

## SECTION 15107 – HVAC UNDERGROUND PIPING

### PART 1 – GENERAL

#### 1.1 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.

#### 1.2 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. Provide stress calculations and forces at all anchors, guides and supports
- D. Secure all permits and local/state approvals for the installation of all components included under this Section.

#### 1.3 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.

#### 1.4 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 Engineers
- 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
10. D-3350: Polyethylene Plastic Pipe and Fittings Materials

1.5 SUBMITTALS

- A. See Section 15050 and General Conditions for additional information.
- B. Product Data: Include data on pipe materials, pipe fittings and accessories. Provide manufacturers catalogue information and mill certificates.
- C. Welders Certificate: Include welders certification of compliance with ASME (BPV IX).
- D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- E. Project Record Documents: Record actual locations of all piping, valves, traps and valve tag numbers.
- F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

- G. Provide piping plans to a minimum scale of ¼" - 1'-0".

#### 1.6 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).

#### 1.7 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of steam and condensate 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.

#### 1.8 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.

#### 1.9 ENVIRONMENTAL

- A. Do not install piping when environmental conditions are outside the specific limitations of the referenced codes and manufacturer's recommendations.

### PART 2 – PRODUCTS

#### 2.1 UNDERGROUND SYSTEM FOR COLD SERVICES LESS THEN 150°F

- A. General
  - 1. Acceptable manufacturers contingent on compliance with the specifications:
    - a. Perma Pipe
    - b. Insul tec
    - c. Thermacore Process, Inc.
    - d. Rovanco Piping Systems

2. All straight sections, fittings, anchors and other accessories shall be factory fabricated to job dimensions and designed to minimize the number of field welds.
3. Each system layout shall be computer analyzed by the piping system manufacturer to determine stress on the carrier pipe and anticipated thermal movement of the service pipe.
4. The system design shall be in strict conformance with ANSI B31.1, latest edition. Factory trained field technical assistance shall be provided for critical periods of installation; unloading, field joint instruction and testing.

B. Service Pipe

1. Standard weight carbon steel A-53 or A-106 seamless or ERW Grade A or B shall be utilized for:
  - a. Condenser water supply and return.
2. All joints
  - a. Butt-welded for 2 1/2" and greater
  - b. Socket or butt-welded for 2" and below.

C. Accessories

1. End seals, gland seals and anchors shall be designed and factory fabricated to prevent the ingress of moisture into the system.

D. Insulation

1. Service pipe insulation shall be spray applied nominal 2 pound per cubic foot density, polyurethane foam for straight sections and preformed polyurethane foam for all fittings.
2. To ensure no voids are present, all insulation shall be inspected by one of the following three methods: visually checked prior to application of the protective jacket; infrared inspection of the entire length; or x-ray inspection of the entire length.
3. The insulation shall be applied to the minimum thickness specified below. The insulation thickness shall not be less than indicated in these specifications.

	<u>Pipe Size (in.)</u>	<u>Insulation Thickness (in.)</u>
a.	1 1/2 - 3	1.5
b.	4 - 6	2
c.	8 - 14	2.5
d.	16 - 20	3

E. Protective Jacket

1. All straight sections of the insulated piping system shall be filament wound, polyester resin/fiberglass reinforcement composite directly applied on the insulating foam or High Density Polyethylene of a minimum thickness of 125-mils.
2. The minimum thickness for FRP jacket shall be as follows: For jacket diameter up to 15.5 inches thickness =.055 inches; jacket diameter between 15.6 and 24.5 inches thickness = .085 inches; jacket diameter between 24.6 and 31.0 inches thickness = .110 inches; and jacket diameter between 31.1 and 40.0 inches thickness = .140 inches.
3. All fittings of the insulated piping system shall be prefabricated to minimize field joints and jacketed in a chopped spray-up, polyester resin/fiberglass reinforcement composite or High Density Polyethylene, directly applied onto the insulating foam to a thickness related to the filament wound jacket thickness.

F. Field Joints

1. The internal pipe shall be hydrostatically tested to 150 psig or 1 1/2 times the operating pressure, whichever is greater, before insulation.
2. Insulation shall then be poured in place into the field weld area.
3. All field applied insulation shall be placed only in straight sections. The mold for the polyurethane shall be made of clear adhesive backed polyester film.
4. The installer shall seal the field joint area with a heat shrinkable adhesive backed wrap or with wrappings of glass reinforcement fully saturated with a catalyzed resin identical in properties to the factory-applied resin. Backfilling shall not begin until the heat shrink-wrap has cooled or until the FRP lay-up has cured.
5. All insulation and coating materials for making the field joint shall be provided by the manufacture.

PART 3 – INSTALLATION

3.1 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 be followed where they are definite and provided such procedure causes no objectionable conditions or does not conflict with other Trades, Laws, Regulations or recommendations of equipment manufacturers.

4. The drawings are intended to indicate the sizes of piping connections and if certain sizes are omitted, or unclear, obtain additional information before proceeding.
  5. Bushings shall not be used for reducers. Reducing fittings shall be used for all changes in pipe size and shall be as follows:
    - a. Horizontal water piping: Eccentric flat on top for venting.
  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.
  7. Arrange piping for maximum accessibility for maintenance and repair, locate valves for easy access and operation.
  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, shall be as follows:
    - a. Water Piping:
      - 1) Up to 1" pipe: 1" in 40'-0", up in direction of flow.
      - 2) 1 1/4" larger: 1" in 100'-0", up in direction of flow.
  10. Drain connections at low points in water piping and where noted:
  11. Manual air vents at high points and where required to expel air:
    - a. To 3" pipe: line size air chamber, 12" long, 1/2" ball valve.
    - b. 4" to 8": line size air chamber, 6" long, 1/2" ball valve.
    - c. 10" and larger: line size pipe cap, 1/2" ball valve.
  12. During construction, temporarily close open ends of pipes with sheet metal caps or duct tape to prevent debris from entering piping systems.
- B. Underground system for cold services less than 150°F
1. A 4 inch layer of sand shall be placed and tamped in the trench to provide a uniform bedding for the pipe.
  2. The entire trench width shall be evenly backfilled with a similar material as the bedding in 6 inch compacted layers to a minimum height of 6 inches above the top of the insulated piping system.
  3. The remaining trench shall be evenly and continuously backfilled in uniform layers with suitable excavated soil complying with the manufacturer's specifications.

### 3.2 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 B31.1 Power 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" nor 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 Architect and the Contractor. Any weld judged defective by the Architect 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. The Owner reserves the right to ultrasonically or radiographically test any welds for full penetration.
- G. Paint all external surfaces of welds with a high temperature paint prior to insulation being applied.

- H. Store all 7018 electrodes in rod oven once original container is opened.

### 3.3 CLEANING AND BLOWING OUT

- 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. Super heated high pressure steam piping shall be blown out following ASME procedures. Precautions shall be used to prevent foreign matter from getting into equipment and piping during construction. The supplier of water treatment equipment and chemicals shall recommend and furnish chemicals for the purpose of cleaning and blowing out of all systems. All chemicals, materials, instruments and labor shall be provided by the Contractor.
- B. The surfaces of all equipment and piping shall be clean upon completion of the work.
- C. All pipe line strainers shall be cleaned immediately before being turned over to the Owner for acceptance.
- D. During cleaning process, hammer welds to remove scale, weld slag and other debris.

### 3.4 TESTING

- A. 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.
- B. Perform all tests other than herein specified which may be required by Legal Authorities or by Agencies to whose requirements this work is to conform.
- C. Furnish all necessary testing apparatus, make all temporary connections and perform all testing operations required, at no additional cost to the Owner.
- D. 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.
- E. Tests performed shall not relieve the Contractor of his responsibility for leaks which may develop after the tests are made.
- F. All piping systems shall be subjected to a hydrostatic test at 150 PSIG or 1 ½ times operating pressure whichever is greater, for a period of (4) hours without drop in pressure.
- G. Tests of piping systems shall be conducted before connections to equipment are made and before piping is covered, buried or otherwise concealed.



- H. Systems found to have leaks shall be subjected to further tests when faulty joints have been repaired or replaced.
- I. Welded joints shall be subjected to a hammer test while under pressure.

END OF SECTION