwise indicated. Remove rocks in trenches that could contact pipe.
				2. Backfill

Retain first paragraph below if installing pipe in body of water; otherwise, delete.

* + - * 1. Extend pipe from trench onto bottom of body of water at an elevation that is at least 12 inches below frost line. Seal membrane or impervious liner under body of water after installing piping.
				2. Install HDPE piping in trenches according to ASTM D2774 or ASTM F645.

Clean HDPE pipe and fittings and make heat-fusion joints according to ASTM D2657. Minimize number of joints.

* + - * 1. Purge, flush, and pressure test piping before backfilling trenches.
				2. Install continuous detectable warning tape for underground piping. Locate tape a minimum of [**24 inches] <Insert dimension**> below finished grade, directly over piping.
			1. VERTICAL PIPING INSTALLATION

Retain this article if Project includes vertical piping in boreholes.

* + - * 1. Install HDPE piping in boreholes according to ASTM D2774 or ASTM F645.

Clean HDPE pipe and fittings and make heat-fusion joints according to ASTM D2657. Minimize number of joints.

* + - * 1. Purge, flush, and pressure test piping before backfilling boreholes.
				2. Completely fill the borehole from bottom to top with backfill material.
				3. Install the header piping 4 to 6 inches deep and install the horizontal piping from the header to the boreholes.
				4. Extend the horizontal piping and connect to ground-loop heat-pump piping systems at outside face of building wall in locations and pipe sizes indicated.

Terminate water-service piping at building wall until building ground-loop heat-pump piping systems are installed. Terminate piping with caps. Make connections to building ground-loop heat-pump piping systems when those systems are installed.

* + - * 1. Backfill the horizontal piping and header trenches.
				2. Fill the entire piping loop with water or antifreeze solution.
				3. Maintain records of backfilling on-site.
				4. Mark borehole locations, header pipes, and horizontal runs with metallic locator tape as specified in Section 230553 "Identification for HVAC Piping and Equipment."
				5. Seal penetrations through building walls.
				6. Wall sleeves are specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
				7. Mechanical sleeve seals are specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
			1. ANTIFREEZE SOLUTION FILL

Delete this article if using Section 232500 "HVAC Water Treatment."

* + - * 1. Fill system with required quantity of propylene glycol and water to provide [**minus 10 deg F] <Insert temperature**> freezing temperature.
				2. Test dilute solution using gas chromatography to verity concentration of propylene glycol, and forward report to Architect.
			1. CONNECTIONS

Coordinate piping installations and specialty arrangements with Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Drawings indicate general arrangement of piping, fittings, and specialties.
			1. FIELD QUALITY CONTROL
				1. Piping Tests: Fill piping 24 hours before testing and apply test pressure to stabilize piping. Use potable water only.
				2. Hydrostatic Tests: Test at not less than 1-1/2 times the pipe working-pressure rating or 300 percent of system design pressure, whichever is more[, **allowing for static pressure of borehole depth].**

Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 30 minutes. Slowly increase to next test pressure increment and hold for 30 minutes. After testing at maximum test pressure, reduce pressure to 30 psig. Hold for 90 minutes, and measure pressure at 30-minute intervals. Repair leaks and retest until no leaks exist.

Maintain a minimum pipe velocity of 24 in./s for a minimum of 15 minutes to remove all air.

* + - * 1. Prepare test and inspection reports.

END OF SECTION 232113.33