PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe

B. Fittings

C. Special Fittings

D. Pipeline Accessories

1.02 DESCRIPTION OF WORK

Construct water mains and building service pipes.

1.03 SUBMITTALS

Follow the General Provisions (Requirements) and Covenants as well as the following:

Submit product information sheet for joint restraint system to be used.

1.04 SUBSTITUTIONS

Follow the General Provisions (Requirements) and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Follow the General Provisions (Requirements) and Covenants as well as the following:

Remove pipe and fittings contaminated with mud and surface water from the site; do not use in construction unless thoroughly cleaned, inspected, and approved by the Engineer.

1.06 SCHEDULING AND CONFLICTS

Follow the General Provisions (Requirements) and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. Water Main:

1. Trenched:

a. Measurement: Each type and size of pipe installed in an open trench will be measured in linear feet along the centerline of the pipe, including the length through the fittings.

b. Payment: Payment will be made at the unit price per linear foot for each type and size of pipe.

c. Includes: Unit price includes, but is not limited to, trench excavation, dewatering, furnishing bedding material, placing bedding and backfill material, tracer system, testing, disinfection, and polyethylene wrap for ductile iron pipe and for fittings.

1.08 MEASUREMENT AND PAYMENT (Continued)

2. **Trenchless:**
   a. **Measurement:** Each type and size of pipe installed by trenchless methods will be measured in linear feet along the centerline of the casing pipe.
   b. **Payment:** Payment will be made at the unit price per linear foot for each type and size of pipe.
   c. **Includes:** Unit price includes, but is not limited to, furnishing and installing pipe; trenchless installation materials and equipment; pit excavation, dewatering, and placing backfill material; tracer system; testing; and disinfection.

B. Water Main with Casing Pipe:

1. **Trenched:**
   a. **Measurement:** Each type and size of pipe with a casing pipe installed in an open trench, will be measured in linear feet along the centerline of the casing pipe from end of casing to end of casing.
   b. **Payment:** Payment will be made at the unit price per linear foot for each type and size of carrier pipe.
   c. **Includes:** Unit price includes, but is not limited to, furnishing and installing both carrier pipe and casing pipe, trench excavation, dewatering, furnishing bedding material, placing bedding and backfill material, casing spacers, furnishing and installing annular space fill material, tracer system, testing, and disinfection.

2. **Trenchless:**
   a. **Measurement:** Each type and size of pipe installed by trenchless methods with a casing pipe will be measured in linear feet along the centerline of the casing pipe.
   b. **Payment:** Payment will be made at the unit price per linear foot for each type and size of carrier pipe.
   c. **Includes:** Unit price includes, but is not limited to, furnishing and installing both carrier pipe and casing pipe; trenchless installation materials and equipment; pit excavation, dewatering, and placing backfill material; casing spacers; furnishing and installing annular space fill material; tracer system; testing; and disinfection.

C. Fittings: One of the following methods will be specified for measurement and payment of water main fittings.

1. **Fittings by Count:**
   a. **Measurement:** Each type and size of fitting installed as specified in the contract documents or as required for proper installation of the water main will be counted.
   b. **Payment:** Payment will be made at the unit price for each type and size of fitting.
   c. **Includes:** Unit price includes, but is not limited to, restrained joints and thrust blocks.

2. **Fittings by Weight:**
   a. **Measurement:** Each type and size of fitting installed as specified in the contract documents or as required for proper installation of the water main will be counted. Determine the total weight of fittings counted, in pounds, based on the standard fitting weights published in AWWA C153 for ductile iron compact fittings.
   b. **Payment:** Payment will be made at the unit price per pound for each type and size of fitting.
   c. **Includes:** Unit price includes, but is not limited to, restrained joints and thrust blocks.

1.08 MEASUREMENT AND PAYMENT (Continued)

D. Water Service Stubs:

1. **Measurement:** Each type and size of water service stub from the water main to the stop box will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of water service stub.

3. **Includes:** Unit price includes, but is not limited to, corporation, service pipe, stop, and stop box.

PART 2 - PRODUCTS

2.01 WATER MAIN

A. Polyvinyl Chloride (PVC) Pipe: Comply with AWWA C900 or AWWA C905 with gray iron pipe equivalent outside diameters.

1. **Minimum Wall Thickness:**
   - **a. 4 inch through 24 inch sizes:** DR 18.
   - **b. Sizes over 24 inch:** As specified in the contract documents.

2. **Joint Type:** Use push-on joint type, except as otherwise specified in the contract documents or as authorized by the Engineer.
   - **a. Push-on:** According to AWWA C900 or AWWA C905.
   - **b. Integral Restrained Joint:** AWWA C900 or AWWA C905 pipe with restraining system manufactured integrally into pipe end.
   - **c. Mechanical Restrained Joint:** Ductile iron mechanical device designed for joint restraint of AWWA C900 or AWWA C905 pipe complying with the requirements of ASTM F 1674.

3. **Markings on Pipe:**
   - a. Name of manufacturer.
   - b. Size and class.
   - c. Spigot insertion depth gauge.
   - d. National Sanitation Foundation (NSF) seal.

B. Ductile Iron Pipe (DIP):

1. **Minimum Thickness Class:**
   - **a. 4 inch through 24 inch sizes:** Special thickness Class 52 according to AWWA C151.
   - **b. Sizes over 24 inches:** As specified in the contract documents.

2. **Cement-mortar Lined:** According to AWWA C104 with asphalt seal coat.

3. **External Coating:** Asphalt according to AWWA C151.

4. **Joint Type:** Use push-on type, unless otherwise specified in the contract documents or as authorized by the Engineer.
   - **a. Push-on:** According to AWWA C111.
   - **b. Mechanical:** According to AWWA C111.
   - **c. Restrained, Buried:** Pipe manufacturer′s standard field removable system.
   - **d. Restrained, in Structures:** Restraining gland, flanged or grooved.
   - **e. Flanged:** According to AWWA C111.
   - **f. Grooved:** According to AWWA C606.
   - **g. Gaskets:** According to AWWA C111.

5. **Markings on Pipe:**
   - a. Name of manufacturer.
   - b. Size and class.
   - c. Spigot insertion depth gauge.

2.01 WATER MAIN (Continued)

C. Prestressed Concrete Cylinder Pipe: Design and manufactured according to AWWA C301 and AWWA C304.

1. Minimum Conditions:
- **a. Internal Pressure:** 150 psi.
- **b. Earth Loads:** Actual trench depth, but not less than 6 feet.
- **c. Live Loads:** HS 20 vehicle over trench.
- **d. Surge Pressure:** Allowance 60 psi.
- **e. Bedding:** Type R2, AWWA C304, Figure 9.
- **f. Safety Factor:** 2.5.

2. Joints:
- **a. Rings:** Steel joint rings with rubber gaskets according to AWWA C301.
- **b. External Joint Filler:** Cement mortar with diapers.
- **c. Outlets:** Flanged, according to ANSI B16.1, Class 125, with 1/8 inch minimum thickness rubber gaskets.

2.02 BOLTS FOR WATER MAIN AND FITTINGS

Use corrosion resistant bolts.

A. Tee-bolts and Hexagonal Nuts for Mechanical Joints:

1. High-strength, low-alloy steel manufactured according to AWWA C111.

2. Provide ceramic-filled, baked-on, fluorocarbon resin coating for bolts and nuts.

3. Include factory-applied lubricant that produces low coefficient of friction for ease of installation.

B. Other Bolts and Nuts:

1. Stainless steel.

2. Ductile iron.

3. Zinc, zinc chromate, or cadmium plated.

2.03 FITTINGS

A. For DIP and PVC Pipe: Comply with AWWA C110 (ductile iron or gray iron) or AWWA C153 (ductile iron).

1. Joint Type:
- a. For pipe sizes 16 inches and less, use mechanical joint complying with AWWA C111.
- b. For pipe sizes greater than 16 inches, use restrained mechanical joint system. Provide follower gland using breakaway torque bolts to engage thrust restraint.
  - 1) Minimum pressure rating same as connecting pipe. For fittings between dissimilar pipes, the minimum pressure rating is the lesser of the two pipes.
  - 2) Suitable for buried service.
  - 3) Joint restraint system to be field installable, field removable, and re-installable.
- c. Use of alternate restraint systems must be approved by the Engineer.

2. Lined: Cement mortar lined according to AWWA C104 with asphalt coating.

2.03 FITTINGS (Continued)

3. **Wall Thickness:** Comply with AWWA C153.

4. **Gaskets:** Comply with AWWA C111.

B. For Prestressed Concrete Cylinder Pipe: As required for prestressed concrete cylinder pipe.

C. Flange Adapter:

1. **Body:** Ductile iron complying with ASTM A 536.

2. **End Rings (Follower Rings):** Ductile iron complying with ASTM A 536.

3. **Gaskets:** New rubber compounded for water service and resistant to permanent set.

4. **Bolts and Nuts:** High strength, low alloy corrosion resistant steel or carbon steel bolts complying with ASTM A 307.

D. Pipe Coupling:

1. **Center Sleeve (Center Ring):** Steel pipe or tubing complying with ASTM A 53 or ASTM A 512, or formed carbon steel with a minimum yield of 30,000 psi.

2. **End Ring (Follower Ring):** Ductile iron complying with ASTM A 536, or steel meeting or exceeding the requirements of ASTM A 576, grade 1010-1020.

3. **Gaskets:** New rubber compounded for water service and resistant to permanent set.

4. **Bolts and Nuts:** High strength, low alloy corrosion resistant steel.

2.04 CONCRETE THRUST BLOCKS

A. Use Iowa DOT Class C concrete.

B. Comply with the contract documents for dimensions and installation of thrust blocks. Comply with Figure 5010.101.

C. Use for all pipe sizes 16 inches in diameter or smaller or when specified.

2.05 PIPELINE ACCESSORIES

A. Polyethylene Wrap:

1. Comply with AWWA C105.

2. Provide tubes or sheets with 8 mil minimum thickness.

B. Tracer System: Comply with Figure 5010.102.

1. **Tracer Wire:** #12 AWG solid single copper conductor.
   a. **Insulation Material:** Linear low-density polyethylene (LLDPE) installation suitable for direct burial applications.
   b. **Insulation Thickness:** 0.045 inches, minimum.

2.05 PIPELINE ACCESSORIES (Continued)

2. **Ground Rod:** 3/8 inch diameter, 60 inch steel rod uniformly coated with metallically bonded electrolytic copper.

3. **Ground-rod Clamp:** High-strength, corrosion-resistant copper alloy.

4. **Splice Kit:** Inline resin splice kit with split bolt for 1 kV and 5 kV. Insulates and seals single conductor and unshielded cable splices for direct bury and submersible applications.

5. **Tracer Wire Station:** Comply with the contract documents.

2.06 SPECIAL GASKETS

A. For soils contaminated with gasoline, use neoprene or nitrile gaskets.

B. For soils contaminated with volatile organic compounds, use nitrile or fluorocarbon gaskets.

C. For other soil contaminants, contact the Engineer for the required gasket.

2.07 WATER SERVICE PIPE AND APPURTENANCES

A. Controlling Standards: Local plumbing and fire codes.

B. Materials (as allowed by Jurisdiction or specified in contract documents)**:**

1. **Copper Pipe:**
   a. Comply with ASTM B 88.
   b. Wall Thickness: Type K.

2. **DIP:** As specified in Section 5010, 2.01. Polyethylene wrap is required.

3. **PVC Pipe:** ASTM D 1785, SDR 21, Schedule 80, Type S joints.

4. **Brass Pipe:** Red, seamless, according to ASTM B 43.

5. **Polyethylene Pipe:** Class 200, according to AWWA C901.

C. Corporations, Stops, and Stop Boxes: Contact the Jurisdiction for requirements.

2.08 NON-SHRINK GROUT

Comply with Iowa DOT Materials I.M. 491.13.

2.09 CASING PIPE

Comply with Section 3020.

PART 3 - EXECUTION

3.01 PIPE INSTALLATION

A. General:

1. Do not use deformed, defective, gouged, or otherwise damaged pipes or fittings.
2. Keep trench free of water. Clean pipe interior prior to placement in the trench.
3. Install pipe with fittings and valves to the lines and grades specified in the contract documents.
4. Clean joint surfaces thoroughly and apply lubricant approved for use with potable water and recommended by the manufacturer.
5. Push pipe joint to the indication line on the spigot end of the pipe before making any joint deflections.
6. Limit joint deflections to one degree less than pipe manufacturer′s recommended maximum limit.
7. Tighten bolts in a joint evenly around the pipe.
8. Install concrete thrust blocks on all fittings 16 inches in diameter or smaller (comply with Figure 5010.101). For fittings larger than 16 inches, install restrained joints, and when specified in the contract documents, also install concrete thrust blocks.
9. Keep exposed pipe ends closed with rodent-proof end gates at all times when pipe installation is not occurring.
10. Close the ends of the installed pipe with watertight plugs during nights and non-working days.
11. Do not allow any water from the new pipeline to enter the existing distribution system piping until testing and disinfection are successfully completed.

B. Trenched:

1. Excavate trench and place pipe bedding and backfill material as specified in Section 3010.
2. Provide uniform bearing along the full length of the pipe barrel. Provide bell holes.

C. Trenchless: Comply with Section 3020.

3.02 ADDITIONAL REQUIREMENTS FOR DIP INSTALLATION

A. Utilize full-length gauged pipe for field cuts. Alternatively, field-gauge pipe selected for cutting to verify the outside diameter is within allowable tolerances.

B. Cut the pipe perpendicular to the pipe barrel. Do not damage the cement lining. Bevel cut the ends for push-on joints according to the manufacturer's recommendations.

C. Encase all pipe, valves, and fittings with polyethylene wrap according to Section 5010, 3.05.

3.03 ADDITIONAL REQUIREMENTS FOR PVC PIPE INSTALLATION

A. Cut the pipe perpendicular to the pipe barrel. Deburr and bevel cut spigot end of the pipe barrel to match factory bevel. Re-mark the insertion line.

B. When connecting to shallow-depth bells, such as on some cast iron fittings or valves, cut the spigot end square to remove factory bevel. Deburr the end and form a partial bevel on the end.

3.04 ADDITIONAL REQUIREMENTS FOR PRESTRESSED CONCRETE CYLINDER PIPE INSTALLATION

A. Install according to AWWA M9.

B. Relieve gasket tension by inserting a small rod between the gasket and the gasket groove and running the tool around the pipe twice.

C. Check gasket position using a metal feeler gauge after the joint has been assembled.

D. Complete joint exterior grouting after pipe has been properly positioned using non-shrink grout.

3.05 POLYETHYLENE ENCASEMENT INSTALLATION

A. Apply polyethylene encasement to buried ductile iron pipe and to buried fittings, fire hydrants, and appurtenances. The polyethylene encasement is used to prevent contact between the pipe and the bedding material, but need not be airtight or watertight.

B. Install polyethylene encasement according to AWWA C105, using tubes or flat sheets, and pipe manufacturer's recommendations.

C. Do not expose the polyethylene encasement to sunlight for long periods before installation.

D. Remove all lumps of clay, mud, cinders, etc. on the pipe surface before encasing the pipe. Take care to prevent soil or bedding material from becoming trapped between the pipe and polyethylene.

E. Lift polyethylene-encased pipe with a fabric-type sling or padded cable.

F. Secure and repair encasement material using polyethylene tape, or replace as necessary.

3.06 TRACER SYSTEM INSTALLATION

A. Install with all buried water main piping. Comply with Figure 5010.102 for tracer wire installation.

B. Begin and terminate the system at all connections to existing mains.

C. Install wire continuously along the lower quadrant of the pipe. Do not install wire along the bottom of the pipe. Attach wire to the pipe at the midpoint of each pipe length; use 2 inch wide, 10 mil thickness polyethylene pressure sensitive tape.

D. Install splices only as authorized by the Engineer. Allow the Engineer to inspect all below-grade splices of tracer wire prior to placing the backfill material.

E. Install ground rods adjacent to connections to existing piping and at locations specified in the contract documents or as directed by the Engineer.

3.06 TRACER SYSTEM INSTALLATION (Continued)

F. Bring two wires to the surface at each fire hydrant location and terminate with a tracer wire station (comply with Figure 5010.102).

G. Final inspection of the tracer system will be conducted at the completion of the project and prior to acceptance by the owner. Verify the electrical continuity of the system. Repair discontinuities.

3.07 CONFLICTS

The following separation information is derived from Iowa DNR's *Iowa Wastewater Facilities Design Standards*, Chapter 12, Section 12.5.8

A. Horizontal Separation of Gravity Sewers from Water Mains:

1. Separate gravity sewer mains from water mains by a horizontal distance of at least 10 feet unless:
   - The top of a sewer main is at least 18 inches below the bottom of the water main, and
   - The sewer is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the water main.

2. When it is impossible to obtain the required horizontal clearance of 3 feet and a vertical clearance of 18 inches between sewers and water mains, the sewers must be constructed of water main materials meeting the requirements of Section 5010, 2.01. However, provide a linear separation of at least 2 feet.

B. Separation of Sewer Force Mains from Water Mains: Separate sewer force mains and water mains by a horizontal distance of at least 10 feet unless:

1. The force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and the requirements of Section 5010, 2.01 and

2. The sewer force main is laid at least 4 linear feet from the water main.

C. Separation of Sewer and Water Main Crossovers:

1. Vertical separation of sanitary sewers crossing under any water main should be at least 18 inches when measured from the top of the sewer to the bottom of the water main. If physical conditions prohibit the separation, the sewer may be placed not closer than 6 inches below a water main or 18 inches above a water main. Maintain the maximum feasible separation distance in all cases.

2. Where the sewer crosses over or less than 18 inches below a water main, locate one full length of sewer pipe of water main material so both joints are as far as possible from the water main. The sewer and water pipes must be adequately supported and have watertight joints. Use a low permeability soil for backfill material within 10 feet of the point of crossing.

3.08 TRANSITIONS IN PIPING SYSTEMS

Where the specified material of a piping system entering or exiting a structure changes, make the change at the outside of the structure wall, beyond any wall pipe or wall fitting required, unless otherwise specified.

3.09 STRUCTURE PENETRATIONS

A. Wall Pipes:

1. Install where pipes penetrate and terminate at a wall or floor surface of a concrete structure, or where the pipe protrudes through the concrete wall or floor and the protrusion is otherwise unsupported.

2. Provide a waterstop flange near the center of the embedment length. The waterstop is to be cast integrally with the wall pipe, or fully welded to it around the pipe circumference.

B. Wall Sleeves:

1. Install where a pipe passes through a structure wall.

2. Sleeves in concrete walls are to be supplied with a waterstop collar, fully welded, and cast-in-place in the concrete.

3.10 WATER SERVICE STUB

A. Install water service pipe, corporations, stops, and stop boxes according to local Jurisdiction requirements.

B. Install 1 inch and smaller corporation valves tapped at 45 degrees above horizontal at a minimum distance of 18 inches from pipe bell or other corporation. Install 1 1/2 inch and 2 inch corporation valves tapped horizontal a minimum distance of 24 inches from pipe bell or other corporation.

C. Construct trench and place backfill material according to Section 3010.

3.11 TESTING AND DISINFECTION

Test and disinfect according to Section 5030.

END OF SECTION