SECTION 23 21 14
GROUND-LOOP HEAT-PUMP PIPING

SPEC WRITER NOTES:
1. Use this section only for NCA projects.
2. Delete between // ---- // if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs.
3. References to pressure in this section are gage pressure unless otherwise noted.
4. The spec writer shall review the Physical Security Design Manual for VA Facilities to determine and include any Life Safety requirements called out.

PART 1 - GENERAL

1.1 DESCRIPTION
A. Ground source water piping to connect HVAC equipment: This Section includes piping for horizontal, vertical, direct-buried, ground-loop, heat-pump systems that operate between 23 and 104 deg F (minus 5 and plus 40 deg C).

1.2 RELATED WORK
A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. //Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for piping.//
D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
E. Section 23 21 23, HYDRONIC PUMPS: Pumps.
F. Section 23 07 11, HVAC AND PLUMBING INSULATION: Piping insulation.
G. Section 23 23 00, REFRIGERANT PIPING: Refrigerant piping and refrigerants.
H. Section 23 25 00, HVAC WATER TREATMENT: Water treatment for open and closed systems.
I. Section 23 21 13, HYDRONIC PIPING: Underground chilled water piping.
J. //Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Temperature and pressure sensors and valve operators.//

1.3 QUALITY ASSURANCE
A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC, which includes welding qualifications.
1.4 SUBMITTALS
A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Manufacturer's Literature and Data:
   1. Pipe and tubing, with specification, class or type, and schedule.
   2. Pipe fittings, including miscellaneous adapters and special fittings.
   3. Propylene glycol solution.
C. As-Built Piping Diagrams: Provide drawing as follows for ground source heat pump piping.
   1. One wall-mounted stick file with complete set of prints.
   2. One complete set of reproducible drawings.
   3. One complete set of drawings in electronic pdf format.

1.5 APPLICABLE PUBLICATIONS
A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. American Society for Testing and Materials (ASTM):
   ASTM D2239-03........Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
   ASTM D2683-04........Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled PE Pipe and Tubing

PART 2 - PRODUCTS
2.1 PIPE AND TUBING
A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.2 PIPE AND FITTINGS
A. PE Pipe: ASTM D 2239, SIDR Numbers 5.3, 7, 9, or 11.5; with PE compound number required to achieve //___// psig working pressure.
B. Molded PE Fittings: ASTM D 2683 or ASTM D 3261, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.
C. U-Bend Assembly: Factory fabricated with embossed depth stamp every 36 inches (900 mm) from U-bend.
2.3 BOREHOLE BACKFILL
A. Surface Seal: Cement with thermal conductivity greater than 1.2 Btu/h x sq. ft. x deg F (0.7 W/sq. m x K).
B. Backfill below Surface Seal with natural or manufactured sand.

2.4 ANTIFREEZE SOLUTION
A. Propylene Glycol: Minimum 99 percent propylene glycol with corrosion inhibitors and environmental stabilizer additives to be mixed with water to protect the piping circuit and connected equipment from physical damage from freezing or corrosion.
B. Quantity: Sufficient solution for initial system startup and for preventive maintenance for one year from date of Substantial Completion.
C. Dilution Water: Chloride content shall be less than 25 ppm, sulfate less than 25 ppm, and hardness less than 100 ppm.

PART 3 - EXECUTION

3.1 GENERAL
A. Excavating, trenching, warning tape, and backfilling are specified in Section 31 20 00 EARTH MOVING.

3.2 HORIZONTAL PIPING INSTALLATION
A. Separate trenches by 10 feet (3 m) minimum, unless otherwise indicated.
   Remove rocks in trenches that could contact pipe.
B. Backfill to 24 inches (600 mm) above pipe with mud developed from excavated rock-free soil or with sand, pea gravel, or fly ash.
   Backfill from slurry level to grade with excavated soil, compacting as specified for pipe burial in Section 31 20 00 EARTH MOVING.
C. Install PE piping in trenches according to ASTM D 2774 or ASTM F 645.
   1. Clean PE pipe and fittings and make heat-fusion joints according to ASTM D 2657. Minimize number of joints.
D. Purge, flush, and pressure test piping before backfilling trenches.
E. Install continuous detectable warning tape for underground piping.
   Locate tape a minimum of 24 inches (600 mm) below finished grade, directly over piping. Underground warning tapes are specified in Section 31 20 00 EARTH MOVING.

3.2 VERTICAL PIPING INSTALLATION
A. Install PE piping in boreholes according to ASTM D 2774 or ASTM F 645.
   1. Clean PE pipe and fittings and make heat-fusion joints according to ASTM D 2657. Minimize number of joints.
B. Purge, flush, and pressure test piping before backfilling boreholes.
C. After installation of loop pipe in borehole, fill piping loop with water or antifreeze solution, and pump backfill into borehole to discharge at base of borehole.

D. Fill borehole with backfill to a point at least 60 inches (1524 mm) below grade and backfill remainder with surface seal material.

E. Extend piping and connect to water-source, ground-loop, heat-pump piping systems at outside face of building wall in locations and pipe sizes indicated.

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

F. Wall sleeves are specified in Section 23 05 11 COMMON WORK RESULTS FOR HVAC.

3.3 ANTIFREEZE SOLUTION FILL

A. Fill system with required quantity of propylene glycol and water to provide minus 10 deg F (minus 23 deg C) freezing temperature.

B. Test the dilute solution using gas chromatography to verify concentration of propylene glycol, and forward report to RE/COTR.

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

3.5 FIELD QUALITY CONTROL

A. Piping Tests: Fill piping 24 hours before testing and apply test pressure to stabilize piping. Use potable water only.

B. Hydrostatic Tests: Test at not less than 1-1/2 times the pipe working-pressure rating allowing for static pressure of borehole depth.

1. Increase pressure in 50-psig (345-kPa) 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 (207 kPa). Hold for 90 minutes, and measure pressure at 30-minute intervals. Repair leaks and retest until no leaks exist.

C. Prepare reports of testing activity and submit to RE/COTR.

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