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**FUSIBLE PVC AND HDPE PIPE****PART 1 - GENERAL****1.01 SECTION INCLUDES**

Water Main Pipe

**1.02 DESCRIPTION OF WORK**

Construct water mains.

**1.03 SUBMITTALS**

Comply with Division 1 - General Provisions and Covenants, as well as the following:

**A. Pre-Construction:**

1. Recommended Minimum Bending Radius
2. Recommended Maximum Safe Pull Force

**B. Post-Construction:**

Fusion joint report containing the following information:

1. Pipe size and thickness
2. Machine size
3. Fusion technician identification
4. Job identification
5. Fusion joint number
6. Fusion, heating, and drag pressure settings
7. Heat plate temperature
8. Time stamp
9. Heating and cool down time of fusion
10. Ambient temperature

**1.04 SUBSTITUTIONS**

Comply with Division 1 - General Provisions and Covenants.

**1.05 DELIVERY, STORAGE, AND HANDLING**

Comply with Division 1 - General Provisions and Covenants, as well as the following:

- A. Load, off-load, store, and otherwise handle pipe according to the pipe supplier's recommendations. Handle and support pipe with woven fiber pipe slings or approved equal. Do not use handling devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe.

**1.05 DELIVERY, STORAGE, AND HANDLING (Continued)**

- B. Exercise caution to avoid compression, damage, or deformation to the ends of the pipe during transportation to the site and while stored on site.
- C. Notify the Engineer of any damaged pipe and remove from the site; do not use in construction unless allowed by the Engineer. Pipe considered as damaged includes the following:
  - 1. Any length of pipe showing a crack.
  - 2. Any length of pipe which has received a blow that may have caused an incident fracture, even though no such fracture is visible.
  - 3. Any length of pipe with a scratch or gouge greater than 10% of the wall thickness.

**1.06 SCHEDULING AND CONFLICTS**

Comply with Division 1 - General Provisions and Covenants.

**1.07 SPECIAL REQUIREMENTS**

Perform thermal fusion of pipe by a Fusion Technician fully qualified by the pipe supplier for the type(s) and size(s) of pipe being used. Ensure qualification is current as of the date of fusion performance on the project.

**1.08 MEASUREMENT AND PAYMENT****A. Fusible Water Main:****1. Trenched:**

- a. **Measurement:** Each type and size of fusible 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, performing fusion jointing, placing bedding and backfill material, tracer system, testing, and disinfection.

**2. Trenchless:**

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

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**1.08 MEASUREMENT AND PAYMENT (Continued)****B. Water Main with Casing Pipe:****1. Trenched:**

- a. Measurement:** Each type and size of fusible 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 fusible carrier pipe and casing pipe, performing fusion jointing, 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 fusible 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 fusible carrier pipe.
- c. Includes:** Unit price includes, but is not limited to, furnishing and installing both fusible carrier pipe and casing pipe; performing fusion jointing, 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.

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**PART 2 - PRODUCTS****2.01 WATER MAIN**

**A. Fusible PVC Pipe:** Comply with AWWA C900 with ductile 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. Pipe Manufacturing:**

- a. Provide pipe extruded with plain ends square to the pipe, free of any bevel or chamfer, and without bells or gaskets of any kind.
- b. Pipe for potable water use to be blue in color.

**3. Markings on Pipe:**

- a. Name of manufacturer.
- b. Size and class.
- c. NSF International (NSF) seal

**B. Fusible HDPE Pipe:** Comply with AWWA C906 with ductile iron pipe equivalent outside diameters.

**1. Material Designation Code:** PE4710.

**2. Minimum Wall Thickness:** DR 9.

- a. 4 inch through 24 inch sizes: DR 9.
- b. Sizes over 24 inch: As specified in the contract documents.

**3. Pipe Manufacturing:**

- a. Provide pipe extruded with plain ends square to the pipe, free of any bevel or chamfer, and without bells or gaskets of any kind.
- b. Pipe for potable water use to be black in color with two blue stripes.

**4. Markings on Pipe:**

- a. Name of manufacturer.
- b. Size and class.
- c. NSF International (NSF) seal.

**PART 3 - EXECUTION**

Comply with Section 5010, Part 3, as well as the following:

**3.01 ADDITIONAL REQUIREMENTS FOR FUSIBLE PIPE INSTALLATION****A. General:**

1. Thermally butt fuse pipe joints and install pipe complying with the contract documents and the pipe supplier's recommendations.
2. Assemble pipe lengths in the field with butt-fused joints. Whenever possible, fuse and stage pipe lengths in their entirety prior to installation.
3. Handle and install pipe in a manner that does not over-stress the pipe or exceed the recommended bending radius at any time.
4. Where pipe is installed by pulling in tension, do not exceed the Safe Pulling Force at any time.
5. Once pipe installation has commenced, continue the operation without interruption until the entire length of the fused section of pipe is installed.
6. Repair sections of pipe damaged during installation by cutting out the damaged section, facing the two pipe pieces according to the tolerances set by the manufacturer, and then rejoining with standard butt-fused joints.

**B. Equipment:**

1. **Fusion Machine:** Use fusion machines in good condition, properly equipped and set up for the pipe size being fused, and approved by the pipe supplier for the fusion process. Fusion machines must incorporate the following elements:
  - a. **Heat Plate:** Free of any debris, contamination, or deep gouges or scratches; sized appropriately and capable of maintaining a uniform and consistent heat profile and temperature for the pipe being fused.
  - b. **Carriage:** Capable of smooth travel with no binding at operating loads.
  - c. **Data Logging Device:** Device compatible with the fusion machine and capable of logging a time stamp with heat plate temperature and pressure during the fusion process.
2. **Pipe Rollers:** Provide pipe rollers of sufficient quantity, spacing, and size to assure adequate support and limit excessive sagging of the pipe during handling and installation operations.
3. **Weather Canopy:** Provide a weather protection canopy which allows full motion of the fusion machine during inclement or windy weather or during extreme temperatures.
4. **Infrared (IR) Pyrometer:** For checking pipe and heat plate temperatures.
5. **Facing Blades:** Use blades specifically designed for cutting the fusible pipe being used.
6. **Pipe Pull Heads:** Where applicable, pull pipe utilizing a pull head specifically designed for use with the type of fusible pipe being used. Provide pull head that employs a positive through-bolt design assuring a smooth wall against the pipe cross-section at all times.

**3.01 ADDITIONAL REQUIREMENTS FOR FUSIBLE PIPE INSTALLATION (Continued)**

**C. Fusion Process:** Prepare and fuse pipe according to the pipe supplier's recommendations as well as the following.

1. **Joint Recording:** Record and log each fusion joint with a data logging device connected to the fusion machine. Manually log required data not logged electronically and include in the fusion joint report.
2. **Joint Finishing:** After fusing, grind the external joint bead to a maximum height of 0.1 inch. If required by the contract documents, grind the internal joint bead to a maximum height of 0.1 inch or as specified.

**D. Trenched Installation:**

1. Do not drop or roll pipe into the trench or excavation.
2. If the length of the fused pipe is longer than what the available equipment can lower into the trench or excavation at one time, stage equipment so that lowering begins at one end of the installation and proceed along the trench or excavation so that the entire fused length is installed without exceeding the minimum bend radius of the fused pipe.
3. Pipe may also be installed by pulling it into the end of the trench via a sloped section that is constructed so as not to exceed the minimum bending radius of the pipe.
4. Bed and backfill fused pipe per the contract documents and all applicable standards.

**E. Trenchless Installation:**

1. Where applicable, grade the pipe entry area as necessary to provide support for the pipe so as not to exceed the minimum bending radius of the pipe and to allow free movement into the bore hole.
2. Use a swivel attachment between the reaming head and the pipe to minimize torsion stress on the pipe assembly.

**F. Pipe Connections:**

1. Allow initial lengths of installed pipe to come to thermal equilibrium with the soil temperature at burial depth, by waiting at least 24 hours after installation prior to making connections such as service lines and laterals.
2. Tap pipe only with standard tapping saddles or sleeves designed according to AWWA C605 for PVC and AWWA M55 for HDPE. Do not direct tap fusible pipe.
3. Observe pipe supplier's guidelines for maximum tap size per pipe diameter and follow pipe supplier recommendations for tapping PVC and HDPE.
5. Use tapping bits specifically made for the pipe type being used, such as slotted shell style cutters. Do not use hole saws intended for cutting wood, steel, ductile iron, or other materials.

**3.02 TESTING AND DISINFECTION**

Test and disinfect according to Section 5030.

END OF SECTION