

University Contact: Energy & Engineering Group

(302) 831-1744

SECTION 23 21 23.2_HYDRONIC PIPING SYSTEMS BELOW GRADE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

- A. Furnish and install all Underground, fittings, and piping and accessories to make complete and operations systems.
- B. All systems shall be installed in accordance with local codes including vent piping and relief discharge termination points.
- C. Secure all permits and local/state approvals for the installation of all components included under this Section.

1.03 RELATED SECTIONS

- A. Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

1.04 REFERENCES

- A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of the Contract Documents.
- B. ASME: American Society of Mechanical Engineer
- C. NFPA: National Fire Protection Association
 - 1. NFPA 54: National Fuel Gas Code
- D. ANSI: American National Standards Institute
 - 1. A13.1: Scheme for Identification of Piping Systems
 - 2. B16.3: Malleable Iron Threaded Fittings
 - 3. B16.5: Pipe Flanges and Flanged Fittings
 - 4. B16.9: Factory Made Wrought Steel Butt Weld Fittings
 - 5. B16.11: Forged Steel Fittings, Socket Weld and Threaded
 - 6. B16.39: Malleable Iron Threaded Pipe Unions
 - 7. B31.1: Power Piping
 - 8. B36.10: Welded and Seamless Wrought Steel Pipe
 - 9. Z49.1: Safety in Welding and Cutting
- E. ASTM: American Society for Testing and Materials
 - 1. A 53: Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - 2. A 74: Cast Iron Soil Pipe and Fittings

3. A 105/A105M: Forgings, Carbon Steel, for Piping Components
 4. A 106: Seamless Carbon Steel Pipe for High-Temperature Service
 5. A 135: Electric-Resistance-Welded Steel Pipe
 6. A193: Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
 7. A 234/A23AM: Pipe Fittings of Wrought Carbon Steel and Alloy / Rev A: Steel for Moderate and Elevated Temperature
 8. A 307: Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength
 9. A 568: Steel, Sheet Carbon and High-Strength Low-Alloy / Rev A: Hot-Rolled and Cold-Rolled, General Requirements
- F. Use in conjunction with the following University of Delaware Standards:
1. Common Work for HVAC Systems 23 05 00
 2. Common Requirements for HVAC Systems 23 05 01
 3. Identification of HVAC Piping & Equipment 23 05 53
 4. HVAC Insulation 23 07 00
 5. Hydronic Piping Systems Above Grade 23 22 23
 6. Hydronic Pumps 23 22 23.13

1.05 SUBMITTALS

- A. Provide with bids the quantity and size of field joints and kits that shall be provided. Provide field insulation kits where vertical offsets are indicated on the plans.
- B. Provide Product Data: Include data on pipe materials, pipe fittings and accessories. Provide manufacturers catalogue information and mill certificates.
- C. Maintenance Data: Include installation instructions, exploded assembly views.

1.06 QUALITY ASSURANCE

- A. Installer: Company specializing in performing work of the type specified in this section, with documented experience.
- B. Welders: Certify in accordance with ASME (BPV IX).

1.07 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.3 Process Piping Code for installation of process piping systems including specialties.
- B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.
- C. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Protect piping systems and specialties from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 – PRODUCTS

2.01 UNDERGROUND CHILLED WATER PIPING

A. General

1. Manufacturer - Rovanco Piping Systems – No substitutes
2. Piping manufacturer shall provide straight sections of factory insulated pipe. The contractor shall provide fittings and other accessories that are field fabricated to job dimensions and designed to minimize the number of field welds. Fitting kits shall be provided by the manufacturer.
3. The system design shall be in strict conformance with ANSI B31.3, latest edition. Factory trained field technical assistance shall be provided for critical periods of installation; unloading, field joint instruction and testing.

B. Operating, Design and Test Pressures

	Chilled Water
Operating Pressure	100 psig
Design Pressure	100 psig
Design Temperature	50 deg. F.
Test Pressure	150 psig

C. Pipe

1. The chilled water shall be Schedule 80, black steel, A106 seamless, Grade B. Fittings shall be seamless carbon steel complying with ASME B16.9 and ASTM A234 and shall match the wall thickness of the piping system.
2. Certified welders shall weld field joints. All pipe welds shall bear the welder’s stamp.
3. Fittings shall be seamless carbon steel complying with ASME B16.9 and ASTM A234.

D. Insulation and Jacket

1. Casing Jacket: The outer jacket shall be seamless high density polyethylene (HDPE) per ASTM D1248 and D3350 with minimum wall thickness of 0.200.
2. Insulation: Nominal 2 lb per cubic ft. density, 90-95% closed cell content in conformance with ASTM C-591 completely filling the annular space between carrier pipe and jacket. Insulation thickness shall be nominal 2” thick (nominal) for pipes 2” and larger.

E. Joining Method: Piping shall be all welded construction. Fitting and joint shall be insulated and jacketed with materials supplied by the system supplier and as per manufacturer’s procedures. Pipe fittings shall be supplied by the installed and insulation kits will be provided by the piping manufacturer.

F. End Seal: At buried ends of the pipe where new and existing piping is joined by a mechanical coupling or other shall be a heat-shrinkable end seal that is sized for specific carrier pipe and

casing outside diameters. Apply a factory end seal to the pre-insulated pipe per the manufacturer's standard procedures.

G. Miscellaneous Materials

Chilled Water Manhole X

(X) 36" dia. Fibrelite steam manhole lids, with rim and skirt

Link seals and wall sleeves for (X) X" CHWS and (X) 10" CHWR

Link seals and wall sleeves for (X) 6" CHWS and (X) 6" CHWR

PART 3 – INSTALLATION

3.01 PIPING INSTALLATION

A. General

1. Provide all piping systems as shown on the drawings and otherwise required to make a complete, workable and neat job, installing all valves, appurtenances, unions and gaskets. The Contractor shall use care arranging all piping as shown on the drawings and shall carefully examine the arrangements where offsets are indicated and shall follow details as shown.
2. All piping shall be run to true alignment parallel to building walls, and with uniform grades and spacing so as to present a neat and workmanlike appearance.
3. The drawings shall indicate the sizes of piping, piece number, and connections. If this information is omitted or unclear, obtain additional information from the field service technician before proceeding.
4. Ends of all pipes shall be reamed clean and all pipes shall be straightened before erection and measures shall be taken to preserve this cleanliness after erection.
5. Provide proper provision for expansion and contraction in all portions of pipe work, to prevent undue strains on piping or apparatus connected.
6. Ends of all pipes shall be reamed clean and all pipes shall be straightened before erection and measures shall be taken to preserve this cleanliness after erection.
8. Provide proper provision for expansion and contraction in all portions of pipe work, to prevent undue strains on piping or apparatus connected.
9. Pipe pitch, unless otherwise indicated on the drawings, 1" in 20', up in direction of flow (preferred).
11. Drain connections at low points in water piping and where noted:
12. During construction, temporarily close open ends of pipes with sheet metal caps or duct tape to prevent debris from entering piping systems.

3.02 Field Quality Control

- A. Installation shall be in strict accordance with the manufacturers printed instructions. The services of a factory trained field service instructor, a full time employee of the manufacturer, shall be required. The field service instructor shall have a minimum of 10 years of field service experience. A resume detailing training and experience of the field service instructor must be furnished with the system supplier's proposal.
- B. The F.S.I. shall be present during critical stages of installation and tests including, but not

limited to, unloading and handling of pipe, placing of pipe in trench, hydrostatic, casing inspection and joints, and backfill. If the field service instructor is unavailable at critical times or quality of the support determined to be unacceptable, the Owner will back-charge the piping vendor against retainage at a rate of \$2,000 per day.

- C. The field service instructor shall submit a report to the owner's representative at each visit to the jobsite certifying that the piping system is being installed in accordance with the manufacturer's requirements and shall report to the University's representative, immediately, any deviation from accepted installation procedures. The instructor shall have no authority to stop any work in progress!
- D. At completion of installation the contractor shall furnish to the University's representative, certification from the manufacturer that the system was installed in accordance with the manufacturer's requirements.

3.03 Field Welding

- A. All welding done under this Contract shall be performed by experienced welders in a neat and workmanlike manner. All welding done shall be in accordance with ASME B31.3 Process Piping Code (latest Edition and Addenda). The Contractor shall furnish to the Owner for approval and record the following:
 - 1. Welding Procedure Specifications (WPS) for each procedure to be used
 - 2. Procedure Qualification Record (PQR)
 - 3. Welding Operator Qualification Tests (WPQ) for each welder to be employed.
- B. Documents shall be on forms similar to the forms referenced in the ASME Boiler & Pressure Vessel Code, Section IX, latest edition. These records shall be furnished to the Owner for this project not less than (2) weeks, prior to any welding. All welders to be employed by the Contractor on this work shall be certified in accordance with the above. The Mechanical Contractor shall test welders to these procedures within (3) months of the work beginning to certify them for this work. The above forms shall be clearly marked specifically for the Contractor's use and certified by the appropriate personnel. Documents prepared for other's use are not allowed. Failure to provide these forms to the satisfaction of the Owner, or his representative, will result in the replacement of the Mechanical Contractor with one who can meet these requirements, at no additional cost to the Owner. No delays or cost increases to the overall project schedule will be accepted due to non-compliance with the above by the Mechanical Contractor.
- C. Mitered elbows are not permitted. Odd angle elbows shall be cut from long radius elbows.
- D. The weld reinforcement shall be not less than 1/16" or more than 1/8" above the normal surface of the joined sections. The reinforcement shall be crowned at the center and shall taper on each side to the surface being joined. The exposed surface of the weld shall present a workmanlike appearance and shall be free of depressions below the surface of the joined members.
- E. No welding of any kind shall be done when the temperature of the base metal is lower than 50°F. Material to be welded during freezing temperatures shall be made warm and dry before welding is started. Temperature of metal shall be "warm to the hand", or approximately 60°F.

- F. Welds will be inspected visually by supervisory representatives of the Engineer and the Contractor. Any weld judged defective by the Engineer from a visual inspection shall be cut out and tested in the presence of the Owner or his representative. In the event any welder consistently produces a high percentage of unsatisfactory production welds, he shall be discharged at the request of the Owner, even though he is able to produce satisfactory welds when especially tested. Removal and replacement of test coupons and samplings shall be done at the expense of the Contractor.
- G. Store all 7018 electrodes in rod oven once original container is opened.

3.04 Radiographic Testing or Magnetic Particle Testing

- A. Welds on all underground chilled water piping shall be radiographically tested to full depth penetrations.
- B. The welds shall meet the X-ray requirements in ANSI B31.3 Process Piping Code.
- C. The independent inspection services shall be provided by the Owner but must be coordinated by the mechanical contractor.

3.05 CLEANING AND FLUSHING

- A. The equipment and piping installed under this Section shall be blown out under pressure and cleaned of foreign matter, through temporary connections where necessary, before the system is placed in service. Water through a minimum 2" fire hose shall be utilized. The water shall discharge through a dirtbag to a grass area. A detail description of the flushing shall be including in the contraction drawings. Alternatively high pressure steam may be used to blown out following ASME procedures. Precautions shall be used to prevent foreign matter from getting into equipment and piping during construction. All materials and labor including hoses, dirtbag, etc. shall be provided by the Contractor.
- B. Following flushing, the piping shall be cleaned. The contractor shall provide hoses, pump with generator, etc. as indicated the flushing detail on the construction drawings. See the pipe cleaning specification. The Owner shall provide chemicals treatment.

3.06 Inspections and Non-Destructive Tests

- A. Visual inspection shall include examination of joint details prior to welding, inspection for defects during welding, and for defects, undercut, overlay, and reinforcement details after welding.
- B. Records of non-destructive examination shall be thoroughly examined by the contractor's qualified Q.A. engineer and the Owner. The records shall be kept in permanent file and forwarded to the Owner at the end of the job.
- D. Tests performed shall not relieve the Contractor of his responsibility for leaks which may develop after the tests are made.
- E. Furnish all labor, material, instruments, supplies and services and bear all costs for the accomplishment of the tests herein specified. Correct all defects appearing under test and repeat the tests until no defects are disclosed; leave the equipment clean and ready for use.
- F. Furnish all necessary testing apparatus, make all temporary connections and perform all testing operations required, at no additional cost to the Owner.

- G. All equipment and piping installed under this Contract shall be tested and found tight. Insulated or otherwise concealed piping shall be tested before being closed in. All leaking joints shall be corrected, retested and found tight. Such tests shall conform to the requirements of Local Codes but shall not be less than the equivalent of the tests called for herein. Threaded joints that leak shall not be seal-welded to correct leakage.
- H. Tests of piping systems shall be conducted before connections to equipment are made and before piping is covered, buried or otherwise concealed.
- I. Systems found to have leaks shall be subjected to further tests when faulty joints have been repaired or replaced.

3.07 Hydrostatic Testing

- A. Hydrostatic testing will be witnessed a designated University of Delaware representative.
- B. Hydrostatic test shall be performed at the pressure indicated on the table 2.01B for one hour with no pressure loss. The test shall be witness and signed off by the designated University of Delaware representative

3.08 Backfill

- A. Flowable fill - The steam and condensate pipes shall be backfilled with flowable fill along the entire trench from 6 inches below to 6" above the top of the insulated piping system. See civil specification for backfill requirements.
- B. The remaining trench shall be evenly and continuously backfilled in uniform layers with suitable soil per the civil specification.

END OF SECTION