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BuildingName
The Description of the Project
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SPECIFICATION DIVISION 33

NUMBER SECTION DESCRIPTION

DIVISION 33 UTILITIES
SECTION 336100 - Hydronic Utilities

END OF CONTENTS TABLE

DIVISION 22
SECTION 336100 – Hydronic Utilities

REVISIONS:
NOVEMBER 2018 NEW SPECIFICATION SECTION. THIS SPECIFICATION IS OWNED AND MAINTAINED BY THE U-M STEAM AND HYDRONICS MECHANICAL TECHNICAL TEAM.

THIS SPEC DOES NOT INCLUDE DETAILED TRENCHING REQUIREMENTS. ASSURE THAT THE PROJECT SPECIFICATIONS INCLUDE A RELATED SECTION 312000 "EARTH MOVING" OR EQUIVALENT, PROVIDING DETAILED TRENCHING, COMPACTING, AND BACKFILLING REQUIREMENTS. IF THE SECTION NUMBER IS DIFFERENT THAN 312000, REVISE 1.1.B AND 3.2.A BELOW.

GENERAL

1.1 RELATED DOCUMENTS

INCLUDE PARAGRAPH 1.1.A AND B IN EVERY SPECIFICATION SECTION. EDIT RELATED SECTIONS 1.1.B TO MAKE IT PROJECT SPECIFIC.

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections, in particular the Related Sections listed below, apply to this Section.

B. Related Sections

1. Section 220500 - Common Work Results for Mechanical
2. Section 221113 – Piping Materials and Methods (only as specifically referenced in this section)
3. Section 312000 – Earth Moving

1.2 SUMMARY

A. This section specifies piping materials and installation methods for underground hydronic piping including:

1. Chilled water piping and valves: ductile iron system

ADD TO LIST AS REQUIRED TO BE PROJECT SPECIFIC; REVISE THE SPECIFICATION TO COVER ANY ADDED SYSTEMS.

1.3 REFERENCES

REVISE DEFINITIONS TO BE PROJECT SPECIFIC.

A. Definitions

1. AASHTO: American Association of State and Highway Transportation Officials.
2. ACI: American Concrete Institute.
3. ANSI: American National Standards Institute.
4. ASTM: American Society for Testing and Materials.
5. AWWA: American Water Works Association.
6. HDPE: High Density Polyethylene.

7. MDOT: Michigan Department of Transportation.
8. OSHA: Occupational Safety and Health Administration.
9. PPM: Parts Per Million.
10. PSI: Pounds per Square Inch.
11. SDR: Standard Dimension Ratio.
12. UL: Underwriters Laboratory.

1.4 SUBMITTALS

A. Product Data: Include manufacturer, catalog illustrations, model, rated capacities, performance, dimensions, component sizes, rough-in requirements, materials of construction, and operating and maintenance clearance requirements. Additionally include:

1. Provide a piping material schedule that indicates, by service, pipe material, pipe manufacturer, fitting type and manufacturer, joint type and manufacturer.
2. Provide a valve schedule that indicates, by service, valve material, model, manufacturer, and installation location.
3. Manufacturer Certification: Mill certifications indicating country of origin and compliance to AWWA/ASTM/ANSI/NSF and other required compliance standards verified by independent third party based in the United States.
4. Layout and staking locations including invert elevations of piping, and locations or valves, fittings and joints.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports for testing activities described in Part 3.

1.6 QUALITY ASSURANCE:

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the specified quality assurance standards; latest editions, unless noted otherwise.

1. AWWA C600 Standard for Installation of Ductile-Iron Water Mains and their Appurtances
2. AWWA C606 Grooved and Shouldered Joints.

C. Comply with the requirements of City of Ann Arbor and MDOT that regulate this work relative to other underground utilities and roadways.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store piping materials and accessories raised off the floor or ground on pallets and protected with coverings to prevent damage or contamination due to weather and construction activities. Deliver piping with factory-applied end caps. If not factory applied, install field caps or equivalent protection. Maintain caps installed at all times until just prior to assembly, and recap open pipe ends at the conclusion of each work day. Store in areas that prevent damage due to freezing and extreme temperatures or sunlight. Arrange coverings to provide air circulation to avoid damage from condensation or chemical build-up. Protect from damage, dirt and debris at all times.

B. Product Inspection: All materials furnished shall be subject to inspection on arrival at the job site by the Owner or Owner's agent. The purpose of the inspection shall be to cull and reject products that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these specifications. Materials shall be subject to rejection on account of any of the following:

1. Variation in any dimension exceeding the permissible variations given in the material specifications. Pipe in all cases shall be full diameter.
2. Fractures or cracks passing through the barrel or socket.
3. Chips or fractures on the interior of the pipe exceeding two inches in length, one inch in width, or depth more than ¼ of the thickness of the wall.
4. Blisters that are either broken, exceed three inches in diameter, or project more than 1/8 inch above the surrounding surface of the pipe.
5. Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.

Rejected materials shall be clearly marked by the Inspector and immediately removed from the site of work by the Contractor, without cost to the Owner.

1.8 COORDINATION

A. Coordinate inspection with the authority having jurisdiction and with Owner's representative.

B. Coordinate connections to existing services/service shutdowns with Owner's representative for impacted facilities. At the beginning of the project provide a construction plan outlining all major construction activities including the proposed dates and durations of service shutdowns, service connections, and sidewalk/roadway interruptions.

C. Contractor shall not turn valves – coordinate with University of Michigan Utilities.

1.9 WARRANTY

A. Provide a complete warranty for parts and labor for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL PIPING REQUIREMENTS:

A. All piping materials shall be compatible for temperature, pressure and service.

B. All wetted seals shall be made from materials that are immune from chloramine degradation.

2.2 DUCTILE IRON PIPE AND FITTINGS FOR CHILLED WATER SERVICE

A. General Requirements

1. Provide the following type components:
   a. Pipe: Ductile iron pipe with mechanically restrained push-on style joints between pipe sections.
   b. Fittings: Tees, elbows, and other fittings to allow directional changes: Flanged, mechanically restrained.
   c. Valves: Gate valves, flanged, mechanically restrained.
   d. Polyethylene encasement, all ductile iron pipe and fittings.

B. Pipe:

1. Ductile iron pipe, 350 PSI minimum working pressure, Class 52, AWWA C151/A21.51, standard thickness cement mortar lining complying to AWWA C104/A21.4, asphaltic coated outside in accordance with ANSI/AWWA C151/A21.51. Pipe beneath railroads shall be thickness class 56.
   a. Provide ductile iron pipe manufactured in the United States of America.
   b. The following information shall be clearly marked on each length of pipe:
      1) Size
      2) Pipe designation and class.
      3) Marked DI or Ductile Iron
      4) Name and trademark of the manufacturer
      5) Country of origin
      6) Year produced
   c. Certification of country of origin shall be provided upon delivery.
2. Restrained push-on style joints, designed to provide a minimum of 3 degrees deflection after assembly.
   a. "TR-Flex" restrained joint by U.S. Pipe.
   b. "Mega Lug" joint restraint system by EBAA Iron Sales, Inc., Series 1700. Restraint ring, bolts, nuts, and all other parts with MEGA-BOND restraint coating system.
3. Where ductile iron pipe transitions to other pipe materials upon entering a building, terminate the ductile iron pipe with a factory threaded and a screw-on, machine tightened, ductile iron flange that complies with ANSI/AWWA C115, similar to that available from American Ductile Iron Pipe and US Pipe. Flanges shall be designed to mate with Class 250 flanges.

C. Fittings:

1. Flanged, ductile iron AWWA C110/A21.10, rated working pressure 350 psi, standard thickness cement mortar lining complying to AWWA C104/A21.4, asphaltic coated outside in accordance with ANSI/AWWA C151/A21.51.
   a. Provide ductile iron fittings manufactured in the United States of America.
   b. The following information shall be clearly marked on each fitting:
      1) Size
      2) Pressure rating
      3) Number of degrees or fraction of the circle on all bends
      4) Marked DI or Ductile Iron
      5) Name and trademark of the manufacturer
      6) Country of origin
      7) Year produced
   c. Certification of country of origin shall be provided upon delivery.
2. Mechanically Restrained Joints (including at valves)
   a. AWWA C111 compliant joint restraint system and bolts.
   b. Provide "Mega Lug" joint restraint system by EBAA Iron Sales, Inc., Series 1100. Gland, bolts, nuts, and all other parts with MEGA-BOND restraint coating system.

D. Gaskets:

1. AWWA C111/A21.11, SBR rubber, of shape matching pipe and fittings.
   a. Lubricants used shall be supplied, or recommended, by the pipe manufacturer and the joints shall be coupled in accordance with manufacturer's requirements.

E. Polyethylene Encasement

1. Thickness and wrapping per ANSI/AWWA C105/A21.5

2.3 STEEL CASING PIPE

A. Provide steel casing pipe where indicated.

B. Steel Casing Pipe

1. ASTM A 53, Type E or S, Grade B steel pipe.
2. Material: Steel casing pipe shall meet the following schedule of thickness based on nominal diameter of casing pipe:

Nominal Diameter of Casing Pipe (inches)	Minimum Wall Thickness (inches)
Under 14	0.250
14, 16, and 18	0.312
20 and 22	0.375
24, 26, 28, and 30	0.500
32 and 34	0.563
36, 38, 40, 42, and 48	0.625

3. Identification: The following information shall be clearly marked on each length of pipe.
   a. The pipe designation and class.
   b. The name or trademark of the manufacturer.
   c. Identification of the manufacturing plant.

2.4 VALVES (CHILLED WATER)

A. Provide gate valves unless otherwise indicated.

B. Gate Valves:

1. Resilient seat non-rising stem, flanged.
2. Two-inch square operating nut.
3. Left-hand open.
4. Joints meeting ANSI/AWWA C111/A21.11.
5. Gate valve shall be of the following models:
   a. Series 300 and T300 NRS Double Disc Gate Valve by Waterous.
   b. A-2380 Series by Mueller.
   c. Series A by East Jordan Iron Works.
   d. AWWA 571X by Kennedy.

C. Gate Valve Box

1. Tyler 6860, Buffalo type, Size D, screw type, 3-piece, 5-1/4-inch shaft.
   a. #6 base for valves 8 inches or less.
   b. #8 base for valves 10 or 12 inches.
2. Casting cover shall be labelled "Chilled Water" in raised lettering (available from East Jordan Iron Works)

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of the piping. Install piping as indicated. If adjustment is needed due to field conditions, obtain the approval of the Owner's engineer before proceeding.

B. Install pipe, fittings, joint restraints, and accessories per manufacturer's written instructions and AWWA C600.

C. Main Connections: Coordinate with the Owner's representative for connections to existing mains.

1. Owner shall be notified 10 working days prior to any proposed interruption of service or building system shutdown.
   a. Contractor shall coordinate with the Owner for main valve shutdowns. Contractor shall not turn valves.
   b. Contractor shall provide means for maintaining the site dry in the event the existing valves provide a poor shutdown.
   c. All pipe, fittings, and appurtenances necessary to complete the main connection shall be on site prior to excavation for the connection.
   d. No water main shutdown will take place after 12:00 PM unless expressly granted by the Owner.

D. Cutting Water Main Pipe:

1. Flame or torch cutting of water main pipe is not allowed.

2. Pipe shall be cut in a manner that will not damage the pipe or cement lining of the pipe and shall provide a clean and 90 degree cut.

E. Install pipe components and joining systems in accordance with the manufacturer's installation instructions.

F. All flushing water, system water (including any drained from existing systems), blow down water, or other fluids or materials discharged or produced as part of the work shall be disposed of in accordance with State of Michigan and local regulations. Contact the Owner's representative, Nick Vanderkolk (nevander@umich.edu), for an analysis of water in existing systems to be drained. If fluids have a pH between 5.0 and 10.0 and meet the requirements of City of Ann Arbor Sewer Use Ordinance, they may be discharged to the sanitary sewer. If the water does not meet the sewer discharge limits, contact U-M Environment, Health and Safety (EHS) Hazmat at 763-4568 for proper disposal requirements. City of Ann Arbor Sewer Use Limitations (Chapter 28 Sewage and Sewage Disposal, subsection 2:43.1. Prohibited Discharges.) can be found at:

1. http://www.municode.com/resources/gateway.asp?pid=11782&sid=22
2. or by contacting U-M EHS - Environmental Protection & Permitting Program at 936-1920.

G. Installed piping shall be free from sagging and low spots.

H. Provide fittings and specialties necessary to properly interconnect all items, whether or not shown in detail.

I. Piping shall remain protected and capped until just prior to connection. Immediately after assembly, restore all protection and cap unprotected ends to prevent dust, gases, moisture, other debris and vermin from entering the piping system.

J. Clean and swab-out all piping before installation.

K. Lay out pipe lines straight, plumb and in true alignment. Offset as required to avoid interference with other work. Lay out all pipes and establish their levels from bench marks.

L. Do not conceal piping until it has been inspected, tested, cleaned, and approved.

M. Lubricate flange bolts and install with hardened flat washers. Use a torque wrench to tighten restraint bolts (when required by the mfr.) and flange bolts to the gasket manufacturer's recommended torque.

N. Locate groups of pipe parallel to each other, spaced to permit servicing of valves and accessories.

3.2 EARTHWORK AND TRENCHING

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

USE BELOW SECTIONS ONLY IF NOT COVERED IN ANOTHER DIVISION.

B. All trenching and backfilling required for the proper installation of the work shall be done as prescribed in other Divisions.

C. Excavate trenches so that pipe can be installed at proper depth. Lay pipe on a firm bed bearing its full length except at the bell. Where piping is installed in backfilled areas, provide machine tamping and be responsible for any settling at, or rupture to the piping work. Keep trenches water free and dry during bedding, laying and jointing through use of de-watering pumps and similar means. After the joints are made, place sufficient backfill along each side of pipe to offset conditions that might tend to move the pipe off line and grade.

D. Backfill only after pipes have been tested, inspected and approved.

E. Piping encountered in excavating, (if shown on the drawings or not), shall be supported and protected from damage. If utility lines are encountered, notify the Owner's Representative and do not disturb the lines unless directed. If existing utility lines are damaged during excavations, immediately repair the lines at no cost to the Owner.

F. No installation of pipe or accessories shall be made in filled or disturbed earth until it has been compacted as directed.

G. Restore street pavements, curbs and sidewalks disturbed in the performance of this work.

H. Where indicated on drawings the work is to be installed by tunneling. In all other locations, excavations shall be done by the open trench method and to the depths and widths as may be necessary. All material excavated shall be deposited on the sides of the trenches and beyond the reach of trench collapse/slides.

I. Provide shoring, bracing or sheet piling necessary to maintain the banks of the excavations or tunnels. Take same out as the work is backfilled. Shoring must prevent any movement of the trench banks and strains on the piping and utility lines.

3.3 PROTECTION AGAINST FREEZING:

A. During construction, protect all piping and accessories from freezing.

3.4 INTERSECTING BASEMENT WALLS OR PENETRATING FLOORS

A. Piping below grade, intersecting basement walls or penetrating floors, shall be run through a sleeve seal system as described in Related Section 221113.

1. Size sleeves and select sleeve seal links per sleeve seal manufacturer's recommendations.
2. Install sleeves and seals per manufacture's recommendations. Center sleeve water stops at midpoint of wall/floor thickness. Provide temporary support to avoid sleeve collapse during pours.

B. Record as-built sketches and dimensions prior to backfilling.

3.5 HYDROSTATIC PRESSURE TESTING

A. Develop a plan for pressure testing the piping system. Submit the plan to the Owner's Representative for approval prior to completion of the piping.

B. Coordinate the testing. Additional time required to obtain a passing result will not be considered sufficient cause for an extension of schedule or increase in cost.

C. Furnish all piping, pumps, gauges and other materials and equipment required to carry out the tests.

D. Connections to the existing main shall not be made until the new piping main has been cleaned and successfully pressure tested and written approval has been obtained from the Owner's Representative.

E. Hydrostatic Acceptance Pressure Test:

1. Test new systems only, from point of connection to the existing systems. Perform initial tests and correct deficiencies prior to requesting acceptance test.
2. Perform acceptance pressure tests in the presence of the authorities having jurisdiction. Acceptance tests must be satisfactorily completed before piping is concealed.
3. Components shall be removed or isolated during testing if damage may occur due to test pressure and/or test media.
4. Acceptance leak testing shall include a test against each new shutoff valve. Arrange testing to allow visual confirmation of zero leakage across each valve.
5. Slowly fill the main and pump the pressure to 150 psi. Test pressure shall be maintained between 145-155 psi during the entire test.
6. Testing Period – 2 hours with zero visual leakage.
7. For each system tested, provide a certificate testifying that the system was satisfactorily tested and passed, using owner furnished forms.

3.6 FLUSHING AND CLEANING OF PIPING

A. Develop a plan for Owner's approval. Submit the plan prior to completion of piping. In cases of large bore pipe, the Owner may approve a visual means of inspecting for cleanliness if the Contractor can demonstrate an effective method for doing so. Provide all temporary and permanent piping, equipment, and materials necessary to complete flushing and cleaning.

B. Prior to flushing, swab/pig out underground piping to remove all particulate.

C. Prior to pigging and flushing, temporarily remove, isolate or bypass dirt sensitive equipment and devices.

D. Prior to opening to the existing system, flush all piping with city water for a minimum of one hour, until water runs clear. Water supply shall be equivalent to piping being flushed. Drain all low points. Refill with clean city water. Obtain Owner's permission in writing prior to opening to the existing system.

END OF SECTION 336100