

**SECTION 336321 – DIRECT BURIED STEAM AND CONDENSATE UTILITY
DISTRIBUTION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the Drawings and as specified herein.
- B. This section includes the furnishing and installation of direct buried steam piping, steam condensate piping, and steam and condensate accessory piping.

1.3 REFERENCES

- A. ASME B31.1, Power Piping.
- B. ASME B31.9, Building Services Piping.
- C. ASHRAE 1996 Systems and Equipment Handbook.
- D. Michigan Boiler Code.

1.4 SUBMITTALS

- A. Shop Drawings to include:
 - 1. Piping specialties.
 - 2. Preinsulated Buried Piping Systems:
 - a. Details of construction.
 - b. Layout drawings.
 - c. Installation instructions.
- B. Test reports data for tests specified.
- C. Certification of installation from manufacturer's representative for all preinsulated buried piping.

1.5 QUALITY ASSURANCE

A. General:

1. The steam piping used for utility distribution is designed for an operating pressure of 150 psig which falls under the jurisdiction of the Michigan Boiler Division and the Boiler Act of 1965.
2. The Act was amended in 1995 which included a clarification of Rule 113 concerning high pressure piping. Steam piping under this rule includes any steam piping where the pressure is over 15 psig and must be installed or repaired in accordance with the ASME B31.1 Power Piping Code and the Rules of the Michigan Boiler Law and Rules.
3. The steam piping used for utility distribution is considered Non-Boiler External Piping under the ASME B31.1 Power Piping Code.

B. General Welding Quality Assurance:

1. Contractors working on these systems are required to be licensed by the State of Michigan Boiler Division.
2. Employers are responsible for qualifying Welding Procedure Specifications (WPS) that are intended to be used by personnel of that organization.
3. Each employer is responsible for qualifying the welders and welding operators employed by that organization and maintain a certificate of Welder/Welding Operator Performance Qualification for each welder under their employment.
4. The employer shall maintain records of the WPS and the welders or welding operators used by that organization and the identification symbol assigned to each welder and their performance qualification.
5. The employer shall use this identification symbol to identify the welds performed by a welder or welding operator by either:
 - a. Applying the symbol of the welder or welding operator to the joint in a manner specified by the organization.
 - b. Maintain weld map records identifying the joint with the welder or weld operator.

C. Buried Installer's Qualifications: An installer who has been trained and certified by the manufacturer to have demonstrated proficiency in the handling and installation of this piping system.

D. Examinations:

1. Examinations are to be performed by the fabricator, erector, or a party authorized by the Owner which include visual examinations and observations.

2. Visual examinations as defined are to be performed as necessary during the fabrication and erection of the piping components to provide verification that the design and WPS requirements are being met.
3. Visual examinations shall also be performed to verify that completed welds in pipe and piping components comply with the acceptance standards specified in the code.
4. Personnel who perform nondestructive examinations of welds shall be qualified and certified for each examination method in accordance with a program established by the employer of the personnel being certified based on the code requirements.

E. Inspections:

1. Inspections are the responsibility of the Owner and may be performed by employees of the Owner or party authorized by the Owner.
2. Prior to initial operation, the "Non-Boiler External Piping" installation shall be inspected to ensure compliance with the engineering design and with the material, fabrication, assembly, examination and test requirements of the code.

F. Field Testing: Provide testing of each section of piping in accordance with Part 3 of this specification. Testing of buried piping must be done prior to backfilling.

PART 2 - PRODUCTS

2.1 STEAM PIPING

- A. Steam piping 4 inches to 24 inches shall be ASTM A53 or A106, seamless, Grade B, Standard Weight with the following schedule/wall thickness:
1. 10 inches and under - Schedule 40.
 2. 12 inches and over - 0.375-inch.

2.2 STEAM CONDENSATE PIPING

- A. Condensate piping 2 inches to 18 inches shall be ASTM A53 or A106, seamless, Grade B, Extra Strong Weight with the following schedule/wall thickness:
1. 8 inches and under - Schedule 80.
 2. 10 inches and above - 0.500-inch.

2.3 ACCESSORY PIPING

- A. Accessory piping shall be extra heavy (Schedule 80) ASTM A53, Grade B, seamless, all welded construction except as otherwise specified.

2.4 PIPE FITTINGS

- A. Weld fittings shall comply with ANSI for steel butt-welding fittings (B16.11) where applicable, and material shall conform to Division 33 Section "Piping for Utility Distribution." Each fitting shall have manufacturer's name or symbol, marked on fitting. Pipe fittings shall have same wall thickness as adjoining pipe.
- B. Threaded fittings shall be Class 300 malleable (ductile) and conform to Division 33 Section "Piping for Utility Distribution."

2.5 [BURIED PIPING SYSTEM – TEMPORARY

- A. General:
 - 1. Piping and all of its components shall be designed to operate up to 250 psig at 400 degrees F, plus typical surges.
 - 2. Pipe and fittings shall conform to the requirements of steam and condensate piping of this Section and Division 33 Section "Piping for Utility Distribution."
- B. Insulation: Inorganic Granular Insulation: Provide engineered inorganic non-toxic, non-flammable, sodium potassium aluminum silicate insulation with calcium carbonate filler in accordance with the requirements of Division 33 Section "Insulation for Utility Distribution."
- C. Installation: Install piping and insulation in accordance with manufacturer's recommendations.
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2.6 PREINSULATED BURIED PIPING SYSTEM [– PERMANENT]

- A. Manufacturers:
 - 1. Rovanco "Insul-800."
 - 2. Thermacor "Duo-Therm 505."
 - 3. As approved.
- B. General:
 - 1. Underground heat distribution lines as indicated on the Drawings shall be a drainable jacketed steel conduit system. The system supplier shall have fabricated systems of the composition defined herein for at least 3 years.
 - 2. Straight sections, fittings, anchors and other accessories shall be factory prefabricated 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 stresses and movements of the service pipe.
 - 4. The system design shall be in strict conformance with ANSI B31.1 latest edition, and stamped by a registered professional engineer.

5. Factory trained field technical assistance shall be provided for the critical periods of the installation; i.e., unloading, field joint instruction and testing.
6. Provide all necessary accessories to make system watertight, including end terminations and seals.

C. Service Pipe:

1. Internal piping shall be in accordance with the requirements of this section.
2. All joints shall be butt welded for sized 2-1/2 inches and larger, and socket welded for 2 inches and below.
3. Where possible, straight sections shall be supplied in 40-foot random length with 6 inches of piping exposed at each end for field joint fabrication.

D. Service Pipe Insulation:

1. Insulation shall be mineral wool in the thickness indicated in the table at the end of Part 2 of this section and in accordance with Division 33 Section "Insulation for Utility Distribution."
2. The insulation shall be fabricated in half or V-Groove insulation sections.
3. The insulation shall be secured to the pipe by stainless steel bands.

E. Conduit:

1. The steel conduit casing shall be smooth wall welded steel conduit of the thicknesses specified below:

Conduit Size	Conduit Thickness
6" - 26"	10 Gage
28" - 36"	6 Gage
38" - 42"	4 Gage

2. Changes in casing size, as required at oversized casing to allow for carrier pipe expansion, shall be accomplished by eccentric and/or concentric fittings and shall provide for continuous drainage.

F. Pipe Supports:

1. Pipes within the outer casing shall be supported at not more than 10-foot intervals.
2. These supports shall be designed to allow for continuous airflow and drainage of the conduit in place.
3. The straight supports shall be designed to occupy not more than 10% of the annular air space.

4. Supports shall be of the type where insulation thermally isolates the carrier pipe from the conduit. The surface of the insulation shall be protected at the support by a sleeve not less than 12 inches long, fitted with traverse and, where required, rotational arresters.

G. Conduit Insulation:

1. Conduit insulation shall be spray applied polyurethane or polyisocyanurate foam, as scheduled, for straight lengths and fittings.
2. The insulation thickness shall be a minimum of 1-inch and shall comply with the requirements of Division 33 Section "Insulation for Utility Distribution."
3. Quality assurance procedures for the insulation shall include either a visual check prior to jacketing or infrared, or x-ray of the entire length to ensure there are no insulation voids.

H. Outer Jacket:

1. The outer jacket shall be high density polyethylene (HDPE) with a minimum wall thickness of 125 mils. Straight lengths and fittings shall be factory jacketed.
2. HDPE jacketing material shall be extruded, black, high density polyethylene (HDPE), having a minimum wall thickness of 125 mils for jacket sizes less than or equal to 12 inches, 150 mils for jacket sizes larger than 12 inches to 24 inches, and 175 mils for jacket sizes greater than 24 inches.

I. System Description Table:

NOTE TO SPECIFIER: Edit service pipe sizes and insulation thicknesses to match project requirements.

Item	Steam			Condensate	
Type	Insul-800 Duo-Therm 505			Insul-800 Duo-Therm 505	
Size	2" - 4"	6" - 10"	12" - 20"	2" - 4"	6" and Above
Pipe	Schedule 40 Steel			Schedule 80 Steel	
Service Pipe Insulation *	1-1/2"	2"	3"	1-1/2"	2"
Conduit	10 Gage Steel			10 Gage Steel	
Conduit Insulation	1-inch High Temperature Polyisocyanurate Foam			1-inch Polyurethane Foam	
Outer Insulation Jacket	HDPE			HDPE	
Design Pressure	125			125	
Operating Pressure	60			30	
Design Temperature	353			212	
Operating Temperature	307			180	
* Mineral Wool; K = 0.29 @ 200 degrees F					

PART 3 - EXECUTION

3.1 INSTALLATION

A. Piping:

1. All piping shall be installed in such a way that it will be free to expand and contract, without noise or damage to itself.
2. Risers and vertical pipe shall be plumb, straight and have no unnecessary fittings or offsets.
3. Filings, dust, and dirt shall be wiped from interior of the pipe or tubing before connections are made.
4. Changes in direction of piping shall be made using the appropriate fittings.
5. Pitch: Horizontal supply mains shall pitch up or down in the direction of flow as indicated.
6. Reducing fittings shall be used for changes in pipe sizes.
7. Open ends of pipelines and equipment shall be capped or plugged during installation to keep dirt or other foreign materials out of the systems.

3.2 FIELD JOINTS FOR DIRECT BURIED PIPING

A. General Requirements:

1. The conduit joint shall be air tested at 15 psi for a period of 2 hours after the cure is complete utilizing the factory installed air tube running through the entire system.
2. Backfilling shall not be started until the joint has passed the air test and service pipe has passed hydrostatic testing.
3. The complete joint shall be installed in accordance with the manufacturer's requirements.
4. Moisture barrier end seals shall be factory applied, sealed to the jacket and carrier pipe. End seals shall be certified as having passed a 20-foot head pressure test. End seals shall be mastic completely sealing the exposed end of the insulation. Field applied end seals shall be installed at each field cut to the piping before continuing with the installation.

B. HDPE Field Joints:

1. Straight run joints shall be insulated using a wrap round HDPE jacket placed over the field joint and insulated with polyurethane foam. The HDPE jacket shall be sealed with a heat shrink sleeve, as recommended by the manufacturer.

2. Conduit fillings are factory prefabricated and preinsulated with urethane to the thickness specified and jacketed with a molded, extrusion welded, or butt fusion welded PE jacket. NO TAPING OR HOT AIR WELDING SHALL BE ALLOWED.

3.3 TESTING

A. Direct Buried Piping:

1. Leak Tests for Steam and Steam Condensate Piping:
 - a. Provide complete hydrostatic testing for leaks of all piping systems in accordance with ASME B31.1 "Code for Pressure Piping," latest revision.
 - b. Test pressure shall be at least 1.5 the design pressure, but in no cases less than 150 psig.
 - c. Following the application of hydrostatic test pressure for at least 4 hours, examination shall be made for leakage of the piping and at all joints and connections.
 - d. If leaks are found, they shall be eliminated as appropriate, and the test repeated until no leakage is found.
 - e. Testing must be witnessed and approved by the Project Representative on each section of buried pipe before backfilling.
2. In-Service Leak Test for Steam and Condensate:
 - a. An in-service test and examination using system steam is acceptable when other types of tests are not practical or when leak tightness is demonstrable due to the nature of the service; i.e., where shut-off valves are not available for isolating a line or where temporary closures are impractical.
 - b. The in-service test shall be conducted only after receiving written authorization from the Engineer.
 - c. This method shall also be used subsequent to pneumatic testing when used in lieu of hydrostatic testing.
 - d. When performing an initial service test, the piping system shall be gradually brought up to normal operating pressure and temperature and continuously held for a minimum time of 10 minutes.

B. Test Procedures:

1. Blank off or replace with spool pieces items of devices and equipment such as vessels, valves, instruments, etc. rated for pressure less than the test pressure. Reconnect equipment after testing.
2. Perform tests before piping is covered, concealed, or backfilled.

3. A pressure recorder shall monitor the testing of piping systems to verify test results.

C. Cycle Testing:

1. Following the completion of the leak testing procedures, the Contractor shall schedule with the Project Representative to have MSU staff conduct a cycle test on both the steam and condensate piping installed under this Contract.
 - a. All testing shall be scheduled through the Project Representative with a minimum of 72 hours notice.
 - b. The cycle test may also be performed in conjunction with the in service test as authorized by the Owner.
 - c. The Contractor shall be present while the cycle test is being conducted.
2. The cycle test shall consist of a single warm-up cycle and cool-down cycle where the systems are gradually brought up to normal operating pressure and temperature for a period of 8 hours.

3.4 CLEANING AND FLUSHING

- A. Piping shall be cleaned before the installation, and flushed after the installation and before system start-up.
- B. Equipment, detergents, solvents and other cleaning agents shall be furnished by a qualified water treatment service.
- C. Disconnect piping to be flushed. Remove instruments which may be damaged by the cleaning procedures. Such items shall be replaced with spool pieces, plugs, or blind flanges.
- D. Before the piping is put in service, clean it using a pressure tank with a hose equipped with a nozzle to direct a high velocity stream of water against the inside wall of the pipe. Make a minimum of 2 passes through the pipe with the hose. A minimum pressure of 250 psi shall be developed at the nozzle.

END OF SECTION 336321